

## **Additional Installation, Operating and Maintenance Instructions**

### **Water Cooled Three-Phase Asynchronous Motors with squirrel-cage rotor for low voltage applications**

**Translation**



**Type series  
K21B/K23B  
WE1B/W21B/W41B**

Motors that comply with the Regulation 2005/32/EC and the order No. 640/2009 receive the marking IEx before the type designation, whereas x= 1,2,3 (acc. to EN 60034-30). (Example IE1-K21R 132 S4)

## General



**Attention! Read installation, operation and maintenance instructions, connection diagram, additional connection diagram and safety regulations before transportation, installation, start-up, maintenance and repair. Mind the information!**

The existing additional operation and maintenance manual is valid together with the already mentioned documents and the operation and maintenance manual for standard motors, where the basic specifications for connection, installation, operation and maintenance as well as the spare parts lists are included.

This manual shall help the user to ease the secure and proper transportation, installation, start-up and maintenance of the explosion-protected electric machine.

Observance of this manual and the conditions and methods used for installation, operation, use and maintenance of the electric motor can not be monitored by the manufacturer. An improper installation can result in property damage and thus result in personal injuries. We therefore do not accept responsibility and liability for losses, damages or costs resulting from improper installation, improper or wrong use and maintenance or connected with this in any kind.

Technical drawings and pictures are simplified illustrations. Due to improvements and changes it might happen that they do not correspond in detail with the supplied electric machine. We strive to improve our products continuously. Consequently technical data and illustrations remain subject to change without prior notice. Specifications may only be considered binding after written confirmation by the supplier.

## Symbols

In this manual two symbols will be used, that indicate important passages:



**Security and warranty advices, possible damage to persons included.**



**Warning against electric voltage, danger of life. Advice that damages to the electrical machine and/or the auxiliary devices can happen.**

## Security regulations

The security regulations, accident prevention regulations, standards and approved rules of technique must be observed unconditionally!

The non-observance of the security advices can result in endangering people and/or damaging of the machine.

## Efficiency classes

Listed are the IE-classes and the rated efficiency. The motor efficiency is determined according to EN 60034-2-1. For motors < 1kW the direct measurement method is used. For motors  $\geq 1$  kW the individual loss method is used. The additional losses of this method are determined from the residual losses. The type designation is extended with the efficiency class as prefix (example IE1-K11R 132 M2...).

## Installation and electrical connection

At installation and start of operation the security advices that are enclosed with the motor have to be observed. Installation work shall only be done by qualified personnel who is skilled because of a technical education, expertise and schooling of knowledge about



- security regulations,
- accident prevention regulations,
- standards and approved rules of technique (for example VDE-regulations, standards).

The qualified personnel must have the ability to assess the assigned job, identify possible dangers and avoid them. The qualified personnel must be authorized by the person in charge for security of the plant to carry out the necessary work and tasks.

A careful installation of the motors on an exactly level support has to be ensured to avoid strain when tightening the machine. Machines that shall be coupled must be adjusted exactly. If possible elastic couplings shall be used.

## Motor connection

**The connection has to be done by qualified personnel according to the valid security regulations. Outside of Germany the required national standards must be applied. Name plate designations have to be observed under all circumstances!**



Compare current type, mains voltage and frequency!

Mind connection type!

Mind rated current for motor protection switch setting!

For motors with type of protection „increased safety“ “e” the  $t_E$ - time has to be observed!

Connect the motor according to the connection diagram inside of the terminal box!

Earthing shall be done with the earthing clip that can be found at the enclosure or at the end shield depending on the type of construction. In addition all motors are equipped with a ground conductor clamp inside of the terminal box. Unused cable glands of the terminal box have to be closed for protection against dust and humidity. For electrical connection the standard security and starting instructions are valid. The cable glands or screwed sealing plugs must be admitted for use in Ex-applications. The installation torques, sealing areas and clamp ranges of the cable clamps given by the manufacturer have to be observed unconditionally.

Supply cables have to be selected according to DIN VDE 0100 taking into account rated current and operational conditions (i.e. ambient temperature, method of cable installation etc. complying with DIN VDE 0298 and IEC / EN 60204-1)

Take extra care when connecting the supply cables in the terminal box of the motor. The nuts of the connection screws have to be fastened without force.

Tightening torques for bolts (terminal box, end shield, bearing cover)

Thread Ø	M5	M6	M8	M10	M12	M16	M20
End shield	-	-	25	45	75	170	275
Bearing cover	5	8	15	20	20	-	-
Terminal box	-	4	7,5	12,5	-	20	-

## Engineering design

Up to size 280 the housing of the motor is manufactured as grey cast iron housing with cast-in cooling pipes. Starting from size 315 the housing is manufactured as double-walled, welded steel construction. Terminal boxes, end shields, insulation of the winding, type of protection and colouring are the same as for standard motors. The advantage of water cooling can be found in a noise reduction compared to surface cooled three-phase motors of the same size and output. The lost heat is dissipated without influence on the environment and the cooling principle allows for a compact design of the motors with increased output and optimised vibration damping at the same time.

Shaft height	Material for			Foot mounting
	Housing	End shield	Feet	
225 – 280	Grey cast iron with cast-in cooling pipes	Grey cast iron	Grey cast iron	bolted on
315	Steel-welded construction	Grey cast iron	Grey cast iron	cast on
355				

## Type of protection

The standard version of the motors has a degree of protection in IP 55; according to the order, the degree of protection can be increased to IP 56. Protection types of IP 65 and higher are available on request.

For all motors in types of mounting with shaft end upwards (IM V3 / IM V36), the user must prevent the ingress of water along the shaft.

The operator must prevent that water can ingress in the motor from the shaft for motors with flange end-shields in types of mounting IM V3 / IM V36. Flange motors in type of constructions IM V3 / IM V36 are fitted with a drain hole as standard so that condensate water can be drained.

For applications in the open, normally no specific protection measures against weather influences are required. If it is possible, that the motors are stored or operated below freezing point, freezing of the cooling water inside the motor must be prevented. Additionally, the motors must be protected against intensive sun radiation, e.g. by a protective roof.

**Classification of shaft size to output**

Size	Rated output [kW]							
	GR	EHL	GR	EHL	GR	EHL	GR	EHL
	2-pole		4-pole		6-pole		8-pole	
225 S	37	45	37	45	-	-	18,5	22
225 M	45	55	45	55	30	37	22	30
250 M	55	75	55	75	37	45	30	37
280 S	75	90	75	90	45	55	37	45
280 M	90	110	90	110	55	75	45	55
315 S	110	132	110	132	75	90	55	75
315 M	132	160	132	160	90	110	75	90
315 MX	160	200	160	200	110	132	90	110
315 MY	200	250	200	250	132	160	110	132
315 L	250	315	250	290	160	200	132	160
315 LX	315	355	315	355	200	240	160	200
355 M	355	400	355	400	250	315	200	250
355MX	400	500	400	500	315	400	250	315
355 L	500	560	500	560	400	450	315	355

GR... basic series, EHL... increased output

**Water cooling**

For water cooled motors the waste heat arising from the motor operation is dissipated by the cooling water. The inlet and outlet for the cooling water is implemented at the non-driving end (N-end). The cooling water must always contain a rust preventive agent, if the frost line could be crossed, also an anti-freeze or a combined agent must be added.



**The motors are intended for operation in closed cycle systems.**

From size 315 upwards the operation in open cycle systems is available as a special version. If an open cycle system shall be used, it is necessary to contact the manufacturer VEM motors GmbH.

**Motor handling**

If there is a possibility that the motors are stored or operated below the frost line, the freezing of the cooling water inside the motor must be prevented. For that purpose the cooling water can be drained off or an anti-freeze must be added to the cooling water, respectively before storage. The following different steps must be observed:

**Version 1** - continuous operation with anti-freeze

If the motor is operated continuously with an anti-freeze and anti-corrosion medium, e.g. HAERTOL Frostox PSF 12/DI or a similar additive, then a continuous protection against corrosion and freezing is given.

**Version 2** – interrupted duty and water as cooling medium

For interrupted motor operation, it is recommended to drain the cooling water off. Before the cooling water is drained off, an anti-freeze, e.g. HAERTOL Frostox PSF 12/DI or similar products must be added for protection of the cooling system. By this procedure, the cooling jacket is protected against corrosion for about three months.

**Version 3** – after long-term standstill (with or without anti-freeze in the cooling system)

After long-term standstill and before putting into operation, it must be checked that there are no obstacles to the free flow of cooling water. Possible traces of rust must be pickled off by a 10 % oxalic acid by the following procedure:

- Empty the cooling system, if there are any remains of water inside
- Fill the cooling system by 10 % oxalic acid (about 100 g per litre) and leave it inside for about 15 min.
- Empty the cooling system, rinse it with fresh water – repeat this, if necessary

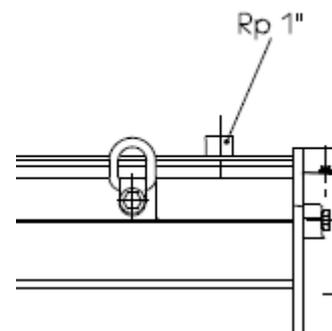
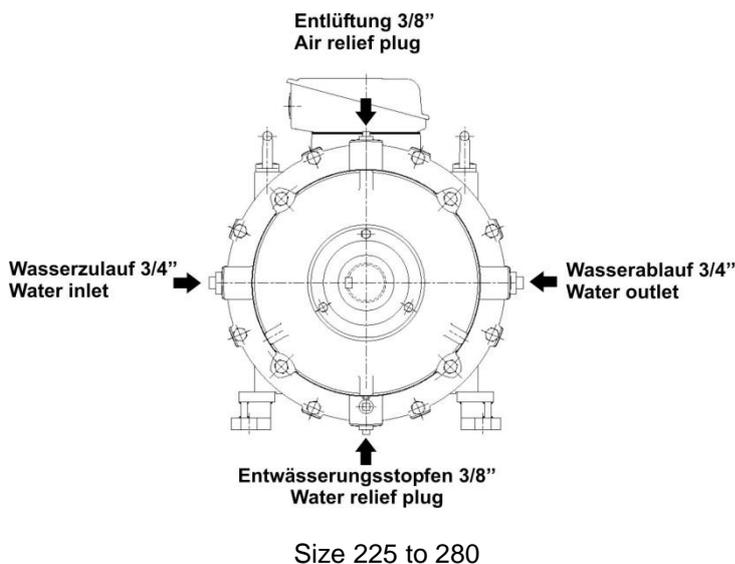
If the motor was in standstill for a long period, and if the water cooling system was empty during this time it must be checked that the cooling water is able to circulate without any restrictions before putting into operation again.

### Water feeding, technical requirements for the cooling water

The cooling water must have the quality of drinking water. The maximum water pressure is 3.5 bar, and the maximum temperature of the entering water must not exceed 35 °C. The following minimum requirements for the cooling system have to be observed.

Size	Flow rate of cooling water [l/min]	Min. water pressure [bar]	Temperature rise of cooling water [°C]
225	10	0,5	6
250	16	0,7	7
280	18	1,0	9
315	18	1,5	8
355	20	2,0	10

The water inlet and outlet are situated on N-side of the housing. Use suitable sealants for the joints.



Size 315/355

The water supply must be secured during operation of the motor.



**Operation without cooling water is not admissible.**

In addition there is an air relief plug with 3/8 " thread on N-end of the motor and a water drain plug with 3/8 " thread at the lowest point for motors of size 225 to 280. When the cooling system is filled, the air relief plug must be opened. The motor must be filled with cooling water, until the water exits from the air relief hole. The filling procedure must be done carefully to make sure that no air remains inside the cooling circuit. Then the air relief hole must be closed. Again an appropriate sealant must be used. Check that the joints are water-proof.

To empty the motor, take off the plugs for air relief and water drain. After complete drainage the plugs must be tightened again. If the cooling system is filled again, check that all plugs are water-proof.

### Auxiliary devices

#### Additional thermal motor protection

For monitoring the stator winding temperature it is possible to have thermo couples installed in the motor (PTC thermistors, KTY or PT100). For their connection suitable auxiliary clamps for auxiliary circuits are available in the main terminal box or in additional terminal boxes. The connection is done according to the attached connection diagram.

#### Anti-condensation heating

The heating power and the input supply voltage are indicated on the name plate of the motor. For their connection either in the main terminal box or in the auxiliary terminal boxes suitable clamps for auxiliary circuits are provided. The connection is done according to the attached connection diagram. The anti-condensation heating has to be switched on only after disconnection of the motor. It shall not be switched on while the motor is in operation.

### Maintenance and repair

Careful and regular maintenance, inspections and revisions are necessary to detect and clear faults in time, before consequential damages will happen. As individual operating conditions can not be defined for all applications the listed terms represent a general advice for undisturbed operation. Individual local conditions (degree of pollution, load, etc.) must be taken into account when adjusting these terms.

What to do?	Time period	Terms
First inspection	After about 500 operating hours	½ year at the latest
Control of air circulation and surface of motor	Depending on local environmental pollution	
Relubrication (as option)	See name plate or relubrication sign	
Main inspection	After about 10,000 operating hours	Once a year
Remove condensate water	Depending on the local environmental conditions	

**The necessary relubrication intervals for anti-friction bearings are different to these inspection intervals. They have to be observed as well!**

The motors up to size 315M are equipped as standard with anti-friction bearings with life-time lubrication. From size 315MX upwards they are equipped with relubrication devices which can be ordered for smaller motors as option. Information about bearings and relubrication can be found in the general installation, maintenance and operation manual or on the name plate or relubrication sign.



Maintenance works (without relubrication) has to be done at standstill of the motor. It has to be assured that the machine is secured against re-connection and labelled with an appropriate sign.

In addition the security advices and accident prevention regulations of the manufacturers for the use of oils, lubricants and detergents has to be observed!

Adjacent live parts have to be covered or secured! It has to be assured that the auxiliary circuits like anti-condensation heating are dead (zero potential).

For design versions with condensate drain hole please observe that the drain plug screw has to be lubricated with a suitable sealant (for example Epple 28) before relocking.

### Spare parts



Except for standard, commercially available and equivalent parts (like anti-friction bearings) only original spare parts (see spare parts list) shall be used; this applies especially for seals and connection parts. For spare parts orders the following information is necessary:

Spare parts name  
Motor type  
Motor number

### Long term storage (more than 12 months)

Long term storage must be done indoors in vibration-free, dry rooms with temperatures not below -20°C and not above +40°C. The storage environment must not contain aggressive gas, vapours, dusts and salts. Preferably motors shall be moved and stored only in original packing. Storage and transport with motors standing on their fan covers is not allowed. Additionally unprotected metal surfaces like shaft ends and flanges must be protected with a medium for long-time corrosion protection in addition to the existing factory-provided temporary corrosion protection. If there is a risk of motors being covered by moisture from condensation, please provide precautionary measures against humidity. Than a special packing in airtight sealed plastic foil is necessary or as alternative packing in plastic foil with desiccants. Please put desiccant bags in the terminal box as well.

For the transport please use the eye bolts/attachment eyes of the motors together with suitable lifting accessories. The eye bolts/attachment eyes must only be used for lifting the motors without additional mountings like foundation plates, gears and others.

Motors with reinforced bearings are supplied with a transportation safety device. The transportation safety device at the shaft end must only be removed during installation of the motor and before switching on.

### Disposal

When disposing of the motors please observe applicable national law.

In addition please take care that all oil and grease is disposed according to the ordinance of waste oils (Altölverordnung). They must not be contaminated with solvents, cold cleaners and paint residues.

Before recycling the individual materials must be separated. Most important components are grey cast iron (housing), steel (shaft, stator and rotor sheets, consumables), aluminium (rotor), copper (windings) and plastics (insulation materials like for example Polyamide, Polypropylene and others). Electronic components like printed circuit boards (inverter, encoder, etc.) must be recycled separately.

### Terminal board connections

In standard design surface cooled motors are adapted for both rotational directions.

The connections U1, V1, W1 at phases L1, L2, L3 (in alphabetical or natural order) result always in clockwise rotation. The sense of rotation can be reversed at direct starting if two main connections at the terminal board are changed.

For a machine with only one shaft end or with two shaft ends that have different diameters, the sense of rotation is that rotational direction which is seen, if a person looks at the front end of the only or thicker shaft end.



**For each motor the correct connection diagram is attached. The connection must be done accordingly. For the connection of auxiliary circuits please see the additional connection diagram, which is also attached.**

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## EC Declaration of Conformity

The electrical apparatus  
water cooled three-phase asynchronous motors with squirrel-cage rotor,  
of series

**K21B / K23B 225 up to 355**  
**WE1B//W21B/W41B**

are in conformity with the instructions of the following EU Directives:

**2006/95/EG**

**Directive of the European Parliament and the Council from 12<sup>th</sup> December 2006 for harmonisation of legislative provisions of the member states concerning electrical equipment for operation within certain voltage limits**

**2004/108/EG**

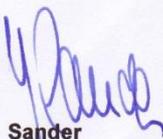
**Directive about Electromagnetic Compatibility**

The conformity with the instructions of these Directives is proved by the observations of following standards:

European Standard / German Standard

EN 61000-6-1, EN 61000-6-2, EN 61000-6-3, EN 61000-6-4  
EN 55014-1, EN 55014-2  
EN 61000-3-2, EN 61000-3-3  
EN 60034-1, EN 60034-2-1, EN 60034-5, EN 60034-6, EN 60034-9, EN 60034-30  
DIN IEC 60038  
EN 61800-3  
EN 60204-1

Wernigerode, 12<sup>th</sup> July 2010

  
**Sander**  
Managing Director

  
**Strümpel**  
Factory Manager

This certificate attests the conformity with the named Directives, however, it is not a promise of properties in the meaning of product liability.

EWN-1200, Blatt 1, Seite 21e

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