



Catalog | February 2015

# Low voltage IE4 synchronous reluctance motor and drive package

With expertise, and a comprehensive portfolio of products and life-cycle services, we help value-minded industrial customers improve their energy efficiency and productivity.



# IE4 synchronous reluctance motors

## Sizes 160 to 315

<b>General information</b>	<b>4</b>
Package benefits	4
ACS880 drive highlights	6
ACS850 drive highlights	7
IE4 synchronous reluctance motors	9
Synchronous reluctance motor technology	10
<b>Ordering information</b>	<b>11</b>
<b>Mounting arrangements</b>	<b>12</b>
<b>Rating plates</b>	<b>13</b>
<b>Technical data</b>	<b>14</b>
<b>Variant codes</b>	<b>15</b>
<b>Mechanical design</b>	<b>19</b>
Motor frame and drain holes	19
Bearings	20
Terminal box	24
<b>Dimension drawings</b>	<b>30</b>
<b>Accessories</b>	<b>34</b>
Separate cooling	34
Protective roof and tachometer	35
Silencer	36
Slide rails	37
<b>Motor construction</b>	<b>39</b>
<b>Motors in brief</b>	<b>40</b>
<b>Total product offering</b>	<b>42</b>
<b>Life cycle services and support</b>	<b>43</b>



# General information

## Package benefits

Lowest energy bill with maximum availability



Traditional IE2 induction motor

### IE4 super premium efficiency

The heart of the synchronous reluctance motor and drive package is a magnet-free efficiency-optimized synchronous reluctance motor. The draft standard IEC 60034-30-1 Edition 1.0 specifying IE classes applies exclusively to motors rated for line operation, which is not the case for ABB synchronous reluctance motors. Therefore, the motor does not have an IE class marking on the rating plate.

So why call the package an IE4? Because its package efficiency at the nominal operating point is the same or higher than that of a motor and drive package utilizing a motor with line-operated IE4 classification. An additional benefit related to synchronous reluctance motors is their excellent partial load efficiency performance compared to induction motors.



IE4 SynRM motor and drive package

### Verified package efficiency

For the first time, you don't have to guess the combined energy consumption of the motor and drive for a given output power. The SynRM motor and drive package is measured to verify efficiency. When comparing efficiencies between different alternatives, make sure you're looking at efficiency values for the whole package and all the speeds that will be run. Read more about package efficiency on page 8.

### Upgrade system efficiency without mechanical modifications

Unlike many other IE4 motors, most synchronous reluctance motors follow harmonized Cenelec size and output combinations. This means that upgrading to the highest efficiency level is easy and straightforward, and there is no need for mechanical modifications, which keeps the payback time of the total investment very short.

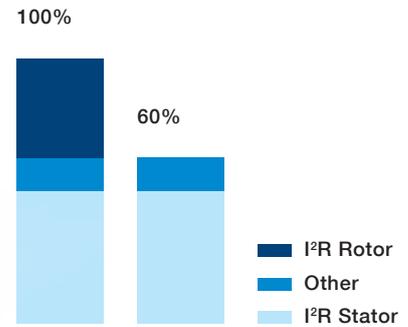
# Ultimate efficiency and reliability to optimize your cost of ownership



Traditional IE2 induction motor



IE4 SynRM motor



Losses

## Innovation inside

The idea is simple. Take a conventional, proven stator technology and a totally new, innovative rotor design. Then combine them with a best-in-class industrial drive loaded with new, purpose-designed software.

## Magnet-free design - Easy service

Synchronous reluctance technology combines the performance of the permanent magnet motor with the simplicity and service-friendliness of an induction motor. The new rotor has neither magnets nor windings and suffers virtually no power losses. And because there are no magnetic forces in the rotor, maintenance is as straightforward as with induction motors.

## Superior reliability to minimize the cost of not running

IE4 synchronous reluctance motors have very low winding temperatures, which increases the reliability and lifetime of

the winding. More importantly, the cool synchronous reluctance rotor means significantly lower bearing temperatures – an important factor because bearing failures cause about 70 percent of unplanned motor outages.



## Winner of the 2011 Automation Award – The ‘Automations Oscars’

The new motor and drive package won Germany’s most important automation award at the SPS/IPC/DRIVES trade show in Nuremberg.



SynRM technology is also available in high output motor and drive packages with up to two frame sizes smaller motor. To learn more, visit [www.abb.com](http://www.abb.com).

# ACS880 drive highlights



## ACS880 drive highlights

- An all-compatible drives range for numerous industries and applications: paper machines, processing lines, pumps, fans, compressors, and conveyors, among others.
- Compact design for easy installation, commissioning, and maintenance.
- Enclosure classes IP21, IP22, IP42, IP54 and IP55 for various ambient conditions.
- Integrated safety, including the safe-torque-off (STO) feature as standard.

- A memory module stores drive settings and can be installed in a new drive by anyone on the site.
- Supports various motor types: induction, permanent magnet, and synchronous reluctance motors.
- Direct torque control (DTC) – ABB’s signature motor control technology provides precise speed and torque control also without any feedback devices like encoders or position sensors.

Other drives are also available. Consult ABB Drives for the latest SynRM-compatible frequency converter offering.



# ACS850 drive highlights



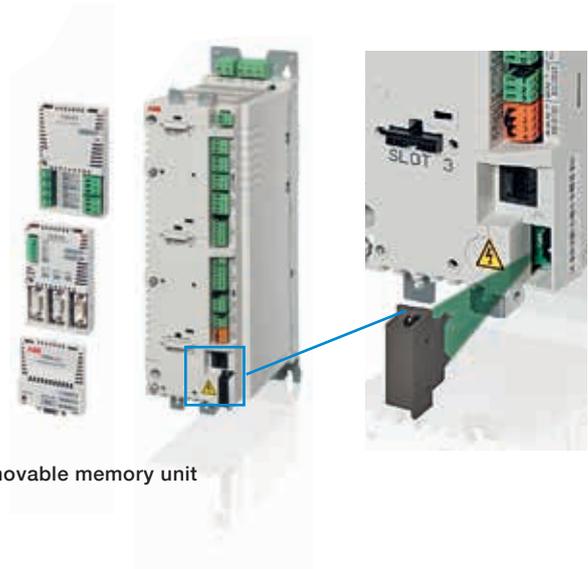
## ACS850 drive highlights

- Designed to meet the production and performance needs of machine builders, system integrators and end users in a broad range of applications.
  - Modular structure with a wide range of options means that users need to purchase only the features they require.
  - Can run induction, permanent magnet, and synchronous reluctance motors, so it can be deployed on other motors if needed.
  - A compact and convenient memory module stores drive settings and can be installed in a new drive by anyone on the site.
- Slim design means the drive occupies the minimum cabinet space.
  - Drive setup simply involves entering the parameters from the motor rating plate just as with an induction motor. No encoders, position sensors or other feedback devices are needed.
  - Direct torque control (DTC) – ABB's signature motor control technology provides precise speed and torque control also without feedback.

Other drives are also available. Consult ABB Drives for the latest SynRM-compatible frequency converter offering.



Removable control panel



Removable memory unit

# Why settle for high motor efficiency?

Using a motor with the highest efficiency class together with speed control is a good start when it comes to minimizing your energy bill.

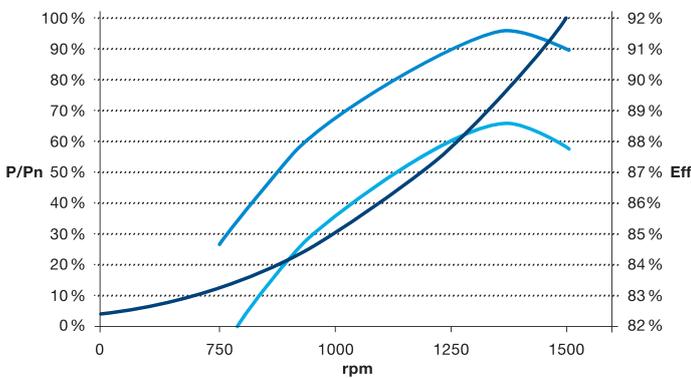
However, the IE class only indicates motor efficiency with a sinusoidal supply at nominal speed and power. This information is not relevant when calculating energy consumption in variable speed applications. Accurate calculations demand efficiency data for the whole motor-drive package and for the entire speed range.

Now – for the first time in the industry – ABB offers you the means to calculate actual energy consumption with a measured efficiency curve for the motor and drive package. Log the operating profile and energy consumption of your present system and calculate the energy consumption with the new IE4 SynRM package.

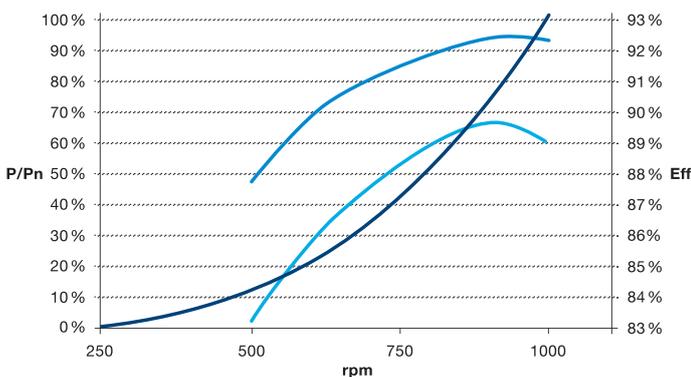
This time your calculations will be based on facts, not assumptions.

## Motor-drive package efficiency curves

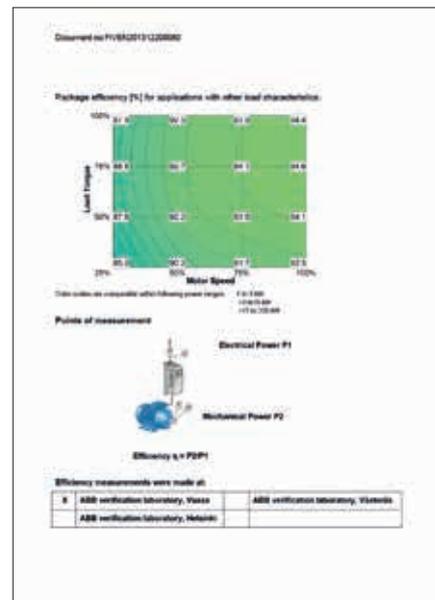
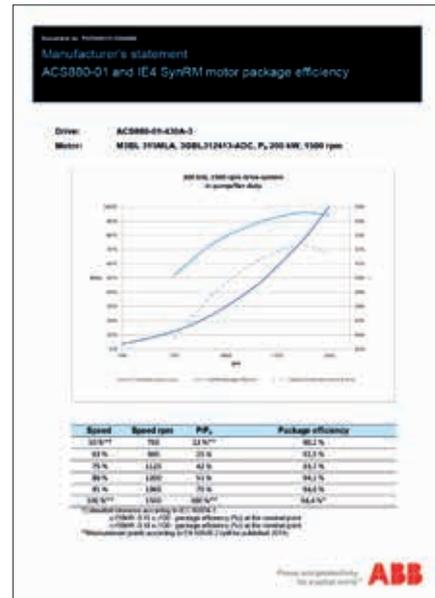
- Pump/fan power curve
- ABB IE4 SynRM & Drive
- IE2 Induction Motor & Drive



15 kW, 1500 rpm, drive system in pump/fan duty



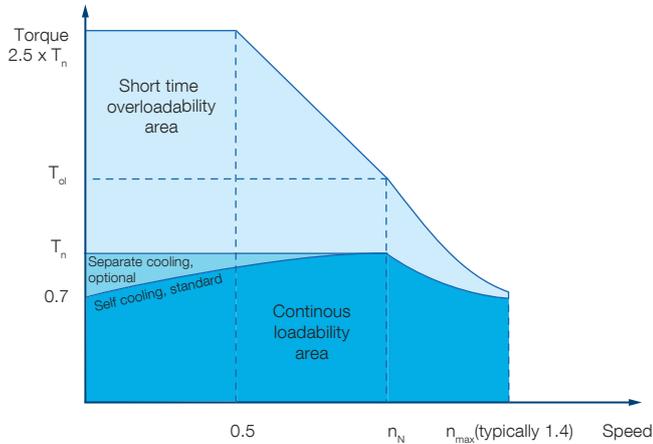
37 kW, 1000 rpm, drive system in pump/fan duty



Motor-drive package efficiency data by ABB.

# IE4 synchronous reluctance motors

## Loadability



Torque characteristics of the SynRM motor

## Efficiency & MEPS

International minimum efficiency performance standards (MEPS) for measuring the efficiency of VSD-only types of motors - such as synchronous reluctance motors - are under development. No local MEPS efficiency requirements for VSD-only motors have been issued by November 2014.

## Service

Servicing synchronous reluctance motors is as straightforward as with induction motors. The winding technology is identical to induction motors. The rotor does not include any magnetic materials, which means that the motor can be disassembled and serviced using the same procedure as for conventional induction motors. For test runs, SynRM capable frequency converter is needed.

## Why motor and drive package

New technology motors are more challenging from the control point of view than traditional induction motors. When selecting a new technology motor and drive package, it is important to ensure that the package is suitable for the application and that the drive has the right control software. The performance of synchronous reluctance motors is verified with an ABB drive. Performance and functionality with other drives cannot be guaranteed.

## Package selection

The technical data section lists matching motor and drive packages for easy package selection for pump and fan applications. Refer to ABB for package selection for other speeds or applications, or use the Drive-Size software.

## Insulation protection

Synchronous reluctance motors have the same stator winding insulation as other ABB low voltage motors. The insu-

lation is approved for 500 V VSD supply. For voltages above 500 V, follow ABB's instructions regarding the correct insulation system and the output filters of the drive.

## Bearing currents

Synchronous reluctance motors rated above 100 kW are equipped with one insulated bearing as standard, which together with the correct cabling is sufficient to secure trouble-free operation up to 350 kW. Above 350 kW the drive should be equipped with a common-mode filter as an additional measure.

## Cabling, grounding, and EMC

Synchronous reluctance motors are not equipped with EMC filters as standard. The variant code to order EMC cable glands is +704.

The use of a frequency converter sets higher demands on the cabling and grounding of the drive system. In other than exceptional circumstances, the motor must be cabled with shielded symmetrical cables and cable glands providing 360-degree bonding (EMC glands). For motors up to 30 kW, asymmetrical cables can be used, but shielded cables are always recommended, especially if there are sensitive components in the driven application.

For motors from frame size 280 upwards, additional potential equalization is needed between the motor frame and machinery, unless the motor and the driven machine are installed on a common steel base. When a steel base is used for potential equalization, the high frequency conductivity of the connection must be checked. For more information, see the ABB manual "Grounding and cabling of drive systems", 3AFY61201998 Rev C.

To meet EMC requirements, special EMC cables must be used in addition to the correct cable gland mounting, with additional special earthing pieces. For more information, refer to drive manuals.

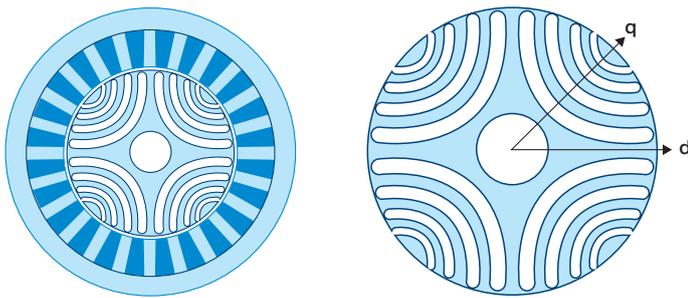
# Synchronous reluctance motor technology

## Introduction

The synchronous reluctance motor is a three-phase electric motor with a magnetically anisotropic rotor structure. In the four-pole version, the rotor has four high- and four low-permeance axes. High permeance means high magnetic conductivity and higher inductance, while low permeance means lower inductance.

Reluctance is the inverse of permeance and is, in practical terms, magnetic resistance; high reluctance results in low inductance. The axes with high permeance can be referred to as the direct or d-axis, while the axes with high reluctance can be referred to as the quadrature or q-axis.

The figures below show cross-sectionals of a synchronous reluctance motor. The different axes in the rotor are identified in the figure on the right.



Cross-sectional illustration of a four-pole synchronous reluctance motor (left), and the definition of the magnetic d- and q-axes of its rotor (right).

## Functional principle

When a magnetic field is produced in the air gap by applying exciting currents to the stator windings, the rotor will strive to align its most magnetically conductive axis, the d-axis, with the applied field, in order to minimize the reluctance in the magnetic circuit. In other words, torque is produced in the air gap between the stator and rotor whenever the applied field vector and the d-axis of the rotor are not aligned.

The magnitude of the vector field and the speed of its rotation can be controlled by a frequency converter. The high saliency of the rotor means that its angular position can be simply detected by a sensorless control. Expensive absolute encoders, resolvers, and other rotational sensors are therefore not required.

The sensorless control system keeps track of the rotor's angular position in relation to the stator and creates a vector field with accurate magnitude and rotational speed in accordance with the control reference signals dictated by the load.

Since performance is dependent on the information about the rotor's position, the motor needs a frequency converter; it cannot be started with a direct-on-line supply. The rotor runs in synchronism with the applied vector field, striving to minimize reluctance in the magnetic circuit that is present. This functional principle has given its name to the technology – synchronous reluctance.

Synchronous reluctance motors run smoothly due to the sinusoidal air gap field distribution and operation with sinusoidal current.

## Rotor design

The rotor design of a synchronous reluctance motor comprises electric steel plates stacked together to form a rotor package. The electric steel plates have punched holes as flux barriers, as illustrated in the figures on the previous page.

The torque produced by the motor is proportional to the difference between the inductances on the d- and q-axes: the greater this difference, the greater the torque production. The synchronous reluctance motor is therefore designed with magnetically conductive material, iron, in the d-axis and magnetically insulating material, air, in the q-axis.

As the rotor has no windings and consequently no joule losses, it runs considerably cooler and with better efficiency than the rotor in an induction motor. The cool running of the rotor also means lower bearing temperatures, which in turn increase the reliability of the bearing system.

## Further considerations

Eliminating rotor joule losses in the synchronous reluctance motor has led to compact construction, good efficiency levels and cooler bearing temperatures. The main disadvantage of this technology is that the motor's power factor is generally not as good as with induction motors.

Since there is always a frequency converter between the motor and the grid, the lower power factor is not apparent on the grid side and consequently does not have an impact on the grid supply dimensioning. However, the lower power factor may sometimes mean that a frequency converter with a higher current rating is needed.

The stator and frame design are based on proven induction motor technology, and the rotor consists of only iron and air. The lack of windings and permanent magnets in the rotor eliminates potential faults associated with these components, resulting in robust motor technology optimized for industrial variable speed applications.

# Ordering information

When placing an order, specify motor type, size, and product code according to the following example.

## Explanation of the product code

Motor type	Motor size	Product code	Mounting arrangement code	Voltage and frequency code	Generation code	Variant codes
M3BL	160 MLA	3GBL 162 104 -	A	S	C	445
		1 2 3 4 5 6 7 8 9 10 11 12		13	14	15

### Positions 1 to 4

3GBL: Totally enclosed fan-cooled synchronous reluctance motor with cast iron frame, sizes 160 - 315

### Positions 5 and 6

#### IEC-frame

16: 160

18: 180

20: 200

22: 225

25: 250

28: 280

31: 315

### Position 7

#### Pole pairs

2: 4 poles

### Positions 8 to 10

Running number

### Position 11

- (dash)

### Position 12

#### Mounting arrangement

A: Foot-mounted motor

B: Flange-mounted motor. Large flange with clearance holes.

Use a variant code for ordering any other mounting arrangement.

### Position 13

Voltage and frequency code

### Position 14

#### Generation code

B High output synchronous reluctance motors

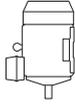
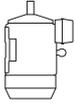
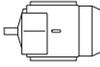
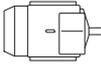
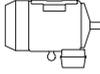
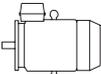
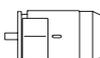
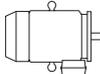
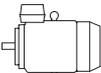
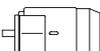
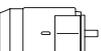
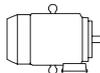
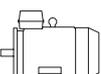
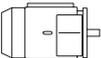
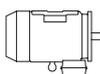
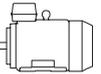
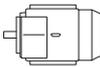
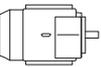
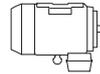
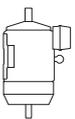
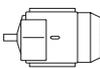
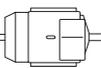
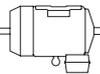
C IE4 synchronous reluctance motors

### Position 15

Variant code

# Mounting arrangements

## Foot- and flange-mounted motors

Code I / code II						Product code pos. 12
<b>Foot-mounted motor</b>						A: foot-mounted, term.box top R: foot-mounted, term.box RHS L: foot-mounted, term.box LHS
						
IM B3 IM 1001	IM V5 IM 1011	IM V6 IM 1031	IM B6 IM 1051	IM B7 IM 1061	IM B8 IM 1071	
<b>Flange-mounted motor, large flange</b>						B: flange mounted, large flange
						
IM B5 IM 3001	IM V1 IM 3011	IM V3 IM 3031	*) IM 3051	*) IM 3061	*) IM 3071	
<b>Flange-mounted motor, small flange</b>						C: flange mounted, small flange
						
IM B14 IM 3601	IM V18 IM 3611	IM V19 IM 3631	*) IM 3651	*) IM 3661	*) IM 3671	
<b>Foot- and flange-mounted motor with feet, large flange</b>						H: foot/flange-mounted, term. box top S: foot/flange-mounted, term. box RHS
						
IM B35 IM 2001	IM V15 IM 2011	IM V35 IM 2031	*) IM 2051	*) IM 2061	*) IM 2071	
<b>Foot- and flange-mounted motor with feet, small flange</b>						T: foot/flangemounted, term. box RHS
						
IM B34 IM 2101	IM V17 IM 2111	IM 2131	IM 2151	IM 2161	IM 2171	
<b>Foot-mounted motor, shaft with free extensions</b>						J: foot/flangemounted, small flange
						
IM 1002	IM 1012	IM 1032	IM 1052	IM 1062	IM 1072	

\*) Not stated in IEC 60034-7.

Note: If the motor is mounted shaft upwards, take measures to prevent water or any other liquid from running down the shaft into the motor.

# Rating plates

The motor's main rating plate shows the motor's performance values at nominal speed. The lubrication plate specifies regreasing amount, regreasing interval in hours - depending on the mounting position and ambient temperature - and types of lubricant recommended.

<b>CE</b>						
3 ~ SYNCHRONOUS RELUCTANCE MOTOR						
M3BL 280SMC 4 IMB3/IM1001						
765780-6		2014		No. 3GF13153877		
				Ins.cl. F		IP 55
V	Hz	kW	r/min	A	Eff.	Duty
370 D	50	110	1500	245	96.3%	S9
Prod. code 3GBL282233-ADC107445						
NETWORK VOLTAGE 400 V						
			Nmax 1500 r/min			
6316/C3			6316/C3VL0241		697 kg	
<b>ABB</b> IEC 60034-1						

Main rating plate

<b>ABB</b>					
Regreasing intervals in duty hours					
Bearings		6316/C3  6316/C3VL0241			
Amount of grease		40 g  40 g			
Mounting	Ambient temp.	1800 r/min	1500 r/min	1000 r/min	0-900 r/min
Hor	25	8000	10500	14000	17000
Hor	40	4000	5250	7000	8500
Vert	25	4000	5250	7000	8500
Vert	40	2000	2630	3500	4250
Do not exceed the motor max. speed					
The following or similar high performance grease can be used:					
Esso	Unirex N2 or N3		Shell	Albida EMS2	
Total	Multis Complex S2 A		Mobil	Mobilith SCH100	
Kluber	Kluberplex BEM41-132		FAG	Arcanol TEMP110	
			765780-6		
<b>See respective "Motor Manual"</b>					

Lubrication plate

# Technical data

## IE4 synchronous reluctance motors

This table presents technical performance data for the currently available IE4 motor and drive packages. Variant codes and construction details are based on the M3BP Process performance motors.

### IP 55 - IC 411 - Insulation class F, temperature rise class B

Output kW	Motor type	Product code	Performance at nominal speed								Suggested ACS880 frequency converter for no overload*	Package efficiency IE4, SynRM & ACS880 $T_N=100\%$ , $n_N=100\%$	Typical package efficiency IE2, IM & ACS880 $T_N=100\%$ , $n_N=100\%$
			Speed $n_N$ r/min	Motor efficiency with VSD supply	Current $I_N$ A	Torque $T_N$ Nm	Torque $T_{OL}/T_N$ Nm	Max speed $n_{max}$ r/min	Inertia J kgm <sup>2</sup>	Weight m kg			
<b>3000 r/min (100 Hz)</b>			<b>400 V network</b>										
11	M3BL 160 MLA 4	3GBL 162 101-_SC	3000	92.6%	25.0	35	1.5	4200	0.0579	133	ACS880-01-025A-3	90.1%	86.7%
15	M3BL 160 MLB 4	3GBL 162 102-_SC	3000	93.3%	34.8	48	1.5	4200	0.0579	133	ACS880-01-038A-3	90.9%	87.5%
18.5	M3BL 160 MLC 4	3GBL 162 103-_SC	3000	93.7%	42.8	59	1.5	4200	0.0579	133	ACS880-01-045A-3	91.6%	88.1%
22	M3BL 180 MLA 4	3GBL 182 101-_SC	3000	94.0%	50.0	70	1.5	4200	0.0702	160	ACS880-01-061A-3	91.8%	88.5%
30	M3BL 200 MLA 4	3GBL 202 101-_SC	3000	94.5%	68.8	95	1.5	4200	0.207	259	ACS880-01-072A-3	91.8%	88.5%
37	M3BL 200 MLB 4	3GBL 202 102-_SC	3000	94.8%	84.6	118	1.5	4200	0.207	259	ACS880-01-087A-3	92.4%	89.2%
45	M3BL 225 SMA 4	3GBL 222 101-_SC	3000	95.0%	103	143	1.5	4200	0.242	282	ACS880-01-105A-3	92.8%	90.0%
55	M3BL 225 SMF 4	3GBL 222 102-_SC	3000	95.3%	122	175	1.5	4200	0.242	282	ACS880-01-145A-3	92.9%	89.9%
<b>1500 r/min (50 Hz)</b>			<b>400 V network</b>										
11	M3BL 160 MLA 4	3GBL 162 104-_SC	1500	93.3%	24.9	70	1.5	2100	0.0702	160	ACS880-01-025A-3	90.9%	87.1%
15	M3BL 160 MLB 4	3GBL 162 105-_SC	1500	93.9%	33.7	95	1.5	2100	0.0864	177	ACS880-01-038A-3	91.6%	87.9%
18.5	M3BL 180 MLA 4	3GBL 182 102-_SC	1500	94.2%	42.0	118	1.5	2100	0.0864	177	ACS880-01-045A-3	92.2%	88.4%
22	M3BL 200 MLF 4	3GBL 202 106-_SC	1500	94.5%	49.1	140	1.5	2100	0.287	304	ACS880-01-061A-3	92.4%	88.8%
30	M3BL 200 MLA 4	3GBL 202 103-_SC	1500	94.9%	66.7	191	1.5	2100	0.287	304	ACS880-01-072A-3	92.8%	89.4%
37	M3BL 250 SMF 4	3GBL 252 104-_SC	1500	95.2%	82.0	236	1.5	2100	0.575	428	ACS880-01-087A-3	93.1%	89.8%
45	M3BL 250 SMG 4	3GBL 252 105-_SC	1500	95.4%	99.5	286	1.5	2100	0.575	428	ACS880-01-105A-3	93.2%	90.2%
55	M3BL 250 SMA 4	3GBL 252 102-_SC	1500	95.7%	121	350	1.5	2100	0.633	454	ACS880-01-145A-3	93.4%	90.1%
75	M3BL 280 SMA 4	3GBL 282 213-_DC	1500	96.0%	173	478	2.0	2100	1.00	639	ACS880-01-206A-3	93.7%	90.6%
90	M3BL 280 SMB 4	3GBL 282 223-_DC	1500	96.1%	202	573	2.1	2100	1.00	639	ACS880-01-206A-3	93.9%	90.8%
110	M3BL 280 SMC 4	3GBL 282 233-_DC	1500	96.3%	245	699	2.1	2100	1.21	697	ACS880-01-246A-3	94.2%	91.1%
110	M3BL 315 SMA 4	3GBL 312 213-_DC	1500	96.3%	244	702	2.0	1800	1.64	873	ACS880-01-246A-3	94.2%	91.1%
132	M3BL 315 SMB 4	3GBL 312 223-_DC	1500	96.4%	290	842	2.0	1800	1.87	925	ACS880-01-293A-3	94.2%	91.3%
160	M3BL 315 SMC 4	3GBL 312 233-_DC	1500	96.6%	343	1018	1.9	1800	2.04	965	ACS880-01-363A-3	94.5%	91.5%
200	M3BL 315 MLA 4	3GBL 312 413-_DC	1500	96.7%	427	1272	1.9	1800	2.45	1116	ACS880-01-430A-3	94.4%	91.7%
250	M3BL 315 LKA 4	3GBL 312 813-_DC	1500	96.7%	542	1591	2.0	1800	3.04	1357	ACS880-04-585A-3**	94.4%	91.8%
315	M3BL 315 LKC 4	3GBL 312 833-_DC	1500	96.7%	650	2006	1.8	1800	3.77	1533	ACS880-04-650A-3**	94.3%	92.0%
<b>1000 r/min (33 Hz)</b>			<b>400 V network</b>										
7.5	M3BL 160 MLA 4	3GBL 162 106-_SC	1000	91.3%	17.3	72	1.5	1400	0.0702	160	ACS880-01-025A-3	88.9%	84.6%
11	M3BL 160 MLB 4	3GBL 162 107-_SC	1000	92.3%	25.0	105	1.5	1400	0.0864	177	ACS880-01-025A-3	89.9%	86.0%
15	M3BL 200 MLF 4	3GBL 202 107-_SC	1000	92.9%	34.0	143	1.5	1400	0.242	282	ACS880-01-038A-3	90.6%	87.0%
18.5	M3BL 200 MLA 4	3GBL 202 104-_SC	1000	93.4%	41.8	177	1.5	1400	0.287	304	ACS880-01-045A-3	91.4%	87.6%
22	M3BL 200 MLB 4	3GBL 202 105-_SC	1000	93.7%	49.5	210	1.5	1400	0.287	304	ACS880-01-061A-3	91.6%	88.1%
30	M3BL 250 SMF 4	3GBL 252 106-_SC	1000	94.2%	67.2	286	1.5	1400	0.499	391	ACS880-01-072A-3	92.1%	88.9%
37	M3BL 250 SMA 4	3GBL 252 103-_SC	1000	94.5%	82.6	353	1.5	1400	0.575	428	ACS880-01-087A-3	92.4%	89.4%
45	M3BL 280 SMA 4	3GBL 282 212-_DC	1000	94.8%	103	430	2.3	1400	1.00	639	ACS880-01-105A-3	92.6%	89.8%
55	M3BL 280 SMB 4	3GBL 282 222-_DC	1000	95.1%	123	526	2.0	1400	1.00	639	ACS880-01-145A-3	92.8%	89.8%
75	M3BL 280 SMC 4	3GBL 282 232-_DC	1000	95.4%	166	715	2.1	1400	1.21	697	ACS880-01-169A-3	93.4%	90.3%
75	M3BL 315 SMA 4	3GBL 312 212-_DC	1000	95.4%	166	717	2.0	1400	1.64	873	ACS880-01-169A-3	93.3%	90.3%
90	M3BL 315 SMB 4	3GBL 312 222-_DC	1000	95.6%	198	859	2.0	1400	1.87	925	ACS880-01-206A-3	93.4%	90.6%
110	M3BL 315 SMC 4	3GBL 312 232-_DC	1000	95.8%	241	1051	1.9	1400	2.04	965	ACS880-01-246A-3	93.7%	90.9%
132	M3BL 315 MLA 4	3GBL 312 412-_DC	1000	96.0%	279	1261	1.7	1400	2.45	1116	ACS880-01-293A-3	93.9%	91.1%
160	M3BL 315 LKA 4	3GBL 312 812-_DC	1000	96.2%	340	1527	1.9	1400	3.04	1357	ACS880-01-363A-3	94.1%	91.3%
200	M3BL 315 LKC 4	3GBL 312 832-_DC	1000	96.3%	418	1910	1.8	1400	3.77	1533	ACS880-01-430A-3	94.1%	91.5%

\* Consult ABB for motor and drive dimensioning for applications with other load characteristics. \*\* ACS880-04 drive module, protection IP 21.

# Variant codes

## IE4 synchronous reluctance motors

Variant codes specify additional options and features to the standard motor. The desired features are listed as three-digit variant codes in the motor order. Note also that there are variants that cannot be used together. In case of some variants, applicability depends not only on frame size but on package length (SM, ML, etc.).

Code/ Variant		Frame size						
		160	180	200	225	250	280	315
<b>Administration</b>								
530	Two-year extension on standard warranty	-	-	-	-	-	•	•
531	Sea freight packing	-	-	-	-	-	•	•
532	Packing of motor in vertical mounting position	-	-	-	-	-	•	•
590	Mounting of customer supplied part other than coupling.	-	-	-	-	-	•	•
999	Case specific design requiring a quotation	•	•	•	•	•	•	•
<b>Balancing</b>								
423	Balanced without key.	•	•	•	•	•	•	•
424	Full-key balancing	•	•	•	•	•	•	•
<b>Bearings and Lubrication</b>								
036	Transport lock for bearings.	•	•	•	•	•	•	•
037	Roller bearing at D-end.	•	•	•	•	•	•	•
039	Cold-resistant grease	-	-	-	-	-	•	•
040	Heat-resistant grease	-	-	-	-	-	•	•
041	Bearings regreasable via grease nipples.	•	•	•	•	○	○	○
043	SPM compatible nipples for vibration measurement	•	•	•	•	○	○	○
057	2RS bearings at both ends.	•	•	•	•	•	-	-
058	Angular contact bearing at D-end, shaft force away from bearing.	•	•	•	•	•	•	•
059	Angular contact bearing at N-end, shaft force towards bearing.	•	•	•	•	•	•	•
060	Angular contact bearing at D-end, shaft force towards bearing.	-	-	-	-	-	•	•
061	Angular contact bearing at N-end, shaft force away from bearing.	-	-	-	-	-	•	•
107	Pt100 2-wire in bearings.	•	•	•	•	•	•	•
128	Double PT100, 2-wire in bearings	-	-	-	-	-	•	•
129	Double PT100, 3-wire in bearings	-	-	-	-	-	•	•
130	Pt100 3-wire in bearings.	-	-	-	-	-	•	•
194	2Z bearings greased for life at both ends.	○	○	○	•	•	-	-
420	Bearing mounted PTC thermistors.	-	-	-	-	-	•	•
433	Outlet grease collector	-	-	-	-	-	•	•
506	Nipples for vibration measurement : SKF Marlin Quick Connect stud CMSS-2600-3	-	-	-	-	-	•	•
654	Provision for vibration sensors (M8x1)	-	-	-	-	-	•	•
796	Grease nipples JIS B 1575 PT 1/8 Type A	•	•	•	•	•	•	•
797	Stainless steel SPM nipples	•	•	•	•	•	•	•
798	Stainless steel grease nipples	•	•	•	•	•	•	•
799	Grease nipples flat type DIN 3404, thread M10x1	-	-	-	-	-	•	•
800	Grease nipples JIS B 1575 PT 1/8" pin type	-	-	-	-	-	•	•
<b>Branch standard designs</b>								
178	Stainless steel / acid proof bolts.	•	•	•	•	•	•	•
204	Jacking bolts for foot mounted motors.	-	-	-	-	-	•	•
209	Non-standard voltage or frequency, (special winding).	•	•	•	•	•	•	•
419	Textile industry design.	•	•	•	•	•	•	•
<b>Cooling system</b>								
068	Light alloy metal fan	•	•	•	•	•	•	•
183	Separate motor cooling (fan axial, N-end).	•	•	•	•	•	•	•
189	Separate motor cooling, IP44, 400V, 50Hz (fan axial, N-end).	•	•	•	•	•	-	-

- = Included as standard
- = Available as option
- = Not applicable

Code/ Variant		Frame size						
		160	180	200	225	250	280	315
206	Steel fan	-	-	-	-	-	•	•
422	Separate motor cooling (on top) with integrated fan motor	-	-	-	-	-	•	•
791	Stainless steel fan cover	-	-	-	-	-	•	•
<b>Coupling</b>								
035	Assembly of customer supplied coupling-half.	-	-	-	-	-	•	•
<b>Documentation</b>								
141	Binding dimension drawing.	•	•	•	•	•	•	•
<b>Drain holes</b>								
065	Plugged existing drain holes.	•	•	•	•	•	•	•
448	Draining holes with metal plugs.	-	-	-	-	-	•	•
<b>Heating elements</b>								
450	Heating element, 100-120 V	•	•	•	•	•	•	•
451	Heating element, 200 - 240 V	•	•	•	•	•	•	•
<b>Insulation system</b>								
405	Special winding insulation for frequency converter supply.	•	•	•	•	•	•	•
<b>Mounting arrangements</b>								
009	IM 2001 foot/flange mounted, IEC flange, from IM 1001 (B35 from B3).	•	•	•	•	•	•	•
066	Modified for specified mounting position differing from IM B3 (1001), IM B5 (3001), B14 (3601), IM B35 (2001) & IM B34 (2101)	•	•	•	•	•	•	•
305	Additional lifting lugs.	•	•	•	•	•	•	•
<b>Noise reduction</b>								
055	Noise reduction cover for foot mounted motor	-	-	-	-	-	•	•
<b>Painting</b>								
105	Paint thickness report.	-	-	-	-	-	•	•
114	Special paint color, standard grade	•	•	•	•	•	•	•
115	Painting system C4M acc. to ISO 12944-2: 2007	-	-	-	-	-	•	•
168	Primer paint only.	-	-	-	-	-	•	•
710	Thermally sprayed zink metallizing with acrylic top coat	-	-	-	-	-	•	•
754	Painting system C5M acc. to ISO 12944-2:1998	-	-	-	-	-	•	•
<b>Protection</b>								
005	Protective roof, vertical motor, shaft down.	•	•	•	•	•	•	•
072	Radial seal at D-end. Not possible for 2-pole , 280 and 315 frames	•	•	•	•	•	•	•
073	Sealed against oil at D-end.	•	•	•	•	•	•	•
158	Degree of protection IP65.	•	•	•	•	•	•	•
211	Weather protected, IP xx W	•	•	•	•	•	-	-
401	Protective roof, horizontal motor.	-	-	-	-	-	•	•
403	Degree of protection IP56.	•	•	•	•	•	•	•
404	Degree of protection IP56, without fan and fan cover.	•	•	•	•	•	-	-
434	Degree of protection IP56, open deck.	-	-	-	-	-	•	•
783	Labyrinth sealing at D-end.	-	-	-	-	-	•	•
784	Gamma-seal at D-end.	•	•	•	○	○	-	-
<b>Rating &amp; instruction plates</b>								
002	Restamping voltage, frequency and output, continuous duty.	•	•	•	•	•	•	•
004	Additional text on std rating plate (max 12 digits on free text line).	•	•	•	•	•	•	•
126	Tag plate	-	-	-	-	-	•	•
135	Mounting of additional identification plate, stainless.	•	•	•	•	•	•	•
139	Additional identification plate delivered loose.	•	•	•	•	•	•	•
159	Additional plate with text „Made in ....“	-	-	-	-	-	•	•
160	Additional rating plate affixed.	•	•	•	•	•	•	•
161	Additional rating plate delivered loose.	•	•	•	•	•	•	•
163	Frequency converter rating plate. Rating data according to quotation.	•	•	•	•	•	•	•
<b>Shaft &amp; rotor</b>								
069	Two shaft extensions according to catalog drawings.	•	•	•	•	•	•	•
070	Special shaft extension at D-End, standard shaft material	-	-	-	-	-	•	•

○ = Included as standard  
• = Available as option  
- = Not applicable

Code/ Variant		Frame size						
		160	180	200	225	250	280	315
131	Motor delivered with half key (key not exceeding shaft diameter)	●	●	●	●	●	-	-
164	Shaft extension with closed keyway	○	○	○	○	○	●	●
165	Shaft extension with open keyway	●	●	●	●	●	○	○
410	Shaft material stainless steel	-	-	-	-	-	●	●
591	Special shaft extension according to customer specification.	●	●	●	●	●	●	●
600	Special shaft extension at N-end, standard shaft material.	-	-	-	-	-	●	●
<b>Stator winding temperature sensors</b>								
120	KTY 84-130 (1 per phase) in stator winding.	-	-	-	-	-	●	●
121	Bimetal detectors, break type (NCC), (3 in series), 130 °C, in stator winding	●	●	●	●	●	●	●
122	Bimetal detectors, break type (NCC), (3 in series), 150 °C, in stator winding	●	●	●	●	●	●	●
123	Bimetal detectors, break type (NCC), (3 in series), 170 °C, in stator winding	●	●	●	●	●	●	●
124	Bimetal detectors, break type (NCC), (3 in series), 140 °C, in stator winding	●	●	●	●	●	●	●
125	Bimetal detectors, break type (NCC), (2x3 in series), 150 °C, in stator winding	●	●	●	●	●	●	●
127	Bimetal detectors, break type (NCC), (3 in series, 130 °C & 3 in series, 150 °C), in stator winding	●	●	●	●	●	●	●
435	PTC - thermistors (3 in series), 130 °C, in stator winding	●	●	●	●	●	●	●
437	PTC - thermistors (3 in series), 170 °C, in stator winding	●	●	●	●	●	●	●
438	PTC - thermistors (3 in series), 190 °C, in stator winding	-	-	-	-	-	●	●
439	PTC - thermistors (2x3 in series), 150 °C, in stator winding	●	●	●	●	●	●	●
441	PTC - thermistors (3 in series, 130 °C & 3 in series, 150 °C), in stator winding	●	●	●	●	●	●	●
442	PTC - thermistors (3 in series, 150 °C & 3 in series, 170 °C), in stator winding	●	●	●	●	●	●	●
445	Pt100 2-wire in stator winding, 1 per phase	●	●	●	●	●	●	●
446	Pt100 2-wire in stator winding, 2 per phase	●	●	●	●	●	●	●
502	Pt100 3-wire in stator winding, 1 per phase	-	-	-	-	-	●	●
503	Pt100 3-wire in stator winding, 2 per phase	-	-	-	-	-	●	●
511	PTC thermistors (2 x 3 in series), 130 °C, in stator winding	-	-	-	-	-	●	●
<b>Terminal box</b>								
019	Larger than standard terminal box.	-	-	-	-	-	●	●
020	Detached terminal box.	-	-	-	-	-	●	●
021	Terminal box LHS (seen from D-end).	●	●	●	●	●	●	●
022	Cable entry LHS (seen from D-end).	●	●	●	●	●	●	●
157	Terminal box degree of protection IP65.	●	●	●	●	●	●	●
180	Terminal box RHS (seen from D-end).	●	●	●	●	●	●	●
230	Standard metal cable glands.	●	●	●	●	●	○	○
231	Cable entry with clamping device.	-	-	-	-	-	●	●
277	Cable sealing end unit, size small for C-opening	-	-	-	-	-	●	-
278	Cable sealing end unit, size medium for D-opening	-	-	-	-	-	-	●
279	Cable sealing end unit, size large for D-opening	-	-	-	-	-	-	●
292	Adapter C-C	-	-	-	-	-	●	-
293	Adapter D-D	-	-	-	-	-	-	●
294	Adapter E-D	-	-	-	-	-	-	●
295	Adapter E-2D	-	-	-	-	-	-	●
380	Separate terminal box for temperature detectors, std. material	-	-	-	-	-	●	●
413	Extended cable connection, no terminal box.	-	-	-	-	-	●	●
418	Separate terminal box for auxiliaries, standard material.	●	●	●	●	●	●	●
447	Top mounted separate terminal box for monitoring equipment.	-	-	-	-	-	●	●
466	Terminal box at N-end.	-	-	-	-	-	●	●
468	Cable entry from D-end.	-	-	-	-	-	●	●
469	Cable entry from N-end.	●	●	●	●	●	●	●
567	Separate terminal box material: cast Iron	●	●	●	●	●	●	●
568	Separate terminal box for heating elements, std. material	-	-	-	-	-	●	●
569	Separate terminal box for brakes	-	-	-	-	-	●	●
729	Aluminum non-drilled flange for cable glands	●	●	●	●	●	●	●
730	Prepared for NPT cable glands.	-	-	-	-	-	●	●
731	Two standard metal cable glands.	●	●	●	●	●	○	○

○ = Included as standard  
● = Available as option  
- = Not applicable

Code/ Variant		Frame size						
		160	180	200	225	250	280	315
740	Prepared for PG cable glands.	●	●	●	●	●	-	-
742	Protective cover for accessory terminal block in main terminal box.	-	-	-	-	-	●	●
743	Painted non-drilled flange in steel for cable glands	●	●	●	●	●	●	●
744	Stainless steel non-drilled flange for cable glands.	-	-	-	-	-	●	●
745	Painted steel flange equipped with nickle plated brass cable glands	-	-	-	-	-	●	●
746	Stainless steel cable flange equipped with standard nickle plated brass cable glands	-	-	-	-	-	●	●
<b>Testing</b>								
148	Routine test report.	●	●	●	●	●	●	●
760	Vibration level test	-	-	-	-	-	●	●
761	Vibration spectrum test for one motor from specific delivery batch.	-	-	-	-	-	●	●
762	Noise level test for one motor from specific delivery batch.	-	-	-	-	-	●	●
763	Noise spectrum test for one motor from specific delivery batch.	-	-	-	-	-	●	●
764	Test for one motor from specific delivery batch with ABB frequency converter available at ABB test field. ABB standard test procedure.	-	-	-	-	-	●	●
<b>Variable speed drives</b>								
062	Tachogenerator.	-	-	-	-	-	●	●
182	Mounting of non-listed pulse tacho.	-	-	-	-	-	●	●
429	Separate motor cooling (fan top, N-end) and 1024 pulse tacho (Leine & Linde 861) mounted.	-	-	-	-	-	●	●
470	Prepared for hollow shaft pulse tacho (L&L equivalent).	●	●	●	●	●	●	●
472	1024 pulse tacho (L&L 861007455-1024).	●	●	●	●	●	●	●
473	2048 pulse tacho (L&L 861007455-2048).	●	●	●	●	●	●	●
474	Separate motor cooling (axial fan, N-end) and prepared for hollow shaft tacho (L&L equivalent)	●	●	●	●	●	●	●
476	Separate motor cooling (axial fan, N-end) and 1024 pulse tacho (L&L 861007455-1024)	●	●	●	●	●	●	●
477	Separate motor cooling (axial fan, N-end) and 2048 pulse tacho (L&L 861007455-2048)	●	●	●	●	●	●	●
478	Separate motor cooling (fan on top, N-end) and prepared for hollow shaft tacho (L&L equivalent)	-	-	-	-	-	●	●
479	Mounting of other type of pulse tacho with shaft extension, tacho not included.	-	-	-	-	-	●	●
486	Separate motor cooling (fan top, N-end) and prepared for DC-tacho.	-	-	-	-	-	●	●
510	Separate motor cooling (fan top, N-end) and 2048 pulse tacho (Leine & Linde 861) mounted.	-	-	-	-	-	●	●
570	Prepared for hollow shaft pulse tacho (L&L 503).	●	●	●	●	●	-	-
572	1024 pulse tacho (L&L 503).	●	●	●	●	●	-	-
573	2048 pulse tacho (L&L 503).	●	●	●	●	●	-	-
582	1024 pulse tacho, GHK912-GBR-1024, BEI IDEACOD	-	-	-	-	-	●	●
583	2048 pulse tacho, GHK912-GBR-2048, BEI IDEACOD	-	-	-	-	-	●	●
658	Special tacho mounted, price category 1	-	-	-	-	-	●	●
659	Special tacho mounted, price category 2	-	-	-	-	-	●	●
660	Special tacho mounted, price category 3	-	-	-	-	-	●	●
701	Insulated bearing at N-end.	●	●	●	●	●	○	○
704	EMC cable entry.	●	●	●	●	●	●	●

- = Included as standard
- = Available as option
- = Not applicable

# Mechanical design

## Motor frame and drain holes

### Motor frame

The motor frame is made of cast iron, and the standard design includes cast iron feet, bearing housing, and terminal box. Integrated cast iron feet provide rigid mounting and minimize vibration. Motors can be supplied for foot mounting, flange mounting, and combinations of these.

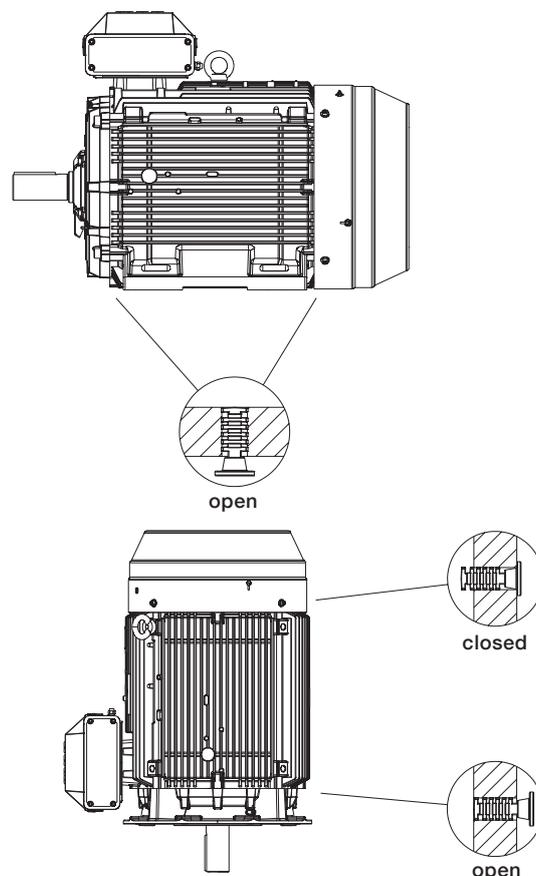
### Drain holes

Motors that will be operated in very humid or wet environments, and especially under intermittent duty, should be provided with drain holes. The IM designation, such as IM 3031, determines the intended mounting arrangement for the motor.

Motors are fitted with drain holes and closable plugs. The plugs are open on delivery. When mounting the motors, ensure that the drain holes face downwards.

In case of vertical mounting, the upper plug must be hammered home completely. In very dusty environments, both plugs should be hammered home.

When mounting differs from foot-mounted IM B3 arrangement, use variant code 066 when ordering. (See variant code 065 under Drain holes and variant code 066 under Mounting arrangements in the Variant codes section.)



As standard, the motor is delivered with drain holes and closable plugs.

# Bearings

Synchronous reluctance motors are normally fitted with single-row deep-groove ball bearings, as shown in the table below.

If the bearing at the D-end is replaced with a roller bearing (NU- or NJ-), higher radial forces can be handled. Roller bearings are suitable for belt-drive applications.

When there are high axial forces, angular-contact ball bearings should be used. This option is available on request. When ordering a motor with an angular-contact ball bearing, specify also the method of mounting and the direction and magnitude of axial force. See Variant codes for special bearings.

## Standard motor with deep-groove ball bearings

Motor size	n <sub>N</sub> r/min	Deep-groove ball bearings	
		D-end	N-end
160	1000 - 3000	6309-2Z/C3	6209-2Z/C3
180	1500 - 3000	6310-2Z/C3	6209-2Z/C3
200	1000 - 3000	6312-2Z/C3	6210-2Z/C3
225	3000	6313/C3	6210/C3
250	1000 - 1500	6315/C3	6213/C3
280	1000 - 1500	6316/C3	6316/C3*
315	1000 - 1500	6319/C3	6316/C3*

\* Insulated bearing at N-end as standard.

## Motor with roller bearings, variant code 037

Motor size	n <sub>N</sub> r/min	Roller bearings D-end
160	1000 - 3000	NU 309 ECP
180	1500 - 3000	NU 310 ECP
200	1000 - 3000	NU 312 ECP
225	3000	NU 313 ECP
250	1000 - 1500	NU 315 ECP
280	1000 - 1500	NU 316/C3
315	1000 - 1500	NU 319/C3

## Axially locked bearings

All motors are equipped as standard with an axially locked bearing at the D-end.

## Transport locking

Motors with roller bearings or an angular-contact ball bearing are fitted with a transport lock before dispatch to prevent damage to bearings during transport. A warning sign is attached to motors larger than 250 when transport locking is used.

Locking may also be fitted in other cases if severe transport conditions are expected.

## Bearing seals

These tables present the standard and alternative sizes and types of seals per motor size.

### Standard designs

Motor size	n <sub>N</sub> r/min	Standard design Axial seal	
		D-end	N-end
160	1000 - 3000	V-45A	V-45A
180	1500 - 3000	V-50A	V-45A
200	1000 - 3000	V-60A	V-50A
225	3000	RB65	V-50A
250	1000 - 1500	RB75	V-65A

Motor size	n <sub>N</sub> r/min	Standard design	
		D-end	N-end
280	1000 - 1500	Axial seal VS80	Axial seal VS80
315 SM, ML	1000 - 1500	Axial seal VS95	Axial seal VS80
315 LK	1000 - 1500	Labyrinth seal	Axial seal VS80

### Alternative designs in motor sizes 160 – 250

Motor size	n <sub>N</sub> r/min	Alternative design, D-end Radial seal (DIN 3760), variant code 072	
		D-end	N-end
160	1000 - 3000	45×62×8	
180	1500 - 3000	50×68×8	
200	1000 - 3000	60×80×8	
225	3000	65×85×10	
250	1000 - 1500	75×95×10	

### Alternative designs in motor sizes 280 – 315

Motor size	n <sub>N</sub> r/min	Alternative design 1	
		D-end	N-end
280	1000 - 1500	Labyrinth seal	Labyrinth seal
315 SM, ML	1000 - 1500	Labyrinth seal	Labyrinth seal
315 LK	1000 - 1500	(Labyrinth seal)	Labyrinth seal

Motor size	n <sub>N</sub> r/min	Alternative design 2	
		D-end	N-end
280	1000 - 1500	Radial seal 80×110×10	Radial seal 80×110×10
315 SM, ML	1000 - 1500	Radial seal 95×125×10	Radial seal 80×110×10
315 LK	1000 - 1500	(Labyrinth seal)	Radial seal 80×110×10

## Heating elements

Heating elements are installed into windings to keep them free of corrosion in humid conditions. The required power of heating elements is shown in the table. You can order heating elements with variant code 450 or 451.

Motor size	160	180	200	225	250	280	315
Heating element power (W)	25	50	50	50	50	60	2×60

# Bearing life and lubrication

## Bearing life

The nominal life  $L_{10h}$  of a bearing is defined according to ISO 281 as the number of operating hours achieved or exceeded by 90 % of identical bearings in a large test series under specified conditions. 50 % of bearings achieve at least five times this lifetime.

The calculated bearing life  $L_{10h}$  for power transmission by means of coupling is for horizontally mounted motors in sizes 280 to 315  $\geq 200,000$  hours.

## Lubrication

On delivery, motors in frame size 225 and above are pre-lubricated with high-quality grease. Before first start-up, see instructions for relubrication and recommended grease in the Manual for low voltage motors delivered together with the motor, or see the lubrication plate on the motor.

## Lubrication intervals

ABB follows the  $L_1$  principle in defining lubrication intervals. According to this principle, 99 % of motors will make the interval time. The synchronous reluctance motor sizes 250 to 315 have regreasable bearings as the standard solution. The lubrication intervals can also be calculated according to the  $L_{10}$  principle, which usually gives twice as long interval times.  $L_{10}$  values are available from ABB at request.

## Motors with relubrication nipples

In frame sizes 280 – 315, the bearing system allows the use of a valve disc to ease lubrication. Motors are lubricated while running.

The grease outlet opening has closing valves at both ends. These should be opened before greasing and closed 1 – 2 hours after regreasing. This ensures that the construction is tight and bearings remain dust- and dirt-free. A grease-collection method can be used optionally.

The following tables show lubrication intervals according to the  $L_1$  principle for various nominal speeds in 25 °C ambient temperature. These values apply to horizontally mounted motors (B3) with 80 °C bearing temperature and high-quality grease containing lithium-complex soap and mineral or PAO-oil.

Frame size	Amount of grease, g/bearing	Interval h at		
		3000 r/min	1500 r/min	1000 r/min
<b>Ball bearings</b>				
160	greased for life			
180	greased for life			
200	greased for life			
225	50	6500	-	-
250	60	-	11 500	15 000
280	40	-	9600	14 000
315	55	-	7600	11 800

Lubrication intervals in duty hours for ball bearings

Frame size	Amount of grease, g/bearing	Interval h at		
		3000 r/min	1500 r/min	1000 r/min
<b>Roller bearings</b>				
160	25	6000	10 500	12 000
180	30	4500	9000	-
200	40	4000	8500	11 500
225	50	3000	-	-
250	60	-	5500	7500
280	40	-	5250	7000
315	55	-	3800	5900

Lubrication intervals in duty hours for roller bearings

## Grease lifetime

Grease lifetime information is relevant for motors equipped with bearings greased for life, which means standard synchronous reluctance motors in frame sizes 160 – 200.

The standard bearing grease is high-quality grease intended for normal temperatures in dry or humid environments. The normal ambient temperature is 40 °C, in some cases even higher. Refer to the table below to see how temperature affects grease lifetime.

As an optional solution, grease nipples for regreasing can also be provided. See variant code 041.

The grease lifetime  $L_{10}$ , applicable to permanently lubricated bearings, is defined as the number of operating hours after which 90 % of bearings are still adequately lubricated. 50 % of the bearings achieve twice the lifetime  $L_{10}$ .

40 000 hours should be regarded as the definitive maximum lifetime after which bearings should be replaced. Lifetime is subject to the load conditions of the application run by the motor.

Motor size	Speed r/min	Ambient temperature and grease lifetime					
		25 °C	40 °C	50 °C	60 °C	70 °C	80 °C
160	3000	40 000	40 000	40 000	26 000	14 000	8 000
160	1000 - 1500	40 000	40 000	40 000	40 000	40 000	37 000
180	3000	38 000	38 000	38 000	38 000	23 000	13 000
180	1500	40 000	40 000	40 000	32 000	28 000	15 000
200	3000	27 000	27 000	27 000	24 000	14 000	8 000
200	1000 - 1500	40 000	40 000	40 000	40 000	40 000	30 000

Grease lifetime  $L_{10}$  in deep groove ball bearings of type 2Z, horizontally mounted motors in continuous duty

# Radial forces

## Pulley diameter

When the desired bearing life has been determined, the minimum permissible pulley diameter can be calculated with the permissible radial force  $F_R$  as follows:

$$D = \frac{1.9 \cdot 10^7 \cdot K \cdot P}{n \cdot F_R}$$

Where:

D = pulley diameter, mm

P = power requirement, kW

n = motor speed, r/min

K = belt tension factor, dependent on belt type and duty type. A common factor for V-belts is 2.5.

$F_R$  = permissible radial force

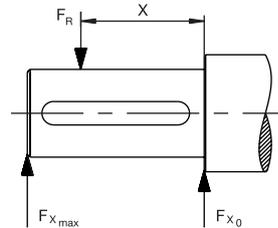
These calculated values further assume mounting position IM B3 (foot-mounted), with force directed sideways. In some cases, the strength of the shaft affects permissible forces.

Permissible loads of simultaneous radial and axial forces can be supplied on request.

If the radial force is applied between points  $X_0$  and  $X_{max}$ , the permissible force  $F_R$  can be calculated with the following formula:

$$F_R = F_{X_0} - \frac{X}{E} (F_{X_0} - F_{X_{max}})$$

E = length of the shaft extension in the standard version.



## Permissible loading on the shaft

The following table shows permissible radial forces on the shaft in Newtons, assuming zero axial force, a 25 °C ambient temperature, and normal conditions. The values are given for a calculated bearing life of 20 000 and 40 000 hours per motor size.

## Permissible radial forces, motor sizes 160 – 315

Motor size	Speed r/min	Length of shaft extension E (mm)	Ball bearings				Roller bearings			
			20 000 hours		40 000 hours		20 000 hours		40 000 hours	
			$F_{X_0}$ (N)	$F_{X_{max}}$ (N)	$F_{X_0}$ (N)	$F_{X_{max}}$ (N)	$F_{X_0}$ (N)	$F_{X_{max}}$ (N)	$F_{X_0}$ (N)	$F_{X_{max}}$ (N)
160	3000	110	5050	3900	4350	3350	6700	4300	5700	4300
160	1500	110	5400	4300	4600	3700	7550	4300	6400	4300
160	1000	110	5400	4300	4600	3700	7780	4300	6500	4300
180	3000	110	6060	4960	5280 <sup>1)</sup>	4305 <sup>1)</sup>	7600	5500	6560	5500
180	1500	110	4800	3940	4020	3300	7280	5500	6140	5500
200	3000	110	8300	6900	7200 <sup>2)</sup>	6000 <sup>2)</sup>	10 700	8900	9200	7650
200	1500	110	8900	7400	7600	6350	12 000	9550	10 150	8500
200	1000	110	8960	7480	7600	6340	12 480	9550	10 520	8780
225	3000	110	6100	5185	5155	4340	13 000	10 700	11 200	9455
250	3000	140	7700	6250	6500	5250	17 100	10 900	14 900	10 900
250	1500	140	8700	7000	7300	5900	19 800	13 800	17 000	13 800
250	1000	140	8900	7200	7355	5955	21 200	13 800	18 000	13 800
280	1500	140	9200	7800	7300	6200	25 100	9200	20 300	9200
280	1000	140	10 600	8900	8400	7000	28 300	9200	23 000	9200
315 SM_	1500	170	11 400	9400	9000	7450	32 500	9600	26 600	9600
315 SM_	1000	170	13 000	9600	10 300	8500	37 000	9600	30 000	9600
315 ML_	1500	170	11 500	9700	9100	7650	32 700	13 600	26 500	13 600
315 ML_	1000	170	13 200	11 100	10 400	8800	36 900	13 600	29 900	13 600
315 LK_	1500	170	11 500	10 000	9100	7850	33 100	13 300	26 800	13 300
315 LK_	1000	170	13 200	11 400	10 400	9000	37 300	13 300	30 300	13 300

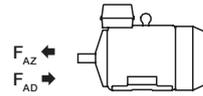
<sup>1)</sup> The maximum lifetime of the grease is 38 000 h, see Grease lifetime

<sup>2)</sup> The maximum lifetime of the grease is 27 000 h, see Grease lifetime

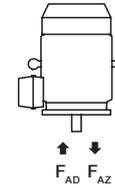
## Axial forces

The following tables present permissible axial forces on the shaft in Newton's, assuming zero radial force, a 25 °C ambient temperature, and normal conditions. The values are given for a calculated bearing life of 20 000 and 40 000 hours per motor size.

Permissible loads of simultaneous radial and axial forces can be supplied on request. For axial force  $F_{AD}$ , it is assumed that the D-bearing is locked with a locking ring.



Mounting arrangement IM B3



Mounting arrangement IM V1

### Permissible axial forces, motor sizes 160 – 315

Motor size	Poles	Length of shaft extension E (mm)	Mounting arrangement IM B3				Mounting arrangement IM V1			
			Ball bearings				Ball bearings			
			20,000 h		40,000 h		20,000 h		40,000 h	
			$F_{AD}$ (N)	$F_{AZ}$ (N)	$F_{AD}$ (N)	$F_{AZ}$ (N)	$F_{AD}$ (N)	$F_{AZ}$ (N)	$F_{AD}$ (N)	$F_{AZ}$ (N)
160	3000	110	4650	4650	3850	3850	4950	4350	4200	3600
160	1500	110	5000	5000	4200	4200	5450	4650	4600	3800
160	1000	110	4840	4840	4000	4000	5400	4420	4540	3560
180	3000	110	5480	5480	4600 <sup>1)</sup>	4600 <sup>1)</sup>	5920	5515	5060 <sup>1)</sup>	4255 <sup>1)</sup>
180	1500	110	4360	4360	3540	3540	5080	3860	4240	3020
200	3000	110	5000	7350	5000 <sup>2)</sup>	6150 <sup>2)</sup>	5000	7050	5000 <sup>2)</sup>	5800 <sup>2)</sup>
200	1500	110	5000	8050	5000	6700	5000	7550	5000	6200
200	1000	110	5000	8300	5000	6880	5000	7505	5000	6025
225	3000	110	4860	4860	3960	3960	5000	4245	4780	3345
250	3000	140	6000	6050	4900	4900	6000	5300	5800	4200
250	1500	140	6000	7100	5800	5800	6000	6300	6000	4900
250	1000	140	6000	7480	6000	6040	6000	6370	6000	4830
280	1500	140	7900	5900	6100	4100	10 000	4500	8200	2700
280	1000	140	9100	7100	7000	5000	11 600	5400	9500	3300
315 SM_	1500	170	9300	7300	7100	5100	12 000	5500	9900	3300
315 SM_	1000	170	10 700	8700	8200	6200	14 300	6300	11 800	3700
315 ML_	1500	170	9200	7200	7000	5000	12 400	5000	10 300	2800
315 ML_	1000	170	10 600	8600	8100	6100	14 900	5800	12 300	3200
315 LK_	1500	170	9000	7000	6900	4900	13 600	3800	11 500	1650
315 LK_	1000	170	10 300	8300	7800	5800	16 500	4100	14 000	1500

<sup>1)</sup> The maximum lifetime of the grease is 38 000 h, see Grease lifetime.

<sup>2)</sup> The maximum lifetime of the grease is 27 000 h, see Grease lifetime.

# Terminal box

## Standard terminal box

### Degree of protection and mounting options

The degree of protection for the standard terminal box is IP 55. By default, terminal boxes are mounted on top of the motor at D-end and can be turned 4\*90°. The terminal box can also be mounted on the left or right side of the motor (see Mounting arrangements).

### Cable entries

Motor sizes 160 to 250 come with connection flanges with tapped cable entries and can be provided with cable glands as an option. In sizes 280 to 315 SM and 315 ML the standard terminal box has a flange with cable glands, and 315 LK has cable sealing end units. The standard flange material is siluminium. See the table below for details on standard terminal boxes.

### Cable type and terminations

If no cable type is specified in the order, it will be a PVC-insulated non-armored cable, and its termination parts are determined as shown in the table below.

Terminations are suitable for copper and aluminum cables (Al-cables on request for motor sizes 160 to 250). Cables are connected to terminals by cable lugs, which are not included in the delivery.

### Ordering

To ensure the delivery of desired terminations for the motor, state the cable type, quantity, size and outer diameter when ordering. Non-standard designs of terminal boxes, such as non-standard size, or higher degree of protection, are available as options.

See Variant codes for all options available.

### Standard terminal box connections

Motor size	Speed r/min	Terminal box type	Size of flange opening	Type of through holes	Size of through holes	Cable outer diameter mm	Max. connectable core cross-section mm <sup>2</sup> /phase	Number and size of terminal bolts	Method of connection
160	1000-3000	50	A	Threaded	2xM40x1.5	2xØ19-27	1x35	6xM6	Terminal lugs
180	1500-3000	50	A	Threaded	2xM40x1.5	2xØ19-27	1x35	6xM6	Terminal lugs
200	1500-3000	120	B	Threaded	2xM63x1.5	2xØ34-45	1x70	6xM10	Terminal lugs
225	3000	120	B	Threaded	2xM63x1.5	2xØ34-45	1x70	6xM10	Terminal lugs
250	1000-3000	120	B	Threaded	2xM63x1.5	2xØ34-45	1x70	6xM10	Terminal lugs
280	1000-1500	210	C	Threaded*	2xM63x1.5	2xØ32-49	2x150	6xM12	Terminal lugs
315 SM, ML	1000-1500	370	D	Threaded*	2xM63x1.5	2xØ32-49	2x240	6xM12	Terminal lugs
315 LKA, LKC	1000-1500	750**	E	End unit	Medium	2xØ48-60	4x240	6xM12	Terminal lugs
<b>Auxiliary cable entries</b>									
160-250	1000-3000				1xM16x1.5	Ø5-9			
280-315	1000-1500				2xM20x1.5	Ø8-14			

\* With cable glands of the same size

\*\* With adapter E-D and medium size end unit

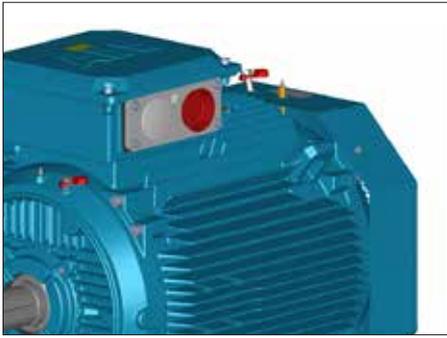
Motor size	Earthing on frame	Earthing in main terminal box
160-250	clamp	M6
280-315	clamp	2xM10

Standard delivery if no other information is provided

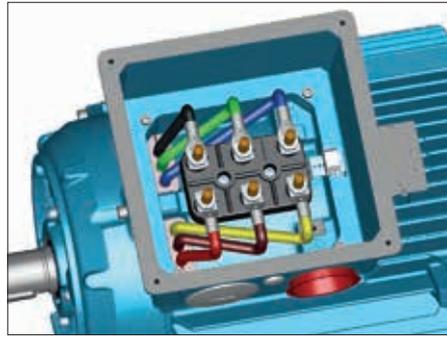
Note: For other network voltages and/or side-mounted motors, contact your ABB sales office.

## Terminal boxes and boards

The pictures below show standard terminal boxes and the corresponding terminal boards for various motor sizes.



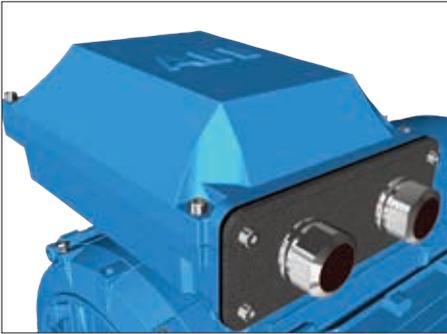
M000900



M000901

Fig. 1 Terminal box for motor sizes 160 – 250. Connection flange with tapped cable entries.

Fig. 2 Terminal board for motor sizes 160 – 250.



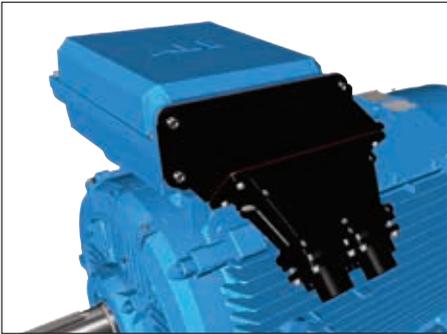
M000423



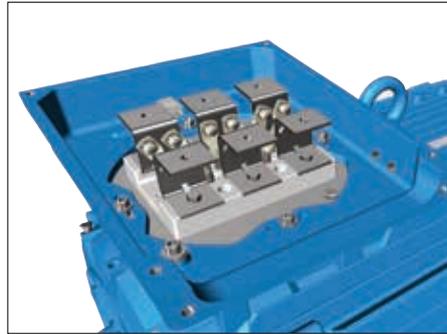
M000427

Fig. 3 Terminal box for motor sizes 280 – 315 SM-ML. Adapter and cable sealing end unit.

Fig. 4 Terminal board for motor sizes 280 – 315 SM-ML.



M000424



M000428

Fig. 5 Terminal box for motor size 315 LK. Adapter and cable sealing end unit.

Fig. 6 Terminal board for 315 LK.

# Terminal box

## Terminal box alternatives

### Optional adapters

There is a broad selection of cable termination accessories for the termination of one or several cables. The most common ones are presented below.



Main terminal box



Adapters

Flange with glands; cable sealing end units

### How to order

- Check first that the terminal box itself allows mounting of the desired cable and cable cores (see previous page).
- If very large cables are used, it may be necessary to use a larger terminal box than standard. Select the right cable gland(s) or cable sealing end unit(s) that match the outer diameter of the cable(s)
- Select the appropriate adapter or flange.
- Note that turning the terminal box to a non-standard position may limit the use of some adapters.

### Ordering example for special cable entry and auxiliary terminal box

Motor	200 kW, 1500 rpm, 400 V 50 Hz
Cables	2 pieces, outer diameter 58 mm, single core cross section 185 mm <sup>2</sup> clamping device needed, cables coming from below

Needed one terminal box for anticondensation heaters and another for temperature detectors, material must be cast iron.

Motor	M3BL 315 MLA, 1500 rpm, B3
Adapter	D-D - variant code 293
Cable sealing end unit	Variant code 278
Clamping	Variant code 231
Auxiliaries	Variant codes 380, 567, 568

### Main terminal box and maximum single core cross-section

The terminal boxes are named according to their current-carrying capacity, from 50 to 1200. You can select one size larger than standard terminal box if a larger single cross-section is needed. The standard sizes of the main terminal box are listed in the following table. Check also the capacity of the cable entry to make sure that the cables fit. A larger terminal box can be ordered with variant code 019.

Standard terminal box	Size of opening	Max. single cross-section, mm <sup>2</sup> /phase
50	A	1×35
120	B	1×70
210	C	2×240
370	D	2×300
750	E	4×500
1200	E	4×500

## Optional adapters

To allow easy termination of cables entering the terminal box from above or below, an angle adapter is recommended. These are available for motor sizes 280 - 315 and can also be used to allow the mounting of several cable sealing end units or gland plates. For detailed information on suitability in a certain motor size, refer to the 'terminal box opening' column in section Standard terminal box.



### Adapter

<b>Variant code</b>	292	293	294	295	296	444
<b>Suited for motor sizes</b>	280	315 SM, ML	315 LKA, LKC	315 LKA, LKC	315 LKA, LKC	315 LKA, LKC
<b>Opening to terminal box</b>	C	D	E	E	E	E
<b>Flange or opening for end unit</b>	C	D	D	2×D	3×D	2×E
<b>Material</b>	Steel	Steel	Steel	Steel	Steel	Steel
<b>Notes</b>			Included in type 750 terminal box when 750 is the standard size.	Only possible on type 1200 terminal box.	Only possible on type 1200 terminal box.	Only possible on type 1200 terminal box.

## Cable sealing end units

As an alternative to flanges and cable glands, cable sealing end units can be used. These allow more space for spreading the cores for easy termination. Cable sealing end units have rubber-sealed entries for one of the two main cables. In addition, there are two plugged M20 holes for auxiliary cables.



### End unit

<b>Variant code</b>	277	278	279
<b>Suited for motor sizes</b>	280	315 SM, ML	315 SM, ML
<b>Opening to terminal box</b>	C	D	D
<b>Cable outer diameter</b>	1 - 2 cables, 48 - 60 mm	1 - 2 cables, 48 - 60 mm	1 - 2 cables, 60 - 80 mm
<b>Cable entry for auxiliary cable</b>	2×M20 plugged holes	2×M20 plugged holes	2×M20 plugged holes
<b>Additional optional variants</b>	EMC cable gland (704); Standard gland with clamping device (231)	EMC cable gland (704); Standard gland with clamping device (231)	EMC cable gland (704); Standard gland with clamping device (231)

## Auxiliary terminal box

You can equip motors from frame size 160 upward with one or several auxiliary terminal boxes for connection of auxiliaries like heaters or temperature detectors. The standard auxiliary terminal box material for motor sizes 280 - 315 is aluminum and for 160 - 250 cast iron. For 280 - 315, cast iron as box material is also available as an option.

Connection terminals are of spring-loaded type for quick and easy connection. These are suitable for up to 2.5 mm<sup>2</sup> wires. Auxiliary terminal boxes for 280 - 315 are equipped with an earthing terminal. The first auxiliary terminal box is located on the right-hand side at D-end as standard.

The standard cable entry size is M20 for the aluminum box and M16 for the cast iron box, and the number of entries depends on the terminal box type and the number of selected auxiliaries.

### Related variant codes

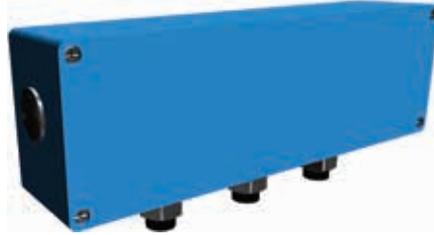
380	Separate terminal box for temperature detectors, standard material
418	Separate terminal box for auxiliaries, standard material
567	Separate terminal box material: cast iron
568	Separate terminal box for heating elements, standard material
569	Separate terminal box for brake



Small auxiliary aluminum terminal box for motor sizes 280 - 315 (variant codes 418, 568, 380, 569).

The size of terminal box ordered with these codes depends on the number of accessories ordered.

80 x 125 mm, max 12 strips. Earthing size M4.



Large auxiliary aluminum terminal box for motor sizes 280 - 315.

The size of terminal box ordered with these codes depends on the number of accessories ordered.

80 x 250 mm, max 30 strips. Earthing size M4.



Auxiliary cast iron terminal box.

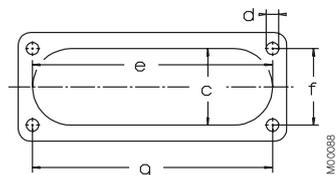
Frame size for motor sizes 160 - 250 (variant code 418): 119 x 170 mm, max. 18 strips. No earthing.

Frame size for motor sizes 280 - 315 (variant code 567): 211 x 188 mm, max 30 strips. Earthing size M6.

# Terminal box

## Dimensions

### Dimensions for terminal box inlets



Inlet	c mm	e mm	f mm	g mm	d thread type
A	47	120	30	120	M6
B	71	194	62	193	M6
C	62	193	62	193	M8
D	100	300	80	292	M10
E	115	370	100	360	M12

### Frame dimensions

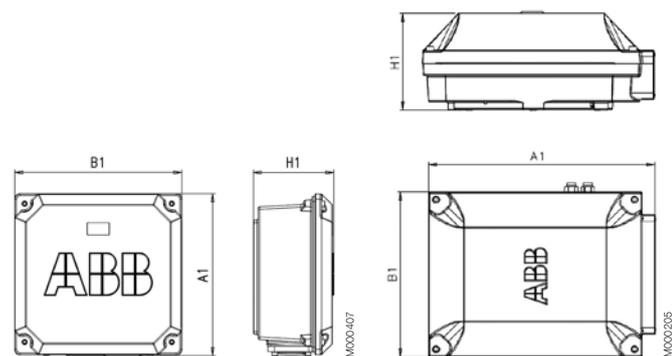


Fig. 1 Motor sizes 160 – 250

Fig. 2 Motor sizes 280 – 315  
SM, ML; top- and side-mounted  
terminal boxes 210 and 370

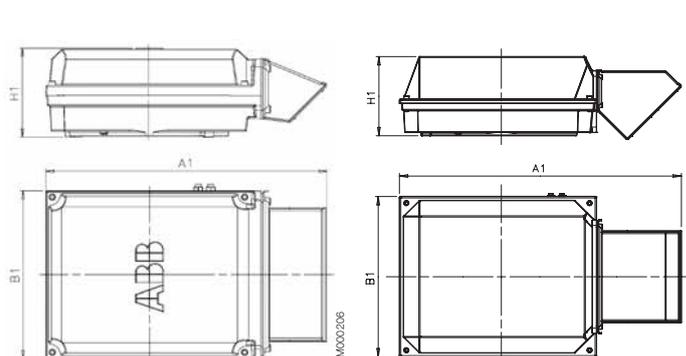


Fig. 3 Motor sizes 315 LKA, LKC;  
terminal box 750 (top-mounted)  
+ adapter

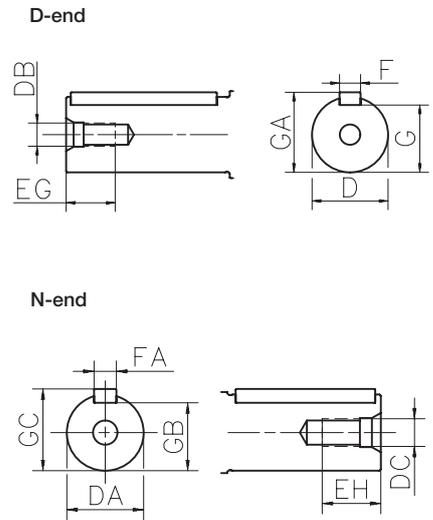
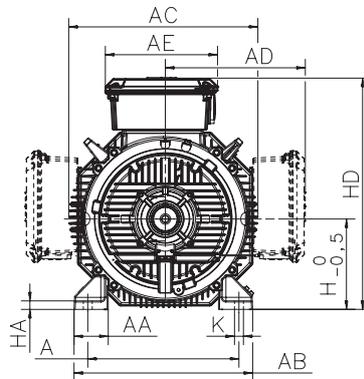
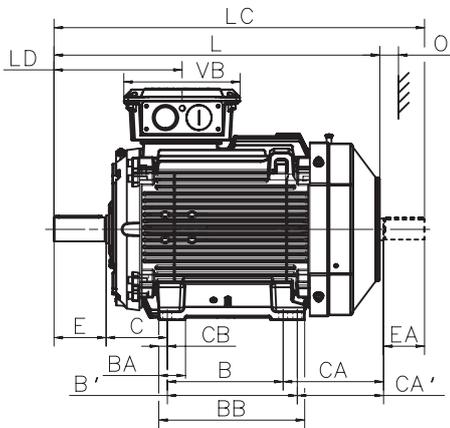
Fig. 4 Optional terminal box for  
315 LKA and LKC; terminal box  
1200 (top-mounted) + adapter

Terminal box types acc. to current capacity	A1	B1	H1
<b>Box types for 160 - 250</b>			
50	257	257	106
120	300	311	150
<b>Box types for 280 - 315</b>			
210	416	306	177
370	451	347	200
750, top-mounted	686	413	219
750, side-mounted	525	413	219
1200 (variant code 295)	1000	578	285
1200 (variant code 444)	1195	578	285
1200 (variant code 296)	1250	578	285

See Optional adapters for more information.

# Dimension drawings

## Foot-mounted motors, 160 - 250



### Mounting options IM B3 (IM 1001), IM B6 (IM 1051), IM B7 (IM 1061), IM B8 (IM 1071), IM V5 (IM 1011), IM V6 (IM 1031)

Motor size	Speed r/min	A	AA	AB	AC	AD	AE	B	B'	BA	BB	C	CA	CA'	CB	D	DA	DB	DC	E
160	3000	254	67	310	338	261	257	210	254	69	294	108	172	128	20	42	32	M16	M12	110
160	1000-1500	254	67	310	338	261	257	210	254	69	294	108	269	225	20	42	32	M16	M12	110
180	1500-3000	279	72	340	338	261	257	241	279	68	318	121	269	225	19	48	32	M16	M12	110
200	1000-3000	318	69	378	413	314	257	267	305	80	345	133	314	276	20	55	45	M20	M16	110
225	3000	356	90	435	413	328	300	286	311	69	351	149	316	291	20	55	45	M20	M16	110
250	1000-1500	406	92	480	508	376	300	311	349	69	392	168	281	243	23	65	55	M20	M20	140

Motor size	Speed r/min	EA	EG	EH	F	FA	G	GA	GB	GC	H	HA	HD	K	L	LC	LD	O	VB
160	3000	80	36	28	12	10	37	45	27	35	160	23	421	14.5	584	671.5	287,5	45	257
160	1000-1500	80	36	28	12	10	37	45	27	35	160	23	421	14.5	681	768.5	287,5	45	257
180	1500-3000	80	36	28	14	10	42.5	51.5	27	25	180	23	441	14.5	681	768.5	287,5	50	257
200	1000-3000	110	42	36	16	14	49	59	39.5	48.5	200	23	514	18.5	821	934	320,5	70	257
225	3000	110	42	42	16	16	49	59	49	59	225	23	553	18.5	821	934	320,5	80	311
250	1000-1500	110	42	42	18	16	58	69	49	59	250	23	626	24.0	884	1010	343,5	90	311

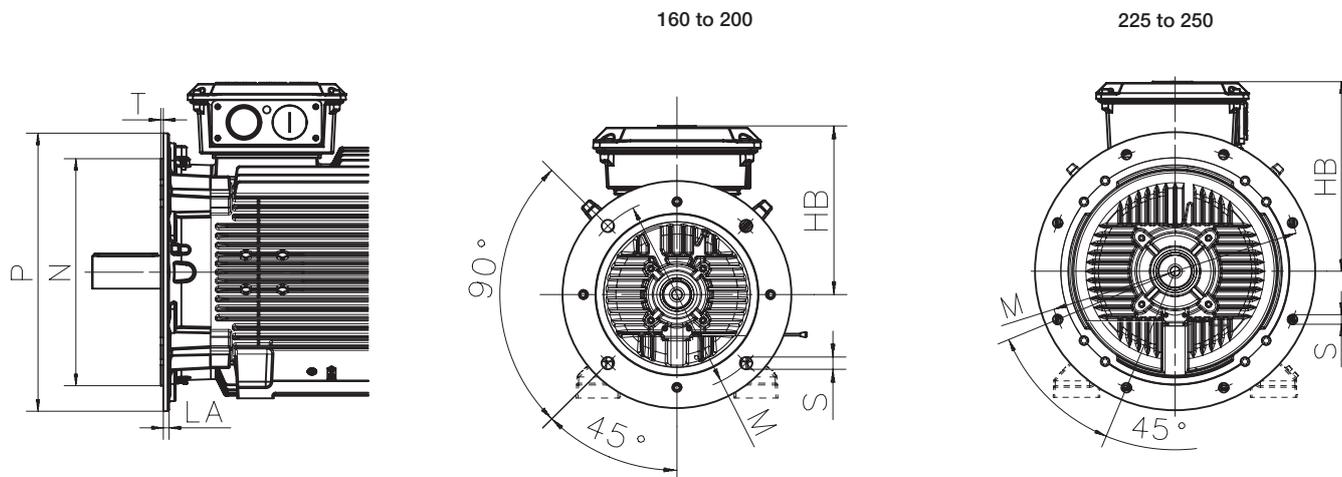
#### Tolerances

A, B	ISO js14
C, CA	± 0.8
D, DA	ISO k6 < Ø 50 mm ISO m6 > Ø 50 mm
F, FA	ISO h9
H	+0 -0.5

The tables show the main dimensions in millimeters. For detailed drawings, visit our web pages at [www.abb.com/motors&generators](http://www.abb.com/motors&generators) or contact ABB.

# Dimension drawings

## Flange- and foot & flange-mounted motors, 160 - 250



### Mounting options IM B5 (IM 3001), V1 (IM 3011), V3 (IM 3031), IM B14 (IM 3601), V18 (IM 3611), V19 (IM 3631), IM B35 (IM 2001), IM V15 (IM 2011), IM V35 (IM 2031)

#### Flange

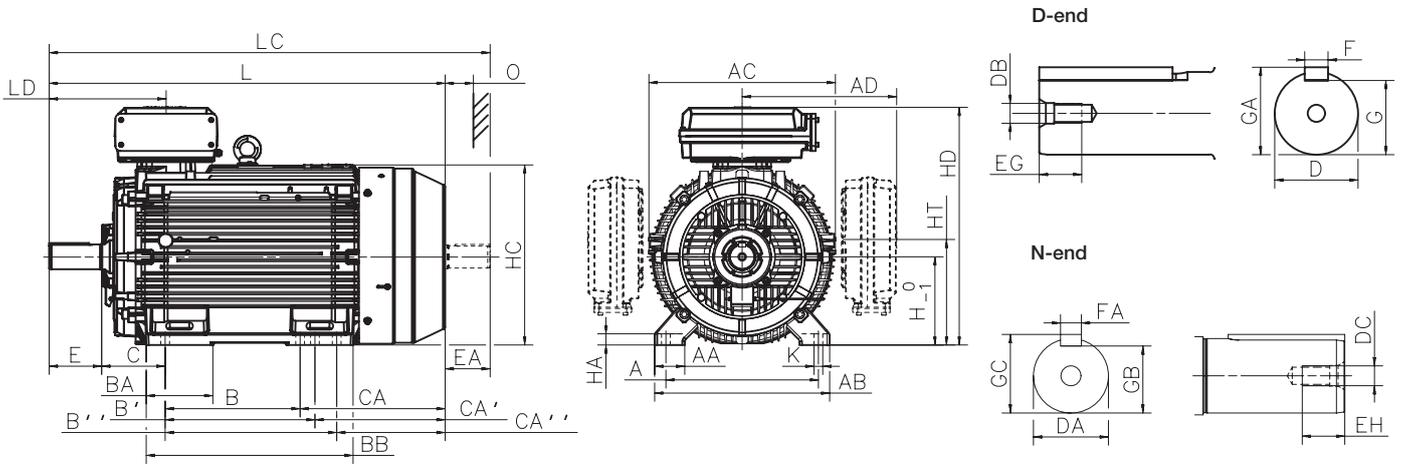
Motor size	Speed r/min	HB	LA	M	N	P	S	T
160	1000-3000	261	20	300	250	350	19	5
180	1500-3000	261	18	300	250	350	19	5
200	1000-3000	314	20	350	300	400	19	5
225	3000	328	20	400	350	450	19	5
250	1000-1500	376	24	500	450	550	19	5

#### Tolerances

A, B	ISO js14
C, CA	± 0.8
D, DA	ISO k6 < Ø 50 mm ISO m6 > Ø 50 mm
F, FA	ISO h9
H	+0 -0.5
N	ISO j6

# Dimension drawings

## Foot-mounted motors, 280 – 315



### Mounting options IM B3 (IM 1001), IM B6 (IM 1051), IM B7 (IM 1061), IM B8 (IM 1071), IM V5 (IM 1011), IM V6 (IM 1031)

Motor size	Speed r/min	A	AA	AB	AC	AD <sup>1)</sup>	AD <sup>2)</sup>	B	B'	B''	BA	BB	C	CA	CA'	CA''	D	DA	DB	DC	E	EA
280 SM <sub>-</sub>	1000-1500	457	84	530	577	481	-	368	419	-	147	506	190	400	349	-	75	65	M20	M20	140	140
315 SM <sub>-</sub>	1000-1500	508	100	590	654	545	-	406	457	-	180	558	216	420	369	-	80	75	M20	M20	170	140
315 ML <sub>-</sub>	1000-1500	508	100	590	654	545	-	457	508	-	212	669	216	480	429	-	90	75	M24	M20	170	140
315 LK <sub>-</sub>	1000-1500	508	100	590	654	562	576	508	560	710	336	851	216	635	583	433	90	75	M24	M20	170	140

Motor size	Speed r/min	EG	EH	F	FA	G	GA	GB	GC	H	HA	HC	HD <sup>1)</sup> top-m.	HD <sup>2)</sup> top-m.	HT	K	L	LC	LD top-m.	LD side-m.	O
280 SM <sub>-</sub>	1000-1500	40	40	20	18	67.5	79.5	58	69	280	31	564	762	-	337.5	24	1088	1238	336	539	100
315 SM <sub>-</sub>	1000-1500	40	40	22	20	71	85	67.5	79.5	315	40	638	852	-	375	28	1204	1352	386	615	115
315 ML <sub>-</sub>	1000-1500	48	40	25	20	81	95	67.5	79.5	315	40	638	852	-	375	28	1315	1463	386	670	115
315 LK <sub>-</sub>	1000-1500	48	40	25	20	81	95	67.5	79.5	315	40	638	852	880	359	28	1521	1669	386	751	115

#### Footnotes

<sup>1)</sup> Terminal box 370

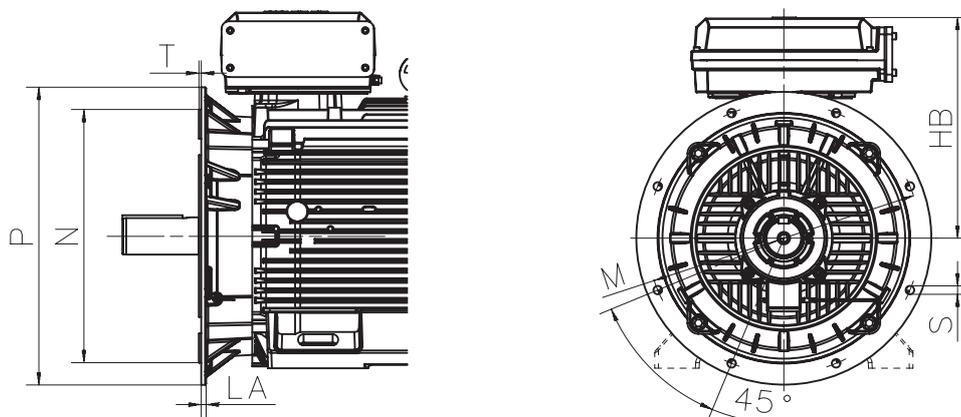
<sup>2)</sup> Terminal box 750

#### Tolerances

A, B	± 0.8
C, CA	± 0.8
D	ISO k6 < Ø 50 mm ISO m6 > Ø 50 mm
F	ISO h9
H	+ 0 -0.5
N	ISO j6

## Dimension drawings

### Flange- and foot & flange-mounted motors, 280 – 315



#### Mounting options IM B5 (IM 3001)V1, (IM 3011), V3 (IM 3031), IM B14 (IM 3601), V18 (IM 3611), V19 (IM 3631), IM B35 (IM 2001), IM V15 (IM 2011), IM V35 (IM 2031)

##### Flange

Motor size	Speed r/min	HB <sup>1)</sup>	HB <sup>2)</sup>	LA	M	N	P	S	T
280 SM_	1000-1500	482	-	23	500	450	550	18	5
315 SM_	1000-1500	537	-	25	600	550	660	23	6
315 ML_	1000-1500	537	-	25	600	550	660	23	6
315 LK_	1000-1500	537	565	25	600	550	660	23	6

##### Footnotes

<sup>1)</sup> Terminal box 370

<sup>2)</sup> Terminal box 750

##### Tolerances

A, B	± 0.8
D	ISO j6
F	ISO h9
H	+0 - 0.1
N	ISO j6 (280 SM_) ISO js6 (315_)
C	± 0.8

# Accessories

## Separate cooling

### Axial fan, N-end

Fan motors with an axial fan are available for motor sizes 160 – 315 and can be ordered with variant code 183. The values here are given for 400 V, but technical data for other voltages can be found in MotSize.

#### Axial fan, N-end (motor sizes 160 - 315)

Main motor	Fan motor type (at 50 Hz)	Voltage V at 50 Hz	Power kW	Current A
M3BL 160 - 250	M2VA 63 B 4 B14	400	0.18	0.61
M3BL 280 - 315 ML	M3BP 80 MD 4 B14	400	0.75	1.83
M3BL 315 LK	M3BP 90 SLD 4 B14	400	1.5	3.0

### Fan on top, N-end

The non-axial fan available for motor sizes 280 – 315 is a Ziehl-Abegg fan with an integrated motor. This cooling option is suited for 400 V, 50 Hz networks and can be ordered with variant code 422.

#### Fan on top

Main motor	Fan motor type	Voltage V	Freq. Hz	Power kW	Current
M3BL 280	Ziehl-Abegg RH35	400 VY	50	0.35	0.83
		460 VY	60	0.5	0.9
M3BL 315	Ziehl-Abegg RH40	400 VY	50	0.50	1.0
		460 VY	60	0.8	1.4

### Special motor and fan on top, N-end

A special ABB fan motor type is available for motor sizes 280 – 315. It is suited for environments where IP 65 is the required IP class or where the input voltage must be other than 360 – 420 V (50 Hz).

The values here are given for 400 V, but technical data for other voltages can be found in MotSize.

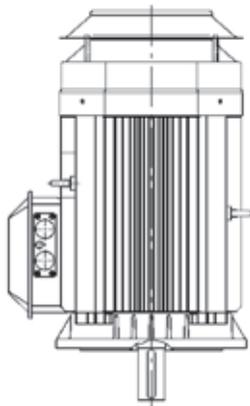
The centrifugal impeller used in the fan is a Ziehl-Abegg impeller. This type of cooling can be ordered with variant code 514.

#### Special motor and fan on top

Main motor	Fan motor type	Voltage V at 50 Hz	Power kW	Current A
M3BL 280 - 315	M3BP 80 MD 4 B34	400	0.75	1.83

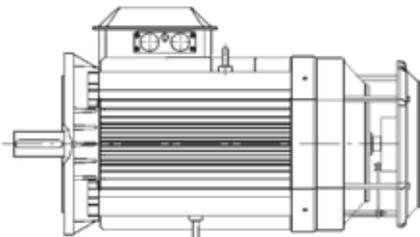
# Accessories

## Protective roof and tachometer



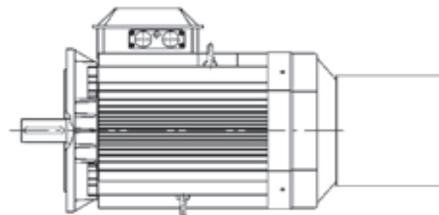
M000057

Protective roof, variant code 005



M000058

Tachometer, variant codes 472, 473, 572, and 573



M000059

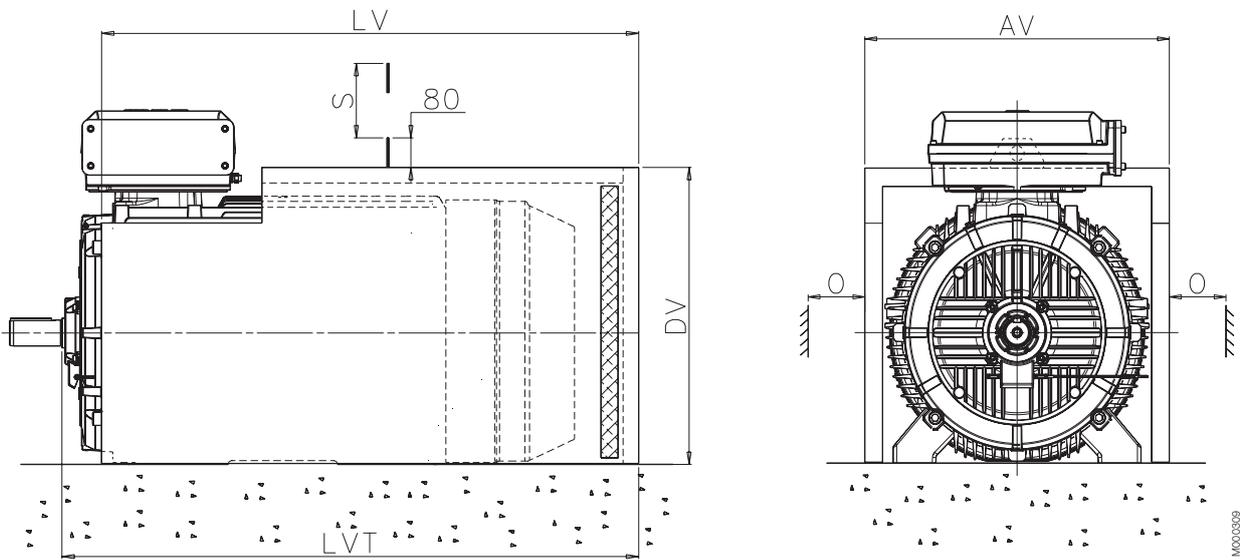
Separate cooling without tachometer: 183 and 189  
With tachometer: 474, 476, 477, 574, 576, and 577

# Accessories

## Silencer for motor sizes 280 - 315

Both foot-mounted and flange-mounted motors can be fitted with a silencer to reduce noise level by about 5 – 6 dB(A). The silencer is painted blue and made of 2 mm steel sheet. The sound absorbing material is 40 mm thick polyurethane foam. On the rim there is a rubber strip for sealing on the floor. The silencer fits loosely over the motor.

The variant code for ordering a silencer is 055.



Motor size	AV	LV	LVT	DV	O <sup>1)</sup>	S <sup>2)</sup>	Weight kg
280 SM_	681	1010	1090	616	50	762	38
315 SM_	760	1094	1191	697	60	852	47
315 ML_	760	1205	1302	697	60	852	51
315 LK_	760	1411	1508	697	60	852	58

<sup>1)</sup> Clearance for motor cooling

<sup>2)</sup> Clearance for removing the silencer

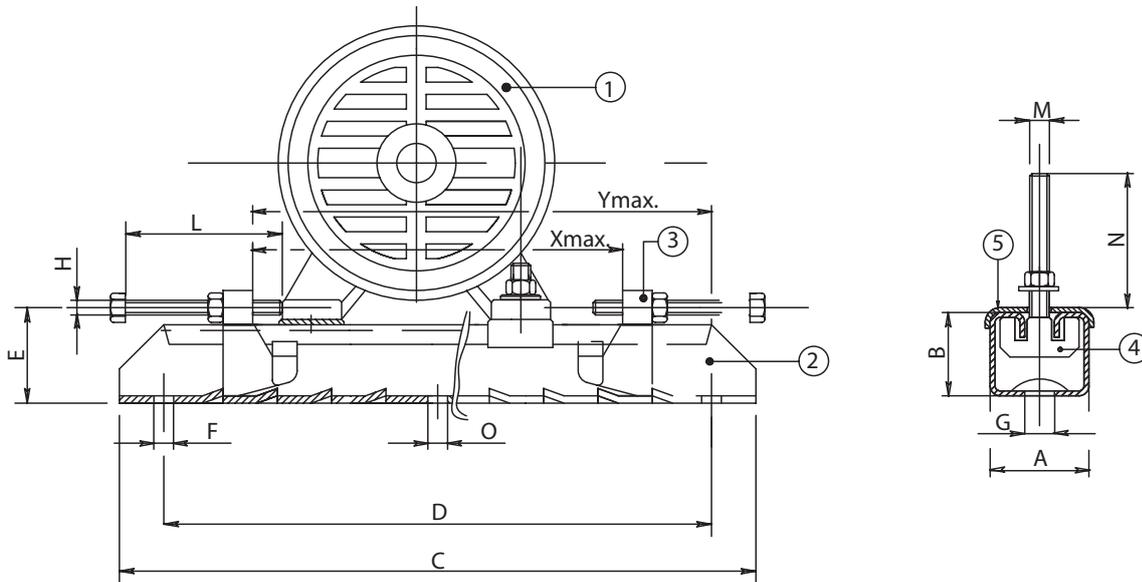
Note: The dimensions are only valid for standard foot-mounted motors.

# Accessories

## Slide rails for motor sizes 160 - 250

A set of slide rails includes two complete rails with screws for mounting the motor on the rails. Screws for mounting the rails on the foundation are not included. Slide rails have unmachined lower surfaces and should, before tightening down, be supported in a suitable manner.

Slide rails can be ordered with article numbers shown in the table.



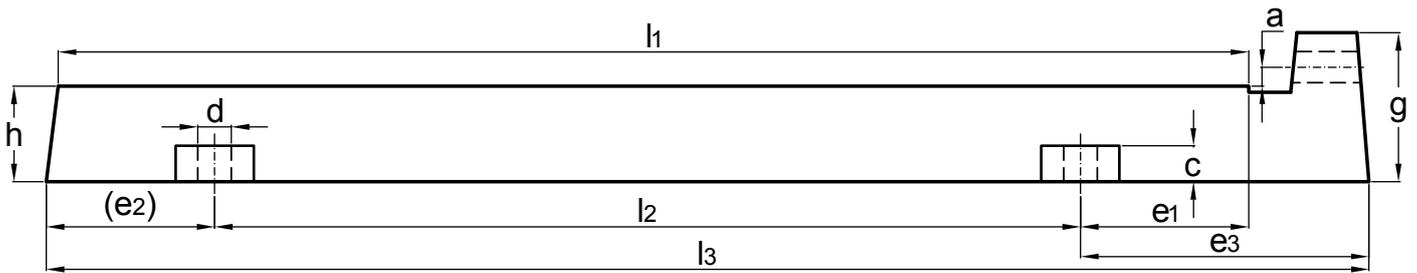
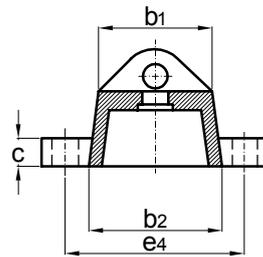
Motor size	Type	Article no. 3GZV103001-	A	B	C	D	E	F	G	H	L	M	N	O	Xmax	Ymax	Weight/ rail kg
160-180	TT180/12	-14	75	42	700	630	57	17	26	M12	120	M12	50	-	520	580	12.0
200-225	TT225/16	-15	82	50	864	800	68	17	27	M16	140	M16	65	17	670	740	20.4
250	TT280/20	-16	116	70	1072	1000	90	20	27	M18	150	M20	80	20	870	940	43.0

# Accessories

## Slide rails for motor sizes 280 - 315

A set of slide rails includes two complete rails with screws for mounting the motor on the rails. Screws for mounting the rails on the foundation are not included. Slide rails have unmachined lower surfaces and should be supported in a suitable manner before tightening down.

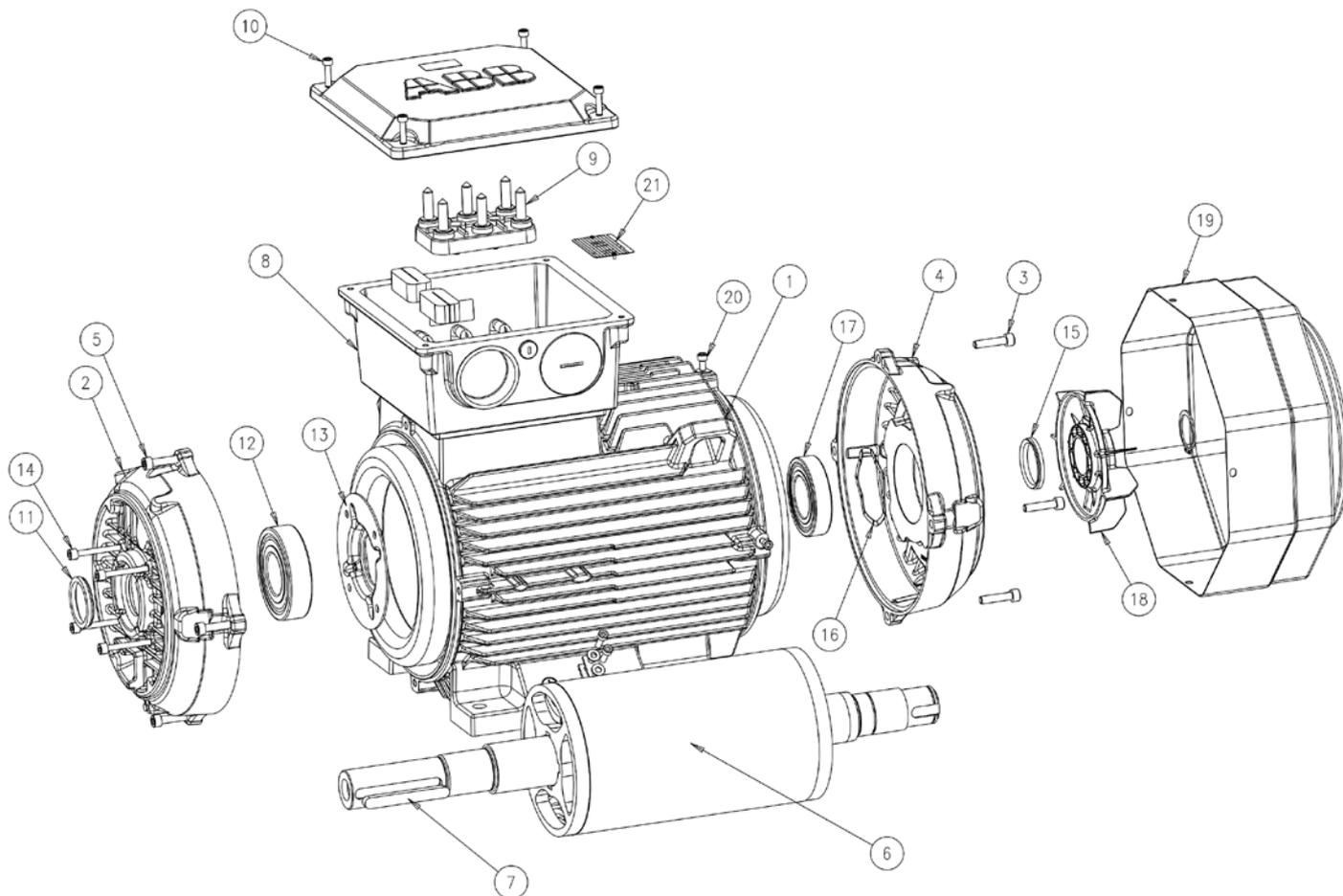
Slide rails can be ordered with article numbers shown in the table.



Note: The drawings are suggestive and do not give all details.

Motor size	Article no.	$l_1$	$l_2$	$l_3$	$a$	$h$	$b_1$	$b_2$	$c$	$d$	$e_1$	$e_2$	$e_3$	$e_4$	Bolts to feet	Horizontal bolts	Weight kg/2 pcs
280	3GZF334730-55	800	600	900	16	75	100	120	35	28	100	100	200	165	M20×90	M24×300	50
315	3GZF334730-56	1000	720	1100	16	80	120	140	40	28	140	140	240	190	M24×100	M24×300	80

# Motor construction



- |   |                              |    |                               |    |                      |
|---|------------------------------|----|-------------------------------|----|----------------------|
| 1 | Stator frame                 | 8  | Terminal box                  | 15 | Seal, N-end          |
| 2 | End shield, D-end            | 9  | Terminal board                | 16 | Wave spring          |
| 3 | Screws for end shield, N-end | 10 | Screws for terminal box cover | 17 | Bearing, N-end       |
| 4 | End shield, N-end            | 11 | Seal, D-end                   | 18 | Fan                  |
| 5 | Screws for end shield, D-end | 12 | Bearing, D-end                | 19 | Fan cover            |
| 6 | Rotor with shaft             | 13 | Inner bearing cover, D-end    | 20 | Screws for fan cover |
| 7 | Key, D-end                   | 14 | Screws for bearing cover      | 21 | Rating plate         |

# Motors in brief

## IE4 synchronous reluctance motors

Motor size		160	180	200	225	250	280	315	
Stator and end shields	Material	Cast iron							
	Paint color shade	Munsell blue 8B 4.5/3.25							
	Corrosion class	C3 (medium) according to ISO/EN 12944-5							
Bearings	D-end	6309-2Z/C3	6310-2Z/C3	6312-2Z/C3	6313/C3	6315/C3	6316/C3	6319/C3	
	N-end	6209-2Z/C3	6209-2Z/C3	6210-2Z/C3	6210/C3	6213/C3	6316/C3	6316/C3*	
Axially locked bearings		Locked at D-end							
Bearing seals		V-ring or gamma seal as standard, radial seal on request. See the Bearing seals page for options.					V-ring or labyrinth seal as standard. See the Bearing seals page for options.		
Lubrication		Permanently lubricated shielded bearings, wide-temperature-range grease			Regreasable bearings, regreasing nipples M6x1		Regreasable bearings, regreasing nipples M10x1		
Measuring nipples		SPM as an option							
Rating plate	Material	Stainless steel							
Terminal box	Frame material	Cast iron							
	Corrosion class	C3 (medium) according to ISO/EN 12944-5							
	Cover screws	Zinc-electroplated steel							
Connections	Cable entries	2xM40x1.5, 1xM16x1.5**		2xM63x1.5, 1xM16x1.5**			2xM63x1.5, 2xM20x1.5**		
	Terminals	6 terminals***							
	Cable glands	Flange as standard, cable glands as option					Cable flange and glands as standard		
Fan	Material	Glass-fiber-reinforced polypropylene							
Fan cover	Material	Hot-dip-galvanized steel							
	Paint color shade	Munsell blue 8B 4.5/3.25							
	Corrosion class	C3 (medium) according to ISO/EN 12944-5							
Stator winding	Material	Copper							
	Insulation	Class F							
	Winding protection	3 PTC thermistors, 150 °C					3 PTC thermistors, 155 °C		
Balancing method		Half-key balancing							
Keyway		Closed keyway					Open keyway		
Drain holes		Standard, open on delivery							
Enclosure		IP 55							
Cooling method		IC 411							

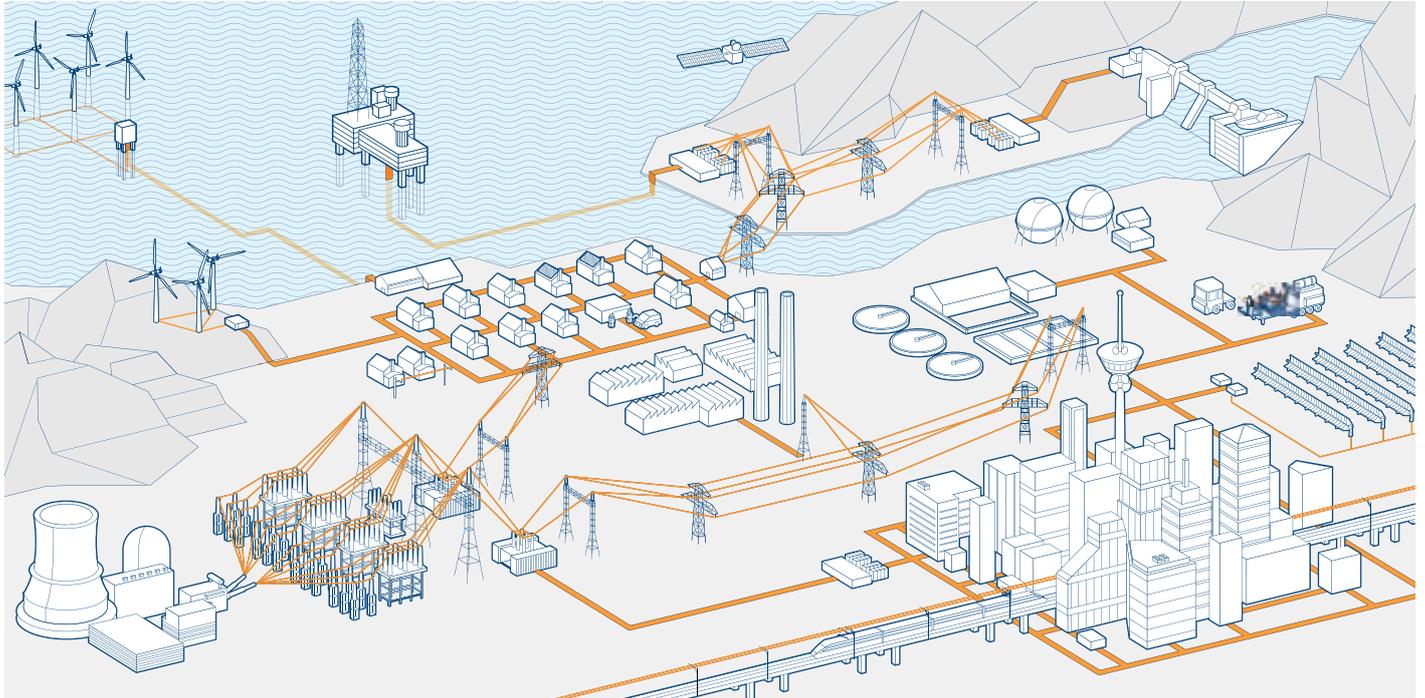
\*\* For detailed information on connections, see Terminal box alternatives section.

\*\*\* Terminals for connection with cable lugs (lugs not included in the delivery).



# Total product offering

Motors, generators and mechanical power transmission products with a complete portfolio of services



**ABB is the leading manufacturer of low, medium and high voltage motors and generators, and mechanical power transmission products. ABB products are backed by a complete portfolio of services. Our in-depth knowledge of virtually every type of industrial process ensures we always specify the best solution for your needs.**

## > Low and high voltage IEC induction motors

- Process performance motors
- General performance motors
- High voltage cast iron motors
- Induction modular motors
- Slip-ring modular motors
- Synchronous reluctance motors

## > Low and medium voltage NEMA motors

- Steel frame open drip proof (ODP) motors
- Weather protected, water cooled, fan ventilated
- Cast iron frame (TEFC)
- Air to air cooled (TEAAC) motors

## > Motors and generators for explosive atmospheres

- IEC and NEMA motors and generators, for all protection types

## > Synchronous motors

### > Synchronous generators

- Synchronous generators for diesel and gas engines
- Synchronous generators for steam and gas turbines

### > Wind power generators

### > Generators for small hydro

### > Other motors and generators

- Brake motors
- DC motors and generators
- Gear motors
- Marine motors and generators
- Single phase motors
- Motors for high ambient temperatures
- Permanent magnet motors and generators
- High speed motors
- Smoke extraction motors

- Wash down motors
- Water cooled motors
- Generator sets
- Roller table motors
- Low inertia motors
- Traction motors and generators

## > Life cycle services

- Installation and commissioning
- Spares and consumables
- Preventive maintenance
- Predictive maintenance
- Condition monitoring
- On-site and workshop
- Remote troubleshooting
- Technical support
- Engineering and consulting
- Extensions, upgrades and retrofits
- Replacements
- Training
- Service agreements

## > Mechanical power transmission components, bearings, gears

# Life cycle services and support

## From pre-purchase to migration and upgrades

**ABB offers a complete portfolio of services to ensure trouble-free operation and long product lifetimes. These services cover the entire life cycle. Local support is provided through a global network of ABB service centers and certified partners.**

### Pre-purchase

ABB's front-end sales organization can help customers to quickly and efficiently select, configure and optimize the right motor or generator for their application.

### Installation and commissioning

Professional installation and commissioning by ABB's certified engineers represent an investment in availability and reliability over the entire life cycle.

### Engineering and consulting

ABB's experts provide energy efficiency and reliability appraisals, advanced condition and performance assessments and technical studies.

### Condition monitoring and diagnosis

Unique services collect and analyze data to provide early warnings of problems before failures can occur. All critical areas of the equipment are covered.

### Maintenance and field services

ABB offers life cycle management plans and preventive maintenance products. The recommended four-level maintenance program covers the entire product lifetime.

### Spare parts

Spare parts and support are offered throughout the life cycle of ABB products. In addition to individual spares, tailored spare part packages are also available.

### Repair and refurbishment

Support for all ABB motors and generators and other brands is provided by ABB's global service organization. Specialist teams can also deliver emergency support.

### Migration and upgrades

Life cycle audits determine the optimum upgrades and migration paths. Upgrades range from individual components to direct replacement motors and generators.

### Training

Product and service training courses take a practical approach. The training ranges from standard courses to specially tailored programs to suit customer requirements.

### Specialized support

Specialized support is offered through ABB's global service organization. Local units provide major and minor repairs as well as overhauls and reconditioning.

### Service contracts

Service contracts are tailored to the customer's needs. The contracts combine ABB's entire service portfolio and 120 years of experience to deploy the optimal service practices.



# Contact us

[www.abb.com/motors&generators](http://www.abb.com/motors&generators)

We reserve the right to make technical changes or modify the contents of this document without prior notice. With regard to purchase orders, the agreed particulars shall prevail. ABB does not accept any responsibility what so ever for potential errors or possible lack of information in this document.

We reserve all rights in this document and in the subject matter and illustrations contained herein. Any reproduction, disclosure to third parties or utilization of its contents – in whole or in parts – is forbidden without prior written consent of ABB.

© Copyright 2015 ABB.  
All rights reserved.

9AKK105828 EN 02-2015