# ABB IE5 Synchronous reluctance motors and Drives IEC Low voltage motors and Drives



#### **Global market and trends** The world is going electric



## Making the case for energy efficiency The critical role of motors and drives

#### Let's talk about saving energy

High efficiency motors and drives play a vital role in reducing energy consumption

#### **Ecodesign Regulation for motors and drives**

When it comes to new regulations, it's essential to be ahead of the game to ensure that customers have future-proof products





# Boosted sustainability

With easy to recycle solutions



higher supply chain reliability and highest efficiency (no rare earch magnets)



Main drive parts can be recycled to preserve natural resources and energy

> The product package is made of cardboard. All materials used in the package can be recycled



### **ABB IE5 synchronous reluctance motors** highest efficiency in rotor technology



#### **Brief history** Synchronous reluctance motors

The increasing number of inverter driven motors lead to the breakthrough of synchronous reluctance motor technology.

#### Proven and reliable technology with ABB

- 2011: first introduction SynRM motors (IE4)
- 2019: introduction of ultra-premium IE5 SynRM
- Suitable for all kind of applications
- Standard motor range available easy replacement of traditional induction motors



#### **IE5 according to IEC TS 60034-30-2** ABB IE5 Synchronous reluctance motors

IEC TS 60034-30-2 defines IE (International Efficiency) classes of variable speed AC (alternating current) motors

Similar standard IEC 60034-30-1 defines IE classes for DOL (direct-on-line) motors

The new standard allows motor to motor comparison in the IE class level, regardless of which standard is used for IE classification

This is the first time that IE5 class has been officially defined

• IE5 is not defined for DOL motors

As a rule of thumb IE5 motors have about 20% fewer losses compared to IE4 motors.



**It's time to upgrade your motors** synchronous reluctance motors

IE4 and also IE5 efficiency available



ready to deliver best in class performance 9AKK108468A4563

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Save money



Save energy



Save CO2 certificates



Improve reliability



For all applications

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## First choice for efficiency

#### ABB IE5 SynRM motors deliver a new level of efficiency: Ultra-premium IE5



#### Significantly more efficient



Highest efficiency IE5



**Energy** savings up to 40% (compared to induction motors)



Savings in CO2 certificates



Good carbon footprint

## First choice for reliability

#### ABB IE5 SynRM motors deliver the highest reliability and easy service



**Minimized motor failures and downtime,** ensuring the most reliable, sustainable and long-lasting performance

**∭**=

**cooler temperatures** (bearing and winding)

Longer lifetime Extended service intervals

Magnet-free rotor

**Easy** service and maintenance

free of rare earth

silet operation

Environmentally sustainable

**Better** working environment

# First choice for highest process quality accurate control of speed and torque





Full torque even with zero speed

Low inertia

Reliable starting

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Fast motor control

High quality production

### **It's easy to upgrade** ABB IE5 synchronous reluctance motors

#### Proven and reliable technology from ABB

- Long experience with SynRM motor-drive packages
- Delivering high-efficiency SynRM packages since 2011
- Numerous customer cases

#### ABB IE5 SynRM motors easily replace induction motors

- The same size
- The same output power
- Significantly lower life cycle costs



### **Practical guidance to an easy comparison** IE5 vs IE3 in VSD duty

How to calculate motor efficiency with VSD supply if only motor DOL efficiency is known?

Add additional losses as given in IEC TS 60034-30-2

- 15% additional losses for motors up to 90kW
- 25% additional losses for motors above 90kW
- 15 kW IE3 motor DOL efficiency 92,1%

Same motor with VSD supply 91,0%

This is the right value to compare against SynRM 94,8%

→ PDS (power drive system) efficiency ACx580 + 15 kW IE5 SynRM = 92,6%

Output kW	Type designation	Product code	IE class acc. to IEC TS 60034-30-2	Motor efficiency with VSD supply T <sub>N</sub> =100% n <sub>N</sub> =100%	Typical IE3 induction motor efficiency with VSD supply <sup>1</sup>
1500 r/min (50 Hz)			400 V network		
5.5	M3AL 132SMA 4	3GAL132213-•SC	IE5	93.7	88.2
7.5	M3AL 132SMB 4	3GAL132223-•SC	IE5	93.7	89.1
11	M3AL 132SMC 4	3GAL132233-•SC	IE5	94.2	90.2
11	M3BL 160MLA 4	3GBL162413-•SC	IE5	94.0	90.2
15	M3BL 160MLB 4	3GBL162423-•SC	IE5	94.8	91.0

Performance at nominal speed

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#### **IE5 SynRM + Drive vs. IE3 motor + Drive** Full load and part load efficiency

ABB measurements confirm SynRM efficiency advantage also at partial load conditions

There is about a 2-3% of benefit at full load, while at partial load the benefit can be as much as 6-7%

IE5 + VSD vs. IE3 + VSD payback calculation can be done by comparing nominal point efficiency

Partial load efficiency not critical as the power consumption is also much less

Using "average power" to assume VSD duty





Payback calculation can be done with nominal point efficiency comparison

#### **IE5 SynRM motor + drive package vs IE3 package in 2021** Practical example



**IE5 SynRM motor + drive package vs IE3 package** Practical example with current rising energy costs



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## A complete drive product portfolio Optimized package selections available in the catalogues

ABB offers a broad range of SynRM motor and drive packages with verified IES system efficiency!

## ACS580/ ACH580 / ACQ580 & ACS880 variable speed drives

- SynRM optimized drive types in the catalogue
- For all applications including water and wastewater, HVAC, food and beverage and many more
- Support various motor types including induction, permanent magnet, and synchronous reluctance motors



#### Drive and motor selection tool

finding the perfect match (drive + motor)



- 1. Open the tool
- 2. Select industry
- 3. Select application
- 4. Find your perfect match

#### Please select IE5!



# SynRM and drive package for HVAC

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Comfort continuity at reduced energy consumption

#### **The new first choice for sustainable buildings** ABB IE5 SynRMmotors with ACH580 drives for HVAC

ABB IE5 SynRM motors deliver a new level of efficiency: Ultra-premium



## **Highest energy efficiency in pump applications** Savings of up to 10 kWh per day

A wide range of pump installations in buildings are still using IE2 motors. Replacing these motors with IE5 SynRM motors helps to save a lot of energy instantly.

Calculation on the energy consumption based on:

- 11kW/4 pole motor and drive combination
- running 2000 hours/a

IE5 motor and ACH580 drive energy savings



# Savings of 0.43 kWh per hour

Compared to IE2 motor and drive system

#### **Optimized HVAC processes** ACH580 HVAC features tailored for HVAC industry's needs



#### Anti-condensation

Resonance frequency monitoring Intelligent multipump control Communication loss functionality Soft start and stop Run permissive (damper control) Fireman's override mode Sensorless flow calculation Air filter monitoring Motor bearing monitoring Sleep and boost functions Dry pump run protection

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#### Upgrade your motors now

Complete systems - out of one hand – today and also tomorrow.

IE2 induction motor with ACH550 drive

 $\rightarrow$ 

IE5 synchronous reluctance motor with ACH580 drive



Less cooling required Lower noise level Same size



## **Increased uptime** With improved process control and reliability





#### Success Story – saving energy

### ACH580 and SynRM package for Hobart Aquatic Centre in Tasmania, Australia

- Nineteen IE5 SynRM motor and drive packages and 25 ABB Ability<sup>™</sup> Smart Sensors
- energy savings of \$26,000 USD per year
- savings of 77 tons of carbon dioxide emissions per year
- Advanced analytics and savings of 18% electricity load
- savings in maintenance activities and operational costs
- Return on investment within 3 years
- Project as part of a Centre upgrade to create a more sustainable city for better communities

Learn more



# SynRM and drive package for WWW

Secured water flow with reduced energy consumption

THE STREET



## **The new first choice for energy efficient pumping** ABB IE5 synchronous reluctance motors with ACQ580 drives

ABB IE5 SynRM motors deliver a new level of efficiency: Ultra-premium



### **Saves energy and helps to protect the environment** savings up to 14kWh each day = 100km with an electric vehicle

A wide range of pump installations are still using asynchronous IE1 or IE2 motors. Retrofitting with SynRM IE5 motors will improve energy consumption significantly.

Comparison based on:

- 11kW/4 pole motor and drive combination
- Operating 2000 hours/a

IE5 motor and ACQ580 drive energy savings



#### 14kwh savings each day

Compared to IE1 motor and drive system

#### 10 kWh savings each day

Compared to IE2 motor and drive system

**Optimized water and wastewater process** ACQ580 water specific features tailored for water industry's needs



Intelligent multipump control 9AKK108468A4563 Quick ramps Level control Pump cleaning Sensorless flow calculation Min/max flow and pressure protection Dry pump protection Soft pipe filling Adaptive programming Comm fail Functionality **PID/Loop Control** Anti-cavitation

# Matched motors and drives from the same supplier

IE2 induction motor with ACS550 drive

**Perfect for retrofits** 

 $\rightarrow$ 

IE5 synchronous reluctance motor with ACQ580 drive



Less cooling required Lower noise level Same size



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## **Increased uptime** With improved process control and reliability



Remote condition monitoring  $\longrightarrow$  Reduce unplanned downtime



# Success case – Improving energy efficiency

ACS880 and SynRM package for a sewage treatment plant in North Rhine-Westphalia, Germany

German sewage treatment plant trusts ABB to improve energy efficiency of drive systems.

- Seven IE5 SynRM motor and drive packages
- Ultra-premium efficiency and good partial load efficiency of SynRM motors
- Reduced risk of disturbances in the power network and stable supply voltage with ultra-low harmonic drives
- Project support by the Federal Environment Ministry of Germany as part of the National Climate Protection Initiative



<u>Learn more</u>

# SynRM and drive package for F&B

# Accurate torque and speed control for reliable extruder operation

Whether you are producing confectionery, breakfast cereals or pasta, you need drives and motors that can deliver high torque right down to zero speed. Our products will keep your extruder running reliably while saving energy



Reliable starting



Non-stop operation



Quality extruding



High efficiency





#### Compact drives that offer precise control, flexible integration and broad compatibility

- Direct torque control (DTC) enables full motor torque over whole speed range down to zero
- Wide range of fieldbus adapters enables connectivity with all major automation networks
- Bluetooth capability and mobile app to connect and control drives that are difficult to access
- SIL 3 integrated safety including safe torque off (STO) as standard
- Wide range covering wall-mounted and cabinet-built drives and drive modules
- Compact design for easy installation, commissioning and maintenance



#### IE5 Synchronous Reluctance Motors (SynRM)

- Very high efficiency reduces energy consumption and emissions
- Lower winding and bearing temperatures mean improved reliability and longer lifetime
- Better controllability enables higher quality extruding through accurate speed and torque control
- Quiet operation reduces noise in the plant for a better working environment
- Available in the power range 5.5-315 kW, IEC frame sizes 132-315

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# Sustainable operation of machinery in food and beverage plants

Whether you are producing bread, chocolate, meat, coffee or other products, our motors and drive solutions will keep your machinery operating reliably while ensuring high quality products and saving energy





High efficiency

High quality food processing





## All-compatible variable speed drives enable a more efficient operation, extension of the equipment lifetime, and cost savings

- Drives available with IP21 and IP55 protection class
- Low harmonics based on internal choke
- EMC level C2 due to built-in EMC filter
- Safe torque off (SIL 3/PL e) function ensures machine, production and personnel safety
- Compact design for easy installation, commissioning and maintenance
- State-of-the-art assistant control panel, up to 20 different languages with help functions
- Primary settings and control macros for fast commissioning of the product
- Wide range of fieldbus adapters enables connectivity with all major automation networks
- Bluetooth capability and mobile app to connect and control drives that are difficult to access



#### IE5 Synchronous Reluctance Motors (SynRM)

- Very high efficiency reduces energy consumption and emissions
- Lower winding and bearing temperatures mean improved reliability and longer lifetime
- Enables higher quality processing through accurate speed and torque control
- Quiet operation reduces noise in the plant for a better working environment
- Available in the power range 5.5-315 kW, IEC frame sizes 132-315
- Magnet free rotor increases reliability and reduces need for service

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## **Energy efficient and reliable operation** of cooling compressors in food and beverage plants

Refrigeration accounts for a large portion of the electricity bill in a food processing plant. An energy efficient drive and motor package will reduce energy consumption while making food safety a priority

One stop shop





Precise cooling





**High efficiency** 





#### Variable speed drives enable a more efficient operation, extension of the equipment lifetime, and cost savings

- Drives that provide even better levels of energy efficiency
- Compact general purpose and industrial drives that offer precise control, flexible integration
- Wide range of fieldbus adapters enable connectivity with all major automation networks
- Bluetooth capability and mobile app to connect and control drives that are difficult to access
- Safe torque off (SIL 3/PL e) function ensures machine production and personnel safety
- Compact design for easy installation, commissioning and maintenance



#### IE5 Synchronous Reluctance Motors (SynRM)

- Very high efficiency reduces energy consumption and emissions
- Lower winding and bearing temperatures mean improved reliability and longer lifetime
- Enables precise cooling through accurate speed and torque control
- Quiet operation reduces cooling noise in the plant for a better working environment
- Available in the power range 5.5-315 kW, IEC frame sizes 132-315
- Magnet free rotor increases reliability and reduces need for service

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# Sustainable operation of pumps in food and beverage plants

Pumps are everywhere in a food and beverage plant. Our motor and drive solutions will keep your pumps operating reliably while ensuring high quality products and saving energy



Reliable pumping



Efficient pumping



Quality pumping



High productivity





## ABB general purpose and industrial drives are part of the all-compatible family, which enable a more efficient operation, extension of the equipment lifetime, and cost savings

- Drives available with IP21 and IP55 protection class
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- EMC level C2 due to built-in EMC filter
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#### IE5 Synchronous Reluctance Motors (SynRM)

- Very high efficiency reduces energy consumption and emissions
- Lower winding and bearing temperatures mean improved reliability and longer lifetime
- Enables higher quality pumping through accurate speed and torque control
- Quiet operation reduces noise in the plant for a better working environment
- Available in the power range 5.5-315 kW, IEC frame sizes 132-315
- Magnet free rotor increases reliability and reduces need for service

#### Success case – Minimizing energy consumption

ACS580 and SynRM package for Campbell's refrigeration plant contributes to sustainability

Worldwide known soup manufacturer trusts ABB's motors and drives for improved process efficiency

- 14% reduction in energy consumption
- Dropping energy cost over 10,000 USD annually
- CO2 savings of 131 tonnes

Learn more



#### **Learn more** Useful resources

#### ABB IE5 SynRM and Drive: The perfect match

- <u>Campaign website</u>
- Success cases
- YouTube video
- <u>Podcast</u>

SynRM motor product website: Link

**Drives**: <u>Link</u>

Product catalog, 9AKK107743 EN 12-2019: Low voltage IE5 Synchronous reluctance motors

