



# Foundry Technology

## Copper rotor die casting

Thanks to its simple and robust construction as well as its operational safety and costeffectiveness, the three-phase asynchronous motor is by far the most widely used threephase motor for industrial drives.



However, these induction motors can only achieve the new efficiency targets and standards set out in IEC 60034-30 (IE3 Premium Efficiency and IE4 Super Premium Efficiency) with great difficulty or not at all if – as is often the case – aluminium is deployed as the cage rotor material.

As an alternative to the asynchronous motor, synchronous motors using the promising permanent magnet technology also achieve very high efficiencies. Here, however, attention must be paid to the wide-ranging problems of this different technology, namely the necessity to use inverters, the difficult price and supply situation for rare earths in addition to the unresolved issue of recyclability.

**Hence, the cast copper rotor provides the simplest solution for achieving high engine efficiency in compliance with the IEC 60034-30 efficiency class IE3 and occasionally even IE4 – and this without altering the size!**

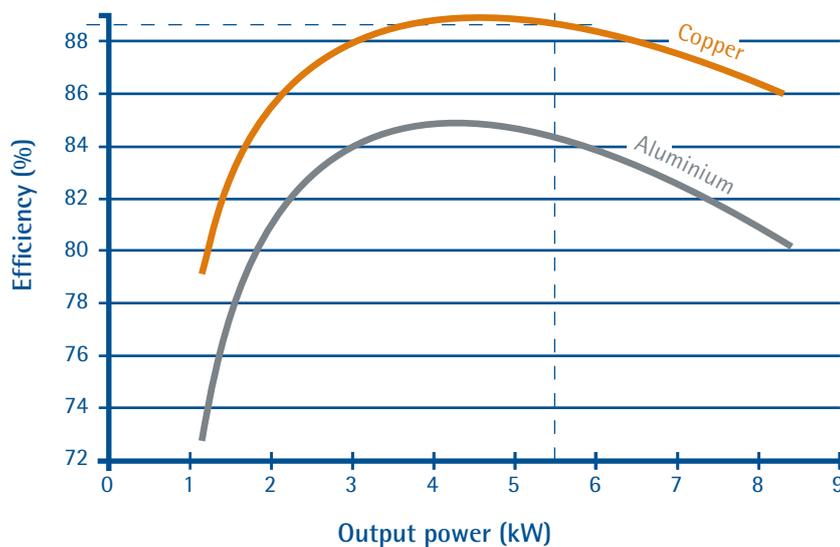


Size 30 – 225

## Technological leap towards higher efficiencies:

Replacing aluminium with copper as the conduction material in the cage rotor allows modern efficiency classes to be achieved.

Efficiency comparison of an old EFF3 motor compared to an optimised motor with a copper rotor



Thanks to the superior conductivity of copper, this new technology contributes to decreasing losses by up to 25%, and also offers further technical advantages:

### ❖ Lower iron losses\*

A series of trials at different annealing temperatures has shown that the high casting temperature of copper does not penetrate the iron deeply, as the thermal conductivity of iron is only one tenth of that of copper. Iron losses are reduced and magnetisability increases.

### ❖ Lower starting torque\*

By replacing aluminium with copper, the resistance in the shading coil of the rotor is reduced – and with it the starting torque.

### ❖ Higher torque\*

The advantage of the copper rotor allows a higher power density to be achieved, i.e. to provide a smaller size or higher performance for the same size.

### ❖ Electric steel

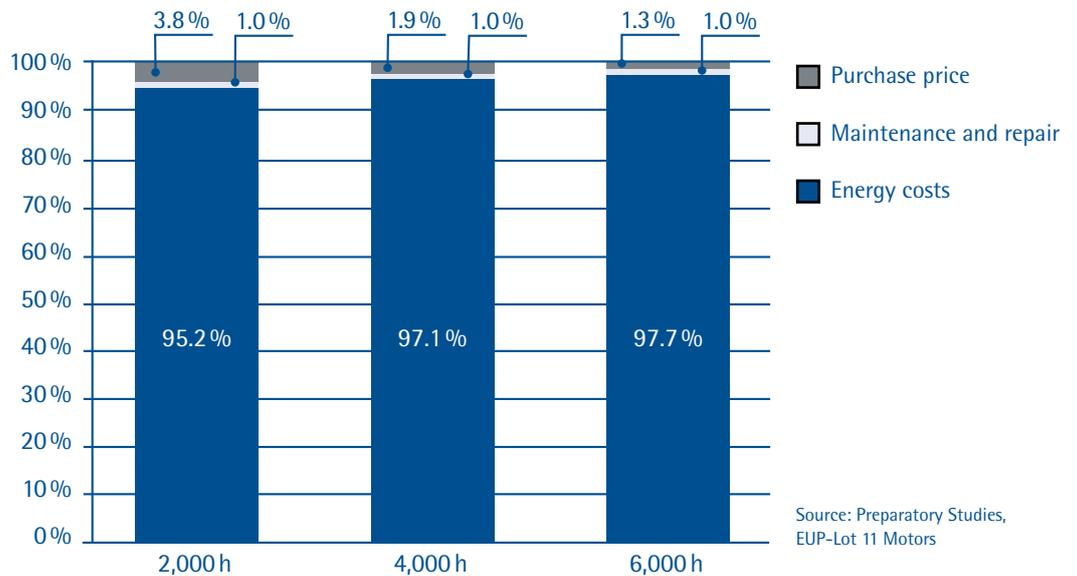
High-quality sheet metal such as M270-35 must not necessarily be used to achieve the desired IE3 efficiency level. M270-35 is high-alloyed with Si and Al resulting in increased tool wear and thereby a lower service life for the cutting die. Silicon increases in-die stacking and weldability, but the magnetization requirement also increases.

\* Source: "Saving with the energy-efficient motor", German Copper Institute



The acquisition costs of a motor for industrial use amount to less than 4% of the operating costs. This must be viewed in comparison to the energy costs, which can amount to a share of 97.7%:

Although the acquisition costs of highly-efficient three-phase asynchronous motors are higher initially, these amortise within a short time due to energy cost savings. For investment decisions, the overall cost-effectiveness of a drive system must be assessed with careful consideration of life-cycle costs (LCC analysis).



### Cost savings by using a motor in the IE3 energy efficiency class.

Operating hours	2,000 h/a	4,000 h/a	6,000 h/a
Energy savings*	5,200 kWh	10,400 kWh	15,600 kWh
Cost savings**	620 €/a	1,250 €/a	1,860 €/a

Source: Information sheet "Electrical drives" from the EnergieAgentur.NRW, Matthias Kabus, Wuppertal, 04.11.2009

\* Replacing a motor with an efficiency of 85% for a motor in the IE3 energy efficiency class.  
 \*\* Calculated for an electricity price of 12 cent.

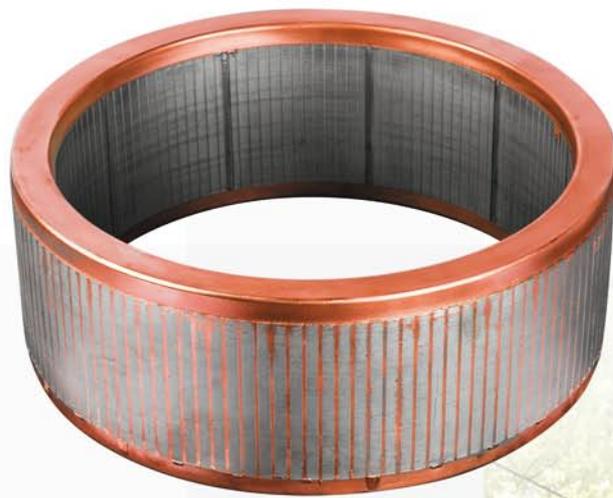
❖ The annual energy costs savings can also be calculated using the following formula:

$$\Delta K = t_b \cdot P_N \cdot F_L \cdot K_E \cdot (1/\eta_{Std} - 1/\eta_{IE})$$

- $\Delta K$ : Savings in euro
- $t_b$ : Annual operating time in h
- $P_N$ : Motor rated power in kW
- $F_L$ : Load factor (degree of utilisation) in % of the rated power  $P_N$
- $K_E$ : Electricity price in euro/kWh
- $\eta_{Std}$ : Efficiency of the standard motor
- $\eta_{IE}$ : Efficiency of the energy-saving motor in the top IE class

Source: "Saving with the energy-efficient motor", German Copper Institute

**Energy efficient motors with copper rotors are not only technically attractive, but also economically!**



Outer diameter: 400 mm

## Our contribution to more efficiency

An ecological amortisation period can also be specified. This is even shorter: in just a few weeks a more efficient motor has saved as much energy as was required to acquire the additional alternative active material.

*("Saving with the energy-efficient motor",  
German Copper Institute)*

## Conserving resources

Nowadays, used products are recycled and incorporated into material cycles. The copper rotor consists of easily separable copper and iron and is therefore not waste following its very long service life, but rather represents a coveted resource of raw materials.



Length: 350 mm

# Foundry technology

## Pressure die casting and permanent mould casting

### *The economic form of moulding*

In our permanent mould foundry, we manufacture small and medium-sized series with unit weights ranging from 10 g up to 10 kg.

Due to the complexity of the cast parts, the critical work stage – namely filling the mould with the liquefied material – is still carried out by hand. Our employees' experience and know-how is a very important asset in this respect.

Pressure die casting is one of the most economical manufacturing methods in the foundry industry. It offers ideal conditions for the manufacture of thin-walled, precise castings with high surface quality.

We manufacture with the following alloys:

**Silicon tombac:** This is a construction material with a high solidity. It is also known under the names of JAKUSIL, OLKUSIL and TOMBASIL. This alloy is very suitable for thin-walled and highly-stressed structural parts. High resistance to corrosion: Salt spray test in accordance with DIN 50021: Discoloration, but no corrosion even after 1,064 hours! Not resistant to ammonia. Good friction bearing properties. Heat resistance up to +200 °C constant, up to -200 °C with slightly increasing solidity.

**Brass:** Good castable construction material. It is utilised in general mechanical engineering as well as in the metal-fitting and electrical industries.

**Copper:** High-purity copper with very good conductivity for electricity and heat. The main fields of application are contact parts for energy supply and copper rotors for three-phase motors.

	Identifier DIN EN 1982	Tensile strength Rm N/mm <sup>2</sup>	Yield point Rp 0,2 N/mm <sup>2</sup>	Strain at failure A %	Hardness HB	Electric conductivity MS/m	Density kg/dm <sup>3</sup>	Melting range °C
Silicon tombac	CuZn16Si4-C	500	300	5-8	130	3	8,3	950-1000
Brass	CuZn38Al-C	380	130	30	75	12	8,3	900-950
Copper	Cu-C	150	40	25	40	>50	8,9	1083



# History

*You can only shape your future if you know your past.*

Hans Breuckmann founded our company in July 1966.

In his 1-man operation, he manufactured permanent mould casting parts from brass and silicon tombac in self-built furnaces. He gathered extensive practical experience while working as operations manager in a leading medium-sized enterprise.

We are now in our second generation under the leadership of Volker Breuckmann and work with 70 employees to achieve joint success.

The traditional permanent mould casting process has been supplemented by pressure die casting technology for heavy metals. In-company mould construction and toolmaking, CNC machining technology and HSC milling technology complete our range.

All the required work stages are carried out in-house. This provides us with a major strength, namely direct access to all departments, thus guaranteeing high quality and flexibility.



<b>Foundry Technology:</b>	<b>Pressure die casting and permanent mould casting from silicon tombac, brass and copper</b>
<b>Mould Making and Toolmaking for in-house casting production:</b>	<b>Casting und solidification simulation, 3D CAD, CAM, CNC technologies, HSC milling technology</b>
<b>Machining Technology:</b>	<b>State-of-the-art CNC Machining Centres, deburring technology</b>
<b>Milling Technology:</b>	<b>Latest HSC technology, 5-axis simultaneous milling</b>

Quality Management according to DIN EN ISO 9001: 2008:

We orientate ourselves to our customers' requirements and expectations and aim to fulfil these promptly. Our business relations are based on our customers' trust in our high quality standard.

Environmental management according to DIN EN ISO 14001: 2009:

In order to achieve our environmental targets, we regularly investigate and evaluate the impacts and benefits of our products and production processes on the environment.

Energy management according to DIN EN ISO 50001: 2011:

To improve energy performance for long term in a systematic way is one of our environmentally responsible targets.



Plant I



Plant II

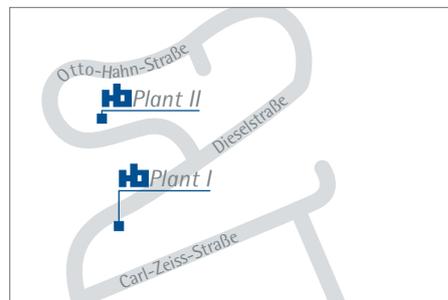


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