ELIN EBG Motoren GmbH

OPERATING INSTRUCTIONS

Three-phase-asynchronous machine with squirrel-cage rotor

„ASU No. 9, Kosice“

Type:	HKM 180 E04
Machine no.:	526020 05001
Customer:	AIR LIQUIDE AGS GmbH
Customers order no.:	4500024310
Our order / project:	123679 / K.V11-04045
Issue no.:	01
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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.

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

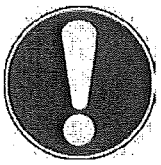
- body and live
- the machine and further property of the user
- the efficient work of the machine

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 15

4.1 Transport 15

Rust protection 15

Transport safeguard 15

Dimensions and weights 15

Package disposal 15

4.2 Storage 16

Dimensions and weights 16

Intermediate storage 16

Long time storage 16

5 Installation and operation 17

5.1 Installation and alignment 17

5.2 Electrical connections 17

5.3 Start up of machine 18

Checking of insulation resistance 18

Operation of heat exchanger 20

Check list for first start up 20

6 Maintenance 22

6.1 Maintenance of bearings 22

6.2 Maintenance of windings 23

6.3 Maintenance of heat exchanger 23

7 Disassembling, assembling, repairs 25

8 Warranty / Failure 26

8.1 Failure 26

9 Emergency data 27
9.1 Fire fighting 27
9.2 First aid measures by accidents with electrical current 28
10 Spare Parts 29
10.1 Spare parts inventory 29
10.2 Order procedure 29
List of revisions 31
Use confirmation 32
Appendix 33
Drawings 33
Descriptions 33
Declaration of conformity 33
Tables 33
Failure report 33

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 polymarization 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 babbit 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!

3 Technical Data

Type		: HKM-180E04
AirLiquide name		: M 110001 8600kW MAC
Kind of motor		: Three-phase-asynchronous motor with Squirrel-cage rotor
Design, tests and tolerances		: EN 60034
Quantity		: 1
Rated output (PN)		: 8600 kW
Duty		: S1
Rated voltage (UN)		: 6000 V +/- 10 %
Connection		: Star
Frequency		: 50 Hz +/- 5 %
Rated speed		: 1492 rpm
Direction of rotation		: left hand side (from DE)
Overspeed		: 1800 rpm, for max. 2 minutes
Efficiency (eta)	4 / 4	: 97,6 -0 tol.% (guaranteed)
	3 / 4	: 97,7 -o tol.% (guaranteed)
	2 / 4	: 97,5%
	1 / 4	: ca. 96,5%
Power factor (cosPhi)	4 / 4	: 0,915 (guaranteed)
	3 / 4	: 0,92 (guaranteed)
	2 / 4	: 0,90
	1 / 4	: ca. 0,77
Full load current (FLC)		: 929 A
No load current		: 150 A
Starting current (IA)		: 5,55 + 0 tol x FLC (guaranteed)

For voltage drop in the grid is less 10%
at the 6 kV level and less 5% in the 110 kV level

Rated torque (FLT)	: 55045 Nm
Starting torque (MA)	: 0,55 x FLT
Saddle torque (Ms)	: 0,45 x FLT
Break down torque (MK)	: 2,0 x FLT
Moment of inertia (J)	: 425 kgm2
Mass of motor, appr.	: 19500 kg
Air gap	: 5,00 mm
Driven load	: Radial compressor MAN Turbo RIK 80-1+1+1+1
Load moment of inertia (JL)	: 2300 (+/-10 %) kgm2 (relating to motor speed)
Load moment characteristics (start)	: acc. to MAN document No: 4-7704059-A1 (breakaway torque 16%, torque at rated speed 25%, decreasing appr. In-line with the motor speed
Starting time (ta)	: 12/16/appr.36s at 100/90/69% Un
Starting frequenzy	: 3 x cold / 2 x warm at U > 90 % Un 2 x cold / 1x warm at start at the transformator (U = 69 % Un

In-between the startings natural runout.
Next starting after 30 minutes

Starting	: via Start-transformator (80% tapping, so That 69% Un at the motor clamps)
Insulation / temperature rise	: F / B, temperature rise of windings 73 K measured with resistance method
Degree of protection	: IP 55
Method of cooling	: IC 81 W with top mounted air-water cooler
- Water inlet temperature	: 37 °C
- Water quantity	: 53 m3/h
- Temperature rise, appr.	: 4 K
- Operating pressure	: max. 8 bar
- Test pressure	: 12 bar
- 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)
- Position of water adapter	: left (view from DE)
- Cooler design	: GEA
- Tubes	: Stainless steel
- Ribs	: Stainless steel or aluminium
- Body	: Rust-free steel
- Tube bottom	: CuZN38
- Water chambers	: Steel
- Internal prodection 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, conical, MAN draw. 4-837 671 356
Type of bearings	: Flange sleeve bearings with forced oil lubrication.
- Oil quantity	: appr. 20 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, heating app. 8 K
- Bearing play, axial	: +/- 3 mm
- Position of oil adapter	: left (view from DE)
- Inlet	: DN40 PN16 flange
- Outlet	: DN80 PN16 flange

- 1 piece fluid thermometer make Sika in the oil return
- 1 piece pressure advice in the oil inlet
- 1 piece oil pressure reduction-valve

NDE-Bearing	: insolated
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 (prodection 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 right hand side (view from DE)
- Cable entrance	: from bottom
- Execution	: with tear seam
Star point terminal box	
Execution	: like main terminal box
Position	: left hand side
Auxiliary terminal box	: 2, separated for Pt 100 and space heater
- Position, from DE	: on the right hand side
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 includet in our delivery
- 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

- Space heater (230 V AC), executed to an own auxiliary terminal box

Spare parts: One set bearing shells incl. lubrication - and sealing rings.

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:

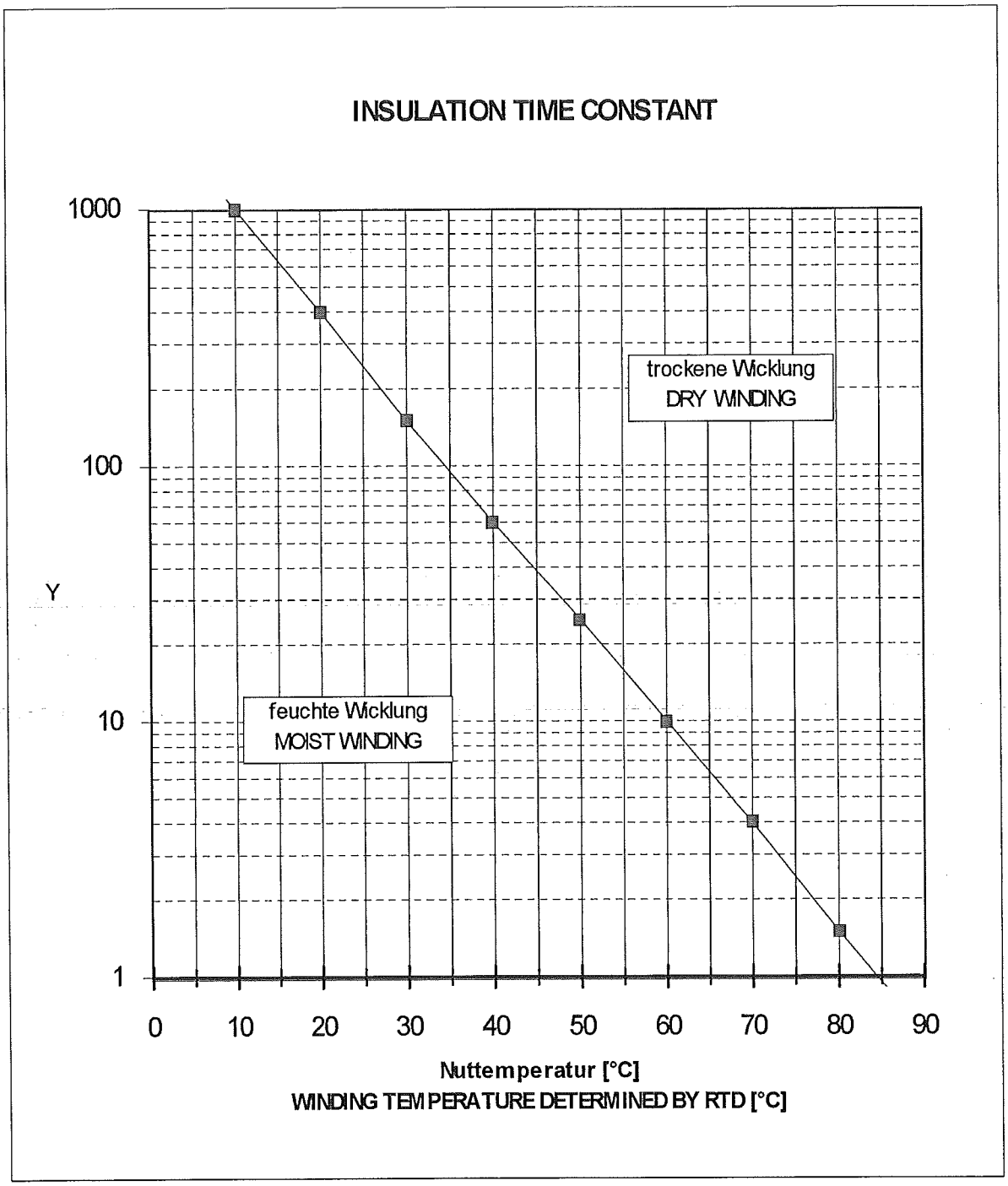
Main-short circuit power	Minimum cross-section of Cu-conductor at a nominal voltage of	
	6 kV	10 kV
< 200 MVA	70 mm²	70 mm²
>200-250 MVA	95 mm²	70 mm²
>250-350 MVA	150 mm²	95 mm²
>350-500 MVA	185 mm²	150 mm²
>500-800 MVA	--- ---	185 mm²

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 MΩ) 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 approxiamately 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 ⇒ Isolationszeitkonstante T / INSULATION TIME CONSTANT T

T = R [MΩ] x C [µF]

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:

Funtion 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 occured, 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 Eskanol 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 slided 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

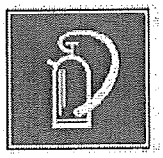
8.1 Failure

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.

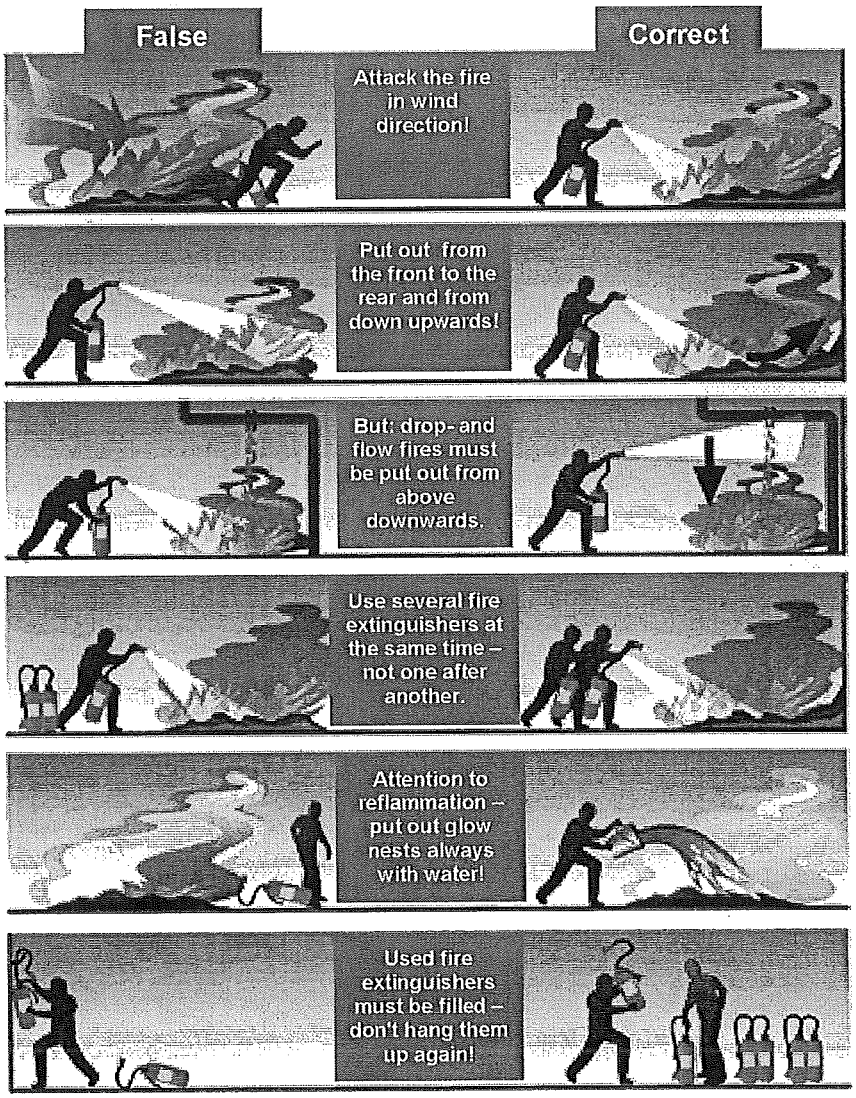
Electronic failure report

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 180 E04
Serial no..:	526020 05001

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

Stock no. :	5981473
Spare part :	E.ZLB 18-200
Quantity :	1 pce

Spare part list

Spare part which are recommended by manufacturer:
O Spare parts inventory necessary
✹ Spare parts inventory recommended

Spare part		pcs	Type	Stock-no.
RENK bearing shell DE	O	1	E.ZLB 18-200	5981473
RENK bearing shell NDE	O	1	EFZLQ 18-200	5981299
Lubrication ring	O	2	18-2	5981301
Sealing	O	1	TYPE10 D=200	5980206
Sealing	O	1	TYPE10 D=225	5981300
Sealing	O	1	TYPE10 D=200	5980206

List of revisions

Date of issue	Issue	Modified page	Kind of modification
03.08.2005	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

Dimension drawing machine	Zg.Nr. 5860359	1 Seite
Sectional drawing	o. Zg.Nr.	1 Seite
Power terminal box	Zg.Nr. 5859792	1 Seite
Instrumentation terminal box	Zg.Nr. 5860390	1 Seite
Connection diagram stator	Zg.Nr. 5203174	1 Seite
Connection diagram monitoring	Zg.Nr. 5882008	1 Seite
Connection diagram space heater	Zg.Nr. 5855183	1 Seite
Shaft dimension drawing	Zg.Nr. 5860344	1 Seite
Starting characteristics 526020 05001		1 Seite

Descriptions

GEA Cooler drawing + Cooler descripion	10 Seiten
RENK-sleave bearings AS EFZLB 18-200 / EFZLQ 18-200 isol.	8 Seiten

Declaration of conformity

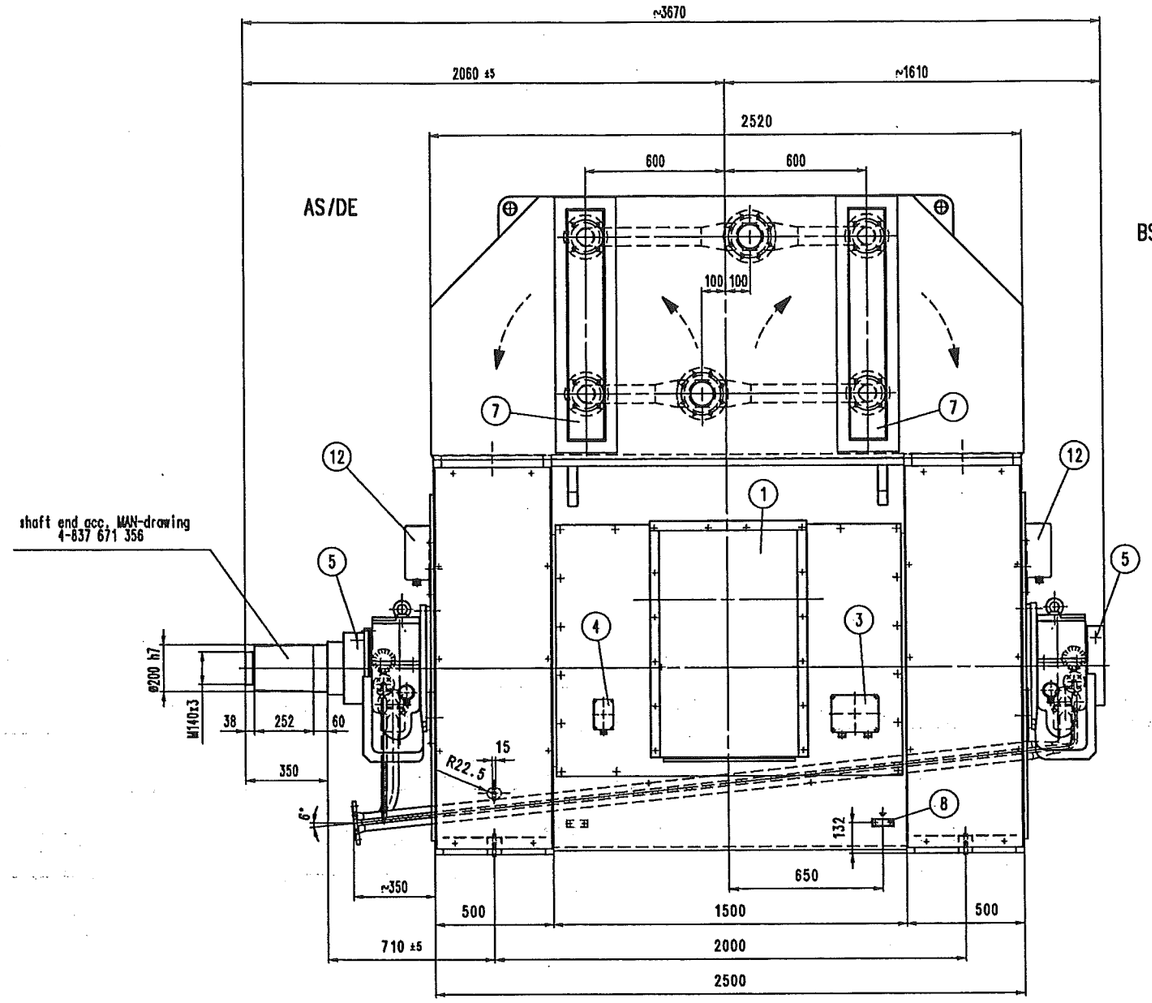
Form	2 pages

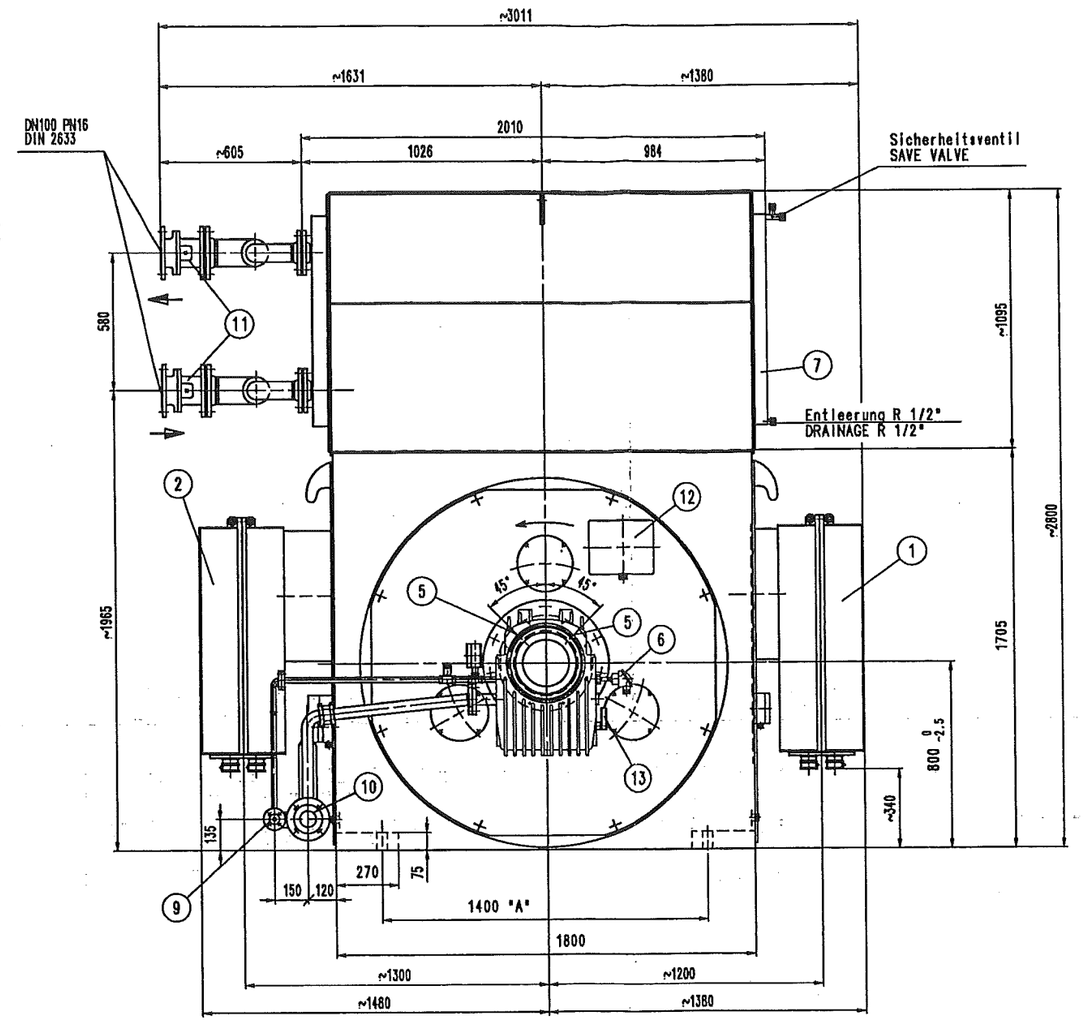
Tables

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





Fundamentplan / FOUNDATION PLAN - 5860345

1. Klemmenkasten U1 V1 W1 / TERMINAL BOX U1 V1 W1
2. Klemmenkasten U2 V2 W2 / TERMINAL BOX U2 V2 W2
3. Klemmenkasten für 6 Nuttherm.u.2 Lagerdoppeltherm. PT100 / TERMINAL BOX FOR 6 SLOTTHERM.AND 2 BEARINGDOUBLE-THERM. PT100
4. Klemmenkasten für Stillstandsheizung / TERMINAL BOX FOR SPACE HEATER ~ 2750 W , 230 V
5. 2 Bently Nevada Schwingungsaufnehmer AS und BS / 2 BENTLY NEVADA VIBRATION DETECTOR DE AND NDE
6. Lagerthermometer 2*PT100 AS und BS / BEARING THERMOMETER 2*PT100 DE AND NDE
7. Wärmetauscher / HEAT EXCHANGERS
8. Erdungsanschluß / EARTHING TERMINAL
9. Ölzulauf mit Mengenregelventil und Manometer / OIL INLET WITH QUANTITY REGULATING VALVE AND MANOMETER DN20 PN16, DIN 2633
10. Ölablauf / OIL OUTLET DN65 PN16, DIN 2633
11. Sperrventil / STOP VALVE
12. Klemmenkasten für BN-Transmitter / TERMINAL BOX FOR BN-TRANSMITTER
13. Flüssigkeitsthermometer Lageröl AS und BS / LIQUID THERMOMETER BEARING OIL DE AND NDE

max. Kühlerleistung (2 Elemente) / MAX. COOLER CAPACITY (2 ELEMENTS)	236 kW
Kühlwassermenge / QUANTITY OF COOLING-WATER	~ 51.5 m3/h
Wasserzulauftemperatur max. / WATER INLET TEMPERATURE MAX.	37 °C
Wasserablauftemperatur / WATER OUTLET TEMPERATURE	~ 41.0 °C
max. Druckabfall wasserseitig / MAX. PRESSURE DROP AT WATER-SIDE	~ 0.16 bar
Wasserqualität / QUALITY OF COOLING-WATER	entspr. Wasseranalyse / ACC. WATER ANALYSIS

Ölqualität / OIL QUALITY:	ISO VG 46
Durchfluß-Ölmenge je Lager / OIL FLOW REQUIRED FOR EACH BEARING:	~ 8 l/min
Öldruck / OIL PRESSURE:	0.05 - 0.1 bar
Max. Öleintrittstemperatur / MAX. OIL INLET TEMPERATURE:	45 °C
Ölinhalt je Lager / QUANTITY OF OIL CONTAINED IN EACH BEARING:	13 l
Axiales Lagerspiel / BEARING PLAY AXIAL:	± 3 mm
Max. Kupplungsspiel axial / COUPPLING PLAY AXIAL:	± 1 mm

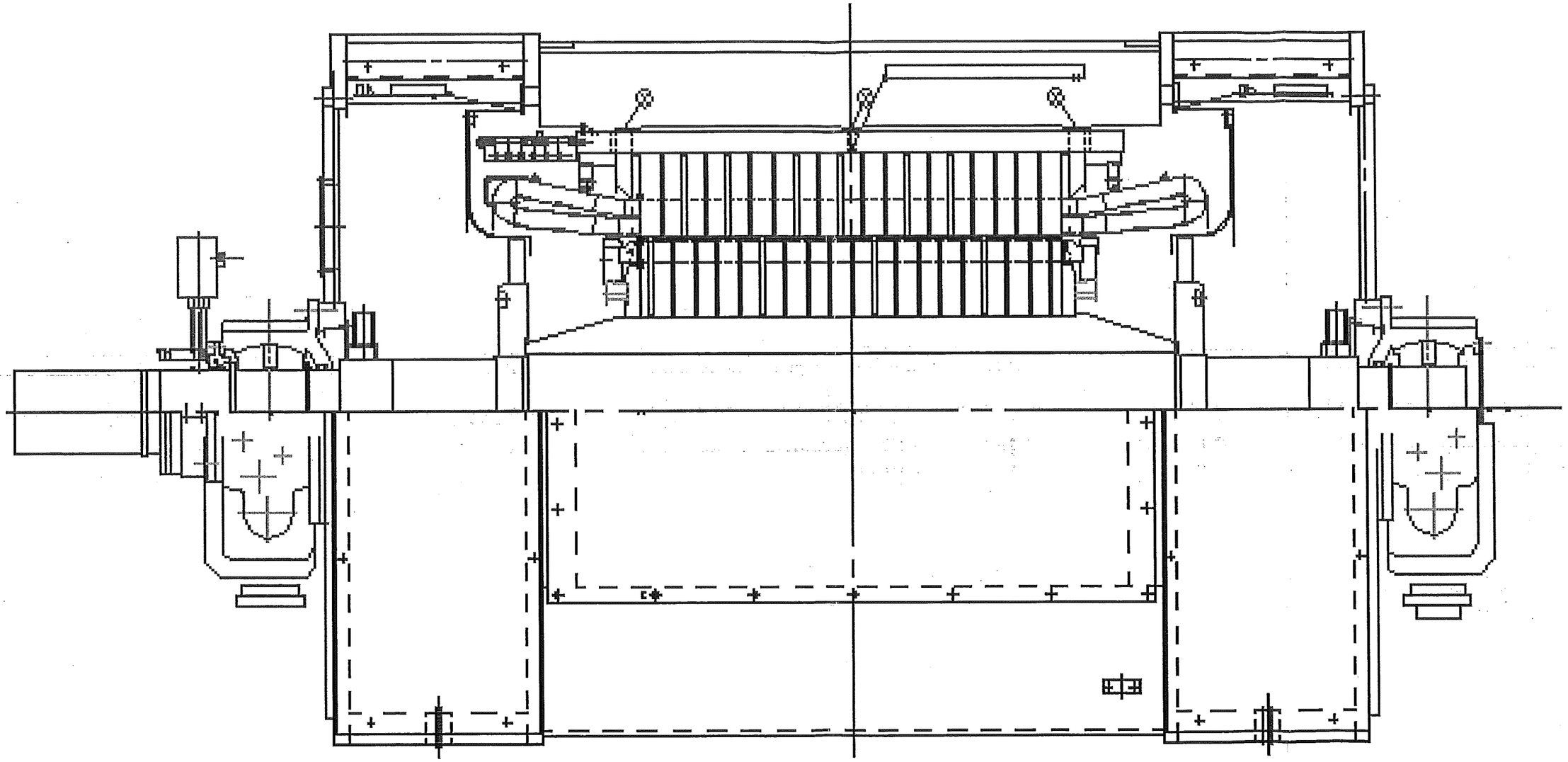
AS/DE ..... Antriebsseite / DRIVE END
BS/NDE ..... Nichtantriebsseite / NONE DRIVE END

Dyn. Fundamentbelastung im Abstand "A" bei:
DYN. FORCE EXERTED AT DISTANCE "A" BY:

Nennmoment / RATED TORQUE:	± 39.4 kN
Max. Moment / MAX. TORQUE:	± 394 kN
Gesamtmasse / TOTAL MASS:	~ 19500 kg
Rotormasse / ROTOR MASS:	~ 5400 kg
Massenträgheitsmoment J / MASS MOMENT OF INERTIA MR2:	~ 400 kgm2

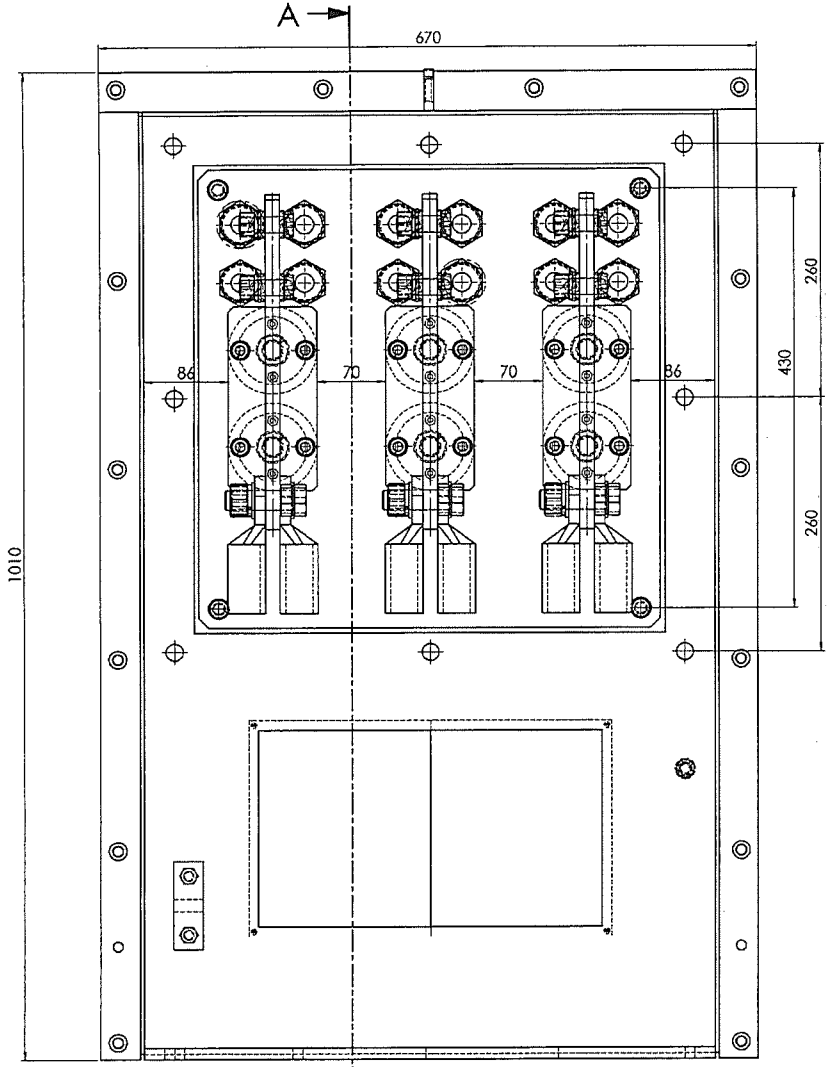
Ers.Stücklste / PARTS LIST SEPERATE: n | A: | B: | C:
Maßst. / SCALE 1:12.5
Anlage/PLANT MAC MOTOR B600KW | Mat.Nr. 526020
Kunde/PURCH. Air Liquide AGS | Projekt Nr.
Type | Klassen Nr.
Bearb/DES 05-02-24 Hommerer
Gepr/CHECK
Oberfläche / SURFACE
ELIN EBG Motoren GmbH
Allgemeintoleranzen / GENERAL TOL. ISO 2768-mH ONORM M 1385-m
Maßbild DIMENSION DRAWING
HKM-180E04 IM1001 (B3) IP55
8600 kW 6 kV 1492 1/min 50 Hz
5860359
Bl./SHT von/OF
And./MOD | Ähn.Z./SIM.TO | Ers.f./SUBST.FOR | Ers.d./REPL.BY
Mod.Nr. 5860359,mosb | Mappen Nr. 180
m A2

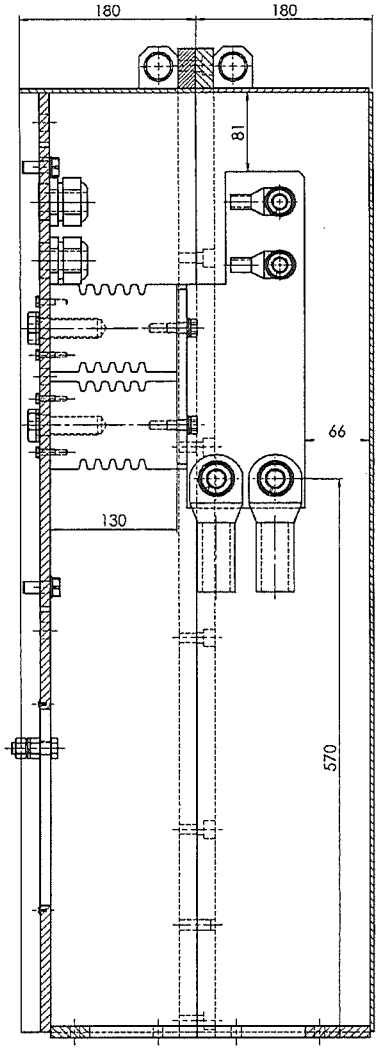
Werkz.Nr./TOOL NR.	Benennung/TITLE	für Teil/FOR POS.	Ä	Änderung/MODIFICATION	DAT.	NAME	APP.



Schnittbild HKM-180E04

Sectional drawing





A-A

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

N° AFFAIRE		Format	Groupe	N°
Rev				
KOSICE 50-3023-01		A3	711	121
A				

X	Änderung	Datum	Name	Apn.

Gelt. Stückliste / PARTS LIST SUPERSEDES: Y / N

Masse: - kg

Massenträgheit: - kgm²

Maßstab SCALE 1:3.5

Anlage / Plant: -

Kunde / PURCH.: -

Type: HRM 090 D04

Bearb./DES: 17.04.05 Rauchenberger

Gepr./CHECK: - -

Mat.Nr. 525883

Projekt Nr.: -

Klassen Nr.: - BG

Oberfläche SURFACE Ra acc. DIN ISO 302

Allgemeintoleranzen GENERAL TOL. ISO 2768 - mH OENORM M 1365 - m

Klemmenkasten kompl.

6kV

mit Stützer

5859792DOK

Bl./SHT 1

von/OF 1

Anc. / REV.

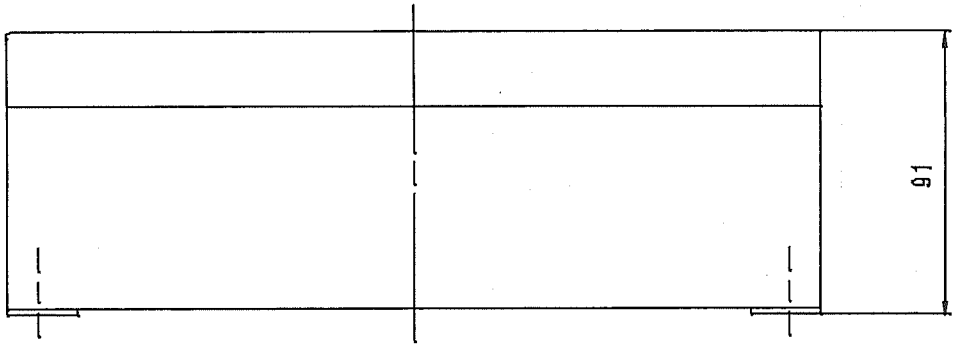
Ers.Z./SUB.TO 5859589

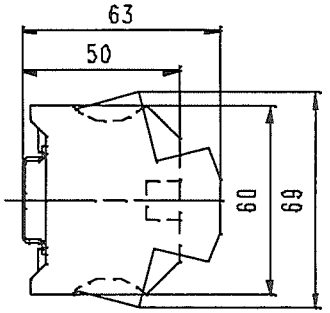
Ers.d. / USST.FOR

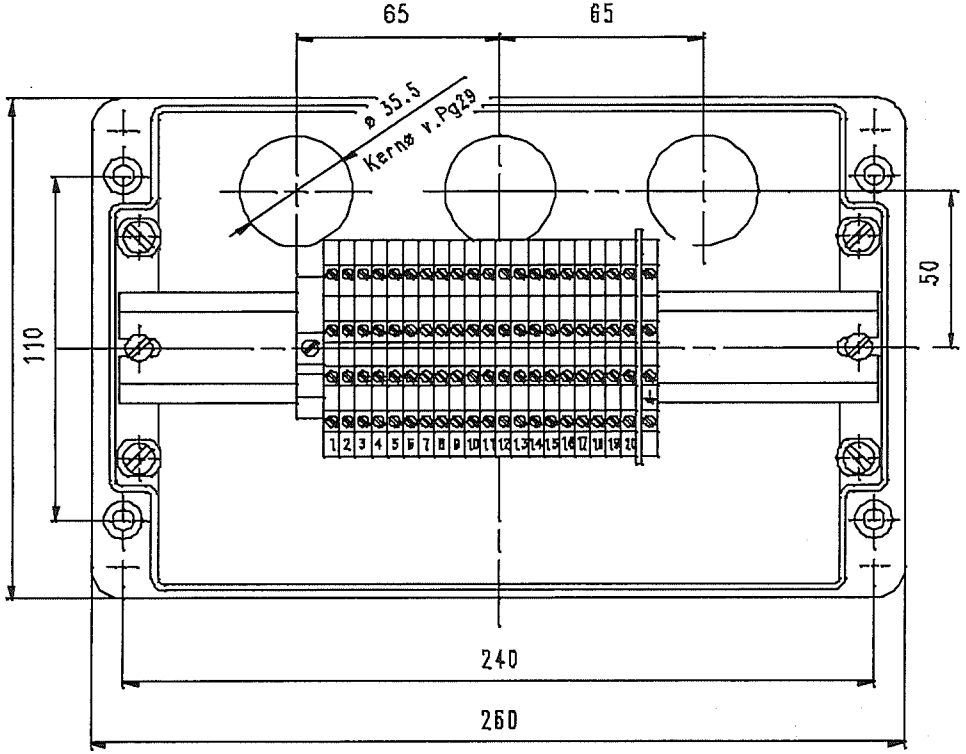
Ers.d. / REPL.BY

EDV Nr. 5859792DOK_Klemmenkasten_komp_ Maape Nr. 20/3 abn

A2







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Rev						
KOSICE 50-3023-01		A4	711	123		
A						
0	21.04.05	Hoerz	first issue		Holzer	
Rev	Date	Drawn by	revisions		check by	appr. by

Getr.Stückliste / PARTS LIST SEPERATE: x / n — A: — B: — C:

Maßst. SCALE: 1

Anlage/PLANT

Kunde/PURCH.

Type

Bearb/DES 05.04.05 Hörz

Gepr/CHECK

Mat.Nr. 526018

Projekt Nr.

Klassen Nr. BG

ELIN EBG Motoren GmbH

Oberfläche/SURFACE

Allgemeintoleranzen GENERAL TOL. ISO 2768-mH ÖNORM M 1365-g

5860390

BL./SHT van/OF

Änd./MOD

Ähn.Z./SIM.TO 5881945

Ers.f./SUBST.FOR

Ers.d./REPL.BY

Klemmenkasten K61

mit Klemmleiste

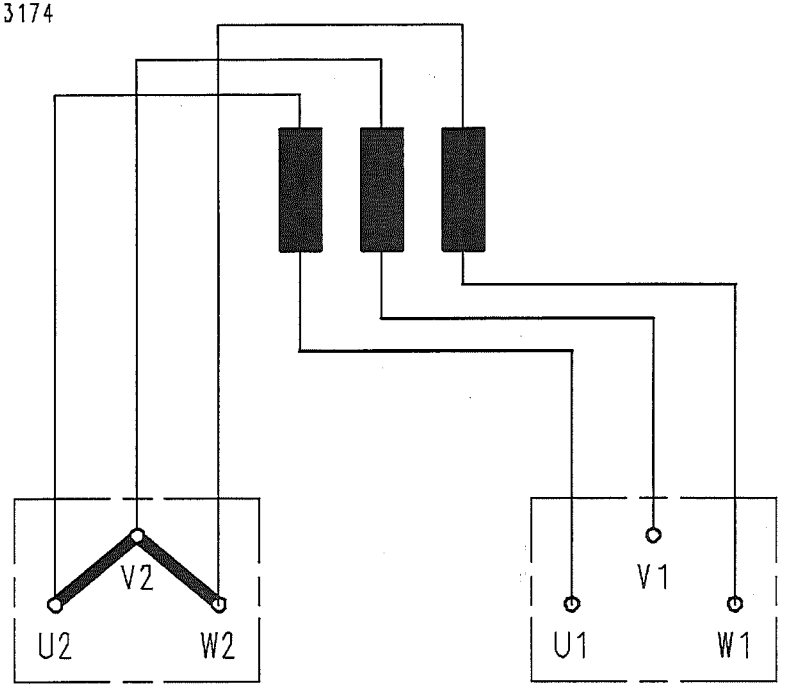
Mod.Nr. 5860390,klt — Mappen Nr. 20 K61

III A3

Teil/POS. | Benennung/TITLE | Wz.Nr./TOOL NR. | Änderung/MODIFICATION | DAT. | NAME | APP.

1	Neues Original	1992 10-19	Tram	
Ä	Änderung/MODIFICATION	DAT.	NAME	APP.

5203174



Ansicht der Klemmenbrücke
VIEW OF TERMINAL BOARD

links von AS
LEFT FROM DE

rechts von AS
RIGHT FROM DE

Schaltbild
6 Ständerklemmen
Sternschaltung

CONNECTION DIAGRAM
6 STATOR TERMINALS
STAR CONNECTION

Bearb/DES	92-10-19	Tramsek		
Gepr/CHECK				

Anlage/PLANT	Kl.Nr.	Maßst. SCALE *	Schaltbild
Kunde/PURCH.			CONNECTION DIAGRAM
Type *	Ers.d./REPL.	Freimaßtol. GENERAL TOL. EN 131	
Proj.Nr.	Ers.f./SUBST. 5203174 vom 2.11.81		
Mat.Nr. *	BG *		

Mod.Nr. A5203174,SCHB | Mp.Nr. 214/8

ELIN EBG Motoren GmbH

5203174

Bl./SHT
von/OF

Änd./MOD 1

Ähnl.Z./SIM.DR.:

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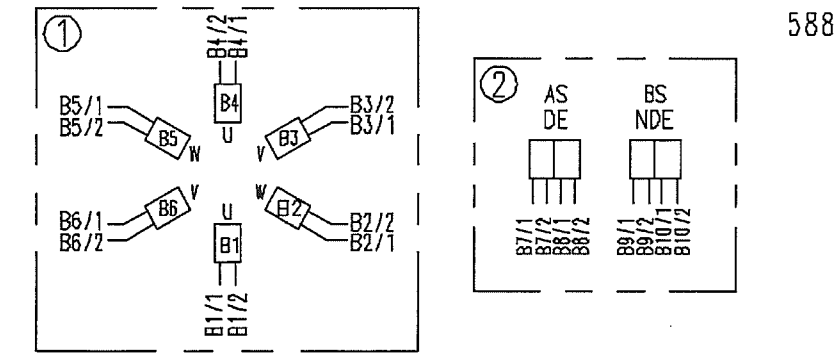
Å	Änderung/MODIFICATION	DAT.	NAME	APP.	

5882008



① B 1-6 .. Nutthermometer PT100 — SLOTTHERMOMETER PT100
② B 7-10 ..Lagerthermometer 2xPT100 — BEARINGTHERMOMETER 2xPT100
③ Klemmen — TERMINALS

			Bearb/DES	02-05-11	Hammerer
			Gepr/CHECK		
Anlage/PLANT	Kl.Nr.	MaBst. SCALE /	Schaltbild CONNECTION DIAGR.		
Kunde/PURCH.			Nutthermometer PT100 / Lagerthermometer 2xPT100 — SLOTTHERMOMETER PT100 / BEARINGTHERMOMETER 2xPT100		
Type	Ers.d./REPL.	Allgem.Tol. GENERAL TOL. ISO 2768-mH ÖNORM M1365-m			
Proj.Nr.	Ers.f./SUBST.				
Mat.Nr.			Mod.Nr. 5882008,schb	Mp.Nr. Schaltb.	

ELIN EBG Motoren GmbH

5882008

Bl./SHT

von/OF

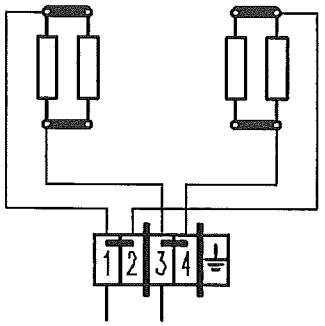
Änd./MOD . . . . . .

Ähn.Z./SIM.TO .

m

A4

5855183



Spannung u. Leistung nach Leistungsschild
Voltage a. rating acc. ratingplate

Ä.	Änderung/MODIFICATION	DAT.	NAME	APP.

Wz.Nr./TOOL NR.	Benennung/TITLE	Teil/POS.

Maßst. SCALE 1:1 K4	Anlage/PLANT			
	Kunde/PURCH.			
	Type			
	Bearb/DES	93-10-20	Papst	
	Gepr/CHECK			

Mat.Nr. 525312
Projekt Nr.
Klassen Nr. BG

Oberfläche/SURFACE

ELIN EBG Motoren GmbH

Allgemeintoleranzen
GENERAL TOL.
ISO 2768-m
ÖNORM M 1365-m

Schaltbild
CONNECTION DIAGRAM
Stillstandsheizung
SPACE HEATER

5855183

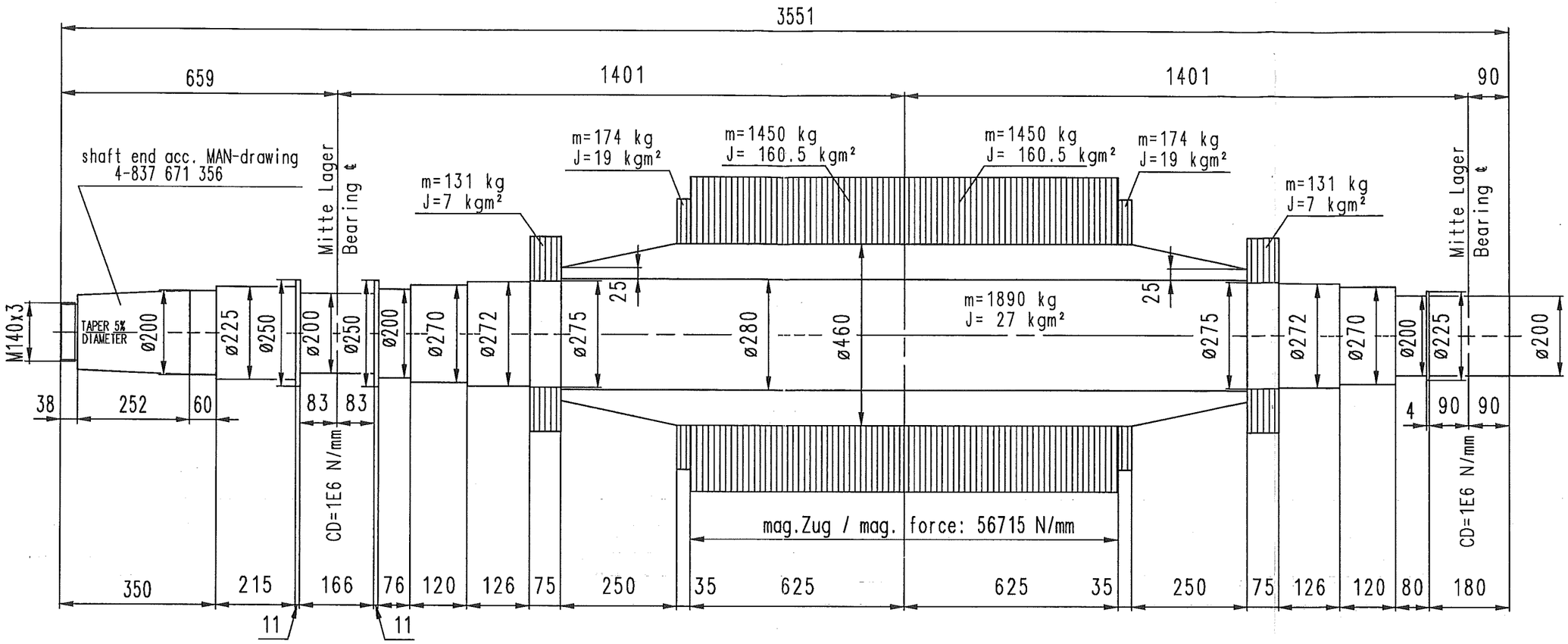
Bl./SHT
von/OF

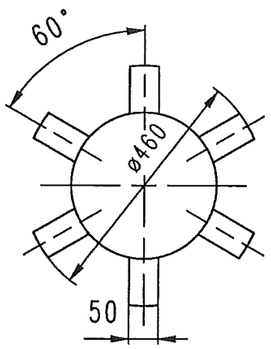
Änd./MOD
Ähn.Z./SIM.TO
Ers.f./SUBST.FOR
Ers.d./REPL.BY

Mod.Nr. A5855183,SCHB | Mappen Nr. Schaltbilder

m | A4

Teil/POS.	Benennung/TITLE	Wz.Nr./TOOL NR.
5860344		





Wellenwerkstoff: S355J2G3
Shaft material:

Rotormasse: ≈ 5400 kg
Rotor mass:

Massenträgheitsmoment J: ≈ 400 kgm²
Mass moment of inertia mr²:

Rev	Date	Drawn by	revisions	check by	appr. by
1	.	.	Wellenende u. Lagerø geändert.	.	.
Ä	.	.	Änderung/MODIFICATION	DAT.	NAME

N° AFFAIRE	Format	Groupe	N°
Rev			
KOSICE 50-3023-01	A3	711	109
2			

Getr.Stückliste / PARTS LIST SEPERATE	* / n	A:	B:	C:

Maßst. SCALE /	Anlage/PLANT "ASU No.9"(MAC MOTOR 8600kW)	Mat.Nr. 526020	Oberfläche/SURFACE
	Kunde/PURCH. Air Liquuide AGS	Projekt Nr.	
	Type	Klassen Nr.	
	Bearb/DES 05-01-17 Hammerer	ELIN EBG Motoren GmbH	Allgemeintoleranzen GENERAL TOL. ISO 2768-m ÖNORM M 1365-m
	Gepr/CHECK	5860344	Bl./SHT von/OF
HKM-180E04		Änd./MOD 1	
Wellenmaßzeichnung		Ähn.Z./SIM.TO .	
Shaft dimension drawing		Ers.f./SUBST.FOR .	
Mod.Nr. 5860344,WEMB	Mappen Nr. HK 180	Ers.d./REPL.BY .	m A3

ELIN EBG Motoren GmbH

ELIN EBG Motoren GmbH

Fabrikationsnr. / Serial no.: 526020 05001

Projekt / project: Air-Liquide / Kosice

Hochlaufkurve

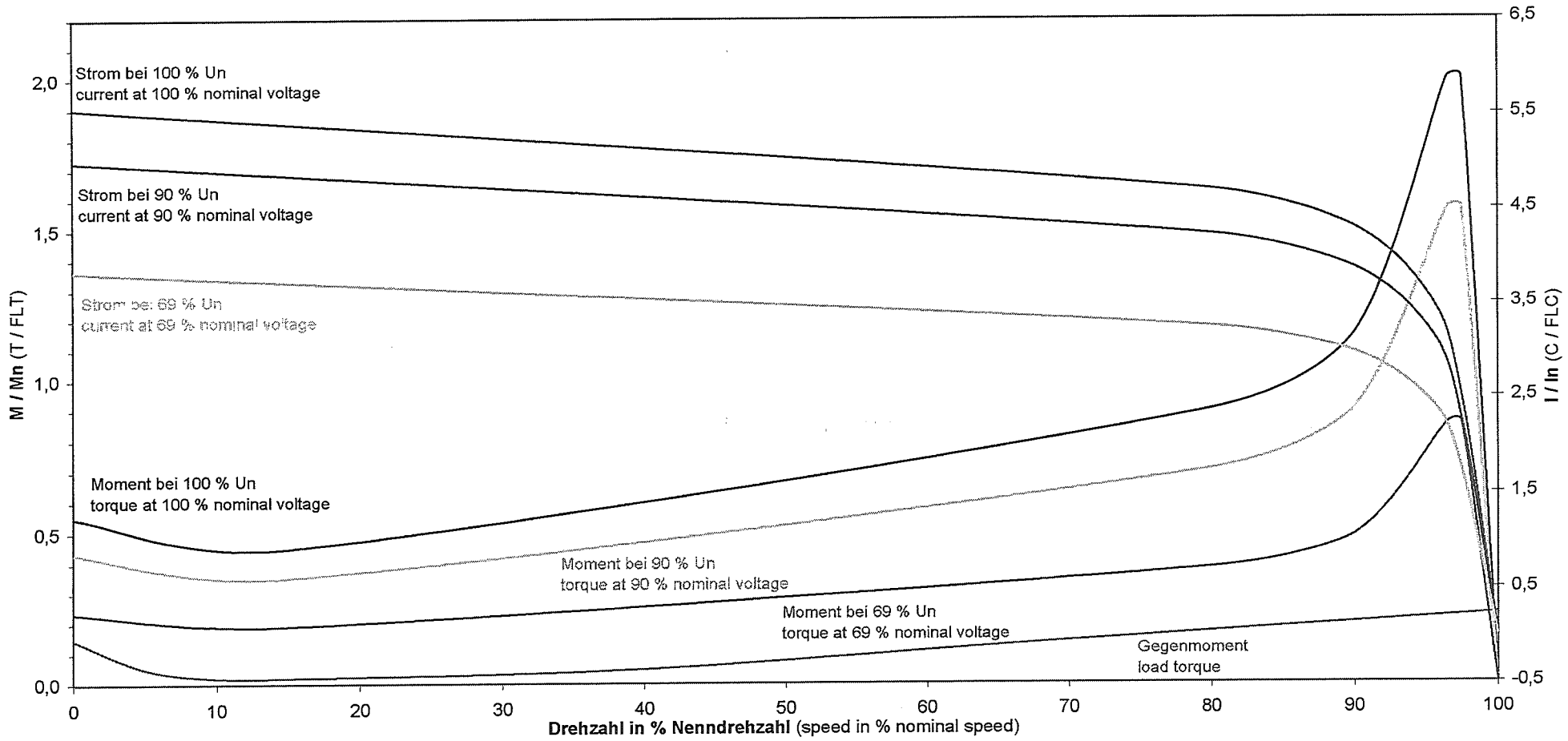
Start-up behavior

Motor type **HKM - 180 E04**

Drehstrom - Asynchronmotor / Three phase squirrel cage induction motor

Motordaten / motor data:

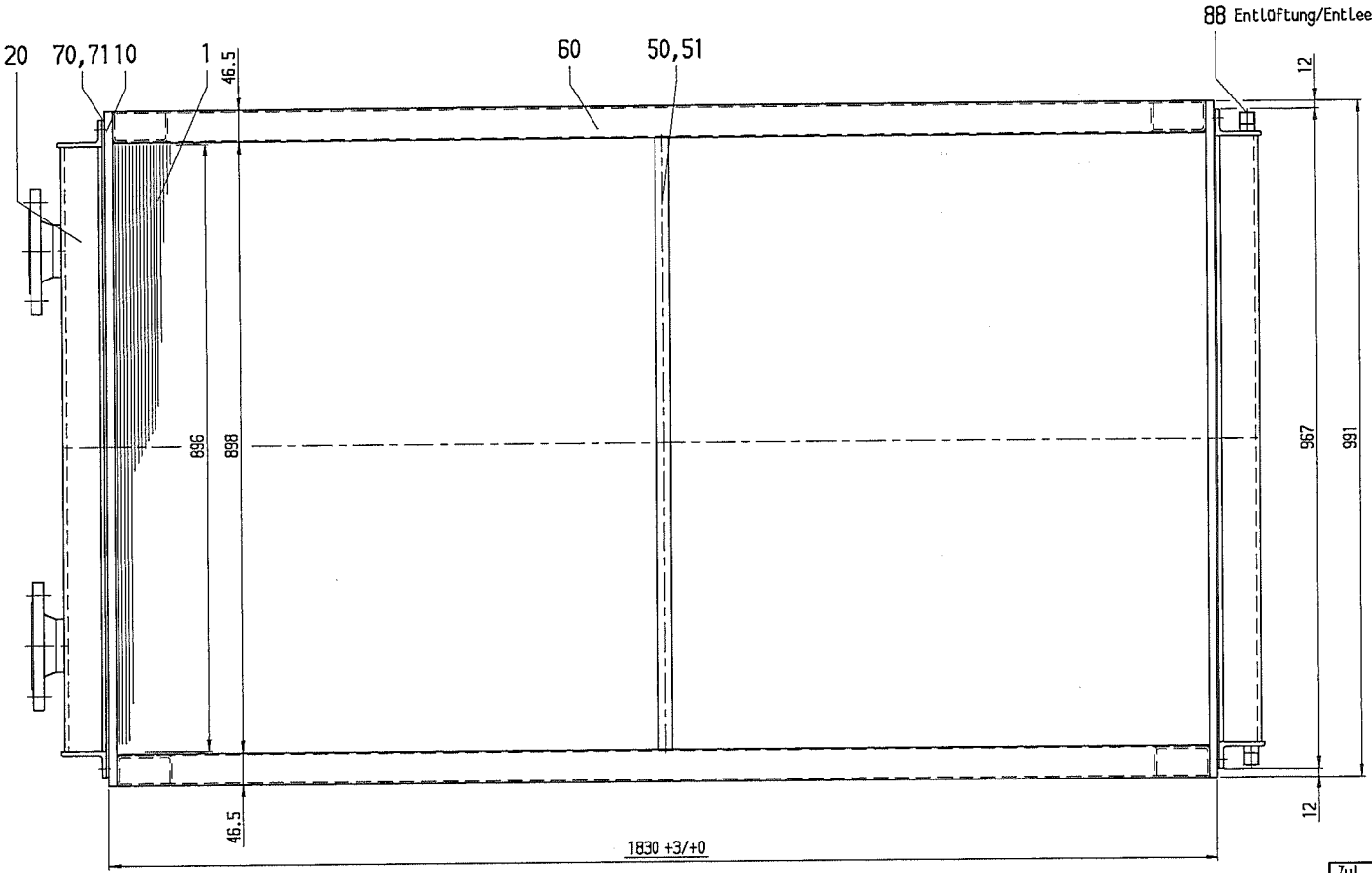
P_N =	8600 kW	f =	50 Hz
M_N =	55046 Nm	n_N =	1492 rpm
U_N =	6000 V	J_{Mot} =	425 kgm²
I_N =	929 A	J_{Last} =	2300 kgm²
t_A at 100% U_N =	12 sec.	t_A at 69% U_N =	36 sec.
t_A at 90% U_N =	16 sec.		

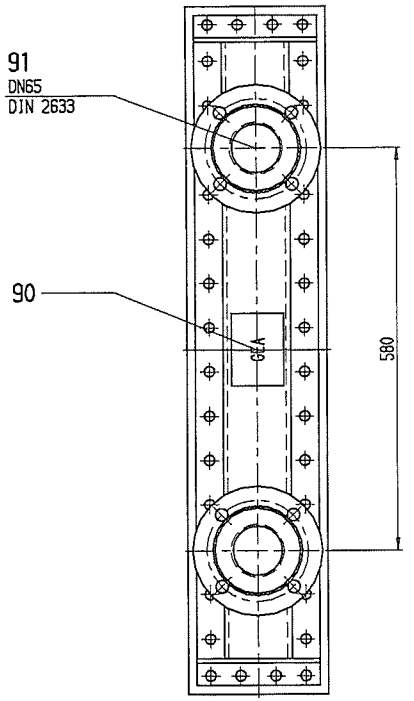


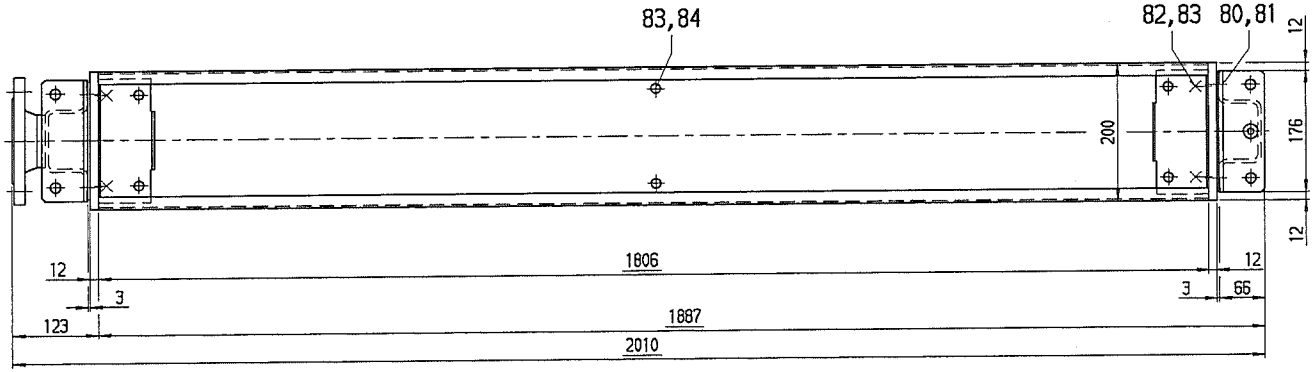
						N° AFFAIRE	Format	Groupe	N°
						Rev			
						KOSICE 50-3023-01	A4	711	107
0	21.01.05	Schneeflock	first issue	Holzer		A			
Rev	Date	Drawn by	revisions	check by	appr. by				

Erstellt: Schneeflock / EMG-TE1
Datum: 21.12.2004

M-I-Kennlinie 526020







Zul. Betriebsüberdruck PERM. OPERATING GAUGE PRESS.	8 bar	Inhalt CONTENTS	~ 23 l
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Kreislaufkühler
CLOSED CIRCUIT COOLER
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GEA Maschinen-
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Betriebs- und Wartungsanleitung

Operation and Maintenance Instruction

GEA Kreislaufkühler

GEA Circuit Cooler

für Elektromotoren und Generatoren
for Electric Motors and Generators

Deutsch/English

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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 Trennstege 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.

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

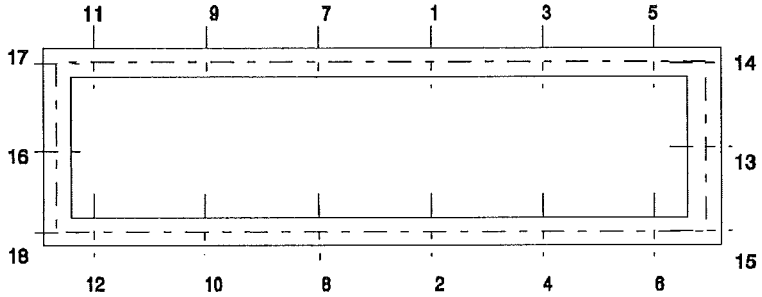
The cooler consists in accordance with the thermal requirements out of one or more single bundles. The design of the cooler arrangement is adapt together with the electric engine builder to the layout of the plant. Normally the air flows in a closed circuit through the engine and the cooler. The air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

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.



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

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

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:

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

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.

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

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

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.

The bundles can be drained or vented by plugs.

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.

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

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.

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.

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

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

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.

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

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

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 Grenzgeschwindigkeiten 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 Grenzgeschwindigkeit 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

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:

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.

4.4.2 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 geschossene 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 Betiebsverhältnissen 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 Rohrinnenseite, 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 Rohrinnenseite 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 Korrosions-Leckage 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 watercircuits 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 payed 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.

INSTRUCTIONS
for installation and operation

SLIDE BEARING TYPE EF
Lubrication by oil circulation, with loose oil ring

Bearing Types and Coding

e.g. EFZLB	14-125	
Type	E	
Housing	F:	finned flange-mounted bearing; for insulated bearing housings the designation »insulated« is added.
Heat dissipation	Z:	lubrication by oil circulation
Shape of bore	L:	cylindrical bore with loose oil ring
Thrust surface	B:	plain whitemetal shoulders
	K:	axial taper lands
	Q:	without thrust faces (non-locating bearing)
Bearing size	14	
shaft diameter	125	

Introduction

All items of the installation and operating instructions are to be complied with in order to ensure the perfect functioning and troublefree operation of the slide bearings. Paramount importance should be attached to the cleanness of the work place and the parts which are to be assembled.

The connections for the thermometer (I) and the oil-level gauge (12) are available on both sides in order to provide possibilities for assembly on the right and on the left side. The oil drain plug (III) is located centrally below the bearing.

In the case of insulated bearings the inside spherical housing surfaces are lined with nonconducting PTFE film which projects in some places in order to avoid sparkovers. The retention stopper (13) in housing (2) which prevents the bearing shell from dislocating is surrounded by a nonconducting sleeve. The shaft seals (9) and (10) are made of nonconducting material. The temperature monitoring instruments which are to be fitted by the user have to be suitably insulated (e.g. by using insulated protective pipes, plastic screw fittings). RENK-Hannover works will offer solutions upon request.

The bearings are supplied fully assembled, but without oil filling. They are suitably protected against corrosion, depending on the relevant case of application.

Oil rings (6), seals and accessories (e.g. flingers and thermometers), if any, are separately packed. Oil outlets (16) of special design (longer) will also be separately packed.

For the transport of the fully assembled bearings eye bolts are screwed into the top part (2) of the housing. For safety reasons special care should be taken to ensure that the threads of these eye bolts are exposed to tensile stress only, but in no case to bending strain.

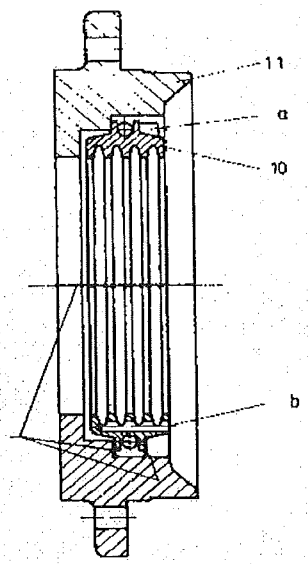
From size 14 onward threads are also available inside the bearing shells (3, 4) allowing for screwing in the eye bolts.

Shaft seal

Bearing size:	14	18	22	28
thread:	M 12	M 16		

The shaft seals are usually designed as floating labyrinth seals. They are made of plastic material and therefore have to be treated carefully. The upper half of the seal is designed in a way to prevent the seal from dislocating (a), while the lower half provides for oil drain holes (b).

Anweisung EF-Lager (Losring)
Nr. 23/03-603 A
englisch, Juni 1994



10 Labyrinth seal
11 Seal carrier
a Anti-rotation stopper
b Oil drain holes

Sealing compound

Outboard shaft seal (10) with seal carrier (11)

For the purpose of dismantling pull apart the assembled seal halves, slightly tilting them to unlatch the garter spring and open by turning the lock to the left.

For special designs please refer to our shaft seal instruction No. 23/03-327.

Oil supply

In order avoid dry run of the bearing when the shaft starts/stops rotating, the oil supply system has to be operated with an appropriate safety period. To assure emergency lubrication by means of the loose oil ring, the peripheral speed of the shaft must not exceed 25 m/s. A weir (16) in the outlet pipe keeps the oil inside the bearing at the required level.

Choose such a pipe size that the flow rate in the inlet pipe does not exceed 1.5 m/s and 0.15 m/s in the return line. The return pipes must not be obstructed by screw connections, and gradients below 15° have to be avoided, otherwise the cross sections have to be respectively larger.

Pipes must be laid and supported in a way that no undue loads or vibrations act on the connections to bearings housings.

Welded and hot bent, rusted or contaminated pipes must be pickled before use and than neutralized.

Installation

After removing the top part of the housing (2), the bearing shell halves (3, 4), the seal carrier (11) and the shaft seals (9 and 10) the housing and the bearing shells must be cleaned of any residues (preservation agents) and checked for eventual damage occured in transit. Completely remove or volatilize all chemical detergents.

Special care has to be taken to ensure that the shaft is clean and in perfect condition in way of the bearing. Before installing the slide bearing it is recommended to check the wear pattern of shaft and the bearing shell (scoring) and to make sure that the floating labyrinth seal does not jam on the shaft. For this purpose:

- Place the garter spring of the seal around the shaft and connect by twisting.
- Locate the seal halves on the shaft and insert the garter spring in its groove.

  ATTENTION:
  The seal must now turn smoothly on the shaft. Otherwise overheating and shaft damage will result during the operation of the bearings.

  Check the seal parts for marks of undue contact. In such case, rework the parts.

Proceed with the installation as follows:

- Mount the machine seal (14) (as far as provided for by the design) inside the machine housing.
- Assemble the bottom part of the housing (1). (The fixing bore in the bottom serves for special applications only!).
- Raise the shaft.
- Lubricate the spherical surface inside the housing with the same type of oil as specified for the application.
- Carefully position the lower bearing shell (3) on the shaft and turn into position.

  ATTENTION:
  Do not damage the thrust surfaces of the locating bearing when turning the shell!
- Align the bottom shell (3) in accordance with the split line of the housing.

Following this, fit the loose oil ring (6). Here again, particular care has to be taken to ensure the safe operation of the bearing. When handling the oil ring its true geometry (ovality, flatness) must not be affected.

- Place the oil ring onto the shaft and screw in the bolts.
- Check the ring as to joint offsetting and align the ring halves in parallel position, if necessary.
- Tighten the bolts according to the torque indicated hereafter:

Bearing size:	9	11	14	18	22	28
Torque Nm:		1,4			2,7	

- Lubricate the shaft and the upper shell (4) with the same type of oil that is to be used later on.
- Lower the shaft; thus spherical seating is achieved.
- Put on the upper shell and make sure that the identification numbers embossed in the upper and lower shell (near the splitline) are identic and are located at the same side.

  ATTENTION:
  Incorrect assembly may cause severe damage to the shaft and the bearing shell!

Now prepare the inboard seal (9) for installation after having checked that it smoothly turns on the shaft. Generally, a floating labyrinth seal, in halves, (held together by a garter spring) is used.

- Apply a thin layer of the enclosed non-hardening sealing compound (Curil T or similar compounds) on both sides of the outer web (see illustration) of the seal halves; the manufacturer's instructions for use of the sealing compound are to be complied with.
- Also apply this non-hardening sealing compound on the splitline of the upper half of the seal.
- Now place the lower half of the seal with oil drain holes (b) to the inside of the bearing, turn it into position and align it parallel to the split-line.
- Then place the upper half of the seal on the shaft (anti-rotation stopper (a) directed to the inside of the bearing).
- Insert the garter spring in the groove of the seal and lock.
- Then again check the parallel alignment of the seal parts, as well as parallelity of sealing system/-split-line of housing.
- Completely coat the joint face of the lower part of the bearing with non-hardening sealing compound (refer to instructions for use).
- Carefully lower the top part of the housing, swing it into the machine shield, position against the flange and attach in parallel position.

  ATTENTION:
  When lowering the top part check that the seal slides into place properly. If so, the top and bottom parts of the housing will close tightly.

  If not, raise the top part of the housing and check and correct the positions of the anti-rotation devices (13) and (a) on the bearing shell (4) and the shaft seal (9)!
- Hand-screw the joint bolts (7) crosswise.
- Tighten the flange bolts of the top part of the housing on the machine shield (15) with the torque indicated:

Bearing size:	9	11	14	18	22	28
Torque Nm:	89	89	215	420	725	1450

In the case of installations subject to vibrations bolts must be secured by means of fixing compounds, such as Loctite 242 or similar.

- Then tighten the joint crosswise with 80 % of the torque indicated above.

  Here too, bolts must be secured, same as in installations subject to vibrations.

  Following this, prepare the outboard shaft seal (10) same as the inboard seal and place it onto the shaft. Then fit the seal carrier (11) as follows:
- Apply the non-hardening sealing compound (following the instructions for use) on the flange surface and the joint of the seal carrier halves.
- Place the seal carrier halves onto the labyrinth seal, slide them into the bearing housing and tighten the bolts according to the table below:

Bearing size:	9	11	14	18	22	28
Torque Nm:	10,5			26		

In case of installations subject to vibrations, bolts have to be secured against loosening (fixing compound).

After removing the respective locking screws the oil circulating system is connected. To facilitate maintenance, it is recommended to mount the oil sight glasses on one side of the bearing.

- The oil outlet (16) has to be mounted in a way that the overflow weir is below and in horizontal position. Then the mark at the flange is visible in the middle (on top).

  ATTENTION:
  With too low torques the lead seal sets, therefore retightening has to be done several times at intervals of some minutes.
- Seal the oil inlet appropriately (hemp, TEFLON strips, LOCTITE 572 or similar).

Putting into operation:

After assembly of the pipe lines the complete oil circuit has to be purged to avoid damage to the bearing due to contamination. Use the same type of oil that will be used later. Disconnect all measuring instruments (pressure controller, flow controller etc.) and seal the connections.

It is recommended to collect the heavier contaminated first few litres of flushing oil separately. Rinsing should be continued until the oil comes out clean. Clean the filters after the rinsing process.

ATTENTION:
Under no circumstances may the bearing be connected to the piping while the lubricating system is being purged.

After removing the oil level gauge (8) the bearing can be filled with the same type of oil as specified for operation. The relevant indications are to be taken from the type plate of the bearing or from the calculations.

Alternatively, filling may be done through the oil supply system.

All holes which are not to be used must be plugged up. Check all connections with regard to tightness, at the same time checking the correct position of the seals.

Prior to putting the plant into operation, check the oil throughput of the oil circulating system. The required throughput can also be taken from the bearing type plate or the RENK pre-calculations. Capacitive measuring or setting of the flow meter should preferrably be done with the oil at service temperature, otherwise the flow meter must be readjusted when steady operating temperature has been reached.

ATTENTION:
If the bearing temperature measured during the trial run is far above the value pre-calculated by RENK Hannover the machine must be stopped and the causes for the increased bearing temperature investigated.

Then the throttle valves, multi-way taps or similar elements must be secured against unauthorized handling. Should the system be started under load, care has to be taken that the oil supply plant is started/stopped with an appropriate time margin.

For further information please refer to the RENK brochure of »Manual for the application of RENK slide bearings« and »Instruction for slide bearing maintenance and inspection«.

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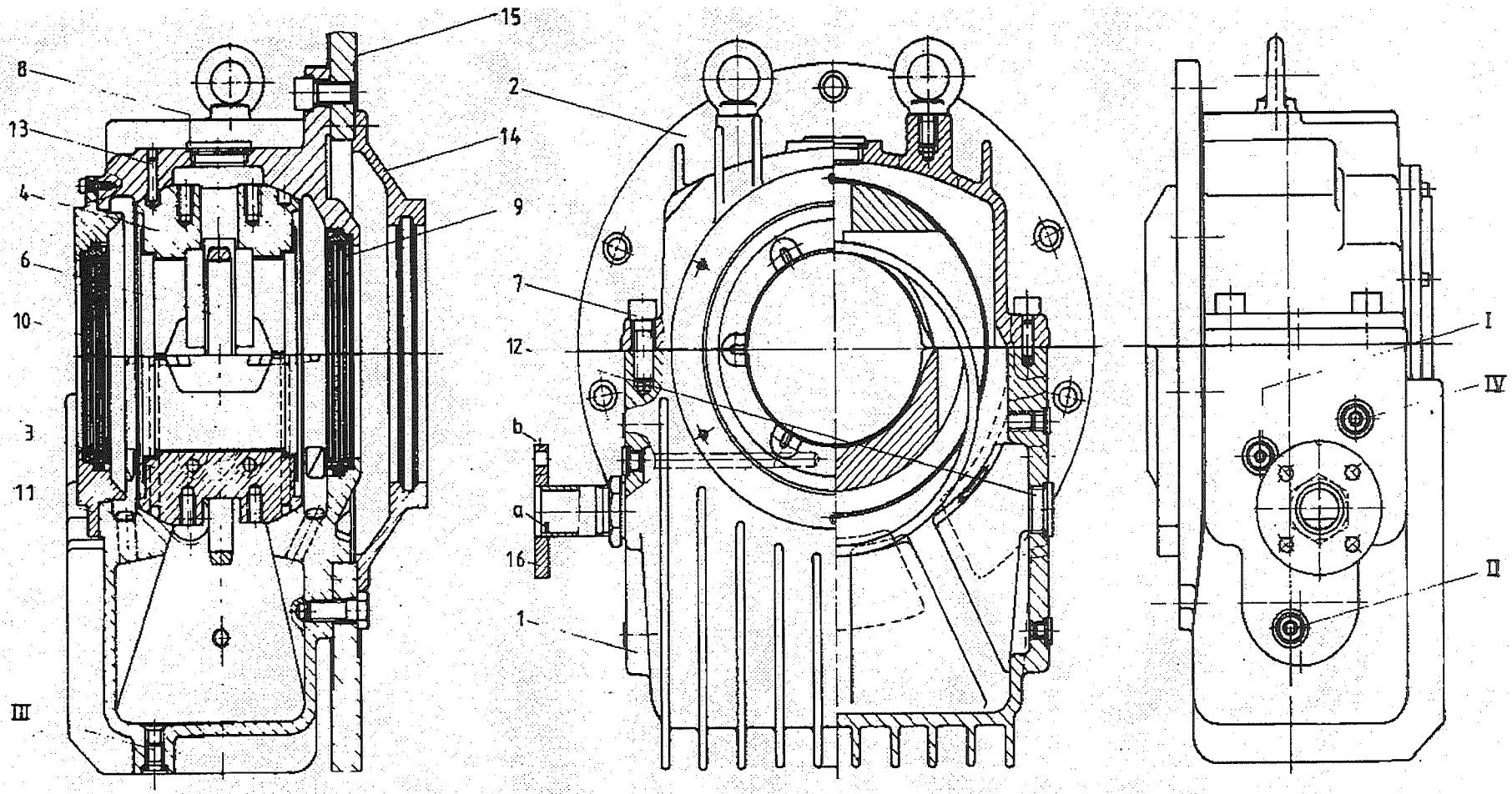


1 Bottom part of housing

2 Top part of housing

3 Lower bearing shell

4 Upper bearing shell

6 Loose oil ring

7 Joint bolt

8 Top sight glass

9 Inboard shaft seal

10 Outboard shaft seal

11 Seal carrier

12 Oil level gauge

13 Retention pin

14 Machine seal

15 Machine shield

16 Oil outlet

I for temperature measurement

II for temperature measurement in the oil sump

III Oil drain hole

IV Oil inlet hole

INSTRUCTIONS
for maintenance and inspection

SLIDE BEARING TYPE EF
lubrication by oil circulation with loose oil ring

Bearing Types and Coding

e.g. EFZLB 14-125

Type	E	
Housing	F:	finned flange-mounted bearing; for insulated bearing housings the designation »insulated« is added.
Heat dissipation	Z:	circulating oil
Shape of bore	L:	cylindrical bore with loose oil ring
Thrust surface	B:	plain whitemetal shoulders
	K:	axial taper lands
	Q:	without thrust faces (non-locating bearing)
Bearing size:	14	
Shaft diameter:	125	

Introduction

All items of the installation and operating instructions are to be complied with in order to ensure the perfect functioning and troublefree operation of the slide bearings. Paramount importance should be attached to the cleanness of the work place and the parts which are to be assembled.

The connections for the thermometer (I) and the oil-level gauge (12) as well as for oil inlet (IV) and oil outlet (16) of the oil circulating system are available on both sides, in order to provide possibilities for assembly on the right and on the left side. The oil drain plug (III) is located centrally in the bottom of the bearing.

With circulating oil the oil cooled outside the bearing is directly returned via oil inlet (IV) into the bearing shell designed for this purpose; therefore, higher mechanical and thermal loads than applicable for bearings with self-contained lubrication and natural cooling can be admitted.

In the case of insulated bearings the inside spherical housing surfaces are lined with a nonconducting PTFE film which projects in some places in order to avoid sparkovers. The retention stopper (13) in housing (2) which prevents the upper shell (4) from dislocating is surrounded by a nonconducting sleeve. The shaft seals (9) and (10) are made of nonconducting material. The temperature monitoring instruments which are to be fitted by the user have to be suitably insulated (e.g. by using insulated protective pipes, plastic screw fittings).

For the purpose of removing the top part of the housing eye bolts are to be screwed into the top part (2) of the housing. For safety reasons special care should be taken to ensure that the threads of these eye bolts are exposed to tensile stress only, but in no case to bending strain.

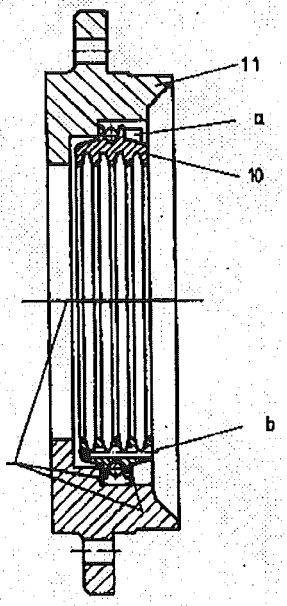
From size 14 onward threads are also available in the bearing shells (3, 4) allowing for screwing in the eye bolts.

Bearing size:	14	18	22	28
threads:	M 12	M 16		

Shaft seal

The shaft seals are usually designed as floating labyrinth seals. They are made of plastic material and therefore have to be treated carefully. The upper half of the seal is designed in a way to prevent the seal from dislocating (a), while the lower half provides for oil drain holes (b).

10 Labyrinth seal
11 Seal carrier
a Anti-rotation stopper
b Oil drain holes



Shaft seal (10)
with seal carrier (11)

For special types, see instructions »Shaft Seals No. 23/03-327.

Anweisung EF-Lager (Lösung)
Nr. 23/03-603 B
englisch, Jan. 94

Maintenance

Keep the bearing housings clean on the outside, since the radiation of heat is reduced by deposits of dust or dirt.

The oil level has to be checked at regular intervals with the machine being switched off; minimum level assuring emergency run is marked by oil being barely visible in the oil level gauge.

If irregular oil levels and operating temperatures are detected the causes for this have to be investigated. RENK Hannover will at any time support you in respect.

Oil change

When using mineral oils we recommend to change the oil after approx. 20 000 operating hours; if necessary, longer intervals may be admitted after prior oil analysis.

Shorter intervals are required in case of frequent starts and stops, high oil temperatures or excessive contamination due to external influences. The general condition of the oil will provide information in this respect.

The housing is drained through the oil drain hole (III) which is located centrally in the bottom of the bearing. Filling is effected through the bore of the sight glass (8) which can be removed using an adjustable face spanner.

When carrying out the oil change special care should be taken to rinse out contaminations and to remove oil sump residues (if possible, drain the oil while the bearing is still warm). If unusual alterations of the oil or extraordinary residues are noted, it is paramount to investigate and, if possible to remove the causes for this before putting the bearing into operation again. If chemical detergents are used they have to be completely removed when the cleaning process is finished.

For filling and re-filling use the same quality of oil as specified for the application. Refer to the type plate of the bearing for the relevant indications.

Inspection

Inspections are to be carried out as a part of the preventive maintenance works. They are also necessary if essential increases of the operating temperature - temperature clearly increased by several degress - or striking alterations of the lubricating oil are detected.

For carrying out an inspection it is sufficient to remove the top part of the bearing while the bottom part may be left on the machine. Thoroughly clean the bearing and the work place before disassembling.

Disassembly

- Unscrew the flange bolts of the top part of the housing (2) on the machine shield (15), the bottom part (1) and on the seal carrier (11).
- Carefully raise the top part of the housing just enough for the housing joint to open evenly, then swing it out of the machine shield and lift it off.
- Remove the upper part of the seal carrier (11).
- Dismantle the shaft seals (9) and (10). For this purpose slightly pull up the relevant upper halves and slightly tilt to unlatch the garter spring.
- Open the garter spring by turning left on the [illegible] and carefully remove the lower half of the seal.
- Mark the assembly position of the upper bearing shell (4) and take it off carefully.
- Unscrew the bolts of the loose oil ring (6) and carefully handle the two halves in a way not to affect their true geometric shape.
- Disconnect the thermometer and all other instruments, if any.
- Raise the shaft (lifting point = middle of the bearing) by only a few tenths of a mm just enough to relieve the lower shell.
- Turn the lower bearing shell (3) until it can be removed.

Visual check

When dismantling the individual components check that all running surfaces are in perfect condition, taking into consideration the period of operation.

In this connection, the bearing shell should show a uniform wear pattern. Possible scorings should be smoothed before reassembling.

Damage to the whitemetal lining, i. e. wiping and whitemetal built-up are not admissible. The causes have to be investigated and removed; new shells have to be used.

Shaft seals have to be replaced should they show an irregular wear pattern or their edges be chipped.

In the case of an insulated bearings check whether the PTFE film and the other components (retention stopper (13) and nonconducting sleeve on the top part of the housing (2)) are in perfect condition.

Check whether the geometry of the loose oil ring is correct (ovality, flatness).

If spare parts are required, please give the original order number indicated on the type plate.

Assembly

After all seal and flange surfaces have been cleaned and all bearing components and the shaft have been checked, it is recommended to check the wear patterns of the shaft and bearing shell and to make sure that the seals (9) and (10) do not jam on the shaft before assembling the slide bearing:

- Place the garter spring of the seal around the shaft and connect by twisting.
- Locate the seal halves on the shaft and insert the garter spring in its groove.

  ATTENTION:
  The seals must now turn smoothly on the shaft. Otherwise overheating and shaft damage will result during the operation of the bearings.

  Disassemble and check seal parts for marks of undue contact. In such case, rework the parts.

Now assemble the bearing as follows:

- Lubricate the spherical surfaces inside the housing as well as the running surfaces with the same type of oil as specified for the application.
- Carefully place the lower bearing shell (3) in its original assembly position on the shaft and insert it into the bottom part of the housing by turning.

  ATTENTION:
  Do not damage the axial running surfaces of the locating bearing when inserting the bearing shell!
- Align the lower bearing shell according to the split line of the housing.

Following this fit the loose oil ring (6). Again, particular care must be taken to ensure the safe operation of the bearing. When handling the oil ring its perfect geometry (ovality, flatness) must not be affected.

- Place the oil ring onto the shaft and screw-in the bolts.
- Check the oil ring as to joint offsetting and align the ring halves in parallel, if necessary.
- Tighten the bolts according to the torque indicated:

Bearing size:	9	11	14	18	22	28
Torque Nm:	1,4			2,7		

- Lubricate the shaft and the upper shell (4) with the oil to be used later on.
- When now lowering the shaft, spherical seating is achieved.
- Put on the upper shell and make sure that the identification numbers embossed in the upper and lower shell (near the splitline) are identic and are located at the same side and in the original assembly position.

  ATTENTION:
  Incorrect assembly may cause severe damage to the shaft and the bearing shell!

Now prepare the inboard seal (9) for installation after having checked that it smoothly turns on the shaft.

- Apply a thin layer of the enclosed non-hardening sealing compound (Curil T or similar compounds) on both sides of the outer web (see illustration) of the seal halves; the manufacturer's instructions for use of the sealing compound have to be complied with.
- Also apply this non-hardening sealing compound on the splitline of the upper half of the seal.
- Place the lower half of the seal on the shaft (oil drain holes (b) towards the inside of the bearing), turn it into position and align it parallel to the split-line.
- Place the upper half of the seal on the shaft (anti-rotation stopper (a) towards the inside of the bearing).
- Insert the garter spring in the groove of the seal and lock.
- Then again check the parallel alignment of the seal parts, as well as parallelity of sealing system/split-line of housing.
- Completely coat the joint face of the lower parts of the bearing with non-hardening sealing compound (refer to instructions for use).
- Carefully lower the upper part of the housing, swing it into the machine shield, place it against the flange and attach in parallel position.

  ATTENTION:
  When lowering the top part check that the seal fits in properly. If so, the housing will close tightly.

  If not, raise the top part of the housing and check and correct the positions of the anti-rotation devices (13) and (a) on the bearing shell (4) and the shaft seal (9)!
- Hand-screw the joint bolts (7) crosswise.
- Tighten the flange bolts of the top part of the housing on the machine shield (15) with the torque indicated:

Bearing size:	9	11	14	18	22	28
Torque Nm:	89	89	215	420	725	1450

If bolts had been secured against loosening, e. g. in the case of installations subject to vibrations (by means of fixing compounds, such as Loctite 242 or similar) they should again be secured in the same way when reassembling.

- Then tighten the joint crosswise with 80 % of the torque indicated above.

Following this, prepare the outboard shaft seal (10) same as the inboard seal and place it onto the shaft. Then fit the seal carrier (11) as follows:

- Apply the non-hardening sealing compound (following the instructions for use) on the flange surface and the joint of the seal carrier halves.
- Place the seal carrier halves onto the labyrinth seal, slide them into the bearing housing and tighten the bolts according to the table below:

Bearing size:	9	11	14	18	22	28
Torque Nm:	10,5			26		

Putting into operation

After removing the oil level gauge (8) the bearing can be filled with the same type of oil as specified for the operation. The relevant indications are to be taken from the type plate of the bearing or from the calculations.

All holes which are not to be used must be plugged up. Check all connections with regard to tightness, at the same time that the seals are correctly positioned. As the lead seal of the oil outlet (16) may settle, it is recommended to retighten the nut after a few minutes.

During the following test run, pay attention to the oil thighness of all connections, to temperature behaviour and oil level which should come up to approx. 5 mm above the lower edge of the oil sight glass.

ATTENTION:
If the temperature prevailing on the bearing after restarting the machine is far above the temperature measured before, the machine must be stopped and the causes for the increased bearing temperature investigated.

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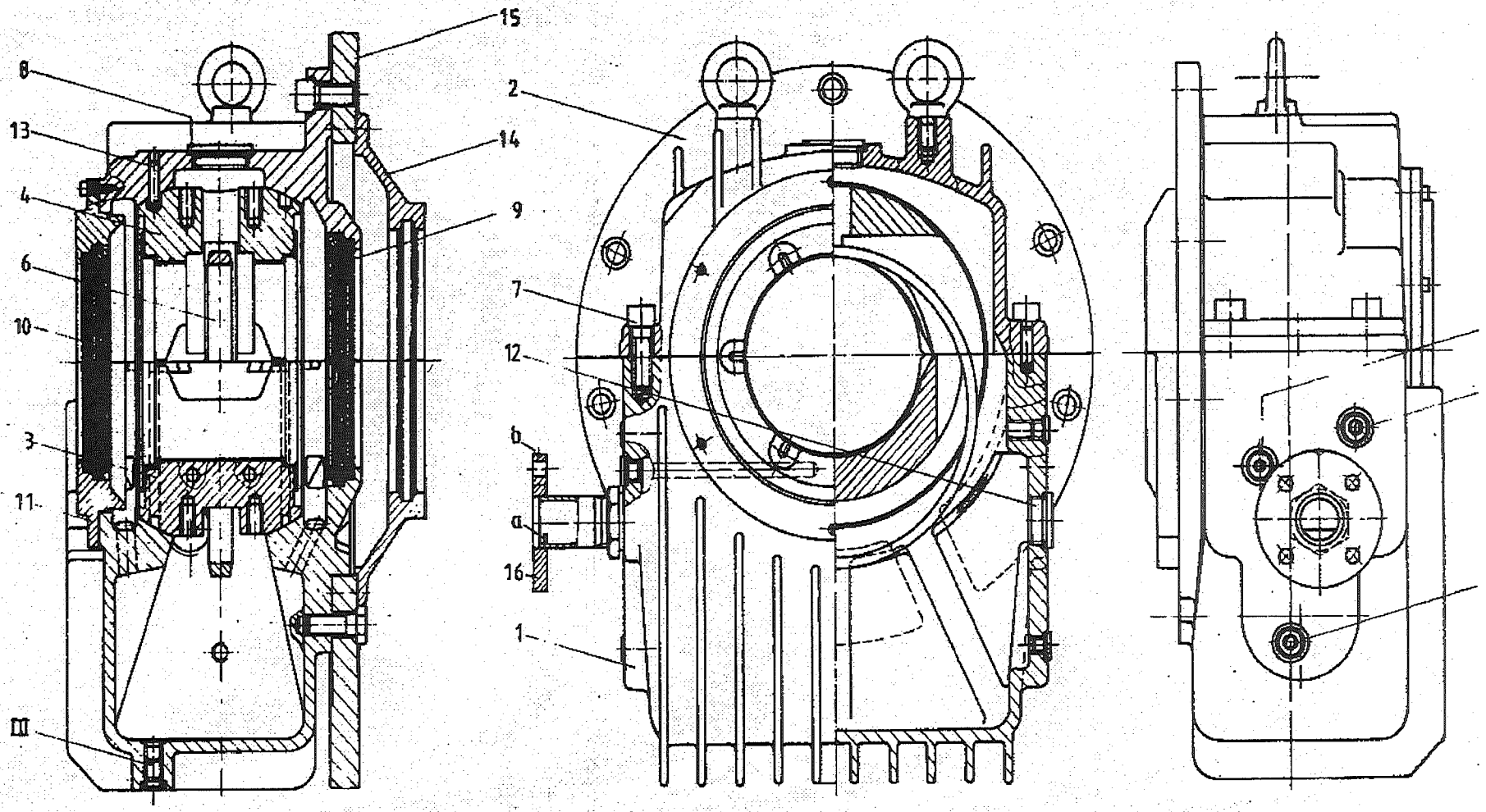

1 Bottom part of housing
2 Top part of housing
3 Lower bearing shell
4 Upper bearing shell
6 Loose oil ring
7 Joint bolt
8 Top sight glass
9 Inboard shaft seal
10 Outboard shaft seal
11 Seal carrier
12 Oil level gauge
13 Retention pin
14 Machine seal
15 Machine shield
16 Oil outlet

I for temperature measurement
II for temperature measurement in the oil sump
III Oil drain hole
IV Oil inlet hole

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, Achshöhe bis - 560 mm** *Three-phase asynchronous machine with squirrel-cage rotor, shaft centre height up to - 560 mm*
Typ: *Model:*	**HKZ**

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

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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
EN 292	*Safety of machinery, Basic concepts, general principles for design*
EN 60034 Reihe	Drehende elektrische Maschinen
IEC 60034 series	*Rotating electrical machines*
EN 60204-1	Sicherheit von Maschinen-Elektrische Ausrüstung von Maschinen, allgemeine Anforderungen
EN 60204-1	*Safety of machinery - Electrical equipment of machines, General requirements*

We Keep the
World in Motion

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

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ELIN EBG
Motoren GmbH

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		

ELIN EBG Motoren GmbH

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. Josef Nistelberger Mr. Manfred Schlagbauer

2. Customer

Company:	Fax:
	Phone:
	E-mail:
Contact person:	
Address of the plant:	☐ 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: ☐ YES ☐ NO	