

Instruction Manual

Explosion protected electrical motor
Type of protection „ec“ and „t*“

Manufacturer and Service
AC-Motoren GmbH
Einsteinstr. 17
D-64859 Eppertshausen
Tel. +49-06071-49887-0
www.ac-motoren.de

1. Safety rules

This manual is addressed to experienced electricians and properly instructed personnel in accordance with directive 99/92/EC, EN60079 part 14 and 17.

Whenever work is to be done on the installation of the machine, be sure to observe the national safety and accident prevention code as well as the safety rules that follow in this instruction manual, which are stated in italics like this paragraph.

Operate the machine only in undamaged state. No modifications to the machine are allowed, except for manufactures permission. The use of a frequency converter with the machine is just allowed up to a maximum of 400V supply voltage.

This equipment is intended for the use in potentially explosive atmospheres in accordance with directive 2014/34/EU. The design and appropriate use are to be seen by the marking.

Category	Use in Zone	Temperature class
3 G	2	T3 or T4
3 D	22	125°C

The ambience conditions may not exceed the values stated by the technical data, in particular the requirements to the IP-degree of protection are to be observed.

The use is not allowed for locations where hazardous existence of hybrid mixtures form explosive gas atmosphere and combustibile dust is possible.

Furthermore external heat sources must not cause additional heat to the machine, because otherwise the motor heat balance and the maximum surface temperature may be infringed. No general assessment of ignition risks is more likely for that case. It must be handled by single evaluation.

Whenever work is to be done on the machine it must be done by experienced personnel under exclusion of explosives and when the machine is not running, isolated and secured against reconnection.




2. Conformity with standards

The machine complies with the requirements of EN 1127-1, EN 60034 series of standards and EN 60079 part 0, 7 and 31.

It was developed, manufactured and tested in accordance with state-of-the-art-engineering practices and ISO 9001:2015.

3. Technical Data

Type	1	
Serial Number	2	
Weight	3	
Insulation class	4	
Protection level	5	
Duty type	6	
Atex marking	7	
Voltage	8	
Frequency	9	
Power	10	
Power factor	11	
Speed	12	
Current	13	
Efficiency	14	
Rotation direction		right or left
Connection		Delta / Star
Permissible temperature		-20°C to +40°C (Check possible for deviating values)
Permissible humidity		90% (Check possible for deviating values)
max. Temperature rise (K)		< 75 (Check possible for deviating values)
Cooling method		IC 411
Start-up conditions		max. 3 cold, 2 warm direct start-up
Protection device		PTC (stator winding)

 Wir treiben Sie an! D-64859 Eppertshausen www.ac-motoren.de		IE3  IEC 60034-1					
1	Type FCA 100 LB-4/PHE	2	SN 18013111112	3	20 kg		
4	THCL F/B	5	IP 55	6	S 1		
7  II 3G Ex ec IIC T3 Gc							
	V	Hz	kW	cos φ	rpm	A	η %
8	Δ400 / Y690	50	0,82	3	1420	6,02 / 3,49	87,7
	Δ460 / Y795	60	0,82	11 3,6	12 1704	13 6,26 / 3,63	14 88

4. Storage and Transport ⚠

4.1 Requirements for storage

- Store in dry rooms, at average temperature of -5°C up to +50°C,
- Relative Humidity less than 60%
- No corrosive ambient
- Avoid undesirable condensation
- Low vibration environment ($V_{ms} \leq 0.2\text{mm/s}$)

For long term storage a corrosion protection for all bare metallic surfaces is required.

4.2 Transport

The machine will be shipped in a completed manner. On DE it is suited with a special shaft block to lock the rotor. Without the shaft block any transport and lifting/setting down operations aren't permitted!

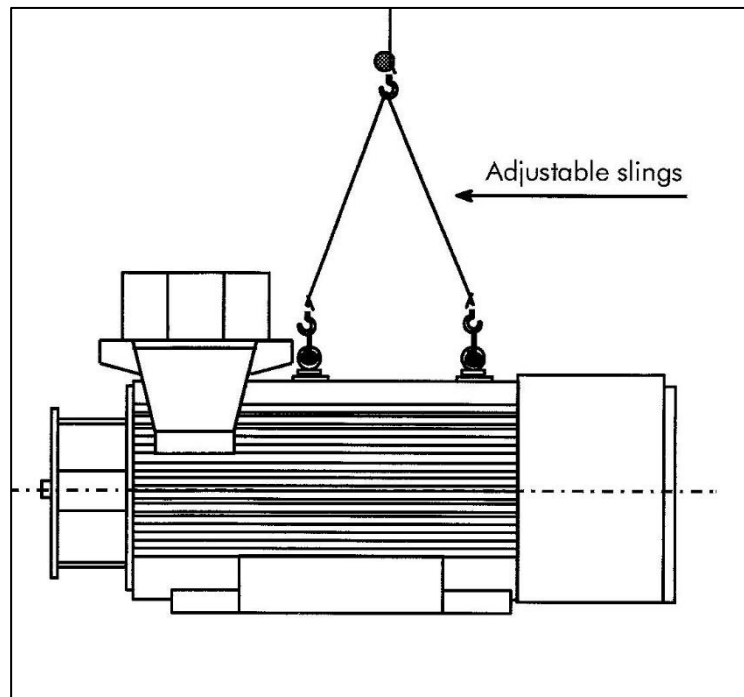
For transport the motor is fitted with lifting eyes. They are designed for the weight of the motor; do not apply any extra loads. Use suitable adequately dimensioned means of transport (e.g. rope guides). The lifting eyes of the terminal boxes or fans housing are designed for the weight of this part only.

Setting down has to be carried out without impact and to a flat and smooth foundation having sufficient weight.

Immediately report damage established after delivery to transport company and insurance and stop commissioning if necessary.

All official reservations should be made to ourselves within 24 hours by e-mail.

The following diagram shows the advised use of lifting beams and slings:



5. Installation

For installation/operation, the provisions of EN 60079 part 14 and/or local authority regulations in accordance with directive 1999/92EC apply, as to generally accepted engineering practice and this Instruction Manual.

The motor complies with the requirements of directive 2014/34/EU (ATEX) provided that the design criterion given from the manufacturer and this Instruction Manual are met. In particular the observance of threshold values of voltage, current and speed play an important role.

5.1 Mounting:

On factory site you have to check the machine type of protection is in accordance to the environmental conditions. Free access to the terminal boxes lubricant and control devices is required.

Ventilation air inlets are to be free and you have to ensure that no warmed ventilation air can be taken (consider neighbouring equipment).

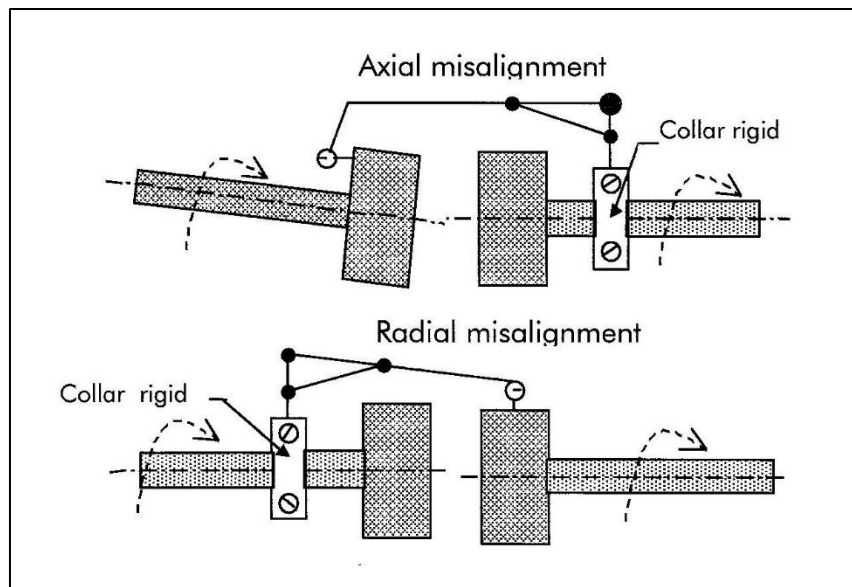
Dismantle anticorrosive coating. No soiling shall impair the machine interior. Damaged painting shall be touched up.

The machine shall be securely mounted to a most possible vibration and shock-free base.

The machine is fitted with a canopy for the fan cowl, preventing foreign objects from falling into the ventilation openings. This canopy must be prevented from damages.

Align the machines carefully to ensure smooth running. Axial deviation and deviation of parallel surfaces of both coupling halves must be not more than 0.01mm considering the heat extensions.

Please observe the instructions of the manufacturer of the driven machine and the coupling too.



Permissible Tightening torque settings of machine mounting bolts:

Bolt	Permissible Tightening Torque (Nm)
M20	310
M24	540
M30	1000

After alignment the machine feet are recommended to be fixed to the base.

The alignment behaviour shall be checked in appropriate time (8000 operation hours)

The motor is intended for the use of a flexible coupling and the direct drive.

The rotor is balanced with **half-key** (balancing quality G2.5)
The coupling has to be dynamic balanced correspondingly.

The mounting of this coupling must be realized by appropriate means. Shocks may damage the bearings! Test run with the feather key fitted without a coupling halve is not permitted due to the key!

For the installation to driven and transmission components their meeting of the ATEX requirements must be provided!

Coverage of transmission components shall be provided.

When for special cases torque shocks (blocked rotor, heavy starting) shall be considered, the hazard of mechanical breakage of overheating of the motor and the resulting ignition risk must be prevented by mechanical protection devices.

5.2 Electrical Connection:

All mounting and installation works must be done by experienced personnel in accordance with EN 60079 part 14 and local authority regulations.

And they must be carried out on standstill machine, isolated and secured against reconnection only. Check safe isolation from supply! This also applies for auxiliary circuits.

The stator winding is to be connected resulting in the clockwise shaft rotation for the line connection L1, L2, L3 to terminals U1, V1, W1 and anti-clockwise rotation for connection to W1, V1, U1. The Delta of Star connection has to be made on the main terminals.

Line cable and their installation shall adhere to EN 60079-14. Observe the degree of protection level especially (sealing).

Short circuit safety of the terminals box is only assured for use of cable cross-sections and cable lugs in accordance with DIN 46235 or adequate hexagon lugs. Due to dynamic short circuit strain pull out damage of the cable lug may occur.

In the case of cables with outside armoring the latter must not be entered to the terminal box. It should simply be taken to the strain-relief point then arranged outside in order to prevent moisture from penetration into the terminal box. The connection lead shall be sealed in the entry opening by means of a sealing insert capable of being cut out.

Connection of auxiliary circuits is to be made by the means of two separate terminals in the terminal box.

Only separately certified cable glands are permitted usable for hazardous areas zone 2/22. Unused entry openings should be closed off with dummy plug, same way certified.

All of the motor terminals boxes are designed separately certified for the use in hazardous areas. During installation the creep age and clearance distances considering the cable and lugs must be observed in particular.

The connections must be made as to maintain a permanent safe electrical connection with appropriate cable terminals, permissible cable type and wiring system and safe equipotential bonding. Take care of the mounting of cable entries, self-loosing prevention, permanent sealing of the entries and temperatures of entry and cable (70°C max.)

Exceeding of the tolerances specified by EN 60034-1 (i.e. voltage +/-5%, frequency +/-2%, waveform, symmetry) leads to elevated temperatures affecting the permitted surface temperatures and the category 3G/D use of the machine.

Permissible Tightening torque settings of terminals and cover bolts:

Bolt	Permissible Tightening Torque (Nm)
M4	2.0
M5	3.2
M6	5
M7	10
M10	16
M12	25
M16	50
M20	85
M24	130

You have to assure by appropriate circuitry interlock that the motor operation is only possible with fault-free ventilation. If not, there is a hazard of exceeding the maximum permissible surface temperature.

Refer to the electrical connection diagram enclosed with the terminal boxes when wiring the PTC temperature sensors.

Furthermore there are required electrical protection measures against overload and two phase operation.

The motor must be connected to the local grounding system.

5.3 Winding Insulation:

Before the first start up and after long time non-operation the insulation resistance of the motor winding must be measured (stator winding against machine housing).

This has to be done using appropriate measuring instruments having 500V DC test voltage at least.

Permissible insulation resistance is:

winding temperature	min. resistance
20°C	1MΩ
75°C	0,5MΩ

If these values are failed, the winding must be dried out. The appropriate measure depends on the local equipment and shall be negotiated with the manufacturer (drying out oven, current, hot air, space heater).

For each case the maximum temperature of the winding shall not exceed a 90°C temperature as the maximum. It has to be observed while drying out.

Reading the insulation resistance at three-hours intervals, the drying procedure should be stopped two or three hours after the insulation resistance reaches the required value.

It should be noted that the insulation resistance reading measured after the machine has cooled may be higher than the value obtained with the machine hot at the time when drying was stopped.

5.4 Starting conditions:

It is permitted

- Having ambient temperature status, three continuous starting are allowed, but there should be a natural stopping between them
- The next starting needs a 30min interval when there was a natural stopping
- Having rated running temperature status, starting twice is allowed
- For further starting a cooling interval of 4 hours is required
- Starts with having rest voltage are not allowed

5.5 Checks prior to start-up:

Check before starting the motor:

- Motor and driven machines are correctly coupled and fixed together
- Safety covers on moving parts are fitted, in position and fixed to the floor or a fixed object
- Nobody is working on the machine
- There are no loose objects in or on the machine
- Complete installation is suitable for the starting of the motor
- Frame is correctly earthed, offering proper protection for workers
- Electrical power and instrument connections comply with the wiring diagram
- Power cables are correctly fitted to the motor terminals
- All protection devices are operational, grease nozzles are clean
- Covers and inspection hatches are closed
- Protection degree and certification level of the electrical motor and all accompanying equipment is suitable for the risks and conditions of the area in which it is to operate

5.6 Checks during start-up:

Check if the motor is running:

- Motor is turning in the right direction
- There are no abnormal vibrations on the bearings:
- Immediately after start-up, after 1 hour and after 4 hours running
- There are no abnormal temperature on bearings and housing
- There are no abnormal noises

5.7 On-going checks

- The readings given by the safety devices (temperature of the bearings and wiring) must be remain within the set limits.

6. Operation and maintenance

For maintenance/overhaul/testing, the provisions of local authority regulations in accordance with directive 99/92/EC apply, as do generally accepted engineering practice and this instruction manual.

When performing maintenance work, pay special attention to checking those parts that govern the equipment's type of protection.

Maintenance work must be done by manufacturer or properly qualified workshop personnel using original spare parts only.

Due to the adherence to the permitted surface temperatures the ambient temperatures shall meet the range provided in clause 3. You have to observe the effect of external heat sources (sun influence, nearby equipment heat e.g.) for the temperature evaluation.

The operation shall be accompanied by correct metering of the installed temperature sensors.

The schedule of periodic inspections to retain the conditions meeting the local requirements shall include in a period of 3000 hours of duty or 6 month maximum (or shorter if required!) visual inspections referring environmental conditions, leakages, mounting (tighten if necessary), coupling and running conditions (vibration measurement, noise)

Vibrations severities of $V_{ms} \leq 2.8 \text{ mm/s}$ are acceptable in coupled-mode
Operation in accordance with EN 60034 part 14.

6.1 Bearing lubrication:

Permissible for motor type	ACA, FCA, FCPA, ACM, FCM, FCMP, ARA, FRPA, ALA, FLPA, ACR, FCPR, ACL, FCPL
----------------------------	---

Frame Size	Number of pole	Bearing type	Speed	Relubrication interval	First regreasing	Relubrication grease quantity
			rpm	h	g	g
112	2	6306.C3	3000	4000	14	10
	4	6306.C3	1500	6000		
	6	6306.C3	1000	8200		
	8	6306.C3	750	8200		
132	2	6308.C3	3000	2200	24	18
	4	6308.C3	1500	5500		
	6	6308.C3	1000	7000		
	8	6308.C3	750	7000		
160	2	6309.C3	3000	2000	26	20
	4	6309.C3	1500	5400		
	6	6309.C3	1000	6900		
	8	6309.C3	750	6900		
180	2	6311.C3	3000	2000	26	20
	4	6311.C3	1500	5400		
	6	6311.C3	1000	6900		
	8	6311.C3	750	6900		
200	2	6312.C3	3000	1500	32	25
	4	6312.C3	1500	5000		
	6	6312.C3	1000	6500		
	8	6312.C3	750	6500		
225	2	6313.C3	3000	1500	32	25
	4	6313.C3	1500	5000		
	6	6313.C3	1000	6500		
	8	6313.C3	750	6500		
225	2	NU313.C3	3000	1500	32	25
	4	NU313.C3	1500	5000		
	6	NU313.C3	1000	6500		
	8	NU313.C3	750	6500		
250	2	6314.C3	3000	1000	45	35
	4	6314.C3	1500	4500		
	6	6314.C3	1000	6300		
	8	6314.C3	750	6300		

Permissible for motor type	ACA, FCA, FCPA, ACM, FCM, FCMP, ARA, FRPA, ALA, FLPA, ACR, FCPR, ACL, FCPL
----------------------------	---

Frame Size	Number of pole	Bearing type	Speed	Relubrication interval	First regreasing	Relubrication grease quantity
			rpm	h	g	g
250	2	NU314.C3	3000	1000	45	35
	4	NU314.C3	1500	4500		
	6	NU314.C3	1000	6300		
	8	NU314.C3	750	6300		
280	2	6314.C3	3000	1000	45	35
	4	6317.C3	1500	4000		
	6	6317.C3	1000	6000		
	8	6317.C3	750	6000		
280	2	NU314.C3	3000	1000	45	35
	4	NU317.C3	1500	4000		
	6	NU317.C3	1000	6000		
	8	NU317.C3	750	6000		
315	2	6317.C3	3000	1000	65	50
	4	6319.C3	1500	3500		
	6	6319.C3	1000	5800		
	8	6319.C3	750	5800		
315	2	NU317.C3	3000	1000	65	50
	4	NU319.C3	1500	3500		
	6	NU319.C3	1000	5800		
	8	NU319.C3	750	5800		
355	2	6319.C3	3000	1000	80	60
	4	6322.C3	1500	2800		
	6	6322.C3	1000	4800		
	8	6322.C3	750	4800		
355	2	NU319.C3	3000	1000	80	60
	4	NU322.C3	1500	2800		
	6	NU322.C3	1000	4800		
	8	NU322.C3	750	4800		

Grease: SKF LGMT3

Permissible for motor type	AWM, AWR, AWL, FWM, FWMP, FWMR, FWML
----------------------------	---

Frame Size	Number of pole	Bearing type	Speed rpm	Relubrication interval h	First regreasing g	Relubrication grease quantity g
315	2	6317.C3	3000	2000	74	37
	4	6319.C3	1500	4000	90	45
	6	6319.C3	1000	4000	90	45
	8	6319.C3	750	4000	90	45
315	2	NU317.C3	3000	2000	74	37
	4	NU319.C3	1500	4000	90	45
	6	NU319.C3	1000	4000	90	45
	8	NU319.C3	750	4000	90	45
315X	2	6317.C3	3000	2000	76	38
	4	6322.C3	1500	4000	90	45
	6	6322.C3	1000	4000	90	45
	8	6322.C3	750	4000	90	45
315X	2	NU317.C3	3000	2000	76	38
	4	NU322.C3	1500	4000	90	45
	6	NU322.C3	1000	4000	90	45
	8	NU322.C3	750	4000	90	45
355	2	6317.C3	3000	2000	74	37
	4	6322.C3	1500	4000	120	60
	6	6322.C3	1000	4000	120	60
	8	6322.C3	750	4000	120	60
355	2	NU317.C3	3000	2000	74	37
	4	NU322.C3	1500	4000	120	60
	6	NU322.C3	1000	4000	120	60
	8	NU322.C3	750	4000	120	60
355X	2	6220.C3	3000	2000	80	40
	4	6322.C3	1500	4000	120	60
	6	6322.C3	1000	4000	120	60
	8	6322.C3	750	4000	120	60
355X	2	NU220.C3	3000	2000	80	40
	4	NU322.C3	1500	4000	120	60
	6	NU322.C3	1000	4000	120	60
	8	NU322.C3	750	4000	120	60

Grease: CALTEX SRI-2

The first re-lubrication must be performed with double re-lubrication amount. The old grease which accumulates at the bearing cap has to be removed after 5 re-lubrications.

We recommend using the grease SKF LGMT3 or any equivalent miscible grease after manufacturer permission.

The recommended lubricants are valid for ambient temperature range from -20°C up to 40°C. For temperature outside this range, please refer to specific information.

The permanently lubricated bearings should be changed after approximately 20.000 hours of operation, or at the least after 3 or 4 years, or in accordance with manufacturer specification.

6.2 Inverter setting range:

The following overview shows the maximum permissible frequencies for motors controlled by a frequency converter. From a frequency of less than 30 Hz at constant torque the use of a forced cooling fan is necessary. This information assumes that the motor is properly cooled and does not run in the overload range.

Frame size	Pole	Frequency range
56	2	5 – 100 Hz
63	2	5 – 100 Hz
71	2	5 – 100 Hz
80	2	5 – 100 Hz
90	2	5 – 100 Hz
100	2	5 – 100 Hz
112	2	5 – 100 Hz
132	2	5 – 100 Hz
160	2	5 – 100 Hz
180	2	5 – 75 Hz
200	2	5 – 75 Hz
225	2	5 – 75 Hz
250	2	5 – 75 Hz
280	2	5 – 75 Hz
315	2	5 – 75 Hz
355	2	5 – 75 Hz
56	4, 6, 8	5 – 100 Hz
63	4, 6, 8	5 – 100 Hz
71	4, 6, 8	5 – 100 Hz
80	4, 6, 8	5 – 100 Hz
90	4, 6, 8	5 – 100 Hz
100	4, 6, 8	5 – 100 Hz
112	4, 6, 8	5 – 100 Hz
132	4, 6, 8	5 – 100 Hz
160	4, 6, 8	5 – 100 Hz
180	4, 6, 8	5 – 100 Hz
200	4, 6, 8	5 – 100 Hz
225	4, 6, 8	5 – 100 Hz
250	4, 6, 8	5 – 100 Hz
280	4, 6, 8	5 – 100 Hz
315	4, 6, 8	5 – 100 Hz
355	4, 6, 8	5 – 75 Hz

6.3 Maintenance plan:

Maintenance measures are to be registered evidence able.

Part	Daily, every 24h	Monthly, every	Semi-annually, every 4300h	Annually every 8600h
Motor, Complete	Check operation behaviour, temperatures, vibrations, noise			General inspection and cleaning. Check insulation resistance and lubricant behaviour
Coupling		After 1. week Operation Check shaft alignment		Checking shaft Alignment
Anti-friction Bearings		Bearings are permanently lubricated. They should be changed after 20.000 hours of after 3 to 4 years, or acc. Manufacturer specifications		
Terminal box, connections of cables, Protective earth				Cleaning (all over), Contacts-cleaning and assure pressure conditions

6.4 Trouble shooting

For trouble shooting see following diagnosis chart

Defects	Possible cause	Remedy
<ul style="list-style-type: none"> Motor does not turn, any noise 	<ul style="list-style-type: none"> At least 2 power lines broken No voltage 	<ul style="list-style-type: none"> Check on fuses, power, circuit breaker and terminals
<ul style="list-style-type: none"> Motor does not turn, magnetic noise 	<ul style="list-style-type: none"> 1 power line broken Damaged bearing 	<ul style="list-style-type: none"> See above Check bearing, exchange if necessary
<ul style="list-style-type: none"> Motor start under load is too slow 	<ul style="list-style-type: none"> Excessive load Main voltage drop 	<ul style="list-style-type: none"> Reduce the load of the driven machine Check power system
<ul style="list-style-type: none"> Motor runs without load 	<ul style="list-style-type: none"> Power line disconnection after start 	<ul style="list-style-type: none"> Check power line
<ul style="list-style-type: none"> Motor makes abnormal noise, fast heating of stator winding 	<ul style="list-style-type: none"> Stator winding interrupt Voltage too high Inadequate cooling Wrong rotation direction 	<ul style="list-style-type: none"> Check winding resistance of three phases and temperature Check power supply Check and clean the cooling system Observe marking Check terminal connections
<ul style="list-style-type: none"> Abnormal noise 	<ul style="list-style-type: none"> Mechanical reasons Electrical reasons 	<ul style="list-style-type: none"> Check founding, coupling, bearings, fan If noise disappears with turn-off, negotiate manufacturer

Defects	Possible cause	Remedy
<ul style="list-style-type: none"> High vibrations with coupling, but low vibrations without coupled load 	<ul style="list-style-type: none"> Fault of the coupling or driven machine Fundamental subsidence Balancing problems 	<ul style="list-style-type: none"> Check coupling, alignment and driven machine Renew fundament New balancing
<ul style="list-style-type: none"> High vibrations without coupling 	<ul style="list-style-type: none"> Unbalance remains with natural stopping Interrupted winding Rotor scrape Unlocked bolts Foundation in resonance Motor wrong brace 	<ul style="list-style-type: none"> New balancing Check current of all phases Check or remove bearing Check and tighten the bolts New foundation Check alignment
<ul style="list-style-type: none"> Bearing overheating 	<ul style="list-style-type: none"> Bearing damaged Main voltage drop Lubricant problems (aged, dirty, viscosity) 	<ul style="list-style-type: none"> Examine bearings Check alignment, balancing Check grease, renew/change grease, Renew defective seals
<ul style="list-style-type: none"> Bearing oil leakage 	<ul style="list-style-type: none"> Defective seals 	<ul style="list-style-type: none"> Renew seals

7. Recycling and disposal

For recycling and disposal, the provisions of local authority regulations apply.

In the first line, the motor is manufactured in general from steel, cast iron, copper further metallic alloy, ready-to-recycle plastic materials and elastomers and asbestos-free sealing and gaskets.

Lubricants are to be picked up and dispose separately.

Follow the grease manufacturer instructions as to how to dispose of used grease.

Do not throw used grease in nature.