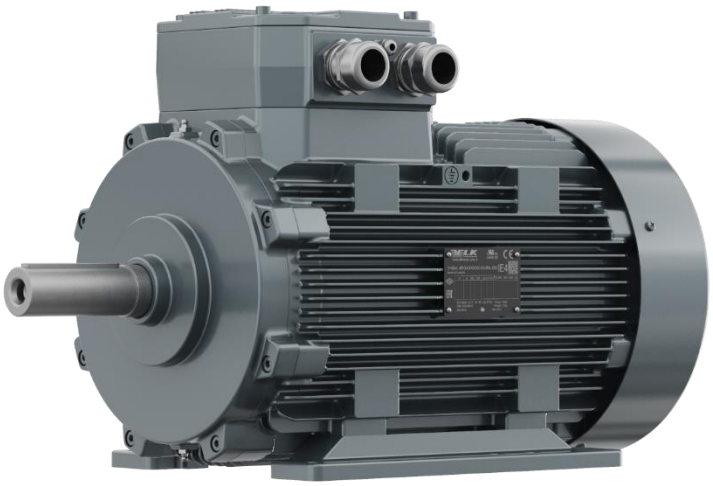
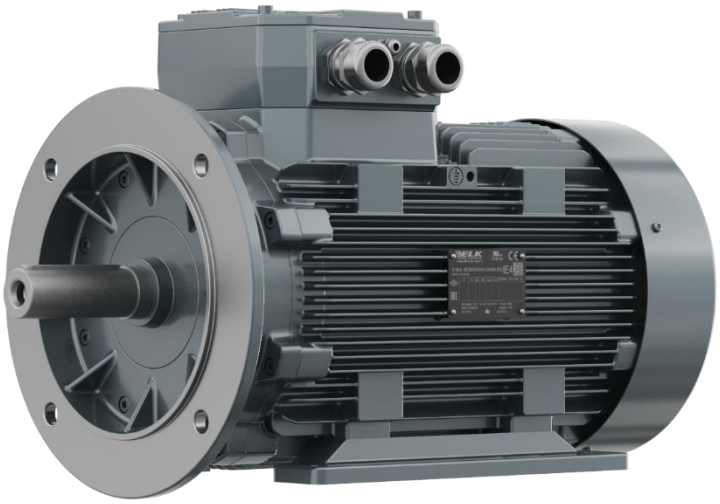




OPERATING MANUAL FOR ASYNCHRONOUS ELECTRIC MOTORS DESIGNED FOR OPERATION IN EXPLOSIVE ATMOSPHERES (EX-PROOF/ATEX)

CE 2284

2024/07/EN-08

CONTENTS

Web
elkmotor.com.tr/tr

Instagram
instagram.com/elkmotor

linkedin
linkedin.com/company/elk-motor

ASYNCHRONOUS ELECTRIC MOTORS DESIGNED FOR OPERATION IN EXPLOSIVE ATMOSPHERES (EX-PROOF/ATEX)

Operating Manual

1 INTRODUCTION / GENERAL DESCRIPTION

These instructions describe the electric motor and explain best practices in motor handling, from initial delivery to final disposal of the equipment. Our motors, designed for operation in explosive atmospheres as described in the operating manual, have been designed, manufactured, and tested for operation in industrial facilities with explosive atmospheres following Directive 2014/34/EU ("Explosion Protection Directive").

These instructions must be read carefully to ensure the safe and proper installation, operation, and maintenance of the motor. The specified safety instructions must be paid attention to and fully followed.

1.1 Symbols and Descriptions

The following symbols are taken part in the operating manual.

	**WARNING** This symbol indicates a warning of dangerous situations in terms of life and property safety.
	**ELECTRIC SHOCK HAZARD** This symbol indicates a warning against an electric shock hazard. The symbol means that caution should be taken against the risk of electric shock and necessary measures should be taken.
	**ATEX (Ex-PROOF) LOGO** ATEX mark to state compliance with the European Directive 94/9/EC and/or 2014/34/EU.

The signs above indicate the mandatory requirements that must be followed primarily during the operation, maintenance, or repair of the motor.

1.2 Area of Application and Intended Use of The Motors

This product is an electric motor that converts electrical energy into mechanical energy. The product series described in this manual are three-phase squirrel cage induction motors designed for operation in explosive atmospheres.

Electric motors of this series are self-ventilated low voltage three phase asynchronous motors with a cylindrical shaft end and feather keyway.

Electric motors in this series are used to provide propulsion in industrial systems. These motors have a wide range of usage since they are designed following the IEC/EN 60034 and IEC / EN 60079 standards. They can be directly connected to the mains or operate smoothly with frequency converters.

Low-voltage motors are components designed for installation in machines in accordance with the current Machinery Directive. The motors must not be commissioned until it has been verified that the end product complies with this directive (refer to EN 60204-1).

The instructions are valid for 2ZL, 3ZL, 3ZG, 4ZL, 4ZG, 3TG and 4TG type electric motors.

1.3 Environmental Requirements

The motors are designed for the following conditions unless otherwise stated on the rating plate.

- Ambient temperature limits are -20°C to +50°C for Zone 1/21 motors and -20°C to +40°C for Zone 2/22 motors, (-40°C to +60°C is optional for Zone 2/22 motors)
- Maximum altitude is 1000 m above sea level
- Tolerance for supply voltage is ±5% in Zone A and ±10% in Zone B. Tolerance for frequency is ±2% for Zone A and ±4% for Zone B according to EN/IEC 60034-1.

1.4 General Safety Rules:

The motor must only be operated in hazardous areas in strict accordance with the specifications of the responsible supervisory authority. The relevant supervisory authority is responsible for determining the danger level of each area and classifying the zones. The type of protection and special regulations are stated on the nameplate or test certificate. If an X is added to the end of the certificate number, any special notes in the operating instructions, EU type examination certificate, or IECEx Certificate of Conformity, if applicable, must be considered to operate the machine safely.

The basic requirements for electrical systems and their operation in hazardous areas are described, for example, in EU Directive 1999/92/EC and IEC / EN 60079-14.3.

The basic requirements for the assessment of ignition hazards arising from electrical equipment and their operation in hazardous areas are specified in the 2014/34/EU and 1999/92/EC directives and the IEC/EN 60079 series standards.

Electrostatic discharge represents a potential source of ignition. Dangerous electrostatic charges may occur when performing certain tasks such as maintenance or cleaning the motor. There is a risk of explosion in an explosive atmosphere. This could result in death, serious injury, or property damage. Situations that may cause such undesirable events should be avoided.

This machine has been designed following IEC/EN 60034 and, when used as specified, meets the requirements of the European Directive 2014/30/EU on Electromagnetic Compatibility.

Disassembling the motor causes it to lose its Ex-Proof feature. Only remove the terminal box cover (for electrical connection). Do not remove the front and rear covers. For situations requiring such action, please contact the manufacturer.

Please read the operating manual for correct storage, installation, and use. Mechanical and electrical installation and maintenance activities must be carried out by qualified persons!

For your safety and to prevent property damage when working on the motor, always follow the safety instructions and rules, according to EN 50110-1 (Dead Working).

- Disconnect the system. Disconnect the auxiliary circuits, for example, anti-condensation heating.
- Prevent reconnection.
- Make sure that the equipment is at zero voltage.
- Ground and short-circuit the terminals.
- Cover or isolate leads that are still live.

To energize the system, apply the measures in reverse order.

Electric motors have hot surfaces and contain live parts and dangerous rotating parts. Fatal or severe injuries and substantial property damage can occur if the required covers are removed or if the motors are not handled, operated, or maintained properly.

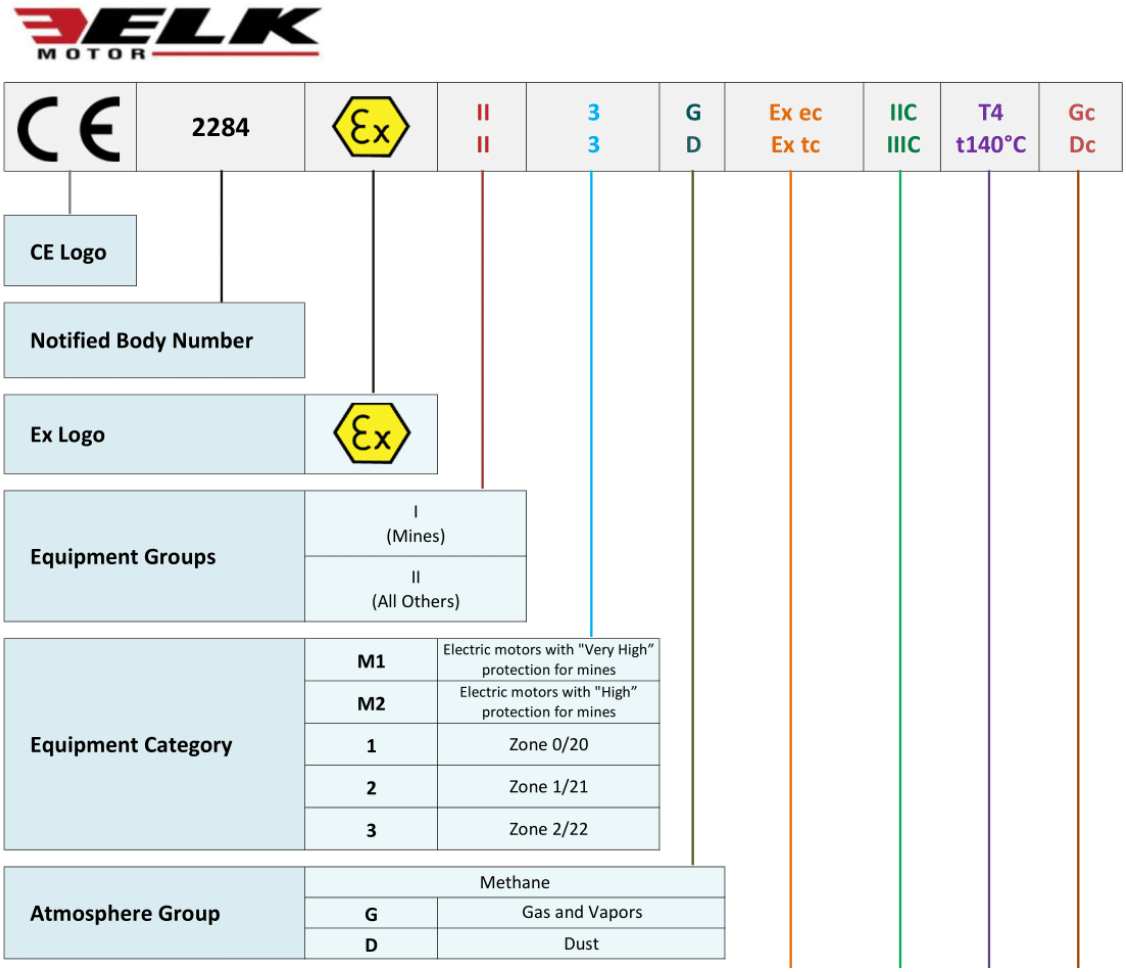
1.5 General Definition and Technical Properties of The Motors:

All of our standard products are designed, manufactured, and tested according to the IEC and EN standards given below:

IEC 60034-1	Rating and performance
IEC 60034-2-1	Methods for determining losses and efficiency
IEC 60034-5	Classification of degrees of protection
IEC 60034-6	Methods of cooling
IEC 60034-7	Symbols of construction and mounting arrangements
IEC 60034-8	Terminal marking and direction of rotation
IEC 60034-9	Noise limits
IEC 60034-11	Built-in thermal protection
IEC 60034-14	Vibration limits
IEC 60034-18-1	Functional evaluation of insulation system
IEC 60034-30	Efficiency classes (IE-code)
IEC 60038	Standard voltages
EN 50347	Dimensions and output for electrical machines
EN 55014-1	Electromagnetic compatibility
EN 61000-3-2	
EN 61000-3-3	
IEC 60079-0	Explosive atmospheres - Part 0: Equipment - General requirements
IEC 60079-1	Explosive atmospheres - Part 1: Equipment protection by flameproof enclosures "d"
IEC 60079-7	Explosive atmospheres - Part 7: Equipment protection by increased safety "e"
IEC 60079-31	Explosive atmospheres - Part 31: Equipment dust ignition protection by enclosure "t"

1.6 Marking/Classification and Explanations:

Marking, or in other words classification, indicates the technical details of the motor such as equipment group, equipment category, atmosphere class, explosion protection concept, temperature class, and equipment protection level. The data indicated by the marking defines the limits of the use of the motor. When the motor is used in conditions other than marking specifications, the responsibility is on the end user.



Explosion Protection Concept	**Ex db**	Flameproof Enclosure
	Ex tb	Protection By Enclosure

Atmosphere Subcategory	**Gas Group**	
	I	Methane
	IIA	Propane
	IIB	Ethylene
	IIC	Hydrogen
	IIC	Acetylene
	Dust Group	
	IIIA	Flammable Fibres
	IIIB	Small Dust
	IIIC	Coal Dust
	IIIC	Metal Dust

Temperature Class	**Maximum Surface Temperature**	
	Gas Group	
	T1	450°C
	T2	300°C
	T3	200°C
	T4	135°C
	T5	100°C
	T6	85°C
	Dust Group	
	t120°C	120°C
	t100°C	100°C

Equipment Protection Class		**Protection Class**	**Protection Class**
	Ma	Very High	Suitable for Ex Environment
	Mb	High	Electricity may be cut off in Ex Environment
	Ga	Very High	Zone 0,1 ve 2
	Da		Zone 20,21 ve22
	Gb	High	Zone 1 ve 2
	Db		Zone 21 ve 22
	Gc	Increased	Zone 2
	Dc		Zone 22

1.6.1 CE Logo

"CE" Mark is a sign that shows that the product complies with the relevant technical regulations and provided the products are used for their intended purpose, they will not cause any harm to people, property, plant and animal existence, and the environment.

1.6.2 2284

The phrase indicates the number/identity of the approved organization (notified body).

1.6.3 Ex Logo

The phrase indicates the explosion protection definition by Directive 2014/34/EU. It is found on ex-proof equipment labels.

1.6.4 Equipment groups

The equipment group is determined according to the state of gas and vapor in the environment where the motor will be operated. There are 2 types of equipment groups.

Group I: Indicates that the electric motor is suitable for mines where there is a possibility of firedamp (methane).

Group II: Indicates that the electric motor is suitable for explosive atmospheres other than mines.

1.6.5 Equipment category

The equipment category is one of the subcategories of equipment groups. They are divided into various classes according to the type of protection the motor has. The equipment categories defined for Group I and Group II are as follows. (Directive 2014/34/EU)

M1: Electric motors with **"Very High"** protection for mines where there is a possibility of firedamp (methane) presence.
M2: Electric motors with **"High"** protection for mines where there is a possibility of firedamp (methane) presence.
1 (Zone 0/20): Electric motors with **"Very High"** protection for explosive atmospheres other than the mining environment
2 (Zone 1/21): Electric motors with **"High"** protection for explosive atmospheres other than the mining environment
3 (Zone 2/22): Electric motors with **"Increased"** protection for explosive atmospheres other than the mining environment

EQUIPMENT PROTECTION LEVEL						
Equipment Group	**Equipment Category**	**Zone**	**Equipment Protection Class**	**Atmosphere Group**	**Protection Class**	**Use**
I (Mines)	M1	-	Ma	Methane	Very High	Suitable for Ex environment
	M2	-	Mb		High	Electricity may be cut off in Ex environment
II (All Others)	1	0	Ga	G-Gas and Vapors	Very High	Zone 0,1 and 2
		20	Da			Zone 20,21 and 22
	2	1	Gb		High	Zone 1 and 2
		21	Db			Zone 21 and 22
	3	2	Gc	D-Dust	Increased	Zone 2
		22	Dc			Zone 22

1.6.6 Atmosphere Group

The atmosphere group is another subcategory of equipment groups. It indicates which atmosphere group the environmental conditions in which the motor can operate. There are 2 types of atmosphere groups. (IEC/EN 60079-10)

G : Electric motors suitable for gas and vapor atmosphere
D : Electric motors suitable for dust atmosphere

1.6.7 Ex Phrase

A sign indicating explosion protection identification. Ex-proof is found on equipment labels.

1.6.8 Explosion protection concept

These are the phrases indicating the type of protection of the motor to be used in explosive atmospheres. It varies for gas and dust atmosphere groups. The motor should be used in environments that comply with its protection concept such as Ex d, Ex e, Ex tb, and Ex tc .etc.

PROTECTION CONCEPT				
Electrical Equipment for Flammable Gas, Vapor and Smoke				
Protection Type	**Code**	**Area**	**Standard**	**Protection Concept**
Flameproof	Ex d (..)	Zone 1	IEC/EN 60079-1	Stopping explosion and preventing flame spread
Increased Security	Ex e	Zone 1	IEC/EN 60079-7	No arcing, sparks, or hot surfaces
non-sparking	Ex nA	Zone 2	IEC/EN 60079-15	
pressurized	Ex px	Zone 1	IEC/EN 60079-2	Keeping flammable gas out
	Ex py	Zone 1	IEC/EN 60079-2	
	Ex pz	Zone 2	IEC/EN 60079-2	
Electrical Equipment for Combustible Dusts				
Protection Type	**Code**	**Area**	**Standard**	**Protection Concept**
Protection by Surrounding	Ex tb	Zone 21	IEC/EN 60079-31	Keeping flammable dust-out
	Ex tc	Zone 22	IEC/EN 60079-31	
Protection by Pressurization	Ex pD	Zone 21	IEC/EN 60079-4	
	Ex pD	Zone 22	IEC/EN 60079-4	

Flameproof enclosure "db" (Ex db): Type of protection involves enclosing parts that could ignite explosive gas environments within a housing capable of withstanding the pressure generated by internal explosions of explosive mixtures. This housing prevents the explosion from propagating into the surrounding explosive gas atmospheres.

Increased safety "eb" (Ex eb): Type of protection in which additional measures are taken in electrical devices to provide increased safety against the possibility of excessive temperatures and the possibility of arcing and sparking in normal service or under specified abnormal conditions.

Increased safety "ec" (Ex ec): Type of protection applied to electrical devices that cannot ignite an explosive gas atmosphere in normal service and under specified abnormal conditions.

Protection against dust explosion by enclosure "t" (Ex t): Type of protection applied for explosive dust atmosphere, where electrical equipment is provided with an enclosure resistant to the ingress of dust and with possibilities to limit surface temperatures

1.6.9 Atmosphere subcategory

The Atmosphere subcategory is a subcategory of the atmosphere group. It details the environmental conditions containing gas or dust in which the motor can operate. There are 9 types of atmosphere subcategories. (The degree of protection increases as you move from A to C.)

I : Electric motors suitable for environments containing methane gas
IIA : Electric motors suitable for environments containing propane gas
IIB : Electric motors suitable for environments containing ethylene gas
IIC : Electric motors suitable for environments containing hydrogen gas
IIC : Electric motors suitable for environments containing acetylene gas
IIIA : Electric motors suitable for environments containing fibers and airborne dust
IIIB : Electric motors suitable for environments containing small dust particles
IIIC : Electric motors suitable for environments containing coal dust
IIIC : Electric motors suitable for environments containing metal dust

1.6.10 Temperature Class

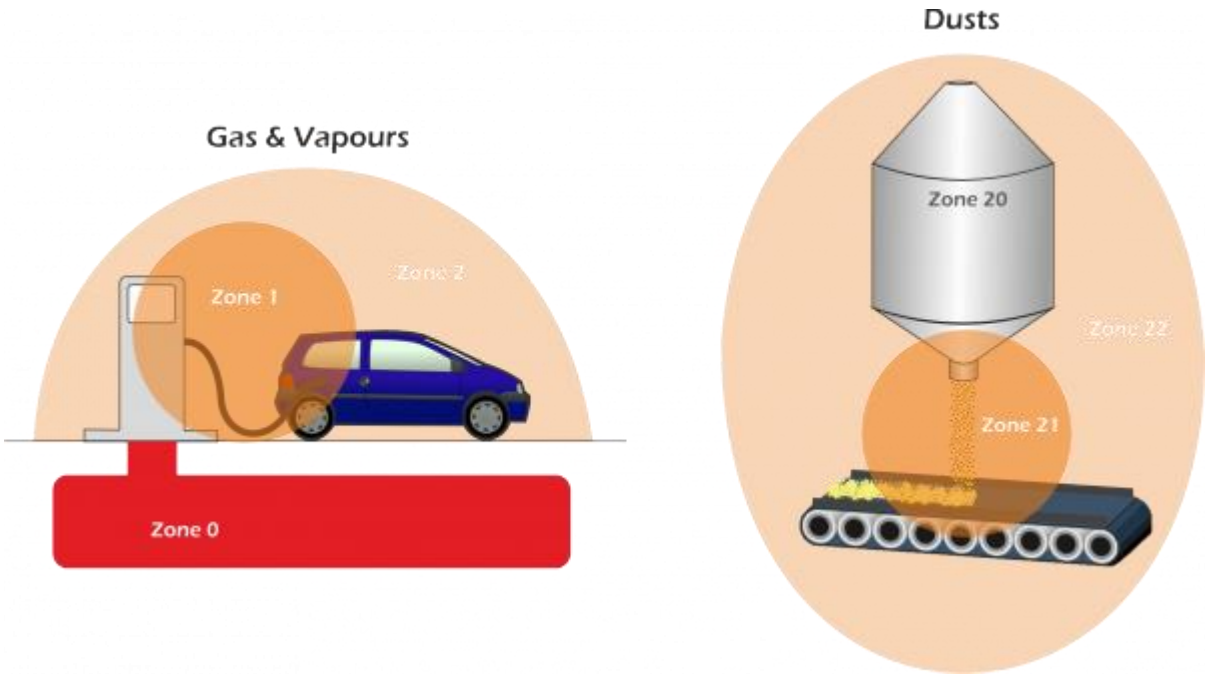
The temperature class category indicates the upper limit of the maximum operating temperature reached on the surface of the motor in the most unfavorable conditions. Motor codes specific to temperature class IEC codes are as follows.

TEMPERATURE CLASS		
	IEC Code	**Maximum Surface Temperature**
Gas Group	T1	450 °C
	T2	300 °C
	T3	200 °C
	T4	135 °C
	T5	100 °C
	T6	85 °C
Dust Group	t120	120 °C
	t100	100 °C

1.6.11 Equipment protection class

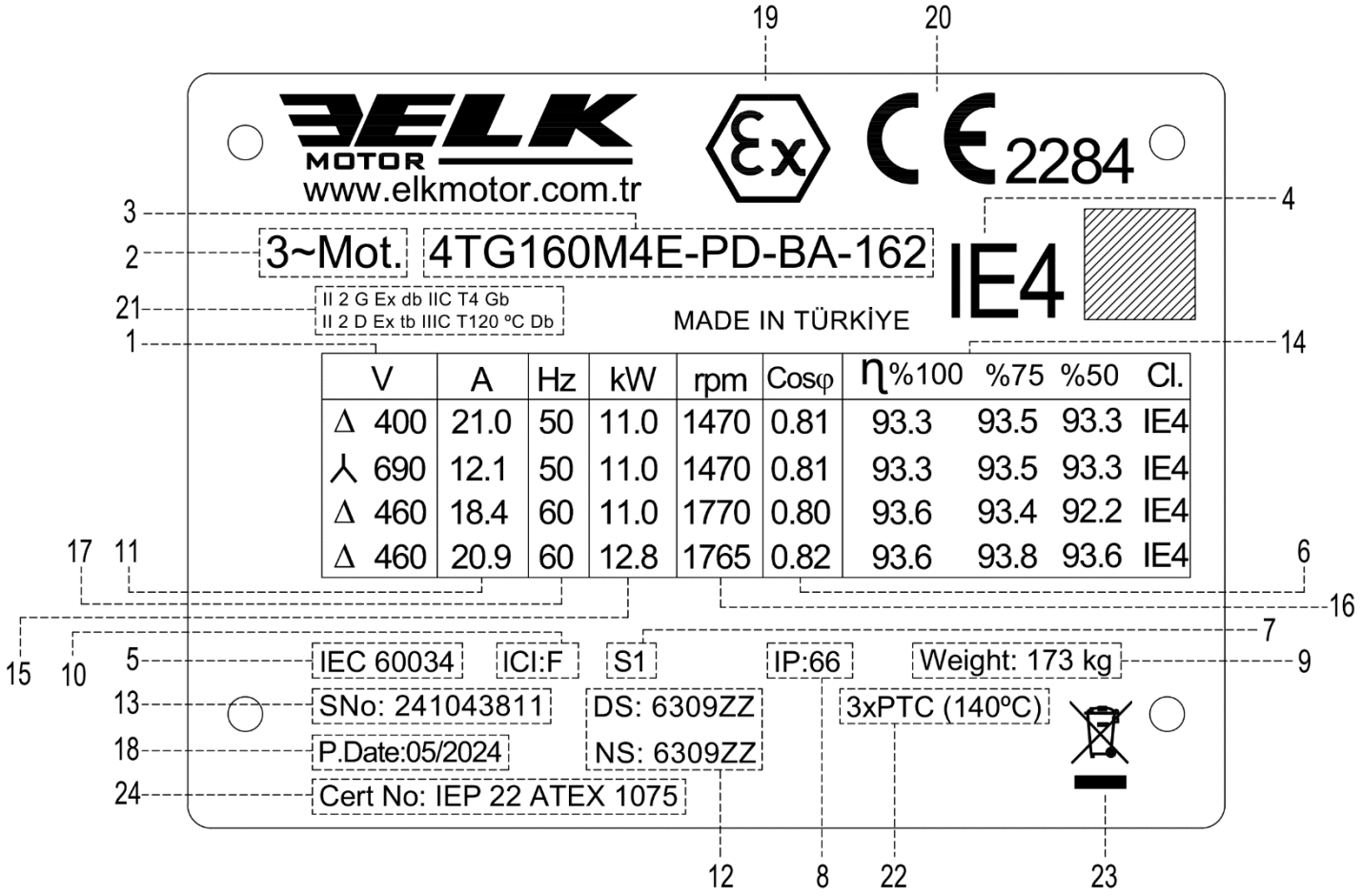
Equipment protection class is one of the subcategories of equipment groups. It varies depending on the zone where the motor will operate (Zone 0/20, Zone 1/21, Zone 2/22, etc.). (IEC/EN 60079-0)

Ma : Electric motors with **"Very High"** protection suitable for mining equipment group.
Mb : Electric motors with "**High"** protection suitable for mining equipment group.
Ga,Da : Electric motors with **"Very High"** protection suitable for Ex atmospheres other than mines (Zone 0/20)
Gb,Db : Electric motors with "**High"** protection suitable for Ex atmospheres other than mines (Zone 1/21)
Gc,Dc: Electric motors with **"Increased"** protection suitable for Ex atmospheres other than mines (Zone 2/22)



1.7 Ex-Proof (ATEX) Motor Nameplate Descriptions

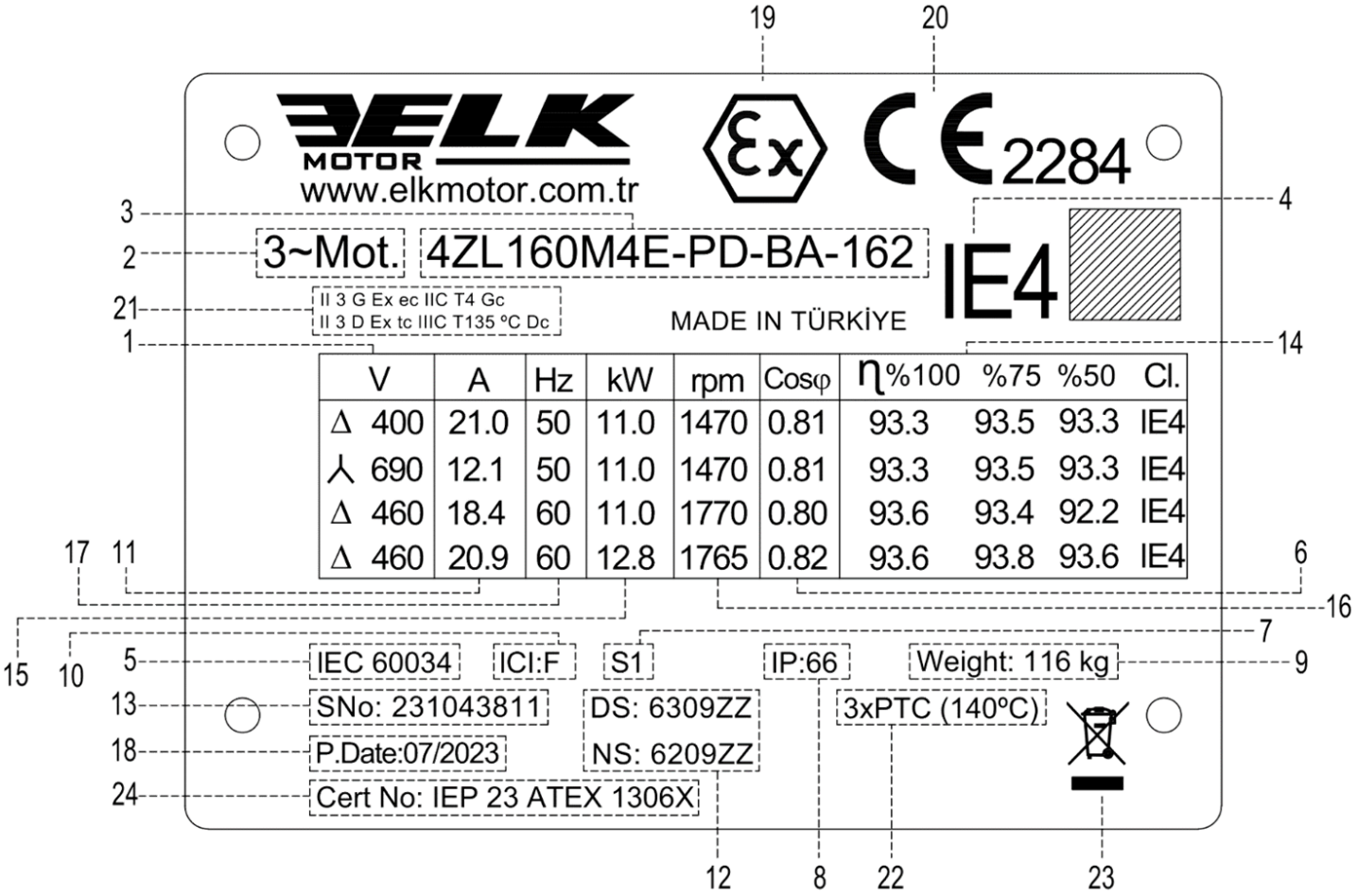
1.7.1 Zone 1/21 Ex-Proof (ATEX) motor nameplate description



1. Rated Voltage
2. Motor Type: 3-Phase Asynchronous Motor
3. Motor Code
4. Efficiency Class
5. Manufacture Standard
6. Power Factor
7. Duty Cycle
8. Protection Class
9. Motor Weight
10. Insulation Class
11. Rated Current
12. Bearing Type
13. Serial Number
14. Efficiency
15. Output Power
16. Speed
17. Frequency
18. Production Date
19. Ex-proof Logo
20. CE Logo
21. Ex-Proof Classification Codes
22. 3xPTC Phrase
23. WEEE Logo
24. Certificate Number

The nameplate shows the identification and the most important technical data. The nameplate also defines the limits of proper usage and manufacturing year of the motors. The first two digits in the serial number show the manufacturing year. For example, 24XXXXXXX shows that the product is manufactured in 2024.

1.7.2 Zone 2/22 Ex-Proof (ATEX) Motor Nameplate Description



1. Rated Voltage
2. Motor Type: 3-Phase Asynchronous Motor
3. Motor Code
4. Efficiency Class
5. Manufacture Standard
6. Power Factor
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8. Protection Class
9. Motor Weight
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24. Certificate Number

The nameplate shows the identification and the most important technical data. The nameplate also defines the limits of proper usage and manufacturing year of the motors. The first two digits in the serial number show the manufacturing year. For example, 24XXXXXXX shows that the product is manufactured in 2024.

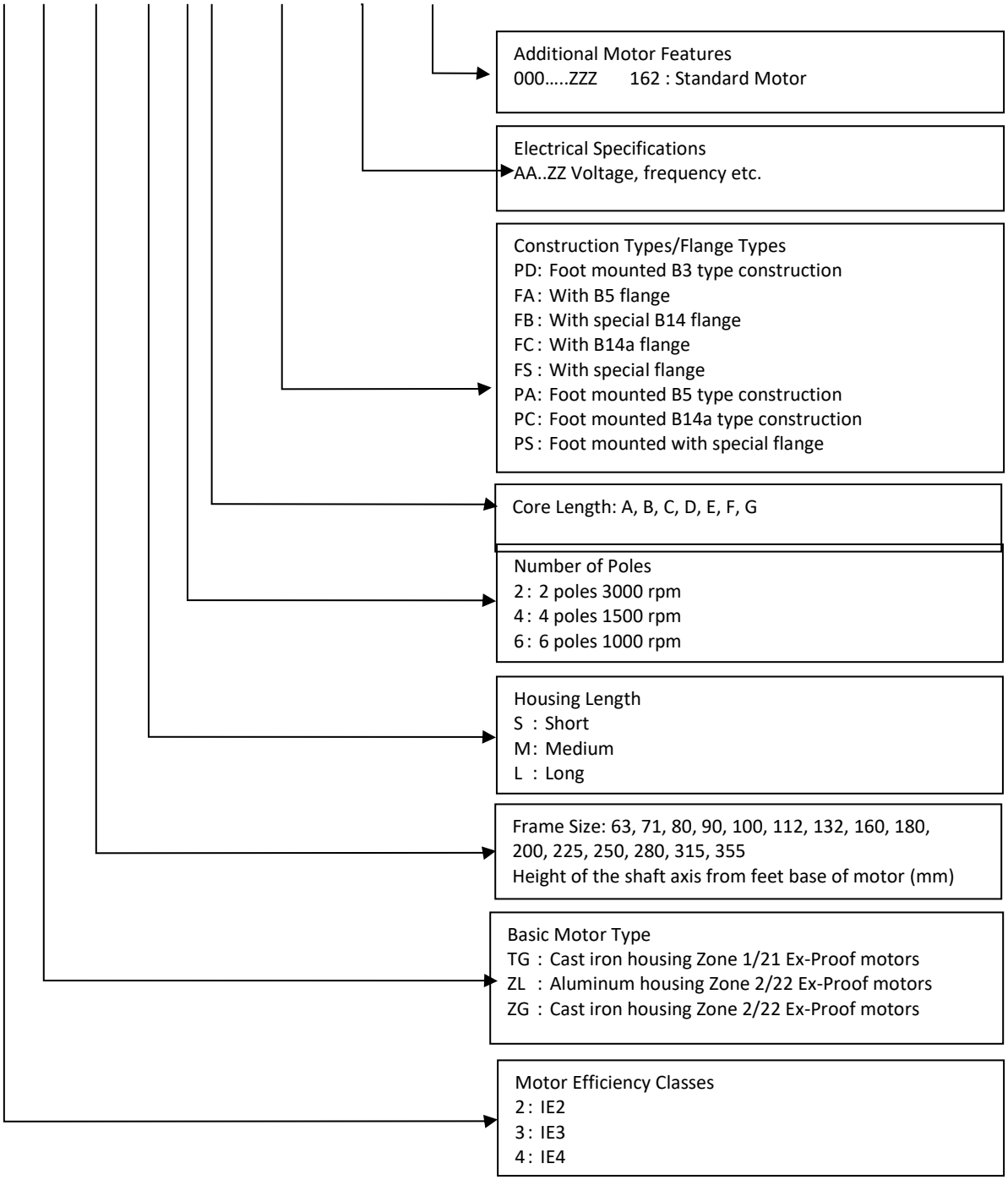
1.7.3 Ex-Proof (ATEX) Motor Warning Label

- The warning label is affixed on the terminal box and is used in ATEX (Ex-Proof) motors.
- Any problems that may occur if the warning is ignored are the responsibility of the end user.

WARNING - Don’t open when energized.

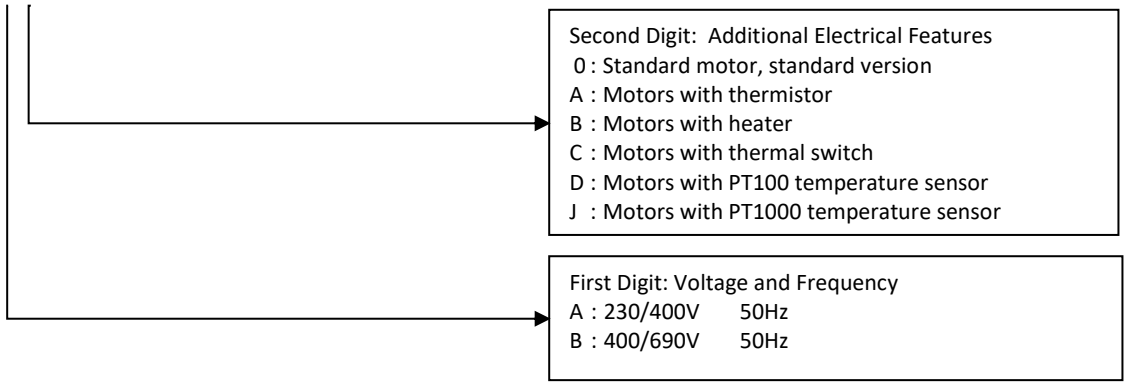
1.8 Product Type Codes

4 TG 160 M 4 E - FA - BA - 162



1.9 Electrical Properties

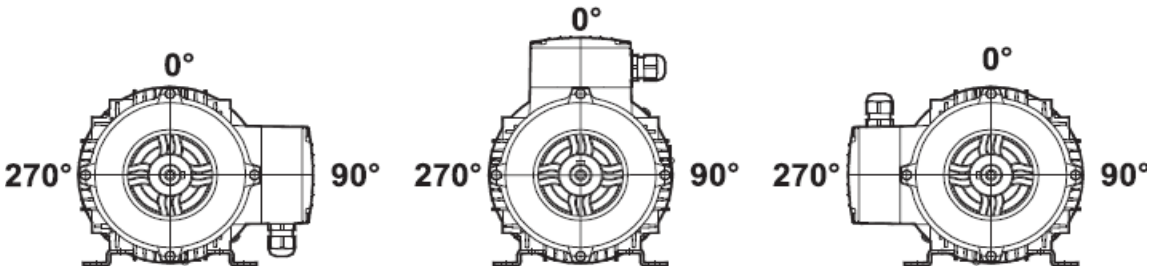
B A



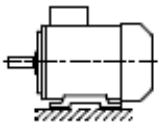
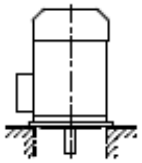
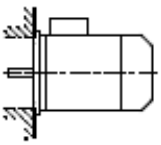
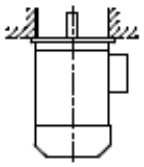
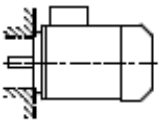
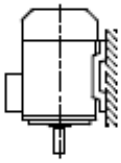
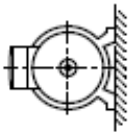
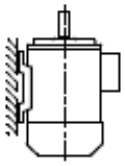
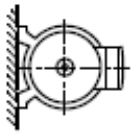
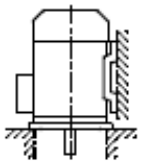
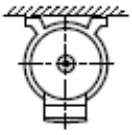
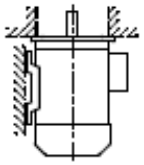
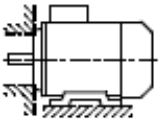
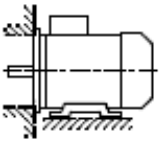
Please contact us for current motor code descriptions.

1.10 Motor Foot Structure

Zone 2-22 Ex-Proof ELK motors, with frame sizes ranging from 63 to 315, and Zone 1-21 Ex-Proof ELK motors, with frame sizes ranging from 100 to 250, feature removable feet attached to three housing sides. Thus, the user can easily create a motor structure with the terminal box on the right, top, or left by changing the foot position. In standard motors, the terminal box is in the upper position.



ELK electric motors are manufactured following International Assembly Standards.

International Mounting Code via IEC 60034-7					
	Horizontal Mounting Alpha Numeric Marking			Vertical Mounting Alpha Numeric Marking	
	I	II		I	II
	IM B3	IM 1001		IM V1	IM 3011
	IM B5	IM 3001		IM V3	IM 3031
	IM B14	IM 3601		IM V5	IM 1011
	IM B7	IM 1061		IM V6	IM 1031
	IM B6	IM 1051		IM V15	IM 2011
	IM B8	IM 1071		IM V35	IM 2031
	IM B34	IM 2101			
	IM B35	IM 2001			

2 LIFTING AND STORAGE

Please inspect the delivered product for any potential damages that may have occurred during the transportation process.
Motors weighing more than 25 kg are equipped with lifting lugs and eye bolts. The actual weights of the motors are shown on their nameplate.

- Only lifting lugs and eye bolts should be used to lift the motor.
- Lift the motor using all of the lifting lugs on it.
- Do not use damaged lifting lugs.

Precautions should be taken against shocks, falls, and moisture during transportation.

The following conditions must be met during storage or when motors are disabled for a long time;

- Motors should be stored in a way that is not affected by adverse weather conditions. Storage areas must be dry, free from dirt, frost, vibration, and well-ventilated.
- The motor shaft should be turned by hand at least once a year. Gloves should be used when turning by hand.
- Motors must be protected from corrosive environments, direct sunlight, and gases against corrosion.
- Unprotected machine surfaces (shaft end and flanges) must be treated against corrosion.
- If an anti-condensation heater is provided, the heater should be activated when the machine is not operating.

3 COMMISSIONING

Upon receipt, check the motor for damage (e.g., shaft ends, flanges, and painted surfaces). Do not put damaged motors into operation until the damage is repaired.

To protect the motor and ensure proper connections (especially motor operating voltage and winding connection type), check all information on the motor nameplate.

3.1 Checking The Insulation Resistance

The insulation resistance of the motor winding should be measured and checked before the motor is operating.

- Only qualified personnel may carry out this work.
- Before starting commissioning, ensure that protective covers preventing contact with rotating and active parts are in place.
- If the power cable is connected to the motor, check the cables to ensure that the voltage is zero.
- Once the insulation resistance has been measured, the winding should be grounded.
- Measurement of insulation resistance should be performed while the motor is not in operation.
- If the measurements are performed at winding temperatures not equal to 25 °C, convert the measured value to the reference temperature of 25 °C to be able to compare the values with the table below.
- The insulation resistance halves every time the temperature rises by 10 °K.
- The resistance doubles every time the temperature falls by 10 °K.

Insulation resistance, corrected to 25°C, must be higher than the reference value given below.

If the reference resistance value is not attained, the winding is too damp and must be oven-dried. The oven temperature should be 90°C - 100 °C for 12 hours.

After the drying process, the insulation resistance should be measured and confirmed to be greater than the specified reference value.

Insulation Resistance of The Stator Winding at 25 °C	
Measuring circuit voltage	500 V
Minimum insulation resistance for new, cleaned or repaired windings	100 MΩ

4 MECHANICAL INSTALLATION

4.1 Safety Considerations

- The machine is intended for installation and use by qualified personnel, familiar with health and safety requirements and national legislation.
- Safety equipment necessary for the prevention of accidents at the installation and operating site must be provided in accordance with local regulations.
- The temperature of the outer casing of the motor may be too hot to touch during normal operation and especially after shut-down.
- Be aware of rotating parts of the motor.
- Do not open terminal boxes while energized.

Please check before operating;

- Connect the motor according to the specified direction of rotation.
- Make sure that all felts and felted surfaces are undamaged and clean.

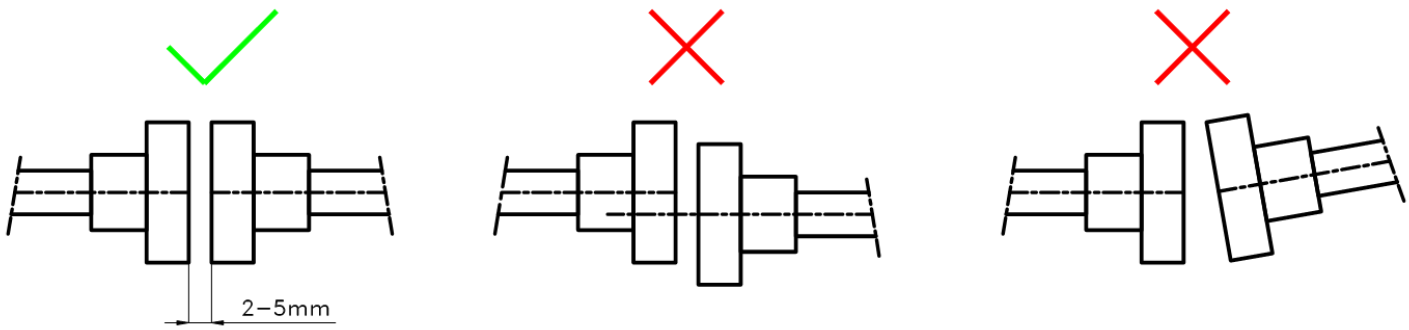
When aligning and fastening the motor, please bear the following in mind:

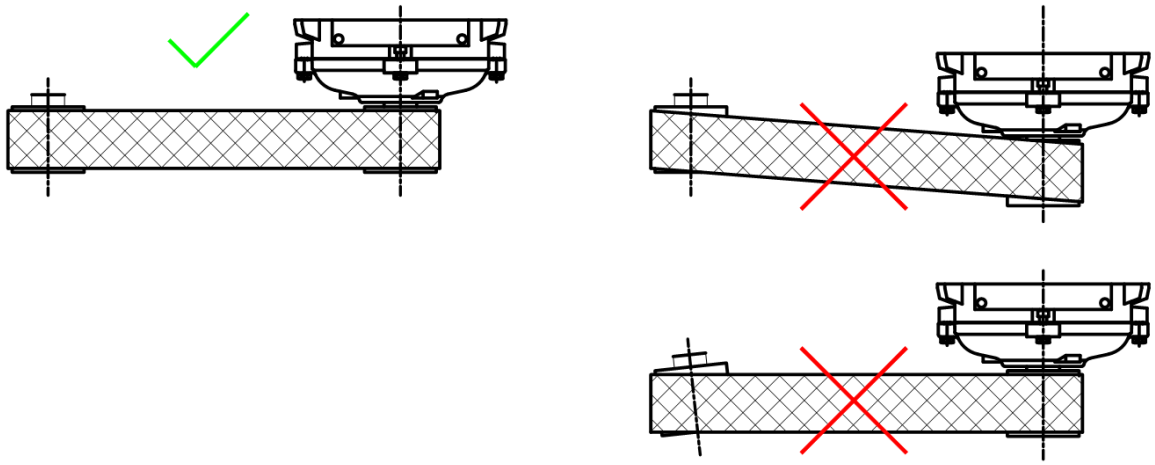
- The motor shall be mounted on a base, which is rigid enough to prevent distortion and vibration.
- Feet and flanges must be fastened securely.
- Avoid using rigid coupling measures.
- The motors must be carefully aligned. Incorrect alignment can lead to beating failure, vibration, even shaft fracture.
- Coupling halves and pulleys must be fitted on the shaft by using suitable equipment and tools which do not damage the bearings and seals. Never fit a coupling half or pulley by hammering or by removing it using a lever pressed against the body of the motor
- Excessive belt tension will damage bearings and can cause shaft damage.
- If a belt drive is used, make sure that the driving and the driven pulleys are correctly aligned.
- The motor should be mounted in such a way that the cooling air should flow to and away from the motor without obstruction.
- For Technical details about the motor dimensions see the catalogue.
- Do not exceed permissible loading values for bearings as stated in the product catalogs.

As standard, balancing of the motor has been carried out using half key.

Coupling halves or pulleys must be balanced after machining the keyways. Balancing must be done following the balancing method specified for the motor.

When aligning the motor to the load, it must be ensured that the couplings used are on the same axis. In addition, at least 2-5 mm axial clearance is required between the couplings.





If the belt pulley system is used when connecting the motor to the load, care must be taken to ensure that the pulleys are in parallel axes and that the belt is not too tight or too loose.

5 ELECTRICAL INSTALLATION AND OPERATION CONDITIONS

Before installation, check motor specifications from nameplate if they fit the requirements of the load and specification of voltage and frequency.

Measure the insulation resistance between windings and housing. Please check the detailed information in the Checking the insulation resistance section.

Note the following safety information before connecting the motor:

- Only qualified and trained personnel should carry out work on the motor while it is stationary.
- Earthing must be carried out according to local regulations before the machine is connected to the supply voltage.
- Disconnect the motor from the power supply and take measures to prevent it from being reconnected. This also applies to auxiliary circuits.
- Check that the motor is in a no-voltage condition.
- It must be ensured that there are no foreign bodies, dirt, or moisture in the terminal box.
- Keep the inside of the terminal box clean and free from trimmed-off ends of wire.
- Close any additional open cable entries with O-rings or suitable flat gaskets, the terminal box itself must sealed so that it is dust and water-tight using the original seal.
- When performing a test run, secure the feather keys without output elements.

5.1 Terminals and Direction of Rotation

The standard motors are suitable for clockwise and counter-clockwise rotation.

In three phase motor, when the power cables L1, L2, L3 are connected to U1, V1, W1 respectively, the three phase motor shaft turns in a clockwise direction (looking at the shaft from the drive side). If two of the power cables are interchanged then the resulting direction of rotation is counter-clockwise.

Select the connecting cables in accordance with the rated current, ambient temperature, cable gland, starting method etc. according to IEC/EN 60204-1.

Please observe the tightening torques for cable glands, terminal screws, and other screws.

Tightening Torques For Electrical Connections On The Terminal Board								
Thread Ø		**M4**	**M5**	**M6**	**M8**	**M10**	**M12**	**M16**
Nm	Min.	0.8	1.8	2.7	5.5	9	14	27
	Max .	1,2	2.5	4	8	13	20	40

In order to provide the ingress protection class specified on the motor nameplate;

1- Cable gland must be tightened properly and ensure that the gland is fully tightened.

Cable Gland Tightening Torque ±10% Nm								
Cable Gland	M12	M16	M20	M25	M32	M40	M50	M63
Nm	6 - 9	9 – 15	13 - 25	20 – 35	25 – 45	45 – 70	50 – 75	55 - 85

2- Ensure that the terminal box of the Atex Zone 1/21 class motors has an O-Ring for sealing, and ensure that the O-Ring is intact and undamaged.

3- Ensure that there is a viton gasket in the terminal box and on the box cover of the Atex Zone 2/22 class motors, and ensure that the viton gasket is intact and undamaged.

4- Tighten the terminal box cover bolts with the appropriate torque.

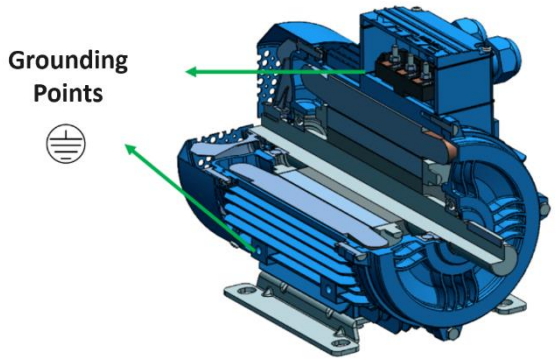
Atex Zone 1/21 Terminal Box Cover 12.9 Quality Bolt Tightening Torques ±10% Nm					
Thread Ø	M6	M8	M10	M12	M16
Nm	16.4	40	79	136	341

Cast Iron Frame Atex Zone 2/22 Terminal Box Cover Bolt Tightening Torques ±10% Nm			
Thread Ø	M5	M6	M8
Nm	5.5	9.5	23

Aluminum Frame Atex Zone 2/22 Terminal Box Cover Bolt Tightening Torques ±10% Nm			
Thread Ø	M4	M5	M6
Nm	3.5	5	6

There are six leads in the terminal box of a standard single-speed three-phase motor. The presence of six leads allows the motor to be used with DOL (Direct On Line) or Y/Δ (star-delta) starting.

Ground connection points are located inside the terminal box and at certain locations on the motor housing. Optionally, the motor feet can also be used as ground connection points. According to the IEC 60079-0 standard, the cross-sectional area of the ground cable to be used must be at least 4 mm². In addition, before energizing the motor, it should be checked whether the motor is firmly grounded following current standards.
It is the end user's responsibility to make grounding connections.



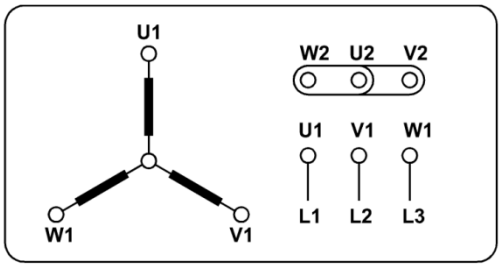
The use of components that generate sparks, such as grounding brushes, is prohibited in explosive atmospheres.

As a standard, our Zone 1/21 class motors have 3 cable glands, while our Zone 2/22 motors have 2 cable glands. According to the demands of our customers, support can be obtained from the sales unit of the company regarding the production of Zone 2/22 motors with 3 cable glands.

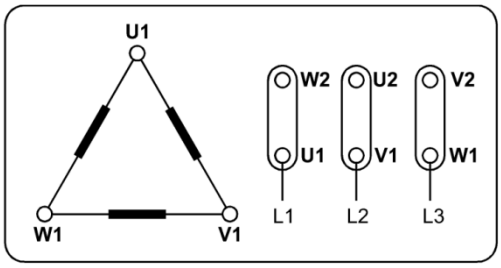
Three-phase motors must be connected as delta or star according to the rated voltage and mains voltage given on the nameplate.

Terminal connections for our three-phase motors are given below:

5.2 Terminal Connection for Three Phase Motors:



Star Connection

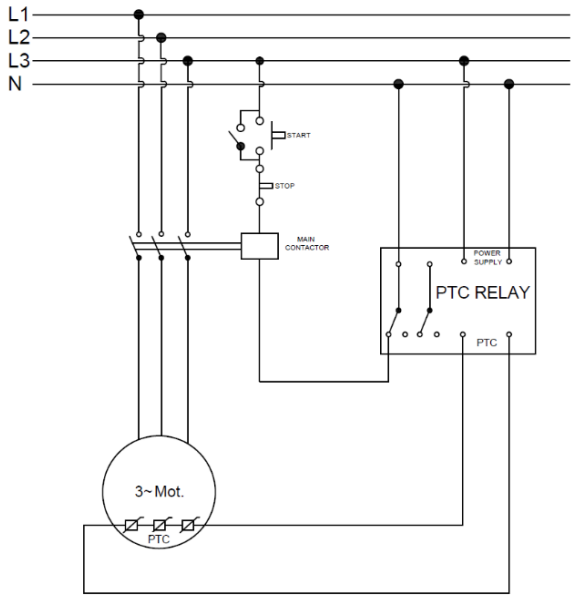


Delta Connection

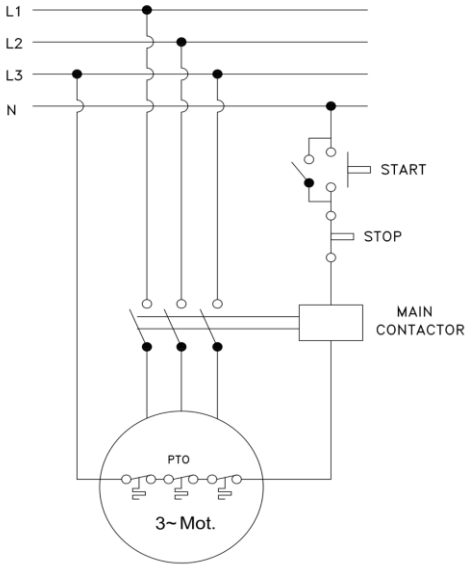
5.3 Connection of Thermal Protection Equipment

In addition to the terminals used for the connection of the main winding ends, the terminal box may also contain terminals used for the connection of thermal protection devices, such as thermistors or thermostats. If the motor is supplied with a thermal protection element, such as a thermistor (PTC) or thermostat (PTO), these accessories must be connected to the relevant control equipment following the connection diagrams provided below. Failure to follow this procedure may invalidate the product warranty and cause serious property damage.

All thermal protection equipment (thermistor, thermostat or PT100 etc.) used in our motors designed for use in explosive atmospheres can be connected to standard control equipment in safe areas without explosive risk.



Thermistor Connection



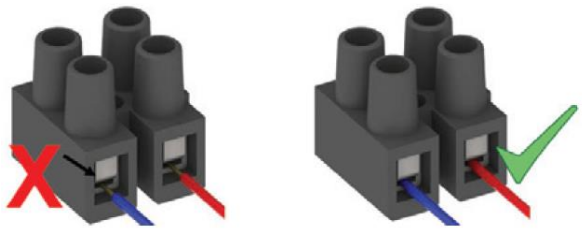
Thermostat Connection

As a standard, Zone 1/21 motors are manufactured with 120°C thermistors, while Zone 2/22 motors are manufactured with 140°C thermistors. Before operating Ex Motors, thermistor connections must be established by qualified personnel. Otherwise, any issues arising are the responsibility of the end user.

The relevant connection diagrams must be carefully followed.

Voltage greater than 30V (DC) should not be applied to positive temperature coefficient thermistors.

Accessory cables should be connected to the connection element as follows. The uninsulated part of the cable should not exceed 1mm.

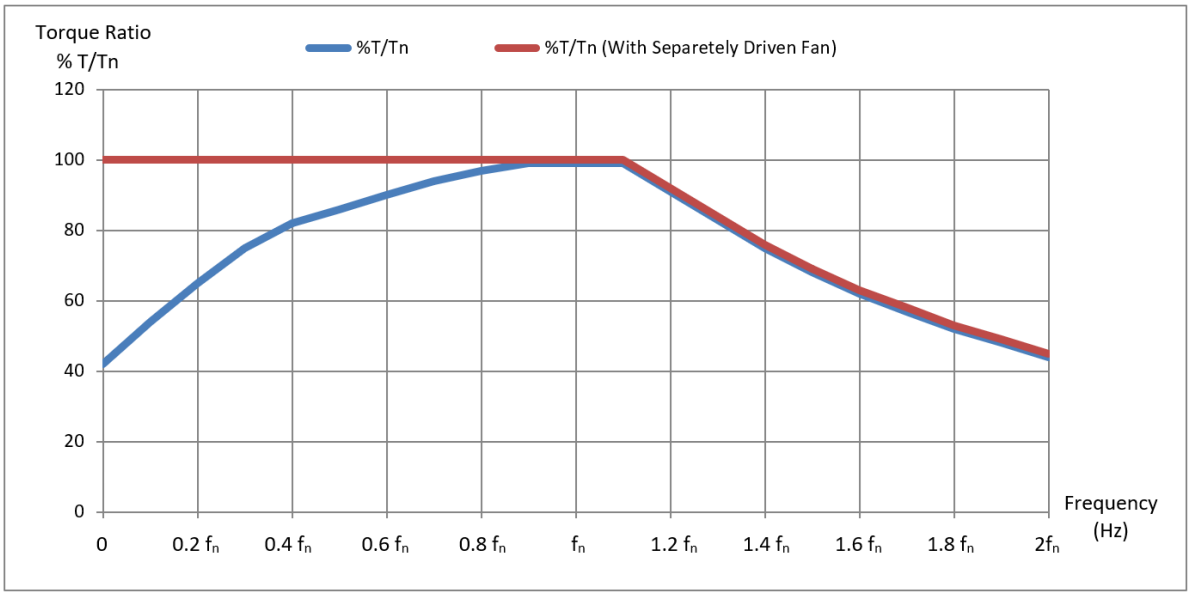


5.4 Operating Conditions

Our standard motors have an F (155°C) class electrical insulation system. However, all standard motors in our product range remain within the B class temperature rise limits. Thus, with the safety margin provided by the temperature class, our motors can operate under more challenging conditions than declared or have a longer operating life under normal conditions.

50Hz Rated voltage	60Hz Supply voltage	Rated Speed	Rated Power	Rated Torque	Rated Current	Starting Torque	Break Down Torque	Starting Current
230V	220V	1,193	1.00	0.84	0.97	0.77	0.8	0.8
400V	380V	1,193	1.00	0.84	0.97	0.77	0.8	0.8
400V	440V	1.20	1.16	0.97	0.98	0.87	0.9	0.9

When operating at speeds above rated speed, for example when used with frequency converters, for adjustable speed control, noise and vibration levels will be increased, and bearing lifetime will be decreased. The user may require better balance for better operation above the rated speed. Attention should be paid to the re-greasing intervals and the grease service life.



Standard three phase motors are suitable for electronic speed control operations. The frequency range that the motor can be driven with their fan is shown with the blue line in the above graph. If the motor will be driven in a wider range, then an external fan is necessary. By using an external fan, the motors can be driven in the range defined by the red line.

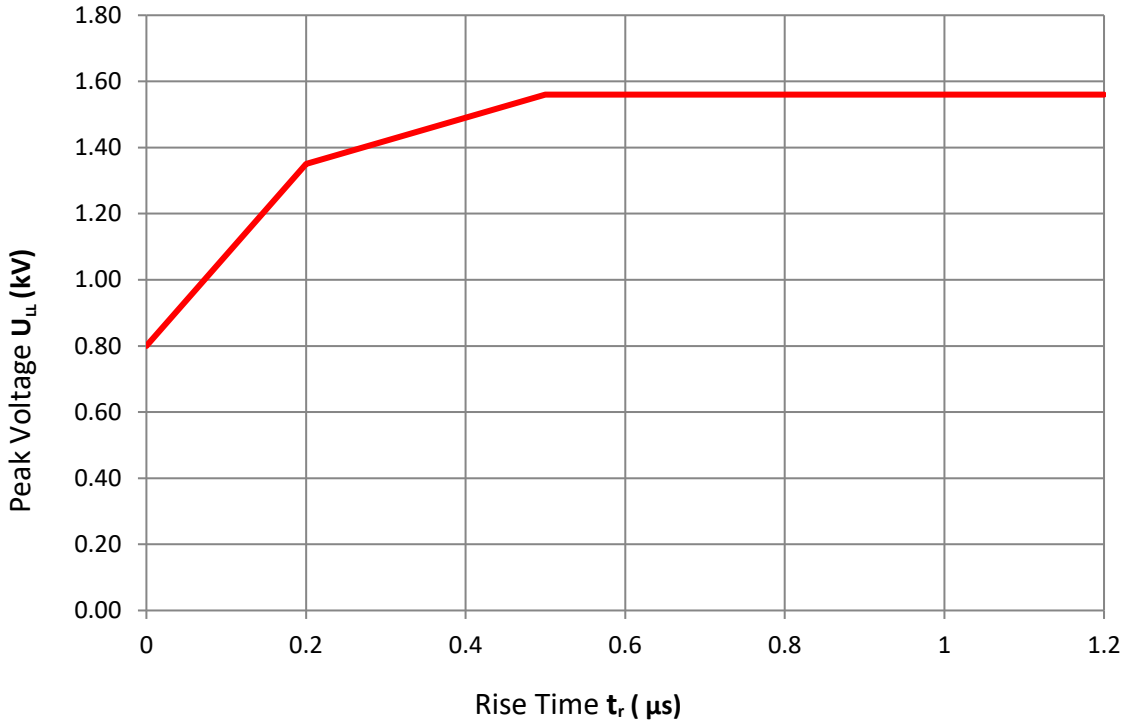
Do not exceed the speeds given in the table because high speeds increases the level of vibration and noise, and the bearing lifetime may be reduced.

Maximum Safe Operating Speed (rpm) Single-Speed Cage Induction Motors			
Frame Size	2 Poles	4 Poles	6 Poles
<100	5200	3600	2400
112	5200	3600	2400
132	4500	2700	2400
160	4500	2700	2400
180	4500	2700	2400
200	4500	2300	1800
225	3600	2300	1800
250	3600	2300	1800
280	3600	2300	1800
315	3600	2300	1800

Whenever the peak voltage and the rise time of the pulses at motor terminals are within the limit of the curve given below, there will be no significant decrease in motor lifetime.

The maximum allowed phase-to-phase voltage peaks ($\hat{U}_{LL}$) at the motor terminals, as a function of the rise time (t_r) of the pulse, is shown in the figure below.

Suitable filters must be incorporated at the converter output to not decrease insulation lifetime, whenever the peak voltages are not within the limit of the curve.



Limit curves of admissible three phase motor terminal peak voltage for motors up to and including 500V AC rated voltage.

6 TROUBLESHOOTING

6.1 Troubleshooting For Three Phase Motors

Motor service and any troubleshooting must be handled by qualified persons who have the proper tools and equipment. Before rectifying any faults, please read the information in the section titled Safety Information.

Defect	Causes	Solution
Motor does not start	Blown fuses	Replace the fuses with the correct one with the rated value
	Incorrect line connections	Check the connections
	Motor overloaded	Decrease the load
	Mechanical damage	Check whether the motor and drive rotate freely
	The motor is stuck in two phases or there is no energy	Check phases
Motors rotation direction is different each time	Motor stuck in two phases	Check the phases
Motor stalls	One of the phases may be open.	Check phases
	Improper motor selection.	Change the type or size. Contact the device's supplier or designer.
	Overload	Decrease the load
	Low voltage	Check whether the voltage stated on the rating plate is maintained. Check the connection.
	Open the power supply or control circuit.	Blown fuses, check the load relay, stator, and control buttons.
Motor takes a long time to gain speed	Low voltage	Check the voltage source
	Overloading	Decrease the load
	Rotor damaged	Replace the rotor
Motor runs and dies down	Power failure	Check for a loose connection in the power supply line, fuses, and control.
Wrong rotation direction	Wrong sequence of phases	Reverse connections at terminals
Motor heats up excessively	Motor overloaded	Decrease the load
	Low voltage	Adjust the motor supply voltage to the appropriate level
	Ambient temperature is too high	Pay attention to the permitted temperature range and decrease the load if necessary
	Insufficient cooling	Ensure that the air ducts are clean and provide airflow
	Bearing failure	Replace the bearings
	Unbalanced voltage	Check phase voltages
	Short circuit in motor's winding	Rewind the motor
	One of the phases may be open	Check the phases on the line
	Broken ventilator or lack of ventilator	Check the ventilator
Noisy operation	One of the phases may be open	Check the phases on the line
	Improper air gap	Check the bearing housings and bearings
	Broken ventilator	Check the fan mounting
	Broken propeller	Replace the ventilator
	Misalignment or tight belt	Adjust the motor orientation and belt tension
	Broken rotor bar	Replace the rotor with qualified personnel

6.2 Faults During Operation

Deviations from conditions during normal operation, such as an increase in power consumption, temperatures or vibrations, unusual noises or odors, tripping of monitoring devices, etc., indicate that the motor is not functioning properly. This can cause faults which can result in eventual or immediate death, severe injury, or material damage.

- Immediately inform the maintenance personnel.
- If you are in doubt, immediately switch off the motor, being sure to observe the system-specific safety conditions.

7 INSPECTION

7.1 Safety Instructions

- Before starting to work on the motors, make sure that the plant or system has been disconnected in a manner that is compliant with the appropriate specifications and regulations.
- In addition to the main currents, make sure that supplementary and auxiliary circuits, particularly in heating devices, are also disconnected.
- A motor with a frequency converter supply may energize even if the motor is at a standstill.
- Certain parts of the motor may reach temperatures above 50°C. Physical contact with the motor could result in burn injuries! Check the temperature of the parts before touching them.

7.2 General Inspection

Inspect the motor at regular intervals, at least once a year. The frequency of checks depends on, for example, the humidity level of the ambient air and on the local weather conditions. This can initially be determined experimentally and must then be strictly adhered to

Keep the motor clean and ensure free ventilation and airflow. If the motor is used in a dusty environment, the ventilation system must be regularly checked and cleaned in the case of Ex-Proof Zone 1/21 and Zone 2/22 motors, external intervention should be avoided, bolt connections should not be loosened, and the interior of the motor should not be accessed in the event of an issue. If any suspicion arises regarding a problem, immediate contact with the manufacturer should be made.

- ✓ Check the bearing condition by listening for any unusual noise, vibration measurement, bearing temperature, inspection of spent grease, and communication should be initiated with the manufacturer for sharing.
- ✓ Check if the electrical parameters are maintained.
- ✓ Check if the winding insulation resistances are sufficiently high.
- ✓ Check if the cables and insulating parts and components are in good condition and are not discolored. In case of any deformation in the cables or other electrical components, they should not be repaired and the repair should be done by the manufacturer.

Immediately correct any impermissible deviations that are determined in the inspection.

If the paint is damaged, it must be repaired to protect the unit against corrosion. In Ex-Proof Motors, the paint must be antistatic or flame retardant!

Pay special attention to bearings when their calculated rated lifetime is coming to an end.

When signs of wear are noticed, the worn parts should be inspected, and if necessary, replaced by the motor manufacturer.

The calculated life of the bearings of 2Z, 2RS according to ISO 281 is at least 20,000 hours with utilization of the permissible radial/axial forces. However, the achievable useful life of the bearings can be significantly longer in the case of lower forces.

Coolant Temperature	Principle of Operation	Bearing Replacement Intervals
40° C	Horizontal coupling operation	40,000h
40° C	With axial and radial forces	20,000h

8 MAINTENANCE AND REPAIR

8.1 Cleaning

To ensure proper airflow, air ducts should be cleaned periodically. For example; with dry compressed air.

Particularly when using the dry compressed air cleaning method, ensure that appropriate safety clothing is worn for the process.

Risk of Explosion Due to Static Charge

Before cleaning the motor with compressed air, the motor must be checked for plastic components. Plastic components can become statically charged during cleaning with compressed air and create a potentially explosive environment. It can cause an explosion. This could result in death, serious injury, or property damage.

- Compressed air must not be used to clean plastic parts in an explosive atmosphere.
- If the motor contains plastic components, it is recommended to clean the motor with a damp or wet cloth.

8.2 Instructions for Repair

Only appropriately qualified persons should be deployed to commission and operate equipment. Qualified persons, as far as the safety instructions specified in this manual are concerned, are those who have the necessary authorization to commission, ground and identify equipment, systems and circuits in accordance with the relevant safety standards.

Before you begin working on the three-phase motor, in particular before you open the covers of active parts, make sure that the three-phase motor or system is properly isolated from the supply.

8.2.1 Replacing Bearings

Particular attention should be paid to bearings.

In the case of Ex-Proof motors, if a bearing replacement is needed, the motor manufacturer should be contacted. Ex-Proof motors must not be opened by individuals or institutions without an Ex-quality production certificate and proper authorization.

8.2.2 Rewinding

Winding repair and rewinding should always be carried out by the relevant motor manufacturer.

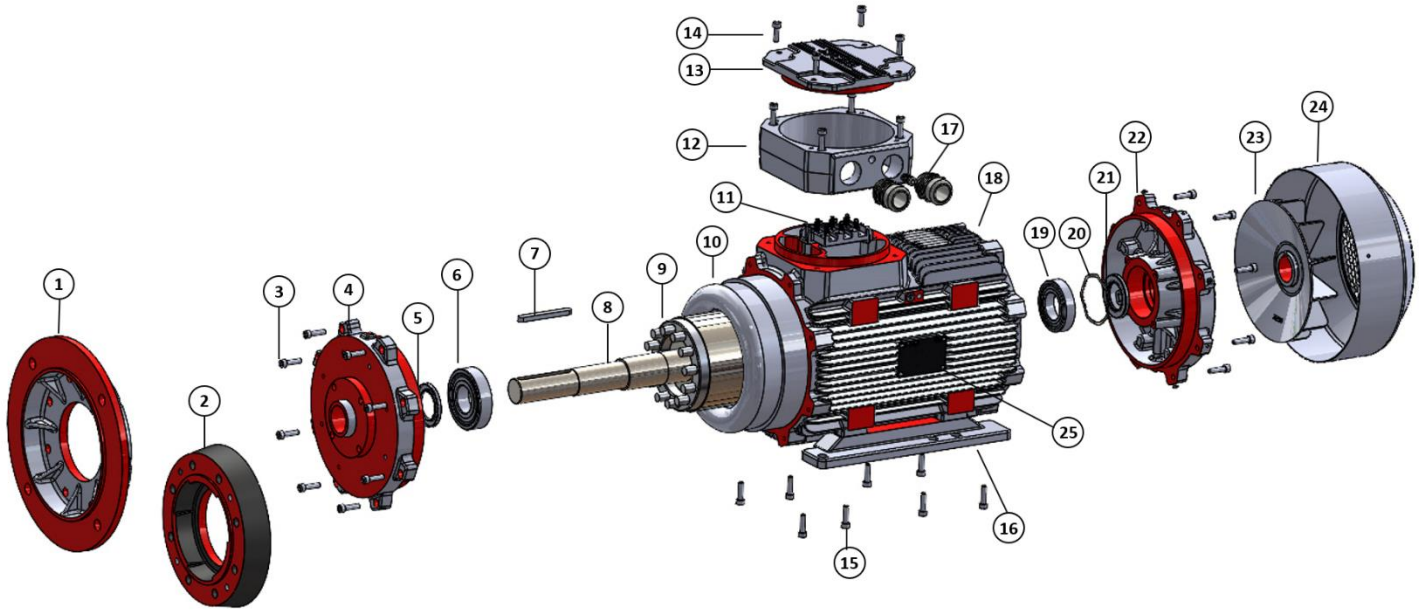
8.2.3 Assembly

- The motor should be mounted on a clean and properly leveled platform.
- Care must be taken to ensure that the cable insulation is not damaged. Tightening torques should be set to levels that do not harm the cable insulation.
- The gaskets in the terminal box should be inspected and replaced if necessary.
- Any damage to the paint should be repaired using antistatic or flame-retardant paints that comply with ATEX standards.
- The tightening torques of the terminal box cover and the terminal phase cables should be checked.

9 SPARE PARTS

9.1 Spare Parts for Zone 1/21 (Ex-Proof/Atex) Motor

All the standard three phase are produced by ELK MOTOR consist of the following main parts;

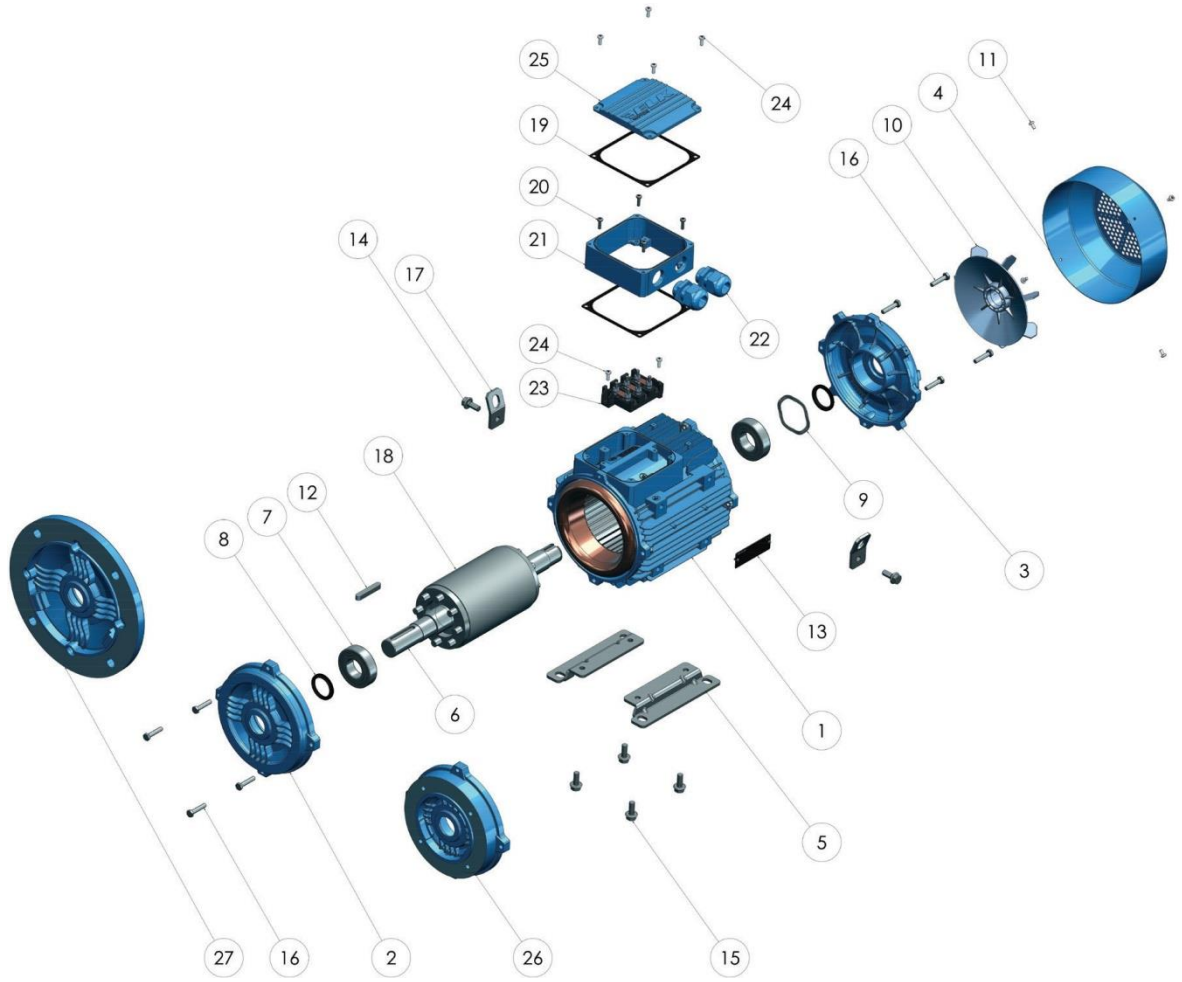


1. Flange B5
2. Flange B14
3. Bolt
4. Drive side B3 motor cover (front cover)
5. Shaft seal
6. Bearing
7. Key
8. Shaft
9. Rotor core
10. Stator core
11. Terminal block
12. Terminal box
13. Terminal box cover
14. Bolt
15. Foot mounting bolt
16. Mounting foot
17. Cable gland
18. Housing
19. Bearing
20. Spring washer
21. Shaft seal
22. Fan side cover
23. Fan
24. Fan cover
25. Motor nameplate

In Ex-Proof motors, spare parts that protect the internal volume must not be replaced by individuals or institutions that do not possess a module E certificate. The replacement of these critical parts should be carried out by certified personnel or the manufacturer.

9.2 Spare Parts for Zone 2-22 (Ex-Proof/Atex) Motor

All the zone 2/22 motors are produced by ELK MOTOR consist of the following main parts;



1. Housing
2. End Shield (DE)
3. End Shield (NDE)
4. Fan cover
5. Mounting foot
6. Shaft
7. Bearing
8. Shaft sealing
9. Spring washer
10. Fan
11. Screw
12. Key
13. Nameplate
14. Screw
15. Screw
16. Bolt
17. Lifting lug
18. Squirrel cage rotor
19. Terminal box gasket
20. Screw
21. Terminal box
22. ATEX (Metal) cable gland
23. Terminal
24. Screw
25. Terminal box cover
26. Flange B14
27. Flange B5

When ordering spare parts, the motor serial number, full type designation, and product code, as stated on the nameplate, must be specified.

10 RECYCLING AND DISPOSAL

Environmentally friendly design, technical safety, and health protection are always main target for us even at the product development stage.

Recommendations for the environmentally friendly disposal of the motor and its components are given in the following section. Be sure to comply with local disposal regulations.

Dismantle the motor using the general procedures commonly used in mechanical engineering.

Following Directive 2012/19/EU of the European Parliament and of the Council of 4 July 2012 on waste electrical and electronic equipment (WEEE), the symbol shown on the side indicates that motors should not be disposed of as household garbage. Motors are defined as “Waste Electrical and Electronic Equipment” after they have completed their useful life or become unusable due to malfunction. Waste motors should be recycled or disposed of by reaching the waste collection centers established by the municipalities or the closest specialist company to the usage area.

10.1 Disposal of Components

Motors are mainly composed of steel, copper, and aluminum. Metals are generally considered completely recyclable.

Recycled parts can be listed as follows:

- Iron and steel
- Aluminum
- Winding (enameled copper wire)
- Insulation materials
- Cables and wires
- Oil
- Grease
- Cleaning substances and solvents
- Paint residues
- Anti-corrosion agent

Additionally, the disposal of parts must be carried out in accordance with local regulations or outsourced to specialized disposal companies.

10.2 Packaging Materials

- If necessary, contact a suitable specialist disposal company.
- Wooden packaging for sea transport consists of impregnated wood. Observe the local regulations.

WARRANTY CERTIFICATE

MANUFACTURER	VENDOR
Name:ELK MOTOR SAN. VE TİC. A.Ş. **Address:**YıldırımBeyazıt OSB Mah. 7.Cad No:71/1 59500 Çerkezköy/TEKİRDAĞ **Phone :**+90 282 726 92 94 **e-mail:**elkmotor@elkmotor.com.tr **Authorized Signatory:**	**Name:** **Address:** **Phone:** **Fax:** **e-mail:** **Invoice Date and Number:** **Authorized Signatory:** **Company Stamp:**
PRODUCT	
Type: Electric Motor **Brand:**ELK MOTOR **Model:** **Nameplate and Serial Number:** **Delivery Date and Place:**	**Warranty Period:**2 (two) Years **Max. Repair Time:**20 (twenty)Working Days

DISCLOSURE:

Due to 28.11.2013 dated, 28835 numbered Turkish Official Gazette publish and 28.05.2014 dated 6502 numbered Consumer Protection Law's 56th article, Ministry Approval is removed from the warranty certificates.
The products life cycle, as determined and declared by the Ministry of Industry and Trade, is 10 (ten) years.

TERMS OF WARRANTY

1)Warranty periodis 2 (two) years and begins with the ELK Motor's invoice date.

2) Product's warranty covers all parts of the product.

3)Repair time of the product is utmost **20 working days**after the failed products have reached our factory or recognized service/maintenance point. ELK Motor intends to fix the malfunction within maximum**10 working days** as a company policy.

4) In case ELK Motor assessments reveals that the replacement of malfunctioned product is a better approach rather than repairing, due to time and/or cost and/or service process practicalities, ELK Motor has right to replace the malfunctioned product with a brand new one, including a new updated version – if any.

5)If the product malfunctions in the warranty period due to any manufacturing problems such as material, workmanship or assembly, the repair and/or replacement cost will be totally covered by the manufacturer.

6)Any problems occurred due to non-manufacturing issues (such as; modification on the product, unauthorized repair, customer misuse, any usage under conditions that noncompliant to the user manual) void the warranty.

7)Our product warranty does not include on-site service. The shipment address for possible replacement products, within the warranty period, is the first delivery address. In case the need of service, the product has to be sent to ELK Motor factory. For any extra special cases on special on-site service demands, a prior agreement must be made with ELK Motor including the cost of operations.

8) The Consumer may appeal to Turkey **Ministry of Customs and Trade Directorate General of Consumer Protection and Market Surveillance** in case of issues related to warranty certificate.

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