

OPERATING INSTRUCTIONS

Three-phase-asynchronous machine
with
squirrel-cage rotor

„ASU No. 9 Kosice / GAN 1700 kW “

Type:	HKM 156 Z02
Machine no.:	526018 05001-002
Customer:	AIR LIQUIDE AGS GmbH
Customers order no.:	45000243.0
Our order / project:	123679 / K.V11-04045

Issue no.:	01
Date:	11.05.2005

contact:
docucenteremg@elinebg.at

This Operating instruction is a translated version of the "Betriebshandbuch" of the ELIN EBG Motoren GmbH. It is understood that in all cases of mistranslation and/or misinterpretation the German version shall be valid.

This Document must neither be copied nor used in any other way without our written consent. Neither is it to be handed over; nor in other way communicated to a third party. Infringement will lead to prosecution.

© ELIN EBG Motoren GmbH

**We Keep the
World in Motion**

ELIN EBG Motoren GmbH
Elingasse 3
8160 Weiz, Austria

Tel.: (+43/3172) 606-0
Fax: (+43/3172) 606-784

Gesellschaftssitz Weiz,
registriert beim Handelsgericht Graz unter
FN 58429a; UID: ATU1477 3404; DVR 0748897

www.elinebgmotoren.at

1 Safety instructions

This operating instruction contains important warning instructions and safety instructions. The user has to pay attention to this.

This machine is assigned only for a certain use which is described in the instructions. Besides you find the most important assumptions and safety measures for use and running the machine to guarantee a running without complaining.

We don't take the guarantee and responsibility for use outside the described purpose and without attention to the necessary assumptions and safety measures.

Only specialists are allowed to transport, set up, connect, put into operation, service and operate machines and generators. The specialist has to know the valid safety regulations and erection standards.

All work has to be controlled by responsible specialists.

The specialists have to be authorised for their work.

Specialists are people who

- are well skilled and have the experience
- know the valid standards, instructions, regulations and accident prevention instructions
- know the functioning and operating conditions of the electrical machines
- know and may avoid dangers

Non-qualified people and wrong use can lead to dangers for

- body and live
- the machine and further property of the user
- the efficient work of the machine

It's only allowed to operate a machine with the delivered accessories and material from ELIN EBG Motoren GmbH



The danger warnings characterised in this manual have to be considered especially.



Warning of dangerous electrical voltage.

Protection equipment



Insulated tools, isolating protective clothing, protection device, seat belts, devices and other aids must be received in perfect condition. The isolating protective clothing must be examined before each use by the user for obvious damage.

Damage to isolating protective clothing may be eliminated only by technically suitable workshops. Gloves may not be repaired however. Isolating gloves and shoes must be examined in certain time intervals also electrically for their protective effect.

Carrying of wrist-watches, rings and bracelets with the work is forbidden.

First aid measures by accidents with electrical current



By accidents with electrical current you should take the following measures:

- ◆ Interruption of circuit by switching off, by pulling the plug, by taking the safety device out.
- ◆ If these measures are not immediately possible, casualty must be pulled away from the electric circuit by using non conductive articles.
- ◆ Call a doctor!
- ◆ **Emergency call:**
Rescue guidance center Phone:
- ◆ Accomplish first aid measures up to the arrival of the doctor.

- immediate placing in rest position
- control of respiration and pulse
- when respiratory arrest then breath donation
- when cycle stop then heart-lung-revival
- when unconsciousness and existing respiration then side storage
- germ-free coverage of the fire wounds

Table of contents:

1	Safety instructions	2
2	General machine description	6
2.1	Constructional design of stator	6
2.2	Constructional design of rotor	7
2.3	Bearing supports	8
2.4	Bearing arrangement.....	8
2.5	Cooling	9
2.6	Terminal boxes and electrical connections	10
2.7	Auxiliary equipment and protective devices.....	10
2.7.1	Slot thermometer	10
2.7.2	Bearing thermometer	11
2.7.3	Space heater.....	11
3	Technical Data	12
4	Transport and storage	16
4.1	Transport	16
	Rust protection.....	16
	Transport safeguard	16
	Dimensions and weights.....	16
	Package disposal.....	16
4.2	Storage	17
	Dimensions and weights.....	17
	Intermediate storage	17
	Long time storage	17
5	Installation and operation.....	18
5.1	Installation and alignment	18
5.2	Electrical connections.....	18
5.3	Start up of machine	19
	Checking of insulation resistance	19
	Operation of heat exchanger	21
	Check list for first start up	21
6	Maintenance	23
6.1	Maintenance of bearings.....	23
6.2	Maintenance of windings	24
6.3	Maintenance of heat exchanger	24
7	Disassembling, assembling, repairs	26
8	Warranty / Failure	27
8.1	Failure	27

9	Emergency data	28
9.1	Fire fighting	28
9.2	First aid measures by accidents with electrical current	29
10	Spare Parts	30
10.1	Spare parts inventory	30
10.2	Order procedure	30
	List of revisions	32
	Use confirmation	33
	Appendix	34
	Drawings	34
	Descriptions	34
	Declaration of conformity.....	34
	Tables.....	34
	Failure report.....	34

2 General machine description

Design

The internal-cooled squirrel cage machines have a modern design and are constructed with end shields for bearing brackets. See [outline drawing](#).

Standards and construction specifications

The construction of machines conforms to the regulations according to standards listed on [data sheets](#).

Explanation of the abbreviations used in the text:

DE ... Drive End

NDE ... Non Drive End

Area of application

Only according to specification of your order. See [data sheet](#).

2.1 Constructional design of stator

Stator

The stator housing is of a single section welded steel construction providing solid support for the core and the winding. Large openings ensure a good accessibility for inspection and maintenance.

Stator core

The core consists of 0,5 mm thick laminations of high-grade alloy steel with both sides insulated.

The core is assembled in several stacks separated by rigid steel spacers to provide radial cooling ducts. The core assembly is clamped under high pressure by end ring plates connected by welding through strong steel rods at the back of laminations.

Stator winding

The stator winding is of the fractional pitch, double layer type with form wound coils. A sealed class F VACUTAPE insulations system is used.

System Vacutape:

The insulation consists of tapes which are wound half-tapped. The tape is made of mica on carrier materials. In order to prevent any discharges the windings are provided with a corona protection varnish over the zone of slots.

The insulated coils are located firmly in the open slots of the stator core using appropriate packing material and are held in place by means of slot wedges. Strong retaining rings on brackets supported and absorbent connection pieces between the coils and adequate designed bandages are provided.

The finished wound stator core is tested with special respect to correct wiring and voltage stress. After having successfully withstood these tests the complete core is impregnated under vacuum with epoxy-resin. Final polymerization is done in a forced-air circulation oven. The so produced windings have a high mechanical and thermal strength and are hardly sensitive against humidity and aggressive gases and vapours.

After impregnation and polymerization a quality control by loss-factor measurement is performed.

Space heater

To prevent condensation of moisture, the machines are equipped with a space heater.

For ratings see [data sheet](#).

2.2 Constructional design of rotor

Shaft

The shaft, a welded spider type shaft construction of forged and rolled steel, annealed free of tension, is carefully machined and tested.

Rotor core

The rotor core consists of 0,5 mm thick laminations of high grade electrical steel which are insulated on both sides.

The core is sub-divided into individual sections in axial direction, and these are spaced by means of steel spacers. The ducts that are thus formed allow the axially flowing cooling air to radiate outwards, which means rapid dispersal of the heat due to energy losses created in the rotor.

The exact compression of the rotor core is held by heavy end plates, connected to the shaft by proper means.

The rotor core is shrink fitted on the shaft and secured by means of round keys.

Squirrel cage rotor winding

The bare rotor bars are inserted stiffly into the half-open slots of the rotor core and are fixed in the middle of the core. Thin metal liners are used to provide good mechanical and electrical contact. The short-circuit rings are connected to the rotor bars by brazing. Centring rings and shrink fitted, non magnetic rings of high strength material over the end-rings are provided.

2.3 Bearing supports

Bearing brackets

The bearing brackets, made of thick rolled metal sheets, support the components of the bearing mountings. Covered openings allow for the exact setting of the air gap of the electrical machine and give accessibility for inspection.

2.4 Bearing arrangement

Sleeve bearings

The bearing housing, flange-mounting type, supports the bearing shell. The split housing and split shell are connected together by means of pins and bolts. The bearing shells have a spherical seat to provide self alignment and to avoid stress concentrations.

The shell is prevented from radial distortion by means of a cylindrical pin and a corresponding keyway. The shells are lined with high-grade babbitt metal and carefully machined to obtain exact clearances. The shaft journals are superfinished. The bearings are sealed off by split sealing rings. A pressure equalizing sealing chamber prevents oil entering to machine. Machines with great drop of pressure have an additional pressurized sealing chamber.

The sleeve bearings are equipped with one oil ring.

Large machines have one bearing housing insulated from the bracket to eliminate circulating currents.

See [data sheet](#).

Bearing temperature

According to relevant standards is a bearing temperature rise of 50 K over an ambient temperature of 40 °C allowable.

For reasons of a safety operation, it will be strived for the fact, that the bearing operating temperature should not exceed 80 °C.

Higher operating temperatures may result in accelerated deterioration of the oil and more frequent changes may be necessary.

Bearing temperatures can be monitored by the use of bearing thermometers.

Equipment according to order. See [data sheet](#).

Bearing lubrication - circulating oil

Sleeve bearings with circulating oil lubrication have to be connected to a suitable oil supply system. Pay attention to feed the bearings with pure dynamo oil within a temperature range of +48 °C to 60°C. The required quantity and quality of oil and the essential oil pressure in front of the bearing are stated on the outline drawing and in the [data sheet](#). The calculation of the essential oil is based on a normal 8 K flow-heating. See [data sheet](#).

The cooling oil is lead directly to the shell. A flow control valve in front of the bearing serves as an exact dosing device for the oil through-put. The oil drainage pipe must be of sufficient size and diameter as well as gradient to allow a free reflux of the oil.

Attention!

If the machine is equipped with insulated bearing assemblies the required insulation materials for an insulated connection with the oil inlet and oil outlet pipes as well as abnormal counter-flanges are despatched with the machine. Pay attention during erection to make perfect connections without any electrical by-pass.

First operation sleeve bearings

Please note!

All sleeve bearings are shipped without oil. Before operation a quality dynamo oil must be filled in up to the marked level via the bearing inspection hole.

The data sheets and the lubrication plate contain instructions on the amount and quality of the oil to be used. The instructions are based normally on an ambient temperature of +10 °C to 40 °C or if otherwise stated in the [data sheet](#).

Adjustment of the oil-throughput

The correct quantity of oil for each bearing has to be adjusted during the first start-up and has to be checked after changing the bearing.

The oil-supply has to be adjusted by means of the flow regulation valve in such a way that the specified bearing temperature (see [data sheet](#)) is not exceeding and the oil level is kept constant in respect of the mark on the oil level indicator.

An increase of the oil level causes flooding of the bearing and oil may enter the inside of the machine.

2.5 Cooling

Two sides ventilation, closed circuit

The internally ventilated electrical machine is equipped with a two sides ventilation system with closed-circuit cooling.

The kind of cooling as per standards IEC-34-6/1969 and the data for the air-water heat exchanger are stated on the [data sheet](#), and the [cooler description in the appendix](#).

Two fans, one on each side located take in the air at the ends of the machine and discharge it at the middle of the machine.

Special air guide devices provide for an effective cooling of all active parts.

The cooling air direction and the arrangement of the heat exchanger is shown on the [outline drawing](#).

2.6 Terminal boxes and electrical connections

Stator terminal box

The stator terminal box is made of welded steel sheets.

It consists of the bottom part which is screwed to the stator and the removable cover. The design of the flanges enable a double-side enclosure and an inlaying of the cables.

The fixation of the cables is done in the terminal box. Special compression glands and sealing rings with pressure plates ensure an absolute sealing of the cable entry.

The one-part pressure plate has to be shifted on the cable before connecting! The sealing rings are cutted up on one side by reasons of easy mounting and are to be laid around the cable after closing the terminal box. Pay attention to mount the three sealing rings of each cable entry with displaced joints.

The bottom part of the terminal box is provided with a fail-safe device which parts in case of a short circuit inside the terminal box. This prevents compact sections from parting or blowing out which means safety to operating personnel and the other equipment nearby.

The ends of the stator winding are brought out to the terminal box. Porcelain bushings as per DIN 46265 with brass connection bolts are applied. These bushings are fixed to a terminal plate which is separated from the bottom part of the terminal box. See [sketch of terminal box](#).

Location of terminal box and number and size of the cable entries are marked on the [outline drawing](#). The connection and arrangement of terminals are made according to the [connection diagram](#). See [data sheet](#) also.

Auxiliary terminal boxes

The machine is equipped with 2 auxiliary terminal boxes. The position, arrangement and connecting dimensions are to be obtained from the [outline drawing](#). The connections for measuring and control devices are made inside the auxiliary terminal boxes.

Design

The required number of terminals are placed inside split housings. Each terminal is marked with a destination plate.

The destinations comply with the connection diagram provided in each terminal box. The cable entry is done via stuffing boxes.

2.7 Auxiliary equipment and protective devices

2.7.1 Slot thermometer

For measuring the winding temperature are RTD's, Pt 100 (100 Ohm at 0 °C) installed in each phase of the winding between the upper and lower coil in the slot.

See [data sheet](#). Connections are made to an auxiliary terminal box.

2.7.2 Bearing thermometer

To control the bearing temperature each bearing is equipped with a resistance temperature detector Pt 100. (100 Ohm at 0 °C). Connections are made to an auxiliary terminal box. See [outline drawing](#).

2.7.3 Space heater

In order to prevent from moisture condense the machine is equipped with space heater. Arrangement and connecting dimensions are to be obtained from the confirmed [outline drawing](#). For type of heating rods see [data sheets](#).



During operation of the machine the space heater must be switched off!

Starting time (ta) : 10/15 s at 100/90% Un
 Min. voltage for save starting : 80% Un
 Starting frequency at 90% Un : 2 x cold / 1 x warm
 In-between the startings natural runout.
 Next starting after 30 minutes
 Starting : direct

Insulation / temperature rise: F / B, temperature rise of windings 73 K
 measured with resistance method

Degree of protection : IP 55
 Ex- protection : none

Method of cooling : IC 81 W with top mounted
 air-water cooler

- Water inlet temperature : 37 °C
- Water quantity : ca. 13 m3/h
- Temperature rise, appr. : 5 K
- Operating pressure : max. 8 bar
- Test pressure : 12 bar
- Cooling water quality :
- Fouling factor : 0,00018 SK/J
- Cooling water tubing : DN100 flange
 Stop valve with mechanical assurance
 possibility at in- and outlet,
 pressure control valve (8 bar) is
 provided
- Position of water adapter : right (view from DE)
- Cooler design : GEA
- Tubes : Stainless steel
- Ribs : Stainless steel or aluminium
- Body : Rust-free steel
- Tube bottom : CuZN38 or stainless steel
- Water chambers : Steel
- Internal protection water side : Rilsan coating
- Air side : Sand blasting and primed or zinc plated

Noise level : 85 + 0 tol. dB(A) (guaranteed)

Mounting : IM 1001 (B3)

Shaft end(s) : 1, normal, cylindrical

Type of bearings : Flange sleeve bearings with forced
 oil lubrication.

- Oil quantity : appr. 6 l/min for both bearings
- Oil quality : ISO VG 46
- Oil pressure : 5 - 10 kPa (0.05 - 0.1 bar)
- Oil inlet temperature : max. 45 °C
- Bearing play, axial : +/- 3 mm
- Position of oil adapter : right (view on DE)
- 1 piece fluid thermometer make Sika in the oil return
- 1 piece pressure advice in the oil inlet
- 1 piece oil pressure reduction-valve

DE-Bearing : insulated
 Coupling : direct, flexible
 Axial play limit : +/- 1 mm
 Additional load : none

Installation : indoor
 Ambient temperature min./max.: 0 / +40 °C
 Site elevation max. : 1000 m above sea level
 Climatic protection stage : K2 (protection against 100 % air humidity and chemically aggressive atmosphere)
 Final painting : Standard RAL 5012

Main terminal box : 1
 - Degree of protection : IP 55
 - Amount of connections : 3
 - Position : on the left hand side (view on DE)
 - Cable entrance : from bottom
 - Execution : with tear seam
 - Amount of cables : undrilled cable entrance plate
 - Diameter of cables : undrilled cable entrance plate

Star point terminal box : right (view on DE)
 Execution : like main terminal box

Auxiliary terminal box : 2, separated for Pt 100 and space heater
 - Position, from DE : on the right hand side
 - Cable entrances : undrilled cable entrance plate

Balancing quality : G 2,5 acc. to DIN ISO 1940 - 1
 (The rotor will be balanced with half key in accordance with DIN VDE 0530 part 14.)

Smoothness of running : Grade N according to EN 60034-14
 Shaft oscillation : max. 50 ym top-top

Accessories:
 - 6 RTD's (Pt 100) in the stator winding
 - 1 duplex-RTD (Pt 100) on each bearing side (at DE bearing in below bearing shell)
 1 Pt 100 on each bearing side on reserve
 - Monitoring equipments not included in our delivery
 - All Pt 100 in 2-wire design from the element
 - All Pt 100 in 2-wire design from the terminal box

Oil tubing : see above
 Water tubing : see above

Bently Nevada DE & NDE
 - 2 drillings for Bently Nevada-sensor (90° displaced),
 - BN990 transmitter with 3300 encoder

- Fixing material:
- VibraCons, bolts for steel frame
- Space heater (230 V AC), executed to an own auxiliary terminal box

4 Transport and storage

4.1 Transport

Delivery

The machines are delivered completely mounted. Assembly and foundation bolts are included in the packaging. In principle all the supporting shims required to align the equipment properly are included in the supply. The packaging is conform to requirements according to order.



Do not lift the machine over the cooler housing!

Rust protection

All bare surfaces which are susceptible to rust will be given a protective coating before being packed.

Transport safeguard

To ensure that the bearings are protected during transport all machines are fitted with transport safeguard devices.

Corresponding instruction plates are placed on the machine.



Before operation the safeguard device and / or the transportation covers must be removed.

Dimensions and weights

The dimensions and weights can be inferred from the [data sheet](#) and/or [outline drawing](#).



For the lifting of the machine you must use the lifting noses!

Package disposal

The package must be dispose by the local waste industry law.

4.2 Storage

The machines should be stored in a dry, vibration-free and well ventilated warehouse.

Dimensions and weights

The dimensions and weights can be inferred from the [data sheet](#) and/or [outline drawing](#).

Intermediate storage

If the machines have to be stored intermediately, the following has to be considered:



The machines shall be stored in a dry, dust- and shock less room which has to be kept at an adequate temperature. The machines may not be directly exposed to any influences of the weather (e.g. rain, solar radiation).

Long time storage

For long time storage without operation the machines have to be protected as follows:



**All bright surfaces must be conserved by means of corrosion protection (e.g. Tectyl).
In order to prevent damages of the bearings caused by non - operation, the machines should be switched on resp. turned for a short time at least every 3 months.**

Before you put the machine in operation you must change the grease and the insulation resistance of the winding must be measured. (See [5.3 Start up of machine](#))

If a turning of the machine should not be possible during the storage, also the bearings must be renewed before start-up.

For the storage of the radiators see notes of the manufacturer in the [appendix](#).

5 Installation and operation

5.1 Installation and alignment

Trained personnel and precise tools are needed for exact installation and alignment. A solid anchorage on a suitable foundation is required. The shaft height is made with a tolerance (see [outline drawing](#)) to allow for adjustment. A set of shims approx. 1 to 2 mm thick of 0,1 to 0,5 mm sheet metal has to be placed between machine and foundation.

Coupling

The coupling has to be equipped with an axial displacement limitation. The permissible axial displacement is stated on the [data sheet](#) and/or on the [outline drawing](#).

Cooling water supply connection

The air to water heat exchanger or exchangers are to be connected to a cooling water supply system. For cooling water data see [data sheet](#) and the description of the manufacturer in the [appendix](#).

5.2 Electrical connections

Before connecting the machine to the network, the relevant safety instructions and the appropriate national regulations have to be observed.

Power requirement, mains voltage and frequency have to correspond with the indicated data on the name plate of the machine.

Line connection

The line connection must be as per the [connection diagram](#) fitted to the inside of the terminal box.

Connection of auxiliary equipment

The auxiliary equipment must be connected as per the [connection diagrams](#) supplied inside the auxiliary terminal boxes.

Earthing connection

An earthing terminal is located on the machine casing labelled with an earthing symbol and suitable for earthing conductor or strip for the earth connection.

Another earthing terminal is placed inside the terminal box for earthing of the cables.

Earthing conductors should have a cross-section as follows:

Main- short circuit power	Minimum cross-section of Cu-conductor at a nominal voltage of	
	6 kV	10 kV
< 200 MVA	70 mm ²	70 mm ²
>200-250 MVA	95 mm ²	70 mm ²
>250-350 MVA	150 mm ²	95 mm ²
>350-500 MVA	185 mm ²	150 mm ²
>500-800 MVA	--- ---	185 mm ²

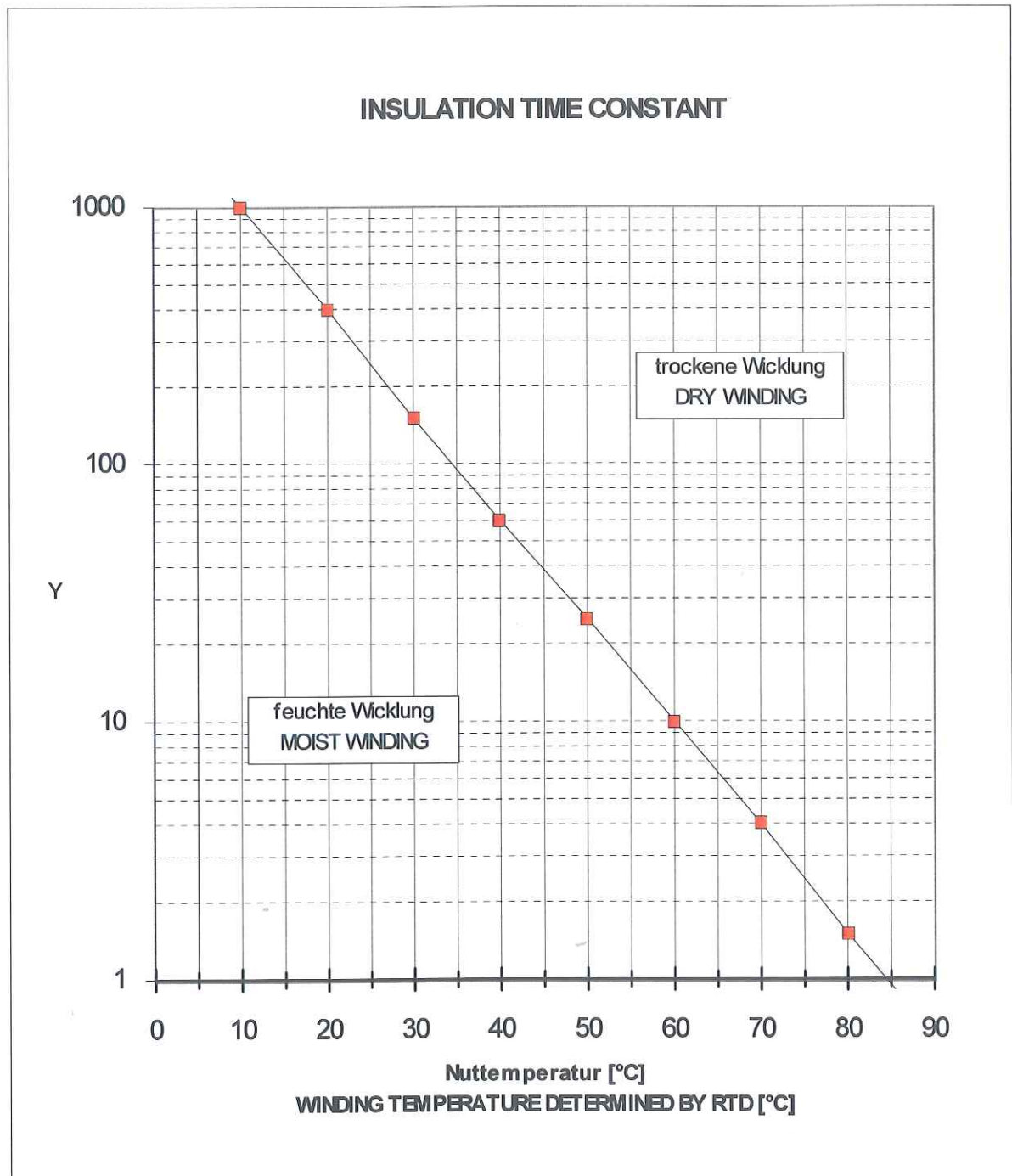
5.3 Start up of machine

Checking of insulation resistance

The machine is equipped with windings being unsensitive against humidity. Nevertheless humidity will condense under unfavourable climatic conditions on the surface of the windings, the parts surrounding the windings, and on the supportings and connections to the terminals. By this fact, it is important to measure the insulation resistance towards earth before first start up and after extended outage. If the winding is connected in star or in delta it is sufficient to determine the insulation resistance of one phase towards earth. The insulation resistance depends on the temperature of the winding. For justification of the insulation condition it is essential to measure the insulation resistance R (in $M\Omega$) during 1 minute by means of DC-voltage. A measuring voltage of 1000 V is preferable. In doing so the temperature of the winding has to be approximately determined.

In order to obtain an evaluation hardly depending on the size of the machine the capacity C (μF) towards earth has to be determined, too, or taken from the test certificate. The measurement of the capacity may be done by means of a capacitance measuring bridge or can be taken from a measurement of current voltage using 230 V AC. The product of insulation resistance and capacity is to be listed in the enclosed diagram over the determined winding temperature. Depending on the location of the point within the ranges "DRY WINDING" or "MOIST WINDING" the machine is ready for starting-up or has to be dried out by proper means until the condition for starting-up is achieved. The drying out should be done with warm air taking care of the possibility of air exchange. Any method of drying that involves heating the winding must be checked and controlled so that the winding temperature in the stator and rotor does not exceed 60 °C. The manufacturer is always at your disposal if you need additional informations in special cases.

Diagram see next page!



$Y \Rightarrow$ Isolationszeitkonstante T / INSULATION TIME CONSTANT T

$$T = R \text{ [M}\Omega\text{]} \times C \text{ [}\mu\text{F}\text{]}$$

Operation of heat exchanger

Before each start-up of the machine, the cooling water supply is to be started and the function to be controlled. For cooling water data see [data sheet](#).

During first operation the quantity of cooling water must be set, taking care of the winding temperature not to exceed the allowable temperature.

See description of the supplier of the heat exchanger in the [appendix](#).

Check list for first start up

The machine is surely installed:

Screw firmly attraction?

☐

After longer storage or stop:

Insulation resistances of the windings ok?

☐

Examine the electrical connections:

Correct connection?

Perfect condition of the terminals?

Terminal distances ok?

Mechanical firmness given?

Electrical conductivity?

☐
☐
☐
☐
☐

Protection device:

Everything ok?

None manipulates?

Function control?

☐
☐
☐

Transport safeguard devices:

Are all from the machine shaft removed?

☐

Examine the free movement:

Correct adjustment?

☐

Lock the covers and cover plates:

Are all again properly locked?

☐

Examine the direction of rotation:

The machine turns into the correct direction?

☐
Abnormal behavior:

Vibrations?

Noise?

Temperatures?

☐
☐
☐
Cooling:

Sufficient cooling ensures?

Cooling water flow and temperature ok?

☐
☐
Bearings:

Function control during operation?

☐
Machine is ready for use!
☐

The first start up was accomplished by:

Confirmation to the manufacturer

Name:

Date:

Company:

Signature:

.....

.....

6 Maintenance

General



Before starting any work on the machine, check that it is switched off and blocked up for switching on again.

Of vital importance for a long satisfactory operation of the machine is the way the machine is operated and the degree of care taken over its maintenance.

One of the most important factors is keeping all cooling air paths clean. It is therefore necessary to clean the machine at intervals decided on once the equipment is set up and in accordance with local environmental conditions.

The machine should be checked regularly for abnormal vibrations, abnormal operating noises and any other changes. The cause of whatever has occurred, should be determined and the fault remedied. In normal operating conditions we recommend that the equipment should be serviced after a maximum of two years operation.

6.1 Maintenance of bearings

Sleeve bearings - forced feed lubrication

If the initial operating instructions are observed, the maintenance of the sleeve bearings is restricted to periodic temperature checks, oil level checks and observance of the oil change intervals. The inspection hole in the casing should be used to check the proper turning of the lubricating oil ring.

During the first days and weeks of operation or after a change of the bearing shell, the bearings have to be watched carefully; particularly the oil level, oil flow and bearing temperature should be checked regularly.

Oil changes have to be made if necessary. Use only high grade non-foaming oils.



If for whatever reason the bearing temperature rises more than 40 °C above ambient temperature, the equipment must be switched off and the reason for this abnormal rise in temperature ascertained.

If the lining of the bearing shell is very worn it should be renewed or replaced by a new bearing shell. See the [table showing wearing parts](#).

Bearing temperature

If after start up, or during operation, the actual bearing temperature is considerably higher than normally or as calculated the machine has to be switched off and the cause be found.

6.2 Maintenance of windings

Cleaning and maintenance of windings

Dust and dirt are the biggest enemies of all mechanical equipment, particularly of stator windings. Depending on the amount of dirt, they should be cleaned when checked. Increased winding temperatures are usually the result of a dirty winding, or dirt in the cooling air ducts or in the heat exchanger itself.

In order to ensure that no damage is done to the insulation, no tools with sharp edges may be used for cleaning the winding. Windings covered with loose dust should be blown out thoroughly using dry compressed air or cleaned by means of a vacuum cleaner. It is particularly important to clean the cooling air ducts in the stator core. Plastic nozzles should be used if at all possible. Wipe down sticky dirt and dust with a dry cloth, and this applies to oily patches too. Where the dirt is stubborn, moisten a clean cloth using Ekanol and then wring it well, so that the solvent only attacks the dirt on the surface.

Wipe down treated area with a dry cloth and remove all solvent traces. Avoid directly spraying the winding with cleansing agent.

If layers of paint are attacked despite careful cleaning, they should be repainted where deficient using an insulating paint which resists oil and which dries naturally.

The paints used must be compatible with those used by the manufacturers. Please consult us if is any doubt.

6.3 Maintenance of heat exchanger

Maintenance

For maintenance of cooler see description of the manufacturer in the appendix.

See [data sheet](#) and [appendix](#).

Maintenance overview

Maintenance work	period of time
cooling water analysis	1 year
water flow measuring, inlet - outlet temperature control	1 month
inside cleaning	1 year
corrosion control	1 year
sealings, valves inspection	3 months

The specifications in the maintenance plan are recommended minimum entries and do not apply after longer downtimes. They have to be adapted to the ambient operating conditions and do not give a operating warranty at compliance.

A detailed description of the cooler is to find in the [appendix](#).

Dismantling

The cooler are fixed at the machine via an air -direction changing box. See [outline drawing](#). The fixing has to be done on both sides with a pressure-frame.

If it is necessary to change the cooler, the water connections and the pressure frame have to be disassembled. Afterwards the cooler can be slid out on one side.

7 Disassembling, assembling, repairs

Dismantling of the machine is usually not required for normal maintenance work. The machine has only to be dismantled in case that the bearings have to be changed.

For installation and service works you have the possibility to keep the services of ELIN EBG Motoren GmbH busy.



We can not take on the liability resp. responsibility for independent works on machine which not be carried out by experts of our company.

8 Warranty / Failure

In case of any warranty claims, the "General Terms of Delivery of the Austrian Electric and Electronic Industry" shall apply for goods supplied within Austria.

For supplies to foreign countries, our "General Terms of Delivery" shall apply. They are essentially based on the recommendations of the "United Nations Economic Commission for Europe".



We want to emphasize that we will not assume any liability in case of non-observance of this Installation, Operating and Maintenance Instruction.

We also can not take on the liability resp. guarantee for damages on the machine which has been caused by independent works resp. not under the supervision of experts of our company.

Not to loose the right to guarantee, please inform in any way our department „Services“

ELIN EBG Motoren GmbH

Dep. Services

Elingasse 3

8160 Weiz

Austria

Phone: (+43/3172) 606 – 2463

Fax: (+43/3172) 5850

E-mail : serviceemg@elinebg.at

8.1 Failure



If there occurs any failures you must switch off the machine and please contact our service-department (address see above). In the appendix you have some failure reports which you can send us by fax. So we can treat your failure diagnosis faster. The machine may not be switch on without our agreement.

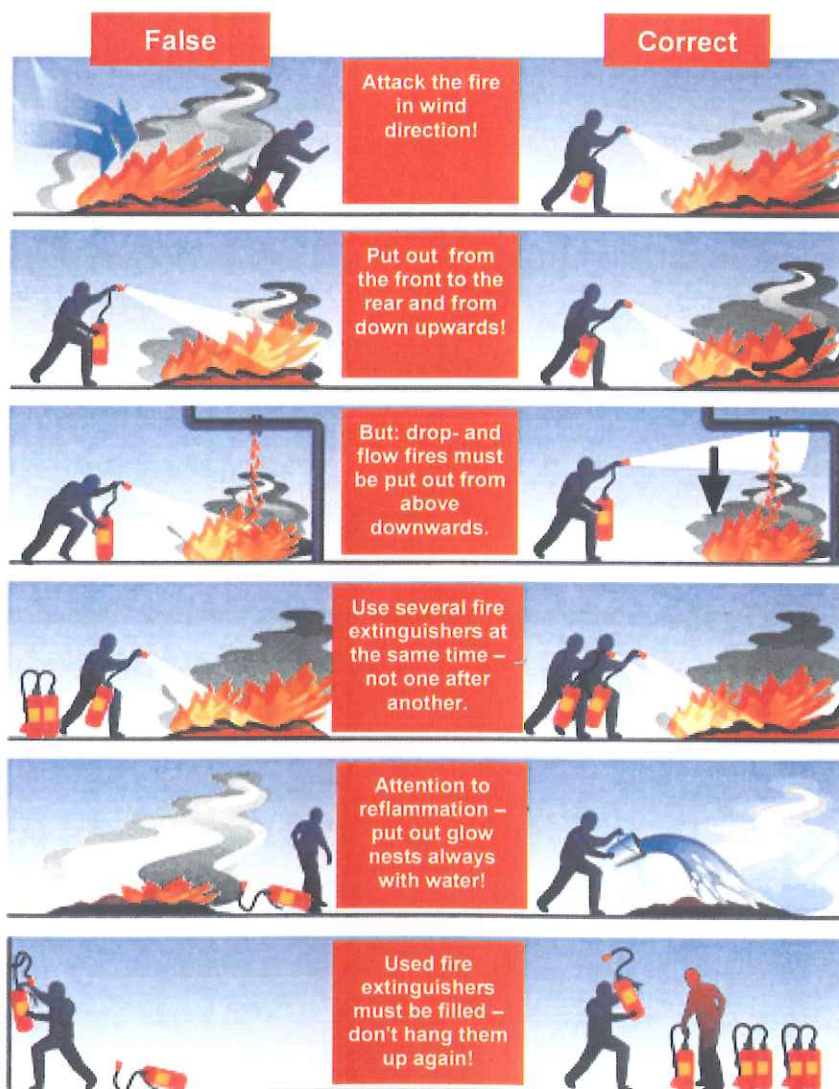
Electronic failure report

9 Emergency data

9.1 Fire fighting



- 1) Switch off the machine immediately
- 2) Secure against restarting
- 3) Contact the fire department and refer to electrical fire
- 4) Fight fire with suitable extinction agent (e.g. CO₂ - Fire extinguisher)



9.2 First aid measures by accidents with electrical current



By accidents with electrical current you should take the following measures:

- ◆ Interruption of circuit by switching off, by pulling the plug, by taking the safety device out.
- ◆ If these measures are not immediately possible, casualty must be pulled away from the electric circuit by using non conductive articles.
- ◆ Call a doctor!
- ◆ **Emergency call:**
Rescue guidance center Phone:
- ◆ Accomplish first aid measures up to the arrival of the doctor.
 - immediate placing in rest position
 - control of respiration and pulse
 - when respiratory arrest then breath donation
 - when cycle stop then heart-lung-revival
 - when unconsciousness and existing respiration then side storage
 - germ-free coverage of the fire wounds

10 Spare Parts

10.1 Spare parts inventory

A list of the parts subjected to wear is attached to the specification. This list shows those parts which are usually required. There is a precise distinction between parts subjected to normal wear and tear, which can therefore be regarded as "required" spare parts, and parts that might become faulty and are therefore merely "recommended" spare parts.

10.2 Order procedure

Ordering address:

ELIN EBG Motoren GmbH
Dep. Services
Elingasse 3
8160 Weiz
Austria

Phone: (+43/3172) 606 – 2463
Fax: (+43/3172) 5850
E-mail : serviceemg@elinebg.at

Necessary data for a perfect order processing:

Machine data:

Type: HKM 156 Z02
Serial no.: 526018 05001

Data of spare parts: (e.g.: RENK bearing shell DE)

Stock no. : 5980235
Spare part : EFZLB 11-110
Quantity : 1 piece

List of revisions

Date of issue	Issue	Modified page	Kind of modification
11.05.2005	01	---	First Edition / gh



Use confirmation

I confirm that I read the operating manual attentively and I will keep the aforementioned regulations and references.

The operating manual read of:

..... Signature Date
..... Signature Date
..... Signature Date
..... Signature Date
..... Signature Date

ELIN EBG Motoren GmbH

Elingasse 3
8160 Weiz
Austria

Phone: (+43/3172) 606 – 0
Fax: (+43/3172) 606 – 784
E-mail: contactemg@elinebg.at
Internet: www.elinebgmotoren.at

Appendix

Drawings

Outline drawing machine	Dg.no. 5860375	1 page
Sectional drawing machine	w. Dg.no.	1 page
Power terminal box	Dg.no. 5860295	1 page
Neutral terminal box	Dg.no. 5860295A	1 page
Instrumentation terminal box	Dg.no. 5860390	1 page
Juction box space heater	Dg.no. 5860509	1 page
Connection diagram stator	Dg.no. 5203198	1 page
Connection diagram control devices	Dg.no. 5882008	1 page
Connection diagram space heater	Dg.no. 5860301	1 page
Shaft dimension drawing	Dg.no. 5860436	1 Seite
Starting characteristics 526018 05001-002		1 page

Descriptions

GEA cooler drawing + cooler description	10 page
RENK sleeve bearing DE EMZLB 11 – 110 / NDE EMZLQ 11 - 110 insol.	6 pages

Declaration of conformity

Form	2 pages
----------------------	---------

Tables

PT - Calibration	w. Dg.no.	1 page
Guide values for adjustment of tripping temperatures	w. Dg.no.	1 page

Failure report

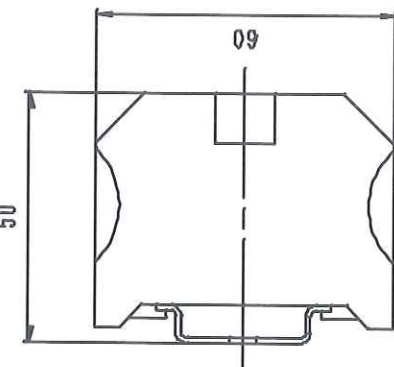
Form	QC4-EMG02-002E	1 page
----------------------	----------------	--------

Technical drawing of a rectangular electronic device, likely a control unit or interface. The drawing includes the following dimensions and features:

- Overall Dimensions:**
 - Width: 250
 - Height: 240
- Internal Dimensions and Features:**
 - Top edge: 50 (width of the top section)
 - Left edge: 65 (width of the left section)
 - Right edge: 65 (width of the right section)
 - Bottom edge: 110 (width of the bottom section)
- Component Grid:**
 - A grid of components is located in the center-right area, labeled with numbers 1 through 20.
 - The grid is divided into two columns of 10 components each.
 - The components are labeled with numbers 1 through 20, with the first column containing odd numbers (1, 3, 5, 7, 9, 11, 13, 15, 17, 19) and the second column containing even numbers (2, 4, 6, 8, 10, 12, 14, 16, 18, 20).
- Other Features:**
 - Three circular components are located on the left side, with a diameter of $\varnothing 35.5$.
 - The text "Kern v. P. 739" is written near the circular components.
 - The drawing includes various mounting holes and internal wiring connections.

Änderung/Modifikation

6E19716ES EIGENES MATHIN DER
UND DORT MIT IHNEN WERDEN
LERNEN, VERLEBEN UND VORAN-
GEHT. ABER NICHT DIE UNTER-
SUCHUNG.

[illegible]

0	21.04.05	Hoerz	first issue	Hoerz	
Rev	Date	Drawn by	revisions	check by	appr hv

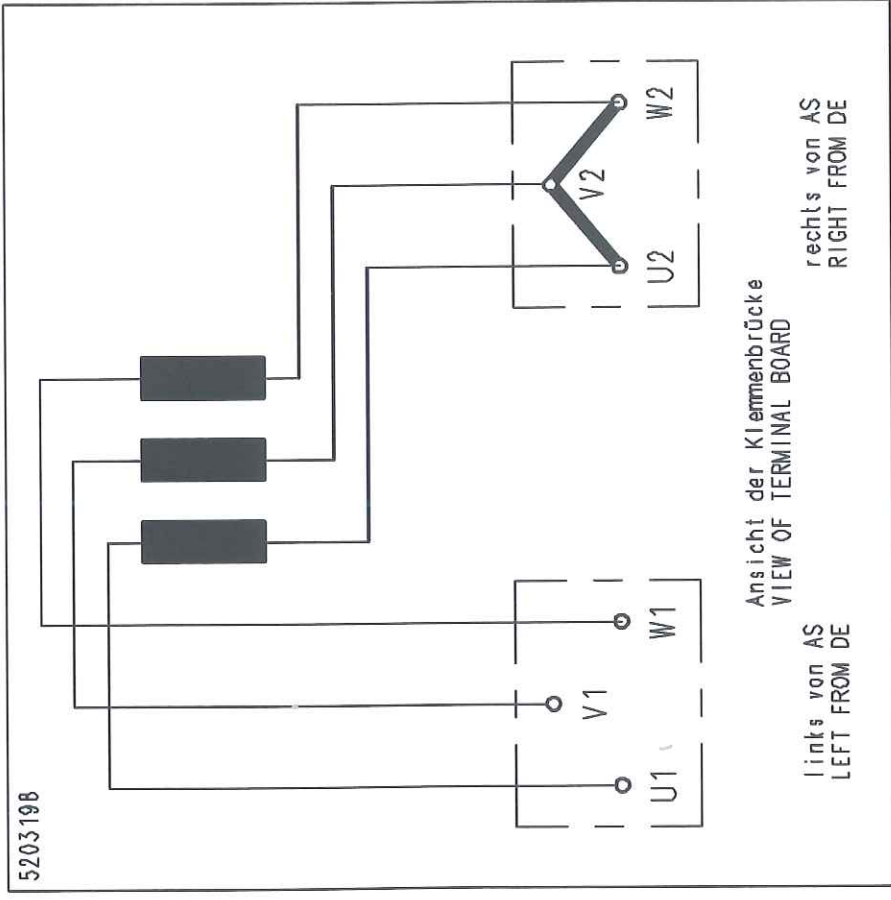
Betr. Stockliste	A:	B:	C:
Werkst.	Anlage / PLANT	Mat. Nr. 520018	Oberfläche / SURFACE
SCALE	Kunde / PURCH.	Projekt Nr.	
1 : 1	Type	Klappen Nr.	EG
Bearb./DES	5.04.05	FBrz	
Gepf./CHECK			
		Allgemeine Informationen GENERAL TOL. ISO 2768-MK DIN EN ISO 9001	
		Bl. / SHIT	ventOF
Junction Box		5860509	
Space Heater		And. / MOD	
		Abn. Z. / SIM. TO	5897554
		Ers.f. / SUBST.FOR	
End.Nr. 5860509-114	Mappen Nr. 20 Messk.L.	Ers.d. / REPL.BY	

1	Neues Original	15.4.99	W0.		
A	Änderung/MODIFICATION	DAT.	NAME	APP.	

0	21.04.05	Hoerz	first issue		
	Rev	Date	Drawn by	revisions	
				check by	Holzer
				appr. by	

Schaltbild
6 Ständerklemmen
Sternschaltung

CONNECTION DIAGRAM
6 STATOR TERMINALS
STAR CONNECTION



N° AFFAIRE	Format	Groupe	N°
Rev			
KOSICE 50-3023-01	A4	711	510
0			

Anlage/PLANT		Kl. Nr.		Maßst. SCALE		Bearb./DES		15.4.99		Wonisch	
Kunde/PURCH.						Gepr./CHECK					
Type *	Ers.d./REPL.										
Proj.Nr.	Ers.f./SUBST.	5203198 vom 5.4.94		Freimaßst. GENERAL TOI							
Mat.Nr.	BG *			EN 131		Mod.Nr. A5203198 SCHB		Mp.Nr. 214/8			

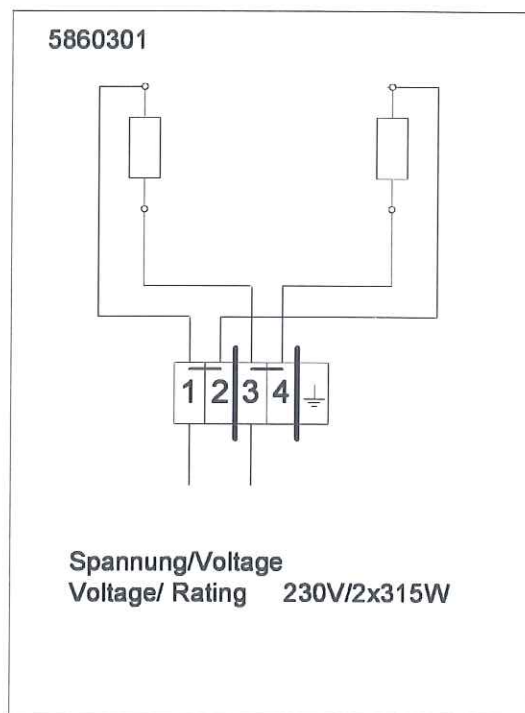
Schaltbild

Connection Diagram Stator

ELIN EBG Motoren GmbH		5203198		Bl./SHT		von/OF	
Änd./MOD	1						
Änrl.Z./SIM.DR.:						m A4	

-		-	-	-
-		-	-	-
-		-	-	-
Ä	Änderung		Datum	Name App.

Ä	Änderung	Datum	Name	App.
x			x	x
x			x	x
x			x	x
x			x	x



Connection diagramm

Hörz	6.12.04
------	---------

N° AFFAIRE	Format	Groupe	N°
Rev			
KOSICE 50-3023-01	A4	711	512/1
0			



Änd. / MOD	-	-	-	-	-	-	
------------	---	---	---	---	---	---	--

Fabrikationsnr. / Serial no.: 526018 05001 - 002

Projekt / project: Air-Liquide / Kosice

Hochlaufkurve

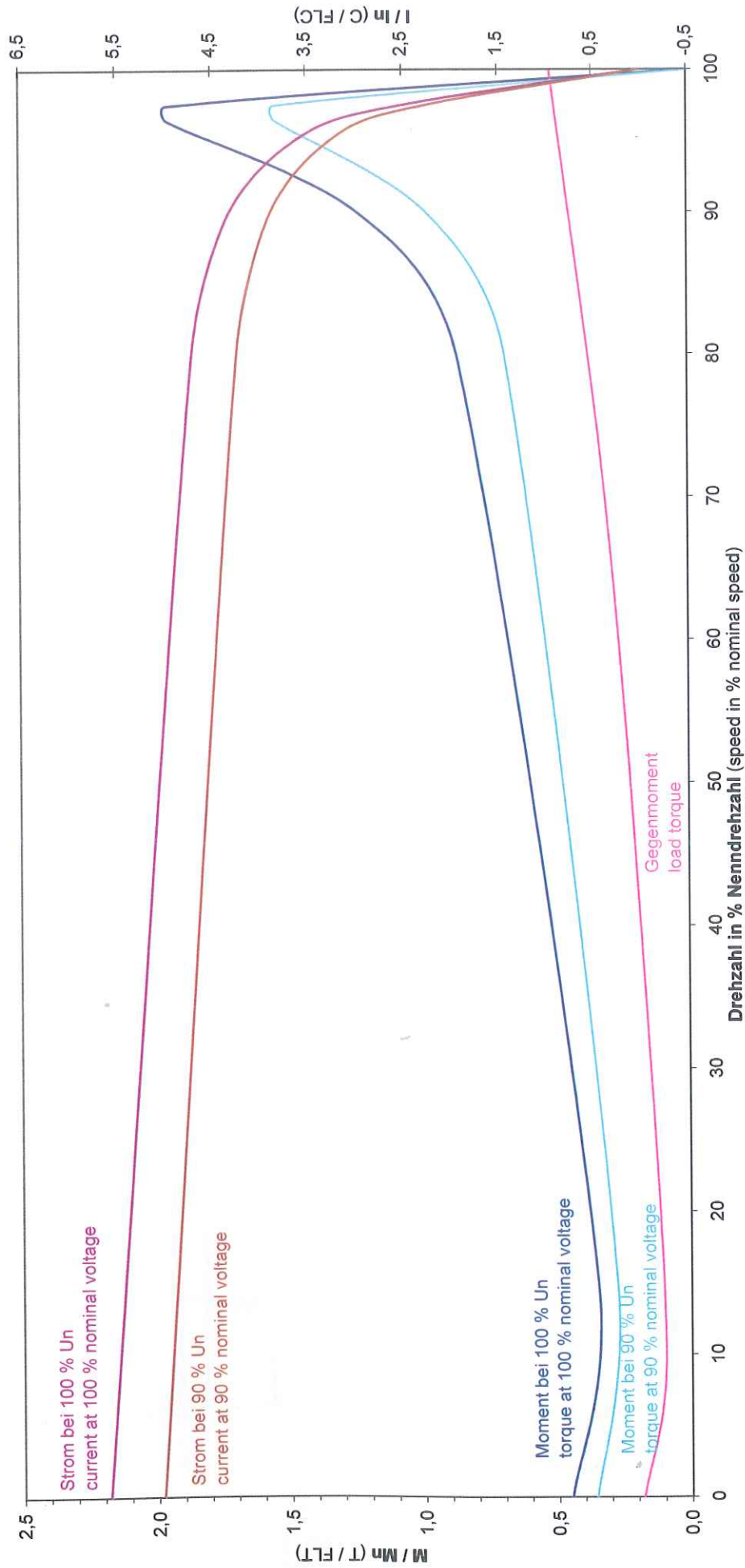
Start-up behavior

Motordaten / motor data:

$P_N = 1700 \text{ kW}$
 $M_N = 5451 \text{ Nm}$
 $U_N = 6000 \text{ V}$
 $I_N = 189 \text{ A}$
 $t_A \text{ at } 100\% U_N = 10 \text{ sec.}$
 $f = 50 \text{ Hz}$
 $n_N = 2978 \text{ rpm}$
 $J_{Mot} = 25 \text{ kgm}^2$
 $J_{Last} = 44 \text{ kgm}^2$
 $t_A \text{ at } 90\% U_N = 15 \text{ sec.}$

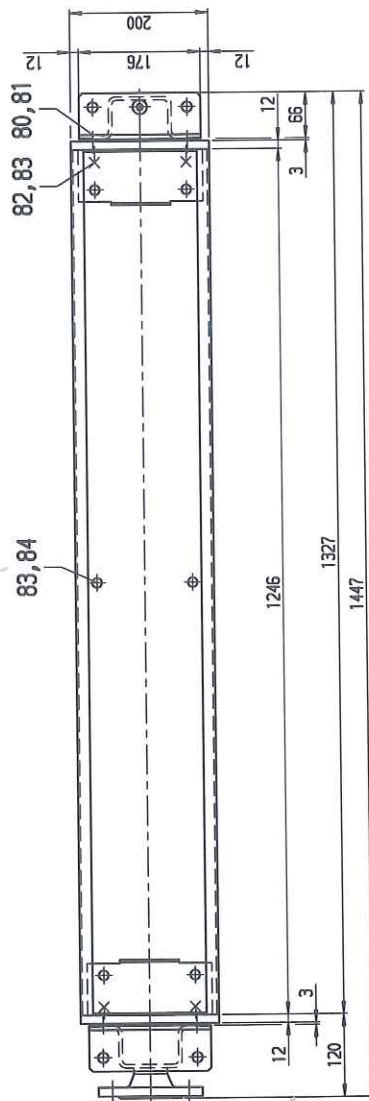
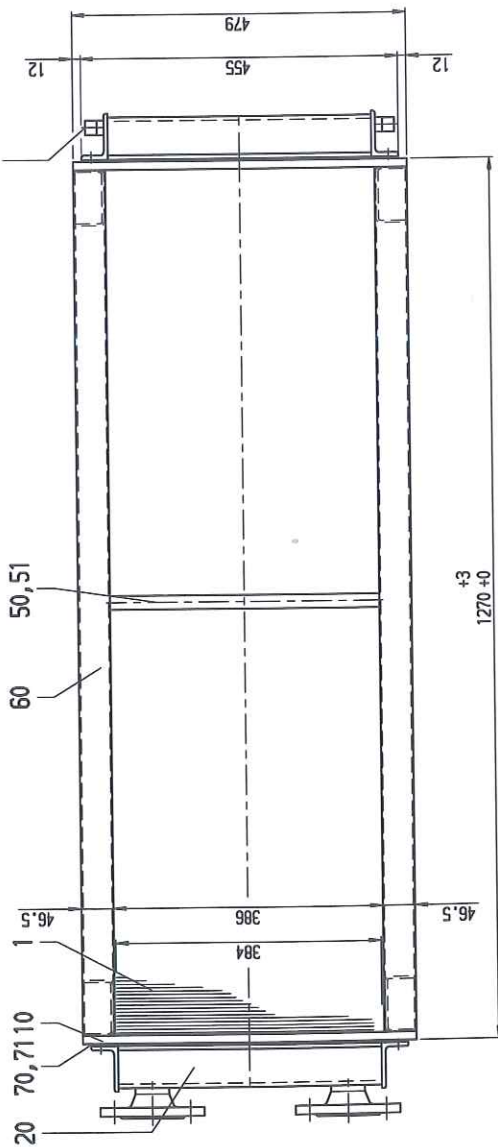
Motor type HKM - 156 Z02

Drehstrom - Asynchronmotor / Three phase squirrel cage induction motor



		N° AFFAIRE		Format	Groupe	N°
		Rev				
		Kosice 50-3023-01		A4	711	507
0	21.12.04	Schneeflock	first issue	Holzer	check by	appr. by
Rev	Date	Drawn by	revisions			

88 Entlüftung/Entleerung 61/2



Zul. Betriebsdruck PERM. OPERATING GAUGE PRESS.		8 bar	Inhalt CONTENTS	- 8 l						
Prüfdruck TEST GAUGE PRESS.		12 bar								
Gewicht WEIGHT		ohne Wasser WITHOUT WATER	- 92 kg							
Allgemeintoleranzen nach DIN ISO 2768 - s LIMIT OF ACCURACY ACC. TO DIN ISO 2768 - s										
Betriebs- und Montageanleitung nach GEA 0156 01 OPERATING- AND MOUNTING MANUAL ACC. TO 11 49 0156 01										
Rev.	1	Änderung / Modification								
2005	Date									
Proj.-Nr.	Proj. No.									
Kor.	Order No.									
Best.	Customer									
Code	Code									
Appr.	Appr.									
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr.		Proj. No.								
Kor.		Order No.								
Best.		Customer								
Code		Code								
Appr.		Appr.								
SIP-Nr.		1008 8615	SIP-Nr.							
Name		Name								
Proj.-Nr										

**Betriebs- und Wartungsanleitung
Operation and Maintenance Instruction**

GEA Kreislaukühler

GEA Circuit Cooler

**für Elektromotoren und Generatoren
for Electric Motors and Generators**

Deutsch/English

**11 49 0156 01
Ausgabe/Edition: 3.0
Version 2.2000
Vöge EE**

Inhaltsverzeichnis

Artikel	Titel	Seite
1.	Allgemein	3
2.	Konstruktionsbeschreibung	3
3.	Lagerung, Ein- und Ausbau des Kühlers	4
3.1	Lagerung	4
3.2	Einbau des Kühlers	4
3.3	Ausbau des Kühlers	4
4.	Inbetriebnahme	5
4.1	Dichtprobe	5
4.2	Entlüftung	5
4.3	Offener Kühlkreislauf	5
4.3.1	Kühlwassermengenstrom	5
4.3.2	Schutzschicht	6
4.4	Geschlossener Kühlkreislauf	6
4.4.1	Kühlwassermengenstrom	6
4.4.2	Schutzschicht	6
5.	Betriebsstillstand	7
5.1	Betriebsstillstand bei offenem Kühlkreislauf	7
5.2	Betriebsstillstand bei geschlossenem Kühlkreislauf	7
5.3	Betriebsstillstand bei Frostgefahr	7
6.	Wartung und Reinigung	7
6.1	Mechanische Reinigung der Rohre	8
6.2	Chemische Reinigung der Rohre	8
7.	Reparatur bei Wasserleckagen	8

Contents

Item	Title	Page
1.	General	3
2.	Design Description	3
3.	Storage Installation and Removing of Cooler Bundles	4
3.1	Storage	4
3.2	Installation of Cooler Bundles	4
3.3	Removing of Cooler Bundles	4
4.	Commissioning	5
4.1	Pressure Test	5
4.2	Venting	5
4.3	Open Cooling Circuit	5
4.3.1	Cooling Water Flow	5
4.3.2	Protective Film	6
4.4	Closed Cooling Circuit	6
4.4.1	Cooling Water Flow	6
4.4.2	Protective Film	6
5.	Standstill	7
5.1	Standstill in Case of Open Cooling Circuit	7
5.2	Standstill in Case of Closed Cooling Circuit	7
5.3	Standstill at Freezing Conditions	7
6.	Maintenance and Cleaning	7
6.1	Mechanical Cleaning of Tubes	8
6.2	Chemical Cleaning of Tubes	8
7.	Repair of Water Leakage's	8

1. Allgemein

Der Kreislaufkühler ist ein Rippenrohr-Wärmeaustauscher. Er hat die Aufgabe, die von der Umluft im Elektromotor oder Generator aufgenommene Wärme an das Kühlwasser zu übertragen. Das Kühlwasser fließt durch die Rohre. Um die Rippen strömt die Luft.

2. Konstruktionsbeschreibung

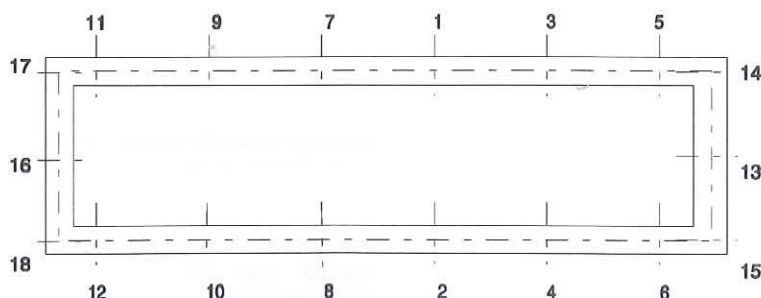
Der Kühler besteht, je nach Anforderung an die Kühlleistung, aus einem oder auch mehreren einzelnen Bündeln. Die Anordnung des Kühlers im Gesamtsystem ist anlagenabhängig und wird mit dem Hersteller der elektrischen Maschine abgestimmt. In der Regel wird der Kühler so angeordnet, daß die Luft im geschlossenen Kreislauf durch die Maschine und den Kühler geführt wird. Der Lufttransport erfolgt entweder durch Eigenbelüftung der Maschine oder durch Fremdbelüftung.

Je nach Anlagenkonzeption ist der Kühler in die elektrische Maschine eingeschoben oder in einen Luftkanal eingebaut.

Zwischen den beiden Rohrböden liegt das Rippenrohrbündel. Die Rohrhälse der Rohre sind wasserdicht in die Rohrböden eingewalzt.

Zur Wasserführung dienen Stutzen- und Umlenkwasserkammer. Die Kammern sind mit Flachdichtungen auf den Rohrböden verschraubt. Die Trennsteg für die Wasserwege werden durch Profildichtungen abgedichtet.

Die Verschraubung der Kammern erfolgt mit Kopf- oder Stiftschrauben und Muttern. Die Gewindeabmessung ist M12, in einzelnen Fällen M16. Die Vorspannung ist gleichmäßig in drei Stufen, jeweils von der Mitte der beiden Längsseiten entsprechend nachfolgendem Schema aufzubringen.



Die Gewinde sind mit Öl zu schmieren, andere Gleitmittel sind nicht zulässig.

Bei einer Elastomerdichtung aus EPDM (Gummiqualität) sind die 3 Stufen des Anzugdrehmoments:

Gewinde/thread	M12	- 25	- 50	- 73	Nm
Gewinde/thread	M16	- 40	- 80	- 115	Nm

1. General

The circuit cooler is a compact heat exchanger. The cooler transmits the thermal heat from the circuit air of the electric motor or generator to the cooling water. The cooling water flows through the tubes. The air flows around the fins.

2. Design Description

The cooler consists in accordance with the thermal requirements out of one or more single bundles. The design of the cooler arrangement is adapt together with the electric engine builder to the layout of the plant. Normally the air flows in a closed circuit through the engine and the cooler. The air is blown by a fan of the engine itself or by an additional fan.

In accordance to the plant draft the cooler is fitted to the engine as a slide in bundle or fitted into the air housing.

The fin tube bundle is arranged between the both tube sheets. The ends of the tubes are water tight rolled in into the tube sheets.

The headers are bolted to the tube sheets by insertion of gaskets. The separating baffles are sealed by a profile seal.

The headers are bolted with bolts or studs and nuts M12 in some cases with M16. The torque has to be given in three steps, each from the middle of both longitudinal sides of the headers, according following scheme.

The threads have to be oiled. Other lubricant are not allowed.

In case of a elastomer gasket out of EPDM (rubber quality) the three steps of the torque are:

Bei einer Dichtung aus gebundenem Aramidfasermaterial (Asbestersatz) sind die 3 Stufen:

In case of a aramidfibre gasket (asbestos substitute) the three steps are:

Gewinde/thread	M12	- 25	- 50	- 73	Nm
-----------------------	------------	-------------	-------------	-------------	-----------

Gewinde/thread	M16	- 60	- 120	- 180	Nm
-----------------------	------------	-------------	--------------	--------------	-----------

Die Seitenwände zwischen den Rohrböden dienen der Luftführung. Bei längeren Kühlern sind die Seitenwände untereinander mit Trageisen verbunden. Die Trageisen dienen gleichzeitig zur Schwingungsabstützung des Rippenrohrbündels.

The side walls between the tube sheets guiding the circuit air. In case of longer coolers the side walls are connected with support beams. The support beams additional support the tube stake against vibration.

Die Wasserräume der Kühlerbündel können über Verschraubungen entlüftet und entwässert werden.

The bundles can be drained or vented by plugs.

Der Wasseranschluß hat gemäß dem entsprechenden Kühler-Montageplan / Einbauzeichnung zu erfolgen.

The water pipes have to be connected according to the cooler mounting plan or installation plan.

3. Lagerung, Ein- und Ausbau des Kühlers

3. Storage, Installation and Removing of Cooler Bundles

3.1 Lagerung

3.1 Storage

Die Lagerung der Kühler hat vor dem Einbau in einer gut belüfteten, trockenen Halle zu erfolgen. Sie sind gegen Verschmutzung abzudecken und vor mechanischer Beschädigung zu schützen.

The coolers have to be stored in a dry and vented hall. They have to be protected against dirt and mechanical damages.

Der Innenraum der Kühlerbündel ist vor dem Versand entwässert und die Wasseranschlußflansche sind mit Kunststoffkappen verschlossen worden. Das Rippenfeld ist mit einer Schutzplatte abgedeckt.

The inside of the cooler bundles is drained before dispatch. The water flanges are closed with plastic caps and the fin bay is covered with a protection plate.

3.2 Einbau des Kühlers

3.2 Installation of Cooler Bundles

Vor dem ersten Einbau des Kühlers sind die Schutzplatten vom Rippenfeld zu entfernen.

Before first installation the protection plates from the fin bay have to be removed. On the side walls are 4 lifting lugs with holes Ø 14 mm to mount Ø 12 shackles. In case of vertical fin tube arrangement lifting lugs are on the headers.

An den Seitenwänden der Bündel sind 4 Transporteisen mit Loch Ø14 mm angebracht, in die zum Transport Schäkel Ø12 angebracht werden können. Bei einer Einbaulage mit stehenden Rohren sind an den Kammern Transportösen vorgesehen.

The air connections have to be sealed with new gaskets provided at site against the outside air.

Die luftseitigen Anschlüsse sind mit bauseitig beizustellenden neuen Dichtungen gegen die Außenluft abzudichten.

The water connections have to be fitted to the water piping with new gaskets provided at site. All connections must be free of tensions.

Die wasserseitigen Anschlüsse sind mit bauseitig beizustellenden neuen Dichtungen mit dem Wasserleitungssystem zu verbinden. Alle Anschlüsse haben spannungsarm zu erfolgen, Verspannungen sind nicht zulässig.

3.3 Ausbau des Kühlers

3.3 Removing of Cooler Bundles

Vor dem Ausbau des Kühlers ist er wasserseitig zu entleeren. Der Ausbau der Bündel erfolgt in umgekehrter Reihenfolge wie der Einbau. Der Kühler ist an einem geeigneten Platz abzulegen. Das Rippenfeld ist vor Beschädigungen und Verschmutzungen zu schützen. Bei längerer Lagerzeit sind auch die Wasseranschlüsse zu verschließen.

Before removing the cooler has to be drained. Removing the cooler is carried out vice versa as the mounting. The cooler has to be deposit at a suitable place. The fin bay has to be protected against damages and dirt. For long term storage the water connections have also be closed.

4. Inbetriebnahme

4.1 Dichtprobe

Nach dem Anschluß der Wasserleitungen wird vor der eigentlichen Inbetriebnahme eine Wasserdruckprobe mit sauberem Wasser (Trinkwasserqualität) empfohlen. Wird der Kühler nicht unmittelbar danach in Betrieb genommen, ist der Kühler zu entleeren (siehe Betriebsstillstand Artikel 5).

Nach längeren Lagerzeiten und auch nach längeren Stillstandszeiten sind die Kammerschrauben generell mit dem vorgeschriebenen Drehmoment zu überprüfen, bei Bedarf nachzuziehen und auf Dichtigkeit zu überprüfen. Sollten die Bündel im Bereich der Dichtung dann undicht sein, sind die Dichtungen auszuwechseln (siehe Konstruktionsbeschreibung Artikel 2).

4.2 Entlüftung

Die Entlüftung der Wasserräume erfolgt über die Entlüftungsschrauben an der Stutzenkammer. An diesem Anschluß kann auch eine Dauerentlüftung zum Wasseraustritt angeschlossen werden.

4.3 Offener Kühlkreislauf

4.3.1 Kühlwassermengenstrom

Der Mengenstrom ist entsprechend den Auslegungsdaten einzustellen.

Häufige Schwankungen der Wassergeschwindigkeit sind nachteilig für eine natürliche Schutzschichtausbildung gegenüber Korrosion. Bei offenen Kühlkreisläufen (Durchlaufkühlung, Kühlturmwasser) kann eine zu geringe Wassergeschwindigkeit zu gefährlichen Schmutzablagerungen führen, eine zu hohe Geschwindigkeit zu Erosion. Bei offenen Kühlkreisläufen darf die Mindestgeschwindigkeit nicht über einen längeren Zeitraum eingestellt werden.

Folgende Grenzggeschwindigkeiten sind einzuhalten

4. Commissioning

4.1 Pressure Test

After the water pipes have been connected GEA, however, recommend to check the tightness prior to the commissioning. Clean water (drinking water quality) has to be used for the pressure test. If the commissioning didn't start immediate after the pressure test the cooler has to be drained (see item 5 Standstill).

After prolonged storage or extended standstill the header screws have to be checked with the recommended torque and shall be tightened with the recommended torque if necessary. After that the cooler has to be pressure tested. In case of leakage's the gaskets have to be changed (see item 2).

4.2 Venting

For cooler venting use the venting plug at the nozzle header. For continuously venting a venting pipe can be installed.

4.3 Open Cooling Circuit

4.3.1 Cooling Water Flow

The flow rate of cooling water has to be in accordance with the layout values of the cooler.

Frequent fluctuations of the water velocity impend the formation of a natural protective film against corrosion. In case of open cooling circuits too low water velocity encourages dangerous dirt deposits and too high velocity causes erosion. In case of open cooling water circuits never operate at min. velocity for a prolonged period.

The following water velocities have to be observed:

Material	DIN Material Nr./No.	vergleichbar comparable ASTM-Nr./No.	zulässige Grenzggeschwindigkeit m/s admissible Cooling Water Velocity m/s	
			min	max
CuNi10Fe1Mn	2.0872	B-111 C70600	1,5	2,5
CuNi30Mn1Fe	2.0882	B-111 C71500	1,5	3,0
CuZn28Sn1	2.0470	B-111.C44300	1,0	2,0
CuZn20Al	2.0460	B-111.C68700	1,0	2,2
Edelstahl Stainless Steel	1.4571	A-249 TP316Ti	1,5	3,0
Titan/Titanium Grad 1	3,7025	B-338 Gr. 1	1,0	4,0

4.3.2 Schutzschicht

Die chemische Beständigkeit von Kupferlegierungen, Edelstahl und Titan gegen Kühlwasser beruht auf Ihrer Fähigkeit zur Bildung schwerlöslicher natürlicher Schutzschichten.

Neue Kühlrohre, insbesondere Kupfernickelrohre, deren Schutzschicht noch nicht voll entwickelt ist, dürfen anfänglich nicht mit verschmutztem Wasser in Verbindung gebracht werden, da der sofort entstehende Schmutzfilm den Aufbau einer Schutzschicht stört.

Zur Wasserdruckprobe der Bündel darf deshalb nur sauberes Wasser (Trinkwasserqualität) verwendet werden.

Titan ist ein Werkstoff mit höchster Korrosionsbeständigkeit, die Anforderungen an die Kühlwasserqualität sind sehr gering. Bei der Druckprobe ist Wasser in Trinkwasserqualität nicht erforderlich.

4.4 Geschlossener Kühlkreislauf

4.4.1 Kühlwassermengenstrom

Der Mengenstrom ist entsprechend den Auslegungsdaten einzustellen.

Es muß sichergestellt sein, daß das Kreislaufwasser sauber ist und keine Ablagerungen in den Rohren erfolgen (Trinkwasserqualität).

Folgende maximale Geschwindigkeiten sind einzuhalten:

4.3.2 Protective Film

Material	DIN Material Nr./No.	vergleichbar comparable ASTM-Nr./No.	zulässige Grenzgeschwindigkeit m/s admissible Cooling Water Velocity m/s min max
Cu	2.0090	UNS-C12200	2,0
CuNi10Fe1Mn	2.0872	B-111 C70600	2,5

4.4.2 Schutzschicht

Die chemische Beständigkeit von Kupfer und Kupfernickellegierungen gegen Kühlwasser beruht auf Ihrer Fähigkeit zur Bildung schwerlöslicher natürlicher Schutzschichten.

Neue Kühlrohre deren Schutzschicht noch nicht voll entwickelt ist, dürfen nicht mit verschmutztem Wasser in Verbindung gebracht werden, da der sofort entstehende Schmutzfilm den Aufbau einer Schutzschicht stört.

Auch zur nachträglichen Wasserdruckprobe der Bündel darf deshalb nur sauberes Wasser verwendet werden.

4.3.2 Protective Film

The good chemical resistance of copper alloys, stainless steel and titanium against corrosion is due to their ability to form a natural protection coat which is difficult to dissolve .

New cooling tubes, especially copper alloy tubes, of which the protection coat has not yet fully developed shall not come into contact with contaminated water. The immediately forming dirt deposit will disturb the formation of a protective coat.

Water pressure test have to be done therefore only with clean water.

Titanium is a material with highest corrosion resistance. The recommendations to the cooling water quality are very low. Water in drinking water quality is therefor not necessary for the pressure test.

4.4 Closed Water Circuit

4.4.1 Cooling Water Flow

The flow rate of cooling water has to be in accordance with the layout values of the cooler.

It must be guaranteed that the circuit water is clean and no deposits in the tubes can occur (drinking water quality).

The following water velocities have to be observed:

4.4.2 Protective Film

The good chemical resistance of copper and copper nickel alloy against corrosion is due to their ability to form a natural protection coat which is difficult to dissolve .

New cooling tubes of which the protection coat has not yet fully developed shall not come into contact with contaminated water. The immediately forming dirt deposit will disturb the formation of a protective coat.

Water pressure test have to be done therefore only with clean water.

5. Betriebsstillstand

5.1 Betriebsstillstand bei offenem Kühlkreislauf

Wird der Kühler für mehr als 3 Tage aus dem Betrieb genommen, ist er grundsätzlich auf der Wasserseite zu entleeren.

Ein Stillstand ist besonders für wasserberührte Rohre aus Kupferlegierungen schädlich, wenn sich die Schutzschicht noch nicht voll ausgebildet hat oder aber die Gefahr ihrer Zerstörung durch Korrosion unter Ablagerungen besteht.

Nach Möglichkeit soll der Betrieb während der ersten 2 Monate nicht durch Stillstände unterbrochen werden. Fällt die Kühlwasserversorgung aus und wird der Betrieb innerhalb von 3 Tagen wieder aufgenommen, kann der Kühler mit Kühlwasser gefüllt stehenbleiben. Es muß aber sichergestellt sein, daß die Rohre frei von Ablagerungen sind.

Im Fall von Ablagerungen muß das Kühlwasser abgelassen, die Rohre gereinigt, mit sauberem Wasser gespült und anschließend getrocknet werden. Empfohlen wird das Durchblasen mit warmer vorgetrockneter Luft. Der Kühler muß ausreichend belüftet werden. Wird See-, Brack- oder salzreiches Wasser (Richtwert: Chloridgehalt ≥ 500 mg/l) als Kühlwasser eingesetzt, muß mit sauberem Wasser (Trinkwasserqualität) gespült werden.

Bei Stillständen von mehr als 3 Tagen innerhalb der Einfahrphase von 2 Monaten und später bei Stillständen von 2 Wochen und mehr, ist das gleiche Reinigungsverfahren anzuwenden.

Für kurze Betriebsunterbrechungen ist das Fahren niedriger Kühlwassermengen (Schleichströmung) günstiger als absoluter Kühlwasser-Stillstand.

5.2 Betriebsstillstand bei geschlossenem Kühlkreislauf

Für geschlossene Kühlkreisläufe ist Kreislaufwasser in Trinkwasserqualität vorgeschrieben (siehe Artikel 4.4). Unter diesen Voraussetzungen ist ein Entleeren der Wasserseite nicht erforderlich.

5.3 Betriebsstillstand bei Frostgefahr

Falls Stillstände im Winter auftreten und Einfriergefahr besteht, sind die Bündel auch bei kurzen Betriebsunterbrechungen zu entleeren.

6. Wartung und Reinigung

Die Luftseite unterliegt unter normalen Betriebsverhältnissen keiner Verschmutzung.

Bei geschlossenem Kühlkreislauf und der geforderten guten Wasserqualität ist auch die Wasserseite wartungsfrei. Ist durch mangelhafte Sorgfalt eine Verschmutzung des Kreislaufwassers entstanden, ist eine umgehende wasserseitige Reinigung erforderlich und das Wasser ist auszutauschen.

5. Standstill

5.1 Standstill in Case of Open Cooling Water Circuit

In case of standstills of more than 3 days the water side has to be drained.

A standstill is especially dangerous for copper alloy tubes in case of not complete build up protective coat or the risk of getting disturbed by corrosion under deposits.

The cooler operation should not be interrupted during the first 2 months after commissioning if possible. However, if there is a failure in cooling water supply and operation is resumed within three days time, the cooler can be left undrained. It must be guaranteed that the tubes are free of deposits.

In case of deposits the cooler must be drained, the tubes have to be cleaned, flushed with clean water and dried. A blow through with warm predried air through the pipes is recommended. The cooler has to be sufficient vented. If sea water, brackish or saline water (reference value chloride content ≥ 500 mg/l) is used as cooling water for flushing clean water (drinking water quality) has to be used.

In case of standstills for more than 3 days during the start-up period of 2 months and later on during standstills for more than 2 weeks the same cleaning procedure has to be used.

In case of short standstills operating with low water velocity is to be preferred to water standstill.

5.2 Standstill in Case of Closed Cooling Circuit

Drinking water quality is prescribed for closed cooling water circuits (see item 4.3). Under this conditions no draining in case of standstill is necessary.

5.3 Standstill at Freezing Conditions

The cooler has to be drained in case of wintertime standstills, when a frost injury to the cooler must be feared, also during short standstill periods.

6. Maintenance and Cleaning

Under normal conditions the air side is free of fouling.

In case of closed water circuit the water side of the cooler is generally free of maintenance good water quality assumed. If by poor care a contamination of the circuit water has happened a immediate cleaning of the water side is necessary and the water must be exchanged

Bei offenem Kühlkreislauf sind die Wartungsintervalle auf der Wasserseite von der eingesetzten Wasserqualität abhängig. GEA empfiehlt die erste Kontrolle nach einem viertel Jahr.

Je nach Befund kann der Zeitraum ausgedehnt werden. Es ist jedoch auch bei einem offenen Kühlkreis durchaus möglich, daß auf eine Wartung verzichtet werden kann. Bei extrem schlechter Wasserqualität, kann unter Umständen auch ein kürzeres Kontrollintervall erforderlich werden. Bei Kühlturmwasser ist eventuell die Wasserbehandlung des Kühlturms zu überprüfen. Bei Durchlaufwasser ist eventuell eine Wasserbehandlung sinnvoll.

Zur Wartung sind die Bündel zuerst über die Wasserleitungen und die Entleerungsschrauben zu entwässern und dann beide Kammern zu demontieren.

6.1 Mechanische Reinigung der Rohre

Zeigen sich bei der Wartung Ablagerungen auf der Rohrinne, muß gereinigt werden.

Jedes Rohr muß noch in feuchtem Zustand mit der Reinigungsbürste gereinigt werden. Nach Abschluß der Reinigung müssen die abgelösten Ablagerungen herausgespült werden.

Nach der Reinigung sind die Kammern mit neuen Dichtungen wieder zu montieren (Montage siehe Konstruktionsbeschreibung Artikel 2).

6.2 Chemische Reinigung der Rohre

Wenn die mechanische Reinigung erfolglos ist (z.B. Kesselsteinablagerungen), ist eine chemische Reinigung der Rohrinne durch eine fachkundige Firma erforderlich.

Insbesondere ist darauf zu achten, daß der Reinigungsvorgang nur so kurz wie nötig erfolgt und keine Reinigungsmittelrückstände im Kühlsystem verbleiben.

Der erneute Aufbau der Schutzschicht gemäß Artikel 4.3.2 oder 4.4.2 muß beachtet werden.

7. Reparatur bei Wasserleckage

Ursache einer Wasserleckage kann ein durchkorrodiertes Rohr oder eine undichte Einwalzstelle sein. Um das schadhafte Rohr ausfindig zu machen, ist es zweckmäßig, das Bündel auszubauen und auf geeignete Auflageböcke abzulegen.

Das ausgebaute Bündel ist mit Wasser wieder aufzufüllen und unter Wasserdruck zu setzen. Aus dem abtropfenden Wasser kann der Bereich der Leckage abgeschätzt werden. Zur genaueren Identifizierung einer Korrosionsleckage kann es erforderlich werden, die Rohre einzeln aus dem fraglichen Bereich abzudrücken. Dazu sind die Kammern zu demontieren. (siehe Konstruktionsbeschreibung Artikel 2).

The cleaning intervals of the water side in case of open cooling water circuits depends on the quality of the cooling water is used. GEA recommend the first control after three months time.

The control intervals could be extended in accordance with the finding. It may be that even in case of an open cooling water circuit maintenance might not be necessary. In case of extremely bad water quality it may be necessary to shorten the control intervals. In case of cooling tower water, the water treatment has to be checked. It may be useful to treat also passage water.

For maintenance the bundles have to be drained through the water pipes and the draining plugs and the headers have to be dismantled.

6.1 Mechanical Cleaning of the Tubes

In case that deposits at the tube inside are found during the maintenance the tubes have to be cleaned.

All tubes have to be brushed with the cleaning brush in wet state. After brushing the detached deposits have to be rinsed.

After that the headers have to be mounted together with new gaskets (mounting see design description item 2).

6.2 Chemical Cleaning of the Tubes

Chemical cleaning is required if mechanical cleaning is not successful (for instance in case of boiler scale). The chemical cleaning should be done by a competent company.

Especially it has to be taken care of a cleaning procedure as short as possible and that no cleaning residue is left in the cooling system.

It must be paid attention to format the protective coat new. See item 4.3.2 or 4.4.2.

7. Repair of Water Leakage's

Cause of a water leakage may be a corroded tube or a leaking rolled in tube end. To find out the leaking tube it is helpful to remove the bundle and to deposit it on suitable benches.

The removed bundle has to be filled up with water and should be put under water pressure. The area of the leaking can be estimated by the dripping water. To find out the real leaking tube it could be necessary to do an individual pressure test of single tubes of the identified area. Therefore the headers have to be dismantled (see design description item 2).

Im Bedarfsfall, insbesondere bei einer undichten Einwalzstelle, empfiehlt es sich zur Lokalisierung der Leckage, wasserseitig Druckluft von max. 0,5 bar Überdruck aufzubringen und das Bündel in ein Wasserbecken mit sauberem Trinkwasser abzutauchen. Das Restwasser muß nach erfolgter Druckprobe mit Druckluft aus dem Rippenpaket ausgeblasen werden.

Eine undichte Einwalzstelle ist nachzuwalzen. Ein durchkorrodiertes Rohr ist beidseitig mit konischen Verschlußstopfen abzudichten. Der Werkstoff der Stopfen soll gleich dem Rohrbodenwerkstoff sein. Der Kegel des Stopfens ist 1 : 25.

Die Verschlußstopfen sind mit leichten Hammerschlägen einzutreiben. Die Kammern werden mit neuen Dichtungen wieder montiert und das Bündel einer Wasserdruckprobe unterzogen. Zeigen sich keine weiteren Leckagen, Beobachtungszeit > 15 min, kann das Bündel wieder montiert und in Betrieb genommen werden.

In case of need, especially of a leaking rolled in tube end, it is recommended to find out the leaking tube by floating the bundle in a tank filled up with clean water (drinking water quality). The water side has to put under air over pressure of 0,5 bar. The remained water in the coil has to be blown out with compressed air after the check.

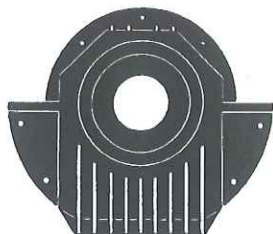
A leaking tube end has to be rolled again. The defective tube must be plugged with a conical plug. The material of the plug should be identical to the tube sheet material. The cone of the plug is 1 : 25.

The plugs should be driven with a hammer into the leaking tube on both sides. The header must be mounted with new gaskets and the bundle has to be pressure tested again over a period of in minimum of 15 minutes. After that the bundle could be mounted and commissioned again.

Slide Bearings Type E For Shaft Diameter Range 80-355 mm Main Application Field Electric Machines

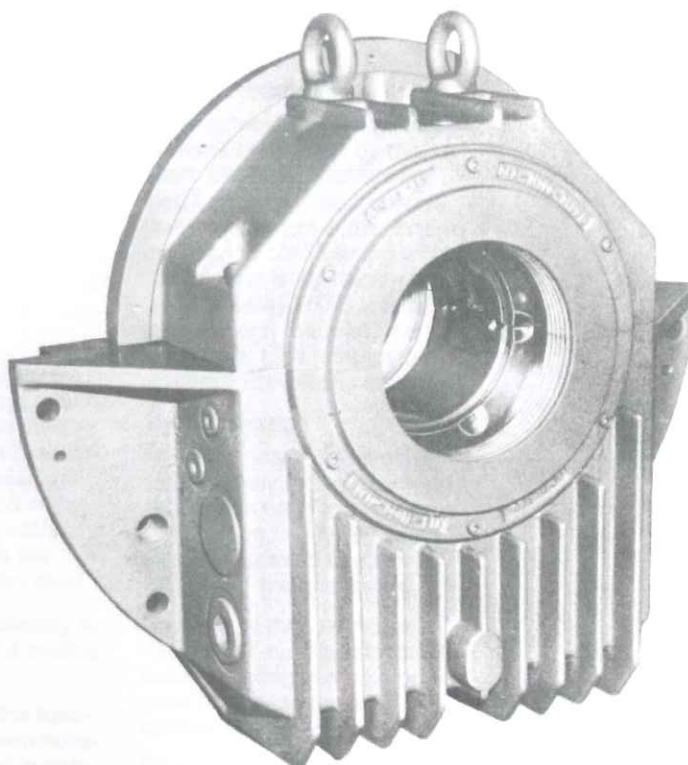


Centre flange mounted bearing type EM (DIN 31 694)



The EM-type slide bearings are a variation of the E-type bearing modular system. They are centrally flange-mounted slide bearings which are mainly used for electric machines.

This leaflet contains data required for designs incorporating EM-type bearings as far as they are not contained in the main catalogue "RENK Slide Bearings Type E".



Technical Information

This leaflet contains information which should be considered for the majority of applications where EM-type bearings are used with electric machines. All the other facilities of the E-type bearing modular system will, of course, also apply to EM-type bearings: e.g. bearing shells with two- or four-lobe bore, with journal tilting pads or RD thrust pads (relevant details on request).

Most parts of the variants mentioned in this leaflet are available from stock.

Bearing Housing

The finned EM-type housings are made from a high-quality cast iron (EN-GJL-300) and are designed for heavy duty performance. Other materials such as, for instance, nodular cast iron EN-GJS-400-15 or cast steel GS 45 can be supplied by special arrangement.

Tapped holes for thermometer, oil inlet and outlet, oil sight glass, thermometer in the oil sump or suction line of a circulating pump are available on either side. For special cases (e.g. fitting of oil coolers or vibration detectors) finish machined housings are taken from stock and provided with additional connection holes.

Bearing Shell

The shells are spherically seated in the housing. They consist of a supporting steel body lined with lead based RENKmetal therm V6 or therm 89. Both design and manufacture are in accordance with the highest standards required in heavy engineering: trouble-free assembly and long life even under severe operating conditions.

EM-type bearings are mostly equipped with shells with plain cylindrical bore and loose oil ring.

Shells are available either for self-contained operation (E.NL.) or prepared for external oil circulation (E.ZL.).

Apart from bearings without thrust parts (type...Q) there are shells with plain white-metal lined shoulders (type...B) to absorb limited non-continuous axial loads, as well as shells with build-in taper land faces (type...K) which will absorb medium axial loads.

Thrust loads of a medium size are absorbed by taper land faces integral with the shoulders and suitable for one sense of rotation (type...E).

High thrust loads can be taken by tilting RD thrust pads (type...A). In addition to the oil film, the cup springs supporting the RD thrust pads have damping properties and intercept shocks elastically.

This design requires lubrication by circulating oil, e.g. the use of an oil pump.

Seals

EM-type bearings with floating labyrinth seals (type 10) are used for standard applications. This seal conforms to protection grade IP 44. Higher protection grades (up to IP 56) can be fitted under the modular system.

To protect machines fitted with EM-type bearings against any interference from inside (e.g. vacuum or strong air circulation), EM-type bearings are generally supplied with additional "machine seals". These machine seals are made of non-corrosive alloy.

The seals are fitted directly to the housing forming a sealing gap with the shaft.

In order to improve the function the space between housing and machine seal is connected to atmosphere via two hoses. Optionally the airtightness of this machine seal can be improved by inserting a hemp tallow packing in the standard circumferential groove of the seal.

All seal types (type 10, 12 and the machine seal insert) are

made of fiber reinforced, high temperature resistant RENKplastic therm 50 and are resistant to wear.

Oil Supply

Self-lubrication by means of a loose oil ring for peripheral shaft speeds up to 20 m/s. The lubricating oil delivered to the internal perimeter is transferred by the loose oil ring directly to the shaft. Where bearings are lubricated by oil circulation systems, loose oil rings can be used with peripheral shaft speeds of up to 26 m/s to permit emergency shut-down without causing any damage. Loose oil rings can also be used for marine applications. In this case additional guide bushes are built into the shells (details on request).

Electrical Insulation

As a protection against stray currents conducted by the shaft, EM-type bearings can also be supplied as insulated versions. To do so, the spherical bearing shell seating within the housing is electrically insulated by using PTFE insulating foil or inserts made of fiber reinforced, high temperature resistant RENKplastic therm 50.

Heat dissipation

Frictional heat is often dissipated merely by radiation and convection only: "natural cooling". Depending on the shaft diameter, speeds of up to 3600 min⁻¹ are admissible.

Because of their advanced design, EM-type bearings with natural cooling can now be used for a wide range of applications.

Oil coolers (with seawater-resistant finned cooler tubes) incorporated in the oil sump can be used in addition. Dimensions on request. EM-type housings are generally suitable for connection to an oil circulating system.

In such case the oil level in the housing is defined by the weir

in the oil outlet pipe of our supply.

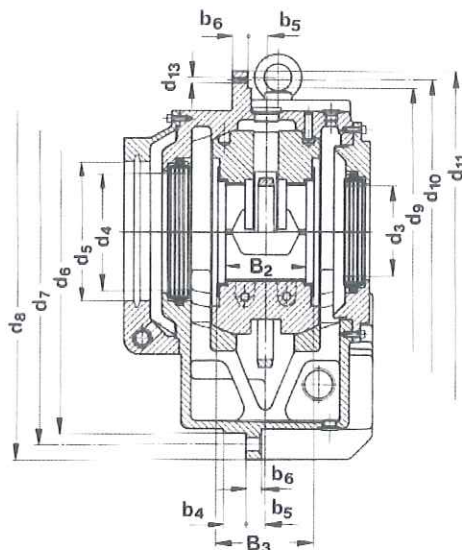
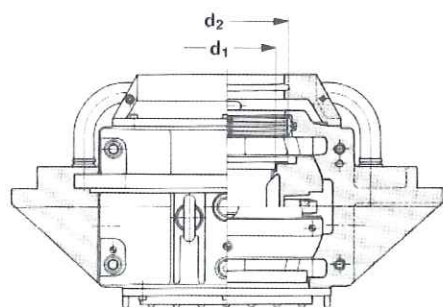
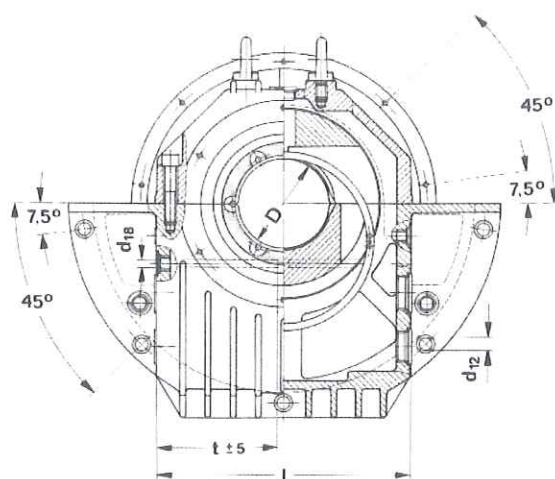
Temperature Control

Two independent commercially available thermosensors can be used for temperature control. We recommend the use of RENK resistance thermometers or RENK angle thermometers for direct visual control.

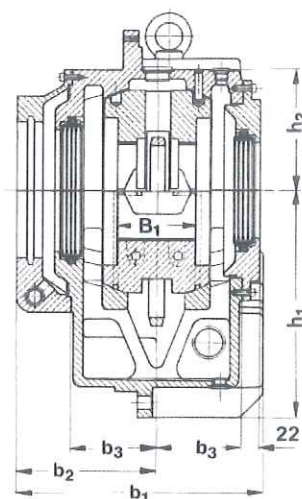
Oil Selection

Generally any branded mineral oil of low foaming tendency and good resistance to ageing can be used as a lubricant. The correct viscosity for each operating condition should be checked by EDP calculation. Such calculations are carried out at the design stage. A printout of results computed can be provided on request.

Dimensions of Bearings (DIN 31 694)

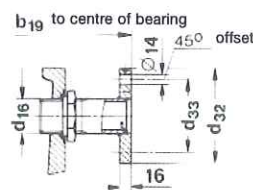
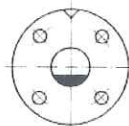


EM.LB
EM.LK



EM.LQ

As for bearing types EMZL., the oil outlet with weir is to be mounted horizontally at the bottom. The mark at the flange will then be visible centrally at the top.



flange DIN 2573
oil outlet

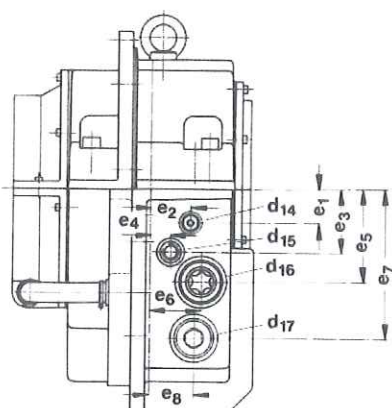
Dimensions in mm

Size	D	B ₁	B ₁ ³⁾	B ₃	b ₁	b ₂	b ₃	b ₄	b ₅	b ₆	b ₁₉	d ₁	d ₂	d ₃	d ₄	d ₅	d ₆	d ₇	d ₈	d ₉	d ₁₀	d ₁₁
9	80	61,4										86	110			111,5						
	90	61,4	(60)	80	250	145	80	30	20	16	205	96	120	80/90/100/110	100	121,5	375	400	425	270	285	300
	100	65		-0,22								106	130			131,5						
11	100	81,4										108	135			136,5						
	110	81,4	(80)	100	280	160	95	30	20	18	230	118	150	100/110/125/140	125	151,5	450	475	500	320	340	355
	125	85		-0,22								133	160			161,5						
14	125	105,4	(105)									135	170			171,5						
	140	105,4	(105)	125	325	185	112,5	30	25	20	280	150	190	125/140/160/180	160	191,5	530	560	600	380	400	425
	160	106,4	(105)	-0,22								170	200			201,5						
	180 ¹⁾	106,4										190	220			221,5						
18	160	135,7	(135)									172	215			216,5						
	180	135,7	(135)	160	375	210	132,5	30	25	25	310	192	240	160/180/200/225	200	241,5	630	670	710	450	475	500
	200	140,4	(135)	-0,22								212	250			251,5						
	225 ¹⁾	140,4										237	275			276,5						
22	200	168,5	(170)									214	265			266,5						
	225	168,5	(170)									239	290			291,5						
	250	175,7	(170)	200	445	245	167,5	30	30	30	385	264	315	200/225/250/280/300	250	316,5	800	850	900	570	600	630
	280 ¹⁾	175,7		-0,22								294	345			346,5						
	300 ¹⁾	175,7										310	345			346,5						
28	250	213,2	(215)									266	325			326,5						
	280	213,2	(215)									296	355			356,5						
	300	218,5	(215)	250	550	300	212,5	35	30	35	465	316	375	250/280/300/315/355	315	376,5	1000	1060	1120	730	765	800
	315	218,5		-0,24								331	390			391,5						
	335 ²⁾	218,5										351	410			431,5						
	355 ²⁾	218,5										371	430			431,5						

¹⁾ Available only with shells B and Q.

²⁾ Not available with shells type A.

³⁾ The dimensions in brackets will be dropped in the future.



- ① Type E
- ② Housing M = centrally flange mounted
- ③ Heat dissipation
 - N = natural cooling
 - Z = lubrication by oil circulation with external oil cooling
 - X = lubrication by oil circulation with external oil cooling for high oil throughput
 - W = water cooling (finned tube cooler in oil sump)
 - U = circulating pump and natural cooling
 - T = circulating pump and water cooling
- ④ Shape of bore and type of lubrication L = plain cylindrical bore with loose oil ring lubrication
- ⑤ Thrust surface
 - Q = without thrust parts (non-locating bearing)
 - B = plain sliding surfaces (locating bearing)
 - K = taper land faces for both senses of rotation (locating bearing)
 - E = taper land faces for one sense of rotation (locating bearing)
 - A = elastically supported circular tilting pads (locating bearing)

Example

for quoting a slide bearing, type EM, lubrication by oil circulation with external oil cooling, cylindrical bore with loose oil ring lubrication (for emergency operation), thrust part with taper land faces, size 14, shaft diameter 125 mm:

Slide bearing ① ② ③ ④ ⑤
E M Z L K 14-125

The indicated weights are average values (not binding).
 The drawings are not strictly binding.

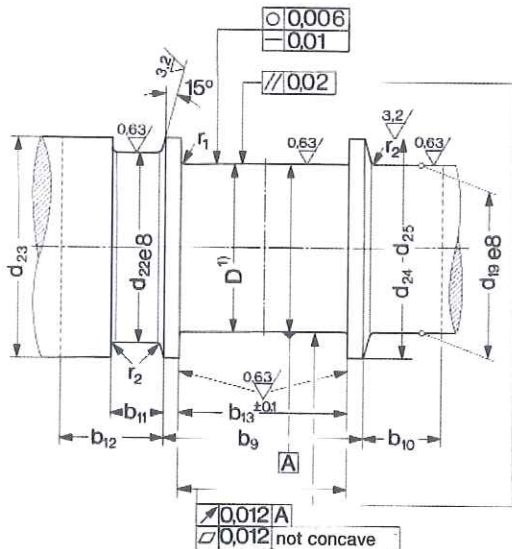
	d ₁₃	d ₁₄	d ₁₆	d ₁₈	d ₃₂	d ₃₃	e ₁	e ₂	e ₃	e ₄	e ₅	e ₆	e ₇	e ₈	h ₁	h ₂	l	t	weight approx. [kg]	oil quantity [Liter]
11	M6	G 3/8	G 1 1/4	11	120	90	27,5	35,5	60	20	85	67,5	142	45	212	110	250	105 105 105	55	2,4
14	M6	G 3/8	G 1 1/4	11	120	90	35	42	70	22,5	100	70	167	55	250	130	300	130 130 122	85	4,2
18	M6	G 3/8	G 1 1/2	11	130	100	45	55	85	27,5	125	85	200	70	300	158 158 137 117	355	140	140	6,3
22	M8	G 1/2	G 1 1/2	13	130	100	60	68	105	30	155	80	240	80	355	190 190 170 145	425	230	230	10,0
26	M10	G 3/4	G 2	13	140	110	70	83	135	40	175	100	310	100	450	242 242 228 182 166	530	425	425	24,4
33	M12	G 3/4	G 2 1/2	13	160	130	95	106	155	50	220	130	385	130	560	312 312 262 257 232 219	670	860	860	44,4

G = B.S.P.

Shaft Dimensions

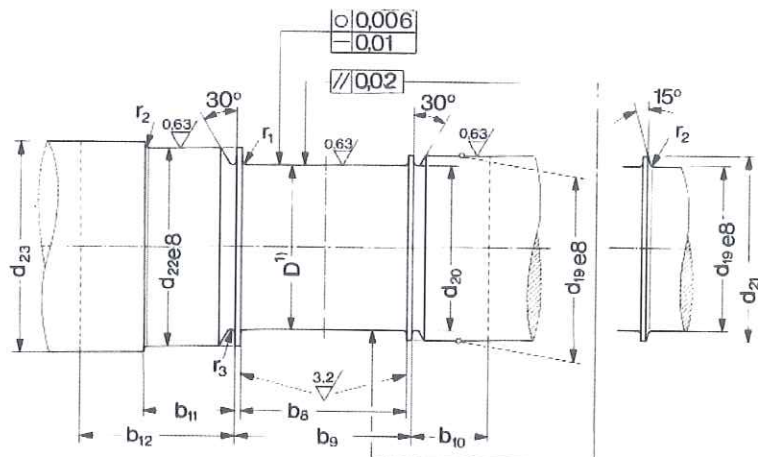
Locating bearing

Type of bearing shell E...B (mit d_{24})
E...K (mit d_{24})
E...E (mit d_{24})
E...A (mit d_{25})



Non-locating bearing

Type of bearing shell E...Q



chamfered edges 0,5 x 45°
surface condition DIN ISO 1302

Dimensions in mm

Size	D ¹⁾	b ₈ ²⁾	b ₉	b ₁₀	b ₁₁	b ₁₂	b ₁₃ ³⁾	d ₁₉ d ₂₀	d ₂₁	d ₂₂	d ₂₃	d ₂₄	d ₂₅	r ₁	r ₂	r ₃
9	80															
	90	90	100	55	60	95	80,4	80	90	100	110	120	142	2,5	4	1,6
	100							80	90	100	110	120	143			
11	100															
	110	110	120	60	65	105	100,4	100	110	125	140	150	162	2,5	4	1,6
	125							100	110	125	140	150	168			
14	125															
	140	140	150	65	75	115	125,4	125	140	160	180	190	207	4	6	2,5
	160							125	140	160	180	190	217			
	180							160	180	200	220	240	264			
18	160															
	180	180	190	65	75	120	160,4	160	180	200	225	240	264	4	6	2,5
	200							160	180	200	225	240	273			
	225							200	225	250	280	290	308			
22	200															
	225	220	240	75	80	130	200,4	200	225	250	280	290	328			
	250							200	225	250	280	290	339	6	10	4
	280							250	280	315	345	375	408			
	300							280	315	345	375	408	423			
28	250															
	280	280	300	90	90	155	250,4	250	280	315	335	355	408	6	10	6
	300							250	280	315	335	355	408			
	315							280	315	335	355	375	423			
	335							315	335	355	375	390	430			
	355							335	355	375	390	410	430			

1) For shaft tolerances see "Manual for the application of RENK slide bearings".

2) Where a non-locating bearing is to permit greater axial movement (e.g. to allow for thermal expansion), the distance b_8 between the collars may be increased.

Tolerances of form and position follow DIN 31 699.

Degree of accuracy B 10 (radial). Degree of accuracy B 20 (axial); others upon request.

General tolerance DIN 7168 mS.

3) The normal axial clearance is 0,5 mm. When directional changes of thrust loads or axial shocks are to be anticipated, the dimensions b_{13} may be reduced by a further 0,3 mm. Where a locating bearing is only required for test run, the dimension b_{13} can be increased by 3...6 mm. In this case dimensions " b_8 " and " b_9 " have to be considered.

4) All diameters d_{23} are valid for each shaft diameter D.

Sales Organisation



Domestic

Weltausstellungsallee 21
D-30539 Hannover
Telephone: (5 11) 86 01-203
Telefax: (5 11) 86 01-288

Export

Weltausstellungsallee 21
D-30539 Hannover
Telephone: (5 11) 86 01-265
Telefax: (5 11) 86 01-288

Sales Agencies

Australia	G.B. and Ireland	Norway
Austria	Hungary	PR China
Belgium	India	Slovak Republic
Brazil	Italy	Slovenia Republic
Canada	Japan	South Africa
Czech Republic	Liechtenstein	South Korea
Croatia	Luxembourg	Spain
Finland	Mexico	Switzerland
France	Netherlands	USA

Headquarters and Manufacturing Plant



RENK AKTIENGESELLSCHAFT
Werk Hannover
Weltausstellungsallee 21
D-30539 Hannover
Telephone: + 49 (5 11) 86 01-0
Telefax: + 49 (5 11) 86 01-288
e-mail: gleitlager.hannover@renk-ag.com
Internet: www.renk.de

Assembly and Distribution Centers with Sales and Engineering Support



RENK Corporation
304, Tucapau Road
29334 Duncan S.C.
USA
Telephone: (1-8 64) 4 33 00 69
Telefax: (1-8 64) 4 33 06 36



MAN B&W (Japan) Ltd.
Hibiya Park Building (R. 410)
1-8-1, Yurakucho
Chiyoda-ku, Tokyo 100-0006
Japan
Telephone: (81-3) 32 15-1310
Telefax: (81-3) 32 84-0867

We reserve the right to changes made in the interests of technical improvement.



ELIN EBG
Motoren GmbH

EG-Konformitätserklärung EC-Declaration of Conformity

Hersteller:
Manufacturer:

ELIN EBG Motoren GmbH
Elingasse 3
A-8160 Weiz

**Beschreibung der
Komponente**
Description of product:

Drehstrom-Asynchronmotor mit Kurzschlussläufer
Three-phase asynchronous machine with squirrel-cage rotor

Typ:
Model:

HKM

Als Hersteller drehender, elektrischer Maschinen bescheinigen wir die Übereinstimmung der genannten Komponente mit den Vorschriften folgender Europäischen Richtlinien:

As a manufacturer of rotating electrical machines we hereby confirm the conformity of the above product with the following European standards:

98/37/EG
98/37/EEC

Maschinenrichtlinie
Machinery Directive

Weitere Angaben über die Einhaltung dieser Richtlinien sind auf Seite 2 ersichtlich.
Please continue on page 2 for further information on compliance with above directives.

Asynchronmaschinen sind Komponenten einer Maschine im Sinne der Maschinenrichtlinie 98/37/EG. Die Inbetriebnahme ist solange untersagt, bis die Konformität des Endproduktes mit dieser Richtlinie festgestellt ist (vgl. Anhang II, Absatz B der Richtlinie).

In accordance with EC Directive 98/37/EG, asynchronous machines are intended solely for integration into other machines. Commissioning is prohibited until conformity of the end product with EC Directive 98/37/EG has been established (refer to Annex II, Section B of said Directive).

Ort, Datum: Weiz, 15. Oktober 2003
Place, date

Ing. Gustav Hauschka
Geschäftsführer
managing director

Karl Schorna
Leiter Material Management
head of the material management department

Seite 1 von 2

**We Keep the
World in Motion**

ELIN EBG Motoren GmbH
Elingasse 3
8160 Weiz, Austria
Tel.: (+43/3172) 606-0
Fax: (+43/3172) 606-784

Gesellschaftssitz Weiz,
registriert beim Handelsgericht Graz unter
FN 58429a; UID: ATU1477 3404; DVR 0748897

www.elinebgmotoren.at



EG-Konformitätserklärung *EC-Declaration of Conformity*

Diese Erklärung beinhaltet keine Zusicherung von Eigenschaften des Gerätes.
Die Sicherheitshinweise der mitgelieferten Produktdokumentation sind zu beachten.

*Please note: this declaration will not imply warranty of any product properties.
Safety instructions given in the product documentation must be observed.*

Das umseitig angeführte Produkt entspricht unter anderem folgenden Normen:
Above product complies among other things with the following standards:

EN 292	Sicherheit von Maschinen, Grundbegriffe und allg. Gestaltungsleitsätze
<i>EN 292</i>	<i>Safety of machinery, Basic concepts, general principles for design</i>
EN 60034 Reihe IEC 60034 series	Drehende elektrische Maschinen Rotating electrical machines
EN 60204-1	Sicherheit von Maschinen-Elektrische Ausrüstung von Maschinen, allgemeine Anforderungen
<i>EN 60204-1</i>	<i>Safety of machinery - Electrical equipment of machines, General requirements</i>

Seite 2 von 2

**Eichreihe für Platin-Widerstandsthermometer
 Calibration for Platinum-Resistance Thermometers**

°C	Ohm	°C	Ohm
-100	59,90	+ 11	104,33
- 95	61,95	+ 12	104,72
- 90	64,00	+ 13	105,11
- 85	66,04	+ 14	105,50
- 80	68,08	+ 15	105,90
- 75	70,11	+ 16	106,29
- 70	72,14	+ 17	106,68
- 65	74,15	+ 18	107,07
- 60	76,18	+ 19	107,45
- 55	78,19	+ 20	107,83
- 50	80,20	+ 25	109,76
- 45	82,20	+ 30	111,70
- 40	84,20	+ 35	113,63
- 35	86,19	+ 40	115,56
- 30	88,18	+ 45	117,49
- 25	90,11	+ 50	119,42
- 20	92,14	+ 55	121,34
- 15	94,06	+ 60	123,26
- 10	96,08	+ 65	125,17
- 9	96,45	+ 70	127,08
- 8	96,85	+ 75	128,99
- 7	97,25	+ 80	130,90
- 6	97,64	+ 85	132,80
- 5	98,03	+ 90	134,70
- 4	98,42	+ 95	136,60
- 3	98,72	+ 100	138,50
- 2	99,21	+ 110	142,28
- 1	99,61	+ 120	146,04
0	100,00	+ 130	149,78
+ 1	100,39	+ 140	153,52
+ 2	100,79	+ 150	157,24
+ 3	101,18	+ 160	160,96
+ 4	101,58	+ 170	164,66
+ 5	101,97	+ 180	168,36
+ 6	102,36	+ 190	172,04
+ 7	102,75	+ 200	175,70
+ 8	103,15		
+ 9	103,54		
+ 10	103,92		

Guide values for adjustment of tripping temperatures

Measuring points	permissible operation temperature	Adjustment according to measured values for normal operation T = Operation temperature	
		Warning	Disconnection
Stator Winding Temp. rise acc. to Ins. Cl. B	max. 120 °C	T + 10 K	T + 15 K
Stator Winding Temp. rise acc. to Ins. Cl. F	max. 140 °C	T + 10 K	T + 15 K
Sleeve bearing	max. 90 °C	T + 5 K	T + 10 K
Antifriction bearing	max. 100 °C	T + 5 K	T + 10 K
Cold air after cooler	max. 40 °C	T + 10 K	T + 15 K
Warm-air before cooler (forced air cooling from one side)	max. 65 °C	T + 10 K	T + 15 K
Warm-air before cooler (forced air cooling from two sides)	max. 70 °C	T + 10 K	T + 15 K
Exhaust air (HKR)	max. 60 °C	T + 10 K	T + 15 K
Exhaust air (HKL)	max. 55 °C	T + 10 K	T + 15 K
Ambient temperature	max. 40 °C		

Failure report for industry machines

1. Supplier

Company: ELIN EBG Motoren GmbH Elingasse 3 8160 Weiz Austria	Fax: (++43/3172) 5850
	Phone: (++43/3172) 606-2463
	E-mail: serviceemg@elinebg.at
Contact persons department services:	Mr. Günther Pöttler, Mr. Werner Fladenhofer Mr. Manfred Schlagbauer

2. Customer

Company:	Fax:
	Phone:
	E-mail:
Contact person:	
Address of the plant:	<input type="checkbox"/> Description of way

3. Machine data

Serial number:	First starting up:
Project name:	Running hours:

4. Failure description

Date of breakdown:	Initiated by:
Failure description:	
Attach possibly existing recordings please!	
Plant in operation: <input type="checkbox"/> YES <input type="checkbox"/> NO	