General

These are installation, operating, maintenance and safety instructions for three-phase and single-phase low voltage asynchronous motors.
For "Explosion-protected asynchronous motors" (with protection types: "Ex db", "Ex eb", "Ex ec", "Ex tb", "Ex tc") please follow also the additional instructions reported in the related paragraph.

To prevent damage to the motors and the driven equipment, the provisions of the operating and maintenance instructions and if appropriate the applicable supplements must be complied with.

⚠ Qualified personnel

Installation work, commissioning and operation of motors must only be done by qualified personnel.
The qualified personnel must be authorized by the person in charge for security of the plant to carry out the necessary work and tasks.

Intended use

These motors are only approved for the intended use given by the manufacturer in his catalogue and the corresponding technical documentation.
Changes or reconstruction of the motor are not allowed.

Disclaimer

We 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 way.

Description

The motors have been manufactured in accordance with IEC 34-1, EN 60034-1 and other connected European standards. Motors can also be supplied complying with special regulations (e.g. regulations for explosion protection).

Efficiency

Efficiency and Efficiency class complying with EN 60034-30 are listed on the rating plate of energy saving motors.

Degree of Protection

The degree of protection of the motors is indicated on their rating plate.
If motors are installed outdoors (degree of protection ≥ IP 44), they should be protected against direct effects of the climate).

Type of Construction

The motors can be used in different types of construction only with permission of the manufacturer and if necessary, after modification carried out in accordance with the manufacturer's instructions. In case of vertical mounting with shaft downwards the user must ensure that any object cannot fall into the fan cowl.

Transport & Storage

If possible, the motors should only be stored in closed and dry rooms. Outdoor storage under cover is only permitted for a short time and requires adequate protection against all harmful effects of the climate. The motors also have to be protected against mechanical damage. Temperature between -20°C and 40°C. For longer periods of storage, a low vibration environment shall be provided so that bearing damage due to downtime can be avoided. After a storage period of more than 12 months the condition of the grease must be checked before putting the motor into operation. Do not handle the motor by cable.

Installation and Fitting

⚠ **As during normal operation of electric motors, high temperatures can occur on their surface, any contact with them must be prevented if the motors are installed in accessible areas. Because of this temperature sensitive parts must never be fitted to them or have contact with them**.

⚠ **The key in the shaft end is secured by the shaft protective sleeve for transport and storage only. Because of the danger that the key may be thrown aside, a start-up or a trial run with the key protected by the shaft sleeve only is strictly forbidden.**

Transmission components must never be driven onto the shaft using hammer because the shaft, the bearings and other components of the motor could be damaged.

In case of direct coupling to the driven the motor requires a particularly accurate alignment. The shafts of both machines must be in alignment. The shaft height is to be adjusted to that of the driven machine using appropriate shims.

Belt drives put a lot of stress on the motor because of relatively high radial forces.
When pre-tensioning the belt during installation the instructions of the belt manufacturers must be strictly adhered to.

The threaded holes of the flange types listed in the table are through holes (type IM B14, IM B34).
To avoid damage to the winding overhang of the motor winding, observe the maximum permissible tap depths in conformity with the following table.

Motor size	Flange type	Tap depth (mm)
IEC56	C80	8
IEC63	C90	8
IEC71	C105	8
IEC80	C120	8
IEC90	C140	9
IEC100-112	C160	11
IEC132	C200	14
IEC160	C250	16

If a motor of type IM B34 without flanged attachments is used, the user must take appropriate measures at the through holes to maintain the specified IP degree of protection.

Insulation Check

When the motor is first commissioned and especially after extended storage, the insulation resistance of the winding is to be measured to earth and between phases. The check must take place using the rated voltage, but at least 500 V.

⚠ **During and immediately after the measurements dangerous voltages are present at the terminals. Therefore, never touch the terminals and follow the operating instructions of the insulation resistance meter closely!**

Depending on the rated voltage U_N, the following minimum values must be maintained with a winding temperature of 25 °C:

Rated Power PN in kW	Insulation Resistance referred to Rated Voltage in kΩ/V
1 < PN ≤ 10	6,3
10 < PN ≤ 100	4

If the minimum values are lower, the winding must be dried properly until the insulation resistance reaches the required value.

Motor connection

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

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.

Connecting thread	Tightening torque [Nm]
M4	1.2 ± 0.2
M5	2 ± 0.5
M6	3 ± 1
M8	6 ± 1.5

Put in use

Please follow the Safety Regulations closely. All work is to be carried out only when there is no voltage on the motor.
Initially the mains conditions (voltage and frequency) must be compared with the data on the rating plate of the motor.
The dimensions of the connecting cables must be adjusted according to the rated currents of the motor (normally 4 A/mm^2).
Before closing the terminal box make absolutely sure that:

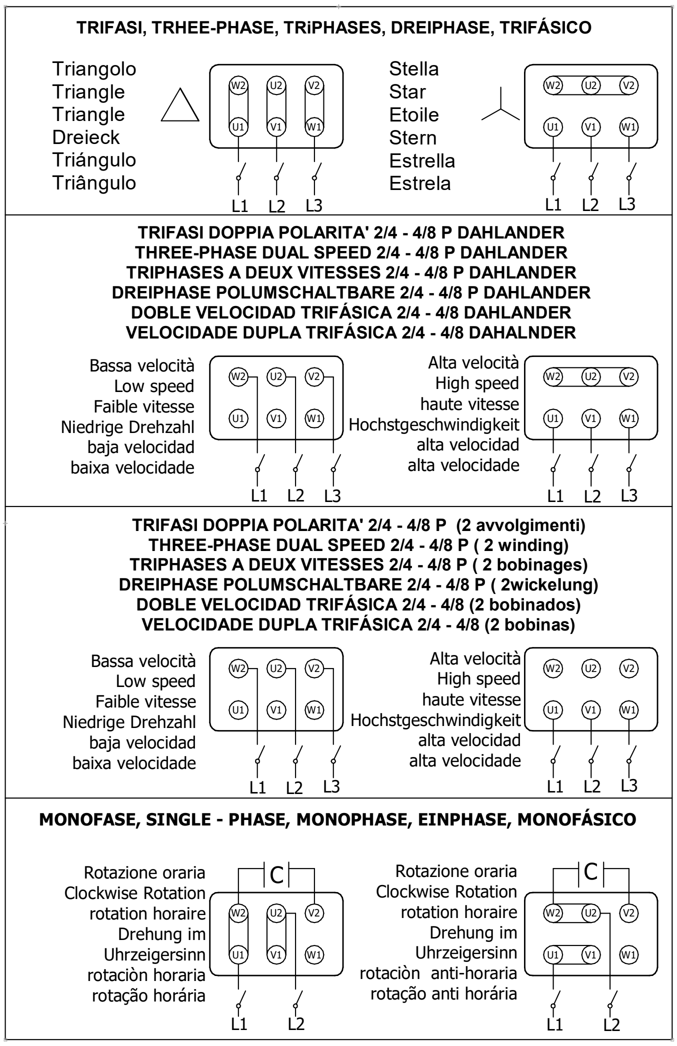
- the connection has been made in accordance with the wiring diagram
- all terminal box connections are tightened
- the interior of the terminal box is clean and free from foreign bodies
- all minimum values of air paths are respected (> 6mm up to 400V >8 mm up to 500 V, >10mm up to 630V > 12 mm up to 800 V).
- unused cable entries are blanked off and the threaded plugs with seals are tightened
- the seal in the terminal box cover is clean and in the correct position and all sealing surfaces are in the correct state to ensure that the relevant degree of protection is maintained.

Before starting up the motor check that all safety regulations are strictly adhered to, that the machine is correctly installed and aligned, that all fixing parts and earthing connections are tightened, that the auxiliary and additional devices are functionally and correctly connected and if a second shaft end is fitted that the key is secured against being thrown aside. If possible, the motor is to be connected without load.
If the motor is running smoothly and without any abnormal noises, the load of the driven machine is to be applied to the motor.
When the motor is started up it is recommended to monitor the current consumption if the motor is loaded with its driven machine so that any possible overloads and asymmetries occurring in the mains can be recognised immediately.

Protective measures against unacceptable warming

The motor has to be protected against unacceptable warming at starting for example with a motor protection switch. That means a current-dependent delayed protection switch according to EN 60947-8 or a similar device for all phases has to be installed, so that unacceptable warming is prevented.
The protective device must be adjusted to the rated current.

Electrical connections



Maintenance

You are once again referred to the Safety Regulations, in particular to insulation, to securing against reconnection, to checking whether all components connected to a voltage source are in dead state. If it is necessary to disconnect the motor from the mains for maintenance work particular care must be taken to ensure that any possibly existing auxiliary circuits (e.g. anti-condensation heaters, forced ventilators, brakes) are also disconnected from the mains.

Inspections

The following examinations will be done at standstill of the motor:

- Check of the foundations.
- Check of the motor alignment.
- Check of the fastening bolts.
- Check of the cables and the insulation material
- Check of the insulation resistance.
- Check of oil seal.

The following examinations will be done when the motor is running:

- Check of the electrical characteristics.
- Check of absence of running noises.
- Check of absence of vibration.

Cleaning

So that the effects of cooling air are not interfered with, all parts of the motor must be cleaned at regular intervals. In the majority of cases it is sufficient to clean the machine with compressed air that is free from water and oil. Especially the vent holes and the spaces between the ribs must be kept clean.

Bearings

Pre-lubricated bearings with life L10h of 20.000 h (2p) and 40.000 h (4-6-8p).

		Max radial load F_R [N]			
Size	**Bearing**	**2p**	**4p**	**6p**	**8p**
56	**6201-2Z**	320	320	-	-
63	**6202-2Z**	360	360	410	-
71	**6202-2Z**	450	450	510	560
80	**6204-2Z**	580	580	660	730
90	**6205-2Z**	660	660	750	820
100	**6206-2Z**	910	910	1030	1140
112	**6206-2Z**	1340	1340	1530	1680
132	**6208-2Z**	1930	1910	2190	2410
160	**6309-2Z**	2450	2450	2790	3080

Motors with Thermal Winding Protection

A continuity test of the thermistor sensor circuit using a test lamp, a hand generator and such like is strictly prohibited because this would destroy the sensors immediately.
If it becomes necessary to verify the cold resistance of the sensor circuit (at approx. 20 °C) then the measuring voltage must never exceed 2.5 V DC. The cold resistance of the sensor circuit must never exceed 810 Ohms; a measurement of the hot resistance is not necessary.

With motors that are fitted with thermal winding protection, care must be taken that when the thermal winding protection responds and after the cooling down of the motor, no hazards can occur due to spurious automatic reconnection.

Anti-condensation heaters

The anti-condensation heaters have to be switched on only after disconnection of the motor. It shall not be switched on while the motor is in operation. (Not included inside Explosion-protected asynchronous motors)

Electromagnetic Compatibility

It is the responsibility of the equipment operator to ensure by suitable measures that the apparatus or plant in their entirety
comply with the relevant electromagnetic compatibility standards.

Disposal

When disposing of the motors please observe applicable national law.

Additional instructions for Explosion-protected asynchronous motors

The voltage tolerances are as follow:
± 10% for three phase motors and ± 5% for single phase motors.

Where instructions reported in this paragraph conflicts with those previously indicated, the instructions of this paragraph take precedence.

Symbols:

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.

Electrical Ex-motors

Areas with risk of explosions

Explosion-protected electrical machines, that will be covered by this manual, have been designed according to the regulations of series IEC/EN 60034, IEC/EN 60079-0, IEC/EN 60079-1, IEC/EN 60079-7 and/or IEC/EN 60079-31. They shall only be put into operation according to the measures of the appropriate supervisory authority.

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 “e” (“eb”) (Motor) and flame-proof enclosure “d” (“db”) (Capacitor box) can be found. In addition, electrical machines for operation in areas with combustible dusts and type of protection - protection by enclosure “tb” are included in this group (capacitor box has type of protection "Ex tb" too).

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

In this category electrical machines with type of protection increased safety “ec”, and electrical machines for operation in areas with combustible dusts and type of protection - protection by enclosure “tc” can be found. The capacitor box has types of protection Ex db and Ex tb.

Zones			Motor marking	Standards	
2	CE	Ex	II 3G Ex ec IIC (or IIB) T3 Gc	**EN 60079-0, EN 60079-7**	**(1)**
2	CE	Ex	II 3G Ex ec db IIC (or IIB) T3 Gc	**EN 60079-0, EN 60079-1, EN 60079-7**	**(2)**
22	CE	Ex	II 3D Ex tc IIIB T125°C Dc	**EN 60079-0, EN 60079-31**	
1	CE 0722	Ex	II 2G Ex eb IIC (or IIB) T3 Gb	**EN 60079-0, EN 60079-7**	**(1)**
1	CE 0722	Ex	II 2G Ex eb db IIC (or IIB) T3 Gb	**EN 60079-0, EN 60079-1, EN 60079-7**	**(2)**
21	CE 0722	Ex	II 2D Ex tb IIIC T125°C Db	**EN 60079-0, EN 60079-31**	
(1)	3ph motors or 1ph without capacitor box				
(2)	1ph motors with capacitor box				

CE	EU marking of Conformity
0722	Number of Notify Body who check the production (cat. 2)
Ex	Ex symbol for ATEX
II	Surface plats different from mines (ATEX)
2, 3	Categories: 2 high level, 3 normal level (ATEX)
G	GAS explosive atmosphere (ATEX)
D	DUST explosive atmosphere (ATEX)
e	Increased safety protection
t	Dust tight enclosure 't' protection
d	Flameproof enclosure 'd' protection (capacitor fox only)
b, c	Equipment Protection Level: 'b' high, 'c' normal
IIC	GAS group (cover also IIB and IIA)
IIB	GAS group (cover also IIA)
IIIC	Conductive DUST group (cover also IIIB and IIIA)
IIIB	Non-Conductive DUST group (cover also IIIA)
T3	GAS temperature class (200°C) - Installation suitability in compliance with IEC 60079-14:2015 § 5.6
T4	GAS temperature class (135°C) - Installation suitability in compliance with IEC 60079-14:2015 § 5.6
T125°C	DUST Maximum surface temperature - Installation suitability in compliance with IEC 60079-14:2015 § 5.6
Ta	Range of ambient temperature (at the point of installation) for which the motor is suitable
tE	Maximum time in which the current-dependent safety device must cut off the power supply in case of fault (locked rotor condition or equivalent) - Only for "eb" motors – See IEC 60079-14:2015 §11
Ia/In	ratio between starting current *IA* and rated current *IN*
Certificates	IMQ 21 ATEX 0000 (N.B./year/number)
Certificates	IECEx IMQ 21.0000 (N.B./year.number)

Motors with double identification are only intended for use in gas <u>or</u> dust explosive atmospheres.

See IEC 60079-10-1 for Group classification and ignition temperature for specific gas

See IEC 60079-10-2 for Group classification and ignition temperature for specific dust

General notes for operating motors driven by frequency converters

Equipment of Category 2 driven by frequency converter

For the type of ignition protection increased safety "eb" (EPL Gb) it is not allowed; for protection by enclosure "tb" (EPL Db) it is allowed when the motor is provided with PTC protector suitable for the Temperature class of the motor.
Each temperature sensing device shall be separately protected by associated apparatus, placed in safe zone, having suitable electrical characteristics (minimum: EPL Db, dust Group IIIC).
The safety device (with non-automatic resetting), in case of activation, shall cut-off the power supply.
Maximum temperature safety systems integrity level shall be at least 2, according to EN 61508 or EN 61511 standard.
The intervention temperature of the safety devices shall not exceed 130°.
If the safety devices are not provided by the manufacturer, they must be installed by the user.

Equipment of Category 3 driven by frequency converter

For the type of ignition protection increased safety "ec" (EPL Gc) it is allowed when the motor is provided with PTC120°C (T4) or PTC150°C(T3) and the converter is in compliance with 5.2.8.4 of IEC60079-7; for protection by enclosure "tc" (EPL Dc) see what written above for "tb".

Installation and electrical connection

The installer must be sure that the motor is suitable for the classified area in consideration of the different inflammable substances present in the installation area (**please verify the marking on the motor plate before installation**).

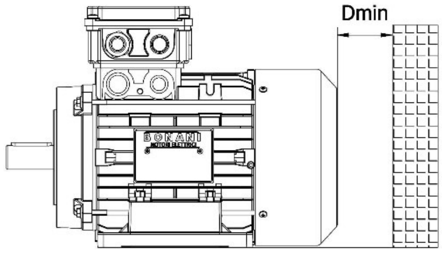
At installation and start of operation the security advices that are enclosed with the motor have to be observed. Installation work shall only be done by qualified personnel who is skilled because of a technical education, expertise and schooling of knowledge about:

- **security regulations,**
- **accident prevention regulations,**
- **standards and approved rules of technique**
- **IEC/EN 60079-14: "Explosive atmospheres - Part 14: Electrical installations design, selection and erection" or equivalent National standard (current edition).**

Environmental effects

The permitted ambient temperature range of installation, which is reported on the marking plate, shall be respected 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 should be noted that the cooling air flow freely through the air inlet openings and through the air outlet openings freely and cannot be sucked back directly. Inlet and outlet openings have to be protected against pollution and dirt particles. The direct intake of discharged air from neighbouring aggregates must be prevented by suitable measures.
Avoid any heat sources such as to affect the temperature of air and motor.

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



Size	*Dmin [mm]*
56, 63, 71	***14***
80, 90	**16**
100, 112	**20**
132, 160	**40**

It must be prohibited that foreign particles and liquids can fall into the fan of motors with vertical shaft orientation. This shall be done as follows:

Shaft end directed downwards:
The protection cover of the fan is equipped with a protective roof (supplied condition). Alternatively, the operator can implement the protection against ingress of foreign bodies and liquids.

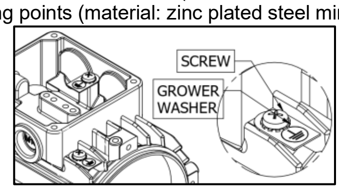
Shaft end directed upwards:
For type of constructions with shaft end upwards the operator has to ensure that no foreign substances can fall inside from above. For shaft ends directed upwards it must be prohibited that water or other liquids can penetrate into the motor next to the shaft.

Motor connection

The connection has to be done by qualified personnel according to the valid security regulations. EN 60079-14 or equivalent national standard (current edition) 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 "eb" the t_E-time and the relative starting current I_A/I_N has to be observed!
Connect the motor according to the electrical connections.

The motors are provided with internal (inside terminal box) and external (on motor body) earthing points (material: zinc plated steel min Cl. 4.8)



The cross-section of external earth conductor shall be like the table below but at least 4 mm^2. The internal like the table below.

earth conductor	Line conductors
= S	**S ≤ 16 mm²**
16	**16 mm² < S ≤ 35 mm²**
≥ 0,5 S	**S > 35 mm²**

For ambient temperatures of more than 45°C have to be used cables suitable for an operation of at least 80°C.

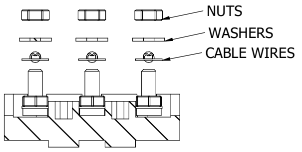
Take extra care when connecting the supply cables in the terminal box of the motor. The nuts of the connection screws have to be fastened without force.

Attention: do not open terminal boxes in atmospheres with risk of explosions when they are still hot from operation!

Tightening torques for connections

Thread Ø	M4	M5	M6
Terminal box cover (Motor)	2	4	7
Terminal board stud	1.2	2	3
Max cable section (mm²)	2,5	6	10

POWER CONNECTION



PTC CONNECTION
Wago 221 ATEX/IECEx approved

Connections of power and PTC for motor without terminal box

Crimping connection + heat -shrinkable tubing insulation

Before closing the terminal box make absolutely sure that:

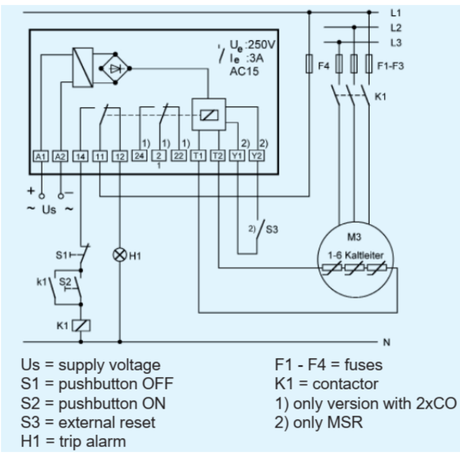
- all minimum values of air paths are respected (IEC 60079-7:2017) > 6mm up to 400V >8 mm up to 500 V, >10mm up to 630V > 12 mm up to 800 V).
- Auxiliary circuit (PTC) have to be always separated by main circuit; the connection will be always made using the Alternative types of connection reported above.
- Auxiliary circuit and Power circuit use different cable entry.

Protective measures against unacceptable warming

The motor must be protected by a release device which, in the event of a fault, removes voltage from the motor so as to prevent the surface temperature of the parts in contact with the explosive atmosphere from reaching the value shown on the marking.

Motors without PTC: for the type of protection increased safety “e” (“eb”) the starting will be controlled as well. Therefore, the protection device must switch off within the time period t_E that is given for the corresponding 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) for the ratio I_A/I_N is not higher than the indicated t_E time.

Motors with PTC protectors: each PTC of the motor must be connected to a release relay (PTC-Resistor-Relay Type MS220KA ZIEHL) according to the diagram below.



For pole-changing motors it is necessary to have separate protection devices for each rotation speed level, that can be locked against each other. The automatic rest is forbidden. The device has to be placed in a safe zone or inside a flame-proof box.

Cable glands admitted for explosion protection

Cable glands (for motor and terminal box enclosure) shall be ATEX/IECEx certified according to current edition of IEC 60079-0, IEC 60079-7 and IEC 60079-31 standards.
Cable glands (for capacitor box) shall be barrier type M16x1.5, ATEX/IECEx certified according to current edition of IEC 60079-0, IEC 60079-1 and IEC 60079-31 standards and suitable for a pressure of 4600 kPa.
They shall have at least an IP65 degree of protection, with EPLs according to marking plate, and operating temperature range between 80°C and the minimum ambient temperature reported on the motor label.
The user must ensure that all “Special Conditions for Safe Use/ Schedule of Limitations” (reported in the Certificate of installed cable glands) must be satisfied and that they do not affect the safety characteristics of the equipment.

Unused cable entries shall be closed through a blanking element with the same characteristics as reported for cable entry devices. Existing plugs must be checked accordingly and if necessary, they have to be changed.

CABLE GLANDS
IT IS POSSIBLE TO MOUNT TILL 2 CABLE GLANDS FOR EACH SIDE OF THE TERMINAL BOX

Thread	Cable Ø Range [mm]	Power cable motor size	Control cable Motor size	On request	Tightening torque [Nm]	
					Plastic	Metal
M 16 x 1.5	5...10	56…71	56…160	80-90	2,5	5
M 20 x 1.5	7...12	80…112	80…160	56…71	4	8
M 20 x 1.5	10...14	-	-	80…112	4	8
M 25 x 1.5	9...16	132	-	80…112/160	6	12
M 32 x 1.5	12...21	160	-	132	10	20

Maintenance and repair

More information about testing and maintenance of electrical systems or repair and reconditioning of electric equipment can be found in IEC 60079-17 (maintenance) and IEC 60079-19 (Repair).
Except for the opening of terminal box cover, any other opening cancels the warranty conditions of the motors.

Activities that will influence the explosion protection such as:

- repair of the stator winding and of the terminals,
- repair of the ventilation system
- repair of the sealing

This must only be done by BONANI service personnel or by authorized facilities IECEx certified according to IEC 60079-19.

Flameproof joints of capacitor box are not intended to be repaired.

For dust explosion-protected motors the dust explosion protection is depending very much on the local environmental 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 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.
Remove periodically dust layer through damp cloth or anti-static products

The indicated surface temperature of the motor is only valid, if the dust layer on the motor is max. 5 mm.
The securing of these conditions (dust type, maximum layer thickness and other) has to be assured.

Live maintenance is not allowed.

Do not open the equipment when explosive atmosphere may be present.
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 safe area (without potential explosive atmosphere).
At disassembly take extra care that the sealing parts like sealing, end faces and other are not damaged.
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 cannot 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 considered when adjusting these terms.
The advices within the standards IEC 60079-17 and IEC 60079-19 must be considered as well.

Inadmissible deviations detected during the inspections have to be eliminated immediately. For Maintenance inspections and Cleaning see page 2.