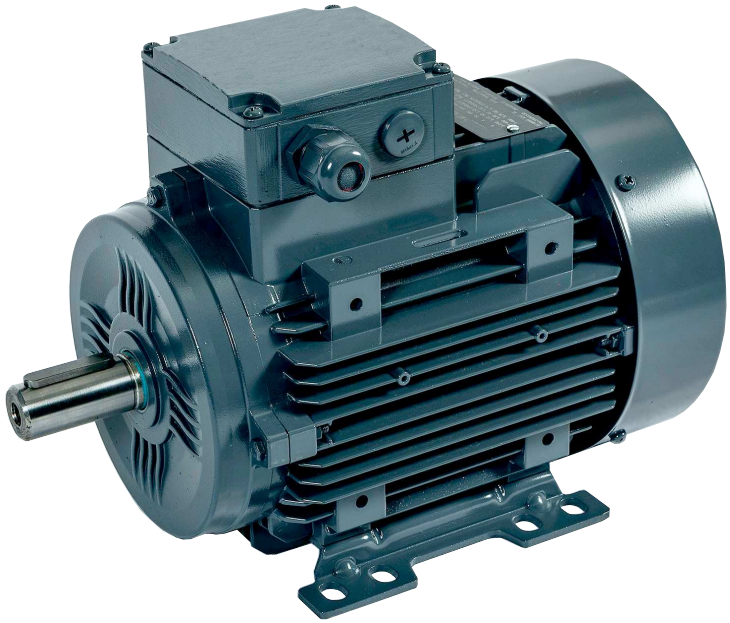
FCM
ELECTRIC MOTORS

2EL...
2EG...
3EL...
3EG...



Installation, Operation & Maintenance Instructions

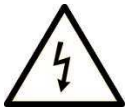
Issue 03/2021

THREE PHASE ASYNCHRONOUS ELECTRIC MOTORS
Operation Manual

1 INTRODUCTION /GENERAL DESCRIPTION
These instructions describe the FCM electric motors and explain best practices in motor handling, from initial delivery to final disposal of the equipment.

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

1.1 Symbols and their Descriptions
The following symbols are taken part in the operating manual.

	WARNING This symbol indicates a warning of dangerous situations in terms of health and safety.
	ELECTRIC SHOCK HAZARD This symbol indicates a warning against an electric shock hazard. The symbol means that caution must be taken against the risk of electric shock and necessary measures must be taken.

1.2 Area of Application and Intended Use of The Motors
An electric motor converts electric energy into mechanical energy. The products defined in this manual are three-phase squirrel cage induction motors.
Motors of this series are self-ventilated low voltage three-phase asynchronous motors with a cylindrical shaft end and shaft key.

The motors are designed for a wide range of drive applications both for line operation (DOL) as well as for VSD (in conjunction with frequency converters).

These motors are intended for use in industrial plants. They comply with the harmonized standards of the series IEC/EN 60034.

Low-voltage motors are components designed for installation in machines in accordance with the current Machinery Directive. They 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 2EL, 3EL, 4EL, 2EG, 3EG, 4EG, types of electric motors.

1.3 Environmental Requirements
All of FCM Motors have a sound pressure level not exceeding 70dB(A) at 50Hz when operated at the rated output and rated voltage.

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

- Normal ambient temperature limits are -15°C to +40°C
- Maximum altitude 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 +3%, -5% for Zone B
  according to EN/IEC 60034-1.

These motors have not been designed for use in hazardous area applications.

1.4 General Safety Rules:

Please observe operating manual for proper storage, installation, and operation. Mechanical and electrical installation and maintenance shall be done by qualified technicians!

Always observe the safety instructions and follow safety rules, according to EN 50110-1 (Operation of electrical installations) for your personal safety and to prevent material damage when working on the motor.

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

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

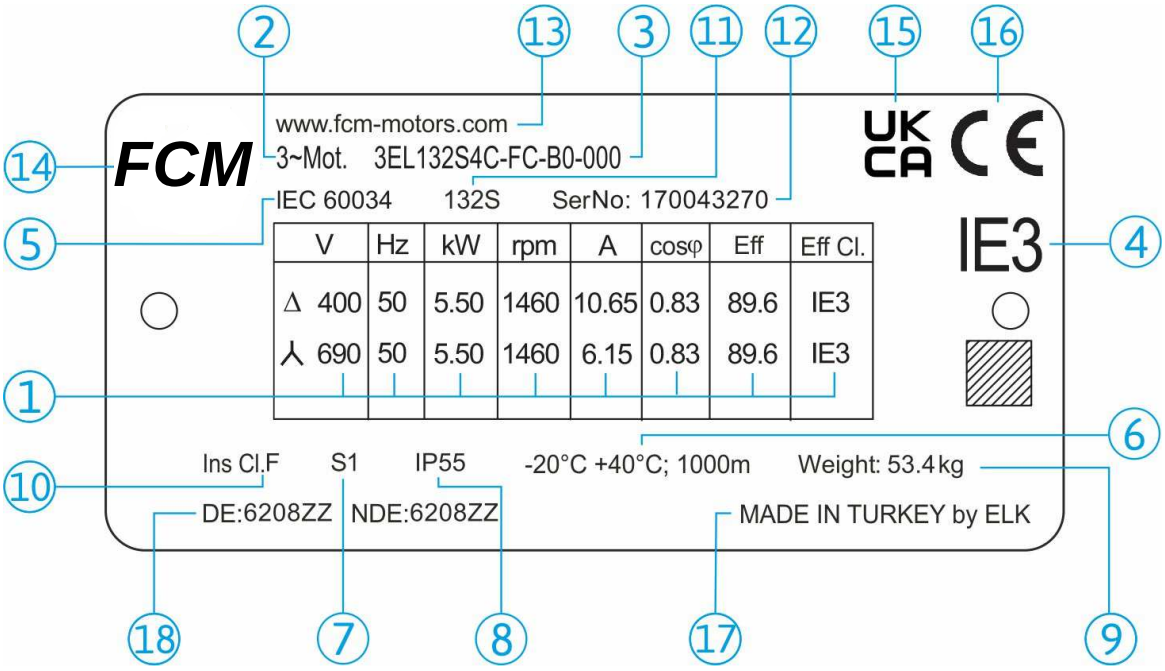
Electric motors have hot surfaces, contain live parts and dangerous rotating parts. Fatal or severe injuries and substantial material damage can occur if the required covers are removed or if the motors are not handled, operated or maintained properly.

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 listed 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 markings 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 of electrical machines
EN 55014-1	Electromagnetic compatibility
EN 61000-3-2	
EN 61000-3-3	

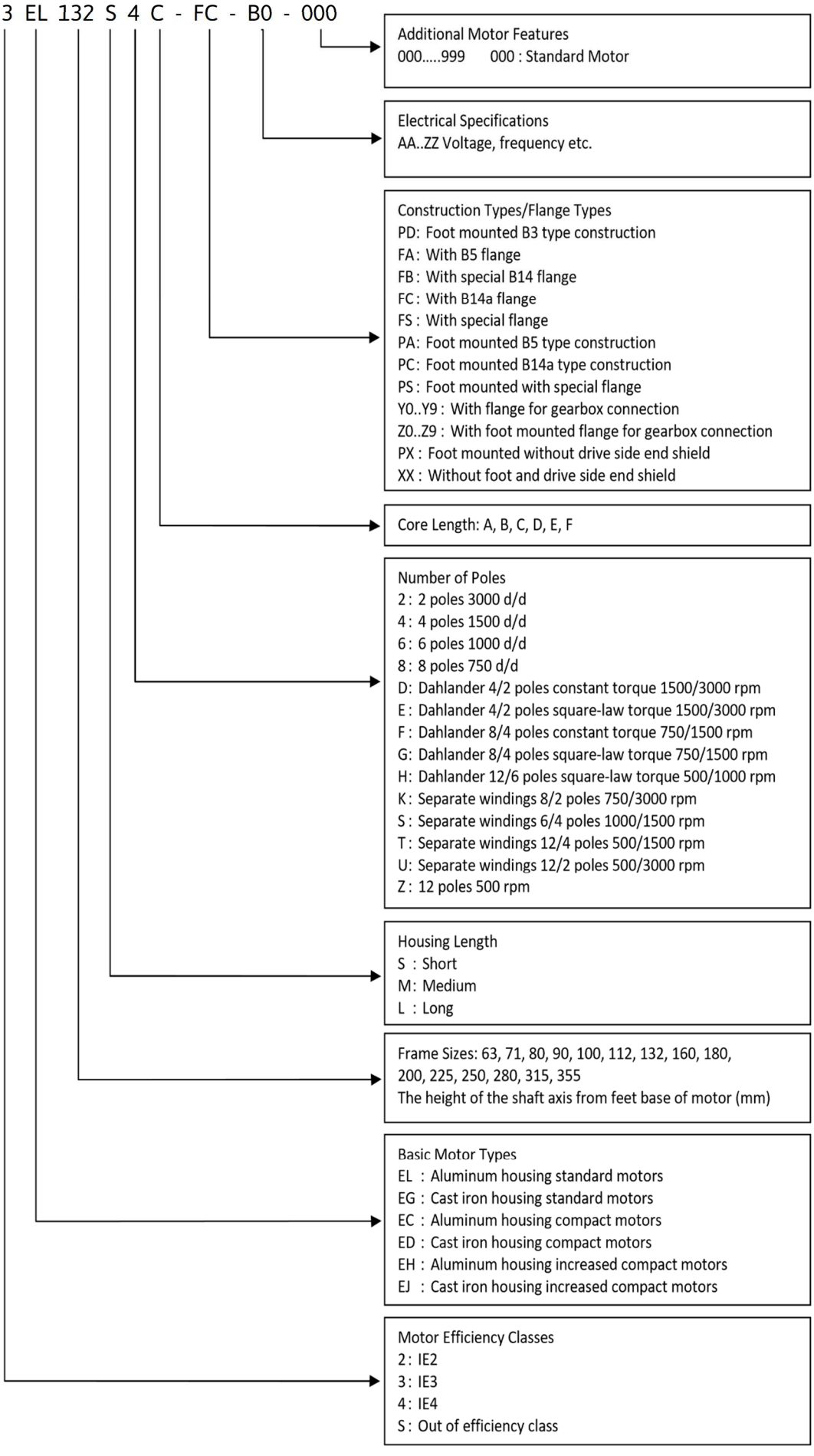
1.6 Nameplate Description



1	Rated parameters (voltage, frequency, power, current, power factor, efficiency, eff class)
2	Motor Type: Three-phase Asynchronous Motor
3	Motor Type Name
4	Efficiency Class
5	Manufacture Standard
6	Environmental conditions (Temperature range, max Altitude)
7	Duty Cycle
8	Ingress Protection Class (IP rating)
9	Motor weight
10	Insulation Class of the motor winding
11	Frame size
12	Unique Serial number
13	Manufacturer's/Distributor's identification address
14	Manufacturer's/Distributor's logo
15	UKCA Marking (For United Kingdom)
16	CE Marking (for European Union)
17	Country of manufacture
18	Bearing at DE and NDE

The nameplate shows the identification, and the most important technical data. The nameplate also defines the limits of proper usage, and year of manufacture of the motors. The first two digits in the serial number, show the manufacturing year. For example, 17XXXXXXX shows that the motor was manufactured in 2017.

1.7 Product Type Code



1.8 Electrical Properties

0 0

2nd Digit: Additional Electrical Features
0: Standard motor, basic version
A: Motors with thermistor
B: Motors with heater
C: Motors with thermal switch
D: Motors with PT100 temperature sensor
K: Motors with thermistor and heater
E: Motors with double thermistor
F: Motors with heater + double thermistor
G: Motors with heater + PT100 temperature sensor

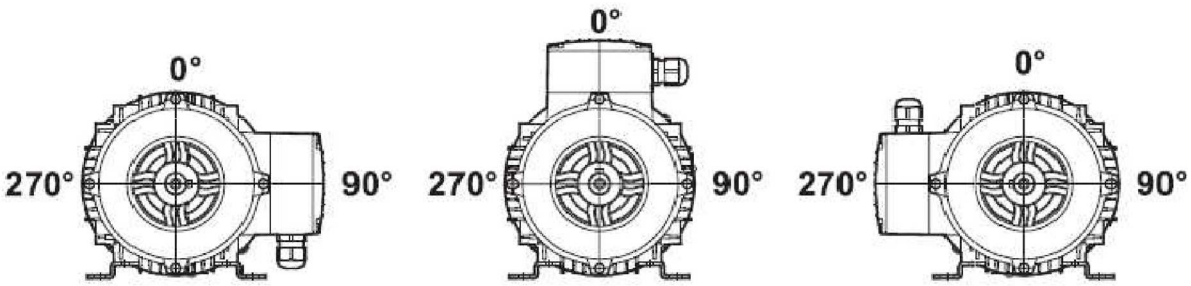
1st Digit : Voltage and Frequency

A : 230/400V	50Hz	
B : 400/690V	50Hz	
C : 240/415V	50Hz	
D : 415/720V	50Hz	
E : 230/400V	60Hz	Standard power
F : 400/690V	60Hz	Standard power
G : 127/220V	60Hz	
H : 290/500V	50Hz	
I : 220/380V	60Hz	16% Increased rated output power
J : 380/660V	60Hz	16% Increased rated output power
K : 255/440V	50Hz	
L : 24/42V	50Hz	
M: 275/480V	50Hz	
N : 48/83V	50Hz	
P : 332/575V	60Hz	
R : S3 230/400V	50Hz	
S : S3 400/690V	50Hz	
T : 400V	87Hz	
U : 440/760V	50Hz	
V : 275/480V	60Hz	
W: 480/830V	60Hz	
1 : 400V	80Hz	
2 : 255/440V	60Hz	
3 : 440/760V	60Hz	
4 : 42/72V	50Hz	
5 : 200V	50Hz	
9 : 9 terminals	220/440V	60Hz

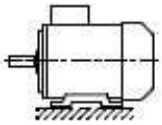
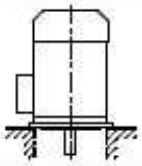
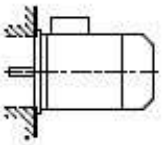
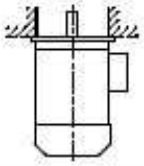
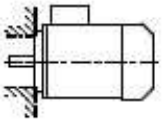
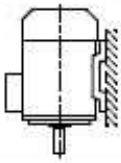
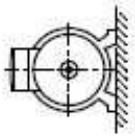
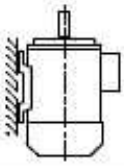
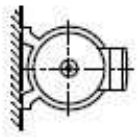
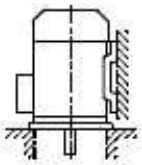
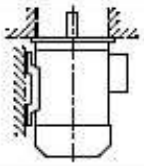
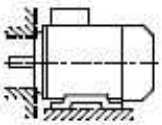
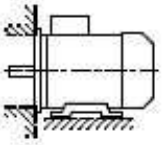
Please contact us for specific motor code descriptions.

1.9 Motor Foot Mounting

FCM Motors provide flexibility in different mounting types through their detachable feet, which can be re-mounted so the terminal box is on left / on top / on right. Standard motor terminal box position is on top.



FCM electric motors are manufactured according to International Mounting Standard IEC 60034-7.

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 check the motors for damage caused in transportation upon delivery.

Motors weighing 25kg and above weight have lifting lugs or eye bolts. The actual weight of motors is printed on the nameplate.

- Only the lifting lugs or eyebolts should be used for lifting of the motor.
- All lifting eyes fitted on the motor must be used.
- Do not use a lifting lug if it is damaged.

Shocks, falls, and humidity should be avoided during transportation

During storage, following conditions must be maintained:

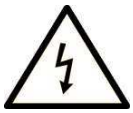
- The storage room must provide protection against extreme weather conditions. It must be dry, free from dust, frost, and vibration, and well ventilated.
- Temperature shall be between -15℃ and 40℃.
- Motor shaft shall be rotated by hand at least once a year.
- Protect motors from direct sun and from corrosive gases.
- Unprotected machined surfaces (shaft-ends and flange faces) should be treated against corrosion.
- Open any condensation drain holes to drain the condensation (<6 months).

3 COMMISSIONING

Check the motor for external damage (e.g. shaft-ends and flanges and painted surfaces) immediately upon receipt. Inform the forwarding company of any damage without delay!

Check all nameplate data, especially voltage and winding connection (Star or Delta) to ensure that the motor voltage, protection and connection comply with your requirements.

3.1 Checking the Insulation Resistance



If the winding is damp motor winding insulation resistance shall be tested prior to the motor commissioning.

- Only appropriately qualified and trained personnel may carry out this work.
- Install all covers designed to prevent active or rotating parts from being accessible before commissioning.
- Check that the voltage supply is disconnected in case any power cables are installed.
- Once you have tested the insulation resistance, discharge the winding by connecting it to the ground terminal.
- Insulation resistance testing must be performed while the motor power supply is isolated.
- If the tests are performed at winding temperatures not equal to 25°C, convert the tested value to the reference temperature of 25°C in order to be able to compare the tested 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 of the motor winding, recalculated to 25°C, must be higher than the reference value given below. If the reference resistance value is lower, the winding may be too damp and must be oven dried. The oven drying should be performed at a temperature 90-100°C for 12 hours.

Insulation Resistance of The Stator Winding at 25 °C	
Testing voltage	500 V
Minimum insulation resistance of new, clean or repaired windings	100 MΩ

4 MECHANICAL INSTALLATION

4.1 Safety Considerations

- The motors need to be installed and used 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 hot to touch during normal operation and especially after power disconnection.
- Motor rotating parts must be observed.
- Do not open terminal box while the motor is energized.

Before start-up, please check that:

- Condensation drain holes are always located at the lowest point of the motor!
- Connect the motor corresponding to the specified direction of rotation.
- Ensure that all seals and sealing surfaces are undamaged and clean.

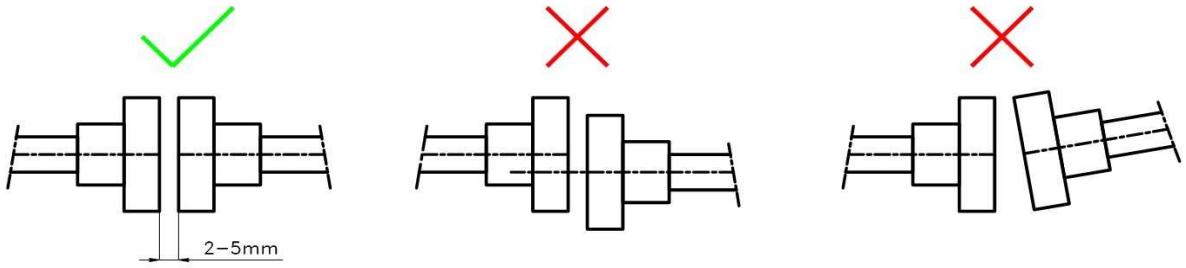
When fitting the motor in situ and aligning the shaft the following points must be observed:

- 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.
- The shafts must be carefully aligned. Incorrect alignment can result in vibration, mechanical failure and even shaft fracture.
- Half coupling and pulleys must be fitted on the shaft by using suitable equipment and tools, which do not damage bearings and seals. Never fit a half coupling or pulley by force. Do not force a lever pressed against the motor casing.
- Excessive belt tension will damage bearings and can cause shaft damage.
- If a belt drive is used, make sure that the driving pulley and the driven pulley are correctly aligned.
- The motor cooling must not be obstructed in any way.
- See the catalogue for technical details and motor dimensions.
- Do not exceed permissible loading of bearings specified in the product catalogue.

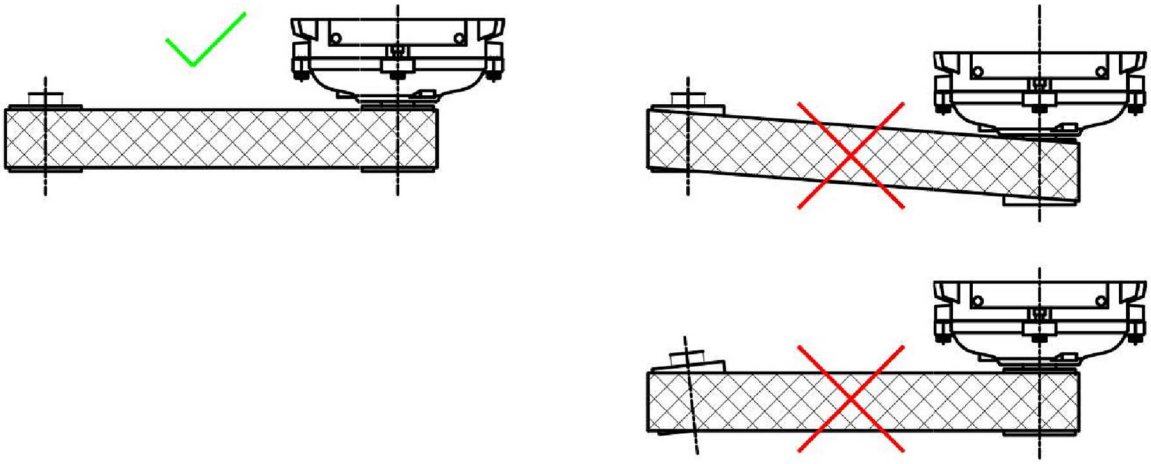
Balancing of the motor rotating parts has been carried out with half key.

Half coupling and pulleys must be balanced after the keyways have been machined. Balancing must be done in accordance with the balancing method specified for electric motors.

Same shaft axis must be maintained when aligning the shafts. In addition, axial clearance at least 2-5mm is required between the half couplings.



If the belt & pulley system is used when connecting the motor to the load, care must be taken in ensuring that the pulleys are mounted on parallel shafts and that the belt is correctly tightened.



5 ELECTRICAL INSTALLATION AND OPERATION CONDITIONS

Check the motor nameplate before installation with particular emphasis on the motor power, voltage and frequency.

In case the insulation resistance needs testing, test it between all winding phases and winding phases and housing. Please check section **3.1 Checking the Insulation Resistance** for detailed information.

Observe the following safety information before connecting supply cable to the motor:

- Only qualified and trained personnel must carry out the work whilst the motor is stationary.
- Safety measures must be implemented when the motor is disconnected from the power supply. Measures must be taken to prevent power reconnection. This also applies to auxiliary circuits.
- Make sure that the voltage is safely removed before commencement of any work.
- It must be ensured that there are no foreign bodies, dirt, or moisture inside the terminal box.
- Keep the inside of the terminal box clean and free from impurities.
- Close any unused cable entries with blanking plugs.
- Seal the terminal box to prevent ingress of water or dust.
- Make sure that the cables are not loose in the cable glands. Cable glands with clamping range corresponding with the cable outer diameter must be used to maintain tightness.
- When performing a test run, secure the shaft key with an adhesive tape.
- Earthing must be carried out before the motor is connected to the power supply, whilst observing local regulations.

5.1 Terminals and Direction of Rotation

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

When the power cables (phases L1, L2, L3) are connected to U1, V1, W1 in this sequence, the motor shaft turns in clockwise direction (when looking at the shaft end). Any two phases need to be swapped over to change the direction of rotation into counter-clockwise.

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

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

Tightening Torque applied for Connecting Studs on the Terminal Board								
Stud Ø		M4	M5	M6	M8	M10	M12	M16
Torque	Min.	0.8 Nm	1.8 Nm	2.7 Nm	5,5 Nm	9 Nm	14 Nm	27 Nm
	Max.	1.2 Nm	2.5 Nm	4 Nm	8 Nm	13 Nm	20 Nm	40 Nm

In order to maintain the mechanical protection class (IP-rating) specified on the motor nameplate:

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

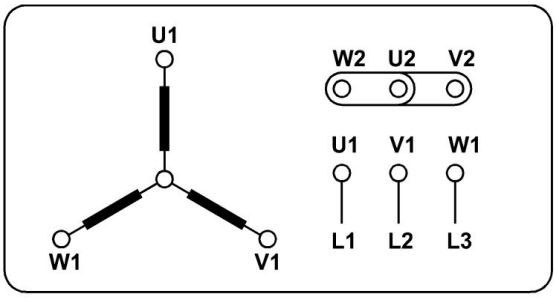
Cable Gland Tightening Torque ±10%						
M16	M20	M25	M32	M40	M50	M63
3 Nm	4 Nm	5 Nm	7 Nm	11 Nm	11 Nm	13 Nm

2. Ensure that the terminal box lid seal is undamaged.
3. Tighten the terminal box lid screws with the appropriate torque.

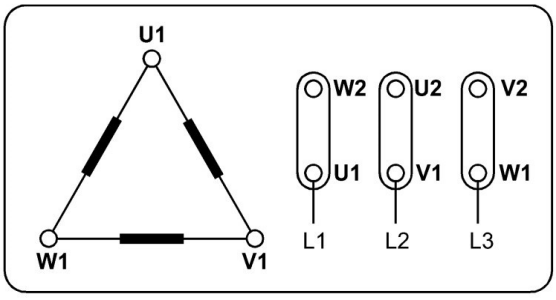
In addition to the main winding terminals and earthing terminal, the terminal box may also contain connectors for thermistors, anticondensation heaters and other auxiliary devices.
The terminal box at standard single speed motors normally contains six terminals and at least one earthing terminal. This enables the use of DOL (Direct On Line) or Y/D (Star/Delta) starting connection.

The motors shall be connected in Star or Delta according to the rated voltage printed on the nameplate, which must be the same as the line voltage that will be connected to the motor. The standard voltage is 230V∆/400VY [Delta (∆)/Star (Y)] and 400V∆/690VY [Delta (∆)/Star (Y)] at 50Hz.

5.2 Terminal Connection of Single Speed Motor:



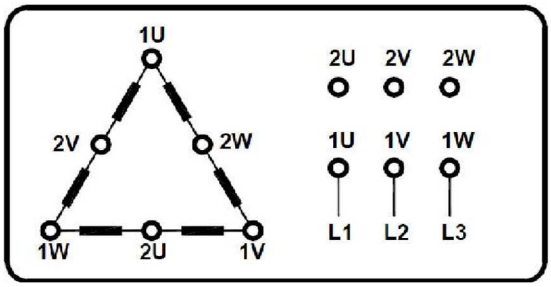
Star Connection



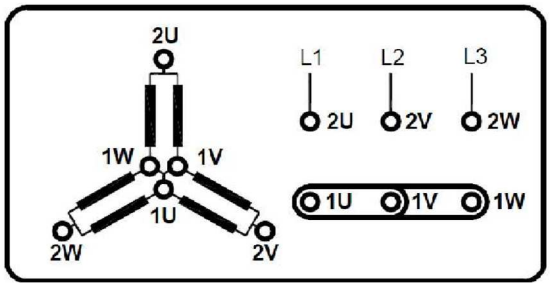
Delta Connection

5.3 Terminal Connection of Double Speed Motor:

5.3.1 Constant Power Dahlander Winding

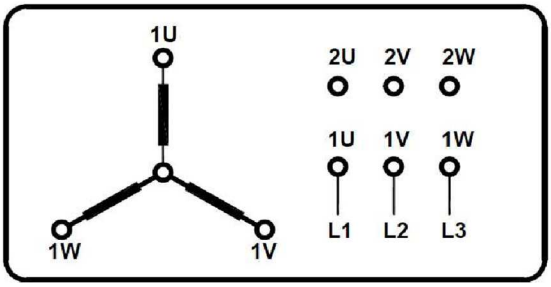


Low Speed

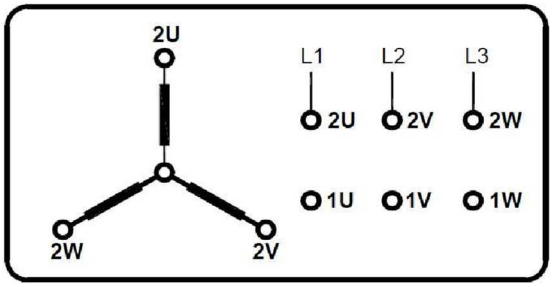


High Speed

5.3.2 Terminal Connection of Motor with Separate Windings



Low Speed



High Speed

5.4 Operating Conditions

The standard motors have insulation Class F (155°C) while the temperature rise is in Class B. This means the motors will have a longer service life and work well under hard conditions.

Motors are designed to operate at altitudes up to 1000 m and ambient temperature -20° to +40°C according to IEC 60034-1. Rated output needs derating for different altitudes and/or ambient temperature range.

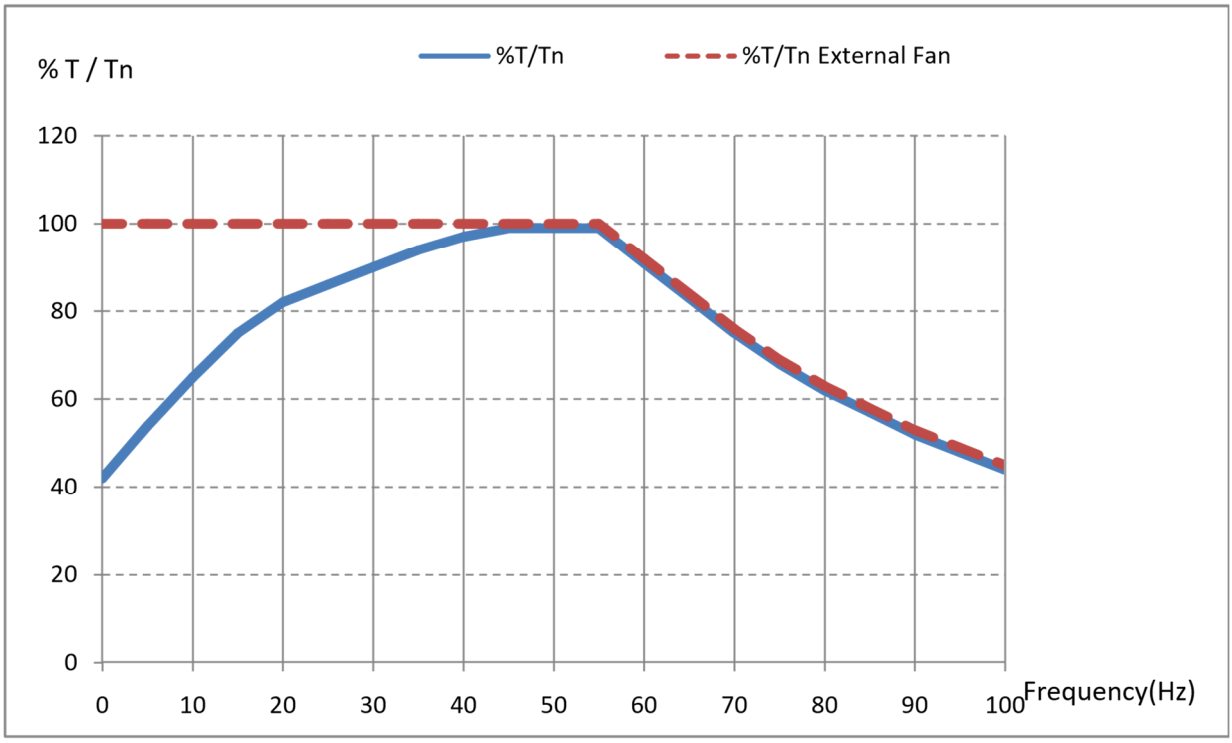
Rated Power deration according to the Altitude							
ALTITUDE	Up to 1000m	Up to 1500 m	Up to 2000m	Up to 2500m	Up to 3000m	Up to 3500m	Up to 4000m
% Power Ratio	100	98	95	91	87	83	78

Rated Power deration according to the Ambient Temperature							
AMBIENT TEMPERATURE	<30 °C	35 °C	40 °C	45 °C	50 °C	55 °C	60 °C
% Power Ratio	105	102	100	97	93	87	82

The standard motors that have been manufactured for 50Hz power supply. They can also be used at 60Hz network. The below ratios indicate recalculation factors of the rated values.

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	0.84	0.97	0.77	0.8	0.8
400V	380V	1.193	1	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

VSD controlled motors operating at speeds above the rated speed the noise and vibration levels will be increased and bearing life decreased. You may require enhanced rotor balancing for better operation at high speeds. Attention should be paid to the re-greasing intervals and the grease service life.



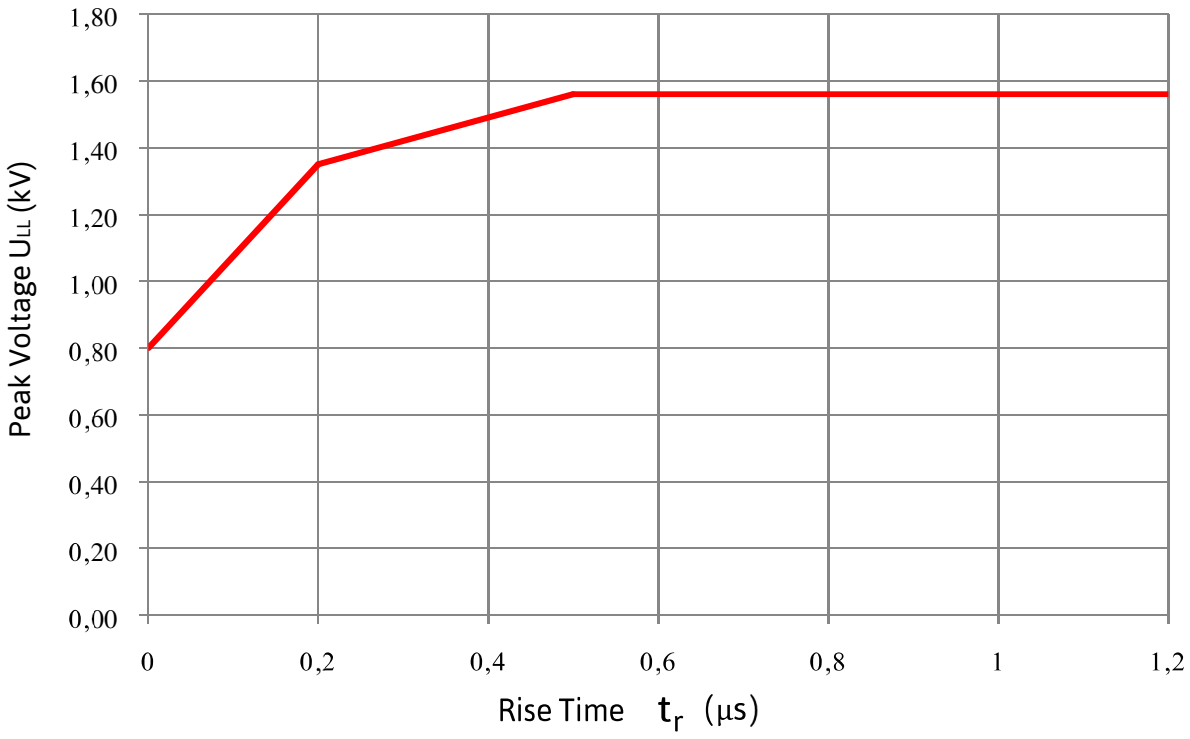
Standard FCM motors are suitable for inverter control. The above Torque/Frequency curve shows the performance of the TEFC motor (blue curve) and the TEFV motor (red curve) at S1-continuous duty.
TEFC IC411 (Totally Enclosed Fan Cooled) - blue line
TEFV IC416 (Totally Enclosed Force Ventilated) - red line

The maximum speeds of speed controlled standard motors with standard level of balancing. When exceeding these maximum recommended speeds, level of vibration and noise, and the bearing life may be reduced.

Maximum Safe Operating Speed (rpm) of Three-phase Single-speed Squirrel Cage Induction Motors			
Frame Size	2 Pole	4 Pole	6 Pole
<100	5400	3600	2400
112	5200	3600	2400
≥132	4500	3000	2400

Both IE2 and IE3 efficiency class motors are suitable for operation with frequency converters. The recommended limit peak voltage and the rise time of the pulses at motor terminals are as per the red curve below. It shows the maximum allowed phase to phase voltage peaks (U_{LL}) at the motor terminals, as a function of the rise time (t_r) of the pulse.

Suitable filters must be employed at the converter output when the peak voltages are not within the limit set out by the curve. Failing to do so will decrease lifetime of the motor insulation.



Limit curve showing allowable terminal peak voltage for motors with rated voltage ≤500V.

6 TROUBLESHOOTING

Servicing of electric motors and their troubleshooting must be carried out by qualified personnel who have appropriate tools and equipment available. Please read the section **1.4 General Safety Rules** before commencement of any problem solving, fault finding and/or rectification.

Problem	Cause	Solution
Motor does not start	Blown fuses /tripped breaker	Replace the fuses with correct ones reflecting rated value
	Incorrect line connections	Check the connections in Terminal Box
	Motor overloaded	Decrease the load
	Mechanical damage	Check whether the motor rotates freely at no load
	One of the phases may be open	Check the phases on the power supply
Motor stalls	One of the phases may be open	Check the phases on the power supply
	Incorrect motor selection.	Change the motor for more powerful one
	Overloaded condition	Decrease the loading
	Low voltage.	Check the voltage of the power supply
	Open power supply, control circuit	Blown fuses, check the load contactor
Motor takes a long time to get to full speed	Low voltage	Check the circuit capacity and power supply
	Overloading	Decrease the load
	Rotor damaged	Replace the rotor
	Incorrect converter settings	Correct the settings
Motor runs and then stops	Power failure	Check for loose cable connection of the power supply, fuses and controls.
Incorrect direction of rotation	Incorrect sequence of phases	Swap any two phases at terminals
Motor excessively hot	Motor overloaded	Decrease the load
	Undervoltage	Correct supply voltage
	Ambient temperature is too high	Observe the permitted temperature range, decrease the load if necessary
		Check insulation class. You may need to use class H motor
	Insufficient cooling	Provide air cooling supply, unblock cooling air passages
	Bearing failure	Replace bearings
	Unbalanced voltage	Check power supply
	Short circuit in motor's winding	Replace/rewind the motor
	One of the phases may be open	Check phases on Terminal Board
	Broken fan or lack of cooling	Check fan
Noisy operation	One of the phases may be open	Check phases on Terminal Board
	Air gap not uniform	Check bearing fitting
	Fan rubbing against motor parts	Check fan fitting
	Broken fan	Replace fan
	Incorrect coupling alignment motor / driven machine	Realign shafts or pulleys. Adjust belt tension.
	Broken rotor bar	Replace rotor

6.1 Faults Occurring During Operation

Deviations from standard conditions during normal operation, such as an increase in power consumption, temperature or vibrations, appearance of unusual noises or smells, tripping of monitoring devices, etc., indicate that the motor is not functioning properly. The cause could be faults, which potentially can result in severe injury or death or material damage.

- Immediately inform personnel responsible for maintenance.
- Switch the motor off immediately if in doubts, system-specific safety conditions must be observed.

7 INSPECTION

7.1 Safety Instructions

- Make sure that the plant or system has been disconnected in a manner that is compliant with the appropriate specifications and regulations before the commencement of any work on electric motors.
- Make sure that supplementary and auxiliary circuits, particularly heating devices, are also disconnected alongside the main power supply.
- Note! A motor supplied through frequency converter may be energized even at zero speed (at standstill).
- Check the temperature of motor parts before touching them. Certain motor parts may reach temperatures above +50°C. Physical contact with such motor parts could result in burn injuries!

7.2 General Inspection

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

Keep the motor clean and ensure that no obstacles prevent free ventilation airflow. The ventilation system must be regularly checked and cleaned when the motor operates in a dusty environment.

- Check the condition of shaft seals and replace them if necessary.
- Check the condition of connections, fixing and assembly screws and bolts.
- Check the bearing condition for unusual noise, vibration and bearing temperature. Inspect the grease where possible.
- Check that the electrical parameters are maintained.
- Check that the winding insulation resistance is in compliance with the gueidlines.
- Check all cables and insulating components for discolouration. Maintain all in good condition.

Corrective actions must be done immediately upon determination of faults and deviations during inspection.

Damaged paint must be repaired to maintain protection against corrosion.

Special attention to bearings must be paid when their calculated nominal life is coming to an end.

Dismantle the motor, check and replace parts as necessary when signs of wear are noticed. Replacement bearings must be of the same type as the bearings originally fitted on the motor. The shaft seals must be replaced with seals of the same quality and design as the original seals, when changing bearings.

IP55 motors have drain holes closed with plugs. It is recommended to open the drain holes regularly by removing the plugs to drain condensation water off. Do not drain condensation water during motor operation. Isolate the power supply before commencement of the work.

The calculated life of 2Z, 2RS bearings according to ISO 281 is at least 20,000 hours whilst the permissible radial and axial forces have not been exceeded. The useful life of the bearings is usually significantly longer in the case forces lower than limit forces are applied on the bearings.

Cooling Temperature	Motor Operation	Bearing Replacement Intervals
max +40° C	Horizontally mounted, coupling connected	40,000 hours
max +40° C	When axial and radial limit forces are applied	20,000 hours

8 MAINTENANCE AND REPAIR

8.1 Cleaning

Clean regularly the cooling air passages. Use of dry compressed air is recommended.

Observe general safety particularly when using compressed air for cleaning.

Drain off condensate water regularly. The intervals depend on climatic conditions. Do not neglect to close the drain holes to maintain the specified degree of protection.

8.2 Instructions for Repair

Only qualified personnel must be deployed to commission and operate electric motors. Safety instructions specified in this manual must be observed at all times. The necessary authorization must be obtained to commission, ground and inspect the motors and the driven equipment, systems and circuits in accordance with the relevant local safety standards.

Isolate the motor from the power supply before commencement of work. Particular attention must be paid to active parts.

8.2.1 Replacing Bearings

Extra care should be taken when replacing bearings. Remove bearings with pullers. Heat the replacement bearings accordingly using special bearing heaters available from bearing manufacturers and/or suppliers for this specific purpose.

Do not reuse bearings that have been previously removed.

8.2.2 Rewinding

Rewinding should be always be carried out by qualified repair shops.

8.2.3 Assembly

Damaging the windings heads protruding out of the stator housing when fitting the endshield or flange must be avoided by careful manipulation.

Do not to damage the cable sheath. Cable glands with appropriate clamping range and recommended tightening torques must be applied to prevent any damage to cables.

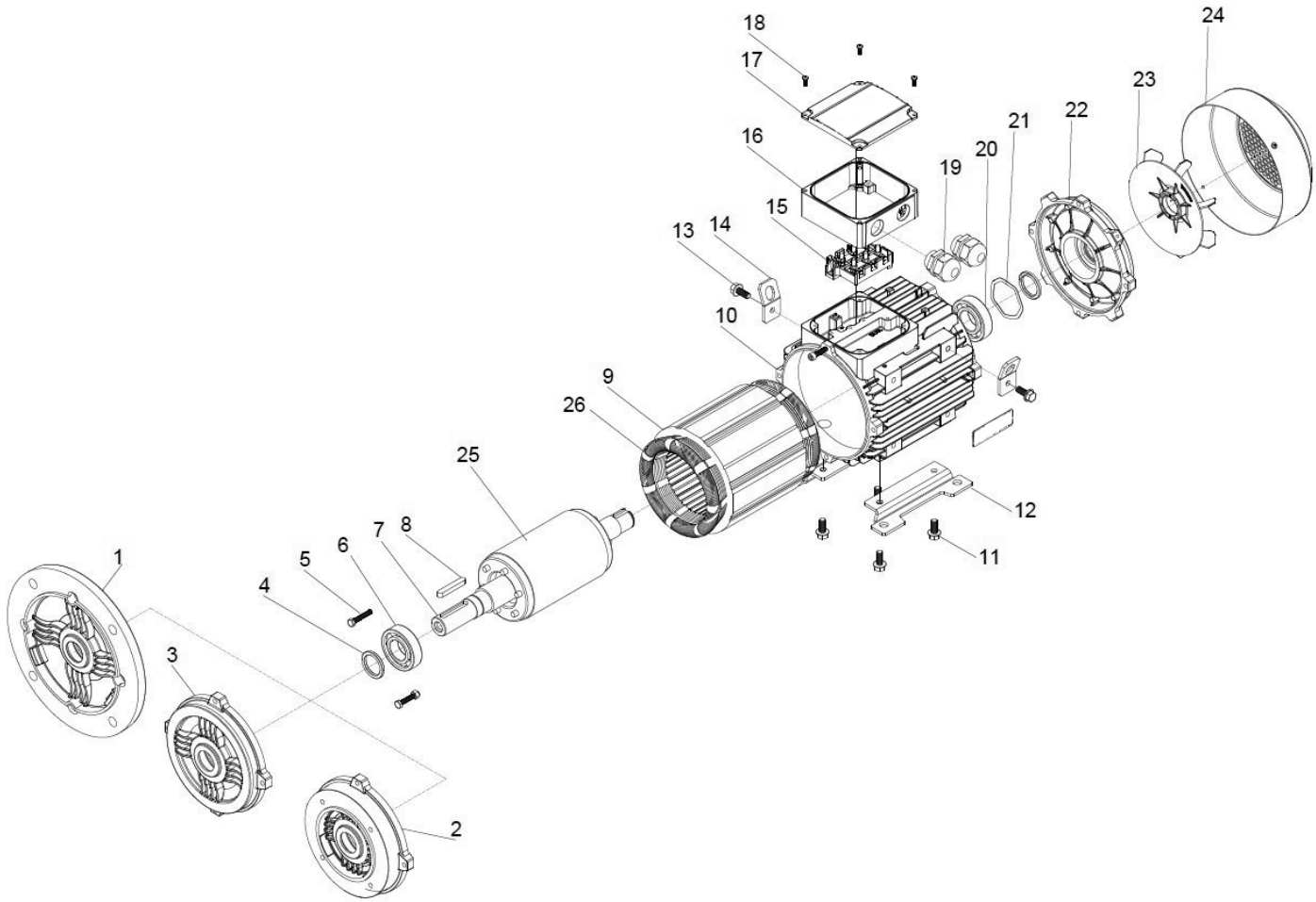
Care must be taken not to damage shaft seals during disassembly and reassembly.

Check the terminal box lid rubber seal. Replace any damaged seal when necessary.

- Replace unused cable glands with banking plugs.
- Prevent cables rubbing against sharp edges.
- Repair any damage to the paint (also on screws/bolts).
- Check the tightening torques of all screws irrespective of their manipulation.

9 SPARE PARTS

2EL, 3EL, 4EL, 2EG, 3EG, 4EG motor series consist of the following main parts:



1. B5 Flange
2. B14A Flange
3. DE endshield
4. Shaft seal
5. Screw
6. DE Bearing
7. Shaft
8. Shaft key
9. Stator lamination pack
10. Motor frame/housing
11. Screw
12. Bolt-on feet
13. Screw
14. Lifting lug
15. Terminal board (block)
16. Terminal box
17. Terminal box lid (cover)
18. Screw
19. Cable gland
20. NDE Bearing
21. Spring washer (wavy washer)
22. NDE endshield
23. Fan
24. Fan cover
25. Squirrel cage rotor
26. Winding

Motor serial number, full type name and product code as stated on the nameplate must be specified when ordering spare parts. Legible photo of the name is helpful.

Please contact your supplier for spare parts and additional information and/or replacement motor.

10 END OF LIFE DISPOSAL

Environmentally friendly design, technical safety and health protection have been the main target during the development and manufacture of FCM electric motors.

Recommendations for the environmentally friendly disposal of the motors and their components are listed in the following section. Local disposal directives and regulations must be observed and complied with at all times.

Dismantle the motors following the general procedures commonly used in mechanical engineering.

10.1 Disposal of Components

The motors consist of mainly steel, copper, and aluminium. These metals are generally considered to be recyclable without limitation.

Segregate the components and process materials for recycling according to groups:

- Iron and steel
- Aluminium
- Copper winding (enamelled wire); the winding insulation gets incinerated during recycling
- Insulating materials
- Cables and wires
- Grease (Oil when applicable)
- Cleaning substances and solvents
- Paint residues
- Anti-corrosion agents

Dispose of the segregated components according to local regulations or through a company specialising in material disposal.

10.2 Disposal of Packaging Material

- For cardboard and wood contact a suitable disposal specialist as necessary.
- Wooden packaging for sea transport includes impregnated wood. Observe the local regulations when disposing of seaworthy packaging materials.