**Motors made by ebm-papst**

In AC and EC technology, ebm-papst relies on the proven external-rotor motor principle, with the rotor turning around the stator within. Advantages of the ebm-papst external-rotor principle are:

- Space-saving design due to integrated bearings and direct installation inside the impeller
- Lower load and more precise balancing due to the fixed connection of all rotating elements
- Prolonged service life due to the motor-impeller unit placed right within the air flow

The ebm-papst motors achieve very good results in efficiency and acoustic behaviour when used in EC technology.

<table>
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<tr>
<th>Features</th>
<th>Shaded-pole motor</th>
<th>Single-phase capacitor motor</th>
<th>3-phase motor</th>
<th>Single-core motor</th>
<th>3-core motor</th>
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<tbody>
<tr>
<td>1~ AC voltage connector</td>
<td>Yes</td>
<td>Yes</td>
<td>Limited use (Steinmetz circuit)</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>3~ AC voltage connector</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>DC voltage connector</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

**Design of circuit diagram - Stator -**

- **Rotor principle**
  - Squirrel cage
  - Squirrel cage
  - Squirrel cage
  - Magnetic rotor
  - Magnetic rotor

- **Efficiency**
  - Low
  - Medium
  - Good
  - Excellent
  - Excellent

- **Continuous speed setting integrated**
  - No
  - No
  - No
  - Yes
  - Yes

- **Noise behaviour**
  - Medium
  - Good
  - Excellent
  - Medium
  - Excellent
AC motors

AC motors (induction motors) are based on their function on the principle of the asynchronous rotation of the stator rotating field and rotor.

Shaded-pole motor
Each pole of the motor is divided electromagnetically into a main and auxiliary pole (split) via a cage winding in order to generate a starting torque.

At ebm-papst, shaded-pole motors are available as 2 or 4-pole symmetrical external or internal rotor designs.

Advantages:
- Extremely robust motor design due to cast squirrel cage rotor and stable bearing system
- Cost-efficient motor
- Extremely easy to connect
- Long service life

Torque curves of the motor types

<table>
<thead>
<tr>
<th>Key</th>
<th>Motor Type</th>
<th>Characteristics</th>
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<td>1</td>
<td>EC motor</td>
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<tr>
<td>2</td>
<td>3-phase motor</td>
<td>Starting torque</td>
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<td>3</td>
<td>Single-phase motor</td>
<td>Saddle torque</td>
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<td>4</td>
<td>Shaded-pole motor</td>
<td>Breakdown torque</td>
</tr>
<tr>
<td>5</td>
<td>System characteristic</td>
<td></td>
</tr>
</tbody>
</table>

Start-up current
The start-up current of our AC motors is maximally 4x higher than the nominal current given.
**Single-phase capacitor motor**

Two cores (main winding MW and auxiliary winding AW) generate the rotating field of the single-phase capacitor motor via a capacitor connected in series to form an auxiliary winding.

![Single-phase capacitor motor diagram](image)

**Advantages:**
- Extremely robust motor design due to cast squirrel cage rotor and stable bearing system
- Diverse options for setting speed
- Efficiency between 30% and 75% (depending on motor size)
- Long service life
- Good vibration and noise behaviour

**3-phase motor**

The three motor cores are offset by 120° and generate a circular rotating field when connected to the 3-phase mains.

![3-phase motor diagrams](image)

**Advantages:**
- Extremely robust motor design due to cast squirrel cage rotor and stable bearing system
- Very good vibration and noise behaviour
- Efficiency between 40% and 80% (depending on the motor size)
- Long service life

**Torque curves of 3-phase motors**

![Torque curves graph](image)

**Key:**
1 — Delta
2 — Star
3 — Steinmetz circuit
EC motors

EC motors are based in their function on the principle of the synchronous rotation of stator rotating field and rotor.

**Torque curves of the motor types**

Key:
1. EC motor
2. 3-phase motor
3. Single-phase motor
4. Shaded-pole motor
5. System characteristic

- Starting torque
- Saddle torque
- Breakdown torque

**Single-core motor**

Advantages:
- Integrated speed setting
- Efficiency between 50 % and 80 % (depending on the motor size)
- Long service life

**3-core motor**

Advantages:
- Integrated speed setting
- Good efficiency between 60 % and 90 % (depending on the motor size)
- Long service life
- Very good vibration and noise behaviour even in controlled operation
- Can be used as drive motor