

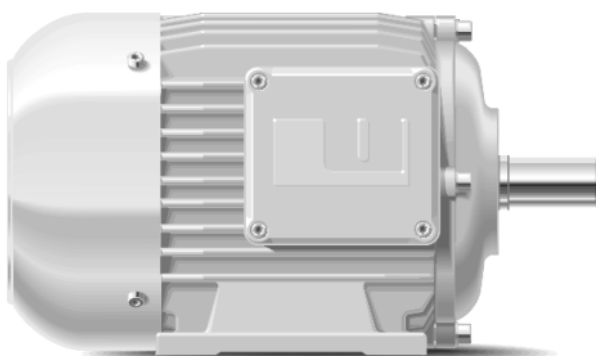
Edition 9. 2001

Operating Instructions

Induction motors



for your own safety



Leumann & Uhlmann AG

Elektromotorenbau / Industrie-Elektronik

1 Declaration of conformity

Declarations of conformity in accordance with Low-voltage Directive 73/23 EEC (Council Directive dated 19 February 1973) on the harmonisation of the legislation of member states concerning electrical apparatus for use within defined voltage limits, amended by Directive 93/68 EEC dated 22 July 1993, are issued separately.

2 Area of application

The operating instructions cover the following motor series, constructed in accordance with EN 60 034:

E
D
DD
D2A, D2J
DCD
with shaft heights of 56 to 400

DM2AA.... shaft heights 90 to 180
DemBT shaft heights 200 to 250

3 Use

The electrical machines are intended for driving equipment such as fans, mixing machines, pumps and similar machinery, and to a limited extent for braking such equipment. Any legal restrictions must be considered. Operation without attached equipment, machines or the like is not permitted, since the necessary protection against physical contact during operation is not ensured.

4 Installation

4.1 General



The live and rotating parts of electrical machines can cause serious or fatal injuries. Setting up, starting and maintenance may only be carried out by authorised staff. The manufacturer's instructions and the relevant local legal provisions, regulations and the like must be observed during setting up, starting, use and maintenance.

The motor is to be mounted on a solid and vibration-rigid base. The base surface must be flat, to avoid any distortion of the electrical machine.

The motor is designed for a surrounding temperature of -20 °C to +40 °C. The protection class of the electrical apparatus must be appropriate to the situation in which it is to be installed.

The performance data of the machine relate to a maximum installation height of 1000 m above sea-level.



Installations at over 1000 m require a reduction in power, respectively a lower current value to be set on the thermal-delay overcurrent trip.

It must be ensured that the machine receives the required flow of cooling air, without obstruction. When fixing the motor in position, care must be taken that any condensate drainholes are placed at the lowest point.



Obstruction of the cooling air, for example by an unsuitable sound-insulation casing, can damage the machine by overheating. Fire danger !

4.2 *Coupling arrangements*

In motors built up to 30.04.98 the rotor is dynamically balanced together with the whole adapter-key. From 01.05.98 onward the motors are constructed with half-key balancing, in accordance with EN 60 034-14. In order to avoid confusion, the motors are marked on the end as follows:

F (full)	for full-key balancing
H (half)	for half-key balancing



Non-observance of the type of balancing used leads to vibration, which can damage bearings and machine components.

4.2.1 *Belt pulleys*



The conductivity of belts for use in areas subject to the risk of explosion must be such as to avoid an electrostatic charge



Explosion risk.

Assembly of couplings or belt pulleys must be carried out using a suitable fitting device. The motor shaft and the driven shaft must be aligned with each other accurately. Alignment errors cause vibration or indeed bearing damage. Where belt pulleys are used, care must be taken that no excessive radial forces act on the bearings. Where the drive uses several drive-belts, motors with strengthened bearings must be used if necessary.

Excessive drive-belt tension leads to early bearing failures, and may cause the belt to rupture or the shaft to break.



Danger of injury from flying parts.

4.3 *Lifting device*

The mechanical design of lifting devices such as lifting eyes is adequate only for lifting the motor itself. Machines attached to the motor must not be lifted in this way.



Danger of injury by a falling load.

4.4 Climbing onto electrical machines



The mechanical design of mounting flanges and other attachment parts does not allow for any additional load, such as that caused by climbing onto the machine.
Danger of breakage and injury.

4.5 Special machines

For special machines supplementary documentation is issued if necessary.

5 Setting to work

When setting machines to work local regulations and instructions must be observed.



In Ex areas, supplementary regulations and instructions apply.



Danger of explosion.

5.1 Motor insulation resistance

Before putting a machine into operation it is advisable to check its insulation resistance. Particularly with an electrical machine which has been stored for a long period, there is a risk that as a result of atmospheric effects or even condensed water the stator winding has become humid.

It is advisable to measure the insulation resistance using an insulation tester such as a hand-cranked generator with a measurement voltage of 500 V DC. At an ambient temperature of 25 °C, the measured value should not be less than the following value:

$$R_{\text{Ins.}} [\text{M}\Omega] \geq \frac{20 \cdot U_{\text{B}} [\text{V}]}{1000 + 2 P_2 [\text{kW}]}$$

$R_{\text{Ins.}}$	insulation resistance
U_{B}	design voltage
P_2	power

For higher ambient temperatures, the value of resistance determined should be halved for every 10 °C of temperature difference.



The measurement may only be carried out by authorised staff. On completion of the measurement the winding must be discharged to earth, to avoid possible electric shock on touching the winding.

If the values measured are too low, further action should be agreed with the manufacturer or an authorised service centre.

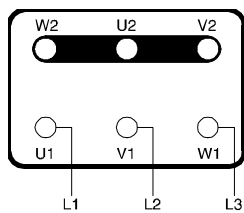
5.2 Preparation



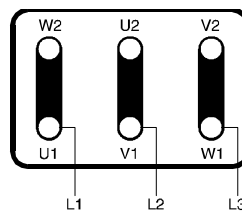
The junction box may not be opened under voltage (danger to life).

5.2.1 Connection

Star connection



Delta connection



5.2.2 Other forms of connection

For forms of connection such as "Dahlander" connection, two separate windings etc., an appropriate circuit diagram is provided in the junction box of the motor.

5.2.3 Star/delta starting

For star/delta starting, the motor must be of suitable design. Only motors in which the winding is designed for the rated voltage in the delta connection and a star connection is possible, may be used for star/delta starting.

Star/delta starting possible

Mains voltage 400 V

Motor rating, star/delta 400/690 V

Star/delta starting not possible

Mains voltage 400 V

Motor rating, star/delta 230/400 V

After checking the information given on the data-plate and inserting the correct connecting links on the terminal plate in accordance with the circuit inside the junction box, the motor is ready to be connected.

Connection to the mains may only be carried out by an authorised technician.

5.3 Installation



When installing mains-operated motors in Ex areas, the supplementary information for apparatus in explosion-risk areas given in Section 7 must be observed, and for motors fed by a frequency convertor that in Section 8 also.



Electrical installations may only be carried out by authorised technical staff.



When determining the correct size of motor supply cable and the circuit protection devices, the relevant installation instructions must be strictly observed (fire risk).



Incorrect installation can lead to a fatal electric shock or set off a fire.



The surface temperature of the machine can cause burns to the skin even in normal use.

5.3.1 Cable entries generally

The cable entries do not belong to the scope of supply. The openings for the cable entries are provided with a metric thread. Before the initiation these openings are provisionally locked, so that the penetration of dust and water is prevented to a large extent. With the electrical installation of the engine, these openings need to be provided with covers or cable entries which correspond to the relevant standards and regulations.

5.3.2 Cable entry of increased safety motors "e"

Only cable entries and covers with a design inspection certificate may be used starting from 1 July 2003. Up to this date also cable glands with a conformance certificate or in Switzerland with a grant of the ESTI can be used.

5.3.3 Cable entry of flameproof motors "d"

Only cable entries and covers with a design inspection certificate may be used starting from 1 July 2003. Up to this date also cable glands with a conformance certificate or in Switzerland with a grant of the ESTI can be used.

5.4 Direction of rotation

When the mains connections L1, L2, L3 are connected correctly to the connection terminals U1, V1, W1, the motor runs to the right, that is to say clockwise when looking at the front end of the drive shaft.



Checking the direction of rotation may only be carried out by authorised technical staff. When doing so, the necessary protection against physical contact must be considered, and the key or belt pulley, and any other loose parts must be properly secured.

5.5 *Motor protection*

5.5.1 Electrical machines must be protected against excessive heating caused by an overload. Motors which are able to withstand their starting current at the rated voltage and rated frequency continuously, or similarly generators which support their short-circuit current without excessive heating, do not require overload protection.

The following protection devices may be considered:

- a) Overcurrent protection devices with current-dependent delayed tripping, e.g. motor starters conforming to the standards of the DIN VDE 0660 series in all external conductors, which are to be set to no more than the nominal current of the machine. If in the case of delta connection trip devices or relays are connected in series with the winding phases, then the choice and setting of the trip devices must be based on the rated value of the phase current, i.e. 0.58 times the rated motor current.
- b) Devices for direct temperature monitoring, using temperature sensors
- c) Other devices which provide the required protection against excessive heating as the devices referred to above.



If the value is set too high, the machine may become excessively hot and cause a fire. The relevant installation instructions must be observed.



For machines of the protection class Increased Safety "e", supplementary specifications apply in Zone 1.



The relevant national regulations must be strictly observed, for example

Germany DIN VDE 0165
Switzerland SN SEV 1000
etc.

5.5.2 *Thermal motor protection with sensors*

Motors with thermal motor protection are fitted with temperature sensors incorporated in the stator winding, such as PTC resistors, Pt-100, bi-metallic switches etc. The connection of the sensors avoids largely to exceed the permissible maximum winding temperature. The relevant instructions concerning connection of one of these monitoring systems must be strictly observed.



When connecting explosion-protected machines, the relevant instructions concerning installation and the monitoring devices which may be used must be strictly observed.



Explosion risk from thermal or electrical ignition sources.



The effectiveness of these monitoring arrangements must be checked by an authorised person when the machine is being put into operation.

6 Maintenance

Maintenance work may not be carried out under voltage. Before opening the junction box, the machine must be disconnected from the mains supply.



Touching under voltage standing bright conductors may be lethal.



Maintenance of electrical machines for areas with explosion-risk may only be carried out by authorised technical staff. The requirements for attaining this status are regulated at national level.

In Germany for example work must be carried out in accordance with "Elex V", Art.9. The apparatus must be provided with an additional data-plate, so that traceability is ensured.

In the case of machines in protection class the "Flameproof Enclosure" , if air-gaps or the flameproof enclosure are damaged or modified, the production equipment may no longer be used in Ex areas. All "Ex" markings must imperatively be removed. If necessary the apparatus must in addition be marked "Not for areas with explosion-risk".

6.1 Lubrication of antifriction bearings



If unusual bearing noises occur, a technician must be brought in to investigate.

For the initial lubrication of bearings, DIN 51825-KL3K grease with lithium soap as thickening agent and with mineral oil as base oil, Type SKF LGMT3, is normally used.

If when the machines were ordered special operating conditions were known which make a different grease necessary, then the grease type is given on the data plate. For machines equipped with a lubrication device, in addition to specifying the grease to be used, the lubrication interval and the quantity of grease required are also stated on the data-plate.

It is advisable to adhere strictly to the lubrication instructions. Mixing greases with different thickening agents and base oils reduces the quality of the grease and should therefore be avoided. Only in special cases should be deviated from the normal lubrication data. The lubrication intervals should be reduced if the machines are operated at coolant temperatures higher than those on which the intervals were originally based, or if hostile vapours or extremely severe contamination are present.

6.1.1 Long-term lubrication

Where no relubrication device is provided, the grease filled into the bearings lasts for several years under normal operating conditions. If the operating conditions allows it, on machines of up to size 250 running at speeds of up to 1800 rpm, the bearings should be cleaned and repacked with grease after 20,000 running hours or 3 years, whichever occurs sooner. These grease-change intervals apply under normal load conditions (coupling drive), operation at low vibration levels, approximately neutral ambient air and the use of high-quality ball-bearing grease. On larger motors, higher speeds and other unfavourable operating conditions, correspondingly shorter intervals should be planned. No more than one third of the space within the bearing cap should be filled with grease.

Changing the bearings or replacing the grease as a rule requires the armature to be taken out of the machine. Before doing so always ensure that all mains supply conductors are disconnected from the machine. This can be achieved by means of a security switch with a padlock (provided locally) or other organisational measures. The local regulations must in addition be observed.



During the warranty period the armature may be taken out only with the prior agreement of the manufacturer, or of a person or company authorised by the manufacturer.



In the case of motors for explosion-risk areas, only bearings with original dimensions and bearing clearance may be used.



A greater bearing clearance may cause a too small air gap, or in motors in flameproof enclosure, a too large gap width. Explosion risk.

6.2 General cleaning

Depending on the operating conditions, the motor is to be cleaned as required on standstill. In particular, the cooling-air channels must be kept free from dirt and dust. Take care that no dirt gets into the bearings during cleaning.



Cleaning work and in particular removal of covers such as the protective guards around the fan, coupling and the like may only be carried out with the machine disconnected from the mains supply at all conductors, as described at section 3.1.

Any contact protection which suffers damage must be replaced. The machine may be put back into operation only after all protections have been fitted correctly.

6.3 Replacement parts

Damaged parts should only be replaced by original parts.



The use of foreign parts can lead to accidents. Fans may not have a sufficient air flow and lead to the machine overheating. Fire danger !

At high speeds, foreign makes of fan may burst, endangering equipment and people.



Only original parts may be used. Replacement must be carried out by specialized staff (see Maintenance).



Foreign parts, such as fans with a higher surface resistance, can lead to electrostatic discharges, etc.



Explosion risk.

6.4 Changes and modifications



If changes and modifications are made to the machine without the manufacturer's consent, all warranty claims become invalid.



Changes and modifications may only be carried out by the manufacturer or by service centres authorised by the manufacturer.

Improper insertion of drill-holes, adaptation of parts, application of seals etc. may breach the relevant safety standards.



Improper changes and modifications can be the cause of an explosion or cause the propagation of an explosion.

6.5 Faults

The following table makes it possible to locate the faults which most frequently occur in AC motors and to correct these by the local specialized staff. Within the warranty period, all work under warranty which it is intended that third parties shall carry out must be agreed in writing with the manufacturer in advance. In case of doubt, please apply directly to our factory in Muttenz.



The junction box must not be opened when the circuits are under voltage. Lethal risk!



None of the parts which provide physical protection, such as the fan casing or coupling guard, may be removed during operation. Before putting the machine into operation all parts which serve as guards must be fitted. Rotating parts can cause serious or fatal injuries.

Electrical fault	Incorrect connection Δ instead of Y Y instead of Δ	Poor contact at one of the connections	Phase dis-connection	Inadequate connecting cable	Over-load	Shorted wire in the stator winding	Mains voltage too low	Winding short circuited
1 On no load, motor does not start or runs very slowly								
2 Stator winding is too hot in places								
3 Motor speed drops when load is applied								
4 No current in one of the phases								
5 Stator winding excessively hot								
6 Motor hums								
7 Safety-cutout trips on switching on								

Mechanical fault	Too much grease in the bearing	Sealing-ring pressing on the shaft	Foreign body in the bearing	Bearing clearance too small	Bearing clearance too great	Fault on the bearing surfaces	Fitting error, bearing misaligned	Lack of lubrication	Faulty sealing	Misalignment caused by excessive belt tension
1 Bearing too hot										
2 Bearing knocks										
3 Bearing whistles										
4 Bearing wears										

7 Supplementary information for production equipment in areas subject to the risk of explosion

Directive 94/9/EC issued by the European Parliament and Council dated 23 March 1994 on harmonisation of the legal provisions of member states for equipment and protective systems for authorised use in areas subject to the risk of explosion in accordance with Art.15 (2) allows member states to put into circulation and to put into operation equipment and protective systems which at the time when the present directives were agreed comply with the regulations applicable in their area, for a period up to 30 June 2003.

7.1 Marking (examples) in accordance with ATEX directive

Enhanced Safety "EEx e II T3" in accordance with EN 50 019 for Zone 1 and Zone 2 areas.

Leumann & Uhlmann AG		CH-4132 Muttenz	
3-Motor Typ	Nr.	S	
P ₂	kW	min ⁻¹	Hz IP
V	A	cosφ	
CE 0102 Ex II 2 G EEx e II T 3			
XXX 01 ATEX 0000	I _A /I _N	t _E	s IEC 60 034
t _A	s PTC DIN 44081/82-	Th.cl.	IC
Auslösegerät		Bauj.	
TMS, bei Angabe der t _A -Zeit, nur mit bescheinigtem PTC-Auslösegerät			

Leumann & Uhlmann AG		CH-4132 Muttenz	
3-Motor Typ	Nr.	S	
Umrichter Typ		Motordaten bei	Hz
P ₂	kW	min ⁻¹	V A
CE 0102 Ex II 2 G EEx e II T 3			
XXX 01 ATEX 0000		IP	IEC 60034
t _A	s PTC DIN 44081/82-	Th.cl.	IC
Auslösegerät		Bauj.	
M	Nm	min ⁻¹	Hz ED %/ min
M	Nm	min ⁻¹	Hz M _A Nm
P ₂	kW	min ⁻¹	Hz

Flameproof enclosure "EEx de IIC T4" in accordance with EN 50 018/19 for Zone 1 and Zone 2 areas

Leumann & Uhlmann AG		CH-4132 Muttenz	
3-Motor Typ	Nr.	S	
P ₂	kW	min ⁻¹	Hz IP
V	A	cosφ	
CE 0102 Ex II 2 G EEx de IIC T 4			
XXX 01 ATEX 0000	I _A /I _N	t _E	s IEC 60 034
t _A	s PTC DIN 44081/82-	Th.cl.	IC
Auslösegerät		Bauj.	
TMS, bei Angabe der t _A -Zeit, nur mit bescheinigtem PTC-Auslösegerät			

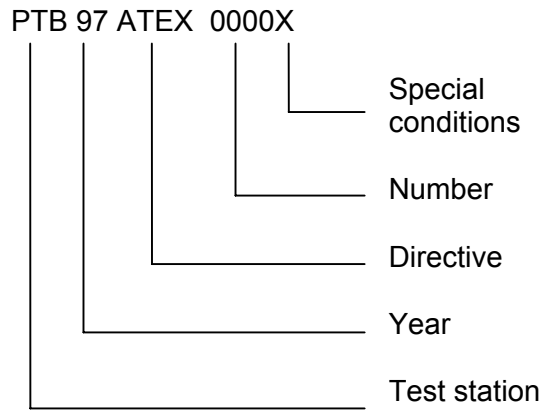
Leumann & Uhlmann AG		CH-4132 Muttenz	
3-Motor Typ	Nr.	S	
Umrichter Typ		Motordaten bei	Hz
P ₂	kW	min ⁻¹	V A
CE 0102 Ex II 2 G EEx de IIC T 4			
XXX 01 ATEX 0000		IP	IEC 60034
t _A	s PTC DIN 44081/82-	Th.cl.	IC
Auslösegerät		Bauj.	
M	Nm	min ⁻¹	Hz ED %/ min
M	Nm	min ⁻¹	Hz M _A Nm
P ₂	kW	min ⁻¹	Hz

Non sparking "EEx nA II T3" in accordance with EN 50 021

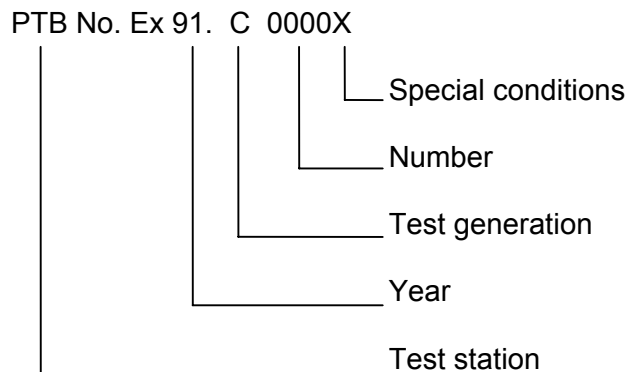
Leumann & Uhlmann AG		CH-4132 Muttenz	
3-Motor Typ	Nr.	S	
P ₂	kW	min ⁻¹	Hz IP
V	A	cosφ	
CE 0102	II 3 G	EEx nA II	T 3
XXX 01 ATEX 0000	I _A /I _N	t _E	s IEC 60 034
t _A	s PTC DIN 44081/82-	Th.cl.	IC
Auslösegerät		Bauj.	
TMS, bei Angabe der t _A -Zeit, nur mit bescheinigtem PTC-Auslösegerät			

Leumann & Uhlmann AG		CH-4132 Muttenz	
3-Motor Typ	Nr.	S	
Umrichter Typ		Motordaten bei	Hz
P ₂	kW	min ⁻¹	V A
CE 0102	II 3 G	EEx nA II	T 3
XXX 01 ATEX 0000		IP	IEC 60034
t _A	s PTC DIN 44081/82-	Th.cl.	IC
Auslösegerät		Bauj.	
M	Nm	min ⁻¹	Hz ED %/ min
M	Nm	min ⁻¹	Hz M _A Nm
P ₂	kW	min ⁻¹	Hz

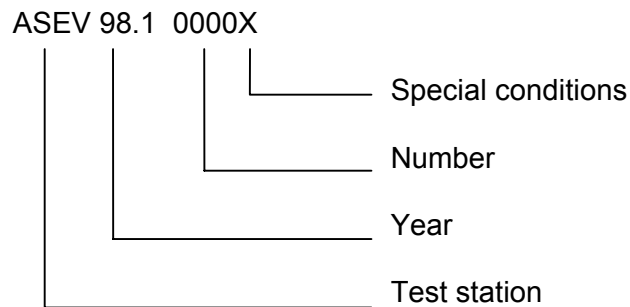
7.1.1 EU test number in accordance with ATEX directive



7.1.2 EU test number up to 2003



7.1.3 Test number in Switzerland



7.1.4 Notes



If the symbol "X" appears at the end of the certification, reference is made to special conditions for the safe use of the apparatus in the annex to this certification



These conditions must be strictly observed.



If the symbol "U" appears at the end of the certification number, the document concerns an incomplete apparatus.

7.2 Directive, Regulations

7.2.1 Switzerland

Putting products into circulation and into operation is regulated in:

- The order on low-voltage electrical products (NEV) dated 9 April 1997
- The order on apparatus and protective systems for use in areas subject to the risk of explosion (VGSEB) dated 2 March 1998

Installation is regulated in the SEV technical standards, " Low-voltage installations SN SEV 1000".



Important

The listing is not final.

7.2.2 European Community

Directive 94/9/EC issued by the European Parliament and Council dated 19 April 1994 regulates the following areas:

Area of application, putting products into circulation, free circulation of goods, conformity procedure and CE-conformity marking.



Important

The listing is not final.

8. Operation by frequency convertor for the continuously variable speed control

8.1 EEx e - Motors

Motors of the protection class Increased Safety "e" may be operated by means of a frequency converter only if the conditions laid down in EN 50 019: 1994 Art.5.1.4.5 are fulfilled.

Art. 5.1.4.5 *Motors supplied at varying frequency and voltage by a convertor shall be tested and certified for this duty as a unit in association with the convertor specified in the descriptive documents according to 23.2 of EN 50014:1992 and with the protective device provided.*

8.2 EEx d - Motors

Motors of the protection class Flameproof Enclosure "d" may be operated by means of a frequency converter only if the conditions laid down in EN 50 014: 1992 Art.23.4.6.1 are fulfilled.

Art. 23.4.6.1 Temperature measurements (extract)

The thermal tests shall be made at the rating of the electrical apparatus, with the exception of the thermal test to determine the maximum surface temperature. The latter test is performed with the most adverse conditions at the most unfavourable supply voltage between 90% to 110% of the rated voltage of the electrical apparatus, unless the manufacturer can demonstrate that other international standards prescribe other tolerances for equivalent industrial electrical apparatus.

Explanation

By "least favourable conditions" is understood for example overload operation, mechanical blockage etc.

By "least favourable supply voltage" is understood for example the voltage waveform, the pulse frequency, the effective value of the voltage, the frequency (speed of rotation), etc. I.e. the frequency converter parameters relevant to safety laid down by the person adducing the proof.

Proof of suitable thermal performance for frequency converter operation does not form part of standard contractual provision. It can be offered as an option for a limited number of converter makes and model series.

The company Leumann & Uhlmann AG confirms in a separate document the thermal proof carried out with the respective converters and the parameters relevant for safety laid down accordingly.

Where a different make or type of converter is used, or where set parameters relevant to safety differ from those specified in the relevant document, there the user is responsible for providing the thermal proof.



An incorrect design can lead to an explosion.



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