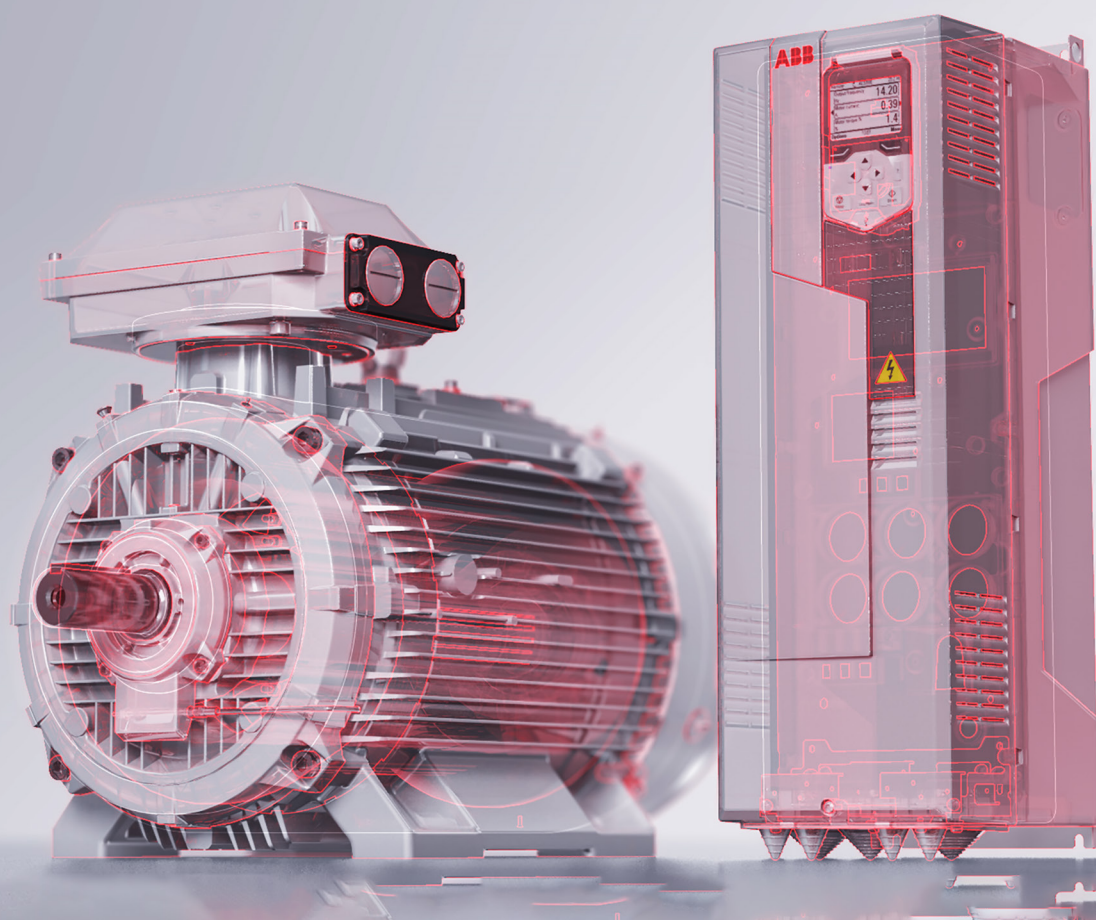


CATALOG | NOVEMBER 2022

Low voltage

Synchronous reluctance motors



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

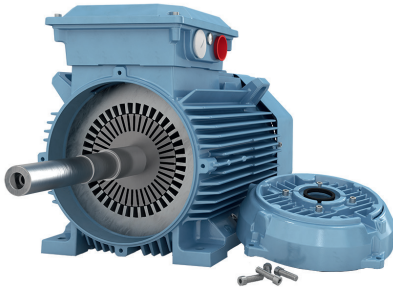
Low voltage Synchronous reluctance motors

Sizes 90 to 315, 1.1 to 315 kW

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Synchronous reluctance motors

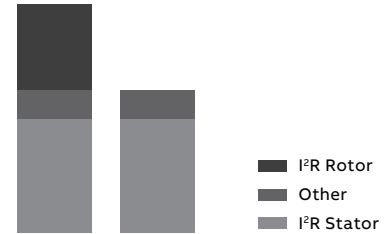
Ultimate efficiency and reliability to optimize your cost of ownership



Traditional induction motor



IE5 SynRM motor



Losses

Ultimate efficiency and reliability to optimize your cost of ownership

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

Magnet-free design

Synchronous reluctance technology combines the performance of the permanent magnet motor with the simplicity and service-friendliness of an induction motor. The 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.

SynRM technology	Benefit
Higher efficiency IE5	Lowest energy consumption
No rare earth metals	Environmental sustainability
Magnet-free rotor	Easy service
Lower winding and bearing temperatures	Longer life time, extended service intervals
Better controllability	Accurate speed and torque control
Lower noise level	Better working environment
Same size with IE2	Perfect for retrofits

Highest reliability to minimize the cost of not running

IE5 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.

Full motor control, down to zero speed

Many processes require accurate speed control. As the name says, SynRM is a synchronous motor that always runs at reference speed with practically no error, without an encoder. Even the best slip compensation systems in an induction motor inverter will never match the precision of SynRM. Sometimes your application may require you to run your motor at slow speeds, for example at less than 40 rpm. If you are using SynRM and your drive cannot provide the necessary torque, it may trip. This means you may have downtime while the problem is being debugged. ABB drives provide full control and torque down to zero speed, even without speed sensors.

For all applications

This is important if you are planning on using the motor with applications other than quadratic torque applications like pumps and fans. Our drives provide full SynRM motor control for constant torque applications such as extruders, conveyors and wire drawing machines.

Perfect for retrofits

The IE5 SynRM motor is a perfect solution for motor retrofits. It is the same size as an IE2 induction motor, eliminating the need for mechanical modifications. The increased efficiency will, on the other hand, reduce the payback time of the investment.

Common features

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 September 2022.

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.

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 insulation 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 symmetri-

cal 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.

IE5 according to IEC TS 60034-30-2

New technical specification IEC TS 60034-30-2 (2016) specify the efficiency classes for variable speed drive (VSD) motors (i.e. motors which cannot be operated direct on line (DOL)). Typical standard low voltage induction motor efficiency is determined according to IEC 60034-30-1 in sinusoidal (DOL) supply.

IEC TS 60034-30-2 highlights

- The IE class limit values in new IEC TS 60034-30-2 are reduced by adding the additional harmonic losses caused by the drive:
 - 15% additional losses for motors up to 90kW
 - 25% additional losses for motors above 90kW
- Limit values available also for IE5 level
- Limit values to be achieved with 90% speed, 100% torque

DOL or VSD motor – Same IE class, same efficiency performance in VSD duty

This allows direct comparison in IE class level of traditional induction motors in variable speed usage and advanced technology motors designed only for variable speed drive (like Synchronous reluctance motors). It does not matter if the IE classification is done with DOL supply according to IEC 60034-30-1 or with VSD supply according to IEC TS 60034-30-2. The given IE class still illustrates efficiency performance of both solutions in VSD operation very well. Same IE class, same efficiency performance.

Example:

110 kW 4-pole motor efficiency	
IEC 60034-30-1 (DOL)	IEC TS 60034-30-2 (VSD)
Losses 4,2 kW	Losses 4,2 kW x 1,25 = 5,25 kW
Eff. (110kW/114,2 kW)	Eff. (110 kW/ (110 + 5,25 kW))
= 96,3%	= 95,4%
IE4 limit 96,3%	IE4 limit 95,4% %
Same motor is IE4 according to both standards	

IE5 SynRM efficiency with VSD duty for same rating is 96,8 %.

In practice, IE5 motor has 20% less losses compared to an IE4 motor. In the technical tables you can see the measured SynRM motor efficiency with VSD supply. Typical values of IE3 induction motor efficiency with VSD supply are listed for comparison.

High output for compactness

High performance for compact machine designs

High output SynRM motor is a compact and yet highly efficient motor that's up to three frame sizes smaller than a conventional motor. Rotor losses are virtually eliminated, resulting in cool running. This advantage is the basis for a high output SynRM design that delivers high power density coupled with good efficiency. High output SynRM motors enable compact and cost efficient machine designs or increased machine output without increasing motor size.

Same power - smaller motor

The High output synchronous reluctance motor is up to three frame sizes smaller than an induction motor with the same output. The size advantage increases with speed so the benefit is greater for 3000 than for 1500 rpm applications. A light, compact motor means cost-efficient installations.

Same size - higher power

The size advantage of synchronous reluctance motors can also be exploited to increase capacity without changes in the motor installation. In other words, a high output synchronous reluctance motor can deliver up to twice the output of an induction motor of the same size. Again, this power advantage is greater at higher speeds.

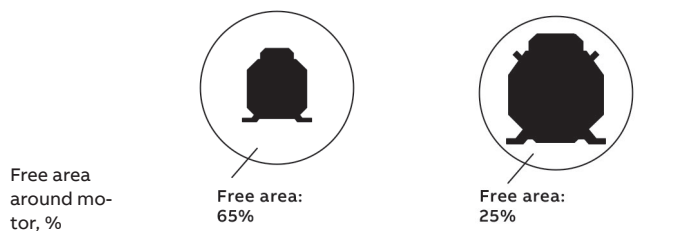
Customer benefits

Same output from a smaller size or higher output from the same size.

Application example, 22 kW, 1500 rpm		
	High output SynRM motor	IE3 induction motor
Frame size	160	180
Weight, kg	174	222

Reduced system space – lower weight, easier installation.

Application example, 37 kW, 3000 rpm		
	High output SynRM motor	IE3 induction motor
Frame size	160	200
Weight, kg	157	298



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.

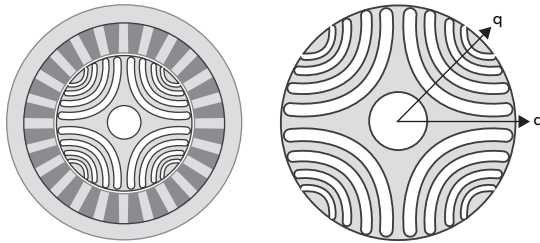


Figure 4: Cross-sectional illustration of a four-pole synchronous reluctance motor (left), and the definition of the magnetic d- and q-axes of its rotor (right).

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 easily be 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 di-

rect-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 figure 01.

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.

Synchronous reluctance motors with ABB variable speed drives



ACS580 general purpose drive highlights

- A scalable offering from 0.75 kW to 500 kW.
- All compatible drive for typical light industry applications such as compressors, conveyors, mixers, pumps and fans, as well as many other linear, variable and constant torque applications.
- The assistant control panel with multiple language choices as standard.
- An optional Bluetooth control panel for wireless commissioning and monitoring. Primary settings and application control macros ensure quick product setup.
- Enclosure IP55 for harsh conditions.
- Supports various motor types: induction, permanent magnet, and synchronous reluctance motors.
- Integrated safety, including the safe-torque off (STO) feature as standard.
- Supports various motor types: induction, permanent magnet, and synchronous reluctance motors.

Industry specific ACH580 drives for HVAC and ACQ580 drives for water and wastewater are also available for SynRM control. Consult ABB to find the drive that matches your business needs the best or visit our web page .


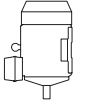
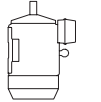
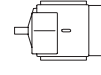
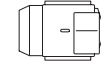
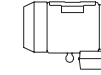
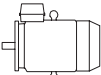
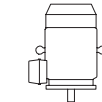
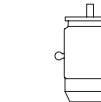

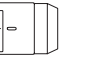
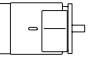
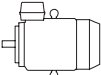
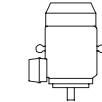
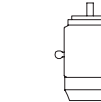

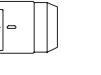
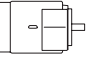

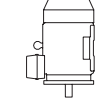
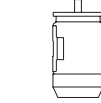
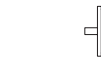
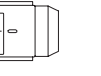
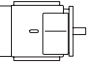
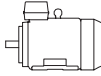
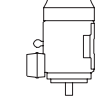
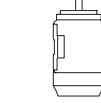

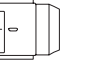
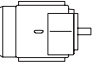
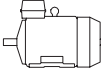
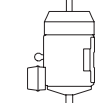
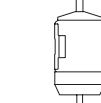

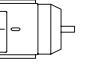
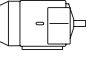
ACS880 industrial drive highlights

- All compatible drives range for numerous demanding industries and applications such as cranes, extruders, winches, winders, conveyors and compressors, 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.

Consult ABB to find the drive that matches your business needs the best or visit our web page .

General information

Mounting arrangements

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

Ordering information

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 162 413	- ASC	445
		1 2 3 4 5 6 7 8 9 10 11 12 13 14		

Positions 1 to 4

3GAL	Totally enclosed fan-cooled synchronous reluctance motor with cast aluminum frame, sizes 90 - 132
3GBL	Totally enclosed fan-cooled synchronous reluctance motor with cast iron frame, sizes 160 - 315

Positions 5 to 6

IEC size	
09:	90
10:	100
11:	112
13:	132
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	
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Position 11

-(dash)	
---------	--

Position 12 (marked with black dot in data tables)

Mounting arrangement	
A:	Foot-mounted
B:	Flange-mounted, large flange
C:	Flange-mounted, small flange (sizes 90-112)
Use a variant code for ordering any other mounting arrangement	

Position 13 (marked with black dot in data tables)

Voltage and frequency	
D:	400 VΔ, 415 VΔ, 690 VY 50 Hz, 460VΔ 60 Hz
E:	500 VΔ 50 Hz
F:	500 VY 50 Hz
S:	230 VΔ, 400 VY, 415 VY 50 Hz
U:	690 VΔ 50 Hz

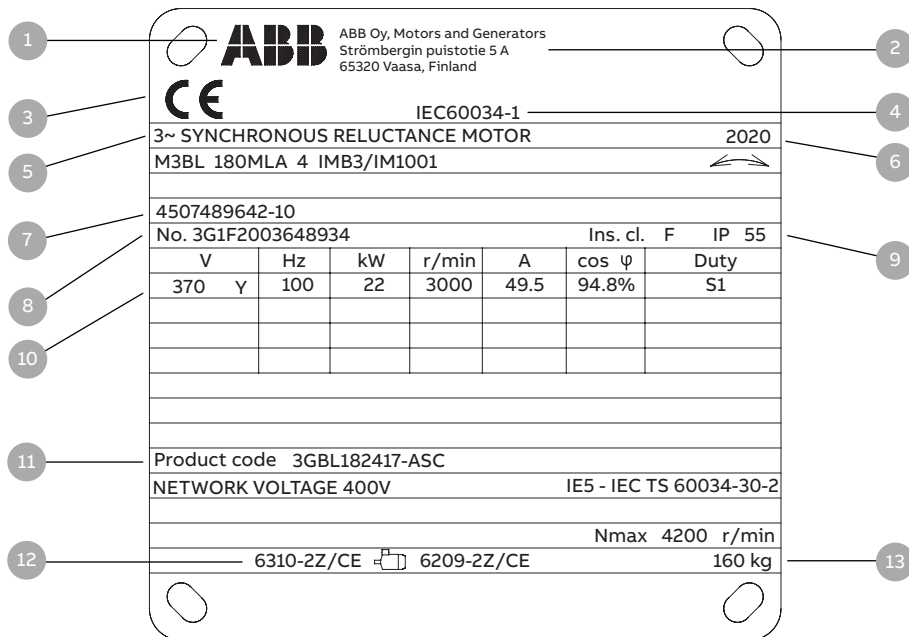
Position 14

Generation code	
B	High output synchronous reluctance motors
C	IE5 synchronous reluctance motors

Variant codes

The product code must be, if needed, followed by variant codes.

Rating plates



- 1 ABB logo
- 2 Manufacturing place
- 3 CE mark on Ecodesign approved motors UKCA mark on UK approved motors
- 4 Manufacturing standard
- 5 Product description
- 6 Manufacturing year
- 7 Factory order reference number
- 8 Serial number
- 9 Insulation class, IP protection class
- 10 Voltage, Frequency, output, speed, current, power factory, duty
- 11 Product code
- 12 Bearing type
- 13 Weight

Technical data

IE5 synchronous reluctance motors, 400 V

Out-put, kW	Type designation	Product code	Speed at 100% of nominal power (M) (r/min)	IE class acc. to IEC TS60034-30-2	Motor efficiency with VSD supply $T_N=100\%$, $n_N=100\%$	Typical IE3 induction motor efficiency with VSD supply $T_N=100\%$, $n_N=100\%$	Max speed, n_{max} r/m	Current, I_N A	Torque			Rotor inertia (J=1/4GD ²) (M) (kgm ²)	Weight, Kg	Temperature rise class (M)
									T_N /Nm	T_{OL}/T_N Nm				
3000 r/min (100 Hz)														
400 V network														
5.5	M3AL 132SMA 4	3GAL132217-●●C	3000	IE5	92.8	87.8	4500	12.1	17.5	1.5	0.0145	41	B	
7.5	M3AL 132SMB 4	3GAL132227-●●C	3000	IE5	93.1	88.8	4500	16.5	23.9	1.5	0.0145	41	B	
11	M3AL 132SMC 4	3GAL132237-●●C	3000	IE5	94.0	90.0	4500	24.5	35.0	1.5	0.0184	47	B	
15	M3AL 132SMD 4	3GAL132247-●●C	3000	IE5	94.1	90.8	4500	32.9	47.8	1.5	0.0184	47	B	
11	M3BL 160MLA 4	3GBL162417-●●C	3000	IE5	93.6	90.0	4500	25.6	35.0	1.5	0.0579	133	B	
15	M3BL 160MLB 4	3GBL162427-●●C	3000	IE5	95.1	90.8	4500	34.6	48.0	1.5	0.0579	133	B	
18.5	M3BL 160MLC 4	3GBL162437-●●C	3000	IE5	94.6	91.4	4500	43.3	59.0	1.5	0.0579	133	B	
22	M3BL 180MLB 4	3GBL182427-●●C	3000	IE5	95.5	91.7	4500	50.5	70.0	1.6	0.116	190	B	
30	M3BL 200MLC 4	3GBL202437-●●C	3000	IE5	95.9	92.4	4500	68.9	95.6	1.9	0.207	277	B	
37	M3BL 200MLD 4	3GBL202447-●●C	3000	IE5	96.1	92.8	4500	84.5	118	2.0	0.207	277	B	
45	M3BL 225SMB 4	3GBL222227-●●C	3000	IE5	96.1	93.2	4500	99.8	143	2.1	0.302	330	B	
55	M3BL 250SMA 4	3GBL252217-●●C	3000	IE5	96.4	93.5	3600	123	175	1.6	0.499	396	B	
75	M3BL 250SMB 4	3GBL252227-●●C	3000	IE5	96.5	94.0	3600	167	239	2.0	0.499	396	B	
90	M3BL 250SMC 4	3GBL252237-●●C	3000	IE5	96.4	94.3	3600	198	286	2.3	0.632	454	B	
1500 r/min (50 Hz)														
400 V network														
5.5	M3AL 132SMA 4	3GAL132213-●●C	1500	IE5	93.7	88.2	4500	11.7	35.0	1.5	0.0277	63	B	
7.5	M3AL 132SMB 4	3GAL132223-●●C	1500	IE5	93.7	89.1	4500	15.7	47.8	1.5	0.0277	63	B	
11	M3AL 132SMC 4	3GAL132233-●●C	1500	IE5	94.2	90.2	4500	23.8	70.0	1.5	0.0317	69	B	
11	M3BL 160MLA 4	3GBL162413-●●C	1500	IE5	94.0	90.2	4500	24.2	70.0	1.5	0.0702	160	B	
15	M3BL 160MLB 4	3GBL162423-●●C	1500	IE5	94.9	91.0	4500	31.3	95.0	1.5	0.0864	177	B	
18.5	M3BL 180MLB 4	3GBL182423-●●C	1500	IE5	95.0	91.6	4500	42.8	118	2.6	0.156	222	B	
22	M3BL 180MLC 4	3GBL182433-●●C	1500	IE5	95.4	92.0	4500	49.4	118	2.2	0.156	222	B	
30	M3BL 200MLB 4	3GBL202423-●●C	1500	IE5	95.9	92.7	4500	65.0	191	2.3	0.287	304	B	
37	M3BL 225SMB 4	3GBL222223-●●C	1500	IE5	96.3	93.0	3600	79.3	236	2.2	0.38	385	B	
45	M3BL 225SMC 4	3GBL222233-●●C	1500	IE5	96.3	93.4	3600	98.5	286	2.3	0.38	350	B	
55	M3BL 250SMB 4	3GBL252223-●●C	1500	IE5	96.5	93.8	3600	117	350	2.3	0.632	454	B	
75	M3BL 280SMA 4	3GBL282213-●●C	1500	IE5	96.2	94.3	2600	166	478	2.0	1	454	B	
90	M3BL 280SMB 4	3GBL282223-●●C	1500	IE5	96.5	94.5	2600	199	573	2.1	1	639	B	
110	M3BL 280SMC 4	3GBL282233-●●C	1500	IE5	96.7	94.3	2600	241	699	2.1	1.21	697	B	
110	M3BL 315SMA 4	3GBL312213-●●C	1500	IE5	96.8	94.3	2200	243	702	2.0	1.64	873	B	
132	M3BL 315SMB 4	3GBL312223-●●C	1500	IE5	96.8	94.6	2200	290	842	2.0	1.87	925	B	
160	M3BL 315SMC 4	3GBL312233-●●C	1500	IE5	97.1	94.8	2200	343	1018	1.9	2.04	965	B	
200	M3BL 315MLA 4	3GBL312413-●●C	1500	IE5	97.2	95.0	2200	428	1272	1.9	2.45	1116	B	
250	M3BL 315LKA 4	3GBL312813-●●C	1500	IE5	97.1	95.0	2200	552	1591	2.0	3.04	1357	B	
315	M3BL 315LKC 4	3GBL312833-●●C	1500	IE5	97.2	95.0	2200	662	2006	1.8	3.77	1533	F	
1000 r/min (33,3 Hz)														
400 V network														
7.5	M3BL 160MLA 4	3GBL162412-●●C	1000	IE5	93.1	87.7	4500	16.5	72	1.5	0.0702	160	B	
11	M3BL 160MLB 4	3GBL162422-●●C	1000	IE5	93.7	89.0	4500	24.1	105	1.5	0.0864	177	B	
15	M3BL 180MLC 4	3GBL182432-●●C	1000	IE5	94.2	90.0	4500	34.1	143	2.2	0.156	216	B	
18.5	M3BL 200MLA 4	3GBL202412-●●C	1000	IE5	95.2	90.6	4500	39.9	177	1.5	0.287	304	B	
22	M3BL 200MLB 4	3GBL202422-●●C	1000	IE5	95.0	91.1	4500	47.0	210	1.5	0.287	304	B	
30	M3BL 225SMB 4	3GBL222222-●●C	1000	IE5	95.5	91.9	3600	64.7	287	2.1	0.38	348	B	
37	M3BL 250SMA 4	3GBL252212-●●C	1000	IE5	95.6	92.4	3600	80.5	353	1.5	0.575	428	B	
45	M3BL 280SMA 4	3GBL282212-●●C	1000	IE5	96.2	92.8	2600	98.6	430	2.3	1	639	B	
55	M3BL 280SMB 4	3GBL282222-●●C	1000	IE5	96.0	93.3	2600	119.0	526	2.0	1	639	B	
75	M3BL 280SMC 4	3GBL282232-●●C	1000	IE5	96.2	93.8	2600	160.0	715	2.1	1.21	697	B	
75	M3BL 315SMA 4	3GBL312212-●●C	1000	IE5	96.5	93.8	2200	164	717	2.0	1.64	873	B	
90	M3BL 315SMB 4	3GBL312222-●●C	1000	IE5	96.8	94.2	2200	199	859	2.0	1.87	925	B	
110	M3BL 315SMC 4	3GBL312232-●●C	1000	IE5	96.8	93.9	2200	241	1051	1.9	2.04	965	B	
132	M3BL 315MLA 4	3GBL312412-●●C	1000	IE5	97.1	94.3	2200	278	1261	1.7	2.45	1116	B	
160	M3BL 315LKA 4	3GBL312812-●●C	1000	IE5	97.1	94.6	2000	341	1527	1.9	3.04	1357	B	
200	M3BL 315LKC 4	3GBL312832-●●C	1000	IE5	97.3	94.8	2000	416	1910	1.8	3.77	1533	B	

* Additional motor losses acc. to IEC TS 60034-30-2.

Technical data

IE5 synchronous reluctance motors, 500 V

Out-put, kW	Type designation	Product code	Speed at 100% of nominal power (M) (r/min)	IE class acc. to IEC TS60034-30-2	Motor efficiency with VSD supply T _N = 100%, nN=100%	Typical IE3 induction motor efficiency with VSD supply *T _N = 100%, nN=100%	Max speed, n _{max} r/m	Current, I _N A	Torque			Rotor inertia (J=1/4GD ²) (M) (kgm ²)	Weight, Kg	Temperature rise class (M)
									T _n /Nm	T _{OL} /T _N Nm				
3000 r/min (100 Hz)														
500 V network														
5.5	M3AL 132SMA 4	3GAL132217-●●C	3000	IE5	92.8	87.8	4500	9.6	17.5	1.5	0.0145	41	B	
7.5	M3AL 132SMB 4	3GAL132227-●●C	3000	IE5	93.1	88.8	4500	13.3	23.9	1.5	0.0145	41	B	
11	M3AL 132SMC 4	3GAL132237-●●C	3000	IE5	93.1	90.0	4500	19.8	35.0	1.5	0.0184	47	B	
15	M3AL 132SMD 4	3GAL132247-●●C	3000	IE5	94.1	90.8	4500	26.6	47.7	1.5	0.0184	47	B	
11	M3BL 160MLA 4	3GBL162417-●●C	3000	IE5	93.6	90.0	4500	20.8	35.0	1.5	0.0579	133	B	
15	M3BL 160MLB 4	3GBL162427-●●C	3000	IE5	95.1	90.8	4500	27.2	47.8	1.5	0.0579	133	B	
18.5	M3BL 160MLC 4	3GBL162437-●●C	3000	IE5	94.5	91.4	4500	34.1	58.9	1.5	0.0579	133	B	
22	M3BL 180MLB 4	3GBL182427-●●C	3000	IE5	95.5	91.7	4500	39.7	70.0	1.6	0.116	190	B	
30	M3BL 200MLC 4	3GBL202437-●●C	3000	IE5	95.9	92.4	4500	50.9	95.5	1.9	0.207	277	B	
37	M3BL 200MLD 4	3GBL202447-●●C	3000	IE5	96.1	92.8	4500	66.4	118.0	2.0	0.207	277	B	
45	M3BL 225SMB 4	3GBL222227-●●C	3000	IE5	96.1	93.2	4500	78.4	143.0	2.1	0.302	330	B	
55	M3BL 250SMA 4	3GBL252217-●●C	3000	IE5	96.9	93.5	3600	97.0	175.0	1.9	0.499	396	B	
75	M3BL 250SMB 4	3GBL252227-●●C	3000	IE5	96.5	94.0	3600	134.0	239.0	2.1	0.499	396	B	
90	M3BL 250SMC 4	3GBL252237-●●C	3000	IE5	96.4	94.3	3600	153.0	286.0	2.1	0.632	454	B	
1500 r/min (50 Hz)														
500 V network														
5.5	M3AL 132SMA 4	3GAL132213-●●C	1500	IE5	93.7	88.2	4500	9.5	35.0	1.5	0.0277	63	B	
7.5	M3AL 132SMB 4	3GAL132223-●●C	1500	IE5	93.7	89.1	4500	12.8	47.8	1.5	0.0277	63	B	
11	M3AL 132SMC 4	3GAL132233-●●C	1500	IE5	94.1	90.2	4500	19.3	70.0	1.5	0.0317	69	B	
11	M3BL 160MLA 4	3GBL162413-●●C	1500	IE5	94.0	90.2	4500	19.1	70.0	1.5	0.0702	160	B	
15	M3BL 160MLB 4	3GBL162423-●●C	1500	IE5	94.8	91.0	4500	25.3	95.5	1.5	0.0864	177	B	
18.5	M3BL 180MLB 4	3GBL182423-●●C	1500	IE5	95.0	91.6	4500	33.2	118	0.0	0.156	222	B	
22	M3BL 180MLC 4	3GBL182433-●●C	1500	IE5	95.4	92.0	4500	39.5	140	2.4	0.156	222	B	
30	M3BL 200MLB 4	3GBL202423-●●C	1500	IE5	95.9	92.7	4500	51.2	191	2.2	0.287	304	B	
37	M3BL 225SMB 4	3GBL222223-●●C	1500	IE5	96.3	93.0	3600	61.2	236	2.2	0.38	385	B	
45	M3BL 225SMC 4	3GBL222233-●●C	1500	IE5	96.3	93.4	3600	78.2	286	2.3	0.389	350	B	
55	M3BL 250SMB 4	3GBL252223-●●C	1500	IE5	96.5	93.8	3600	91.6	350	2.3	0.632	454	B	
75	M3BL 280SMA 4	3GBL282213-●●C	1500	IE5	96.2	94.3	2600	131	477	2.0	1	639	B	
90	M3BL 280SMB 4	3GBL282223-●●C	1500	IE5	96.5	94.5	2600	157	573	2.1	1	639	B	
110	M3BL 280SMC 4	3GBL282233-●●C	1500	IE5	96.7	94.3	2600	190	700	2.1	1.21	697	B	
110	M3BL 315SMA 4	3GBL312213-●●C	1500	IE5	96.8	94.3	2200	191	700	2.0	1.64	873	B	
132	M3BL 315SMB 4	3GBL312223-●●C	1500	IE5	96.8	94.3	2200	232	840	2.0	1.87	925	B	
160	M3BL 315SMC 4	3GBL312233-●●C	1500	IE5	97.1	94.6	2200	271	1019	2.0	2.04	965	B	
200	M3BL 315MLA 4	3GBL312413-●●C	1500	IE5	97.2	94.8	2200	326	1273	1.9	2.45	1116	B	
250	M3BL 315LKA 4	3GBL312813-●●C	1500	IE5	97.1	95.0	2200	434	1592	1.9	3.04	1357	B	
315	M3BL 315LKC 4	3GBL312833-●●C	1500	IE5	97.2	95.0	2200	517	2005	1.8	3.77	1533	F	
1000 r/min (33,3 Hz)														
500 V network														
7.5	M3BL 160MLA 4	3GBL162412-●●C	1000	IE5	93.3	87.7	4500	13.1	71.6	1.5	0.0702	160	B	
11	M3BL 160MLB 4	3GBL162422-●●C	1000	IE5	93.7	89.0	4500	19.0	105	1.5	0.0864	177	B	
15	M3BL 180MLC 4	3GBL182432-●●C	1000	IE5	94.2	90.0	4500	25.2	143	2.2	0.156	216	B	
18.5	M3BL 200MLA 4	3GBL202412-●●C	1000	IE5	95.4	90.6	4500	31.5	177	1.5	0.287	304	B	
22	M3BL 200MLB 4	3GBL202422-●●C	1000	IE5	95.2	91.1	4500	37.0	210	1.5	0.287	304	B	
30	M3BL 225SMB 4	3GBL222222-●●C	1000	IE5	95.5	91.9	3600	51.3	287	2.1	0.38	348	B	
37	M3BL 250SMA 4	3GBL252212-●●C	1000	IE5	95.8	92.4	3600	63.4	353	1.5	0.575	428	B	
45	M3BL 280SMA 4	3GBL282212-●●C	1000	IE5	96.2	92.8	2600	77.6	430	2.3	1	639	B	
55	M3BL 280SMB 4	3GBL282222-●●C	1000	IE5	96.1	93.3	2600	93.7	525	2.0	1	639	B	
75	M3BL 280SMC 4	3GBL282232-●●C	1000	IE5	96.2	93.8	2600	126	716	2.1	1.21	697	B	
75	M3BL 315SMA 4	3GBL312212-●●C	1000	IE5	96.5	93.8	2200	129	716	2.0	1.64	873	B	
90	M3BL 315SMB 4	3GBL312222-●●C	1000	IE5	96.8	94.2	2200	157	859	2.0	1.87	925	B	
110	M3BL 315SMC 4	3GBL312232-●●C	1000	IE5	96.8	93.9	2200	190	1050	1.9	2.04	965	B	
132	M3BL 315MLA 4	3GBL312412-●●C	1000	IE5	97.1	94.3	2200	219	1261	1.7	2.45	1116	B	
160	M3BL 315LKA 4	3GBL312812-●●C	1000	IE5	97.1	94.6	2000	269	1528	1.9	3.04	1357	B	
200	M3BL 315LKC 4	3GBL312832-●●C	1000	IE5	97.3	94.8	2000	327	1910	1.8	3.77	1533	B	

* Additional motor losses acc. to IEC TS 60034-30-2.

Technical data

IE5 synchronous reluctance motors, 690 V

Out-put, kW	Type designation	Product code	Speed at 100% of nominal power (M) (r/min)	IE class acc. to IEC TS60034-30-2	Motor efficiency with VSD supply T _N = 100%, nN=100%	Typical IE3 induction motor efficiency with VSD supply *T _N = 100%, nN=100%	Max speed, nmax r/m	Torque			Rotor inertia (J=1/4GD ²) (M) (kgm ²)	Weight, Kg	Temperature rise class (M)
								Current, I _N A	T _N /Nm	T _{OL} /T _N Nm			
3000 r/min (100 Hz)													
690 V network													
5.5	M3AL 132SMA 4	3GAL132217-●●C	3000	IE5	92.5	87.8	4500	7.0	17.5	1.5	0.0145	41	B
7.5	M3AL 132SMB 4	3GAL132227-●●C	3000	IE5	92.8	88.8	4500	9.5	23.9	1.5	0.0145	41	B
11	M3AL 132SMC 4	3GAL132237-●●C	3000	IE5	92.9	90.0	4500	14.1	35.0	1.5	0.0184	47	B
15	M3AL 132SMD 4	3GAL132247-●●C	3000	IE5	93.7	90.8	4500	18.9	47.8	1.5	0.0184	47	B
11	M3BL 160MLA 4	3GBL162417-●●C	3000	IE5	93.6	90.0	4500	14.8	35.0	1.5	0.0579	133	B
15	M3BL 160MLB 4	3GBL162427-●●C	3000	IE5	94.9	90.8	4500	20.0	47.8	1.5	0.0579	133	B
18.5	M3BL 160MLC 4	3GBL162437-●●C	3000	IE5	94.5	91.4	4500	25.1	58.9	1.5	0.0579	133	B
22	M3BL 180MLB 4	3GBL182427-●●C	3000	IE5	95.4	91.7	4500	28.9	70.0	1.6	0.116	190	B
30	M3BL 200MLC 4	3GBL202437-●●C	3000	IE5	95.9	92.4	4500	39.3	95.5	1.9	0.207	277	B
37	M3BL 200MLD 4	3GBL202447-●●C	3000	IE5	96.1	92.8	4500	47.8	118	1.9	0.207	277	B
45	M3BL 225SMB 4	3GBL222227-●●C	3000	IE5	96.1	93.2	4500	57.2	143	2.3	0.302	330	B
55	M3BL 250SMA 4	3GBL252217-●●C	3000	IE5	94.4	93.5	3600	70.0	175	1.6	0.499	396	B
75	M3BL 250SMB 4	3GBL252227-●●C	3000	IE5	96.5	94.0	3600	96.0	239	2.1	0.499	396	B
90	M3BL 250SMC 4	3GBL252237-●●C	3000	IE5	96.4	94.3	3600	111	286	2.2	0.632	454	B
1500 r/min (50 Hz)													
690 V network													
5.5	M3AL 132SMA 4	3GAL132213-●●C	1500	IE5	93.3	88.2	4500	6.8	35.0	1.5	0.0277	63	B
7.5	M3AL 132SMB 4	3GAL132223-●●C	1500	IE5	93.3	89.1	4500	9.2	47.8	1.5	0.0277	63	B
11	M3AL 132SMC 4	3GAL132233-●●C	1500	IE4	93.7	90.2	4500	13.9	70.0	1.5	0.0317	69	B
11	M3BL 160MLA 4	3GBL162413-●●C	1500	IE4	93.6	90.2	4500	14.1	70.0	1.5	0.0702	160	B
15	M3BL 160MLB 4	3GBL162423-●●C	1500	IE4	94.6	91.0	4500	18.4	95.5	1.5	0.0864	177	B
18.5	M3BL 180MLB 4	3GBL182423-●●C	1500	IE5	95.0	91.6	4500	24.3	118	2.6	0.156	222	B
22	M3BL 180MLC 4	3GBL182433-●●C	1500	IE5	95.4	92.0	4500	28.0	140	2.2	0.156	222	B
30	M3BL 200MLB 4	3GBL202423-●●C	1500	IE5	95.5	92.7	4500	37.3	191	2.3	0.287	304	B
37	M3BL 225SMB 4	3GBL222223-●●C	1500	IE5	96.3	93.0	3600	45.2	236	2.2	0.38	385	B
45	M3BL 225SMC 4	3GBL222233-●●C	1500	IE5	96.3	93.4	3600	54.8	286	2.3	0.38	350	B
55	M3BL 250SMB 4	3GBL252223-●●C	1500	IE5	96.5	93.8	3600	67.0	350	2.4	0.632	454	B
75	M3BL 280SMA 4	3GBL282213-●●C	1500	IE5	96.2	94.3	2600	92.6	477	2.0	1	639	B
90	M3BL 280SMB 4	3GBL282223-●●C	1500	IE5	96.3	94.5	2600	110	573	2.1	1	639	B
110	M3BL 280SMC 4	3GBL282233-●●C	1500	IE5	96.6	94.3	2600	133	700	2.1	1.21	697	B
110	M3BL 315SMA 4	3GBL312213-●●C	1500	IE5	96.7	94.3	2200	138	700	2.0	1.64	873	B
132	M3BL 315SMB 4	3GBL312223-●●C	1500	IE5	96.7	94.6	2200	165	840	2.0	1.87	925	B
160	M3BL 315SMC 4	3GBL312233-●●C	1500	IE5	97.0	94.8	2200	195	1019	1.9	2.04	965	B
200	M3BL 315MLA 4	3GBL312413-●●C	1500	IE5	97.1	95.0	2200	244	1273	1.9	2.45	1116	B
250	M3BL 315LKA 4	3GBL312813-●●C	1500	IE5	97.0	95.0	2200	314	1592	2.0	3.04	1357	B
315	M3BL 315LKC 4	3GBL312833-●●C	1500	IE5	97.1	95.0	2200	377	2005	1.8	3.77	1533	F
1000 r/min (50 Hz)													
690 V network													
7.5	M3BL 160MLA 4	3GBL162412-●●C	1000	IE5	93.0	87.7	4500	9.5	71.6	1.5	0.0702	160	B
11	M3BL 160MLB 4	3GBL162422-●●C	1000	IE4	93.4	89.0	4500	13.8	105	1.5	0.0864	177	B
15	M3BL 180MLC 4	3GBL182432-●●C	1000	IE5	94.2	90.0	4500	19.3	143	2.3	0.156	216	B
18.5	M3BL 200MLA 4	3GBL202412-●●C	1000	IE5	95.0	90.6	4500	22.6	177	1.5	0.287	304	B
22	M3BL 200MLB 4	3GBL202422-●●C	1000	IE5	94.9	91.1	4500	26.5	210	1.5	0.287	304	B
30	M3BL 225SMB 4	3GBL222222-●●C	1000	IE5	95.5	91.9	3600	36.7	287	2.1	0.38	348	B
37	M3BL 250SMA 4	3GBL252212-●●C	1000	IE5	95.6	92.4	3600	46.0	353	1.5	0.575	428	B
45	M3BL 280SMA 4	3GBL282212-●●C	1000	IE5	96.0	92.8	2600	54.6	430	2.3	1	639	B
55	M3BL 280SMB 4	3GBL282222-●●C	1000	IE5	95.8	93.3	2600	66.8	525	2.0	1	639	B
75	M3BL 280SMC 4	3GBL282232-●●C	1000	IE5	96.0	93.8	2600	89.8	716	2.1	1.21	697	B
75	M3BL 315SMA 4	3GBL312212-●●C	1000	IE5	96.4	93.8	2200	91.6	716	2.0	1.64	873	B
90	M3BL 315SMB 4	3GBL312222-●●C	1000	IE5	96.6	94.2	2200	111	860	2.0	1.87	925	B
110	M3BL 315SMC 4	3GBL312232-●●C	1000	IE5	96.7	93.9	2200	134	1051	1.9	2.04	965	B
132	M3BL 315MLA 4	3GBL312412-●●C	1000	IE5	96.9	94.3	2200	156	1261	1.7	2.45	1116	B
160	M3BL 315LKA 4	3GBL312812-●●C	1000	IE5	96.9	94.6	2000	189	1528	1.0	3.04	1357	B
200	M3BL 315LKC 4	3GBL312832-●●C	1000	IE5	97.0	94.8	2000	232	1910	1.8	3.77	1533	B

* Additional motor losses acc. to IEC TS 60034-30-2.

Technical data

High output synchronous reluctance motors, 400 V

Out-put, kW	Type designation	Product code	Efficiency class	Speed at 100% of nominal power (M) (r/min)	Motor ef- ficiency with VSD supply	Max speed, n_{max} r/m	Current, I_N A	Torque		Rotor inertia (J=1/4GD2) (M) (kgm2)	Weight, kg
								T_N /Nm	T_{OL}/T_N Nm		
3000 r/min (100 Hz)											
400 V network											
1.5	M3AL 90L 4	3GAL092507-●●B	IE3	3000	84.2	4200	3.9	4.8	1.5	0.002	13
2.2	M3AL 90LA 4	3GAL092517-●●B	IE3	3000	85.9	4200	5.6	7.0	1.5	0.00202	13
3	M3AL 90LB 4	3GAL092527-●●B	IE3	3000	87.1	4200	7.5	9.6	1.5	0.00276	16
4	M3AL 90LC 4	3GAL092537-●●B	IE3	3000	88.1	4200	9.8	12.7	1.5	0.00276	16
5.5	M3AL 90LD 4	3GAL092547-●●B	IE3	3000	89.2	4200	13.4	17.5	1.5	0.00351	17
7.5	M3AL 100LB 4	3GAL102527-●●B	IE3	3000	90.1	4200	16.9	23.9	1.5	0.00565	23
11	M3AL 112MB 4	3GAL112327-●●B	IE3	3000	91.2	4200	25.0	35.0	1.5	0.00813	33
15	M3AL 132SMB 4	3GAL132227-●●B	IE3	3000	91.9	4200	33.5	47.8	1.5	0.0184	47
18.5	M3AL 132SMC 4	3GAL132237-●●B	IE3	3000	92.4	4200	41.1	58.9	1.5	0.0226	57
22	M3AL 132SMD 4	3GAL132247-●●B	IE3	3000	92.7	4200	48.7	70.0	1.5	0.0226	57
30	M3AL 132SME 4	3GAL132257-●●B	IE3	3000	93.3	4200	68.7	95.5	1.5	0.0277	80
37	M3AL 132SMF 4	3GAL132267-●●B	IE3	3000	93.7	4200	84.4	118	1.5	0.0332	89
33	M3BL 160MLB 4	3GBL162427-●●B	IE3	3000	93.5	4200	76.7	105	1.5	0.0579	130
40	M3BL 160MLC 4	3GBL162437-●●B	IE3	3000	93.9	4200	92.5	127	1.5	0.0702	157
45	M3BL 160MLE 4	3GBL162457-●●B	IE4	3000	94.6	4200	103.0	143	1.5	0.0864	174
62	M3BL 200MLA 4	3GBL202417-●●B	IE4	3000	95.1	4200	144.0	197	1.5	0.242	279
72	M3BL 200MLC 4	3GBL202437-●●B	IE4	3000	95.4	4200	166	229	1.5	0.287	304
97	M3BL 250SMA 4	3GBL252217-●●B	IE4	3000	95.2	3600	224	309	1.5	0.499	396
112	M3BL 250SMB 4	3GBL252227-●●B	IE4	3000	95.3	3600	259	357	1.5	0.575	428
125	M3BL 250SMC 4	3GBL252237-●●B	IE4	3000	95.5	3600	288	398	1.5	0.633	454

Technical data

High output synchronous reluctance motors, 400 V

Out-put, kW	Type designation	Product code	Efficiency class	Speed at 100% of nominal power (M) (r/min)	Motor efficiency with VSD supply	Max speed, n _{max} r/m	Current, I _N A	Torque		Rotor inertia (J=1/4GD ²) (M) (kgm ²)	Weight, Kg
								T _N /Nm	T _{OL} /T _N Nm		
2100 r/min (70 Hz)											
400 V network											
25	M3BL 160MLB 4	3GBL162425-●●B	IE3	2100	92.3	2940	58.8	114	1.5	0.0579	130
31	M3BL 160MLC 4	3GBL162435-●●B	IE3	2100	93.0	2940	72.4	141	1.5	0.0702	157
39	M3BL 160MLE 4	3GBL162455-●●B	IE3	2100	93.7	2940	90.4	177	1.5	0.0864	174
44	M3BL 200MLA 4	3GBL202415-●●B	IE3	2100	93.8	2940	102	200	1.5	0.242	279
62	M3BL 200MLC 4	3GBL202435-●●B	IE3	2100	94.0	2940	143	282	1.5	0.287	174
88	M3BL 250SMA 4	3GBL252215-●●B	IE3	2100	95.0	2940	201	400	1.5	0.499	396
98	M3BL 250SMB 4	3GBL252225-●●B	IE4	2100	95.2	2940	224	446	1.5	0.575	428
115	M3BL 250SMC 4	3GBL252235-●●B	IE4	2100	95.5	2940	258	523	1.5	0.633	454
124	M3BL 280SMA 4	3GBL282215-●●B	IE4	2100	95.2	2400	259	564	1.6	0.857	604
134	M3BL 280SMB 4	3GBL282225-●●B	IE4	2100	95.5	2400	279	609	1.7	1	639
160	M3BL 280SMC 4	3GBL282235-●●B	IE4	2100	95.8	2400	329	728	1.7	1.21	697

Out-put, kW	Type designation	Product code	Efficiency class	Speed at 100% of nominal power (M) (r/min)	Motor efficiency with VSD supply	Max speed, n _{max} r/m	Current, I _N A	Torque		Rotor inertia (J=1/4GD ²) (M) (kgm ²)	Weight, Kg
								T _N /Nm	T _{OL} /T _N Nm		
1500 r/min (50 Hz)											
400 V network											
1.1	M3AL 90LA 4	3GAL092513-●●B	IE2	1500	81.4	2100	2.9	7.0	1.5	0.00202	13
1.5	M3AL 90LB 4	3GAL092523-●●B	IE2	1500	82.8	2100	3.8	9.6	1.5	0.00276	16
2.2	M3AL 90LD 4	3GAL092543-●●B	IE2	1500	84.3	2100	5.5	14.0	1.5	0.00351	17
3	M3AL 100LB 4	3GAL102523-●●B	IE2	1500	85.5	2100	7.1	19.1	1.5	0.00565	23
4	M3AL 100LD 4	3GAL102543-●●B	IE2	1500	86.6	2100	9.4	25.5	1.5	0.0069	27
5.5	M3AL 112MB 4	3GAL112323-●●B	IE2	1500	87.7	2100	13.1	35.0	1.5	0.00813	33
7.5	M3AL 132SMB 4	3GAL132223-●●B	IE2	1500	88.7	2100	17.4	47.7	1.5	0.0184	47
11	M3AL 132SMC 4	3GAL132233-●●B	IE2	1500	89.8	2100	25.0	70.0	1.5	0.0226	57
15	M3AL 132SME 4	3GAL132253-●●B	IE2	1500	90.6	2100	34.5	95.5	1.5	0.0277	80
18.5	M3AL 132SMF 4	3GAL132263-●●B	IE2	1500	91.2	2100	42.2	118	1.5	0.0332	89
17	M3BL 160MLB 4	3GBL162423-●●B	IE2	1500	91.2	2100	42.6	108	1.5	0.0579	130
20	M3BL 160MLC 4	3GBL162433-●●B	IE2	1500	92.0	2100	49.2	127	1.5	0.0702	157
25	M3BL 160MLE 4	3GBL162453-●●B	IE3	1500	92.8	2100	58.5	159	1.5	0.0864	174
33	M3BL 200MLA 4	3GBL202413-●●B	IE3	1500	93.2	2100	76.9	210	1.5	0.242	279
40	M3BL 200MLC 4	3GBL202433-●●B	IE3	1500	93.5	2100	92.9	255	1.5	0.287	304
71	M3BL 250SMA 4	3GBL252213-●●B	IE3	1500	94.3	2100	166	452	1.5	0.499	396
86	M3BL 250SMB 4	3GBL252223-●●B	IE3	1500	94.6	2100	184	547	1.5	0.575	428
97	M3BL 250SMC 4	3GBL252233-●●B	IE3	1500	95.0	2100	225	618	1.5	0.633	454
103	M3BL 280SMA 4	3GBL282213-●●B	IE3	1500	94.8	2100	221	656	1.5	0.857	604
118	M3BL 280SMB 4	3GBL282223-●●B	IE3	1500	95.3	2100	246	758	1.5	1	639
134	M3BL 280SMC 4	3GBL282233-●●B	IE4	1500	95.6	1800	279	853	1.7	1.21	697
155	M3BL 315SMA 4	3GBL312213-●●B	IE4	1500	95.7	1800	321	987	1.5	1.64	873
180	M3BL 315SMB 4	3GBL312223-●●B	IE4	1500	96.0	1800	374	1146	1.5	1.87	925
205	M3BL 315SMC 4	3GBL312233-●●B	IE3	1500	96.1	1800	423	1305	1.5	2.04	965
250	M3BL 315MLA 4	3GBL312413-●●B	IE4	1500	96.4	1800	516	1592	1.5	2.45	1116
275	M3BL 315MLB 4	3GBL312423-●●B	IE3	1500	96.5	1800	573	1751	1.6	2.68	1169
315	M3BL 315LKA 4	3GBL312813-●●B	IE4	1500	96.4	1800	659	2005	1.6	3.04	1357
350	M3BL 315LKC 4	3GBL312833-●●B	IE4	1500	96.5	1800	712	2228	1.7	3.77	1533

Mechanical design

Motor frame and drain holes

Motor frame

Motor sizes 90 - 132 have aluminum alloy stator frame with integrated aluminum feet and terminal box. Motor sizes 160 and above have cast iron frame and feet and a removable terminal box. Integrated 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.)

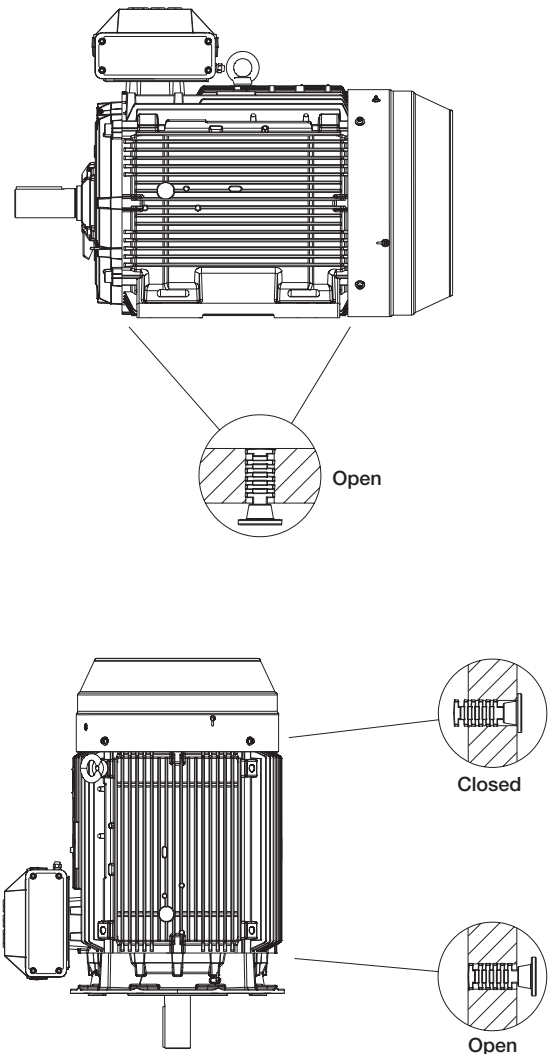


Figure 8: As standard, the motor is delivered with drain holes and closable plugs.

Mechanical design

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	90	100	112	132	160	180	200	225	250	280	315
Heating element power (W)	25	25	25	25	25	50	50	50	50	60	2x60

Mechanical design

Bearings

Standard and alternative bearing designs

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 to ensure that the optimal bearing system design is selected. The variant codes for ordering angular-contact ball bearings at D-end are 058 and 060.

Standard and alternative designs

Motor size	n_N r/ min	Standard design		Alternative design	
		Deep-groove ball bearings		Roller bearing (VC037)	Angular contact ball bearing (VC058)
		D-end	N-end		
90	4	6205-2Z/C3	6204-2Z/C3	NU 205	7205 B
100	4	6206-2Z/C3	6205-2Z/C3	NU 306	7206 B
112	4	6206-2Z/C3	6205-2Z/C3	NU 306	7206 B
132	4	6208-2Z/C3	6206-2Z/C3	NU 308	7208 B
160	4	6309-C3	6209-C3	NU 309 ECP/C3	7209 B
180	4	6310-C3	6209-C3	NU 310 ECP/C3	7210 B
200	4	6312-C3	6210-C3	NU 312 ECP/C3	7312 B
225	4	6313/C3	6210/C3	NU 313 ECP/C3	7313 B
250	4	6315/C3	6213/C3	NU 315 ECP/C3	7315 B
280	4	6316/C3	6316/C3*	NU 316/C3	7316 B
315	4	6319/C3	6316/C3*	NU 319/C3	7319 B

* Insulated bearing at N-end as standard.

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.

Motor size	n_N r/ min	Standard design		Alternative-design
		Axial seal		Radial seal (DIN3760)
		D-end	N-end	D-end, (Variant code 037)
90	4	V-25A	Labyrinth seal	25x42x7
100	4	V-30A	Labyrinth seal	30x47x7
112	4	V-30A	Labyrinth seal	30x47x7
132	4	VA40	Labyrinth seal	40x62x7
160	4	RB45	RB45	45x62x8
180	4	RB50	RB45	50x68x8
200	4	RB60	RB50	60x80x8
225	4	RB65	RB50	65x85x10
250	4	RB75	RB65	75x95x10
280	4	Labyrinth sealing	Labyrinth sealing	80x110x10
315 SM, ML	4	Labyrinth sealing	Labyrinth sealing	95x125x10
315 LK	4	Labyrinth seal	Labyrinth sealing	-

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 prelubricated 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 160 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.

Lubrication intervals in duty hours for ball bearings

Frame size	Amount of grease, g/bearing	Interval hours at		
		3000 r/min	1500 r/min	1000 r/min
Ball bearings				
90-132	Greased for life			
160	13	12000	21500	24000
180	15	9000	18500	24000
200	20	8000	17500	23000
225	23	6500	16500	22000
250	30	4000	8000	11500
280	40	-	6300	9600
315	55	-	-	7600

Lubrication intervals in duty hours for roller bearings

Frame size	Amount of grease, g/bearing	Interval hours at		
		3000 r/min	1500 r/min	1000 r/min
Roller bearings				
90 - 132	On request			
160	13	6000	10 800	13700
180	15	5200	10000	12900
200	20	3900	8700	11 500
225	23	3400	8000	10900
250	30	2500	6900	9800
280	40	-	3100	5250
315	55	-	-	3800

Grease lifetime

Grease lifetime information is relevant for motors equipped with bearings greased for life. Synchronous reluctance motors in frame sizes 90 - 132 are equipped with them, while this is also available as an option for frame sizes 160 - 250.

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.

Ambient temperature and grease lifetime

Motor size	Speed r/min	Ambient temperature and grease lifetime					
		25 °C	40 °C	50 °C	60 °C	70 °C	80 °C
90	3000	40000	40000	33000	20000	11000	6000
90	1500-1000	40000	40000	40000	33000	18000	9000
100	3000	40000	39000	25000	15000	8000	4000
100	1500	40000	40000	40000	30000	17000	9000
100	1000	40000	40000	40000	33000	18000	9000
112	3000	40000	39000	25000	15000	8000	4000
112	1500	40000	40000	40000	30000	17000	9000
112	1000	40000	40000	40000	33000	18000	9000
132	3000	40 000	31 000	20 000	12 000	6 000	3 000
132	1500	40 000	40 000	40 000	24 000	13 000	7 000
132	1000	40 000	40000	40000	33000	18000	9000
160	3000	40 000	40 000	40 000	26 000	14 000	8 000
160	1500-1000	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	1500-1000	40 000	40 000	40 000	40 000	40 000	30 000

Mechanical design

Radial forces

Permissible loading on the shaft

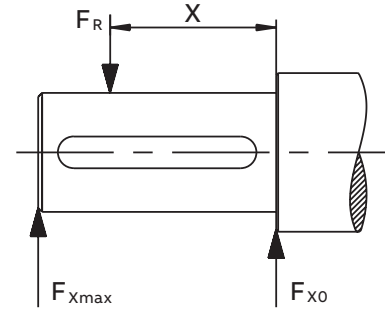
The following table shows permissible radial forces on the shaft in Newtons, assuming zero axial force, a 25 °C ambient temperature, and normal conditions. The values are given for a calculated bearing life of 20 000 and 40 000 hours per motor size.

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.

Where:

E: length of the shaft extension in the standard version



Permissible loading on the shaft

Permissible radial forces, motor sizes 90 – 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_{x0} (N)	F_{xmax} (N)	F_{x0} (N)	F_{xmax} (N)	F_{x0} (N)	F_{xmax} (N)	F_{x0} (N)	F_{xmax} (N)
90	3000	50	1010	810	1010	810	-	-	-	-
90	1500	50	1010	810	1010	810	-	-	-	-
100	3000	60	2280	1800	2280	1800	-	-	-	-
100	1500	60	2280	1800	2280	1800	-	-	-	-
112	3000	80	2280	1800	2280	1800	-	-	-	-
112	1500	80	2280	1800	2280	1800	-	-	-	-
132	3000	80	2120	1610	2120	1610	-	-	-	-
132	1500	80	2120	1610	2120	1610	-	-	-	-
160	3000	110	3540	2740	2955	2285	7100	4300	6140	4300
160	1500	110	4000	3100	3325	2570	8000	4300	6870	4300
160	1000	110	4170	3200	3440	2655	8600	4300	7270	4300
180	3000	110	4100	3385	3455	2825	8125	5500	7025	5500
180	1500	110	4270	3485	3525	2885	8600	5500	7300	5500
180	1000	110	4700	3800	3855	3155	9400	5500	7900	5500
200	3000	110	5600	4685	4700	3925	10900	9100	9470	9700
200	1500	110	6285	5200	5240	4370	12500	9550	10700	8900
200	1000	110	6800	5700	5700	4770	13600	9550	11670	9550
225	3000	110	6400	5400	5355	4500	13300	10700	11500	9700
225	1500	140	7300	5900	6155	4970	15400	10250	13200	10250
225	1000	140	7600	6200	6370	5140	16400	10250	14000	12500
250	3000	140	7700	6285	6500	5285	17100	10900	14900	10900
250	1500	140	8700	7000	7300	5900	19800	13800	17000	13800
250	1000	140	8900	7200	7355	5955	21200	13800	18000	13800
280	1500	140	9200	7800	7300	6200	25100	9200	20300	9200
280	1000	140	10600	8900	8400	7000	28300	9200	23000	9200
315 SM_	1500	170	11400	9400	9000	7450	32500	9600	26600	9600
315 SM_	1000	170	13000	9600	10300	8500	37000	9600	30000	9600
315 ML_	1500	170	11500	9700	9100	7650	32700	13600	26500	13600
315 ML_	1000	170	13200	11100	10400	8800	36900	13600	29900	13600
315 LK_	1500	170	11500	10000	9100	7850	33100	13350	26800	13350
315 LK_	1000	170	13200	11400	10450	9050	37300	13350	30300	13350

If the radial force is applied between points X0 and Xmax, the permissible force F_R can be calculated with the following formula:

$$F_R = F_{x0} - \frac{X}{E} (F_{x0} - F_{xmax})$$

Mechanical design

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.

Permissible axial forces, motor sizes 90 – 315

Motor size	Speed, r/min	Length of shaft extension E (mm)	Mounting arrangement IM B3				Mounting arrangement IM V1			
			Ball bearings		Ball bearings		Ball bearings		Ball bearings	
			20,000 h	40,000 h	20,000 h	40,000 h	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)	F_{AD} (N)	F_{AZ} (N)	
90	3000	50	885	485	720	320	945	450	775	280
90	1500	50	1170	650	945	425	1245	600	1020	375
100	3000	60	1620	1120	1280	780	1710	1060	1370	715
100	1500	60	2065	1565	1615	1115	2180	1485	1735	1035
112	3000	60	1615	1115	1275	775	1725	1040	1385	700
112	1500	60	2060	1560	1610	1110	2210	1460	1110	1010
132	3000	80	2245	1645	1760	1160	2460	1505	1970	1015
132	1500	80	2595	1980	2025	1425	2815	1850	2245	1280
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	4600	5920	5515	5060	4255
180	1500	110	4360	4360	3540	3540	5080	3860	4240	3020
180	1000	110	3990	3990	2820	2820	5240	3780	4060	2610
200	3000	110	5000	7350	5000	6150	5000	7050	5000	5800
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
225	1500	140	4820	4820	3470	3470	6770	4320	5420	2960
225	1000	140	5960	5960	4210	4210	7910	5450	6160	3700
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	8000	6000	6250	4250	9600	4550	7800	2750
280	1000	140	7250	9250	7150	5150	11150	5500	9000	3350
315 SM_	1500	170	9400	7400	7250	5250	11750	5500	9500	3300
315 SM_	1000	170	10 900	8900	8350	6350	13600	6300	11 050	3750
315 ML_	1500	170	9250	7250	7100	5100	12 500	5500	10 300	2900
315 ML_	1000	170	10650	8650	8100	6100	14 900	5800	12 350	3250
315 LK_	1500	170	9100	7150	7000	5000	13 100	3850	10900	1700
315 LK_	1000	170	10 500	8500	7950	5950	15700	4100	13100	1550

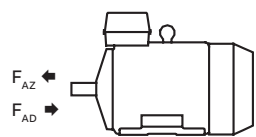


Figure 11: Mounting arrangement IM B3

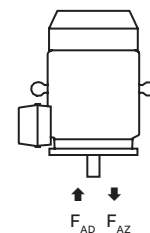


Figure 12: Mounting arrangement IM V1

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 the D-end. In motor sizes 90 - 132, the terminal box is integrated in the motor frame. On request, the terminal box can also be mounted on the left or right side regardless of the motor size (see Mounting options).

Turnability

The standard terminal boxes for motor sizes 160–315 can be turned 4*90° after delivery. For motors in size 90–132, a 4*90° turnable terminal box is optional - this can be ordered with variant code 400.

Cable entries

The terminal box is provided with tapped holes for cable glands. No cable glands are included as standard, the entry holes are closed with blanking plugs made of plastic. Very large motors have an angle adapter between the terminal box and the cable gland. Please refer to the table on the next page for further information about the amount and size of threaded holes, plugs and cable sealing units provided as standard.

Different types of cable glands are available as an option. Please refer to the terminal box alternatives section for more details.

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 following table.

Terminations are suitable for copper and aluminum cables. Cables are connected to terminals by cable lugs, which are not included in the delivery.

Cable entries

Standard terminal box connections

Motor size	Speed r/min	Terminal box type	Size of flange opening	Amount and size of threaded plugged holes	Plugged holes	Max. con- nectable core cross- section mm ² /phase	Number and size of ter- minal bolts	Earthing in the main terminal box
90	1000-3000	Integrated	-	2xM25x1.5	2xM25	1x6	6xM5	M4
100	1000-3000	Integrated	-	2xM32x1.5	2xM32	1x10	6xM5	M4
112	1000-3000	Integrated	-	2xM32x1.5	2xM32	1x10	6xM5	M5
132	1500, 3000	Integrated	-	2xM32x1.5	2xM32	1x10	6xM5	M4
160	1000-3000	63	B	2xM40x1.5	2xM40	1x35	6xM6	M6
180	1500-3000	63	B	2xM40x1.5	2xM40	1x35	6xM6	M6
200	1500-3000	160	C	2xM63x1.5	2xM63	1x70	6xM10	M6
225	3000	160	C	2xM63x1.5	2xM63	1x70	6xM10	M6
250	1000-3000	160	C	2xM63x1.5	2xM63	1x70	6xM10	M6
280	1000-1500	210	C	2xM63	2xM63	2x150	6xM12	2xM10
315 SM, ML	1000-1500	370	D	2xM63x1,5	2xM63	2x240	6xM12	2xM10
315 LKA, LKC	1000-1500	750*	E	2xM75x1,5	1xM75	4x240	6xM12	2xM10

* With adapter E-D and medium size end unit

Auxiliary cable entries		
90 -132	1500, 3000	2xM12
160-250	1000-3000	2xM20x1.5
280-315	1000-1500	2xM20x1.5

Shaft height	Earthing on frame
90 - 112	M4
132	M5
160 - 250	M6 (with clamp)
280-315	M10

Standard delivery if no other information is provided.



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

Cable entries

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 section Variant codes for all options available.

Terminal box

Terminal box dimensions

For dimensions of integrated terminal boxes in aluminum motors, sizes 90 - 132, see the following Dimension drawings pages.

To match the correct terminal box with motor sizes 160 - 315, find the motor type and correspondent terminal box type on the previous page. The box types and their dimensions are presented on this page.

Frame dimensions

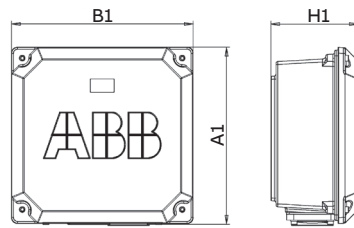


Figure 13: Terminal box type 63 and 160

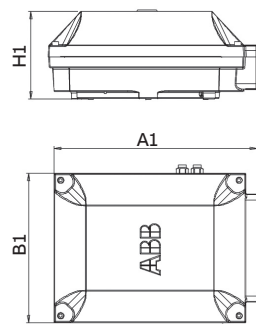


Figure 14: Terminal box types 210 and 370.

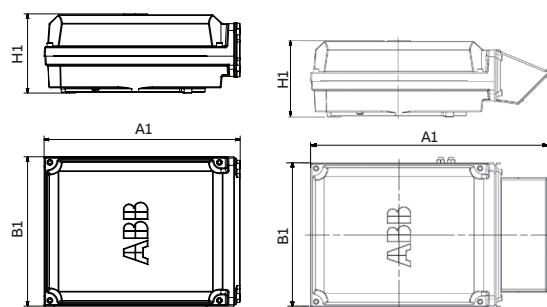
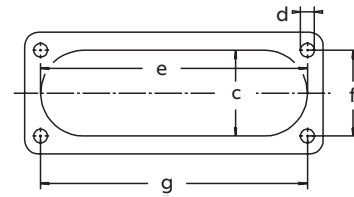


Figure 15: Terminal box type 750 + adapter

Terminal box types	A1	B1	H1	Gland plate opening
63	248	248	109	B
160	291	302	154	C
210	416	306	177	C
370	451	347	200	D
750 with E-D adapter	686	413	219	D
750 without E-D adapter	523	413	219	E
750 with E-2D adapter	826	413	219	2xD

Dimensions for terminal box inlets



Flange opening	c mm	e mm	f mm	g mm	d thread type
B	71	194	62	193	M8
C	62	193	62	193	M8
D	100	300	80	292	M10
E	115	370	100	360	M12

Cable glands

The motors are delivered as standard with plugged cable entries or cable sealing units as described in the previous section. There is available a broad selection of different type of cable glands, which are suitable for different types of cable and outer diameter ranges.

Size of threaded opening for cable gland	Cable gland(s) nickel plated brass, variant code 230 or 731	EMC Cable gland(s) nickelplated brass, variant code 704	Cable gland(s) plastic, variant code 375 or 376
	Cable outer diameter, mm	Cable outer diameter, mm	Cable outer diameter, mm
M16 x 1.5	4-12	4-8	4-12
M20 x 1.5	4-12	4-12	4-12
M25 x 1.5	10-18	10-18	10-18
M32 x 1.5	14-24	14-24	14-24
M40 x 1.5	22-32	22-32	22-32
M50 x 1.5	26-35	26-35	26-35
M63 x 1.5 ¹⁾	35-45	35-45	35-45
M75 x 1.5	46-62	46-62	not available

Threaded openings for cable glands with NPT thread (variant code 730)

The standard delivery for the motors are provided with openings for cable glands with metric threads as listed in the section describing the standard terminal box. If NPT threads will be needed, the variant code 730 is to be ordered. If nothing else is stated on the order, the sizes in tables below will be delivered.

Motor frame size	Main cable entries	NPT plug
90-112	1 x 3/4"	-
132	2 x 3/4"	1 x 3/4"
160-180	2 x 1 1/4"	1 x 1 1/4"
200-250	2 x 1 1/2"	1 x 1 1/2"
280	2 x 2"	1 x 2"
315	2 x 3"	1 x 3"

Motor frame size	Cable entries for	
	auxiliaries	NPT plug
90–112	2 x ¾"	2 x ¾"
132	1 x ¾"	1 x ¾"
160–315	2 x ¾"	2 x ¾"

Gland plates with threaded openings for cable glands of nonstandard size

If the standard size of threaded openings for cable glands is not suitable then nonstandard size openings are also available, either by fitting the reducers to make the openings smaller or by increasing the amount or size of holes. The maximum possible size and amount for each gland plate size is listed below. Threaded openings of non-standard size can be ordered by using variant codes 554 and 727.

Gland plate size	Maximum amount and size of threaded holes
B	2 x M40
C	2 x M63
D	2 x M90 or 3 x M75
E	2 x M90 or 4 x M75

Terminal box

Terminal boxes and boards

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

Motor size 90 - 132

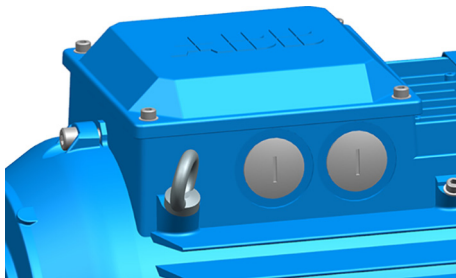


Figure 16: Integrated terminal box for motor size 90-132. Knock-out openings for cable entries.

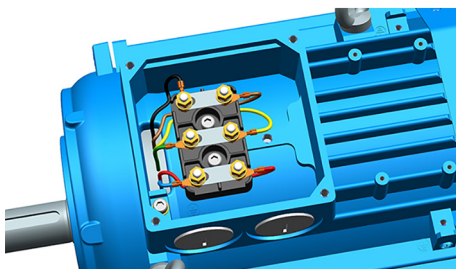


Figure 17: Terminal board for motor sizes 90 - 100.

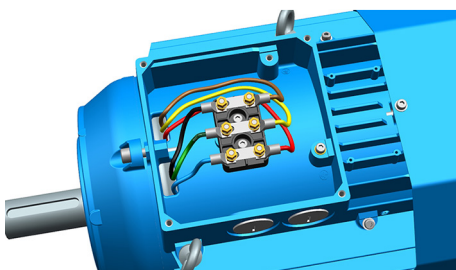


Figure 18: Terminal board for motor sizes 112 - 132

Motor sizes 160 – 250

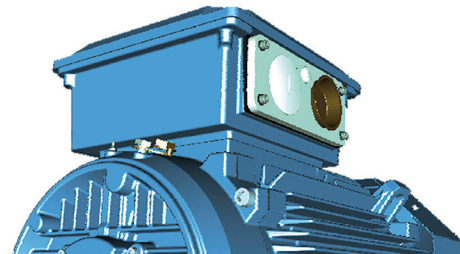


Figure 19: Terminal box for motor sizes 160 – 250. Connection flanges with tapped cable entries.

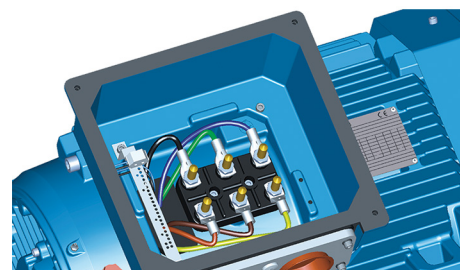


Figure 20: Terminal board for 160 – 250

Motor sizes 280 – 315

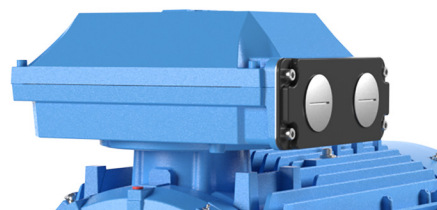


Figure 21: Terminal box for motor sizes 280 - 315, except LKC. Connection flange with tapped cable entries.

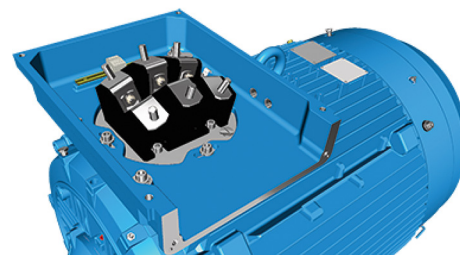


Figure 22: Terminal board for motor sizes 280 - 315, except LKC.



Figure 23: Terminal box for motor sizes 315 LKC.

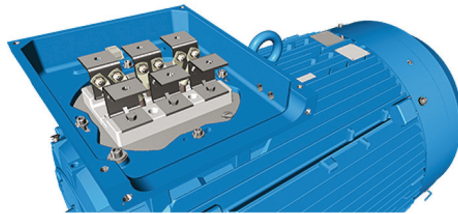


Figure 24: Terminal board for 315 LKC.

Terminal box

Terminal box alternatives

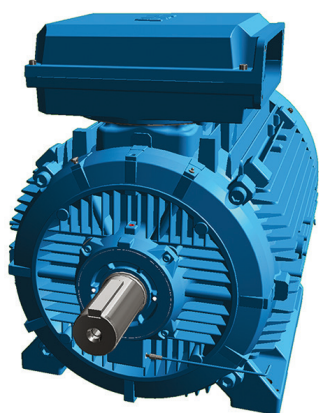


Figure 25: Main terminal box

Optional adapters

There is a broad selection of cable termination accessories available to allow termination of one or several cables. The most common ones are explained below.

How to order

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

Ordering example for special cable entry and auxiliary terminal box

Motor Cables	250 kW, 1500 rpm, 400 V 50 Hz 2 pieces, outer diameter 58 mm, single core cross section 185 mm² 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



Figure 26: Adapters, Flange with glands; cable sealing end units.




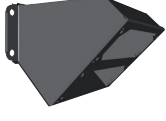
Main terminal box and maximum single core cross-section

The terminal boxes are named according to their current-carrying capacity, from 120 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	Large terminal box	Size of opening	Max single cross-section mm ² /phase
120	210	B	1 x 70
210	370	C	2 x 240
370	750	D	2 x 300
750	1200	E	4 x 500
1200	-	-	-

Optional adapters

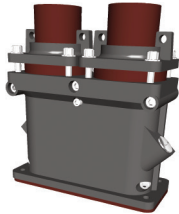
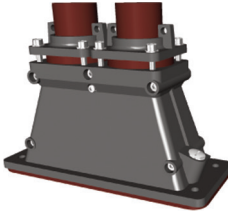
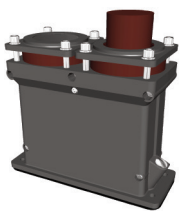
To allow easy termination of cables entering the terminal box from above or below, an angle adapter is recommended. These are available for motor sizes 280 - 315 and can also be used to allow the mounting of several cable sealing end units or gland plates.

Adapater				
Variant code	292	293	294	295
Suited for motor sizes	280 with gland plate opening C in the terminal box.	280-315 with gland plate opening D in the terminal box.	315 with gland plate opening E in the terminal box.	315 with gland plate opening E in the terminal box.
Opening to terminal box	C	D	E	E
Flange or opening for end unit	C	D	D	2 x D
Material	Cast iron	Cast iron	Cast iron	Steel
Notes				Included in type 750 terminal box when 750 is the standard size.

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.

Please note that the table below is only for guidance. Due to the large amount of combinations possible between terminal box sizes, end units and adapters, not all possible combinations can be described. Please contact your ABB sales office for more detailed information.

	Small	Medium	Large
End unit			
Variant code	277	278	279
Suited for motor sizes	280	315	315
Opening to terminal box	C	D	D
Cable outer diameter	1 - 2 cables, 48 - 60 mm	1 - 2 cables, 48 - 60 mm	1 - 2 cables, 60 - 80 mm
Cable entry for auxiliary cable	2xM20 plugged holes	2 x M20 plugged holes	2 x M20 plugged holes
Additional optional variants	EMC cable gland (704)	EMC cable gland (704)	EMC cable gland (704)

Auxiliary terminal box

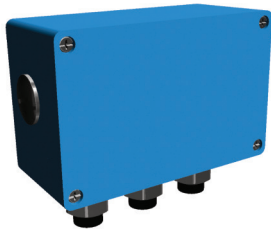
You can equip motors from frame size 160 upward with one or several auxiliary terminal boxes for connection of auxiliaries like heaters or temperature detectors. The standard auxiliary terminal box material for motor sizes 280 - 315 is aluminum and for 160 - 250 cast iron. For frame sizes 280 - 315,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

Connection terminals are of a spring-loaded type for quick and easy connection. These are suitable for up to 2.5 mm² wires. Auxiliary terminal boxes for frame sizes 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 both aluminum and cast iron, and the number of entries depends on the terminal box type and the number of selected auxiliaries.

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

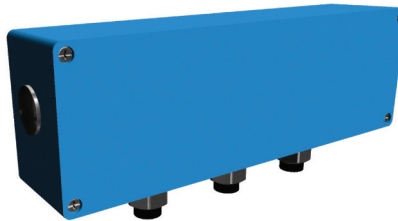
Related variant codes

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



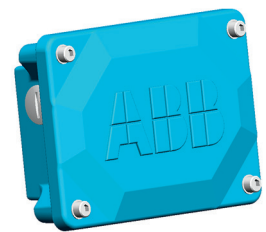
Small auxiliary aluminum terminal box for motor sizes 280 - 315 (variant codes 418, 568, 380, 569).

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.



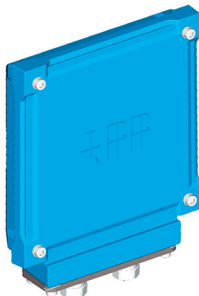
Large auxiliary aluminum terminal box for motor sizes 280 - 315.

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): 111 x 162 mm, max. 18 strips. No earthing.



Frame size for motor sizes 280 - 315 (variant code 567): 208 x 180 mm, max 30 strips. Earthing size M6.

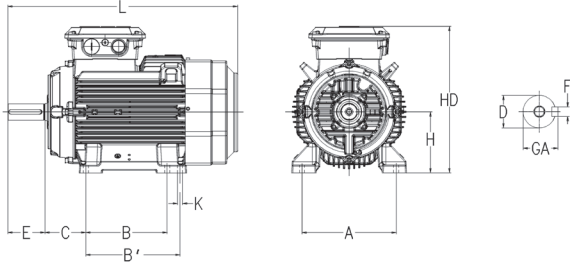


Small auxiliary aluminum terminal box for motor sizes 71-132 (variant code: 418): 80 x 75 mm, max 8 strips. Earthing size M4.

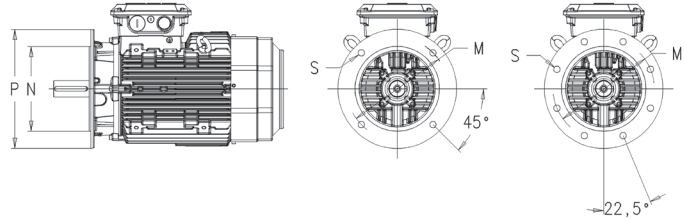
Dimension drawings

Synchronous reluctance (SynRM) motors

Foot-mounted motor IM 1001, IM B3



Flange-mounted motor IM 3001, IM B5



Main dimensions for IE5 SynRM motors (C-generation)

Motor size	Speed r/min	IM1001, IMB3 and IM3001, IMB5																					
		IM1001, IMB3					IM B5 (IM3001)					IM B14 (IM 3601), IM 3602											
		D	GA	F	E	L max	A	B	B1	C	H	HD max	K	M	N	P	S	T	M	N	P	S	T
132 SMA-D	3000	38	41	10	80	487	216	140	178	89	132	109.5	12	265	230	300	14.5	4	165	130	200	M10	3.5
132 SMA-B	1500	38	41	10	80	550	216	140	178	89	132	321	12	265	230	300	14.5	4	165	130	200	M10	3.5
132 SMC	1500	38	41	10	80	590	216	140	178	89	132	321	12	265	230	300	14.5	4	165	130	200	M10	3.5
160 MLA-C	3000	42	45	12	110	584	254	210	254	108	160	421	14.5	300	250	350	19	5	300	250	350	19	5
160 MLA-B	1500-1000	42	45	12	110	681	254	210	254	108	160	421	14.5	300	250	350	19	5	300	250	350	19	5
180 MLB	3000-1500	48	51.5	14	110	726	279	241	279	121	180	461	14.5	300	250	350	19	5	300	250	350	19	5
180 MLB-C	1500-1000	48	51.5	14	110	766	279	241	279	121	180	461	14.5	300	250	350	19	5	300	250	350	19	5
200 MLA-F	3000-1000	55	59	16	110	821	318	267	305	133	200	528	18.5	350	300	400	19	5	350	300	400	19	5
225 SMB	3000	55	59	16	110	879	356	286	311	149	225	573	18.5	400	350	450	19	5	400	350	450	19	5
225 SMB-C	3000-1000	60	64	16	110	879	356	286	311	149	225	573	18.5	400	350	450	19	5	400	350	450	19	5
250 SMA-C	3000	60	64	18	140	884	406	311	349	168	250	626	24	500	450	550	19	5	500	450	550	19	5
250 SMA,B,F,G	1500-1000	65	69	18	140	884	406	311	349	168	250	626	24	500	450	550	19	5	500	450	550	19	5
280	1500-1000	75	79.5	20	140	1088	457	368	419	190	280	762	24	500	450	550	23	5	500	450	550	23	5
315 SM_	1500-1000	80	85	22	170	1204	508	406	457	216	315	852	28	600	550	660	23	6	600	550	660	23	6
315 ML_	1500-1000	90	95	25	170	1315	508	457	508	216	315	852	28	600	550	660	23	6	600	550	660	23	6
315 LK_	1500-1000	90	95	25	170	1521	508	508	560	216	315	880	28	600	550	660	23	6	600	550	660	23	6

Main dimensions for High output SynRM motors (B-generation)

Motor size	Speed r/min	IM1001, IMB3 and IM3001, IMB5																					
		IM1001, IMB3					IM B5 (IM3001)					IM B14 (IM 3601), IM 3602											
		D	GA	F	E	L max	A	B	B1	C	HD ¹	HD ²	K	M	N	P	S	T	M	N	P	S	T
90 L, LA-LC	3000-1500	24	27	8	50	309,5	140	100	125	56	217	-	10	165	130	200	12	3,5	115	95	140	M8	3
90 LDA	3000-1500	24	27	8	50	331,5	140	100	125	56	217	-	10	165	130	250	12	3,5	115	95	140	M8	3
100	3000-1500	28	31	8	60	351	160	140	-	63	237	-	12	215	180	250	15	4	130	110	160	M8	3.5
112	3000-1500	28	31	8	60	393	190	140	-	70	249	-	12	215	180	300	15	4	130	110	160	M8	3.5
132 SMB-D	3000-1500	38	41	10	80	487	216	140	178	89	295,5	-	12	265	230	300	14.5	4	165	200	200	M10	3.5
132 SME-F	3000-1500	38	41	10	80	550	216	210	178	89	321	-	12	265	230	350	14.5	4	165	200	200	M10	3,5
160 MLB	3000-1500	42	45	12	110	584	254	210	254	108	460	-	14.5	300	250	350	19	5	300	250	350	19	5
160 MLC, MLE	3000-1500	42	45	12	110	681	254	241	254	108	460	-	14.5	300	250	350	19	5	300	250	350	19	5
200	3000-1500	55	59	16	110	821	318	267	305	133	514	-	14,5	350	300	400	19	5	350	300	400	19	5
250	3000	60	64	18	140	884	406	311	349	168	626	-	24	500	450	550	19	5	500	450	550	19	5
250	2100-1500	65	69	18	140	884	406	311	349	168	626	-	24	500	450	550	19	5	500	450	550	19	5
280	1500-1000	75	79,5	20	140	1088	457	368	419	190	762	-	24	500	450	550	18	5	500	450	550	19	5
315 SM_	1500	80	85	22	170	1204	508	406	457	216	852	880	28	600	550	660	23	6	600	550	660	23	6
315 ML_	1500	90	95	25	170	1315	508	457	508	216	852	880	28	600	550	660	23	6	600	550	660	23	6
315 LK_	1500	90	95	25	170	1521	508	508	560	216	852	880	28	600	550	660	23	6	600	550	660	23	6

¹) Terminal box 370

²) Terminal box 750

The tables gives the main dimension in mm. For detailed drawings please see our web pages .

Motors in brief

Synchronous reluctance aluminum frame motors, sizes 90-132

Motor size		90	100	112	132
Stator and end shields	Material	Die-cast aluminum alloy			
	Paint color shade	Munsell blue 8B 4.5/3.25			
	Corrosion class	C3			
Bearings	D-end	6205-2Z/C3	6306-2Z/C3	6306-2Z/C3	6308-2Z/C3
	N-end	6204-2Z/C3	6205-2Z/C3	6205-2Z/C3	6206-2Z/C3
Axi-ally locked bearings	Inner bearing cover	Locked at D-end			
Bearing seals	D-end	V-ring			
	N-end	Labyrinth seal			
Lubrication		Permanently lubricated shielded bearings, wide-temperature-range grease			
Measuring nipples for condition monitoring of the bearings		Not included			
Rating plate	Material	Aluminum			
Terminal box	Frame and cover	Aluminum			
	Corrosion class	Die-cast aluminum alloy, integrated in stator			
	Cover screws	Zinc-electroplated steel			
Connections	Cable entries	2x(M25+M20)			2x(M40, M32, M12)/ 2x(M25, M20)
	Terminals	6 screw terminals			6 terminals with lugs
	Cable glands	Integrated knock-out openings; no cable glands			
Fan	Material	Glass-fiber-reinforced polypropylene			
Fan cover	Material	Polypropylene			
	Paint color shade	Munsell blue 8B 4.5/3.25			
	Corrosion class	-			
Stator winding	Material	Copper			
	Insulation	Insulation class F			
	Winding protection	Optional			
Balancing method		Half-key balancing			
Keyway		Closed keyway			
Drain holes		Standard, open on delivery			
Enclosure		IP 55, higher protection on request			
Cooling method		IC 411			

Motors in brief

Synchronous reluctance cast iron frame motors, sizes 160 – 315

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						
Bearings	D-end	6309/C3	6310/C3	6312/C3	6313/C3	6315/C3	6316/C3	6319/C3
	N-end	6209/C3	6209/C3	6210/C3	6210/C3	6213/C3	6316/C3*	6316/C3*
Axially locked bearings	Inner bearing cover	Locked at D-end						
Bearing seals	D-end	Gamma-ring					Labyrinth seal	
	N-end	Gamma-ring					Labyrinth seal	
Lubrication	Regreasable bearings, regreasing nipples M6x1					Regreasable bearings, regreasing nipples M10x1		
Measuring nipples for condition monitoring of the bearings	Included							
Rating plate	Material	Stainless steel						
Terminal box	Frame and cover	Cast iron						
	Corrosion class	C3						
	Cover screws	Zinc-electroplated steel						
Connections	Cable entries	2x(M40x1.5, M20x1.5)		2x(M63x1.5, M20x1.5)				
	Terminals	6 terminals for connection with cable lugs (not included)						
	Cable glands	Cable flange included, glands as option						
Fan cover	Material	Glass-fiber-reinforced polypropylene						
Fan cover	Material	Steel						
	Paint color shade	Munsell blue 8B 4.5/3.25						
	Corrosion class	C3						
Stator winding	Material	Copper						
	Insulation	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	Drain holes with closable plastic plugs, open on delivery							
Enclosure	IP 55, higher protection on request							
Cooling method	IC 411							

* Insulated bearing at N-end as standard.

Total product offering

Motors and generators with a complete portfolio of services



IEC motors

- Low voltage motors
- High voltage induction and synchronous motors
- Marine motors
- Motors for explosive atmospheres
- Motors for food and beverage
- Motors for variable speed drives
- Permanent magnet motors
- Synchronous reluctance motors
- Traction motors

NEMA motors

- Low voltage motors
- High voltage induction and synchronous motors
- Marine motors
- Motors for explosive atmospheres
- Motors for variable speed drives
- Permanent magnet motors
- Servomotors
- Washdown motors

Generators

- Generators for wind turbines
- Generators for diesel and gas engine power plants
- Generators for steam and gas turbine power plants
- Generators for marine applications
- Generators for industrial applications
- Generators for traction applications
- Synchronous condensers for reactive power compensation

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Being able to rely on the continuous high performance and efficiency of your operations is something you want to take for granted. ABB variable-frequency drives are made with all this in mind, established upon more than 40 years of experience and backed by a broad range of life cycle services.

ABB drives help you to optimize your processes and systems with state-of-the-art motor control technology, resulting in increased energy efficiency, better product quality, and reduced operating costs with higher output, less downtime, and reduced need for maintenance. All ABB drives are designed for easy selection, ordering, installation and use, and they offer integrated safety features, giving you more time to focus on what matters for you and your business.

Our portfolio offers low-voltage AC and DC drives, medium-voltage AC drives, and motion control drives spanning the fractional-kilowatt to multi-megawatt power level. There is a drive available for essentially every industry and application and for all types of motors, in environments ranging from water utility facilities to clean electrical rooms, and to harsh coal mines and windy offshore platforms to food and beverage production. This wide product range allows you to select the best-fitting drive solution, providing maximum reliability and efficiency for every need.

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