



## ELECTRIC DRIVES

FOR EVERY DEMAND



**Easy job with heavy loads**

VEM electric motors for cranes and hoists

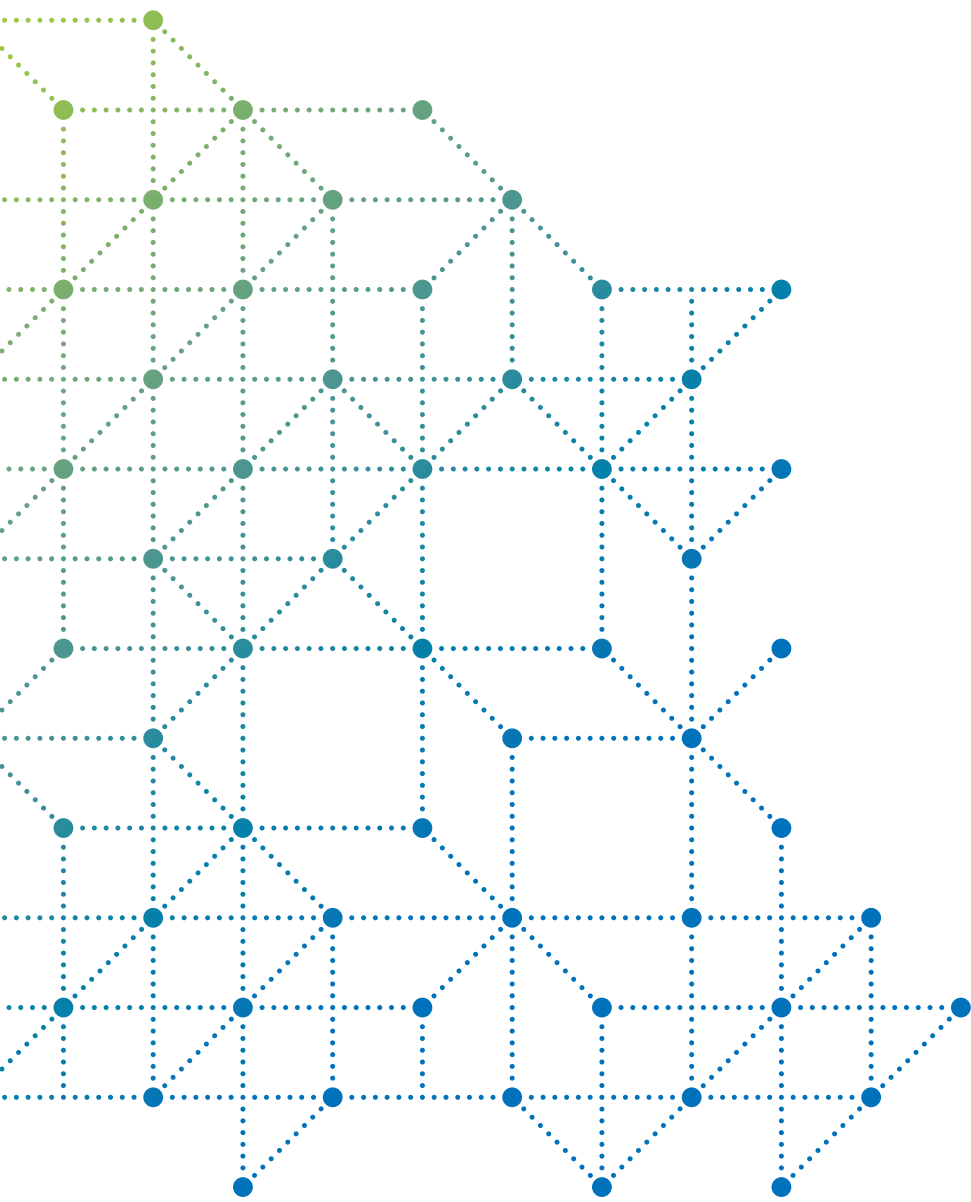
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## Introduction

VEM is an innovative, dependable and internationally recognised manufacturer of technically sophisticated system and drive solutions, as well as special drives and individual components. The product range covers practically the complete spectrum of electric motors and drives for industrial use. Through many years of experience in three-phase drive design, manufacturing, assembly and project development, VEM has gathered a wealth of know-how in many special fields of applica-

tion. One of these fields is the crane and harbour industry, with its extremely challenging demands and operating conditions. VEM has developed a full, complex package of drive solutions tailored to the specific requirements of this sector. This package includes standard as well as special motors for particular applications like hoist, boom, trolley and gantry.

## VEM – your competent partner for drive questions

Wherever our customers need electric machines, we are at hand as a partner and offer every necessary support at all phases of a project. It is not important whether you are doing business in Europe, the Middle East, Asia or America. As the VEM market share increases also outside Germany, we are also expanding our sales network with a combination

of own subsidiary companies and strategic alliances. Already today, our customers can address their questions to competent and experienced local partners all over the world. The dense network of sales and service contacts comprises agents and representatives in more than 40 countries.

## About VEM

There are currently around 30 million electric machines bearing the VEM badge in use around the world. They are found aboard ships, in trains and trams as well as in chemical plants and rolling mills. VEM generators produce electricity in hydropower plants and wind farms.

The VEM product range embraces variable-speed electric drive systems, special motors and special machines for outputs ranging from 0.06 kW to 80 MW, as well as a diversity of drive technology and power generation components.



**Steel and rolling mills**



**Shipbuilding**



**Chemical, oil and gas industry**



**Transportation**



**Power plant technology**



**Cement and mining industry**



**Renewable energy**



**Machine and plant engineering**



**Water management**



**Material Handling**



## Information on applicable standards and regulations

### Notes on the application of (EG) 640/2009 + (EG) 4/2014 resp. (EU) 2019/1781 + (EU) 2021/341

With Commission Regulation (EC) No. 640/2009 of 22<sup>nd</sup> July 2009, which serves to implement European Directive 2005/32/EC, minimum efficiency classes (Minimum Efficiency Performance Standard, MEPS) are now stipulated on the basis of EN 60034-30:2009 and are to be gradually introduced in the market for certain types of electric motor. It was repealed by the Commission on 30.06.2021.

In its place, the new VO(EU) 2019/1781 and its amendment and supplement VO(EU) 2021/341 entered into force. The determination of the minimum performance classes is based on IEC/EN 60034-30-1:2014.

### Which deadlines apply for the introduction of minimum efficiency classes according to (EU) 2019/1781 + (EU) 2021/341?

In addition to the already existing stipulations from the Regulations, the conditions for the following products will be tightened according to the following schedule:

#### Stage 1 since 1<sup>st</sup> July 2021:

- minimum efficiency (MEPS) IE3 for three-phase motors with a rated output power of not less than 0.75 kW and not more than 1 000 kW, 2 - 8 pole, (except Ex eb motors),
- minimum efficiency (MEPS) IE2 for three-phase motors with a rated output power of at least 0.12 kW and less than 0.75 kW, 2 - 8 pole.

#### Stage 2 from 1<sup>st</sup> July 2023:

- minimum efficiency (MEPS) IE2 for Ex eb motors with a rated output power of 0.12 kW to 1,000 kW, 2 - 8 pole.
- minimum efficiency (MEPS) IE2 for single-phase motors with a rated output power of at least 0.12 kW.
- minimum efficiency (MEPS) IE4 for three-phase motors with a rated output power of 75 kW to 200 kW, 2 - 6 poles (does not apply to brake motors and explosion-proof motors.)

The manufacturer guarantees to the customer by way of CE marking that the required nominal efficiency is attained and that the rated efficiency specified on the rating plate is observed.

The permissible tolerances specified in IEC/EN 60034-1 continue to apply.

### Which motors are covered by (EU) 2019/1781 + (EU) 2021/341

Single-speed three-phase asynchronous motors with squirrel-cage rotor for 50 Hz and/or 60 Hz which are designed:

- with a rated voltage  $U_n$  of more than 50 V and up to and including 1,000 V,
- with a rated output power  $P_n$  of 0.12 kW up to and including 1,000 kW,
- with 2, 4, 6 or 8 poles,
- on the basis of the operating mode S1 (continuous operation) or S3 (periodic intermittent operation) or S6 (continuous intermittent duty) with a relative duty cycle of 80 % or more, or are rated,
- are suitable for direct mains operation,
- rated for operating conditions in accordance with IEC/EN 60034-1, section 6.

### Which motors are not covered by Commission Regulations (EU) 2019/1781 + (EU) 2021/341?

- motors which are designed to be operated wholly immersed in a liquid,
- motors which are fully integrated into a product (e. g. a gearbox,

pump, fan or compressor) such that the energy efficiency cannot be determined separately from the product,

- motors which are designed specifically for operation under the following conditions:
  - altitude more than 4000 metres above sea level,
  - ambient temperatures above 60 °C,
  - maximum operating temperatures above 400 °C,
  - ambient temperatures below –30 °C (any motor) or below 0 °C (water-cooled motor),
  - coolant temperatures below 0 °C or above 32 °C at the inlet to a product,
  - potentially explosive atmospheres in the sense of Directive 2014/34/EU
- motors with an integrated brake,
- motors with an integrated speed control (compact drives),
- motors for nuclear installations according to Council Directive 2009/71/Euratom,
- explosion-proof motors, designed for underground installations according to Directive 2014/34/EU,
- motors in cordless or battery-operated equipment,
- motors in hand-held equipment whose weight is supported by hand during operation,
- motors in hand-guided mobile equipment moved while in operation,
- motors with mechanical commutators,
- totally enclosed non-ventilated (TENV) motors,
- motors placed on the market before 1<sup>st</sup> July 2029 as substitutes for identical motors integrated in products placed on the market before 1<sup>st</sup> July 2022, and specifically marketed as such,
- multi-speed motors, i.e. motors with multiple windings or with a switchable winding, providing a different number of poles and speeds,
- motors designed specifically for the traction of electric vehicles.

### New requirements for documentation according to (EU) 2019/1781 + (EU) 2021/341

From 1<sup>st</sup> July 2021, the information set out in points 1 to 13 is to be displayed visibly:

- in the technical documentation of motors,
- in the technical documentation of products into which motors are incorporated,
- on freely accessible websites of the manufacturers of motors,
- on freely accessible websites of the manufacturers of products into which motors are incorporated.

In the technical documentation, the information must be provided in the order as presented in points 1 to 13. It is not imperative to use the exact wording used in the list. The information may also be presented using graphs, diagrams and symbols.

- nominal efficiency ( $\eta$ ) at 100 %, 75 % and 50 % of the rated load and voltage ( $U_n$ );
- efficiency level: "IE2", "IE3" or "IE4"
- manufacturer's name or trademark, commercial registration number and place of business,
- product model number,
- number of poles of the motor,
- rated power output(s) or range of rated power output [kW],
- rated input frequency(-ies) of the motor (Hz),
- rated voltage(s) or range of rated voltage [V],
- rated speed(s) or range of rated speed [rpm],
- indication of whether the motor is single-phase or three-phase,
- information on the range of operating conditions for which the motor is specifically designed:
  - altitudes above sea level



- (ii) ambient air temperatures, also for motors with air cooling
  - (iii) water coolant temperature at the inlet to the product
  - (iv) maximum operating temperature
  - (v) potentially explosive atmospheres
12. indication of the reason why the motor is exempted from Regulation (EU) 2019/1781 or Regulation (EU) 2021/341.
  13. indication of power losses as a percentage (%) of the rated output power for the following operating points (speed vs. torque): (25;25)

(25;100) (50;25) (50;50) (50;100) (90;50) (90;100).

The placing on the market of non-classified, IE1 or IE2 standard motors, to which Regulation (EU) 2019/1781 or Regulation (EU) 2021/341 applies, is no longer permitted within the EU as of 1<sup>st</sup> July 2021. Since 23<sup>rd</sup> February 2021, the conditions tightened by Regulation (EU) 2021/341 have also applied.

## VEM - qualified and certified worldwide

Quality, environmental energy management	Chemicals, oil & gas	Shipbuilding
<ul style="list-style-type: none"> <li>EN ISO 9001</li> <li>EN ISO 14001</li> <li>EN ISO 50001</li> <li>EN ISO/IEC 80079-34</li> </ul>		

## Product-specific approvals and certificates for selected countries

- EAC declaration for the Eurasian Economic Union (EEU) and Uzbekistan
- UL approval for low-voltage motors („recognized components“) Sizes 56 to 400 for the USA and Canada
- CSA approval for low-voltage motors („recognized components“) Sizes 56 to 315 for Canada and the USA
- CSA approval (EEV) for energy-saving motors („recognized components“) Sizes 112 to 315 („Energy Verified“)
- UL approval (EEV) for energy-saving motors („recognized components“) Sizes 80 to 400 („Energy Verified“)
- DoE approval (CC301B) for energy-saving motors Sizes 80 to 400
- CEL – China Energy Label



## Standards and regulations

The motors comply with all relevant standards and regulations, in particular with the following:

Title	International IEC	Europe EN
Rotating electrical machines. Rating and performance	IEC 60034-1	EN 60034-1
Methods for determining losses and efficiency of rotating electrical machinery from tests	IEC 60034-2-1	EN 60034-2-1
Efficiency classes of single-speed, three-phase, cage-induction motors	IEC 60034-30-1	EN 60034-30-1
Degrees of protection provided by the integral design of rotating electrical machines (IP code) – Classification	IEC 60034-5	EN 60034-5
Methods of cooling (IC code)	IEC 60034-6	EN 60034-6
Classification of types of construction, mounting arrangements and terminal box position (IM code)	IEC 60034-7	EN 60034-7
Terminal markings and direction of rotation	IEC 60034-8	EN 60034-8
Noise limits	IEC 60034-9	EN 60034-9
Starting performance of single-speed three-phase cage induction motors	IEC 60034-12	EN 60034-12
Mechanical vibration of certain machines with shaft heights 56 mm and higher – Measurement, evaluation and limits of vibration severity	IEC 60034-14	EN 60034-14
Balance quality requirements	ISO 1940	-
IEC standard voltages	IEC 60038	-
Electrical insulation – Thermal evaluation and designation	IEC 60085	-
General purpose three-phase induction motors	IEC 60072-1	EN 50347

VEM motors comply furthermore with various foreign regulations which are either based on IEC 60034-1 or else transpose the latter's stipulations as European standard EN 60034-1.

The following temperature-rise limits apply in conjunction with the aforementioned standards and regulations:

Regulation	Cooling air temperature	Permissible temperature-rise limit in K (measured by resistance method)				
Thermal class acc. to EN 62114	°C	105 [A]	120 [E]	130 [B]	155 [F]	14,80 [H]
EN 60034-1	40	60	75	80	105	125
IEC 60034-1	40	60	75	80	105	125
Great Britain	40	60	75	80	105	125
Italy	40	60	70	80	105	125
Sweden	40	60	70	80	105	125
Norway	40	60	-	80	105	125
Belgium	40	60	75	80	105	125
France	40	60	75	80	105	125
Switzerland	40	60	75	80	105	125

## Type designation

The type designation comprises 7 basic parts + a code for special versions, namely

- the energy efficiency class,
- the motor version,
- the series code,
- the type of cooling,
- the size/ shaft height,
- the foot length and a supplementary code for output definition
- the number of poles, and
- the special version code, which are strung together to form a

complete motor designation. It is not imperative for each of the 8 elements to be present. In the following, the individual elements are explained together with their possible combinations. Deviations from the type designation are only permissible for certified series, for example CSA-certified motors are only available as K11R.

The type code is valid for newly determined ID numbers from the date of publication.

IE3	-	W	4	3	R	160	M	X	2	IL	...	HW
1		2		3	4	5		6	7	8		

### 1. Energy efficiency class

	Designation	Standard
(none)	Not classified	-
IE2	High Efficiency	IEC/EN 60034-30-1
IE3	Premium Efficiency	IEC/EN 60034-30-1
IE4	Super Premium Efficiency	IEC/EN 60034-30-1

### 2. Motor version

	Designation
W	Energy-efficient motor
WK	Crane series
B	Brake motor (squirrel-cage rotor)
K	Squirrel-cage motor
S	Slip-ring motor

### 3. Series

	Designation
	Not specified in case of three-phase transnorm motors as welded steel construction
E1	Energy-saving series with efficiency class IE2, design generation 1
E2	Energy-saving series with efficiency class IE2, design generation 2 (all sizes/numbers of poles)
20	Construction type 2, progressive IEC-series
21	Construction type 2, IEC/DIN-series
25	Construction type 2, progressive series, DIN-shaft height/allocation of output
41	Energy efficient series with efficiency class IE3
42	Energy efficient series with efficiency class IE3, Standard motors, modified electrical design
43	Energy efficient series with efficiency class IE3, optimized motor series
45	Energy efficient series with efficiency class IE3, DIN-shaft height/allocation of output
61	Energy efficient series with efficiency class IE4/ IE5

### 4. Type of cooling

#### 4.1 Standard series

	Designation	Type of cooling
A	Internal cooling (self-cooling, external cooling)	IC 01, IC 06
F	Ribcooling with forced ventilation	IC 416
O	Ribcooling without self ventilation	IC 410
R	Ribcooling with self ventilation	IC 411

### 5. Size

63, 71, 80, 90, 100, 112, 132, 160, 180, 200, 225, 250, 280, 315, 355, 400, 450, 500, 560, 630

### 6. Foot length/supplementary code for output definition

Foot length	Designation	Supplementary code	Designation
S	short	X	Higher output in case of two outputs/foot length
M	medium	Y	Reduced output <sup>*)</sup>
L	long	Z	Higher output in case of three outputs/foot length

<sup>\*)</sup> increased output for size 315



## 7. Number of poles

2p=	Synchronous speed n (at 50 Hz) [rpm]
2	3,000
4	1,500
6	1,000
8	750
10	600
12	500
16	375
20	300
24	250

Hyphen as separator in case of pole-switching motors, descending number of poles

## 8. Codes for special versions

IL	Insulated bearing
TPM	Thermal winding protection with PTC thermistor
WE	Special shaft

For further details, see overview of modifications

## Name plate

In the normal standard version, the motor name plate displays information in the German and English languages. Other languages are possible, though an extra charge must be made for non-EU languages. The name plate displays the most important rating data, such as the type designation and motor number, output, rated voltage and frequency, rated current, type of construction, type of protection, power factor, speed and thermal class.

The scope of information may vary according to motor type. In the case of motors with relubrication system, the relubrication interval and the grease amount per lubrication cycle are also specified either on the name plate itself or on an additional plate. Name plates are attached to the housing using grooved pins such that they are permanently secure. They can be made of aluminium or stainless steel (extra charge). Consultation is necessary if additional plates are required.

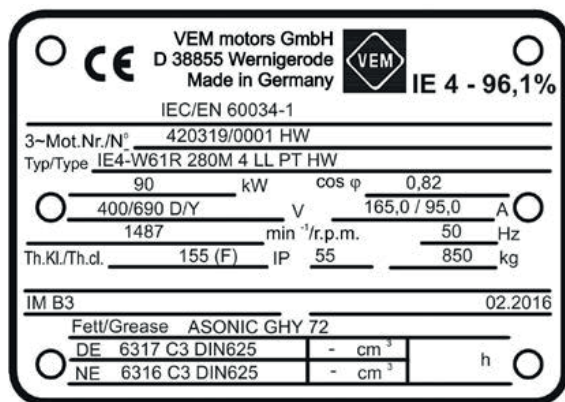


Figure: Example of a name plate for IE4 standard motor

## Cooling and ventilation

The motors are fitted with radial fans made from plastic or cast aluminium alloy, which provide cooling independently of the running direction of the motor (IC 411 to IEC/EN 60034-6).

For noise reasons, 2-pole motors with shaft height 355/400 can only be supplied with low-noise, direction-dependent fans. If requested by the customer, 2-pole motors with smaller shaft heights can also be fitted

with a low-noise, direction-dependent fan. When installing the motors, a minimum clearance between the fan cowl and the wall (dimension BI) must be observed to ensure correct cooling. The fan cowl is always manufactured in sheet steel.

## Design versions

Motors comprise the following main components:

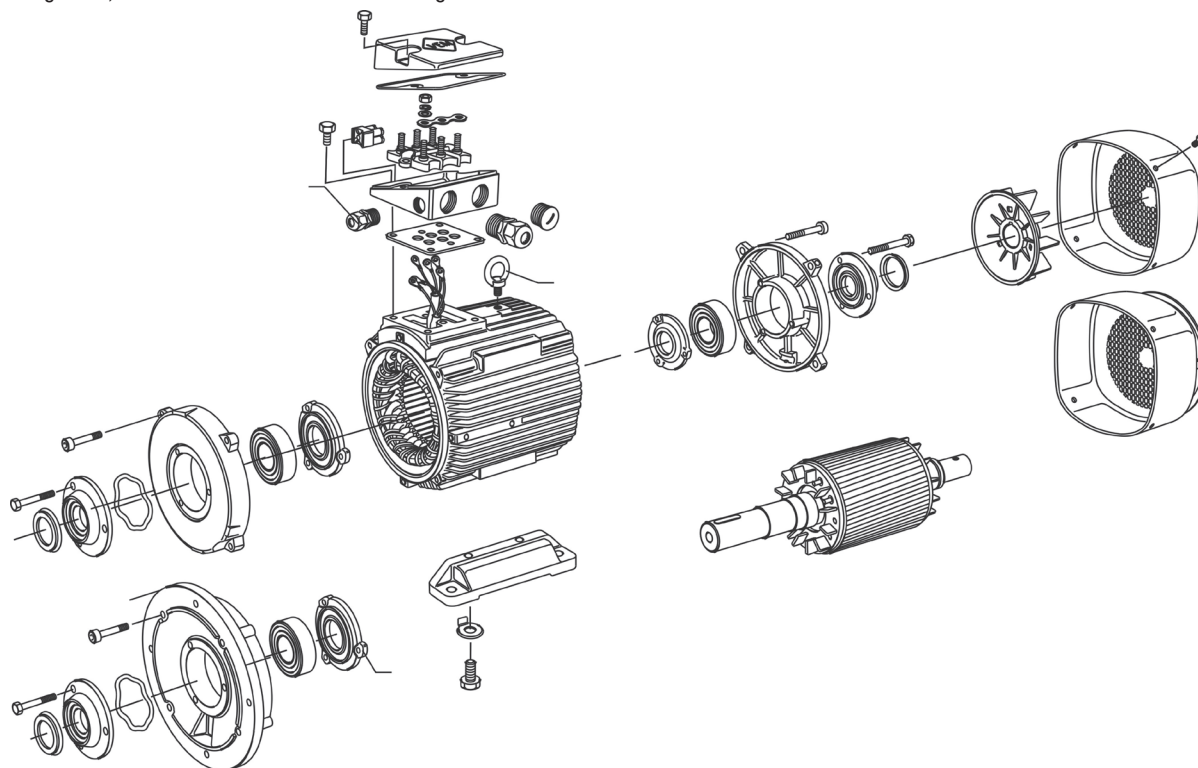
- stator housing with laminated core and winding
- end shields with bearings
- die-cast rotor (aluminium or copper)
- fan with fan cowl
- terminal box

The motor space is defined by the housing, the two end shields, the outer bearing cover, the shaft seal and the terminal box gasket. Stator hous-

ings are always manufactured

in grey cast iron, with radially or horizontally/vertically arranged cooling ribs. A flange surface with a corresponding opening to the housing inner is cast-on for mounting of the terminal box and terminal base. The flange surface is covered by the terminal box gasket. The terminal box can be arranged on the right, on the left or on the top.

In the case of heavy-duty roller table motors, ring-ribbed housings are used.



Design of an IE3-A4.R motor, schematic representation

Shaft height	Series	Material for housing   end shields   feet	Foot mounting
63 to 132 T	KPER, K21R, W.2R	Grey cast iron	Bolted
100 LX	KPER, K21R, W.2R		Cast-on
132 to 280	K11R, K21R, W.1R, W.2R		Bolted
315	K11R, K21R, W.1R, W.2R, PE.R		Cast-on
355, 400	K22R, W22R, WE1R, WE2R, W41R, W42R		
56 to 100	KPR, K20R		Cast-on
112 to 250	K10R, K20R		Bolted
280 to 315	K10R, K20R		Cast-on
225 to 450	K33A	Sheet steel   Grey cast iron   Grey cast iron	Cast-on
	W2BA	Sheet steel   Grey cast iron   Sheet steel	Welded
132 to 280	K2.R, W.1R, W.2R, W.3R	Grey cast iron	Cast-on
132 to 280	WK.R	Grey cast iron	Cast-on
132 to 250 M	SPER, SPEH	Grey cast iron	Bolted
250 MX to 315	S11R, S11H		Cast-on
132 to 225	SPR, SPH		Bolted
250 to 280	S10R, S10H		Cast-on

## Degree of protection

Overview of possible degrees of protection in accordance with IEC/EN 60034-5, EN 60529:

Against penetration of foreign objects		Not protected	$\geq 1,0 \text{ mm}$	Dust-proof	Dust-tight
Against contact with hazardous parts		Not protected	Wire	Wire	
	1 <sup>st</sup> numeral →	0	4	5	6
Against harmful ingress of water		2 <sup>nd</sup> numeral			
Not protected	0	IP 00			
Splashed water	4		IP44	IP54	
Water jets	5			IP55	IP65
Powerful water jets	6			IP56	IP66
Temporary immersion	7			IP 57S <sup>1)</sup>	IP67

<sup>1)</sup> S ... Standstill

The motors possess condensate drain holes in the end shields (by request only for shaft heights up to 132 T); these holes are closed with plastic plugs.

In case of motors with a shaft end pointing upwards, the user must take appropriate precautions to prevent the penetration of water along the shaft.

On flange motors of construction types IM V3 / IM V36, a drain hole is provided as standard to prevent the collecting of liquid in the flange end. Where motors are to be used or stored outdoors, a corresponding roof or additional covers are recommended in order to avoid long-term exposure to direct sunlight, rain, snow and dust, and to eliminate the risk of the fan freezing up due to direct snowfall or icing. In such cases, it is recommended to consult the manufacturer for technical clarification.

The machines are suitable for use in tropical environments.

Guide value of 60 % relative humidity at

coolant temperature 40 °C

ambient temperature: -20 °C to +40 °C

Installation altitude:  $\leq 1000$  metres above sea level

The use of non-rusting bolts and screws (option) is recommended if the motor is to be used outdoors or in a corrosive environment. Any deviating ambient conditions are specified on the motor rating plate.

The specifications on the rating plate shall then apply.

## Vibration response and balancing

The permissible vibration severities for electric motors are specified in standard EN 60034-14.

VEM motors already meet or remain below the limit values specified for

vibration severity grade A (normal, with designation on the name plate) in their basic versions. Vibration severity grade B (special code "SGB" in the type designation) can be supplied at extra charge.

EN 60034-14 recommends the following values:

Vibration severity grade	Shaft height H	56 ≤ H ≤ 132			132 ≤ H ≤ 280			280 > H		
	Machine installation	$s_{\text{eff}}$ [μm]	$v_{\text{eff}}$ [mms <sup>-1</sup> ]	$a_{\text{eff}}$ [ms <sup>2</sup> ]	$s_{\text{eff}}$ [μm]	$v_{\text{eff}}$ [mms <sup>-1</sup> ]	$a_{\text{eff}}$ [ms <sup>2</sup> ]	$s_{\text{eff}}$ [μm]	$v_{\text{eff}}$ [mms <sup>-1</sup> ]	$a_{\text{eff}}$ [ms <sup>2</sup> ]
A	Free suspension	25	1.6	2.5	35	2.2	3.5	45	2.8	4.4
	Rigid mounting	21	1.3	2.0	29	1.8	2.8	37	2.3	3.6
B	Free suspension	11	0.7	1.1	18	1.1	1.7	29	1.8	2.8
	Rigid mounting	-	-	-	14	0.9	1.4	24	1.5	2.4

Grade A is applicable for machines with no special vibration requirements.

This grade is essentially equivalent to the old grade N in case of free suspension. For motors from size 250, the limit values are tightened from 3.5 mm/s to 2.8 mm/s. This corresponds to the former limit value for R at speeds > 1800 rpm.

Grade B is applicable for machines with special vibration requirements.

This grade is essentially equivalent to the old grade S in case of free suspension. The corner frequencies for vibration displacement/vibration velocity and vibration velocity/vibration acceleration are 10 Hz and 250 Hz, respectively. It must be noted that the measured values may deviate from the actual values by  $\pm 10\%$  due to the tolerances of the measuring devices.

With regard to the routine testing of machines with speeds between 600 and 3600 rpm, EN 60034-14 states that it is sufficient to measure the vibration velocity.

All rotors are balanced dynamically with a half-key in place. This balancing is documented on the name plate by way of the letter "H" after the motor number. Upon request, it is possible to perform balancing with a full key. This is subsequently indicated by the letter "F" after the motor number.

In case of converter-fed operation with frequencies greater than 60 Hz, special balancing is required to observe the specified limit values (high-speed version, special code "HS" in the type designation).

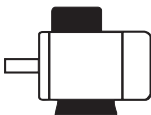

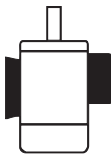

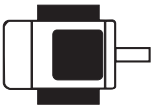
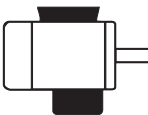
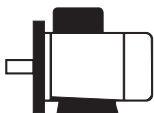





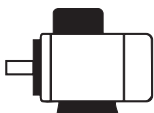


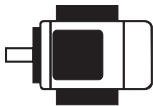
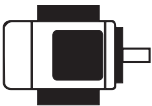
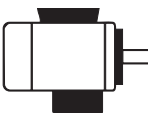



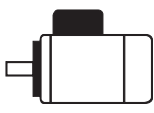




## Types of construction

The most common types of construction are shown in the table below. Further types of construction can be supplied upon request. The type of construction is indicated on the name plate in accordance with Code I, EN 60034-7. Standard motors which are ordered in a basic type in sizes 56 to 200 can also be operated with the following derived types of construction.

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

Motors of types IM V5, IM V1 or IM V18 can be designed with an optional protective canopy to prevent small parts falling into the motor. With types of construction with the shaft end pointing upwards, it is the responsibility of the user to provide a suitable cover to prevent small parts falling into the fan shroud (see also standard IEC/EN 60079-0). The cooling air flow must not be hindered by the cover. From size 225, it is necessary to consult the manufacturer regarding types of construction IM V5, IM V6, IM B6, IM B7 and IM B8. The types of construction IM B5 and IM V3 are not available for frame sizes from 315 L. To facilitate connection to the mains power supply, the terminal box can be rotated by 90° with all types of construction.

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

## Bearings

VEM motors are fitted with anti-friction bearings from leading manufacturers. The nominal service lifetime of the bearings is at least 10,000 hours for 2-pole motors or 20,000 hours for motors with 4 or more poles, assuming full exploitation of the maximum permissible load. The nominal service lifetime of the bearings for motors installed

in a horizontal position without additional axial load is 40,000 hours in coupled operation. Under average operating conditions, with loads below the maximum permissible load, a nominal service life  $L_{h10}$  of 10,000 hours can be achieved. Detailed specifications are to be found in the Main Catalogue.

## Bearing monitoring

To permit monitoring of the condition of the bearings, motors can be fitted with or prepared for the fitting of temperature, shock pulse and vibration sensors. PT100-type temperature sensors can be mounted at the bearing points in 2-, 3- or 4-wire configurations. The sensors are connected at the main terminal box or else in a separate box mounted either on the main terminal box or on the motor housing,

depending on the individual design.

For monitoring of the wear of the anti-friction bearings, shock pulse sensors [SPM] can be mounted on the end shields from size 132. This permits monitoring by way of mobile recording units. It is also possible to use hard-wired shock pulse or vibration sensors to enable remote monitoring.

## Use of insulated bearings

When motors are operated on the mains, magnetic asymmetries result in a voltage along the shaft. This shaft voltage causes compensating currents to flow between the rotor and stator via the anti-friction bearings. If the voltage exceeds a threshold of 500 mV, the bearings may be damaged. The design of VEM standard motors ensures that this value can never be exceeded.

The effects may be intensified in case of converter-fed operation. The converter design is a decisive influencing factor. Pulse-controlled con-

verters produce especially high-frequency voltages and currents dependent on the pulse frequency and the pulse modulation. Output filters in the converter minimise these effects. To avoid bearing damage, motors for converter-fed operation from size 315 MY are always fitted with an insulated bearing on the non-drive end.

In addition to this measure, it is always imperative to provide for proper earthing of the motor housing in order to drain the currents circulating between the converter and stator.

## Shaft ends

IEC 60034-7 defines the two sides of a motor as follows:

D-end (DS): Drive side of the motor (drive end)  
N-end (NS): Side of the motor opposite the drive (non-drive side)  
Centre holes in accordance with DIN 332, sheets 1 and 2, form DS.

The keys and keyways are machined in accordance with DIN 6885 sheet 1, form A or B for frame sizes 56 – 112 and in accordance with DIN 6885 sheet 1, form A for frame sizes 132 – 355. The lengths of the keys comply with EN 50347 for shaft heights 132 – 355.

### Threads for fitting and pulling fixtures

Shaft end diameter	Thread
from 7 to 10 mm	M3
from 10 to 13 mm	M4
from 13 to 16 mm	M5
from 16 to 21 mm	M6
from 21 to 24 mm	M8
from 24 to 30 mm	M10
from 30 to 38 mm	M12
from 38 to 50 mm	M16
from 50 to 85 mm	M20
from 85 to 130 mm	M24

The motors are always supplied with the shaft key inserted.

## Noise ratings

Noise levels are measured at rated output, rated voltage and rated frequency in accordance with EN ISO 3741. EN 60034-9 stipulates that the noise level in dB(A) is to be specified as the spatial mean value of the sound pressure level  $L_{pA}$  measured at a distance of 1 metre from the machine contour.

The A-weighted sound power level  $L_{WA}$  over the measuring surface  $L_s$  ( $d = 1$  m) is calculated with

$$L_{WA} = L_{pA} + L_s \quad (\text{dB})$$

The second shaft is able to transmit the full nominal output in the case of a coupled drive. The output transmitted by the second shaft end in the case of belt, chain and pinion drives can be notified upon request. Slotted drive elements, such as belt pulleys or couplings, must be balanced with a half-key to at least balance quality grade G 6.3 according to DIN ISO 1940-1.

### True running of the shaft ends

The true running of the shaft ends complies with the requirements of EN 50347. The relevant values can be reduced by 50% as an option (extra charge).

The measuring surface level is dependent on the machine geometry and is for

Frame size	$L_s$ (dB)
56 – 132	12
160 – 225	13
250 – 315	14
355	15

The noise values for the main series are presented in tabular form. For machines in 60 Hz versions, a value 4 dB(A) higher than the table value can be taken as a guideline. Binding specifications for 60 Hz upon request. Consultation is necessary with regard to special series.

## Winding and insulation

VEM motors are designed for thermal class 155 [F] as standard. High-quality enamelled wires and insulating sheet materials are used in conjunction with low-solvent resin impregnation. The standard insulation system accommodates rated voltages up to 725 V [mains infeed]. It

guarantees high mechanical and electrical strength, and provides for a long service life.

Further winding systems especially for frequency converter operation are available as below.

### IVIC - impulse voltage insulation classes in accordance to IEC 60034-18-41

Rated voltage $U_N$	220 - 290		380 - 400		415		440 - 500		660 - 690		$U_{pk/pk}$		$t_r$
$U_{pk/pk}$	Ph-Ph	Ph-Earth	Ph-Ph	Ph-Earth	Ph-Ph	Ph-Earth	Ph-Ph	Ph-Earth	Ph-Ph	Ph-Earth	Ph-Ph	Ph-Earth	
Standard	D	D	C	C	B	B	B	B	A	A	2,380	1,680	> 0.3
KU			D	D	D	D	C	C	B	B	3,100	2,160	> 0.3
KV			D	D	D	D	D	D	C	C	4,100	2,870	> 0.3

IVIC    A    low  
           B    medium  
           C    high  
           D    extreme

$U_{pk/pk}$     max. peak-to-peak operating voltage in V  
 Ph-Ph    phase-phase  
 Ph-Earth    phase-earth  
 $t_r$     impulse rise time in  $\mu s$

## Rated voltage and frequency

In their basic versions, motors are supplied for the following rated voltages and frequencies:

230/ 400 V  $\Delta/Y$ , 50 Hz                      220...240 V  $\Delta$ / 380...420 V Y, 50 Hz  
 400/ 690 V  $\Delta/Y$ , 50 Hz                      380...420 V  $\Delta$ / 660...725 V Y, 50 Hz  
 500 V, 50 Hz                                      475...525 V, 50 Hz

275/ 480 V  $\Delta/Y$ , 60 Hz                      265...290 V  $\Delta$ / 460...500 V Y, 60 Hz  
 600 V, 60 Hz                                      570...630 V, 60 Hz

The motors can be operated without modification of the rated output on mains systems where the voltage at rated frequency deviates by up to + 5% from the nominal value (rated voltage range A). At rated voltage, the frequency in these mains systems may deviate by  $\pm 2\%$  from the nominal value. The aforementioned standard voltages to DIN IEC 60038 are taken to define the design point. Special voltages and frequencies are possible by customer request.

Motors which are to be suitable for a mains voltage to DIN IEC 60038 with an overall tolerance of  $\pm 10\%$  are selected according to the corresponding rated voltage as listed in the technical tables. The rated voltage range limited by  $U_u$  and  $U_o$  is similarly specified there.

If the motors are fed with voltages between 95% and 105% of the rated voltage range (corresponding to the relevant mains voltage to DIN IEC 60038  $\pm 10\%$ ), then it is permissible – in accordance with EN 60034-1 – for the temperature-rise limit of the stator winding to be exceeded by approximately 10 K already at the voltage and frequency limits of the rated range, without taking into account the tolerances.

For motors of sizes 56 to 112 (DIN)/56 to 100 (progressive series), the current for the upper voltage range  $U_o$  is set such that, given normal setting of the motor circuit-breaker to  $1.05 \times I_n$ , the breaker will also not be tripped in no-load operation and at  $\pm 5\%$  tolerance.

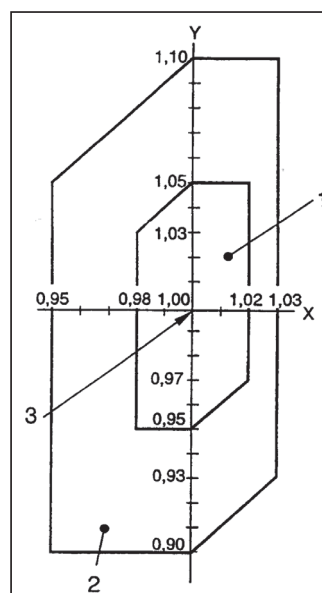


Figure: Voltage and frequency limits for motors in accordance with EN 60034-1

1 Range A  
 2 Range B  
 3 Design point  
 x Relative frequency  $f/f_N$   
 y Relative voltage  $U/U_N$



## Rated output

The specified rated output applies for continuous operation to EN 60034-1 and refers to a coolant temperature of 40 °C, installation at an altitude ≤ 1,000 m above sea level, operating frequency 50 Hz and rated voltage. The series A4.R possess thermal reserves which permit the following type-dependent continuous loads:

- Output up to 10% above rated output at coolant temperature 40 °C
- Rated output up to coolant temperature 50 °C
- Rated output at altitudes up to 2500 m

The above alternative conditions are mutually exclusive. If more than one condition applies, it is necessary to reduce the output. In such cases, consultation with the manufacturer is recommended.

## Motor torque

The rated torque (in Nm) delivered at the motor shaft amounts to

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

where P = Rated output in kW  
n = Speed in rpm

In the motor selection data, the starting, pull-up and breakdown torques are given as multiples of the rated torque.

If the voltage deviates from its rated value, this results in an approximately quadratic change in the torque.

## Ambient temperature

All VEM motors are suitable for ambient temperatures from -20 °C to +40 °C in their basic versions. Motors can be used at ambient temperatures down to -40 °C, provided they have been ordered specifically for such conditions. In case of deviating ambient temperatures at instal-

lation sites below 1,000 m above sea level, the following factors are applied to determine the permissible output, depending on the thermal class:

Coolant temperature °C	10	15	20	25	30	35	40	45	50	55	60	70
Thermal class factor F	1.21	1.17	1.14	1.10	1.07	1.03	1.00	0.95	0.90	0.85	0.80	0.68

Table 5: Factors for adjustment of the permissible output in case of deviating coolant temperatures

If frequent moisture condensation is to be expected at the place of motor installation, we recommend the use of a space heater or other suitable precautions.

## Installation altitude

Unless specified otherwise by the customer, it is assumed that the place of installation is not more than 1,000 m above sea level. If the machine is to be operated at an altitude above 1,000 m but below 4,000 m above sea level, the limit values for the temperature rise remain unchanged. The rated output, however, is subject to the following adjustment factors:

In case of installation at altitudes > 4,000 m, the limit values for temperature rise must be agreed separately between the manufacturer and the customer.

Altitude above sea level in m	Coolant temperature in °C					
	< 30	30 – 40	45	50	55	60
1,000	1.07	1.00	0.95	0.90	0.85	0.80
1,500	1.04	0.97	0.93	0.89	0.84	0.79
2,000	1.00	0.94	0.90	0.86	0.82	0.77
2,500	0.96	0.90	0.86	0.83	0.78	0.74
3,000	0.92	0.86	0.82	0.79	0.75	0.70
3,500	0.88	0.82	0.79	0.75	0.71	0.67
4,000	0.82	0.77	0.74	0.71	0.67	0.63

Table: Adjustment factors for altitude/coolant temperature

## Overload capacity

In accordance with EN 60034-1, all motors can be subjected to the following overload conditions:

- 1.5 x rated current for a duration of 2 minutes
- 1.6 x rated torque for a duration of 15 seconds

Both conditions apply for rated voltage and rated frequency.

## Rated efficiency and power factor

The efficiency  $\eta$  and the power factor  $\cos \phi$  are given in the lists of motor selection data.

## Restarting with residual field and phase opposition

When an electric machine is switched off, a voltage system remains effective in its winding for a short time on account of the decaying magnetic field. Restarting could result in transient electrodynamic reactions

in the machine. VEM motors can be restarted against a 100% residual field and phase opposition after mains failure.

## Motor protection

Upon request, the following motor protection variants are possible:

- Motor protection with PTC thermistors as temperature sensors in the stator winding
- Bi-metal temperature sensor as normally closed or normally open contact in the stator winding
- KTY silicon sensors
- Resistance thermometer for winding or bearing temperature monitoring
- Bearing vibration diagnosis

## Duty type

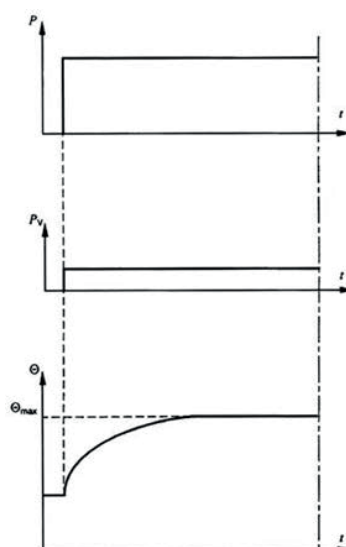
Special duty types for crane motors are S1, S2, S3 and S9, others are possible upon request.

EN 60034-1 defines the following nominal duty type, which take into account thermal and mechanical conditions:

### Duty type S1 – Continuous duty

Operation with a constant load which remains effective for a sufficient duration for the machine to reach thermal equilibrium. If no duty type is indicated on the name plate, the motor is designed for continuous duty S1. In the motor selection data lists, the rated data are specified for this duty type.

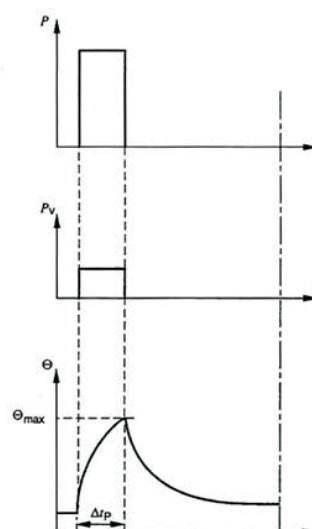
$P$	load
$P_v$	electrical losses
$\theta$	temperature
$\theta_{max}$	maximum temperature
$t$	time



### Duty type S2 – Short-time duty

Operation with a constant load which does not remain effective for a sufficient duration for the machine to reach thermal equilibrium, and a subsequent period of standstill with de-energised windings which is sufficient for the machine temperature to fall back to a level which deviates from the temperature of the coolant by less than 2 K. In case of duty type S2, the duration of operation must be specified.

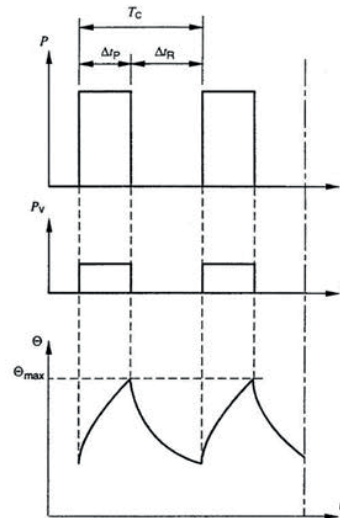
$P$	load
$P_v$	electrical losses
$\theta$	temperature
$\theta_{max}$	maximum temperature
$t$	time
$\Delta t_p$	duration of operation at constant load



### Duty type S3 – Intermittent periodic duty

Operation which comprises a succession of identical type, each of which consists of a period of operation with constant load and a period of standstill with de-energised windings, where the starting current does not significantly influence the temperature rise. The specification of this duty type must be accompanied by indication of the cyclic duration factor. Periodic duty means that the state of thermal equilibrium is not reached during the period of the load.

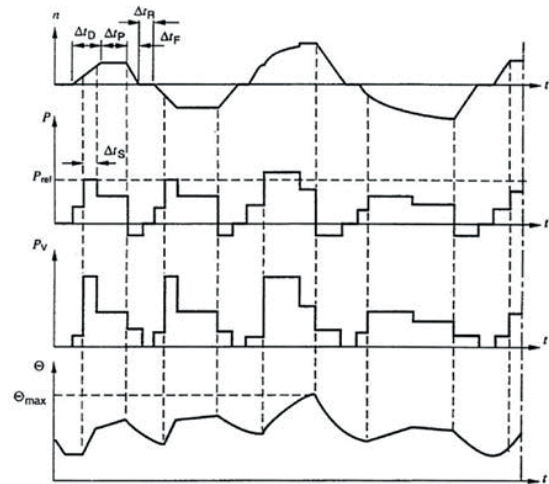
$P$	load
$P_v$	electrical losses
$\theta$	temperature
$\theta_{max}$	maximum temperature
$t$	time
$T_c$	cycle duration
$\Delta t_p$	duration of operation at constant load
$\Delta t_R$	duration of standstill with de-energised windings
	cyclic duration factor = $\Delta t_p / T_c$



### Duty type S9 – Continuous operation with non-periodic load and speed variation

Operation during which the load and speed generally vary non-periodically within a permissible operating range. This duty type frequently leads to overloads which far exceed the reference load. A suitable constant load corresponding to duty type S1 must be selected as the reference value for overload.

$P$	load
$P_{ref}$	reference load
$P_v$	electrical losses
$\theta$	temperature
$\theta_{max}$	maximum temperature
$n$	speed
$t$	time
$\Delta t_D$	starting period
$\Delta t_p$	duration of operation at constant load
$\Delta t_F$	duration of electrical braking
$\Delta t_R$	duration of standstill with de-energised windings
$\Delta t_S$	duration of overload



## Paint finish

Paint finishes must withstand the most diverse stresses and influences in order to ensure long-term reliable protection. With the switch to low-solvent paint systems, VEM has adapted its production to the tightened demands of the 31st Ordinance on Implementation of the Federal Immission Control Act (Ordinance regarding the reduction of VOC emissions resulting from the use of organic solvents in specific installations – German Solvent Ordinance) [31. BImSchV] and is thus making an active contribution to the improvement of environmental protection.

### Normal paint finish

Suitable for climate group “moderate” in accordance with IEC 60721-2-1: Indoor and outdoor installation, moderate climate (short-time exposure to relative humidity up to 100% at temperatures up to +30 °C; continuous exposure to relative humidity up to 85% at up to +25 °C)

### Special paint finish

Suitable for climate group “worldwide” in accordance with IEC 60721-

2-1: Outdoor installation in atmospheres with a general tendency to increased stress, tropical climate (short-time exposure to relative humidity up to 100% at temperatures up to +35 °C; continuous exposure to relative humidity up to 98% at up to +30 °C)

Without specifying the colour shade, all motors are supplied in RAL 7031 “blue grey”.

For divergent colour shades, the corresponding RAL number and colour designation must be stated when ordering.

Only the paint systems 04 and 07 provide a topcoat on the inside of the fan guard and on the N-side of the motor.

With the 09L/10L paint system, only the N side of the engine receives a topcoat.

The 09S/10S painting system includes painting of the fan guard on the inside as well as the entire paint structure (up to 250/200 μm) also on the N-side of the motor.



### Standard components VEM motors GmbH (Wernigerode)

Primer	GG: Hydro-dip primer, contains zinc phosphate, EP ester primer Fan guards/sheet metal terminal boxes: Hydro primer ALU KK: EPD coated
2K EP DL (water-based)	2K EP topcoat based on water "Seevenax 312-40", Mankiewicz/Hamburg
2K PUR DL	2K PUR topcoat "Alexit S432/431" Mankiewicz/Hamburg, 2K PUR topcoat "Alexit 402-08", Mankiewicz/Hamburg for off-shore
2K EP primer (water-based)	2K EP primer on water base "Seevenax 313-22", Mankiewicz/Hamburg
2K EP DL	2K EP DL "Seevenax 112/110", Mankiewicz/Hamburg
2K EP ceramic filled	2K EP "Ceram Kote 54S", Chesterton International GmbH <b>(only RAL 7031)</b>
2K EP primer	2K EP primer "Seevenax 113-77/60", Mankiewicz/Hamburg
2K PU conductive lacquer	2K PU conductive lacquer Alexit topcoat 412-11, Mankiewicz/Hamburg

### Coating systems basic type 132 to 450

01 Moderate WKL F/H  RAL 7031	01 S Moderate WKL F  Special colour tone	02 World Wide WKL F/H  RAL 7031	02 S World Wide WKL F  Special colour tone	02 D Special coat	04* Special coat	06 Moderate / World Wide WKL H  Special colour tone	07 Special coat	08 primed	09 L light off-shore version	09 S heavy off-shore version	10 L Special coat	10 S Special coat
Heat, interior, open air roofed	Heat, interior, open air roofed	Heat, open air, damp interior	Heat, open air, damp interior	Ex version dust	Sea, port <b>(RAL 7031 only)</b>	Heat, humidity, open air	Chemical, heat, humidity, high protection against corrosion	Can be painted over	UV-resistant, outdoor installation, high protection against corrosion	Offshore, heavy protection against corrosion	General Ex version at > 200 µm, high protection against corrosion	General Ex version at > 200 µm, heavy protection against corrosion
≥ 70 µm	≥ 70 µm	≥ 110 µm	≥ 110 µm	≥ 110 µm	≥ 150 µm	≥ 110 µm	≥ 150 µm	≥ 70 µm	≥ 210 µm	≥ 300 µm	≥ 210 µm	≥ 300 µm
up to 120°C briefly 180°C	up to 100°C briefly 120°C	up to 120°C briefly 180°C	up to 100°C briefly 120°C	up to 100°C briefly 120°C	up to 80-90°C briefly 130°C	up to 120°C briefly 180°C	up to 120°C briefly 180°C		up to 100°C briefly 140°C	up to 100°C briefly 140°C	up to 100°C briefly 140°C	up to 100°C briefly 140°C
KK C2	KK C2	KK C2 - C3	KK C2 - C3	KK C2 - C3	KK C3/C4	KK C2 - C3	KK C3		KK C4	KK C5 <sup>(1)</sup>	KK C4	KK C5 <sup>(1)</sup>
2K-EP DL 40 µm	2K PUR DL 40 µm	2K EP primer 40 µm	2K EP primer. 40 µm	2K EP primer 40 µm	2K EP, ceramic filled 120 µm	2K EP DL 40 µm	2K EP primer 80 µm	2K EP primer 40 µm	2K PURDL 80 µm	2K PUR DL 90 µm	2K PUR DL 80µm	2K PUR DL 80 µm
									2K EP primer 100 µm	2K EP primer 180µm	2K conductive lacquer minimum 100 µm	2K conductive lacquer minimum 110 µm
Grey cast iron components/fan guards: Dip primers approx. 30 µm, ALU terminal boxes: EPD coated												
Steel shot blasting with SA 2.5/SiS for grey cast iron components, washing, pickling for sheet metal components												

\*Special colours available on request

KK: Corrosivity class according to EN ISO 12944

KK C5<sup>(1)</sup>: The 09S colour scheme fulfils the salt spray test according to DIN EN ISO 9227 with 1440 h – corresponds to C5-M long

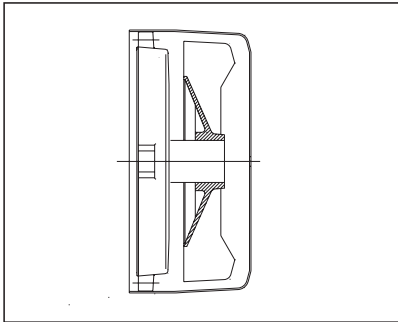
The specified coating thicknesses are nominal coating thicknesses for external engine surfaces. The layer thickness may vary on inaccessible surfaces, e.g., ribbed surfaces.

If no colour is specified, all motors are supplied in RAL 7031 "Blue grey".  
If a different colour is required, the corresponding RAL number and colour designation must be specified at the time of ordering. VEM paint systems

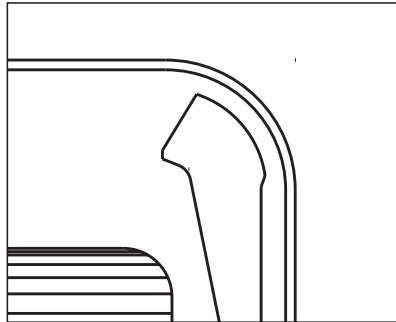
provide lasting, high-performance corrosion protection. Their functional capabilities have been proven in exacting and comprehensive test series. Customer-specific paint systems are always subject to prior consultation.

## Modular construction of different series and modifications

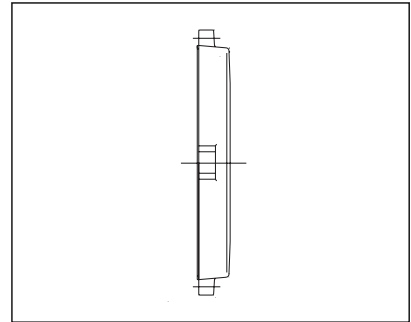
The design concepts of the different series provide for the optional incorporation of components such as pulse generators, tacho generators, brakes, speed monitors or forced ventilation units to solve the customer's individual control tasks.



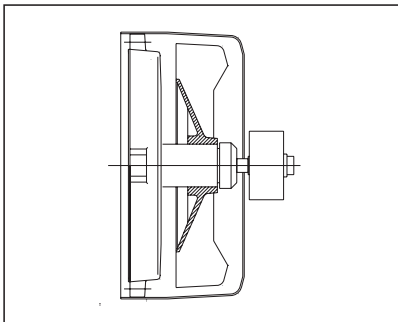
Standard version  
Type of cooling IC 411, self-ventilated



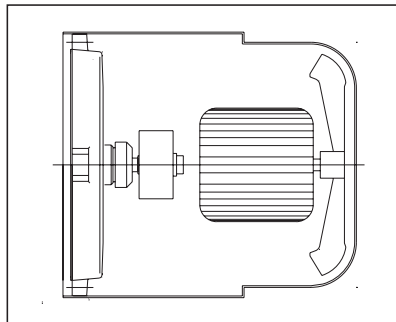
Special version  
Type of cooling IC 416, forced ventilation



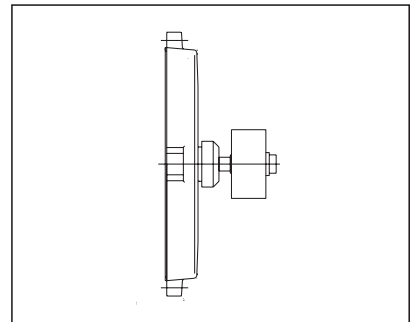
Special version  
Type of cooling IC 410, non-ventilated



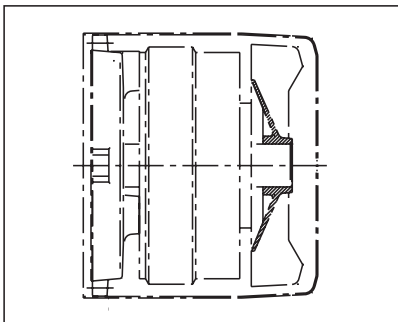
Special version  
Type of cooling IC 411, self-ventilated  
with built-on incremental encoder



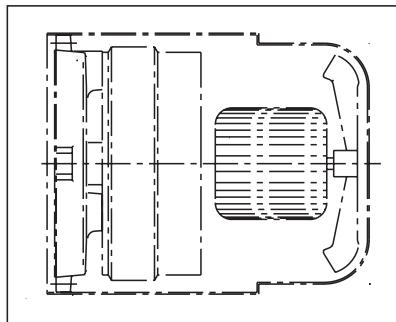
Special version  
Type of cooling IC 416, forced ventilation  
with built-on incremental encoder



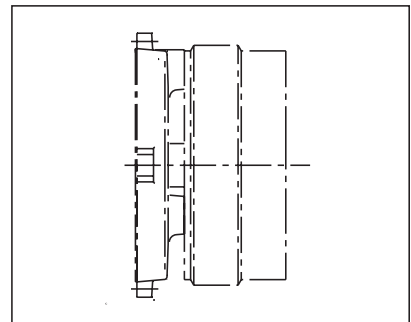
Special version  
Type of cooling IC 410, non-ventilated  
with built-on incremental encoder



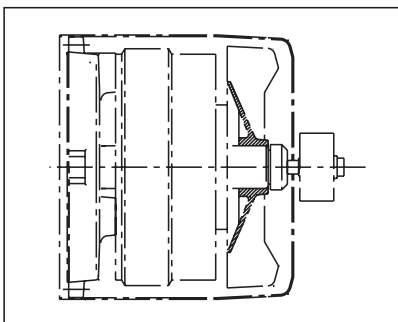
Special version  
Type of cooling IC 411, self-ventilated  
with built-on brake



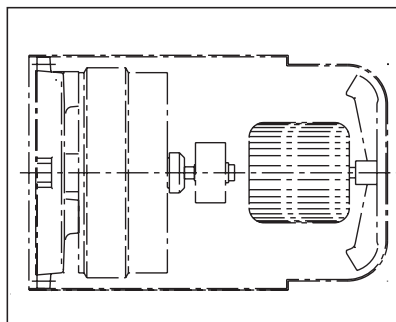
Special version  
Type of cooling IC 416, forced ventilation  
with built-on brake



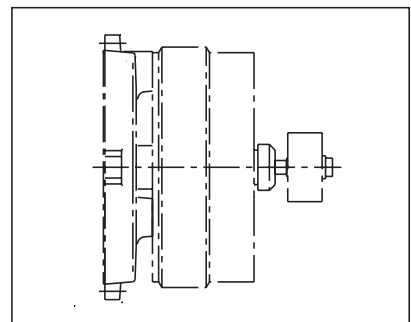
Special version  
Type of cooling IC 410, non-ventilated  
with built-on brake



Special version  
Type of cooling IC 411, self-ventilated  
with built-on brake and incremental encoder



Special version  
Type of cooling IC 416, forced ventilation  
with built-on brake and incremental encoder



Special version  
Type of cooling IC 410, non-ventilated  
with built-on brake and incremental encoder

## Maintenance

Attention is drawn expressly to the safety notes and instructions, and here in particular to the procedures for safe isolation, safeguarding against accidental restarting, and checking the proper disconnection of all components connected to a voltage source. When a motor is disconnected from the mains supply for maintenance purposes, particular care must be taken to ensure that any auxiliary circuits, e.g. space heaters, forced ventilation fans or brakes, are similarly disconnected from their power supply. If it is necessary to dismantle the motor to perform maintenance work, the sealing compound left on the centring edges must be removed. New sealing compound of

a suitable type is to be used for sealing when the motor is reassembled. Any copper sealing rings must always be refitted.

Careful and regular maintenance and inspection is imperative, so as to be able to detect and rectify any arising problems in good time before further damage is caused. As the operating conditions are not exactly defined, it is only possible to specify general maintenance intervals, under the assumption of trouble-free operation. These intervals must always be adapted in accordance with the local circumstances (contamination, loads, etc.).

What is to be done?	Regular interval	Max. interval
Initial inspection	After approx. 500 operating hours	At the latest after six months
Check of air passages and motor surface	Depending on degree of local contamination	
Relubrication (option)	See name plate or lubrication plate	
Main inspection	Approx. 10,000 operating hours	Once a year
Drain condensation	Depending on climatic conditions	

## Inspections

### Initial inspection

In accordance with the specifications, an initial inspection of the motor should be performed after approx. 500 operating hours, but at the latest after six months.

The following checks are to be performed with the motor at standstill:

- Check the foundation. There must be no cracks or other damage such as depressions or the like.

The following checks are to be performed with the motor running:

- Check the electrical parameters.
- Check the bearing temperatures. It is to be determined whether the permissible bearing temperatures are exceeded during operation of the motor.
- Check for unusual noises during operation. An acoustic check is performed to determine whether the quiet running of the motor has deteriorated.

If the checks reveal any deviations from the values specified in the operating and maintenance manual, or any other defects or errors, these deviations and defects must be rectified immediately.

### Main inspection

In accordance with the specifications, a main inspection should be performed once a year or after approx. 10,000 operating hours.

The following checks are to be performed with the motor at standstill:

- Check the foundation. There must be no cracks or other damage such as depressions or the like.
- Check the alignment of the motor. The alignment must lie within the specified tolerances.
- Check the mounting screws and bolts. All screws and bolts which are used to make mechanical and electrical joints and connections

must be properly tight (see also the table of tightening torques for screws and bolts under Section 11 "Commissioning" of the operating and maintenance manual).

- Check the cables and the insulation materials. It is to be checked whether the cables and the insulation materials used are in a good and proper condition. They must not display discolouration, and in particular not burn marks, and must not be broken, cracked or otherwise damaged.
- Check the insulation resistance. When checking the insulation resistance of the winding, observe the specifications given in the operating and maintenance manual (Section 9).
- Depending on the grease quality and the bearings of the motor, it may also be necessary to replace the grease of the anti-friction bearings after 10,000 operating hours (see also Section 13 "Bearings and lubrication" of the operating and maintenance manual). Otherwise, the specified relubrication intervals for the anti-friction bearings must be observed separately, as they deviate from the inspection intervals.

The following checks are to be performed with the motor running:

- Check the electrical parameters.
- Check the bearing temperatures. It is to be determined whether the permissible bearing temperatures are exceeded during operation of the motor.
- Check for unusual noises during operation. An acoustic check is performed to determine whether the quiet running of the motor has deteriorated.

If the checks reveal any deviations from the values specified in the operating and maintenance manual, or any other defects or errors, these deviations and defects must be rectified immediately.

### Long-term storage (over 12 months)

If long-term storage is necessary, motors must be protected from vibration and kept in closed, dry rooms at temperatures between -20 and +40 °C and in an atmosphere free from aggressive gases, vapours, dusts and salts. Motors should preferably be transported and stored in their original packaging. Storage and transport resting on the fan shrouds is not permissible. Unprotected metal surfaces, for example shaft ends and flanges, are to be provided with long-term corrosion protection, in addition to the temporary corrosion protection applied before motors leave the factory.

If the motors are subject to condensation under the given ambient conditions, precautions are to be taken to protect the motors against

moisture. In such cases, the motors must be specially packed in airtight welded foil or under plastic foil with appropriate desiccants. Desiccant sachets are also to be placed in the motor terminal boxes.

For transport, the ring bolts/load beams of the motors are to be used together with appropriate lifting tackle. The ring bolts/load beams are only intended for lifting of the bare motor without additional built-on parts such as base plate, gearing, etc.

Motors with reinforced bearings are supplied with a transport brace. The transport brace on the shaft end should only be removed after assembly of the motor and prior to the first starting.

### Disposal

The applicable national regulations are to be observed with regard to disposal of the machines.

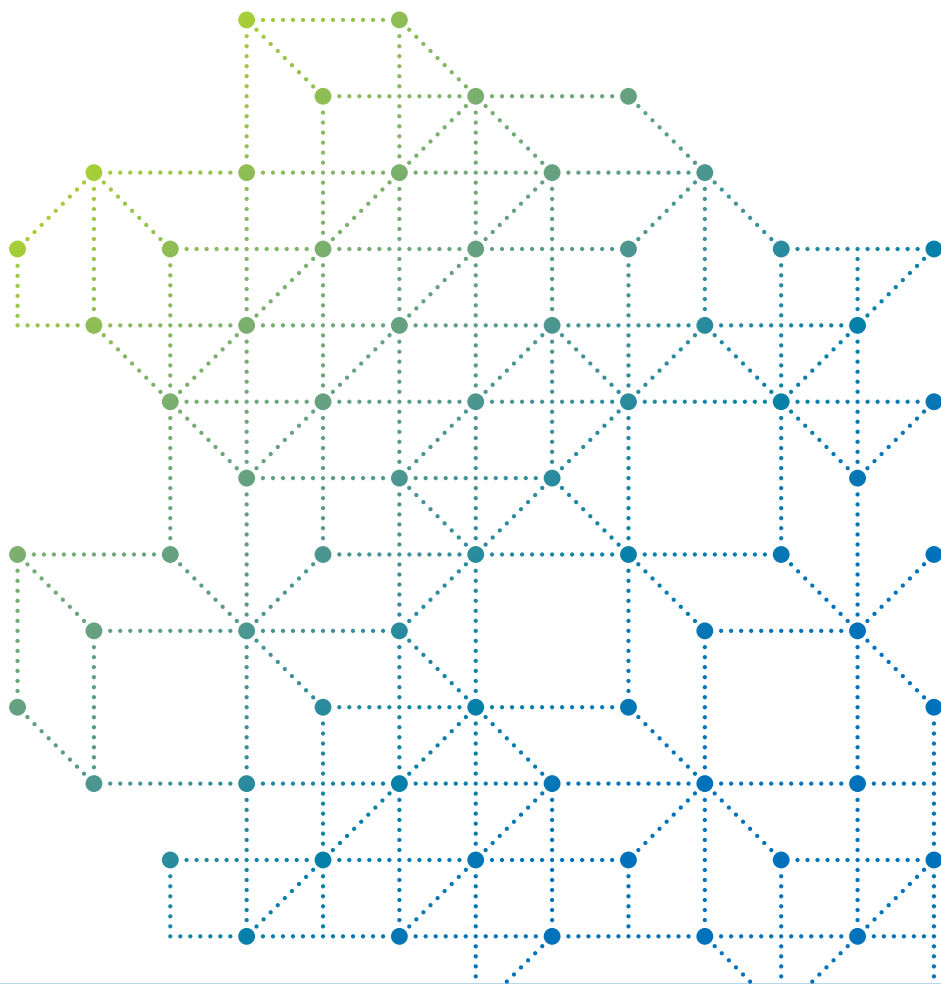
It is furthermore to be ensured that oils and greases are collected for disposal in accordance with the corresponding regulations on waste oils. They must not be contaminated with solvents, cold cleaners and paint residues.

The individual materials should be segregated for recycling. The most important components are grey cast iron (housing), steel (shaft, stator and rotor lamination, small parts), aluminium (rotor), copper (windings) and plastics (insulation materials, such as polyamide, polypropylene, etc.). Electronic components such as circuit boards (converter, sensors, etc.) are recycled separately.

### Warranty, repairs, spare parts

Our authorised service workshops are responsible for all warranty repairs, unless expressly agreed otherwise. They can also be contacted in connection with any other repairs which may become necessary. Information on our customer service network can be requested from

our central offices. Maintenance in accordance with the instructions given in the section "Maintenance" is not considered a breach of the warranty stipulations. It thus cannot be deemed to release the manufacturer from any agreed warranty obligations.



## Tolerances

### Electrical parameters

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

Efficiency (when determined indirectly)	- 0.15 (1- $\eta$ ) at $P_N \leq 150$ kW - 0.1 (1- $\eta$ ) at $P_N > 150$ kW
Power factor	$\frac{1-\cos\phi}{6}$ min. 0.02 max. 0.07
Slip (with nominal load and at operating temperature)	$\pm 20$ % at $P_N \geq 1$ kW $\pm 30$ % at $P_N < 1$ kW
Starting current (with intended starting circuit)	+20 % no lower limit
Starting torque	-15 % and +25 %
Pull-up torque	-15 %
Breakdown torque	-10 % ( $M_K/M_N$ still at least 1.6 after application of this tolerance)
Moment of inertia	$\pm 10$ %
Noise level (sound pressure level at measuring surface)	+3 dB (A)

These tolerances are applicable to the guaranteed values for three-phase asynchronous motors, taking into account necessary manufacturing tolerances and possible deviations in the raw materials used. The standard includes the following notes:

1. It is not intended that guarantees necessarily have to be given for all or any of the items involved. Quotations including guaranteed values subject to tolerances should say so, and the tolerances should be in

accordance with the table.

2. Attention is drawn to the different interpretation of the term "guarantee". In some countries, a distinction is made between guaranteed values and typical or declared values.
3. Where a tolerance is stated in only one direction, the value is not limited in the other direction.

### Mechanical parameters – Usual tolerances

Dimension symbol to DIN EN 50347	Meaning of dimension	Fit or tolerance
B [a]	Spacing of fixing holes for housing feet in axial direction	$\pm 1$ mm
P [a <sub>1</sub> ]	Diameter or width across corners of flange	-1 mm
A [b]	Spacing of fixing holes for housing feet transverse to axial direction	$\pm 1$ mm
N [b <sub>1</sub> ]	Diameter of centring edge of mounting flange	up to diameter 230 mm j6 from diameter 250 mm h6
D, DA [d, d <sub>1</sub> ]	Diameter of cylindrical shaft end	up to diameter 48 mm k6 from diameter 55 mm m6
M [e <sub>1</sub> ]	Pitch circle diameter of mounting flange	$\pm 0.8$ mm
AB [f], AC [g]	Greatest width of motor (without terminal box)	+2 %
H [h]	Shaft height (bottom edge of foot to centre of shaft end)	up to 25 -0.5 mm over 250 -1 mm
L, LC [k, k <sub>1</sub> ]	Total motor length	+1 %
HD [p]	Total motor height (bottom edge of foot, housing or flange to highest point of motor)	+2 %
K, K' [s, s <sub>1</sub> ]	Diameter of mounting holes of foot or flange	+3 %
GA, GC [t, t <sub>1</sub> ]	Bottom edge shaft end to top edge key	+0.2 mm
F, FA [u, u <sub>1</sub> ]	Width of key	h9
C, CA [w <sub>1</sub> , w <sub>2</sub> ]	Distance from centre of first foot mounting hole to shaft shoulder or flange face Distance from shaft shoulder to flange face with fixed bearing at D-end Distance from shaft shoulder to flange face	$\pm 3.0$ mm $\pm 0.5$ mm $\pm 3.0$ mm
m	Motor mass	-5 bis +10 %

#### Usual fits for shaft ends

Shaft ends	up to $\varnothing 48$ from $\varnothing 55$	k6 m6
Mating part		H7

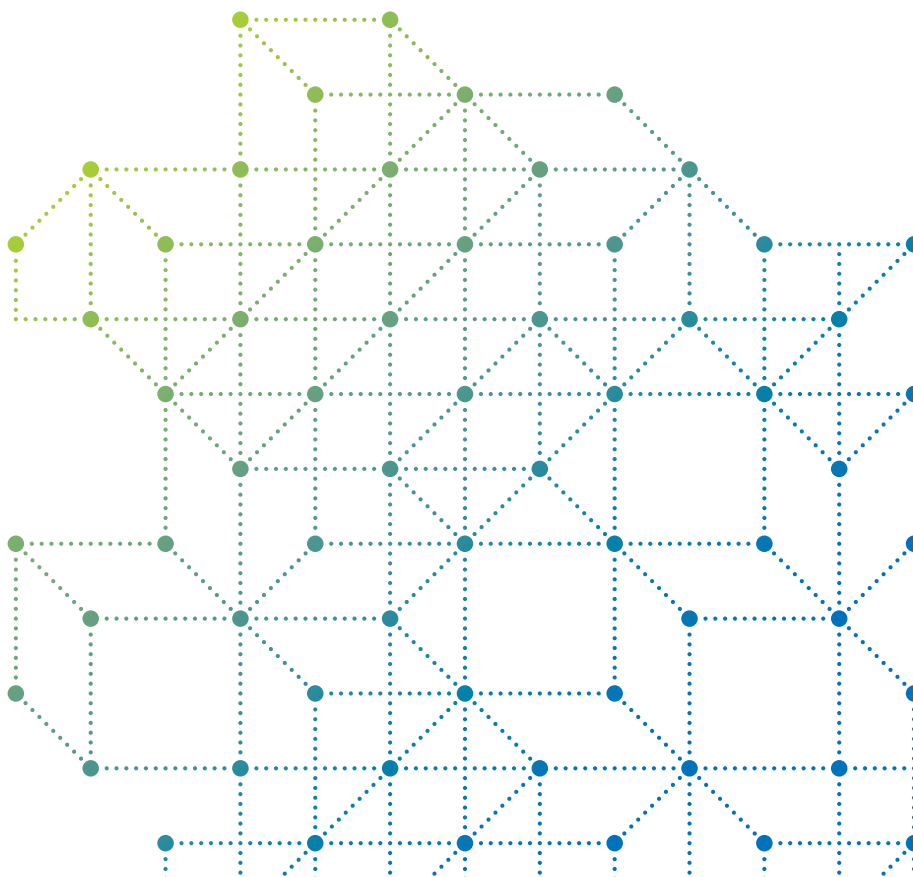


## General technical data

### Product group IE3 motors

The most important technical data are summarised in the following table. Further information can be taken from the catalogue section “Technical explanations”.

Product group	IE3
Rated output	0.12 kW to 1,000 kW
Duty type	S1/ S9
Sizes	56 to 450
Stator winding insulation	Thermal class 155, optional 155 [F(B)], 180 to EN 60034-1 (IEC 60034-1)
Type of protection	IP 55 acc. to EN 60034-5 (IEC 60034-5) optionally IP 56 and higher
Type of cooling	IC 411 acc. to EN 60034-6 (IEC 60034-6)
Coolant temperature/ installation altitude	Standard -20 °C to +40 °C, Altitude 1,000 m above sea level
Rated voltage	Rated voltage range A to EN 60034-1 (IEC 60034-1) Standard voltages to EN 60038 50 Hz, 230 V, 400 V, 500 V, and 690 V 60 Hz, 275 V, 480 V and 600 V
Types of construction	IM B3, IM B35, IM B5 and derived types complying with DIN EN 60034-7
Paint finish	Normal finish “Moderate”, colour RAL 7031, blue-grey Special finish “Worldwide”, colour RAL 7031, blue-grey
Vibration severity grade	Grade “A” as standard for machines with no special vibration requirements
Shaft ends	acc. to DIN 748 (IEC 60072), balanced with half-key
Sound pressure level	acc. to DIN EN ISO 1680, tolerance +3 dB, see technical explanations for values



# Three-phase asynchronous motors, self-ventilated IC 411, 400 V/ 50 Hz, 2-poles

	P	P	M	n	η			cos φ	I	I <sub>a</sub> /I <sub>n</sub>	M <sub>a</sub> /M <sub>n</sub>	M <sub>s</sub> /M <sub>n</sub>	M <sub>k</sub> /M <sub>n</sub>	M <sub>max</sub>	I <sub>max</sub>	J	m
		Inverter	Inverter						400V								
Type	[kW]	[kW]	[Nm]	[min <sup>-1</sup> ]	[100%]	[75%]	[50%]	[-]	[A]	[-]	[-]	[-]	[-]	[Nm]	[A]	[kgm²]	[kg]
IE3-W41R 56 G2	0.12	0.12	on request	2,770	60.8	59.4	55.9	0.77	0.34	4.5	2.1	2.1	2.3	on request	0.00013	4.5	
IE3-W41R 63 K2	0.18	on request		2,840	65.9	64.6	59.8	0.84	0.44	5.5	2.5	2.4	2.9	on request	0.00025	6.3	
IE3-W41R 63 G2	0.25	0.25	on request	2,825	69.7	70.1	67.1	0.83	0.58	4.9	2.4	2.2	2.7	on request	0.00025	6.3	
IE3-W42R 71 K2	0.37	0.37	on request	2,840	73.8	78.2	75.5	0.82	0.83	5.4	2.4	2.3	2.9	on request	0.00032	7.6	
IE3-W41R 71 GY2	0.55	0.55	on request	2,870	77.8	77.5	74.4	0.79	1.23	6.3	2.9	2.9	3.5	on request	0.00057	10	
IE3-W42R 80 K2	0.75	0.75	on request	2,870	80.7	80.7	78.2	0.81	1.65	6.4	2.6	2.6	3.5	on request	0.00072	11.5	
IE3-W41R 80 GY2	1.1	1.1	on request	2,870	82.7	83.8	82.6	0.86	2.22	7	2.8	2.7	3.4	on request	0.00132	15	
IE3-W42R 90 S2	1.5	1.5	on request	2,900	84.2	85.4	83.2	0.81	3.12	7.9	3.5	3.5	4.4	on request	0.0017	19	
IE3-W41R 90 LY2	2.2	2.2	on request	2,880	85.9	85.7	83.9	0.88	4.25	8	2.5	2.3	2.9	on request	0.00275	23.5	
IE3-W41R 100 LY2	3	3	on request	2,920	87.1	86.9	84.7	0.82	6	7.7	2.3	2.2	3.5	on request	0.0045	31	
IE3-W41R 112 MY2	4	4	on request	2,920	88.1	87.5	86.9	0.84	7.9	8.3	2.3	2.1	3.3	on request	0.0055	38	
IE3-W41R 132 S2T	5.5	5.5	on request	2,910	89.2	90.3	89.9	0.83	10.7	8	2.7	2.5	3.6	on request	0.0068	48	
IE3-W43R 132 SX2	7.5	7.5	24	2,930	90.5	90.9	90.2	0.84	14	8.7	2.2	1.3	4	67	43	0.0138	66
IE3-W43R 160 M2	11	11	36	2,930	91.6	92.3	92.1	0.91	19	7.8	2.5	1.9	3.4	86	50	0.0339	101
IE3-W43R 160 MX2	15	15	49	2,940	91.9	92.5	92.3	0.88	27	7.1	2.1	1.8	3.1	106	64	0.0575	117
IE3-W43R 160 L2	18.5	18.5	60	2,945	92.4	92.9	92.5	0.87	33	7.9	2.4	2	3.4	143	87	0.0575	136
IE3-W43R 180 M2	22	22	71	2,945	92.7	93.3	92.9	0.89	38.5	8.5	2.6	2.1	3.4	169	101	0.078	155
IE3-W43R 200 L2	30	30	97	2,950	93.3	93.5	92.2	0.88	52.5	8	2.2	1.8	3.4	231	138	0.128	200
IE3-W43R 200 LX2	37	37	120	2,955	93.8	94.2	93.9	0.9	63.5	7.4	1.8	1.5	2.9	244	142	0.22	285
IE3-W43R 225 M2	45	45	145	2,960	94	94.2	93.7	0.87	79.5	7.4	1.9	1.6	3	305	184	0.22	285
IE3-W43R 250 M2	55	55	177	2,960	94.3	94.6	94.2	0.88	95.5	8	2.3	2.1	2.9	359	213	0.375	375
IE3-W41R 280 S2	75	75	241	2,967	94.7	94.5	93.9	0.89	128	8.1	1.9	1.9	2.8	472	276	0.65	510
IE3-W43R 280 M2	90	90	289	2,970	95.3	95.5	95.1	0.91	150	8	2.1	1.9	3	607	347	0.675	540
IE3-W41R 315 S2	110	110	354	2,970	95.2	94.5	93.5	0.89	187	10	1.9	1.7	3	741	432	1.21	750
IE3-W43R 315 M2	132	132	424	2,973	95.7	95.9	95.7	0.89	224	7.5	1.3	1.2	2.3	683	397	1.21	770
IE3-W43R 315 MX2	160	160	514	2,975	96.1	96.1	96.1	0.9	267	8.8	1.6	1.5	2.6	934	535	1.76	940
IE3-W41R 315 MY2	200	192	615	2,980	95.8	95.9	95.5	0.91	331	8.3	2.6	1.6	2.4	1,075	612	2.82	1,200
IE3-W41R 315 L2	250	220	704	2,985	96	96	95.9	0.92	409	8.4	2.5	1.4	2.3	1,286	724	3.66	1,460
IE3-W41R 315 LX2	315	315	1,008	2,985	95.8	95.8	95.8	0.92	516	8.5	2.8	1.6	2.5	1,762	993	4.43	1,700
IE3-W41R 355 MY2G	315	315	1,006	2,990	96	96	95.5	0.9	526	8.5	1.4	1	2.7	1,901	1,093	4.1	1,900
IE3-W41R 355 M2G	355	330	1,056	2,985	96	96	96	0.92	580	7.7	1.3	1	2.6	2,066	1,161	4.2	2,000
IE3-W42R 355 MX2G	400	355	1,135	2,988	96	96	96	0.92	654	8.5	1.8	1.1	2.5	2,237	1,259	5.5	2,275
IE3-W42R 355 L2G	500	370	1,182	2,990	96.2	96.2	96.2	0.9	834	11	2.2	1.4	3.2	3,575	2,055	7.1	2,450
IE3-W42R 400 M2G	560	450	on request	2,995	96	96	95.5	0.83	1,014	9	2.8	on request	3	3,749	2,343	8.44	3,000
IE3-W42R 400 MX2G	630	500	on request	2,993	97	97	96.7	0.9	1,042	8.8	2.5	1.5	2.7	3,799	2,166	9.41	3,200
IE3-W42R 400 L2G	710	580	on request	2,985	96	96	95.5	0.9	1186	7.7	2.2	1.1	2.8	4,451	2,557	10.41	3,400

# Three-phase asynchronous motors, self-ventilated IC 411, 400 V/ 50 Hz, 4-poles

	P	P	M	n	η			cos φ	I	I <sub>a</sub> /I <sub>n</sub>	M <sub>a</sub> /M <sub>n</sub>	M <sub>s</sub> /M <sub>n</sub>	M <sub>k</sub> /M <sub>n</sub>	M <sub>max</sub>	I <sub>max</sub>	J	m
		Inverter	Inverter						400V								
Type	[kW]	[kW]	[Nm]	[min <sup>-1</sup> ]	[100%]	[75%]	[50%]	[-]	[A]	[-]	[-]	[-]	[-]	[Nm]	[A]	[kgm²]	[kg]
IE3-W41R 63 K4	0.12	on request		1,400	64.8	63.4	58.7	0.71	0.35	3.8	2	1.9	2.3	on request		0.0004	6.3
IE3-W41R 63 G4	0.18	0.18	on request	1,415	69.9	69.5	64.3	0.67	0.55	4.4	1.8	1.8	2.7	on request		0.0005	7.1
IE3-W41R 71 K4	0.25	on request		1,430	73.5	76.6	73	0.71	0.66	5.6	2.5	2.3	2.9	on request		0.00087	9.9
IE3-W41R 71 GY4	0.37	0.37	on request	1,420	77.3	76.8	73.6	0.74	0.95	4.9	2.5	2.4	2.8	on request		0.00087	9.9
IE3-W41R 80 K4	0.55	0.55	on request	1,440	80.8	80.1	76.7	0.77	1.27	6.6	3	2.9	3.6	on request		0.00207	14.5
IE3-W41R 80 G4	0.75	0.75	on request	1,445	82.5	82.3	79.6	0.77	1.7	7	3.1	3.1	3.7	on request		0.0026	17
IE3-W41R 90 SY4	1.1	1.1	on request	1,450	84.1	84.9	82.5	0.75	2.5	7	3.1	2.9	3.9	on request		0.004	22.5
IE3-W41R 90 S4	1.1	on request		1,450	84.1	83.5	80	0.74	2.55	8	3.6	3.5	4.2	on request		0.0045	28
IE3-W41R 90 LX4	1.5	on request		1,455	85.3	84	80.6	0.75	3.4	9.5	4.5	3.8	4.9	on request		0.0058	31
IE3-W41R 100 L4	2.2	on request		1,450	86.7	87	85.1	0.81	4.55	8.2	2.9	2.7	3.8	on request		0.011	45
IE3-W41R 100 LZ4	3	on request		1,455	87.7	87.7	85.8	0.75	6.55	8.4	3.9	3.7	4.5	on request		0.013	50
IE3-W42R 112 M4	4	4	26	1,460	88.6	89.1	87.9	0.83	7.9	7.9	2.5	1.9	3.8	69	23	0.015	55
IE3-W43R 132 SY4	5.5	5.5	36	1,465	90	90.2	88.9	0.79	11	8.6	2.9	2	4.4	111	37	0.0216	65
IE3-W43R 132 M4	7.5	7.5	49	1,470	90.5	90.5	89.2	0.75	16	7.6	3	2.6	3.9	134	48	0.035	88
IE3-W43R 160 M4	11	11	72	1,465	91.4	91.9	91.5	0.82	21	7	2.3	1.8	3.4	171	55	0.043	105
IE3-W41R 160 L4	15	15	97	1,475	92.2	92.4	91.6	0.85	27.5	8.7	3.1	2.6	3.5	238	74	0.115	165
IE3-W43R 180 M4	18.5	18.5	120	1,475	92.6	92.7	91.9	0.84	34.5	7.8	2.9	2.3	3.3	277	88	0.115	160
IE3-W43R 180 L4	22	22	142	1,475	93	93.3	92.7	0.83	41	6.9	2	1.9	3	298	95	0.168	206
IE3-W43R 200 L4	30	30	194	1,480	93.6	94	93.7	0.86	54	6.4	1.8	1.6	2.5	340	104	0.313	304
IE3-W43R 225 S4	37	37	240	1,475	93.9	94.4	94.2	0.85	67	6.4	2.2	1.7	2.6	437	134	0.356	341
IE3-W43R 225 M4	45	45	291	1,475	94.3	94.8	94.7	0.83	83	7.2	2.5	2	2.4	489	153	0.525	377
IE3-W43R 250 M4	55	55	354	1,482	94.6	94.9	94.4	0.81	104	7.6	2.7	1.9	2.6	644	208	0.619	435
IE3-W43R 280 S4	75	75	483	1,482	95	95.3	95	0.82	139	7.6	2.1	1.9	2.5	845	267	0.95	545
IE3-W43R 280 M4	90	90	580	1,482	95.2	95.5	95.3	0.83	164	8	2.1	1.9	2.5	1,013	316	1.1	600
IE3-W41R 315 S4	110	110	706	1,487	95.4	95	94.3	0.82	203	9.5	1.9	1.7	2.7	1,160	435	1.96	760
IE3-W43R 315 M4	132	132	849	1,485	96	96	95.5	0.8	248	8.3	2	1.9	2.7	1,603	516	1.96	790
IE3-W43R 315 MX4	160	160	1,029	1,485	95.9	96.1	95.8	0.82	294	8.2	1.8	1.6	2.5	1,799	566	2.27	850
IE3-W43R 315 MY4	200	200	1,286	1,485	96	96.2	95.9	0.82	367	8.3	1.8	1.8	2.4	2,160	678	2.73	970
IE3-W41R 315 L4	250	250	1,602	1,490	96.2	96.2	96	0.87	431	9.4	2.2	1.8	2.7	3,028	896	5.93	1,450
IE3-W41R 315 LX4	315	315	2,019	1,490	96	96	96	0.87	544	9.5	2.3	1.7	2.9	4,097	1,215	6.82	1,630
IE3-W41R 355MY 4	315	315	2,016	1,492	96	96	95.5	0.86	551	7	1	0.8	2.4	3,387	1,018	5.6	1,950
IE3-W41R 355M 4	355	355	2,271	1,493	96.2	96.2	95.5	0.87	612	8.1	1.3	1	2.7	4,290	1,272	7.9	2,150
IE3-W42R 355 MX4	400	390	2,500	1,490	96.2	96.2	96.2	0.84	714	8.2	1.7	1.4	2.4	4,306	1,320	9.5	2,410
IE3-W42R 355 L4	500	480	3,077	1,490	96.4	96.4	96	0.84	891	7.4	2.5	1.2	2.3	4,800	1,525	10	2,500
IE3-W42R 400 M4	560	500	3,196	1,494	96.5	96.3	96	0.87	963	10	2.1	on request	3.1	7,766	2,299	12.6	3,060
IE3-W42R 400 MX4	630	580	3,707	1,494	96.5	96.5	96.5	0.86	1,096	10	3.1	on request	3.3	9,302	2,785	14.33	3,100
IE3-W42R 400 L4	710	630	4,030	1,493	96.5	96.5	96.5	0.86	1,235	11	2	on request	3.6	9,082	2,595	16.29	3,400

### Three-phase asynchronous motors, self-ventilated IC 411, 400 V/ 50 Hz, 6-poles

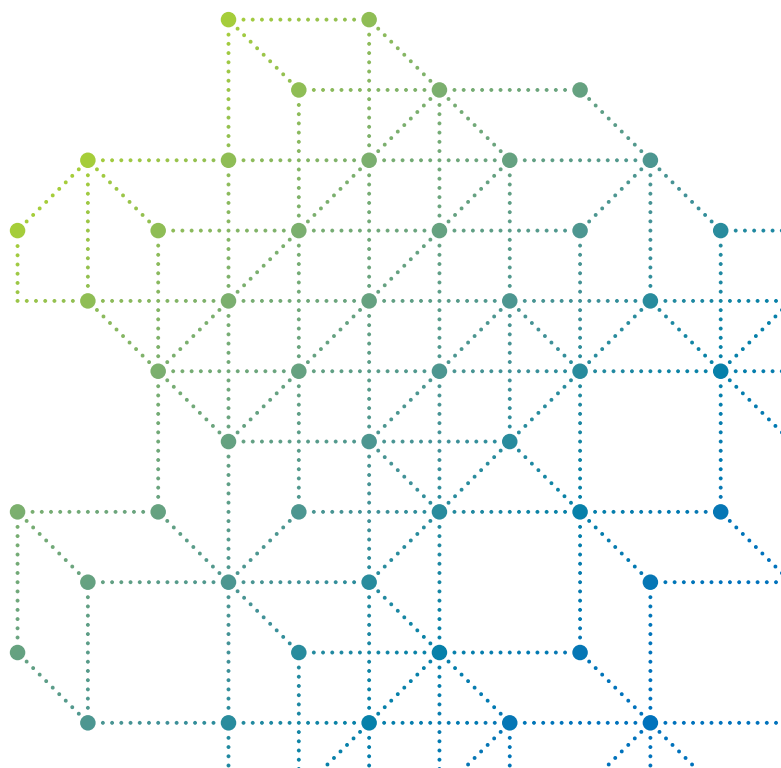
	P	P	M	n	η			cos φ	I	I <sub>a</sub> /I <sub>n</sub>	M <sub>a</sub> /M <sub>n</sub>	M <sub>s</sub> /M <sub>n</sub>	M <sub>k</sub> /M <sub>n</sub>	M <sub>max</sub>	I <sub>max</sub>	J	m
		Inverter	Inverter						400V								
Type	[kW]	[kW]	[Nm]	[min <sup>-1</sup> ]	[100%]	[75%]	[50%]	[-]	[A]	[-]	[-]	[-]	[-]	[Nm]	[A]	[kgm <sup>2</sup> ]	[kg]
IE3-W41R 63 G6	0.12	0.12	on request	930	57.7	60	54	0.56	0.5	2.8	1.9	1.8	2.1	on request	0.00045	6.7	
IE3-W41R 71 K6	0.18	on request	on request	930	63.9	62.9	57.5	0.68	0.57	3.4	2	2	2.2	on request	0.0013	11	
IE3-W41R 71 G6	0.25	on request	on request	935	68.6	66.9	62.2	0.67	0.75	3.9	2.3	2.3	2.5	on request	0.00175	12.5	
IE3-W41R 80 K6	0.37	0.37	on request	950	73.5	72.9	69.2	0.7	1.03	4	1.9	1.9	2.4	on request	0.00325	15	
IE3-W41R 80 G6	0.55	0.55	on request	950	77.2	75.9	72.4	0.65	1.58	4.4	2.2	2.2	2.8	on request	0.00425	18	
IE3-W41R 90 SY6	0.75	0.75	on request	955	78.9	78.3	75.1	0.71	1.95	4.9	2.4	2.3	2.6	on request	0.00625	24	
IE3-W41R 90 L6	1.1	1.1	on request	960	81	81	77.9	0.68	2.88	5.6	2.9	2.6	3.4	on request	0.0072	30	
IE3-W41R 100 LX6	1.5	1.5	on request	955	82.5	83.5	81.5	0.76	3.45	5.9	2.3	2.2	2.8	on request	0.0139	36	
IE3-W41R 112 MV6	2.2	2.2	on request	955	84.3	83.6	80.9	0.74	5.15	5.7	2.4	2.3	2.9	on request	0.0155	48	
IE3-W41R 132 S6	3	3	29	975	85.6	86.6	85.5	0.82	6.2	6.2	2	1.3	3.1	63	14.8	0.029	69
IE3-W43R 132 M6	4	4	40	965	87.2	89.3	87.6	0.79	8.4	4.9	1.7	1.5	2.4	67	15.5	0.043	74
IE3-W43R 132 MX6	5.5	5.5	54	965	88	88.9	88.3	0.81	11	5	1.7	1.5	2.4	91	20.4	0.043	87
IE3-W43R 160 M6	7.5	7.5	73	975	89.6	89.4	87.8	0.82	14.5	5.8	2.5	1.9	2.8	143	31.2	0.113	116
IE3-W41R 160 L6	11	11	108	975	90.4	90.8	89.8	0.85	20.5	7.1	2.7	2.2	2.9	219	45.7	0.166	157
IE3-W43R 180 L6	15	15	147	975	91.2	91.4	90.5	0.85	28	6.4	2.3	2	3	309	65	0.268	201
IE3-W43R 200 L6	18.5	18.5	180	980	91.8	91.6	90.2	0.84	34.5	6.9	2.4	2.2	3.2	403	85	0.324	237
IE3-W43R 200 LX6	22	22	214	980	92.5	92.8	92.2	0.88	39	6.7	2.5	1.9	2.8	419	84	0.514	298
IE3-W43R 225 M6	30	30	291	983	93	93.2	92.5	0.84	55.5	6.4	2.67	2.06	2.67	544	114	0.825	360
IE3-W43R 250 M6	37	37	359	985	93.4	93.5	92.7	0.85	67.5	6.6	2.6	2	2.7	679	140	1.28	460
IE3-W43R 280 S6	45	45	436	985	93.7	93.9	93.3	0.86	80.5	6.6	2.4	2	2.6	794	161	1.48	553
IE3-W43R 280 M6	55	55	531	990	94.6	95	94.7	0.86	97.5	7	1.8	1.7	2.5	928	188	2.63	720
IE3-W43R 315 S6	75	75	723	990	95.1	95.3	95	0.86	132	8	2.1	1.9	2.8	1,417	285	3.33	815
IE3-W43R 315 M6	90	90	868	990	94.9	94.9	94	0.84	163	8.5	2.3	2.1	3	1,823	377	3.6	850
IE3-W41R 315 MX6	110	110	1,061	990	95.1	95	94.5	0.86	194	8.5	2.5	1.7	2.7	2,005	403	6.67	1,210
IE3-W41R 315 L6	132	132	1,267	995	95.4	95	94.5	0.87	230	9	2.8	2	3.2	2,836	567	10	1,550
IE3-W41R 355 MY6	132	132	1,267	995	95.5	95.5	94.5	0.83	240	9	2	1.6	3	2,659	554	8.2	1,550
IE3-W41R 355 M6	160	160	1,536	995	95.6	95.6	95.2	0.86	281	7.5	1.6	1.3	2.4	2,579	519	8.2	1,850
IE3-W42R 355 MX6	200	200	1,920	995	95.8	95.5	95	0.84	359	9.6	2.2	1.7	2.8	3,761	774	12.1	2,350
IE3-W42R 355 LY6	250	250	2,399	995	95.8	95.5	95	0.82	459	8.8	1.8	1.5	2.5	4,198	884	14	2,450
IE3-W42R 355 L6	315	315	3,023	995	95.8	96	95.7	0.84	565	7.8	2	1.5	2.2	4,655	957	14	2,450
IE3-W42R 400 MY6	355	355	3,407	995	96	96	95.8	0.83	643	7.5	1.2	1.2	2.1	5,008	1,040	16.54	3,000
IE3-W42R 400 M6	400	400	3,839	995	96.2	96.2	96	0.83	723	8	1.5	1.3	2.5	6,718	1,392	16.54	3,000
IE3-W42R 400 MX6	450	450	4,319	995	96.5	96.5	96.5	0.83	811	6.9	1.5	on request	2.2	6,651	1,374	18.44	3,200
IE3-W42R 400 L6	500	500	4,794	996	96.3	96.3	96	0.84	892	7.5	1.7	on request	2.2	7,383	1,511	20.63	3,320
IE3-W42R 400 LX6	560	500	4,794	996	96.4	96.4	96.4	0.82	1,023	7.5	1.7	on request	2.2	8,268	1,733	20.63	3,320

## General technical data

### Product group WK series

The most important technical data are summarised in the following table. Further information can be taken from the catalogue section "Technical explanations".

Product group	WK3, WK5
Rated output	3 kW to 196 kW, depending on the duty cycle and cooling type
Duty type	short-term duty (S2) and intermitted duty (S3) S3-100% just for Information, but not available!
Sizes	132 to 280
Stator winding insulation	Thermal class 155, optional 155 [F(B)], 180 to EN 60034-1 (IEC 60034-1)
Type of protection	IP 55 acc. to EN 60034-5 (IEC 60034-5) optionally IP 56 and higher
Type of cooling	IC 411 and IC410 acc. to EN 60034-6 (IEC 60034-6)
Coolant temperature/ installation altitude	Standard -20 °C to +40 °C, Altitude 1,000 m above sea level
Rated voltage	Rated voltage range A to EN 60034-1 (IEC 60034-1) Standard voltages to EN 60038 50 Hz, 400 V 60 Hz, 460 V
Types of construction	IM B3, IM V5, IM V1 and derived types complying with DIN EN 60034-7
Paint finish	04 according to KK C3/C4 suitable for sea-/port climate-protection
Vibration severity grade	Grade "A" as standard for machines with no special vibration requirements
Shaft ends	acc. to DIN 748 (IEC 60072), balanced with half-key
Sound pressure level	acc. to DIN EN ISO 1680, tolerance +3 dB, see technical explanations for values
Inverter duty	without filter up to 500 V, reinforced insulation acc. to IVC C (IEC 60034-18-41), $U_{pk/pk}$ phase- phase 3,1kV / $U_{pk/pk}$ phase-earth 2,16kV $d_U/d_t < 5,8 \text{ kV}/\mu\text{s}$ Impulse rise time $t_r > 0,3 \mu\text{s}$





# Three-phase asynchronous motor for frequency converter operation, unventilated IC 410, 400 V/ 50 Hz

Type	S2-30min / S3-15%				S2-60min / S3-25%				S3-40%				S3-60%				S3-100%				M <sub>max</sub> Nm	I <sub>max</sub> A	J kgm <sup>2</sup>	m kg
	P kW	n min <sup>-1</sup>	M Nm	I A	P kW	n min <sup>-1</sup>	M Nm	I A	P kW	n min <sup>-1</sup>	M Nm	I A	P kW	n min <sup>-1</sup>	M Nm	I A	P kW	n min <sup>-1</sup>	M Nm	I A				
WK5-Series																								
WK50 132 S4	8.5	1,456	55.8	18	7.5	1,462	49.0	16.5	6	1,470	39.0	15	4.5	1,478	29.08	13.5	3	1,486	19.3	12	105	34.5	0.028	71
WK50 132 M4	12.5	1,454	82.1	26	11	1,461	71.9	23.5	8.5	1,471	55.2	20.5	6.5	1,487	41.75	19	4	1,487	25.7	17	161	58	0.035	100
WK50 132 MX4	15	1,457	98.3	31	13.2	1,462	86.2	30	10.5	1,472	68.1	25	8	1,478	51.7	22	5	1,487	32.1	20	189	67	0.043	105
WK50 160 S4	17.5	1,460	114.5	37	15	1,467	97.6	33	11.5	1,476	74.4	38	9	1,481	58.0	35	5.5	1,489	35.3	20	217	81	0.078	120
WK50 160 M4	21	1,463	137.1	44	18.5	1,469	120.3	40	14.5	1,475	93.9	35	11	1,482	70.9	30	7	1,488	44.9	25	258	94.5	0.090	136
WK50 160 MX4	23	1,466	149.8	48	20	1,470	129.9	43	15.5	1,478	100.2	35	12	1,485	77.2	31	7.5	1,491	48.0	25	279	102	0.107	151
WK50 160 L4	25	1,473	162.1	48	22	1,472	142.7	45	17	1,479	109.8	35	13	1,485	83.6	31	8	1,484	51.5	21	309	107	0.115	165
WK50 180 S4	28	1,466	182	58	24	1,471	156	51.5	18.5	1,478	119	43.5	14	1,484	90	37.5	9	1,490	58	32.5	336	116	0.138	185
WK50 180 M4	35	1,467	228	71.5	30	1,472	195	63.5	23	1,479	149	53.5	17.5	1,484	113	46.5	11	1,490	71	39.5	410	134	0.168	206
WK50 180 MX4	41	1,472	266	89	36	1,475	233	83	28	1,481	181	71.5	21	1,486	135	64.5	13.5	1,491	86	56	520	185	0.203	240
WK50 200 M4	43	1,470	279	84	37	1,475	240	79	29	1,481	187	67.5	22	1,486	141	57.5	13.5	1,491	87	49	490	128	0.275	282
WK50 200 L4	52	1,470	337	107.5	45	1,475	291	95.5	35	1,481	226	81	27	1,485	174	70	16.5	1,491	106	58	625	206	0.313	323
WK50 200 LX4	63	1,467	409	135	55	1,472	357	122	43	1,479	278	104	32	1,484	206	88.5	20	1,490	128	76	698	220	0.356	341
WK50 225 M4	63	1,477	408	127	55	1,482	355	114	43	1,485	277	100	32	1,490	205	87	20	1,494	128	77	710	217	0.525	377
WK50 225 MX4	75	1,478	484	149	64	1,482	412	131	51	1,486	327	110	35	1,490	224	90	24	1,493	153	79	790	262	0.619	435
WK50 250 S4	90	1,483	580	171	75	1,487	482	146	60	1,490	385	123	44	1,493	282	101	28	1,495	179	83	964	293	0.950	540
WK50 250 M4	105	1,482	677	197	90	1,485	579	171	70	1,489	449	140	53	1,491	339	111	33	1,495	211	87	1,158	345	1.100	600
WK50 250 MX4	127	1,482	817	235	110	1,485	707	205	86	1,489	551	167	65	1,491	416	137	41	1,495	262	108	1,340	443	1.340	715
WK50 280 S4	152	1,485	978	300	132	1,487	848	260	103	1,490	660	220	78	1,493	499	185	49	1,495	313	150	1,760	575	1.960	790

Type	S2-30min / S3-15%				S2-60min / S3-25%				S3-40%				S3-60%				S3-100%				M <sub>max</sub> Nm	I <sub>max</sub> A	J kgm <sup>2</sup>	m kg
	P kW	n min <sup>-1</sup>	M Nm	I A	P kW	n min <sup>-1</sup>	M Nm	I A	P kW	n min <sup>-1</sup>	M Nm	I A	P kW	n min <sup>-1</sup>	M Nm	I A	P kW	n min <sup>-1</sup>	M Nm	I A				
WK5-Series																								
WK30 132 M4	8.5	1,456	55.8	18	7.5	1,462	49.0	16.5	6	1,470	39.0	15	4.5	1,478	29.08	13.5	3	1,486	19.3	12	105	34.5	0.028	71
WK30 160 M4	12.5	1,454	82.1	26	11	1,461	71.9	23.5	8.5	1,471	55.2	20.5	6.5	1,487	41.75	19	4	1,487	25.7	17	161	58	0.035	100
WK30 160 MX4	15	1,457	98.3	31	13.2	1,462	86.2	30	10.5	1,472	68.1	25	8	1,478	51.7	22	5	1,487	32.1	20	189	67	0.043	105
WK10 160 L4	17.5	1,460	114.5	37	15	1,467	97.6	33	11.5	1,476	74.4	38	9	1,481	58.0	35	5.5	1,489	35.3	20	217	81	0.078	120
WK30 180 M4	21	1,463	137.1	44	18.5	1,469	120.3	40	14.5	1,475	93.9	35	11	1,482	70.9	30	7	1,488	44.9	25	258	94.5	0.090	136
WK30 180 MX4	23	1,466	149.8	48	20	1,470	129.9	43	15.5	1,478	100.2	35	12	1,485	77.2	31	7.5	1,491	48.0	25	279	102	0.107	151
WK30 180 L4	25	1,473	162.1	48	22	1,472	142.7	45	17	1,479	109.8	35	13	1,485	83.6	31	8	1,484	51.5	21	309	107	0.115	165
WK30 180 LX4	28	1,466	182	58	24	1,471	156	51.5	18.5	1,478	119	43.5	14	1,484	90	37.5	9	1,490	58	32.5	336	116	0.138	185
WK30 200 L4	35	1,467	228	71.5	30	1,472	195	63.5	23	1,479	149	53.5	17.5	1,484	113	46.5	11	1,490	71	39.5	410	134	0.168	206
WK30 200 LX4	41	1,472	266	89	36	1,475	233	83	28	1,481	181	71.5	21	1,486	135	64.5	13.5	1,491	86	56	520	185	0.203	240
WK30 225 S4	43	1,470	279	84	37	1,475	240	79	29	1,481	187	67.5	22	1,486	141	57.5	13.5	1,491	87	49	490	128	0.275	282
WK30 225 M4	52	1,470	337	107.5	45	1,475	291	95.5	35	1,481	226	81	27	1,485	174	70	16.5	1,491	106	58	625	206	0.313	323
WK30 225 MX4	63	1,467	409	135	55	1,472	357	122	43	1,479	278	104	32	1,484	206	88.5	20	1,490	128	76	698	220	0.356	341
WK30 250 M4	63	1,477	408	127	55	1,482	355	114	43	1,485	277	100	32	1,490	205	87	20	1,494	128	77	710	217	0.525	377
WK30 250 MX4	75	1,478	484	149	64	1,482	412	131	51	1,486	327	110	35	1,490	224	90	24	1,493	153	79	790	262	0.619	435
WK30 280 S4	90	1,483	580	171	75	1,487	482	146	60	1,490	385	123	44	1,493	282	101	28	1,495	179	83	964	293	0.950	540
WK30 280 M4	105	1,482	677	197	90	1,485	579	171	70	1,489	449	140	53	1,491	339	111	33	1,495	211	87	1,158	345	1.100	600
WK30 280 MX4	127	1,482	817	235	110	1,485	707	205	86	1,489	551	167	65	1,491	416	137	41	1,495	262	108	1,340	443	1.340	715
WK30 280 MY4	152	1,485	978	300	132	1,487	848	260	103	1,490	660	220	78	1,493	499	185	49	1,495	313	150	1,760	575	1.960	790

## Three-phase asynchronous motor for frequency converter operation, unventilated IC 410, 460 V/ 60 Hz

Type	S2-30min / S3-15%				S2-60min / S3-25%				S3-40%				S3-60%				S3-100%				M <sub>max</sub> Nm	I <sub>max</sub> A	J kgm <sup>2</sup>	m kg
	P kW	n min <sup>-1</sup>	M Nm	I A	P kW	n min <sup>-1</sup>	M Nm	I A	P kW	n min <sup>-1</sup>	M Nm	I A	P kW	n min <sup>-1</sup>	M Nm	I A	P kW	n min <sup>-1</sup>	M Nm	I A				
WK5-Series																								
WK50 132 S4	10	1,759	54	23	8.5	1,465	55	21	6.5	1,774	35	19	5	1,780	27	17	3	1,788	16	9	102	43	0.028	71
WK50 132 M4	14.5	1,754	79	28	12.5	1,760	68	25	8.5	1,774	46	20	6.5	1,781	35	19	4	1,788	21	18	144	55	0.035	100
WK50 132 MX4	17.5	1,750	96	33	15	1,762	81	28	11.5	1,772	62	23	9	1,778	48	18	5.5	1,787	29	18	170	65	0.043	105
WK50 160 S4	20	1,762	108	35	17.5	1,768	95	34	13.5	1,776	73	28	10.5	1,782	56	23	6.5	1,788	35	19	195	69.5	0.078	120
WK50 160 M4	25	1,760	136	45	21.5	1,769	116	40	17	1,777	91	35	12.5	1,783	67	30	8	1,789	43	25	231	88	0.090	136
WK50 160 MX4	26	1,760	141	54	23	1,770	124	45	18	1,777	97	37	13.5	1,783	72	38	8.5	1,788	45	24	249	99.5	0.107	151
WK50 160 L4	29	1,768	157	49	25.5	1,772	137	45	20	1,779	107	38	15	1,784	80	30	9.5	1,790	51	26	302	109	0.115	165
WK50 180 S4	32	1,767	173	54.5	27.5	1,772	148	48.5	21	1,779	113	40.5	16	1,784	86	35	10	1,790	53	29.5	332	109	0.138	185
WK50 180 M4	40	1,766	216	66.5	34.5	1,771	186	59	27	1,778	145	49	20	1,784	107	41	13	1,790	69	34.5	429	136	0.168	206
WK50 180 MX4	48	1,769	259	79.5	41.5	1,773	224	70.5	32	1,780	172	58	24	1,785	128	49.5	15.5	1,790	83	42	478	151	0.203	240
WK50 200 M4	49	1,770	264	82	42.5	1,774	229	72.5	33	1,780	177	61	25	1,785	134	51.5	15.5	1,791	83	43	508	160	0.275	282
WK50 200 L4	59	1,772	318	102	51.5	1,775	277	89	40	1,781	214	76	30	1,786	160	63.5	19	1,791	101	53.5	621	200	0.313	323
WK50 200 LX4	72	1,769	389	130	63	1,774	339	116.5	49	1,780	263	99	37	1,785	198	87.5	23	1,791	123	76	671	231	0.356	341
WK50 225 M4	72	1,777	387	120	63	1,780	338	108	49	1,785	262	91	34	1,790	181	75	23	1,793	123	66	710	217	0.525	377
WK50 225 MX4	91	1,780	488	151	77	1,782	413	129	60	1,785	321	105	40	1,790	213	81	25	1,793	133	67	790	262	0.619	435
WK50 250 S4	107	1,780	574	174	90	1,784	482	146	70	1,788	374	118	53	1,791	283	97	33	1,794	176	75	964	293	0.950	540
WK50 250 M4	119	1,780	638	181	108	1,782	579	172	84	1,786	449	137	64	1,789	342	111	40	1,793	213	83	1,158	345	1.100	600
WK50 250 MX4	144	1,780	773	229	132	1,782	707	205	102	1,785	546	166	71	1,789	379	128	47	1,793	250	101	1,340	445	1.340	715
WK50 280 S4	175	1,782	938	285	152	1,784	814	250	119	1,788	636	210	90	1,792	480	170	56	1,794	298	135	1,560	575	1.960	790

Type	S2-30min / S3-15%				S2-60min / S3-25%				S3-40%				S3-60%				S3-100%				M <sub>max</sub> Nm	I <sub>max</sub> A	J kgm <sup>2</sup>	m kg
	P kW	n min <sup>-1</sup>	M Nm	I A	P kW	n min <sup>-1</sup>	M Nm	I A	P kW	n min <sup>-1</sup>	M Nm	I A	P kW	n min <sup>-1</sup>	M Nm	I A	P kW	n min <sup>-1</sup>	M Nm	I A				
WK3-Series																								
WK30 132 M4	10	1,759	54	23	8.5	1,465	55	21	6.5	1,774	35	19	5	1,780	27	17	3	1,788	16	9	102	43	0.028	71
WK30 160 M4	14.5	1,754	79	28	12.5	1,760	68	25	8.5	1,774	46	20	6.5	1,781	35	19	4	1,788	21	18	144	55	0.035	100
WK30 160 MX4	17.5	1,750	96	33	15	1,762	81	28	11.5	1,772	62	23	9	1,778	48	18	5.5	1,787	29	18	170	65	0.043	105
WK10 160 L4	20	1,762	108	35	17.5	1,768	95	34	13.5	1,776	73	28	10.5	1,782	56	23	6.5	1,788	35	19	195	69.5	0.078	120
WK30 180 M4	25	1,760	136	45	21.5	1,769	116	40	17	1,777	91	35	12.5	1,783	67	30	8	1,789	43	25	231	88	0.090	136
WK30 180 MX4	26	1,760	141	54	23	1,770	124	45	18	1,777	97	37	13.5	1,783	72	38	8.5	1,788	45	24	249	99.5	0.107	151
WK30 180 L4	29	1,768	157	49	25.5	1,772	137	45	20	1,779	107	38	15	1,784	80	30	9.5	1,790	51	26	302	109	0.115	165
WK30 180 LX4	32	1,767	173	54.5	27.5	1,772	148	48.5	21	1,779	113	40.5	16	1,784	86	35	10	1,790	53	29.5	332	109	0.138	185
WK30 200 L4	40	1,766	216	66.5	34.5	1,771	186	59	27	1,778	145	49	20	1,784	107	41	13	1,790	69	34.5	429	136	0.168	206
WK30 200 LX4	48	1,769	259	79.5	41.5	1,773	224	70.5	32	1,780	172	58	24	1,785	128	49.5	15.5	1,790	83	42	478	151	0.203	240
WK30 225 S4	49	1,770	264	82	42.5	1,774	229	72.5	33	1,780	177	61	25	1,785	134	51.5	15.5	1,791	83	43	508	160	0.275	282
WK30 225 M4	59	1,772	318	102	51.5	1,775	277	89	40	1,781	214	76	30	1,786	160	63.5	19	1,791	101	53.5	621	200	0.313	323
WK30 225 MX4	72	1,769	389	130	63	1,774	339	116.5	49	1,780	263	99	37	1,785	198	87.5	23	1,791	123	76	671	231	0.356	341
WK30 250 M4	72	1,777	387	120	63	1,780	338	108	49	1,785	262	91	34	1,790	181	75	23	1,793	123	66	710	217	0.525	377
WK30 250 MX4	91	1,780	488	151	77	1,782	413	129	60	1,785	321	105	40	1,790	213	81	25	1,793	133	67	790	262	0.619	435
WK30 280 S4	107	1,780	574	174	90	1,784	482	146	70	1,788	374	118	53	1,791	283	97	33	1,794	176	75	964	293	0.950	540
WK30 280 M4	119	1,780	638	181	108	1,782	579	172	84	1,786	449	137	64	1,789	342	111	40	1,793	213	83	1,158	345	1.100	600
WK30 280 MX4	144	1,780	773	229	132	1,782	707	205	102	1,785	546	166	71	1,789	379	128	47	1,793	250	101	1,340	445	1.340	715
WK30 280 MY4	175	1,782	938	285	152	1,784	814	250	119	1,788	636	210	90	1,792	480	170	56	1,794	298	135	1,560	575	1.960	790

# Three-phase asynchronous motor for frequency converter operation, self-ventilated IC 411, 400 V/ 50 Hz

Type	(S3-100%) S9				S3-60%				S3-40%				S3-25%				M <sub>max</sub> Nm	I <sub>max</sub> A	J kgm <sup>2</sup>	m kg
	P kW	n min <sup>-1</sup>	M Nm	I A	P kW	n min <sup>-1</sup>	M Nm	I A	P kW	n min <sup>-1</sup>	M Nm	I A	P kW	n min <sup>-1</sup>	M Nm	I A				
WK5R 132 S4	7.5	1,462	49	16.5	9	1,453	59	23	10	1,447	66	23	11	1,441	65.5	25	105	34.5	0.028	71
WK5R 132 M4	11	1,461	71.9	23.5	13	1,452	85.5	30	14.5	1,475	94	33	16.5	1,439	65.5	36	161	58	0.035	100
WK5R 132 MX4	13.2	1,462	86	30	15.5	1,456	101.5	34	17	1,451	112	35	19.5	1,442	111	40	189	67	0.043	105
WK5R 160 S4	15	1,467	98	33	18	1,457	118	40	19.5	1,452	128.5	43	22	1,444	127	46	217	81	0.078	120
WK5R 160 M4	18.5	1,469	120	40	22	1,461	144	45	24	1,457	157.5	50	27	1,449	156	55	258	94.5	0.090	136
WK5R 160 MX4	20	1,470	130	43	24	1,464	156.5	49	26	1,461	170	53	30	1,453	169	60	279	102	0.107	151
WK5R 160 L4	22	1,472	143	45	26	1,467	169.5	50	29	1,462	189.5	55	33	1,456	188	64	309	107	0.115	165
WK5R 180 S4	24	1,471	156	51.5	28	1,466	182.5	58	31	1,461	202.5	60.5	36	1,453	236	70	336	116	0.138	170
WK5R 180 M4	30	1,472	195	63.5	36	1,466	234.5	70	39	1,462	255	75	44	1,456	288	84	410	134	0.168	206
WK5R 180 MX4	36	1,475	233	83	43	1,470	279.5	89.5	47	1,467	306	95	53	1,462	346	105	520	185	0.203	255
WK5R 200 M4	37	1,475	240	79	44	1,469	286	86	48	1,466	312.5	92.5	55	1,460	360	105	490	128	0.275	270
WK5R 200 L4	45	1,475	291	95.5	53	1,470	344.5	103	59	1,466	384.5	113.5	67	1,460	438	127.5	625	206	0.313	300
WK5R 200 LX4	55	1,472	357	122	65	1,466	423.5	131	72	1,461	470.5	144.5	82	1,454	538	163	698	220	0.356	341
WK5R 225 M4	55	1,482	355	114	65	1,477	420	129	72	1,475	466	141	82	1,470	533	158	710	217	0.525	377
WK5R 225 MX4	64	1,485	412	131	76	1,480	490.5	151	84	1,476	543.5	165	95	1,474	615.5	188	790	262	0.619	425
WK5R 250 S4	75	1,487	481.5	146	89	1,484	572.5	170	98	1,482	631.5	187	111	1,478	717	214	964	339	0.950	520
WK5R 250 M4	90	1,485	579	171	107	1,483	689	199	117	1,480	755	219	133	1,476	860.5	253	1,158	345	1.100	580
WK5R 250 MX4	110	1,485	707	205	130	1,482	837.5	241	144	1,480	929	267	163	1,477	1,054	308	1,340	443	1.340	690
WK5R 280 S4	132	1,487	848	260	156	1,487	1002	300	172	1487	1,104.5	325	196	1,487	1,104.5	375	1,760	575	1.960	740

Type	(S3-100%) S9				S3-60%				S3-40%				S3-25%				M <sub>max</sub> Nm	I <sub>max</sub> A	J kgm <sup>2</sup>	m kg
	P kW	n min <sup>-1</sup>	M Nm	I A	P kW	n min <sup>-1</sup>	M Nm	I A	P kW	n min <sup>-1</sup>	M Nm	I A	P kW	n min <sup>-1</sup>	M Nm	I A				
WK3R 132 M4	7.5	1,462	49	16.5	9	1,453	59	23	10	1,447	66	23	11	1,441	65.5	25	105	34.5	0.028	71
WK3R 160 M4	11	1,461	71.9	23.5	13	1,452	85.5	30	14.5	1,475	94	33	16.5	1,439	65.5	36	161	58	0.035	100
WK3R 160 MX4	13.2	1,462	86	30	15.5	1,456	101.5	34	17	1,451	112	35	19.5	1,442	111	40	189	67	0.043	105
WK1R 160 L4	15	1,467	98	33	18	1,457	118	40	19.5	1,452	128.5	43	22	1,444	127	46	217	81	0.078	120
WK3R 180 M4	18.5	1,469	120	40	22	1,461	144	45	24	1,457	157.5	50	27	1,449	156	55	258	94.5	0.090	136
WK3R 180 MX4	20	1,470	130	43	24	1,464	156.5	49	26	1,461	170	53	30	1,453	169	60	279	102	0.107	151
WK3R 180 L4	22	1,472	143	45	26	1,467	169.5	50	29	1,462	189.5	55	33	1,456	188	64	309	107	0.115	165
WK3R 180 LX4	24	1,471	156	51.5	28	1,466	182.5	58	31	1,461	202.5	60.5	36	1,453	236	70	336	116	0.138	170
WK3R 200 L4	30	1,472	195	63.5	36	1,466	234.5	70	39	1,462	255	75	44	1,456	288	84	410	134	0.168	206
WK3R 200 LX4	36	1,475	233	83	43	1,470	279.5	89.5	47	1,467	306	95	53	1,462	346	105	520	185	0.203	255
WK3R 225 S4	37	1,475	240	79	44	1,469	286	86	48	1,466	312.5	92.5	55	1,460	360	105	490	128	0.275	270
WK3R 225 M4	45	1,475	291	95.5	53	1,470	344.5	103	59	1,466	384.5	113.5	67	1,460	438	127.5	625	206	0.313	300
WK3R 225 Mx4	55	1,472	357	122	65	1,466	423.5	131	72	1,461	470.5	144.5	82	1,454	538	163	698	220	0.356	341
WK3R 250 M4	55	1,482	355	114	65	1,477	420	129	72	1,475	466	141	82	1,470	533	158	710	217	0.525	377
WK3R 250 MX4	64	1,485	412	131	76	1,480	490.5	151	84	1,476	543.5	165	95	1,474	615.5	188	790	262	0.619	425
WK3R 280 S4	75	1,487	481.5	146	89	1,484	572.5	170	98	1,482	631.5	187	111	1,478	717	214	964	339	0.950	520
WK3R 280 M4	90	1,485	579	171	107	1,483	689	199	117	1,480	755	219	133	1,476	860.5	253	1,158	345	1.100	580
WK3R 280 MX4	110	1,485	707	205	130	1,482	837.5	241	144	1,480	929	267	163	1,477	1,054	308	1,340	443	1.340	690
WK3R 280 MY4	132	1,487	848	260	156	1,487	1002	300	172	1487	1,104.5	325	196	1,487	1,104.5	375	1,760	575	1.960	740

# Three-phase asynchronous motor for frequency converter operation, self-ventilated IC 411, 460V/ 60Hz

Type	S3-25%				S3-40%				S3-60%				S3-100%				M <sub>max</sub>	I <sub>max</sub>	J	m
	P	n	M	I	P	n	M	I	P	n	M	I	P	n	M	I				
WK5-Series	kW	min <sup>-1</sup>	Nm	A	kW	min <sup>-1</sup>	Nm	A	kW	min <sup>-1</sup>	Nm	A	kW	min <sup>-1</sup>	Nm	A	Nm	A	kgm <sup>2</sup>	kg
WK5R 132 S4	13.5	1,743	74	27.0	11.5	1,752	62.5	25.0	10.5	1,757	57	23.0	9	1,754	49	16.5	105	34.5	0.028	71
WK5R 132 M4	19.5	1,732	108	36.0	17	1,749	93	31.0	15.5	1,749	85	30.0	13	1,753	71	23.5	161	58.0	0.035	100
WK5R 132 MX4	24	1,734	132	42.0	21	1,744	115	36.0	19	1,750	104	34.0	16	1,754	87	30.0	189	67.0	0.043	105
WK5R 160 S4	27	1,737	149	49.0	23	1,749	126	42.0	21	1,754	115	39.0	18	1,760	97.5	33.0	217	81.0	0.078	120
WK5R 160 M4	33	1,743	181	59.0	29	1,752	158	52.0	26	1,758	141	46.0	22	1,766	119	40.0	260	95.5	0.090	136
WK5R 160 MX4	36	1,747	197	63.0	31	1,757	169	54.0	28	1,762	152	49.0	24	1,768	129.5	43.0	279	102	0.107	151
WK5R 160 L4	39	1,756	212	65.0	34	1,763	184	56.0	31	1,767	168	54.0	26	1,766	140.5	45.0	309	107	0.115	165
WK5R 180 S4	43	1,752	235	71.0	38	1,759	207	63.5	34	1,764	184	57.5	29	1,770	156.5	50.0	332	109	0.138	170
WK5R 180 M4	53	1,753	289	85.5	47	1,759	255	76.5	43	1,763	233	70.5	36	1,770	194	60.5	429	136	0.168	206
WK5R 180 MX4	64	1,756	348	103	56	1,762	304	90.5	51	1,766	276	83.5	43	1,772	231.5	72.0	478	151	0.203	255
WK5R 200 M4	65	1,758	353	106	57	1,764	309	92.5	52	1,768	281	85.5	44	1,773	237	74.5	508	160	0.275	270
WK5R 200 L4	80	1,759	435	130	70	1,765	379	115	64	1,768	346	106	54	1,774	290.5	92.0	625	206	0.313	300
WK5R 200 LX4	98	1,755	534	168	86	1,762	466	149	78	1,766	422	136	66	1,772	355.5	120	671	231	0.356	341
WK5R 225 M4	98	1,770	529	159	86	1,773	463	140	78	1,776	420	129	66	1,780	354	113	710	217	0.525	377
WK5R 225 MX4	114	1,774	614	194	101	1,778	543	169	91	1,781	488	151	77	1,785	412	129	790	281	0.619	425
WK5R 250 S4	133	1,775	716	222	117	1,780	628	191	107	1,782	574	174	90	1,786	481	147	900	343	0.950	520
WK5R 250 M4	160	1,774	862	268	141	1,777	758	228	128	1,780	687	205	108	1,784	578	171	1,158	342	1.100	580
WK5R 250 MX4	196	1,776	1,054	325	172	1,778	924	277	156	1,781	837	248	132	1,784	706.5	210	1,340	443	1.340	690
WK5R 280 S4	234	1,784	1,253	380	206	1,784	1,103	330	187	1,784	1,001	305	158	1,784	846	260	1,560	575	1.960	740

Type	S3-25%				S3-40%				S3-60%				S3-100%				M <sub>max</sub>	I <sub>max</sub>	J	m
	P	n	M	I	P	n	M	I	P	n	M	I	P	n	M	I				
WK3-Series	kW	min <sup>-1</sup>	Nm	A	kW	min <sup>-1</sup>	Nm	A	kW	min <sup>-1</sup>	Nm	A	kW	min <sup>-1</sup>	Nm	A	Nm	A	kgm <sup>2</sup>	kg
WK3R 132 M4	13.5	1,743	74	27.0	11.5	1,752	62.5	25.0	10.5	1,757	57	23.0	9	1,754	49	16.5	105	34.5	0.028	71
WK3R 160 M4	19.5	1,732	108	36.0	17	1,749	93	31.0	15.5	1,749	85	30.0	13	1,753	71	23.5	161	58.0	0.035	100
WK3R 160 MX4	24	1,734	132	42.0	21	1,744	115	36.0	19	1,750	104	34.0	16	1,754	87	30.0	189	67.0	0.043	105
WK1R 160 L4	27	1,737	149	49.0	23	1,749	126	42.0	21	1,754	115	39.0	18	1,760	97.5	33.0	217	81.0	0.078	120
WK3R 180 M4	33	1,743	181	59.0	29	1,752	158	52.0	26	1,758	141	46.0	22	1,766	119	40.0	260	95.5	0.090	136
WK3R 180 MX4	36	1,747	197	63.0	31	1,757	169	54.0	28	1,762	152	49.0	24	1,768	129.5	43.0	279	102	0.107	151
WK3R 180 L4	39	1,756	212	65.0	34	1,763	184	56.0	31	1,767	168	54.0	26	1,766	140.5	45.0	309	107	0.115	165
WK3R 180 LX4	43	1,752	235	71.0	38	1,759	207	63.5	34	1,764	184	57.5	29	1,770	156.5	50.0	332	109	0.138	170
WK3R 200 L4	53	1,753	289	85.5	47	1,759	255	76.5	43	1,763	233	70.5	36	1,770	194	60.5	429	136	0.168	206
WK3R 200 LX4	64	1,756	348	103	56	1,762	304	90.5	51	1,766	276	83.5	43	1,772	231.5	72.0	478	151	0.203	255
WK3R 225 S4	65	1,758	353	106	57	1,764	309	92.5	52	1,768	281	85.5	44	1,773	237	74.5	508	160	0.275	270
WK3R 225 M4	80	1,759	435	130	70	1,765	379	115	64	1,768	346	106	54	1,774	290.5	92.0	625	206	0.313	300
WK3R 225 Mx4	98	1,755	534	168	86	1,762	466	149	78	1,766	422	136	66	1,772	355.5	120	671	231	0.356	341
WK3R 250 M4	98	1,770	529	159	86	1,773	463	140	78	1,776	420	129	66	1,780	354	113	710	217	0.525	377
WK3R 250 MX4	114	1,774	614	194	101	1,778	543	169	91	1,781	488	151	77	1,785	412	129	790	281	0.619	425
WK3R 280 S4	133	1,775	716	222	117	1,780	628	191	107	1,782	574	174	90	1,786	481	147	900	343	0.950	520
WK3R 280 M4	160	1,774	862	268	141	1,777	758	228	128	1,780	687	205	108	1,784	578	171	1,158	342	1.100	580
WK3R 280 MX4	196	1,776	1,054	325	172	1,778	924	277	156	1,781	837	248	132	1,784	706.5	210	1,340	443	1.340	690
WK3R 280 MY4	234	1,784	1,253	380	206	1,784	1,103	330	187	1,784	1,001	305	158	1,784	846	260	1,560	575	1.960	740

## Three-phase asynchronous motor for frequency converter operation in the passage, internally-externally cooled IC06, protection class IP23

Type	AH	2p	P <sub>n</sub> kW	460U <sub>n</sub> V	I <sub>n</sub> A	f <sub>n</sub>	Connection	n <sub>n</sub> 1/min	M <sub>n</sub> Nm	M <sub>k</sub> /M <sub>n</sub>	cos φ	η %	J <sub>mot</sub> kgm <sup>2</sup>
W2BA 225 M 4	225	4	140	480	219	60	D	1,765	757	3.2	0.86	93.90	0.7
W2BA 225 LX4	225	4	205	480	308	60	D	1,765	1,109	3.1	0.89	94.30	1.1
W2BA 225 LZ4	225	4	230	460	350	60	D	1,767	1,243	3.3	0.87	94.40	1.2
W2BA 280 MX4	280	4	230	460	336	60	Y	1,771	1,240	3.4	0.91	94.70	1.5
W2BA 280 LZ4	280	4	325	460	474	60	Y	1,773	1,751	3.7	0.91	95.00	2.1
W2BA 315 MY4	315	4	280	460		60		1,800	1,486				
W2BA 315 MX4	315	4	335	460	483	60	D	1,800	1,777	3.6	0.91	95.10	2.7
W2BA 315 L 4	315	4	375	460	535	60	D	1,776	2,016	3.5	0.92	95.20	3.0
W2BA 315 LX4	315	4	450	460	640	60	D	1,777	2,418	3.6	0.92	95.30	3.6
W2BA 355 MY6	255	6	315	460	495	45	D	882	3,410	3.2	0.86	93.60	6.5
W2BA 355 M 6	255	6	290	460	607	45	D	884	4,107	3.5	0.84	93.70	8.0
W2BA 355 MX6	255	6	465	460	714	45	D	882	5,033	3.3	0.87	94.10	9.5
W2BA 355 L 6	255	6	490	460	763	45	D	883	5,298	3.4	0.86	94.20	10.0
W2BA 355 LX6	255	6	530	460	827	45	D	884	5,729	3.5	0.86	94.20	11.1
W2BA 400 MX6	400	6	600	460	892	45	D	886	6,464	3.1	0.89	94.90	14.5
W2BA 400 L 6	400	6	685	460	1,041	45	D	888	7,369	3.4	0.87	95.20	16.3
W2BA 400 LX6	400	6	760	460	1,145	45	D	888	8,177	3.4	0.88	95.10	18.0
W2BA 400 LZ6	400	6	870	460	1,287	45	D	887	9,368	3.3	0.89	95.20	21.0

### Technical features of the W2BA series

- steel-welded enclosure with proven grey cast iron components of the standard series
- die-cast aluminium rotor body
- compact design with high power density (low space requirement, low weight)
- open design, air-cooled (IP23, IC06)
- power range 4 poles: 140 kW to 450 kW / 6 poles: 315 kW to 870 kW
- mains voltages:
  - 50 Hz: 400 V, 500 V, 690 V
  - 60 Hz: 460 V, 480 V



- ▶ highly efficient
- ▶ very high torque density
- ▶ can operate at permanent maximum output
- ▶ suitable for short time duty

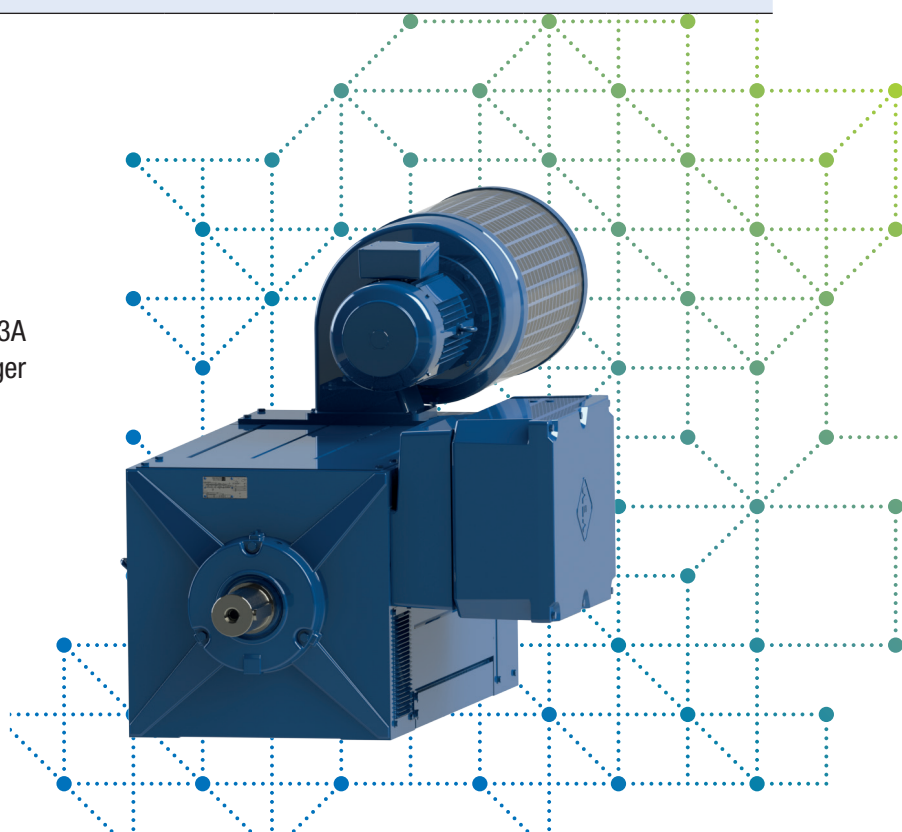


## Three-phase asynchronous motor for frequency converter operation (without enclosure), in the passage, internally-externally cooled IC06; protection class IP23

Type	AH	2p	P <sub>n</sub> kW	U <sub>n</sub> V	I <sub>n</sub> A	f <sub>n</sub>	Connection	n <sub>n</sub> 1/min	M <sub>n</sub> Nm	M <sub>k</sub> /M <sub>n</sub>	cos φ	η %	J <sub>mot</sub> kgm <sup>2</sup>
K33A 250S4	250	4	135	500	190	26	Y	750	1,719	3.3	0.88	92.63	2.1
K33A 250M4	250	4	175	500	242	26	Y	750	2,228	3.1	0.90	92.81	2.6
K33A 250L4	250	4	225	500	310	26	Y	750	2,865	3.3	0.90	93.28	3.3
K33A 280S4	280	4	210	500	287	26	Y	750	2,673	3.6	0.90	93.99	4.2
K33A 280M4	280	4	250	500	333	26	Y	750	3,183	3.6	0.92	94.12	5.1
K33A 280L4	280	4	320	500	420	26	Y	750	4,074	3.2	0.94	94.01	6.4
K33A 315S4	315	4	290	500	391	25	Y	750	3,693	3.2	0.91	94.47	6.9
K33A 315M4	315	4	340	500	458	25	Y	750	4,329	3.4	0.90	94.81	8.2
K33A 315L4	315	4	420	500	569	25	Y	750	5,348	3.7	0.90	95.08	10.0
K33A 355S4	355	4	450	500	590	25	Y	750	5,729	4.1	0.92	95.57	15.9
K33A 355M4	355	4	500	500	669	25	Y	750	6,366	4.6	0.90	95.84	17.7
K33A 355L4	355	4	630	500	834	25	Y	750	8,021	4.5	0.91	95.91	21.3
K33A 400S4	400	4	620	500	817	25	D	750	7,895	4.2	0.91	96.19	25.9
K33A 400M4	400	4	720	500	944	25	Y	750	9,167	4.3	0.91	96.29	29.8
K33A 400L4	400	4	850	500	1,149	25	D	750	10,822	4.9	0.89	96.50	34.9

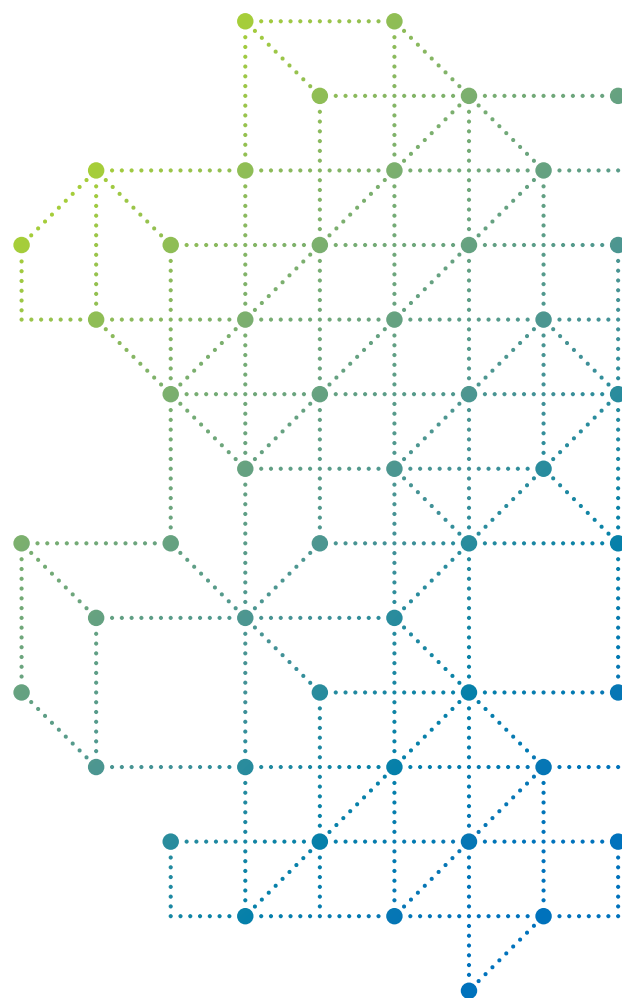
### Technical features of the K33 series

- steel-welded design without enclosure (self-supporting laminated core)
- die-cast aluminium rotor body
- compact design with high power density (low space requirement, low weight)
- open design, air-cooled (IP23, IC06) Series K33A
- closed design, water-cooled with heat exchanger (IP55, IC86W) Series K33C
- power range 4 poles: 135 kW to 850 kW
- mains voltages:
  - 50 Hz: 400 V, 500 V, 690 V
  - 60 Hz: 460 V



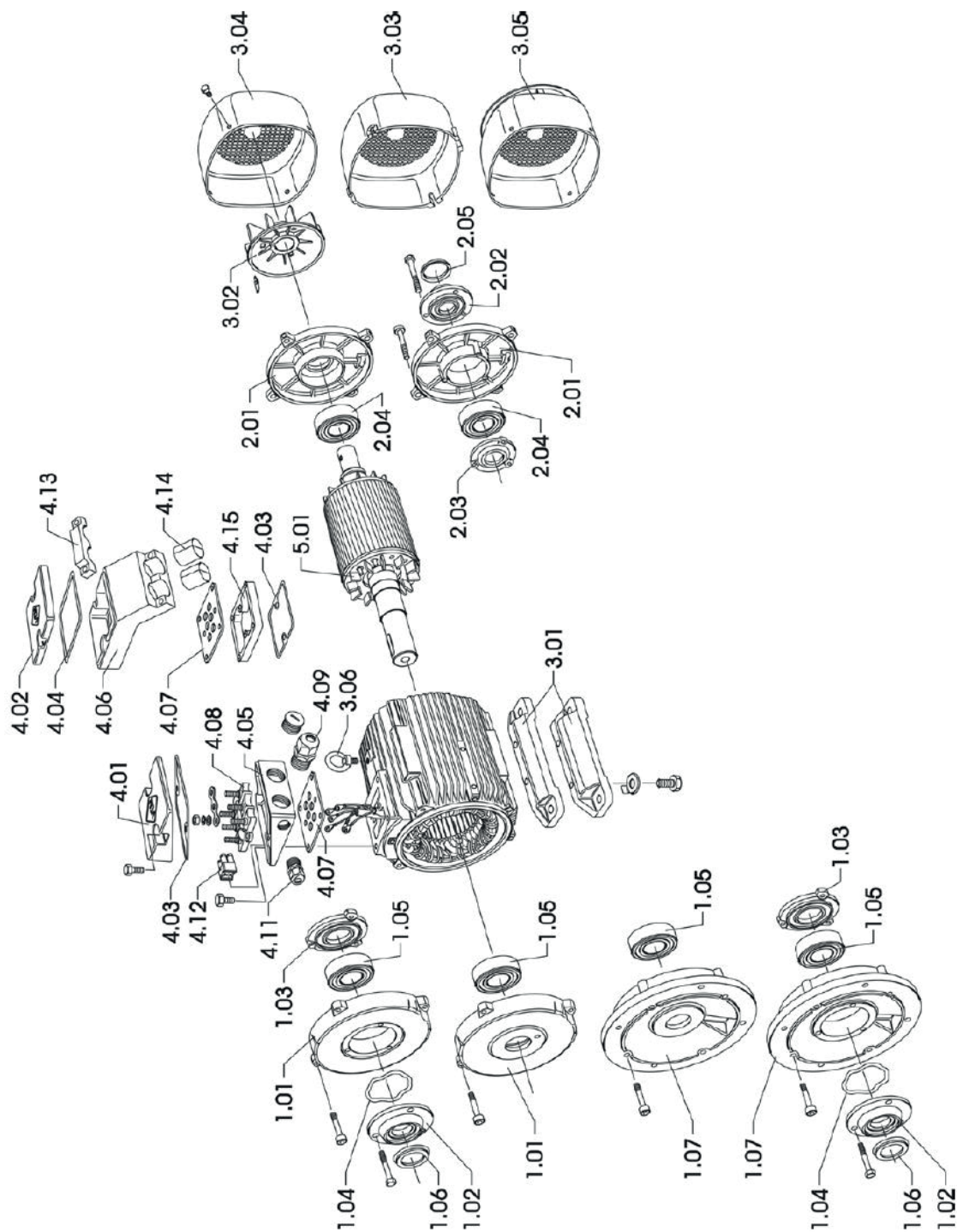
## Overview of spare parts: Three-phase asynchronous motors with squirrel-cage rotor

Item no.	Designation
1.01	End shield, D-end
1.02	Bearing cover, D-end, outside
1.03	Bearing cover, D-end, inside
1.04	Disc spring/wave spring, D-end, not with roller bearings
1.05	Antifriction bearing, D-end
1.06	V-ring, D-end
1.07	Flange end shield
1.08	Felt ring, D-end
2.01	End shield, N-end
2.02	Bearing cover, N-end, outside
2.03	Bearing cover, N-end, inside
2.04	Antifriction bearing, N-end
2.05	V-ring, N-end
2.06	Wave spring, N-end (or D-end)
2.08	Felt ring, N-end
3.01	Motor feet (pair)
3.02	Fan
3.03	Fan cowl, plastic
3.04	Fan cowl, sheet steel
3.05	Fan cowl with canopy
3.06	Eye bolt
4.01/4.02	Terminal box cover
4.03/4.04	Gasket, terminal box cover
4.05/4.06	Terminal box base
4.07	Gasket, terminal box base
4.08	Terminal plate
4.09	Cable gland
4.10	Screw plug
4.11	Cable gland for thermal winding protection
4.12	Terminal for thermal winding protection
4.13	Clamp
4.14	Sealing plugs
4.15	Adapter plate
4.16	Flat terminal box
4.17	Standard parts bag
5.01	Rotor, complete
5.02	Shaft key
6.01	Thrower ring, D-end
6.02	Thrower ring, N-end
6.03	Labyrinth gland, D- and N-end
6.04	Guide disc, D-end
6.05	Guide disc, N-end



## Three-phase asynchronous motors with squirrel-cage rotor, frame size 56 to 132 T

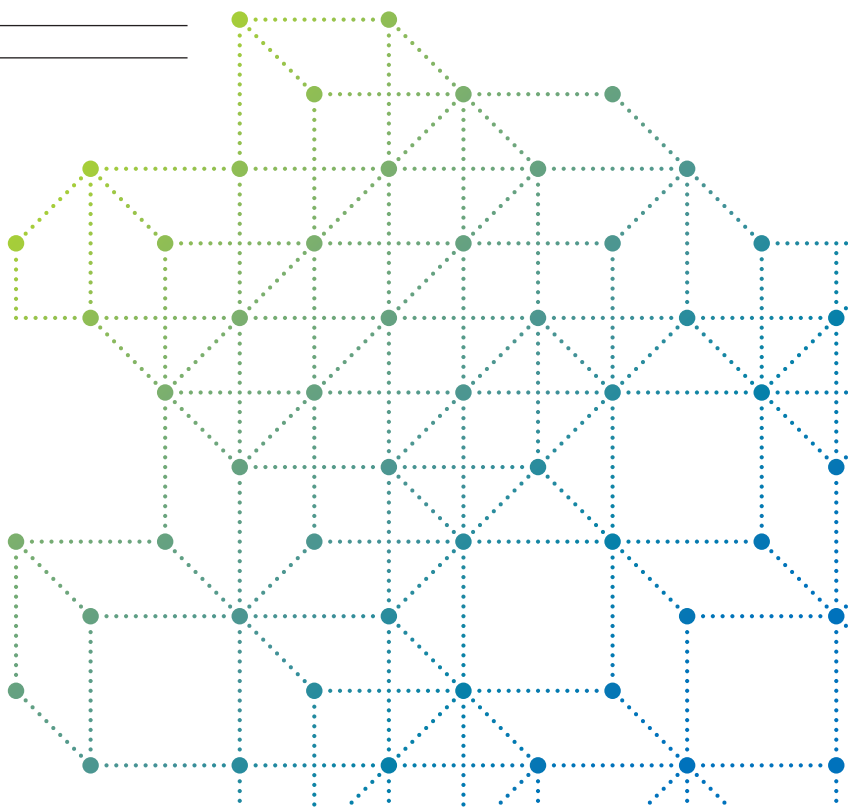
(Example; delivered version may differ in certain details)



## Overview of spare parts: Three-phase transnorm motors with squirrel-cage rotor

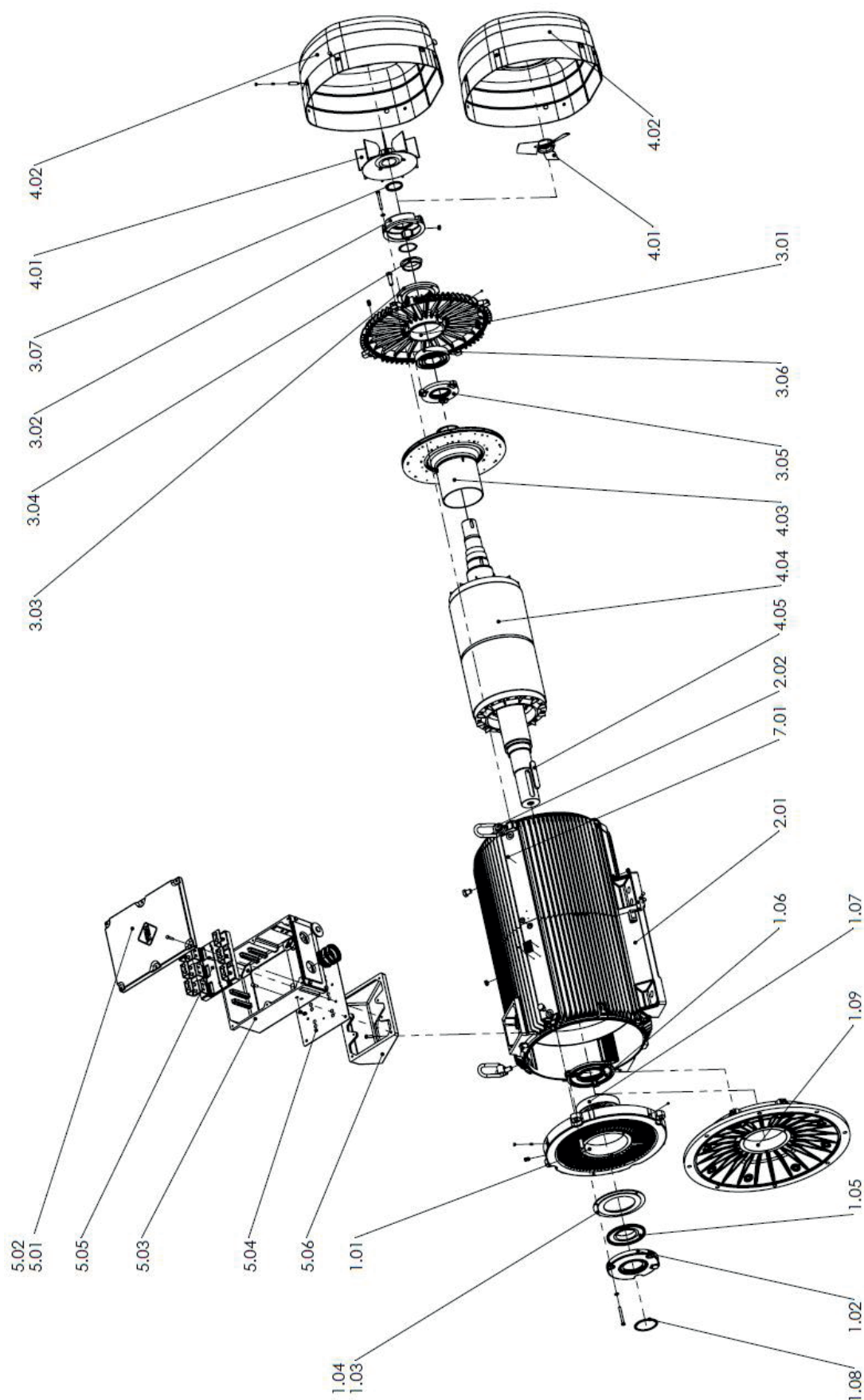
### Basic version frame size 355 to 450

Item no.	Designation
1.01	End shield, D-end
1.02	Bearing cover, D-end, outside
1.03	Guide disc, D-end
1.04	Pressure springs
1.05	Thrower ring, D-end
1.06	Bearing cover, D-end, inside
1.07	Antifriction bearing, D-end
1.08	Sealing ring, D-end
1.09	Flange end shield
2.01	Housing with winding
2.02	Eye bolt
3.01	End shield, N-end
3.02	Bearing cover, N-end, outside
3.03	Guide disc, N-end
3.04	Thrower ring, N-end
3.05	Bearing cover, N-end, inside
3.06	Antifriction bearing, N-end
3.07	Sealing ring, N-end
4.01	Fan
4.02	Fan cowl
4.03	Internal fan
4.04	Rotor, complete
4.05	Shaft key
	Terminal box, motor type W4..
5.01	Terminal box cover
5.02	Gasket, terminal box cover
5.03	Terminal box base
5.04	Gasket, terminal box base
5.05	Terminal plate
5.06	Adapter flange with gasket
7.01	Transponder



## Three-phase transnorm motor with squirrel-cage rotor, basic version W42R 355 to 400

(Example; delivered version may differ in certain details)





## Our VEM product portfolio for the most diverse applications

Depending on the application, VEM motors are used to drive main hoists, boom hoists, trolleys and gantrys. The design principle of the series permits the add-on mounting of components such as encoders, tachos, brakes and forced ventilation units to solve the customer's individual control tasks.

The robust and low-vibration motor design with grey cast iron housing is characterized by its high mechanical strength.



In combination with a corresponding paint system, the motors guarantee a very high level of proven corrosion protection to withstand the most varied environmental and climatic influences.

The VEM trademark stands for brand-name products made in Germany. These products today hold a considerable share of the worldwide market, reflecting the company's more than 100 years of tradition and experience in the manufacturing of electric machines.



Type of crane	Location	Applications/ Types	Year
Ship to shore	Trisakti Port / Indonesia (Pelabuhan)	Gantry	2022
Rubber Tyred Gantry Crane	Malaysia West Port	Gantry	2021
Transport crane	Audi Ingolstadt, Germany	various	2021
Ship to shore	Kingston Jamaica	Gantry	2021
Tool transport and double girder overhead cranes	Audi Mexico	various	2021
cRMG	Vancouver/ Canada (DPW)	Gantry & Trolley	2021
Process Cranes	Hot strip mill in Mexico (Arcelor)	Hoist, Trolley, Gantry	2021
Quay Crane	NIT Norfolk Port of Virginia	Gantry	2021
Process cranes	Tesla, Germany	various	2021
transport and double girder overhead cranes	FAW Hongqi, Shanghai (LOADWELL)	various	2021
Quay Crane	Oakland/USA (GTA)	Gantry	2020
Quay Crane	Los Angeles/USA (GTA)	Gantry	2020
Rubber Tyred Gantry Crane	Peru (DPW)	Gantry	2020
Rubber Tyred Gantry Crane	Felixstowe/UK	Gantry	2020
Press Shop Crane	Wolfsburg/Germany (VW)	various	2020
Rubber Tyred Gantry Crane	Malaysia Penang Port	Gantry	2020



Three-phase asynchronous motor in non-ventilated version with electromagnetic spring-set brake and protected hollow shaft incremental encoder between motor housing and brake, type of protection IP 56



Three-phase asynchronous motor with slip-ring rotor for intermittent duty



Three-phase asynchronous motor in non-ventilated version with electromagnetic spring-set brake and incremental encoder, type of protection IP 66



## Good reasons for VEM

- Made in Germany
- own design engineers develop tailored solutions
- high proportion of flexible in-house manufacturing, e.g. press shop, core assembly and winding shop
- fast response times
- worldwide service availability
- durable and robust under extreme conditions
- environment-friendly and energy-efficient
- low life-cycle costs





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FOR EVERY DEMAND

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