



## Additional Installation, Operating and Maintenance Instructions

### Explosion-protected three-phase asynchronous motors with squirrel cage rotor for low voltage application

Type of protection „Increased safety e”

Type of protection „n”

Motors for use in areas with occurrence of combustible dust  II 2D,  II 3D

VEM motors GmbH  
VEM motors Thurm GmbH



### 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. Technical changes of the electric machines that are included in this manual are subject to alterations by us. 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. The technical data and the dimensions are non-binding. No claims can be derived from it.

### Symbols

In this manual four 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 on the electrical machine and/or on the auxiliary devices can happen.**



**Additional advice for electrical Ex-motors of Group II of category 2 (zone 1, 21) or Group II of category 3 (zone 2, 22).**

### 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 results in endangering people and/or damaging the machine.

### Operation according to regulations

This manual is valid for explosion-protected, surface-cooled electric machines at low voltages. The type of protection according to DIN EN 60035, part 5 is at least IP 54 for motors for operation in zones 1 and 2, at least IP 55 for operation in zone 22 and IP 65 for operation in zones 21 and 22 with conducting dust.

For combinations always the highest required type of protection has to be used. The type of protection is always declared on the name plate of the motor.

In areas with risk of explosion only electric motors with the permitted type of protection may be used.



**Electric machines of Group II, category 2 (zone 1, 21) or Group II, category 3 (assigned to zones: 2, 22)**

Other or different operations are not classified in accordance to the regulations.

For damages and operational disturbances that result from faults at installation, ignorance of this manual or improper repair no warranty can be claimed.

### Areas with risk of explosions

Which areas outdoors or indoors have to be considered at risk of explosion according to the relevant rules and regulations must be left at the responsibility of the operator or the supervisory authority if there is any doubt about the localisation of areas with risk of explosion.

The responsibilities for the operator of such plants are described in the regulation 99/92/EG – ATEX 137 (former ATEX 118a), occupational health and safety regulation. The directive 94/9/EG – ATEX 95 (former ATEX 100a) contains the fundamentals for explosion-protected products.

The requirements for products for operation in areas with risk of explosion are determined in it. They will be supported by the correspondent regulations (see below).

## Additional Installation, Operating and Maintenance Instructions

Explosion-protected electrical machines, that will be covered by this manual, have been designed according to the regulations of series DIN EN 60034 (VDE 0530), DIN EN 60079-0 and the regulation for the correspondent type of protection DIN EN 60079-7, DIN EN 60079-15, EN 50281 or DIN EN 61241-1. They shall only be put into operation according to the measures of the appropriate supervisory authority. The supervisory authority is responsible for acknowledgement of the risk of explosion.



**Type of protection, temperature class and characteristics have to be taken from the name plate of the motor.**

### - Group II, category 2 (assigned zones: 1, 21)

In this category electrical machines of type of protection „increased safety“ and „flame-proof enclosure“ can be found. In addition electrical machines for operation in areas with combustible dusts with type of protection “protection by enclosure” have been integrated in this group.

### - Group II, category 3 (assigned zones: 2, 22)

In this category electrical machines with type of protection “n” and electrical machines for operation in areas with combustible dusts and type of protection “protection by enclosure” can be found.



If the certification number includes the letter X, special requirements have to be observed that are listed in the correspondent type examination certificate.

### Characterisation of explosion-protected motors

	Nr. NB	RL 94/9/EG	New name 60079 ff., 61241 ff.	Old name 50014 ff., 50281
CE	0637	Ex II 2G	DIN EN 60079-0 / 60079-7 Ex e II T2, T3 or T4	DIN EN 50014 / 50019 EEx e II T2, T3 or T4
CE	0637	Ex II 3G	DIN EN 60079-0 / DIN EN 60079-15 EEx nA II T2, T3 or T4 and Ex nA II T2, T3 or T4	DIN EN 50014 / 50021, IEC 79-15 EEx nA II T2, T3 or T4 and Ex Na II T2, T3 or T4
CE	0637	Ex II 2D	pr EN 61241-0 / DIN EN 61241-1 Ex tD A21 T 125°C IP65	DIN EN 50014 / DIN EN 50281-1-1 IP65 T 125°C
CE	0637	Ex II 3D	pr EN 61241-0 / DIN EN 61241-1 Ex tD A22 T 125°C IP55 (IP 65 for combustible dust)	DIN EN 50014 / DIN EN 50281-1-1 IP55 T 125°C (IP 65 for combustible dust)
			<b>combination gas or dust</b>	
CE	0637	Ex II 2D Ex II 2G	Ex tD A21 T 125°C IP65 Ex e II T2, T3 or T4	IP65 T 125°C EEx e II T2, T3 or T4
CE	0637	Ex II 3D Ex II 2G	Ex tD A22 T 125°C IP55 (IP 65 for combustible dust) Ex e II T2, T3 or T4	IP55 T 125°C (IP 65 for combustible dust) EEx e II T2, T3 or T4
CE	0637	Ex II 2D Ex II 3G	Ex tD A21 T 125°C IP55 EEx nA II T2, T3 or T4 (and Ex nA II T2, T3 or T4)	IP65 T 125°C EEx nA II T2, T3 or T4
CE	0637	Ex II 3D Ex II 3G	Ex tD A22 T 125°C IP55 (IP 65 for combustible dust) EEx nA II T2, T3 or T4 (and Ex nA II T2, T3 or T4)	IP55 T 125°C (IP 65 for combustible dust) EEx nA II T2, T3 or T4

QS certification from NB 0637 ... IBExU Freiberg

[When indicating a maximum surface temperature: for zone 2 (gas): total surface including rotor and windings; for zone 21,22 (dust): outer surface (enclosure, shaft)!]

### Operation with inverter

Inverter-fed operation must be explicitly allowed. The separate hints of the manufacturer have to be observed unconditionally. For the type of protection “increased safety” and for motors for operation in zone 21 special EC-type examination certificates are necessary, where the operation with inverter is explicitly allowed and where the required conditions and parameters of the system motor-inverter-security device are listed.

## Additional Installation, Operating and Maintenance Instructions

For protection type „n“ the motors, that will be fed by inverter with a variable frequency and/or voltage, have to be tested with the predefined inverter or with an inverter, that is comparable according to the specification for output voltage and current.

The necessary parameters and conditions have to be taken from the name plate or the documentation of the motor.

The amplitude of the voltage peaks generated by the inverter can be influenced unfavourably by the installed connecting cable between inverter and electrical machine. In the system inverter – cable – electrical machine the maximum value for the voltage peaks at the terminal of the machine shall not exceed the value that is named in the separate manufacturer instructions.

### 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



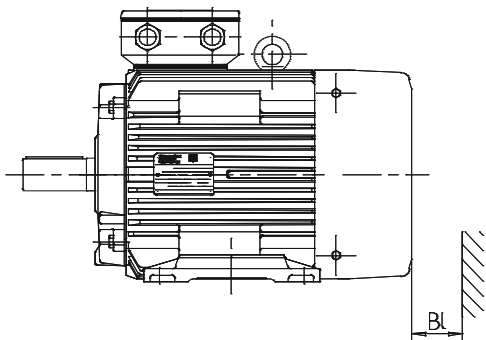
- security regulations,
- accident prevention regulations,
- standards and approved rules of technique (for example VDE-regulations, DIN-standards).

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.

In Germany the construction of electrical systems in areas with risk of explosion is liable to the following regulations:

- |                   |   |
|-------------------|---|
| ▪ BetrSichG       | ”Operational Safety Act”,                 |
| ▪ DIN EN 60079-14 | ”Electrical systems for hazardous areas”, |
| ▪ GefStoffV       | ”Hazardous Goods Regulations”             |

The permissible coolant temperature (room temperature at place of installation) according to DIN EN 60034-1/IEC 34-1 is maximum 40°C/minimum –20°C without lapping and the permissible altitude of site is up to 1000 m above sea level (other than the given values have to be specified on the name plate of the motor) It must be observed that the cooling air can flow unobstructed to the air inlet and can come out of the air outlet without hindrance and without getting sucked in again. Inlet and outlet openings have to be protected against pollution and coarser dust.



The minimum distance of air inlet into the fan cover against any obstacles (dimension Bl) has to be observed under all circumstances.

For type of constructions with shaft end upwards the operator has to see that no foreign substances can fall inside. During installation of the surface cooled motors it has to be observed that the condensate drain holes are located at the lowest possible place. If the condensate drain holes are closed, the screws must be reinserted with a sealant after drainage of condensation water. If the condensate drain holes are open, the direct contact with a jet or gush of water must be avoided. A careful installation of the motors on an exactly level support has to be ensured absolutely to avoid strain when tightening the machine. Machines that shall be coupled must be adjusted exactly. If possible elastic couplings shall be used.

**The connection has to be done by qualified personnel according to the valid security regulations. Outside of Germany the correct national regulations have to be observed.**

**Name plate designations have to be observed under all circumstances!**



Compare current type, mains voltage and frequency!  
Mind connection!  
Mind rated current for motor protection switch setting!  
For motors with type of protection „increased safety“ the  $t_E$ - time has to be observed!  
Connect the motor according to the connection diagram which can be found in 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 have a ground conductor clamp inside of the terminal box. Unused cable glands inside of the terminal box have to be closed for protection against dust and humidity. All contact screws or nuts have to be tightened well to avoid too high transfer resistances. 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.



For room temperatures of more than 40°C cables have to be used, that are allowed for an operation of at least 90°C. This is also valid for motors, that are marked with X on the supplemental sheet of the EC-type examination certificates which indicates special requirements for the cable design.

When connecting the motors extra care has to be taken when installing the connections of the cables in the terminal box. The nuts of the connection screw have to be fastened without force. When inserting the feed line in the terminal box it has to be observed that no tensile loading acts on the cables. The inside of the terminal box must be kept clean. The seals must be undamaged and have to be fitting. The terminal box must be always closed when the motor is in operation.



Attention, do not open terminal boxes at operating state temperature in atmospheres with risk of dust explosions!

### **Motors with type of protection „increased safety“ and with outgoing cable (including the design version with flat terminal box)**

The outgoing cable is led through with 4 or 7 conductors according to the demands of the customer. If the terminal box is delivered complete and the connection is done in a Ex-e-protected room, than the following instructions have to be observed:

1. The terminal box has to be fastened in a way so that at least the type of protection IP54 is reached.
2. For compliance with the required clearance the terminal socket has to be fastened according to the indicated drawing of holes.
3. The inner earth conductor that has been carried along from the motor (green/yellow) with crimped lug has to be placed under the clamping yoke of the earth connection.
4. The outgoing cables of the motor have to be soft soldered into the angled lugs of the terminal socket. The correct connection U1, V1, W1 (U2, V2, W2) has to be observed.

At the assembly of the aggregate it has to be observed if the motor number on the name plate agrees completely with the number on the riveted plate inside of the terminal box cover.

### **Protective measures against unacceptable warming**

If there is no other information on the test certificate or on the name plate concerning duty type and tolerances, electrical machines are designed for continuous duty and normal, not frequently recurring starts, at which no significant warming occur. The motors shall only be operated in the duty type indicated on the name plate. The range A of the voltage and frequency limits of DIN EN 60034-1 (DIN VDE 0530, part 1) – voltage  $\pm 5\%$ , frequency  $\pm 2\%$ , shape of curve, mains symmetry – has to be observed, so that the warming will stay in the allowed range. Bigger deviations of the design values can result in warming the electrical machine more than is acceptable and they have to be indicated on the name plate. The motor has to be protected against unacceptable warming for example with a motor protection switch, that means a current-dependent delayed protection switch according to DIN VDE 0660 or a similar device for all phases is installed, that prevents an inadmissible warming.

The protective device must be adjusted to the design current. Windings in delta-connection have to be protected in a way so that the release or relay is connected in series with the phase windings. For selection and adjustment of the releases the rated value of the phase current, that means it is based on the  $x0,58$  rated current of the motor. If such a connection is not possible, suitable protection switches has to be used, for example with phase failure control. For pole-changing motors current-dependent delayed releases or relays have to be provided for each rotation speed level, that can be locked against each other.



For type of protection „increased safety“ the starting will be controlled as well. Therefore the protection device must switch off during the  $t_E$  time that is valid for the correspondent temperature class when the rotor is blocked. The requirement is fulfilled if the release time – it can be taken from the release characteristics (starting temperature 20°C)  $f$  or the ratio  $I_A/I_N$  – is not higher than the indicated  $t_E$  time.

Electrical machines of type of protection „increased safety“ for heavy starting (start-up time  $> 1,7 \times t_E$  time) must be protected with a starting control according to the information of the certificate of conformity and they have to be certified accordingly.



Thermal motor protection by means of direct temperature monitoring of the winding is permissible if this is certified and indicated on the name plate. It consists of thermo couples according to DIN 44081 / 44082, that ensure the explosion protection together with a tripping device with the seal of approval of a named body. For pole-changing motors it is necessary to have separate protection devices for each rotation speed level, that can be locked against each other.

### Auxiliary devices

Explosion-protected motors can be equipped additionally with different 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 shut of the motor. It shall not be switched on while the motor is in operation.

#### Forced ventilation unit

The forced ventilation unit is dissipating the lost heat at operation of the main motor. During operation of the main motor the motor of the forced ventilation unit has to be switched on. After shut of the main motor the forced ventilation has to continue depending on the temperature. For motors with forced ventilation units that are dependent of the sense of rotation, the sense of rotation has to be observed unconditionally (see rotation mark). Only the forced ventilation units that are approved by the manufacturer shall be used. Motors for operation in zones 1, 2 and 21 need special certificates.

The forced ventilation unit has to be connected according to the connection diagram that is supplied inside of the terminal box.

#### Maintenance and repair

Maintenance, repair and changes of explosion-protected machines have to be done in Germany taking the workplace safety ordinance (BetrSichV), the explosion protection ordinance (ExVO, 11. GSGV), DIN EN 60079-17, DIN IEC 60079-19, the security advices and the description of the general maintenance manual into account.

For the design version with condensate drain hole it has to be observed that the drain plug screw has to be lubricated with a suitable sealant (for example Eppl 28) before relocking.

Activities that will influence the explosion protection:

- repair of the stator winding and of the terminal,
  - repair of the ventilation system
  - repair of the bearings and of the sealing of dust explosion protected motors (Ex 2D, 3D)
- must be done by the manufacturer or by a specially prepared workshop for electrical machines.

For dust explosion-protected motors the dust explosion protection is depending very much on the environmental ambient conditions. For that reason the motors have to be checked and maintained regularly.



Thick layers of dust will result in a temperature rise on the surface of the motor due to the thermal insulation. Layers of dust on the motors or even the total coverage should be avoided as far as possible by suitable installation and constant maintenance.



## Additional Installation, Operating and Maintenance Instructions

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The indicated surface temperature of the motor is only valid, if the dust layer on the motor is thinner than 5 mm. The securing of this condition (dust type, maximum layer thickness and other) has to be assured. The motor shall not be opened before a suitable time has passed to reduce the inner temperatures to values that are not ignitable. If the motors have to be opened for maintenance or repair, the work has to be done in a dust-free room if possible. If it is not possible, suitable measures have to be taken to prohibit that dust can collect inside of the enclosure.

At disassembly it has to be observed especially that the sealing parts like sealing, end faces and other are not damaged.



Maintenance works (without relubrication) has to be done at standstill of the motor.

It has to be assured that the machine is protected against switch on 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 not under voltage.

The work has to be marked with an additional repair sign with the following information:

- date,
- executive company,
- if necessary type of repair,
- if necessary sign of the expert.



If the work is not done by the manufacturer it has to be accepted by an officially approved expert. He has to issue a written confirmation about it or mark the machine with his test mark. Outside of Germany the relevant state regulations have to be observed.

### 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 sealings and connection parts.

For spare parts orders the following information is necessary:

Spare parts name  
Motor type  
Motor number

### Terminal board connections



In standard design the surface cooled motors are adapted for both rotational directions. An exception are the types K12R 355/2-pole. They are equipped with a ventilator that depends on the sense of rotation. If ventilators that depend on the sense of rotation or return stops (zone 22) are used, than a sign for sense of rotation has to be fixed on the fan cover.

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 will be 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 noticeable, if a person looks at the front end of the only or thicker shaft end.



**Each motor has attached the binding connection diagram, after which the connection must be done. The connection of the auxiliary circuits must be done according to the also attached auxiliary connection diagram.**

### Hints for screwed cable glands that are admitted for explosion protection

## Additional Installation, Operating and Maintenance Instructions



As already above mentioned under **Installation and electrical connection**, the installation torques, sealing areas and clamp ranges given by the manufacturer have to be observed unconditionally. Only ATEX cable glands have to be used.

For explosion protected VEM-motors cable glands of the company Jacob are used. The following specifications have to be observed for these special cable glands:

Ex-brass screw connection, metric thread,  
EC declaration of conformity DMT 99 ATEX E 016

thread	Part-No.	For cable diameter mm	Width across flats mm	Installation torque Nm
M 12,x1,5	50.612 M/EX	3...6	14	5
M 12x1,5	50.612 M1/EX	3...6,5	14	5
M 16x1,5	50.616 M/EX	5...9	17	5
M 20x1,5	50.620 M1/EX	6...12	22	7,5
M 20x1,5	50.620 M/EX	9...13	22	7,5
M 25x1,5	50.625 M/EX	11...16	27	10
M 32x1,5	50.632 M/EX	14...21	34	15
M 40x1,5	50.640 M/EX	19...27	43	20
M 50x1,5	50.650 M/EX	24...35	55	20
M 63x1,5	50.663 M/EX	32...42	65	20
M 63x1,5	50.663 M1/EX	40...48	65	20
M 75x1,5 *)	Fa. HAWKE International	54,5...65,3	95	20
M 80x1,5 **)	Fa. HAWKE International	67...73	106,4	20

\*) BAS 01 ATEX 2070X, \*\*) BAS 01 ATEX 2294X

Ex-EMC- brass screw connection, metric thread 016  
EC declaration of conformity DMT 99 ATEX E 016

thread	Part-No.	For cable diameter mm	Width across flats mm	Installation torque Nm
M 12,x1,5	50.612 M/EMV/EX	3...6	14	5
M 12x1,5	50.612 M1/EMV/EX	3...6,5	14	5
M 16x1,5	50.616 M/EMV/EX	5...9	17	5
M 20x1,5	50.620 M1/EMV/EX	6...12	22	7,5
M 20x1,5	50.620 M/EMVEX	9...13	22	7,5
M 25x1,5	50.625 M/EMV/EX	11...16	27	10
M 32x1,5	50.632 M/EMV/EX	14...21	34	15
M 40x1,5	50.640 M/EMV/EX	19...27	43	20
M 50x1,5	50.650 M/EMV/EX	24...35	55	20
M 63x1,5	50.663 M/EMV/EX	32...42	65	20
M 63x1,5	50.663 M1/EMV/EX	40...48	65	20