

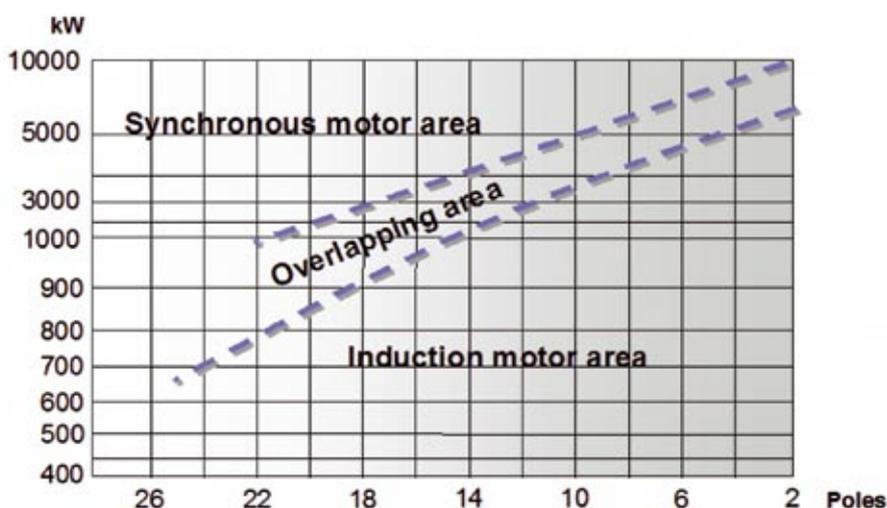
Induction versus synchronous: how to select the right type of motor

Selection based on the speed-power ratio

In many applications the required speed-power ratio provides a rough determination of which type of motor should be used. Applications where low power and high speed are needed generally use induction motors, while

synchronous motors are used in high power and low speed applications.

For applications which fall into the overlapping area, other issues need to be considered.



In cases where both types of motor can be used (overlapping area in graphic), the following criteria can guide the selection process.

Power factor and reactive power

If power factor control or reactive power compensation is needed then a synchronous motor is the correct choice.

Network reliability and stability

In applications where network stability is an issue, an induction motor should generally be selected to ensure stable operation during voltage dips. A synchronous motor can also be used, but steps must be taken to ensure that the inertia and protection mode are adequate.

Efficiency and lifetime cost

The initial investment cost is higher with synchronous motors, but better efficiency means that overall lifetime costs can be lower than with induction motors.

Installation and protection

Induction motors are easier to install and protect than synchronous motors.

ABB manufactures a comprehensive range of induction and synchronous motors rated up to 60 MW.



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Technical notes

Comparison overview

Characteristic	Induction	Synchronous
Efficiency	High	Very high
Power factor	0.8 – 0.9 lagging	Adjustable
Reactive power	Consumed	Consumed or produced, can be used for network stabilization
Rotor		
Rotation speed	Slightly slower ('slip') than electric field	Same speed as electric field
Speed and load torque relationship	Some speed variation depending on load torque	No speed variation depending on load torque
Current in rotor	AC	DC
Magnetization	Through induction	By exciter
Design	Laminated, cylindrical	Solid (fast machines) or laminated (slow); salient poles
Thermal capacity	Lower	Higher
Stiffness	Lower	Higher
Starting characteristics		
Torque (slip = 100%)	Lower	Higher
Current	Higher	Lower
Protection		
	Easier to protect	Requires pull-out protection
Sensitivity to network disturbances	Robust	Sensitive to power supply cut-offs

