

Katalog ABB Synchron-Reluktanzpaket (High-Output)



KAT-ABSRHO-0416

Ideen verbinden, Technik nutzen



Catalog | April 2016

Low voltage High output synchronous reluctance motors

Power and productivity
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ABB

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



High output synchronous reluctance motors

Sizes 90 to 315

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General information

Technology highlights



Traditional IE2 induction motor



High output SynRM motor

Synchronous reluctance motors combine conventional, proven stator technology with an innovative rotor design. The High output synchronous reluctance motors offer compactness and control accuracy comparable with permanent magnet motors. ABB's industrial and machine-builder drives are loaded with purpose-designed software, and the packages as a whole are suited for a wide range of applications from pumps and fans to compressors, extruders, conveyors, mixers and many others.

High performance for compact machine designs

The synchronous reluctance rotor has neither magnets nor windings. Rotor losses are virtually eliminated, resulting in cool running. This advantage is the basis for a design that delivers high power density coupled with good efficiency especially in partial load conditions. High output SynRM motors enable compact and cost efficient machine designs or increased machine output without increasing motor size.

Superior reliability to minimize the cost of downtime

Bearing failure causes approximately 70 % of unplanned motor outages. Bearing temperature in the synchronous reluctance motor is low, which extends bearing lifetime and service intervals for lower maintenance costs and improved reliability. Even when a bearing eventually needs replacing, there are no magnetic forces involved – unlike in a permanent magnet motor – so bearing change is as fast and easy as with an induction motor.



SynRM technology is also available in the IE4 super premium efficiency version. To learn more, visit www.abb.com/motors&generators

Motor highlights



Motor highlights

- A powerful yet highly compact motor that's up to three frame sizes smaller than a conventional motor.
- Can be customized like an induction motor: variant codes and mechanical construction for motor sizes 90 to 132 and 160 to 315 are based on the proven M3AA aluminum and M3BP cast iron Process performance motors respectively.
- Straightforward design without magnets or rotor cage.
- Competitive when compared to traditional and other new technologies.
- Higher reliability through low bearing temperatures.
- Motor efficiency at least on the same level as IE2 induction motors in VSD operation.
- Motor-drive package efficiency similar or higher than with a comparable IE2 induction motor-drive package.



A powerful yet highly compact motor that's up to three frame sizes smaller than a conventional motor.

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



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.
- ACS880-01 SynRM optimized drive types for cost-efficient packages.
- 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.



High output synchronous reluctance motors

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.

Application example, 22 kW, 1500 rpm

	High output SynRM motor	ABB IE2 induction motor
Frame size	160, 174 kg	180, 222 kg

Motor characteristics

Customer benefit: Same output from a smaller size or higher output from the same size

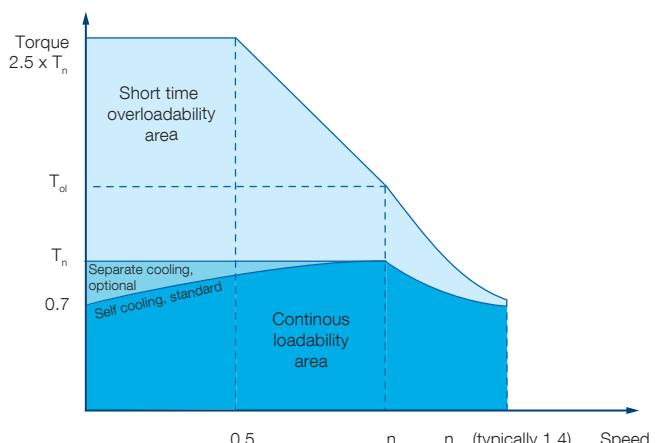
Application example, 37 kW, 3000 rpm

	High output SynRM motor	ABB IE2 induction motor
Frame size	160, 157 kg	200, 298 kg

Motor characteristics

Customer benefit: Reduced system space – lower weight, easier installation

Loadability



Torque characteristics of the SynRM motor

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 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.

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.

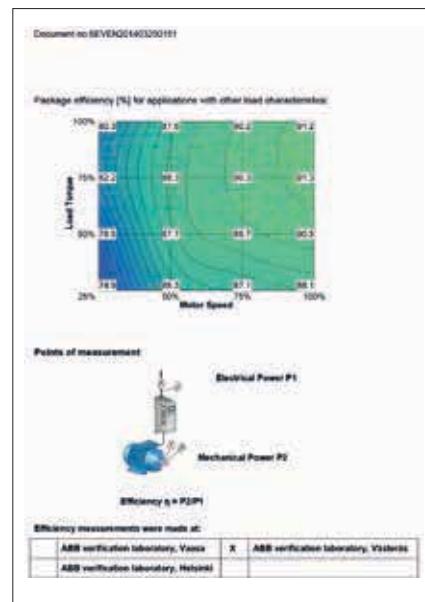
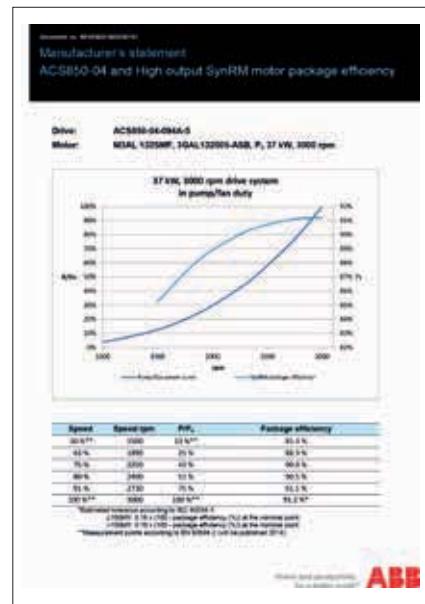
Measured motor-drive package efficiency

Even though compactness and low weight are the most obvious advantages of the High output SynRM motor range, there are package efficiency statements available also for the High output SynRM motor-drive packages. Measured efficiency performance data enables accurate energy consumption calculations for all applications. This package efficiency data makes SynRM the definite motor-drive package for variable speed applications.

See also the IE4 SynRM offering for applications where highest efficiency performance 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.



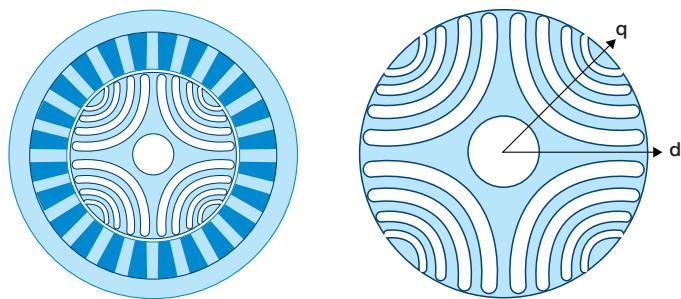
Synchronous reluctance motor technology

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 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 accord-

ance 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	MLB 3GBL 162 423 - A	S	B	445	
		1 2 3 4 5 6 7 8 9 10 11 12	13	14	15	

Positions 1 to 4

3GAL: Totally enclosed fan-cooled synchronous reluctance motor with aluminum frame, sizes 90 - 132

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

Positions 5 and 6

IEC-frame

09: 90

10: 100

11: 112

13: 132

16: 160

20: 200

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

Network voltage 400 V 50 Hz

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

Foot-mounted motor

						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

						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

						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

						H: foot/flange-mounted, term. box top S: foot/flange-mounted, term. box RHS
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

						T: foot/flangemounted, term. box RHS
IM B34	IM V17					
IM 2101	IM 2111	IM 2131	IM 2151	IM 2161	IM 2171	

Foot-mounted motor, shaft with free extensions

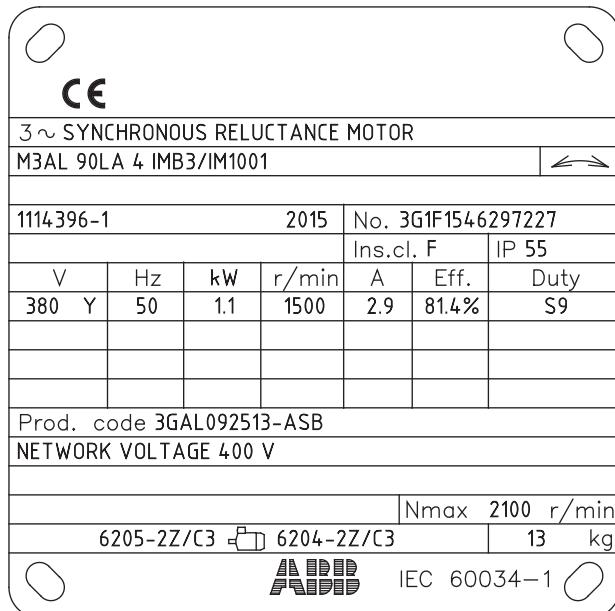
						J: foot/flangemounted, small flange
IM 1002	IM 1012	IM 1032	IM 1052	IM 1062	IM 1072	

*) Not stated in IEC 60034-7.

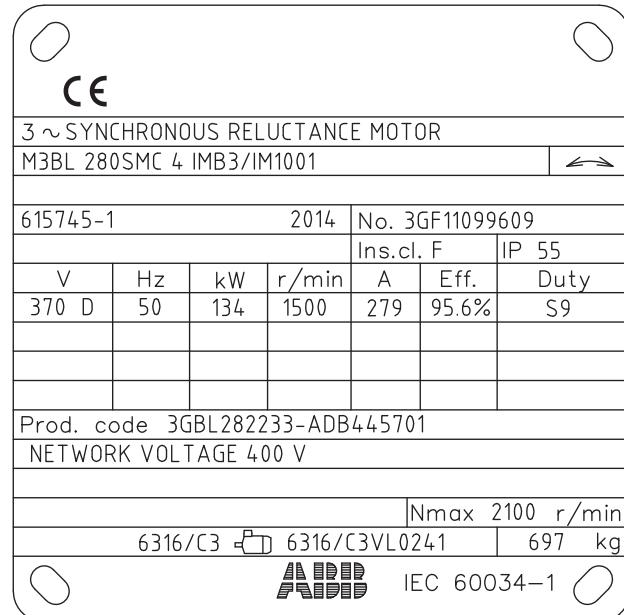
Note: If the motor is mounted shaft upwards, take measures to prevent water or any other liquid from running down the shaft into the motor.

Rating plates

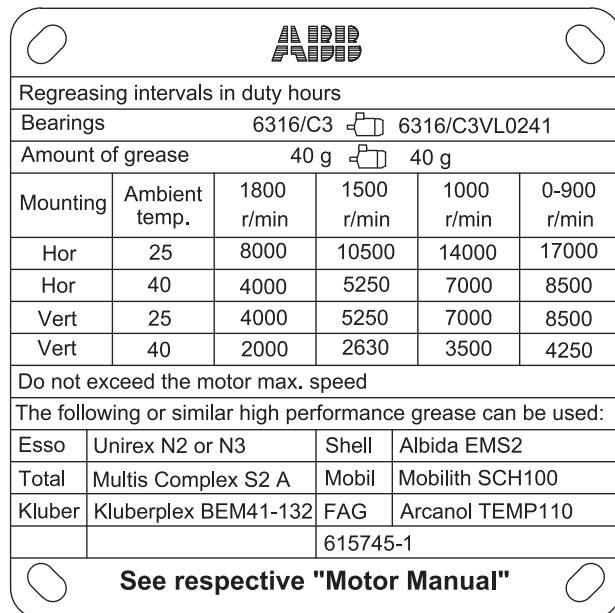
The motor's main rating plate shows the motor's performance values at nominal speed. The lubrication plate specifies re-greasing amount, regreasing interval in hours - depending on the mounting position and ambient temperature - and types of lubricant recommended.



Main rating plate, motor sizes 90 - 132



Main rating plate, motor sizes 160 - 315



Lubrication plate, motor sizes 280 - 315

Technical data

High output synchronous reluctance motors, 3000 and 2100 r/min

This table presents technical performance data for the currently available high output motor and drive packages. The variant codes and construction details for M3AL and M3BL synchronous reluctance motors are based on M3AA and M3BP process performance motors respectively.

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

Output kW	Motor type	Product code	Motor efficien- cy with VSD supply			Torque		Max speed, n_{max} r/min	Inertia J / kgm ²	Weight kg	Suggested ACS850 frequency converter for no overload pump and fan use	Suggested ACS880 frequency converter for no overload pump and fan use
			Speed n_N r/min	VSD supply	Cur- rent I_N A	T_n / Nm	T_{OL} / T_N Nm					
3000 r/min (100 Hz)			400 V network									
1.5	M3AL 90L 4	3GAL092507-••B	3000	84.2	3.9	4.8	1.5	4200	0.002	13	ACS850-04-04A8-5	ACS880-01-03A9-3
2.2	M3AL 90LA 4	3GAL092517-••B	3000	85.9	5.6	7.0	1.5	4200	0.00202	13	ACS850-04-06A0-5	ACS880-01-05A8-3
3	M3AL 90LB 4	3GAL092527-••B	3000	87.1	7.5	9.6	1.5	4200	0.00276	16	ACS850-04-08A0-5	ACS880-01-07A5-3
4	M3AL 90LC 4	3GAL092537-••B	3000	88.1	9.8	12.7	1.5	4200	0.00276	16	ACS850-04-010A-5	ACS880-01-09A8-3
5.5	M3AL 90LD 4	3GAL092547-••B	3000	89.2	13.4	17.5	1.5	4200	0.00351	17	ACS850-04-014A-5	ACS880-01-14A3-3
7.5	M3AL 100LB 4	3GAL102527-••B	3000	90.1	16.9	23.9	1.5	4200	0.00565	23	ACS850-04-018A-5	ACS880-01-17A7-3
11	M3AL 112MB 4	3GAL112327-••B	3000	91.2	25.0	35.0	1.5	4200	0.00813	33	ACS850-04-025A-5	ACS880-01-25A5-3
15	M3AL 132SMB 4	3GAL132227-••B	3000	91.9	33.5	47.8	1.5	4200	0.0184	47	ACS850-04-035A-5	ACS880-01-035A-3
18.5	M3AL 132SMC 4	3GAL132237-••B	3000	92.4	41.1	58.9	1.5	4200	0.0226	57	ACS850-04-044A-5	ACS880-01-043A-3
22	M3AL 132SMD 4	3GAL132247-••B	3000	92.7	48.7	70.0	1.5	4200	0.0226	57	ACS850-04-050A-5	ACS880-01-050A-3
30	M3AL 132SME 4	3GAL132257-••B	3000	93.3	68.7	95.5	1.5	4200	0.277	80	ACS850-04-078A-5	ACS880-01-069A-3
37	M3AL 132SMF 4	3GAL132267-••B	3000	93.7	84.4	118	1.5	4200	0.0332	89	ACS850-04-094A-5	ACS880-01-085A-3
33	M3BL 160MLB 4	3GBL162427-••B	3000	93.5	76.7	105	1.5	4200	0.0579	130	ACS850-04-078A-5	ACS880-01-085A-3
40	M3BL 160MLC 4	3GBL162437-••B	3000	93.9	92.5	127	1.5	4200	0.0702	157	ACS850-04-094A-5	ACS880-01-103A-3
45	M3BL 160MLE 4	3GBL162457-••B	3000	94.6	103	143	1.5	4200	0.0864	174	ACS850-04-103A-5	ACS880-01-103A-3
62	M3BL 200MLA 4	3GBL202417-••B	3000	95.1	144	197	1.5	4200	0.242	279	ACS850-04-144A-5	ACS880-01-173A-3
72	M3BL 200MLC 4	3GBL202437-••B	3000	95.4	166	229	1.5	4200	0.287	304	ACS850-04-166A-5	ACS880-01-173A-3
97	M3BL 250SMA 4	3GBL252217-••B	3000	95.2	224	309	1.5	3600	0.499	396	ACS850-04-225A-5	ACS880-01-245A-3
112	M3BL 250SMB 4	3GBL252227-••B	3000	95.3	259	357	1.5	3600	0.575	428	ACS850-04-260A-5	ACS880-01-290A-3
125	M3BL 250SMC 4	3GBL252237-••B	3000	95.5	288	398	1.5	3600	0.633	454	ACS850-04-290A-5	ACS880-01-290A-3
2100 r/min (70 Hz)			400 V network									
25	M3BL 160MLB 4	3GBL162425-••B	2100	92.3	58.8	114	1.5	2940	0.0579	130	ACS850-04-061A-5	ACS880-01-069A-3
31	M3BL 160MLC 4	3GBL162435-••B	2100	93.0	72.4	141	1.5	2940	0.0702	157	ACS850-04-078A-5	ACS880-01-085A-3
39	M3BL 160MLE 4	3GBL162455-••B	2100	93.7	90.4	177	1.5	2940	0.0864	174	ACS850-04-094A-5	ACS880-01-103A-3
44	M3BL 200MLA 4	3GBL202415-••B	2100	93.8	102	200	1.5	2940	0.242	279	ACS850-04-103A-5	ACS880-01-103A-3
62	M3BL 200MLC 4	3GBL202435-••B	2100	94.0	143	282	1.5	2940	0.287	174	ACS850-04-144A-5	ACS880-01-173A-3
88	M3BL 250SMA 4	3GBL252215-••B	2100	95.0	201	400	1.5	2940	0.499	396	ACS850-04-202A-5	ACS880-01-202A-3
98	M3BL 250SMB 4	3GBL252225-••B	2100	95.2	224	446	1.5	2940	0.575	428	ACS850-04-225A-5	ACS880-01-245A-3
115	M3BL 250SMC 4	3GBL252235-••B	2100	95.5	258	523	1.5	2940	0.633	454	ACS850-04-260A-5	ACS880-01-290A-3
124	M3BL 280SMA 4	3GBL282215-••B	2100	95.2	259	564	1.6	2400	0.857	604	ACS850-04-260A-5	ACS880-01-290A-3
134	M3BL 280SMB 4	3GBL282225-••B	2100	95.5	279	609	1.7	2400	1.00	639	ACS850-04-290A-5	ACS880-01-290A-3
160	M3BL 280SMC 4	3GBL282235-••B	2100	95.8	329	728	1.7	2400	1.21	697	ACS850-04-387A-5	ACS880-01-343A-3

For further information, see the drives catalogs "ABB machinery drives, ACS850" and "ABB industrial drives, ACS880".

Technical data

High output synchronous reluctance motors, 1500 r/min

This table presents technical performance data for the currently available high output motor and drive packages. The variant codes and construction details for M3AL and M3BL synchronous reluctance motors are based on M3AA and M3BP process performance motors respectively.

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

Output kW	Motor type	Product code	Speed n _N r/min	Motor efficien- cy with VSD supply	Cur- rent I _N A	Torque		Max speed, n _{max} r/min	Inertia J / kgm ²	Weight kg	Suggested ACS850	Suggested ACS880
						T _n / Nm	T _{OL} / T _N Nm				frequency converter for no overload pump and fan use	frequency converter for no overload pump and fan use
1500 r/min (50 Hz)												400 V network
1.1	M3AL 90LA 4	3GAL092513-••B	1500	81.4	2.9	7.0	1.5	2100	0.00202	13	ACS850-04-03A0-5	ACS880-01-03A0-3
1.5	M3AL 90LB 4	3GAL092523-••B	1500	82.8	3.8	9.6	1.5	2100	0.00276	16	ACS850-04-04A8-5	ACS880-01-03A9-3
2.2	M3AL 90LD 4	3GAL092543-••B	1500	84.3	5.5	14.0	1.5	2100	0.00351	17	ACS850-04-06A0-5	ACS880-01-05A8-3
3	M3AL 100LB 4	3GAL102523-••B	1500	85.5	7.1	19.1	1.5	2100	0.00565	23	ACS850-04-08A0-5	ACS880-01-07A5-3
4	M3AL 100LD 4	3GAL102543-••B	1500	86.6	9.4	25.5	1.5	2100	0.0069	27	ACS850-04-010A-5	ACS880-01-09A8-3
5.5	M3AL 112MB 4	3GAL112323-••B	1500	87.7	13.1	35.0	1.5	2100	0.00813	33	ACS850-04-014A-5	ACS880-01-14A3-3
7.5	M3AL 132SMB 4	3GAL132223-••B	1500	88.7	17.4	47.7	1.5	2100	0.0184	47	ACS850-04-018A-5	ACS880-01-17A7-3
11	M3AL 132SMC 4	3GAL132233-••B	1500	89.8	25.0	70.0	1.5	2100	0.0226	57	ACS850-04-025A-5	ACS880-01-25A5-3
15	M3AL 132SME 4	3GAL132253-••B	1500	90.6	34.5	95.5	1.5	2100	0.0277	80	ACS850-04-035A-5	ACS880-01-035A-3
18.5	M3AL 132SMF 4	3GAL132263-••B	1500	91.2	42.2	118	1.5	2100	0.0332	89	ACS850-04-044A-5	ACS880-01-043A-3
17	M3BL 160MLB 4	3GBL162423-••B	1500	91.2	42.6	108	1.5	2100	0.0579	130	ACS850-04-044A-5	ACS880-01-043A-3
20	M3BL 160MLC 4	3GBL162433-••B	1500	92.0	49.2	127	1.5	2100	0.0702	157	ACS850-04-050A-5	ACS880-01-050A-3
25	M3BL 160MLE 4	3GBL162453-••B	1500	92.8	58.5	159	1.5	2100	0.0864	174	ACS850-04-061A-5	ACS880-01-069A-3
33	M3BL 200MLA 4	3GBL202413-••B	1500	93.2	76.9	210	1.5	2100	0.242	279	ACS850-04-078A-5	ACS880-01-085A-3
40	M3BL 200MLC 4	3GBL202433-••B	1500	93.5	92.9	255	1.5	2100	0.287	304	ACS850-04-094A-5	ACS880-01-103A-3
71	M3BL 250SMA 4	3GBL252213-••B	1500	94.3	166	452	1.5	2100	0.499	396	ACS850-04-166A-5	ACS880-01-173A-3
86	M3BL 250SMB 4	3GBL252223-••B	1500	94.6	200	547	1.5	2100	0.575	428	ACS850-04-202A-5	ACS880-01-202A-3
97	M3BL 250SMC 4	3GBL252233-••B	1500	95.0	225	618	1.5	2100	0.633	454	ACS850-04-225A-5	ACS880-01-245A-3
103	M3BL 280SMA 4	3GBL282213-••B	1500	94.8	221	656	1.5	2100	0.857	604	ACS850-04-225A-5	ACS880-01-245A-3
118	M3BL 280SMB 4	3GBL282223-••B	1500	95.3	246	758	1.5	2100	1.00	639	ACS850-04-260A-5	ACS880-01-290A-3
134	M3BL 280SMC 4	3GBL282233-••B	1500	95.6	279	853	1.7	1800	1.21	697	ACS850-04-290A-5	ACS880-01-290A-3
155	M3BL 315SMA 4	3GBL312213-••B	1500	95.7	321	987	1.5	1800	1.64	873	ACS850-04-387A-5	ACS880-01-343A-3
180	M3BL 315SMB 4	3GBL312223-••B	1500	96.0	374	1146	1.5	1800	1.87	925	ACS850-04-387A-5	ACS880-01-427A-3
205	M3BL 315SMC 4	3GBL312233-••B	1500	96.1	423	1305	1.5	1800	2.04	965	ACS850-04-500A-5	ACS880-01-427A-3
250	M3BL 315MLA 4	3GBL312413-••B	1500	96.4	516	1592	1.5	1800	2.45	1116	ACS850-04-580A-5	**ACS880-04-585A-3
275	M3BL 315MLB 4	3GBL312423-••B	1500	96.5	573	1751	1.6	1800	2.68	1169	ACS850-04-580A-5	**ACS880-04-585A-3
315	M3BL 315LKA 4	3GBL312813-••B	1500	96.4	659	2005	1.6	1800	3.04	1357	ACS850-04-710A-5	**ACS880-04-725A-3
350	M3BL 315LKC 4	3GBL312833-••B	1500	96.5	712	2228	1.7	1800	3.77	1533	ACS850-04-710A-5	**ACS880-04-725A-3

** At high power ranges select either the ACS880-04 drive module, protection IP 21, or the ACS880-07 cabinet-built single drive.

For further information, see the drives catalogs "ABB machinery drives, ACS850" and "ABB industrial drives, ACS880".

Variant codes

High output 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								
		90	100	112	132	160	200	250	280	315
Administration										
530	Two-year extension on standard warranty	-	-	-	-	-	-	-	●	●
531	Sea freight packing	-	-	-	-	●	●	●	●	●
532	Packing of motor in vertical mounting position	-	-	-	-	-	-	●	●	●
533	Wooden sea freight packing	-	-	-	-	●	●	●	●	●
590	Mounting of customer supplied part other than coupling.	-	-	-	-	●	●	●	●	●
Balancing										
423	Balanced without key.	●	●	●	●	●	●	●	●	●
424	Full-key balancing	●	●	●	●	●	●	●	●	●
Bearings and Lubrication										
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.	-	-	-	-	-	-	-	●	●
188	63-series bearing in D-end	●	○	○	○	○	○	○	○	○
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	-	-	-	-	●	●	●	●	●
Branch standard designs										
178	Stainless steel / acid proof bolts.	●	●	●	●	●	●	●	●	●
204	Jacking bolts for foot mounted motors.	-	-	-	-	-	-	-	●	●
209	Non-standard voltage or frequency, (special winding).	●	●	●	●	●	●	●	●	●
217	Cast iron D-end shield (on aluminum motor).	●	●	●	●	-	-	-	-	-
425	Corrosion protected stator and rotor core.	-	-	-	-	-	-	-	●	●

○ = Included as standard

● = Available as option

- = Not applicable

Code	Variant	Frame size								
		90	100	112	132	160	200	250	280	315
Cooling system										
053	Metal fan cover.	●	●	●	●	○	○	○	○	○
068	Light alloy metal fan	●	●	●	●	●	●	●	●	●
075	Cooling method IC418 (without fan).	●	●	●	●	●	●	●	●	●
183	Separate motor cooling (fan axial, N-end).	●	●	●	●	●	●	●	●	●
189	Separate motor cooling, IP44, 400V, 50Hz (fan axial, N-end).	-	-	-	-	●	●	●	-	-
206	Steel fan	-	-	-	-	-	-	-	●	●
422	Separate motor cooling (on top) with integrated fan motor	-	-	-	-	-	-	-	●	●
514	Separate motor cooling (fan on top)	-	-	-	-	-	-	-	●	●
791	Stainless steel fan cover	-	-	-	-	-	-	●	●	●
Coupling										
035	Assembly of customer supplied coupling-half.	-	-	-	-	-	-	-	●	●
Documentation										
141	Binding 2D main dimension drawing.	-	-	-	-	●	●	●	●	●
374	Binding 2D motor detailed drawing	-	-	-	-	●	●	●	●	●
722	Rotor dimension drawing (incl. torsional stiffness)	-	-	-	-	●	●	●	●	●
Drain holes										
065	Plugged existing drain holes.	●	●	●	●	●	●	●	●	●
448	Draining holes with metal plugs.	-	-	-	-	-	-	-	●	●
Earthing Bolt										
067	External earthing bolt.	●	●	●	●	○	○	○	○	○
Heating elements										
450	Heating element, 100-120 V	●	●	●	●	●	●	●	●	●
451	Heating element, 200 - 240 V	●	●	●	●	●	●	●	●	●
Insulation system										
405	Special winding insulation for frequency converter supply.	-	-	-	-	-	●	●	●	●
Mounting arrangements										
008	IM 2101 foot/flange mounted, IEC flange, from IM 1001 (B34 from B3).	●	●	●	●	-	-	-	-	-
009	IM 2001 foot/flange mounted, IEC flange, from IM 1001 (B35 from B3).	●	●	●	●	●	●	●	●	●
047	IM 3601 flange mounted, IEC flange, from IM 3001 (B14 from B5).	●	●	●	●	-	-	-	-	-
048	IM 3001 flange mounted, IEC flange, from IM 3601 (B5 from B14).	●	●	●	●	-	-	-	-	-
066	Modified for specified mounting position differing from IM B3 (1001), IM B5 (3001), B14 (3601), IM B35 (2001), IM B34 (2101)	●	●	●	●	●	●	●	●	●
200	Flange ring holder.	●	●	●	●	-	-	-	-	-
218	Flange ring FT 85.	●	-	-	-	-	-	-	-	-
219	Flange ring FT 100.	●	-	-	-	-	-	-	-	-
220	Flange ring FF 100.	●	-	-	-	-	-	-	-	-
223	Flange ring FF 115.	●	-	-	-	-	-	-	-	-
224	Flange ring FT 115.	●	-	-	-	-	-	-	-	-
226	Flange ring FF 130.	●	●	●	-	-	-	-	-	-
227	Flange ring FT 130.	●	●	●	-	-	-	-	-	-
229	Flange FT 130.	-	●	●	-	-	-	-	-	-
233	Flange ring FF 165.	●	●	●	-	-	-	-	-	-
234	Flange ring FT 165.	●	●	●	-	-	-	-	-	-
235	Flange FF 165.	●	-	-	-	-	-	-	-	-
236	Flange FT 165.	-	-	-	-	●	-	-	-	-
243	Flange ring FF 215.	-	-	-	-	●	-	-	-	-
244	Flange ring FT 215.	-	-	-	-	●	-	-	-	-
253	Flange ring FF 265.	-	-	-	-	●	-	-	-	-
254	Flange ring FT 265.	-	-	-	-	●	-	-	-	-
255	Flange FF 265.	-	-	-	-	●	-	-	-	-
305	Additional lifting lugs.	-	-	-	-	●	●	●	●	●

○ = Included as standard

● = Available as option

- = Not applicable

Code	Variant	Frame size									
		90	100	112	132	160	200	250	280	315	
Noise reduction											
055	Noise reduction cover for foot mounted motor	-	-	-	-	-	-	-	●	●	
Painting											
105	Paint thickness report.	-	-	-	-	●	●	●	●	●	
114	Special paint color, standard grade	●	●	●	●	●	●	●	●	●	
115	Painting system C4M acc. to ISO 12944-2: 1998.	-	-	-	-	●	●	●	●	●	
168	Primer paint only.	-	-	-	-	●	●	●	●	●	
710	Thermally sprayed zink metallizing with acrylic top coat	-	-	-	-	●	●	●	●	●	
754	Painting system C5M acc. to ISO 12944-2:1998	-	-	-	-	●	●	●	●	●	
Protection											
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.	●	●	●	●	●	●	●	●	●	
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.	●	●	●	●	●	●	○	-	-	
Rating & instruction plates											
002	Restamping voltage, frequency and output, continuous duty.	●	●	●	●	●	●	●	●	●	
004	Additional text on std rating plate (max 12 digits on free text line).	●	●	●	●	●	●	●	●	●	
098	Stainless rating plate.	○	○	○	○	○	○	○	○	○	
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.	●	●	●	●	●	●	●	●	●	
528	Rating plate sticker	-	-	-	-	●	●	●	●	●	
Shaft & rotor											
069	Two shaft extensions according to catalog drawings.	●	●	●	●	●	●	●	●	●	
070	Special shaft extension at D-End, standard shaft material	●	●	●	●	●	●	●	●	●	
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.	-	-	-	-	●	●	●	●	●	
Standards and Regulations											
208	Fulfilling Underwriters Laboratories (UL), listed requirements	-	-	-	-	●	●	●	●	●	
Stator winding temperature sensors											
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	●	●	●	●	●	●	●	●	●	
321	Bimetal detectors, closing type (NO), (3 in parallel), 130°C, in stator winding.	●	●	●	●	-	-	-	-	-	

○ = Included as standard

● = Available as option

- = Not applicable

Code	Variant	Frame size									
		90	100	112	132	160	200	250	280	315	
322	Bimetal detectors, closing type (NO), (3 in parallel), 150°C, in stator winding.	●	●	●	●	-	-	-	-	-	
325	Bimetal detectors, closing type (NO), (2x3 in parallel), 150°C, in stator winding.	●	●	●	●	-	-	-	-	-	
327	Bimetal detectors, closing type (NO), (3 in parallel, 130°C & 3 in parallel, 150°C), in stator winding.	●	●	●	●	-	-	-	-	-	
435	PTC - thermistors (3 in series), 130 °C, in stator winding	●	●	●	●	●	●	●	●	●	
436	PTC - thermistors (3 in series), 150 °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	●	●	●	●	●	●	●	●	●	
440	PTC - thermistors (3 in series, 110°C & 3 in series, 130°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	-	-	-	-	●	●	●	●	●	
Terminal box											
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 gland.	●	●	●	●	●	●	●	○	○	
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	-	-	-	-	-	-	-	-	●	
375	Standard plastic cable gland	●	●	●	●	-	-	-	-	-	
376	Two standard plastic cable glands	●	●	●	●	-	-	-	-	-	
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.	●	●	●	●	●	●	●	○	○	
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 nickel plated brass cable glands	-	-	-	-	-	-	-	●	●	
746	Stainless steel cable flange equipped with standard nickel plated brass cable glands	-	-	-	-	-	-	-	●	●	

○ = Included as standard

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- = Not applicable

Code	Variant	Frame size								
		90	100	112	132	160	200	250	280	315
Testing										
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.	-	-	-	-	-	-	•	•	•
Variable speed drives										
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).	-	-	-	-	•	•	•	-	-
574	Separate motor cooling (fan axial, N-end) and prepared for hollow shaft tacho (L&L 503).	-	-	-	-	•	•	•	-	-
576	Separate motor cooling (fan axial, N-end) and 1024 pulse tacho (L&L 503).	-	-	-	-	•	•	•	-	-
577	Separate motor cooling (fan axial, N-end) and 2048 pulse tacho (L&L 503).	-	-	-	-	•	•	•	-	-
578	Separate motor cooling, IP44, 400V, 50Hz (fan axial, N-end) and prepared for hollow shaft tacho (L&L 503).	-	-	-	-	•	•	•	-	-
580	Separate motor cooling, IP44, 400 V, 50Hz (axial fan, N-end) and 1024 pulse tacho (L&L 503)	-	-	-	-	•	•	•	-	-
581	Separate motor cooling, IP44, 400V, 50Hz (fan axial, N-end) and 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	-	-	-	-	-	-	-	•	•
661	1024 Pulse tacho mounted, Hohner series 59, 11-30V	•	•	•	•	-	-	-	-	-
662	2048 Pulse tacho mounted, Hohner series 59, 11-30V	•	•	•	•	-	-	-	-	-
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

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.

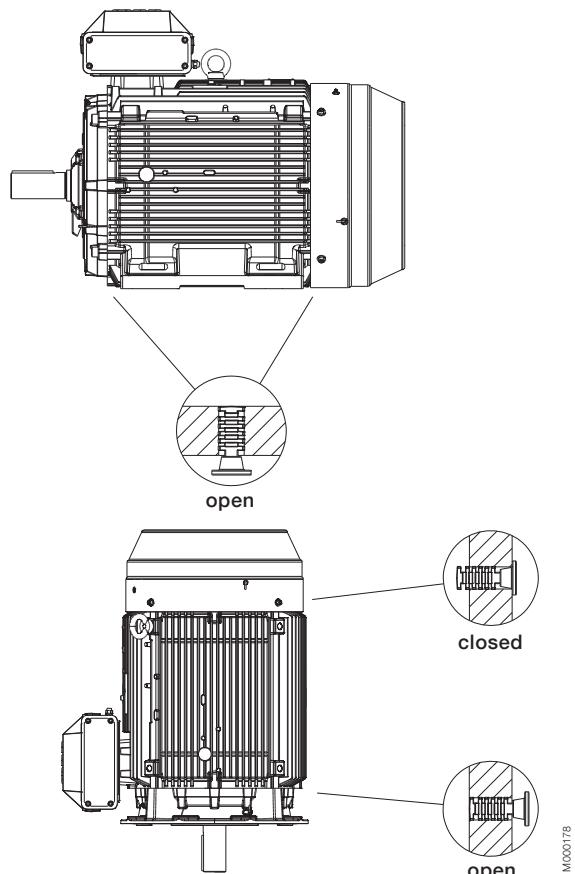
Drain holes

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.)



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

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	50	50	50	50	60	2x60	

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 and can be ordered with variant code 037.

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. The variant codes for ordering angular-contact ball bearings are 058 and 059.

Standard motor with deep-groove ball bearings

Motor size	n_N r/min	Deep-groove ball bearings	
		D-end	N-end
90	1500, 3000	6205-2Z/C3	6204-2Z/C3
100	1500, 3000	6306-2Z/C3	6205-2Z/C3
112	1500, 3000	6306-2Z/C3	6205-2Z/C3
132	1500, 3000	6308-2Z/C3	6206-2Z/C3
160	1500 - 3000	6309-2Z/C3	6209-2Z/C3
200	1500 - 3000	6312-2Z/C3	6210-2Z/C3
250	1500 - 3000	6315/C3	6213/C3
280	1500 - 2100	6316/C3	6316/C3*
315	1500	6319/C3	6316/C3*

* Insulated bearing at N-end as standard.

Alternative design with roller bearings, variant code 037

Motor size	n_N r/min	Roller bearings D-end	
		NU 205	NU 306
90	1500, 3000	NU 205	NU 306
100	1500, 3000	NU 205	NU 306
112	1500, 3000	NU 205	NU 306
132	1500, 3000	NU 205	NU 308
160	1500 - 3000	NU 309 ECP	NU 312 ECP
200	1500 - 3000	NU 312 ECP	NU 315 ECP
250	1500 - 3000	NU 315 ECP	NU 316/C3
280	1500 - 2100	NU 316/C3	NU 319/C3
315	1500	NU 319/C3	NU 316/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 transportation. 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 bearing seals per motor size.

Standard designs

Motor size	n_N r/min	Standard design, axial seal	
		D-end	N-end
90	1500, 3000	V-25A	Labyrinth seal
100	1500, 3000	V-30A	Labyrinth seal
112	1500, 3000	V-30A	Labyrinth seal
132	1500, 3000	V-40A	Labyrinth seal
160	1500 - 3000	V-45A	V-45A
200	1500 - 3000	V-60A	V-50A
250	1500 - 3000	RB75	V-65A

Motor size	n_N r/min	Standard design	
		D-end	N-end
280	1500 - 2100	Axial seal VS80	Axial seal VS80
315 SM, ML	1500	Axial seal VS95	Axial seal VS80
315 LK	1500	Labyrinth seal	Axial seal VS80

Alternative designs in motor sizes 90 - 250

Motor size	n_N r/min	Alternative design, D-end Radial seal (DIN 3760), variant code 072	
		D-end	N-end
90	1500, 3000	25x42x7	
100	1500, 3000	30x47x7	
112	1500, 3000	30x47x7	
132	1500, 3000	40x62x7	
160	1500 - 3000	45x62x8	
200	1500 - 3000	60x80x8	
250	1500 - 3000	75x95x10	

Alternative designs in motor sizes 280 - 315

Motor size	n_N r/min	Alternative design 1	
		D-end	N-end
280	1500 - 2100	Labyrinth seal	Labyrinth seal
315 SM, ML	1500	Labyrinth seal	Labyrinth seal
315 LK	1500	(Labyrinth seal)	Labyrinth seal

Motor size	n_N r/min	Alternative design 2	
		D-end	N-end
280	1500 - 2100	Radial seal 80x110x10	Radial seal 80x110x10
315 SM, ML	1500	Radial seal 95x125x10	Radial seal 80x110x10
315 LK	1500	(Radial seal)	Radial seal 80x110x10

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, synchronous reluctance motors in frame size 250 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.

Motor sizes 90 – 200 have permanently lubricated bearings, but can be provided as an option with grease nipples for regreasing.

Lubrication intervals

ABB follows the L_1 principle in defining lubrication intervals. According to this principle, 99 % of motors will make the interval time. Synchronous reluctance motors in 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. As an option, a grease-collection method can be used.

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	2100 r/min	1500 r/min
Ball bearings				
90 - 200	greased for life			
250	60	4000	8000	11500
280	40	-	6300	9600
315	55	-	-	7600

Lubrication intervals in duty hours according to the L_1 principle

Frame size	Amount of grease, g/bearing	Interval h at		
		3000 r/min	2100 r/min	1500 r/min
Roller bearings				
90 - 132	on request			
160	25	6000	8500	10500
200	40	4000	6500	8500
250	60	2000	4000	5500
280	40	-	3100	5250
315	55	-	-	3800

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 90 – 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 L₁₀, 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 L₁₀.

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
90	3000	40 000	40 000	33 000	20 000	11 000	6 000
	1500	40 000	40 000	40 000	33 000	18 000	9 000
100	3000	40 000	39 000	25 000	15 000	8 000	4 000
	1500	40 000	40 000	40 000	30 000	17 000	9 000
112	3000	40 000	39 000	25 000	15 000	8 000	4 000
	1500	40 000	40 000	40 000	30 000	17 000	9 000
132	3000	40 000	31 000	20 000	12 000	6 000	3 000
	1500	40 000	40 000	40 000	24 000	13 000	7 000
160	3000	40 000	40 000	40 000	26 000	14 000	8 000
	2100	40 000	40 000	40 000	38 000	21 000	11 000
	1500	40 000	40 000	40 000	40 000	40 000	37 000
200	3000	27 000	27 000	27 000	24 000	14 000	8 000
	2100	40 000	40 000	40 000	32 000	18 000	10 000
	1500	40 000	40 000	40 000	40 000	40 000	30 000

Grease lifetime L₁₀ in deep groove ball bearings of type 2Z, horizontally mounted motors in continuous duty

Radial forces

Permissible loading on the shaft

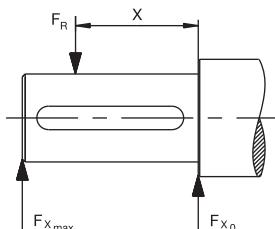
The following table shows permissible radial forces on the shaft in Newtons, assuming zero axial force, a 25 °C ambient temperature, and normal conditions. The values are given for a calculated bearing life of 20,000 and 40,000 hours per motor size.

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.

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 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_{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)
90	3000	50	1010	810	1010	810	-	-	-	-
	1500	50	1010	810	1010	810	-	-	-	-
100	3000	60	2280	1800	2280	1800	-	-	-	-
	1500	60	2280	1800	2280	1800	-	-	-	-
112	3000	60	2280	1800	2280	1800	-	-	-	-
	1500	60	2280	1800	2280	1800	-	-	-	-
132	3000	80	2600	2100	2600	2100	-	-	-	-
	1500	80	2600	2100	2600	2100	-	-	-	-
160	3000	110	5 050	3 900	4 350	3 350	6 700	4 300	5 700	4 300
	2100	110	5 300	4 100	4 550	3 500	7 200	4 300	6 100	4 300
	1500	110	5 400	4 300	4 600	3 700	7 550	4 300	6 400	4 300
200	3000	110	8 300	6 900	7 200 ¹⁾	6 000 ¹⁾	10 700	8 900	9 200	7 650
	2100	110	8 700	7 250	7 500	6 250	11 400	9 550	9 800	8 150
	1500	110	8 900	7 400	7 600	6 350	12 000	9 550	10 150	8 500
250	3000	140	7 700	6 250	6 500	5 250	17 100	10 900	14 900	10 900
	2100	140	8 050	6 550	6 800	5 500	18 400	13 800	15 800	13 800
	1500	140	8 700	7 000	7 300	5 900	19 800	13 800	17 000	13 800
280	2100	140	7 400	6 200	5 700	4 800	21 600	9 700	17 400	9 700
	1500	140	9 200	7 800	7 300	6 200	25 100	9 200	20 300	9 200
315	1500	170	11 400	9 400	9 000	7 400	32 500	9 600	26 600	9 600

¹⁾ The maximum lifetime of the grease is 27 000 h, see Grease lifetime.

Axial forces

The following table presents permissible axial forces on the shaft in Newtons, 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.

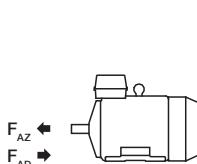
Permissible loads of simultaneous radial and axial forces can be supplied on request.

For axial force F_{AD} , it is assumed that the D-bearing is locked with a locking ring.

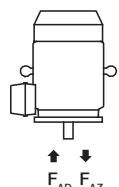
Permissible axial forces, motor sizes 90 – 315

Motor size	Speed r/min	Length of shaft extension E (mm)	Mounting arrangement IM B3				Mounting arrangement IM V1			
			Ball bearings				Ball bearings			
			20,000 h		40,000 h		20,000 h		40,000 h	
90	3000	50	$F_{AD}(N)$	$F_{AZ}(N)$	$F_{AD}(N)$	$F_{AZ}(N)$	$F_{AD}(N)$	$F_{AZ}(N)$	$F_{AD}(N)$	$F_{AZ}(N)$
	1500	50	885	485	720	320	945	450	775	280
100	3000	60	1170	650	945	425	1245	600	1020	375
	1500	60	1620	1120	1280	780	1710	1060	1370	715
112	3000	60	2065	1565	1615	1115	2180	1485	1735	1035
	1500	60	1615	1115	1275	775	1725	1040	1385	700
132	3000	80	2060	1560	1610	1110	2210	1460	1110	1010
	1500	80	2220	1620	1740	1140	2435	1480	1950	995
160	3000	110	2840	2240	2205	1605	3150	2035	2515	1400
	2100	110	4 650	4 650	3 850	3 850	4 950	4 350	4 200	3 600
200	3000	110	4 900	4 900	4 100	4 100	5 200	4 600	4 400	3 850
	2100	110	5 000	5 000	4 200	4 200	5 450	4 650	4 600	3 800
250	3000	110	5 000	7 350	5 000 ¹⁾	6 150 ¹⁾	5 000	7 050	5 000 ¹⁾	5 800 ¹⁾
	2100	140	5 000	7 800	5 000	6 500	5 000	7 450	5 000	6 150
280	3000	140	5 000	8 050	5 000	6 700	5 000	7 550	5 000	6 200
	2100	140	6 000	6 400	5 200	5 200	6 000	5 850	6 000	4 650
315 SM_	3000	140	6 000	7 100	5 800	5 800	6 000	6 300	6 000	4 900
	1500	140	6 950	4 950	5 400	3 400	9 100	3 650	7 500	2 050
315 ML_	3000	170	8 000	6 000	6 100	4 150	10 050	4 600	8 200	2 750
	1500	170	9 400	7 400	7 150	5 150	12 100	5 550	9 900	3 300
315 LK_	3000	170	9 250	7 250	7 050	5 050	10 500	4 900	10 500	2 700
	1500	170	9 000	7 050	6 900	4 900	13 650	3 850	11 500	1 650

¹⁾ The maximum lifetime of the grease is 27 000 h, see Grease lifetime



Mounting arrangement IM B3



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 IP55. By default, terminal boxes are mounted on top of the motor at D-end. The terminal box can also be mounted on the left or right side (see Mounting options).

Turnability

The terminal boxes for motor sizes 160 to 315 are made of cast iron and can be turned 4 x 90°. In sizes 90 to 132, the terminal box is integrated in the aluminum frame and cannot be turned. Instead, it has knock-out openings on both sides.

Cable entries

In motor sizes 90 to 132, the terminal box has two knock-out openings for cable connections on both sides of the box. Size 132 also has an additional small opening. Motor sizes 160 to 250 come with connection flanges with tapped cable entries, and can be provided with cable glands as an option.

In motor sizes 280 to 315 SM and 315 ML the standard terminal box has flanges with cable glands, and 315 LK has cable sealing end units. The standard flange material is siluminum.

Standard terminal box connections

Motor size	Speed r/min	Terminal box type	Size of flange opening	Type of holes	Size of threaded holes/adapter	Cable outer diameter mm	Max. connectable core cross-section mm ² /phase	Number and size of terminal bolts	Method of connection
90-112	1500, 3000	Integrated	-	Knock-out	2x(M25+M20)	2x(Ø11-16+Ø8-14)	1x6	6xM4, 6xM5	Screw terminals, terminal lugs
132	1500, 3000	Integrated	-	Knock-out	2x(M40+M32+M12)	2x(Ø19-27+Ø14-21)	1x35	6xM5, 6xM6	Terminal lugs
160	1500-3000	160	-	Threaded	2xM63x1.5	2xØ34-45	1x70	6xM10	Terminal lugs
200	1500-3000	260	-	Threaded	2xM63x1.5	2xØ34-45	1x95	3xM10	Terminal lugs
250	1500-3000	350	B	Threaded	2xM63x1.5	2xØ34-45	1x150	3xM12	Terminal lugs
280	1500-2100	210	C	Threaded*	2xM63x1.5	2xØ32-49	2x150	6xM12	Terminal lugs
315 SM, ML	1500	370	D	Threaded*	2xM63x1.5	2xØ32-49	2x240	6xM12	Terminal lugs
315 LKA, LKC	1500	750**	E	End unit	Medium (278)	2xØ48-60	4x240	6xM12	Terminal lugs
Auxiliary cable entries									
132	1500, 3000				2xM12	Ø3-6			
160 - 250	1500-3000				2xM20x1.5	Ø4-12			
280 - 315	1500-2100				2xM20x1.5	Ø4-12			

* 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
90 - 112	M4	M4
132	M5	M5
160 - 200	clamp	M6
250	clamp	M8
280 - 315	M10	2xM10

Standard delivery if no other information is provided

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

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.

Terminal boxes and boards

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

Motor sizes 90 – 112



Fig. 1. Integrated terminal box for motor sizes 90 – 112.
Knock-out openings for cable entries.

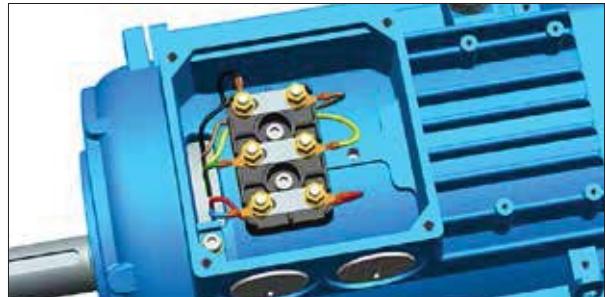


Fig. 2. Terminal board for 90 – 112.

Motor size 132



Fig. 3. Integrated terminal box for motor size 132. Knock-out openings for cable entries.



Fig. 4 Terminal board for 132.

Motor sizes 160 – 250



Fig. 5. Terminal box for motor sizes 160 – 200. Tapped cable entries integrated in the terminal box.



Fig. 6. Terminal board for 160.

Motor sizes 280 – 315

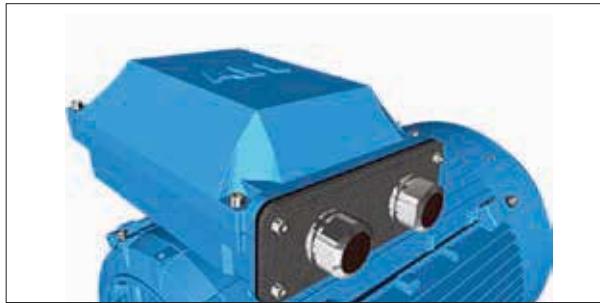


Fig. 7. Terminal box for motor sizes 280 – 315 SM-ML. Adapter and cable sealing end unit.

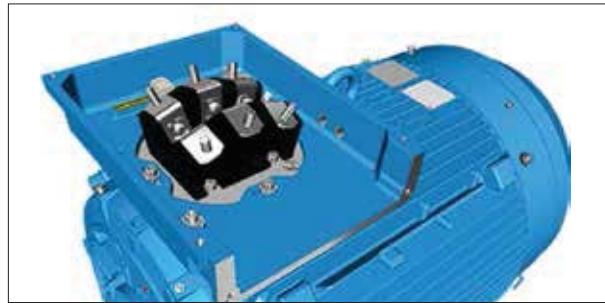


Fig. 8. Terminal board for 280 – 315 SM-ML.

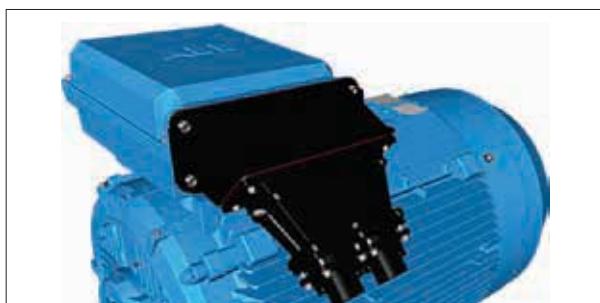


Fig. 9. Terminal box for motor size 315 LK. Adapter and cable sealing end unit.

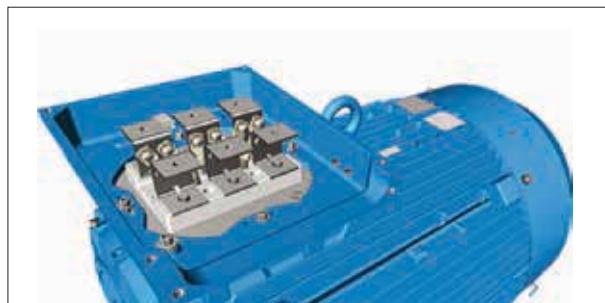


Fig. 10. Terminal board for 315 LK.

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	250 kW, 1500 rpm, 400 V 50 Hz
Cables	2 pieces, outer diameter 58 mm, single core cross section 185 mm ² 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 160 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 ² /phase
160	B	1x70
210	C	2x240
370	D	2x300
750	E	4x500
1200	E	4x500

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.

			
Adapter			
Variant code	292	293	294
Suited for motor sizes	280	315 SM, ML	315 LKA, LKC
Opening to terminal box	C	D	E
Flange or opening for end unit	C	D	D
Material	Steel	Steel	Steel
Notes	Included in type 750 terminal box when 750 is the standard size.		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		
Variant code	277	278
Suited for motor sizes	280	315 SM, ML
Opening to terminal box	C	D
Cable outer diameter	1 - 2 cables, 48 - 60 mm	1 - 2 cables, 48 - 60 mm
Cable entry for auxiliary cable	2xM20 plugged holes	2xM20 plugged holes
Additional optional variants	EMC cable gland (704); Standard gland with clamping device (231)	EMC cable gland (704); Standard gland with clamping device (231)
		279
		315 SM, ML
		D
		1 - 2 cables, 60 - 80 mm
		2xM20 plugged holes
		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 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.

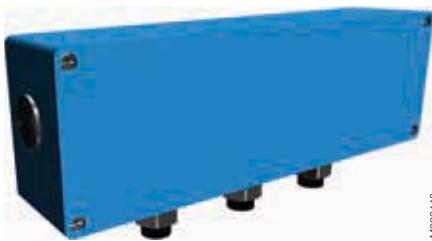
Related variant codes

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.

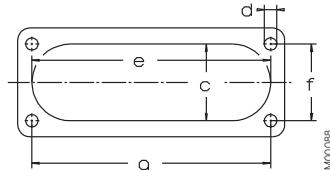
Frame size for motor sizes 280 - 315 (variant code 567): 211 x 188 mm, max 30 strips. Earthing size M6.

Terminal box

Dimensions

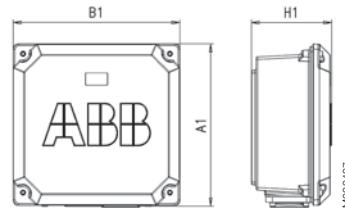
The terminal box dimensions presented on this page apply to cast-iron motors in sizes 160 – 315. For dimensions of integrated terminal boxes in aluminum motors, sizes 90 – 132, see the following Dimension drawings pages.

Dimensions for terminal box inlets

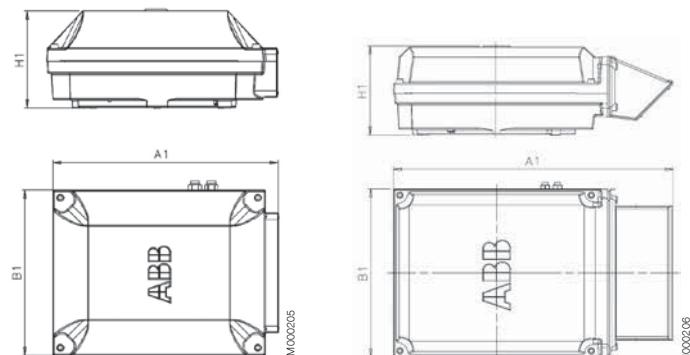


Flange opening	c mm	e mm	f mm	g mm	d thread type
B	71	194	62	193	M8
C	62	193	62	193	M8
D	100	300	80	292	M10
E	115	370	100	360	M12

Frame dimensions



Motor sizes 160 – 250

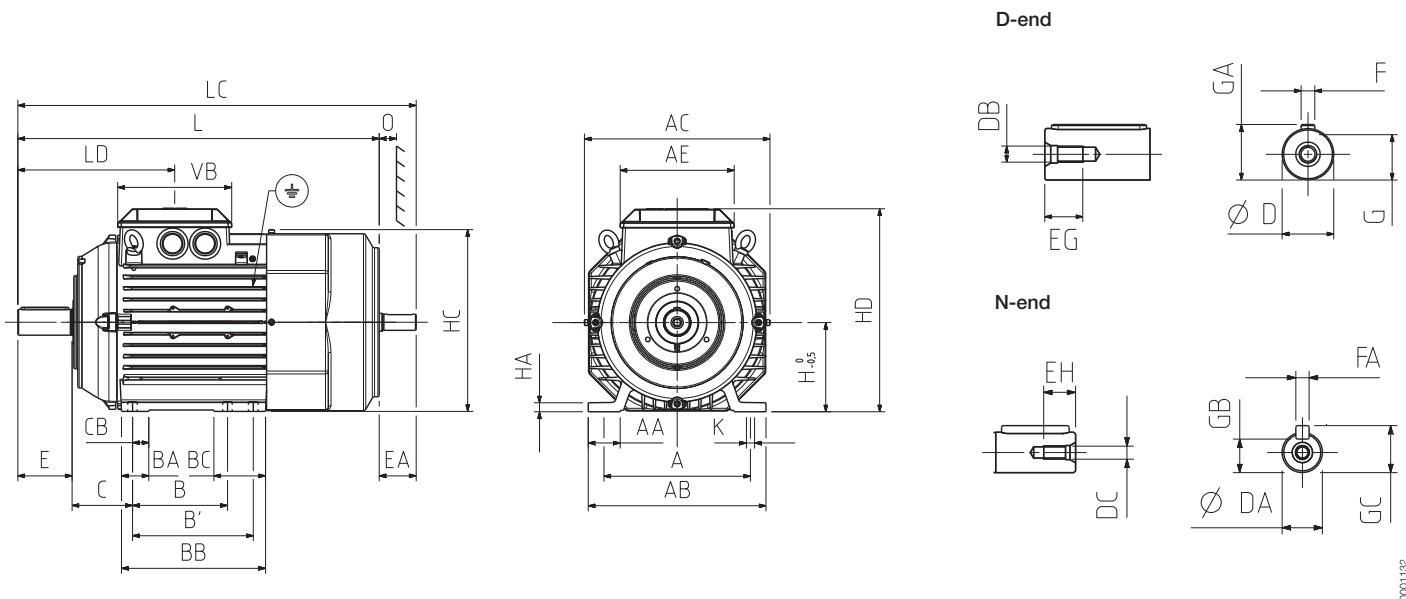


Motor sizes 280 – 315. Top- and side-mounted terminal boxes.

Terminal box types acc. to current capacity	A1	B1	H1
Box types for 90 - 132			
Terminal box integrated in frame			
Box types for 160 - 250			
160	257	257	145
260	257	257	136
350	300	311	150
Box types for 280 - 315			
210	416	306	177
370	451	347	200
750, top-mounted	686	413	219
750, side-mounted	525	413	219

Dimension drawings

Foot-mounted aluminum motors, 90 – 132



Mounting options IM B3 (IM 1001), IM 1002

Motor size	A	AA	AB	AC	AE	B	B'	BA	BB	BC	C	CB	D-Tol.	DA	DB	DC	E	EA	EG	EH
90 L, LA-LC	140	27	170	177	110	100	125	32	150	32	56	12.5	24-j6	14	M8	M5	50	30	19	12.5
90 LDA	140	27	170	177	110	100	125	32	150	32	56	12.5	24-j6	14	M8	M5	50	30	19	12.5
100 LB	160	32	200	197	110	140	-	36	172	36	63	16	28-j6	19	M10	M6	60	40	22	16
100 LDA	160	32	200	197	110	140	-	36	172	36	63	16	28-j6	19	M10	M6	60	40	22	16
112	190	32	230	197	110	140	-	36	172	36	70	16	28-j6	19	M10	M6	60	40	22	16
132 SMB-D	216	47	262	261	160	140	178	40	212	76	89	18	38-k6	24	M12	M8	80	50	28	19
132 SME	216	47	262	261	160	140	178	40	212	76	89	18	38-k6	24	M12	M8	80	50	28	19
132 SMF	216	47	262	261	160	140	178	40	212	76	89	18	38-k6	24	M12	M8	80	50	28	19

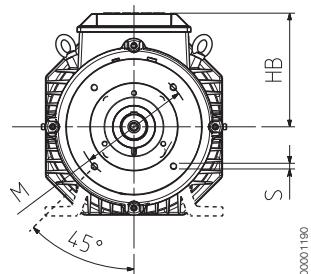
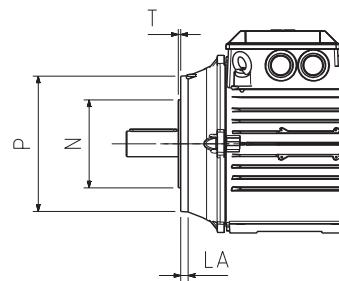
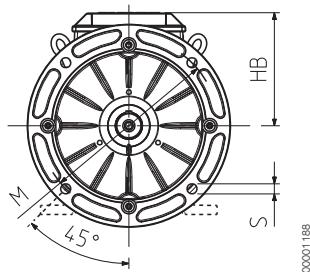
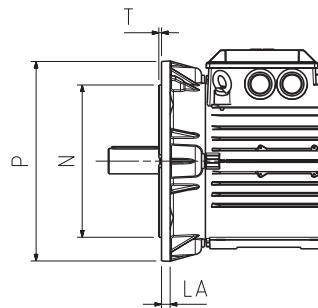
Motor size	F	FA	G	GA	GB	GC	H	HA	HC	HD	K	L	LC	LD	O	VB
90 L, LA-LC	8	5	20	27	11	16	90	10	189	217	10	309.5	344.5	151	20	110
90 LDA	8	5	20	27	11	16	90	10	189	217	10	331.5	366.5	151	20	110
100 LB	8	6	24	31	15.5	21.5	100	12	209	237	12	351	396	164	25	110
100 LDA	8	6	24	31	15.5	21.5	100	12	209	237	12	373	418	164	25	110
112	8	6	24	31	15.5	21.5	112	12	221	249	12	393	436	200	25	110
132 SMB-D	10	8	33	41	20	27	132	14	263.5	295.5	12	487	557	231	30	160
132 SME	10	8	33	41	20	27	132	14	287	321	12	550	620	231	30	160
132 SMF	10	8	33	41	20	27	132	14	287	321	12	590	660	231	30	160

Tolerances

A, B	± 0.8
D, DA	ISO j6
F, FA	ISO h9
H	+0 -0.5
N	ISO j6
C, CA	± 0.8

Dimension drawings

Flange- and foot- & flange-mounted aluminum motors, 90 – 132



Mounting options IM B5 (IM 3001), IM 3002; IM B35 (IM 2001), IM 2002

Large flange

Motor size	HB	LA	M	N	P	S	T
90	127	10	165	130	200	12	3.5
100	137	11	215	180	250	15	4
112	137	11	215	180	250	15	4
132 SMB-D	163.5	14	265	230	300	14.5	4
132 SME-F	189	14	265	230	300	14.5	4

Mounting options IM B14 (IM 3601), IM 3602; IM B34 (IM 2101), IM 2102

Small flange

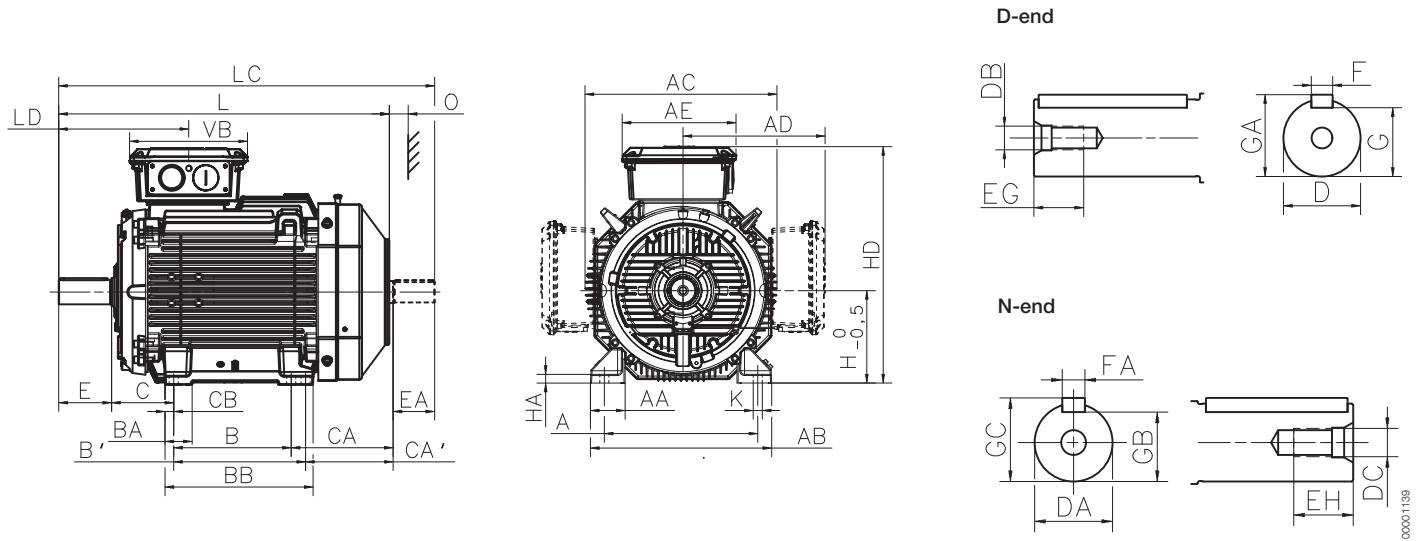
Motor size	HB	LA	M	N	P	S	T
90	127	13	115	95	140	M8	3
100	137	14	130	110	160	M8	3.5
112	137	14	130	110	160	M8	3.5
132 SMB-D	163.5	14.5	165	130	200	M10	3.5
132 SME-F	189	14.5	165	130	200	M10	3.5

Tolerances

A, B	± 0.8
D, DA	ISO j6
F, FA	ISO h9
H	+0 -0.5
N	ISO j6
C, CA	± 0.8

Dimension drawings

Foot-mounted cast iron 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'	CB	D	DA	DB	DC	E	EA	EG	
160 ¹⁾	1500-3000	254	67	310	338	300	257	210	254	69	294	108	172	128	20	42	32	M16	M12	110	80	36
160 ²⁾	1500-3000	254	67	310	338	300	257	210	254	69	294	108	269	225	20	42	32	M16	M12	110	80	36
200	1500-3000	318	69	378	413	314	257	267	305	80	345	133	314	276	20	55	45	M20	M16	110	110	42
250	3000	406	92	480	508	376	300	311	349	69	392	168	281	243	23	60	55	M20	M20	140	110	42
250	1500-2100	406	92	480	508	376	300	311	349	69	392	168	281	243	23	65	55	M20	M20	140	110	42

Motor size	Speed r/min	EH	F	FA	G	GA	GB	GC	H	HA	HD	HE	K	L	LC	UB1	UB2	VA	VB	VC	VD	VE
160 ¹⁾	1500-3000	28	12	10	37	45	27	35	160	23	460	227	14.5	584	671.5	M63	M16	49	257	81	177	129
160 ²⁾	1500-3000	28	12	10	37	45	27	35	160	23	460	227	14.5	681	768.5	M63	M16	49	257	81	177	129
200	1500-3000	36	16	14	49	59	39.5	48.5	200	23	514	241	18.5	821	934	M63	M16	82	257	81	177	129
250	3000	42	18	16	53	64	49	59	250	23	626	297	24.0	884	1010	M63	M16	48	311	111	201	156
250	1500-2100	42	18	16	58	69	49	59	250	23	626	297	24.0	884	1010	M63	M16	48	311	111	201	156

M3BL:

¹⁾ MLB

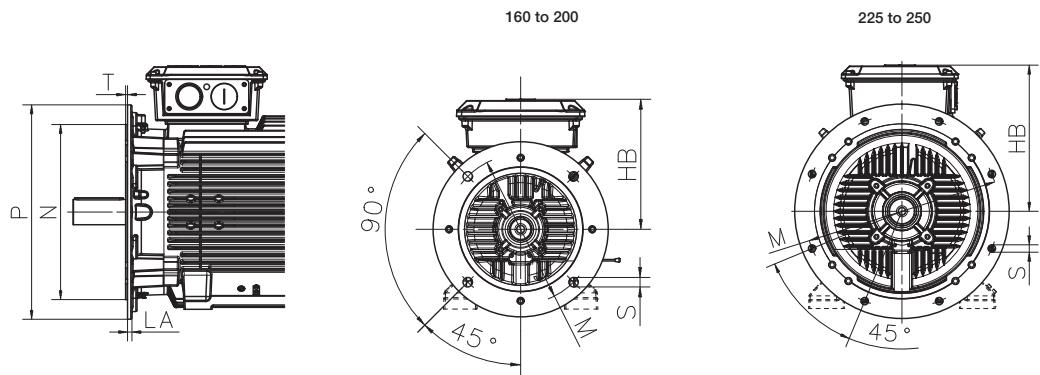
²⁾ MLC and MLE

Tolerances

A, B	ISO js14
C, CA	$\pm 0,8$
D, DA	ISO k6 $< \varnothing 50$ mm
	ISO m6 $< \varnothing 50$ mm
F, FA	ISO h9
H	$+0 -0,5$

Dimension drawings

Flange- and foot & flange-mounted cast iron motors, 160 – 250



00001156

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 V36 (IM 2031)

Motor size	Speed r/min	HB	LA	M	N	P	S	T
160 ¹⁾	1500-3000	261	20	300	250	350	19	5
160 ²⁾	1500-3000	261	20	300	250	350	19	5
200	1500-3000	328	20	350	300	400	19	5
250	3000	376	24	500	450	550	19	5
250	1500-2100	376	24	500	450	550	19	5

M3BL:

¹⁾ MLB

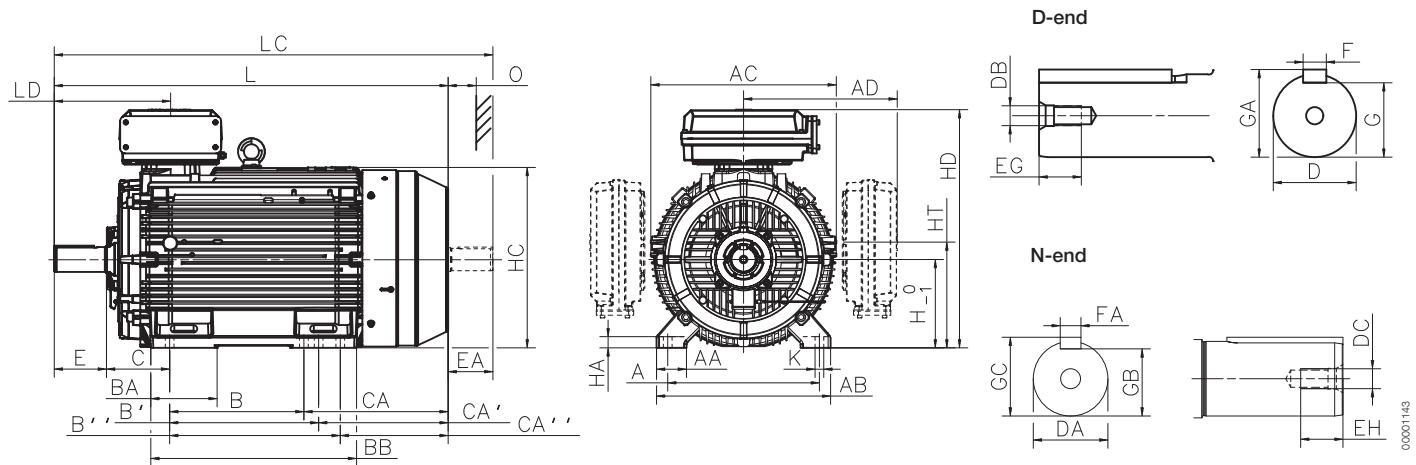
²⁾ MLC and MLE

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 cast iron 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 ¹⁾	AD ²⁾	B	B'	B''	BA	BB	C	CA	CA'	CA''	D	DA	DB	DC	E	EA
280 SM_	1500-2100	457	84	530	577	481	-	368	419	-	147	506	190	400	349	-	75	65	M20	M20	140	140
315 SM_	1500	508	100	590	654	545	-	406	457	-	180	558	216	420	369	-	80	75	M20	M20	170	140
315 ML_	1500	508	100	590	654	545	-	457	508	-	212	669	216	480	429	-	90	75	M24	M20	170	140
315 LK_	1500	508	100	590	654	562	576	508	560	710	336	851	216	635	583	433	90	75	M24	M20	170	140

EG	EH	F	FA	G	GA	GB	GC	GD	GF	H	HA	HC	HD ¹⁾ top- m.	HD ²⁾ top- m.	HT	K	L	LC	LD	LD	O		
Motor size	Speed r/min																						
280 SM_	1500-2100	40	40	20	18	67.5	79.5	58	69	12	11	280	31	564	762	-	337.5	24	1088	1238	336	539	100
315 SM_	1500	40	40	22	20	71	85	67.5	79.5	14	12	315	40	638	852	880	375	28	1204	1352	386	615	115
315 ML_	1500	48	40	25	20	81	95	67.5	79.5	14	12	315	40	638	852	880	375	28	1315	1463	386	670	115
315 LK_	1500	48	40	25	20	81	95	67.5	79.5	14	12	315	40	638	852	880	359	28	1521	1669	386	751	115

¹⁾ Terminal box 370

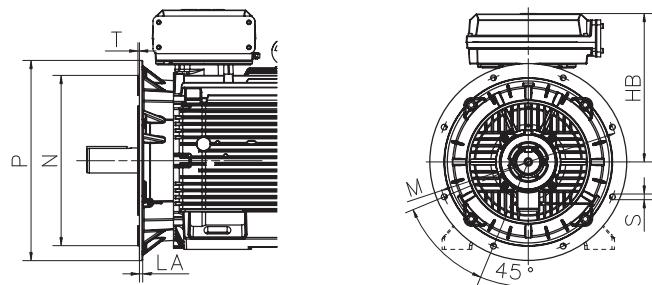
²⁾ Terminal box 750

Tolerances

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

Dimension drawings

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



00001159

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 V36 (IM 2031)

Motor size	Speed r/min	HB ¹⁾	HB ²⁾	LA	M	N	P	S	T
280 SM_	1500-2100	482	-	23	500	450	550	18	5
315 SM_	1500	537	-	25	600	550	660	23	6
315 ML_	1500	537	-	25	600	550	660	23	6
315 LK_	1500	537	565	25	600	550	660	23	6

¹⁾ Terminal box 370

²⁾ 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 90 – 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 90 - 132

Main motor	Fan motor type	Voltage range V at 50 Hz	Voltage range at 60 Hz, V	Power kW	Current A
M3AL 90	Wistro 169	380 - 500	380 - 575	75	0.19
		220 - 290	220 - 332	78	0.33
M3AL 100	Wistro 187	380 - 500	380 - 575	94	0.17
		220 - 290	220 - 332	87	0.31
M3AL 112	Wistro 210	380 - 500	380 - 575	99	0.17
		220 - 290	220 - 332	103	0.31
M3AL 132	Wistro 250	380 - 500	380 - 575	148	0.25
		220 - 290	220 - 332	146	0.45

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, motor sizes 280 - 315

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.

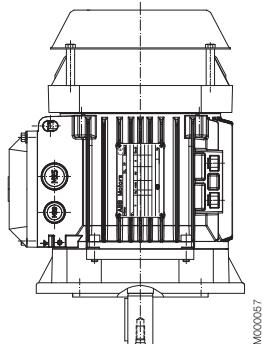
Special motor and fan on top, motor sizes 280 - 315

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

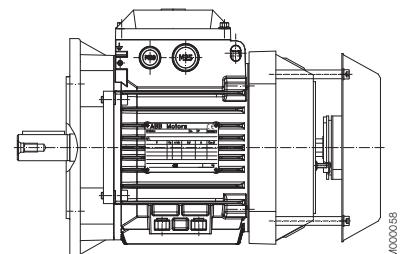
Accessories

Protective roof and tachometer

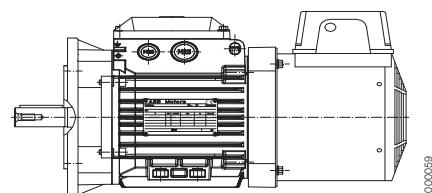
Motor sizes 90 – 132



Protective roof, variant code 005

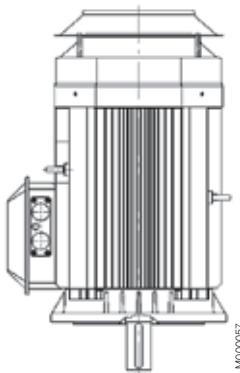


Tachometer, variant codes 661, 662

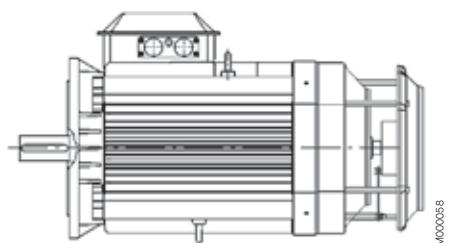


Separate cooling, without tacho: 183

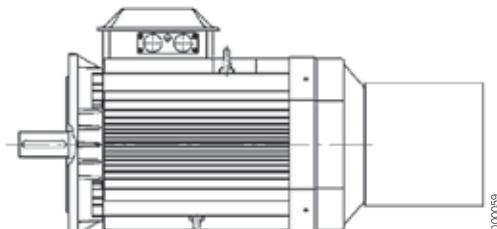
Motor sizes 160 – 315



Protective roof, variant code 005



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



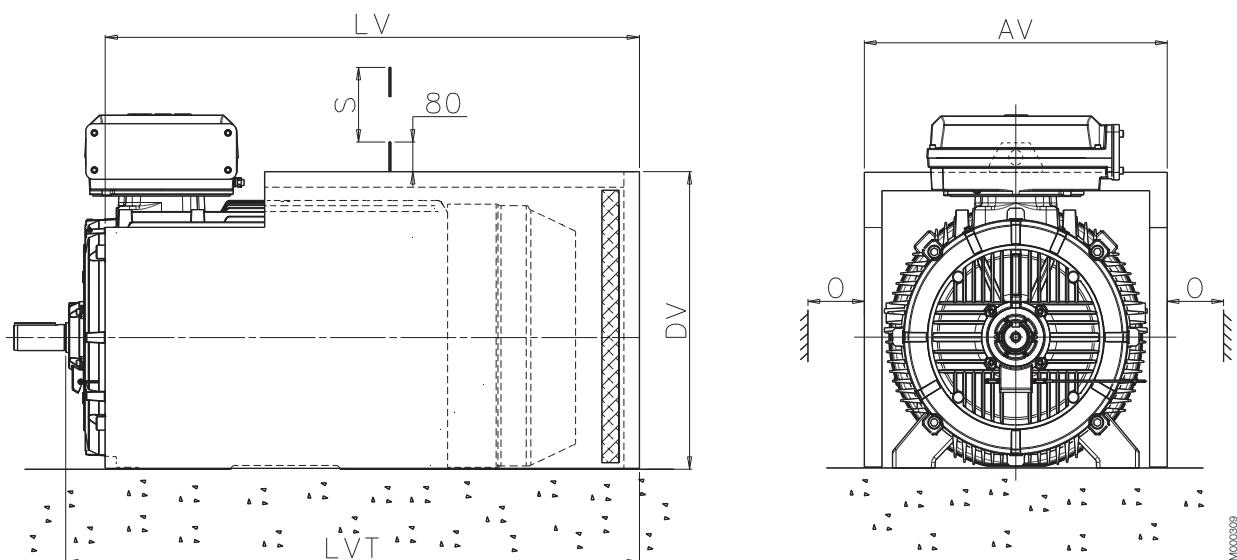
Separate cooling, without tacho: 183 and 189; with tacho: 474, 476, 477, 574, 576, 577, 580, 581, 582 and 583

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 ¹⁾	S ²⁾	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

¹⁾ Clearance for motor cooling

²⁾ Clearance for removal of silencer

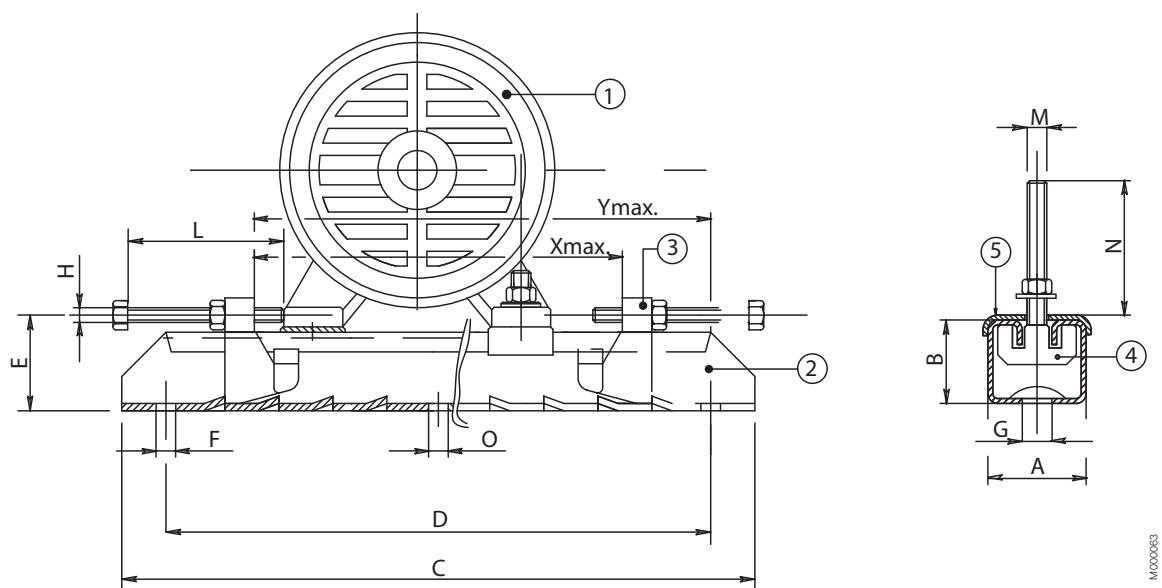
Note: The dimensions are only valid for standard foot-mounted motors.

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.



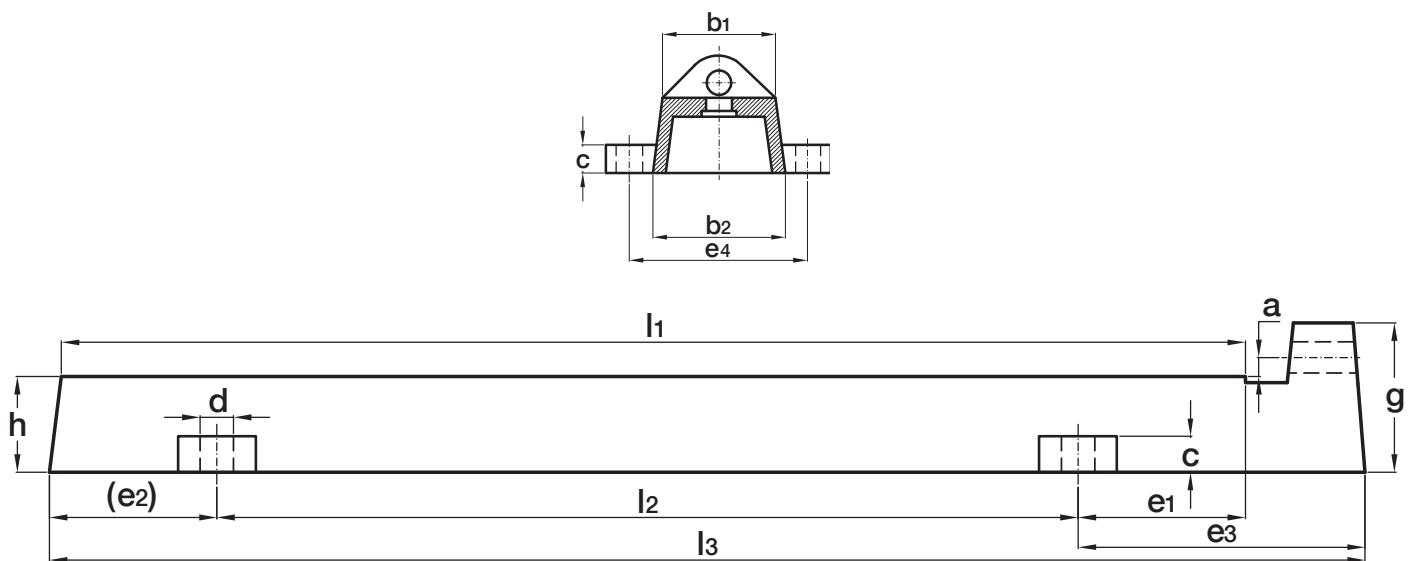
Motor size	Type	Article no. 3GZV103001-	A	B	C	D	E	F	G	H	L	M	N	O	Xmax	Ymax	Weight/rail kg
160	TT180/12	-14	75	42	700	630	57	17	26	M12	120	M12	50	-	520	580	12.0
200	TT225/16	-15	82	50	864	800	68	17	27	M16	140	M16	65	17	670	740	20.4
250	TT280/20	-16	116	70	1072	1000	90	20	27	M18	150	M20	80	20	870	940	43.0

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.

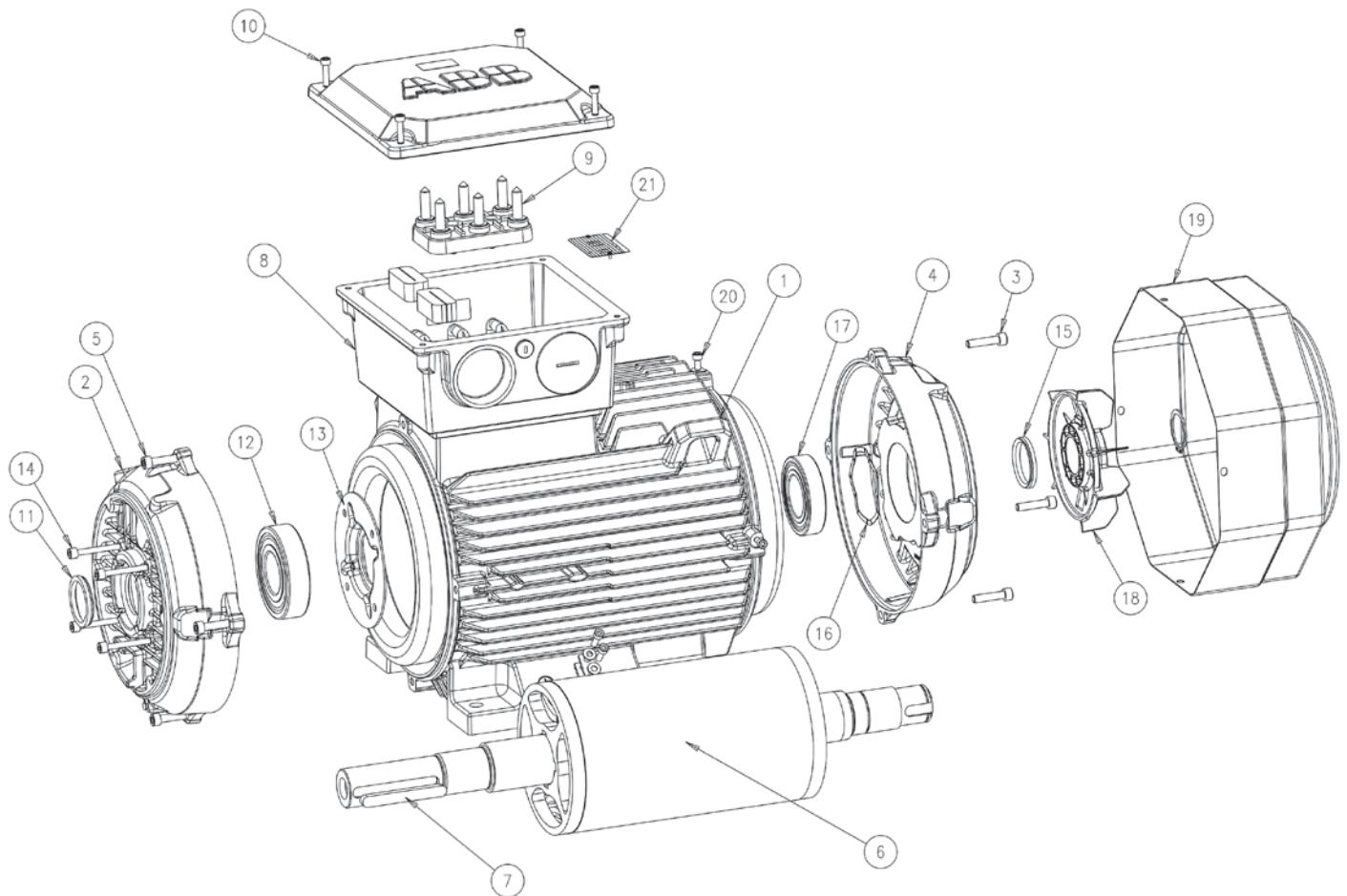


Note: The drawings are suggestive and do not give all details.

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	M20x90	M24x300	50
315	3GZF334730-56	1000	720	1100	16	80	120	140	40	28	140	140	240	190	M24x100	M24x300	80

Motor construction

Exploded view, frame size 160



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

Motors in brief

High output synchronous reluctance motors, 90 – 132

This table summarizes the standard design features of High output synchronous reluctance motors.

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	Polyester powder paint			
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
Axially 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		Not included			
Rating plate	Material	Aluminum			
Terminal box	Frame and cover	Die-cast aluminum alloy, integrated in stator			
	Corrosion class	Polyester powder paint			
	Cover screws				
Connections	Cable entries	2x(M25+M20)		2x(M40+M32+M12)	
	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	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

High output synchronous reluctance motors, 160 – 315

This table summarizes the standard design features of High output synchronous reluctance motors.

Motor size		160	200	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	6312-2Z/C3	6315/C3	6316/C3	6319/C3
	N-end	6209-2Z/C3	6210-2Z/C3	6213/C3	6316/C3*	6316/C3*
Axially locked bearings	Inner bearing cover	Locked at D-end				
Bearing seals	D-end	V-ring		Gamma-ring	V-ring or labyrinth seal, see section Bearing seals	
	N-end	V-ring			V-ring	
Lubrication		Permanently lubricated shielded bearings, wide-temperature-range grease		Regreasable bearings, regreasing nipples M6x1	Regreasable bearings, regreasing nipples M10x1	
Measuring nipples		SPM as option		SPM as standard		
Rating plate	Material	Stainless steel				
Terminal box	Frame and cover	Cast iron				
	Corrosion class	C3 (medium) according to ISO/EN 12944-5				
	Cover screws	Zinc electroplated steel				
Connections	Cable entries	2xM63x1.5, 1xM16x1.5**			2xM63x1.5, 2xM20x1.5**	
	Terminals	6 terminals***	3 terminals***		6 terminals***	
	Cable glands	Cable entries integrated in terminal box		Flange as standard, cable glands optional	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, higher protection on request				
Cooling method		IC 411				

* Insulated bearing at N-end as standard.

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

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

For your notes

For your notes

Total product offering

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

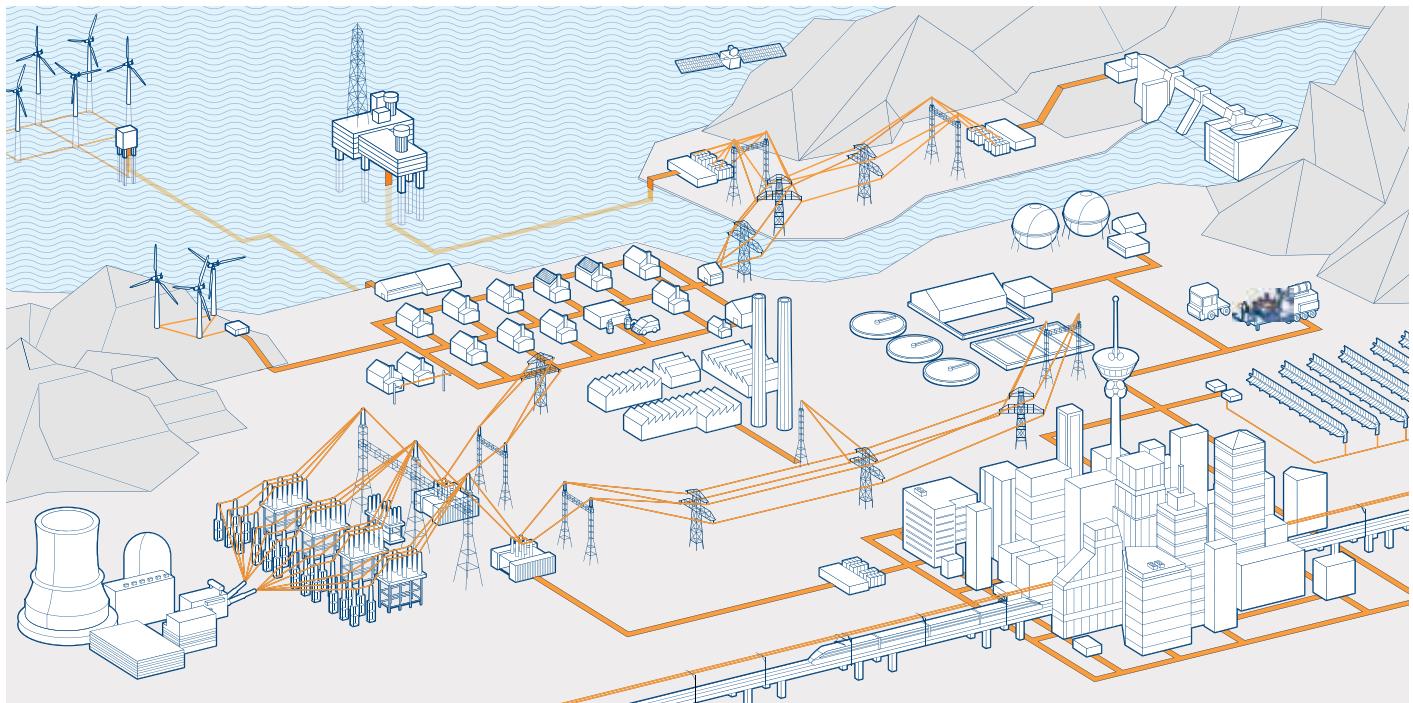


ABB is the leading manufacturer of low, medium and high voltage motors and generators, and mechanical power transmission products. ABB products are backed by a complete portfolio of services. Our in-depth knowledge of virtually every type of industrial process ensures we always specify the best solution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

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.



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Zentrale

MAX LAMB GMBH & CO. KG
Am Bauhof 2
97076 Würzburg

VERTRIEB WÄLZLAGER
Telefon: 0931-2794-210
E-Mail: wlz@lamb.de

VERTRIEB ANTRIEBSTECHNIK
Telefon: 0931-2794-260
E-Mail: ant@lamb.de

Niederlassungen

ASCHAFFENBURG
Schwalbenrainweg 30a
63741 Aschaffenburg
Telefon: 06021-3488-0
Telefax: 06021-3488-511
E-Mail: ab@lamb.de

NÜRNBERG
Dieselstraße 18
90765 Fürth
Telefon: 0911-766709-0
Telefax: 0911-766709-611
E-Mail: nb@lamb.de

SCHWEINFURT
Carl-Zeiss-Straße 20
97424 Schweinfurt
Telefon: 09721-7659-0
Telefax: 09721-7659-411
E-Mail: sw@lamb.de

STUTTGART
Heerweg 15/A
73770 Denkendorf
Telefon: 0711-93448-30
Telefax: 0711-93448-311
E-Mail: st@lamb.de

Ideen verbinden, Technik nutzen