

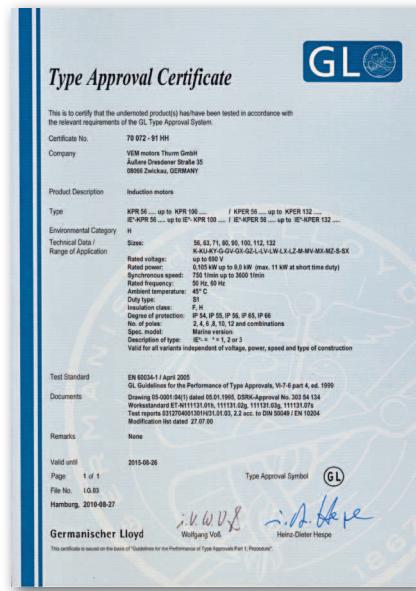
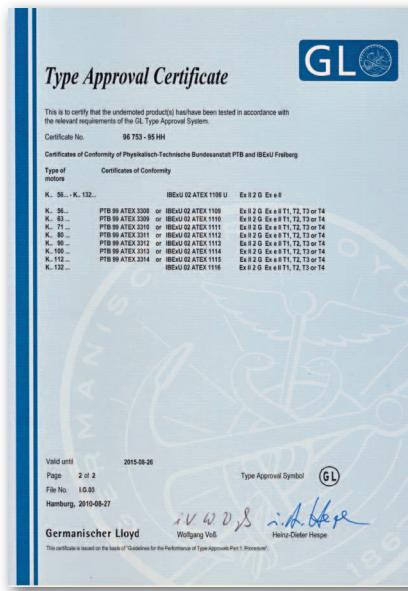
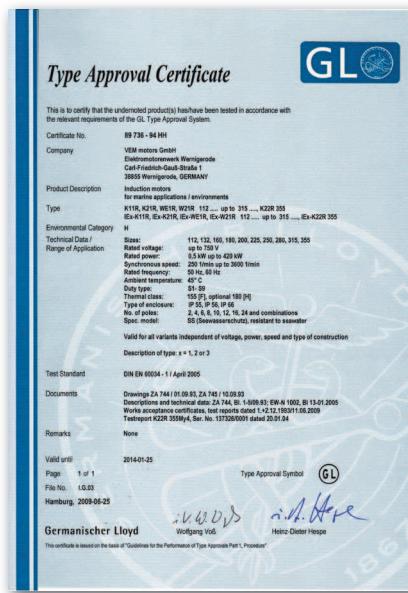
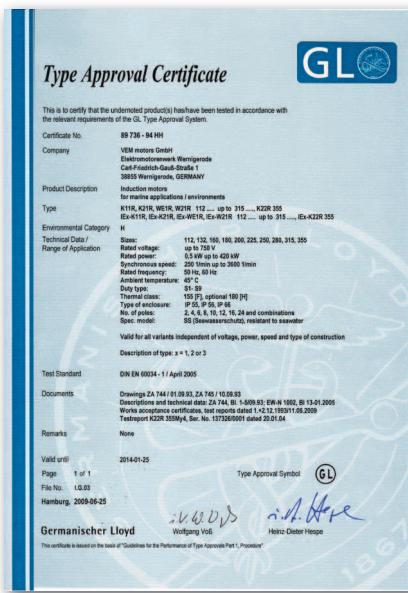
# Permanent magnet synchronous motors for inverter operation





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## Innovative drives made in Germany

The reduction of CO<sub>2</sub>-emission is the big challenge of our time. Thus the reduction of energy consumption is the main topic in many applications. Especially modern speed-controlled electric drives offer the chance to save maximum energy. A solution with remarkable energy efficiency is offered by using permanent magnet synchronous motors (PM motors).

They are operated exclusively with frequency inverters and are characterised by a significantly higher efficiency (>IE3) and an improved part load behaviour than asynchronous motors.

In addition PM-motors can reach a higher output than asynchronous motors of the same size. Because of the rotor following exactly the rotating field, PM-motors can be used for example in conveyor belts with several drives that are operated synchronously. All types of constructions and a multitude of modifications of standard motor design are available.

With the three new design series  
*PM synchronous energy saving motors*  
*PM synchronous high-power motors*  
*PM synchronous torque motors*

VEM has entered into technology of permanent magnet synchronous motors. These products combine the established design principles of the series K21R/WE1R with this new technology.

### Technical characteristics

#### Synchronous energy saving motors PE1R/PE0R

- Power range 0,09 to 75 kW
- 4-, 6- and 8-pole design
- 750 to 3.000 r.p.m.
- Torque 0,6 Nm to 860 Nm
- Sizes 56 to 315
- Degree of protection IP55
- Thermal class 155 [F/B]

The application range and usage of this new design series is comparable to asynchronous motors for pumps, ventilators, compressors and process technology.

### Advantages

- Highest energy efficiency
- Approved robust and low-vibration grey cast iron design
- Compact design with minimised dimensions
- Low-noise operation
- Modern modular system complying with series K21R/K22R
- Colour systems for climate groups „moderate“ and „world wide“ according to IEC 721-2-1
- High operational reliability by modern production technologies

### Technical characteristics

#### Synchronous torque motors P2.F/P2.B

- Power range 12 to 471kW
- 12-pole design
- 200 to 600 r.p.m.
- Torque 573 Nm to 7.500 Nm
- Sizes 200 to 355
- Degree of protection IP55
- Thermal class 155 [F/B]

The motors comply with the relevant national and international regulations.

Design, construction, production and test are done according to the requirements of DIN ISO 9001 and are certified by German Lloyd Certification GmbH.

The products contained in this printed information are also listed in the interactive electronic catalogue of the VEM group, edition V 7.0 and newer.

More information about the company and the products of the VEM group can be found in the internet: [www.vem-group.com](http://www.vem-group.com)

### Technical characteristics

#### Synchronous high-power motors P21R/P20R

- Power range 0,25 to 75 kW
- 4-, 6-, 8- and 12-pole design
- 500 to 3.000 r.p.m.
- Torque 0,55 Nm to 700 Nm
- Sizes 56 to 280
- Degree of protection IP55
- Thermal class 155 [F/B]

## Technical explanations

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## Standards and regulations

The motors comply with the relevant standards and regulations, particularly with the following:

| Title   | EN / DIN VDE     | IEC                      |
|---|------------------|--------------------------|
| Rotating electrical machines, rating and performance  | EN 60034-1       | IEC 60034-1<br>IEC 60085 |
| Efficiency classes of single-speed, three-phase, cage induction motors  |                  | IEC 60034-30             |
| Rotating electrical machines, methods for determining losses and efficiency                                     | DIN EN 60034-2-1 | IEC 60034-2-1            |
| Three-phase asynchronous motors for general use, with standardised dimensions and outputs, frame sizes 56 – 315 | EN 50347         | IEC 60072                |
| Terminal markings and direction of rotation for rotating electrical machines                                    | EN 60034-8       | IEC 60034-8              |
| Rotating electrical machines, symbols for types of construction and erection                                    | EN 60034-7       | IEC 60034-7              |
| Built-in thermal protection   | -                | IEC 60034-11             |
| Rotating electrical machines, methods of cooling  | EN 60034-6       | IEC 60034-6              |
| Rotating electrical machines, degrees of protection   | EN 60034-5       | IEC 60034-5              |
| Rotating electrical machines, mechanical vibrations   | EN 60034-14      | IEC 60034-14             |
| Rotating electrical machines, noise limits  | EN 60034-9       | IEC 60034-9              |
| Rotating electrical machines, starting performance of induction cage motors up to 660 V, 50 Hz                  | EN 60034-12      | IEC 60034-12             |
| IEC standard voltages   | -                | IEC 60038                |

VEM motors conform furthermore to various foreign regulations which are aligned to IEC 60034-1 or else have taken over the latter's stipulations as European standard EN 60034-1.

## Rating plates

In standard design, the motor rating plate is normally marked in the German and English languages.

Other languages may be used with non-EU languages available against extra price.

The rating plate indicates the most important design data such as type designation and motor number, output, rated voltage and frequency, rated current, type of construction, degree of protection, power factor, speed, thermal class.

For PM motors this information is extended with data necessary for inverter parameterisation (e.g. rating plate for inverter parameterisation for FC302/Danfoss).

The data may vary according to type. In the case of motors with relubricating device, the quantity of grease per lubrication event and the relubricating intervals are also indicated on the rating plate or an additional plate. The rating plates are fastened on the housing with grooved drive studs and cannot be lost. They may be made of aluminium or stainless steel (extra price).

## Dimensions and types of construction

The motors are available in types of construction IM B3, IM B35 and IM V1 and related types taking into account all constraints valid for the basic design.

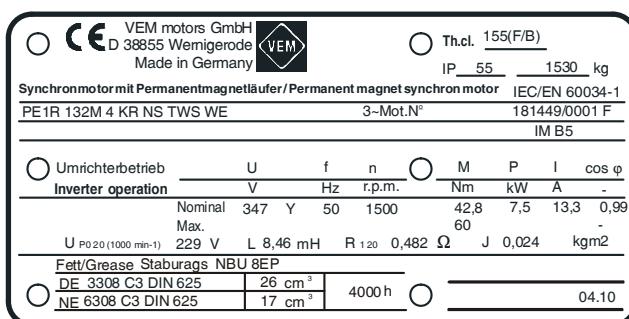
## Ambient temperature

The standard versions of all VEM motors are suitable for use under ambient temperatures from -20°C to +40°C. The motors can be used at ambient temperatures as low as -40°C, but they have to be ordered accordingly.

If frequent moisture condensation is to be expected at the place of installation of a motor, we recommend the use of anti-condensation heating devices or other appropriate precautions.

## Rated output

The rated output applies to continuous operation as specified in DIN EN 60034-1, related to a coolant temperature of 40°C and an altitude of  $\leq 1000$  m above sea level.



## Rated voltage and frequency

In the basic version, motors are supplied for mains power systems with 400 V and 50 Hz (complies with inverter input voltage). The motors can only be operated in connection with a frequency inverter.

Rated voltage and frequency will be adjusted to the technical requirements of the drive. The rated voltage (fundamental wave output voltage) of the PM synchronous motors is always smaller than the mains voltage. The rated frequency complies with the required rated speed.

## Motor torque

The design torque in Nm given at the motor shaft will be

$$M = 9550 \cdot \frac{P}{n}$$

where P = design output in kW  
n = speed in rpm

## Type designation

| P | E | 1 | R | 160 | M | X | 4 | KTY |
|---|---|---|---|-----|---|---|---|-----|
| 1 | 2 | 3 | 4 | 5   | 6 | 7 | 8 | 9   |

|   |  |
|---|--|
| 1 | Design version   |
|   | P ... Permanent magnet synchronous motor                             |
| 2 | Design condition   |
|   | 2 ... Series 2   |
|   | E ... Energy saving motor  |
| 3 | Standard characteristic numberm                                      |
|   | 0 ... IEC, progressive design series                                 |
|   | 1 ... DIN design   |
|   | 2 ... Transnorm design, IEC  |
| 4 | Degree of cooling  |
|   | R ... Fin cooled, IC 411   |
|   | F ... Forced-air cooled, IC 416                                      |
|   | B ... Water cooled, IC 31W   |
| 5 | Shaft height in mm   |
|   | 56, 63, 71, 80, 90, 100, 112, 132, 160, 180, 200, 250, 280, 315, 355 |
| 6 | Foot length  |
|   | K ... small  |
|   | G ... large  |
|   | S ... short  |
|   | M ... medium   |
|   | L ... long   |
| 7 | Symbols for different output   |
|   | X, Y, Z ...  |
| 8 | Pole number  |
|   | 4, 6, 8, 12  |
| 9 | Special designs  |
|   | KTY ... Temperature detector KTY                                     |
|   | ... for further symbols refer to Modifications summary               |
|   | Base catalogue 01-2010   |

## Motor protection

The following variations of motor protection are possible, if ordered:

- motor protection with thermistor temperature sensors in the stator winding
- bimetal temperature sensor as opener or closer in the stator winding
- silicon diodes KTY
- resistance thermometer to monitor winding or bearing temperature
- bearing vibration diagnosis

## Bearings/bearing lubricatio

VEM motors are equipped with anti-friction bearings from respected manufacturers. The rated bearing lifetime is at least 20,000 h with the exploitation of the maximum permissible load. The rated bearing lifetime for motors installed in a horizontal position without additional axial loading is 40,000 h in the case of coupling service.

The versions fixed bearing at N-end, without fixed bearing (floating bearing arrangement), permanent lubrication, relubrication device, heavy bearing on D-end (for increased lateral forces), easy bearing arrangement and the bearing schedules disk spring or wave washer types, V-ring types and figures of bearing arrangement can be taken from the overviews of the bearing arrangements.

The respective flat grease nipples are contained in the tables of the design drawings. Motors in the normal versions with two deep groove ball bearings have preloaded bearings, where the preloading is implemented by a disk spring or a wave washer. Versions with cylindrical roller bearings on the D-end (heavy bearing arrangement VL) are excepted from the preloading. The "fixed bearing N-end" version is possible in the case of motors without a "fixed bearing". Fixed bearing at D-end possible on request.

The most important prerequisite for achieving the normal bearing lifetime is correct lubrication, i.e. the use of the right kind of grease according to the application, the filling with the correct amount of grease and the maintenance of the subsequent relubrication periods.

The frame sizes 56 to 160 are equipped with life-lubricated bearings. These bearings are to be changed promptly in accordance with the usable grease life.

In the case of motors from size 180, the bearings must be relubricated promptly in accordance with the usable grease life. Under normal operating conditions, the lubrication filling will allow 10,000 operating hours for the 2-pole version and 20,000 operating hours for the 4-pole version without relubrication. Under normal service conditions, for version with relubrication device, 2,000 or 4,000 operational hours will apply. A grease of type KE2R-40 as specified in DIN 51825 will be used as standard grease. The used grease is to be removed from the lubrication chamber in the external bearing cover after five relubrications.

A change of bearings is only possible when using suitable equipment. The best solution is to ask an authorized service centre (see also installation, operation and maintenance manual). Information about bearing sizes, grease types and quantities and times for relubrication are to be taken from an additional plate attached to the motor.

### Bearing monitoring

The motors can be prepared for equipment of or equipped with temperature detectors, shock pulse and vibration detectors for bearing monitoring. PT100 can be fitted on the bearings as temperature sensors.

They can be designed in 2-, 3- or 4-wire circuit. The connection is either done in the main terminal box or in a separate auxiliary terminal box that is fixed at the main terminal box or on the motor housing depending on the design. For wear monitoring of the anti-friction bearings it is possible for size 132 and bigger to install shock pulse sensors (SPM) at the end shields. Thus a monitoring with mobile recorders is possible. For remote monitoring it is also possible to use permanently wired shock pulse or vibration sensors.

### Use of insulated bearings

Magnetic unbalances induce a voltage in the shaft of the motors. This shaft voltage results in equalising currents between rotor and stator leading through the bearings. If the voltage rises above a limit value of 500 mV, bearings can be damaged. Because of the design this value will not be exceeded in any case for VEM standard motors at mains operation. However these effects can be amplified by frequency inverter operation, whereas the design of the inverter is one of the most important influences. Pulse inverters generate especially high frequency voltages and currents depending on the pulse frequency and the pulse modulation. Output filters in the inverter minimise these effects.

To avoid bearing damages motors in size 315 and above are fitted with insulated bearings on N-end as standard.

### Winding and insulation

VEM motors of design series P2../PE... are produced in thermal class 155 [F] as standard. High quality enamelled copper wires and insulation materials combined with an impregnation treatment based on low-solvent varnish are used. These materials offer a high mechanical and electrical strength and guarantee a long life time of the motors. A design in thermal class 180 [H/F] is available (additional charge).

Inverter supply means higher voltage loads for the motor winding than sinusoidal mains supply. Therefore the winding insulation of the motor must be selected according to the following information:

| Series     | Size                    | Max. permitted values |         |
|------------|-------------------------|-----------------------|---------|
|            |                         | U                     | du/dt   |
|            |                         | [V]                   | [kV/μs] |
| PE../P2..  | 56-132T                 | ≤ 1,000               | ≤ 0.5   |
|            | 56-132T acc. to Sp.2945 | ≤ 1,350               | ≤ 1.0   |
|            | 132[P20. 112] to 355    | ≤ 1,350               | ≤ 1.5   |
| PU1./ PU0. | 56-132T acc. to Sp.9382 | ≤ 1,560               | ≤ 3.0   |
|            | 132 [PU0. 112] to 355   | ≤ 1,850               | ≤ 5.0   |
| PV1./PV0.  | 132[PV0. 112] to 355    | ≤ 2,500               | ≤ 5.0   |

### Motors for inverter operation in VIK design

(VIK 04.2005)

#### Output voltages at the inverter ≤ 690 V

According to VIK recommendation 04.2005, no. 6.7 / NAMUR recommendation NE38, motors are permitted to be operated with a maximum peak voltage of 1,350 V complying with DIN IEC 60034-17 and a voltage rise time du/dt of 1.5 kV/μs at the motor terminals. Higher peak voltages must be agreed separately. This means VIK motors for inverter operation are produced in design PE.../P2.. if no other voltage peak values are agreed. It is not allowed to use permanent magnet motors in zone 2.

### Wiring, grounding and EMC

All motors must be connected with shielded, symmetric cables and EMC cable glands (glands with 360°-shield contacting) to assure a proper grounding and design complying with the EMC regulation. The 360° grounding has to be done for all cable entries according to the product related information for the cable glands. It must be assured to have the best available potential equalisation between motor housing and inverter. Thus it is prevented to induce a grounding current through the motor shaft in the working machine.

### Types of construction

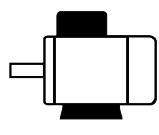
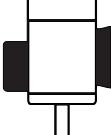
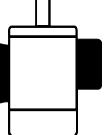
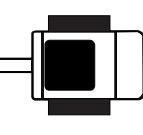
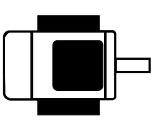
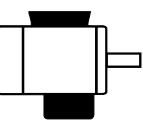
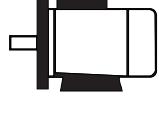
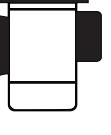
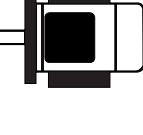
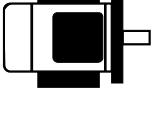
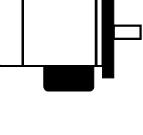
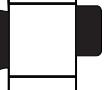
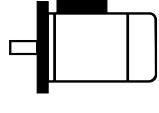
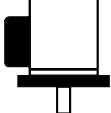
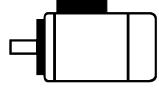
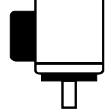
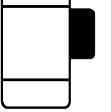
The most frequently used types of construction are shown in the following table. Other types of construction on request. The type of construction is designated on the nameplate according to Code I, DIN EN 60034-7. Standard motors in sizes 56 – 200 that are ordered in the basic types of construction can also be used in the following other types of construction:

IM B3 in IM B5, IM B7, IM B8 und IM V6  
 IM B35 in IM 2051, IM 2061, IM 2071 und IM V36  
 IM B34 in IM 2151, IM 2161, IM 2171 und IM 2131  
 IM B5 in IM V3  
 IM B14 in IM V19

Motors of types IM V5, IM V1 or IM V18 may optionally be fitted with a protective roof to prevent smaller parts from falling into their interior. For types with the shaft end pointing upward the user must provide a suitable covering to prevent smaller parts from falling into the fan cover.

The cooling air flow must not be obstructed by the covering. As from frame size 225, consultation with the manufacturer will be necessary for the types IM V5, IM V6, IM B6, IM B7 and IM B8. In the frame size range as of 315L, the types IM B5 and IM V3 are not available.

## Overview of types of construction

| Basic types of construction   | Derived types of construction   |   |  |  |  |
|---|---|---|--|--|--|
| IM B3<br>IM 1001  | IM V5<br>IM 1011  | IM V6<br>IM 1031  | IM B6<br>IM 1051   | IM B7<br>IM 1061   | IM B8<br>IM 1071   |
|    |    |    |   |   |   |
| IM B35<br>IM 2001   | IM V15<br>IM 2011   | IM V36<br>IM 2031   | -<br>IM 2051   | -<br>IM 2061   | -<br>IM 2071   |
|    |    |    |   |   |   |
| IM B34<br>IM 2101   | -<br>IM 2111  | -<br>IM 2131  | -<br>IM 2151   | -<br>IM 2161   | -<br>IM 2171   |
|   |   |   |  |  |  |
| IM B5<br>IM 3001  | IM V1<br>IM 3011  | IM V3<br>IM 3031  |  |  |  |
|  |  |  |  |  |  |
| IM B14<br>IM 3601   | IM V18<br>IM 3611   | IM V19<br>IM 3631   |  |  |  |
|  |  |  |  |  |  |

### Design version

| Shaft height | Series | Material for Housing<br>End shields<br>Feet | Foot mounting |
|--------------|--------|---|---------------|
| 63 to 132T   | P.1R   | Grey cast iron                              | bolted on     |
| 100 LX       | P.1R   |   | cast on       |
| 132 to 280   | P.1R   |   | bolted on     |
| 315, 355     | P2.R   |   | cast on       |
| 56 to 100    | P20R   |   | cast on       |
| 112 to 250   | P20R   |   | bolted on     |
| 280 to 315   | P20R   |   | cast on       |

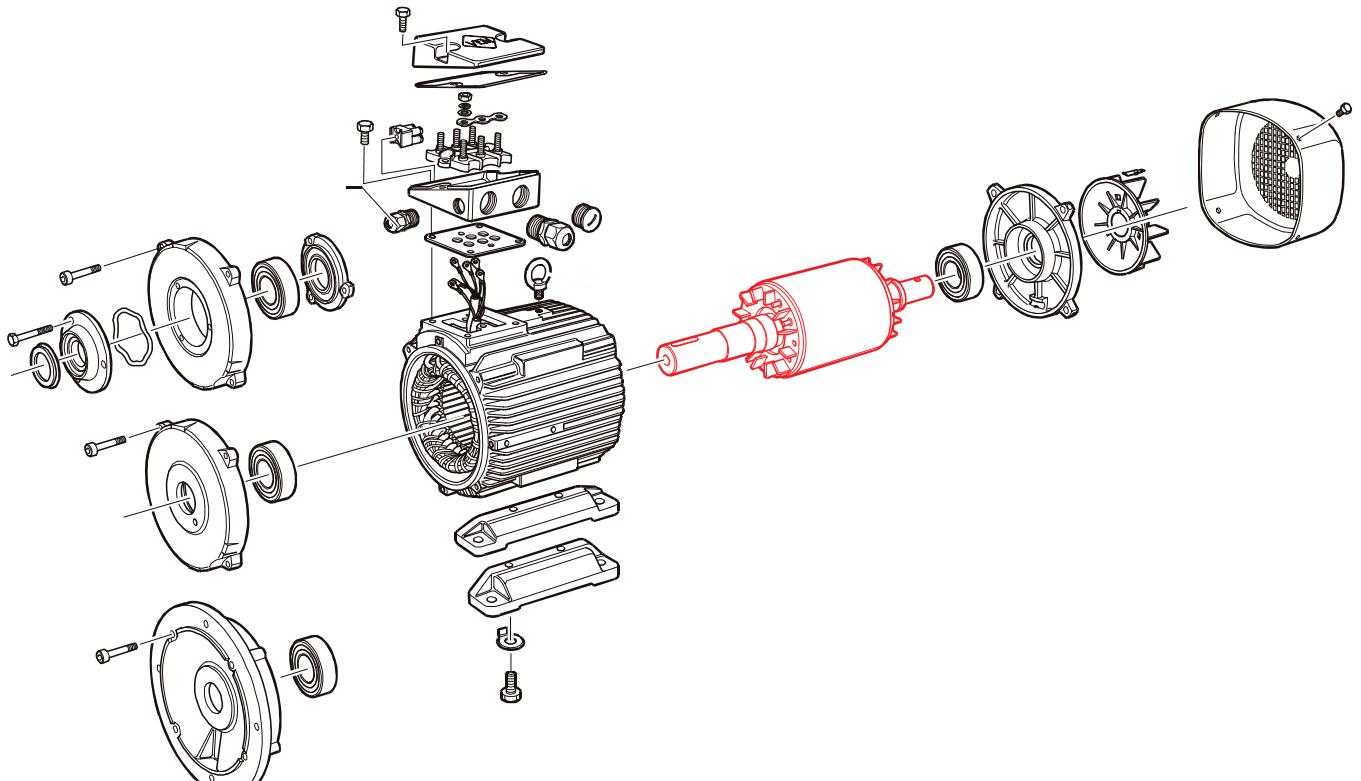


Figure 1: principle design of PM motor



Figure 2: principle design of PM motor

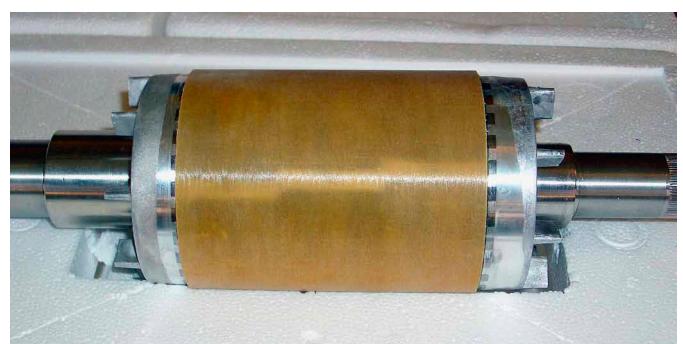


Figure 3: PM rotor complete, with bandage

From the outside PM motors don't differ from asynchronous motors (ASM). The design is based on the robust and reliable VEM standard motors in grey cast iron housing. The stator complies with the basic series K2.R. In addition the squirrel

cage of the ASM is used as basis for the magnet wheel (rotor). The rotor body of the squirrel cage motor is turned after die casting, then the neodymium magnets are fixed by gluing and afterwards they will be bandaged (see figure 2 and 3).

## Cooling and ventilation

The motors are equipped with radial plastic or aluminium alloy fans, which cool independently of the direction of rotation of the motor (IC 411 as specified in DIN EN 60034-6).

Attention is to be paid that a minimum distance of the fan cover from the wall is maintained (dimension B1) when the motor is being installed.

### Hints for calculation of drive design and for operation of motors in connection with frequency inverters

Motors are only one part of a complex electric drive system. However a poor design of the drive system will mainly show in motor operation, whereas a faulty parameterisation will be noticed at the mechanical transmission elements like couplings and belt drives. Modern inverters mostly protect themselves and the motor against thermal overload. But unacceptable high voltage peaks at the motor terminals will not be recognized. The drive can have problems if the output circuit is missing at the inverter and/or the cables are too long. In addition this often results in serious damage of the motor insulation.

There are several options to optimise the drive system:

- Output filter circuits at the inverter (choke, du/dt filters or sine filters)
- Motor with reinforced insulation system
- Combination of both options

The planning of whole drive systems is bound to the knowledge of the interaction of all used components.

The planning engineer has to select the different components very carefully. It is mainly his responsible decision that, at the motor terminals, the permissible voltages are not exceeded. This includes also the decision about the motor insulation system, always taking the effects of the other components into account.

Examples for drive components having decisive influences on the motor insulation system:

#### **Motor cable**

(Length, type, wiring, shielding, etc.)

Long motor cables can induce unacceptable pulse voltages at the motor terminals. The impact of long motor cables can be reduced by the following components that are directly attached to the output of the inverter, so that the values can be reduced:

#### *Output chokes*

reduce the capacitive recharging currents for long cables. Due to the shape of the output voltage of the inverter, capacitance components have particularly for long lines a negative effect. The cable capacitances result in recharging currents that the inverter has to produce additionally. The total current (motor current and recharging current) can become very high, for long motor lines (an for the operation of several motors), that the peak output current is exceeded. In such a case, the inverter shuts off with the message "over-current".

When using the shielded cable, required for the observance of the electromagnetic compatibility (EMC), the critical cable length is further reduced due to the fact that the shield forms, together with the power cables, additional capacitances. The chokes reduce the recharging current it must be located directly at the inverter output, to lower the switching loss in the inverter. The output choke reduces, with the cable capacitances, the rise speed at the motor terminals, the voltage spikes are minimised.

#### *du/dt-Filter*

By the high switching frequencies, resulting from the very short switching periods, voltage spikes of up to 5 kV/μs are produced. These spikes are shortening the lifetime of the motor insulation system. Using a du/dt filter, the rise speed of the voltage can be limited below 500 V/μs, and the voltage peaks decrease to values below 1.000 V. If the voltage strength of the motor insulation system is unknown or the motor cables are very short, a du/dt filter should be used. For very long lines it could be required to implement additionally to the du/dt filter one or two chokes.

#### *Sine filter*

modulate the non-sinusoidal output voltage of the inverter into a sinusoidal motor voltage. The advantages of sine filters base on a significant improve of the harmonic distortion factor of the voltage (near to sine shape). A specific insulation system is not necessary. The true running is improved, the motor loss and the magnetic noise is reduced.

Sine filters have the general disadvantage that there is a voltage drop that could not be neglected. The output voltage at the filter could be reduced as much as 15%, i.e. the edge frequency of the inverter has to be decreased by about 15% resulting possibly in a larger motor, or the motor winding has to be adapted to the reduced feeding voltage.

## Motor limits for continuous operation

The planning of variable speed drives prerequisites both the knowledge about the torque or the output along the speed of the driven machine, and also for the motor itself. Within the speed range below the nominal motor speed, the torque for the continuous operation (limit torque) must be observed, and for speed above the nominal motor speed, the reduced breakdown torque must be taken into account.

The provided torque depends both on the motor (design, cooling method, etc.) and the inverter (parameters, pulse frequency, modulation procedure, output circuitry).

## Adjustable drive systems with permanent magnet synchronous motors

Permanent magnet synchronous motors can be used in every application where machines are driven with variable speed. As for separately excited synchronous motors a direct start from the mains is not possible for permanent magnet synchronous motors. PM synchronous motors must only be operated in connection with a frequency inverter.

As a PM synchronous motor with field-oriented control has the same characteristics as a DC motor, the PM motor was almost exclusively used in demanding applications for controlled drives because of the missing brushes (lower maintenance costs). Today PM synchronous motors are used also in application ranges where efficiency is very important. As the efficiency is very high in full load and part load operational range, this kind of drive is economically advantageous for working machines with a quadratically declining torque characteristic (e.g. pump drives)

PM synchronous motors fulfil the requirements for efficiency class IE3 without additional expenses for motor mass. Because of this effect of double savings

- High efficiency in operation (reduction of energy consumption) and
- Reduction of material (copper, grey cast iron, aluminium, etc.) at the production (compared to asynchronous motors)

is a drive with PM synchronous motor a sustainable investment for the future.

#### **Special features of the calculation of a controlled drive system with PM synchronous motor:**

PM synchronous motors are excited by permanent magnets. That means the strength of the exciting field is determined when calculating the design of the motor. It remains constant. A PM synchronous motor has therefore no field weakening operation as is known for asynchronous motors. In the whole speed control range (condition: rated speed = maximum speed) the induced voltage is proportional to the speed. If a suitable inverter is used, a limited field weakening range can be realised by changing one component of the current.

In PM synchronous motors the standard correlation of rated speed to motor pole number and rated frequency (mainly 50 Hz or 60 Hz) is not necessary anymore. The optimum adjustment of the motor to the working machine or the process requirements and the output voltage of the inverter is possible without any problems.

As example the rated speed of 3,000 r.p.m. is realised by a 4-pole PM synchronous motor with a winding of 100 Hz. 2-pole PM synchronous motors are not available in our production range. On the other hand lower rated speeds (e.g. 1,200 r.p.m or 900 r.p.m.) can be realised with smaller rated frequencies. PM synchronous motors can transfer very high overload torques. They must only be designed accordingly and the inverter must be able to transfer the necessary peak currents for the required amount of time.

As option PM synchronous motors can also be supplied with resolver. Thus we are able to detect exactly the speed of the magnet wheel and its position in the stator. By means of a field-oriented control we are than able to realise drives that require for example very high accuracy of synchronised speed and constant torque. It might be necessary to use a brake resistance to protect the inverter at high moments of inertia and fast speed changes.

The motors are also available as drive unit with frequency inverter. There are some benefits for the customer:

- Pre-parameterised unit
- Radio interference suppression grade complying with EN 55011 class A1 up to
- 150 m shielded cable length
- Radio interference suppression grade complying with EN 55011 class B1 up to 50 m shielded cable length
- Integrated braking chopper
- Mains input voltage 380 ... 500 V +/- 10%, 50/60 Hz

#### **What information must be contained in a motor inquiry?**

If a controlled asynchronous motor is exchange with a comparable PM synchronous motor the information remain the same (e.g. for drives with quadratically decreasing torque characteristic). A 2-pole design is not available. Instead a 4-pole motor with 100 Hz winding is used.

For the best possible design and optimum quotation of a PM synchronous motor the manufacturer will need the following information:

- Mains voltage, mains frequency

For determination of pole number and torque/output:

- Required torque of the working machine in the adjusting speed range

Because of the limited field-weakening range a value for maximum speed shall be selected that is equal to the rated speed. Alternatively the adjusting speed range must be stated, in which the motor is operated with constant output.

#### **Motors with forced ventilation:**

- Information about the time period of loading in the lower speed range (below 50% of the rated speed) for drives with constant torque
- Required thermal reserve
- (F/B, F/90K or H/F)
- Maximum cooling air temperature, if deviating from +40°C
- Maximum height of installation if it is above 1,000 m
- Overload requirements and – periods

For determination of winding insulation

- Maximum pulse voltages at the motor terminals of the installed motor (if necessary information about the use of output chokes or filters)

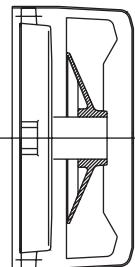
#### **Start of operation and parameterisation of the inverter**

The start of operation and the parameterisation of the inverter must be done according to the installation manual and the manual for parameterisation of the inverter manufacturer.

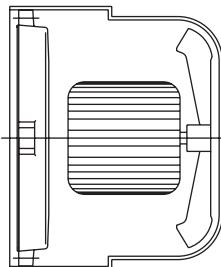
## Modular design of motor series and modifications

The design concept of the series permits the option of adding components to solve modern control tasks, such as a pulse

generator, a tacho generator, brakes, a speed monitor and forced-ventilation units according to the customer's need.



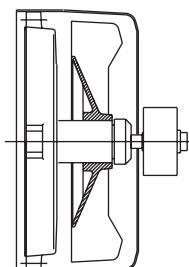
**Standard version**  
Cooling method IC 411, Self-ventilation



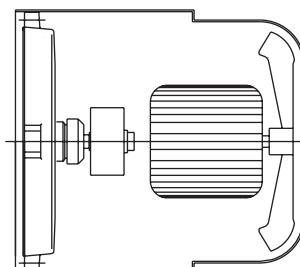
**Special version**  
Cooling method IC 416, Forced-ventilation



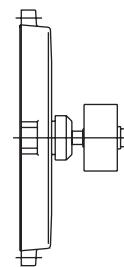
**Special version**  
Cooling method IC 410, Non-ventilated



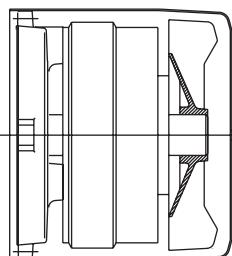
**Special version**  
Cooling method IC 411, Self-ventilation,  
With built-on incremental sensor



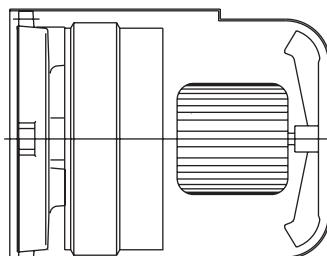
**Special version**  
Cooling method IC 416, Forced-ventilation,  
With built-on incremental sensor



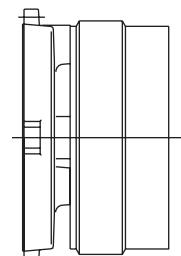
**Special version**  
Cooling method IC 410, Non-ventilated,  
With built-in incremental sensor



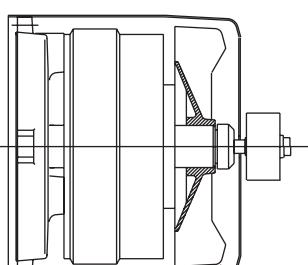
**Special version**  
Cooling method IC 411, Self-ventilation,  
With built-on brake



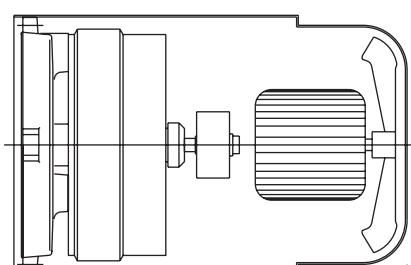
**Special version**  
Cooling method IC 416, Forced-ventilation,  
With built-on brake



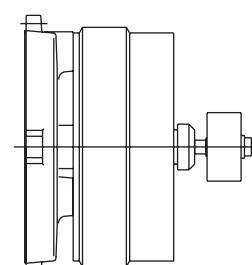
**Special version**  
Cooling method IC 410, Non-ventilated,  
With built-on brake



**Special version**  
Cooling method IC 411, Self-ventilated,  
With built-on brake and incremental  
sensor



**Special version**  
Cooling method IC 416, Forced-ventilation,  
With built-on brake and incremental  
sensor



**Special version**  
Cooling method IC 410, Non-ventilated,  
With built-on brake and incremental  
sensor

## Fits

### Shaft ends

|                       |    |
|-----------------------|----|
| Shaft ends up to Ø 48 | k6 |
| starting from Ø 55    | m6 |
| Matching part         | H7 |

## Tolerances

### Electrical parameters

The following tolerances are permitted as specified in DIN EN 60034-1:

|  |   |
|--|---|
| Efficiency (when determined indirectly)                          | - 0.15 (1-η) for $P_N \leq 150$ kW<br>- 0.1 (1-η) for $P_N > 150$ kW        |
| Power factor   | $1 - \cos \varphi$ min. absolute value 0.02<br>6 max. absolute value 0.07   |
| Total losses (used for machines with rated output $\geq 150$ kW) | + 10%   |
| Slip<br>(at standard load in warmed-up state)                    | $\pm 20\%$ for $P_N \geq 1\text{ kW}$<br>$\pm 30\%$ for $P_N < 1\text{ kW}$ |
| Starting current<br>(in the planned starting connection)         | + 20 %<br>without lower limit   |
| Starting torque  | - 15 % and + 25 %   |
| Pull-up torque   | - 15 %  |
| Pull-out torque  | - 10 % (after application of this tolerance $M_K/M$ still at least 1.6)     |
| Moment of inertia  | $\pm 10\%$  |
| Noise level (measurement area – sound intensity level)           | + 3 dB (A)  |

### Tolerances – Mechanical parameters

| Letter codes                             | Meaning of the dimension  | Fit or tolerance |
|--|---|------------------|
| acc. to DIN EN 50347                     |   |                  |
| B [a]                                    | Spacing of feet fixing holes in axial direction   | $\pm 1$ mm       |
| P [a <sub>1</sub> ]                      | Diameter or width across corners of flange  | - 1 mm           |
| A [b]                                    | Spacing of feet fixing holes across axial direction   | $\pm 1$ mm       |
| N [b <sub>1</sub> ]                      | Diameter of centring flange   | h6               |
| D, DA [d, d <sub>1</sub> ]               | Diameter of the cylindrical shaft end   | m6               |
| M [e <sub>1</sub> ]                      | Pitch circle diameter of the mounting flange  | $\pm 0,8$ mm     |
| AB [f], AC [g]                           | Largest width of the motor (without terminal boxes)   | + 2 %            |
| H [h]                                    | Shaft height (lowest edge of foot to centre of shaft end)                                     | - 1mm            |
| L, LC [k, k <sub>1</sub> ]               | Total length of the motor   | + 1 %            |
| HD [p]                                   | Total height of the motor (lowest edge of foot)   | + 2 %            |
| K, K' [s, s <sub>1</sub> ]               | Diameter of the mounting holes of the foot or flange  | + 3%             |
| GA, GC [t, t <sub>1</sub> ]              | Lowest edge of shaft end to the upper edge of the key   | + 0,2 mm         |
| F, FA [u, u <sub>1</sub> ]               | Width of the key  | h9               |
| C, CA [w <sub>1</sub> , w <sub>2</sub> ] | Distance from the centre of the first foot mounting hole to the shaft shoulder or flange face | $\pm 3,0$ mm     |
|  | Distance from the shaft shoulder to the flange face in the case of fixed bearing on D-end     | $\pm 0,5$ mm     |
|  | Distance from the shaft shoulder to the flange face   | $\pm 3,0$ mm     |
| m  | Motor mass  | - 5 to +10 %     |

Taking necessary manufacturing tolerances and deviations in materials in the case of the raw materials used into account, these tolerances are permitted for three-phase asynchronous motors. The following remarks are given in the standard:

1. A guarantee of all or any of the values as specified in the table is not mandatory. Guaranteed values to which the permissible deviations should apply must be specified expressly in tenders. The permissible deviations must comply with the table.
2. Attention is drawn to the differences in the interpretation of the concept of a "guarantee". In some countries, there is a differentiation between typical and declared values.
3. If a permissible deviation only applies in one direction, the value will not be limited in the other direction

## Bearings

Permanent magnet synchronous motors for inverter operation

Basic design (light bearing arrangement LL)

| Type     | Bearing D-end | V-Ring     | Y-Ring | Felt ring | Wave washer | Disk spring | Bearing N-end     | V-Ring     | Wave washer | Felt ring | Figure |       |
|----------|---------------|------------|--------|-----------|-------------|-------------|-------------------|------------|-------------|-----------|--------|-------|
| P.1R 63  | 6201 2Z C3    | -          | -      | 11.5x19   | -           | -           | 6201 2Z C3        | -          | 32          | 12x22     | 1 2    |       |
| P.1R 71  | 6202 2Z C3    | -          | -      | 14.5x21   | -           | -           | 6202 2Z C3        | -          | 35          | 15x24     | 1 2    |       |
| P.1R 80  | 6204 2Z C3    | -          | -      | 19.5x26   | -           | -           | 6204 2Z C3        | -          | 47          | 20x32     | 1 2    |       |
| P.1R 90  | 6205 2Z C3    | -          | -      | 24.5x35   | -           | -           | 6205 2Z C3        | -          | 52          | 25x40     | 1 2    |       |
| P.1R 100 | 6206 2Z C3    | -          | -      | 29.2x40   | -           | -           | 6205 2Z C3        | -          | 52          | 25x40     | 1 2    |       |
| P.1R 100 | LX            | 6206 2Z C3 | -      | -         | 29.2x40     | -           | -                 | 6206 2Z C3 | -           | 62        | 30x50  | 1 2   |
| P.1R 112 |               | 6206 2Z C3 | -      | -         | 29.2x40     | -           | -                 | 6206 2Z C3 | -           | 62        | 30x50  | 1 2   |
| P.1R 132 | S4T           | 6208 2Z C3 | -      | -         | 39x60       | -           | -                 | 6206 2Z C3 | -           | 62        | 30x50  | 1 2   |
| P.1R 132 | S, M6, 8      | 6208 2Z C3 | -      | -         | -           | 80          | -                 | 6207 2Z C3 | -           | -         | -      | 6 8   |
| P.1R 132 | M4, MX6       | 6308 2Z C3 | -      | -         | -           | 90          | -                 | 6308 2Z C3 | -           | -         | -      | 6 8   |
| P.1R 160 | M, MX8        | 6309 2Z C3 | -      | -         | -           | 100         | -                 | 6308 2Z C3 | -           | -         | -      | 6 8   |
| P.1R 160 | L             | 6310 2Z C3 | -      | -         | -           | 110         | -                 | 6309 2Z C3 | -           | -         | -      | 6 8   |
| P.1R 180 | M4, L6, 8     | 6310 2Z C3 | -      | -         | -           | 110         | -                 | 6309 2Z C3 | -           | -         | -      | 6 8   |
| P.1R 180 | L4            | 6310 C3    | 50A    | -         | -           | -           | 6310 C3           | 50A        | -           | -         | -      | 6 8   |
| P.1R 200 | L, LX6        | 6312 C3    | 60A    | -         | -           | 130         | 6310 C3           | 50A        | -           | -         | -      | 6 8   |
| P.1. 225 | S, M          | 6313 C3    | 65A    | -         | -           | 140         | 6312 C3           | 60A        | -           | -         | -      | 6 8   |
| P.1. 250 | S, M          | 6314 C3    | 70A    | -         | -           | 150         | 6313 C3           | 65A        | -           | -         | -      | 6 8   |
| P.1. 280 | S, M          | 6316 C3    | 80A    | -         | -           | 170         | 6314 C3           | 70A        | -           | -         | -      | 6 8   |
| P21. 315 | S, M          | 6317 C3    | 80A    | -         | -           | 180         | 6316 M C3 VL 0241 | 80A        | -           | -         | -      | 6 8   |
| P21. 315 | MX            | 6220 C3    | -      | RB100     | -           | 180         | 6316 M C3 VL 0241 | 80A        | -           | -         | -      | 13 16 |
| P21. 315 | MY, L, LX     | 6320 C3    | -      | RB100     | -           | 180         | 6317 M C3 VL 0241 | 85A        | -           | -         | -      | 18 19 |
| P22. 355 |               | 6324 C3    | -      | RB120     | -           | 260         | 6317 M C3 VL 0241 | 85A        | -           | -         | -      | 18 19 |

missing values in preparation

Special design (heavy bearing arrangement VL)

| Type     | Bearing D-end | V-Ring    | Y-Ring | Bearing N-end | V-Ring            | Figure | DS | NS |
|----------|---------------|-----------|--------|---------------|-------------------|--------|----|----|
| P.1R 132 | S, M6, 8      | NU 208 E  | 40A    | -             | 6207 2Z C3        | -      | 4  | 10 |
| P.1R 132 | M4, MX6       | NU 308 E  | 40A    | -             | 6308 2Z C3        | -      | 4  | 10 |
| P.1R 160 | M, MX8        | NU 309 E  | 45A    | -             | 6308 2Z C3        | -      | 4  | 10 |
| P.1R 160 | L             | NU 310 E  | 50A    | -             | 6309 2Z C3        | -      | 7  | 10 |
| P.1R 180 | M4, L6, 8     | NU 310 E  | 50A    | -             | 6309 2Z C3        | -      | 7  | 10 |
| P.1R 180 | L4            | NU 310 E  | 50A    | -             | 6310 C3           | 50A    | 7  | 9  |
| P.1R 200 | L, LX6        | NU 312 E  | 60A    | -             | 6310 C3           | 50A    | 7  | 9  |
| P.1. 225 | S, M          | NU 313 E  | -      | RB65          | 6312 C3           | 60A    | 7  | 9  |
| P.1. 250 | S, M          | NU 314 E  | -      | RB70          | 6313 C3           | 65A    | 7  | 9  |
| P.1. 280 | S, M          | NU 316 E  | -      | RB80          | 6314 C3           | 70A    | 7  | 9  |
| P21. 315 | S, M          | NU 317 E  | -      | RB85          | 6316 M C3 VL 0241 | 80A    | 7  | 9  |
| P21. 315 | MX            | NU 2220 E | -      | RB100         | 6316 M C3 VL 0241 | 80A    | 15 | 16 |
| P21. 315 | MY, L, LX     | NU 320 C3 | -      | RB100         | 6317 M C3 VL 0241 | 85A    | 20 | 19 |
| P21. 355 |               | NU 324 C3 | -      | RB120         | 6317 M C3 VL 0241 | 85A    | 20 | 19 |

### Notes:

≤ 132T without fixed bearing, from size 132 fixed bearing on N-end as standard

For vertical types of construction ≥ 315MY: Q317 C3, figure 20, 21

≥ 315 insulated bearing as standard on N-end (vertical types of construction with Q-bearing, insulated bearing D-end)

≥ 315MX relubrication device as standard

### Bearing arrangement

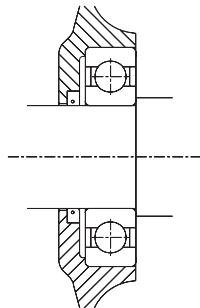


Figure 1

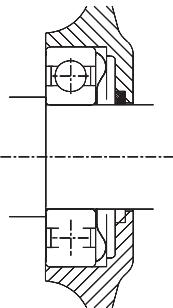


Figure 2

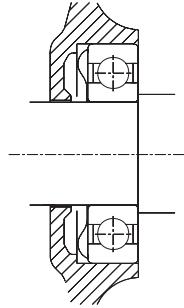


Figure 3

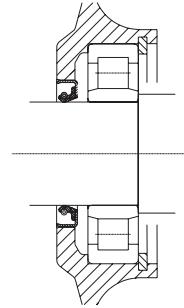


Figure 4

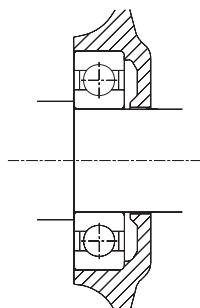


Figure 5

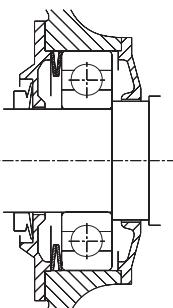


Figure 6

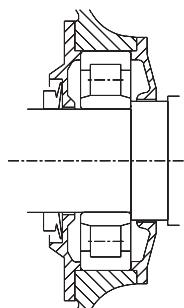


Figure 7

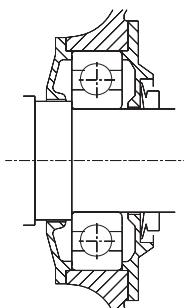


Figure 8

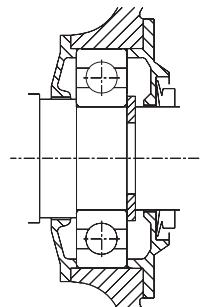


Figure 9

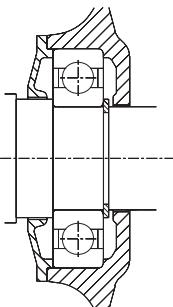


Figure 10

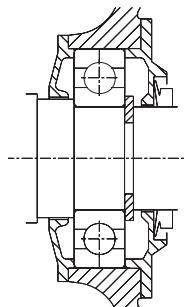


Figure 11

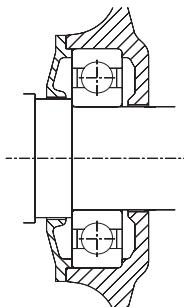


Figure 12

## Bearing arrangement

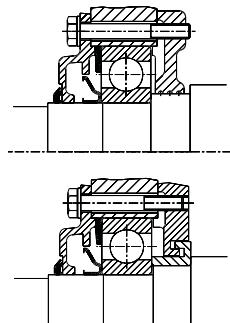


Figure 13

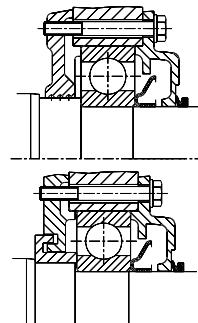


Figure 14

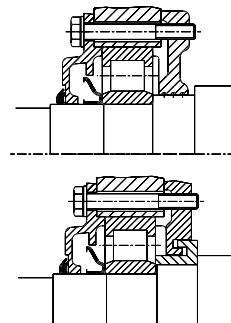


Figure 15

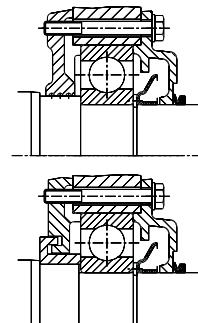


Figure 16

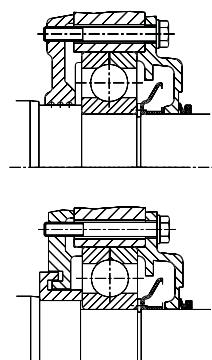


Figure 17

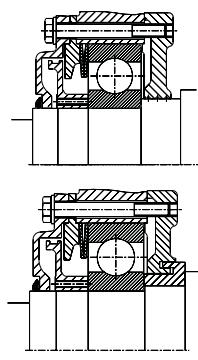


Figure 18

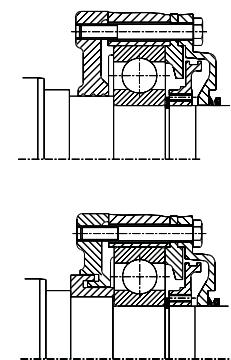


Figure 19

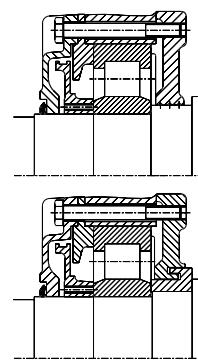


Figure 20

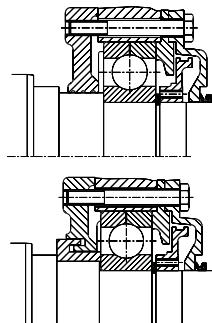


Figure 21

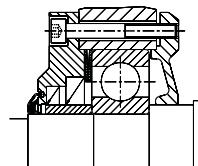


Figure 22

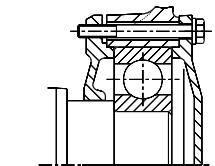


Figure 23

## Permanent magnet synchronous energy saving motors for inverter operation

with surface cooling, type of cooling IC 411  
thermal class 155 [F/B], type of protection IP 55

Motor selection data

Inverter input voltage 400 V, 50 Hz

|               |             | Rated speed | Rated frequency | Rated output | Torque | max. torque (2 min) | Voltage | Efficiency η | Power factor  | Rated current | Phase resistance at 20°C | No load voltage at speed 1000 r.p.m. | Magnetising inductance | Leakage inductance | Magnetising reactance | Leakage reactance | Motor moment of inertia | Motor mass |
|---------------|-------------|-------------|-----------------|--------------|--------|---------------------|---------|--------------|---------------|---------------|--------------------------|--------------------------------------|------------------------|--------------------|-----------------------|-------------------|-------------------------|------------|
|               |             | [kW]        | [Nm]            | [V]          | [%]    | [-]                 | [A]     | [Ω]          | V/1000 r.p.m. | [mH]          | [mH]                     | [Ω]                                  | [Ω]                    | J                  | m                     |                   |                         |            |
| PE1R 63 K4    | PE0R 56 K4  | 0.18        | 0.6             | 2.5          | 335    | 80                  | 0.99    | 0.35         | 32            | 100           | 60                       | 28                                   | 37.7                   | 17.59              | 0.00019               | 4.8               |                         |            |
| PE1R 63 G4    | PE0R 56 G4  | 0.25        | 0.8             | 3.5          | 320    | 81.5                | 0.99    | 0.5          | 18            | 105           | 42                       | 18                                   | 26.39                  | 11.31              | 0.00024               | 5.2               |                         |            |
| PE1R 71 K4    | PE0R 63 K4  | 0.37        | 1.2             | 4            | 300    | 81                  | 0.99    | 0.8          | 13.5          | 95            | 37                       | 15                                   | 23.25                  | 9.42               | 0.0004                | 6.8               |                         |            |
| PE1R 71 G4    | PE0R 63 G4  | 0.55        | 1.8             | 7            | 320    | 83                  | 0.99    | 1.1          | 8.5           | 105           | 31                       | 10                                   | 19.48                  | 6.28               | 0.0005                | 7.8               |                         |            |
| PE1R 80 K4    | PE0R 71 K4  | 0.75        | 2.4             | 10           | 335    | 81.6                | 0.99    | 1.6          | 4.6           | 110           | 25                       | 8                                    | 15.7                   | 5                  | 0.00087               | 10.6              |                         |            |
| PE1R 80 G4    | PE0R 71 G4  | 1.1         | 3.5             | 14           | 330    | 86.4                | 0.99    | 2.25         | 2.8           | 105           | 18                       | 5                                    | 11.3                   | 3.1                | 0.00107               | 11.7              |                         |            |
| PE1R 90 S4    | PE0R 80 K4  | 1.5         | 4.8             | 19           | 315    | 88                  | 0.99    | 3            | 14            | 105           | 12                       | 3                                    | 7.54                   | 1.88               | 0.00207               | 15.5              |                         |            |
| PE1R 90 L4    | PE0R 80 G4  | 2.2         | 7               | 28           | 280    | 88.1                | 0.99    | 5.2          | 0.8           | 90            | 5                        | 1                                    | 3.142                  | 0.63               | 0.0026                | 18                |                         |            |
| PE1R 100 L4   | PE0R 90 L4  | 3           | 9.5             | 45           | 320    | 92.7                | 0.99    | 5.9          | 0.6           | 100           | 4.7                      | 1.3                                  | 3                      | 0.8                | 0.004                 | 23.5              |                         |            |
| PE1R 112 MY4  | PE0R 100 S4 | 4           | 12.7            | 50           | 330    | 91.2                | 0.99    | 7.75         | 0.4           | 110           | 3.2                      | 0.8                                  | 2.011                  | 0.5                | 0.00725               | 30                |                         |            |
| PE1R 132 SY4T | PE0R 100 L4 | 5.5         | 17.5            | 85           | 320    | 92.5                | 0.99    | 10.5         | 0.25          | 110           | 2.4                      | 0.6                                  | 1.508                  | 0.38               | 0.009                 | 37                |                         |            |
| PE1R 132 S4T  | -           | 7.5         | 23.9            | 100          | 314    | 93                  | 1.00    | 14.6         | 0.2           | 105           | 1.6                      | 0.4                                  | 1.005                  | 0.25               | 0.011                 | 45                |                         |            |
| PE1R 132 M4   | PE0R 132 S4 | 11          | 35              | 44           | 370    | 92                  | 0.99    | 18.8         | 0.11          | 121           | 1.8                      | 0.79                                 | 1.13                   | 0.5                | 0.028                 | 70                |                         |            |
| PE1R 160 M4   | PE0R 132 M4 | 15          | 48              | 60           | 366    | 92.1                | 0.99    | 24.5         | 0.063         | 120           | 1.2                      | 0.48                                 | 0.76                   | 0.31               | 0.035                 | 92                |                         |            |
| PE1R 160 L4   | PE0R 160 S4 | 18.5        | 59              | 74           | 374    | 92.2                | 0.99    | 32           | 0.039         | 123           | 1.07                     | 0.38                                 | 0.67                   | 0.24               | 0.078                 | 120               |                         |            |
| PE1R 180 M4   | PE0R 160 M4 | 22          | 70              | 88           | 368    | 92.3                | 0.99    | 36.5         | 0.032         | 121           | 0.86                     | 0.29                                 | 0.54                   | 0.18               | 0.09                  | 136               |                         |            |
| PE1R 180 L4   | PE0R 180 S4 | 30          | 95              |              |        |                     |         |              |               | R             |                          |                                      |                        |                    | 0.138                 | 170               |                         |            |
| PE1R 200 L4   | PE0R 180 M4 | 37          | 118             |              |        |                     |         |              |               | R             |                          |                                      |                        |                    | 0.168                 | 200               |                         |            |
| PE1R 225 S4   | PE0R 200 M4 | 45          | 143             |              |        |                     |         |              |               | R             |                          |                                      |                        |                    | 0.275                 | 270               |                         |            |
| PE1R 225 M4   | PE0R 200 L4 | 55          | 175             |              |        |                     |         |              |               | R             |                          |                                      |                        |                    | 0.313                 | 300               |                         |            |
| PE1R 250 M4   | PE0R 225 M4 | 75          | 239             |              |        |                     |         |              |               | R             |                          |                                      |                        |                    | 0.525                 | 375               |                         |            |
| PE1R 63 K4    | PE0R 56 K4  | 0.12        | 0.8             | 2.5          | 310    | 77                  | 0.98    | 0.3          | 95            | 170           | 160                      | 80                                   | 50.3                   | 25.13              | 0.00019               | 4.8               |                         |            |
| PE1R 63 G4    | PE0R 56 G4  | 0.18        | 1.1             | 3.5          | 310    | 80.5                | 0.98    | 0.4          | 57            | 180           | 130                      | 60                                   | 40.8                   | 18.85              | 0.00024               | 5.2               |                         |            |
| PE1R 71 K4    | PE0R 63 K4  | 0.25        | 1.6             | 4            | 300    | 69.5                | 0.98    | 0.65         | 44            | 165           | 110                      | 50                                   | 34.6                   | 15.71              | 0.0004                | 6.8               |                         |            |
| PE1R 71 G4    | PE0R 63 G4  | 0.37        | 2.4             | 7            | 310    | 74                  | 0.98    | 0.95         | 26            | 175           | 85                       | 35                                   | 26.7                   | 11                 | 0.0005                | 7.8               |                         |            |
| PE1R 80 K4    | PE0R 71 K4  | 0.55        | 3.5             | 10           | 320    | 81                  | 0.98    | 1.25         | 14.5          | 190           | 76                       | 24                                   | 23.9                   | 7.5                | 0.00087               | 10.6              |                         |            |
| PE1R 80 G4    | PE0R 71 G4  | 0.75        | 4.8             | 14           | 325    | 82.4                | 0.98    | 1.65         | 9.5           | 195           | 61                       | 19                                   | 19.2                   | 6                  | 0.00107               | 11.7              |                         |            |
| PE1R 90 S4    | PE0R 80 K4  | 1.1         | 7               | 19           | 315    | 84.9                | 0.99    | 2.4          | 6             | 195           | 36                       | 9                                    | 11.3                   | 2.8                | 0.00207               | 15.5              |                         |            |
| PE1R 90 L4    | PE0R 80 G4  | 1.5         | 9.5             | 28           | 305    | 86.9                | 0.99    | 3.3          | 3.4           | 190           | 24.5                     | 5.5                                  | 7.7                    | 1.7                | 0.0026                | 18                |                         |            |
| PE1R 100 L4   | PE0R 90 L4  | 2.2         | 14              | 45           | 315    | 90.5                | 0.99    | 4.5          | 2.1           | 195           | 1.5                      | 4.5                                  | 4.9                    | 1.4                | 0.004                 | 23.5              |                         |            |
| PE1R 100 LX4  | PE0R 100 S4 | 3           | 19.1            | 50           | 335    | 91.6                | 0.99    | 5.7          | 1.5           | 215           | 16                       | 4                                    | 5                      | 1.3                | 0.00725               | 30                |                         |            |
| PE1R 112 M4   | PE0R 100 L4 | 4           | 25.5            | 70           | 320    | 92.3                | 0.99    | 7.9          | 0.9           | 205           | 10.5                     | 2.5                                  | 3.3                    | 0.8                | 0.009                 | 37                |                         |            |
| PE1R 112 MX4  | PE0R 132 S4 | 5.5         | 35              | 100          | 325    | 93.1                | 0.99    | 10.6         | 0.65          | 210           | 8.2                      | 1.8                                  | 2.6                    | 0.6                | 0.011                 | 45                |                         |            |
| PE1R 132 M4   | PE0R 132 M4 | 7.5         | 42.8            | 60           | 347    | 94                  | 0.99    | 13.3         | 0.482         | 229           | 6.09                     | 2.37                                 | 1.91                   | 0.74               | 0.024                 | 70                |                         |            |
| PE1R 160 M4   | PE0R 160 S4 | 11          | 70              | 88           | 352    | 94.1                | 0.99    | 19.5         | 0.29          | 228           | 4.12                     | 1.48                                 | 1.3                    | 0.46               | 0.033                 | 92                |                         |            |
| PE1R 160 L4   | PE0R 160 M4 | 15          | 95.5            | 119          | 356    | 94.8                | 0.98    | 26           | 0.128         | 228           | 3.69                     | 1.31                                 | 1.16                   | 0.41               | 0.068                 | 120               |                         |            |
| PE1R 180 M4   | PE0R 180 S4 | 18.5        | 118             | 147          | 355    | 95                  | 0.98    | 32.3         | 0.107         | 227           | 3.04                     | 1.03                                 | 0.96                   | 0.32               | 0.079                 | 136               |                         |            |
| PE1R 180 L4   | PE0R 180 M4 | 22          | 140             | 175          | 355    | 95.4                | 0.98    | 38.5         | 0.08          | 227           | 2.84                     | 0.94                                 | 0.89                   | 0.3                | 0.126                 | 170               |                         |            |
| PE1R 200 L4   | PE0R 200 M4 | 30          | 191             | 239          | 352    | 95.6                | 0.98    | 52.5         | 0.052         | 225           | 2.11                     | 0.65                                 | 0.66                   | 0.2                | 0.162                 | 220               |                         |            |
| PE1R 225 S4   | PE0R 200 L4 | 37          | 236             | 294          | 366    | 95.6                | 0.97    | 62           | 0.039         | 235           | 1.91                     | 0.56                                 | 0.6                    | 0.18               | 0.269                 | 270               |                         |            |
| PE1R 225 M4   | PE0R 225 M4 | 45          | 286             | 358          | 365    | 95.7                | 0.98    | 76.6         | 0.026         | 233           | 1.6                      | 0.45                                 | 0.5                    | 0.14               | 0.308                 | 300               |                         |            |
| PE1R 250 M4   | PE0R 225 M4 | 55          | 350             | 420          | 367    | 95.8                | 0.97    | 93           | 0.019         | 236           | 1.31                     | 0.37                                 | 0.41                   | 0.12               | 0.517                 | 375               |                         |            |

R = on request

The maximum speed depends on the DC link voltage of the inverter, on the load and on the type of inverter.

Parameters with index 1: phase values

Parameters with index 20: valid for 20°C, e.g.:  $R_{120}$ : phase resistance at 20°C

Changes reserved due to technical progress.

missing values in preparation

## Permanent magnet synchronous energy saving motors for inverter operation

with surface cooling, type of cooling IC 411  
thermal class 155 [F/B], type of protection IP 55

Motor selection data

Inverter input voltage 400 V, 50 Hz

|              |              | Rated speed | Rated frequency | Rated output | Torque | max. torque (2 min) | Voltage | Efficiency η | Power factor  | Rated current | Phase resistance at 20°C | No load voltage at speed 1000 r.p.m. | Magnetising inductance | Leakage inductance | Magnetising reactance | Leakage reactance | Motor moment of inertia | Motor mass |
|--------------|--------------|-------------|-----------------|--------------|--------|---------------------|---------|--------------|---------------|---------------|--------------------------|--------------------------------------|------------------------|--------------------|-----------------------|-------------------|-------------------------|------------|
|              |              | [kW]        | [Nm]            | [V]          | [%]    | [·]                 | [A]     | [Ω]          | V/1000 r.p.m. | [mH]          | [mH]                     | [Ω]                                  | [Ω]                    | [kgm²]             | [kg]                  | m                 |                         |            |
| PE1R 63 K6   | PE0R 56 K6   | 0.09        | 0.8             | 3.5          | 280    | 76.5                | 0.99    | 0.25         | 86            | 240           | 110                      | 110                                  | 34.6                   | 34.56              | 0.00024               | 4.9               |                         |            |
| PE1R 63 G6   | PE0R 56 G6   | 0.12        | 1.3             | 4.8          | 285    | 79                  | 0.99    | 0.3          | 63            | 260           | 90                       | 90                                   | 28.3                   | 28.27              | 0.00027               | 5.7               |                         |            |
| PE1R 71 K6   | PE0R 63 K6   | 0.18        | 1.7             | 7            | 275    | 81.5                | 0.99    | 0.45         | 36            | 250           | 70                       | 60                                   | 22                     | 18.85              | 0.00045               | 7.4               |                         |            |
| PE1R 71 G6   | PE0R 63 G6   | 0.25        | 2.4             | 10           | 285    | 83                  | 0.99    | 0.6          | 25            | 270           | 55                       | 45                                   | 17.3                   | 14.14              | 0.0006                | 8.3               |                         |            |
| PE1R 80 K6   | PE0R 71 K6   | 0.37        | 3.5             | 14           | 310    | 84                  | 0.99    | 0.75         | 19            | 280           | 37                       | 23                                   | 11.6                   | 7.23               | 0.0013                | 11                |                         |            |
| PE1R 80 G6   | PE0R 71 G6   | 0.55        | 5.3             | 21           | 310    | 86                  | 0.99    | 1.15         | 10.7          | 295           | 25                       | 15                                   | 7.9                    | 4.71               | 0.00175               | 12.5              |                         |            |
| PE1R 90 S6   | PE0R 80 K6   | 0.75        | 7.2             | 28           | 305    | 86.5                | 0.99    | 1.6          | 7.5           | 290           | 25                       | 13                                   | 7.9                    | 4.08               | 0.00325               | 16                |                         |            |
| PE1R 90 L6   | PE0R 80 G6   | 1.1         | 10.5            | 42           | 300    | 87.5                | 0.99    | 2.4          | 4.7           | 290           | 19                       | 9                                    | 6                      | 2.83               | 0.00425               | 19                |                         |            |
| PE1R 100 L6  | PE0R 90 L6   | 1.5         | 14.3            | 60           | 310    | 89                  | 0.99    | 3            | 2.7           | 305           | 14                       | 6                                    | 4.4                    | 1.88               | 0.00625               | 24                |                         |            |
| PE1R 112 M6  | PE0R 100 L6  | 2.2         | 21              | 75           | 305    | 91                  | 0.99    | 4.4          | 1.6           | 300           | 10                       | 3                                    | 3.1                    | 0.94               | 0.01225               | 33.5              |                         |            |
| PE1R 132 S6T | -            | 3           | 29              | 100          | 310    | 91.5                | 0.99    | 6            | 1.3           | 305           | 9                        | 3                                    | 2.8                    | 0.94               | 0.0139                | 39                |                         |            |
| PE1R 132 S6  | PE0R 112 MX6 | 3           | 28.6            | 57           | 369    | 91                  | 0.99    | 5.2          | 1.71          | 348           | 10.9                     | 5.9                                  | 3.43                   | 1.85               | 0.016                 | 46                |                         |            |
| PE1R 132 M6  | PE0R 112 MX6 | 4           | 38.2            | 76           | 361    | 92                  | 0.99    | 7            | 1.06          | 342           | 7.72                     | 4.02                                 | 2.42                   | 1.26               | 0.021                 | 53                |                         |            |
| PE1R 132 MX6 | PE0R 132 S6  | 5.5         | 52.5            | 105          | 369    | 93                  | 0.99    | 9.3          | 0.547         | 355           | 6.91                     | 3.2                                  | 2.17                   | 1.01               | 0.04                  | 70                |                         |            |
| PE1R 160 M6  | PE0R 132 M6  | 7.5         | 71.5            | 143          | 365    | 93.2                | 0.99    | 13           | 0.38          | 351           | 5.16                     | 2.3                                  | 1.62                   | 0.72               | 0.052                 | 86                |                         |            |
| PE1R 160 L6  | PE0R 160 S6  | 11          | 105             | 210          | 354    | 93.5                | 0.99    | 19.5         | 0.244         | 338           | 4.36                     | 1.67                                 | 1.37                   | 0.53               | 0.103                 | 114               |                         |            |
| PE1R 180 L6  | PE0R 160 M6  | 15          | 143             | 286          | 360    | 94                  | 0.98    | 26           | 0.168         | 345           | 3.38                     | 1.22                                 | 1.06                   | 0.38               | 0.135                 | 136               |                         |            |
| PE1R 200 L6  | PE0R 180 S6  | 18.5        | 177             | 353          | 368    | 93.5                | 0.98    | 31.6         | 0.111         | 354           | 2.95                     | 1.03                                 | 0.93                   | 0.32               | 0.224                 | 175               |                         |            |
| PE1R 200 LX6 | PE0R 180 M6  | 22          | 210             | 420          | 374    | 93.6                | 0.99    | 37           | 0.087         | 361           | 2.49                     | 0.84                                 | 0.78                   | 0.26               | 0.269                 | 200               |                         |            |
| PE1R 225 M6  | PE0R 200 M6  | 30          | 286             | 707          | 377    | 94.2                | 0.98    | 50           | 0.057         | 364           | 2.05                     | 0.66                                 | 0.65                   | 0.21               | 0.437                 | 265               |                         |            |
| PE1R 250 M6  | PE0R 225 M6  | 37          | 353             | 442          | 362    | 94                  | 0.98    | 64           | 0.038         | 351           | 1.45                     | 0.49                                 | 0.46                   | 0.15               | 0.825                 | 360               |                         |            |
| PE1R 280 S6  | PE0R 250 S6  | 55          | 525             | 657          | 354    | 94.3                | 0.98    | 97.5         | 0.025         | 341           | 1.12                     | 0.37                                 | 0.35                   | 0.12               | 1.2                   | 465               |                         |            |
| PE1R 280 M6  | PE0R 250 M6  | 75          | 716             | 895          | 358    | 94.6                | 0.97    | 132          | 0.018         | 343           | 0.88                     | 0.28                                 | 0.28                   | 0.09               | 1.49                  | 520               |                         |            |
| PE1R 315 S6  | PE0R 280 S6  | 90          | 860             | 1074         | 361    | 93.8                | 0.97    | 158          | 0.012         | 347           | 0.79                     | 0.24                                 | 0.25                   | 0.08               | 2.42                  | 690               |                         |            |
| PE1R 71 K8   | PE0R 63 K8   | 0.09        | 1.1             | 5            | 300    | 80                  | 0.99    | 0.2          | 88            | 375           | 90                       | 110                                  | 28.3                   | 34.56              | 0.0005                | 6.6               |                         |            |
| PE1R 71 G8   | PE0R 63 G8   | 0.12        | 1.5             | 7            | 290    | 82.5                | 0.99    | 0.3          | 51            | 365           | 60                       | 75                                   | 18.9                   | 23.56              | 0.0006                | 8.1               |                         |            |
| PE1R 80 K8   | PE0R 71 K8   | 0.18        | 2.3             | 9            | 300    | 80.5                | 0.99    | 0.4          | 40            | 365           | 65                       | 55                                   | 20.4                   | 17.28              | 0.0013                | 10.5              |                         |            |
| PE1R 80 G8   | PE0R 71 G8   | 0.25        | 3.2             | 14           | 310    | 83.5                | 0.99    | 0.6          | 26            | 390           | 50                       | 40                                   | 15.7                   | 12.57              | 0.00175               | 12                |                         |            |
| PE1R 90 S8   | PE0R 80 K8   | 0.37        | 4.7             | 20           | 300    | 85.6                | 0.99    | 0.8          | 12            | 400           | 22                       | 21                                   | 6.9                    | 6.6                | 0.003                 | 15                |                         |            |
| PE1R 90 L8   | PE0R 80 G8   | 0.55        | 7               | 28           | 310    | 86.8                | 0.99    | 1.1          | 7.3           | 410           | 18                       | 16                                   | 5.6                    | 5.03               | 0.00378               | 18                |                         |            |
| PE1R 100 L8  | PE0R 90 L8   | 0.75        | 9.6             | 38           | 275    | 87.3                | 0.99    | 1.7          | 4.8           | 370           | 14                       | 11                                   | 4.4                    | 3.46               | 0.00625               | 23                |                         |            |
| PE1R 100 LX8 | PE0R 100 S8  | 1.1         | 14              | 55           | 310    | 88.2                | 0.99    | 2.3          | 3.6           | 410           | 14                       | 9                                    | 4.4                    | 2.83               | 0.009                 | 28                |                         |            |
| PE1R 112 M8  | PE0R 100 L8  | 1.5         | 19.1            | 75           | 320    | 89.4                | 0.99    | 2.9          | 2.4           | 430           | 11                       | 7                                    | 3.5                    | 2.2                | 0.01225               | 33.5              |                         |            |
| PE1R 132 S8T | -            | 2.2         | 28              | 100          | 300    | 89.9                | 0.99    | 4.6          | 1.5           | 400           | 8                        | 4                                    | 2.5                    | 1.26               | 0.0139                | 39                |                         |            |

The maximum speed depends on the DC link voltage of the inverter, on the load and on the type of inverter.

Parameters with index 1: phase values

Parameters with index 20: valid for 20°C, e.g.:  $R_{120}$ : phase resistance at 20°C

Changes reserved due to technical progress.

## Permanent magnet synchronous high-power motors for inverter operation

with surface cooling, type of cooling IC 411  
thermal class 155 [F/B], type of protection IP 55

Motor selection data

Inverter input voltage 400 V, 50 Hz

|              |             | Rated speed | Rated frequency | Rated output | Torque | max. torque (2 min) | Voltage | Efficiency η | Power factor  | Rated current | Phase resistance at 20°C | No load voltage at speed 1000 r.p.m. | Magnetising inductance | Leakage inductance | Magnetising reactance | Leakage reactance | Motor moment of inertia | Motor mass |
|--------------|-------------|-------------|-----------------|--------------|--------|---------------------|---------|--------------|---------------|---------------|--------------------------|--------------------------------------|------------------------|--------------------|-----------------------|-------------------|-------------------------|------------|
|              |             | [kW]        | [Nm]            | [V]          | [%]    | [·]                 | [A]     | [Ω]          | V/1000 r.p.m. | [mH]          | [mH]                     | [Ω]                                  | [Ω]                    | J                  | m                     |                   |                         |            |
| P21R 63 K4   | P20R 56 K4  | 0.37        | 1.2             | 2.5          | 95     | 77.5                | 0.98    | 0.8          | 32            | 100           | 60                       | 28                                   | 37.7                   | 17.6               | 0.00019               | 4.8               |                         |            |
| P21R 63 G4   | P20R 56 G4  | 0.55        | 1.8             | 3.5          | 100    | 78                  | 0.98    | 1.2          | 18            | 105           | 42                       | 18                                   | 26.4                   | 11.3               | 0.00024               | 5.2               |                         |            |
| P21R 71 K4   | P20R 63 K4  | 0.75        | 2.4             | 4            | 95     | 75                  | 0.98    | 1.7          | 13.5          | 95            | 37                       | 15                                   | 23.2                   | 9.4                | 0.0004                | 6.8               |                         |            |
| P21R 71 G4   | P20R 63 G4  | 1.1         | 3.5             | 7            | 93     | 78                  | 0.98    | 2.5          | 8.5           | 105           | 31                       | 10                                   | 19.5                   | 6.3                | 0.0005                | 7.8               |                         |            |
| P21R 80 K4   | P20R 71 K4  | 1.5         | 4.8             | 10           | 100    | 81                  | 0.98    | 3.2          | 4.6           | 110           | 25                       | 8                                    | 15.7                   | 5                  | 0.00087               | 10.6              |                         |            |
| P21R 80 G4   | P20R 71 G4  | 2.2         | 7               | 14           | 100    | 85.5                | 0.98    | 4.6          | 2.8           | 105           | 18                       | 5                                    | 11.3                   | 3.1                | 0.00107               | 11.7              |                         |            |
| P21R 90 S4   | P20R 80 K4  | 3           | 9.5             | 19           | 90     | 86                  | 0.98    | 6.8          | 14            | 105           | 12                       | 3                                    | 7.5                    | 1.9                | 0.00207               | 15.5              |                         |            |
| P21R 90 L4   | P20R 80 G4  | 4           | 12.7            | 28           | 90     | 87.4                | 0.98    | 9.3          | 0.8           | 90            | 5                        | 1                                    | 3.14                   | 0.63               | 0.0026                | 18                |                         |            |
| P21R 100 L4  | P20R 90 L4  | 5.5         | 17.5            | 45           | 100    | 92.9                | 0.98    | 10.9         | 0.6           | 100           | 4.7                      | 1.3                                  | 3                      | 0.8                | 0.004                 | 23.5              |                         |            |
| P21R 112 MY4 | P20R 100 S4 | 7.5         | 23.9            | 50           | 110    | 93.3                | 0.99    | 14.2         | 0.4           | 110           | 3.2                      | 0.8                                  | 2                      | 0.5                | 0.00725               | 30                |                         |            |
| P21R 63 K4   | P20R 56 K4  | 0.19        | 1.2             | 2.5          | 340    | 73                  | 0.98    | 0.45         | 95            | 170           | 160                      | 80                                   | 50.3                   | 25.1               | 0.00019               | 4.8               |                         |            |
| P21R 63 G4   | P20R 56 G4  | 0.25        | 1.6             | 3.5          | 330    | 77.5                | 0.98    | 0.57         | 57            | 180           | 130                      | 60                                   | 40.8                   | 18.8               | 0.00024               | 5.2               |                         |            |
| P21R 71 K4   | P20R 63 K4  | 0.3         | 1.9             | 4            | 315    | 66.5                | 0.98    | 0.75         | 44            | 165           | 110                      | 50                                   | 34.6                   | 15.7               | 0.0004                | 6.8               |                         |            |
| P21R 71 G4   | P20R 63 G4  | 0.45        | 2.9             | 7            | 340    | 75                  | 0.98    | 1.4          | 26            | 175           | 85                       | 35                                   | 26.7                   | 11                 | 0.0005                | 7.8               |                         |            |
| P21R 80 K4   | P20R 71 K4  | 0.8         | 5.1             | 10           | 330    | 79                  | 0.98    | 1.75         | 14.5          | 190           | 76                       | 24                                   | 23.9                   | 7.5                | 0.00087               | 10.6              |                         |            |
| P21R 80 G4   | P20R 71 G4  | 1.2         | 7.6             | 14           | 340    | 80                  | 0.98    | 2.5          | 9.5           | 195           | 61                       | 19                                   | 19.2                   | 6                  | 0.00107               | 11.7              |                         |            |
| P21R 90 S4   | P20R 80 K4  | 1.5         | 9.6             | 19           | 330    | 81                  | 0.98    | 3.3          | 6             | 195           | 36                       | 9                                    | 11.3                   | 2.8                | 0.00207               | 15.5              |                         |            |
| P21R 90 L4   | P20R 80 G4  | 2.2         | 14              | 28           | 320    | 85                  | 0.97    | 4.8          | 3.4           | 190           | 24.5                     | 5.5                                  | 7.7                    | 1.7                | 0.0026                | 18                |                         |            |
| P21R 100 L4  | P20R 90 L4  | 3.5         | 22              | 45           | 325    | 88                  | 0.98    | 6.2          | 2.1           | 195           | 15.5                     | 4.5                                  | 4.9                    | 1.4                | 0.004                 | 23.5              |                         |            |
| P21R 100 LX4 | P20R 100 S4 | 4           | 25.5            | 50           | 335    | 90                  | 0.98    | 8            | 1.5           | 215           | 16                       | 4                                    | 5                      | 1.3                | 0.00725               | 30                |                         |            |
| P21R 112 M4  | P20R 100 L4 | 5.5         | 35              | 70           | 325    | 92                  | 0.98    | 10.9         | 0.9           | 205           | 10.5                     | 2.5                                  | 3.3                    | 0.8                | 0.009                 | 37                |                         |            |
| P21R 112 MX4 |             | 7.5         | 48              | 100          | 330    | 92                  | 0.98    | 14.6         | 0.65          | 210           | 8.2                      | 1.8                                  | 2.6                    | 0.6                | 0.011                 | 45                |                         |            |
| P21R 132 M4  | P20R 132 S4 | 7.5         | 48              |              |        |                     |         | R            |               |               |                          |                                      |                        |                    | 0.024                 | 70                |                         |            |
| P21R 160 M4  | P20R 132 M4 | 11          | 70              |              |        |                     |         | R            |               |               |                          |                                      |                        |                    | 0.033                 | 92                |                         |            |
| P21R 160 L4  | P20R 160 S4 | 22          | 140             |              |        |                     |         | R            |               |               |                          |                                      |                        |                    | 0.068                 | 120               |                         |            |
| P21R 180 M4  | P20R 160 M4 | 30          | 191             |              |        |                     |         | R            |               |               |                          |                                      |                        |                    | 0.079                 | 136               |                         |            |
| P21R 180 L4  | P20R 180 S4 | 33          | 207             |              |        |                     |         | R            |               |               |                          |                                      |                        |                    | 0.126                 | 170               |                         |            |
| P21R 200 L4  | P20R 180 M4 | 43          | 271             |              |        |                     |         | R            |               |               |                          |                                      |                        |                    | 0.162                 | 200               |                         |            |
| P21R 225 S4  | P20R 200 M4 | 49          | 309             |              |        |                     |         | R            |               |               |                          |                                      |                        |                    | 0.269                 | 270               |                         |            |
| P21R 225 M4  | P20R 200 L4 | 60          | 382             |              |        |                     |         | R            |               |               |                          |                                      |                        |                    | 0.308                 | 300               |                         |            |
| P21R 250 M4  | P20R 225 M4 | 75          | 478             |              |        |                     |         | R            |               |               |                          |                                      |                        |                    | 0.517                 | 375               |                         |            |

R = on request

The maximum speed depends on the DC link voltage of the inverter, on the load and on the type of inverter.

Parameters with index 1: phase values

Parameters with index 20: valid for 20°C, e.g.: R<sub>120</sub>: phase resistance at 20°C

Changes reserved due to technical progress.

missing values in preparation

## Permanent magnet synchronous high-power motors for inverter operation

with surface cooling, type of cooling IC 411  
thermal class 155 [F/B], type of protection IP 55

Motor selection data

Inverter input voltage 400 V, 50 Hz

|               |              | Rated speed | Rated frequency | Rated output | Torque | max. torque (2 min) | Voltage | Efficiency η | Power factor | Rated current | Phase resistance at 20°C | No load voltage at speed 1000 r.p.m. | Magnetising inductance | Leakage inductance | Magnetising reactance | Leakage reactance | Motor moment of inertia | Motor mass |
|---------------|--------------|-------------|-----------------|--------------|--------|---------------------|---------|--------------|--------------|---------------|--------------------------|--------------------------------------|------------------------|--------------------|-----------------------|-------------------|-------------------------|------------|
|               |              |             |                 | [kW]         | [Nm]   | [V]                 | [%]     | [·]          | [A]          | [Ω]           | R <sub>120</sub>         | U <sub>P020</sub>                    | L <sub>1H</sub>        | L <sub>1a</sub>    | X <sub>1H</sub>       | X <sub>1a</sub>   | J                       | m          |
| P21R 63 K6    | P20R 56 K6   |             |                 | 0.18         | 1.72   | 3.5                 | 330     | 67           | 0.99         | 0.45          | 86                       | 240                                  | 110                    | 110                | 34.6                  | 34.6              | 0.00024                 | 4.9        |
| P21R 63 G6    | P20R 56 G6   |             |                 | 0.25         | 2.4    | 4.8                 | 330     | 69.5         | 0.99         | 0.6           | 63                       | 260                                  | 90                     | 90                 | 28.3                  | 28.3              | 0.00027                 | 5.7        |
| P21R 71 K6    | P20R 63 K6   |             |                 | 0.4          | 3.8    | 7                   | 310     | 73.5         | 0.99         | 0.9           | 36                       | 250                                  | 70                     | 60                 | 22                    | 18.8              | 0.00045                 | 7.4        |
| P21R 71 G6    | P20R 63 G6   |             |                 | 0.5          | 4.8    | 10                  | 330     | 74           | 0.99         | 1.3           | 25                       | 270                                  | 55                     | 45                 | 17.3                  | 14.1              | 0.0006                  | 8.3        |
| P21R 80 K6    | P20R 71 K6   |             |                 | 0.6          | 5.7    | 14                  | 335     | 75.5         | 0.99         | 1.7           | 19                       | 280                                  | 37                     | 23                 | 11.6                  | 7.2               | 0.0013                  | 11         |
| P21R 80 G6    | P20R 71 G6   |             |                 | 0.9          | 8.6    | 21                  | 335     | 80.5         | 0.99         | 2.3           | 10.7                     | 295                                  | 25                     | 15                 | 7.9                   | 4.7               | 0.00175                 | 12.5       |
| P21R 90 S6    | P20R 80 K6   |             | 50 Hz           | 1.4          | 13.4   | 28                  | 335     | 81           | 0.99         | 3.2           | 7.5                      | 290                                  | 25                     | 13                 | 7.9                   | 4.1               | 0.00325                 | 16         |
| P21R 90 L6    | P20R 80 G6   |             |                 | 1.9          | 18.1   | 42                  | 330     | 82           | 0.99         | 4.7           | 4.7                      | 290                                  | 19                     | 9                  | 6                     | 2.8               | 0.00425                 | 19         |
| P21R 100 L6   | P20R 90 L6   |             |                 | 3            | 29     | 60                  | 335     | 85.5         | 0.99         | 6             | 2.7                      | 305                                  | 14                     | 6                  | 4.4                   | 1.9               | 0.00625                 | 24         |
| P21R 112 M6   | P20R 100 L6  |             |                 | 3.5          | 33     | 75                  | 325     | 89           | 0.99         | 8.8           | 1.6                      | 300                                  | 10                     | 3                  | 3.1                   | 0.9               | 0.01225                 | 33.5       |
| P21R 132 S6 T | P20R 132 S6  |             |                 | 5            | 48     | 100                 | 330     | 89           | 0.99         | 11            | 1.3                      | 305                                  | 9                      | 3                  | 2.8                   | 0.9               | 0.0139                  | 39         |
| P21R 132 MX6  | P20R 132 S6  |             | 1,000 r.p.m.    | 8.5          | 81     |                     |         |              |              |               | R                        |                                      |                        |                    |                       |                   | 0.04                    | 70         |
| P21R 160 L6   | P20R 160 S6  |             |                 | 11           | 105    |                     |         |              |              |               | R                        |                                      |                        |                    |                       |                   | 0.103                   | 114        |
| P21R 180 L6   | P20R 160 M6  |             |                 | 15           | 143    |                     |         |              |              |               | R                        |                                      |                        |                    |                       |                   | 0.134                   | 136        |
| P21R 200 L6   | P20R 180 S6  |             |                 | 19           | 177    |                     |         |              |              |               | R                        |                                      |                        |                    |                       |                   | 0.224                   | 175        |
| P21R 200 LX6  | P20R 180 M6  |             |                 | 22           | 210    |                     |         |              |              |               | R                        |                                      |                        |                    |                       |                   | 0.269                   | 200        |
| P21R 225 M6   | P20R 200 M6  |             |                 | 30           | 286    |                     |         |              |              |               | R                        |                                      |                        |                    |                       |                   | 0.437                   | 265        |
| P21R 250 M6   | P20R 225 M6  |             |                 | 37           | 353    |                     |         |              |              |               | R                        |                                      |                        |                    |                       |                   | 0.825                   | 360        |
| P21R 280 S6   | P20R 250 S6  |             |                 | 55           | 525    | 657                 | 354     | 94           | 0.98         | 97.5          | 0.025                    | 341                                  | 1.12                   | 0.37               | 0.35                  | 0.12              | 1.2                     | 465        |
| P21R 280 M6   | P20R 250 M6  |             |                 | 75           | 716    | 895                 | 358     | 94.6         | 0.97         | 132           | 0.018                    | 343                                  | 0.88                   | 0.28               | 0.28                  | 0.09              | 1.49                    | 520        |
| P21R 71 K8    | P20R 63 K8   |             |                 | 0.18         | 2.3    | 5                   | 340     | 74           | 0.98         | 0.4           | 88                       | 375                                  | 90                     | 110                | 28.3                  | 34.6              | 0.0005                  | 6.6        |
| P21R 71 G8    | P20R 63 G8   |             |                 | 0.25         | 3.2    | 6.5                 | 320     | 76.5         | 0.98         | 0.6           | 51                       | 365                                  | 60                     | 75                 | 18.8                  | 23.6              | 0.0006                  | 8.1        |
| P21R 80 K8    | P20R 71 K8   |             |                 | 0.37         | 4.7    | 9                   | 345     | 71.7         | 0.98         | 0.85          | 40                       | 365                                  | 65                     | 55                 | 20.4                  | 17.3              | 0.0013                  | 10.5       |
| P21R 80 G8    | P20R 71 G8   |             |                 | 0.55         | 7      | 14                  | 350     | 75.5         | 0.98         | 1.2           | 26                       | 390                                  | 50                     | 40                 | 15.7                  | 12.6              | 0.00175                 | 12         |
| P21R 90 S8    | P20R 80 K8   |             | 50 Hz           | 0.75         | 9.6    | 20                  | 325     | 82.5         | 0.98         | 1.6           | 12                       | 400                                  | 22                     | 21                 | 6.9                   | 6.6               | 0.003                   | 15         |
| P21R 90 L8    | P20R 80 G8   |             |                 | 1.1          | 14     | 28                  | 330     | 84.4         | 0.98         | 2.2           | 7.3                      | 410                                  | 18                     | 16                 | 5.6                   | 5                 | 0.00375                 | 18         |
| P21R 100 L8   | P20R 90 L8   |             |                 | 1.5          | 19.1   | 38                  | 300     | 83.9         | 0.98         | 3.4           | 4.8                      | 370                                  | 14                     | 11                 | 4.4                   | 3.5               | 0.00625                 | 23         |
| P21R 100 LX8  | P20R 100 S8  |             |                 | 2.2          | 28     | 55                  | 330     | 85           | 0.98         | 4.5           | 3.6                      | 410                                  | 14                     | 9                  | 4.4                   | 2.8               | 0.009                   | 28         |
| P21R 112 M8   | P20R 100 L8  |             |                 | 3            | 38.2   | 75                  | 340     | 87           | 0.98         | 5.5           | 2.4                      | 430                                  | 11                     | 7                  | 3.5                   | 2.2               | 0.01225                 | 33.5       |
| P21R 132 S8T  |              |             |                 | 4            | 50.9   | 100                 | 310     | 87.7         | 0.98         | 8.3           | 1.5                      | 400                                  | 8                      | 4                  | 2.5                   | 1.3               | 0.0139                  | 39         |
| P21R 90 S12   | P20R 80 K12  |             | 500 r.p.m.      | 0.55         | 10.5   | 21                  | 330     | 74.8         | 0.99         | 1.3           | 23                       | 530                                  | 40                     | 60                 | 12.6                  | 18.8              | 0.00325                 | 16         |
| P21R 90 L12   | P20R 80 G12  |             |                 | 0.75         | 14.3   | 28                  | 315     | 77           | 0.99         | 1.8           | 15                       | 530                                  | 25                     | 35                 | 7.9                   | 11                | 0.00425                 | 19         |
| P21R 100 LX12 | P20R 100 S12 |             |                 | 1.5          | 29     | 60                  | 340     | 75.5         | 0.99         | 3.4           | 8.5                      | 560                                  | 20                     | 22                 | 6.3                   | 6.9               | 0.009                   | 28         |

R = on request

The maximum speed depends on the DC link voltage of the inverter, on the load and on the type of inverter.

Parameters with index 1: phase values

Parameters with index 20: valid for 20°C, e.g.: R<sub>120</sub>: phase resistance at 20°C

Changes reserved due to technical progress.

missing values in preparation

## Permanent magnet synchronous torque motors for inverter operation

with forced ventilation, cooling type IC 416  
thermal class 155 [F/B], type of protection IP 55

Motor selection data

Inverter input voltage 400 V, 50 Hz

|  | Rated values at operating voltage |      |                |                |                |                |                    |                    |                  |                                  | Values at max. voltage |                  |                      |                  |       |       |
|--|-----------------------------------|------|----------------|----------------|----------------|----------------|--------------------|--------------------|------------------|----------------------------------|------------------------|------------------|----------------------|------------------|-------|-------|
|  | U A <sup>1)</sup>                 | f    | P <sub>n</sub> | M <sub>n</sub> | I <sub>n</sub> | n <sub>n</sub> | cos φ <sub>n</sub> | U <sub>A max</sub> | M <sub>max</sub> | M <sub>max</sub> /M <sub>n</sub> | I <sub>max</sub>       | n <sub>max</sub> | cos φ <sub>max</sub> | J                | m     |       |
| (S1)   |                                   |      |                |                |                |                |                    |                    |                  |                                  |                        |                  |                      |                  |       |       |
|  | [V]                               | [Hz] | [kW]           | Nm             | A              | %              | -                  | [V]                | Nm               |                                  | A                      | %                | -                    | kNm <sup>2</sup> | kg    |       |
| Rated speed 220 r.p.m. – 22 Hz cut-off-frequency |                                   |      |                |                |                |                |                    |                    |                  |                                  |                        |                  |                      |                  |       |       |
| P21F 225 M12                                     | P20F 200 M12                      | 339  | 22             | 13             | 573            | 27.5           | 86.7               | 0.95               | 395              | 1,031                            | 1.8                    | 50               | 78.7                 | 0.88             | 0.44  | 265   |
| P21F 250 M12                                     | P20F 225 M12                      | 338  | 22             | 17             | 750            | 35             | 88.5               | 0.95               | 390              | 1,35                             | 1.8                    | 63.5             | 82.4                 | 0.88             | 0.825 | 360   |
| P21F 280 S12                                     | P20F 250 S12                      | 335  | 22             | 22             | 950            | 44             | 90                 | 0.95               | 387              | 1,62                             | 1.7                    | 76               | 84                   | 0.87             | 1.35  | 465   |
| P21F 280 M12                                     | P20F 250 M12                      | 343  | 22             | 28             | 1200           | 54.5           | 90                 | 0.95               | 397              | 2,2                              | 1.8                    | 100              | 84.5                 | 0.87             | 1.55  | 520   |
| P21F 315 S12                                     | P20F 280 S12                      | 338  | 22             | 37             | 1600           | 74             | 91.5               | 0.93               | 392              | 2,88                             | 1.8                    | 134              | 86.5                 | 0.84             | 2.63  | 690   |
| P21F 315 M12                                     | P20F 280 M12                      | 341  | 22             | 47             | 2050           | 93             | 91.5               | 0.94               | 394              | 3,69                             | 1.8                    | 170              | 87                   | 0.84             | 3.33  | 800   |
| P21F 315 MX12                                    | P20F 280 MX12                     | 337  | 22             | 51             | 2200           | 101            | 91.5               | 0.94               | 389              | 3,96                             | 1.8                    | 183              | 87                   | 0.85             | 3.6   | 880   |
| P21F 315 L12                                     | P20F 315 L12                      | 345  | 22             | 78             | 3400           | 152            | 92.5               | 0.93               | 397              | 6,12                             | 1.8                    | 284              | 88                   | 0.82             | 6.76  | 1250  |
| P22F 355 MY12                                    |                                   |      | 22             | 97             | 4200           |                |                    |                    |                  | 7,56                             | 1.8                    |                  |                      |                  | 9.3   | 1500  |
| P22F 355 M12                                     |                                   | 313  | 22             | 120            | 5200           | 261            | 94                 | 0.9                | 372              | 9,36                             | 1.8                    | 483              | 90                   | 0.77             | 9.3   | 1500  |
| P22F 355 MX12                                    |                                   |      | 22             | 143            | 6200           |                |                    |                    |                  | 11,16                            | 1.8                    |                  |                      |                  | 9.5   | 1600  |
| P22F 355 LY12                                    |                                   |      | 22             | 150            | 6500           |                |                    |                    |                  | 11,7                             | 1.8                    |                  |                      |                  | 15.8  | 2400  |
| P22F 355 L12                                     |                                   |      | 22             | 173            | 7500           |                |                    |                    |                  | 13,5                             | 1.8                    |                  |                      |                  | 15.8  | 2400  |
| Rated speed 300 r.p.m. – 30 Hz cut-off-frequency |                                   |      |                |                |                |                |                    |                    |                  |                                  |                        |                  |                      |                  |       |       |
| P21F 225 M12                                     | P20F 200 M12                      | 350  | 30             | 18             | 573            | 35             | 89.5               | 0.95               | 400              | 1031                             | 1.8                    | 65.5             | 83.2                 | 0.86             | 0.44  | 265   |
| P21F 250 M12                                     | P20F 225 M12                      | 330  | 30             | 24             | 750            | 47.5           | 91                 | 0.95               | 377              | 1350                             | 1.8                    | 86.5             | 86.1                 | 0.87             | 0.825 | 360   |
| P21F 280 S12                                     | P20F 250 S12                      | 335  | 30             | 30             | 950            | 59.5           | 92                 | 0.94               | 384              | 1620                             | 1.7                    | 102              | 87.5                 | 0.86             | 1.35  | 465   |
| P21F 280 M12                                     | P20F 250 M12                      | 334  | 30             | 38             | 1200           | 75.5           | 92                 | 0.94               | 383              | 2200                             | 1.8                    | 138              | 88                   | 0.86             | 1.55  | 520   |
| P21F 315 S12                                     | P20F 280 S12                      | 333  | 30             | 50             | 1600           | 101            | 93                 | 0.93               | 383              | 2880                             | 1.8                    | 182              | 89                   | 0.84             | 2.63  | 690   |
| P21F 315 M12                                     | P20F 280 M12                      | 343  | 30             | 64             | 2050           | 125            | 93.5               | 0.93               | 394              | 3690                             | 1.8                    | 226              | 89.5                 | 0.84             | 3.33  | 800   |
| P21F 315 MX12                                    | P20F 280 MX12                     | 329  | 30             | 69             | 2200           | 140            | 93                 | 0.93               | 377              | 3960                             | 1.8                    | 252              | 90                   | 0.84             | 3.6   | 880   |
| P21F 315 L12                                     | P20F 315 L12                      | 336  | 30             | 107            | 3400           | 210            | 94                 | 0.93               | 384              | 6120                             | 1.8                    | 392              | 90                   | 0.82             | 6.76  | 1,250 |
| P22F 355 MY12                                    |                                   |      | 30             | 132            | 4200           |                |                    |                    |                  | 7560                             | 1.8                    |                  |                      |                  | 9.3   | 1,500 |
| P22F 355 M12                                     |                                   | 326  | 30             | 163            | 5200           | 338            | 95                 | 0.9                | 385              | 9360                             | 1.8                    | 631              | 92                   | 0.76             | 9.3   | 1,500 |
| P22F 355 MX12                                    |                                   |      | 30             | 195            | 6200           |                |                    |                    |                  | 11160                            | 1.8                    |                  |                      |                  | 9.5   | 1,600 |
| P22F 355 LY12                                    |                                   |      | 30             | 204            | 6500           |                |                    |                    |                  | 11700                            | 1.8                    |                  |                      |                  | 15.8  | 2,400 |
| P22F 355 L12                                     |                                   |      | 30             | 236            | 7500           |                |                    |                    |                  | 13500                            | 1.8                    |                  |                      |                  | 15.8  | 2,400 |
| Rated speed 430 r.p.m. – 43 Hz cut-off-frequency |                                   |      |                |                |                |                |                    |                    |                  |                                  |                        |                  |                      |                  |       |       |
| P21F 225 M12                                     | P20F 200 M12                      | 350  | 43             | 26             | 573            | 49.5           | 91.7               | 0.94               | 397              | 1031                             | 1.8                    | 91.5             | 87                   | 0.85             | 0.44  | 265   |
| P21F 250 M12                                     | P20F 225 M12                      | 337  | 43             | 34             | 750            | 65.5           | 93.1               | 0.95               | 381              | 1350                             | 1.8                    | 120              | 89.5                 | 0.86             | 0.825 | 360   |
| P21F 280 S12                                     | P20F 250 S12                      | 346  | 43             | 43             | 950            | 81             | 93.5               | 0.94               | 393              | 1620                             | 1.7                    | 148              | 90.5                 | 0.8              | 1.35  | 465   |
| P21F 280 M12                                     | P20F 250 M12                      | 333  | 43             | 54             | 1200           | 106            | 94                 | 0.94               | 380              | 2200                             | 1.8                    | 195              | 91                   | 0.85             | 1.55  | 520   |
| P21F 315 S12                                     | P20F 280 S12                      | 342  | 43             | 72             | 1600           | 138            | 94.5               | 0.93               | 392              | 2880                             | 1.8                    | 252              | 91.5                 | 0.83             | 2.63  | 690   |
| P21F 315 M12                                     | P20F 280 M12                      | 324  | 43             | 92             | 2050           | 187            | 94.5               | 0.93               | 370              | 3690                             | 1.8                    | 340              | 92                   | 0.83             | 3.33  | 800   |
| P21F 315 MX12                                    | P20F 280 MX12                     | 349  | 43             | 99             | 2200           | 185            | 95                 | 0.93               | 397              | 3960                             | 1.8                    | 340              | 92                   | 0.83             | 3.6   | 880   |
| P21F 315 L12                                     | P20F 315 L12                      | 337  | 43             | 153            | 3400           | 297            | 95                 | 0.93               | 383              | 6120                             | 1.8                    | 554              | 92.5                 | 0.81             | 6.76  | 1250  |
| P22F 355 MY12                                    |                                   |      | 43             | 189            | 4200           |                |                    |                    |                  | 7560                             | 1.8                    |                  |                      |                  | 9.3   | 1500  |
| P22F 355 M12                                     |                                   | 324  | 43             | 234            | 5200           | 483            | 96                 | 0.9                | 383              | 9360                             | 1.8                    | 901              | 94                   | 0.75             | 9.3   | 1500  |
| P22F 355 MX12                                    |                                   |      | 43             | 279            | 6200           |                |                    |                    |                  | 11160                            | 1.8                    |                  |                      |                  | 9.5   | 1600  |
| P22F 355 LY12                                    |                                   |      | 43             | 293            | 6500           |                |                    |                    |                  | 11700                            | 1.8                    |                  |                      |                  | 15.8  | 2400  |
| P22F 355 L12                                     |                                   |      | 43             | 338            | 7500           |                |                    |                    |                  | 13500                            | 1.8                    |                  |                      |                  | 15.8  | 2400  |

<sup>1)</sup> inverter output voltage realised as operating voltage for active current  
missing values in preparation

## Permanent magnet synchronous torque motors for inverter operation

with forced ventilation, cooling type IC 416  
thermal class 155 [F/B], type of protection IP 55

Motor selection data

Inverter input voltage 400 V, 50 Hz

| Rated values at operating voltage                       |               |                |                |                |                |                    |                    |                  |                                  | Values at max. voltage          |                  |                      |                  |      |       |      |
|---|---------------|----------------|----------------|----------------|----------------|--------------------|--------------------|------------------|----------------------------------|---------------------------------|------------------|----------------------|------------------|------|-------|------|
| U A <sup>1)</sup>                                       | f             | P <sub>n</sub> | M <sub>n</sub> | I <sub>n</sub> | η <sub>n</sub> | cos φ <sub>n</sub> | U <sub>A max</sub> | M <sub>max</sub> | M <sub>max</sub> /M <sub>n</sub> | I <sub>max</sub>                | η <sub>max</sub> | cos φ <sub>max</sub> | J                | m    |       |      |
| (S1)  |               |                |                |                |                |                    |                    |                  |                                  | corresponds to M <sub>max</sub> |                  |                      |                  |      |       |      |
| [V]   | [Hz]          | [kW]           | Nm             | A              | %              | -                  | [V]                | Nm               |                                  | A                               | %                | -                    | kNm <sup>2</sup> | kg   |       |      |
| <b>Rated speed 500 r.p.m. – 50 Hz cut-off-frequency</b> |               |                |                |                |                |                    |                    |                  |                                  |                                 |                  |                      |                  |      |       |      |
| P21F 225 M12  | P20F 200 M12  | 336            | 50             | 30             | 573            | 59                 | 92.6               | 0.94             | 379                              | 1031                            | 1.8              | 109                  | 88.6             | 0.85 | 0.44  | 265  |
| P21F 250 M12  | P20F 225 M12  | 341            | 50             | 39             | 750            | 75.5               | 93.5               | 0.94             | 384                              | 1350                            | 1.8              | 136                  | 90.7             | 0.86 | 0.825 | 360  |
| P21F 280 S12  | P20F 250 S12  | 341            | 50             | 50             | 950            | 96                 | 93.5               | 0.94             | 392                              | 1620                            | 1.7              | 161                  | 91.5             | 0.85 | 1.35  | 465  |
| P21F 280 M12  | P20F 250 M12  | 340            | 50             | 63             | 1200           | 120                | 94.5               | 0.94             | 387                              | 2200                            | 1.8              | 220                  | 91.8             | 0.85 | 1.55  | 520  |
| P21F 315 S12  | P20F 280 S12  | 346            | 50             | 84             | 1600           | 158                | 95                 | 0.93             | 396                              | 2880                            | 1.8              | 290                  | 92.5             | 0.82 | 2.63  | 690  |
| P21F 315 M12  | P20F 280 M12  | 344            | 50             | 94             | 2050           | 179                | 95                 | 0.93             | 392                              | 3690                            | 1.8              | 369                  | 93               | 0.83 | 3.33  | 800  |
| P21F 315 MX12   | P20F 280 MX12 | 336            | 50             | 115            | 2200           | 223                | 95.5               | 0.93             | 382                              | 3960                            | 1.8              | 406                  | 93               | 0.83 | 3.6   | 880  |
| P21F 315 L12  | P20F 315 L12  | 339            | 50             | 178            | 3400           | 341                | 95.5               | 0.93             | 385                              | 6120                            | 1.8              | 638                  | 93               | 0.81 | 6.76  | 1250 |
| P22F 355 MY12   |               | 50             | 220            | 4200           |                |                    |                    |                  |                                  | 7560                            | 1.8              |                      |                  |      | 9.3   | 1500 |
| P22F 355 M12  |               | 322            | 50             | 272            | 5200           | 562                | 96                 | 0.9              | 380                              | 9360                            | 1.8              | 1045                 | 95               | 0.75 | 9.3   | 1500 |
| P22F 355 MX12   |               |                | 50             | 325            | 6200           |                    |                    |                  |                                  | 11160                           | 1.8              |                      |                  |      | 9.5   | 1600 |
| P22F 355 LY12   |               |                |                | 50             | 340            | 6500               |                    |                  |                                  | 11700                           | 1.8              |                      |                  |      | 15.8  | 2400 |
| P22F 355 L12  |               |                |                | 50             | 393            | 7500               |                    |                  |                                  | 13500                           | 1.8              |                      |                  |      | 15.8  | 2400 |
| <b>Rated speed 600 r.p.m. – 60 Hz cut-off-frequency</b> |               |                |                |                |                |                    |                    |                  |                                  |                                 |                  |                      |                  |      |       |      |
| P21F 225 M12  | P20F 200 M12  | 336            | 60             | 36             | 573            | 70.5               | 93.1               | 0.94             | 379                              | 1031                            | 1.8              | 129                  | 89.7             | 0.85 | 0.44  | 265  |
| P21F 250 M12  | P20F 225 M12  | 329            | 60             | 47             | 750            | 93.5               | 94.3               | 0.94             | 370                              | 1350                            | 1.8              | 168                  | 91.8             | 0.86 | 0.825 | 360  |
| P21F 280 S12  | P20F 250 S12  | 347            | 60             | 60             | 950            | 112                | 94.5               | 0.94             | 393                              | 1620                            | 1.7              | 190                  | 92.5             | 0.85 | 1.35  | 465  |
| P21F 280 M12  | P20F 250 M12  | 325            | 60             | 75             | 1200           | 150                | 95                 | 0.94             | 368                              | 2200                            | 1.8              | 279                  | 92.5             | 0.84 | 1.55  | 520  |
| P21F 315 S12  | P20F 280 S12  | 325            | 60             | 101            | 1600           | 201                | 95.5               | 0.93             | 370                              | 2880                            | 1.8              | 364                  | 93.5             | 0.83 | 2.63  | 690  |
| P21F 315 M12  | P20F 280 M12  | 336            | 60             | 129            | 2050           | 249                | 95.5               | 0.93             | 382                              | 3690                            | 1.8              | 455                  | 94               | 0.82 | 3.33  | 800  |
| P21F 315 MX12   | P20F 280 MX12 | 321            | 60             | 138            | 2200           | 281                | 95                 | 0.93             | 365                              | 3960                            | 1.8              | 504                  | 94               | 0.83 | 3.6   | 880  |
| P21F 315 L12  | P20F 315 L12  | 334            | 60             | 214            | 3400           | 418                | 96                 | 0.92             |                                  | 6120                            | 1.8              |                      |                  |      | 6.76  | 1250 |
| P22F 355 MY12   |               | 60             | 264            | 4200           |                |                    |                    |                  |                                  | 7560                            | 1.8              |                      |                  |      | 9.3   | 1500 |
| P22F 355 M12  |               | 321            | 60             | 327            | 5200           | 677                | 96.5               | 0.9              | 379                              | 9360                            | 1.8              | 1257                 | 95               | 0.75 | 9.3   | 1500 |
| P22F 355 MX12   |               |                | 60             | 390            | 6200           |                    |                    |                  |                                  | 11160                           | 1.8              |                      |                  |      | 9.5   | 1600 |
| P22F 355 LY12   |               |                |                | 60             | 408            | 6500               |                    |                  |                                  | 11700                           | 1.8              |                      |                  |      | 15.8  | 2400 |
| P22F 355 L12  |               |                |                | 60             | 471            | 7500               |                    |                  |                                  | 13500                           | 1.8              |                      |                  |      | 15.8  | 2400 |

<sup>1)</sup> inverter output voltage realised as operating voltage for active current

missing values in preparation

## Permanent magnet synchronous torque motors for inverter operation

water-cooled, type of cooling IC 31W  
thermal class 155 [F/B], type of protection IP 55

Motor selection data

Inverter input voltage 400 V, 50 Hz

|  | Rated values at operating voltage |      |                |                |                |                |                    |                    |                  |                                  | Values at max. voltage |                  |                      |                  |     |
|--|-----------------------------------|------|----------------|----------------|----------------|----------------|--------------------|--------------------|------------------|----------------------------------|------------------------|------------------|----------------------|------------------|-----|
|  | U A <sup>1)</sup>                 | f    | P <sub>n</sub> | M <sub>n</sub> | I <sub>n</sub> | n <sub>n</sub> | cos ϕ <sub>n</sub> | U <sub>A max</sub> | M <sub>max</sub> | M <sub>max</sub> /M <sub>n</sub> | I <sub>max</sub>       | n <sub>max</sub> | cos ϕ <sub>max</sub> | J                | m   |
| (S1)   |                                   |      |                |                |                |                |                    |                    |                  |                                  |                        |                  |                      |                  |     |
|  | [V]                               | [Hz] | [kW]           | Nm             | A              | %              | -                  | [V]                | Nm               |                                  | A                      | %                | -                    | kgm <sup>2</sup> | kg  |
| Rated speed 220 r.p.m. – 22 Hz cut-off-frequency |                                   |      |                |                |                |                |                    |                    |                  |                                  |                        |                  |                      |                  |     |
| P21B 225 M12                                     | 373                               | 22   | 19.8           | 860            | 41.5           | 81.5           | 0.91               | 395                | 1031             | 1.2                              | 50                     | 78.7             | 0.88                 | 0.44             | 265 |
| P21B 250 M12                                     | 369                               | 22   | 25.9           | 1125           | 52.5           | 84.5           | 0.91               | 390                | 1350             | 1.2                              | 63.5                   | 82.4             | 0.88                 | 0.825            | 360 |
| P21B 280 S12                                     | 366                               | 22   | 32.8           | 1425           | 67             | 86             | 0.9                | 387                | 1620             | 1.1                              | 76                     | 84               | 0.87                 | 1.35             | 465 |
| P21B 280 M12                                     | 374                               | 22   | 41.5           | 1800           | 82             | 87             | 0.9                | 397                | 2200             | 1.2                              | 100                    | 84.5             | 0.87                 | 1.55             | 520 |
| P21B 315 S12                                     | 371                               | 22   | 55.3           | 2400           | 110            | 88.5           | 0.88               | 392                | 2880             | 1.2                              | 134                    | 86.5             | 0.84                 | 2.63             | 690 |
| P21B 315 M12                                     | 373                               | 22   | 70.8           | 3075           | 140            | 89             | 0.88               | 394                | 3690             | 1.2                              | 170                    | 87               | 0.84                 | 3.33             | 800 |
| P21B 315 MX12                                    | 371                               | 22   | 78.3           | 3400           | 157            | 88.5           | 0.88               | 389                | 3960             | 1.2                              | 183                    | 87               | 0.85                 | 3.6              | 880 |
| Rated speed 300 r.p.m. – 30 Hz cut-off-frequency |                                   |      |                |                |                |                |                    |                    |                  |                                  |                        |                  |                      |                  |     |
| P21B 225 M12                                     | 380                               | 30   | 27             | 860            | 53.5           | 85.5           | 0.9                | 400                | 1031             | 1.2                              | 65.5                   | 83.2             | 0.86                 | 0.44             | 265 |
| P21B 250 M12                                     | 358                               | 30   | 35.3           | 1125           | 72             | 88             | 0.9                | 377                | 1350             | 1.2                              | 86.5                   | 86.1             | 0.87                 | 0.825            | 360 |
| P21B 280 S12                                     | 364                               | 30   | 44.8           | 1425           | 89.5           | 89             | 0.89               | 384                | 1620             | 1.1                              | 102                    | 87.5             | 0.86                 | 1.35             | 465 |
| P21B 280 M12                                     | 362                               | 30   | 56.5           | 1800           | 113            | 89.5           | 0.89               | 383                | 2200             | 1.2                              | 138                    | 88               | 0.86                 | 1.55             | 520 |
| P21B 315 S12                                     | 363                               | 30   | 75.4           | 2400           | 151            | 90.5           | 0.88               | 383                | 2880             | 1.2                              | 182                    | 89               | 0.84                 | 2.63             | 690 |
| P21B 315 M12                                     | 374                               | 30   | 96.6           | 3075           | 188            | 91             | 0.87               | 394                | 3690             | 1.2                              | 226                    | 89.5             | 0.84                 | 3.33             | 800 |
| P21B 315 MX12                                    | 360                               | 30   | 106.8          | 3400           | 216            | 91             | 0.87               | 377                | 3960             | 1.2                              | 252                    | 90               | 0.84                 | 3.6              | 880 |
| Rated speed 430 r.p.m. – 43 Hz cut-off-frequency |                                   |      |                |                |                |                |                    |                    |                  |                                  |                        |                  |                      |                  |     |
| P21B 225 M12                                     | 378                               | 43   | 38.7           | 860            | 75             | 88.5           | 0.89               | 397                | 1031             | 1.2                              | 91.5                   | 87               | 0.85                 | 0.44             | 265 |
| P21B 250 M12                                     | 363                               | 43   | 50.7           | 1125           | 98.5           | 91             | 0.90               | 381                | 1350             | 1.2                              | 120                    | 89.5             | 0.86                 | 0.825            | 360 |
| P21B 280 S12                                     | 374                               | 43   | 64.2           | 1425           | 122            | 91.5           | 0.89               | 393                | 1620             | 1.1                              | 148                    | 90.5             | 0.8                  | 1.35             | 465 |
| P21B 280 M12                                     | 359                               | 43   | 81.1           | 1800           | 159            | 92             | 0.89               | 380                | 2200             | 1.2                              | 195                    | 91               | 0.85                 | 1.55             | 520 |
| P21B 315 S12                                     | 371                               | 43   | 108.1          | 2400           | 208            | 93             | 0.87               | 392                | 2880             | 1.2                              | 252                    | 91.5             | 0.83                 | 2.63             | 690 |
| P21B 315 M12                                     | 351                               | 43   | 138.5          | 3075           | 281            | 93             | 0.87               | 370                | 3690             | 1.2                              | 340                    | 92               | 0.83                 | 3.33             | 800 |
| P21B 315 MX12                                    | 380                               | 43   | 153.1          | 3400           | 287            | 93             | 0.87               | 397                | 3960             | 1.2                              | 340                    | 92               | 0.83                 | 3.6              | 880 |
| Rated speed 500 r.p.m. – 50 Hz cut-off-frequency |                                   |      |                |                |                |                |                    |                    |                  |                                  |                        |                  |                      |                  |     |
| P21B 225 M12                                     | 361                               | 50   | 45.0           | 860            | 90             | 90             | 0.89               | 379                | 1031             | 1.2                              | 109                    | 88.6             | 0.85                 | 0.44             | 265 |
| P21B 250 M12                                     | 366                               | 50   | 58.9           | 1125           | 114            | 91.9           | 0.89               | 384                | 1350             | 1.2                              | 136                    | 90.7             | 0.86                 | 0.825            | 360 |
| P21B 280 S12                                     | 373                               | 50   | 74.6           | 1425           | 140            | 92.5           | 0.89               | 392                | 1620             | 1.1                              | 161                    | 91.5             | 0.85                 | 1.35             | 465 |
| P21B 280 M12                                     | 366                               | 50   | 94.2           | 1800           | 180            | 93             | 0.89               | 387                | 2200             | 1.2                              | 220                    | 91.8             | 0.85                 | 1.55             | 520 |
| P21B 315 S12                                     | 376                               | 50   | 125.7          | 2400           | 237            | 93.5           | 0.87               | 396                | 2880             | 1.2                              | 290                    | 92.5             | 0.82                 | 2.63             | 690 |
| P21B 315 M12                                     | 372                               | 50   | 161.0          | 3075           | 306            | 94             | 0.87               | 392                | 3690             | 1.2                              | 369                    | 93               | 0.83                 | 3.33             | 800 |
| P21B 315 MX12                                    | 366                               | 50   | 178.0          | 3400           | 347            | 94             | 0.86               | 382                | 3960             | 1.2                              | 406                    | 93               | 0.83                 | 3.6              | 880 |
| Rated speed 600 r.p.m. – 60 Hz cut-off-frequency |                                   |      |                |                |                |                |                    |                    |                  |                                  |                        |                  |                      |                  |     |
| P21B 225 M12                                     | 361                               | 60   | 54.0           | 860            | 107            | 91             | 0.89               | 379                | 1031             | 1.2                              | 129                    | 89.7             | 0.85                 | 0.44             | 265 |
| P21B 250 M12                                     | 353                               | 60   | 70.7           | 1125           | 140            | 92.8           | 0.89               | 370                | 1350             | 1.2                              | 168                    | 91.8             | 0.86                 | 0.825            | 360 |
| P21B 280 S12                                     | 374                               | 60   | 89.5           | 1425           | 168            | 93.5           | 0.88               | 393                | 1620             | 1.1                              | 190                    | 92.5             | 0.85                 | 1.35             | 465 |
| P21B 280 M12                                     | 349                               | 60   | 113.1          | 1800           | 225            | 93.5           | 0.89               | 368                | 2200             | 1.2                              | 279                    | 92.5             | 0.84                 | 1.55             | 520 |
| P21B 315 S12                                     | 351                               | 60   | 150.8          | 2400           | 302            | 94.5           | 0.87               | 370                | 2880             | 1.2                              | 364                    | 93.5             | 0.83                 | 2.63             | 690 |
| P21B 315 M12                                     | 363                               | 60   | 193.2          | 3075           | 374            | 94.5           | 0.87               | 382                | 3690             | 1.2                              | 455                    | 94               | 0.82                 | 3.33             | 800 |
| P21B 315 MX12                                    | 350                               | 60   | 213.6          | 3400           | 434            | 94.5           | 0.86               | 365                | 3960             | 1.2                              | 504                    | 94               | 0.83                 | 3.6              | 880 |

<sup>1)</sup>inverter output voltage realised as operating voltage for active current

## Notes to dimensions

Dimensional designations according to EN 50 347 and IEC 60 072.

Flange sizes in the dimensional tables are given in accordance to DIN 42948.

All dimensional data in mm VEM motors GmbH reserves the right to change technical data without preceding information. Dimensional data in catalogues can lose their validity. Binding dimensional data can be requested from the VEM sales organisations.

## Flange dimensions

### Flanges with threadholes

| Flange type<br>acc. to EN 50 347 | Flange type<br>acc. to DIN 42948 | LA<br>$c_1$ | M<br>$e_1$ | N<br>$b_1$ | P<br>$a_1$ | S<br>$s_1$ | T<br>$f_1$ |
|----------------------------------|----------------------------------|-------------|------------|------------|------------|------------|------------|
| FT 65                            | C 80                             | 6.5         | 65         | 50         | 80         | M5         | 2.5        |
| FT 75                            | C 90                             | 8           | 75         | 60         | 90         | M5         | 2.5        |
| FT 85                            | C 105                            | 8.5         | 85         | 70         | 105        | M6         | 2.5        |
| FT 100                           | C 120                            | 8           | 100        | 80         | 120        | M6         | 3          |
| FT 115                           | C 140                            | 10          | 115        | 95         | 140        | M8         | 3          |
| FT 130                           | C 160                            | 10          | 130        | 110        | 160        | M8         | 3.5        |
| FT 165                           | C 200                            | 12          | 165        | 130        | 200        | M10        | 3.5        |
| FT 215                           | C 250                            | 12          | 215        | 180        | 250        | M12        | 4          |

### Flanges with through holes

| Flange type<br>acc. to EN 50 347 | Flange type<br>acc. to DIN 42948 | LA<br>$c_1$ | M<br>$e_1$ | N<br>$b_1$ | P<br>$a_1$ | S<br>$s_1$ | T<br>$f_1$ |
|----------------------------------|----------------------------------|-------------|------------|------------|------------|------------|------------|
| FF 100                           | A 120                            | 9           | 100        | 80         | 120        | 7          | 3          |
| FF 115                           | A 140                            | 9           | 115        | 95         | 140        | 9          | 3          |
| FF 130                           | A 160                            | 9           | 130        | 110        | 160        | 9          | 3.5        |
| FF 165                           | A 200                            | 10          | 165        | 130        | 200        | 11         | 3.5        |
| FF 215                           | A 250                            | 11          | 215        | 180        | 250        | 14         | 4          |
| FF 265                           | A 300                            | 12          | 265        | 230        | 300        | 14         | 4          |
| FF 300                           | A 350                            | 13          | 300        | 250        | 350        | 18         | 5          |
| FF 350                           | A 400                            | 15          | 350        | 300        | 400        | 18         | 5          |
| FF 400                           | A 450                            | 16          | 400        | 350        | 450        | 18         | 5          |
| FF 500                           | A 550                            | 18          | 500        | 450        | 550        | 18         | 5          |
| FF 600                           | A 660                            | 22          | 600        | 550        | 660        | 22         | 6          |
| FF 740                           | A 800                            | 25          | 740        | 680        | 800        | 22         | 6          |

According to EN 50 347 the flanges FF have through holes and the flanges FT have threadholes.

The standard DIN 42948 for flanges A and C are still valid yet.

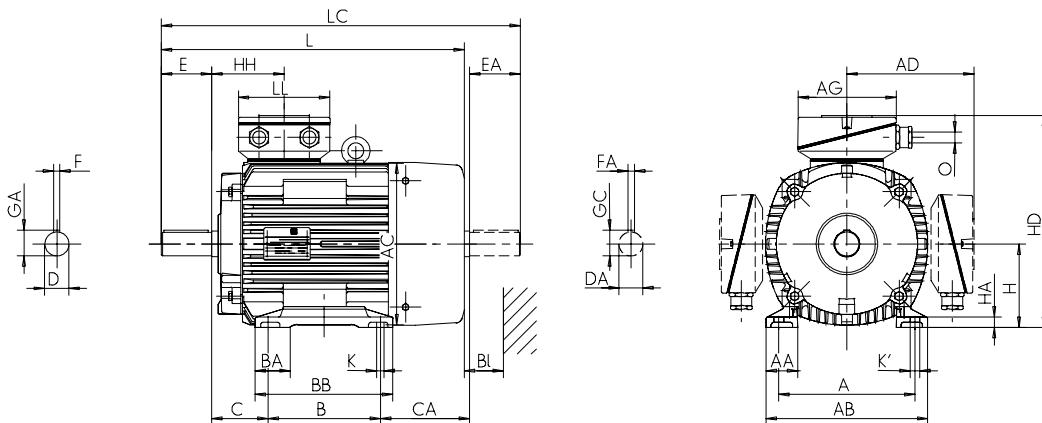
Tolerances for dimension N ( $b_1$ ) see respective dimensional tables  
LA ( $c_1$ ) length of engagement

## Permanent magnet synchronous motors for inverter operation

Size 56 to 280

with surface ventilation, cooling method IC 411, thermal class 155 [F/B], degree of protection IP 55

Type of construction IM B3 [IM 1001]



| Type designation<br>PE1R, P21R | Flange<br>size<br>FF100 | A<br>b | AA<br>n | AB<br>f | AC<br>g | AD**)<br>g1 | B<br>a | BA<br>m | BB<br>e | C<br>w1 | CA<br>w2 | D<br>d | DA<br>d1 | DB *)<br>d1 | E<br>I | EA<br>I1 | F<br>u | FA<br>u1 |
|--------------------------------|-------------------------|--------|---------|---------|---------|-------------|--------|---------|---------|---------|----------|--------|----------|-------------|--------|----------|--------|----------|
| P.10 56 K4 U                   | FF100                   | 90     | 18      | 110     | -       | 98          | 71     | -       | 86      | 36      | 28       | 9      | 9        | M3          | 20     | 20       | 3      | 3        |
| P.1R 56 G2,4                   | FF100                   | 90     | 18      | 110     | 109     | 98          | 71     | -       | 86      | 36      | 52       | 9      | 9        | M3          | 20     | 20       | 3      | 3        |
| P.1R 63 K4,6                   | FF115                   | 100    | 28      | 128     | 109     | 98          | 80     | -       | 100     | 40      | 39       | 11     | 11       | M4          | 23     | 23       | 4      | 4        |
| P.1R 63 G2,4,6                 | FF115                   | 100    | 28      | 128     | 109     | 98          | 80     | -       | 100     | 40      | 39       | 11     | 11       | M4          | 23     | 23       | 4      | 4        |
| P.1R 71 K4,6,8                 | FF130                   | 112    | 32      | 138     | 124     | 104         | 90     | -       | 116     | 45      | 43,5     | 14     | 14       | M5          | 30     | 30       | 5      | 5        |
| P.1R 71 G4,6,8                 | FF130                   | 112    | 32      | 138     | 124     | 104         | 90     | -       | 116     | 45      | 43,5     | 14     | 14       | M5          | 30     | 30       | 5      | 5        |
| P.1R 80 K4,6,8                 | FF 165                  | 125    | 38      | 168     | 139     | 111         | 100    | -       | 125     | 50      | 63       | 19     | 19       | M6          | 40     | 40       | 6      | 6        |
| P.1R 80 G4,6,8                 | FF 165                  | 125    | 38      | 168     | 139     | 111         | 100    | -       | 125     | 50      | 63       | 19     | 19       | M6          | 40     | 40       | 6      | 6        |
| P.1R 90 S4,6,8                 | FF 165                  | 140    | 40      | 178     | 157     | 119         | 100    | -       | 130     | 56      | 74       | 24     | 22       | M8          | 50     | 50       | 8      | 6        |
| P.1R 90 L4,6,8                 | FF 165                  | 140    | 40      | 178     | 157     | 119         | 125    | -       | 155     | 56      | 71       | 24     | 22       | M8          | 50     | 50       | 8      | 6        |
| P.1R 100 L4,6,8                | FF 215                  | 160    | 45      | 192     | 177     | 126         | 140    | -       | 175     | 63      | 73       | 28     | 24       | M10         | 60     | 50       | 8      | 8        |
| P.1R 100 LX4,8                 | FF 215                  | 160    | 32      | 188     | 196     | 136         | 140    | -       | 171     | 63      | 102      | 28     | 28       | M10         | 60     | 60       | 8      | 8        |
| P.1R 112 M6,8                  | FF 215                  | 190    | 50      | 224     | 196     | 136         | 140    | -       | 180     | 70      | 95       | 28     | 28       | M10         | 60     | 60       | 8      | 8        |
| P.1R 112 MY4                   | FF 215                  | 190    | 50      | 224     | 196     | 136         | 140    | -       | 180     | 70      | 95       | 28     | 28       | M10         | 60     | 60       | 8      | 8        |
| P.1R 112 M4                    | FF 215                  | 190    | 50      | 224     | 196     | 136         | 140    | -       | 180     | 70      | 129      | 28     | 28       | M10         | 60     | 60       | 8      | 8        |
| P.1R 132 S4,6,8T               | FF265                   | 216    | 50      | 256     | 196     | 155         | 140    | -       | 180     | 89      | 129      | 38     | 28       | M12         | 80     | 60       | 10     | 8        |
| P.1R 132 S4,6,8                | FF265                   | 216    | 50      | 256     | 217     | 178         | 140    | 55      | 180     | 89      | 153      | 38     | 32       | M12         | 80     | 80       | 10     | 10       |
| P.1R 132 M4                    | FF265                   | 216    | 50      | 256     | 258     | 199         | 178    | 55      | 218     | 89      | 138      | 38     | 38       | M12         | 80     | 80       | 10     | 10       |
| P.1R 132 MX6                   | FF265                   | 216    | 50      | 256     | 258     | 199         | 178    | 55      | 218     | 89      | 138      | 38     | 38       | M12         | 80     | 80       | 10     | 10       |
| P.1R 132 M6,8                  | FF265                   | 216    | 50      | 256     | 217     | 178         | 178    | 55      | 218     | 89      | 135      | 38     | 32       | M12         | 80     | 80       | 10     | 10       |
| P.1R 160 M4,6,8                | FF300                   | 254    | 55      | 296     | 258     | 214         | 210    | 60      | 257     | 108     | 135      | 42     | 38       | M16         | 110    | 80       | 12     | 10       |
| P.1R 160 MX8                   | FF300                   | 254    | 55      | 296     | 258     | 199         | 210    | 60      | 257     | 108     | 135      | 42     | 38       | M16         | 110    | 80       | 12     | 10       |
| P.1R 160 L4,6,8                | FF300                   | 254    | 55      | 296     | 313     | 242         | 254    | 60      | 301     | 108     | 142      | 42     | 42       | M16         | 110    | 110      | 12     | 12       |
| P.1R 180 M4                    | FF300                   | 279    | 62      | 328     | 313     | 242         | 241    | 65      | 288     | 121     | 142      | 48     | 42       | M16         | 110    | 110      | 14     | 12       |
| P.1R 180 L4                    | FF300                   | 279    | 62      | 328     | 351     | 261         | 279    | 65      | 326     | 121     | 176      | 48     | 48       | M16         | 110    | 110      | 14     | 14       |
| P.1R 180 L6,8                  | FF300                   | 279    | 62      | 328     | 313     | 242         | 279    | 65      | 326     | 121     | 104      | 48     | 42       | M16         | 110    | 110      | 14     | 12       |
| P.1R 200 L4,6,8                | FF 350                  | 318    | 70      | 372     | 351     | 261         | 305    | 70      | 360     | 133     | 138      | 55     | 48       | M20         | 110    | 110      | 16     | 14       |
| P.1R 200 LX6                   | FF 350                  | 318    | 70      | 372     | 351     | 261         | 305    | 70      | 360     | 133     | 138      | 55     | 48       | M20         | 110    | 110      | 16     | 14       |
| P.1R 225 S4,8                  | FF 400                  | 356    | 75      | 413     | 390     | 300         | 286    | 75      | 343     | 149     | 196      | 60     | 55       | M20         | 140    | 110      | 18     | 16       |
| P.1R 225 M4                    | FF 400                  | 356    | 75      | 413     | 390     | 300         | 311    | 75      | 368     | 149     | 211      | 60     | 55       | M20         | 140    | 110      | 18     | 16       |
| P.1R 225 M6,8,12               | FF 400                  | 356    | 75      | 413     | 390     | 300         | 311    | 75      | 368     | 149     | 171      | 60     | 55       | M20         | 140    | 110      | 18     | 16       |
| P.1R 250 M4,6,8,12             | FF 500                  | 406    | 84      | 471     | 440     | 358         | 349    | 84      | 412     | 168     | 210      | 65     | 55       | M20         | 140    | 110      | 18     | 16       |
| P.1R 280 S4,6,8,12             | FF 500                  | 457    | 94      | 522     | 490     | 386         | 368    | 96      | 431     | 190     | 234      | 75     | 65       | M20         | 140    | 140      | 20     | 18       |
| P.1R 280 M4,6,8,12             | FF 500                  | 457    | 94      | 522     | 490     | 386         | 419    | 96      | 482     | 190     | 229      | 75     | 65       | M20         | 140    | 140      | 20     | 18       |

\*) Centre holes acc. to DIN 332-DS

\*\*) Terminal box left/right

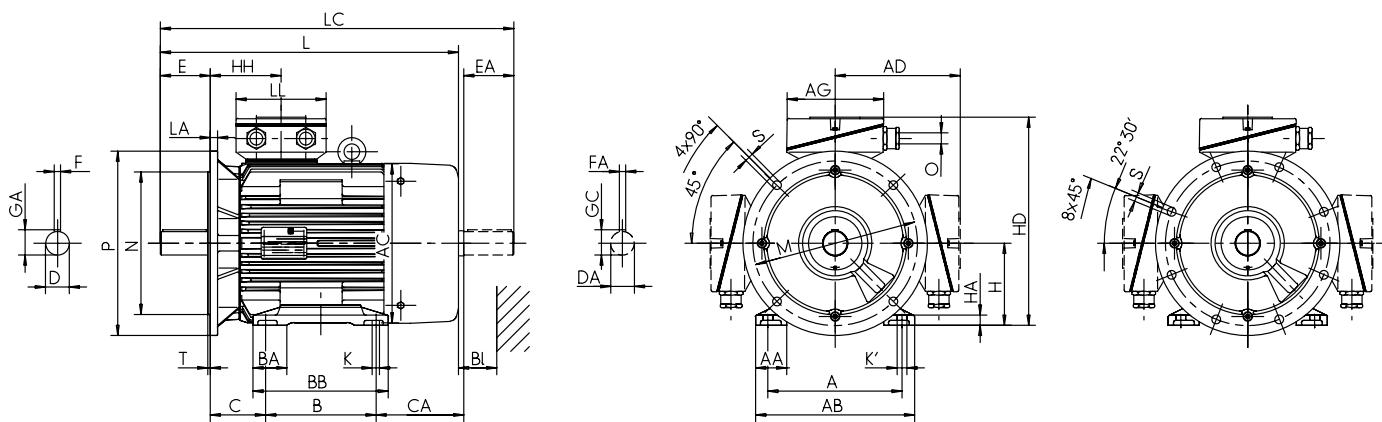
## Permanent magnet synchronous motors for inverter operation

Size 56 to 280

with surface ventilation, cooling method IC 411, thermal class 155 [F/B],  
degree of protection IP 55

**Type of construction IM B35 [IM 2001]**

Flange dimensions see table „flange dimensions“



| Type designation<br>PE1R, P21R | GA<br>t | GC<br>t1 | H<br>h | HA<br>c | HD<br>p | HD **)<br>p | HH<br>A | K<br>s | K'<br>s' | L<br>k | LC<br>k1 | Terminal<br>box type | AG<br>x | LL<br>z | O<br>r  | Hole<br>pattern | Bl.<br>Bl |
|--------------------------------|---------|----------|--------|---------|---------|-------------|---------|--------|----------|--------|----------|----------------------|---------|---------|---------|-----------------|-----------|
| P.10 56 K4 U                   | 10.2    | 10.2     | 56     | 7       | 154     | R           | 58      | 6      | 6        | 150    | 175      | KA 05                | 92      | 92      | M20x1.5 | 4L              | 14        |
| P.1R 56 G2,4                   | 10.2    | 10.2     | 56     | 7       | 154     | R           | 58      | 6      | 6        | 176    | 199      | KA 05                | 92      | 92      | M20x1.5 | 4L              | 14        |
| P.1R 63 K4,6                   | 12.5    | 12.5     | 63     | 10      | 161     | R           | 58      | 8      | 8        | 179    | 205      | KA 05                | 92      | 92      | M20x1.5 | 4L              | 14        |
| P.1R 63 G2,4,6                 | 12.5    | 12.5     | 63     | 10      | 161     | R           | 58      | 8      | 8        | 179    | 205      | KA 05                | 92      | 92      | M20x1.5 | 4L              | 14        |
| P.1R 71 K4,6,8                 | 16      | 16       | 71     | 11      | 175     | R           | 61      | 8      | 8        | 206    | 239      | KA 05                | 92      | 92      | M20x1.5 | 4L              | 14        |
| P.1R 71 G4,6,8                 | 16      | 16       | 71     | 11      | 175     | R           | 61      | 8      | 8        | 206    | 239      | KA 05                | 92      | 92      | M20x1.5 | 4L              | 14        |
| P.1R 80 K4,6,8                 | 21.5    | 21.5     | 80     | 12      | 191     | R           | 67      | 10     | 10       | 249    | 293      | KA 05                | 92      | 92      | M20x1.5 | 4L              | 16        |
| P.1R 80 G4,6,8                 | 21.5    | 21.5     | 80     | 12      | 191     | R           | 67      | 10     | 10       | 249    | 293      | KA 05                | 92      | 92      | M20x1.5 | 4L              | 16        |
| P.1R 90 S4,6,8                 | 27      | 24.5     | 90     | 14      | 210     | R           | 70      | 10     | 10       | 275    | 330      | KA 05                | 92      | 92      | M25x1.5 | 4L              | 16        |
| P.1R 90 L4,6,8                 | 27      | 24.5     | 90     | 14      | 210     | R           | 70      | 10     | 10       | 297    | 352      | KA 05                | 92      | 92      | M25x1.5 | 4L              | 16        |
| P.1R 100 L4,6,8                | 31      | 27       | 100    | 15      | 227     | R           | 75      | 12     | 12       | 331    | 386      | KA 05                | 92      | 92      | M25x1.5 | 4L              | 18        |
| P.1R 100 LX4,8                 | 31      | 31       | 100    | 11      | 237     | R           | 77      | 12     | 12       | 357    | 425      | KA 05                | 92      | 92      | M25x1.5 | 4L              | 20        |
| P.1R 112 M6,8                  | 31      | 31       | 112    | 18      | 249     | R           | 77      | 12     | 12       | 357    | 425      | KA 05                | 92      | 92      | M25x1.5 | 4L              | 20        |
| P.1R 112 M6,8                  | 31      | 31       | 112    | 18      | 249     | R           | 77      | 12     | 12       | 357    | 425      | KA 05                | 92      | 92      | M25x1.5 | 4L              | 20        |
| P.1R 112 M4                    | 31      | 31       | 112    | 18      | 249     | R           | 77      | 12     | 12       | 391    | 459      | KA 05                | 92      | 92      | M25x1.5 | 4L              | 20        |
| P.1R 132 S6,8T                 | 41      | 31       | 132    | 18      | 287     | R           | 105     | 12     | 12       | 430    | 498      | KA 05-13             | 104     | 112     | M32x1.5 | 4L              | 20        |
| P.1R 132 S4,6,8                | 41      | 35       | 132    | 16      | 310     | 257         | 108     | 12     | 12       | 459    | 542      | KK 25 A              | 156     | 145     | M32x1.5 | 4L              | 35        |
| P.1R 132 M4                    | 41      | 41       | 132    | 16      | 331     | 279         | 114     | 12     | 12       | 481    | 565      | KK 25 A              | 156     | 145     | M32x1.5 | 4L              | 35        |
| P.1R 132 MX6                   | 41      | 41       | 132    | 16      | 331     | 279         | 114     | 12     | 12       | 481    | 565      | KK 25 A              | 156     | 145     | M32x1.5 | 4L              | 35        |
| P.1R 132 M6,8                  | 41      | 35       | 132    | 16      | 310     | 257         | 108     | 12     | 12       | 479    | 562      | KK 25 A              | 156     | 145     | M32x1.5 | 4L              | 35        |
| P.1R 160 M4,6,8                | 45      | 41       | 160    | 18      | 374     | 307         | 114     | 15     | 15       | 559    | 643      | KK 63 A              | 193     | 167     | M40x1.5 | 4L              | 35        |
| P.1R 160 MX8                   | 45      | 41       | 160    | 18      | 374     | 307         | 114     | 15     | 15       | 559    | 643      | KK 63 A              | 193     | 167     | M40x1.5 | 4L              | 35        |
| P.1R 160 L4,6,8                | 45      | 45       | 160    | 18      | 402     | 336         | 138     | 15     | 20       | 609    | 724      | KK 63 A              | 193     | 167     | M40x1.5 | 4L              | 35        |
| P.1R 180 M4                    | 51.5    | 45       | 180    | 20      | 422     | 356         | 138     | 15     | 20       | 609    | 724      | KK 63 A              | 193     | 167     | M40x1.5 | 4L              | 35        |
| P.1R 180 L4                    | 51.5    | 51.5     | 180    | 20      | 441     | 369         | 147     | 15     | 20       | 680    | 796      | KK 63 A              | 193     | 167     | M40x1.5 | 4L              | 35        |
| P.1R 180 L6,8                  | 51.5    | 45       | 180    | 20      | 422     | 369         | 138     | 15     | 20       | 609    | 724      | KK 63 A              | 193     | 167     | M40x1.5 | 4L              | 35        |
| P.1R 200 L4,6,8                | 59      | 51.5     | 200    | 22      | 461     | 389         | 147     | 19     | 25       | 680    | 796      | KK 63 A              | 193     | 167     | M40x1.5 | 4L              | 35        |
| P.1R 200 LX6                   | 59      | 51.5     | 200    | 22      | 461     | 389         | 147     | 19     | 25       | 680    | 796      | KK 63 A              | 193     | 167     | M40x1.5 | 4L              | 35        |
| P.1R 225 S4,8                  | 64      | 59       | 225    | 25      | 525     | 442         | 168     | 19     | 25       | 757    | 881      | KK 100 A             | 213     | 207     | M50x1.5 | 8L              | 40        |
| P.1R 225 M4                    | 64      | 59       | 225    | 25      | 525     | 442         | 168     | 19     | 25       | 797    | 921      | KK 100 A             | 213     | 207     | M50x1.5 | 8L              | 40        |
| P.1R 225 M6,8,12               | 64      | 59       | 225    | 25      | 525     | 442         | 168     | 19     | 25       | 757    | 881      | KK 100 A             | 213     | 207     | M50x1.5 | 8L              | 40        |
| P.1R 250 M4,6,8,12             | 69      | 59       | 250    | 28      | 608     | 484         | 177     | 24     | 30       | 862    | 977      | KK 200 A             | 282     | 242     | M63x1.5 | 8L              | 45        |
| P.1R 280 S4,6,8,12             | 79.5    | 69       | 280    | 32      | 666     | 546         | 206     | 24     | 30       | 924    | 1072     | KK 200 A             | 282     | 242     | M63x1.5 | 8L              | 50        |
| P.1R 280 M4,6,8,12             | 79.5    | 69       | 280    | 32      | 666     | 546         | 206     | 24     | 30       | 970    | 1118     | KK 200 A             | 282     | 242     | M63x1.5 | 8L              | 50        |

\*\*) Terminal box left/right

R = on request

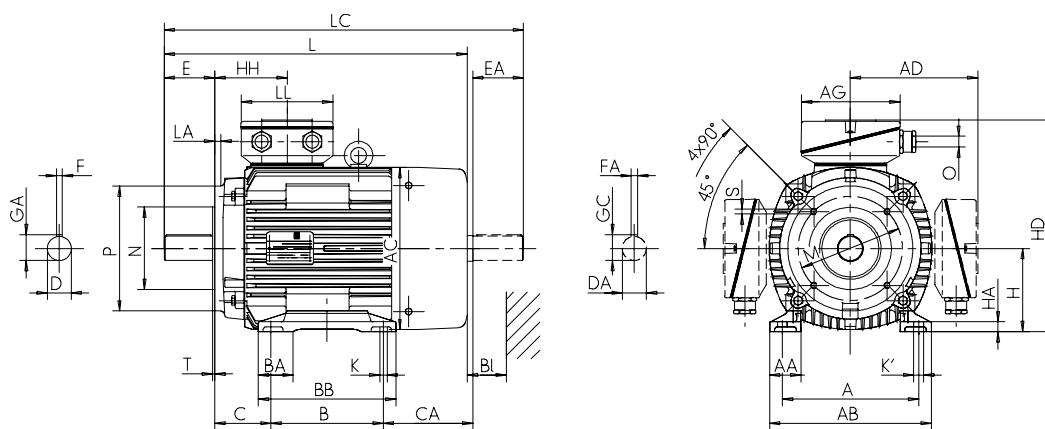
## Permanent magnet synchronous motors for inverter operation

Size 56 to 180

with surface ventilation, cooling method IC 411, thermal class 155 [F/B],  
degree of protection IP 55

**Type of construction IM B34 [IM 2101]**

Flange dimensions see table „flange dimensions“



| Type designation | Flange size<br>small<br>big | A<br>b | AA<br>n | AB<br>f | AC<br>g | AD**)<br>g1 | B<br>a | BA<br>m | BB<br>e | C<br>w1 | CA<br>w2 | D<br>d | DA<br>d1 | DB*)<br>I | E<br>I | EA<br>I1 | F<br>u | FA<br>u1 |    |
|------------------|-----------------------------|--------|---------|---------|---------|-------------|--------|---------|---------|---------|----------|--------|----------|-----------|--------|----------|--------|----------|----|
| K210 56 K4 U     | FT 65                       | FT 85  | 90      | 18      | 110     | -           | 98     | 71      | -       | 86      | 36       | 28     | 9        | 9         | M3     | 20       | 20     | 3        | 3  |
| P.1R 56 G4       | FT 65                       | FT 85  | 90      | 18      | 110     | 109         | 98     | 71      | -       | 86      | 36       | 52     | 9        | 9         | M3     | 20       | 20     | 3        | 3  |
| P.1R 63 K2,4,6   | FT 75                       | FT 100 | 100     | 28      | 128     | 109         | 98     | 80      | -       | 100     | 40       | 39     | 11       | 11        | M4     | 23       | 23     | 4        | 4  |
| P.1R 63 G2,4,6   | FT 75                       | FT 100 | 100     | 28      | 128     | 109         | 98     | 80      | -       | 100     | 40       | 39     | 11       | 11        | M4     | 23       | 23     | 4        | 4  |
| P.1R 71 K4,6,8   | FT 85                       | FT 115 | 112     | 32      | 138     | 124         | 104    | 90      | -       | 116     | 45       | 43,5   | 14       | 14        | M5     | 30       | 30     | 5        | 5  |
| P.1R 71 G4,6,8   | FT 85                       | FT 115 | 112     | 32      | 138     | 124         | 104    | 90      | -       | 116     | 45       | 43,5   | 14       | 14        | M5     | 30       | 30     | 5        | 5  |
| P.1R 80 K4,6,8   | FT 100                      | FT 130 | 125     | 38      | 168     | 139         | 111    | 100     | -       | 125     | 50       | 63     | 19       | 19        | M6     | 40       | 40     | 6        | 6  |
| P.1R 80 G4,6,8   | FT 100                      | FT 130 | 125     | 38      | 168     | 139         | 111    | 100     | -       | 125     | 50       | 63     | 19       | 19        | M6     | 40       | 40     | 6        | 6  |
| P.1R 90 S4,6,8   | FT 115                      | FT 130 | 140     | 40      | 178     | 157         | 119    | 100     | -       | 130     | 56       | 74     | 24       | 22        | M8     | 50       | 50     | 8        | 6  |
| P.1R 90 L4,6,8   | FT 115                      | FT 130 | 140     | 40      | 178     | 157         | 119    | 125     | -       | 155     | 56       | 71     | 24       | 22        | M8     | 50       | 50     | 8        | 6  |
| P.1R 100 L4,6,8  | FT 130                      | FT 165 | 160     | 45      | 192     | 177         | 126    | 140     | -       | 175     | 63       | 73     | 28       | 24        | M10    | 60       | 50     | 8        | 8  |
| P.1R 100 LX4,8   | FT 130                      | FT 165 | 160     | 32      | 188     | 196         | 136    | 140     | -       | 171     | 63       | 102    | 28       | 28        | M10    | 60       | 60     | 8        | 8  |
| P.1R 112 M6,8    | FT 130                      | FT 165 | 190     | 50      | 224     | 196         | 136    | 140     | -       | 180     | 70       | 95     | 28       | 28        | M10    | 60       | 60     | 8        | 8  |
| P.1R 112 M6,8    | FT 130                      | FT 165 | 190     | 50      | 224     | 196         | 136    | 140     | -       | 180     | 70       | 95     | 28       | 28        | M10    | 60       | 60     | 8        | 8  |
| P.1R 112 M4      | FT 130                      | FT 165 | 190     | 50      | 224     | 196         | 136    | 140     | -       | 180     | 70       | 129    | 28       | 28        | M10    | 60       | 60     | 8        | 8  |
| P.1R 132 S6,8T   | FT 130                      | FT 165 | 216     | 50      | 256     | 196         | 155    | 140     | -       | 180     | 89       | 129    | 38       | 28        | M12    | 80       | 60     | 10       | 8  |
| P.1R 132 S4,6,8  | FT 130                      | FT 165 | 216     | 50      | 256     | 217         | 178    | 140     | 55      | 180     | 89       | 153    | 38       | 32        | M12    | 80       | 80     | 10       | 10 |
| P.1R 132 M4      | FT 165                      | FT 215 | 216     | 50      | 256     | 258         | 199    | 178     | 55      | 218     | 89       | 138    | 38       | 38        | M12    | 80       | 80     | 10       | 10 |
| P.1R 132 MX6     | FT 165                      | FT 215 | 216     | 50      | 256     | 258         | 199    | 178     | 55      | 218     | 89       | 138    | 38       | 38        | M12    | 80       | 80     | 10       | 10 |
| P.1R 132 M6,8    | FT 130                      | FT 165 | 216     | 50      | 256     | 217         | 178    | 178     | 55      | 218     | 89       | 135    | 38       | 32        | M12    | 80       | 80     | 10       | 10 |
| P.1R 160 M4,6,8  | FT 165                      | FT 215 | 254     | 55      | 296     | 258         | 214    | 210     | 60      | 257     | 108      | 135    | 42       | 38        | M16    | 110      | 80     | 12       | 10 |
| P.1R 160 MX8     | FT 165                      | FT 215 | 254     | 55      | 296     | 258         | 199    | 210     | 60      | 257     | 108      | 135    | 42       | 38        | M16    | 110      | 80     | 12       | 10 |
| P.1R 160 L4,6,8  | FT 215                      | FT 265 | 254     | 55      | 296     | 313         | 242    | 254     | 60      | 301     | 108      | 142    | 42       | 42        | M16    | 110      | 110    | 12       | 12 |
| P.1R 180 M4      | FT 265                      | -      | 279     | 62      | 328     | 313         | 242    | 241     | 65      | 288     | 121      | 142    | 48       | 42        | M16    | 110      | 110    | 14       | 12 |
| P.1R 180 L6,8    | FT 265                      | -      | 279     | 62      | 328     | 313         | 242    | 279     | 65      | 326     | 121      | 104    | 48       | 42        | M16    | 110      | 110    | 14       | 12 |

\*) Centre holes acc. to DIN 332-DS

\*\*) Terminal box left/right

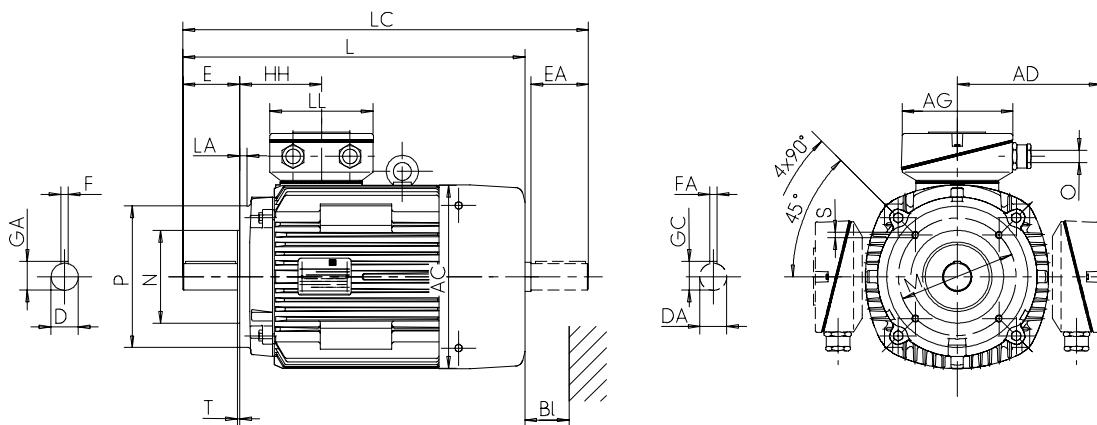
## Permanent magnet synchronous energy efficient motors for inverter operation

Size 56 to 180

with surface ventilation, cooling method IC 411, thermal class 155 [F/B], degree of protection IP 55

**Type of construction IM B14 [IM 3601]**

Flange dimensions see table „flange dimensions“



| Type designation   | GA<br>t | GC<br>t1 | H<br>h | HA<br>c | HD<br>p | HD **)<br>p | HH<br>A | K<br>s | K'<br>s' | L<br>k | LC<br>k1 | Terminal<br>box type | AG<br>x | LL<br>z | O<br>r  | Hole<br>pattern | Bl.<br>Bl. |
|--------------------|---------|----------|--------|---------|---------|-------------|---------|--------|----------|--------|----------|----------------------|---------|---------|---------|-----------------|------------|
| K210 56 K2,4 U     | 10.2    | 10.2     | 56     | 7       | 154     | A           | 58      | 6      | 6        | 150    | 175      | KA 05                | 92      | 92      | M20x1.5 | 4L              | -          |
| P.1R 56 G2,4       | 10.2    | 10.2     | 56     | 7       | 154     | A           | 58      | 6      | 6        | 176    | 199      | KA 05                | 92      | 92      | M20x1.5 | 4L              | 14         |
| P.1R 63 K2,4,6     | 12.5    | 12.5     | 63     | 10      | 161     | A           | 58      | 8      | 8        | 179    | 205      | KA 05                | 92      | 92      | M20x1.5 | 4L              | 14         |
| P.1R 63 G2,4,6     | 12.5    | 12.5     | 63     | 10      | 161     | A           | 58      | 8      | 8        | 179    | 205      | KA 05                | 92      | 92      | M20x1.5 | 4L              | 14         |
| P.1R 71 K2,4,6,8   | 16      | 16       | 71     | 11      | 175     | A           | 61      | 8      | 8        | 206    | 239      | KA 05                | 92      | 92      | M20x1.5 | 4L              | 14         |
| P.1R 71 G2,4,6,8   | 16      | 16       | 71     | 11      | 175     | A           | 61      | 8      | 8        | 206    | 239      | KA 05                | 92      | 92      | M20x1.5 | 4L              | 14         |
| P.1R 80 K2,4,6,8   | 21.5    | 21.5     | 80     | 12      | 191     | A           | 67      | 10     | 10       | 249    | 293      | KA 05                | 92      | 92      | M20x1.5 | 4L              | 16         |
| P.1R 80 G2,4,6,8   | 21.5    | 21.5     | 80     | 12      | 191     | A           | 67      | 10     | 10       | 249    | 293      | KA 05                | 92      | 92      | M20x1.5 | 4L              | 16         |
| P.1R 90 S2,4,6,8   | 27      | 24.5     | 90     | 14      | 210     | A           | 70      | 10     | 10       | 275    | 330      | KA 05                | 92      | 92      | M25x1.5 | 4L              | 16         |
| P.1R 90 L2,4,6,8   | 27      | 24.5     | 90     | 14      | 210     | A           | 70      | 10     | 10       | 297    | 352      | KA 05                | 92      | 92      | M25x1.5 | 4L              | 16         |
| P.1R 100 L2,4,6,8  | 31      | 27       | 100    | 15      | 227     | A           | 75      | 12     | 12       | 331    | 386      | KA 05                | 92      | 92      | M25x1.5 | 4L              | 18         |
| P.1R 100 LX4,8     | 31      | 31       | 100    | 11      | 237     | A           | 77      | 12     | 12       | 357    | 425      | KA 05                | 92      | 92      | M25x1.5 | 4L              | 20         |
| P.1R 112 M6,8      | 31      | 31       | 112    | 18      | 249     | A           | 77      | 12     | 12       | 357    | 425      | KA 05                | 92      | 92      | M25x1.5 | 4L              | 20         |
| P.1R 112 MY4       | 31      | 31       | 112    | 18      | 249     | A           | 77      | 12     | 12       | 357    | 425      | KA 05                | 92      | 92      | M25x1.5 | 4L              | 20         |
| P.1R 112 M4        | 31      | 31       | 112    | 18      | 249     | A           | 77      | 12     | 12       | 391    | 459      | KA 05                | 92      | 92      | M25x1.5 | 4L              | 20         |
| P.1R 132 S4,2,6,8T | 41      | 31       | 132    | 18      | 287     | A           | 105     | 12     | 12       | 430    | 498      | KA 05-13             | 104     | 112     | M32x1.5 | 4L              | 20         |
| P.1R 132 S4,6,8    | 41      | 35       | 132    | 16      | 328     | 275         | 108     | 12     | 12       | 459    | 542      | KK 25 A              | 156     | 145     | M32x1.5 | 4L              | 35         |
| P.1R 132 M4        | 41      | 41       | 132    | 16      | 349     | 297         | 114     | 12     | 12       | 481    | 565      | KK 25 A              | 156     | 145     | M32x1.5 | 4L              | 35         |
| P.1R 132 MX6       | 41      | 41       | 132    | 16      | 349     | 297         | 114     | 12     | 12       | 481    | 565      | KK 25 A              | 156     | 145     | M32x1.5 | 4L              | 35         |
| P.1R 132 M6,8      | 41      | 35       | 132    | 16      | 328     | 275         | 108     | 12     | 12       | 479    | 562      | KK 25 A              | 156     | 145     | M32x1.5 | 4L              | 35         |
| P.1R 160 M4,6,8    | 45      | 41       | 160    | 18      | 389     | 322         | 114     | 15     | 15       | 559    | 643      | KK 63 A              | 193     | 167     | M40x1.5 | 4L              | 35         |
| P.1R 160 MX8       | 45      | 41       | 160    | 18      | 389     | 322         | 114     | 15     | 15       | 559    | 643      | KK 63 A              | 193     | 167     | M40x1.5 | 4L              | 35         |
| P.1R 160 L2,4,6,8  | 45      | 45       | 160    | 18      | 417     | 351         | 138     | 15     | 20       | 609    | 724      | KK 63 A              | 193     | 167     | M40x1.5 | 4L              | 35         |
| P.1R 180 M4        | 51.5    | 45       | 180    | 20      | 417     | 351         | 138     | 15     | 20       | 609    | 724      | KK 63 A              | 193     | 167     | M40x1.5 | 4L              | 35         |
| P.1R 180 L6,8      | 51.5    | 45       | 180    | 20      | 417     | 364         | 138     | 15     | 20       | 609    | 724      | KK 63 A              | 193     | 167     | M40x1.5 | 4L              | 35         |

\*\*) Terminal box left/right

## Permanent magnet synchronous motors for inverter operation

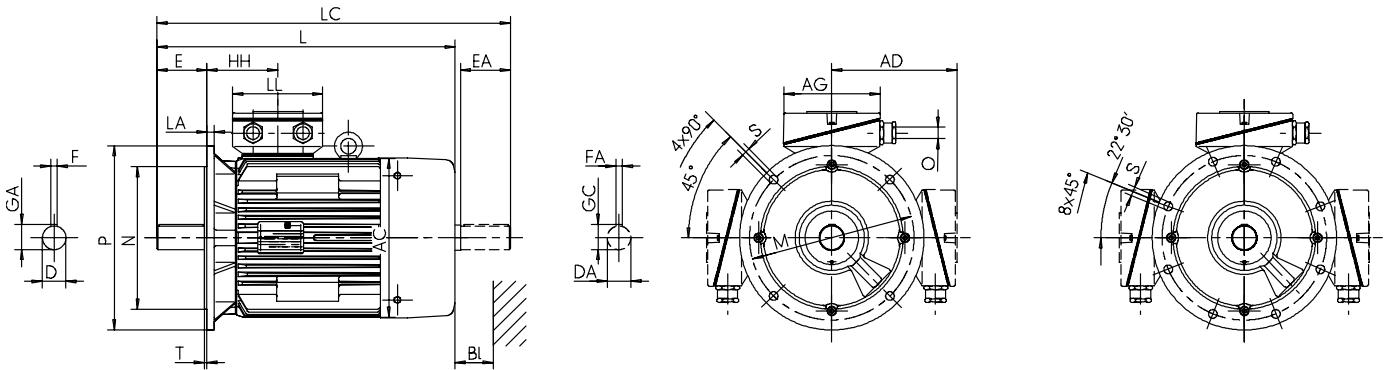
Size 56 to 280

with surface ventilation, cooling method IC 411, thermal class 155 [F/B], degree of protection IP 55

**Type of construction IM B5 [IM 3001]**

**Type of construction IM V1 [IM 3011]**

Flange dimensions see table „flange dimensions“



| Type designation   | Flange size | AC g | AD**) g1 | D d | DA d1 | DB *) l | E I | EA l1 | F u | FA u1 | GA t | GC t1 | H h | HH A | L k | LC k1 | Terminal box type | AG x | LL z | O r     | Hole pattern | Bl. Bl |
|--------------------|-------------|------|----------|-----|-------|---------|-----|-------|-----|-------|------|-------|-----|------|-----|-------|-------------------|------|------|---------|--------------|--------|
| P.1O 56 K4 U       | FF100       | -    | 98       | 9   | 9     | M3      | 20  | 20    | 3   | 3     | 10.2 | 10.2  | 56  | 81   | 173 | 197   | KA 05             | 92   | 92   | M20x1.5 | 4L           | 14     |
| P.1R 56 G4         | FF100       | 109  | 98       | 9   | 9     | M3      | 20  | 20    | 3   | 3     | 10.2 | 10.2  | 56  | 81   | 199 | 223   | KA 05             | 92   | 92   | M20x1.5 | 4L           | 14     |
| P.1R 63 K4,6       | FF115       | 109  | 98       | 11  | 11    | M4      | 23  | 23    | 4   | 4     | 12.5 | 12.5  | 63  | 58   | 179 | 205   | KA 05             | 92   | 92   | M20x1.5 | 4L           | 14     |
| P.1R 63 G4,6       | FF115       | 109  | 98       | 11  | 11    | M4      | 23  | 23    | 4   | 4     | 12.5 | 12.5  | 63  | 58   | 179 | 205   | KA 05             | 92   | 92   | M20x1.5 | 4L           | 14     |
| P.1R 71 K4,6,8     | FF130       | 124  | 104      | 14  | 14    | M5      | 30  | 30    | 5   | 5     | 16   | 16    | 71  | 61   | 206 | 239   | KA 05             | 92   | 92   | M20x1.5 | 4L           | 14     |
| P.1R 71 G4,6,8     | FF130       | 124  | 104      | 14  | 14    | M5      | 30  | 30    | 5   | 5     | 16   | 16    | 71  | 61   | 206 | 239   | KA 05             | 92   | 92   | M20x1.5 | 4L           | 14     |
| P.1R 80 K4,6,8     | FF 165      | 139  | 111      | 19  | 19    | M6      | 40  | 40    | 6   | 6     | 21.5 | 21.5  | 80  | 67   | 249 | 293   | KA 05             | 92   | 92   | M20x1.5 | 4L           | 16     |
| P.1R 80 G4,6,8     | FF 165      | 139  | 111      | 19  | 19    | M6      | 40  | 40    | 6   | 6     | 21.5 | 21.5  | 80  | 67   | 249 | 293   | KA 05             | 92   | 92   | M20x1.5 | 4L           | 16     |
| P.1R 90 S4,6,8     | FF 165      | 157  | 119      | 24  | 22    | M8      | 50  | 50    | 8   | 6     | 27   | 24.5  | 90  | 70   | 275 | 330   | KA 05             | 92   | 92   | M25x1.5 | 4L           | 16     |
| P.1R 90 L4,6,8     | FF 165      | 157  | 119      | 24  | 22    | M8      | 50  | 50    | 8   | 6     | 27   | 24.5  | 90  | 70   | 297 | 352   | KA 05             | 92   | 92   | M25x1.5 | 4L           | 16     |
| P.1R 100 L4,6,8    | FF 215      | 177  | 126      | 28  | 24    | M10     | 60  | 50    | 8   | 8     | 31   | 27    | 100 | 75   | 331 | 386   | KA 05             | 92   | 92   | M25x1.5 | 4L           | 18     |
| P.1R 100 LX4,8     | FF 215      | 196  | 136      | 28  | 28    | M10     | 60  | 60    | 8   | 8     | 31   | 31    | 100 | 77   | 357 | 425   | KA 05             | 92   | 92   | M25x1.5 | 4L           | 20     |
| P.1R 112 M6,8      | FF 215      | 196  | 136      | 28  | 28    | M10     | 60  | 60    | 8   | 8     | 31   | 31    | 112 | 77   | 391 | 425   | KA 05             | 92   | 92   | M25x1.5 | 4L           | 20     |
| P.1R 112 MY4       | FF 215      | 196  | 136      | 28  | 28    | M10     | 60  | 60    | 8   | 8     | 31   | 31    | 112 | 77   | 391 | 425   | KA 05             | 92   | 92   | M25x1.5 | 4L           | 20     |
| P.1R 112 M4        | FF 215      | 196  | 136      | 28  | 28    | M10     | 60  | 60    | 8   | 8     | 31   | 31    | 112 | 77   | 391 | 459   | KA 05             | 92   | 92   | M25x1.5 | 4L           | 20     |
| P.1R 132 S4,6,8T   | FF265       | 196  | 155      | 38  | 28    | M12     | 80  | 60    | 10  | 8     | 41   | 31    | 132 | 105  | 430 | 498   | KA 05-13          | 104  | 112  | M32x1.5 | 4L           | 20     |
| P.1R 132 S4,6,8    | FF265       | 217  | 178      | 38  | 32    | M12     | 80  | 80    | 10  | 10    | 41   | 35    | 132 | 108  | 459 | 542   | KK 25 A           | 156  | 145  | M32x1.5 | 4L           | 35     |
| P.1R 132 M4        | FF265       | 258  | 199      | 38  | 38    | M12     | 80  | 80    | 10  | 10    | 41   | 41    | 132 | 114  | 481 | 565   | KK 25 A           | 156  | 145  | M32x1.5 | 4L           | 35     |
| P.1R 132 MX6       | FF265       | 258  | 199      | 38  | 38    | M12     | 80  | 80    | 10  | 10    | 41   | 41    | 132 | 114  | 481 | 565   | KK 25 A           | 156  | 145  | M32x1.5 | 4L           | 35     |
| P.1R 132 M6,8      | FF265       | 217  | 178      | 38  | 32    | M12     | 80  | 80    | 10  | 10    | 41   | 35    | 132 | 108  | 479 | 562   | KK 25 A           | 156  | 145  | M32x1.5 | 4L           | 35     |
| P.1R 160 M4,6,8    | FF300       | 258  | 214      | 42  | 38    | M16     | 110 | 80    | 12  | 10    | 45   | 41    | 160 | 114  | 559 | 643   | KK 63 A           | 193  | 167  | M40x1.5 | 4L           | 35     |
| P.1R 160 MX8       | FF300       | 258  | 199      | 42  | 38    | M16     | 110 | 80    | 12  | 10    | 45   | 41    | 160 | 114  | 559 | 643   | KK 63 A           | 193  | 167  | M40x1.5 | 4L           | 35     |
| P.1R 160 L4,6,8    | FF300       | 313  | 242      | 42  | 42    | M16     | 110 | 110   | 12  | 45    | 45   | 45    | 160 | 138  | 609 | 724   | KK 63 A           | 193  | 167  | M40x1.5 | 4L           | 35     |
| P.1R 180 M4        | FF300       | 313  | 242      | 48  | 42    | M16     | 110 | 110   | 14  | 12    | 51.5 | 45    | 180 | 138  | 609 | 724   | KK 63 A           | 193  | 167  | M40x1.5 | 4L           | 35     |
| P.1R 180 L4        | FF300       | 351  | 261      | 48  | 48    | M16     | 110 | 110   | 14  | 14    | 51.5 | 51.5  | 180 | 147  | 680 | 796   | KK 63 A           | 193  | 167  | M40x1.5 | 4L           | 35     |
| P.1R 180 L6,8      | FF300       | 313  | 242      | 48  | 42    | M16     | 110 | 110   | 14  | 12    | 51.5 | 45    | 180 | 138  | 609 | 724   | KK 63 A           | 193  | 167  | M40x1.5 | 4L           | 35     |
| P.1R 200 L4,6,8    | FF350       | 351  | 261      | 55  | 48    | M20     | 110 | 110   | 16  | 14    | 59   | 51.5  | 200 | 147  | 680 | 796   | KK 63 A           | 193  | 167  | M40x1.5 | 4L           | 35     |
| P.1R 200 LX6       | FF350       | 351  | 261      | 55  | 48    | M20     | 110 | 110   | 16  | 14    | 59   | 51.5  | 200 | 147  | 680 | 796   | KK 63 A           | 193  | 167  | M40x1.5 | 4L           | 35     |
| P.1R 225 S4,8      | FF 400      | 390  | 300      | 60  | 55    | M20     | 140 | 110   | 18  | 16    | 64   | 59    | 225 | 168  | 757 | 881   | KK 100 A          | 213  | 207  | M50x1.5 | 8L           | 40     |
| P.1R 225 M4        | FF 400      | 390  | 300      | 60  | 55    | M20     | 140 | 110   | 18  | 16    | 64   | 59    | 225 | 168  | 797 | 921   | KK 100 A          | 213  | 207  | M50x1.5 | 8L           | 40     |
| P.1R 225 M6,8,12   | FF 400      | 390  | 300      | 60  | 55    | M20     | 140 | 110   | 18  | 16    | 64   | 59    | 225 | 168  | 757 | 881   | KK 100 A          | 213  | 207  | M50x1.5 | 8L           | 40     |
| P.1R 250 M4,6,8,12 | FF 500      | 440  | 358      | 65  | 55    | M20     | 140 | 110   | 18  | 16    | 69   | 59    | 250 | 177  | 862 | 977   | KK 200 A          | 282  | 242  | M63x1.5 | 8L           | 45     |
| P.1R 280 S4,6,8,12 | FF 500      | 490  | 386      | 75  | 65    | M20     | 140 | 140   | 20  | 18    | 79.5 | 69    | 280 | 206  | 924 | 1,072 | KK 200 A          | 282  | 242  | M63x1.5 | 8L           | 50     |
| P.1R 280 M4,6,8,12 | FF 500      | 490  | 386      | 75  | 65    | M20     | 140 | 140   | 20  | 18    | 79.5 | 69    | 280 | 206  | 970 | 1,118 | KK 200 A          | 282  | 242  | M63x1.5 | 8L           | 50     |

\*) Centre holes acc. to DIN 332-DS

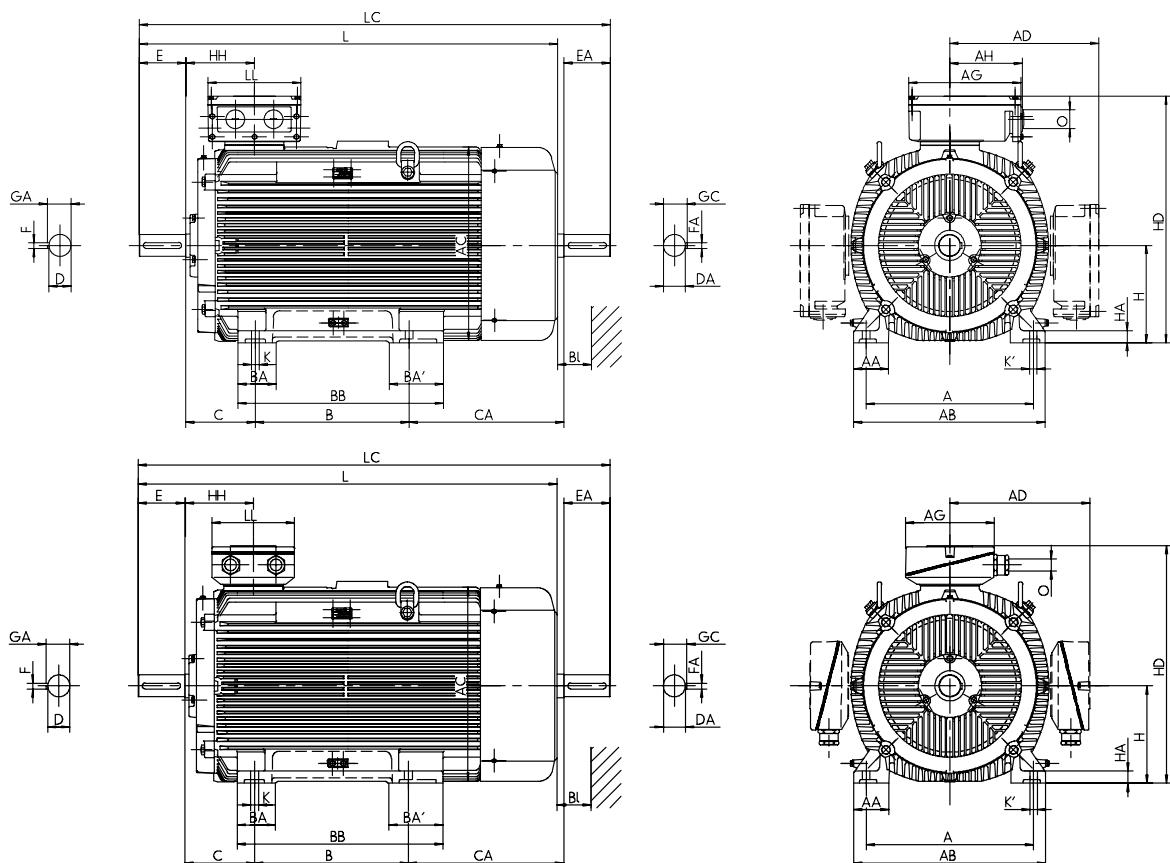
\*\*) Terminal box left/right

## Permanent magnet synchronous motors for inverter operation

Size 315

with surface ventilation, cooling method IC 411, thermal class 155 [F/B], degree of protection IP 55

Type of construction IM B3 [IM 1001]



| Type designation<br>PE1R, P21R | Flange<br>size | A<br>b | AA<br>n | AB<br>f | AC<br>g | AD**)<br>g1 | B<br>a | BA<br>m | BA'<br>m1 | BB<br>e | C<br>w1 | CA<br>w2 | D<br>d | DA<br>d1 | DB *)<br>I | E<br>I | EA<br>I1 | F<br>u | FA<br>u1 |
|--------------------------------|----------------|--------|---------|---------|---------|-------------|--------|---------|-----------|---------|---------|----------|--------|----------|------------|--------|----------|--------|----------|
| P21R 315 S4,6,8,12             | FF 600         | 508    | 126     | 590     | 550     | 416         | 406    | 120     | -         | 503     | 216     | 316      | 80     | 70       | M20        | 170    | 140      | 22     | 20       |
| P21R 315 M4,6,8,12             | FF 600         | 508    | 126     | 590     | 550     | 416         | 457    | 120     | -         | 554     | 216     | 320      | 80     | 70       | M20        | 170    | 140      | 22     | 20       |
| P21R 315 MX4                   | FF 600         | 508    | 126     | 590     | 550     | 416         | 457    | 120     | 150       | 554     | 216     | 400      | 80     | 70       | M20        | 170    | 140      | 22     | 20       |
| P21R 315 MX6,8                 | FF 600         | 508    | 126     | 590     | 550     | 416         | 457    | 120     | 150       | 554     | 216     | 320      | 80     | 70       | M20        | 170    | 140      | 22     | 20       |
| P21R 315 MX12                  | FF 600         | 508    | 126     | 590     | 550     | 416         | 457    | 120     | 150       | 554     | 216     | 320      | 80     | 70       | M20        | 170    | 140      | 22     | 20       |
| P21R 315 MY4,6,8,12            | FF 600         | 508    | 110     | 590     | 610     | 498         | 457    | 120     | -         | 573     | 216     | 495      | 80     | 70       | M20        | 170    | 140      | 22     | 20       |
| P21R 315 L4,6,8,12             | FF 600         | 508    | 110     | 590     | 610     | 498         | 508    | 120     | -         | 624     | 216     | 564      | 80     | 70       | M20        | 170    | 140      | 22     | 20       |
| P21R 315 LX4                   | FF 600         | 508    | 110     | 590     | 610     | 481         | 508    | 120     | -         | 624     | 216     | 689      | 80     | 70       | M20        | 170    | 140      | 22     | 20       |
| P21R 315 LX6,8,12              | FF 600         | 508    | 110     | 590     | 610     | 498         | 508    | 120     | -         | 624     | 216     | 564      | 80     | 70       | M20        | 170    | 140      | 22     | 20       |

\*) Centre holes acc. to DIN 332-DS

\*\*) Terminal box left/right

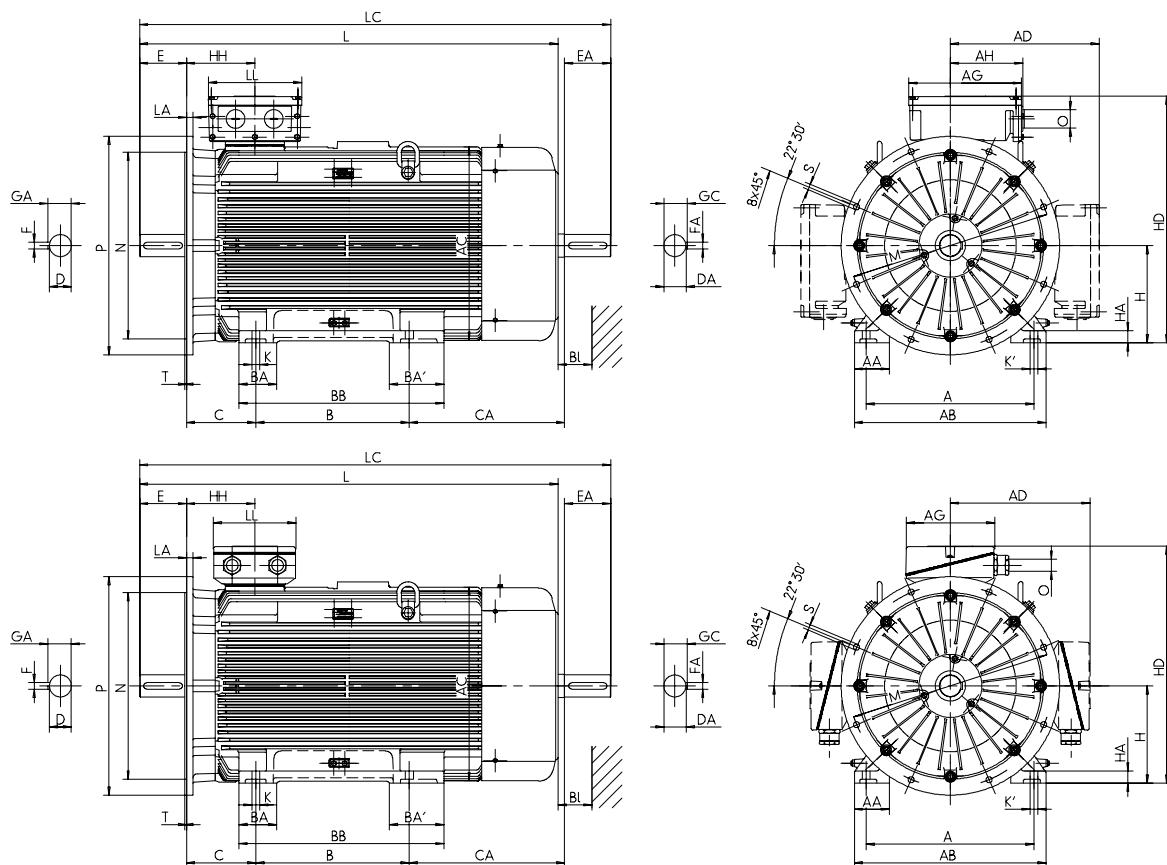
## Permanenterregte Synchronmotoren für Umrichterbetrieb

Size 315

with surface ventilation, cooling method IC 411, thermal class 155 [F/B], degree of protection IP 55

Type of construction IM B35 [IM 2001]

Flange dimensions see table „flange dimensions“



| Type designation    | GA | GC   | H   | HA | HD  | HD**) | HH  | K  | K' | L    | LC   | Terminal box type | AG  | LL  | AH  | O       | Bl. |
|---------------------|----|------|-----|----|-----|-------|-----|----|----|------|------|-------------------|-----|-----|-----|---------|-----|
|                     | t  | t1   | h   | c  | p   | p     | A   | s  | s' | k    | k1   |                   | x   | z   | -   | r       | Bl. |
| P21R 315 S4,6,8,12  | 85 | 74.5 | 315 | 44 | 731 | 595   | 211 | 28 | 35 | 1080 | 1248 | KK 200 A          | 282 | 242 | -   | M63x1.5 | 55  |
| P21R 315 M4,6,8,12  | 85 | 74.5 | 315 | 44 | 731 | 595   | 211 | 28 | 35 | 1135 | 1303 | KK 200 A          | 282 | 242 | -   | M63x1.5 | 55  |
| P21R 315 MX4        | 85 | 74.5 | 315 | 44 | 731 | 595   | 211 | 28 | 35 | 1210 | 1383 | KK 200 A          | 282 | 242 | -   | M63x1.5 | 55  |
| P21R 315 MX6,8      | 85 | 74.5 | 315 | 44 | 731 | 595   | 211 | 28 | 35 | 1135 | 1303 | KK 200 A          | 282 | 242 | -   | M63x1.5 | 55  |
| P21R 315 MX12       | 85 | 74.5 | 315 | 44 | 731 | 595   | 211 | 28 | 35 | 1135 | 1303 | KK 200 A          | 282 | 242 | -   | M63x1.5 | 55  |
| P21R 315 MY4,6,8,12 | 85 | 74.5 | 315 | 44 | 774 | 628   | 230 | 28 | 35 | 1300 | 1478 | KK 400 B          | 315 | 294 | 265 | M63x1.5 | 55  |
| P21R 315 L4,6,8,12  | 85 | 74.5 | 315 | 44 | 774 | 628   | 230 | 28 | 35 | 1420 | 1598 | KK 400 B          | 315 | 294 | 265 | M63x1.5 | 55  |
| P21R 315 LX4        | 85 | 74.5 | 315 | 44 | 796 | 628   | 230 | 28 | 35 | 1540 | 1723 | KK 400 B          | 315 | 294 | 265 | M63x1.5 | 55  |
| P21R 315 LX6,8,12   | 85 | 74.5 | 315 | 44 | 796 | 628   | 230 | 28 | 35 | 1420 | 1598 | KK 400 B          | 315 | 294 | 265 | M63x1.5 | 55  |

\*\*) Terminal box left/right

## Permanent magnet synchronous motors for inverter operation

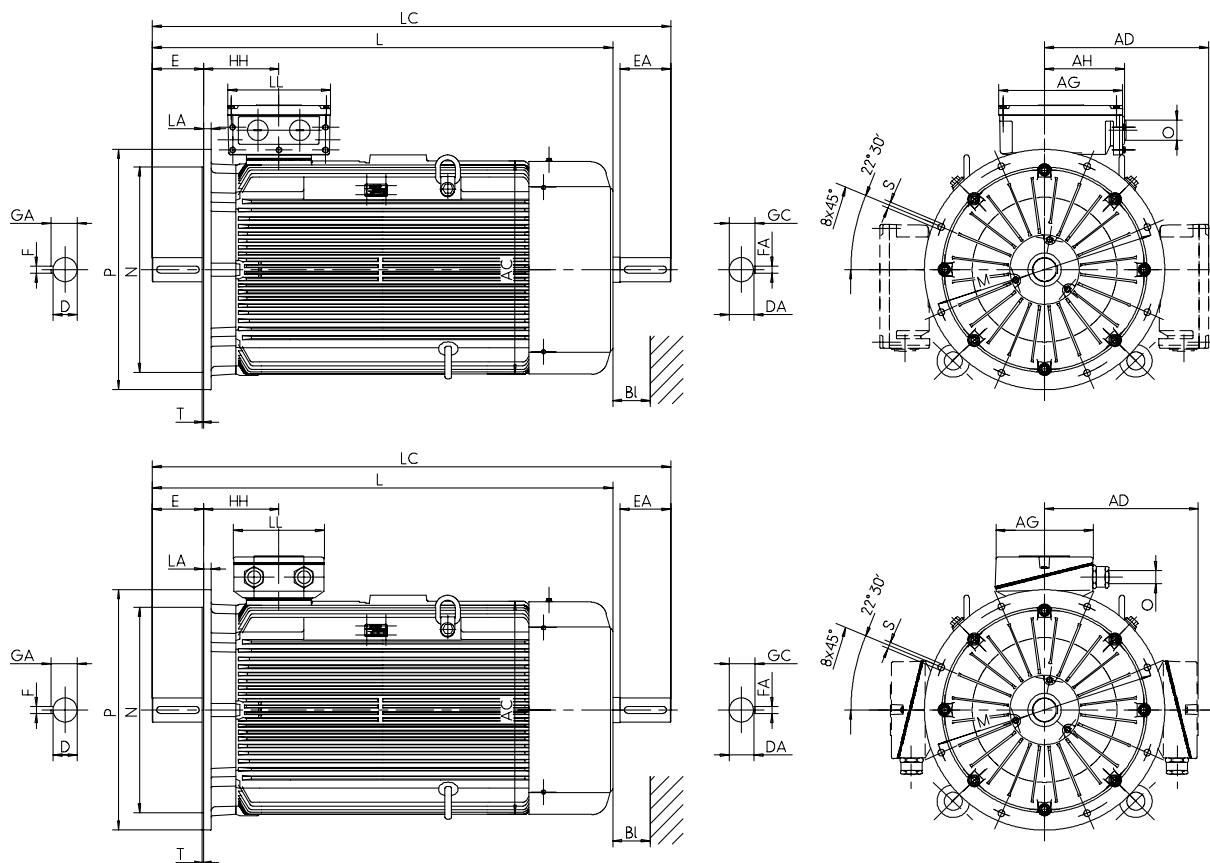
Size 315

with surface ventilation, cooling method IC 411, thermal class 155 [F/B], degree of protection IP 55

**Type of construction IM B5 [IM 3001]** up to size 315 MY,

**Type of construction IM V1 [IM 3011]**

Flange dimensions see table „flange dimensions“



| Type designation    | Flange size | AC g | AD**) g1 | D d | DA d1 | DB *) I | E l | EA l1 | F u | FA u1 | GA t | GC t1 | H h | HH A | L k  | LC k1 | Terminal box type | AG x | LL z | AH - | O r     | Bl. Bl. |
|---------------------|-------------|------|----------|-----|-------|---------|-----|-------|-----|-------|------|-------|-----|------|------|-------|-------------------|------|------|------|---------|---------|
| P21R 315 S4,6,8,12  | FF 600      | 550  | 416      | 80  | 70    | M20     | 170 | 140   | 22  | 20    | 85   | 74.5  | 315 | 211  | 1080 | 1248  | KK 200 A          | 282  | 242  | -    | M63x1.5 | 55      |
| P21R 315 M4,6,8,12  | FF 600      | 550  | 416      | 80  | 70    | M20     | 170 | 140   | 22  | 20    | 85   | 74.5  | 315 | 211  | 1135 | 1303  | KK 200 A          | 282  | 242  | -    | M63x1.5 | 55      |
| P21R 315 MX4        | FF 600      | 550  | 416      | 80  | 70    | M20     | 170 | 140   | 22  | 20    | 85   | 74.5  | 315 | 211  | 1215 | 1383  | KK 200 A          | 282  | 242  | -    | M63x1.5 | 55      |
| P21R 315 MX6,8      | FF 600      | 550  | 416      | 80  | 70    | M20     | 170 | 140   | 22  | 20    | 85   | 74.5  | 315 | 211  | 1135 | 1303  | KK 200 A          | 282  | 242  | -    | M63x1.5 | 55      |
| P21R 315 MX12       | FF 600      | 550  | 416      | 80  | 70    | M20     | 170 | 140   | 22  | 20    | 85   | 74.5  | 315 | 211  | 1135 | 1303  | KK 200 A          | 282  | 242  | -    | M63x1.5 | 55      |
| P21R 315 MY4,6,8,12 | FF 600      | 610  | 498      | 80  | 70    | M20     | 170 | 140   | 22  | 20    | 85   | 74.5  | 315 | 230  | 1300 | 1478  | KK 400 B          | 315  | 294  | 265  | M63x1.5 | 55      |
| P21R 315 L4,6,8,12  | FF 600      | 610  | 498      | 80  | 70    | M20     | 170 | 140   | 22  | 20    | 85   | 74.5  | 315 | 230  | 1420 | 1598  | KK 400 B          | 315  | 294  | 265  | M63x1.5 | 55      |
| P21R 315 LX4        | FF 600      | 610  | 481      | 80  | 70    | M20     | 170 | 140   | 22  | 20    | 85   | 74.5  | 315 | 230  | 1540 | 1723  | KK 400 B          | 315  | 294  | 265  | M63x1.5 | 55      |
| P21R 315 LX6,8,12   | FF 600      | 610  | 498      | 80  | 70    | M20     | 170 | 140   | 22  | 20    | 85   | 74.5  | 315 | 230  | 1420 | 1598  | KK 400 B          | 315  | 294  | 265  | M63x1.5 | 55      |

\*) Centre holes acc. to DIN 332-DS

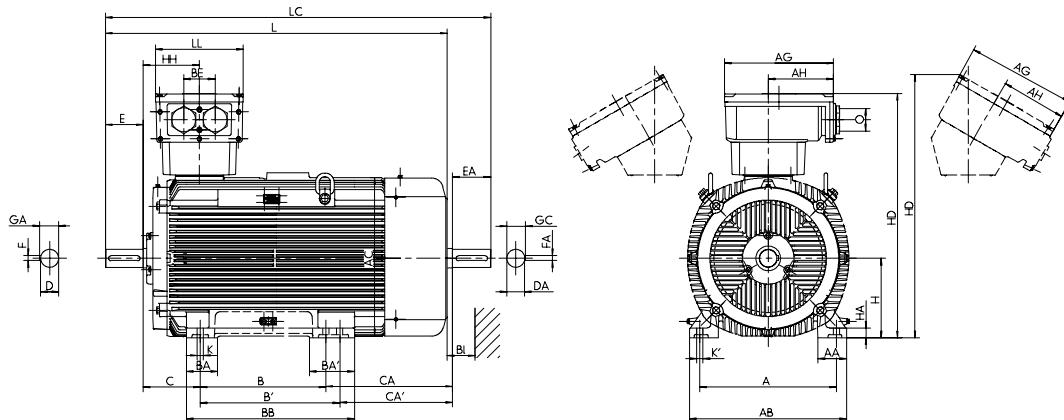
\*\*) Terminal box left/right

## Permanent magnet synchronous motors for inverter operation

**Size 355**

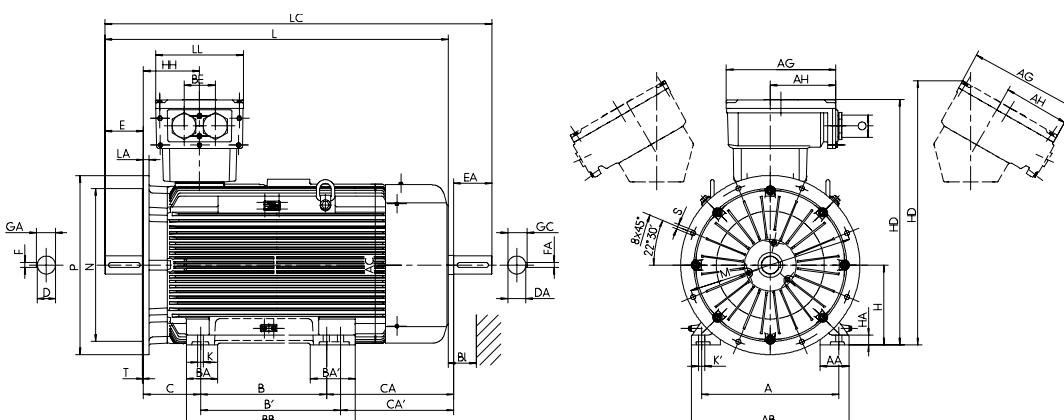
with surface ventilation, cooling method IC 411, thermal class 155 [F/B], degree of protection IP 55

**Type of construction IM B3 [IM 1001],**



### Type of construction IM B35 [IM 2001]

Flange dimensions see table „flange dimensions“



| Type designation     | Flange size | A<br>b | AA<br>n | AB<br>f | AC<br>g | B<br>a | BA<br>m | BA'<br>m1 | BB<br>e | C<br>w1 | CA<br>w2 | D<br>d | DA<br>d1 | DB *)<br>I | E<br>I1 | F<br>u | FA<br>u1 |    |
|----------------------|-------------|--------|---------|---------|---------|--------|---------|-----------|---------|---------|----------|--------|----------|------------|---------|--------|----------|----|
| P22R 355 MY4,6,8,12  | FF 740      | 610    | 130     | 700     | 715     | 560    | 140     | 200       | 750     | 254     | 561      | 100    | 80       | M24        | 210     | 170    | 28       | 22 |
| P22R 355 M4          | FF 740      | 610    | 130     | 700     | 715     | 560    | 140     | 200       | 750     | 254     | 561      | 100    | 80       | M24        | 210     | 170    | 28       | 22 |
| P22R 355 M6,8,10     | FF 740      | 610    | 130     | 700     | 715     | 560    | 140     | 200       | 750     | 254     | 561      | 100    | 80       | M24        | 210     | 170    | 28       | 22 |
| P22R 355 MX6,8,12    | FF 740      | 610    | 130     | 700     | 715     | 560    | 140     | 200       | 750     | 254     | 681      | 100    | 80       | M24        | 210     | 170    | 28       | 22 |
| P22R 355 MX4         | FF 740      | 610    | 130     | 700     | 715     | 560    | 140     | 200       | 750     | 254     | 681      | 100    | 80       | M24        | 210     | 170    | 28       | 22 |
| P22R 355 LY4,L4      | FF 740      | 610    | 130     | 700     | 715     | 630    | 140     | 200       | 750     | 254     | 611      | 100    | 80       | M24        | 210     | 170    | 28       | 22 |
| P22R 355 L, LY6,8,12 | FF 740      | 610    | 130     | 700     | 715     | 630    | 140     | 200       | 750     | 254     | 611      | 100    | 80       | M24        | 210     | 170    | 28       | 22 |

| Type designation     | GA<br>t | GC<br>t1 | H<br>h | HA<br>c | HD<br>p | HD **)<br>p | HH<br>A | K<br>s | K'<br>s' | L<br>k | LC<br>k1 | Terminal<br>box type | AG<br>x | LL<br>z | AH<br>- | BE<br>- | O<br>r | Bl.<br>Bl |
|----------------------|---------|----------|--------|---------|---------|-------------|---------|--------|----------|--------|----------|----------------------|---------|---------|---------|---------|--------|-----------|
| P22R 355 MY4,6,8,12  | 106     | 85       | 355    | 44      | 1091    | 1172        | 250     | 28     | 35       | 1570   | 1755     | KK 630 A             | 496     | 390     | 301     | 140     | M72x2  | 60        |
| P22R 355 M4          | 106     | 85       | 355    | 44      | 1091    | 1172        | 250     | 28     | 35       | 1570   | 1755     | KK 630 A             | 496     | 390     | 301     | 140     | M72x2  | 60        |
| P22R 355 M6,8,10     | 106     | 85       | 355    | 44      | 1091    | 1172        | 250     | 28     | 35       | 1570   | 1755     | KK 630 A             | 496     | 390     | 301     | 140     | M72x2  | 60        |
| P22R 355 MX6,8,12    | 106     | 85       | 355    | 44      | 1091    | 1172        | 327     | 28     | 35       | 1690   | 1875     | KK 630 A             | 496     | 390     | 301     | 140     | M72x2  | 60        |
| P22R 355 MX4         | 106     | 85       | 355    | 44      | 1083    | 1174        | 327     | 28     | 35       | 1690   | 1875     | KK 1000 A            | 615     | 474     | 385     | 200     | M72x2  | 60        |
| P22R 355 LY4,L4      | 106     | 85       | 355    | 44      | 1083    | 1174        | 327     | 28     | 35       | 1690   | 1875     | KK 1000 A            | 615     | 474     | 385     | 200     | M72x2  | 60        |
| P22R 355 L, LY6,8,12 | 106     | 85       | 355    | 44      | 1083    | 1174        | 327     | 28     | 35       | 1690   | 1875     | KK 1000 A            | 615     | 474     | 385     | 200     | M72x2  | 60        |

\*) Centre holes acc. to DIN 332-DS

\*\*) Terminal box left/right

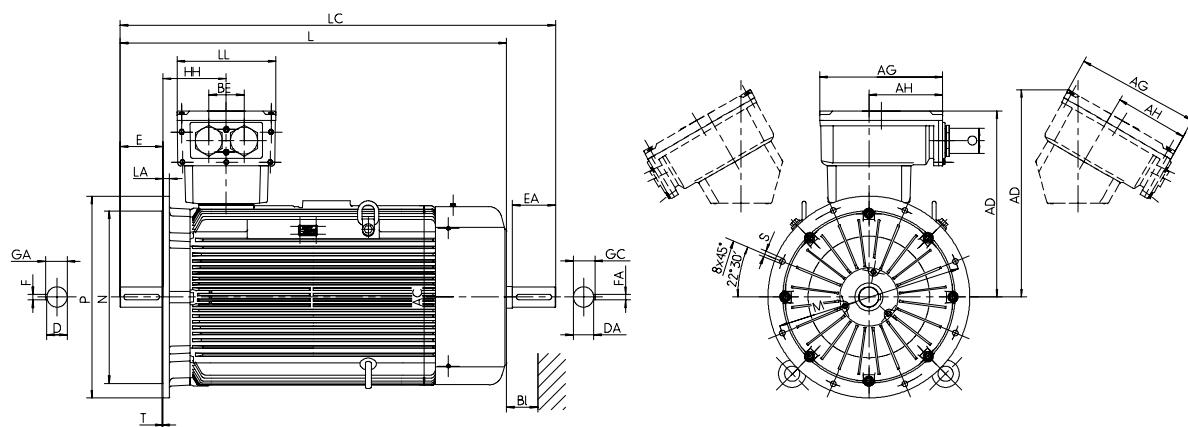
## Permanent magnet synchronous motors for inverter operation

Size 355

with surface ventilation, cooling method IC 403, thermal class 155 [F/B], degree of protection IP 55

**Type of construction IM V1 [IM 3011]**

Flange dimensions see table „flange dimensions“



| Type designation     | Flange size | AC g | AD g1 | AD **) | D d | DA d1 | DB *) | E I | EA I1 | F u | FA u1 | GA t | GC t1 | H h | HH A | L K  | LC K1 | Terminal box type | AG x | LL z | AH - | BE - | O r   | Bl Bl |
|----------------------|-------------|------|-------|--------|-----|-------|-------|-----|-------|-----|-------|------|-------|-----|------|------|-------|-------------------|------|------|------|------|-------|-------|
| P22R 355 MY4,6,8,12  | FF 740      | 715  | 736   | 817    | 100 | 80    | M24   | 210 | 170   | 28  | 22    | 106  | 85    | 355 | 250  | 1570 | 1755  | KK 630 A          | 496  | 390  | 301  | 140  | M72x2 | 60    |
| P22R 355 M4          | FF 740      | 715  | 736   | 817    | 100 | 80    | M24   | 210 | 170   | 28  | 22    | 106  | 85    | 355 | 250  | 1570 | 1755  | KK 630 A          | 496  | 390  | 301  | 140  | M72x2 | 60    |
| P22R 355 M6,8,12     | FF 740      | 715  | 736   | 817    | 100 | 80    | M24   | 210 | 170   | 28  | 22    | 106  | 85    | 355 | 250  | 1570 | 1755  | KK 630 A          | 496  | 390  | 301  | 140  | M72x2 | 60    |
| P22R 355 MX6,8,12    | FF 740      | 715  | 736   | 817    | 100 | 80    | M24   | 210 | 170   | 28  | 22    | 106  | 85    | 355 | 327  | 1690 | 1875  | KK 630 A          | 496  | 390  | 301  | 140  | M72x2 | 60    |
| P22R 355 MX4         | FF 740      | 715  | 728   | 819    | 100 | 80    | M24   | 210 | 170   | 28  | 22    | 106  | 85    | 355 | 327  | 1690 | 1875  | KK 1000 A         | 615  | 474  | 385  | 200  | M72x2 | 60    |
| P22R 355 LY,L4       | FF 740      | 715  | 728   | 819    | 100 | 80    | M24   | 210 | 170   | 28  | 22    | 106  | 85    | 355 | 327  | 1690 | 1875  | KK 1000 A         | 615  | 474  | 385  | 200  | M72x2 | 60    |
| P22R 355 L, LY6,8,12 | FF 740      | 715  | 728   | 819    | 100 | 80    | M24   | 210 | 170   | 28  | 22    | 106  | 85    | 355 | 327  | 1690 | 1875  | KK 1000 A         | 615  | 474  | 385  | 200  | M72x2 | 60    |

\*) Centre holes acc. to DIN 332-DS

\*\*) Terminal box left/right

## Permanent magnet synchronous motors for inverter operation

Size 225 to 355

Design with forced ventilation, type of cooling IC 416

changes in dimensions for design with forced ventilation and water cooling

| Type designation | L      |
|------------------|--------|
|                  | K      |
| P21F 225 M12     | 950.5  |
| P21F 250 M12     | 1016.5 |
| P21F 280 S12     | 1119   |
| P21F 280 M12     | 1165   |
| P21F 315 S12     | 1223.5 |
| P21F 315 M12     | 1278.5 |
| P21F 315 MX12    | 1278.5 |
| P21F 315 L12     | 1568.5 |
| P22F 355 MY12    | 1890.5 |
| P22F 355 M12     | 1890.5 |
| P22F 355 MX12    | 1890.5 |
| P22F 355 LY12    | 1890.5 |
| P22F 355 L12     | 1890.5 |

Design with water cooling, type of cooling 31W

| Type designation | L    | LC   |
|------------------|------|------|
|                  | K    | K1   |
| P21B 225 M12     | 710  | 830  |
| P21B 250 M12     | 737  | 857  |
| P21B 280 S12     | 875  | 1028 |
| P21B 280 M12     | 875  | 1028 |
| P21B 315 S12     | 909  | 1056 |
| P21B 315 M12     | 964  | 1111 |
| P21B 315 MX12    | 964  | 1111 |
| P21B 315 L12     | 1266 | 1410 |
| P22B 355 MY12    | 1405 | 1592 |
| P22B 355 M12     | 1405 | 1592 |
| P22B 355 MX12    | 1525 | 1712 |
| P22B 355 LY12    | 1485 | 1672 |
| P22B 355 L12     | 1525 | 1712 |





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