



# **BARTEC VARNOST**

## **ELECTRIC MOTORS FOR EXPLOSIVE ATMOSPHERES**

Instructions manual for installation, operation and maintenance of electric  
motors



## 1. Introduction

The installation, operation and maintenance of the motor must be always performed by qualified and authorised personnel using proper tools and methods and following the instructions contained in the documents supplied with the motor.

The instructions presented in this document are valid for BARTEC VARNOST d.o.o 4KTU motor series, which are three-phase induction motors, with squirrel-cage rotor.

These motors can be used in hazardous areas with the following types of protection:

- Flameproof – »Ex d«
- Protection by Enclosure (combustible dust) – »Ex t«
- Class I Division 1, Group C&D
- Class II Division 1, Group E,F&G
- Class II Division 2, Group E,F&G
- Class I, Zone 1, Exd IIC, IIB&IIA
- Class II, Zone 21&22, Ex tb

Details of motor marking can be found on nameplate and product certification, which is part of the motor documentation.



Figure 1: Nameplate - example for 4KTU 213 4-4

In case if the electric motor is converter-fed, additional nameplate is fixed on the motor housing.

Umrichterbetrieb/Inverter operation	
Mot.Nr.	
P <sub>2</sub>	kW
U <sub>N</sub>	V
I <sub>N</sub>	A
n	min
f	Hz
M <sub>D</sub>	Nm

Figure 2: Marking plate for converter-fed electric motor-example

The objective of this manual is to provide important information, which must be considered during the shipment, storage, installation, operation and maintenance of Bartec Varnost motors. Therefore, we advise to make a careful and detailed reading of the instructions contained herein before performing any intervention on the motor. The noncompliance with the instructions informed in this manual voids the product warranty and may compromise the type of protection of the motor and still result in serious personal injuries and material damages.



**Any component added to the motor by the user, for example, cable glands, thread plug, encoder, etc., must meet the type of protection of the enclosure, the »equipment protection levels« (EPL) and the degree of protection of the motor, according to the Standards indicated in the product certification.**

#### **Special Conditions for Safe Use**



**The sign »X« added to the certificate number, informed on the nameplate of the motor, indicates that the equipment demands special conditions for installation, operation and/or maintenance, being those described in the certificate and the motor documentation.**

**The correct classification of the installation area and ambient characteristics is user's responsibility.**

**Electric motors have energized circuits and exposed rotating parts which may cause injuries to people.**

## **2. Shipment, storage and handling**

Check the condition of the motor right after receiving. When any damage is noticed, it must be immediately communicated to Bartec Varnost d.o.o. In this case, no installation job can be started before the detected problem has been solved.

Check if the nameplate data match the invoice data, the environment conditions where the motor will be installed, the type of protection and EPL of the motor. If the motor is not immediately installed, it must be stored in a clean and dry room protected against dust, vibrations, gases and corrosive agents. In order to prevent oxidation of the bearings and ensure an even distribution of the lubricant, rotate the motor at least once a month (at least five turns), always leaving it in a different position. If the motors are stored for more than two years, it is recommended to change the bearings, or to remove, wash, inspect and relubricate them before the motor is started.

Improper motor storage will result in seriously reduced reliability and failure. An electric motor that does not experience regular usage while being exposed to normally humid atmospheric conditions is likely to develop rust in the ball bearings or rust particles from surrounding surfaces may contaminate the bearings. The electrical

insulation may absorb an excessive amount of moisture leading to the motor winding failure.

A wooden crate "shell" should be constructed to secure the motor during storage. This is similar to an export box but the sides & top must be secured to the wooden base with lag bolts (not nailed as export boxes are) to allow opening and reclosing many times without damage to the "shell".

To avoid condensation inside the motor, do not unpack until the motor has reached room temperature. (Room temperature is the temperature of the room in which it will be installed). The packing provides insulation from temperature changes during transportation.

#### Preparation for Storage:

1. Some motors have a shipping brace attached to the shaft to prevent damage during transportation. The shipping brace, if provided, must be removed and stored for future use. The brace must be reinstalled to hold the shaft firmly in place against the bearing before the motor is moved.
2. Store in a clean, dry, protected warehouse where control is maintained as follows:
  - a) Shock or vibration must not exceed 2 mils maximum at 60 hertz, to prevent the bearings from brinelling. If shock or vibration exceeds the limit vibration isolation pads must be used.
  - b) Storage temperatures of 10°C (50°F) to 49°C (120°F) must be maintained.
  - c) Relative humidity must not exceed 60%
  - d) Motor space heaters (when present) are to be connected and energized whenever there is a possibility that the storage ambient conditions will reach the dew point. Space heaters are optional.

**Note: Remove motor from containers when heaters are energized, reprotect if necessary.**

3. Measure and record the resistance of the winding insulation (dielectric withstand) every 30 days of storage
  - a) If motor insulation resistance decreases below the minimum resistance, contact your local Bartec office
  - b) Place new desiccant inside the vapor bag and re-seal by taping it closed
  - c) If a zipper-closed type bag is used instead of the heat-sealed type bag, zip the bag closed instead of taping it. Be sure to place new desiccant inside bag after each monthly inspection
  - d) Place the shell over the motor and secure with lag bolts

4. Motors with anti-friction bearings are to be greased at the time of going into extended storage with periodic service as follows:
  - a) ball and roller bearing (anti-friction) motor shafts are to be rotated manually every 3 months and greased every 6 months in accordance with the Maintenance section of this manual.
5. Coat all external machined surfaces with a rust preventing material. For this purpose, we recommend Exxon Rust Ban # 392.

**Before storage, the following procedure must be performed:**

1. Remove the grease drain plug, if supplied, (opposite the grease fitting) on the bottom of each bracket prior to lubricating the motor.
2. The motor with regreasable bearing must be greased as instructed in this manual
3. Replace the grease drain plug after greasing
4. The motor shaft must be rotated a minimum of 15 times after greasing
5. Motor shafts are to be rotated at least 15 revolutions manually every 3 months and additional grease added every nine months to each bearing
6. Bearings are to be greased at the time of removal from storage

DEEP-GROOVE BALL BEARINGS				Speed [min-1]					
				Re-lubrication interval [h]					
Frame size	Max. Radial shaft force [kN]	Bearing type	Grease quantity [g]	3600	3000	1800	1500	1000	500
160	4,8	6309 C3							
180	5,6	6310 C3	80		24000		33000	33000	
200	6,8	6312 C3	130		17000		33000	33000	
225	16,6	6313 C3							
250	18,7	6314 C3	260		12000		24000	33000	
280	23	6316 C3	260		12000		24000	33000	
315	21,93	6317 C3	310		12000		24000	33000	

ROLLER BEARINGS				Speed [min-1]					
				Re-lubrication interval [h]					
Frame size	Max. Radial shaft force [kN]	Bearing type	Grease quantity [g]	3600	3000	1800	1500	1000	500
160	4,8	NU 309							
180	5,6	NU 310	32		17000		33000	33000	
200	6,8	NU 312	20		2800		5600	8000	
225	16,6	NU 313							
250	18,7	NU 314	25		2000		5600	8000	
280	23	NU 316	35		2000		4000	5600	
315	21,93	NU 317	35		2000		4000	5600	

**Removal From Storage**

1. Remove all packing material
2. Measure and record the electrical resistance of the winding insulation resistance meter at the time of removal from storage. The insulation must not be less than 50% from the initial reading recorded when the motor was placed into storage. A decrease in resistance indicates moisture in the windings and necessitates electrical or mechanical drying before the motor can be placed into service. If resistance is low, contact your local Bartec office.
3. Regrease the bearings as instructed in this manual

4. Reinstall the original shipping brace if motor is to be moved. This will hold the shaft firmly against the bearing and prevent damage during movement (large motors only)



**Always handle the motor carefully in order to prevent impacts and damages to the bearings and always install the shaft transportation/locking device (if supplied) when transporting the motor.**

**Use only the eyebolts and for this purpose specially designed holes to lift the motor. However these eyebolts are designed for the motor weight only. Thus never use these eyebolts to lift the motor with additional loads coupled to it.**

Periodically and mainly before the initial start-up, measure the insulation resistance of the motor winding. For recommended values and measuring procedures contact your local Bartec office.

### **3. Installation**

Installation should conform to the National Electrical Code (NEC) as well as local codes and practices. When other devices are coupled to the motor shaft, be sure to install protective devices to prevent future accidents. Some protective devices include, coupling, belt guard, chain guard, shaft covers etc. These protect against accidental contact with moving parts. Machinery that is accessible to personnel should provide further protection in the form of guard rails, screening, warning signs etc.



**During the installation, the motors must be protected against accidental energization.**

**Check the motor direction of rotation, turning it without load before it is coupled to the load.**

Remove the transportation devices and shaft locking device (if supplied) before starting the motor installation.

Motors must be only installed in places compatible with their mounting features and in applications and environments for which they are intended. It must be respected the type of protection and the EPL of the motor, according to the classification of the area where the motor will be installed.

The motors with feet must be installed on bases duly planned in order to prevent vibrations and assure perfect alignment. The motor shaft must be properly aligned with the shaft of the driven machine. Incorrect alignment, as well as improper belt tension, will certainly damage the bearings, resulting in excessive vibrations and even causing the shaft rupture. The admissible shaft radial and axial loads indicated in Table 1 must be respected.

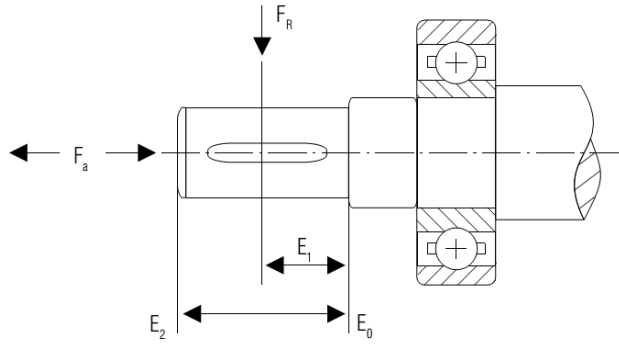


Figure 3: Admissible radial and axial loads

Table 1: Shaft radial loads

Frame size (IEC)	Number of poles	Radial force $F_r$ [kN]		
		E0	E1	E2
71	2	0,48	0,43	0,39
	4	0,6	0,54	0,5
	6	0,69	0,62	0,56
	8	0,76	0,68	0,62
80	2	0,64	0,7	0,51
	4	0,81	0,72	0,65
	6	0,93	0,83	0,74
	8	1,02	0,91	0,82
90	2	0,72	0,64	0,57
	4	0,9	0,8	0,71
	6	1,04	0,92	0,82
	8	1,14	1,01	0,9
100	2	1,01	0,9	0,81
	4	1,28	1,15	1,04
	6	1,45	1,3	1,17
	8	1,61	1,43	1,3
112	2	0,99	0,87	0,79
	4	1,23	1,09	1,08
	6	1,42	1,25	1,12
	8	1,57	1,39	1,24
132	2	1,56	1,38	1,23
	4	1,96	1,78	1,55
	6	2,24	1,98	1,77
	8	2,45	2,16	1,96
160	2	2,99	2,63	2,35
	4	3,83	3,38	3,02
	6	4,33	3,81	3,4
	8	4,79	4,22	3,78
180	2	3,55	3,14	2,84
	4	4,43	3,82	3,53
	6	5,1	4,52	4,08
	8	5,63	5	4,52
200	2	4,33	4,24	3,6
	4	4,45	4,95	4,52
	6	6,28	5,71	5,23
	8	6,88	6,25	5,72
225	2	10,4	9,45	8,32
	4	13,1	11,65	10,49
	6	15,03	13,37	12,03
	8	16,6	14,78	13,3

Remove the corrosion protection grease from the shaft end and flange only right before the motor installation.

Unless specified otherwise in the purchase order, motors are dynamically balanced with »half key« and without load (uncoupled). The driving elements, such as pulleys, couplings, etc., must be balanced with »half key« before they are mounted on the shaft of the motors.



**Do not block the motor ventilation openings. Ensure a minimum clearance of  $\frac{1}{4}$  of the diameter of the air intake of the fan cover from the walls. The air used for cooling the motor must be at ambient temperature, limited to the temperature range indicated on the motor nameplate (when not indicated,  $-20^{\circ}\text{C}$  to  $+40^{\circ}\text{C}$  must be considered).**

**Motors installed outdoors or in the vertical position require the use of additional cover to protect them from water; for instance, use a rain cover.**

#### **4. CONNECTION TO THE POWER SUPPLY**

##### **Power connection**

**Motor and control wiring, overload protection, disconnects, accessories and grounding should conform to the National Electrical Code and local codes and practices.**



**The explosion-proof motor versions may be mounted and connected to the power supply by qualified persons only; The installer must have additional knowledge about explosion protection.**

**To prevent accidents, ensure that the grounding connection has been performed according to the applicable standards and that the shaft key has been well-fixed fastened before the motor is started.**

For motors installed in compliance with IEC requirements, the following minimum cross sectional area of the protective conductors should be used:

Cross-sectional area of phase conductors, S	Minimum cross-sectional area of the corresponding protective conductor, S <sub>p</sub>
mm <sup>2</sup>	mm <sup>2</sup>
S < 16	S
16 < S ≤ 35	16
S > 35	0,5 S



Equipotential bonding connection shall be made using a conductor with a cross-sectional area at least 4 mm<sup>2</sup>.

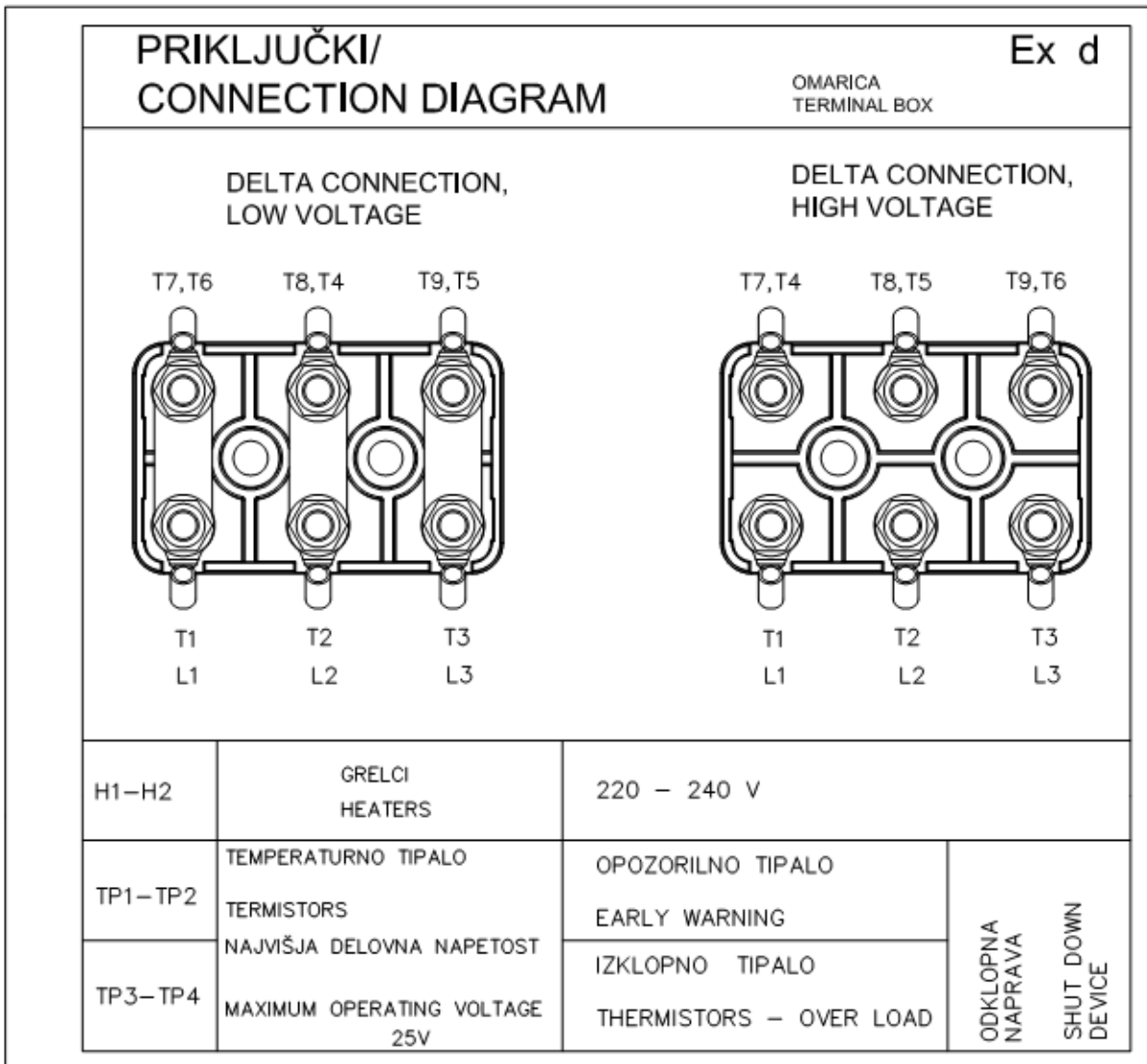


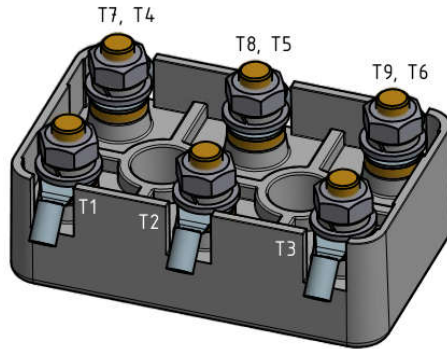
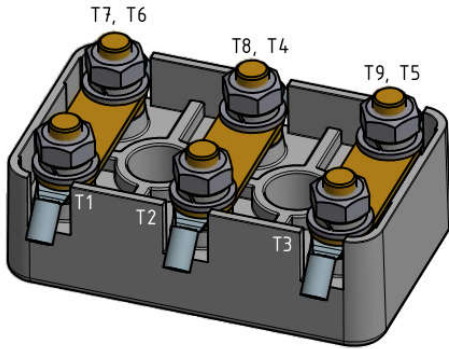
To prevent equipment damage, be sure that the electrical service is not capable of delivering more than the maximum motor rated amps listed on the rating plate.



If a HI POT test (High Potential Insulation test) must be performed, follow the precautions and procedure in NEMA MG1 and MG2 standards to avoid equipment damage.

Connect the motor properly to the power supply by means of safe and permanent contacts, always considering the data informed on the nameplate, such as rated voltage, wiring diagram, etc.





**When using terminals, all wires that form the stranded cable must be fastened inside the sleeve.**

**Motors with space heaters are marked with an additional label indication the nominal data of the heating system. The electric control unit must make sure, that the nominal motor voltage and the heater are not present simultaneously.**



**The space heaters are designed to operate at or below the maximum surface temperature stated on the nameplate. If the marked ambient and/or voltage are exceeded this maximum surface temperature can be exceeded and can damage the motor windings. If applied in a Divisions 2 or Zone 2 environment this excessive temperature may cause ignition of hazardous materials.**

The power cables and grounding system connections and terminal box assembly, the tightening torques indicated in Table 3 and Table 4 must be respected.

Table 3: Tightening torque:Ex enclosure. Tightening torque for screws of the strenth class 8.8 and A4-70.

Thread	Tightening torque [Nm] (lbf-ft)	Thread	Tightening torque [Nm] (lbf-ft)
M5	4.6 (3.5)	M14	105 (77)
M6	7.9 (6)	M16	160 (118)
M8	19 (14)	M20	330 (243)
M10	38 (28)	M24	560 (413)

Table 4: Tightening torque for electrical connections

Thread	Tightening torque [Nm] (lbf-ft)	Thread	Tightening torque [Nm] (lbf-ft)
M4	1.2 (0.9)	M10	10 (7.4)
M5	2 (1.5)	M12	15.5 (11.43)
M6	3 (2.2)	M16	30 (22)
M8	6 (4.25)	M20	52 (38.35)

For power cables, switching and protection devices dimensioning, consider the rated motor current, the service factor, and the cable length, among others. For motors without terminal block, insulate the motor terminal cables by using insulating materials that are compatible with the insulation distance between the non-insulated live parts themselves and between live parts and the grounding must respect the Table 5.

Table 5: Minimum insulation distance (mm)

Voltage	Type of protection of the enclosure	
	Ex e/ Ex de	Ex d/ Ex t
$U \leq 440 \text{ V}$	6	4
$440 > U \leq 690 \text{ V}$	10	5,5
$690 > U \leq 1000 \text{ V}$	14	8



**Not-used cable inlet holes in the terminal box must be properly closed with certified plugs in order to assure the type of protection, EPL and degree of protection indicated on the nameplate. The cable entries used must be fitted with components (such as, cable glands and conduits) that meet the applicable standards and regulations for each country. For »Ex d« motors, the conduit entries are permitted only for electrical equipment of Class I/ Group II .**

The motor must be installed with overload protection devices. These protection devices can be integrated to the motor (such as thermistors in the windings) or external protection devices, where the motor load is monitored by the nominal current.

Motors driven by variable speed drives (VSD) must have their winding thermal protections connected. For other starting methods, the use of the thermal protections is optional. When connected to the motor control circuit, the thermal protection must be connected to a suitable certified disconnecting device.

Ensure the correct operation of the accessories (brake, encoder, thermal protection, forced ventilation, etc.) installed on the motor before it is started. The temperature limits for alarm (optional) and tripping of thermal protection can be defined according to the application, however they may not exceed the values shown in Table 6.

Table 6: Maximum temperature of actuation for thermal protections

Component	Classified area marked on nameplate	Classified area where product will be installed	Maximum operating temperature (°C)
			Tripping
Winding	Ex d	Ex d	120
	Ex t	Ex t	
	Ex d + Ex t	Ex d	
		Ex t	
	Class I Div. 1	Class I Div. 1	
	Class II Div. 1	Class II Div. 1	
Class II Div. 2	Class II Div. 2		
Bearings	All	All	

**Notes:**

- 1) *The quantity and type of thermal protections installed in the motor are visible on the additional nameplates included on it.*
- 2) *In case of calibrated thermal protection (for example, Pt-100), the monitoring system must be set at the operation temperature indicated on Table 6.*

## 5. Operation



**During operation, do not touch the non-insulated energized parts and never touch or stay too close to rotating parts.**

**Ensure that the space heater is always OFF during the motor operation.**

The rated performance values and the operating conditions are specified on the motor nameplate. The voltage and frequency variations of the power supply should never exceed the limits established in the applicable standards. Occasional different behaviour during the normal operation (actuation of thermal protections, noise level, vibration level, temperature and current increase) must always be assessed by qualified personnel. In case of doubt, turn off the motor immediately and contact Bartec Varnost d.o.o. Do not use roller bearings for direct coupling. Motors fitted with roller bearings require a minimum radial load to ensure a proper operation.

After complete standstill, the cooling and lubrication systems (if any exist) must be switched OFF and the space heaters (if available) must be switched ON.

## 6. Maintenance



**Before any service is performed, ensure that the motor is at standstill, disconnected from the power supply and protected against accidental energization. Even when the motor is stopped, dangerous voltages may be present in space heater terminals.**



**Motor disassemble during the warranty period must be performed by UL/CSA Approved Authorized BARTEC Service Centers or manufacturer.**



**For Flameproof or Protection by enclosure motors, only open the terminal box and/or disassembly the motor when the motor surface temperature is at ambient temperature.**



**Thermostat contacts automatically reset when the motor has sufficiently cooled down. To prevent injury or damage, the control circuit should be designed so that automatic starting of the motor is not possible when the thermostat resets.**

Motors with degree of protection greater than IP55 are supplied with grease on joints and fixing bolts. Before assembly the components with machined surfaces (for example, terminal box cover of Flameproof motors), clean these surfaces and apply a new layer of this product.

For Flameproof motors joints only the following products can be used: Renolit RHF-1 Fuchs or Setral MI PD LL/2A (for ambient temperatures  $-20^{\circ}\text{C}$  to  $+40^{\circ}\text{C}$ ) and CASTROL OPTITEMP LG2 (for ambient temperatures below  $-20^{\circ}\text{C}$ ).

For explosion-proof motors, special care should be taken with the machined surfaces of the flame path. These surfaces must be free of burrs, scratches, etc. that reduce the flame path length and increase the gap.

For terminal box cover mounting, please follow the tightening torques indicated in Table 3 for fixing bolts. In case of replacement of a fixing bolt, it is necessary to keep the dimensions and quality of material. For flameproof motors, the yield stress of the fastener elements of motor and terminal boxes enclosures must be at least equal to class 8.8. for carbon steel bolts and class A4-70 for stainless steel bolts.

Motors which may have a potential risk of electrostatic charge accumulation, supplied duly identified, must receive proper cleaning and maintenance interventions, i.e. with the use of a damp cloth, avoiding electrostatic discharges.

For Protection by Enclosure motors (group III), the maximum permissible dust layer on the motor enclosure is five millimeters (5 mm).



**Regularly inspect the operation of the motor, according to its application, and ensure a free air flow. Inspect the seals, the fastening bolts, the bearings, the vibration and noise levels, the drain operation, etc. The lubrication interval is specified on motor's nameplate.**

## **7. Additional information**

For further information about shipment, storage, handling, installation, operation and maintenance of electric motors, contact Bartec Varnost d.o.o.

For special applications and operating conditions (for example totally enclosed air over (TEAO), motors with brake, motors with encoder, etc.) contact Bartec Varnost d.o.o.

When contacting Bartec Varnost d.o.o, have the full description of the motor at hand, as well as the serial number and manufacturing date, indicated on the motor nameplate.

## 8. Conformity

Flameproof electric motors are designed for use in explosive atmospheres conforms to following European / IEC, and UL / CSA standards:

Table 7: EN/IEC list of used standards

<b>STANDARD</b>	<b>Description</b>
EN 60079-0:2012+A11:2013/ IEC 60079-0:2011	Electrical apparatus for explosive gas atmospheres - Part 0: General requirements
EN 60079-1:2007/ IEC 60079-1:2007	Electrical apparatus for explosive gas atmospheres - Part 1: Flameproof enclosures "d"
EN 60079-7:2007/ IEC 60079-7:2006-07	Electrical apparatus for explosive gas atmospheres - Part 7: Increased safety "e"
EN 60079-31:2009/ IEC 60079-31:2008+Cor. 1:2009	Explosive atmospheres - Part 31: Equipment dust ignition protection by enclosure "t"
EN 60034-1: 2010	Rotating electrical machines - Part 1: Rating and performance (IEC 60034-1:2010)
EN 60034-5:2001/A1:2007 IEC 60034-5:2000/A1:2006	Rotating electrical machines - Part 5: Degrees of protection provided by the integral design of rotating electrical machines (IP code) - Classification
EN 60034-7:1993/A1:2001 IEC 60034-7:1992/A1:2000	Rotating electrical machines - Part 7: Classification of types of constructions and mounting arrangements (IM-code) - Amendment A1
EN 60204-1:2006/A1:2009 IEC 60204-1:2005/A1:2008	Safety of machinery - Electrical equipment of machines Part 1: General requirements

Table 8: UL/CSA list of used standards

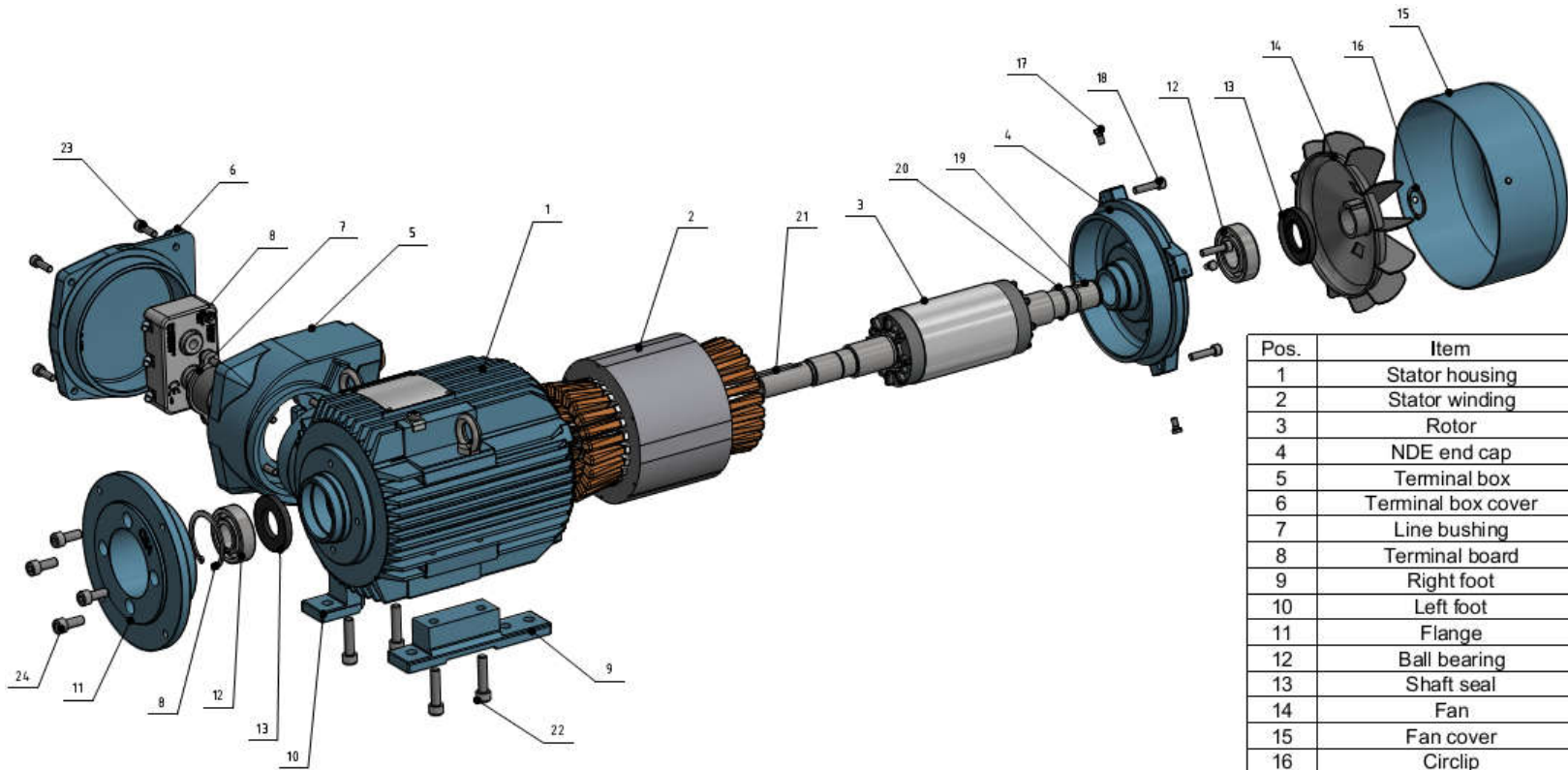
<b>STANDARD</b>	<b>Description</b>
UL 60079-0/ CSA C22.2 No. 60079-0:11	Electrical apparatus for explosive gas atmospheres - Part 0: General requirements
UL 60079-1/ CSA C22.2 No. 60079-1:11	Electrical apparatus for explosive gas atmospheres - Part 1: Flameproof enclosures "d"
UL 60079-7/ CSA C22.2 No. 60079-7:12	Electrical apparatus for explosive gas atmospheres - Part 7: Increased safety "e"
CSA C22.2 No. 100-14	Motors and generators
CSA C22.2 No. 25-1966 (R2014)	Enclosures for Use in Class II Groups E, F and G Hazardous Locations
CSA C22.2 No. 30-M1986 (R2012)	Explosion-proof Eclosures for Use in Class I Hazardous Locations
UL 1203	Explosion-proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations
UL 1004-1	Rotating Electrical Machines - General requirements

Table 9: List of used Directives

<b>DIRECTIVE</b>	<b>Description</b>
2014/34/EU	ATEX Directive 2014/34/EU
93/68/EC	Gas appliances directive - GA
2006/42/EC	Directive on machinery
2004/108/EC	Electromagnetic compatibility (EMC)

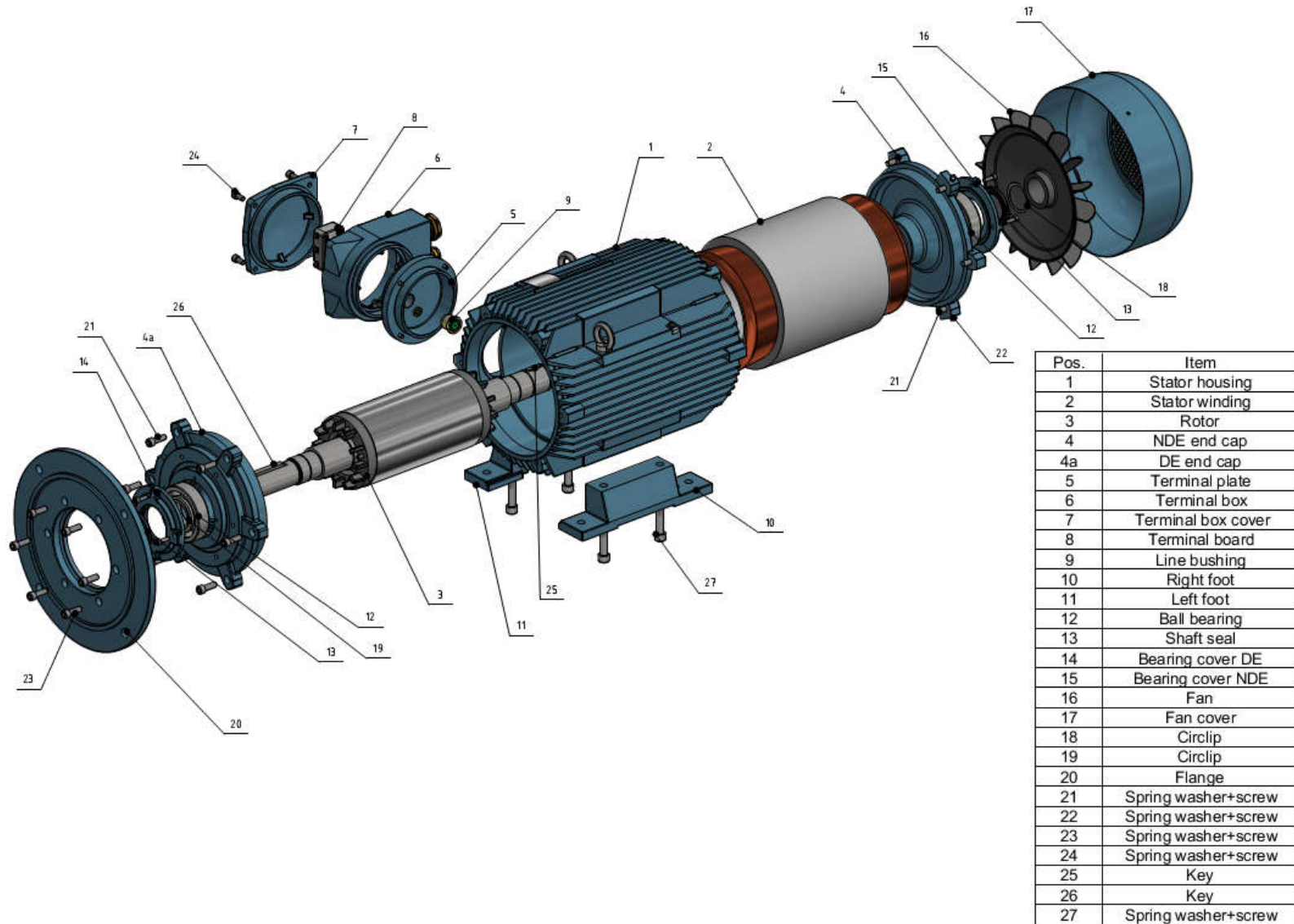


## SPARE PARTS FOR 4KTU 143-215



Pos.	Item
1	Stator housing
2	Stator winding
3	Rotor
4	NDE end cap
5	Terminal box
6	Terminal box cover
7	Line bushing
8	Terminal board
9	Right foot
10	Left foot
11	Flange
12	Ball bearing
13	Shaft seal
14	Fan
15	Fan cover
16	Circlip
17	Spring washer, screw
18	Spring washer, screw
19	Key
20	Circlip
21	Key
22	Spring washer, screw
23	Spring washer, screw
24	Spring washer, screw

## SPARE PARTS FOR 4KTU 254-365





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