

LOW VOLTAGE INDUCTION MOTORS

IEC FRAME SIZES: 80 to 355
OUTPUT POWER: 0.55 to 500kW

IE3 - IE4

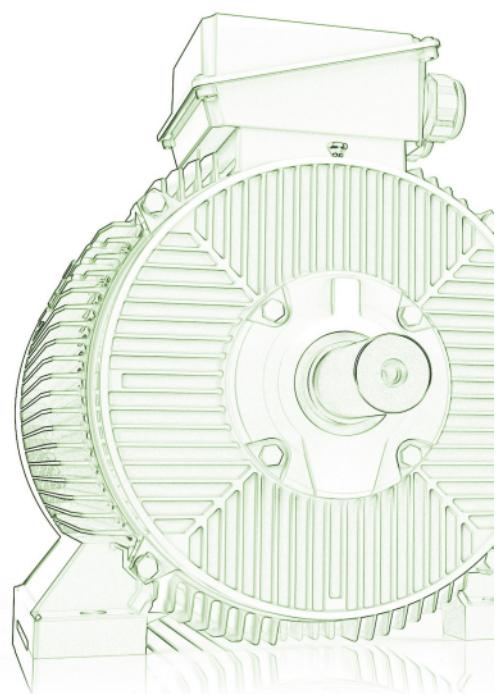


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1. STANDARDS

Omega Motor low voltage induction motors are designed, produced and tested in accordance with the given international electrical and mechanical standards.

STANDARDS	TITLE
IEC 60034-1	Rating and performance
IEC 60034-2-1	Standard methods for determining losses and efficiency from tests
IEC 60034-5	Degrees of protection provided by the integral design of rotating electrical machines (IP Code)
IEC 60034-6	Methods of cooling (IC Code)
IEC 60034-7	Classification of types of construction, mounting arrangements and terminal box position (IM Code)
IEC 60034-8	Terminal markings and direction of rotation
IEC 60034-9	Noise limits
IEC 60034-11	Thermal protection
IEC 60034-12	Starting performance of single-speed three-phase cage induction motors
IEC 60034-14	Measurement, evaluation and limits of vibration severity
IEC 60034-26	Effects of unbalanced voltages on the performance of three-phase cage induction motors
IEC 60034-30-1	Efficiency classes of line operated AC motors (IE Code)
IEC 60034-31	Selection of energy-efficient motors including variable speed applications - Application guide
IEC 60038	Standard voltages
IEC 60072-1	Dimensions and output series for rotating electrical machines - Frame numbers 56 to 400 and flange numbers 55 to 1080
IEC 60072-2	Dimensions and output series for rotating electrical machines - Frame numbers 355 to 1000 and flange numbers 1180 to 2360
IEC 60085	Electrical insulation - Thermal evaluation and designation
IEC 60947-8	Control units for built-in thermal protection (PTC) for rotating electrical machines
EN ISO 1680	Test code for the measurement of airborne noise emitted by rotating electrical machines

2. EFFICIENCY

In 1998 the European Committee of Manufacturers of Electrical Machines and Power Systems (CEMEP) issued a voluntary agreement of motor manufacturers on efficiency classification with three efficiency classes namely Eff1, Eff2, and Eff3, which can be treated as the first concrete approach towards efficiency in the European region. The lack of regularity authority behind the agreement have limited the success of this formation and helped to convert as low as 1% of Eff3 low-efficiency motors to Eff1 high-efficiency motors in about 10 years.

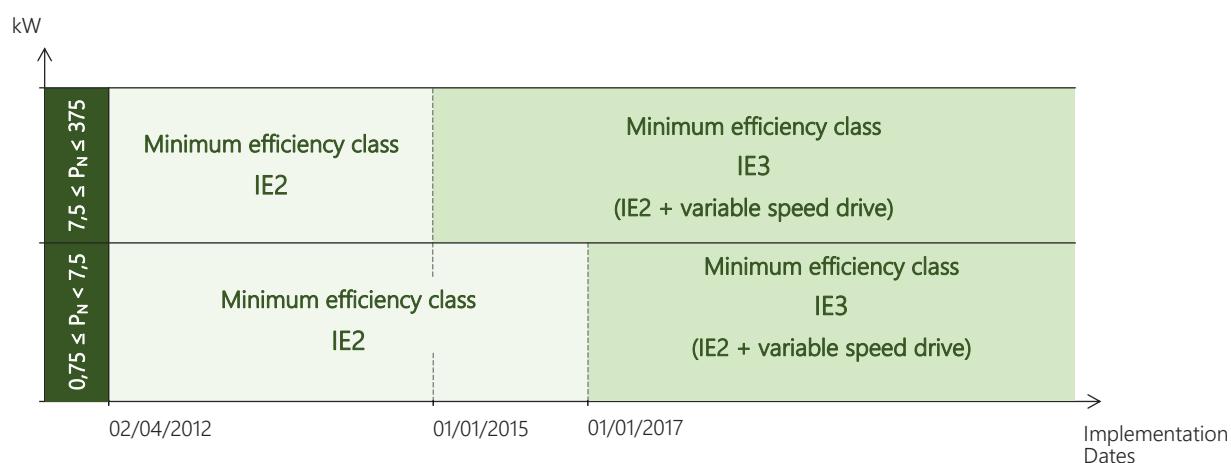
International Electrotechnical Commission (IEC) conducted a comprehensive study within this period of time and came up with two efficiency standards of which latest versions are 60034-30-1:2014 where IE codes are defined and 60034-2-1:2014 where test methods are specified.

IEC is an organization that defines efficiencies, test procedures by publishing standards but it is not a body that is controlling the application of these standards. They are rather controlled via MEPS (Minimum Energy Performance Standards) which are made mandatory by government energy efficiency bodies in the relevant countries. In the European Union, Eu regulation 640/2009 and the supplement 04/2014 is a force to regulate energy efficiency of industrial motors in the industrial environment. In Turkey, it is regulated by communiqué 28197 (SGM-2012/2) dated 07/02/2012 on ecodesign requirements for electric motors and the supplement 29294 (SGM-2015-2015/15 dated 13/03/2015).

The aim of these legislative regulations in the European Union and Turkey is to maintain usage of motors not less than IE3 efficiency level as from 1 January 2015 (motors between 7,5kW – 375kW) and 1 January 2017 (motors between 0,75 – 7,5 kW) hence reduce Co2 emissions worldwide.

The table below lists the scope of the international standard IEC 60034-30-1 and of Regulation 640/2009

Timeline as per EU Regulation



SCOPE	DIRECTIVES: 640/2009 and 04/2014	STANDARD: IEC 60034-30-1:2014
Pole Number	2, 4 and 6 pole	2, 4, 6 and 8 pole
Motor Output Power	0,75kW < P _N < 375kW	0,12kW < P _N < 1000kW
Nominal Voltage	0 < U _N < 1000V	50V < U _N < 1000V
Frequency	50Hz or 50/60Hz	50Hz or 60Hz
Altitude	0 < altitude < 4000m	0 < altitude < 4000m
Ambient Temperature*	-30°C < t < 60°C	-20°C < t < 60°C
Maximum Operating Temperature	400°C	400°C**

* Minimum ambient temperature should be 0°C for water cooled motors.

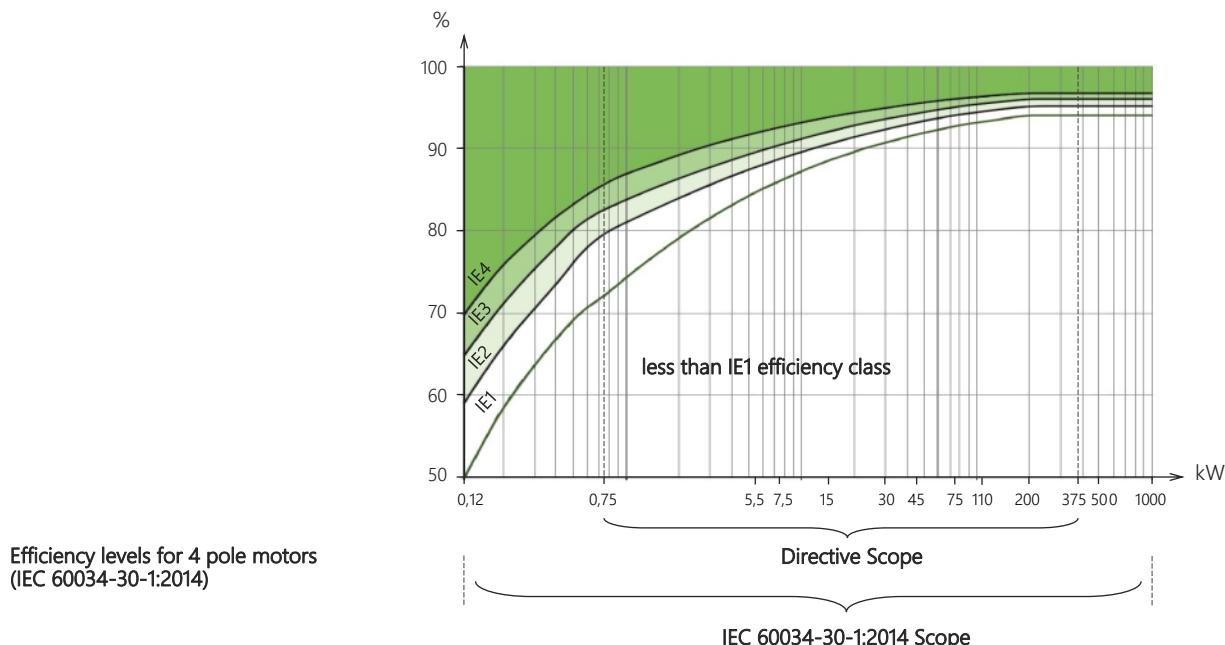
** Smoke extraction motors

2.1. IEC 60034-30-1:2014

IEC 60034-30-1: 2014 specifies the latest efficiency classes for single-speed electric motors that are rated according to IEC 60034-1 and operating on a sinusoidal voltage supply.

The motors listed below are excluded from this standard:

- Single-speed motors with 10 or more poles or multi speed motors.
- Motors completely integrated into a machine (for example pump, fan and compressor) that cannot be tested separately from the driven machine.
- Motors with integrated frequency converter (compact drives) when the motor cannot be tested separately from the converter.
- Brake motors when the brake is an integral part of the inner motor construction and cannot be dismantled or separately fed.
- Submersible motors specially designed to operate wholly immersed in a liquid.



2.2. IEC 60034-2-1:2014

IEC defines three different preferred testing methods in the latest IEC 60034-2-1:2014/06 standard, in order to determine the efficiencies of rotating electrical machines.

Omega Motor uses test **Method 2-1-1B** with low uncertainty. This is an indirect method and determines the efficiency by summation of losses with additional load losses from residual losses. The respective loss components are iron losses, windage and friction losses, stator and rotor losses and additional load losses. These losses are calculated by parameters measured and derived during the test of the motor, hence by their summation, the motor efficiency is determined precisely.

There are two other test methods in the standards which can be preferred depending on the type or rating of the machine under test.

- **Method 2-1-1A:** Direct measurement of input and output
- **Method 2-1-1C:** Summation of losses with additional load losses from assigned allowance.

Nominal efficiency values (%) for 50Hz are specified in IEC 60034-30-1:2014 and given below:

Efficiency value determination based on the test methods specified in IEC 60034-2-1:2014

Output Power	IE1 Standard Efficiency Motors				IE2 High Efficiency Motors				IE3 Premium Efficiency Motors				IE4 Super Premium Efficiency Motors			
	kW	2 pole	4 pole	6 pole	8 pole	2 pole	4 pole	6 pole	8 pole	2 pole	4 pole	6 pole	8 pole	2 pole	4 pole	6 pole
0,12	45,0	50,0	38,3	31,0	53,6	59,1	50,6	39,8	60,8	64,8	57,7	50,7	66,5	69,8	64,9	62,3
0,18	52,8	57,0	45,5	38,0	60,4	64,7	56,6	45,9	65,9	69,9	63,9	58,7	70,8	74,7	70,1	67,2
0,20	54,6	58,5	47,6	39,7	61,9	65,9	58,2	47,4	67,2	71,1	65,4	60,6	71,9	75,8	71,4	68,4
0,25	58,2	61,5	52,1	43,4	64,8	68,5	61,6	50,6	69,7	73,5	68,6	64,1	74,3	77,9	74,1	70,8
0,37	63,9	66,0	59,7	49,7	69,5	72,7	67,6	56,1	73,8	77,3	73,5	69,3	78,1	81,1	78,0	74,3
0,40	64,9	66,8	61,1	50,9	70,4	73,5	68,8	57,2	74,6	78,0	74,4	70,1	78,9	81,7	78,7	74,9
0,55	69,0	70,0	65,8	56,1	74,1	77,1	73,1	61,7	77,8	80,8	77,2	73,0	81,5	83,9	80,9	77,0
0,75	72,1	72,1	70,0	61,2	77,4	79,6	75,9	66,2	80,7	82,5	78,9	75,0	83,5	85,7	82,7	78,4
1,1	75,0	75,0	72,9	66,5	79,6	81,4	78,1	70,8	82,7	84,1	81,0	77,7	85,2	87,2	84,5	80,8
1,5	77,2	77,2	75,2	70,2	81,3	82,8	79,8	74,1	84,2	85,3	82,5	79,7	86,5	88,2	85,9	82,6
2,2	79,7	79,7	77,7	74,2	83,2	84,3	81,8	77,6	85,9	86,7	84,3	81,9	88,0	89,5	87,4	84,5
3	81,5	81,5	79,7	77,0	84,6	85,5	83,3	80,0	87,1	87,7	85,6	83,5	89,1	90,4	88,6	85,9
4	83,1	83,1	81,4	79,2	85,8	86,6	84,6	81,9	88,1	88,6	86,8	84,8	90,0	91,1	89,5	87,1
5,5	84,7	84,7	83,1	81,4	87,0	87,7	86,0	83,8	89,2	89,6	88,0	86,2	90,9	91,9	90,5	88,3
7,5	86,0	86,0	84,7	83,1	88,1	88,7	87,2	85,3	90,1	90,4	89,1	87,3	91,7	92,6	91,3	89,3
11	87,6	87,6	86,4	85,0	89,4	89,8	88,7	86,9	91,2	91,4	90,3	88,6	92,6	93,3	92,3	90,4
15	88,7	88,7	87,7	86,2	90,3	90,6	89,7	88,0	91,9	92,1	91,2	89,6	93,3	93,9	92,9	91,2
18,5	89,3	89,3	88,6	86,9	90,9	91,2	90,4	88,6	92,4	92,6	91,7	90,1	93,7	94,2	93,4	91,7
22	89,9	89,9	89,2	87,4	91,3	91,6	90,9	89,1	92,7	93,0	92,2	90,6	94,0	94,5	93,7	92,1
30	90,7	90,7	90,2	88,3	92,0	92,3	91,7	89,8	93,3	93,6	92,9	91,3	94,5	94,9	94,2	92,7
37	91,2	91,2	90,8	88,8	92,5	92,7	92,2	90,3	93,7	93,9	93,3	91,8	94,8	95,2	94,5	93,1
45	91,7	91,7	91,4	89,2	92,9	93,1	92,7	90,7	94,0	94,2	93,7	92,2	95,0	95,4	94,8	93,4
55	92,1	92,1	91,9	89,7	93,2	93,5	93,1	91,0	94,3	94,6	94,1	92,5	95,3	95,7	95,1	93,7
75	92,7	92,7	92,6	90,3	93,8	94,0	93,7	91,6	94,7	95,0	94,6	93,1	95,6	96,0	95,4	94,2
90	93,0	93,0	92,9	90,7	94,1	94,2	94,0	91,9	95,0	95,2	94,9	93,4	95,8	96,1	95,6	94,4
110	93,3	93,3	93,3	91,1	94,3	94,5	94,3	92,3	95,2	95,4	95,1	93,7	96,0	96,3	95,8	94,7
132	93,5	93,5	93,5	91,5	94,6	94,7	94,6	92,6	95,4	95,6	95,4	94,0	96,2	96,4	96,0	94,9
160	93,8	93,8	93,8	91,9	94,8	94,9	94,8	93,0	95,6	95,8	95,6	94,3	96,3	96,6	96,2	95,1
200	94,0	94,0	94,0	92,5	95,0	95,1	95,0	93,5	95,8	96,0	95,8	94,6	96,5	96,7	96,3	95,4
250	94,0	94,0	94,0	92,5	95,0	95,1	95,0	93,5	95,8	96,0	95,8	94,6	96,5	96,7	96,5	95,4
315	94,0	94,0	94,0	92,5	95,0	95,1	95,0	93,5	95,8	96,0	95,8	94,6	96,5	96,7	96,6	95,4
355	94,0	94,0	94,0	92,5	95,0	95,1	95,0	93,5	95,8	96,0	95,8	94,6	96,5	96,7	96,6	95,4
400	94,0	94,0	94,0	92,5	95,0	95,1	95,0	93,5	95,8	96,0	95,8	94,6	96,5	96,7	96,6	95,4
450	94,0	94,0	94,0	92,5	95,0	95,1	95,0	93,5	95,8	96,0	95,8	94,6	96,5	96,7	96,6	95,4
500 - 1000	94,0	94,0	94,0	92,5	95,0	95,1	95,0	93,5	95,8	96,0	95,8	94,6	96,5	96,7	96,6	95,4

3. DEGREES OF PROTECTION

IEC 60034-5 defines the degrees of protection provided by enclosures for rotating electrical machines.

EXAMPLE OF DESIGNATION

Characteristic letters (International Protection)	IP	X	X
First characteristic numeral			
Second characteristic numeral			

Motor	Degree of protection	First Numeral		Second Numeral
		Protection against contact	Protection against foreign bodies	Protection against water
Surface Ventilated	IP55	Complete protection against contact with live or moving parts	Dust protected. Ingress of dust is not totally prevented but dust can not enter in sufficient quantity to interfere with satisfactory operation of the motors	Protected against jets. Water projected by a nozzle against the motor from any direction shall not do any harmful effect.
	IP56			Protected against water from heavy seas.
	IP65		Dust tight. Ingress of dust is totally prevented	Water projected by a nozzle from any direction.

4. COOLING METHOD

Brief information on the cooling methods, specified in IEC 60034-6, is given below.

- Code letters (International Cooling)	IC	4	(A)*	1	(A)*	1
- Cooling circuit arrangement						
4: Frame surface cooled						
- Movement method of primary coolant						
1: Air circulation inside the motor						
- Movement method of secondary coolant						
0: Free convection via frame surface, without fan						
1: With the fan on the motor shaft (NDE side) via frame surface						
6: With an independent fan from the motor shaft (forced cooling)						
8: Cooling with driven fan by the motor itself						

* (A): This letter indicates the surrounding medium (A for air. W for water). For air cooled motors, A is omitted for simpler designation.

5. TYPES of CONSTRUCTION

Types of construction and mounting arrangements according to IEC 60034-7.

Foot Mounted Motors

Example Sketch						
Mounting Arrangements	IM B3 IM 1001	IM B6 IM 1051	IM B7 IM 1061	IM B8 IM 1071	IM V5 IM 1011	IM V6 IM 1031
Frame Size	80 - 355	80 - 355	80 - 355	80 - 355	80 - 355	80 - 355
Product Code (Position 13)	A	H	J	K	L	M

Flange Mounted Motors

Example Sketch						
Mounting Arrangements	IM B5 IM 3001	IM V1 IM 3011	IM V3 IM 3031	IM B14 IM 3601	IM V18 IM 3611	IM V19 IM 3631
Frame Size	80 - 355	80 - 355	80 - 315	80 - 160	80 - 160	80 - 160
Product Code (Position 13)	B	D	N	S	Y	Z

Motors without Foot and Endshield at D-End

Foot and Flange Mounted Motors

Example Sketch						
Mounting Arrangements	IM B9 IM 9101	IM V8 IM 9111	IM V9 IM 9131	IM B35 IM 2001	IM V15 IM 2011	IM B34 IM 2101
Frame Size	80 - 355	80 - 355	80 - 315	80 - 355	80 - 355	80 - 160
Product Code (Position 13)	F	P	R	C	E	T

6. LIMITS OF VIBRATION SEVERITY

The permissible vibration severities for electric motors are specified in standard IEC 60034-14. All motors from frame size 80 to 355 already meet or remain below the limit values specified for vibration severity grade A (normal). Vibration severity grade A is the standard version and is valid up to a rated frequency of 60 Hz. Vibration severity grade B can be supplied on request (code B01). For converter operation with frequencies higher than 60 Hz, special balancing is required for compliance with the specified limit values.

IEC 60034-14 recommends the following maximum vibration magnitude limits in terms of displacement, speed and acceleration for a frame size H:

Vibration Grade	Frame Size	80 ≤ H ≤ 132			132 < H ≤ 280			H > 280		
		Displacement µm	Velocity mm/s	Acceleration m/s ²	Displacement µm	Velocity mm/s	Acceleration m/s ²	Displacement µm	Velocity mm/s	Acceleration m/s ²
A	Free suspension	25	1,6	2,5	35	2,2	3,5	45	2,8	4,4
	Rigid mounting	21	1,3	2,0	29	1,8	2,8	37	2,3	3,6
B	Free suspension	11	0,7	1,1	18	1,1	1,7	29	1,8	2,8
	Rigid mounting	-	-	-	14	0,9	1,4	24	1,5	2,4

Based on ISO 8821, the key convention "half key (H)" must be used for balancing. All rotors are balanced dynamically with an inserted half-key in place. Upon request, it is possible to perform balancing with or without a full key (order code for full key balancing is B11, and without key is B12). Shaft fitments, such as couplings, pulleys, gears and fans must also be balanced likewise to prevent undue vibration and adverse effects on bearing life. A full feather is always inserted in the keyway on delivery.

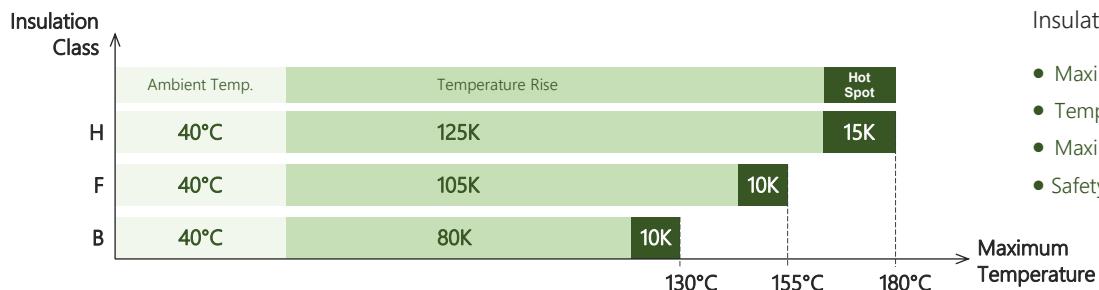
7. INSULATION SYSTEM

The insulation system applied in our motors ensures a high level of mechanical and electrical strength along with a very long motor life. The winding insulation is resistant against aggressive gasses, vapors, dust, oil and humid air. It helps the windings to withstand against vibration stress. This system accomplished by using mainly high grade enameled copper wires, insulating sheets, sleeves and solvent free impregnating epoxy resin.

All standard range motors are of class F (155°C) insulation with class B (80K) temperature rise which gives the product a 25°C safety margin. This reserve of temperature allows the motors to operate continuously at;

- Up to 15% above its rated outputs
- Up to 55°C ambient temperature at rated outputs
- Up to 3000m asl altitude at rated outputs

Furthermore, this temperature reserve permits the motor to withstand against greater voltage and frequency tolerances. The insulation life of the motor will extend if the safety margin is not utilized.



Insulation system in brief;

- Maximum temperature: 155°C
- Temperature rise: 80K
- Maximum ambient temperature: 40°C
- Safety margin: 35°C

8. VARIABLE SPEED DRIVES

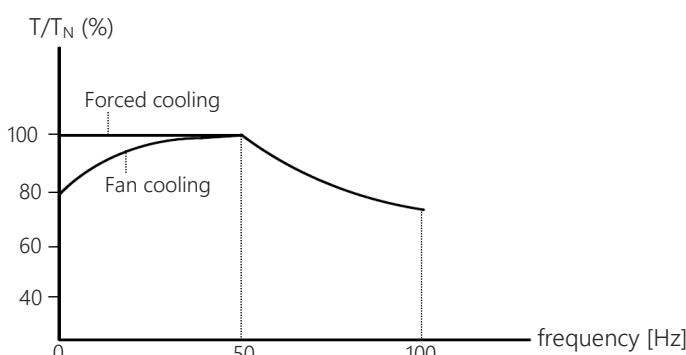
Squirrel cage induction motors used in industry and many other applications offer highly efficient, robust and reliable operation. The performance of motors having constant speed and starting DOL can be further improved when used with a frequency converter. The VSD enables to control the process accurately by adjusting the torque and speed. With a correct application of frequency converter, it is possible to increase the efficiency of the system and in some cases improve the capacity of the process by increasing the speed over nominal speeds.

With a VSD, it is possible to make smooth starting which helps to reduce significantly the stress on the motors and supply network.

Following points under related subtitles must be taken into consideration when motors are driven by frequency converter.

8.1. WINDING INSULATION

The output voltage waveform from a frequency converter is not fully sinusoidal. Further, harmonics will be produced in the inverter. This may affect the motor additional losses and increase the motor temperature rise. In this case, the motor must be correctly sized to compensate for the losses incurred. In addition to thermal dimensioning, an adequate torque margin must be maintained for stabilities which must be at least 30% higher than the load torque. However, standard production of Omega Motors which are IE3 premium and IE4 super premium efficiency motors, may be enough to maintain the torque and output requirements over the whole duty range without the need to oversize the motor as the temperature rise is considerably reduced due to the lower losses.

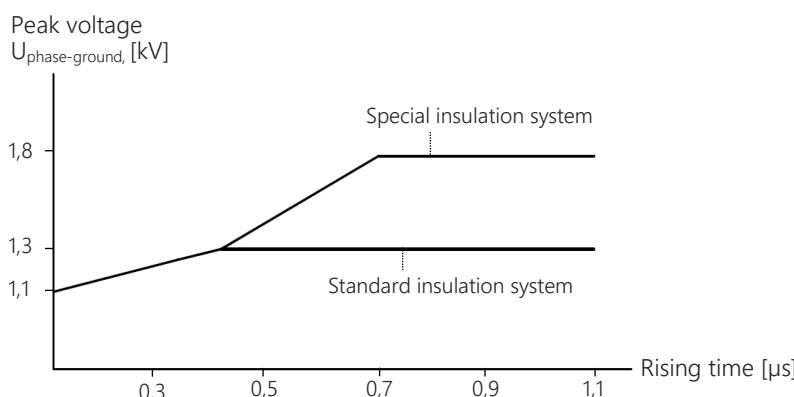


The adjacent figure gives an idea about the thermal capacity of a motor. Mechanical speed limits should be taken into consideration during the operation above nominal speeds.

Standard design induction motors of Omega Motor are capable of working with frequency converters up to 500V supply voltage without any special design. However, limit values for peak voltages and voltage rising time must be taken into consideration. Limit values for standard design motors are:

- Peak voltage $U_{\text{phase-ground}} \leq 1100 \text{ V}$
- Voltage rising time $t_s > 0.1 \mu\text{s}$

The voltage peaks at the motor terminals are mainly caused by converter switching frequency and cabling between the converter and motor. It is recommended not to exceed 5kHz switching frequency in order to protect the insulation system of the motor. In case the maximum allowed phase-to-ground ($U_{\text{phase-ground}}$) voltage peaks in motor terminals as a function of pulse rise time (t_s) shown in the figure below are exceeded, a special insulation system with Y02 Code must be inquired. However, if this condition can not be satisfied, filters must be used.



Maximum peak voltage (phase-ground) as a function of rising time.

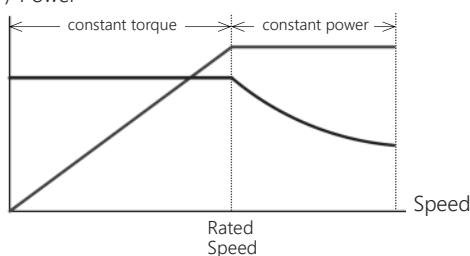
8.2. COOLING

When the motor is operated at low speeds, the cooling capacity of the fan fitted on its shaft will decrease in a proportion, with the speed.

In variable torque loads, when the torque is reduced with decreasing speed, such as with centrifugal pumps and fans, this reduction in cooling air often stays in balance with the reduction in motor losses as the load is reduced with speed. In constant torque loads, the motor's temperature rise limits will likely to be exceeded if the low-efficiency motor is being used in which case a forced ventilation must be considered. However, IE3 premium efficiency and IE4 super premium efficiency motors generate less heat which means they have a higher thermal reserve and may not need forced ventilation but of course this depends on the extent of the speed reduction.

In high speed applications due to magnetic field weakening , the motor torque will reduce and can only supply constant power. The output of the motor will remain constant to a certain extent depending on the breakdown torque and then will start to reduce as illustrated in below figures.

Torque / Power



When the motor is operated in high speed (higher than 60Hz operation) standard fan will generate more noise and friction&windage losses will increase. In such cases forced ventilation is strongly recommended to prevent additional friction&windage losses and noise problem.

When placing the order, operating conditions must be stipulated.

8.3. BEARING LIFE - LUBRICATION

Bearing temperature varies as a function of motor load and speed, in variable speed applications. The ideal way to determine the bearing life expectancy of permanently lubricated bearings of frame sizes 80 to 225 and lubrication intervals for the re-greaseable bearing of frame sizes 250 to 355 is best done by measuring the bearing temperature during motor operation. Please note that the lubrication periods and grease amount will be different for variable speed applications than that given in the technical catalog and motor label.

Bearing temperature of motors that are operated above their nominal speed will be higher due to friction and the lifetime of permanently lubricated bearings and lubrication period of re-greaseable bearings will become shorter.

8.4. MECHANICAL SPEED LIMITS

The permissible mechanical speed limits of Omega Motors are given at the following table. The speed limits of the bearings, critical rotor speeds and rigidity of the rotating parts determines the maximum mechanical speeds. Please note that operation at speeds higher than nominal speed may cause higher mechanical vibrations.

Frame Size	2 Pole	4 Pole	6 Pole	8 Pole	Frame Size	2 Pole	4 Pole	6 Pole	8 Pole
80	4500	4500	4500	-	200	4500	4500	4500	4500
90	4500	4500	4500	-	225	3600	3600	3600	3600
100	4500	4500	4500	-	250	3600	3600	3600	3600
112	4500	4500	4500	-	280	3600	3600	3600	3600
132	4500	4500	4500	4500	315	3600	2300	2300	2300
160	4500	4500	4500	4500	355	3600	2300	2300	2300
180	4500	4500	4500	4500	-	-	-	-	-

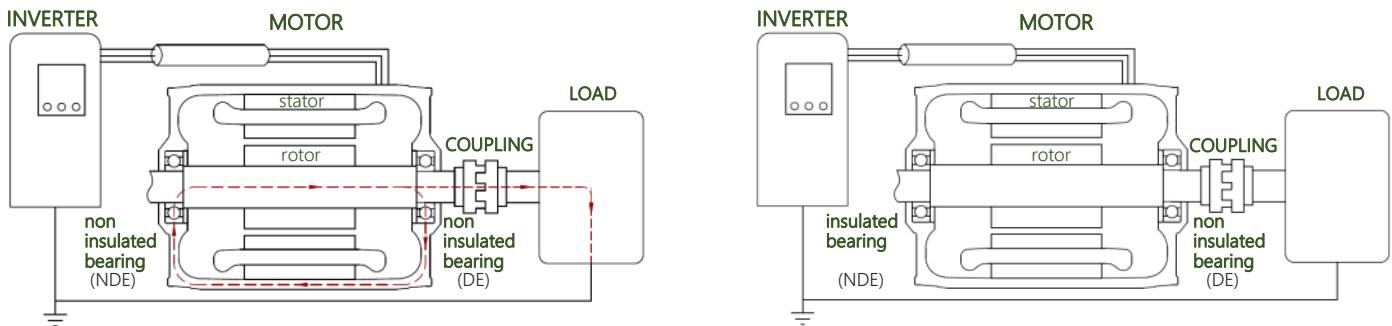
8.5. BEARING CURRENTS

The rapid switching in modern AC frequency converters may generate high-frequency current pulses which tend to complete their path through the motor bearings. If the energy of these pulses is high enough, this can lead to a damage on the bearings. The induced voltage on the shaft will overcome the dielectric of the lubricant in the bearing and hence cause bearing discharges known as Electrical Discharging Machining EDM effect that causes destructive pitting and damage on the bearing raceway. Beside the rise time, the cable length is a predominant factor influencing the voltage peaks occurrence at the inverter fed motor terminals. Therefore, shortening the cable length between the motor and the drive and/or using a symmetrical shielded cable will help to reduce the radiated emission through the motor cables in the Radio Frequency range (RF).

For motors lower than 100kW, the effects are usually minimal, and no additional provision needed to be made. However, for motors with an output higher than 100kW the effects become more noticeable and following additional provisions need to be made in order to eliminate the harms of bearing currents:

- Using an insulated bearing at Non-drive end side.
- Insulating the Non-drive end shield and components contacting the bearing.
- Using Drive-end grounding brush.

Using common-mode filters at the output of the inverter will avoid bearing currents. When placing the order, please specify if the motor is to be driven by a frequency converter.



9. TOLERANCES

According to IEC 60034-1, the following tolerances are permissible:

Parameters	Tolerances
Efficiency (η) (when determined indirectly)	
-Motors $P_N \leq 150\text{kW}$	- $0,15 \times (1-\eta)$
-Motors $P_N > 150\text{kW}$	- $0,1 \times (1-\eta)$
Power factor ($\cos\phi$)	$1/6 (1 - \cos\phi)$ minimum absolute value: 0,02 maximum absolute value: 0,07
Total losses (applicable for machines with rated outputs $> 150\text{kW}$)	+10% of the total losses
Slip (s)	
Motors $P_N < 1\text{kW}$	$\pm 30\%$ of the slip
Motors $P_N \geq 1\text{kW}$	$\pm 20\%$ of the slip
Locked rotor current (I_A)	+20% (without lower limit)
Locked rotor torque (T_A)	+25%* of the torque -15% of the torque
Breakdown torque (T_K)	-10% (M_K/M_N still at least 1.6 after application of this tolerance)
Moment of inertia (J)	$\pm 10\%$
Noise level (sound pressure level at measuring surface)	+ 3 dB (A)

These tolerances are applicable to the warranted values for three-phase asynchronous motors, taking into account necessary manufacturing tolerances and possible deviations in the raw materials used.

* + 25% may be exceeded by agreement

10. MECHANICAL DESIGN

10.1. FRAME, ENDSHIELDS AND FLANGES

Frame Size	80	90	100	112	132	160	180	200	225	250	280	315	355
Frame	Aluminium				Aluminium or Cast Iron				Cast Iron				
End shields (DE/NDE Sides)	Aluminium				Aluminium or Cast Iron		Cast Iron						
Flange (B5)	Aluminium				Cast Iron				Cast Iron				
Flange (B14)	Aluminium			Cast Iron		—							
Flange (B14-2)	Aluminium			Cast Iron		—							

10.1.1. ALUMINIUM FRAME

The motor frames are made of pressure die cast aluminium alloy from frame size 80 to 225. Frame sizes 80 to 112 have both integral and removable feet construction where terminal box is located on top in both versions. Frame sizes 132 to 225 are multi mount frames having removable/bolt-on feet and allows the motor to be left, right or top terminal box mounting position. All removable feet are made of pressure die cast aluminium alloy. Multi mount frame motors are available on top terminal box position as standard. Please inquire if left or right terminal box position is required.

10.1.2. CAST IRON FRAME

The motor frames are made of cast iron from frame size 160 to 355. All cast iron frames are available as with feet and without feet. Frame with feet has a solid and integrated cast feet which provide greater strength. The terminal box is always located on top as standard.

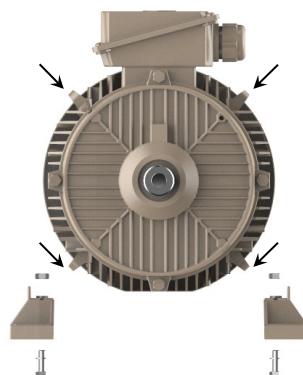
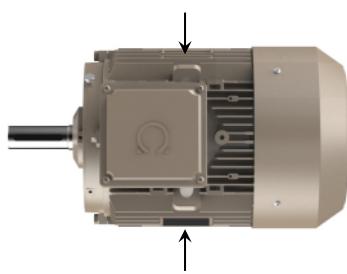
The cast iron frame produced of GG20 is capable to withstand against high mechanical impacts and strengths and reduce mechanical vibrations. Its unique fin design provide maximum heat dissipation and ensures excellent thermal performance of the motor.

10.2. LIFTING LUGS

Eye bolts, lifting lugs or lifting openings, if provided, are intended only for lifting the motor. These lifting provisions should never be used when lifting or handling the motor and driven ancillary equipment together. Please refer to "Motor Installation and Maintenance Guide" for further information.

To facilitate lifting to the different mounting positions, the motors have multiple points where lifting lugs are available or eyebolts can be fitted.

No lifting facility is provided in frame size 80 to 112 motors. Four lifting lugs integral with aluminium frame are available in frame size 132 to 225 motors. Once feet are bolt on the frame, two lifting lugs opposite to each other can be used to lift the horizontal motor no matter if the terminal box is on top, right or left position. Furthermore, two optional points are available for fitting DIN580 eyebolts in aluminium frame motors from frame size 160 to 225 which has to be inquired with an option code of X06.

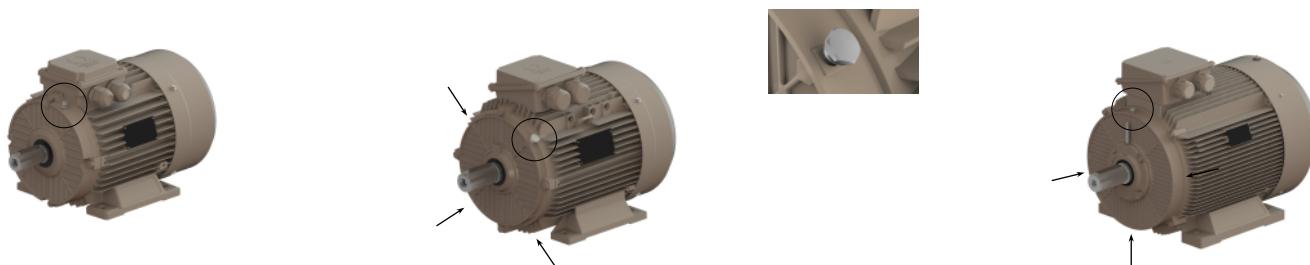


Two lifting lugs integral with cast iron frame are available in frame sizes 160, 180, 200 and 225. Moreover, two additional points are available for fitting DIN580 eyebolts, one top (demand code X04) and the other one bottom (demand code X05). One DIN580 eyebolt fitted on top for frame size 250 to 355 as standard. One additional DIN580 eyebolt can be fixed bottom when needed and it has to be inquired with an option code X05.



10.3. VIBRATION MEASURING POINTS AND NIPPLES

There is one flat area on the drive and non drive end of the motors from frame size 80 to 112, for better placement of accelerometer or vibration tester. Motors of frame size 132 to 355 have four of these flat areas on both ends. Measuring nipples for SPM shock pulse measurement are optionally possible to check the bearings.



10.4. EXTERNAL FINISH

Omega Motors are protected with a range of surface finishes as shown below.

Surface	Parts	Treatment
Cast Iron	End shields, Housing	Shot blasting + Primer
Steel	Fan Cover	Zinc galvanized
Aluminium alloy	Housing, End shields, Terminal boxes, Bearing caps	Shot blasting
Polymer	Ventilation fans	None

Standard paint system of Omega Motor

Motors	Atmosphere	Applications	Corrosivity Category Acc. to ISO 12944-2
80 to 112 Aluminium Frame	Non-harsh and not very harsh (indoors, industrial)	Solvent-based acrylic paint	C3
132 to 225 Aluminium Frame	Moderately corrosive, humid and outdoors (temperate climate)	2 pack (water based) Epoxy top coat 50µm	C3
160 to 355 Cast Iron			

Omega motor standard paint color reference:

RAL
1019

10.6. SHAFT EXTENSION

All standard design motors are produced with one shaft extension and fitted with a proper shaft key in accordance with IEC 60072-1. Motors with second standard shaft extension can be delivered upon request with special order code M30. The shaft ends have a 60° center hole to DIN332, Part 2 with M5 to M24 tapped hole depending on the shaft diameter.

10.5. COOLING

All standard motors are totally enclosed and fan cooled (TEFC)-IC411 as per IEC 60034-6. Motors frame size 80 to 355 have radial flow fan, fitted on the non-drive end shaft of the motor and operate regardless of the direction of rotation. The air flows from the non-drive end (NDE) to drive end (DE) direction. Totally enclosed non-ventilated (TENV) – IC410, totally enclosed air over (TEAO) – IC418 and totally enclosed forced ventilated (TEFV) – IC416 versions are also available on request.

The standard fan impeller is made out of plastic. Where necessary, metal fan impeller can also be supplied on request. The fan covers of all motors are made of sheet metal by drawing to its final shape.

For motors having vertical shaft extension pointing upwards, the end user must prevent, ingress of fluid along the shaft. Downwards, a protective cover (canopy) is recommended. When the motors are installed outdoors, over a long period of time, they must be protected with a sort of cover against direct intensive solar radiation, rain, snow, ice or dust.

When the motor is mounted to a place where the air intake is restricted, it must be ensured that minimum clearance is maintained between the fan cover and the restricted element. This restriction may be caused either by a wall or any adjacent part fitted on the non-drive end shaft of the motor like flywheels or large hand wheels. Recommended minimum clearance between the wall and fan cover;

Frame Size	80	90	100	112	132	160	180	200	225	250	280	315	355
Clearance [mm]	25		30			45		60		90		110	

10.8. DRAIN HOLES

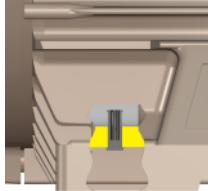
There are drain holes at both ends of the frame for drainage of water that may condense inside of the enclosure.

These drain holes are situated underneath of the frame as standard for horizontal mounting arrangement where the terminal box is on top. Condensation drain holes can also be implemented in motors designed for vertical operation (shaft up or down), feet located on side or top provided that it is inquired with the order. Motors with a protection degree of IP55 are delivered with plugs closed. It is advisable to periodically open the drain plugs in order to ensure that the condensed water drains out. When opened, the enclosure degree of protection will reduce to IP44.

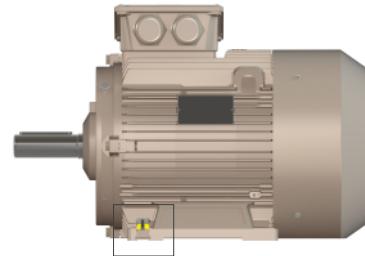
The open and closed positions of drain plugs are illustrated below.



Drain hole open position.



Drain hole is close position



- Location of drain hole depends on motor's mounting arrangement and frame material.
These pictures are given for IM B3, aluminium frame motors.

10.10. CABLE GLAND

Cable entry to the terminal box is maintained by means of polyamide cable glands produced according to DIN EN 62444 and sealed with IP68 protection degree. Motors from frame size 80 and 90 have one and motors of frame sizes 100 and 112 have two snap-in glands and are fitted on right when viewed from drive end shaft extension. Motors from frame size 132 to 355 have two glands with thread and are fitted on right when viewed from drive end shaft extension.

Frame Size	80	90	100	112	132	160	180	200	225	250	280	315	355
Cable Glands	1 x M25		2 x M25		2 x M32	2 x M40		2 x M50		2 x M63			
Max. Cable Outer Diameter [mm]	Ø18		Ø18		Ø25	Ø32		Ø39		Ø46			
Min. Cable Outer Diameter [mm]	Ø10		Ø10		Ø12	Ø18		Ø27		Ø33			

10.7. ANTI-CONDENSATION HEATING ELEMENTS

Heating elements are used to protect the windings of the motor against condensation. The use of anti-condensation heaters are recommended for motors installed in highly humid environments and left idle for long periods or for motors that are subjected to widely fluctuating temperatures. The supply voltage for anti-condensation heaters must be defined by the customer. It can be either 115V (demand code H01) or 230V (demand code H02).

Anti-condensation heaters must be energized when the motor is switched off and de-energized when the motor is switched on.

An additional M16 cable gland is provided for the connecting cable in the terminal box.

The power rating and number of anti-condensation heaters corresponding to the frame sizes are indicated in the below table:

Frame Size	80	90	100	112	132	160	180	200	225	250	280	315	355
No. of Heaters x Output Power	2 x 20W			2 x 30W			2 x 40W			2 x 60W			

Instead of anti-condensation heaters, another alternative is to apply a low voltage that is approximately 5 to 10% of motor rated voltage to stator terminals U1 and V1 by means of auto-transformer. After the motor is de-energized 20% to 30% of the motor rated current will be enough to heat the motor.

10.9. TERMINAL BOX

The terminal box of all frame sizes is made of high pressure die-cast aluminium alloy and positioned towards the drive end of the motor. This arrangement improves the air flow over the cooling fins, and reduces the motor operating temperature.

From frame size 132 to 355, it is diagonally split for easier access and handling of leads and connections. It allows cable entry from both sides simply by rotating the terminal box 180°.

From frame size 80 to 112, terminal box is integrally cast with the aluminium motor frame. Cable entry is maintained by means of readily fit snap-in cable gland. It also permits cable entry from opposite side by removing the aluminium knockout.

All motors from frame size 80 to 355 are provided with earth terminal on the frame inside the terminal box.

Accessory terminals are assembled on connectors whenever the motor is supplied with thermistors, thermostats, PT100 monitoring sensors or anti-condensation heaters. A M16 cable gland is fitted for the incoming connection leads.

The motor terminal block is made from thermoplastic material duly reinforced with fiber glass. It has six terminals with sizes given below.

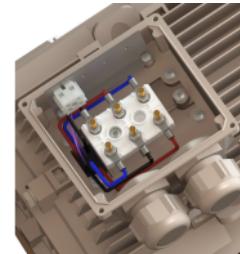
Frame Size	80	90	100	112	132	160	180	200	225	250	280	315	355
Terminal Size	M4 x 12			M5 x 15	M6 x 24			M8 x 28	M10 x 24			M12	

*External earth terminal is standard for frame size 250 to 355 motors. It is located on the foot.

For **80 to 112** frame sizes terminal box, terminal and cable outputs are shown above.



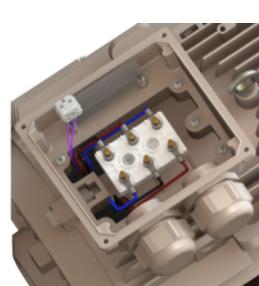
For **132** frame size terminal box, terminal and cable outputs are shown above.



For **315 and 355** frame sizes terminal box, terminal and cable outputs are shown above.



For **160 to 280** frame sizes terminal box, terminal and cable outputs are shown above.



10.11. BEARINGS

The standard bearing configuration of Omega Motor is single row deep groove ball bearings. The maximum permissible radial and axial forces are given at pages 20 to 23. Reinforced design with cylindrical roller bearing at DE should be considered in applications where high radial load is available and exceeding the values given for standard design at page 20. Roller bearings are suitable for belt and pulley applications. When high axial loads greater than the values given for standard design at pages 21, 22 and 23 are available, then angular contact ball bearing should be used. When ordering a motor with an angular contact ball bearing, specify also the method of mounting and the direction and magnitude of axial force.

Frame Size	Number of Poles	Standard design Deep groove ball bearing			Reinforced design for high radial forces NU bearing at DE			Reinforced design for high axial forces Angular contact ball bearing at DE									
		Drive end (DE) bearing	Non-drive end (NDE) bearing	Fig. No.	Drive end (DE) bearing	Non-drive end (NDE) bearing	Fig. No.	Drive end (DE) bearing	Non-drive end (NDE) bearing	Fig. No.							
80	2 to 8	6204 ZZ CM		1	-		-	-	-	-							
90	2 to 8																
100	2 to 8																
112	2 to 8																
132	2 to 8																
160	2 to 8	6309 ZZ C3	6209 ZZ C3	2	NU 309 E / CN	6309 C3	-	6309 C3	7309 B	-							
180	2 to 8	6310 ZZ C3	6210 ZZ C3														
200	2 to 8	6312 ZZ C3	6212 ZZ C3														
225	2 to 8	6313 ZZ C3	6213 ZZ C3														
250	2 to 8	6315 C3		3	NU 310 E / CN	6310 C3	-	6310 C3	7310 B	-							
280	2 to 8	6316 C3															
315	2																
315	4 to 8	6319 C3		4	NU 312 E / CN	6312 C3	-	6312 C3	7312 B	-							
355	2																
355	4 to 8	6322 C3			NU 313 E / CN	6313 C3	-	6313 C3	7313 B	6							
					NU 315 E / CN	6315 C3	-	6315 C3	7315 B								
					NU 316 E / CN	6316 C3	-	6316 C3	7316 B								
					NU 319 E / CN	6319 C3	-	6319 C3	7319 B								
					NU 322 E / CN	6322 C3	-	6322 C3	7322 B								

Standard design with deep groove ball bearings

From frame size 80 to 225, the motors are fitted with double shielded (ZZ) deep groove ball bearings which are factory grease packed for life. Motors of frame size 250 to 355 have open type single row deep groove ball bearings and are equipped with greasing nipples for re-lubrication during operation.

Motors from frame size 80 to 132 have floating bearings at both drive end and non-drive end (see Fig.1). On request, axially-secured located bearing can be supplied on the drive end (DE) complete with a retaining ring to avoid the play of the shaft.

The non-drive end bearings of motors from frame size 160 to 225 are axially located with a retaining ring (see Fig.2). From frame size 250 upwards, the located bearing is axially secured at drive end with a bearing cap (see Fig.3 and Fig.4).

Motors from frame size 160 to 225 can be supplied with NDE bearing upgraded to the size of DE bearing on request with the configuration of Fig.2.

In frame sizes 160 to 225, if required, the drive end (DE) bearing can be located with a retaining ring. A located bearing at the drive end (DE) is recommended when gearing is installed or pumps and fans are mounted directly on the motor shaft.

To compensate for any axial movement of the shaft, the motors are fitted with pre-load washers up to frame size 225 at DE and frame sizes 250 and 280 at NDE. Motors of frame size 315 and 355 have pre-load springs located at NDE (see Fig.4).

Reinforced design with NU cylindrical roller bearing

Reinforced design with NU cylindrical roller bearing is recommended for belt and pulley application in cases where the permissible radial force values given for standard deep groove ball bearing design at page 20 is not enough.

Motors from frame size 160 upwards can be supplied with cylindrical roller bearings. The non-drive end (NDE) bearing is located and the axial movement is compensated by the axial play of the drive end (DE) roller bearing. (see Fig.5)

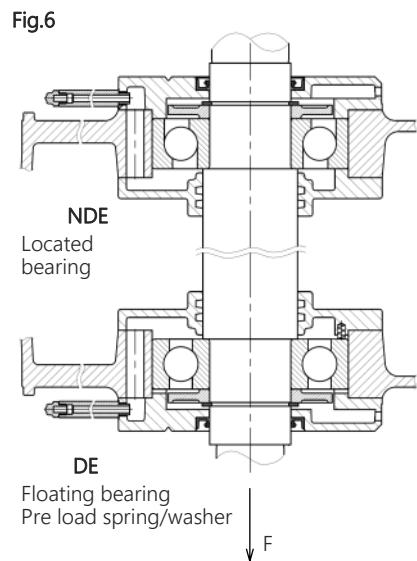
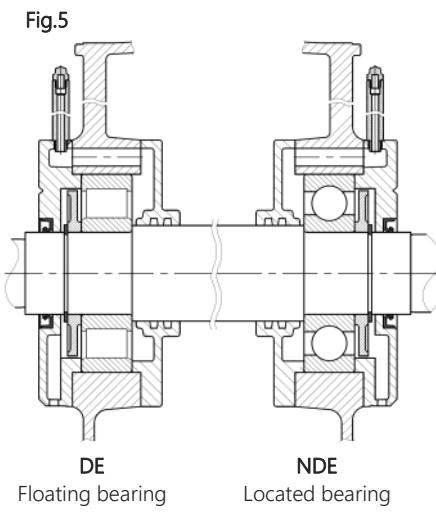
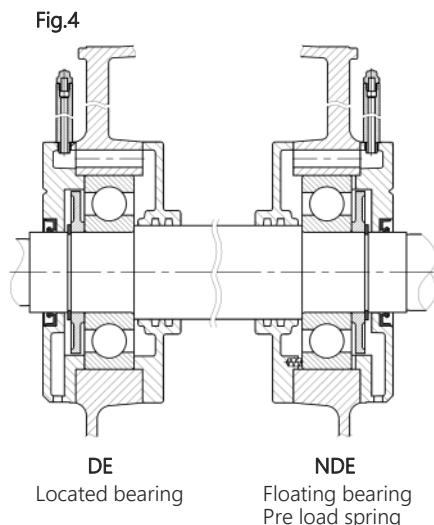
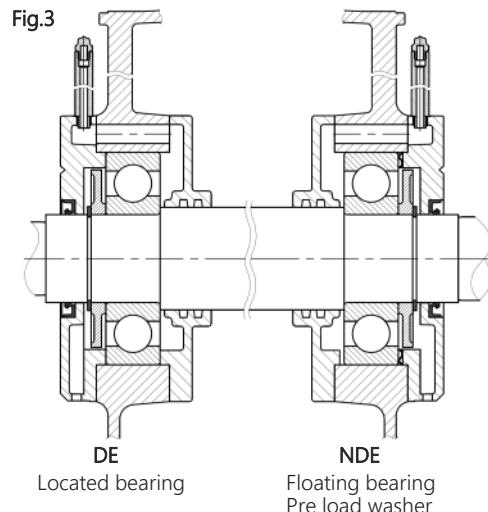
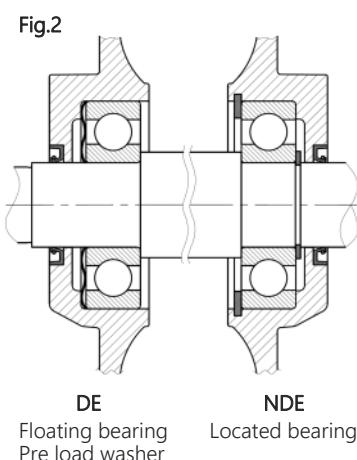
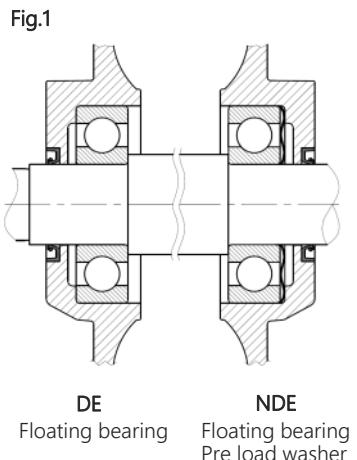
For NU cylindrical roller bearings, in contrast to ball bearings, a minimum radial force is required to ensure proper operation. Cylindrical roller bearings are not suitable for coupling arrangement and high speed operation.

Reinforced design with angular contact ball bearing

Reinforced design with angular contact ball bearing is recommended for applications where the permissible axial force values given at pages 21, 22 and 23 is not enough. When ordering a motor with an angular contact ball bearing, specify also the method of mounting, direction and magnitude of axial force.

Motors from frame size 160 upwards can be supplied with angular contact ball bearings. The non-drive end (NDE) bearing is located and the axial movement is compensated by the pre-load washers/springs at drive end (DE). (see Fig.6)

Motors with roller bearings or angular-contact ball bearings are fitted with a transport lock before dispatch to prevent damage to bearings during transport. The transport lock must be removed before operation.



10.11.1. BEARING LIFETIME AND LUBRICATION

The lifetime of a bearing is expressed as the number of revolutions or the number of operating hours at a given speed that the bearing can accomplish before the first sign of metal fatigue (spalling) begins to appear on a raceway of the inner or outer ring or a rolling element.

The nominal bearing lifetime L_{10h} as defined in ISO 281 is the life that 90% of a sufficiently large group of apparently identical bearings can be expected to reach or exceed when operating under conventional conditions, i.e. after a stated amount of time 90% of a group of identical bearings will not yet have developed metal fatigue. The majority of bearings last much longer than the nominal lifetime; the average lifetime achieved or exceeded by 50% of bearings is around 5 times longer than the nominal lifetime.

Generally, the lifetime of the bearing is dependent on its type and size, the radial and axial mechanical loads it is submitted to, operating conditions (environment, temperature, mounting orientation), rotational speed and grease life. Therefore, bearing lifetime is closely related to its correct use, maintenance and lubrication. A bearing lifetime calculation is possible on request.

The approximate bearing life of four-pole motors at 50 Hz operation with horizontal mounting is about 40000 hours if there is no additional axial or radial forces when direct coupled to the load and 20000 hours when utilized according to the maximum admissible loads given in pages 20 to 23. The nominal bearing lifetime is reduced for converter operation at higher frequencies.

10.11.1.1. Motors with bearings greased for life

Motors in frame size 80 to 225, are fitted with double shielded (ZZ) deep groove ball bearings which are factory grease packed for life. The bearing grease lifetime is matched to the bearing lifetime. This can, however, only be achieved if the motor is operated in accordance with the catalog specifications.

10.11.1.2. Motors with relubrication nipples

Motors in frame size 250 to 355 have open type single row deep groove ball bearings and are equipped with greasing nipples for re-lubrication during operation. On request, motors in frame size 160 to 225 can be equipped with greasing nipples. In aluminium frame motors, both DE and NDE end shields will be cast iron if regreasing facility is requested.

Bearings are lubricated with high quality grease containing lithium soap (thickener) and mineral oil (base).

The quantity of grease and lubrication intervals are stamped in the motor nameplate. The lubrication intervals are shown in table below. It must be emphasized that excessive lubrication, i.e. a quantity of grease greater than that recommended in below table and on the motor nameplate, can result in the increase of bearing temperatures leading to reduced operating hours. Respecting the quantity of grease and lubrication intervals allows bearings to reach the lifetime given.

High speeds that exceed the rated speed with converter operation and the resulting increased vibrations alter the mechanical running smoothness and the bearings are subjected to increased mechanical stress. This reduces the grease lifetime and the bearing lifetime.

Lubrication intervals for deep groove ball bearing

Frame Size	Grease Amount		Lubrication Intervals (hour)			
	Drive end (DE) Bearing	Non-drive end (NDE) Bearing	2 Pole 3000 rpm	4 Pole 1500 rpm	6 Pole 1000 rpm	8 Pole 750 rpm
	g	g	hour	hour	hour	hour
160	12	12	8500	16000	20000	22000
180	15	15	7500	15000	19000	21000
200	20	20	6000	13000	17000	20000
225	23	23	5000	12000	16500	19000
250	30	30	4000	11000	15000	18000
280	33	33	3500	10000	14500	17000
315	33	33	2500	-	-	-
315	45	45	-	8500	13000	16000
355	45	45	2000	-	-	-
355	60	60	-	6500	11000	14000

Lubrication intervals are given above for both standard design housing and alternative design housing against over axial forces.

Lubrication intervals for roller bearing

Frame Size	Grease Amount		Lubrication Intervals (hour)			
	Drive end (DE) Bearing	Non-drive end (NDE) Bearing	2 Pole 3000 rpm	4 Pole 1500 rpm	6 Pole 1000 rpm	8 Pole 750 rpm
	g	g	hour	hour	hour	hour
160	12	12	3000	8000	11000	13000
180	15	15	2500	7500	10000	12000
200	20	20	1900	6000	9000	11000
225	23	23	1600	5500	9000	11000
250	30	30	1100	4500	7500	10000
280	33	33	900	4000	7000	9000
315	33	33	500	-	-	-
315	45	45	-	3300	6000	8000
355	45	45	300	-	-	-
355	60	60	-	2300	4500	6500

10.11.2. PERMISSIBLE RADIAL FORCES

In pulley and belt couplings, the drive shaft carrying the pulley is subjected to a radial force F_r applied at a distance X (mm) from the shoulder of the shaft extension (length E). The line of force (i.e. the centerline of the pulley) of the radial force must lie within the free shaft extension (dimension x).

The radial force F_r expressed in N applied to the drive shaft is found by the formula.

$$F_r = 1,9 \cdot \frac{P \cdot k}{D \cdot n} \cdot 10^7$$

F_r = Radial force in N

n = rated motor speed in rpm

P = Rated motor power (transmitted power) in kW

D = Pulley diameter in mm

k = Belt tension factor, dependent on belt type and type of duty

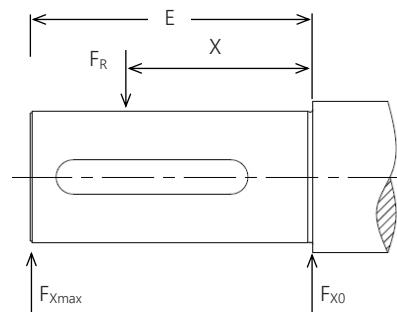
The belt tension factor k is a value gained from experience from the belt manufacturer. The following approximate value can be assumed:

- $k = 1$ to 1.5 for toothed belts
- $k = 2$ to 2.5 for V-belts
- $k = 2.5$ to 3 for flat belts with tensioner
- $k = 3$ to 4 for flat belts without tensioner

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:

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

Where E stands for length of the shaft extension in the standard version



The following table shows permissible radial forces on the shaft in Newton, assuming zero axial force ($F_a=0$), 20 000 hours bearing life and 50 Hz operation. Please consult for values at 60 Hz. operation.

Standard design with deep groove ball bearing ($F_a = 0$)

Pole Number	2 Pole			4 Pole			6 Pole			8 Pole		
Frame Size	F_{x0}	F_{xmax}	Shaft Extension									
			E			E			E			E
	N	N	mm									
80	710	588	40	893	739	40	-	-	-	-	-	-
90	792	648	50	996	816	50	-	-	-	-	-	-
100	1095	877	60	1375	1101	60	-	-	-	-	-	-
112	1094	887	60	1376	1115	60	-	-	-	-	-	-
132	1610	1275	80	2000	1580	80	2300	1820	80	2530	2000	80
160	3000	2400	110	3750	3000	110	4300	3440	110	4730	3785	110
180	3500	2840	110	4370	3540	110	5045	4090	110	5570	4515	110
200	4580	3820	110	5700	4750	110	6600	5500	110	7280	6070	110
225	5095	4270	110	6400	5145	140	7430	5970	140	8230	6610	140
250	6175	5060	140	7760	6365	140	9035	7410	140	9995	8195	140
280	6570	5525	140	8130	6835	140	9545	8025	140	10580	8895	140
315	5879	5063	140	8361	7165	170	9759	8364	170	10982	9412	170
355	6650	5700	170	12000	10000	210	14000	11500	210	15700	12300	210

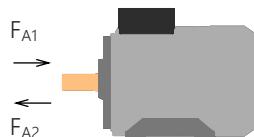
Reinforced design with NU cylindrical roller bearing ($F_a = 0$)

Pole Number	2 Pole			4 Pole			6 Pole			8 Pole		
Frame Size	F_{x0}	F_{xmax}	Shaft Extension									
			E			E			E			E
	N	N	mm									
160	7505	6000	110	9200	7360	110	10400	8315	110	11330	9060	110
180	8430	6830	110	10330	8370	110	11700	9485	110	12775	10350	110
200	11490	9580	110	14070	11730	110	15955	13300	110	17410	14515	110
225	13637	11437	110	16765	13470	140	19025	15280	140	20780	16700	140
250	18075	14820	140	22220	18220	140	25230	20685	140	27545	22585	140
280	19340	16265	140	23645	19880	140	26920	22640	140	29410	24734	140
315	18202	15676	140	29668	25427	170	33660	28847	170	36910	31630	170
355	24100	20700	170	38600	31800	210	43700	36000	210	47900	39500	210

10.11.3. PERMISSIBLE AXIAL FORCES

The following table shows permissible axial forces on the shaft in Newton, assuming 20 000 hours bearing life and 50 Hz operation. Please consult for values at 60 Hz. operation.

10.11.3.1. HORIZONTAL MOUNTING



Standard design with deep groove ball bearing

Pole Number	2 Pole			4 Pole			6 Pole			8 Pole		
F _R = 0	F _R = max F _{X0} F _{Xmax}	F _R = 0	F _R = 0	F _R = max F _{X0} F _{Xmax}	F _R = 0	F _R = 0	F _R = max F _{X0} F _{Xmax}	F _R = 0	F _R = 0	F _R = max F _{X0} F _{Xmax}	F _R = 0	
N	N	N	N	N	N	N	N	N	N	N	N	
80	390	343	289	150	573	505	431	150	-	-	-	-
90	429	385	320	160	626	562	477	160	-	-	-	-
100	583	525	421	220	846	764	639	220	-	-	-	-
112	580	525	426	220	843	764	645	220	-	-	-	-
132	1050	970	840	1650	1475	1365	1190	2075	1814	1685	1465	2415
160	1155	1045	800	1655	1585	1435	1135	2085	1935	1740	1375	2435
180	1380	1260	990	1900	1880	1710	1380	2400	2300	2090	1650	2820
200	2065	1895	1595	2565	2760	2545	2175	3255	3340	3075	2615	3840
225	2345	2140	1815	2905	3160	2910	2420	3720	3835	3520	2915	4395
250	5305	2805	2805	4765	6890	3625	3625	6350	8150	4220	4220	7610
280	5495	2930	2930	5000	7125	3805	3805	6625	8445	4430	4430	7945
315	5290	2928	2929	4730	7869	4430	4430	7270	9252	5147	5147	8652
355	6000	3400	3400	5400	10300	5630	5630	9700	1250	6600	6600	11500

Reinforced design with NU cylindrical roller bearing

Pole Number	2 Pole			4 Pole			6 Pole			8 Pole		
F _R = 0	F _R = max F _{X0} F _{Xmax}	F _R = 0	F _R = 0	F _R = max F _{X0} F _{Xmax}	F _R = 0	F _R = 0	F _R = max F _{X0} F _{Xmax}	F _R = 0	F _R = 0	F _R = max F _{X0} F _{Xmax}	F _R = 0	
N	N	N	N	N	N	N	N	N	N	N	N	
160	2445	2165	1570	2445	3210	2835	2105	3210	3825	3355	2790	3825
180	2830	2520	1900	2830	3710	3310	2540	3710	4420	3930	3015	4420
200	3690	3270	2535	2690	4815	4295	3380	4815	5735	5095	4015	5735
225	4160	3625	2795	4160	5460	4810	3505	5460	6505	5710	4215	6505
250	5050	4290	3110	5050	6630	5715	4135	6630	7895	6780	4985	7895
280	5260	4600	3495	5260	6890	6090	4595	6890	8215	7235	5550	8215
315	4878	3994	3108	5378	7638	6357	4770	7638	9025	7610	5700	9025
355	5700	5000	4000	5700	10100	9330	7380	10100	11940	10800	7800	11940

10.11.3.2. VERTICAL MOUNTING



Standard design with deep groove ball bearings

Frame Size	Pole Number	Shaft Down						Shaft Up					
		F _{A1}			F _{A2}			F _{A1}			F _{A2}		
		F _R = max F _{X0}	F _R = 0 F _{Xmax}	N	F _R = max F _{X0}	F _R = 0 F _{Xmax}	N	F _R = max F _{X0}	F _R = 0 F _{Xmax}	N	F _R = max F _{X0}	F _R = 0 F _{Xmax}	N
80	2	369	316	416	135	135	135	324	271	371	165	165	165
	4	541	467	609	125	125	125	479	405	547	170	170	170
90	2	426	362	470	135	135	135	355	291	399	180	180	180
	4	618	532	683	125	125	125	522	436	587	190	190	190
100	2	591	489	649	190	190	190	481	379	539	255	255	255
	4	850	724	933	165	165	165	703	577	786	265	265	265
112	2	607	509	662	175	175	175	471	373	526	265	265	265
	4	877	756	957	150	150	150	693	572	773	290	290	290
132	2	1120	990	1200	1450	1325	1530	850	720	930	1720	1590	1800
	4	1580	1405	1695	1760	1585	1870	1160	980	1270	1580	1405	2295
	6	1895	1670	2015	2080	1860	2205	1480	1260	1605	2495	2270	2615
	8	2180	1960	2320	2285	2070	2420	1685	1465	1820	2780	2560	2920
160	2	1325	1085	1440	1280	1040	1390	780	540	890	1825	1585	1940
	4	1840	1535	1995	1555	1250	1710	1055	750	1210	2340	2035	2495
	6	2160	1785	2355	1830	1455	2025	1330	955	1525	2660	2285	2855
	8	2470	2040	2660	2040	1610	2235	1540	1115	1735	2970	2540	3160
180	2	1700	1430	1825	1430	1160	1550	910	640	1030	2220	1950	2350
	4	2310	1970	2485	1725	1390	1900	1205	865	1380	2830	2490	3005
	6	2740	2320	2960	2110	1690	2330	1590	1170	1810	3260	2840	3480
	8	3070	2595	3285	2400	1925	2620	1880	1405	2100	3590	3115	3810
200	2	2525	2210	2680	1895	1585	2050	1395	1080	1550	3025	2710	3180
	4	3460	3080	3675	2285	1900	2500	1785	1405	2000	3960	3580	4175
	6	3960	3490	4235	2840	2365	3115	2340	1870	2615	4460	3990	4735
	8	4445	3885	4720	3260	2705	3535	2760	2200	3035	4945	4385	5220
225	2	3055	2715	3240	1930	1600	2115	1370	1035	1555	3615	3275	3800
	4	4010	3505	4265	2475	1975	2730	1915	1410	2170	4570	4065	4825
	6	4755	4125	5080	3135	3510	3460	2575	1950	2900	5315	4685	5640
	8	5300	4560	5630	3660	2925	3990	3100	2360	3430	5860	5120	6190
250	2	3900	3900	6465	1245	1250	3810	1785	1785	4350	3360	3360	5925
	4	5050	5050	8410	1750	1755	5110	2290	2290	5650	4510	4510	7870
	6	5645	5645	9700	2410	2420	6470	2950	2950	7010	5105	5105	9160
	8	6150	6150	10795	2875	2875	7520	3415	3415	8060	5610	5610	10255
280	2	4395	4395	7045	1095	1095	3745	1595	1595	4245	3895	3895	6545
	4	5790	5790	9220	1340	1340	4770	1840	1840	5270	5290	5290	8720
	6	6290	6290	10450	2100	2100	6265	2600	2600	6765	5790	5790	9950
	8	6860	6860	11615	2575	2575	7330	3075	3075	7830	6360	6360	11115

Standard design with deep groove ball bearings

Frame Size	Pole Number	Shaft Down						Shaft Up					
		F _{A1}			F _{A2}			F _{A1}			F _{A2}		
		F _R = max F _{x0}		F _R = 0 F _{xmax}	F _R = max F _{x0}		F _R = 0 F _{xmax}	F _R = max F _{x0}		F _R = 0 F _{xmax}	F _R = max F _{x0}		F _R = 0 F _{xmax}
		N	N	N	N	N	N	N	N	N	N	N	N
315	2	5127	5127	7585	-	-	2890	2890	930	3390	4627	4627	7087
	4	7700	7700	11290	-	-	3423	432	432	4023	7100	7100	10690
	6	8422	8422	12730	325	325	4625	920	920	5225	7822	7822	12130
	8	9040	9040	14007	935	935	5905	1535	1535	6505	8440	8440	13407
355	2	6300	6300	9000	-	-	2430	320	320	3300	5700	5700	8400
	4	9265	9265	14150	740	740	5630	1340	1340	6200	8665	8665	13500
	6	10200	10200	16000	1253	1253	7043	1853	1853	7600	9660	9660	15400
	8	11000	11000	17650	2015	2015	8634	2600	2600	9200	10400	10400	17000

Reinforced design with NU cylindrical roller bearing

Frame Size	Pole Number	Shaft Down						Shaft Up					
		F _{A1}			F _{A2}			F _{A1}			F _{A2}		
		F _R = max F _{x0}		F _R = 0 F _{xmax}	F _R = max F _{x0}		F _R = 0 F _{xmax}	F _R = max F _{x0}		F _R = 0 F _{xmax}	F _R = max F _{x0}		F _R = 0 F _{xmax}
		N	N	N	N	N	N	N	N	N	N	N	N
160	2	2445	1850	2725	1900	1310	2185	1900	1310	2185	2445	1850	2725
	4	3240	2515	3625	2450	1730	2835	2450	1730	2835	3240	2515	3625
	6	3775	2895	4240	2940	2065	3410	2940	2065	3410	3775	2895	4240
	8	4275	3265	4735	3350	2340	3810	3350	2340	3810	4275	3265	4735
180	2	2970	2335	3270	2180	1545	2480	2180	1545	2480	2970	2335	3270
	4	3905	3135	4310	2800	2030	3205	2800	2030	3205	3905	3135	4310
	6	4575	3645	5080	3430	2495	3930	3430	2495	3930	4575	3645	5080
	8	5135	4055	5635	2870	3950	4450	2870	3950	4450	5135	4055	5635
200	2	3895	3145	4305	2760	2015	3175	2760	2015	3175	3895	3145	4305
	4	5205	4295	5735	3530	2625	4060	3530	2625	4060	5205	4295	5735
	6	5975	4880	6630	4355	3260	5005	4355	3260	5005	5975	4880	6630
	8	6690	5420	7390	5000	3730	5700	5000	3730	5700	6690	5420	7390
225	2	4535	3680	5055	2850	2000	3370	2850	2000	3370	4535	3680	5055
	4	5905	4605	6565	3805	2505	4470	3805	2505	4470	5905	4605	6565
	6	6930	5410	7750	4755	3235	5570	4755	3235	5570	6930	5410	7750
	8	7720	5970	8610	5520	3770	6410	5520	3770	6410	7720	5970	8610
250	2	5430	4220	6195	3310	2105	4080	3310	2105	4080	5430	4220	6195
	4	7210	5625	8140	4450	2870	5380	4450	2870	5380	7210	5625	8140
	6	8295	6495	9430	5605	3810	6740	5605	3810	6740	8295	6495	9430
	8	9205	7150	10525	6470	4420	7790	6470	4420	7790	9205	7150	10525
280	2	6110	4980	6790	3310	2180	3990	3310	2180	3990	6110	4980	6790
	4	8150	6655	8970	4195	2705	5020	4195	2705	5020	8150	6655	8970
	6	9200	7520	10200	5510	3835	6515	5510	3835	6515	9200	7520	10200
	8	10200	8285	11365	6415	4500	7580	6415	4500	7580	10200	8285	11365
315	2	6165	5248	7087	2468	1547	3390	1968	1051	2890	6665	5748	7587
	4	9765	8070	10990	2495	800	3725	2495	800	3725	9765	8070	10990
	6	10952	9055	12430	3450	1552	7926	3450	1552	4925	10952	9055	12430
	8	12000	9915	13707	4497	2482	6204	4497	2412	6204	12000	9915	13707
355	2	7900	6900	8700	1930	930	2700	1930	930	2700	7900	6900	8700
	4	13000	11000	13850	5100	3100	5900	5100	3100	5900	13000	11000	13850
	6	14600	11600	15700	6200	3200	7300	6200	3200	7300	14600	11600	16700
	8	16000	12700	17350	7600	4300	8900	7600	4300	8900	16000	12700	17350

10.12. MOTOR PROTECTION

To protect the motor, fuses, thermic relays, thermal magnetic switches and thermal protectors could be used. Fuses protect energy lines (motor, relays, switches etc.) against the short circuit but they are not enough, just themselves, in the case of overloading and over heating. Although it is possible to prevent over current on motor terminals with thermic relays and thermal magnetic switches, in the case of over heating they are not proper solution.

Long-term operating of motor under overload, with unbalanced or low supply voltage may be cause to current flow through stator winding that is more than nominal value, it raises winding temperature over expected and permissible values. To prevent any damaged caused by heating on stator winding thermal motor protectors should be used. They are placed in the motor windings and provide suitable motor thermal protection.

10.12.1. PTC (POSITIVE TEMPERATURE COEFFICIENT) THERMISTORS

PTC thermistors are thermal protectors consisting of semiconductor detectors and using with relays, installed in the motor winding (three in series, one per each phase winding). Their resistance rises suddenly at a certain critical temperature. This sudden resistance increment blocks the PTC current and causing to main circuit switched off.

Where thermistor protection is required to provide both alarm and trip operations, it is necessary to use two sets of thermistors (two thermistors per phase). For alarm operation the temperature should be 20K less than tripping temperature. When it reaches the critical temperature value a warning signal is sent to relay.

PTC thermistors should be chosen according to motor insulation class.

On PTC thermistor can be used on stator windings and the requests must be specified in order with their demand codes. (Demand codes are on page 42.)

10.12.2. PT100

PT100 is a temperature sensor with platinum resistance inside. It has 100Ω resistance at 0°C and the resistance value of platinum changes linearly for even small increment or decrement of temperature. Sensitive and continuous winding temperature measuring is possible through a monitoring display. PT100 can be used both for alarm and trip operations with a relay. It is important to set alarm and tripping temperature values taking into account the insulation class of motor and regular operating temperature.

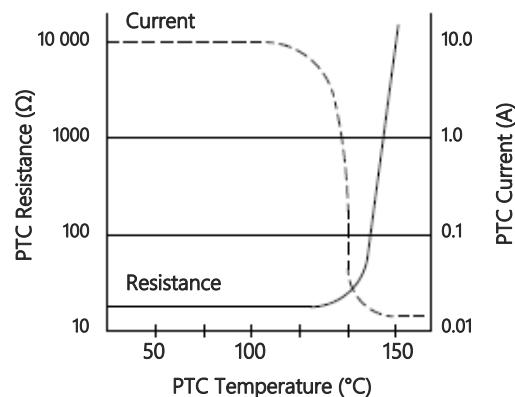
On request PT100 can be used on stator windings and the requests must be specified in order with their demand codes. (Demand codes are on page 42.)

10.12.3. BIMETAL THERMAL PROTECTORS

The bimetallic thermal protectors are placed in stator windings one per each phase and series connected with the contactor coil. With the increasing motor current, winding temperature rises and when the critical temperature is reached, shape of bimetal layer inside the thermostat change and open the contactor. When their operating temperature decreases, they return to their original shape immediately, let the contactor to close again.

They can be used either as alarm or trip. To use both alarm and trip operation two sets of thermostat must be placed. Bimetallic thermal protectors should be chosen according to motor insulation class and maximum permissible operation temperature for motor windings.

On request bimetal thermal protectors can be used on stator windings and the requests must be specified in order with their demand codes. (Demand codes are on page 42.)



10.13. VOLTAGE AND FREQUENCY

Omega Motors are designed for a rated supply of 400V and frequency of 50Hz. However, motors for any standard supply from 110V to 690V at frequencies of 50Hz or 60Hz may be supplied on request. Any request different than 400V 50Hz supply should be specified in the order.

Motors will operate satisfactorily within a voltage band of $\pm 5\%$ of the rated voltage and $\pm 2\%$ of the rated frequency. In case of continuous operation at the extreme voltage limits specified above, the temperature rise limits permitted for various insulation classes may be exceeded by 10K.

When motors are operated at 60Hz, shaft speed increases by 20% compared to 50Hz operation. Based on change of speed all other motor performance values change. Variation of performance values (output power, speed, current, torque) are given at below table.

Rated Voltage at 50Hz [V]	Supply Voltage at 60Hz [V]	60Hz Performance Values							
		Output Power	Speed	Current	Torque	I_A/I_N	T_A/T_N	T_K/T_N	I_0
220	220	1	1,2	1	0,83	0,87	0,75	0,85	0,73
	220*	1,15	1,2	1,15	0,96	0,98	0,93	1	1,12
	240	1,1	1,2	1	0,91	0,96	0,83	0,94	0,85
	255	1,15	1,2	1	0,96	1	0,93	1	0,93
400	400	1	1,2	1	0,83	0,87	0,75	0,85	0,73
	400*	1,15	1,2	1,15	0,96	0,98	0,93	1	1,12
	440	1,1	1,2	1	0,92	0,98	0,90	0,96	0,87
	460	1,15	1,2	1	0,96	1	0,93	1	0,93
500	500	1	1,2	1	0,83	0,87	0,75	0,85	0,73
	500*	1,15	1,2	1,15	0,96	0,98	0,93	1	1,12
	550	1,1	1,2	1	0,92	0,98	0,90	0,96	0,87
	575	1,15	1,2	1	0,96	0,98	0,93	1	0,93
600	600	1,2	1,2	1	1	1,03	0,98	1,03	0,98

* Special winding for 60Hz.

I_N : Nominal current

T_N : Nominal torque

I_A : Locked rotor current

T_A : Locked rotor torque

T_K : Breakdown torque

I_0 : No-load current

Any request different than 400V 50Hz supply should be specified in the order.

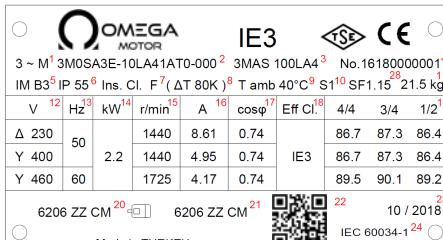
10.14. PRODUCT CODE

Sample Product Code	3 M 0 S	A 4 E	- 22 M A	4 0 C T 0	- A 0 1	
Positions	1 2 3 4	5 6 7	- 8 9 10	11 12	13 14	15 - 16 17 18
3 Phase, Totally enclosed, Fan cooled, Induction motor	3 M 0 S				X 0 0	Demand Codes
Frame Material	Aluminium	A		0	0, 1, 2, 3,	Generation Code
	Cast Iron	G		...	4, 5, 6,	
	Steel	S		9	7, 8, 9	
Efficiency Class One Speed Motors	3E: IE3 efficiency class 4E: IE4 efficiency class	3 E 4 E		L	Left Hand Side	Terminal Box Position
Winding Type	1S: Two speed, Dahlander, Constant torque 1D: Two speed, Dahlander, Variable torque 2S: Two speed, Constant torque 2D: Two speed, Variable torque 3S: Three speed, Constant torque 3D: Three speed, Variable torque	1 S 1 D 2 S 2 D 3 S 3 D		R	Right Hand Side	(Viewed from DE side)
Pole-Changing Motors				T	Top	
				B	Bottom	
Frame Size	80 90 100 112 132 160 180 200 225 250 280 315 355	08 09 10 11 13 16 18 20 22 25 28 31 35		A	IM B3	Mounting Arrangements
				B	IM B5	
				C	IM B35 D: IM V1 E: IM V15	
				F	IM B9 G: IM B15 H: IM B6	
				J	IM B7 K: IM B8 L: IM V5	
				M	IM V6 N: IM V3 P: IM V8	
				R	IM V9 S: IM B14 T: IM B34	
				Y	IM V18 Z: IM V19	
				Q	IM B14-2 U: IM V18-2	
				V	IM V19-2 W: IM B34-2	
Frame Length	L M S	L M S		0	400/690V - Δ/Y, 50Hz	Voltage Connection Frequency
Core Length	A, B, C, D, E	A ... E		1	230/400V - Δ/Y, 50Hz	
Pole Number	2: 2pole, 4: 4pole, 6: 6pole, 8: 8pole A: 10pole, B: 12pole, C: 16pole D: 4/2, E: 8/4, F: 6/4	2 ... 8 A D		2	380/660V - Δ/Y, 50Hz	One Speed Motors
				3	220/380V - Δ/Y, 50Hz	
				4	240/415V - Δ/Y, 50Hz	
				5	500V - Δ, 50Hz	
				6	500V - Y, 50Hz	
				7	550V - Δ, 50Hz	
				8	550V - Y, 50Hz	
				9	415/715V - Δ/Y, 50Hz	
				A	400/690V - Δ/Y, 60Hz	
				B	230/400V - Δ/Y, 60Hz	
				C	380/660V - Δ/Y, 60Hz	
				D	220/380V - Δ/Y, 60Hz	
				E	400V, 50 Hz	
				F	500V, 50 Hz	Pole-Changing Motors
				G	230V, 50 Hz	
				H		
				Z	Special Requests	

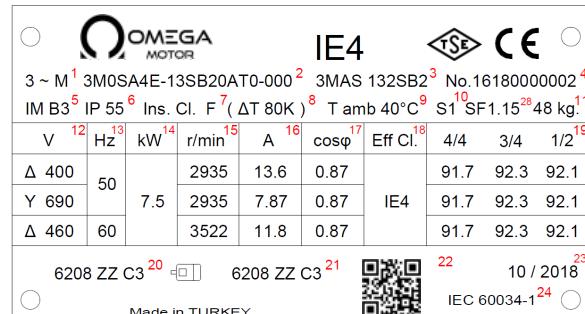
ORDERING EXAMPLE		Product Code	
Motor Type	3 Phase, Totally enclosed induction motor	3M0SA4E - 22MA40CT0 - A01	
Frame Material	Aluminium	3M0SA4E - 22MA40CT0 - A01	
Efficiency Class	IE4 efficiency class	3M0SA4E - 22MA40CT0 - A01	
Frame Size - Pole Number/Speed	225 M - 4 pole / 1500rpm	3M0SA4E - 22MA40CT0 - A01	
Motor Output Power	45 kW		
Voltage - Connection - Frequency	400/690V - Δ/Y - 50Hz	3M0SA4E - 22MA40CT0 - A01	
Mounting Arrangement	IM B35 (IM 3001)	3M0SA4E - 22MA40CT0 - A01	
Terminal Box Position (Viewed from DE side)	On Top	3M0SA4E - 22MA40CT0 - A01	
Special Demands	Codes from pages 42 and 43	3M0SA4E - 22MA40CT0 - A01	

10.15. NAME PLATE

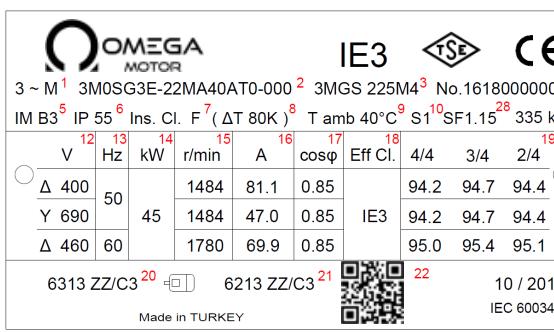
Nominal efficiency values are determined according to IEC 60034-2-1:2014 and efficiency classes are based on IEC 60034-30-1:2014. Label material is aluminium as standard and is located on right hand side (viewed from DE side). Following name plates are only samples. For different name plates and materials please see page 42



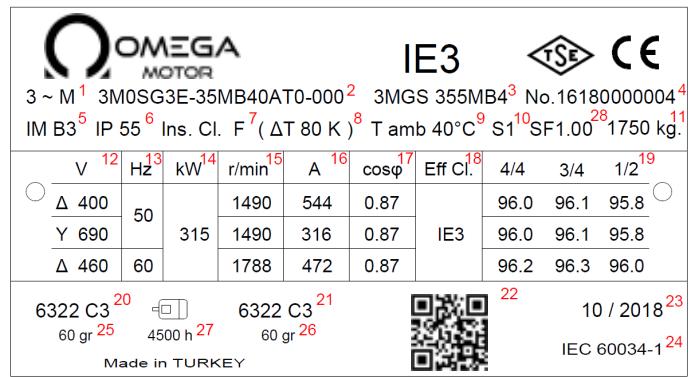
Rating plate for frame sizes 80 to 112 is given above.



Rating plate for aluminium motors, frame sizes from 132 to 225, is given above.



Rating plate for cast iron motors, frame sizes from 160 to 225, is given above.



Rating plate for frame sizes 250 to 355 is given above.

- 1 AC Motor phase number
- 2 Product code
- 3 Motor type
- 4 Product serial number
- 5 Mounting arrangement
- 6 IP Protection degree
- 7 Insulation class
- 8 Temperature rise
- 9 Ambient temperature
- 10 Duty type
- 11 Motor weight
- 12 Connection and voltage
- 13 Frequency
- 14 Nominal output power
- 15 Nominal speed

- 16 Nominal current
- 17 Power factor
- 18 Efficiency class according to IEC 60034-30-1
- 19 Efficiency values at 100%, 75% and 50% load
- 20 Bearing, DE side
- 21 Bearing, NDE side
- 22 QR Code
- 23 Manufacturing date (Week / Year)
- 24 Rating and performance standard
- 25 Grease amount (DE Bearing)
- 26 Grease amount (NDE Bearing)
- 27 Lubrication period
- 28 Service factor

PERFORMANCE VALUES

IE3

Standard 3 phase, Squirrel Cage Induction Motors
 IP 55 protection, IC 411 cooling, F class insulation, B temperature rise
 IE3: Premium Efficiency Class (IEC 60034-30-1:2014)

2 Pole, 3000 rpm; 400 V 50 Hz

ALUMINIUM FRAME

STANDARD MOTORS

Output Power kW	Motor Type	Product Code	Speed n	Current I _N	Torque T _N	Power Factor cosφ	Efficiency			Starting Current Ratio I _A / I _N	Starting Torque Ratio T _A / T _N	Breakdown Torque Ratio T _K / T _N	Moment of Inertia J kgm ²	Weight B3 kg
			rpm	A	Nm		4/4 Load 100%	3/4 Load 75%	2/4 Load 50%					
0,75	3MAS 80MA2	3MOSA3E- 08MA2 ■■■■ -...	2880	1,76	2,48	0,76	80,7	80,1	75,7	5,1	2,6	3,3	0,0009	9
1,1	3MAS 80MB2	3MOSA3E- 08MB2 ■■■■ -...	2870	2,52	3,65	0,76	82,7	82,4	78,9	5,8	3,0	3,6	0,0011	10
1,5	3MAS 90S2	3MOSA3E- 09SA2 ■■■■ -...	2870	3,13	4,99	0,82	84,2	84,9	83,2	6,2	2,7	3,4	0,0018	13
2,2	3MAS 90L2	3MOSA3E- 09LA2 ■■■■ -...	2875	4,45	7,31	0,83	85,9	86,9	85,8	7,0	2,8	3,6	0,0022	16
3	3MAS 100L2	3MOSA3E- 10LA2 ■■■■ -...	2900	5,77	9,87	0,86	87,1	87,8	86,8	8,0	3,0	3,8	0,0041	22
4	3MAS 112M2	3MOSA3E- 11MA2 ■■■■ -...	2910	7,44	13,1	0,88	88,1	88,9	88,2	8,0	3,0	3,8	0,0068	28
5,5	3MAS 132SA2	3MOSA3E- 13SA2 ■■■■ -...	2910	10,5	18,1	0,85	89,2	90,5	90,6	7,6	2,8	3,6	0,0146	43
7,5	3MAS 132SB2	3MOSA3E- 13SB2 ■■■■ -...	2920	14,0	24,6	0,86	90,1	91,3	91,4	7,4	3,0	3,7	0,0180	49
11	3MAS 160MA2	3MOSA3E- 16MA2 ■■■■ -...	2940	19,6	35,8	0,89	91,2	90,7	91,1	7,5	3,0	3,4	0,0385	81
15	3MAS 160MB2	3MOSA3E- 16MB2 ■■■■ -...	2940	26,5	48,8	0,89	91,9	92,8	92,7	7,1	2,4	3,0	0,0470	91
18,5	3MAS 160L2	3MOSA3E- 16LA2 ■■■■ -...	2940	32,1	60,1	0,90	92,4	93,3	93,3	8,3	2,8	3,4	0,0558	106
22	3MAS 180M2	3MOSA3E- 18MA2 ■■■■ -...	2960	38,1	71,0	0,90	92,7	93,2	93,0	7,8	2,4	3,3	0,101	132
30	3MAS 200LA2	3MOSA3E- 20LA2 ■■■■ -...	2960	52,2	96,9	0,89	93,3	93,5	93,1	7,2	2,6	3,1	0,151	197
37	3MAS 200LB2	3MOSA3E- 20LB2 ■■■■ -...	2955	64,3	120	0,89	93,7	94,3	94,0	7,3	2,7	3,1	0,172	212
45	3MAS 225M2	3MOSA3E- 22MA2 ■■■■ -...	2976	75,8	144	0,91	94,0	94,2	93,6	8,4	2,7	3,4	0,309	275

COMPACT MOTORS

Output Power kW	Motor Type	Product Code	Speed n	Current I _N	Torque T _N	Power Factor cosφ	Efficiency			Starting Current Ratio I _A / I _N	Starting Torque Ratio T _A / T _N	Breakdown Torque Ratio T _K / T _N	Moment of Inertia J kgm ²	Weight B3 kg
			rpm	A	Nm		4/4 Load 100%	3/4 Load 75%	2/4 Load 50%					
1,5	3MAS 80MK2	3MOSA3E- 80MK2 ■■■■ -...	2870	3,30	5,00	0,78	84,2	84,7	82,8	6,6	3,4	3,8	0,0012	12
3	3MAS 90LK2	3MOSA3E- 90LK2 ■■■■ -...	2895	6,06	9,90	0,82	87,1	87,6	87,2	8,0	3,8	4,1	0,0024	18
4	3MAS 100LK2	3MOSA3E- 10LK2 ■■■■ -...	2900	7,63	13,2	0,86	88,1	88,8	88,0	7,2	3,2	4,1	0,0048	26
5,5	3MAS 112MK2	3MOSA3E- 11MK2 ■■■■ -...	2910	9,80	18,1	0,91	89,2	90,3	90,2	8,2	3,2	3,8	0,0089	33
11	3MAS 132MK2	3MOSA3E- 13MK2 ■■■■ -...	2910	19,8	36,1	0,88	91,2	92,6	93,1	7,9	3,0	3,6	0,0236	57
22	3MAS 160LK2	3MOSA3E- 16LK2 ■■■■ -...	2940	38,1	71,5	0,90	92,7	93,7	94,0	7,6	2,8	3,2	0,0643	125
30	3MAS 180MK2	3MOSA3E- 18MK2 ■■■■ -...	2955	52,8	97,0	0,88	93,3	93,0	92,8	8,7	2,9	3,4	0,116	155
45	3MAS 200LK2	3MOSA3E- 20LK2 ■■■■ -...	2952	77,0	146	0,90	94,0	94,6	94,5	7,5	2,6	3,1	0,224	244
55	3MAS 225MK2	3MOSA3E- 22MK2 ■■■■ -...	2972	92,6	177	0,91	94,3	94,7	94,5	8,0	2,6	3,4	0,347	312

Efficiency values are determined according to IEC 60034-2-1:2014. (By the summation of all separate losses, including additional load loss)

PERFORMANCE VALUES

IE3

Standard 3 phase, Squirrel Cage Induction Motors
IP 55 protection, IC 411 cooling, F class insulation, B temperature rise
IE3: Premium Efficiency Class (IEC 60034-30-1:2014)

2 Pole, 3000 rpm; 400 V 50 Hz

CAST IRON FRAME

STANDARD MOTORS

Output Power kW	Motor Type	Product Code	Speed n rpm	Current I _N A	Torque T _N Nm	Power Factor cosφ	Efficiency			Starting Current Ratio I _A / I _N	Starting Torque Ratio T _A / T _N	Breakdown Torque Ratio T _K / T _N	Moment of Inertia J kgm ²	Weight B3 kg
			4/4 Load 100%	3/4 Load 75%	2/4 Load 50%	I _A / I _N	T _A / T _N	T _K / T _N						
11	3MGS 160MA2	3M0SG3E- 16MA2 ■■■■ ■... ■■■■ ■...	2940	19,6	35,8	0,89	91,2	90,7	91,1	7,5	3,0	3,4	0,0385	104
15	3MGS 160MB2	3M0SG3E- 16MB2 ■■■■ ■... ■■■■ ■...	2940	26,5	48,8	0,89	91,9	92,8	92,7	7,1	2,4	3,0	0,0470	115
18,5	3MGS 160L2	3M0SG3E- 16LA2 ■■■■ ■... ■■■■ ■...	2940	32,1	60,1	0,90	92,4	93,3	93,3	8,3	2,8	3,4	0,0558	132
22	3MGS 180M2	3M0SG3E- 18MA2 ■■■■ ■... ■■■■ ■...	2960	38,1	71,0	0,90	92,7	93,2	93,0	7,8	2,4	3,3	0,101	164
30	3MGS 200LA2	3M0SG3E- 20LA2 ■■■■ ■... ■■■■ ■...	2960	52,2	96,9	0,89	93,3	93,5	93,1	7,2	2,6	3,1	0,151	236
37	3MGS 200LB2	3M0SG3E- 20LB2 ■■■■ ■... ■■■■ ■...	2955	64,3	120	0,89	93,7	94,3	94,0	7,3	2,7	3,1	0,172	251
45	3MGS 225M2	3M0SG3E- 22MA2 ■■■■ ■... ■■■■ ■...	2976	75,8	144	0,91	94,0	94,2	93,6	8,4	2,7	3,4	0,309	320
55	3MGS 250M2	3M0SG3E- 25MA2 ■■■■ ■... ■■■■ ■...	2980	93,9	177	0,90	94,3	94,4	93,9	7,2	2,3	3,1	0,443	431
75	3MGS 280S2	3M0SG3E- 28SA2 ■■■■ ■... ■■■■ ■...	2980	128	240	0,89	94,7	94,5	93,7	8,6	2,8	3,7	0,896	551
90	3MGS 280M2	3M0SG3E- 28MA2 ■■■■ ■... ■■■■ ■...	2980	154	288	0,89	95,0	94,9	94,2	8,7	2,9	3,7	0,967	624
110	3MGS 315S2	3M0SG3E- 31SA2 ■■■■ ■... ■■■■ ■...	2985	185	352	0,90	95,2	94,9	93,8	8,4	2,4	3,8	1,78	895
132	3MGS 315MA2	3M0SG3E- 31MA2 ■■■■ ■... ■■■■ ■...	2985	222	423	0,90	95,4	95,4	94,8	8,2	2,4	3,8	1,97	942
160	3MGS 315MB2	3M0SG3E- 31MB2 ■■■■ ■... ■■■■ ■...	2985	265	511	0,91	95,6	95,7	95,2	8,4	2,3	3,5	2,16	989
200	3MGS 315MD2	3M0SG3E- 31MD2 ■■■■ ■... ■■■■ ■...	2985	335	640	0,90	95,8	95,9	95,5	8,2	2,4	3,6	2,29	1087
250	3MGS 355MA2	3M0SG3E- 35MA2 ■■■■ ■... ■■■■ ■...	2982	414	801	0,91	95,8	95,8	95,6	7,5	2,1	3,0	3,12	1270
315	3MGS 355MB2	3M0SG3E- 35MB2 ■■■■ ■... ■■■■ ■...	2980	527	1010	0,90	95,8	95,8	95,5	7,4	2,1	2,8	3,61	1460
355	3MGS 355MC2	3M0SG3E- 35MC2 ■■■■ ■... ■■■■ ■...	2983	601	1137	0,89	95,8	95,8	95,4	7,6	2,1	3,0	3,83	1524
400	3MGS 355LA2	3M0SG3E- 35LA2 ■■■■ ■... ■■■■ ■...	2982	662	1281	0,91	95,8	95,6	95,3	7,6	2,1	3,0	4,10	1735
450	3MGS 355LB2	3M0SG3E- 35LB2 ■■■■ ■... ■■■■ ■...	2982	753	1441	0,90	95,8	95,7	95,4	7,7	2,2	3,0	4,58	1940
500	3MGS 355LC2	3M0SG3E- 35LC2 ■■■■ ■... ■■■■ ■...	2982	837	1601	0,90	95,8	95,8	95,5	7,8	2,2	3,0	4,95	2153

COMPACT MOTORS

Output Power kW	Motor Type	Product Code	Speed n rpm	Current I _N A	Torque T _N Nm	Power Factor cosφ	Efficiency			Starting Current Ratio I _A / I _N	Starting Torque Ratio T _A / T _N	Breakdown Torque Ratio T _K / T _N	Moment of Inertia J kgm ²	Weight B3 kg
			4/4 Load 100%	3/4 Load 75%	2/4 Load 50%	I _A / I _N	T _A / T _N	T _K / T _N						
22	3MGS 160LK2	3M0SG3E- 16LK2 ■■■■ ■... ■■■■ ■...	2940	38,1	71,5	0,90	92,7	93,7	94,0	7,6	2,8	3,2	0,0643	157
30	3MGS 180MK2	3M0SG3E- 18MK2 ■■■■ ■... ■■■■ ■...	2955	52,8	97,0	0,88	93,3	93,0	92,8	8,7	2,9	3,4	0,116	199
45	3MGS 200LK2	3M0SG3E- 20LK2 ■■■■ ■... ■■■■ ■...	2952	77,0	146	0,90	94,0	94,6	94,5	7,5	2,6	3,1	0,224	288
55	3MGS 225MK2	3M0SG3E- 22MK2 ■■■■ ■... ■■■■ ■...	2972	92,6	177	0,91	94,3	94,7	94,5	8,0	2,6	3,4	0,347	367
75	3MGS 250MK2	3M0SG3E- 25MK2 ■■■■ ■... ■■■■ ■...	2965	127	242	0,90	94,7	95,0	94,9	7,9	2,6	3,4	0,519	485
110	3MGS 280MK2	3M0SG3E- 28MK2 ■■■■ ■... ■■■■ ■...	2975	190	354	0,88	95,2	95,0	94,7	7,5	2,4	3,3	1,04	715
250	3MGS 315MK2	3M0SG3E- 31MK2 ■■■■ ■... ■■■■ ■...	2983	413	799	0,91	95,8	96,0	95,8	8,0	2,4	3,6	2,67	1183

Efficiency values are determined according to IEC 60034-2-1:2014. (By the summation of all separate losses, including additional load loss)

IE3

PERFORMANCE VALUES

Standard 3 phase, Squirrel Cage Induction Motors
 IP 55 protection, IC 411 cooling, F class insulation, B temperature rise
 IE3: Premium Efficiency Class (IEC 60034-30-1:2014)

4 Pole, 1500 rpm; 400 V 50 Hz

ALUMINIUM FRAME

STANDARD MOTORS

Output Power	kW	Motor Type	Product Code	Speed	Current	Torque	Power Factor	Efficiency			Starting Current Ratio	Starting Torque Ratio	Breakdown Torque Ratio	Moment of Inertia J kgm ²	Weight B3 kg
				n rpm	I _N A	T _N Nm	cosφ	4/4 Load 100%	3/4 Load 75%	2/4 Load 50%	I _A / I _N	T _A / T _N	T _K / T _N		
0,55	3MAS 80MA4	3MOSA3E- 08MA4	█████ - ...	1429	1,40	3,67	0,70	80,8	80,4	76,8	5,4	2,8	3,2	0,0017	10
0,75	3MAS 80MB4	3MOSA3E- 08MB4	█████ - ...	1430	1,87	5,00	0,70	82,5	82,2	79,0	6,0	3,2	3,6	0,0022	12
1,1	3MAS 90S4	3MOSA3E- 09SA4	█████ - ...	1439	2,59	7,31	0,73	84,1	84,2	81,8	6,6	3,3	3,7	0,0035	14
1,5	3MAS 90L4	3MOSA3E- 09LA4	█████ - ...	1438	3,34	9,96	0,76	85,3	85,7	83,8	7,2	3,4	3,8	0,0042	17
2,2	3MAS 100LA4	3MOSA3E- 10LA4	█████ - ...	1444	4,83	14,6	0,76	86,7	86,6	85,2	7,0	2,9	3,5	0,0049	22
3	3MAS 100LB4	3MOSA3E- 10LB4	█████ - ...	1444	6,40	19,8	0,77	87,7	88,3	87,3	7,3	3,3	3,7	0,0062	25
4	3MAS 112M4	3MOSA3E- 11MA4	█████ - ...	1447	8,15	26,4	0,80	88,6	89,4	88,6	7,5	3,2	3,6	0,0124	31
5,5	3MAS 132S4	3MOSA3E- 13SA4	█████ - ...	1455	11,0	36,1	0,81	89,6	90,4	90,2	6,6	2,7	3,1	0,0279	45
7,5	3MAS 132M4	3MOSA3E- 13MA4	█████ - ...	1460	15,0	49,2	0,80	90,4	91,3	90,9	7,3	3,0	3,2	0,0361	58
11	3MAS 160M4	3MOSA3E- 16MA4	█████ - ...	1466	21,2	71,7	0,82	91,4	92,4	92,2	6,9	2,8	3,0	0,0770	89
15	3MAS 160L4	3MOSA3E- 16LA4	█████ - ...	1466	28,3	97,7	0,83	92,1	92,9	92,8	6,5	2,6	2,8	0,0986	111
18,5	3MAS 180M4	3MOSA3E- 18MA4	█████ - ...	1473	35,6	120	0,81	92,6	93,4	93,4	7,1	2,8	3,1	0,154	134
22	3MAS 180L4	3MOSA3E- 18LA4	█████ - ...	1473	42,5	142	0,80	93,0	93,8	93,9	7,2	2,6	3,2	0,177	152
30	3MAS 200L4	3MOSA3E- 20LA4	█████ - ...	1477	53,2	194	0,87	93,6	94,4	94,6	7,5	2,6	3,1	0,305	211
37	3MAS 225S4	3MOSA3E- 22SA4	█████ - ...	1480	66,1	239	0,86	93,9	94,2	93,8	7,5	2,6	3,1	0,465	260
45	3MAS 225M4	3MOSA3E- 22MA4	█████ - ...	1479	81,0	290	0,85	94,2	94,7	94,7	7,6	2,7	3,1	0,537	291

COMPACT MOTORS

Output Power	kW	Motor Type	Product Code	Speed	Current	Torque	Power Factor	Efficiency			Starting Current Ratio	Starting Torque Ratio	Breakdown Torque Ratio	Moment of Inertia J kgm ²	Weight B3 kg
				n rpm	I _N A	T _N Nm	cosφ	4/4 Load 100%	3/4 Load 75%	2/4 Load 50%	I _A / I _N	T _A / T _N	T _K / T _N		
10*	3MAS 132MK4	3MOSA3E- 13MK4	█████ - ...	1462	20,6	65,4	0,77	91,2	91,9	91,4	7,5	3,1	3,6	0,0431	62
18,5	3MAS 160LK4	3MOSA3E- 16LK4	█████ - ...	1475	35,2	120	0,82	92,6	93,0	92,7	7,8	2,8	3,4	0,132	119
30	3MAS 180LK4	3MOSA3E- 18LK4	█████ - ...	1472	56,2	194	0,82	93,6	93,8	93,0	7,9	2,6	2,8	0,236	185
37	3MAS 200LK4	3MOSA3E- 20LK4	█████ - ...	1478	64,6	239	0,88	93,9	94,7	95,0	7,5	2,4	2,9	0,360	234
55	3MAS 225MK4	3MOSA3E- 22MK4	█████ - ...	1478	97,5	355	0,86	94,6	95,3	95,4	6,8	2,5	2,9	0,652	325

* 132MK4 motor's output power is 10kW and it can be run under 11kW load with 1,10 service factor.

Efficiency values are determined according to IEC 60034-2-1:2014. (By the summation of all separate losses, including additional load loss)

PERFORMANCE VALUES

IE3

Standard 3 phase, Squirrel Cage Induction Motors
IP 55 protection, IC 411 cooling, F class insulation, B temperature rise
IE3: Premium Efficiency Class (IEC 60034-30-1:2014)

4 Pole, 1500 rpm; 400 V 50 Hz

CAST IRON FRAME

STANDARD MOTORS

Output Power	kW	Motor Type	Product Code	Speed Current Torque Power Factor				Efficiency			Starting Current Ratio	Starting Torque Ratio	Breakdown Torque Ratio	Moment of Inertia J kgm ²	Weight B3 kg
				n rpm	I _N A	T _N Nm	cosφ	4/4 Load 100%	3/4 Load 75%	2/4 Load 50%					
11	3MGS 160M4	3M0SG3E- 16MA4	█████ -...	1466	21,2	71,7	0,82	91,4	92,4	92,2	6,9	2,8	3,0	0,0770	113
15	3MGS 160L4	3M0SG3E- 16LA4	█████ -...	1466	28,3	97,7	0,83	92,1	92,9	92,8	6,5	2,6	2,8	0,0986	137
18,5	3MGS 180M4	3M0SG3E- 18MA4	█████ -...	1473	35,6	120	0,81	92,6	93,4	93,4	7,1	2,8	3,1	0,154	166
22	3MGS 180L4	3M0SG3E- 18LA4	█████ -...	1473	42,5	142	0,80	93,0	93,8	93,9	7,2	2,6	3,2	0,177	188
30	3MGS 200L4	3M0SG3E- 20LA4	█████ -...	1477	53,2	194	0,87	93,6	94,4	94,6	7,5	2,6	3,1	0,305	250
37	3MGS 225S4	3M0SG3E- 22SA4	█████ -...	1480	66,1	239	0,86	93,9	94,2	93,8	7,5	2,6	3,1	0,465	305
45	3MGS 225M4	3M0SG3E- 22MA4	█████ -...	1479	81,0	290	0,85	94,2	94,7	94,7	7,6	2,7	3,1	0,537	335
55	3MGS 250M4	3M0SG3E- 25MA4	█████ -...	1485	97,7	354	0,86	94,6	95,0	95,0	7,5	2,8	3,0	0,893	433
75	3MGS 280S4	3M0SG3E- 28SA4	█████ -...	1488	134	481	0,85	95,0	95,4	95,1	7,3	2,7	2,9	1,54	548
90	3MGS 280M4	3M0SG3E- 28MA4	█████ -...	1488	161	578	0,85	95,2	95,6	95,5	7,0	2,7	2,9	1,74	643
110	3MGS 315S4	3M0SG3E- 31SA4	█████ -...	1490	194	705	0,86	95,4	95,5	95,0	8,0	2,7	3,5	3,26	864
132	3MGS 315MA4	3M0SG3E- 31MA4	█████ -...	1490	231	845	0,86	95,6	95,7	95,3	8,3	3,0	3,6	3,57	920
160	3MGS 315MB4	3M0SG3E- 31MB4	█████ -...	1490	275	1026	0,88	95,8	96,1	95,9	7,8	2,7	3,3	4,06	990
200	3MGS 315MD4	3M0SG3E- 31MD4	█████ -...	1490	342	1282	0,88	96,0	96,3	96,1	7,8	2,6	3,2	4,68	1148
250	3MGS 355MA4	3M0SG3E- 35MA4	█████ -...	1490	452	1602	0,83	96,0	96,2	95,8	8,7	2,6	3,9	7,14	1504
315	3MGS 355MB4	3M0SG3E- 35MB4	█████ -...	1488	544	2019	0,87	96,0	96,3	96,3	8,0	2,4	3,6	8,98	1562
355	3MGS 355MC4	3M0SG3E- 35MC4	█████ -...	1489	613	2277	0,87	96,0	96,0	95,6	7,0	2,2	2,6	9,01	1612
400	3MGS 355LA4	3M0SG3E- 35LA4	█████ -...	1490	707	2564	0,85	96,0	95,8	95,5	7,3	2,3	2,8	10,3	1825
450	3MGS 355LB4	3M0SG3E- 35LB4	█████ -...	1490	796	2884	0,85	96,0	96,0	95,6	7,5	2,3	2,7	11,4	1930
500	3MGS 355LC4	3M0SG3E- 35LC4	█████ -...	1490	886	3205	0,85	96,0	96,0	95,5	7,2	2,2	2,7	12,5	2040

COMPACT MOTORS

Output Power	kW	Motor Type	Product Code	Speed Current Torque Power Factor				Efficiency			Starting Current Ratio	Starting Torque Ratio	Breakdown Torque Ratio	Moment of Inertia J kgm ²	Weight B3 kg
				n rpm	I _N A	T _N Nm	cosφ	4/4 Load 100%	3/4 Load 75%	2/4 Load 50%					
18,5	3MGS 160LK4	3M0SG3E- 16LK4	█████ -...	1475	35,2	120	0,82	92,6	93,0	92,7	7,8	2,8	3,4	0,132	145
30	3MGS 180LK4	3M0SG3E- 18LK4	█████ -...	1472	56,2	194	0,82	93,6	93,8	93,0	7,9	2,6	2,8	0,236	228
37	3MGS 200LK4	3M0SG3E- 20LK4	█████ -...	1478	64,6	239	0,88	93,9	94,7	95,0	7,5	2,4	2,9	0,360	274
55	3MGS 225MK4	3M0SG3E- 22MK4	█████ -...	1478	97,5	355	0,86	94,6	95,3	95,4	6,8	2,5	2,9	0,652	370
75	3MGS 250MK4	3M0SG3E- 25MK4	█████ -...	1481	133	484	0,86	95,0	95,7	95,9	7,0	2,6	2,9	1,16	482
110	3MGS 280MK4	3M0SG3E- 28MK4	█████ -...	1487	196	707	0,85	95,4	95,8	95,6	7,4	2,6	3,0	2,19	730
250	3MGS 315MK4	3M0SG3E- 31MK4	█████ -...	1489	428	1606	0,88	96,0	96,3	96,1	8,0	2,7	3,4	6,03	1304

Efficiency values are determined according to IEC 60034-2-1:2014. (By the summation of all separate losses, including additional load loss)

IE3

PERFORMANCE VALUES

Standard 3 phase, Squirrel Cage Induction Motors
 IP 55 protection, IC 411 cooling, F class insulation, B temperature rise
 IE3: Premium Efficiency Class (IEC 60034-30-1:2014)

6 Pole, 1000 rpm; 400 V 50 Hz

ALUMINIUM FRAME

STANDARD MOTORS

Output Power kW	Motor Type	Product Code	Speed	Current	Torque	Power Factor	Efficiency			Starting Current Ratio	Starting Torque Ratio	Breakdown Torque Ratio	Moment of Inertia J kgm ²	Weight B3
			n rpm	I _N A	T _N Nm	cosφ	4/4 Load 100%	3/4 Load 75%	2/4 Load 50%	I _A / I _N	T _A / T _N	T _K / T _N	kg	kg
3	3MAS 132S6	3M0SA3E- 13SA6 ■■■■ -...	970	6,92	29,5	0,73	85,6	87,2	86,2	5,8	2,4	3,1	0,0318	37
4	3MAS 132MA6	3M0SA3E- 13MA6 ■■■■ -...	970	8,78	39,5	0,76	86,8	87,5	86,9	6,5	2,3	3,4	0,0408	46
5,5	3MAS 132MB6	3M0SA3E- 13MB6 ■■■■ -...	972	12,2	54,1	0,74	88,0	88,7	87,9	6,6	2,7	3,5	0,0542	57
7,5	3MAS 160M6	3M0SA3E- 16MA6 ■■■■ -...	975	16,6	73,3	0,73	89,1	89,5	88,3	6,6	2,2	3,2	0,0784	77
11	3MAS 160L6	3M0SA3E- 16LA6 ■■■■ -...	975	22,6	108	0,78	90,3	90,9	90,2	7,0	2,4	3,3	0,114	103
15	3MAS 180L6	3M0SA3E- 18LA6 ■■■■ -...	976	30,5	147	0,78	91,2	92,1	93,2	6,1	2,4	3,0	0,181	131
18,5	3MAS 200LA6	3M0SA3E- 20LA6 ■■■■ -...	982	36,9	180	0,79	91,7	92,1	91,7	6,1	2,4	2,9	0,318	177
22	3MAS 200LB6	3M0SA3E- 20LB6 ■■■■ -...	985	43,5	213	0,79	92,2	92,7	92,4	7,3	2,7	3,4	0,373	199
30	3MAS 225M6	3M0SA3E- 22MA6 ■■■■ -...	985	60,4	290	0,77	92,9	93,5	93,0	7,0	2,6	3,2	0,584	263

COMPACT MOTORS

Output Power kW	Motor Type	Product Code	Speed	Current	Torque	Power Factor	Efficiency			Starting Current Ratio	Starting Torque Ratio	Breakdown Torque Ratio	Moment of Inertia J kgm ²	Weight B3
			n rpm	I _N A	T _N Nm	cosφ	4/4 Load 100%	3/4 Load 75%	2/4 Load 50%	I _A / I _N	T _A / T _N	T _K / T _N	kg	kg
37	3MAS 225MK6	3M0SA3E- 22MK6 ■■■■ -...	985	72,7	360	0,79	93,3	93,6	93,4	7,0	2,8	3,2	0,706	276

Efficiency values are determined according to IEC 60034-2-1:2014. (By the summation of all separate losses, including additional load loss)

PERFORMANCE VALUES

IE3

Standard 3 phase, Squirrel Cage Induction Motors
IP 55 protection, IC 411 cooling, F class insulation, B temperature rise
IE3: Premium Efficiency Class (IEC 60034-30-1:2014)

6 Pole, 1000 rpm; 400 V 50 Hz

CAST IRON FRAME

STANDARD MOTORS

Output Power	kW	Motor Type	Product Code	Speed Current Torque Power Factor				Efficiency			Starting Current Ratio	Starting Torque Ratio	Breakdown Torque Ratio	Moment of Inertia J kgm ²	Weight B3 kg
				n rpm	I _N A	T _N Nm	cosφ	4/4 Load 100%	3/4 Load 75%	2/4 Load 50%					
7,5	3MGS 160M6	3M0SG3E- 16MA6	█████ -...	975	16,6	73,3	0,73	89,1	89,5	88,3	6,6	2,2	3,2	0,0784	101
11	3MGS 160L6	3M0SG3E- 16LA6	█████ -...	975	22,6	108	0,78	90,3	90,9	90,2	7,0	2,4	3,3	0,114	129
15	3MGS 180L6	3M0SG3E- 18LA6	█████ -...	976	30,5	147	0,78	91,2	92,1	93,2	6,1	2,4	3,0	0,181	167
18,5	3MGS 200LA6	3M0SG3E- 20LA6	█████ -...	982	36,9	180	0,79	91,7	92,1	91,7	6,1	2,4	2,9	0,318	216
22	3MGS 200LB6	3M0SG3E- 20LB6	█████ -...	985	43,5	213	0,79	92,2	92,7	92,4	7,3	2,7	3,4	0,373	238
30	3MGS 225M6	3M0SG3E- 22MA6	█████ -...	985	60,4	290	0,77	92,9	93,5	93,0	7,0	2,6	3,2	0,584	308
37	3MGS 250M6	3M0SG3E- 25MA6	█████ -...	987	71,5	358	0,80	93,3	93,8	93,5	7,0	2,6	2,9	0,924	403
45	3MGS 280S6	3M0SG3E- 28SA6	█████ -...	991	88,9	434	0,78	93,7	94,0	93,7	6,7	2,2	2,7	1,47	478
55	3MGS 280M6	3M0SG3E- 28MA6	█████ -...	990	107	532	0,79	94,1	94,4	94,2	7,2	2,5	2,8	1,80	574
75	3MGS 315S6	3M0SG3E- 31SA6	█████ -...	991	138	724	0,83	94,6	95,0	94,7	6,8	2,7	2,9	3,59	789
90	3MGS 315MA6	3M0SG3E- 31MA6	█████ -...	991	163	867	0,84	94,9	95,4	95,3	6,7	2,3	2,8	4,37	868
110	3MGS 315MB6	3M0SG3E- 31MB6	█████ -...	990	199	1062	0,84	95,1	95,6	95,5	6,8	2,4	2,8	5,15	947
132	3MGS 315MC6	3M0SG3E- 31MC6	█████ -...	990	235	1274	0,85	95,4	95,9	96,0	7,1	2,5	2,9	6,10	1106
160	3MGS 355MA6	3M0SG3E- 35MA6	█████ -...	993	295	1541	0,82	95,6	95,6	95,0	6,8	2,4	2,6	7,55	1360
200	3MGS 355MB6	3M0SG3E- 35MB6	█████ -...	992	372	1925	0,81	95,8	95,6	95,0	6,5	2,3	2,5	9,08	1520
250	3MGS 355MC6	3M0SG3E- 35MC6	█████ -...	992	471	2407	0,80	95,8	95,9	95,5	6,8	2,4	2,6	11,5	1675
315	3MGS 355LA6	3M0SG3E- 35LA6	█████ -...	992	593	3033	0,80	95,8	95,6	95,1	6,6	2,3	2,5	12,8	1940
355	3MGS 355LB6	3M0SG3E- 35LB6	█████ -...	992	669	3418	0,80	95,8	95,8	95,2	6,7	2,3	2,6	14,4	2155
400	3MGS 355LC6	3M0SG3E- 35LC6	█████ -...	992	753	3850	0,80	95,8	95,8	95,8	6,8	2,3	2,3	16,1	2500

COMPACT MOTORS

Output Power	kW	Motor Type	Product Code	Speed Current Torque Power Factor				Efficiency			Starting Current Ratio	Starting Torque Ratio	Breakdown Torque Ratio	Moment of Inertia J kgm ²	Weight B3 kg
				n rpm	I _N A	T _N Nm	cosφ	4/4 Load 100%	3/4 Load 75%	2/4 Load 50%					
37	3MGS 225MK6	3M0SG3E- 22MK6	█████ -...	985	72,7	360	0,79	93,3	93,6	93,4	7,0	2,8	3,2	0,706	321
45	3MGS 250MK6	3M0SG3E- 25MK6	█████ -...	982	84,6	438	0,82	93,7	94,1	93,6	7,5	2,8	3,3	1,13	435
75	3MGS 280MK6	3M0SG3E- 28MK6	█████ -...	989	136	723	0,84	94,6	94,9	94,6	7,6	2,5	3,1	2,15	635
160	3MGS 315MK6	3M0SG3E- 31MK6	█████ -...	991	285	1545	0,85	95,6	96,1	96,3	6,5	2,3	2,9	7,51	1250

Efficiency values are determined according to IEC 60034-2-1:2014. (By the summation of all separate losses, including additional load loss)

IE3

PERFORMANCE VALUES

Standard 3 phase, Squirrel Cage Induction Motors
 IP 55 protection, IC 411 cooling, F class insulation, B temperature rise
 IE3: Premium Efficiency Class (IEC 60034-30-1:2014)

8 Pole, 750 rpm; 400 V 50 Hz

ALUMINIUM FRAME

STANDARD MOTORS

Output Power kW	Motor Type	Product Code	Speed	Current	Torque	Power Factor	Efficiency			Starting Current Ratio	Starting Torque Ratio	Breakdown Torque Ratio	Moment of Inertia J	Weight B3 kg
			n rpm	I _N A	T _N Nm	cosφ	4/4 Load 100%	3/4 Load 75%	2/4 Load 50%	I _A / I _N	T _A / T _N	T _K / T _N	kgm ²	kg
2,2	3MAS 132S8	3M0SA3E- 13SA8 ■■■■ ...	720	5,88	29,2	0,66	81,9	81,0	78,0	5,3	2,0	3,6	0,0460	27
3	3MAS 132M8	3M0SA3E- 13MA8 ■■■■ ■ ...	720	7,74	39,8	0,67	83,5	83,0	81,2	5,6	2,1	3,7	0,0556	35
4	3MAS 160MA8	3M0SA3E- 16MA8 ■■■■ ■ ...	730	9,86	52,3	0,69	84,8	85,0	84,0	5,2	2,0	2,8	0,108	58
5,5	3MAS 160MB8	3M0SA3E- 16MB8 ■■■■ ■ ...	730	13,3	71,8	0,69	86,2	86,5	95,8	5,4	2,1	3,0	0,126	72
7,5	3MAS 160L8	3M0SA3E- 16LA8 ■■■■ ■ ...	730	17,5	98,3	0,71	87,3	88,0	97,8	5,2	2,0	2,8	0,181	94
11	3MAS 180L8	3M0SA3E- 18LA8 ■■■■ ■ ...	728	25,5	144	0,70	88,6	88,5	97,6	5,6	2,1	2,8	0,245	116
15	3MAS 200L8	3M0SA3E- 20LA8 ■■■■ ■ ...	732	32,3	196	0,75	89,6	90,2	89,8	5,3	2,0	2,5	0,460	181
18,5	3MAS 225S8	3M0SA3E- 22SA8 ■■■■ ■ ...	736	38,0	240	0,78	90,1	90,5	90,2	5,8	2,2	2,6	0,705	218
22	3MAS 225M8	3M0SA3E- 22MA8 ■■■■ ■ ...	738	45,0	285	0,78	90,6	90,8	90,0	6,0	2,3	2,8	0,837	245

Efficiency values are determined according to IEC 60034-2-1:2014. (By the summation of all separate losses, including additional load loss)

PERFORMANCE VALUES

IE3

Standard 3 phase, Squirrel Cage Induction Motors
IP 55 protection, IC 411 cooling, F class insulation, B temperature rise
IE3: Premium Efficiency Class (IEC 60034-30-1:2014)

8 Pole, 750 rpm; 400 V 50 Hz

CAST IRON FRAME

STANDARD MOTORS

Output Power	kW	Motor Type	Product Code	Speed	Current	Torque	Power Factor	Efficiency			Starting Current Ratio	Starting Torque Ratio	Breakdown Torque Ratio	Moment of Inertia J	Weight B3
				n rpm	I _N A	T _N Nm	cosφ	4/4 Load 100%	3/4 Load 75%	2/4 Load 50%	I _A / I _N	T _A / T _N	T _K / T _N	kgm ²	kg
4	3MGS 160MA8	3M0SG3E- 16MA8	█████ -...	730	9,86	52,3	0,69	84,8	85,0	84,0	5,2	2,0	2,8	0,108	82
5,5	3MGS 160MB8	3M0SG3E- 16MB8	█████ -...	730	13,3	71,8	0,69	86,2	86,5	95,8	5,4	2,1	3,0	0,126	96
7,5	3MGS 160L8	3M0SG3E- 16LA8	█████ -...	730	17,5	98,3	0,71	87,3	88,0	97,8	5,2	2,0	2,8	0,181	120
11	3MGS 180L8	3M0SG3E- 18LA8	█████ -...	728	25,5	144	0,70	88,6	88,5	97,6	5,6	2,1	2,8	0,245	152
15	3MGS 200L8	3M0SG3E- 20LA8	█████ -...	732	32,3	196	0,75	89,6	90,2	89,8	5,3	2,0	2,5	0,460	220
18,5	3MGS 225S8	3M0SG3E- 22SA8	█████ -...	736	38,0	240	0,78	90,1	90,5	90,2	5,8	2,2	2,6	0,705	263
22	3MGS 225M8	3M0SG3E- 22MA8	█████ -...	738	45,0	285	0,78	90,6	90,8	90,0	6,0	2,3	2,8	0,837	290
30	3MGS 250M8	3M0SG3E- 25MA8	█████ -...	735	60,1	390	0,79	91,3	91,5	91,2	6,4	2,5	3,0	1,40	396
37	3MGS 280S8	3M0SG3E- 28SA8	█████ -...	740	72,8	478	0,80	91,8	91,8	91,3	6,2	2,2	2,7	2,20	453
45	3MGS 280M8	3M0SG3E- 28MA8	█████ -...	741	89,2	580	0,79	92,2	92,3	91,5	6,4	2,3	2,8	2,59	498
55	3MGS 315S8	3M0SG3E- 31SA8	█████ -...	741	107	709	0,80	92,5	92,5	91,8	6,5	1,8	2,7	3,92	766
75	3MGS 315MA8	3M0SG3E- 31MA8	█████ -...	740	142	968	0,82	93,1	93,0	92,2	6,3	1,7	2,6	5,34	804
90	3MGS 315MB8	3M0SG3E- 31MB8	█████ -...	741	170	1160	0,82	93,4	93,5	92,5	6,8	1,9	2,7	6,32	879
110	3MGS 315MC8	3M0SG3E- 31MC8	█████ -...	742	212	1416	0,80	93,7	93,7	93,0	6,7	1,9	2,6	7,30	936
132	3MGS 355MA8	3M0SG3E- 35MA8	█████ -...	745	254	1692	0,80	94,0	94,0	93,3	7,2	1,4	2,5	8,51	1320
160	3MGS 355MB8	3M0SG3E- 35MB8	█████ -...	745	307	2051	0,80	94,3	94,2	93,5	7,4	1,5	2,6	10,2	1590
200	3MGS 355MC8	3M0SG3E- 35MC8	█████ -...	745	382	2564	0,80	94,6	94,6	94,0	7,2	1,4	2,5	11,6	1745
250	3MGS 355LA8	3M0SG3E- 35LA8	█████ -...	745	480	3205	0,79	94,6	94,3	93,8	7,2	1,5	2,6	13,5	1900

COMPACT MOTORS

Output Power	kW	Motor Type	Product Code	Speed	Current	Torque	Power Factor	Efficiency			Starting Current Ratio	Starting Torque Ratio	Breakdown Torque Ratio	Moment of Inertia J	Weight B3
				n rpm	I _N A	T _N Nm	cosφ	4/4 Load 100%	3/4 Load 75%	2/4 Load 50%	I _A / I _N	T _A / T _N	T _K / T _N	kgm ²	kg
132	3MGS 315MK8	3M0SG3E- 31MK8	█████ -...	744	253	1694	0,80	94,0	94,0	92,8	6,8	1,7	2,6	8,27	1056

Efficiency values are determined according to IEC 60034-2-1:2014. (By the summation of all separate losses, including additional load loss)



PERFORMANCE VALUES

Standard 3 phase, Squirrel Cage Induction Motors
 IP 55 protection, IC 411 cooling, F class insulation, B temperature rise
 IE4: Super Premium Efficiency Class (IEC 60034-30-1:2014)

2 Pole, 3000 rpm; 400 V 50 Hz

ALUMINIUM FRAME

STANDARD MOTORS

Output Power kW	Motor Type	Product Code	Speed	Current	Torque	Power Factor	Efficiency			Starting Current Ratio	Starting Torque Ratio	Breakdown Torque Ratio	Moment of Inertia J kgm ²	Weight B3
			n rpm	I _N A	T _N Nm	cosφ	4/4 Load 100%	3/4 Load 75%	2/4 Load 50%	I _A / I _N	T _A / T _N	T _K / T _N	kg	
0,75	3MAS 80MA2	3M0SA4E- 08MA2 ■■■■■ -...	2875	1,54	2,49	0,84	83,5	84,0	83,3	7,7	3,6	4,0	0,0010	10
1,1	3MAS 80MB2	3M0SA4E- 08MB2 ■■■■■ -...	2875	2,21	3,65	0,84	85,2	85,9	85,0	8,0	3,6	4,0	0,0012	11
1,5	3MAS 90S2	3M0SA4E- 09SA2 ■■■■■ -...	2885	2,98	4,97	0,84	86,5	87,0	86,7	8,2	3,8	3,8	0,0019	15
2,2	3MAS 90L2	3M0SA4E- 09LA2 ■■■■■ -...	2890	4,25	7,27	0,85	88,0	88,5	88,1	9,3	3,9	4,4	0,0024	17
3	3MAS 100L2	3M0SA4E- 10LA2 ■■■■■ -...	2900	5,52	9,88	0,88	89,1	89,4	88,9	9,1	3,3	4,1	0,0048	26
4	3MAS 112M2	3M0SA4E- 11MA2 ■■■■■ -...	2915	7,21	13,1	0,89	90,0	90,4	90,1	9,0	3,2	4,0	0,0082	32
5,5	3MAS 132SA2	3M0SA4E- 13SA2 ■■■■■ -...	2925	10,3	18,0	0,85	90,9	91,5	90,7	7,8	2,9	3,8	0,0166	47
7,5	3MAS 132SB2	3M0SA4E- 13SB2 ■■■■■ -...	2925	13,8	24,6	0,86	91,7	92,6	92,5	8,2	3,3	3,8	0,0206	54
11	3MAS 160MA2	3M0SA4E- 16MA2 ■■■■■ -...	2960	19,3	35,6	0,89	92,6	92,7	91,7	8,4	3,2	3,7	0,0496	88
15	3MAS 160MB2	3M0SA4E- 16MB2 ■■■■■ -...	2960	26,1	48,5	0,89	93,3	93,6	92,9	8,5	3,3	3,7	0,0637	104
18,5	3MAS 160L2	3M0SA4E- 16LA2 ■■■■■ -...	2955	31,7	59,9	0,90	93,7	94,2	93,8	8,4	3,1	3,8	0,0753	122
22	3MAS 180M2	3M0SA4E- 18MA2 ■■■■■ -...	2960	37,1	70,9	0,91	94,0	94,5	94,3	8,4	3,2	3,5	0,115	160
30	3MAS 200LA2	3M0SA4E- 20LA2 ■■■■■ -...	2970	51,5	96,5	0,89	94,5	94,6	93,9	8,4	3,1	3,4	0,185	223
37	3MAS 200LB2	3M0SA4E- 20LB2 ■■■■■ -...	2970	63,3	119	0,89	94,8	94,9	94,2	8,5	3,2	3,5	0,209	254
45	3MAS 225M2	3M0SA4E- 22MA2 ■■■■■ -...	2975	74,9	144	0,91	95,0	95,3	95,0	8,3	2,7	3,3	0,349	337

Efficiency values are determined according to IEC 60034-2-1:2014. (By the summation of all separate losses, including additional load loss)

PERFORMANCE VALUES



Standard 3 phase, Squirrel Cage Induction Motors
IP 55 protection, IC 411 cooling, F class insulation, B temperature rise
IE4: Super Premium Efficiency Class (IEC 60034-30-1:2014)

2 Pole, 3000 rpm; 400 V 50 Hz

CAST IRON FRAME

STANDARD MOTORS

Output Power kW	Motor Type	Product Code	Speed n rpm	Current I _N A	Torque T _N Nm	Power Factor cosφ	Efficiency			Starting Current Ratio I _A / I _N	Starting Torque Ratio T _A / T _N	Breakdown Torque Ratio T _K / T _N	Moment of Inertia J kgm ²	Weight B3 kg
			4/4 Load 100%	3/4 Load 75%	2/4 Load 50%									
11	3MGS 160MA2	3M0SG4E- 16MA2 ■■■■ -...	2960	19,3	35,6	0,89	92,6	92,7	91,7	8,4	3,2	3,7	0,0496	112
15	3MGS 160MB2	3M0SG4E- 16MB2 ■■■■ -...	2960	26,1	48,5	0,89	93,3	93,6	92,9	8,5	3,3	3,7	0,0637	127
18,5	3MGS160L2	3M0SG4E- 16LA2 ■■■■ -...	2955	31,7	59,9	0,90	93,7	94,2	93,8	8,4	3,1	3,8	0,0753	148
22	3MGS 180M2	3M0SG4E- 18MA2 ■■■■ -...	2960	37,1	70,9	0,91	94,0	94,5	94,3	8,4	3,2	3,5	0,115	191
30	3MGS 200LA2	3M0SG4E- 20LA2 ■■■■ -...	2970	51,5	96,5	0,89	94,5	94,6	93,9	8,4	3,1	3,4	0,185	262
37	3MGS 200LB2	3M0SG4E- 20LB2 ■■■■ -...	2970	63,3	119	0,89	94,8	94,9	94,2	8,5	3,2	3,5	0,209	293
45	3MGS 225M2	3M0SG4E- 22MA2 ■■■■ -...	2975	74,9	144	0,91	95,0	95,3	95,0	8,3	2,7	3,3	0,349	382
55	3MGS 250M2	3M0SG4E- 25MA2 ■■■■ -...	2980	91,4	176	0,91	95,3	95,4	95,1	8,2	2,7	3,6	0,515	546
75	3MGS 280S2	3M0SG4E- 28SA2 ■■■■ -...	2981	124	240	0,91	95,6	95,8	95,6	7,6	2,1	3,0	1,17	651
90	3MGS 280M2	3M0SG4E- 28MA2 ■■■■ -...	2981	149	288	0,91	95,8	96,0	95,7	7,8	2,3	3,1	1,27	732
110	3MGS 315S2	3M0SG4E- 31SA2 ■■■■ -...	2983	181	351	0,91	96,0	96,2	95,8	8,0	2,4	3,2	2,59	1105
132	3MGS 315MA2	3M0SG4E- 31MA2 ■■■■ -...	2983	216	423	0,92	96,2	96,3	96,0	7,9	2,4	3,1	2,91	1184
160	3MGS 315MB2	3M0SG4E- 31MB2 ■■■■ -...	2983	261	512	0,92	96,3	96,5	96,2	7,9	2,5	3,1	3,23	1326
200	3MGS 315MD2	3M0SG4E- 31MD2 ■■■■ -...	2983	325	640	0,92	96,5	96,4	96,0	8,0	2,5	3,0	3,60	1408
250	3MGS 355MA2	3M0SG4E- 35MA2 ■■■■ -...	2982	407	801	0,92	96,5	96,5	96,2	7,8	2,3	2,8	3,63	1520
315	3MGS 355MB2	3M0SG4E- 35MB2 ■■■■ -...	2982	518	1009	0,91	96,5	96,4	96,1	8,0	2,4	2,8	3,85	1605
355	3MGS 355MC2	3M0SG4E- 35MC2 ■■■■ -...	2982	584	1137	0,91	96,5	96,4	96,0	7,8	2,4	2,8	4,13	1860

Efficiency values are determined according to IEC 60034-2-1:2014. (By the summation of all separate losses, including additional load loss)



PERFORMANCE VALUES

Standard 3 phase, Squirrel Cage Induction Motors
 IP 55 protection, IC 411 cooling, F class insulation, B temperature rise
 IE4: Super Premium Efficiency Class (IEC 60034-30-1:2014)

4 Pole, 1500 rpm; 400 V 50 Hz

ALUMINIUM FRAME

STANDARD MOTORS

Output Power	kW	Motor Type	Product Code	Speed	Current	Torque	Power Factor	Efficiency			Starting Current Ratio	Starting Torque Ratio	Breakdown Torque Ratio	Moment of Inertia J kgm ²	Weight B3
				n rpm	I _N A	T _N Nm	cosφ	4/4 Load 100%	3/4 Load 75%	2/4 Load 50%	I _A / I _N	T _A / T _N	T _K / T _N	kg	
0,55	3MAS 80MA4	3MOSA4E- 08MA4	█████ - ...	1420	1,21	3,69	0,78	83,9	84,2	83,5	6,5	3,7	3,9	0,0019	11
0,75	3MAS 80MB4	3MOSA4E- 08MB4	█████ - ...	1420	1,60	5,05	0,79	85,7	86,0	85,4	7,0	4,0	4,1	0,0027	14
1,1	3MAS 90S4	3MOSA4E- 09SA4	█████ - ...	1440	2,25	7,30	0,81	87,2	87,5	86,8	8,1	3,9	4,3	0,0046	17
1,5	3MAS 90L4	3MOSA4E- 09LA4	█████ - ...	1440	2,95	9,93	0,83	88,2	88,5	87,7	8,2	3,9	4,3	0,0059	20
2,2	3MAS 100LA4	3MOSA4E- 10LA4	█████ - ...	1450	4,28	14,5	0,83	89,5	89,5	88,8	8,7	3,6	4,4	0,0068	26
3	3MAS 100LB4	3MOSA4E- 10LB4	█████ - ...	1450	5,65	19,8	0,85	90,4	90,8	90,0	8,8	3,7	4,4	0,0085	31
4	3MAS 112M4	3MOSA4E- 11MA4	█████ - ...	1450	7,36	26,3	0,86	91,1	91,5	90,8	8,7	3,3	4,3	0,0159	37
5,5	3MAS 132S4	3MOSA4E- 13SA4	█████ - ...	1470	10,8	35,8	0,80	91,9	91,7	90,2	8,2	3,3	3,8	0,0391	55
7,5	3MAS 132M4	3MOSA4E- 13MA4	█████ - ...	1470	14,8	48,8	0,79	92,6	92,9	92,1	8,2	3,4	3,8	0,0431	62
11	3MAS 160M4	3MOSA4E- 16MA4	█████ - ...	1475	21,0	71,2	0,81	93,3	93,1	92,4	7,5	2,9	3,5	0,112	109
15	3MAS 160L4	3MOSA4E- 16LA4	█████ - ...	1475	28,1	97,1	0,82	93,9	94,1	93,3	8,0	3,1	3,5	0,131	139
18,5	3MAS 180M4	3MOSA4E- 18MA4	█████ - ...	1480	35,3	119	0,80	94,2	94,4	93,9	8,0	3,3	3,7	0,204	167
22	3MAS 180L4	3MOSA4E- 18LA4	█████ - ...	1480	42,0	142	0,80	94,5	94,8	94,3	8,2	3,4	3,8	0,234	184
30	3MAS 200L4	3MOSA4E- 20LA4	█████ - ...	1485	52,7	194	0,87	94,9	95,1	94,6	8,0	2,9	3,4	0,358	275
37	3MAS 225S4	3MOSA4E- 22SA4	█████ - ...	1485	65,2	238	0,86	95,2	95,2	94,7	8,4	3,3	3,6	0,627	319
45	3MAS 225M4	3MOSA4E- 22MA4	█████ - ...	1485	80,3	290	0,85	95,4	95,4	94,8	8,6	3,4	3,7	0,750	366

Efficiency values are determined according to IEC 60034-2-1:2014. (By the summation of all separate losses, including additional load loss)

PERFORMANCE VALUES



Standard 3 phase, Squirrel Cage Induction Motors
IP 55 protection, IC 411 cooling, F class insulation, B temperature rise
IE4: Super Premium Efficiency Class (IEC 60034-30-1:2014)

4 Pole, 1500 rpm; 400 V 50 Hz

CAST IRON FRAME

STANDARD MOTORS

Output Power kW	Motor Type	Product Code	Speed	Current	Torque	Power Factor	Efficiency			Starting Current Ratio	Starting Torque Ratio	Breakdown Torque Ratio	Moment of Inertia J	Weight B3
			n rpm	I _N A	T _N Nm	cosφ	4/4 Load 100%	3/4 Load 75%	2/4 Load 50%	I _A / I _N	T _A / T _N	T _K / T _N	kgm ²	kg
11	3MGS 160M4	3M0SG4E- 16MA4 ■■■■■ ...	1475	21,0	71,2	0,81	93,3	93,1	92,4	7,5	2,9	3,5	0,112	132
15	3MGS 160L4	3M0SG4E- 16LA4 ■■■■■ ...	1475	28,1	97,1	0,82	93,9	94,1	93,3	8,0	3,1	3,5	0,131	165
18,5	3MGS 180M4	3M0SG4E- 18MA4 ■■■■■ ...	1480	35,3	119	0,80	94,2	94,4	93,9	8,0	3,3	3,7	0,204	198
22	3MGS 180L4	3M0SG4E- 18LA4 ■■■■■ ...	1480	42,0	142	0,80	94,5	94,8	94,3	8,2	3,4	3,8	0,234	220
30	3MGS 200L4	3M0SG4E- 20LA4 ■■■■■ ...	1485	52,7	194	0,87	94,9	95,1	94,6	8,0	2,9	3,4	0,358	314
37	3MGS 225S4	3M0SG4E- 22SA4 ■■■■■ ...	1485	65,2	238	0,86	95,2	95,2	94,7	8,4	3,3	3,6	0,627	364
45	3MGS 225M4	3M0SG4E- 22MA4 ■■■■■ ...	1485	80,3	290	0,85	95,4	95,4	94,8	8,6	3,4	3,7	0,750	411
55	3MGS 250M4	3M0SG4E- 25MA4 ■■■■■ ...	1492	96,5	352	0,86	95,7	95,6	94,8	8,8	3,4	3,6	1,15	529
75	3MGS 280S4	3M0SG4E- 28SA4 ■■■■■ ...	1489	127	482	0,89	96,0	96,2	95,8	8,4	3,2	3,6	1,99	647
90	3MGS 280M4	3M0SG4E- 28MA4 ■■■■■ ...	1490	157	576	0,86	96,1	96,3	95,9	8,4	3,3	3,7	2,45	779
110	3MGS 315S4	3M0SG4E- 31SA4 ■■■■■ ...	1491	188	705	0,88	96,3	96,5	96,1	8,2	2,7	3,5	4,41	992
132	3MGS 315MA4	3M0SG4E- 31MA4 ■■■■■ ...	1492	225	846	0,88	96,4	96,5	96,1	8,3	2,7	3,4	5,14	1086
160	3MGS 315MB4	3M0SG4E- 31MB4 ■■■■■ ...	1490	272	1026	0,88	96,6	96,8	96,5	8,4	2,9	3,5	6,37	1243
200	3MGS 315MD4	3M0SG4E- 31MD4 ■■■■■ ...	1490	336	1282	0,89	96,7	96,8	96,6	7,8	2,7	3,2	7,96	1509
250	3MGS 355MA4	3M0SG4E- 35MA4 ■■■■■ ...	1491	434	1601	0,86	96,7	96,7	96,4	7,8	2,4	3,0	8,19	1705
315	3MGS 355MB4	3M0SG4E- 35MB4 ■■■■■ ...	1491	541	2019	0,87	96,7	96,6	96,0	7,5	2,6	3,0	8,74	1750
355	3MGS 355LA4	3M0SG4E- 35LA4 ■■■■■ ...	1491	609	2274	0,87	96,7	96,6	96,2	7,8	2,5	3,0	10,0	1900

Efficiency values are determined according to IEC 60034-2-1:2014. (By the summation of all separate losses, including additional load loss)



PERFORMANCE VALUES

Standard 3 phase, Squirrel Cage Induction Motors
 IP 55 protection, IC 411 cooling, F class insulation, B temperature rise
 IE4: Super Premium Efficiency Class (IEC 60034-30-1:2014)

6 Pole, 1000 rpm; 400 V 50 Hz

ALUMINIUM FRAME

STANDARD MOTORS

Output Power kW	Motor Type	Product Code	Speed	Current	Torque	Power Factor	Efficiency			Starting Current Ratio	Starting Torque Ratio	Breakdown Torque Ratio	Moment of Inertia J kgm ²	Weight B3
			n rpm	I _N A	T _N Nm	cosφ	4/4 Load 100%	3/4 Load 75%	2/4 Load 50%	I _A / I _N	T _A / T _N	T _K / T _N	kg	
3	3MAS 132S6	3MOSA4E- 13SA6 ■■■■ -...	972	6,88	29,5	0,71	88,6	88,9	87,3	6,0	2,4	3,2	0,0331	42
4	3MAS 132MA6	3MOSA4E- 13MA6 ■■■■■ -...	975	8,60	39,2	0,75	89,5	89,5	88,7	6,2	2,3	2,7	0,0495	53
5,5	3MAS 132MB6	3MOSA4E- 13MB6 ■■■■■ -...	975	11,7	53,9	0,75	90,5	90,4	90,0	6,4	2,5	2,8	0,0657	66
7,5	3MAS 160M6	3MOSA4E- 16MA6 ■■■■■ -...	975	16,2	73,2	0,73	91,3	91,3	89,7	7,3	2,7	3,7	0,100	94
11	3MAS 160L6	3MOSA4E- 16LA6 ■■■■■ -...	980	22,3	107	0,77	92,3	92,4	91,3	7,6	2,8	3,8	0,168	133
15	3MAS 180L6	3MOSA4E- 18LA6 ■■■■■ -...	980	30,2	146	0,77	92,9	92,8	92,3	7,3	3,0	3,6	0,230	164
18,5	3MAS 200LA6	3MOSA4E- 20LA6 ■■■■■ -...	985	36,1	179	0,79	93,4	93,3	92,6	7,4	2,5	3,2	0,399	200
22	3MAS 200LB6	3MOSA4E- 20LB6 ■■■■■ -...	985	42,8	213	0,79	93,7	93,6	93,2	7,6	2,9	3,4	0,473	236
30	3MAS 225M6	3MOSA4E- 22MA6 ■■■■■ -...	986	59,4	291	0,78	94,2	94,0	93,6	7,3	3,0	3,4	0,716	318

Efficiency values are determined according to IEC 60034-2-1:2014. (By the summation of all separate losses, including additional load loss)

PERFORMANCE VALUES



Standard 3 phase, Squirrel Cage Induction Motors
IP 55 protection, IC 411 cooling, F class insulation, B temperature rise
IE4: Super Premium Efficiency Class (IEC 60034-30-1:2014)

6 Pole, 1000 rpm; 400 V 50 Hz

CAST IRON FRAME

STANDARD MOTORS

Output Power kW	Motor Type	Product Code	Speed n rpm	Current I _N A	Torque T _N Nm	Power Factor cosφ	Efficiency			Starting Current Ratio I _A / I _N	Starting Torque Ratio T _A / T _N	Breakdown Torque Ratio T _K / T _N	Moment of Inertia J kgm ²	Weight B3 kg
			4/4 Load 100%	3/4 Load 75%	2/4 Load 50%									
7,5	3MGS 160M6	3M0SG4E- 16MA6 ■■■■ ...	975	16,2	73,2	0,73	91,3	91,3	89,7	7,3	2,7	3,7	0,100	118
11	3MGS 160L6	3M0SG4E- 16LA6 ■■■■ ...	980	22,3	107	0,77	92,3	92,4	91,3	7,6	2,8	3,8	0,168	159
15	3MGS 180L6	3M0SG4E- 18LA6 ■■■■ ...	980	30,2	146	0,77	92,9	92,8	92,3	7,3	3,0	3,6	0,230	201
18,5	3MGS 200LA6	3M0SG4E- 20LA6 ■■■■ ...	985	36,1	179	0,79	93,4	93,3	92,6	7,4	2,5	3,2	0,399	239
22	3MGS 200LB6	3M0SG4E- 20LB6 ■■■■ ...	985	42,8	213	0,79	93,7	93,6	93,2	7,6	2,9	3,4	0,473	275
30	3MGS 225M6	3M0SG4E- 22MA6 ■■■■ ...	986	59,4	291	0,78	94,2	94,0	93,6	7,3	3,0	3,4	0,716	362
37	3MGS 250M6	3M0SG4E- 25MA6 ■■■■ ...	988	70,7	358	0,80	94,5	94,5	94,2	7,9	2,9	3,5	1,13	462
45	3MGS 280S6	3M0SG4E- 28SA6 ■■■■ ...	992	80,6	433	0,85	94,8	95,0	94,6	6,7	2,3	2,7	1,79	559
55	3MGS 280M6	3M0SG4E- 28MA6 ■■■■ ...	992	98,6	532	0,85	95,1	95,2	95,0	6,7	2,3	2,7	2,14	661
75	3MGS 315S6	3M0SG4E- 31SA6 ■■■■ ...	992	132	724	0,86	95,4	95,3	94,8	7,0	2,2	3,0	4,35	870
90	3MGS 315MA6	3M0SG4E- 31MA6 ■■■■ ...	992	160	867	0,85	95,6	95,8	95,3	7,0	2,3	3,0	5,13	948
110	3MGS 315MB6	3M0SG4E- 31MB6 ■■■■ ...	992	193	1062	0,86	95,8	95,8	95,3	6,9	2,3	2,9	5,91	1028
132	3MGS 315MC6	3M0SG4E- 31MC6 ■■■■ ...	992	231	1274	0,86	96,0	96,2	95,9	6,9	2,3	2,9	7,15	1217
160	3MGS 355MA6	3M0SG4E- 35MA6 ■■■■ ...	995	289	1535	0,83	96,2	96,1	95,6	6,8	2,2	2,6	9,05	1565
200	3MGS 355MB6	3M0SG4E- 35MB6 ■■■■ ...	995	361	1919	0,83	96,3	96,2	95,5	7,0	2,3	2,6	11,4	1670
250	3MGS 355MC6	3M0SG4E- 35MC6 ■■■■ ...	995	450	2398	0,83	96,5	96,4	95,8	6,8	2,2	2,6	12,8	1850
315	3MGS 355LA6	3M0SG4E- 35LA6 ■■■■ ...	995	567	3023	0,83	96,6	96,3	95,5	6,7	2,3	2,7	14,3	2115
355	3MGS 355LB6	3M0SG4E- 35LB6 ■■■■ ...	995	647	3407	0,82	96,6	96,5	96,0	7,0	2,4	2,8	16,0	2365

Efficiency values are determined according to IEC 60034-2-1:2014. (By the summation of all separate losses, including additional load loss)

DEMAND CODES

Here is all additional features listed below for our standard induction motors. All requests should be specified with their codes in order. These features are applicable to both IE3 and IE4 motors. Note that there are some features that cannot be used together.

Code		Frame Size												
		80	90	100	112	132	160	180	200	225	250	280	315	355
	Packaging													
A01	Overseas packing	o	o	o	o	o	o	o	o	o	o	o	o	o
A02	Overseas packing, wooden	o	o	o	o	o	o	o	o	o	o	o	o	o
A03	Packing of motor in vertical mounting position	o	o	o	o	o	o	o	o	o	o	o	o	o
	Balancing													
B01	Vibration level grade B according to IEC 60034-14	o	o	o	o	o	o	o	o	o	o	o	o	o
B11	Full-key balancing	o	o	o	o	o	o	o	o	o	o	o	o	o
B12	Balanced without key	o	o	o	o	o	o	o	o	o	o	o	o	o
	Painting													
B50	Unpainted motors (Just for aluminium frames)	o	o	o	o	o	o	o	o	o	x	x	x	x
B51	Primer paint only (Just for cast iron frames)	x	x	x	x	x	o	o	o	o	o	o	o	o
B52	Special paint colors, standard RAL codes	o	o	o	o	o	o	o	o	o	o	o	o	o
B53	Painting system C5	o	o	o	o	o	o	o	o	o	o	o	o	o
	Name Plate													
E01	On right, stainless steel material (viewed from DE side)	o	o	o	o	o	o	o	o	o	o	o	o	o
E02	On left, stainless steel material (viewed from DE side)	o	o	o	o	o	o	o	o	o	o	o	o	o
E03	On left, aluminium material (viewed from DE side)	o	o	o	o	o	o	o	o	o	o	o	o	o
E04	2nd rating plate, aluminium material, affixed	o	o	o	o	o	o	o	o	o	o	o	o	o
E05	2nd rating plate, stainless steel material, affixed	o	o	o	o	o	o	o	o	o	o	o	o	o
E06	2nd rating plate, aluminium material, unmounted	o	o	o	o	o	o	o	o	o	o	o	o	o
E07	2nd rating plate, stainless steel material, unmounted	o	o	o	o	o	o	o	o	o	o	o	o	o
E08	Additional information on rating plate (max. 20 characters)	o	o	o	o	o	o	o	o	o	o	o	o	o
	Cooling													
S01	IC 416 Cooling method, forced Cooling	o	o	o	o	o	o	o	o	o	o	o	o	o
S02	IC 410 Cooling method, without fan	o	o	o	o	o	o	o	o	o	o	o	o	o
S03	IC 418 Cooling method, cooling with driven fan by the motor itself	o	o	o	o	o	o	o	o	o	o	o	o	o
	Temperature Sensors													
T60	KTY 84 - 130 in stator winding	o	o	o	o	o	o	o	o	o	o	o	o	o
T02	Bimetal (Thermostat), 130°C, 3 in Stator winding	o	o	o	o	o	o	o	o	o	o	o	o	o
T01	Bimetal (Thermostat), 150°C, 3 in Stator winding	o	o	o	o	o	o	o	o	o	o	o	o	o
T03	Bimetal (Thermostat), 170°C, 3 in Stator winding	o	o	o	o	o	o	o	o	o	o	o	o	o
T20	PTC Thermistor, 130°C, 3 in Stator winding	o	o	o	o	o	o	o	o	o	o	o	o	o
T22	PTC Thermistor, 150°C, 3 in Stator winding	o	o	o	o	o	o	o	o	o	o	o	o	o
T21	PTC Thermistor, 170°C, 3 in Stator winding	o	o	o	o	o	o	o	o	o	o	o	o	o
T30	PTC Thermistor, 130°C - 3 and 150°C - 3 in Stator winding	o	o	o	o	o	o	o	o	o	o	o	o	o
T31	PTC Thermistor, 150°C - 3 and 170°C - 3 in Stator winding	o	o	o	o	o	o	o	o	o	o	o	o	o
T40	PT100, 2-wire in Stator winding	o	o	o	o	o	o	o	o	o	o	o	o	o
T50	PT100, 3-wire in Stator winding	o	o	o	o	o	o	o	o	o	o	o	o	o
R40	PT100, 2-wire on bearings	x	x	x	x	o	o	o	o	o	o	o	o	o
R50	PT100, 3-wire on bearings	x	x	x	x	o	o	o	o	o	o	o	o	o
	Heating Elements													
H01	Heating elements, supply voltage 100V-120V	o	o	o	o	o	o	o	o	o	o	o	o	o
H02	Heating elements, supply voltage 200V-240V	o	o	o	o	o	o	o	o	o	o	o	o	o
	Terminal Box													
K50	Brass cable glands	o	o	o	o	o	o	o	o	o	o	o	o	o
K51	Stainless steel cable glands	o	o	o	o	o	o	o	o	o	o	o	o	o

S : As standard

o : On request

x : Not applicable

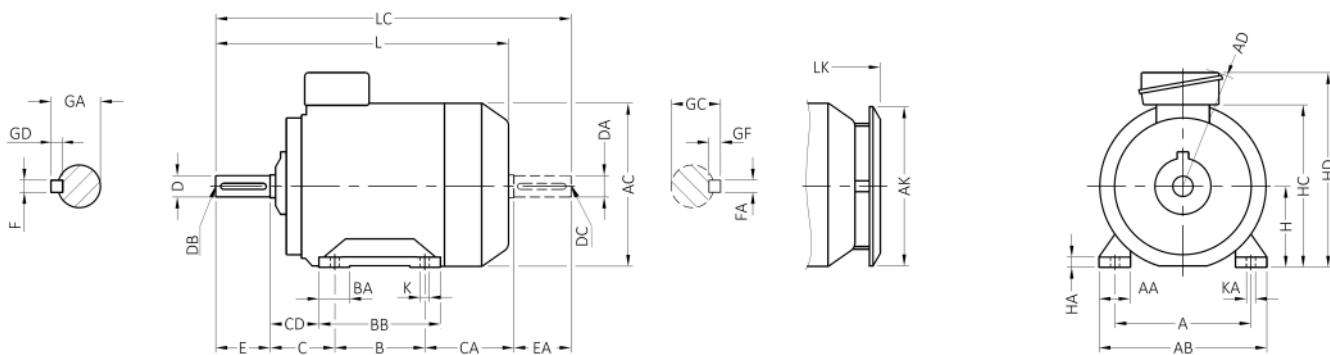
Code		Frame Size												
		80	90	100	112	132	160	180	200	225	250	280	315	355
	Shaft and Rotor													
M01	Shaft material stainless steel	o	o	o	o	o	o	o	o	o	o	o	o	o
M20	Shaft extension with open keyway	o	o	o	o	o	o	o	o	o	o	o	o	o
M21	Motor delivered with half key on its shaft	o	o	o	o	o	o	o	o	o	o	o	o	o
M22	Shaft extension without keyway	o	o	o	o	o	o	o	o	o	o	o	o	o
M29	Shaft extension on both sides according to customer specification	o	o	o	o	o	o	o	o	o	o	o	o	o
M30	Shaft extension on both sides, with dimensions as given in catalogue	o	o	o	o	o	o	o	o	o	o	o	o	o
M31	Special shaft extension dimensions at DE side, standard material	o	o	o	o	o	o	o	o	o	o	o	o	o
M32	Special shaft extension dimensions at NDE side, standard material	o	o	o	o	o	o	o	o	o	o	o	o	o
M33	Special shaft material according to customer specification	o	o	o	o	o	o	o	o	o	o	o	o	o
	Motor Protection													
K01	Protection degree, IP 56	o	o	o	o	o	o	o	o	o	o	o	o	o
K02	Protection degree, IP 65	o	o	o	o	o	o	o	o	o	o	o	o	o
K03	Protection degree, IP 66	o	o	o	o	o	o	o	o	o	o	o	o	o
K10	V-ring	o	o	o	o	o	o	o	o	o	o	o	o	o
K20	Canopy	o	o	o	o	o	o	o	o	o	o	o	o	o
	Bearing and Lubrication													
R01	Transport locking on bearings	x	x	x	x	x	x	o	o	o	o	o	o	o
R02	Vibration measurement nipples suitable for SPM	o	o	o	o	o	o	o	o	o	o	o	o	o
R10	Lubrication nipples and relubricable bearings	x	x	x	x	x	x	o	o	o	o	s	s	s
R17	Bearings greased for life (2Z)	s	s	s	s	s	s	s	s	s	s	o	o	o
R11	Cylindrical roller bearing, DE side	x	x	x	x	x	x	o	o	o	o	o	o	o
R12	Angular contact ball bearing, shaft force towards bearing	x	x	x	x	x	x	o	o	o	o	o	o	o
R13	Angular contact ball bearing, shaft force away from bearing	x	x	x	x	x	x	o	o	o	o	o	o	o
R14	Same bearing both DE and NDE side	s	s	s	s	s	s	o	o	o	o	s	s	s
R15	Isolated bearing, NDE side	x	x	x	x	x	x	o	o	o	o	o	o	o
R16	Isolated endshield, NDE side	x	x	x	x	x	x	o	o	o	o	o	o	o
R19	Sealed bearings (2RS)	o	o	o	o	o	o	o	o	o	o	o	o	o
R20	DE Bearing located	o	o	o	o	o	o	o	o	o	o	s	s	s
R21	NDE Bearing located	o	o	o	o	s	s	s	s	s	s	o	o	o
	Brake													
F01	Electromagnetic brake	o	o	o	o	o	o	o	o	o	o	o	o	o
	Encoder													
E50	1024 Pulse encoder	o	o	o	o	o	o	o	o	o	o	o	o	o
	Standardized Features													
X01	Motor designed for ambient temperature -40°C to 40°C	o	o	o	o	o	o	o	o	o	o	o	o	o
X07	Motor designed for ambient temperature -55°C to 40°C	o	o	o	o	o	o	o	o	o	o	o	o	o
X08	Motor designed for ambient temperature -20°C to 60°C	o	o	o	o	o	o	o	o	o	o	o	o	o
X02	Corrosion protected stator and rotor core	o	o	o	o	o	o	o	o	o	o	o	o	o
X03	Stainless steel or acid proof bolts	o	o	o	o	o	o	o	o	o	o	o	o	o
X04	Additional eyebolt on the top of frame, cast iron frames	x	x	x	x	x	x	o	o	o	o	s	s	s
X05	Additional eyebolt on the bottom of frame, cast iron frames	x	x	x	x	x	x	o	o	o	o	o	o	o
X06	Additional eyebolt on the top of frame, aluminium frames	x	x	x	x	x	x	o	o	o	o	x	x	x
P02	Special winding for non-standard voltage and frequency	o	o	o	o	o	o	o	o	o	o	o	o	o
	Test													
T01	Type test report for one motor from specific delivery batch	o	o	o	o	o	o	o	o	o	o	o	o	o
T02	Test report for one motor from specific delivery batch	o	o	o	o	o	o	o	o	o	o	o	o	o
T03	Overtoltage test	o	o	o	o	o	o	o	o	o	o	o	o	o
T04	Vibration level test	o	o	o	o	o	o	o	o	o	o	o	o	o
T05	Noise level test for one motor from specific delivery batch	o	o	o	o	o	o	o	o	o	o	o	o	o
	Earthing Bolts													
C01	Additional earthing bolt on motor frame, for aluminium motors	o	o	o	o	o	o	o	o	x	x	x	x	x
C02	Additional earthing bolt on motor frame, for cast iron motors	x	x	x	x	x	x	o	o	o	o	o	o	o
	Insulation System													
Y01	H Class winding insulation	o	o	o	o	o	o	o	o	o	o	o	o	o
Y02	Special winding insulation for frequency converter supply	o	o	o	o	o	o	o	o	o	o	o	o	o

S : As standard**o** : On request**x** : Not applicable

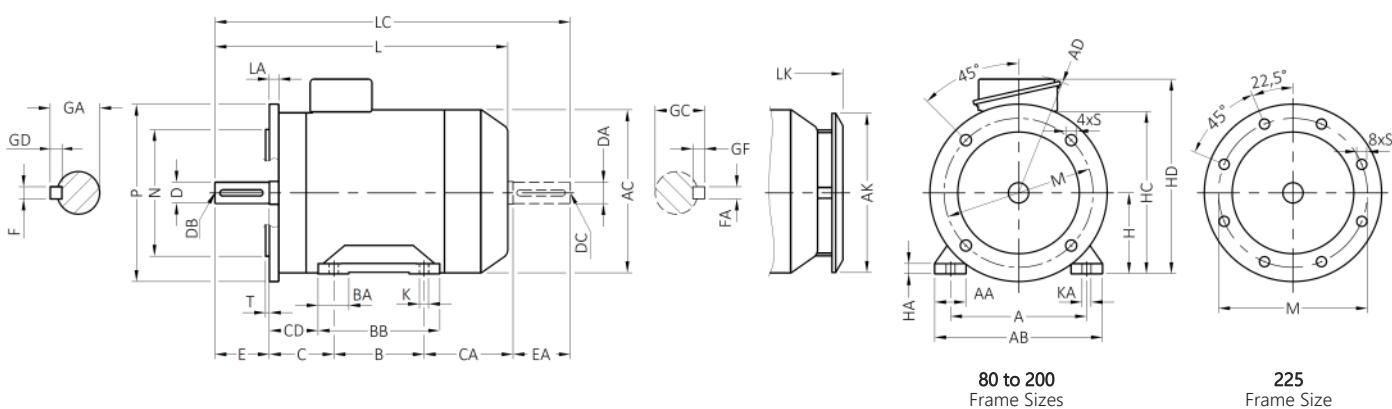
DIMENSION DRAWINGS:

80M - 225M
ALUMINIUM FRAME

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



IM B35 (IM 2001), IM V15 (IM 2011)



TOLERANCES

D, DA	ISO j6	80M - 112M
	ISO k6	132S - 180L
	ISO m6	225M
N	ISO j6	80M - 180L
	ISO h6	200L - 225M
H	-0.5	
F, FA	ISO h6	

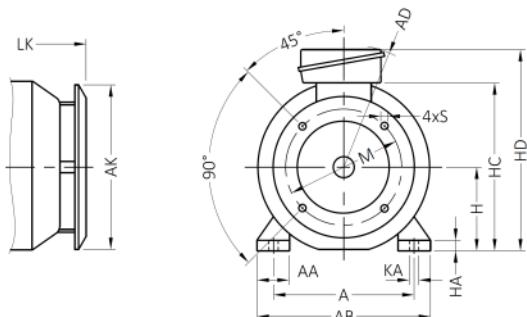
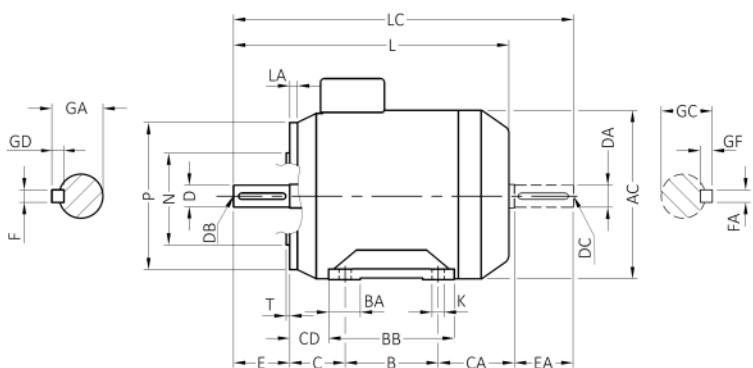
- Shoulder of shaft extension and contact surface of flange are in the same plane.
- The unit for all dimensions is mm.

Frame Size	Pole Number	A	AA	AB	AC	AD	B	BA	BB	C	CA	CD ~	D	DA	DB	DC	E	FxGD	GA	GD	FA	GF	HA	HC	HD
80 M	2-4	125	36	164	160	121	100	32	124	50	104	38	19	M6	40	6 x 6	21,5	80	12	174	194,5				
90 S	2-4	140	40	184	180	130	100	32	124	56	112	44	24	M8	50	8 x 7	27	90	12	194,5	215				
90 L	2-4	140	40	184	180	130	125	32	149	56	112	44	24	M8	50	8 x 7	27	90	12	194,5	215				
100 L	2-4	160	45	208	204	141	140	42	174	63	117	46	28	M10	60	8 x 7	31	100	13	215,5	236				
112 M	2-4	190	45	232	228	153	140	42	174	70	124,5	53	28	M10	60	8 x 7	31	112	13	239,5	260				
132 S	2-4-6-8	216	50	274	270	195	140	46	174	89	128	71,5	38	M12	80	10 x 8	41	132	15	267	317,5				
132 M	2-4-6-8	216	50	274	270	195	178	46	213	89	130	71,5	38	M12	80	10 x 8	41	132	15	267	317,5				
160 M	2-4-6-8	254	62	332	328	252	210	60,5	255	108	189,5	85,5	42	M16	110	12 x 8	45	160	22	324	400				
160 L	2-4-6-8	254	62	332	328	252	254	60,5	299	108	190,5	85,5	42	M16	110	12 x 8	45	160	22	324	400				
180 M	2-4	279	64	364	358	264	241	65	286	121	237	98,5	48	M16	110	14 x 9	51,5	180	22	359	433				
180 L	2-4-6-8	279	64	364	358	264	279	65	324	121	199	98,5	48	M16	110	14 x 9	51,5	180	22	359	433				
200 L	2-4-6-8	318	69	408	408	300	305	67,5	355	133	243	108	55	M20	110	16 x 10	59	200	27	404	485				
225 S	4-8	356	84	470	460	323	286	75	336	149	275,5	124	60	M20	140	18 x 11	64	225	30	455	534				
225 M	2	356	84	470	460	323	311	75	361	149	250,5	124	55	M20	110	16 x 10	59	225	30	455	534				
225 M	4-6-8	356	84	470	460	323	311	75	361	149	250,5	124	60	M20	140	18 x 11	64	225	30	455	534				

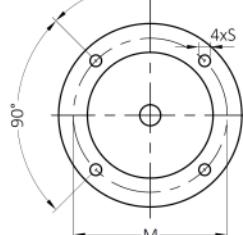
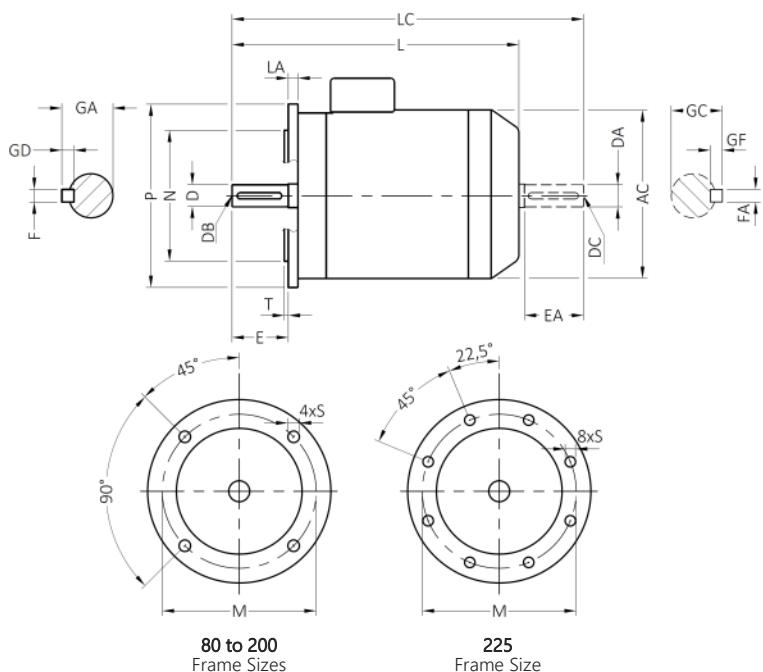
DIMENSION DRAWINGS:

**80M - 225M
ALUMINIUM FRAME**

IM B34 (IM 2101)



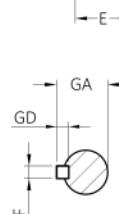
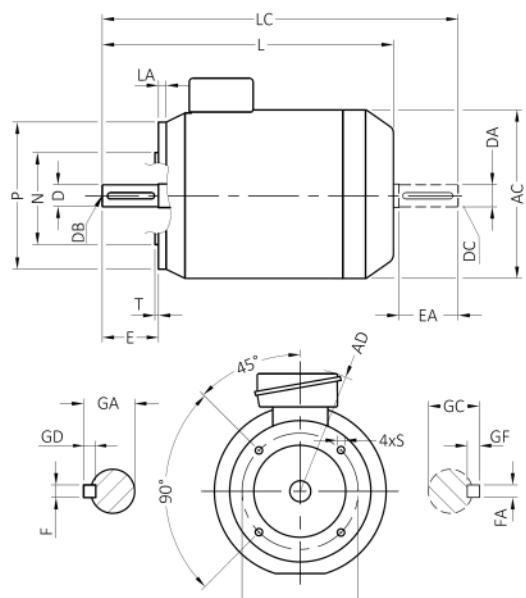
IM B5 (IM 3001), IM V1 (IM 3011), IM V3 (IM 3031)



80 to 200
Frame Sizes

225
Frame Size

IM B14 (IM 3601), IM V18 (IM 3611), IM V19 (IM 3631)



- Shoulder of shaft extension and contact surface of flange are in the same plane.

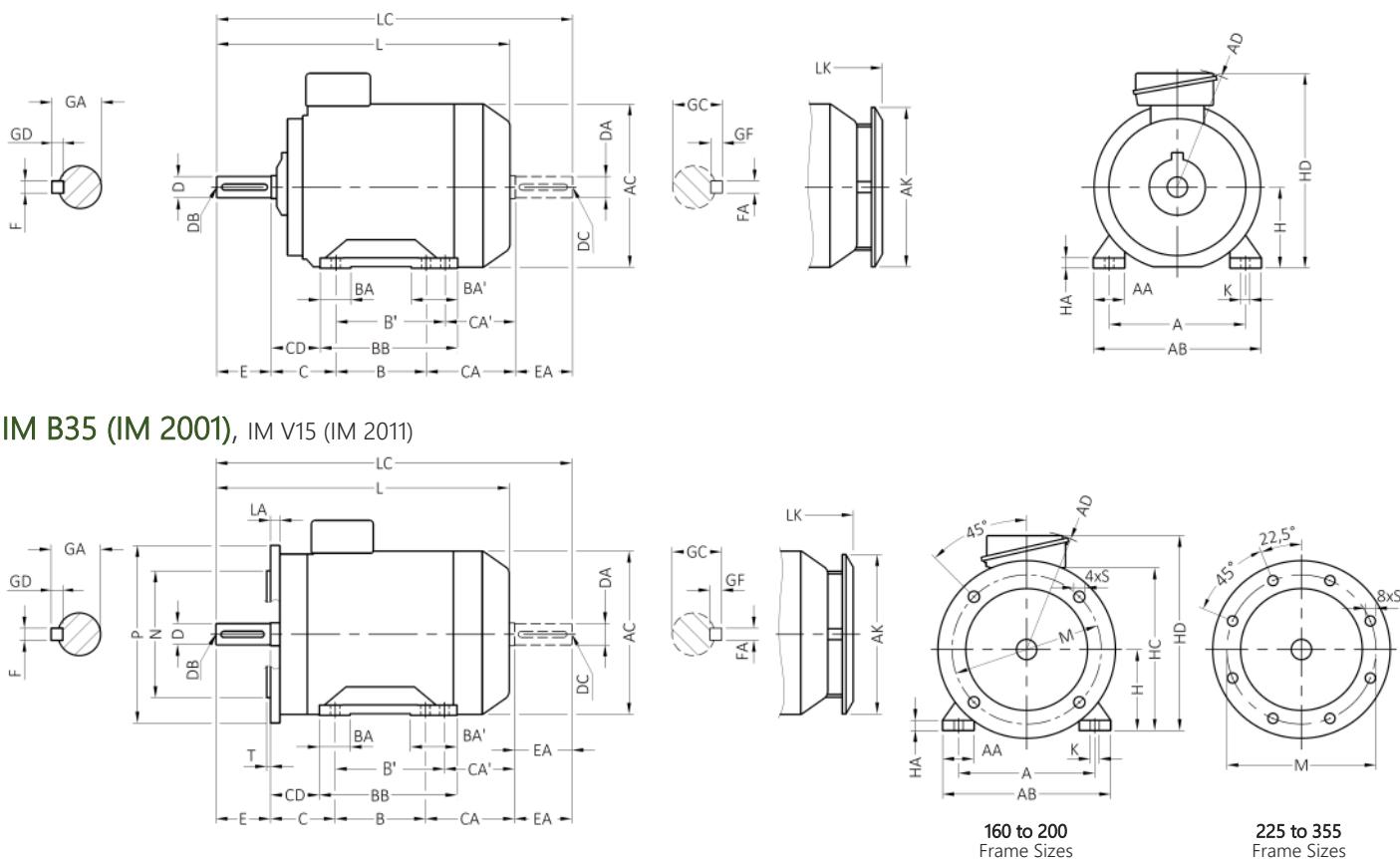
- The unit for all dimensions is mm.

Frame Size	Pole Number	Canopy				B5 Flange Dimensions							B14 Flange Dimensions							Flange No.	M	N	P	S	T	
		K	KA	L ~	LC	AK	LK	Flange No.	LA	M	N	P	S	T	Flange No.	M	N	P	S	T	Flange No.	M	N	P	S	T
80 M	2-4	10	15	289	334	152	326	FF165	12	165	130	200	12	3,5	FT100	100	80	120	M6	3	FT130	130	110	160	M8	3,5
90 S	2-4	10	15	313	368	174	350	FF165	12	165	130	200	12	3,5	FT115	115	95	140	M8	3	FT130	130	110	160	M8	3,5
90 L	2-4	10	15	338	393	174	375	FF165	12	165	130	200	12	3,5	FT115	115	95	140	M8	3	FT130	130	110	160	M8	3,5
100 L	2-4	12	18	375	440	196	412	FF215	15	215	180	250	14,5	4	FT130	130	110	160	M8	3,5	FT165	165	130	200	M10	3,5
112 M	2-4	12	18	389,5	454,5	218	426,5	FF215	15	215	180	250	14,5	4	FT130	130	110	160	M8	3,5	FT165	165	130	200	M10	3,5
132 S	2-4-6-8	12	18	429	517	258	466	FF265	15	265	230	300	14,5	4	FT165	165	130	200	M10	3,5	FT215	215	180	250	M12	4
132 M	2-4-6-8	12	18	469	557	258	506	FF265	15	265	230	300	14,5	4	FT165	165	130	200	M10	3,5	FT215	215	180	250	M12	4
160 M	2-4-6-8	15	19	609,5	727,5	314	665,5	FF300	18	300	250	350	18,5	5	FT215	215	180	250	M12	4	-	-	-	-	-	-
160 L	2-4-6-8	15	19	654,5	772,5	314	710,5	FF300	18	300	250	350	18,5	5	FT215	215	180	250	M12	4	-	-	-	-	-	-
180 M	2-4	15	19	701	819	350	757	FF300	18	300	250	350	18,5	5	-	-	-	-	-	-	-	-	-	-	-	
180 L	2-4-6-8	15	19	701	819	350	757	FF300	18	300	250	350	18,5	5	-	-	-	-	-	-	-	-	-	-	-	
200 L	2-4-6-8	19	24	781	901	390	837	FF350	22	350	300	400	18,5	5	-	-	-	-	-	-	-	-	-	-	-	
225 S	4-8	19	24	840,5	960,5	440	896,5	FF400	22	400	350	450	18,5	5	-	-	-	-	-	-	-	-	-	-	-	
225 M	2	19	24	810,5	930,5	440	866,5	FF400	22	400	350	450	18,5	5	-	-	-	-	-	-	-	-	-	-	-	
225 M	4-6-8	19	24	840,5	990,5	440	896,5	FF400	22	400	350	450	18,5	5	-	-	-	-	-	-	-	-	-	-	-	

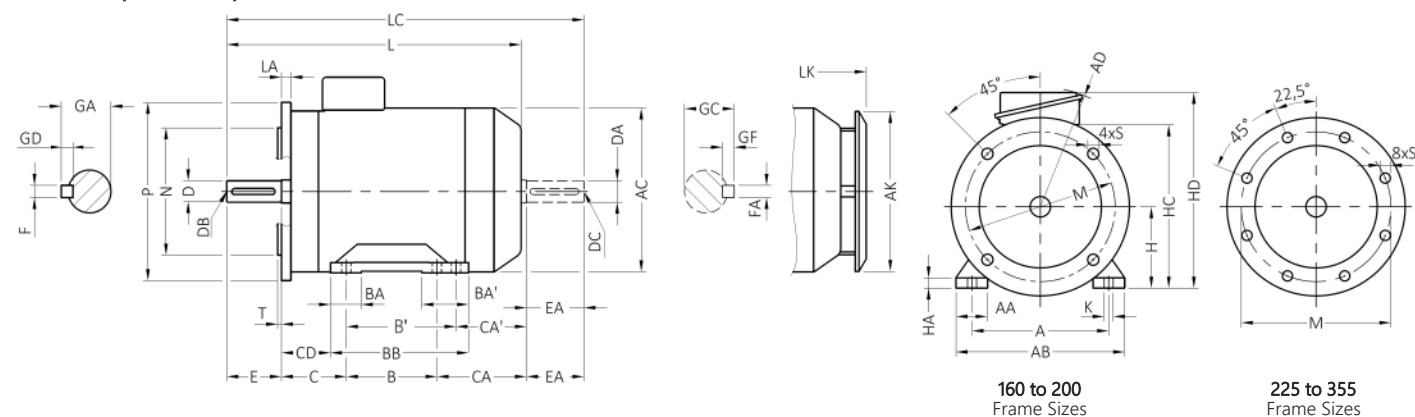
DIMENSION DRAWINGS:

160M - 355L
CAST IRON FRAME

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



IM B35 (IM 2001), IM V15 (IM 2011)



- Shoulder of shaft extension and contact surface of flange are in the same plane.

- The unit for all dimensions is mm.

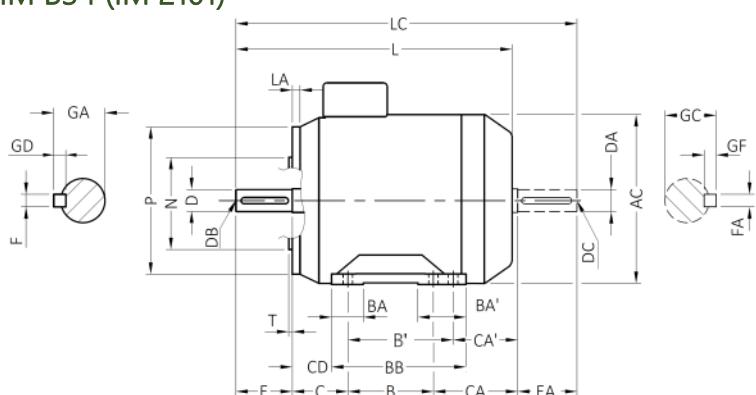
TOLERANCES

D, DA	ISO k6	160M - 180L
	ISO m6	200L - 355L
N	ISO j6	160M - 180L
	ISO h6	200L - 355L
H	-0.5	160M - 250M
	-1	280M - 355L
F, FA	ISO h6	

Frame Size	Pole Number	A	AA	AB	AC	AD	B	B'	BA	BA'	BB	C	CA	CA'	CD ~	D	DB	E	F x GD	GA	H	HA	HD
160 M	2-4-6-8	254	62	332	328	252	210	-	60	-	255	108	189,5	-	85	42	M16	110	12 x 8	45	160	22	400
160 L	2-4-6-8	254	62	332	328	252	254	-	60	-	300	108	190,5	-	85	42	M16	110	12 x 8	45	160	22	400
180 M	2-4	279	64	364	358	264	241	-	65	-	287	121	202	-	98	48	M16	110	14 x 9	51,5	180	22	433
180 L	2-4-6-8	279	64	364	358	264	279	-	65	-	325	121	199	-	98	48	M16	110	14 x 9	51,5	180	22	433
200 L	2-4-6-8	318	80	410	408	300	305	-	71	-	354	133	243	-	108,5	55	M20	110	16 x 10	59	200	25	485
225 S	4-8	356	90	466	460	323	286	311	75	95	368	149	275,5	250,5	120,5	60	M20	140	18 x 11	64	225	30	534
225 M	2	356	90	466	460	323	286	311	75	95	368	149	275,5	250,5	120,5	55	M20	110	16 x 10	59	225	30	534
225 M	4-6-8	356	90	466	460	323	286	311	75	95	368	149	275,5	250,5	120,5	60	M20	140	18 x 11	64	225	30	534
250 M	2	406	100	516	513	377	349	-	100	-	421	168	259,5	-	132	60	M20	140	18 x 11	64	250	36	612
250 M	4-6-8	406	100	516	513	377	349	-	100	-	421	168	259,5	-	132	65	M20	140	18 x 11	69	250	36	612
280 S	2	457	110	606	600	413	368	-	100	-	440	190	268,5	-	154	65	M20	140	18 x 11	69	280	44	679
280 S	4-6-8	457	110	606	600	413	368	-	100	-	440	190	268,5	-	154	75	M20	140	20 x 12	79,5	280	44	679
280 M	2	457	110	606	600	413	419	-	100	-	491	190	272,5	-	154	65	M20	140	18 x 11	69	280	44	679
280 M	4-6-8	457	110	606	600	413	419	-	100	-	491	190	272,5	-	154	75	M20	140	20 x 12	79,5	280	44	679
315 S	2	508	135	680	675	557	406	457	120	170	540	216	373,5	322,5	174	65	M20	140	18 x 11	69	315	47	809
315 S	4-6-8	508	135	680	675	557	406	457	120	170	540	216	373,5	322,5	174	85	M20	170	22 x 14	90	315	47	809
315 M	2	508	135	680	675	525	406	457	120	170	540	216	373,5	322,5	-	65	M20	140	18 x 11	69	315	47	805
315 M	4-6-8	508	135	680	675	525	406	457	120	170	540	216	373,5	322,5	-	85	M20	170	22 x 14	90	315	47	805
355 M	2	610	165	770	760	590	560	-	140	-	660	254	380	-	-	80	M20	170	22 x 14	85	355	52	881
355 M	4-6-8	610	165	770	760	590	560	-	140	-	660	254	380	-	-	100	M24	210	28 x 16	106	355	52	881
355 L	2	610	165	770	760	590	800	-	140	-	900	254	380	-	-	80	M20	170	22 x 14	85	355	52	881
355 L	4-6-8	610	165	770	760	590	800	-	140	-	900	254	380	-	-	100	M24	210	28 x 16	106	355	52	881

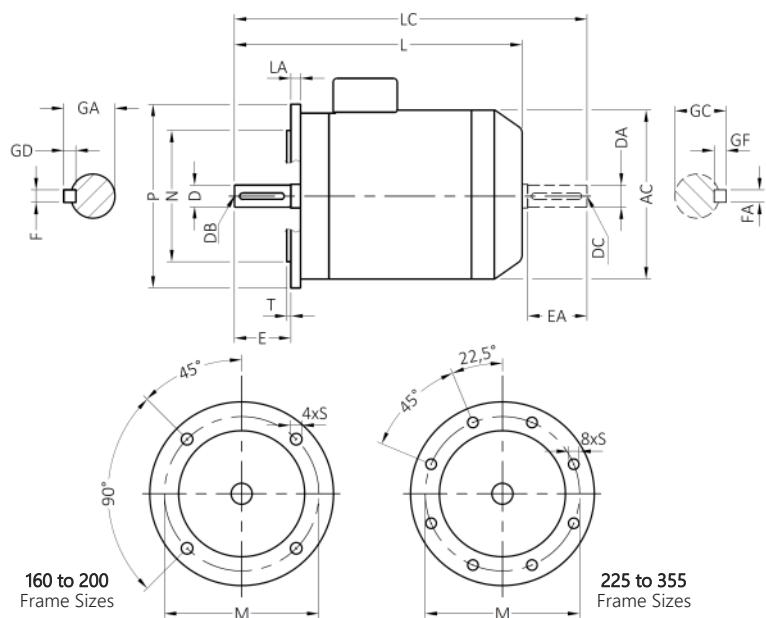
DIMENSION DRAWINGS:

IM B34 (IM 2101)

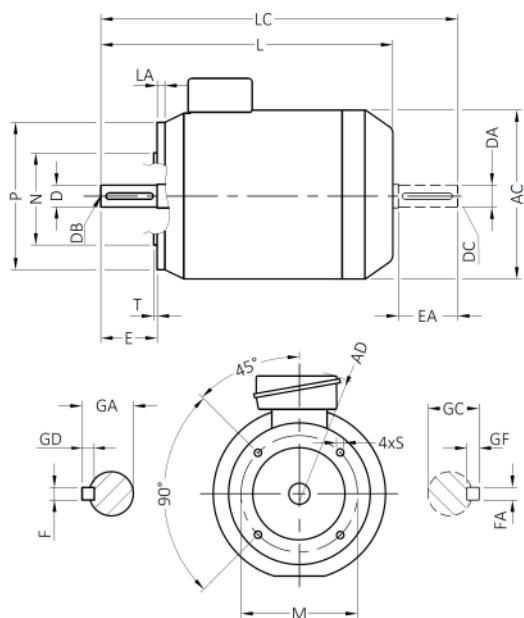


**160M - 355L
CAST IRON FRAME**

IM B5 (IM 3001), IM V1 (IM 3011), IM V3 (IM 3031)



IM B14 (IM 3601), IM V18 (IM 3611), IM V19 (IM 3631)



- Shoulder of shaft extension and contact surface of flange are in the same plane.

- The unit for all dimensions is mm.

Frame Size	Pole Number	Canopy			B5 Flange Dimensions							B14 Flange Dimensions							
		K	L	LC	AK	LK	Flange No.	LA	M	N	P	S	T	Flange No.	M	N	P	S	T
160 M	2-4-6-8	15	609,5	727,5	314	665,5	FF300	18	300	250	350	18,5	5	FT215	215	180	250	M12	4
160 L	2-4-6-8	15	654,5	772,5	314	710,5	FF300	18	300	250	350	18,5	5	FT215	215	180	250	M12	4
180 M	2-4	15	666	784	350	722	FF300	18	300	250	350	18,5	5	-	-	-	-	-	-
180 L	2-4-6-8	15	701	819	350	757	FF300	18	300	250	350	18,5	5	-	-	-	-	-	-
200 L	2-4-6-8	19	781	901	390	837	FF350	22	350	300	400	18,5	5	-	-	-	-	-	-
225 S	4-8	19	840,5	990,5	440	896,5	FF400	22	400	350	450	18,5	5	-	-	-	-	-	-
225 M	2	19	810,5	930,5	440	866,5	FF400	22	400	350	450	18,5	5	-	-	-	-	-	-
225 M	4-6-8	19	840,5	990,5	440	896,5	FF400	22	400	350	450	18,5	5	-	-	-	-	-	-
250 M	2	24	906,5	1056,5	490	962,5	FF500	26	500	450	550	18,5	5	-	-	-	-	-	-
250 M	4-6-8	24	906,5	1056,5	490	962,5	FF500	26	500	450	550	18,5	5	-	-	-	-	-	-
280 S	2	24	956,5	1106,5	550	1012,5	FF500	26	500	450	550	18,5	5	-	-	-	-	-	-
280 S	4-6-8	24	956,5	1106,5	550	1012,5	FF500	26	500	450	550	18,5	5	-	-	-	-	-	-
280 M	2	24	1011,5	1161,5	550	1067,5	FF500	26	500	450	550	18,5	5	-	-	-	-	-	-
280 M	4-6-8	24	1011,5	1161,5	550	1067,5	FF500	26	500	450	550	18,5	5	-	-	-	-	-	-
315 S	2	28	1125,5	1275,5	620	1356	FF600	26	600	550	660	24	6	-	-	-	-	-	-
315 S	4-6-8	28	1155,5	1335,5	620	1416	FF600	26	600	550	660	24	6	-	-	-	-	-	-
315 M	2	28	1126	1276	620	1356	FF600	26	600	550	660	24	6	-	-	-	-	-	-
315 M	4-6-8	28	1156	1336	620	1416	FF600	26	600	550	660	24	6	-	-	-	-	-	-
355 M	2	28	1370	1550	700	1470	FF740	35	740	680	800	24	6	-	-	-	-	-	-
355 M	4-6-8	28	1410	1630	700	1510	FF740	35	740	680	800	24	6	-	-	-	-	-	-
355 L	2	28	1570	1750	700	1670	FF740	35	740	680	800	24	6	-	-	-	-	-	-
355 L	4-6-8	28	1610	1830	700	1710	FF740	35	740	680	800	24	6	-	-	-	-	-	-

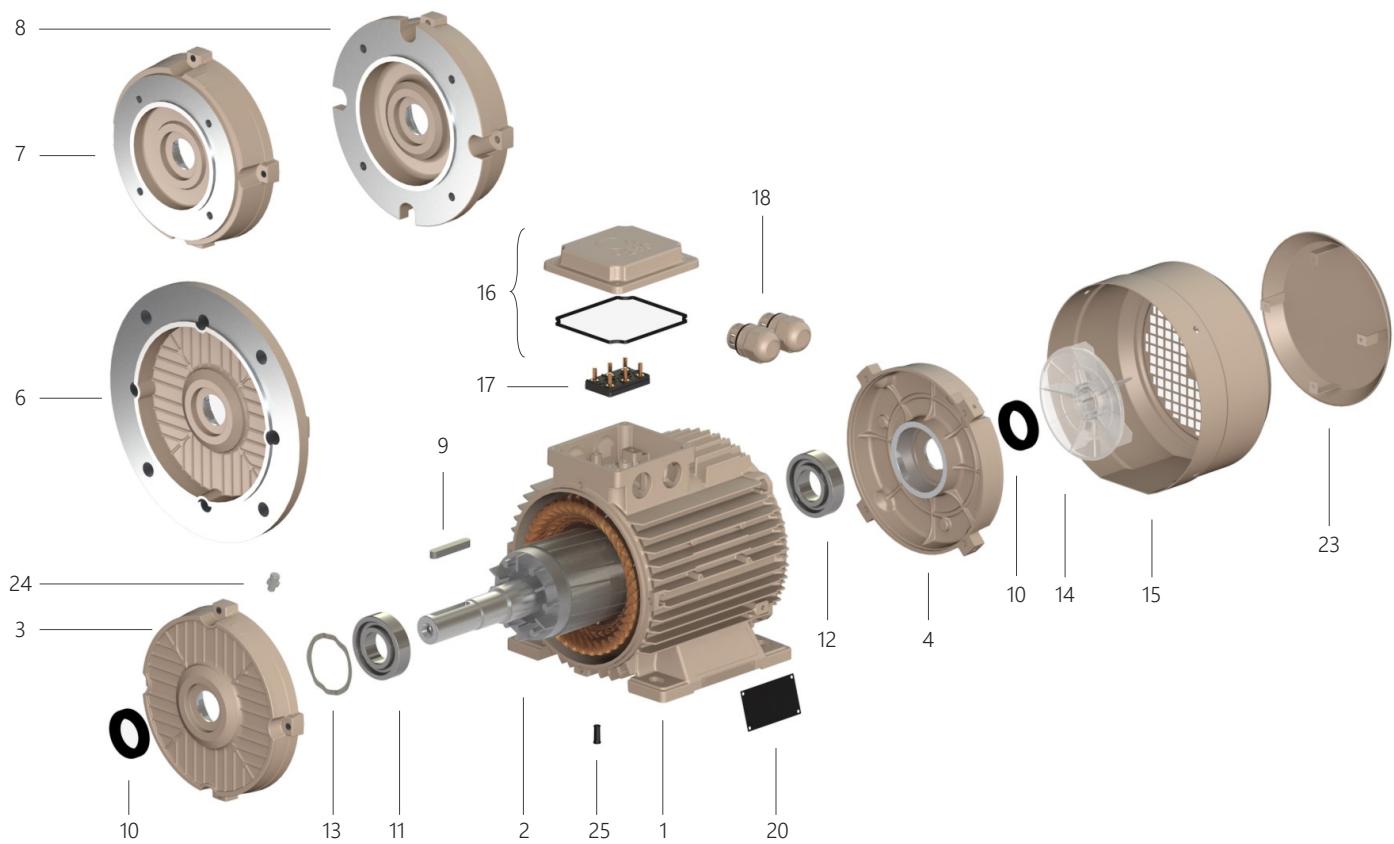
MOTORS IN BRIEF: IE3 & IE4 MOTORS

80 - 112
ALUMINIUM FRAME

Frame Size		80	90	100	112
Frame		Pressure die-cast aluminium alloy			
End shields	Material	Pressure die-cast aluminium alloy			
Flange (B5)	Material	Pressure die-cast aluminium alloy			
Flange (B14)	Material	Pressure die-cast aluminium alloy			
Flange (B14-2)	Material	Cast iron GG 20			
Feet		Integrated, pressure die-cast aluminium feet			
Painting	Material	Solvent-based acrylic paint, RAL 1019			
	Corrosion Class	C3; ISO 12944-2:2007			
Bearings	Locking	Floating bearing			
	Spring	DE Side			
	DE Side	6204 ZZ	6205 ZZ	6206 ZZ	
	NDE Side	6204 ZZ	6205 ZZ	6206 ZZ	
	Seal	Radial seals on both DE and NDE sides			
Lubrication	Grease	Permanently lubricated shielded bearings			
Vibration Measurement Nipples	On Request	SPM			
Terminal Box	Material	Pressure die-cast aluminium alloy			
	Position	Top as standard			
Cable Connections	Cable Glands	1 x M25		2 x M25	
	Terminal	6 terminals for connection with cable lugs (lugs not included)			
Stator Winding	Material	Enameled copper wire			
	Insulation	Insulation class F, temperature rise B			
	Winding Protection	On request			
Heating Elements	On Request	2 x 20W		2 x 30W	
Rotor Winding	Material	Medium pressure die-cast, pure aluminium			
Shaft	Material	AISI 1040			
	Screw Hole	M6	M8	M10	
Vibration		Grade A			
Balance		Half key method			
Shaft Key		Closed keyway			
Rating Plate	Material	Aluminium plate; 0,5 mm			
Earthing		One inside the terminal box and one on the frame next to the foot			
Protection Degree		IP 55 as standard, higher protection on request			
Cooling Method		Totally enclosed, fan cooled - IC 411			
Fan	Material	Polypropylene			
Fan Cover	Material	Steel			
Drain Holes	Material	PA 6			

COMPONENTS:

80 - 112
ALUMINIUM FRAME



STANDARD DESIGN MOTORS

80 to 112 Frame Sizes

- 1 Frame and complete stator
- 2 Rotor with shaft
- 3 End shield, DE side
- 4 End shield, NDE side
- 6 B5 Flange
- 7 B14 Flange
- 8 B14 2nd Flange
- 9 Shaft key
- 10 Radial seal
- 11 Bearing, DE side
- 12 Bearing, NDE side
- 13 Wave spring
- 14 Fan
- 15 Fan cover
- 16.1 Terminal box cover
- 17 Terminal
- 18 Cable glands
- 20 Rating plate
- 23 Canopy
- 24 Vibration measurement nipple
- 25 Plug for drain hole

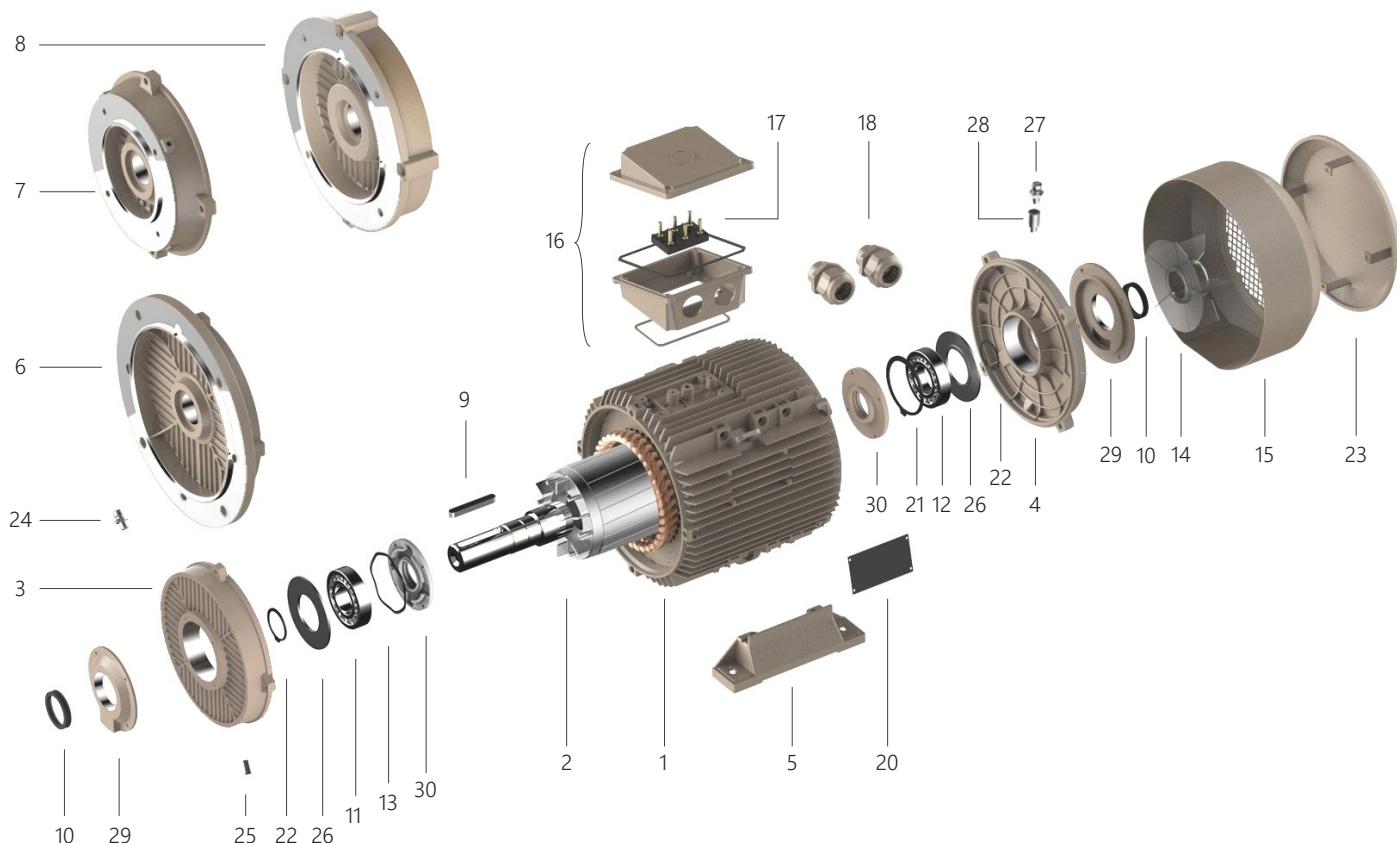
MOTORS IN BRIEF: IE3 & IE4 MOTORS

132 - 225
ALUMINIUM FRAME

Frame Size		132	160	180	200	225					
Frame		Pressure die-cast aluminium alloy									
End shields	Material	Pressure die-cast aluminium alloy			Cast iron GG 20						
Flange (B5)	Material	Pressure die-cast aluminium alloy	Cast iron GG 20								
Flange (B14)	Material	Pressure die-cast aluminium alloy	Cast iron GG 20	—							
Flange (B14-2)	Material	Pressure die-cast aluminium alloy	—								
Feet		Feet bolted to the frame, pressure die-cast aluminium									
Painting	Material	Water based, RAL 1019									
	Corrosion Class	C3; ISO 12944-2:2007									
Bearings	Locking	Floating bearing	Locked at NDE with circlip								
	Spring	NDE Side	NDE Side								
	DE Side	6208 ZZ C3	6309 ZZ C3	6310 ZZ C3	6312 ZZ C3	6313 ZZ C3					
	NDE Side	6208 ZZ C3	6209 ZZ C3	6210 ZZ C3	6212 ZZ C3	6213 ZZ C3					
	Seal	Radial seals on both DE and NDE sides									
Lubrication	Grease	Permanently lubricated shielded bearings.									
	Relubrication	-	M8x1 greasing nipples on request								
Vibration Measurement Nipples	On Request	SPM									
Terminal Box	Material	Pressure die-cast aluminium alloy									
	Position	Top as standard, changeable to LHS and RHS positions by simply bolting the feet accordingly									
Cable Connections	Cable Glands	2 x M32	2 x M40	2 x M50							
	Terminal	6 terminals for connection with cable lugs (lugs not included)									
Stator Winding	Material	Enameled copper wire									
	Insulation	Insulation class F, Temperature rise B									
	Winding Protection	On request									
Heating Elements	On Request	2 x 30W			2 x 40W						
Rotor Winding	Material	Medium pressure die-cast, pure aluminium									
Shaft	Material	AISI 1040									
	Screw Hole	M12	M16	M20							
Vibration		Grade A									
Balance		Half key method									
Shaft Key		Closed keyway									
Rating Plate	Material	Aluminium plate; 0,5 mm									
Earthing		One inside the terminal box and one on the frame next to the foot									
Protection Degree		IP 55 as standard, higher protection on request									
Cooling Method		Totally enclosed, fan cooled - IC 411									
Fan	Material	Polypropylene									
Fan Cover	Material	Steel									
Drain Holes	Material	PA 6									

COMPONENTS:

132 - 225
ALUMINIUM FRAME



STANDARD DESIGN MOTORS

132 to 225 Frame Sizes

- 1 Frame and complete stator
- 2 Rotor with shaft
- 3 End shield, DE side
- 4 End shield, NDE side
- 5 Feet
- 6 B5 Flange
- 7 B14 Flange (for frame sizes 132 and 160)
- 8 B14 2nd Flange (for frame size 132)
- 9 Shaft key
- 10 Radial seal
- 11 Bearing, DE side
- 12 Bearing, NDE side
- 13 Wave spring
- 14 Fan
- 15 Fan cover
- 16 Terminal box
- 17 Terminal
- 18 Cable glands
- 19 Rating plate
- 20 Internal circlip (NDE side)
- 21 External circlip
- 22 Canopy
- 23 Vibration measurement nipple
- 24 Plug for drain hole

MOTORS with GREASING NIPPLES

160 to 225 Frame Sizes

- 1 Frame and complete stator
- 2 Rotor with shaft
- 3 End shield, DE side
- 4 End shield, NDE side
- 5 Feet
- 6 B5 Flange
- 7 Shaft key
- 8 Radial seal
- 9 Bearing, DE side
- 10 Bearing, NDE side
- 11 Wave spring
- 12 Fan
- 13 Fan cover
- 14 Terminal box
- 15 Terminal
- 16 Cable glands
- 17 Rating plate
- 18 External circlip
- 19 Canopy
- 20 Vibration measurement nipple
- 21 Plug for drain hole
- 22 Grease retaining disc
- 23 Grease nipple
- 24 Extension part for greasing nipple
- 25 Outer bearing cover
- 26 Inner bearing cover

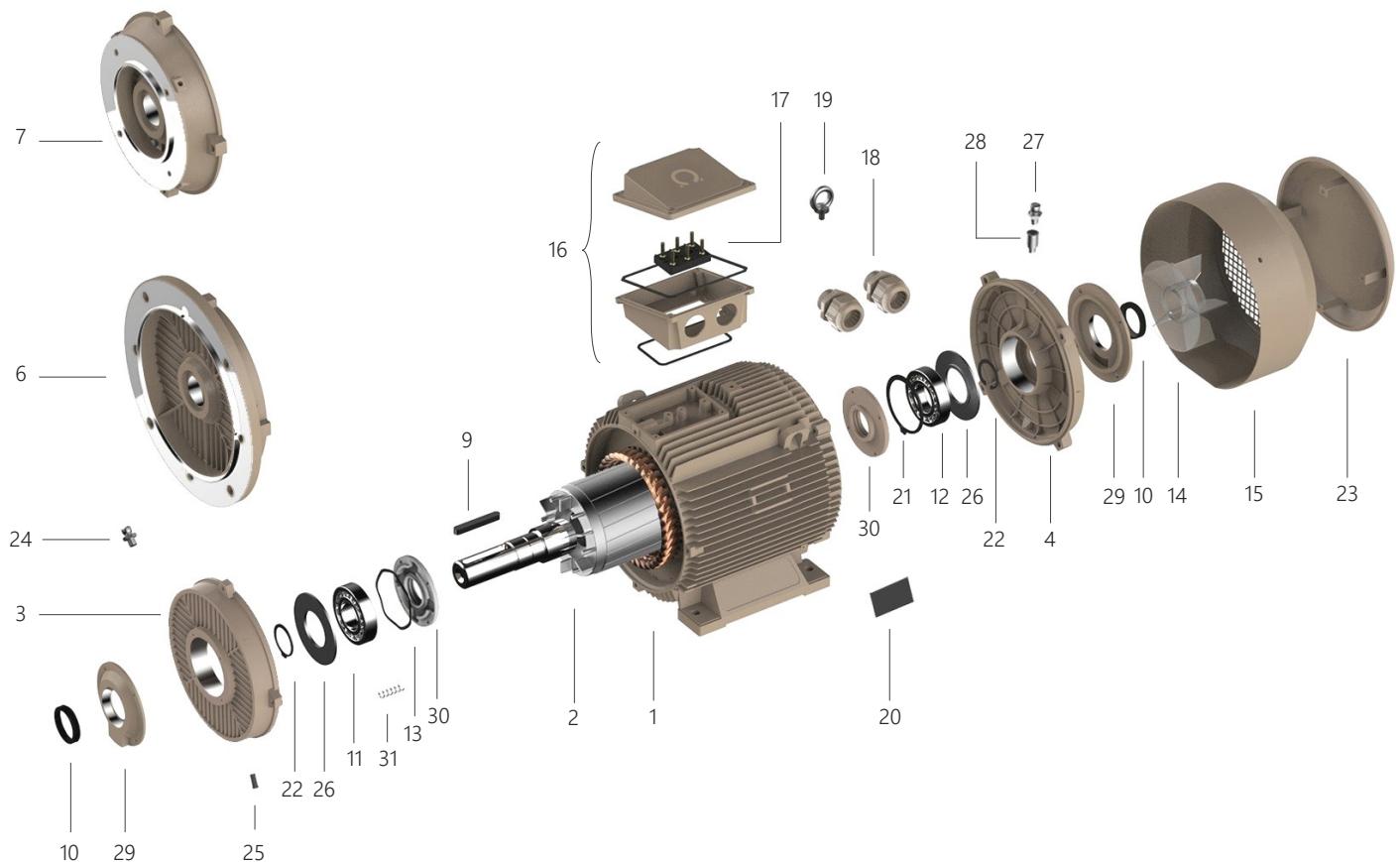
MOTORS IN BRIEF: IE3 & IE4 MOTORS

160 - 355
CAST IRON FRAME

Frame Size		160	180	200	225	250	280	315	355								
Frame		Cast iron GG 20															
End shields	Material	Cast iron GG 20															
Flange (B5)	Material	Cast iron GG 20															
Flange (B14)	Material	Cast iron GG 20	—														
Feet		Integrated cast iron feet															
Painting	Material		Water based, RAL 1019														
	Corrosion Class		C3, ISO 12944-2:2007														
Bearings	Locking		Locked at NDE with circlip				Locked at DE with bearing cover										
	Spring		DE Side				NDE Side										
	DE Side	2 pole	6309 ZZ C3	6310 ZZ C3	6312 ZZ C3	6313 ZZ C3	6315 C3	6316 C3	6316 C3	6319 C3							
		4-6-8 pole															
	NDE Side	2 pole	6209 ZZ C3	6210 ZZ C3	6212 ZZ C3	6213 ZZ C3	6315 C3	6316 C3	6316 C3	6319 C3							
		4-6-8 pole															
Seal		Radial seals on both DE and NDE sides															
Lubrication	Grease		Permanently lubricated shielded bearings				Shell Alvania Rt3										
	Relubrication		M8 x 1 greasing nipples on request				M8 x 1 greasing nipples as standard										
Vibration Measurement Nipples	On Request		SPM														
Terminal Box	Material		Pressure die-cast aluminium alloy														
	Position		Top as standard														
Cable Connections	Cable Glands		2 x M40	2 x M50		2 x M63											
	Terminal		6 terminals for connection with cable lugs (lugs not included)														
Stator Winding	Material		Enameled copper wire														
	Insulation		Insulation class F, temperature rise B														
	Winding Protection		On request														
Heating Elements	On Request		2 x 30W	2 x 40W		2 x 60W											
Rotor Winding	Material		Medium pressure die-cast, pure aluminium														
Shaft	Material		AISI 1040				AISI 1050										
	Screw Hole	2 pole	M16		M20				M20	M24							
		4-6-8 pole															
Vibration			Grade A														
Balance			Half key method														
Shaft			Closed keyway														
Rating Label	Material		Aluminium plate; 0,5 mm														
Earthing	One inside the terminal box and one on the frame next to the foot																
Protection Degree			IP 55 as standard, higher protection on request														
Cooling Method			Totally enclosed, fan cooled - IC 411														
Fan	Material		Polypropylene														
Fan Cover	Material		Steel														
Drain Holes	Material		PA 6														

COMPONENTS:

160 - 355
CAST IRON FRAME



STANDARD DESIGN MOTORS

160 to 225 Frame Sizes

- 1 Frame and complete stator
- 2 Rotor with shaft
- 3 End shield, DE side
- 4 End shield, NDE side
- 5 B5 Flange
- 6 B14 Flange (for frame size 160)
- 7 Shaft key
- 8 Radial seal
- 9 Bearing, DE side
- 10 Bearing, NDE side
- 11 Wave spring
- 12 Fan
- 13 Fan cover
- 14 Terminal box
- 15 Terminal
- 16 Cable glands
- 17 Eyebolt
- 18 Rating plate
- 19 Internal circlip (NDE side)
- 20 External circlip
- 21 Canopy
- 22 Plug for drain hole

MOTORS with GREASING NIPPLES

160 to 355 Frame Sizes

- 1 Frame and complete stator
- 2 Rotor with shaft
- 3 End shield, DE side
- 4 End shield, NDE side
- 5 B5 Flange
- 6 Shaft key
- 7 Radial seal
- 8 Bearing, DE side
- 9 Bearing, NDE side
- 10 Wave spring
- 11 Fan
- 12 Fan cover
- 13 Terminal box
- 14 Terminal
- 15 Cable glands
- 16 Eyebolt
- 17 Rating plate
- 18 External circlip
- 19 Canopy
- 20 Vibration measurement nipple
- 21 Plug for drain hole
- 22 Grease retaining disc
- 23 Grease nipple
- 24 Extension part for greasing nipple
- 25 Outer bearing cover
- 26 Inner bearing cover
- 27 Helical spring (for frame sizes 315 and 355)