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	Sleeve bearing NDE	slide-bearings_EF-external-oil-supply_RENK _instructions	2002-07 (en)	O.K.
	Oil inlet/outlet connection – Flow meter	flow-switch_BR-BL_EMKOMETER_datasheet	2018 (en)	O.K.
	Air-to-water cooler	circuit_cooler_KELVION_instructions	2005-01 (en-de)	O.K.
	Water leakage detector	magnetic_float_switch_ASH-V_KFG _instructions	2016-05 (en-de)	O.K.
	Safety valve	safety_valve_SF05_STASTO_datasheet	2018-01 (en)	O.K.
	Shaft vibration monitoring system	proximity_transducer_PROXPAC-XL_B-N _datasheet	2014-05 (en)	O.K.
	Bearing housing vibration monitoring system	accelerometer_330400_B-N_instructions	2004-05 (en)	O.K.

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This documentation pertains to
FQ1721517501
VILNIUS WtE

Three-phase synchronous generator

1DU Series

Type 1DU2054-8AF02-Z

Operating Instructions / Installation Instructions

Edition

10/2018

Answer for industry.

Synchronous generator

1DU Series
1DU2054-8AF02-Z

Operating Instructions
Installation Instructions

This documentation pertains to
FQ1721517501

VILNIUS WtE

Original instructions
Edition 10/2018

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Legal information

Warning notice system

This manual contains notices you have to observe in order ensure your personal safety, as well as to prevent damage to property. The terms **DANGER**, **WARNING**, **CAUTION** and **NOTICE** indicate specific dangers or special information which requires particular attention:

	DANGER
indicates loss of life, severe personnel injury and/or substantial property damage will result if proper precautions are not taken.	

	WARNING
indicates loss of life, severe personnel injury and/or substantial property damage can result if proper precautions are not taken.	

	CAUTION
indicates minor personnel injury and/or property damage can result if proper precautions are not taken.	

NOTICE	
indicates that property damage can result if proper precautions are not taken.	

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified personnel

These are persons who, on the basis of their training, experience and knowledge of the relevant standards, codes, accident prevention regulations and operating conditions, have been authorized by the responsible plant safety officers to perform the work required and who can recognize and avoid potential work hazards.

A sound knowledge of first aid and the local emergency equipment is also required.

Proper use of Siemens products

Note the following:

	WARNING
Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from the manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.	

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Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

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1 Introduction

These instructions describe the machine and explain how to handle it from initial delivery to final disposal of the equipment. Keep these instructions for later use.

Read these operating instructions before you handle the machine and follow the instructions to become familiar with its design and operating principles and thus ensure safe, problems-free machine operation and long service life.

If you have suggestions for improving the document, please contact our Service Center (Page 97).

Text format features

The warning notice system is explained on the rear of the inside front. Always follow the safety instructions and notices in these instructions.

In addition to the safety-related warning notices which you must read, you will find the text in these instructions is formatted in the following way:

1. Handling instructions are always formatted as a numbered list. Always perform the steps in the order given.
- Lists are formatted as bulleted lists.
 - Lists on the second level are hyphenated.

Note

A Note is an important item of information about the product, handling of the product or the relevant section of the document. Notes provide you with help or further suggestions/ideas.

References to other locations in the text

Page information for references to other locations in the text always refer to the higher-level chapter.

Service and Support

The “Service and Support” (Page 97) appendix contains support information for the setup and operation of the machine:

- Contact possibility to the Siemens service.
- General screw-tightening torques if not stated specifically.

Technical data and drawings

You will find the technical data for the machine and all the necessary drawings, e.g. machine dimension drawing and dimension drawing text, in Appendix B “Technical data and drawings” (Page 103).

Note

Missing technical documentation

Please note that not all technical documents may have been available at the time the operating instructions were dispatched. These documents will be supplied at a later date. Place these documents in the Appendix B “Technical data and drawings”.

Quality documents

You will find all the documents that relate to the machine type in the Appendix C “Quality documents” (Page 105).

You will find all the documents verifying the design quality of the individual machines in the separate Manufacturing Data Book (MDB). The MDB is created specifically for each machine.

Note

Missing quality documents

Please note that not all quality documents may have been available at the time the operating instructions were dispatched. These documents will be supplied at a later date. Place these documents in the Appendix “Quality documents”.

Additional documents

You will find additional documents on the machine components in the Appendix D “Additional documents” (Page 107). These may include documents procedures by component manufacturers, such as

- Operating instructions
- Maintenance instructions
- Installation instructions
- Manufacturer recommendations
- Type or data sheets
- Additional drawings
- Danger notice
- Certificates

Checklists and forms

You will find all of the required checklists, forms and test report forms in the Appendix E "Checklists and forms" (Page 109).

In the case that Appendix E "Checklists and forms" is not supplied, follow the instructions in the "Operating instructions / Installation instructions".

Installation documents

All the documents required for installing the components supplied for the electrical machine can be found in Appendix F "Installation documents" (Page 111).

If you have received these operating instructions as part of the documentation for a complete system, this appendix will not be included. Its content is intended exclusively for trained personnel for the purpose of installing and commissioning the machine.

Note

Missing documents

Please note that not all documents may have been available at the time the machine was dispatched. These documents will be made available to you with the final machine manual. Please then update the relevant appendix as required.

2 Safety instructions

This electrical machine is designed to operate in industrial power systems and satisfies the accepted safety regulations pertaining to such equipment.

When in operation, this equipment contains hazardous voltages and hazardous rotating mechanical parts.

Under certain conditions, deficient installation, operation and maintenance can result in loss of life, severe personal injury or substantial property damage.

Persons responsible for the safety of the plant must therefore ensure that

- only qualified personnel is assigned to work on the machine
- the instruction manual supplied with the machine and all other product information necessary to perform the assigned work are always made available to that personnel and that the relevant instructions are strictly followed;
- Unqualified personnel are prohibited from working on the machine.

The contents of this instruction manual shall not become part of or modify any prior or existing agreement, commitment or relationship. The sales contract contains the entire obligations of Siemens. The warranty contained in the contract between the parties is the sole warranty of Siemens. Any statements contained herein do not create new warranties or modify the existing warranty.

Technical data have been laid down for the machines in accordance with the specifications and standards agreed upon in the order. These data are indicated in the dimension drawing, in the dimension drawing text and in the test certificates which are part of the machine manual.

Operation of the machine is only permissible in accordance with these data; any deviations are subject to prior consultation with the manufacturer.

The operating instructions mainly cover the measures to be observed when using the equipment for the intended purpose. In addition to this, the applicable national, local and plant-specific regulations must be observed.

It is assumed that the planning and execution of the mechanical and electrical installations, the transport, erection and commissioning as well as the maintenance measures will be carried out or supervised by qualified personnel. This refers to the observance of the general erection and safety regulations for work on electrical power installations (e.g. DIN VDE), to the correct use of hoisting gear and tools, and also to the use of personnel protective gear such as safety goggles and the like.

It is advisable to take advantage of the assistance and services of the competent SIEMENS service centers for installation, commissioning and servicing tasks.

2.1 Qualified personnel

These are persons who, on the basis of their training, experience and knowledge of the relevant standards, codes, accident prevention regulations and operating conditions, have been authorized by the responsible plant safety officers to perform the work required and who can recognize and avoid potential work hazards.

A sound knowledge of first aid and the local emergency equipment is also required.

2.2 The Five safety rules

For personal safety and to prevent material damage when carrying out any work, always observe the safety instructions and the following five safety rules, according to EN 50110-1 "Working in a voltage-free state". Apply the five safety rules in the sequence stated before starting work.

Five safety rules

1. Disconnect the system.
Also disconnect the auxiliary circuits, for example anti-condensation heating.
2. Secure against reconnection.
3. Verify absence of operating voltage.
4. Ground and short-circuit.
5. Provide protection against adjacent live parts.

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

2.3 Safe handling

Workplace safety depends on the attentiveness, care, and common sense of the personnel who install, operate, and maintain the machine. In addition to the safety measures cited, as a matter of principle, the use of caution is necessary when you are near the machine. Always pay attention to your safety.

Also observe the following to prevent accidents:

- General safety regulations applicable in the country where the machine is deployed
- Manufacturer-specific and applicable-specific regulations
- Special agreements made with the operator
- Separate safety instructions supplied with the machine
- Safety symbols and instructions on the machine and its packing



DANGER

Live parts

Electric machines contain live parts.

Fatal or severe injuries and substantial material damage can occur if the covers are removed or if the machine is not handled, operated, or maintained properly.

- Always observe the "The Five safety rules" (Page 13) when carrying out any work on the machine.
- Only remove the covers using the methods described by these operating instructions.
- Operate the machine properly.
- Regular and professionally maintain the machine according to the instructions provided in the "Maintenance" chapter of the operating instructions.

**DANGER****Rotating parts**

Electric machines contain dangerous rotating parts.

Fatal or severe injuries and substantial material damage can occur if the covers are removed or if the machine is not handled, operated, or maintained properly.

- Only remove the covers using the methods described by these operating instructions.
- Operate the machine properly.
- Regularly and correctly maintain the machine.
- Secure free-standing shaft extensions and other rotating part such as couplings and pulley belts so that they cannot be touched.

**WARNING****Hot surfaces**

Electric machines have hot surfaces. Touching hot surfaces can result in severe burns.

- Allow the machine to cool before starting work on the machine.
- Only remove the covers using the methods described by these operating instructions.
- Operate the machine properly.

**WARNING****Hazardous substances**

Chemical substances required for the setup, operation and maintenance of machines can present a health risk.

Poisoning, skin damage, cauterization of the respiratory tract, and other health damage may result.

- Read the information in these operating instructions and the product information supplied by the manufacturer.
- Observe the relevant safety regulations and wear the personal protective equipment specified.

**WARNING****Flammable substances**

Chemical substances required for the setup, operation and maintenance of machines may be flammable.

Burns and other damage to health and material may result.

- Read the information in these operating instructions and the product information supplied by the manufacturer.
- Observe the relevant safety regulations and wear the personal protective equipment specified.

**WARNING****Falling persons**

Installation, commissioning and maintenance of the machine sometimes require working at dangerous height. This put people at risk of falling.

If you have to work at a height exceeding one meter, take appropriate measures to eliminate the risk of falling.

Suitable measures include:

- Erecting scaffolding, work platforms or lifting platforms.
- Wearing personal protective equipment that prevents falling.

**WARNING****Falling objects**

Installation, commissioning and maintenance of the machine sometimes require working at dangerous height. This involves a risk of components or tools falling.

If you have to work at such a height, take appropriate measures to ensure that no objects can fall down, and that falling objects cannot injure anyone.

Suitable measures include:

- Installing intermediate ceilings.
- Securing loose components and tools to prevent them falling.
- Wearing personal protective equipment.
- Prevent people from entering the danger area.

**WARNING****Risk of stumbling and injury**

The machine has protruding components, such as pipes, terminal boxes and cables. These can cause personnel to stumble and injure themselves.

- Cordon off these areas using barrier/warning tapes.
- When working close to the machine, always have as heightened level of awareness.

**WARNING****Noise emissions**

During operation, the machine's noise emission level can exceed those permitted work place, which can cause hearing damage.

Take steps to reduce noise, such as introducing covers and protective insulation or adopting hearing protection measures, so that the machine can be operated safely within your system.

2.4 General safety information

Herein mentioned machine is part of heavy-current devices for industrial extent of use. It is produced in compliance with corresponding and acknowledged technical regulations.



WARNING

It is supposed that basic planned operations with a device as well as all operations concerning transport, assembly and installation will be performed by qualified staff or checked by responsible experts.

Concurrently it is necessary to take the following into consideration:

- Technical data and data of admissible use (assembly connection terms, environmental terms and operational terms), which are, among others, stated in a catalogue, in operational instructions, orders, name plates and in the other technical documentation.
- General establishing and safety provisions.
- Local provisions and requirements which are specific for the device.
- Qualified use of tools, lifting and transport devices.
- Use of personal protective devices.
- Duty of responsible people to take part in training on safety of employees in accordance with SAFETY PROVISIONS as well as keeping to the laws of a country in which the device is operated. Above all the laws, concerning protection of environment, handling with waste, safety use of substances that are dangerous for lives or environment e.g. cleaners, lubricants, adhesives, varnishes etc. Detailed information about these special products can be found in a "list of safety data" provided by producers or importer of a product.

If there are any discrepancies, especially missing information which specifies a product, sales department of SIEMENS is in charge of providing necessary explanation. Concerning this matter we ask you to mention mainly type and production number of a machine, please. Concerning planning, assembly, launching and service we recommend using the promotion and services of appropriate service centre of SIEMENS.

2.5 Warranties

Manufacturer's warranty for the supplied machine are refer to adhering with certain conditions for storage, handling the machine, establishment, operation and maintenance instructions in the operation manual. In addition, the machine works on the basis of the technical specifications of the contract or by any other applicable provision of data on the rating plate.

The user is obliged to keep the operational logbook, and he can dismantle the machine only if approved by the producer otherwise the producer shall be released from the obligations under its warranty.

Warranties refer to adhering of storage, handling the machine, establishment, operation and maintenance instructions terms. If these provisions are not adhered, it can result in refusing of warranty claims. During the warranty and after the warranty period, the user must not make any external and internal intervention into the machine design.

During claim or with spare parts order, it is necessary to provide the type of machine, factory (production) number and if needed other data stated in output name plate.

3 Description

Applications

Turbo generators are generators for turbines with speeds of 1500 or 1800 rpm. The design can be adapted for steam or gas turbines, for open foundations or container solutions, for land or classified generators onboard ships or off-shore platforms including all relevant aspects of operation (environmental, declination for ship or offshore etc.) The connection to the turbine, foundation as well as the cable connection and auxiliaries can be optimally adapted to match the setup of the complete aggregate.



WARNING

Risk of explosion

This machine is not designed for use in hazardous areas. An explosion can occur if the machine is operated in these areas. This can result in death, serious injury or material damage.

- Never operate this machine in hazardous areas.

Design

The design of the machine conforms to the international series of standards IEC / EN 60034:

Feature	Standard
Ratings and operating performance	IEC / EN 60034-1
Degree of protection	IEC / EN 60034-5
Cooling	IEC / EN 60034-6
Type of construction	IEC / EN 60034-7
Noise emission	IEC / EN 60034-9
Vibration severity grade	IEC / EN 60034-14

Design of the machine

The regulations and standards underlying the design and testing of this machine are stated on the rating plate.

Machine ends

The designations D end (drive-end) and N end (non-drive end) are defined as follows:

The D end is the end of the machine at which the shaft extension or the thicker one of two shaft extensions is provided.

The direction of rotation is determined from this end of the machine. The opposite end of the machine is called the N end. For details refer to the dimension drawing.

Housing and stator core

The stator core is built into a rugged welded housing, it is axially compressed and held together by clamping elements on the back of the core. The stator core consists of high-grade electric sheet steel laminations, insulated from each other by a varnish coat. Stators up to an outer diameter of 1250 mm are punched as ring sheets, the bigger stator cores are constructed in segments. The three-phase winding and the auxiliary winding for supplying the excitation current (if PMG is not required) are accommodated in the slots of the stator core. Thanks to the excellent winding insulation (MICALASTIC®), the generators are also suitable for installation in areas with extremely high humidity.

The terminal boxes are mounted at the outer shell of the laminated core.

The main-circuit connections of the machine are made in the terminal box for stator connection.

The auxiliary systems of the machine are connected in the terminal box for the auxiliary circuits. For terminal dimensions, bushings and grounding of the terminal boxes, refer to the dimension drawing.

The type designations and dimensions of the terminal boxes are given in the dimension drawing; the circuit arrangement of the main and auxiliary circuits is shown in the associated circuit diagrams. The locations of the terminal boxes are shown in the dimension drawing of the machine.

Equipotential bonding as required for grounding the machine has been carried out in the works. Grounding terminals are provided on the N-end housing wall of the main housing for connecting the ground bus. The location of the terminal is shown in the dimension drawing.

Rotor

The rotor design is based on a laminated cylindrical rotor core pressed on the forged shaft with a cylindrical shaft end for the coupling hub. The rotor winding is a flat-wire compact winding inserted into the rotor slots. The coils are fixed by slot wedges in the active part and by bandages on the overhang areas. Copper damper bars are pressed into the core for smooth operation and resistance against load changes. Apart from the field and damper winding is the rotor equipped with a shaft driven fan, the rotor of the exciter and a rotating rectifier block.

Cooling method, ventilation

The cooling system is designed as a closed, internal cooling circuit. (IC81W).

The built-in cooler is an air-to-air heat exchanger with a water-pipe system.

The heat lost from the machine is dissipated via the surface of the cooling pipes to the ambient air flowing in the pipes.

Fans mounted on the rotor shaft move the cooling air in the primary circuit

Excitation system

The excitation system consists of the auxiliary windings or a PMG, automatic voltage regulator (AVR), CTs and VTs for the current and voltage sensing, built-in exciter and rotating rectifier. In the standard case, turbo-generators are equipped with a digital AVR enabling PF (power factor) regulation and giving many options for monitoring and protection (excitation limiters, overvoltage detection, possibility of redundancy etc.) The DC excitation current from the AVR is amplified by the rotating exciter and then rectified by the rotating rectifier. The rotating rectifier consists of diodes and surge protectors.

Bearings

The rotor of the generator is fixed by two sleeve bearings.

The type of designations and the design data required for operation are given in the dimension drawing text and on the bearing instruction plate.

In the standard is one of the bearings is insulated in order to prevent a shaft current and to protect the bearing shells.

Sleeve bearings are either radial bearings or one thrust bearings depending on requirements. For details on the operation and maintenance see Renk's "Operation and maintenance instructions" in the machine documentation.

Mounting

The machine is designed for eight-point mounting on the foundation (or according to customer requirements). For fastening details, refer to the machine dimension drawing. The civil engineering contractor is responsible for the design calculations needed for the foundation of the machine

3.1 Additional components

Monitoring devices

The stator winding is monitored by temperature detectors embedded in the winding. For monitoring the bearings double temperature detectors and oil-flow meters for sleeve bearings are provided as standard. The air inlet is also monitored by a double sensor. The generator is equipped with an anti-condensation heater in order to prevent surface moisture under certain climatic conditions. The heater is designed so that the active parts of the machine are always warmer than their environment. Optionally the generator can be equipped with CTs for metering or differential protection. The vibration sensors for bearings and shaft are also optionally available.

Anti-condensation heater

Anti-condensation heaters prevent the formation of condensation during machine stoppages. They are designed to ensure that the interior of the machine is always warmer than its surroundings. The heating power required is matched to the design of the electrical machine. Further information is contained in the dimension drawing text.

Oil supply

The machine bearings are prepared for connection to an oil supply system. The required connection conditions are found in the dimension drawing text.

3.2 Rating plate

The rating plate (see Figure 3-1) shows the identification data and the most important applicable technical specifications. In conjunction with the contractual agreements, these data determine the limits of use in accordance with the intended purpose.

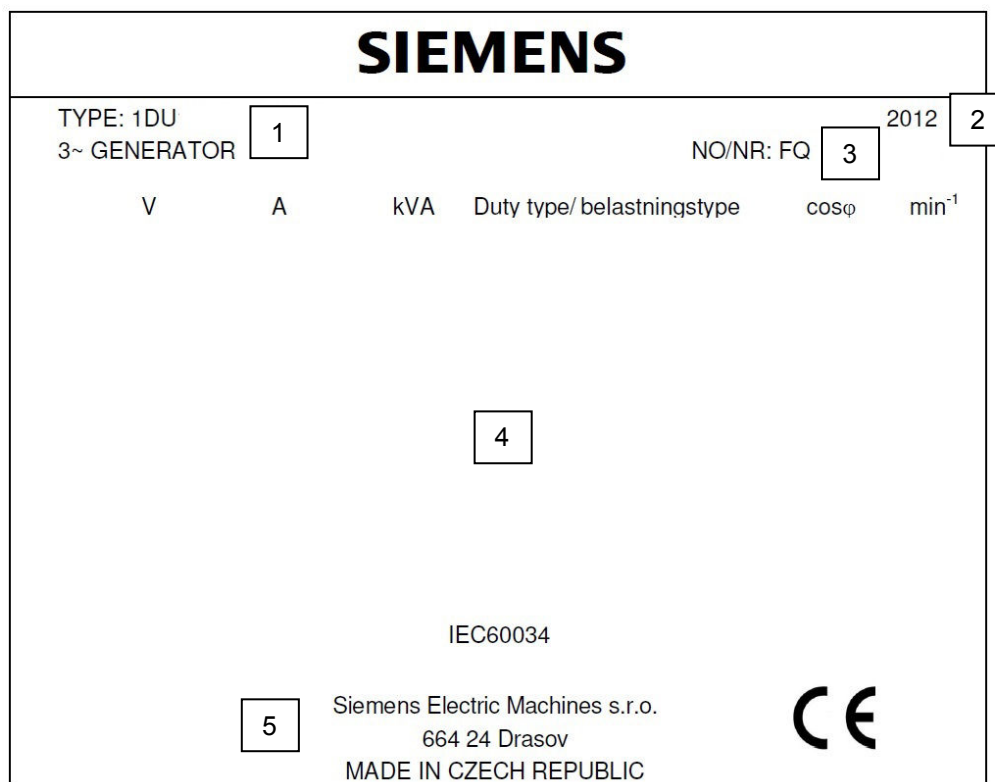


Figure 3-1 Rating plate

Item	Description
1	Product designation
2	Year of manufacture
3	Factory serial number
4	Technical specification data: voltage, current, power, efficiency, revolutions, type of mounting, cooling method
5	Manufacturing location

4 Preparations for use

4.1 Application Planning / Configuration

Good planning and preparation of machine applications are essential in terms of keeping installation simple and avoiding errors, ensuring safe operation, and allowing access to the machine for servicing and corrective maintenance.

This chapter outlines what you need to consider when configuring your plant relation to this machine and the preparations you need to make before the machine is delivered.

A number of residual risks are associated with the machine. These are described in the chapter titled "Safety instructions" (Page 12) and in related sections.

Take appropriate safety precautions (covers, barriers, marking, etc.) to ensure the machine is operated safely within your plant.

Observing the operating mode

Observe the machine's operating mode. Use a suitable control system to prevent over-speeds, thus protecting the machine from damage.

4.2 Locating

Generator must be located in the way that terminal box, bearings and accessories could be easily approachable.

4.3 Cooling

Space, in which is generator situated, must be sufficiently large and aired. Generator cannot suck warm air from other machine. For continuous operation, it is necessary to provide steady cooling air ventilation.

4.4 Foundation



WARNING

Machine damage due to system's resonance

The system consisting of the foundation and the machine set must be designed and tuned up to avoid the occurrence of system resonance at which allowed vibrations would be exceeded. Excessive vibrations may destroy the machine set. Vibration limits according to comprehensive standards DIN ISO 10816 or DIN ISO 8528-9 depending on the application type must not be exceeded.

General information for aligning a rotating electric machine on its foundation

Unless the manufacturer specifies otherwise or unless the machine is supplied with anchoring and underlying elements directly from the machine's manufacturer, observe the following provisions.

Rotating electric machine ("machine") feet must be shimmed under the entire foot surface, and the machine must be aligned so as to avoid machine distortion, twisting, etc. – "soft foot" principle, read chapter "Soft foot check" (Page 36). When designing the machine anchorage, forces applied to the foundation and anchor bolts should be taken into account. Only underlying shims designed for machine adjustment can be used to align the machine. The surface of the shims must be smooth, without corrosion or paint. The shim thickness should be selected so as not to exceed the number of 4 underlying shims per foot. The angle of foot inclination should be compensated by underlying when aligning the machine. Before alignment, the machine feet and areas for screw joints should be cleaned, preservative coatings removed, and minor damages that occurred during transport should be corrected (repair with file, for example).

4.4.1 Preparing the foundation

A solid foundation without external vibrations is required before the machine can be installed. For information on how to ensure the foundation is correctly designed, please refer to the relevant sources such as the DIN 4024 standard. Before installing the machine, carefully check all foundation dimensions with the aid of the machine dimension drawing and the foundation drawing, particularly - where applicable the positional accuracy of the holes for mounting the machine on soleplates, the ducts for piping and cable.

The design and manufacture of the foundation are not included within the scope of delivery.

The static and dynamic foundation loads as well as the foundation stiffness required are provided in the dimension drawing text or in the "Foundation plan" in Appendix "Technical data and drawings".

The civil engineering contractor is responsible for the design calculations needed for the foundation of the machine.

Note

Foundation specifications and drawings are processed according to your order.

The following instructions should be followed when designing the foundation:

- Design the foundation with a view to ensuring safe operation and adequate accessibility.
- Ensure the foundation will be sufficiently rigid for the entire period of machine operation.
- Take appropriate measures to avoid the transmission of external vibrations to the machine via the foundation.
- Design the foundation with a view to avoiding resonance between the machine and the foundation. Please refer to the dimension drawing text or the foundation specifications for information.
- If necessary, once you have decided on the actual installation conditions, consult your Siemens partner to discuss your configuration results relating to the vibration behavior of the machine/foundation system.
- When designing the foundation, consider the need for cutouts to accommodate installation and anchoring elements. Please refer to the machine dimension drawing/dimension drawing text or the foundation specifications for the positions and dimensions of the required cutouts.

Additional instructions for concrete foundation:

- If necessary, incorporate inflow channels for the grouting for the installation elements (e.g. soleplates or base frames). Consideration should be given to the immediate environment, particularly in terms of space, when designing these channels. Once commissioning has been performed, the installation element recesses must be completely grouted.
- Take channels into account for routing the supply lines, if necessary.

4.5 Packing

The purpose of packing is to protect goods during transport, transshipment and storage and to minimize the cost of such transport, transshipment and storage. In addition to the economic efficiency of packaging, safety - i.e. retention of the value of the packed goods - is of primary importance.

Depending on the type of goods to be packed, there are two types of packing cases: supporting or supported.

The lifting lugs of supporting cases are marked on the packing itself, whereas those of supporting packing cases are marked either on the machine part or the transport bracket attached to it.

The cases protect the goods inside them and also the plastic wrappings against mechanical stress, dirt, vermin and theft. In many cases, the bracing elements under the cover allow goods to be handled with a crane.

Sealed packings are used depending on how delicate the components are.

In contrast to standard packing, the machine parts are completely enveloped in foil wrappings whose seams are welded to make an air-tight seal. The air inside the foil wrapping is removed. The calculated amount of desiccant for the indicated duration of transport and storage (max. 24 months) is added. All sharp corners and edges of the machine parts are padded to prevent the foil envelope from ripping (SN 15380).

Symbols for all phases of handling are shown on the outside of the case (see EN ISO 780).

4.6 Transport

The markings (for transport and storage) on the case are to be complied with during all phases of transport (see EN ISO 780). Any instructions in the delivery documents or enclosed with the delivery documents must also be complied with.

Only experienced forwarding agents are permitted to transport goods to the site.

Transportation remains exclusively the responsibility of the forwarding agents. Installation personnel may act only in an advisory and supervisory capacity.

Exercise great care and caution when moving the equipment to and on the site. Use equipment of appropriate design and carrying capacity.

Machines or cases with anti-vibration mountings should be transported in such a way that the shock-absorbing capacity of the mountings is not impaired.

The cases are marked with instructions for safe handling and proper storage.

Cases must be adequately secured to ensure safe transport. This is the responsibility of whoever loads and transports the cases and will be repeated several times on the journey from the manufacturer to the final user (e.g. whenever the cases are re-loaded).

4.7 Markings on the packaging

Two types of packaging can be used, depending on the kind of goods to be packaged: load bearing packaging or supported packaging. The hoisting points for load-bearing packaging are marked on the packaging itself, whereas those of supported packaging are marked either on the machine part or the transport bracket attached to it.

Packages are marked with information symbols to ensure safe handling of the packed goods. The symbols for package handling instructions (

Figure 4-1) are defined according to the international standards ISO R/780 and DIN 55402.

The most important symbols are as follows:

	Top. Package must be transported, handled and stored this way up.		Attach here. Specifies where the package should be attached (hoisting point), but not how (attaching method).
	Fragile contents. Goods should be handled carefully and not knocked over or lashed together.		Center of gravity. Indicates the position of the center of gravity.
	Keep dry. Goods should be protected against high levels of humidity.		Do not use forklift truck here. This symbol is applied to the sides where a forklift truck cannot be used.
	Permitted temperature range. Temperature range with upper ("...°C max.") and lower ("...°C min.") limits.		Permitted stacking load. The permitted stacking load in "... kg max." is specified next to this symbol.
	Keep cool (away from direct sunlight). Goods should be stored in a cool place, and always away from direct sources of heat.		Caution! Do not damage the barrier layer. A waterproof barrier layer containing desiccants is found beneath the packaging.

Figure 4-1 Marking on the packaging

4.8 Package marking, shipping documents

The machines and associated machine parts are dispatched in packages with label attached. The label contains the following information:

- Identifier
- Job number
- Serial number¹⁾
- Dispatch note sheet no.¹⁾
- Drawing no.¹⁾
- Part no.¹⁾

Identifier, job no., and serial no. also appear in the dimension drawing text. The serial no. is engraved on the rating plate and punched into the lifting openings.

For each package, a set of dispatch documents, consisting of dispatch note and supporting documents, is sent with the machine to the site. The information on the label serves to identify the parts listed in the shipping documents.

¹⁾ Be sure to include these details in all requests for further information

4.9 Factory serial number (Project Nr.)

The factory serial number (Figure 4-2) is the most important identification detail for a shipping unit and packages. Shipping units or components with an identical factory serial number belong to exactly the same machine. This factory number is valid from contracts date 1.2.2012.

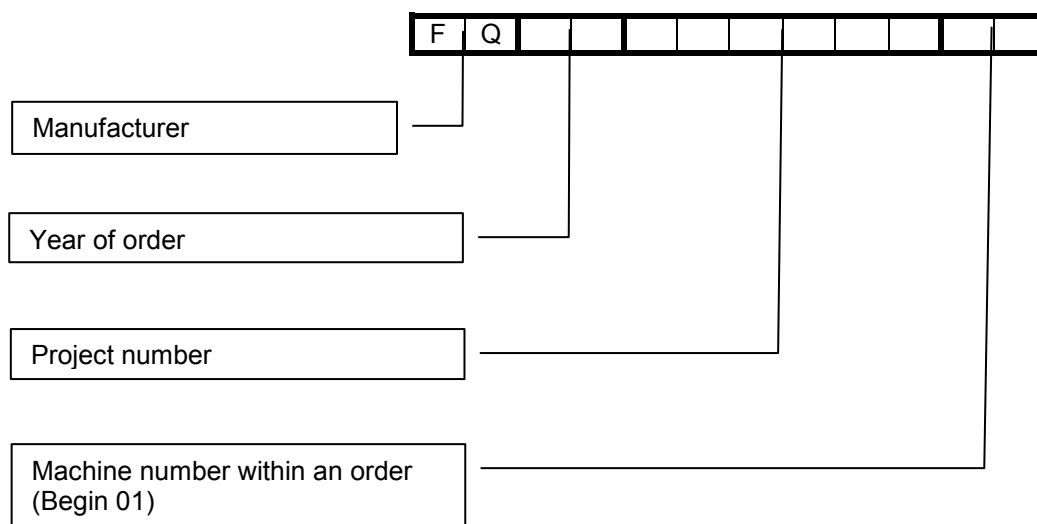


Figure 4-2 Factory serial number

4.10 Receipt

Immediately after receipt of the goods, the case should be examined all round for any signs of damage. If it is damaged, remove the lid or several boards so that the contents can be seen.

If the contents are sealed, do not damage the sealed plastic envelope.

The receiver is responsible for deciding whether to open a packing. If possible, a specialist company should be contracted to do this. The project manager and/or the final customer and the insurance company must be informed at the same time.

Important! When unpacking a consignment which is damaged or presumed to be so, make sure that the contents are stored in a dry place. Otherwise, they must be repacked. It is important that the consignment be examined immediately to determine both the extent and cause of the damage and also the person or persons responsible for it.

In line with general forwarding practice, the carrier should be notified immediately and invited to draw up a joint statement of damage.

If the damage is discovered upon arrival overseas, it is essential to notify the pertinent insurance agent(s) to enable them to inspect and certify the damage. If a thorough examination of the contents of a case cannot be made immediately (e.g. due to poor storage facilities), the recourse to the carrier or other persons responsible for the damage at a much later date is rendered difficult if not completely impossible. Such additional risks should be borne in mind when taking out shipping insurance, e.g. by extending coverage for an appropriate period after the arrival of the goods. It is always advisable to make a photographic record of serious damage. This is imperative for indemnification and lodging a claim with the insurance company.

4.11 Arrival of the machine at its destination

The machine is lowered on a wooden base frame and covered with sheet.

Immediately on arrival, the packaging is to be inspected on all sides for damage. Immediate inspection is important to discover the extent of the damage, cause and person or persons responsible and to make a written record.

It is the general practice to inform the earner concerned immediately and obtain his assistance with a joint assessment of the damage. This assessment is an essential part of any claim for damages and, if applicable, any report of damages that might be made to the insurer.

Transport to the site should be carried out carefully and with due regard to the prevailing conditions. Suitable means of transport are to be chosen for this journey.

4.12 Handling and preparation

Safety recommendation

	WARNING
Falling transported goods due to improper transport	
Danger of death, serious injury, or substantial material damage caused by tipping or falling transported goods.	
Before lifting the machine or individual components, read the following safety instructions and observe them when you carry out all your work.	

- Use a suitable hoisting mechanism only and ensure that qualified personnel are available.
- During any machine handling or its parts, use only lifting lugs provided for the machine (or its parts) lifting.
- Machines must not be lifted hanging on individual parts of a machine!
- Lifting should be performed at axially symmetrical places.
- Refer to any notes in the shipping documentation.
- Pay attention to the handling information markings on the packages during transporting and putting them into storage. Read chapter „Markings on the packaging“ (Page 26).
- For lifting the goods use only the designated lifting points and/or at marked positions. Use suitable strap guiding or spreading devices. All of the information necessary to correctly lift, attach, and transport of the machine is provided in the machine dimension drawing in the Appendix B “Technical data and drawings“. For example see “Figure 4-3”.
- Lifting capacity of applied lifting device should be taken into consideration. Appropriate guiding of ropes should be used with possible superstructures or extension.
- Always observe the lifting capacity of the hoisting mechanism.
- All work must be performed with due caution and care.

The weight of the machine is specified on the rating plate, in the dimension drawing text and in the attachment to the delivery note (parts list for shipping).

The center of gravity is specified in the dimension drawing of the machine.

For packed machines and individual components, the center of gravity is indicated on the packaging.

Note

! Lifting devices should be chosen with respect of the weight of machine !

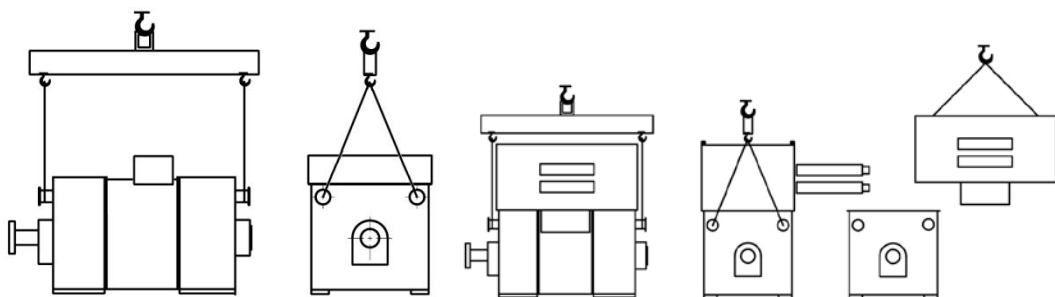


Figure 4-3 Machine lifting

4.13 Storage

4.13.1 Indoor and overland storage conditions and recommendations

Generator and its accessories must be professionally stored before installation if necessary. They must be protected from humidity, harmful environmental conditions and from other strange influences. Dew point level must not be reached because of corrosion. If the machine is placed in a transport box, it must be removed out of it before storage.

Storage areas must be clean, dry, closed, properly ventilated and protected from tremors. Conditions shall be ensured by compliance with the following recommendations:

Room climate

1st condition

- The relative humidity must be kept below 80%
- Temperature ranges for storage must be between 0 to 50°C, dew point temperature will never be achieved

2nd condition

- Where the first condition of storage cannot be observed, it is necessary to observe the following conditions: Temperature inside the storage area = (outer temperature + 10°C)

Outer conditions



WARNING

Only seal packed machine may be store outside for storage period. Seal packaging must be undamaged. For the storage conditions to be applicable for outside storage, observe the information's in "Storage of motors and generators" manual.

- The relative humidity must be kept below 80%
- Temperature ranges for storage must be between -5 to 50°C

Generator is prepared for 6 months storage after dispatch from the factory to the customer. In the case of long term storage, more than 6 months, some requirements such as protection of bearings, extended shaft end, foots or sealed packing with dehumidifiers, etc must be taken into consideration for proper functioning after storage. For some additional information about long term storage of entire machine or its parts (bearings, etc) please ask Siemens Electric Machines s.r.o (see chapter "Service and Support" on Page 97) for manual **Storage of motors and generators**.

4.13.2 Anticorrosion treatment during storage

Machined parts

In case of longer standstill see chapter "Preservation of the installed machine not on standby" (Page 77) or storage see chapter "Storage" (Page 31) and transportation the exposed areas (shaft end, feet, and grounding points) must be protected against corrosion. This anticorrosion precaution must be kept for all time if it is broken for any reason (tests, coupling), while the machine is being handled during dispatch from manufacturer of the machine to its final location.

Sleeve bearings



WARNING

! Warning - Sleeve bearings are generally delivered without oil !

- generators should be stored without oil filling
- shaft bearing journals are provided with an anti-corrosion oil film which dissolves in lubrication oil during operation
- delivered anti-corrosion oil film protection is designed for a storage of half year under dry condition (Page 31).
- for longer storage bearings have to be disassembled and bearing journals and parts have to be provided with a long-term protection coat



WARNING

Anticorrosion treatment of sleeve bearings

Sleeve bearings must be always treated against corrosion before storage and transportation.

In case of doubts or additional question contact "Siemens service" (Page 97).

4.14 Sealed packings

Sealed packings are used for delicate components and for storage of goods in outside conditions.

In contrast to standard packings, machine parts are completely enveloped in plastic foil wrappings whose seams are welded to make an air-tight seal. As much of the air as possible inside the foil wrapping is first removed by suction. The amount of desiccant to be enclosed is calculated for the specified duration of transport and storage, taking into account the climatic zones involved. All sharp corners and edges are padded to prevent the wrapping from ripping.

All cases should be subjected to an immediate visual inspection on arrival to make sure the packing, the contents and the seals are undamaged. If humidity indicators have been provided, the sealed packings must be inspected visually 1 to 2 days after storage.

If cases have been opened in the ports of arrival and the sealed wrappings have been damaged or if cases have been damaged during transport, the sealed wrappings must be repaired as quickly as possible (if possible) in order to ensure proper storage, especially in tropical areas. Opening or damage to the wrappings must be recorded in writing and immediately reported to the project manager/site supervisor.

If humidity indicators (Figure 4-4) are provided in the sealed wrapping, there is an inspection opening in the external packaging, the cover of which can be unscrewed. Humidity indicators change their colors from blue (dry) to pink (damp) to indicate the humidity level (relative humidity) within the sealed plastic wrapping.



Figure 4-4 Humidity indicator

Note

Humidity indicators recondition themselves automatically, i.e. they do not indicate whether the humidity inside the packing was too high at an earlier time.

The accuracy of the humidity indicators depends heavily on the temperature. When the ambient temperature is 20° C, they are sufficiently accurate but, at other temperatures, the humidity levels they indicate are too high.

If the relative humidity rises above 60 %, a check must be made to make sure that the contents and the packing are undamaged. To do this, open the case carefully and check the contents for corrosion.

The date of initial conservation as well as the expiry date is marked on the cases.

Date of initial conservation:

Month Year

Expiry date:

Month Year

Check the effectiveness of sealed wrappings every 8 weeks if no other intervals have been specified.

The results of such inspections must be recorded. Cases in which the relative humidity has risen rapidly or stayed at a high level must be checked.

Note

In case of oil lubrication system, make a connection of oil pumps and connect motor of oil lubrication system to power supply according to motor rating plate.

Make sure that the rotation corresponds with the arrow on the motor.

For further information see dimension drawing text and manufacturer's manual of lubrication system in Appendix D "Additional documents".

5 Installation



WARNING

Danger from incorrect installation

The machine should be installed by qualified personnel, taking due account of the information given in these instructions, in order to assure proper functioning. Non-observance can result severe personal injury or substantial property damage.

Note

Service Center

For any installation work that is required, contact the Service Center (Page 97) or commission service engineers trained by Siemens and authorized for this task.

5.1 General inspection of machine

Generator must be properly inspected prior to erection (installation) with the aim to find out if there are any damages caused during transport or storage. Any imperfections that are found out must be reported to a supplier or transport company and must be professionally repaired. Remove preservative coating from metal surfaces (feet, flange, free end, etc.) prior to machine seating and installation.

5.2 Installing the machine

Note

Mounting of the machine is not included within the scope of delivery. The machine is prepared for mounting accordance with your specification.
All the above documents may not be included in the documentation.

For a representation of how to mount machines on foundations, refer to the machine "Dimension drawing / Dimension drawing text" or the "Foundation specifications".

Preconditions

The soleplates must be arranged and aligned. See document "Foundation data/drawing" in Appendix B "Technical Data and Drawings".

Preparing for installation:

1. Clean the foundation. Pay particular attention to the installation surfaces for the soleplates see chapter "Soft foot check" (Page 36).
2. Check the foundation for any damage.
3. Check that the installation surfaces are even.
4. Compare the foundation dimensions with the details contained in this machine documentation and the details contained in the layout drawing provided by the foundation manufacturer.
5. Check the positions of the mounting elements.

5.3 Setting down and mounting the machine

1. Set the machine down on the prepared installation surface with the help of the alignment elements. For more information on this topic, please see chapter "Handling and preparation" (Page 30).
2. Remove the transportation lock. See chapter "Transport bracing" (Page 37).
3. Align the machine both horizontally and vertically. For more information on this topic, please see the chapter "Alignment" (Page 38).
4. Coat the mounting elements with a suitable form of anti-corrosion protection.
5. Anchor the machine. Use the specified fixing elements to fasten the machine to the foundation. The required information is given in the "Foundation specifications" in Appendix B "Technical data and drawings".
6. Tighten the mounting elements with the required tightening torque. See chapter "Tightening torques for metric bolts" (Page 99).
7. Check the alignment with driven machine, if coupling don't accept, see "Coupling acceptance" in chapter "Alignment" (Page 38), repeat points 3 to 6 and align machine or machine set again.

5.4 Soft foot check

The test conforms to API 541-4.3.1.15

The test is made to see if there is any bending of the base frame while fixing the mounting bolts.

Prior to any mechanical running test, a check for "soft feet" will be made.

After the machine has been aligned, shimmed, and firmly secured to the test base, a dial indicator micrometer oriented in the vertical direction shall be attached at the mounting foot to be checked.

The micrometer is then zeroed, the mounting bolt or bolts loosened at the foot and the change in micrometer reading noted. If the micrometer reading exceeds 0.025 mm, the mounting requires cleaning or re-shimming. This soft foot check shall be performed at each mounting foot, with the other feet secured, until all micrometer change readings are less than 0.025 mm. If there are intermediate bases, this check shall be performed at each interface between the machine and the test floor.

During the shop running test of the assembled machine, vibration measurements will be made with the machine properly shimmed and securely fastened to a massive foundation or test floor stand. Elastic mounts are only used if they are available.

5.5 Transport bracing

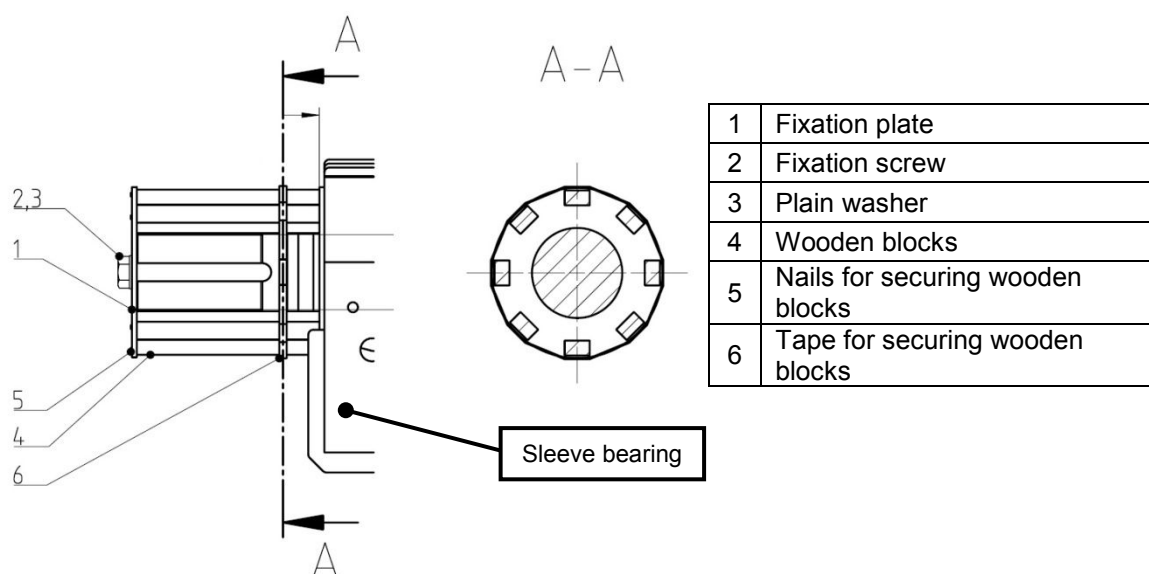


Figure 5-1 Transport bracing (Sleeve bearing)

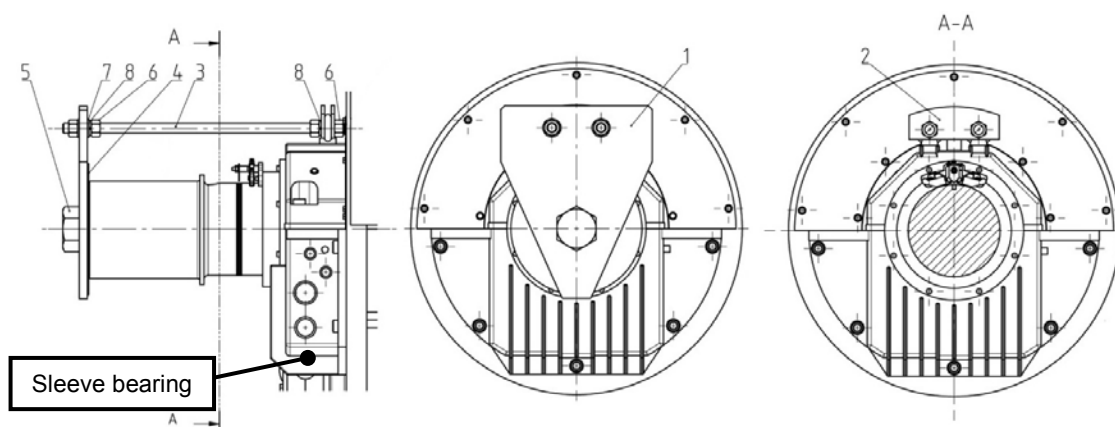


Figure 5-2 Transport bracing

Remove carefully preservative from the machined surfaces. No metallic objects, such as scraper, trowel or metal strip, are to be used for this purpose. Simply wash the preservative off with kerosene or a similar solvent (e.g. Aral 4005 or Shell A151). The bearings do not have to be opened, since the preservative inside the bearings is oil-soluble.

5.6 Alignment



CAUTION

Clutch cover – alignment of generator (motor) with drive machine

Alignment of electric machine with drive machine and covering the clutch must be done this way, that clutch together with cover never create negative pressure on the front side of the bearing. In the case you do not keep this condition it can happen oil taking from the bearing, oil leakage and dripping through bearing seals.



CAUTION

Before alignment of machine, have to be oil lubrication unit and jacking oil unit (where mounted) switched on.

In the case of bearings with self-lubricating bearings should be pre-lube according to chapter “Pre-lube the bearings with oil – If the lubrication unit is not working” (Page 44).

Careful alignment with the drive train is essential for smooth running and trouble-free operation of the machine set.

The generator is aligned with the already trued-up and securely mounted rotor. Written confirmation of the proper alignment of the machine and correct positioning of the coupling flange (height) must be obtained.



CAUTION

The generator has to be aligned geometrically.

When axially aligning, ensure that the rotor is at the geometric center.

When making the axial alignment, bear in mind that the rotor is guided axially in the D-end bearing (see also dimension drawing/text). A symmetrical position of the shaft in the bearing shell must be ensured during alignment.

Where axial alignment is concerned, it is important to ensure that the rotor is positioned in the geometric center. The rotor has to be aligned geometrically.

The pointer on the bearing must point to the middle circumferential groove in the shaft, see dimension drawing text. The two outer grooves indicate the permissible tolerance range.

Measure the axial offset between the coupling halves at four points 1, 2, 3 and 4 spaced evenly around the circumference (for example see Figure 5-3).

Make a note of this first measurement.

Table 5-1 Example of axial measurement

	Measuring point			
	1	2	3	4
1. Measurement:	95	92	85	100
2. Measurement:	95	92	90	100
3. Measurement:	93	87	85	102
4. Measurement:	100	95	98	98
Mean:	97	91,5	89,5	100

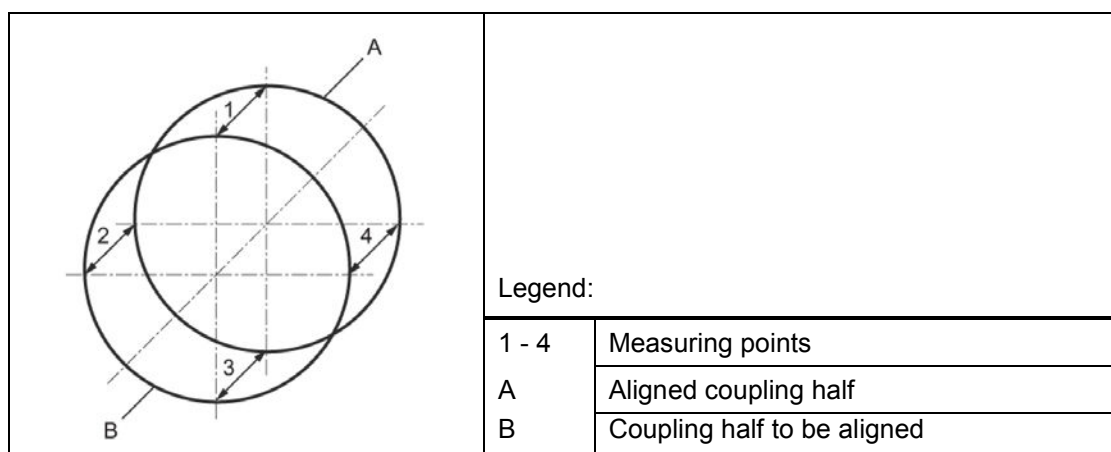


Figure 5-3 Measuring points for axial alignment

$$1^{\text{st}} \text{ evaluation} \quad \frac{97 - 89,5}{2} = 3,75$$

$$2^{\text{st}} \text{ evaluation} \quad \frac{100 - 91,5}{2} = 4,25$$

Deviation in vertical plane 0,0375 mm

Deviation in horizontal plane 0,0425 mm

Repeat and note the measurements after rotating both shafts (together as far as possible) through 90° to the positions 90°, 180° and 270°.

NOTICE

Measuring point 1 is always at the top; i.e. the notional measuring cross is not rotated.

Calculate the mean values for the four measuring points. Measure the radial offset between the coupling halves at four points 1, 2, 3 and 4 distributed evenly around the circumference (Figure 5-4) and make a note of the values measured.

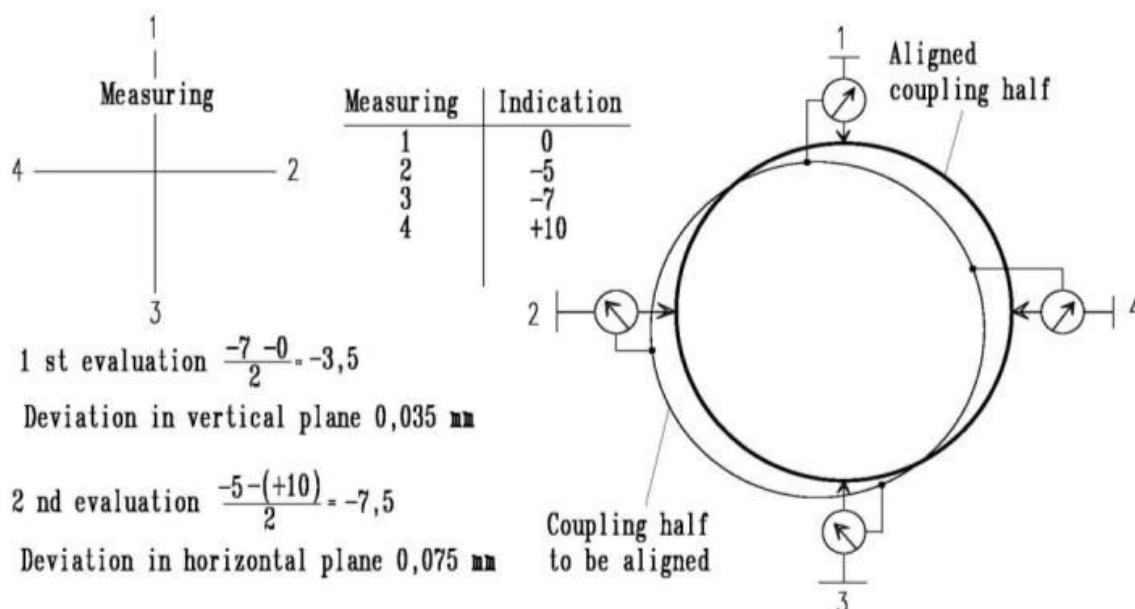


Figure 5-4 Measuring points for radial alignment

Determine the deviation for axial and radial off-set (Table 5-2) from the values measured at opposite measuring points (points 2 and 4 for the horizontal plane, and points 1 and 3 for the vertical plane).

Depending on the deviations, the machine is to be shifted as follows vertically by removing or inserting shims under the feet of the machine horizontally by sliding the machine sideways. These operations are to be repeated until the axial and radial off-sets are within the permitted deviations.

Table 5-2 Permissible deviations

Permissible deviations	Radial off-set mm	Axial off-set mm
Rigid coupling	0,03	0,02
Flexible coupling	0,05	0,05

Coupling acceptance

Coupling acceptance is to be carried out in the presence of representatives of the customer and of the manufacturer of the driven machine.

A written record should be kept of the results of the coupling inspection.
 Test the direction of rotation before coupling the machines.

The coupling halves should be coupled in accordance with the coupling manufacturer's instructions.

5.7 Fill the sleeve bearings with oil

For further information, see bearing manufacturer's "Instructions for Maintenance and Inspection" in the machine documentation. Use only the oil specified in the text to the dimension drawing, or on the type plate on the bearing.

If there is no information about the oil observe information in chapter "Oil cleanliness" (Page 45).

Bearing with self lubrication must be filled so that the bearing is sufficiently lubricated and it is prevented oil leakage and seizure risk. Oil level must be set precisely according to information in this chapter.



CAUTION

Filling procedure

Use filling procedure for bearings with self lubrication prior to the procedure from bearing manufacturer.

Oil temperature has to be set according to oil manufacturer before bearing filling (lower temperature -> higher oil viscosity). Observe storage conditions on the oil package.



DANGER

Non conformity to instruction mentioned in this chapter can cause bearing brass or bearing damage during operation.

5.7.1 Self lubricated sleeve bearing

General procedure for oil filling for self lubricated bearing, see Figure 5-5 and Figure 5-6 (Page 42)

- Remove the screw plugs from the oil filling hole. Keep the filling hole clean and free of any particles.
- Use a lubricant with the viscosity indicated on the bearing type plate or in dimension drawing text.
- Fill the lubricant through the oil filling hole on the upper side to the first third of the oil sight glass (position of the sight glass is described in manufacturer instruction of the bearing).

You can also use this formula: Oil volume = Volume of the bearing tank – 2 liters.

- Wait for min. 10 minutes. Oil fills up inner bearing space and sight glass slowly.
- Add precisely the remaining oil to reach the requested oil level, see Figure 5-5 and Figure 5-6 (Page 42)
- Put the screw plug back and tighten it.

The oil level limits are as follows:

Minimum oil level: bottom third of the sight glass

Maximum oil level: half of the sight glass

Level	Sight glass oil volume	Result
Level 1	$<1/3$	Bearing seizure risk
Level 2	$1/3 < - < 1/2$	Requested oil level
Level 3	$>1/2$	Oil leakage risk

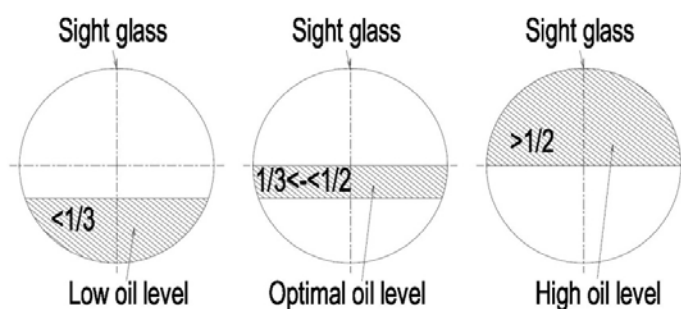


Figure 5-5 Oil level schematic description



Figure 5-6 Optimal oil level

5.7.2 External lubricated sleeve bearing

General procedure for oil filling for external lubricated bearing

- Remove the screw plugs from the oil filling hole. Keep the filling hole clean and free of any particles.
- Use a lubricant with the viscosity indicated on the bearing type plate or in dimension drawing text.
- Fill the lubricant through the oil filling hole. The oil level in the bearing is given by a weir plate in oil outlet pipe, see Figure 5-8. Mostly the first third of the oil sight glass (position of the sight glass is described in manufacturer instruction of the bearing).
- Wait for min. 10 minutes. Oil fills up inner bearing space and sight glass slowly.
- Add precisely the remaining oil to reach the requested oil level.
- Put the screw plug back and tighten it.

The oil level limits are as follows:

Minimum oil level: first third of the sight glass (before operation)

Maximum oil level: approx two thirds of the sight glass (during operation) see Figure 5-7

Level	Sight glass oil volume	Result
Level 1	$< 1/3$	Bearing seizure risk
Level 2	$1/3 < - < 2/3$	Requested oil level
Level 3	$> 2/3$	Oil leakage risk



Figure 5-7 Maximal oil level during operation (external lubrication)

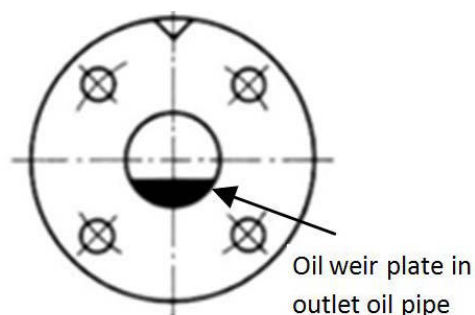


Figure 5-8 Oil damper

5.8 Pre-lube the bearings with oil – If the lubrication unit is not working



CAUTION

Oil feeding to the bearings must be ensured prior to the rotor alignment. If the lubrication unit is not working it is recommended to pre-lube both bearings. Try to move with the rotor as little as possible (e.g. 1/4 to 1/2 turn). Permanent rotation is permitted only when oil supply to the bearings is ensured.



CAUTION

Handling rotor without lubrication, considerably reduces the life of the bearing shell.



CAUTION

During the filling the bearing oil it is necessary to observe cleanliness. Take protective measures to prevent entering dust and any particles into bearing.

Perform following steps:

1. Use an adjustable pin wrench Figure 5-10 to carefully dismantle sight glass, which is located in the upper part of the bearing Figure 5-9.
2. Pour a small amount (about 0,5l) of oil through the opening directly on the shaft.
3. Mount the sight glass back – hand tight.

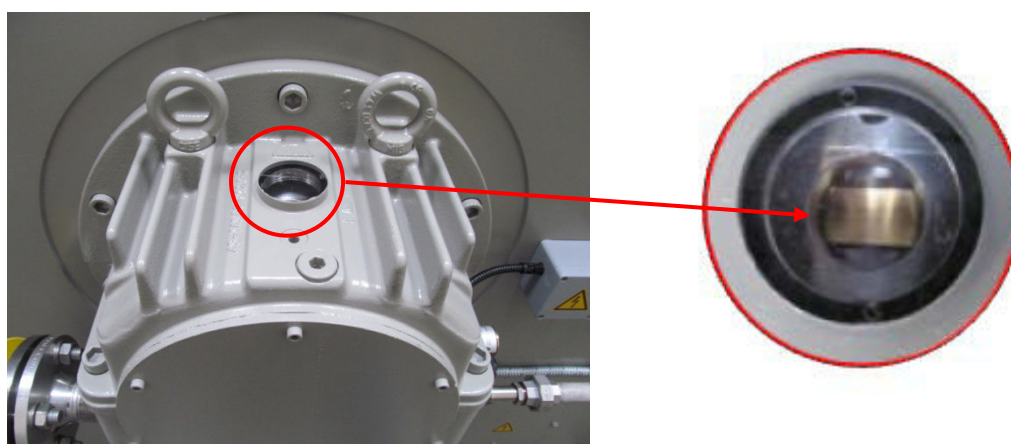


Figure 5-9 Sight glass



Figure 5-10 Adjustable pin wrench

5.9 Oil cleanliness

If nothing different is specified in the dimension drawing text, use oil with oil purity code (ISO 4406 or NAS grade standards) according to Table 5-3. If there is specified different purity code of oil in the dimension drawing text, the purity code in the dimension drawing text must be used as preferred.

Table 5-3 Oil cleanliness requirements

Specification	ISO code	NAS code
ISO number/NAS grade	ISO 17/15/12	NAS6

5.10 Connecting the oil supply system

All the information required on the connection of the oil supply system to the bearings can be found in the machine dimension drawing / dimension drawing text and in the instructions provided by the manufacturers of the bearings and the oil supply system. Further, you should also observe the following information.

1. Make sure that the thermometers of the insulated bearing do not jumper the bearing insulation.
2. Close all unused drill holes with screw plugs. Exception: The atmosphere connection remains open.
3. Route the pipes so that no loads or vibration can occur at the bearing housing connections.
4. Flush the oil-circulating system prior to installation of the oil pipes until only clean oil comes out. To do this, use the quality of oil as specified for use later in operation.
5. Make sure that the oil supply system operates for a sufficiently long time before the motor starts and continues to operate for some time after the motor stops. This is how you avoid the bearing running dry when the motor accelerates and decelerates.
6. Connect the oil supply system to the bearings.

5.11 Connecting the circulating-oil lubrication

You should always observe the notes in the documentation provided by the manufacturer of the oil supply system in the Appendix D "Additional documents". These instructions are only general information.

Installing the oil supply system

When installing the oil supply system, ensure that the following conditions are maintained.

- The oil return lines are laid so that they are straight.
- The oil return lines are laid with a gradient of at least 5%.
- The formation of siphons can be ruled out in the oil return lines.
- No oil block can occur.
- The discharge pipes are larger than the inflow pipes.

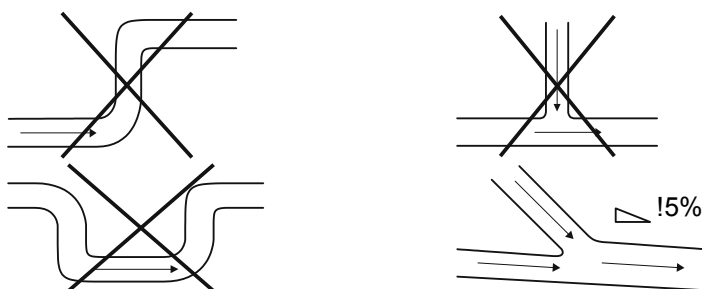


Figure 5-11 How to route oil return lines

Note

Vent holes in the oil return line

If you use oil cooling tank, provide vent holes in the oil return line to the tank or on the tank themselves. Vent holes must be equipped with an air breather cap with filter (of adequate size to ensure good ventilation), to prevent contamination of the oil with impurities. Make sure that the vent holes are located above the oil level in the tank.

Note

Installing the oil vapor extraction at the oil tank

If you install an active oil vapor extraction system at the oil tank, make sure that system generates required underpressure conditions in the oil return line. This ensures that any oil vapor/mist is specifically routed back into the oil tank from the return line. This avoids oil vapors escaping from the sealing gaps of the bearings and oil leakages.

You should also observe the notes in the documentation provided by the manufacturer of the oil supply system in the Appendix D "Additional documents".

5.12 Connection of cooling piping (air-to-water cooler, cooling lubrication system)

Connection between flanges on the water coolers or lubrication oil devices must be done by using flexible element (see Figure 5-12) due to mutual interactions between two independent piping. Flexible element avoid relieve movement stress, reduce noise, isolate vibration, compensate for misalignment during machine operation.

Requirements for coolant piping:

- Ensure that the coolant lines are routed and supported so that the connection flanges are not exposed to stress, strain or vibration loads.
- The required data for the connection flanges are given in the machine dimension drawing/dimension drawing text.

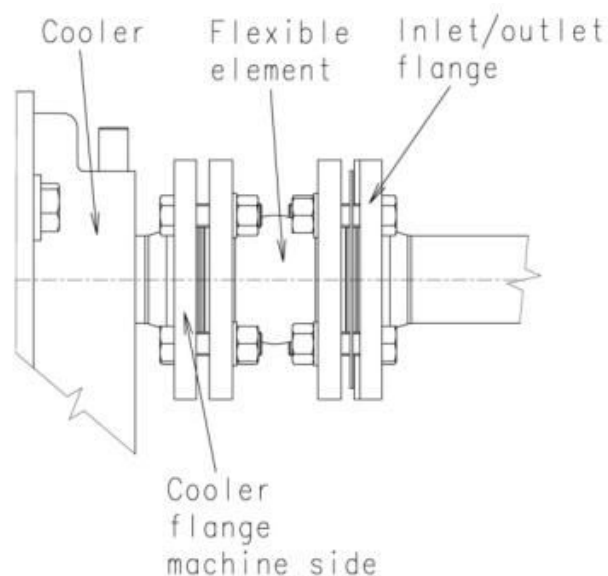


Figure 5-12 Example of flanges flexible connection

5.13 Connecting the coolant supply

You should always observe the notes in the documentation provided by the manufacturer of the oil supply system in the Appendix D "Additional documents". These instructions are only general information.

5.13.1 Connecting

1. Route and support the supply lines so that the connection flanges are not exposed to stress or strain, vibration loads.
2. Flush out the cooling circuit before you connect the coolant supply to the generator. This removes deposits and foreign bodies so that they cannot make their way into the cooling circuit. Use the coolant specified for flushing.
3. If dirt and foreign bodies could be in the liquid coolant, you must use suitable filters in the coolant feeder line.
4. Connect the coolant supply to the generator.

5.13.2 Filling

1. Fill the cooling circuit with coolant until the air has been completely forced out of the cooling circuit. Use only coolant of the specified composition and quality.
2. Perform a pressure check to ensure that the coolant connections are watertight. The maximum pressure must not be exceeded. The maximum permissible pressure is specified in the dimension drawing text.

5.14 Assembly of rotor grounding brushes

Note

In the standard design, the rotor shaft is not grounded. Ensure that the shaft is grounded through the driven load when designing the overall system.



CAUTION

Before grounding brushes assembly, brush holder and contact surface must be out of corrosion protection (grease, vaseline).



WARNING

Defective shaft grounding

If the shaft grounding does not function correctly, the shaft can be at a high voltage level that does not decay quickly enough when the machine comes to a standstill. This can lead to death or serious injury as a result of electric shock, or a bearing damage caused by current flowing through the bearing.

- Regularly check the shaft grounding and maintain it at the maintenance intervals. Observe these operating instructions.

Use of the grounding brush limits the voltage between the bearing and the shaft to the contact voltage of the grounding voltage. The grounding brushes are mounted on the D-end on the un-insulated bearing.

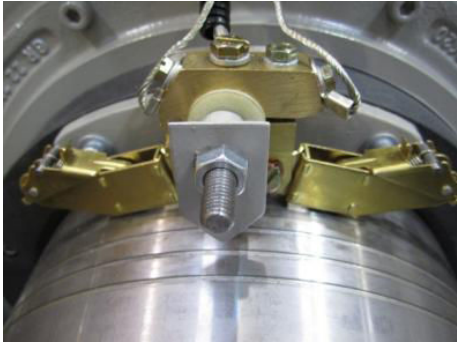
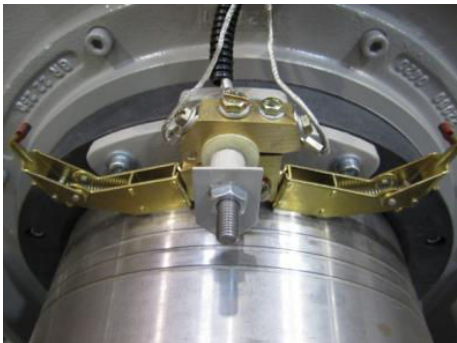
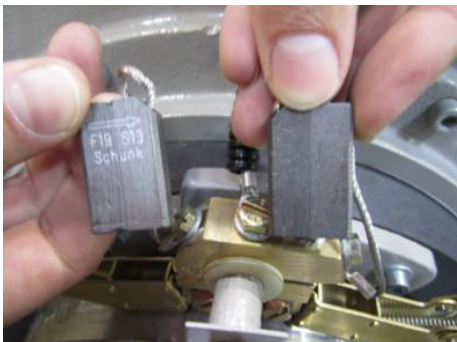
The brushes slide on the shaft and are electrically connected to the bearing/bearing shield. Grounding brushes are connected and packed in protection bag during transport and storage. Before first start or commissioning, grounding brushes must be assembled according to the procedure in "Figure 5-13" (Page 51).

Note

Maintenance intervals

The maintenance intervals must be adapted to suit brush wear, which varies according to operating conditions. For maintenance interval and maintenance points to check, see chapter "Maintenance" (Page 81).

Procedure for grounding brush assembly

Machine delivery – brushes are packed	
Initial position of clamping fingers	
Fold up clamping fingers	
Unpacked brushes and bed the brushes into the holders  CAUTION Always observe direction of rotation. Each brush has an arrow. This arrow must comply with machine direction of rotation.	 

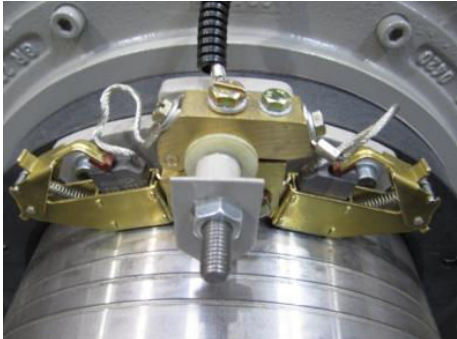
Cover up the clamping fingers. Fingers pushed the brushes against shaft	
Final position of shaft grounding	

Figure 5-13 Grounding brushes assembly

5.15 Complete the installation work

Note

Tidy the machine

Once you have completed the installation work, remove all objects – such as tools, cloths, deposits of dirt and moisture, etc. – from the machine.

1. Close all operating and terminal box covers.
2. Remove all tools and aids. Clear the machine of personnel.
3. Clean the machine to remove any dirt that may have accumulated as a result of the installation work.
4. Make sure that all exposed rotating parts are protected against contact by personnel.
5. Make sure that there are no loose parts on or in rotating machine elements. Observe any feather keys that may be located in free shaft ends.
6. Make sure that all grounding connections (equipotential bonding) are connected.

Record all of the installation work that was carried out to the logbook.

6 Electrical connection

6.1 Checking the insulation resistance of stator winding

The insulation resistance of a rotating machine winding is a function of the type and condition of the insulating material used, as well as their application technique. A good state of insulation secures safe and reliable operation of the machine.

- The insulation resistance of stator and rotor windings must be measured before the first start up of the machine, after long period of standstill and during general maintenance works.
- The insulation resistance gives information about the state of insulation of an electrical machine. The insulation resistance may be affected by presence of moisture in or on the insulation or dirt contamination of the winding.
- Too low a value of insulation resistance may indicate the presence of moisture in or on the insulation or dirt contamination of the winding.
- In this case, the machine should be dried out or cleaned before dielectric tests are made or before the machine is placed.
- Test procedure should comply with IEEE Std. 43-2000 "Recommended Practice for Testing Insulation Resistance of Rotating Machinery", see chapter "Insulation test for stator winding" (Page 54).



CAUTION

The measurement should be performed only by qualified personnel under consideration of safety measures!



CAUTION

If the measured values are too low the winding must be dried - see chapter "Drying windings" (Page 61)

6.1.1 Insulation test for stator winding

The insulation resistance is measured using an appropriate insulation resistance meter (e.g. Megger MIT410).

The test voltage: see Table 6-1 (Page 54)

Test duration: 1 minute

Test conditions:

- All power supply cables are disconnected
- 1 – pole voltage transformers are disconnected
- Lightning arrestors and capacitors are disconnected
- All wiring brought out for resistance temperature detectors (RTDs), thermocouples, or other monitoring devices installed in the coils or windings must be connected together and grounded as well as the auxiliary winding if any.
- Frame of the machine and the stator windings that are not tested must be grounded.
- Temperature of the winding is recorded

The insulation resistance measurement is usually performed in the terminal box. The whole winding as a group is measured at once usually. The insulation resistance meter is connected to the winding of the tested machine and to its frame. The phases are interconnected with the neutral point of the generator.

After 1 minute the value of insulation resistance is recorded.

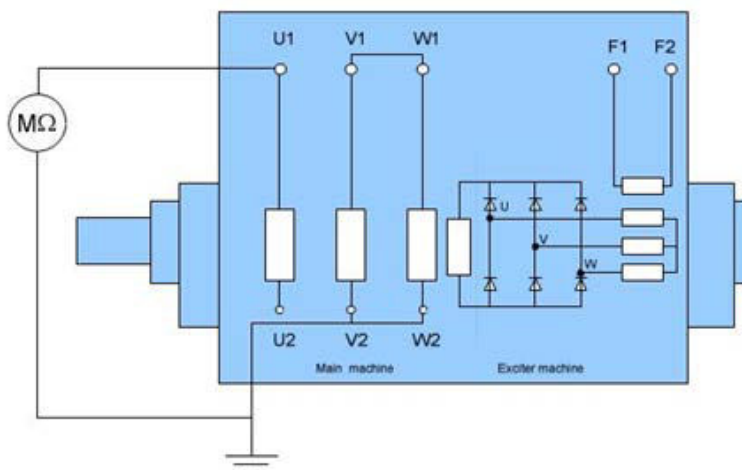


Figure 6-1 Insulation resistance measurement for one phase of the winding

Table 6-1 Measuring voltage for windings and accessories

Rated voltage	Un ≤1000 V	Un ≥1000 V
	Measuring voltage DC	
Stator winding	500 V	1000 V *
Rotor winding	500 V *	
Winding temperature sensors	500 V	
Space heaters	500 V	
Other accessories (e.g. air and bearing temperature sensors, PMG,...)	100 V	
Insulated bearings	100 V	

*) According to customer requirements or other regulations may be the stator and rotor winding of high voltage machines tested with higher voltage. This voltage cannot exceed rated voltage of the machine.

6.1.2 Minimum values of insulation resistance

Normally, the insulation resistance of new machines with dry winding is very high and exceeds the minimum values significantly. The insulation resistance is affected by the age and usage of the machine.

At increased air humidity or increased temperature, lower insulation resistances may be measured.

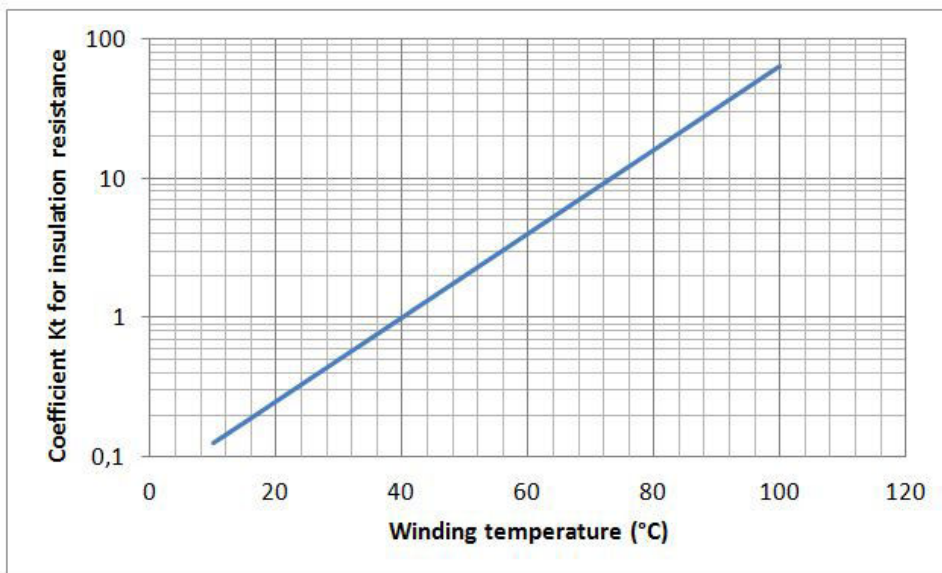
Following figures should be considered as guidelines.

Table 6-2 Minimum value of insulation resistance

New machines (factory test)	Riso1min/ 40°C	> 1000 MΩ
Machine on site	Riso1min/ 40°C	> 100 MΩ
Used machine	Riso1min/ 40°C	> 100 MΩ

6.1.3 Temperature correction of insulation resistance

The value of insulation resistance, are normally stated for 40°C. The actual value taken from measurement should be converted for 40°C using following chart:



R = Insulation resistance at current temperature

R_{40} = Insulation resistance for 40°C reference temperature

$R_{40} = K_t \times R$

Figure 6-2 Temperature correction of insulation resistance

6.1.4 Rotor and exciter stator winding insulation resistance measurement

The insulation resistance is measured using an appropriate insulation resistance meter (e.g. Megger MIT410).

The test voltage: see Table 6-1 (Page 54)

Test duration: 1 minute

Test conditions:

- All diodes are bridged
- Main excitation winding is interconnected with the 3 phase AC winding of brushless exciter
- Shaft of the machine and the stator windings that are not tested must be grounded.
- Temperature of the winding is recorded

6.1.5 Minimum values of insulation resistance

Following figures should be considered as guidelines.

Rotor (main + exciter)	Riso1min/ 40°C	> $U_{2n}(kV)+1M\Omega$
Exciter stator	Riso1min/ 40°C	> 100 MΩ



CAUTION

The short circuit wires have to be removed from the semi conductors after the test!

6.2 Measuring of bearing insulation

By measuring of bearing insulation you prevent the damage to the bearing and degradation of bearing oil.

Both bearings are insulated. Bearings insulation is bridged to the generator frame. Bearing insulation is measured on the machine shaft against the ground.

Bridge wires of bearing insulation are connected to the terminal boxes which are placed on the right next to the bearing (face to each bearing).

Measuring points:

DE side	Free shaft end
NDE side	Opening in the cover between NDE bearing and PMG housing. Plug with hex socket is marked by label. Unplug the nut by using hex wrench.

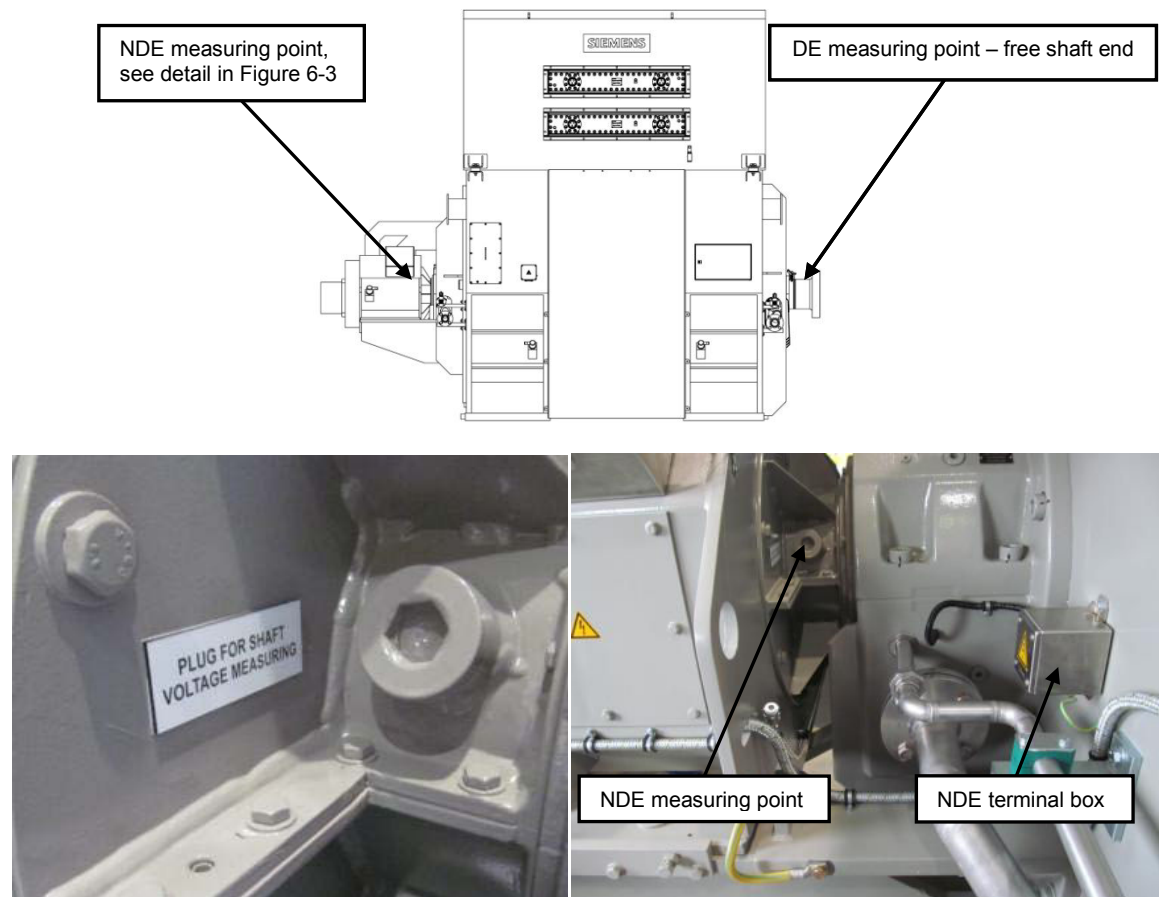


Figure 6-3 Measurement point on the NDE side

Conditions for measuring

For proper evaluation of the bearing state following steps must be done before measurement:

- Coupling not assembled
- Grounding brushes on DE side must be removed from the holders
- Bearing insulation bridge wires disconnected, see chapter "Bridge disconnection" (Page 58).

6.2.1 Bridge disconnection

Procedure for wires disconnection is same for both terminal boxes.



WARNING

Take into account, the bridge wire for both bearing are connected to different terminals. See description in Figure 6-5 and Figure 6-6.

- Open the terminal box cover by unscrewing the screw
- Disconnect the bridge wire, see schema in Figure 6-5 and Figure 6-6

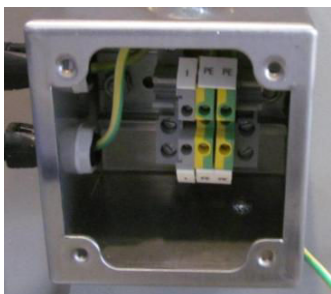


Figure 6-4 DE terminal box

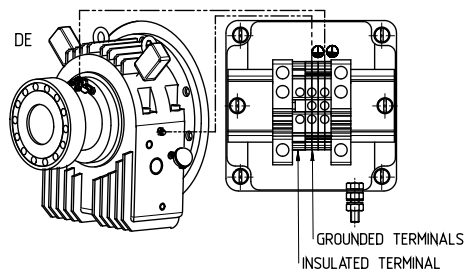


Figure 6-5 Connection schema of DE terminal box



Figure 6-7 NDE terminal box

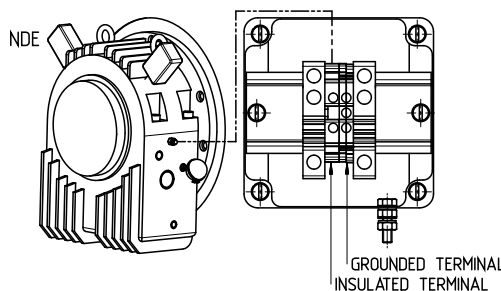


Figure 6-6 Connection schema of NDE terminal box

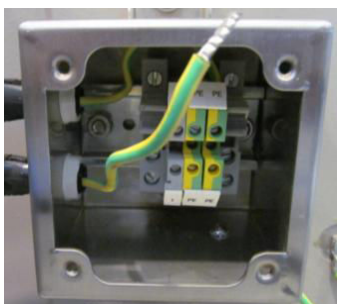


Figure 6-8 Disconnected wire

6.2.2 Procedure for bearing insulation measurement

NOTICE

Before bearings insulation measurement the "Conditions for measuring" (Page 57) must be observed and "Bridge disconnection" (Page 58) must be done.

Measure the insulation by using a 100 V full-scale instrument is usually adequate (for example MIT410).

Where to ambient temperature allow, measure the insulation resistance of the bearing, between temperature 20 to 30 °C.

Recommended measurement time is 1 minute (so long that the measured value of the resistance is no longer changed).

Measure the insulation resistance of the bearing insulation with a measuring voltage of 100 V DC.

Note

Before you begin measuring the insulation resistance, please read the manual for the insulation resistance measuring device you are going to use.



Figure 6-9 Example of bearing insulation measuring

Compare the measured values with the values in following table:

Table 6-3 Required insulation values

Resistance (depending on the temperature)	Minimum required values
$R_{20^{\circ}\text{C}}$	$\geq 10 \text{ k}\Omega$
$R_{40^{\circ}\text{C}}$	$\geq 2,5 \text{ k}\Omega$

NOTICE

Typical resistance range for the new machine is about 1 M Ω - 1 G Ω .

If the resistance values are below required values, contact Siemens service center, chapter "Service and Support" (Page 97).

6.2.3 Finishing the bearing insulation measurement

- After evaluation of bearing insulation connects bridge wires and close covers of the terminal boxes.
- Assemble the plug for NDE measuring point.

6.3 Drying, cleaning, fault tracing

If the above-mentioned minimum insulation resistance values are not attained, the cause may be moisture, contamination or damage to the insulation.

It is necessary to dry the stator winding, if

- external moisture, contamination or damage can be ruled out as the cause of the minimum insulation resistance value being too low.
- external moisture is observed on the winding surface, irrespective of whether or not the minimum insulation values are achieved.
- After deposits or dirt have been removed, the minimum insulation resistance values are still not reached.
- Incompletely hardened resins or varnishes are assumed to be responsible for low insulation resistance values in the case of repaired machines

6.3.1 Drying windings

The heat required for drying the winding can be supplied in the following ways, by

- feed in current from external power sources to generate thermal losses in the winding, e.g. using motor-generator welding sets or a variable high-current rectifier (The value of current is 50-70% of the rated current.)
- directing warm air at the winding, after rigging up a suitable covering with tarpaulins, scrap wood covers, etc

Care should be taken to ensure that the air can circulate to carry away the moisture. The winding should reach a temperature of about 60°C during the drying process. However, this is the steady-state temperature that is not reached until drying has been in progress for about four hours. Starting at a low level due to the temperature rise, the current flowing through the windings, or the volume of warm air input, is to be increased or adjusted so as to meet this steady-state temperature condition.

Measure the temperature with the resistance temperature thermometers embedded in the slots of winding. The rotor winding is normally heated sufficiently by the surrounding air when the stator is heated by passing current through it.

During the drying process, turn the rotor about 90 ° every hour.

Check the insulation condition after 4 hours of drying, see chapter "Checking the insulation resistance of stator winding" (Page 53).

Contact the Service Center (Page 97) for drying the windings or for troubleshooting issues.

For warm air drying, proceed as follows:

- The heaters should be arranged so that by means of suitable covers the winding being heated is in the hot-air stream without concentrating the heat to the extent that excessive temperatures are reached. This requires that a continuous circulation and replacement of the air takes place.
- Openings for inlet and outlet of warm air are placed on the NDE and DE side of the machine.
- Remove the openings covers and place on an external heating inlet on the DE side of the machine.
- The air inlet temperature should not exceed 60°C and the outlet temperature should be at least 10 K above the ambient air temperature.
- Do not allow the air temperature within the machine to drop below the dew point, i.e. there must be no moisture condensation forming at the outlet.
- Because of the risk of fire, this method of drying requires constant monitoring.
- Also observe the general rules listed above.

Note

Anti-condensation heating

Please note that the anti-condensation heating has not been designed to dry the windings, but is intended to prevent condensation.

6.4 Establish grounding connection

Machine grounding

Integrate the machine into the grounding measures that are applicable at the installation site. Carefully take into account the applicable national and sector-specific regulations and standards at the place of installation.

Use the grounding terminals located on the machine housing or on the terminal boxes to ground the machine. This avoids damage due to circuit currents.

Each grounding terminal is marked with a ground symbol.

The positions of the grounding terminals are shown in the machine dimension drawing. Connect the grounding conductors so that a good electrical connection is established.

The factory recommends making the connections as shown in Figure 6-10.

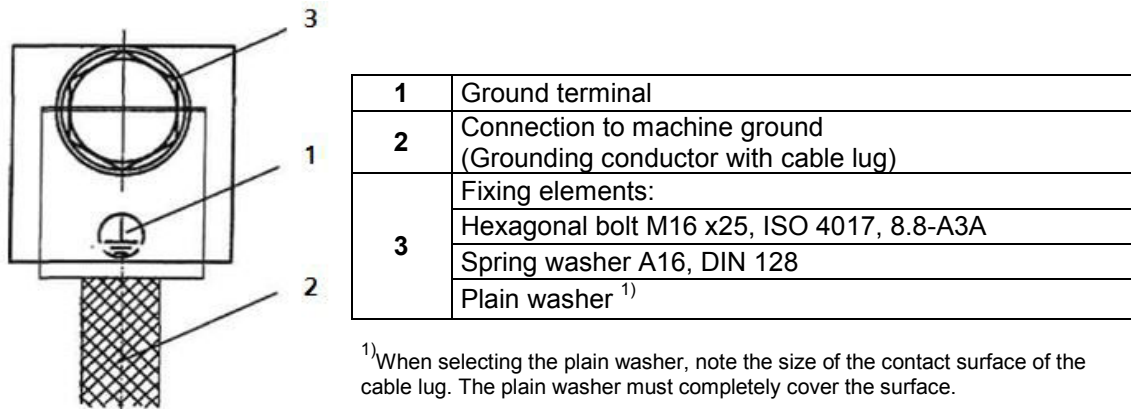


Figure 6-10 Grounding connection

The grounding conductor must make perfect electrical contact, which entails:

- the contact surface should be free from irregularities
- the contact surface should be bright, (i.e. the surface is to be treated with a clean, medium grade steel-wire brush)
- the contact surface should be greased with acid-free vaseline
- the spring washer should be in perfect condition
- the hexagonal bolt should be tightened with the specified torque (see Table A-1).

Selecting the cross-section for the connection to ground

When selecting the connecting cables to ground the machine, ensure that the applicable national and/or sector-specific regulations are complied with.

Examples of the minimum grounding conductor cross-section for various cross-sections of power conductor at each connection terminal are listed in Table 6-4.

Table 6-4 Minimum cross section for grounding conductor

Cross-section of power conductor in mm ²	185	240	300	400
Minimum cross section in mm ² grounding conductor to VDE 0530, Part 1	95	120	150	185
Size ¹⁾ of cable lug to DIN 46235	16 – 95	16 – 120	16 – 150	16 – 185

¹⁾ Size = Diameter point of terminal bolt - conductor cross section

6.5 Establishing the power connection

The following data to connect the machine are defined in the technical data for this machine:

- Direction of rotation
- The number and arrangement of the terminal boxes
- Circuit and connection of the stator winding

Direction of rotation for the machine

The direction of rotation of the machine is shown in the machine dimension drawing / dimension drawing text. The direction of rotation is marked using an arrow on the machine and on the rating plate. For the required terminal assignment, refer to the dimension drawing text.

NOTICE

Machine damage due to incorrect direction of rotation

This machine is designed for a specific direction of rotation. The machine can be damaged if you operate it with the incorrect direction of rotation.

Observe the direction of rotation data in the dimension drawing text.

Mounting the main terminal box

The main terminal box (MTB) is delivered separately from the generator.

Mount the main terminal box after the generator is finally installed. The position of the MTB is shown in machine dimension drawing.

Connect the stator leads to the external main terminal box.

For proper connection read documentation of the MTB manufacturer and following instructions in this manual.

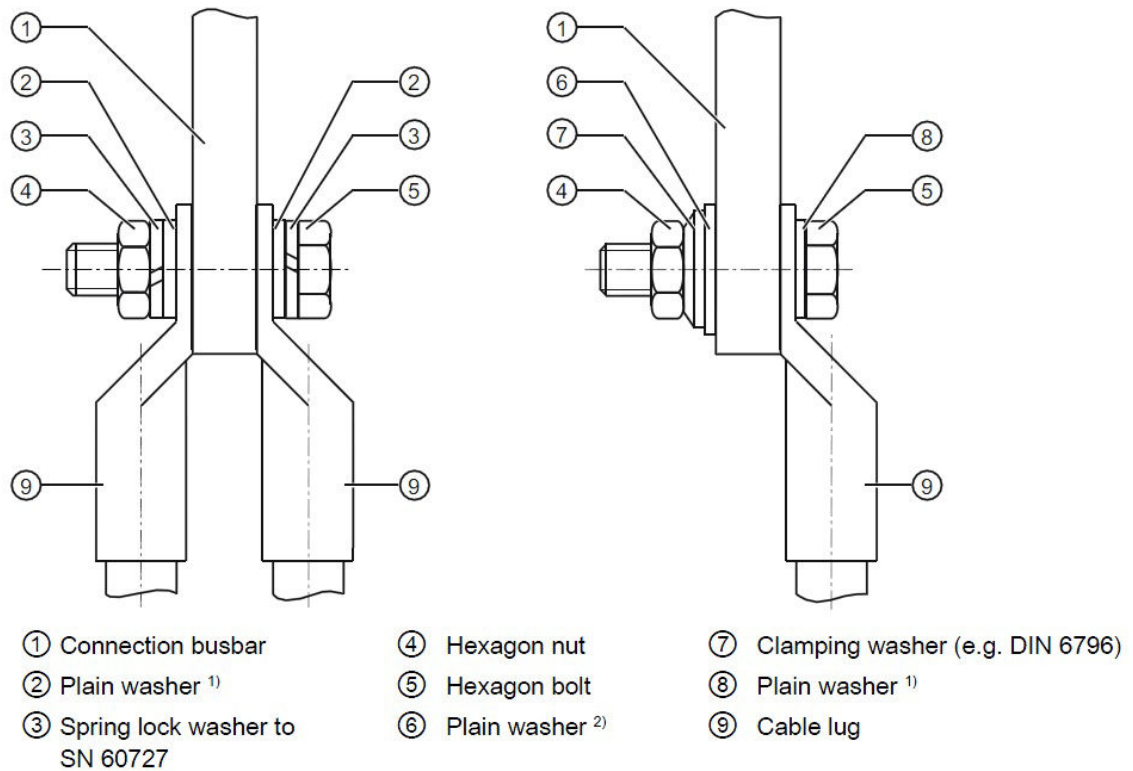
NOTICE

Avoiding tension and compressive forces at the connection points

Route the cables so that tension and compressive forces are avoided at the connection points. Ensure that the thermal expansion of the cables does not exercise additional tension and compressive forces on the connection points. Otherwise there is a risk that the connection points will be damaged.

Connecting electric power cables

The factory recommends making the connections as shown below.



¹⁾ When selecting the plain washer, note the size of the contact surface of the cable lug. The plain washer must completely cover the surface.

²⁾ The external diameter of the plain washer must be greater than the spring washer (approx. 2.5 x nominal diameter of the screw). The spring washer must not be in direct contact with the connection busbar.

Figure 6-11 Stator terminal arrangement

- The bolts and nuts are to be tightened with a torque wrench. Tightening is done using two wrenches.
- The tightening torques for connections using the cable lugs are shown in Table A-1.
- Connections for grounding the cable sheaths are provided in the terminal box.
- The connections and sealing of ends should comply with the local regulations.

Maintaining clearances and creepage distances

Note

Clearances and creepage distances

When installing the connections, observe the necessary clearances and creepage distances. Please observe the regulations applicable to the installation location. Carefully observe new conductive parts that have been installed, such as screws or protruding wire ends.

If no other local or industry-specific requirements apply, then use the following values to check that clearances and creepage distances are adhered to.

Table 6-5 Clearances and creepage distances

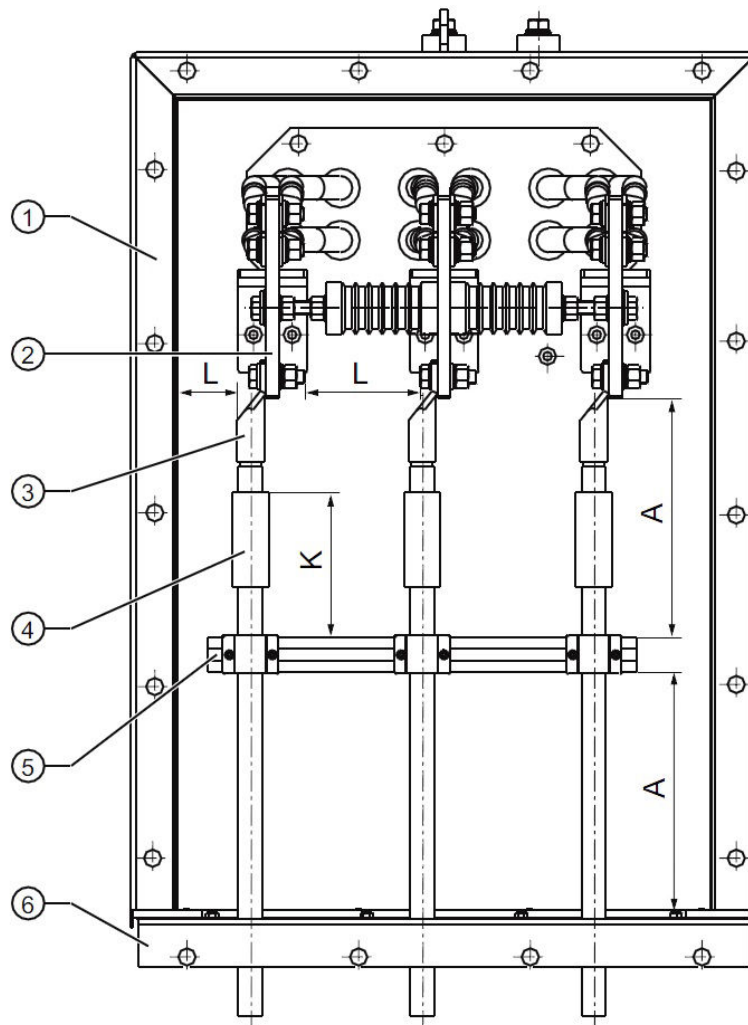
Rated voltage	Terminal test voltage IEC 60034-1	Creepage distance	Clearance
UST [kV]	UP [kV]	K [mm]	L [mm]
≤ 0.6	3.3	30	15
≤ 1.1	4.8	35	20
≤ 2.3	8.4	50	35
≤ 3.3	11.4	75	40
≤ 4.4	14.7	85	50
≤ 5.5	18.0	95	55
≤ 6.6	21.3	110	65
≤ 8.0	25.5	130	80
≤ 9.0	28.5	145	90
≤ 10.0	31.5	160	100
≤ 11.0	34.5	175	110
≤ 12.5	39.0	195	125
≤ 13.8	42.9	215	140
≤ 15.0	46.5	230	150
≤ 16.5	51.0	250	165
≤ 18.0	55.5	270	180
≤ 20.0	61.5	300	200
≤ 22.0	67.5	330	220
≤ 25.0	76.5	370	250

Minimum values for clearances, creepage distances and spacing distances

Clearance L Shortest distance in air between two conducting, un-insulated parts at different potentials.

Creepage distance K Shortest distance along the surface of an insulated part between two conducting, un-insulated parts at different potentials.

Observe the information provided by the cable manufacturer for the necessary distances between two insulated components or an insulated and a bare metal part that conducts current.



A Spacing between power connection bar and transverse bracing or spacing between transverse bracing and cable entry plate

K Creepage distance $\geq L$,
applies only in conjunction with installing cable transverse bracing

L Clearance

① Terminal box

④ Cable with sealing end

② Terminal bar

⑤ Cable transverse bracing, see diagram above

③ Cable lug

⑥ Cable entry plate

Figure 6-12 Clearances and creepage distances, shown schematically using a cable lug connection as example

Establishing cable sealing ends

If you are using cable sealing ends (potheads), maintain the required air and creepage distances – as well as the regulations for manufacturing sealing ends (potheads).

Note

Establishing sealings ends

Observe the applicable conditions at the place of installation for the connection and establishing sealing ends.

Closing the terminal box

1. Before closing the terminal box, please check that:
 - The screwed electrical connections have been assembled properly
 - The seal and the pressure relief diaphragms are undamaged and sealed up properly
 - The inside of the terminal box is clean and free from trimmed-off ends of wiring material
 - The minimum air clearances are adhered to in accordance with the regulations applicable at the installation site. Be aware of any protruding ends of bolts and wires.
 - Unused cable entries are closed and their plugs are tightly screwed in place
2. Close the terminal box.
3. Fasten the ground strip between the terminal box and the cover.

6.6 Connecting the auxiliary circuits

Terminal boxes for auxiliary circuits

Factory-fitted, the cables of the supply and monitoring equipment are routed inside the machine to separate terminal boxes with terminal blocks, where they are connected. The number and the position of the auxiliary terminal boxes is indicated in the machine dimension drawing and dimension drawing text. For the terminal assignment refer to the auxiliary terminal diagram

Drilling the cable entry plate

If the terminal boxes were delivered with an undrilled cable entry plate, drill the required holes for the cable entries in the gland plate.

Cable entry

Note

In standard design are terminal boxes delivered without any cable entries.

Cable glands are provided for cable entry. The cable outer diameters suitable for the individual gland nominal sizes are given in the table below.

Table 6-6 Cable outer diameter/cable gland assignment

Nominal size	Suitable for cable diameter	
	from	to
M20 x 1.5	6 mm	12 mm
M25 x 1.5	9 mm	16 mm
M32 x 1.5	16 mm	20 mm
M40 x 1.5	19 mm	28 mm
M50 x 1.5	26 mm	35 mm

Drilling the cable entry plate

The anti-condensation heating system is designed to ensure that the active components of the machine are always warmer than their surroundings. This prevents condensation. The heating power required was determined when the electrical machine was designed. Refer to the dimension drawing text for the power rating and supply voltage.

1. Make sure that all packaging components have been removed from the machine before you commissioning the anti-condensation heating.
2. Connect the anti-condensation heating as specified in the dimension drawing text/auxiliary terminal diagram. Ensure that the required grounding is provided on site. The control side of a three-phase power system must also have an electrical connection.
3. Ensure that the anti-condensation heating cannot be switched on during operation of the machine.
4. Switch on the anti-condensation heating until the machine is commissioned.

Connecting temperature monitoring for the stator winding

The stator winding is monitored for thermal loading by resistance thermometers embedded in the stator winding. Thermal overloading means a prolonged excess temperature which may destroy the winding insulation or considerably reduce the life of the insulation. If the winding temperature reaches or exceeds the permissible temperature limit in the area of the temperature sensor, then a signal is sent corresponding to the temperature reached. The machine control system can use this signal to output an alarm or shut down the machine being used.

The connecting leads of the temperature sensors are routed to the auxiliary terminal box. The switching and assignment of the terminals is specified in the auxiliary terminal diagram. The auxiliary terminal diagram is also included in the auxiliary terminal box. The type and quantity of thermometers are indicated in the dimension drawing text.

If the event that fewer thermometers are used than are available, please ensure that the following conditions are met:

- Ensure that all three phases, U, V and W are covered.
- Ensure an even distribution around the periphery.

Note

The temperature sensors cannot be changed

The temperature sensors are installed in the separators and are impregnated together with the stator winding. Therefore, it is not possible to replace a defective temperature sensor.

Note

Protection of the complete machine is not necessarily sufficient

The temperature monitoring system of the stator winding does not provide complete thermal protection for the entire machine. Owing to the different time constants, parts of the rotor winding may assume a high temperature earlier than the measuring points in the stator winding when the load quickly changes.

Connecting temperature monitoring of the bearings

The connecting leads of the temperature sensors are routed to the auxiliary terminal box. The circuit and assignment of the terminals are shown in the auxiliary terminal diagram in Appendix "Technical data and drawings". The auxiliary terminal diagram is also included in the auxiliary terminal box.

Closing the terminal boxes

Before closing a terminal box, ensure that the following conditions are maintained.

- The incoming cables match the machine-side terminal assignment in accordance with the terminal diagram.
- The inside of the terminal box is clean and free from trimmed-off ends of wiring material.
- Unused cable entries are closed and their plugs are tightly screwed in place.

7 Commissioning

Note

Service Center

For any installation work that is required, contact the Service Center (Page 97) or commission service engineers trained by Siemens and authorized for this task.

7.1 Preparing for commissioning

Before commissioning the machine, check that the following conditions are maintained. Log the results of the preparatory work and the commissioning in a report. Prepare the corresponding report.

Note

The following list does not claim to be exhaustive. Perform additional checks and tests that are required corresponding to the system-specific situation.
Some checks may not match the configuration of your machine, in this case ignore them.

- The machine has been properly installed and aligned.
- The machine is externally and internally free of any major dirt and loose parts, such as screws or chips.
- The grounding and equipotential bonding connections have been made correctly.
- The transport bracing have been removed.
- The grounding device is ready for operation (in case it is applied).
- The power cables for the machine have been adequately dimensioned.
- All power cables have been labelled correctly and in full.
- The terminal pieces and the cable sealing ends have been assembled properly.
- The electrical and mechanical connections for the power cables have been made correctly.
- The minimum insulation resistance values are observed.
- The machine has the required direction of rotation.
- The operating conditions correspond to the data specified on the name/rating plate.
- The supplementary devices for monitoring the machine have been correctly connected, are functioning correctly and are no longer short-circuited.
- An appropriately configured controller and speed monitoring ensure that higher speeds cannot occur than are specified on the name/rating plate (in case it is applied).
- The input/output elements have the proper setting conditions according to type.
- All fixing screws, connection elements, and electrical connections have been tightened to the specified tightening torque.
- All touch protection measures for moving and live parts have been taken.

Note**Additional equipment**

Ensure that additional equipment not supplied with the machine is connected correctly and ready for operation. This includes, for example:

- Inverters
 - Switchgears
 - Transformers
 - Protective devices
-

- Covers that prevent contact with rotating and live parts must be closed.
- The bearings are ready for operation and have been lubricated according to the instructions in this manual and instructions of the bearing manufacturer.
- The self lubricated sleeve bearings must be always pre-lube before first start of the machine. See chapter “Pre-lube the bearings with oil – If the lubrication unit is not working” (Page 44).
- The bearing housing insulation is not bridged at one end. The end that may not be jumpered is specified in the Dimension drawing text.
- The specific instructions of the bearing manufacturer for commissioning the bearings have been observed and carried out. The documentation of the bearing manufacturer is available in Annex “Additional documents”.
- The quantity of circulating oil has been individually set for each bearing, corresponding to the data in the dimension drawing text or the bearing type plate.
- The valves of the oil supply system are secured so that they cannot be accessed and cannot be inadvertently moved.
- Check that all connections are tight and do not leak.
- The coolant supply is connected and ready for operation.
- The liquid coolant is available in the specified quality and quantity.
- The cooling system is vented.
- The coolant supply feed is open.

7.2 Before switch on

Table 7-1 Prepare

▼			after initial assembly or an inspection	
	▼		for machines stopped for testing but ready for operation	
		▼	for starting under service conditions	
			Machine part	Operations
■	■	■	The entire machine	Visual inspection of the machine (external, internal state). According to Table 9-2 (Page 84).
■	■		Stator	Measure the dielectric strength of the stator winding to stator core and frame. Measure insulation resistance, as described under "Checking the insulation resistance of stator winding" (Page 53).
	■		Connections	Check all electrical connections for tight fit. Inspect all grounding connections.
■	■	■	Oil supply	Switch on the oil supply. Check for proper functioning.
■			Monitoring devices	Check the monitoring devices for correct connection and functioning. Check the guide values for initial setting of the contact assemblies (see Dimension drawing text).
■	■		Air-to-water cooler	Open the vent valves. Fill the pipe system with clean water, till water comes out of the valves. Close the vent valves. Inspect the connections for leaks. Keep service pressure in mind. Observe manufacturers operating manual.
■	■	■		Open the water supply to the cooler.
■	■	■	Bearings	Check the oil filling.
■				Before first start of the machine self lubricated sleeve bearings must be always pre-lube. See chapter "Pre-lube the bearings with oil – If the lubrication unit is not working" (Page 44).
■			Oil supply	Before first start of the machine, open the reduction valves to their maximum position.
■				When the machine reaches the nominal speed only adjust oil flow according to the dimension drawing text. After adjusting the oil flow, lock the reduction valves.
■	■	■	Anti- condensation heating	Make sure that the anti-condensation heating is switched off.

7.3 Connect

Table 7-2 Connect

▼	after initial assembly or an inspection	
	▼	for starting under service conditions
		Operations
■	■	Run up the generator slowly.
■		Compare the machine's direction of rotation with that specified in dimension drawing text or on the rating plate. Ensure that the machine rotates only in the permissible direction.
■	■	Observe that the machine is running smoothly and evenly for a certain period of time. Check for running smoothness on the bearings. Check for irregular noise. Check operation of the oil rings.
■		Observe temperature rise of the bearings. ¹⁾
■	■	If the mechanical running of the generator is satisfactory, start excitation gradually. If the running smoothness deteriorates it indicates a magnetic fault such as uneven air gap or interturn short-circuit.
■	■	When the generator is running satisfactorily it can be synchronized with the supply system and loaded

¹⁾ In the event of sudden changes or wide fluctuations without any apparent reason, shut down the machine immediately at find the cause (also see "Fault diagnosis chart" on Page 78. Such behaviour can be due to installation errors or transport damage).

8 Operation

8.1 Safety information/instructions



WARNING

Covers that prevent contact with rotating and live parts may not be opened or disassembled during operation.

It should be remembered that high surface temperatures can occur on some parts of the machine, e.g. bearing housings; touching these parts should therefore be avoided or prevented.

Non-observance can result severe personal injury or substantial property damage.

Only qualified personnel should work on or around this machine.

Regular monitoring

Regular monitoring is a precondition to promptly identify faults and avoid damage. Any changes in the normal condition indicate that the machine is not operating correctly. The cause should be immediately identified to prevent any further damage.

8.2 Switch on

To switch on the machine, read "Before switch on " (Page 72).

8.3 Running

It is recommended that the following inspections are carried out at fixed intervals - to the extent that monitoring systems are available - and that a record is kept of the values:

Current, voltage, power consumption

Winding temperatures

Cooling air temperatures

Temperatures of the cooling media supplied

Bearing temperatures

Mechanical vibration

Leakage (water, oil)

Wearing of shaft grounding brushes

Wearing of rotor earth fault brushes

The measured values should be compared with the nominal values. The contact assemblies should not be set to the release temperature until the temperatures under normal operating conditions have steadied. The guiding values for alarm and shutdown are given in the dimension drawing text.



WARNING

Long-term deviations from the steady-state values typical for the machine are a clear indication of a fault.

Non-observance can result in substantial property damage.

Note

Setting the monitoring equipment

The final setting of the monitoring equipment to the tripping values can only be carried out when the operating values that occur under normal operation have reached a steady-state condition. The guide values for alarm and shutdown can be found in the dimension drawing text in the appendix "Technical data and drawings".

8.4 Switching off

Table 8-1 Switching off

▼			Switch off
	▼		For switching off a machine ready for run up
		▼	For Inspection
			Operations
■	■	■	Switch machine off with stator current as low as possible and secure against re-starting.
■	■	■	Let machine coast to a standstill, and listen for unusual noise. Coast down can be braked or un-braked.
■	■	■	Observe running of oil-rings down to machine standstill.
	■	■	Shut down all auxiliaries after the machine has come to a standstill (water ¹⁾ , oil).
		■	Drain air-to-water cooler
■	■	■	Switch on the anti-condensation heating.

¹⁾ See information given under “Safety measures at stationary machine ready for start up”
(Page 77)

8.5 Safety measures at stationary machine ready for start up

Machines standing by ready for start-up require special protection if they are exposed to a harsh environment.

Such a situation can occur during:

- the time between the end of installation and the
- commissioning of the machine,
- pauses between two operating times,
- idle time of standby machines.

The following measures are to be taken so that the machine can remain on standby without any detrimental effects:

- Switch on the anti-condensation heating when:
 - The machine is shut down
 - The temperature inside the machine has dropped to 3K above ambient temperature
- Give the air-water-cooler anti-corrosion treatment (see operating instruction: "Air-to-water cooler")
- Check the condensed water

8.6 Preservation of the installed machine not on standby

If machines are shut down over prolonged periods without being kept ready for start-up, they must be protected by suitable preservation measures. The stator and rotor are to be protected from condensation inside the machine, i.e. the humidity is to be kept below 50 %, which can be achieved by the following measures:

- Enclose the machine in moisture-proof covering. Inside a covering of welded polyethylene sheet place ample quantities of desiccant (guidance value: 105 g/m² of sheet surface and month of preservation) and make use of moisture indicator. Regularly monitor the desiccant and renew if necessary.
- Provide the machine with dehydrating breathers and provide for heating and air circulation inside the machine.
- Coat bare surfaces outside of the bearing with anti-rust compound, e.g. Tectyl 506 ¹⁾.

The following measures should be taken to protect the bearings:

- Drain oil from the bearings
- Coat the shaft journals and bearing parts with oil-soluble anti-rust compound, e.g. Tectyl 472 ¹⁾.

¹⁾ Product of Valvoline Öl-Gesellschaft mbH Neuer Wall 75, D-20354 Hamburg

For protection purposes, the cooler should receive the preservation treatment described in the operating manual under "Air-to-water cooler" (see Appendix D "Additional documents"). Keep a list of all preservation measures implemented.

The effectiveness of the preservation measures should be reviewed by qualified personnel at regular intervals. These intervals may be agreed with the factory, if necessary.

As soon as any deterioration is noticed, it should be remedied immediately and corrosion and other damage should be removed.

Before putting a preserved machine into use, reverse the preservation measures so that the machine is re-turned to the condition required for commissioning.

8.7 Fault diagnosis chart



WARNING

The sources of machine faults must be eliminated immediately
Non-observance can result in substantial property damage.

8.7.1 Mechanical causes

Table 8-2 Mechanical causes

▼				Grinding noise	
	▼			Excessive temperature	
		▼		Radial oscillations	
			▼	Axial oscillations	
				Possible cause	Remedy
■				Rotor/shaft touching fixed parts.	Find cause and deal with parts concerned.
	■			Incoming air supply reduced because due to dust in the cooling ducts.	Check air ducts.
	■			Cooler performance has deteriorated. Water flow obstructed.	Clean the cooler in accordance with the manufacturer's instructions, inspect water supply. Bleed air from cooler. ¹⁾
		■		Unbalance in the rotor.	Contact manufacturer and enquire about balancing.
		■		Unbalance in the shafting	Remove unbalance.
			■	Surges from the coupled machine.	Inspect coupled machine.
		■	■	Misalignment or changes in-foundation.	Align machine. Inspect foundation and find out if any changes are caused by heat. Inspect coupling.
		■	■	Resonance with foundation.	Stiffen foundation after consulting the builders.

¹⁾See operating instruction: "Air-to-water cooler" for further details.

8.7.2 Electrical causes

Table 8-3 Electrical causes I

▼				Generator remains dead	
	▼			Rated voltage not obtained when generator loaded	
		▼		Phase Voltage unequal	
			▼	Generator draws inductive VAr	
				Possible cause	Remedy
■				Speed too low.	Increase speed of prime mover.
■				Exciter is not being excited.	Check AC winding of exciter. Check external excitation.
■				Open circuit in rotating section of exciter.	Perform visual inspection and measure circuit.
■				Breakdown of diodes.	Check diodes and replace if necessary as described under in "Maintenance" section (Page 81).
■			■	Open circuit in field circuit.	
		■		Interruption of an outer conductor in the supply circuit.	Check power switchgear and supply circuit.
	■			Overload.	Reduce loading.
■			■	Excitation system defective.	Check excitation system.
		■		Inter-turn or inter-winding fault in the stator winding.	Measure winding resistances and insulation resistances; repair after consultation with the manufacturer.
	■		■	Inter-turn or inter-winding fault in the field winding.	Check temperature rise: discolored varnish may be a hint. Remove short circuit (in workshop).
		■		Unbalanced load.	Reduce load unbalance.

Table 8-4 Electrical causes II

▼				Power supplied fluctuates	
	▼			Excessive temperature	
		▼		Individual winding sections overheat	
				Possible cause	Remedy
	■	■		Overload.	Reduce loading.
■				Excitation system incorrectly adjusted.	Check power switchgear and supply circuit.
		■		Inter-turn or inter-winding fault in the stator winding.	Measure winding resistances and insulation resistances; as described under "Checking the insulation resistance of stator winding" (Page 53). Repair after consultation with the manufacturer.
■				Driving torque fluctuating.	Inspect prime mover.

8.7.3 Bearing causes

Table 8-5 Bearing causes

▼					Bearing overheats	
■	▼				Bearing loses oil	
	■	▼			Oil in the machine	
		■	▼		Oil quickly turns cloudy	
			■	▼	Bearing temperature fluctuates widely	
				■		
					Possible cause	Remedy
■					Low oil level.	Check oil level and top up, if necessary.
■				■	Forced lubrication falls.	Check the oil supply.
■				■	Oil aged or dirty.	Clean bearing housing, renew oil.
■			■	■	Oil-ring runs unevenly.	Fit new oil-ring. ¹⁾
■			■		Excessive radial and axial load.	Check alignment and coupling.
■					Oil viscosity too high.	Compare viscosity with information given in text to dimension drawing, change oil if necessary.
			■	■	Oil viscosity too low.	
	■	■			Oil foams.	Please consult the manufacturer.
			■	■	Bearing surfaces damaged.	Fit new bearing shells. ¹⁾
	■	■			Oil flow too high.	Adjust correct oil flow; see text of dimension-drawing. Check discharge for obstruction. Check oil-level.
	■	■			Knife-edge seals damaged.	Fit new knife-edge seals ¹⁾
	■	■			Oil not returning properly from the sealing rings.	Clean oil-return channels. Inspect machine seal ¹⁾
		■			Machine seal not functioning properly (gap too large).	Inspect machine seal ¹⁾

¹⁾ For further information, see instruction "Sleeve bearings" in Appendix D "Additional documents".

9 Maintenance

Note

Service Center

For any installation/maintenance work that is required, contact the Service Center (Page 97) or commission service engineers trained by Siemens and authorized for this task.

Safety precautions

This instruction contains the essential safety information in chapter "Safety instructions" (Page 12) required for working on heavy-current equipment.



DANGER

Before starting work on the machine, and particularly for opening the enclosures of live parts, make sure that the machine or equipment has been properly isolated from the power supply.

Pay attention not only to the main circuits, but also to any supplementary or auxiliary circuits, particularly space heaters!

9.1 Maintenance interval

Careful maintenance and inspection makes it possible to recognize any faults at an early stage, so that they can be rectified before they can develop and cause damage. Maintenance and inspection therefore help retain the value of the machine, avoid expensive breakdowns and increase reliability and availability.

No hard and fast maintenance intervals can be laid down because operating conditions vary very widely, but at least an inspection should be carried out at the intervals recommended. Depending on the experience gained at the point of installation, this interval should be modified to suit such factors as contamination, switching frequency, load, etc. A careful look at the machine, accessibility permitting, is therefore recommended according to Table 9-1.

The maintenance intervals are recommended on the basis of fault-free operation. If faults or unusual operating conditions (such as overload, short-circuit) occur to overload the machine electrically or mechanically, an inspection should be carried out immediately.

The following intervals are recommended for inspections and repair work:

Table 9-1 Maintenance interval

Typ	Intermittent operation ¹⁾		Continuous operation ^{1) 2)}	
First inspections after commissioning	500	operating hours		
	1	months		
Second inspection	4000	operating hours or	8000	operating hours
	1000	switching operations		
	1	not later than after year of operation	1	not later than after years of operation
Follow-up inspection after	8000	operating hours or	16000	operating hours or
	2	not later than after years of operation	2	not later than after years of operation

¹⁾ Whichever applies first in each case (Note: The slip ring compartment is subject to special intervals)

²⁾ Continuous operation: continuous running with const. Speed and an approximate constant load.



DANGER

Main switch must be switched off and secured against re-activation before maintenance work is started.

In case of non-observance, contact with live parts will result in death or serious personal injury.

NOTICE

Deviating component maintenance intervals

Maintenance intervals may deviate for individual components.

Please observe the maintenance instructions of the component manufacturer. The documentation for components, e.g. operating instructions and maintenance guides, is provided in the Appendix D "Additional documents".

Failure to comply with the documents can result in damage to the components.

9.2 Inspection and maintenance work

The covers to the service openings (see dimension drawing or dimension drawing text) and the terminal box cover are to be removed for inspecting the interiors.

NOTICE

The housing top section (cooler housing), if available, need not be raised for maintenance reasons. If it is raised, however, the cables and screwed couplings inside are to be disconnected.
Replace all damaged seals prior to re-assembly.

NOTICE

Rotor demounting

Using a special tools and procedure is required for demounting the rotor out of generator. Before starting service work associated with demounting the rotor consult the work procedure with Siemens service center (contact on Page 97).
Improper demounting can cause serious damage to your machine!

NOTICE

Observe the maintenance instructions for the components

It is also important to observe the maintenance instructions provided by component manufacturers. The corresponding operating and maintenance instructions are provided in the Appendix D "Additional documents".
Failure to follow these instructions can result in damage to the components concerned.

Table 9-2 Inspection and maintenance work

Item	Points to check	Inspection and maintenance work
Visual inspection of the machine (external, internal state)	Mechanical damage, wear, paint damage, corrosion, leaks, dirt, foreign bodies, porous seals.	If you identify any damage or signs of damage, then initiate measures to remove the damage or to limit the damage. When required, inform "Service and Support" (Page 97). In case of detection of any moisture, it is necessary to measure according to chapter "Checking the insulation resistance of stator winding" (Page 53) and "Drying, cleaning, fault tracing" (Page 60).
Foundation	Foundation settling, foundation cracks.	Notify the civil contractor about these developments.
Machine fastenings	Check machine fixings for tightness.	Tighten machine fastening elements.
Alignment	Check coupling alignment and compare with the report of the last coupling inspection. Visual check.	Determine cause of this change and eliminate, realign coupling, see chapter "Alignment" (Page 38).
Attachments	Check parts for tightness.	Tighten fixing elements, check securing elements, renew if necessary.
Terminal boxes	Securing the conductors and checking the grounding conductor for tightness.	
	Terminal box fastening.	
	Deposits of dirt and moisture.	Remove deposits of dirt and moisture. Dry the inside. Clean the surfaces of insulating parts. Inspect seals.
Sleeve bearings	Oil change	Change the oil at specified intervals according to the bearing manufacturer instructions in the Appendix D "Additional documents". Read also chapter "Bearing maintenance" (Page 86).
	State of the bearing shells. State of the oil-rings. State of the bearing seals.	The maintenance work should be carried out in accordance with the bearing manufacturer instructions in the Appendix D "Additional documents".
	Check the machine seals for tight fit.	Tighten fastening elements, or replace them if necessary.
	State of the temperature detectors and, if necessary, their insulation.	Replace defective temperature detectors with equivalent detectors and, if necessary, replace the insulation.
	State and adjustment of the vibration sensors.	Adjust vibrations sensor. If necessary, replace defective sensor with equivalent sensor.

Oil supply system	Pollution, leaks, damage, function.	Carry-out the maintenance work corresponding to the documentation provided by the manufacturer of the oil supply system.
Machine internals	Check cold air spaces and warm-air spaces and the brushless exciter or deposits of dirt.	Remove dirt and dust.
	Check accessible part of stator winding (N-end) for dirt deposits, discolorations and damage.	In case of discolorations and damage, consult with Siemens service (Page 97).
	Visual check of stator overhang	Check winding overhang (damage, pollution, foreign bodies). If damage or foreign bodies are present, analyze the cause and initiate remedial measures.
	Check the air guiding rings for tight fit.	Tighten fastening elements, or replace them if necessary. Check locking elements and replace if necessary.
	Check condition of monitoring devices.	Replace damaged monitoring devices by equivalent devices. See dimension drawing text or chapter "Spare parts" (Page 94).
	Rectifier supporting wheel: state of the electronic components.	Replace damaged machine parts by equivalent devices. ,see chapter "Troubleshooting components on rectifier supporting wheel" (Page 86).
	Check insulation resistance of stator winding.	See chapter "Checking the insulation resistance of stator winding" (Page 53).
	State and attachment of electric conductors.	Attach conductors securely.
	Check seals, rubber components and damping elements for deformation, wear, porosity and cracks.	Replace deformed, damaged or porous seals, rubber components and damping elements.
Air-to-water cooler	Condition of the coolant lines and air ducts	Carry out the maintenance work in accordance with the "Water cooler" operating instructions.
	Leakages	Identify the cause of leakage. Re-seal the system.
	Anticorrosion protection	When required, improve the anti-corrosion protection.
Coolant pipes	Fixing elements securely in place	Retighten the fixing elements if necessary.
	Leak tightness of the cooling system piping	Replace the seals or the coolant pipes if necessary.
Measuring Slip rings	Condition of the running surfaces (check for unevenness and discoloration). Condition of the insulation between the slip rings. Check deposit of brush dust.	Carefully remove brush dust from the surfaces between the slip rings and the terminal studs. If there is any evidence of damage on the running surfaces, contact your Siemens service (Page 97). Clean the brushes housing using the vacuum cleaner.

Brushes of rotor earth fault detection	Check the wear out of the brushes.	Replace by new one if necessary. Replacement of brushes see chapter "Equipment for rotor earth fault detection" (Page 90).
Brush holders	Condition of holders, easy movement of the joints, alignment and fixing on the brush studs. Manually check that the spring effect is the same on all the brush holders. Condition and secure fit.	Correct the alignment. Retighten all fixing elements. Replace damaged brush holders. Tighten fastening elements. Check securing elements, replace if necessary.
Brushes	Length of brushes. Easy movement in brush holders. Fixing of stranded wires in brushes.	Replace worn or damaged brushes. Replace brushes that have worn down to about 30% of their original length or are damaged. Bed them in if necessary.
Brush contact face	Check condition of brush contact face for grooving and contamination.	Clean brush contact face carefully. If the brush contact face is damaged, refer the matter to the manufacturer for advice.

9.3 Bearing maintenance

Maintenance of sleeve bearings is detailed specified in manufacturer's manual which is enclosed in Appendix D "Additional documents".

Take care of the following:

- a regular oil exchange at specified intervals,
- checks of screwed joints,
- checks of temperature sensors.

9.4 Touch up any damaged paintwork

If the paint is damaged, it must be repaired in order to protect the unit against corrosion.

 CAUTION
Paint system Contact "Siemens Service and Support" (Page 97) before you repair any paint damage. They will provide you with more information about the correct paint system and methods of repairing paint damage.

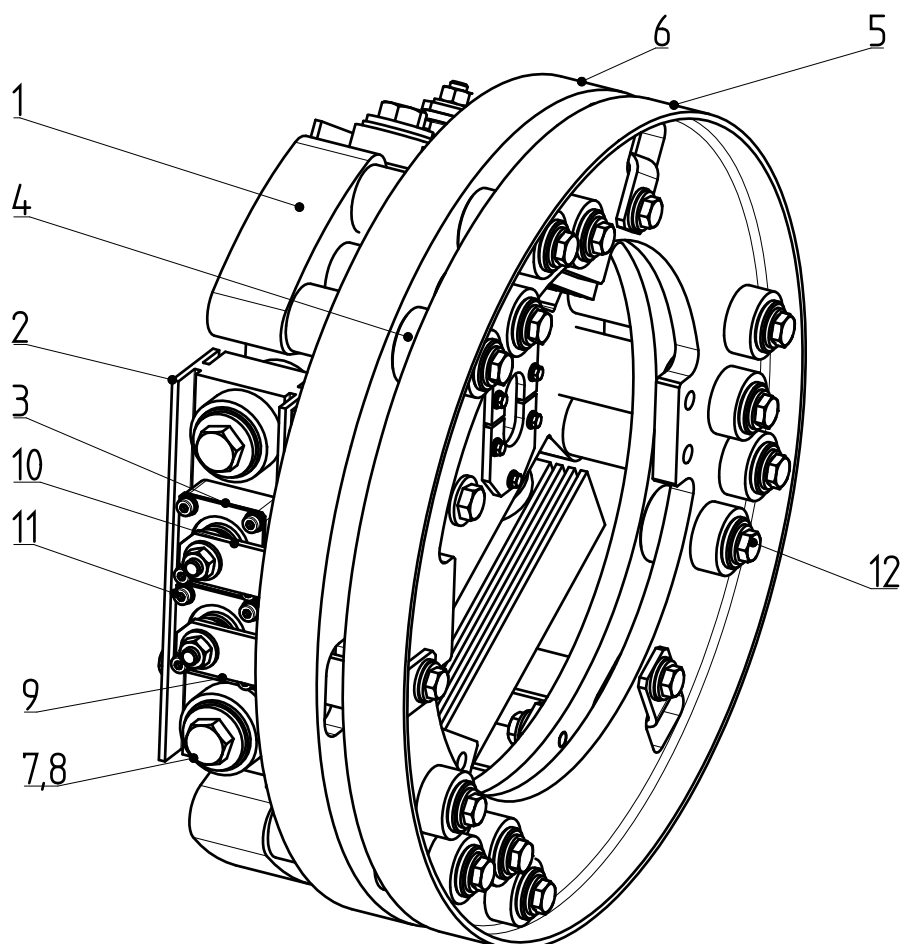
9.5 Troubleshooting components on rectifier supporting wheel

If a fault arises, it is advisable to notify the factory because it is the only source of any additional spare and replacement parts that may be required. In special cases it is best to request delegation of Siemens personnel.

To perform work on the rectifier supporting wheel, it is necessary to open the service covers provided at the N end of the housing top section.

9.6 Rotating rectifier – excitation system with PMG

The rotating rectifier is composed of silicon diodes connected to 3-phase full-wave rectifier circuit. Commutation surges are absorbed by varistors which are in parallel with diodes.



1	Hub
2	Heat sink
3	Spherical cap, diode
4	Varistor disc
5	Collector ring +
6	Collector ring -
7	Fixing screw M16 for heat sink
8	Insulating washer
9	Connector bar +
10	Connector bar -
11	Fixing screw M6 for spherical cap
12	Fixing screw M12 for collector rings

Figure 9-1 Assembly kit for rectifier wheel with diodes

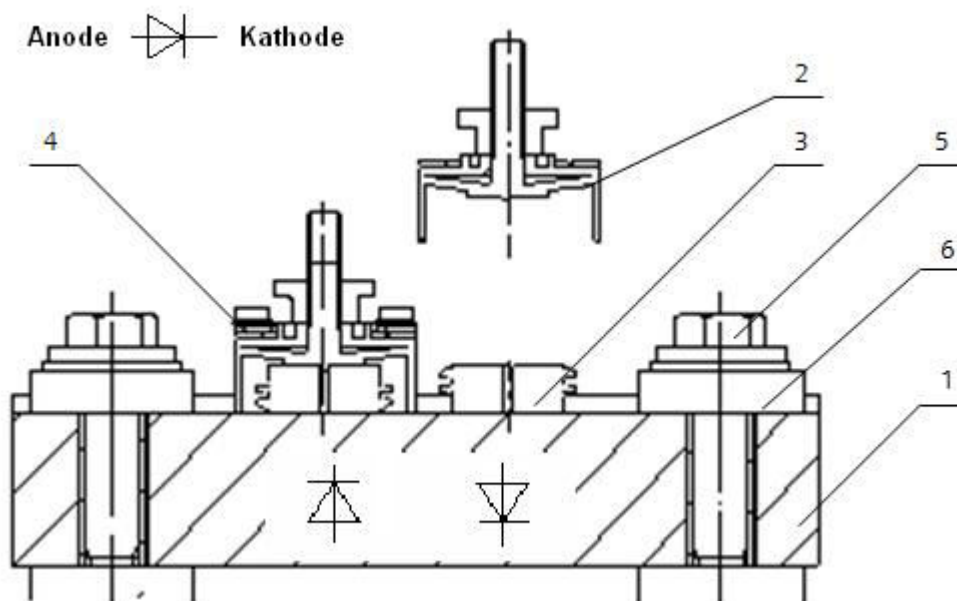
9.6.1 Changing the rectifier diodes

The rectifier diodes (disk-type diodes) are located inside spherical caps which are arranged in pairs on a heat sink. The heat sinks are insulated and fastened on the hub.

If diodes have to be replaced, the replacement diodes should only be unpacked shortly before installation, and once unpacked should be installed immediately. Be careful to avoid hard impacts that might damage the replacement diodes.

Proceed as follows to replace the diodes:

1. Disassemble the front cover of the exciter housing
2. Unscrew connector bars and fixing screws of the spherical cap.
3. Take the cap carefully off and replace diodes.
4. Coat the contact surfaces of the new diodes with contact oil.
5. Insert diode on the heat sink. Keep the polarity in accordance with marks on the heat sink and connector bars.
6. Carefully mount the spherical cap and clamping covers in the reverse order described above.



1	Heat sink
2	Spherical cap
3	Diode
4	Fixing screw M6 for spherical cap
5	Fixing screw M16 for heat sink
6	Insulating washer

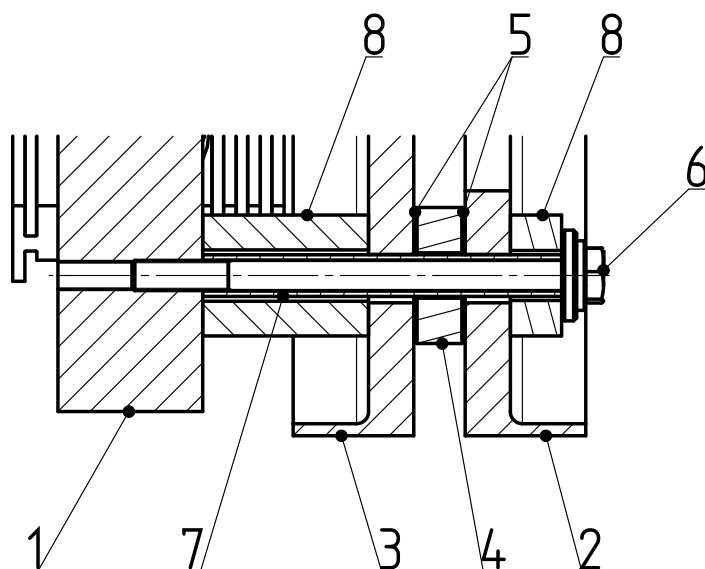
Figure 9-2 Diodes assembly (seen from collector rings side)

9.6.2 Changing the varistors

The varistor discs designed to protect the rectifier diodes are installed axially between the bus rings of the rectifier supporting wheel

Proceed as follows to replace the varistor:

1. Remove the corresponding fastening screw and pull out the insulating sleeve.
2. The varistor disc can then be removed between the collector rings.
3. When replacing the varistor disc, be sure to replace the spacers as well.



1	Hub
2	Collector ring +
3	Collector ring -
4	Varistor disc
5	Spacer
6	Fixing screw M16 for collectors ring
7	Insulating sleeve
8	Insulating washer

Figure 9-3 Varistor assembly

9.7 Equipment for rotor earth fault detection

The purpose of the rotor earth fault protection is to detect earth faults in the excitation circuit of generator.

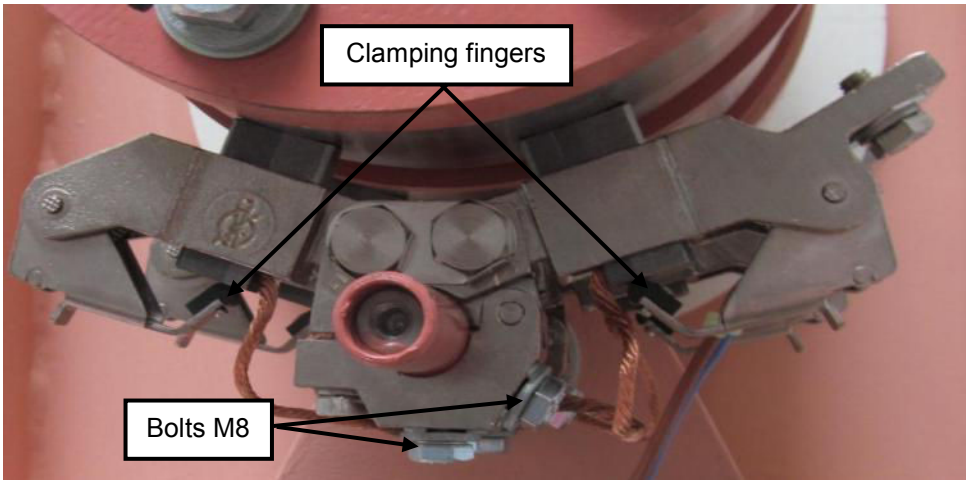
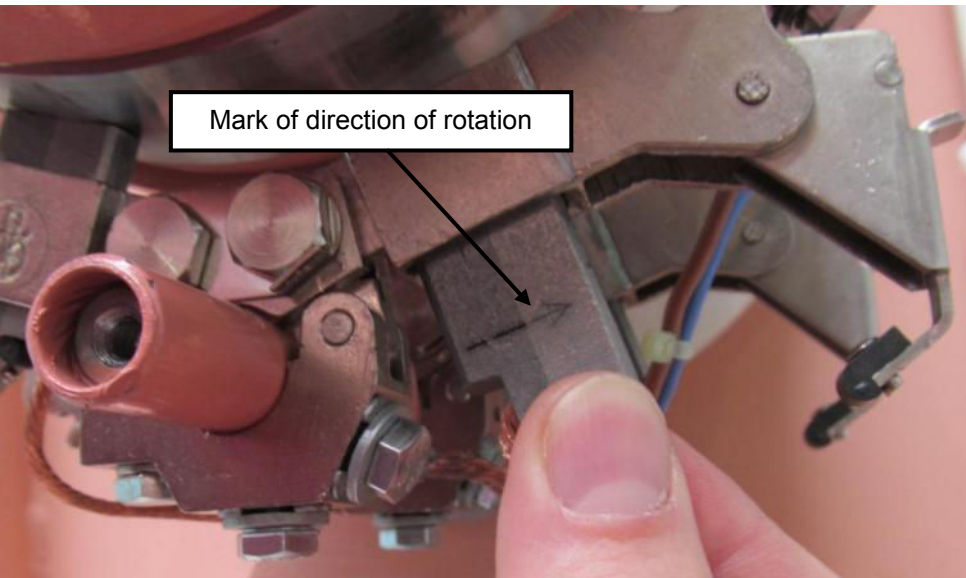
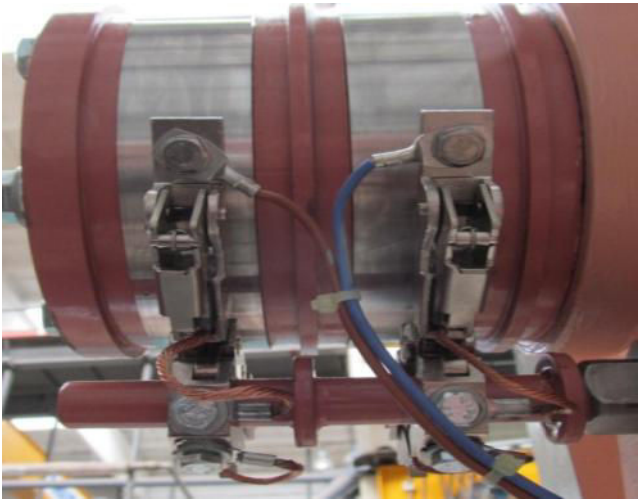
	CAUTION
Brush control must be performed every week. In case of exceeding the maximum permissible wear of the brush, it must be replaced, see procedure according to Table 9-3.	
	CAUTION
Check the axial position of the brushes and eventually place in the middle of the slip ring.	

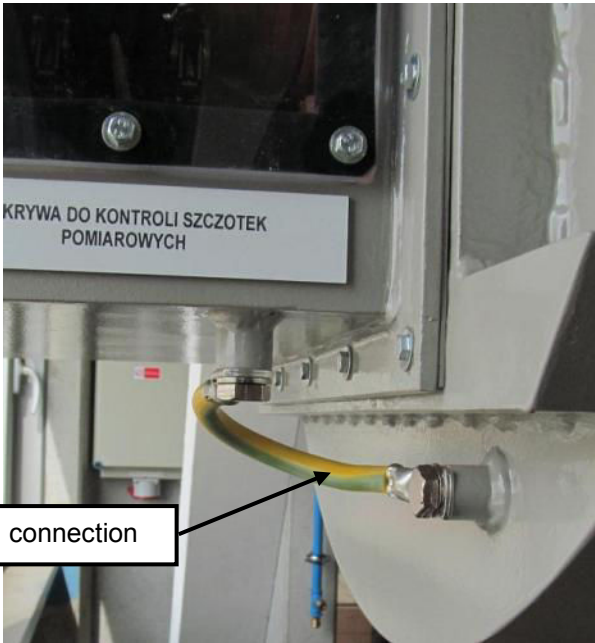
9.7.1 Procedure for replacing the earth fault brushes

Check the wear-out of the carbon brushes and make replacement when the brush height reaches approximately half its original size – the length remaining falls below 16 mm.

Table 9-3 Procedure for the brush replacement

1.	Remove the bolts M5 and remove the transparent cover of slip-ring set.	 16 x Bolts M5 Weight of cover 8 kg
2.	Use a vacuum cleaner and clean rag to clean the dust deposits.	

3.	Fold up clamping fingers. Disconnect the brushes removing the screw M8.	 Clamping fingers Bolts M8
4.	Replace the brushes – the brushes are to be used in such a way that in direction of rotation of the rotor shaft the silver layer brush follows after the carbon film brush. The direction of rotation is marked by arrow on the brush.	 Mark of direction of rotation
5.	Connect the brushes and cover up the clamping fingers. Fingers pushing the brushes against ring.	
6.	Check the axial position of the brushes and eventually place in the middle of the slip ring (rotor is set in working position). If is necessary, repeat this step after final rotor alignment.	

7.	Put the cover and its grounding back on the exciter housing.	 The photograph shows a close-up of an exciter housing. A white label with black text reads 'KRYWA DO KONTROLI SZCZOTEK POMIAROWYCH'. Below the label, a yellow and green grounding cable is connected to a terminal. A black arrow points from a box labeled 'Grounding connection' to this terminal.
----	--	---

9.8 Completing maintenance work

When all maintenance work has been completed, close the service openings and terminal box cover.

Finally, reconnect the power in accordance with DIN VDE 0105-100 as follows:

- Remove tools and aids, make sure that all persons stay well clear.
- Remove safety barriers, etc.
- Make equipment ready for operation.
- Notify the operating personnel.
- Turn the power back on.
- Remove safety measures at the switching points.

Prepare written record with date after the maintenance work has been finished.

10 Spare parts

10.1 General information

This machine contains parts subject to wear which you must replace when they wear limit is reached. Components subject to wear are parts that are subjected to particular mechanical loads. Make sure that certain components subject to wear and spare parts are at hand to avoid long machine downtimes. For information on which wear and spare parts you should have in stock, please contact the Service Center (Page 97).

Note

Plan in advance

The availability of some components can be limited. Therefore plan the procurement of spare parts and components that are subject to wear in good time.

If you want to order wear or spare parts, please also contact the Service Center (Page 97). In this way, you ensure that the parts used can be interchanged and the required quality characteristics are observed.

Procure on the open market only those parts whose designations clearly indicate compliance with the appropriate standards and specifications.

You can use commercially available, standard components, but ensure that they have the same construction type, dimensions, strength class etc.

List of original spare parts for Siemens machine is contained in Appendix B "Technical data and drawings" in document "List of Spare parts".

10.2 Ordering data

When ordering spare parts, in addition to the precise designations of the spare parts, specify the generator type and the serial number of the generator. Ensure that the spare part designation matches the designation in the spare parts list and add the associated part number. Document "List of Spare parts" you can find in Appendix B "Technical Data and Drawings".

Example:

Designation: Bearing thermometer
Part number: 5944 0085
Machine type: 1DU1747-8AN02-Z
Serial number: FQ1234567890

The generator type and serial number can be found on the rating plate data and in the Electrical data under Appendix B "Technical data and drawings".

11 Disposal

11.1 Introduction

Protecting the environment and preserving its resources are corporate goals of the highest priority for us. Our worldwide environmental management system to ISO 14001 ensures compliance with legislation and sets high standards in this regard. Environmentally friendly design, technical safety and health protection are always firm goals even at the product development stage.

Recommendations for the environmentally friendly disposal of the machine and its components are given in the following section. Be sure to comply with local disposal regulations.

11.2 Preparing for disassembly

Disassembly of the machine must be carried out and/or supervised by qualified personnel with appropriate expert knowledge.

1. Contact a certified waste disposal organization in your vicinity. Clarify what is expected in terms of the quality of dismantling the machine and provision of the components.
2. Follow the five safety rules.
3. Disconnect all electrical connections.
4. Remove all liquids such as oil, water, ...
5. Remove all cables.
6. Detach the machine fixings.
7. Transport the machine to a suitable location for disassembly.

Refer also to the information in the section headed "Maintenance" (Page 81).

11.3 Dismantling the machine

Dismantle the machine using the general procedures commonly used in mechanical engineering.



WARNING

Machine parts can fall

The machine is made up of heavy parts. These parts are liable to fall during dismantling. This can result in death, serious injury, or material damage.
Secure the machine parts being dismantled to prevent them falling.

11.4 Disposal of components

Components

The machines consist for the most part of steel and various proportions of copper and aluminium. Metals are generally considered to be unlimitedly recyclable.

Sort the components for recycling according to whether they are:

- Iron and steel
- Aluminium
- Non - ferrous metal, e.g. windings. The winding insulation is incinerated during copper recycling.
- Insulating materials
- Cables
- Electronic waste

Process materials and chemicals

Sort the process materials and chemicals for recycling according to whether they are for example:

- Oil
- Grease
- Cleaning substances and solvents
- Paint residues
- Anti-corrosion agent

Dispose of the separated components according to local regulations or via a specialist disposal company. The same goes for cloths and cleaning substances which have been used while working on the machine.

Packaging material

- If necessary, contact a suitable specialist disposal company.
- Wooden packaging for sea transport consists of impregnated wood. Observe the local regulations.
- The foil used for water-proof packaging is an aluminium composite foil. It can be recycled thermally. Dirty foil must be disposed of via waste incineration.

A Service and Support

Contacts for further information

Details regarding the design of this electrical machine and the permissible operating conditions are described in this operating instruction.

If you wish to order spare parts, please contact Customer Service or other contacts below.

If you have any technical queries or you require additional information, please contact the Siemens Electric Machines or Customer Service - Manufacturer. Please have the machine data and especially machine serial number ready.

You can find machine data on the rating plate of the machine.

Address

Drásov 126

664 24 Drásov

Czech Republic

Tel: 420 549 426 103

Fax.: 420 541 231 028

Web: <http://www.siemens.cz/sem�>

A.1 Siemens Service Center

Customer Service – Manufacturer

Tel: 420 549 426 440

Fax: 420 549 426 450

E-Mail: servicedrasov.cz@siemens.com

Internet:

<http://www.siemens.cz/sem�>

<https://www.cee.siemens.com/web/cz/en/corporte/portal/Siemens/industry/sem�/service/Pages/servis.aspx>

Service Coordination Center and Industry Hotline – Worldwide

Intranet: http://portal.automation.siemens.com/ld_servicemeldung

E-Mail: ld-service.i-cs@siemens.com

Fax: 49 911 433 61 6666

Global Industry Hotline

Germany: 49 (0)911 895 7222

America: 1 423 262 2522

Asia: 86 1064 757575

I CS LS LD – USA territory

Technical support

1-800-333-7421 (inside USA)

1-423-262-5710 (Outside USA)

Spare Parts and Repair

1-800-241-4453 (inside USA)

1-423-262-5710 (Outside USA)

<http://support.automation.siemens.com/us>

A.2 Manufacturing location

This machine was manufactured

by Siemens Electric Machines Drásov s.r.o.
PD LD AP MG MF-DSV
Drásov 126
664 24 Drásov
Czech republic
European union (EU)

A.3 Tightening torques for metric bolts

Torques for bolted connection

The following Table A-1 (Page 101) prescribes the torque figures for bolt connections with strength grade **5.6**, **8.8**, unless determined otherwise by documentation. Connections are divided into three grades according to the type of material which they connect:

- **Grade A**
- **Grade B**
- **Grade C**

To ensure an even initial tension created by tightening torque, the threads must be clean (dirt and remnants of oil must be removed).

Note

Replace or correct bolted joints

- If you replace bolted joints or re-establish bolted joints that have been released, always use new retaining elements.
 - If the bolted joint involves a rotating part, also replace connecting elements such as bolts and nuts.
 - Only use connection and retaining elements of the same type with the same property class with which the bolted joint was originally established in the factory.
-

Exception to torque figures

Torque figures hereby prescribed do not apply in cases where different torque figures are prescribed by technical documentation. In case the torque is prescribed by the documentation, a torque spanner must be used for tightening.

If rubber or another sealing is a part of the connection, the torque figures do not apply either. In such case, you can roughly adhere to the values of torque figures for **Grade C** (In case of connecting the cooler housing and the frame by means of elastic resilient pads such as Sylomer or Sylodyn), the determining factor is the degree of deformation of the elastic resilient pad. The tightening rate should be **1/10** of the original size, unless otherwise prescribed by technical documentation.



WARNING

The given values apply for cases where the movements of a bolt (nut) are not obstructed by other parasitic forces such as twisting of assembled parts, dirt in thread, thread deformation, non-alignment, etc.

If the assembly of bolted connections before the actual tightening by torque is hard and it is necessary to apply force which exceeds 20% of the torque prescribed by the table, it is necessary to remedy the matter.

Tolerances

Tolerance for tightening by a prescribed torque is – 10%, + 10%.

Grade A

Torque figures for bolts for fixed bolt connections of steel and cast-iron parts.

This includes the following parts:

- shield
- bearing assembly unit
- agitator
- cooler (does not apply for connecting the cooler housing and the frame by means of flexible connection)
- steel covers
- cable end connector
- connection of sleeve bearing to shield
- connection of exciter to shield
- steel and cast iron spacers of rotor winding
- ventilator fans (agitator to hub, balance weight on ventilator fans)
- connections of bus-bars (copper), connection of cables from winding to bus-bars
- fixing of tools and jigs

Grade B

Torque figures for bolts connecting elements with low strength limit such as aluminum, copper, brass.

This includes the following parts:

- aluminium spacers of rotor winding
- fibre-glass covers, diode carriers, fibre-glass bus-bar supports
- connection of cables to insulators

Grade C

Torque figures for bolts for connecting parts with a very low strength limit.

This includes the following parts:

- insulators
- plastic and ceramic parts
- rectifiers
- connecting of plastic or ceramic terminal box

Table A-1 Torques for bolted connection

Torques [Nm] ¹⁾ of strength grade 5.6, 8.8			
Thread-nominal diameter	Grade A	Grade B	Grade C
M4	3	1,3	1,2
M5	5	2,6	2,5
M6	8	4,5	4
M8	20	10	8
M10	40	20	13
M12	70	34	20
M14	110	54	
M16	170	83	40
M18	240	115	
M20	340	160	110
M22	480	220	
M24	600	280	
M27	890	420	
M30	1200	560	
M33	1600		
M36	2100	990	
M42	2700		
M45	3400		

¹⁾ Permitted tolerance $\pm 10\%$

Torques of chosen machine parts

Part	Thread	Torque [Nm]
Diode (D170U25C, D17S25C,...)		20
Terminal block in the terminal box (Binders – strength grade 8.8)	M10	40
	M12	70
	M16	155

Note

For more information contact Siemens Service (Page 97).

B Technical data and drawings

Note

Finding technical data and drawings

The technical data for this generator and the necessary drawings can be found in the Appendix B “Technical data and drawings”.

C Quality documents

Note

Finding quality documents

You can find all quality verifications relating to the machine type in the Appendix C “Quality documents”.

All the documents verifying the design quality of the individual machines are listed in the separate Manufacturing Data Book (MDB). The MDB is created specifically for each machine.

D Additional documents

Note

Finding additional documents

You will find additional documents for individual machine components in the Appendix D “Additional documents”.

E

Checklists and forms

Note

Finding checklists and forms

All of the checklists and forms that are required can be found in the appendix E "Checklists and forms".

In the case that Appendix E "Checklists and forms" is not supplied, follow the instructions in the "Operating instructions / Installation instructions".

F

Installation documents

Note

Finding installation documents

You will find the documents required for installing components in Appendix E “Installation documents”.



WARNING

Damage caused by unauthorized actions

If you have unintentionally acquired these documents, please hand them back to your Siemens partner or destroy them. This will help you ensure that only trained personnel carry out work on your system, and help prevent material damage or personal injury as a result of work being carried out by inadequately qualified personnel.

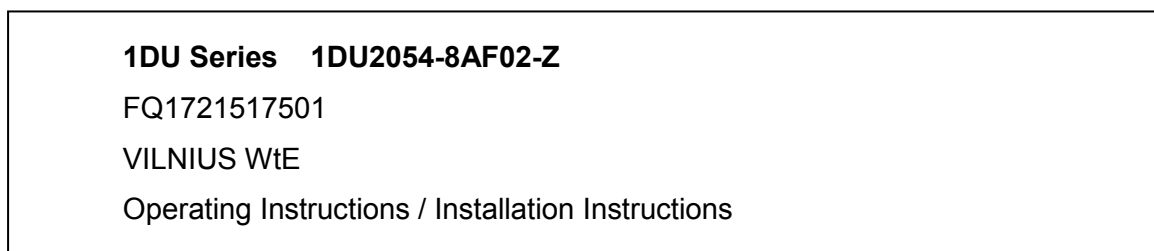
Siemens Electric Machines Drásov s.r.o.
Drásov 126
664 24 Drásov
Czech republic

www.siemens.cz/sem�

Spine label for binder 50 mm (120g/m2)



Spine label for binder 162 mm (120g/m2)



Ši dokumentacija priklauso
FQ1721517501
VILNIUS WtE

Trifazis sinchroninis generatorius

1DU serija

Tipas 1DU2054-8AF02-Z

Naudojimo instrukcija / Montavimo instrukcija

Leidimas

10/2018

Answer for industry.

Sinchroninis generatorius

1DU Series
1DU2054-8AF02-Z

Naudojimo instrukcija
Montavimo instrukcija

Šie dokumentai susiję su
FQ1721517501
VILNIUS WtE

Originali instrukcija
Leidimas: 2018 m. spalio mėn.

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Teisinė informacija

Įspėjamųjų pranešimų sistema

Šiame vadove pateikiama pranešimų, kurių turite laikytis norėdami užtikrinti savo asmeninį saugumą, taip pat išvengti turtinės žalos. Terminai **PAVOJUS**, **ĮSPĖJIMAS**, **PERSPĖJIMAS** ir **PRANEŠIMAS** nurodo konkrečius pavojus arba specialią informaciją, kuri reikalauja ypatingo dėmesio:

	PAVOJUS
nurodo, kad nesilaikant tinkamų atsargumo priemonių galima mirti, rimtai susižeisti ir (arba) sugadinti nuosavybę.	

	ĮSPĖJIMAS
nurodo, kad nesilaikant tinkamų atsargumo priemonių galima mirti, rimtai susižeisti ir (arba) sugadinti nuosavybę.	

	PERSPĖJIMAS
nurodo, kad nesilaikant tinkamų atsargumo priemonių galima lengvai susižeisti ir (arba) sugadinti nuosavybę.	

PRANEŠIMAS	
nurodo, kad, jei nebus imtasi tinkamų atsargumo priemonių, galima patirti turtinės žalos.	

Esant daugiau nei vienam pavojaus laipsniui, pateikiamas įspėjamasis pranešimas, kuriame nurodomas didžiausias pavojaus laipsnis. Pranešime, įspėjančiame apie asmenų sužalojimo riziką, kai vaizduojamas įspėjamasis saugos ženklas, taip pat gali būti įspėjama apie turtinę žalą.

Kvalifikuoti darbuotojai

Tai yra asmenys, kuriuos, pasikliaudami jų mokymu, patirtimi ir žiniomis apie susijusius standartus, kodeksus, nelaimingų atsitikimų prevencijos taisykles ir naudojimo sąlygas, atlikti reikiamą darbą įgaliojo už įrenginio saugą atsakingi asmenys ir kurie atpažįsta bei vengia galimų darbo pavojų. Taip pat būtinos aiškos pirmosios pagalbos ir vietinės avarinės įrangos žinios.

Tinkamas "Siemens" gaminių naudojimas

Atkreipkite dėmesį į toliau nurodytus dalykus.

	ĮSPĖJIMAS
"Siemens" gaminiai gali būti naudojami tik kataloge ir atitinkamoje techninėje dokumentacijoje aprašytais tikslais. Jei naudojami gamintojų gaminiai ir komponentai, juos turi rekomenduoti arba patvirtinti "Siemens". Norint užtikrinti saugų ir sklandų gaminių veikimą, būtina tinkamai juos transportuoti, sandėliuoti, montuoti, surinkti, perduoti eksploatuoti, eksploatuoti ir atlikti jų techninę priežiūrą. Turi būti laikomasi leistinų aplinkos sąlygų. Turi būti vadovaujama atitinkamuose dokumentuose pateikta informacija.	

Prekių ženklai

Visi ženklų ® pažymėti pavadinimai yra registruotieji "Siemens AG" prekių ženklai. Kiti šiame leidinyje minimi prekių ženklai gali būti tokie prekių ženklai, kuriuos trečiosios šalys naudodamos savo tikslams gali pažeisti savininko teises.

Atsakomybės atsisakymas

Peržiūrėjome šio leidinio turinį, kad įsitikintume, jog teisingai aprašyta aparatūra ir programinė įranga. Kadangi visiškai išvengti neatitikimų nepavyks, negalime garantuoti visiško nuoseklumo. Tačiau šiame leidinyje pateikta informacija reguliariai peržiūrima ir kituose leidimuose atliekami visi reikiami pakeitimai.

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1 Įvadas

Šioje instrukcijoje aprašomas mechanizmas ir paaiškinama, kaip juo naudotis, apžvelgiant visus etapus nuo pristatymo iki įrangos utilizavimo. Išsaugokite šią instrukciją, nes jos gali prireikti vėliau.

Prieš naudodamiesi mechanizmu perskaitykite šią naudojimo instrukciją ir, laikydamiesi nurodymų, susipažinkite su jo konstrukcija ir veikimo principais, kad būtumėte tikri, jog mechanizmu naudositės saugiai ir be kliūčių ir jis veiks ilgai.

Jei turite pasiūlymų dėl šio dokumento patobulinimo, kreipkitės į mūsų techninės priežiūros centrą (97 psl.).

Teksto formato savybės

Įspėjamųjų pranešimų sistema paaiškinta vidinės priekinės dalies galinėje dalyje. Visada laikykitės saugos instrukcijų ir šiose instrukcijose pateiktų nurodymų.

Pastebėsite, kad šiose instrukcijose ne tik pateikiama saugos įspėjamųjų pranešimų, kuriuos privalote perskaityti, bet ir tam tikru būdu formatuojamas tekstas.

1. Naudojimo instrukcijos visada formatuojamos kaip sunumeruotas sąrašas. Veiksmus visada atlikite nurodyta tvarka.
- Sąrašai formatuojami kaip sąrašai su ženkleliais.
 - Antrojo lygio sąrašai rašomi su brūkšneliu.

Pastaba

Pastaba yra svarbi informacija apie gaminį, gaminio naudojimą arba atitinkamą dokumento dalį. Pastaboje gali būti nurodoma, kaip elgtis, arba pateikiama kitų pasiūlymų arba idėjų.

Nuorodos į kitas teksto vietas

Puslapyje pateikiant informaciją apie nuorodas į kitas teksto vietas visada minimas aukštesnio lygio skyrius.

Techninė priežiūra ir pagalba

Priede "Techninė priežiūra ir pagalba" (97 psl.) pateikiama pagalbinės informacijos apie mechanizmo sąranką ir eksploatavimą:

- Kaip galima susisiekti su "Siemens" techninės priežiūros centru.
- Bendrieji varžtų prisukimo momentai, jei jie nenurodyti specialiai.

Techniniai duomenys ir brėžiniai

Mechanizmo techninius dokumentus ir visus reikiamus brėžinius, pvz., mechanizmo matmenų brėžinį ir matmenų brėžinio tekstą rasite B priede "Techniniai duomenys ir brėžiniai" (103 psl.).

Pastaba

Trūkstama techninė dokumentacija

Atkreipkite dėmesį į tai, kad išsiunčiant naudojimo instrukciją galėjo būti pasiekiami ne visi techniniai dokumentai. Šie dokumentai bus pateikti vėliau. Įtraukite šiuos dokumentus į B priedą "Techniniai duomenys ir brėžiniai".

Kokybės dokumentai

Visus su mechanizmo tipu susijusius dokumentus rasite C priede "Kokybės dokumentai" (105 psl.).

Visus konkrečių mechanizmų konstrukcijos kokybę patvirtinančius dokumentus rasite atskiroje gamybos duomenų knygoje (MDB). Sukurta specialiai kiekvienam mechanizmui skirta MDB.

Pastaba

Trūkstami kokybės dokumentai

Atkreipkite dėmesį į tai, kad išsiunčiant naudojimo instrukciją galėjo būti pasiekiami ne visi kokybės dokumentai. Šie dokumentai bus pateikti vėliau. Įtraukite šiuos dokumentus į priedą "Kokybės dokumentai".

Papildomi dokumentai

Papildomus dokumentus apie mechanizmo komponentus rasite D priede "Papildomi dokumentai" (107 psl.). Prie šių dokumentų gali būti priskiriami toliau nurodyti komponentų gamintojų parengti dokumentai:

- Naudojimo instrukcija
- Techninės priežiūros instrukcija
- Montavimo instrukcija
- Gamintojo rekomendacijos
- Tipo arba duomenų lapai
- Papildomi brėžiniai
- Pranešimas apie pavojų
- Sertifikatai

Kontroliniai sąrašai ir formos

Visus reikiamus kontrolinius sąrašus, formas ir tyrimo ataskaitos formas rasite E priede "Kontroliniai sąrašai ir formos" (109 psl.).

Jeigu E priedas "Kontroliniai sąrašai ir formos" nepateiktas, vadovaukitės dokumente "Naudojimo instrukcija / Montavimo instrukcija" pateiktais nurodymais.

Montavimo dokumentai

Visus dokumentus, kurių gali prireikti montuojant pateiktus elektrinio mechanizmo komponentus, rasite F priede "Montavimo dokumentai" (111 psl.).

Jeigu šias naudojimo instrukcijas gavote kaip visos sistemos dokumentacijos dalį, šis priedas neįtraukiamas. Jo turinys skirtas tik apmokytiems darbuotojams mechanizmo įrengimo ir eksploatavimo tikslais.

Pastaba

Trūkstanti dokumentai

Atkreipkite dėmesį į tai, kad išsiunčiant naudojimo instrukciją galėjo būti pasiekiami ne visi dokumentai. Šiuos dokumentus rasite galutinėje mechanizmo instrukcijoje. Prireikus atnaujinkite atitinkamą priedą.

2 Saugos instrukcijos

Šis elektrinis mechanizmas sukurtas veikti pramoninėse elektros sistemose ir atitinka priimtus saugumo reikalavimus, susijusius su tokia įranga.

Kai ši įranga veikia, joje yra pavojinga įtampa ir veikia pavojingos besisukančios mechaninės dalys.

Tam tikromis aplinkybėmis aplaidus įrengimas, naudojimas ir techninė priežiūra gali lemti mirtį, rimtą susižeidimą arba padaryti žalos nuosavybei.

Todėl už įrenginio saugą atsakingi asmenys turi užtikrinti, kad

- tik kvalifikuoti darbuotojai įpareigojami dirbti su mechanizmu;
- kartu su mechanizmu pateiktas instrukcijų vadovas ir visa kita gaminio informacija, reikalinga atliekant paskirtą darbą, būtų visada pasiekiami šioms darbuotojams ir būtų griežtai laikomasi susijusių instrukcijų;
- nekvalifikuotiems darbuotojams būtų draudžiama dirbti su mechanizmu.

Šios naudojimo instrukcijos turinys netampa pirmiau sudarytos sutarties, priimto įsipareigojimo arba užmegztų ryšių dalimi ir jų nekeičia. Pardavimo sutartyje nurodyti visi "Siemens" įsipareigojimai. Tarp šalių sudarytoje sutartyje nurodyta garantija yra vienintelė "Siemens" garantija. Jokie šiame dokumente esantys teiginiai nesukuria naujų garantijų, taip pat nekeičia esamos garantijos.

Techniniai duomenys buvo nustatyti mechanizams pagal specifikacijas ir standartus, dėl kurių susitarta užsakyme. Šie duomenys nurodyti brėžinyje su matmenimis, brėžinio su matmenimis tekste ir bandymų sertifikatuose, kurie yra mechanizmo vadovo dalis.

Mechanizmą galima naudoti tik remiantis šiais duomenimis; dėl bet kokių nukrypimų pirmiausia reikia pasitarti su gamintoju.

Iš esmės naudojimo instrukcijos apima priemones, kurių reikia laikytis naudojant įrangą numatyto tikslu. Be to, reikia laikytis taikomų nacionalinių, vietinių ir su įrenginiu susijusių taisyklių.

Laikoma, kad mechaninio ir elektrinio montavimo darbų planavimą ir vykdymą, taip pat transportavimo, montavimo ir eksploatavimo bei techninės priežiūros darbus atliks arba prižiūrės kvalifikuoti darbuotojai. Tai susiję su bendrųjų montavimo ir saugos taisyklių dėl darbo su elektros įranga (pvz., DIN VDE) laikymusi, tinkamu kėlimo įrangos ir įrankių naudojimu bei asmeninės apsaugos priemonių, pavyzdžiui, apsauginių akinių ir kt., naudojimu.

Patariama montuojant, eksploatuojant ir atliekant priežiūros darbus naudotis kompetentingų SIEMENS priežiūros centrų pagalba ir teikiamomis paslaugomis.

2.1 Kvalifikuoti darbuotojai

Tai yra asmenys, kuriuos, pasikliaudami jų mokymu, patirtimi ir žiniomis apie susijusius standartus, kodeksus, nelaimingų atsitikimų prevencijos taisykles ir naudojimo sąlygas, atlikti reikiamą darbą įgaliojo už įrenginio saugą atsakingi asmenys ir kurie atpažįsta bei vengia galimų darbo pavojų.

Taip pat būtinos aiškios pirmosios pagalbos ir vietinės avarinės įrangos žinios.

2.2 Penkios saugos taisyklės

Siekdami užtikrinti asmeninę saugą ir norėdami išvengti atliekant bet kokią darbą galimos materialinės žalos, visada laikykitės saugos instrukcijų ir toliau išvardytų penkių saugos taisyklių (pagal EN 50110-1 "Darbas be įtampos"). Prieš pradėdami dirbti taikykite toliau konkrečia seka išvardytas penkias taisykles.

Penkios saugos taisyklės

1. Atjunkite sistemą.
Taip pat atjunkite pagalbines grandines, pvz., antikondensacinį šildymą.
2. Apsaugokite nuo pakartotinio prisijungimo.
3. Patikrinkite, ar nėra įtampos.
4. Įžeminkite ir padarykite trumpojo jungimo grandinę.
5. Užtikrinkite apsaugą nuo šalia veikiančių dalių.

Norėdami įjungti sistemą, taikykite priemones atvirkštine tvarka.

2.3 Saugus naudojimasis

Sauga darbo vietoje priklauso nuo to, ar mechanizmą montuojantys, juo besinaudojantys ir jį prižiūrintys asmenys yra dėmesingi, rūpestingi ir sąmoningi. Net jei taikomos nurodytos saugos priemonės, būnant arti mechanizmo iš principo reikia elgtis atsargiai. Niekomet nepamirškite apie savo saugumą.

Norėdami išvengti nelaimingų atsitikimų, taip pat vadovaukitės toliau nurodytais dokumentais.

- Bendrosios saugos taisyklės, galiojančios šalyje, kurioje naudojamas mechanizmas
- Konkretūs gamintojo ir kiti atitinkami taikomi reikalavimai
- Specialios su operatoriumi sudarytos sutartys
- Atskiros su mechanizmu pateikiamos saugos instrukcijos
- Saugos simboliai ir instrukcijos ant mechanizmo ir jo pakuotės



PAVOJUS

Dalys, kuriomis teka srovė

Elektriniuose mechanizmuose yra dalių, kuriomis teka srovė. Nuėmus gaubtus arba netinkamai naudojant, valdant bei prižiūrint mechanizmą, galima mirtinai arba rimtai susižeisti ir sugadinti nuosavybę.

- Su mechanizmu atlikdami bet kokius veiksmus visada laikykitės "Penkios saugos taisyklės" (13 psl.).
- Gaubtus nuimkite tik šiose naudojimo instrukcijose aprašytais metodais.
- Tinkamai valdykite mechanizmą.
- Atlikdami įprastinę ir profesionalią techninę priežiūrą vadovaukitės naudojimo instrukcijos skyriuje "Techninė priežiūra" pateiktais nurodymais.



PAVOJUS

Besisukančios dalys

Elektriniuose mechanizmuose yra pavojingų besisukančių dalių.

Nuėmus gaubtus arba netinkamai naudojant, valdant bei prižiūrint mechanizmą, galima mirtinai arba rimtai susižeisti ir sugadinti nuosavybę.

- Gaubtus nuimkite tik šiose naudojimo instrukcijose aprašytais metodais.
- Tinkamai valdykite mechanizmą.
- Reguliariai ir tinkamai prižiūrėkite mechanizmą.
- Apsaugokite neįtvirtintus veleno priedurus ir kitas besisukančias dalis, pvz., movas ir suktuvo diržus, kad nebūtų įmanoma jų paliesti.



ĮSPĖJIMAS

Karšti paviršiai

- Elektrinių mechanizmų paviršiai įkaista. Prisilietus prie karštų paviršių galima smarkiai nusideginti.
- Prieš atlikdami darbus su mechanizmu, leiskite jam atvėsti.
- Gaubtus nuimkite tik šiose naudojimo instrukcijose aprašytais metodais.
- Tinkamai valdykite mechanizmą.



ĮSPĖJIMAS

Pavojingos medžiagos

Montuoti, naudoti mechanizmą ir atlikti jo techninę priežiūrą reikalingos cheminės medžiagos gali kelti pavojų sveikatai.

Galimas apsinuodijimas, odos pažeidimas, kvėpavimo takų apdegimas ir kiti sveikatos pažeidimai.

- Perskaitykite šiose naudojimo instrukcijose pateiktą informaciją ir gamintojo pateiktą gaminio informaciją.
- Laikykitės susijusių saugos reikalavimų ir naudokite nurodytas asmeninės apsaugos priemones.



ĮSPĖJIMAS

Degios medžiagos

Montuoti, naudoti mechanizmą ir atlikti jo techninę priežiūrą reikalingos cheminės medžiagos gali būti degios.

Galimi nudegimai ir kiti sveikatos bei nuosavybės pažeidimai.

- Perskaitykite šiose naudojimo instrukcijose pateiktą informaciją ir gamintojo pateiktą gaminio informaciją.
- Laikykitės susijusių saugos reikalavimų ir naudokite nurodytas asmeninės apsaugos priemones.

**ĮSPĖJIMAS****Krintantys asmenys**

Montuojant mechanizmą, paleidžiant jį eksploatuoti ir atliekant techninę priežiūrą kartais reikia dirbti pavojingame aukštyje. Dėl to kyla pavojus nukristi.

Jei turite dirbti didesniame negu vieno metro aukštyje, imkitės atitinkamų priemonių, kad išvengtumėte pavojaus nukristi.

Prie tinkamų priemonių priskiriamos toliau nurodytos priemonės.

- Pastolių, darbo platformų ar kėlimo platformų statymas.
- Nuo kritimo apsaugančių asmeninių apsaugos priemonių naudojimas.

**ĮSPĖJIMAS****Krintantys objektai**

Montuojant mechanizmą, paleidžiant jį eksploatuoti ir atliekant techninę priežiūrą kartais reikia dirbti pavojingame aukštyje. Kyla pavojus, kad gali nukristi komponentai arba įrankiai.

Jei turite dirbti tokia aukštyje, imkitės atitinkamų priemonių, kad būtumėte tikri, jog nenukris joks objektas, o objektams nukritus jie negalės nieko sužeisti.

Prie tinkamų priemonių priskiriamos toliau nurodytos priemonės.

- Tarpinių lubų montavimas.
- Atsilaisvinusių komponentų ir įrankių pritvirtinimas, kad jie nenukristų.
- Asmeninių apsaugos priemonių naudojimas.
- Draudimas asmenims įžengti į pavojingą zoną.

**ĮSPĖJIMAS****Pavojus užkliūti ir susižaloti**

Mechanizme yra išsikišančių komponentų, pvz., vamzdžių, gnybtų dėžių ir kabelių. Už jų užkliuvę darbuotojai gali susižeisti.

- Atitverkite šias zonas barjerinėmis / įspėjamosiomis juostomis.
- Dirbdami arti mechanizmo visada būkite atidesni.

**ĮSPĖJIMAS****Skleidžiamas triukšmas**

Veikiant mechanizmui gali būti viršijamas darbo vietoje leistinas triukšmo lygis, o tai gali pakenkti klausai.

Imkitės priemonių, kad sumažintumėte sklindantį triukšmą, pvz., naudokite dangčius ir apsauginę izoliaciją arba naudokitės klausos apsaugos priemonėmis, kad sistemoje būtų galima saugiai naudotis mechanizmu.

2.4 Bendroji saugos informacija

Čia aptariamas mechanizmas yra stiprios srovės įrenginių, skirtų naudoti pramonėje, dalis. Jis gaminamas pagal atitinkamus ir patvirtintus techninius reikalavimus.

	ĮSPĖJIMAS
Laikoma, kad bendrąsias suplanuotas įrenginio operacijas bei visas operacijas, susijusias su transportavimu, surinkimu ir montavimu, atliks kvalifikuoti darbuotojai arba patikrins atsakingi ekspertai.	

Taip pat būtina atsižvelgti į:

- techninius duomenis ir leidžiamo naudojimo duomenis (konstrukcijos jungčių, aplinkos apsaugos ir darbo nuostatas), kurie be kitų nurodyti kataloge, naudojimo instrukcijose, užsakymuose, duomenų plokštelėse ir kitoje techninėje dokumentacijoje;
- bendruosius nustatymo ir saugos reikalavimus;
- vietos ir įrenginiui būdingus reikalavimus;
- kvalifikuotą įrankių, kėlimo ir transportavimo įrenginių naudojimą;
- asmeninės apsaugos priemonių naudojimą;
- atsakingų asmenų įsipareigojimą dalyvauti darbuotojų saugos mokymuose pagal SAUGOS REIKALAVIMUS bei šalies, kurioje įrenginys naudojamas, įstatymų laikymąsi. Svarbiausia įstatymų, susijusių su aplinkos apsauga, atliekų tvarkymu, gyvybei ir aplinkai pavojingų medžiagų, pavyzdžiui, valiklių, tepalų, klijų, lakų ir kt., saugiu naudojimu. Išsamią informaciją apie šiuos specialius gaminius galima rasti gamintojų arba gaminio importuotojo pateiktame „saugos informacijos sąrašė“.

Jei yra nesutapimų, ypač trūkstamos informacijos, kuri nurodo gaminį, SIEMENS pardavimų skyrius įgaliotas pateikti reikiamą paaiškinimą. Šiuo atveju pateikite mechanizmo tipą ir gamybos numerį.

Planavimo, montavimo, paleidimo ir techninės priežiūros veiksmus rekomenduojame atlikti naudojantis atitinkamo SIEMENS priežiūros centro teikiamomis paslaugomis.

2.5 Garantijos

Gamintojo garantija pateiktam mechanizmui susijusi su tam tikrų sandėliavimo sąlygų, mechanizmo naudojimo, įrengimo, valdymo ir techninės priežiūros nurodymų, pateiktų naudojimo vadove, laikymąsi. Be to, mechanizmas veikia pagal sutarties technines specifikacijas arba taikant ant duomenų plokštelės pateiktus duomenis.

Naudotojas privalo vesti darbo registracijos žurnalą ir gali išmontuoti mechanizmą tik patvirtinus gamintojui, priešingu atveju gamintojas atleidžiamas nuo garantijoje taikomų įsipareigojimų.

Garantijos susijusios su sandėliavimo, mechanizmo naudojimo, įrengimo, valdymo ir techninės priežiūros instrukcijų laikymąsi. Jei šių sąlygų nesilaikoma, garantinės pretenzijos gali būti atmetos. Garantijos taikymo laikotarpiu ir po jo naudotojas privalo nedaryti mechanizmo konstrukcijos išorės ir vidaus modifikacijų.

Pareiškiant pretenziją arba užsisakant atsarginių dalių, būtina nurodyti mechanizmo tipą, gaminio (gamybos) numerį ir, jei reikia, kitus duomenis, nurodytus duomenų plokštelėje.

3 Aprašymas

Taikymas

Turbogeneratoriai yra generatoriai, skirti turbinoms, kurių greitis 1500 arba 1800 aps./min. Dizainas gali būti pritaikytas prie garų arba dujų turbinų, atvirų pagrindų arba talpų, ant žemės arba laivuose esančių klasifikuotų generatorių arba jūroje esančių platformų, įskaitant visus susijusius naudojimo aspektus (aplinkos apsaugą, laivo ar jūros siūbavimą ir pan.). Tvirtinimas prie turbinos, pagrindo, taip pat kabelių jungtys ir pagalbinių prietaisai gali būti optimaliai pritaikyti, kad atitiktų viso agregato įrengimą.



ĮSPĖJIMAS

Sprogimo pavojus

Šis mechanizmas nėra skirtas naudoti pavojingose vietose. Naudojantis mechanizmu tokiose vietose, gali įvykti sproginimas. Kyla mirties, rimtų sužalojimų arba materialinės žalos rizika.

- Niekada nesinaudokite šiuo mechanizmu pavojingose vietose.

Dizainas

Mechanizmo dizainas atitinka tarptautinius standartus IEC / EN 60034:

Funkcija	Standartas
Parametrai ir darbo našumas	IEC / EN 60034-1
Apsaugos laipsnis	IEC / EN 60034-5
Aušinimas	IEC / EN 60034-6
Konstrukcijos tipas	IEC / EN 60034-7
Triukšmo emisija	IEC / EN 60034-9
Vibracijos sunkumo laipsnis	IEC / EN 60034-14

Mechanizmo dizainas

Reikalavimai ir standartai, taikomi šio mechanizmo dizainui ir išbandymui, pateikti duomenų plokštelėje.

Mechanizmo galai

Pažymėti D (varomasis galas) ir N (nevaromasis galas) galai apibūdinti taip, kaip nurodyta toliau.

D galas – mechanizmo galas, kuriame pateikiamas veleno pailginimas arba vienas storesnis pailginimas iš dviejų velenų pailginimų.

Sukimosi kryptis nustatoma nuo šio mechanizmo galo. Priešingas mechanizmo galas vadinamas N galu. Norėdami sužinoti daugiau, žr. brėžinį su matmenimis.

Korpusas ir statoriaus šerdis

Statoriaus šerdis įmontuota į grublėtą suvirintą korpusą, suspausta palei ašį ir sujungta šerdies gale esančiais suspaudimo elementais. Statoriaus šerdį sudaro aukštos kokybės plieninės dangos elektrinės plokštelės, kurios viena nuo kitos izoliuotos lako sluoksniu. Statoriai, kurių išorės skersmuo siekia iki 1250 mm, gaminami kaip žiedo formos lakštai; didesnių statorių šerdys sudarytos iš segmentų. Trifazė apvija ir papildoma apvija, tiekiančios žadinimo srovę (jei nereikia PMG), yra įrengtos statoriaus šerdies angose. Dėl puikaus apvijų izoliavimo (MICALASTIC®) generatoriai taip pat gali būti įrengti srityse, kuriose yra itin didelė drėgmė.

Gnybtų dėžės montuojamos lakštinės šerdies išoriniame apvalkale.

Pagrindinės mechanizmo grandinės jungtys yra gnybtų dėžėje, skirtoje prijungti statorių.

Papildomos mechanizmo sistemos yra prijungtos gnybtų dėžėje, skirtoje papildomoms grandinėms. Dėl gnybtų matmenų, gnybtų dėžių įvorių ir įžeminimo žr. brėžinį su matmenimis.

Gnybtų dėžių tipo pavadinimai ir matmenys nurodyti brėžinyje su matmenimis; pagrindinės ir papildomos grandinių išdėstymas parodytas susijusiose grandinės schemose. Gnybtų dėžių vietos nurodytos mechanizmo brėžiniuose su matmenimis.

Buvo atliktas ekvipotencialinis sujungimas pagal mechanizmo įžeminimo reikalavimus.

Įžeminimo gnybtai pateikti ant pagrindinio korpuso N galo korpuso sienelės siekiant prijungti įžeminimo šyną. Gnybto vieta parodyta brėžinyje su matmenimis.

Rotorius

Rotoriaus dizainas pagrįstas lakštine cilindrinio rotoriaus šerdimi, prispausta prie kaltinio veleno su cilindrinio veleno galu, skirtu jungiamajam mazgui. Rotoriaus apvija yra plokščio laido kompaktiška apvija, įkišta į rotoriaus angas. Vijos pritvirtintos angų pleištais aktyviojoje dalyje ir raiščiais išsikišusiose srityse. Variniai slopintuvo strypai įspausti į šerdį siekiant užtikrinti sklandų veikimą ir apsaugą nuo apkrovos pasikeitimų. Be žadinimo ir slopinimo apvijų rotoriuje įrengtas veleno varomas ventiliatorius, žadintuvo rotorius ir besisukančio lygintuvo blokas.

Aušinimo būdas, vėdinimas

Aušinimo sistema suprojektuota kaip uždara vidinė aušinimo grandinė. (IC81W).

Įmontuotas aušintuvas yra orinis šilumokaitis su vandens vamzdžių sistema.

Iš mechanizmo prarandama šiluma išsklaidoma aušinimo vamzdžių paviršiumi į vamzdžiais tekančią aplinkos orą.

Ant rotoriaus veleno sumontuotas ventiliatorius stumia vėsinantį orą į pradinę grandinę.

Žadinimo sistema

Žadinimo sistemą sudaro papildomos apvijos arba PMG, automatinis įtampos reguliatorius (AVR), srovės transformatoriai (CT) ir įtampos transformatoriai (VT), įmontuotas žadintuvas ir besisukantis lygintuvas. Standartiškai turbogeneratoriuose įrengtas skaitmeninis AVR, leidžiantis PF (galios koeficiento) reguliavimą ir suteikiantis daugybę stebėjimo ir apsaugos parinkčių (žadinimo ribotuvai, viršįtampio aptikimas, pertekliaus galimybė ir pan.). NS žadinimo srovę iš AVR stiprina besisukantis žadintuvas, o po to ją išlygina besisukantis lygintuvas. Besisukančių lygintuvą sudaro diodai ir nuo perkrovų apsaugantys saugikliai.

Guoliai

Generatoriaus rotorius tvirtinamas dviem slydimo guoliais.

Pavadinimų tipas ir eksploatavimui reikalingi konstrukciniai duomenys nurodyti matmenų brėžinio tekste ir guolio instrukcijų lentelėje.

Pagal standartą vienas iš guolių izoliuotas, siekiant išvengti veleno srovės ir apsaugoti guolių korpusus.

Slydimo guoliai yra radialiniai guoliai arba vienos atramos guoliai, priklausomai nuo reikalavimų. Daugiau informacijos apie tai, kaip naudotis įrenginiu ir jį prižiūrėti, ieškokite į mechanizmo dokumentaciją įtrauktame „Renk“ dokumente „Naudojimo ir techninės priežiūros instrukcija“.

Montavimas

Mechanizmas skirtas aštuonių taškų montavimui ant pagrindo (arba pagal kliento reikalavimus). Dėl tvirtinimo informacijos žr. mechanizmo brėžinį su matmenimis. Statybos inžinerijos rangovas atsakingas už projektinius skaičiavimus, reikalingus mechanizmo pagrindui.

3.1 Papildomi komponentai

Stebėjimo prietaisai

Statoriaus apviją stebi temperatūros jutikliai, įmontuoti į apviją. Standartiškai guoliuose įmontuoti dvigubi temperatūros jutikliai, o alkūniniuose guoliuose – alyvos srauto matuokliai. Oro angą taip pat stebi dvigubas jutiklis. Generatoriuje įrengtas antikondensacinis šildytuvas, kad tam tikromis klimato sąlygomis paviršiuje nesikauptų drėgmė. Šildytuvas sukurtas taip, kad aktyvios mechanizmo dalys visada būtų šiltesnės nei jų aplinka. Galima pasirinkti, kad generatoriuje būtų įrengti CT, skirti matavimui arba diferencialų apsaugai. Taip pat galimi vibracijos jutikliai guoliams ir velenui.

Antikondensacinis šildytuvas

Antikondensaciniai šildytuvai neleidžia formuotis kondensacijai, kai mechanizmas sustabdomas. Jie sukurti taip, kad užtikrintų, jog mechanizmo vidus visada būtų šiltesnis nei jo aplinka. Reikalinga šildymo galia sutampa su elektrinio mechanizmo konstrukcija. Išsamesnė informacija pateikta brėžinio su matmenimis tekste.

Alyvos tiekimas

Mechanizmo guoliai paruošti prijungti prie alyvos tiekimo sistemos. Būtinose prijungimo sąlygos nurodytos matmenų brėžinio tekste.

3.2 Duomenų plokštelė

Duomenų plokštelėje (žr. pav. 3-1) nurodyti identifikavimo duomenys ir svarbiausios techninės specifikacijos. Kartu su sutartimis šie duomenys nurodo naudojimo apribojimus atsižvelgiant į numatytąjį tikslą.

SIEMENS						
TYPE: 1DU	1				2012	2
3~ GENERATOR				NO/NR: FQ		
V	A	kVA	Duty type/ belastningstype	cosφ	min ⁻¹	
4						
IEC60034						
5		Siemens Electric Machines s.r.o. 664 24 Drasov MADE IN CZECH REPUBLIC				

pav. 3-1 Duomenų plokštelė

Elementas	Aprašymas
1	Gaminio pavadinimas
2	Pagaminimo metai
3	Gaminio serijos numeris
4	Techninės specifikacijos duomenys: įtampa, srovė, galia, efektyvumas, apsisukimai, montavimo tipas, aušinimo būdas
5	Gamybos vieta

4 Pasirengimas naudoti

4.1 Naudojimo paskirties planavimas / konfigūravimas

Tinkamas mechanizmo naudojimo paskirties planavimas ir paruošimas yra būtini norint, kad montavimas būtų paprastas, kad pavyktų išvengti klaidų, užtikrinti saugų naudojimąsi mechanizmu ir suteikti prieigą prie mechanizmo techninės priežiūros ir taisymo darbams atlikti.

Šiame skyriuje nurodoma, ką reikėtų apsvarstyti, kai konfigūruojate savo gamyklos ir šio mechanizmo suderinamumą ir kokius pasiruošimo veiksmus reikia atlikti iki mechanizmo pristatymo.

Su šiuo mechanizmu susiję įvairių liekamųjų rizikų. Tai aprašyta skyriuje pavadinimu "Saugos instrukcijos" (12 puslapyje) ir su juo susijusiuose skyriuose.

Imkitės tinkamų atsargumo priemonių (dangčiai, barjerai, ženklėjimas ir t. t.), kad galėtumėte saugiai naudotis mechanizmu savo gamykloje.

Veiksenos stebėjimas

Stebėkite mechanizmo veikseną. Naudokite tinkamą valdymo sistemą, kad išvengtumėte per didelio greičio ir tokiu būdu apsaugotumėte mechanizmą nuo pažeidimų.

4.2 Vietos nustatymas

Generatorius turi būti pastatytas taip, kad gnybtų dėžė, guoliai ir priedai būtų lengvai pasiekiami.

4.3 Aušinimas

Vieta, kurioje generatorius yra, turėtų būti pakankamai didelė ir vėdinama. Generatorius negali siurbti šilto oro iš kito mechanizmo. Siekiant užtikrinti nuolatinį veikimą, būtina suteikti pastovią aušinimo oro ventiliaciją.

4.4 Pagrindas



ĮSPĖJIMAS

Mechanizmo pažeidimas dėl sistemos rezonanso

Sistema, susidedanti iš pagrindo ir mechanizmo derinio, turi būti suprojektuota ir sureguliuota taip, kad būtų išvengta sistemos rezonanso, dėl kurio viršijama leistina vibracija. Dėl pernelyg didelės vibracijos mechanizmas gali sugesti. Negalima viršyti išsamiuose standartuose DIN ISO 10816 arba DIN ISO 8528-9 nurodytų vibracijos apribojimų priklausomai nuo paskirties tipo.

Bendroji informacija dėl besisukančio elektrinio mechanizmo lygiavimo ant jo pagrindo

Išskyrus atvejus, kai gamintojas nurodo kitaip, arba jei mechanizmas su tvirtinimo ir pagrindiniais elementais tiekiamas tiesiai iš mechanizmo gamintojo, laikykitės toliau išvardytų nuostatų.

Besisukantis elektrinis mechanizmas ("mechanizmas") turi būti paremtas pleištais po visu atramos paviršiumi ir mechanizmas turi būti sulygiuotas taip, kad būtų išvengta mechanizmo iškraipymų, sukimosi ir t. t. – taikomas "minkštos atramos" principas, skaitykite skyrių "Minkštos atramos (Soft Foot) patikrinimas" (36 puslapyje). Projektuojant mechanizmo tvirtinimo elementus turi būti atsižvelgiama į tai, kokia jėga spaudžiamas pagrindas ir tvirtinimo varžtai. Lygiuojant mechanizmą gali būti naudojami tik pagrindinius mechanizmo reguliavimui pritaikytus pleištus. Pleišto paviršius turi būti lygus, be korozijos ar dažų. Pleišto storis turi būti parinktas taip, kad atramoje nebūtų daugiau negu 4 pagrindiniai pleištai. Lygiuojant mechanizmą atramos posvyrio kampas turi būti kompensuojamas pagrindu. Prieš lygiuojant reikėtų nuvalyti mechanizmo atramą ir varžtų jungčių vietas, pašalinti apsaugines dangas ir ištaisyti smulkius transportuojant atsiradusius pažeidimus (pavyzdžiui, dilde).

4.4.1 Pagrindo paruošimas

Prieš įrengiant mechanizmą reikalingas tvirtas pagrindas be išorinių vibracijų. Norėdami informacijos apie tai, kaip užtikrinti, kad pagrindas yra tinkamai suprojektuotas, žr. susijusius šaltinius, pavyzdžiui, DIN 4024 standartą. Prieš įrengdami mechanizmą, atidžiai patikrinkite visus pagrindo matmenis remdamiesi mechanizmo brėžiniu su matmenimis ir pagrindo schema, ypač, kur būtinas pozicinis mechanizmo montavimo ant pagrindo plokštės angų tikslumas, vamzdžiai vamzdynui ir kabeliams.

Pagrindo projektavimas ir gamyba nėra įtraukti į komplektą.

Statinė ir dinaminė pagrindo apkrovos bei reikalingas pagrindo tvirtumas pateikti "Brėžinio su matmenimis tekste" arba priedo "Techniniai duomenys ir brėžiniai" skyriuje "Pagrindo planas". Statybos inžinerijos rangovas atsakingas už projektinius skaičiavimus, reikalingus mechanizmo pagrindui.

Pastaba

Pagrindo specifikacijos ir schemos apdorotos pagal jūsų užsakymą.

Projektuojant pagrindą reikėtų laikytis toliau pateiktų instrukcijų.

- Projektuokite pagrindą taip, kad užtikrintumėte saugų veikimą ir pakankamą prieinamumą.
- Užtikrinkite, kad pagrindas būtų pakankamai tvirtas visu mechanizmo veikimo metu.
- Įmkitės atitinkamų priemonių, kad išvengtumėte išorinių vibracijų perdavimo mechanizmui per pagrindą.
- Projektuokite pagrindą taip, kad išvengtumėte rezonanso tarp mechanizmo ir pagrindo. Norėdami informacijos, žr. brėžinio su matmenimis tekstą arba pagrindo specifikacijas.
- Jei reikia, apsisprendę dėl faktinių įrengimo sąlygų, kreipkitės į savo "Siemens" partnerį ir aptarkite konfigūravimo rezultatus, susijusius su mechanizmo / pagrindo sistemos vibracija.
- Projektuodami pagrindą, atsižvelkite į išpjavų poreikį, kad palengvintumėte įrengimą ir elementų tvirtinimą. Žr. mechanizmo brėžinį su matmenimis / brėžinio su matmenimis tekstą arba pagrindo specifikacijas, kad nustatytumėte reikiamų išpjavų padėtį ir matmenis.

Papildomos instrukcijos betoniniam pagrindui:

- Jei reikia, montavimo elementų (pvz., pagrindo plokščių arba pagrindo rėmų) cementavimui prijunkite įleidimo kanalus. Projektuojant šiuos kanalus, reikėtų atsižvelgti į artimiausią aplinką, ypač kalbant apie erdvę. Perdavus eksploatuoti, montavimo elementų grioveliai turi būti visiškai užpilti cementu.
- Atsižvelkite į kanalus tiesdami tiekimo linijas, jei reikia.

4.5 Pakuotė

Pakuotės paskirtis – apsaugoti prekes transportavimo, perkrovimo ir sandėliavimo metu ir siekiant sumažinti tokio transportavimo, perkrovimo ir sandėliavimo išlaidas. Be pakuotės ekonominio efektyvumo, nepaprastai svarbus saugumas, t. y. supakuotų prekių vertės išsaugojimas.

Priklausomai nuo pakuojamų prekių tipo yra dvi pakavimo dėžių rūšys: palaikančios arba palaikomos.

Palaikančiųjų dėžių kėlimo kilpos pažymėtos ant pakuotės, o palaikomų dėžių kėlimo kilpos pažymėtos ant mechanizmo dalies arba prie jos pritvirtintos transportavimo gembės.

Dėžės apsaugo viduje esančias prekes, o plastikinės pakuotės apsaugo nuo mechaninės įtampos, nešvarumų, kenkėjų ir vagystės. Daugeliu atveju po dangčiu esantys tvirtinimo elementai leidžia prekes pakelti kranu.

Sandarios pakuotės naudojamos atsižvelgiant į komponentų trapumą.

Priešingai nei standartinė pakuotė, mechanizmo dalys yra visiškai įvyniotos į foliją, kurios siūlės suvirintos, kad pakuotė būtų sandari. Folijoje esantis oras pašalinamas. Pridėtas apskaičiuotas desikanto kiekis, kurio reikia transportavimo ir sandėliavimo trukmei (daug. 24 mėn.). Visi mechanizmo aštrūs kampai ir kraštai yra paminkštinti, kad folija nesuplyštų (SN 15380).

Visų naudojimo etapų simboliai nurodyti pakuotės išorėje (žr. EN ISO 780).

4.6 Transportavimas

Į ant dėžių esančias žymes (transportavimo ir sandėliavimo metu) reikia atkreipti dėmesį visų transportavimo etapų metu (žr. EN ISO 780). Taip pat reikia laikytis visų nurodymų, pateiktų pristatymo dokumentuose arba pridėtų prie pristatymo dokumentų.

Tik patyrę ekspeditoriai gali transportuoti prekes į vietą. Už transportavimą atsakingas tik ekspeditorius. Montavimo darbuotojai gali veikti tik kaip patarėjai arba prižiūrėtojai.

Būkite itin atsargūs ir dėmesingi perkeldami įrangą į darbo vietą ir joje. Naudokite tinkamos konstrukcijos ir kėlimo galios įrangą.

Mechanizmai arba dėžės su nuo vibracijos apsaugančiais tvirtinimo elementais turėtų būti transportuojami taip, kad tvirtinimo elementų smūgių sugėrimo funkcija nebūtų pažeista.

Ant dėžių nurodytos instrukcijos, kaip saugiai ir tinkamai sandėliuoti.

Dėžės turi būti tinkamai apsaugotos siekiant užtikrinti saugų transportavimą. Už tai atsakingas asmuo, kuris pakrauna ir transportuoja dėžes, ir tai reikia užtikrinti kelis kartus visos kelionės iš gamintojo galutiniam naudotojui metu (t. y. visada, kai dėžės yra perkraunamos).

4.7 Ženkla ant pakuočių

Galima naudoti dviejų rūšių pakuotes priklausomai nuo pakuojamų prekių rūšies: apkrovą laikančios pakuotės arba palaikomos pakuotės. Apkrovą laikančių pakuočių kėlimo vietos pažymėtos ant pakuotės, o palaikomų pakuočių kėlimo vietos pažymėtos ant mechanizmo dalies arba prie jos pritvirtintos transportavimo gembės.

Pakuotės pažymėtos informaciniais simboliais siekiant užtikrinti saugų supakuotų prekių tvarkymą. Pakuočių naudojimo instrukcijų simboliai apibūdinti pagal tarptautinius standartus ISO R/780 ir DIN 55402. Svarbiausieji simboliai yra šie:



Viršus.
Pakuotė turi būti transportuojama, tvarkoma ir sandėliuojama šia kryptimi.



Dūžtantys turinys.
Prekės turėtų būti tvarkomos atsargiai ir jų negalima vartyti arba suriši kartu..



Laikyti sausai.
Prekės turėtų būti apsaugotos nuo drėgmės.



Leidžiamas temperatūros intervalas.
Temperatūros intervalas su viršutine („...°C maks.“) ir apatine („...°C min.“) ribomis.



Laikyti vėsiai (toliau nuo tiesioginių saulės spindulių).
Prekės turėtų būti laikomos vėsioje vietoje ir visada toliau nuo tiesioginių šilumos šaltinių.



Tvirtinti čia.
Nurodo, kur pakuotė turėtų būti tvirtinama (kėlimo taškas), tačiau ne kaip (tvirtinimo būdas).



Gravitacijos centras.
Nurodo gravitacijos centro padėtį.



Nenaudokite šakinio krautuvo.
Šis simbolis tvirtinamas prie tų šonų, kur negalima naudoti šakinio krautuvo.



Leidžiama krovimo apkrova.
Leidžiama krovimo apkrova „... kg maks.“ nurodyta šalia šio simbolio.



Dėmesio! Nepažeiskite barjero.
Vandens nepraleidžiantis sluoksnis su desikantais yra pakuotės apačioje

pav. 4-1 Ženkla ant pakuočių

4.8 Pakuotės ženklėjimas, siuntimo dokumentai

Mechanizmai ir susijusios mechanizmo dalys siunčiamos pakuotėse su pritvirtintomis etiketėmis.

Etiketėje nurodoma ši informacija:

- Identifikacijos numeris
- Užduoties numeris
- Serijos numeris¹⁾
- Išsiuntimo pranešimo lapo Nr.¹⁾
- Schemos Nr.¹⁾
- Dalies Nr.¹⁾

Identifikacijos, užduoties ir serijos numeriai taip pat nurodomi brėžinio su matmenimis tekste.

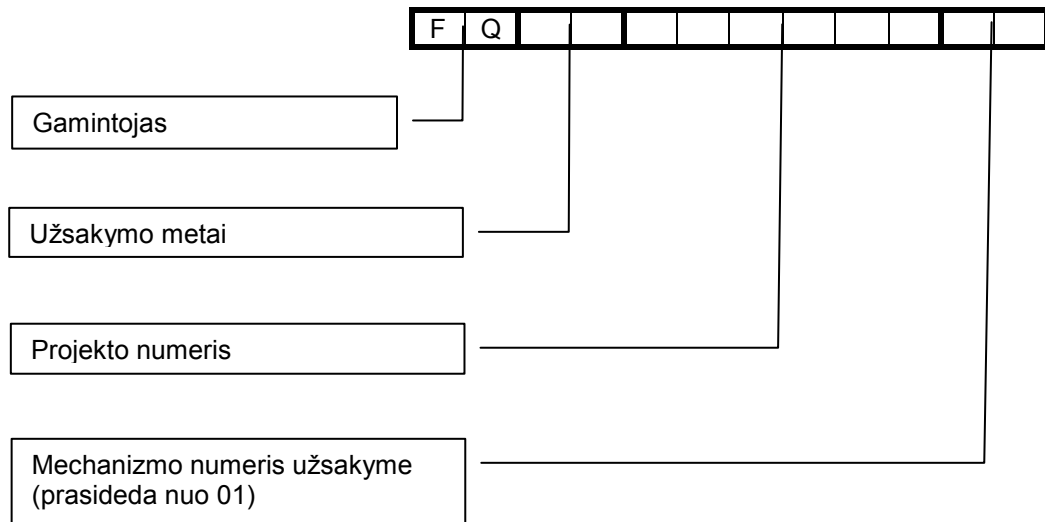
Serijos Nr. nurodytas duomenų plokštelėje ir įspaustas į kėlimo angas.

Prie kiekvienos pakuotės pridedami siuntimo dokumentai, kuriuos sudaro išsiuntimo pranešimas ir patvirtinantys dokumentai, ir išsiunčiami kartu su mechanizmu. Etiketėje nurodyta informacija padeda identifikuoti dalis, pateiktas siuntimo dokumentuose.

¹⁾ Nurodykite šiuos duomenis prašydami išsamesnės informacijos

4.9 Gaminio serijos numeris (projekto Nr.)

Gaminio serijos numeris yra svarbiausia identifikavimo informacija siunčiant įrenginį ir pakuotes. Siunčiami įrenginiai arba komponentai, turintys tokį patį gaminio serijos numerį, priklauso tam pačiam mechanizmui. Šis gaminio numeris galioja nuo sutarties dienos 2012-02-01.



pav. 4-2 Gaminio serijos numeris

4.10 Gavimas

Gavus prekes nedelsiant reikėtų apžiūrėti dėžę, ar nėra pažeidimo požymių. Jei ji pažeista, nuimkite dangtį arba kelias lentas, kad matytumėte turinį.

Jei turinys sandarus, nepažeiskite sandarios plastikinės pakuotės.

Gavėjas privalo nuspręsti, ar atidaryti pakuotę. Jei įmanoma, reikėtų pasamdyti specialistų įmonę, kuri tai atliktų. Projekto vadovas ir (arba) galutinis klientas bei draudimo įmonė turi būti informuoti tuo pačiu metu.

Svarbu! Atidarydami krovinį, kuris yra pažeistas arba tokiu laikomas, įsitikinkite, kad turinys laikomas sausoje vietoje. Priešingu atveju jį reikia supakuoti iš naujo. Svarbu, kad krovinyje būtų apžiūrėtas iš karto siekiant nustatyti pažeidimo mastą ir priežastį bei už tai atsakingą asmenį arba asmenis.

Remiantis bendrąją vežimo praktika, vežėjas turėtų būti nedelsiant informuotas ir pakviestas sudaryti bendrą pažeidimo pareiškimą.

Jei pažeidimas aptinkamas pristačius krovinį į užsienį, būtina informuoti tinkamą (-us) draudimo agentą (-us), kad jis (jie) apžiūrėtų ir patvirtintų žalą. Jei negalima nedelsiant atlikti dėžės turinio kruopščios apžiūros (pvz., dėl prasto sandėliavimo), vėlesnis kreipimasis į vežėją arba kitus už žalą atsakingus asmeninius laikomas sudėtingu, jei ne išvis neįmanomu. Tokius papildomus pavojus reikėtų turėti omenyje išsiimant siuntimo draudimą, pvz., pailginant kompensavimo laikotarpį po prekių gavimo. Patariama visada nufotografuoti rimtus pažeidimus. Tai būtina norint identifikuoti ir pareikšti pretenziją draudimo įmonei.

4.11 Mechanizmo pristatymas į paskirties vietą

Mechanizmas nuleidžiamas ant medinio pagrindo rėmo ir apdengiamas audeklu.

Iš karto pristačius pakuotę iš visų pusių apžiūrima, ar nematyti pažeidimų. Tokia apžiūra svarbi siekiant nustatyti pažeidimo mastą, priežastį bei už tai atsakingą asmenį ar asmenis ir surašyti raštišką protokolą.

Tai bendroji praktika, taikoma norint nedelsiant informuoti susijusį asmenį ir gauti jo pagalbą dėl bendro žalos įvertinimo. Šis įvertinimas yra svarbi bet kokių pretenzijų dėl žalos ir, jei taikoma, žalos ataskaitos, kuri gali būti išduodama draudėjui, dalis.

Transportavimas turėtų būti atliekamas atidžiai ir atsižvelgiant į esamas sąlygas. Tam reikia pasirinkti tinkamas transportavimo priemones.

4.12 Tvarkymas ir paruošimas

Saugos rekomendacijos

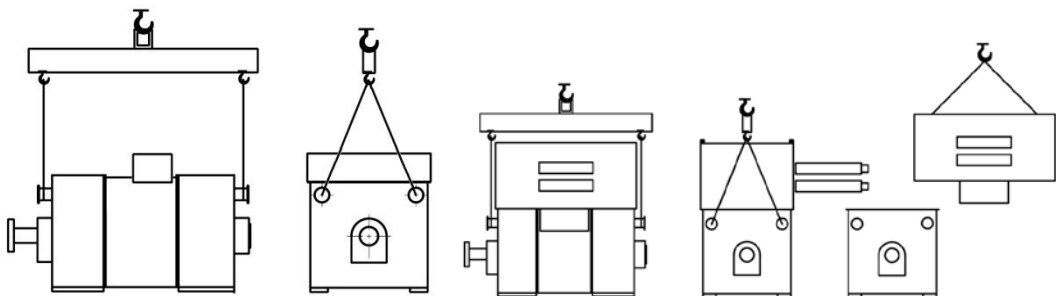
	ĮSPĖJIMAS
Netinkamai gabenant krintantys daiktai	
Mirties, rimtų sužalojimų ar didelės turtinės žalos pavojus pakrypus arba nukritus gabenamiems daiktams.	
Prieš keldami mechanizmą ar atskirus komponentus, perskaitykite toliau pateikiamas saugos instrukcijas ir laikykitės jų atlikdami visus savo darbus.	

- Naudokite tik tinkamą kėlimo mechanizmą ir įsitikinkite, kad darbą atlieką kvalifikuoti darbuotojai.
- Naudodamiesi mechanizmu ar bet kuria iš jo dalių naudokite tik mechanizmo (ar jo dalių) kėlimui skirtus kėlimo pavalkėlius.
- Negalima mechanizmą kelti už atskirų jų dalių!
- Kėlimas turėtų būti atliekamas pagal ašį simetriškose vietose.
- Žiūrėkite gabenimo dokumentuose nurodytas pastabas.
- Transportuodami pakuotes ir padėdami jas sandėliuoti, atkreipkite dėmesį į ant jų esančius informacinius ženklus. Skaitykite skyrių "Ženkilai ant pakuočių" (puslapyje 26).
- Daiktams pakelti naudokite tik nurodytus kėlimo taškus ir (arba) pažymėtas vietas. Naudokite tinkamus dirželius nukreipiančius arba išskleidžiančius įtaisus. Visa informacija apie tai, kaip teisingai kelti, tvirtinti ir transportuoti mechanizmą, pateikiama mechanizmo matmenų brėžinyje (B priede „Techniniai duomenys ir brėžiniai“). Pavyzdžiui, žr. "pav. 4-3".
- Reikia atsižvelgti į pasirinkto kėlimo įrenginio keliamąją galią. Turi būti naudojami tinkami virves nukreipiantys įtaisai, kurie galbūt turėtų antstatus arba priedurus.
- Visuomet žinokite kėlimo mechanizmo keliamąją galią.
- Visi darbai turi būti atliekami atsargiai.

Mechanizmo masė nurodyta techninių duomenų plokštelėje, matmenų brėžinio tekste ir pristatymo pranešimo priede (atsarginių dalių sąrašė). Svorio centras nurodytas mechanizmo matmenų brėžinyje. Supakuotų mechanizmų ir atskirų komponentų svorio centras nurodytas ant pakuotės.

Pastaba

! Kėlimo įrenginiai turėtų būti pasirinkti atsižvelgiant į mechanizmo svorį !



pav. 4-3 Mechanizmo kėlimas

4.13 Sandėliavimas

4.13.1 Sandėliavimo viduje ir sausumoje sąlygos bei rekomendacijos

Generatoriai ir jų priedai turėtų būti profesionaliai saugomi prieš įrengimą, jei reikia. Juos reikia apsaugoti nuo drėgmės, kenksmingų aplinkos sąlygų ir nuo kito neįprasto poveikio. Rasos taško lygio nereikėtų pasiekti dėl korozijos. Jei mechanizmas įdėtas į transportavimo dėžę, prieš sandėliuojant jis turi būti išimtas iš jos.

Sandėliavimo vietos turėtų būti švarios, sausos, uždaros, tinkamai vėdinamos ir apsaugotos nuo smūgių. Sąlygas reikia užtikrinti laikantis šių rekomendacijų:

Patalpos klimatas

1^{oji} sąlyga

- Santykinė drėgmė turėtų būti mažesnė nei 80 %
- Sandėliavimo temperatūra turėtų būti nuo 0 iki 50 °C, rasos taško temperatūra nebus niekada pasiekta

2^{oji} sąlyga

- Jei negalima laikytis pirmosios sandėliavimo sąlygos, būtina laikytis šių sąlygų: sandėliavimo vietos temperatūra = (išorės temperatūra + 10 °C)

Išorės sąlygos



ĮSPĖJIMAS

Tik sandariai supakuotas mechanizmas gali būti laikomas lauke. Sandari pakuotė negali būti pažeista. Dėl sandėliavimo sąlygų lauke žr. informaciją vadove „Variklių ir generatorių sandėliavimas“.

- Santykinė drėgmė turėtų būti mažesnė nei 80 %
- Sandėliavimo temperatūros intervalas – nuo –5 iki 50 °C

Generatorius paruošiamas 6 mėnesių sandėliavimui po išsiuntimo iš gamyklos klientui. Ilgalaikio sandėliavimo atveju (ilgiau nei 6 mėnesius), norint, kad pasibaigus sandėliavimo laikotarpiui mechanizmas tinkamai veiktų, reikia atsižvelgti į kai kuriuos reikalavimus, pvz., guolių, išplėsto veleno galo, atramų arba sandarių pakuočių apsauga naudojant nusausinimo įtaisus. Norėdami gauti daugiau informacijos apie ilgalaikį viso mechanizmo ar jo dalių (guolių ir t. t.) sandėliavimą, kreipkitės į "Siemens Electric Machines s.r.o" (žr. skyrių "Techninė priežiūra ir pagalba" 97 psl.) dėl rankinio **variklių ir generatorių sandėliavimo**.

4.13.2 Antikorozinis padengimas sandėliuojant

Mechanizmo dalys

Mechanizmu ilgesnį laiką nesinaudojant (žr. skyrių "Įrengto, tačiau nepristabdyto mechanizmo apsauga" (puslapyje 77)) arba ilgiau jį sandėliuojant (žr. skyrių "Sandėliavimas" (puslapyje 31)) ir transportuojant, atviras zonas (veleno galą, atramą ir įžeminimo taškus) būtina apsaugoti nuo korozijos. Jei apsauginė antikorozinė danga dėl tam tikrų priežasčių suyra (dėl bandymų, movų), ji turi būti užtikrinama visą laiką tol, kol mechanizmas siunčiamas iš mechanizmo gamintojo į galutinę jo vietą.

Slydimo guoliai

	ĮSPĖJIMAS
! Įspėjimas. Slydimo guoliai paprastai tiekiami be alyvos!	

- Generatoriai turi būti laikomi be alyvos.
- Veleno guolių kakliukai padengiami antikorozine alyvos plėvele, kuri mechanizmui veikiant ištirpsta tepimo alyvoje.
- Antikorozinė alyvos plėvelė veiksminga sandėliuojant pusmetį sausoje aplinkoje (31 psl.).
- Jei guoliai sandėliuojami ilgesnį laiką, reikia juos išardyti, taip pat guolių kakliukai ir dalys turi būti padengiami ilgalaikiu apsauginiu sluoksniu.

	ĮSPĖJIMAS
Antikorozinis slydimo guolių padengimas Prieš sandėliuojant ir transportuojant guolius, visada būtina juos padengti antikorozine danga. Jei kilo neaiškumų arba turite klausimų, kreipkitės į „Siemens“ techninės priežiūros centrą (97 psl.).	

4.14 Sandarios pakuotės

Sandarios pakuotės naudojamos trapiems komponentams ir prekių sandėliavimui lauko sąlygomis.

Priešingai nei standartinės pakuotės, mechanizmo dalys yra visiškai įvyniotos į plastikines folijos pakuotes, kurių siūlės suvirintos, kad pakuotė būtų sandari. Folijos pakuotėje esantis oras pašalinamas išsiurbiant. Pridedamas desikanto kiekis apskaičiuojamas nurodytam transportavimo ir sandėliavimo laikotarpiui, atsižvelgiant į klimato zonas. Visi aštrūs kampai ir kraštai paminkštinami, kad pakuotė nesuplyštų.

Visos dėžės turėtų būti nedelsiant apžiūrėtos pristatymo metu siekiant įsitikinti, kad pakuotė, turinys ir siūlės nėra pažeistos. Jei drėgmės indikatoriai pateikti, sandarios pakuotes reikėtų vizualiai apžiūrėti po 1–2 dienos pasibaigus sandėliavimui.

Jei dėžės buvo atidarytos atvykimo uostuose ir sandarios pakuotės buvo pažeistos arba jei dėžės pažeistos transportavimo metu, sandarios pakuotės turi būti kaip įmanoma greičiau sutaisytos (jei įmanoma) siekiant užtikrinti tinkamą sandėliavimą, ypač tropinėse zonose. Pakuočių atidarymas arba pažeidimas turėtų būti fiksuojamas raštu ir apie jį reikėtų nedelsiant pranešti projekto vadovui / darbo vietos prižiūrėtojiui.

Jei drėgmės indikatoriai pateikti sandarioje pakuotėje, išorinėje pakuotėje pateikta apžiūros anga, kurios dangtį galima atsukti. Drėgmės indikatoriai keičia spalvas iš mėlynos (sausas) į rožinę (drėgna) ir nurodo drėgmės lygį (santykinę drėgmę) sandarioje plastikinėje pakuotėje.



pav. 4-4 Drėgmės indikatorius

Pastaba

Drėgmės indikatoriai atsinaujina automatiškai, t. y. jie nenurodo, ar anksčiau drėgmė pakuotėje buvo per didelė.

Drėgmės indikatorių tikslumas labai priklauso nuo temperatūros. Kai aplinkos temperatūra yra 20 °C, jie yra pakankamai tikslūs, tačiau esant kitokiai temperatūrai jų nurodomas drėgmės lygis yra per didelis.

Jei santykinė drėgmė pakyla virš 60 %, reikia atlikti patikrinimą siekiant užtikrinti, kad pakuotėje esantis turinys nėra pažeistas. Norėdami tai padaryti, atsargiai atidarykite dėžę ir patikrinkite, ar turinys nepaveiktas korozijos.

Pradinės konservacijos bei galiojimo pabaigos datos pažymėtos ant dėžių.

Pradinės konservacijos data:	Metai	Mėnuo
Galiojimo pabaigos data:	Metai	Mėnuo

Sandarių pakuočių efektyvumą tikrinkite kas 8 savaites, jei nenurodyti jokie kiti intervalai. Tokių apžiūrų rezultatai turi būti užrašomi. Reikia patikrinti dėžes, kuriose santykinė drėgmė staigiai pakilo arba ilgai buvo didelė.

Pastaba

Alyvos sutepimo sistemos atveju alyvos siurblius ir alyvos sutepimo sistemos variklį prijunkite prie maitinimo šaltinio pagal variklio duomenų plokštelę. Įsitikinkite, kad sukimosi kryptis atitinka ant variklio nurodytos rodyklės kryptį. Dėl išsamesnės informacijos žr. vadovus, pateiktus kliento dokumentacijoje (D priedas "Papildomi dokumentai").

5 Montavimas



ĮSPĖJIMAS

Pavojus dėl netinkamo montavimo

Mechanizmą turėtų įrengti kvalifikuoti darbuotojai atsižvelgdami į informaciją, pateiktą šiose instrukcijose, siekiant užtikrinti tinkamą veikimą. Nepaisymas gali lemti rimtą susižeidimą arba padaryti žalos nuosavybei.

Pastaba

Techninės priežiūros centras

Prireikus bet kokių montavimo darbų kreipkitės į techninės priežiūros centrą (97 psl.) arba kvieskite "Siemens" išmokytus ir atitinkamą užduotį atlikti įgaliotus techninės priežiūros inžinierius.

5.1 Bendroji mechanizmo apžiūra

Prieš pastatymą (įrengimą) generatorius turi būti tinkamai apžiūrėtas siekiant išsiaiškinti, ar nėra pažeidimų, atsiradusių transportavimo arba sandėliavimo metu. Apie bet kokius rastus defektus reikia pranešti tiekėjui arba transportavimo įmonei ir jie turi būti profesionaliai suremontuoti. Nuimkite apsauginę dangą nuo metalinių paviršių (atramų, jungių, laisvojo galo ir pan.) prieš mechanizmo pastatymą ir įrengimą.

5.2 Mechanizmo montavimas

Pastaba

Mechanizmo montavimas nėra įtrauktas į komplektą. Mechanizmas paruoštas montavimui pagal jūsų specifikacijas. Visi pirmiau nurodyti dokumentai gali būti neįtraukti į dokumentaciją.

Norėdami pamatyti, kaip montuoti mechanizmus ant pagrindo, žr. "Brėžinį su matmenimis / brėžinio su matmenimis tekstą" arba "Pagrindo specifikacijas".

Išankstinės sąlygos

Pagrindo plokštės turi būti sumontuotos ir išlygiuotos. Žr. "Pagrindo schema" kliento dokumentacijoje.

Pasiruošimas montuoti:

1. Nuvalykite pagrindą. Ypatingą dėmesį atkreipkite į montavimo paviršius, skirtus pagrindo plokštėms, žr. skyrių "Minkštos atramos (Soft Foot) patikrinimas" (puslapyje 36).
2. Patikrinkite, ar pagrindas nėra pažeistas.
3. Patikrinkite, ar montavimo paviršiai yra lygūs.
4. Palyginkite pagrindo matmenis su informacija, esančia šio mechanizmo dokumentacijoje, ir informacija, esančia išdėstymo brėžinyje, pateiktame pagrindo gamintojo.
5. Patikrinkite montavimo elementų padėtį.

5.3 Mechanizmo pastatymas ir montavimas

1. Pastatykite mechanizmą ant paruošto montavimo pagrindo naudodami išlygiavimo elementus. Daugiau informacijos šia tema ieškokite skyriuje "Tvarkymas ir paruošimas" (puslapyje 30).
2. Pašalinkite transportavimo užraktą. Žr. skyrių "Transportavimo sutvirtinimas" (puslapyje 37).
3. Išlygiuokite mechanizmą horizontaliai ir vertikalčiai. Daugiau informacijos šia tema ieškokite skyriuje "Išlygiavimas" (puslapyje 38).
4. Padenkite montavimo elementus tinkama apsauga nuo korozijos.
5. Pritvirtinkite mechanizmą. Naudokite nurodytus tvirtinimo elementus, kad pritvirtintumėte mechanizmą prie pagrindo. Reikiama informacija pateikta skyriuje "Pagrindo specifikacijos", esančiame priede "Techniniai duomenys ir brėžiniai".
6. Priveržkite tvirtinimo elementus, pasirinkdami reikiamą priveržimo momentą. Žr. skyrių „Metrinių varžtų priveržimo momento vertės“ (99 psl.).
7. Patikrinkite išlygiavimą su varomuoju mechanizmu, jei sujungimas nepriimamas, žr. "Sujungimo priėmimas" skyriuje "Išlygiavimas" (puslapyje 38), pakartokite 3–6 veiksmus ir išlygiuokite mechanizmą arba mechanizmo komplektą dar kartą.

5.4 Minkštos atramos (Soft Foot) patikrinimas

Bandymas atitinka API 541-4.3.1.15

Bandymas atliekamas siekiant išsiaiškinti, ar pagrindo rėme yra koks nors kreivumas tvirtinant montavimo varžtus.

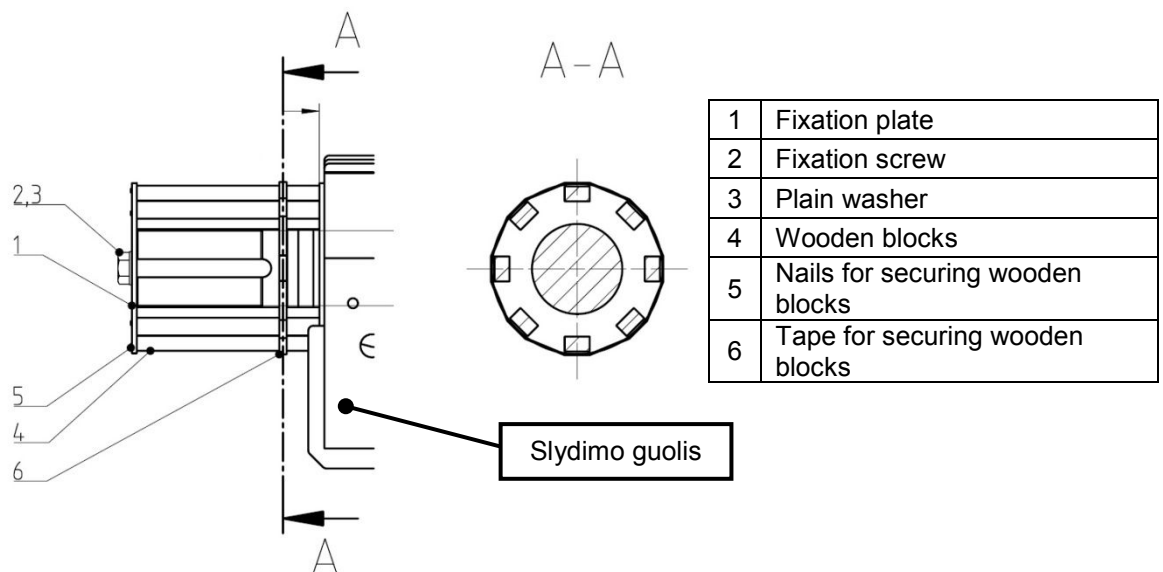
Prieš mechaninį veikimo patikrinimą bus atliktas "minkštos atramos" patikrinimas.

Kai mechanizmas yra išlygiuotas, sureguliuotas tarpikliu ir saugiai pritvirtintas prie bandymo pagrindo, mikrometras (ciferblatinis matuoklis) nukreiptas vertikalia kryptimi turėtų būti pritvirtintas prie tikrinamos montavimo atramos.

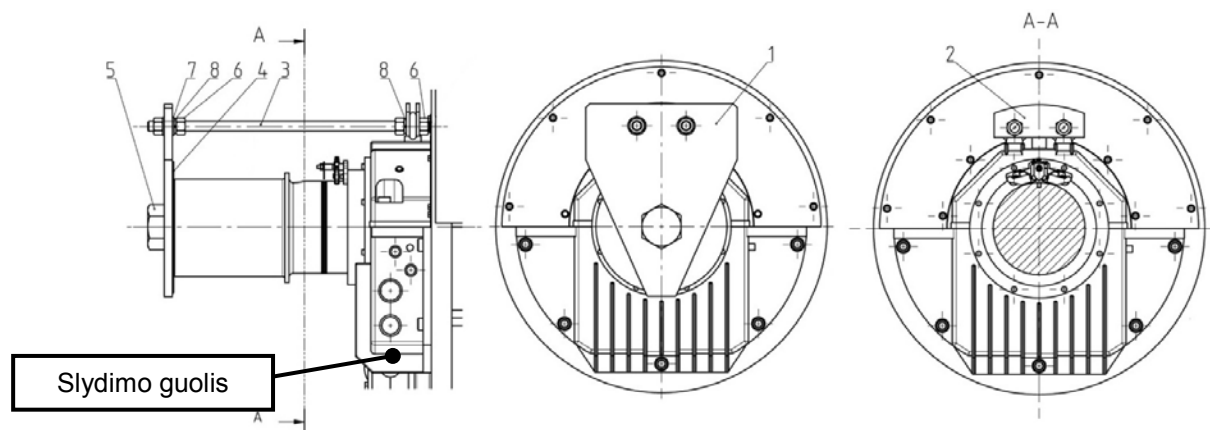
Mikrometras nustatomas ant nulio, montavimo varžtas arba varžtai atlaisvinami ties atrama ir pasižymimas mikrometro rodmens pokytis. Jei mikrometro rodmuo viršija 0,025 mm, įrengimą reikia nuvalyti arba iš naujo sureguliuoti tarpiklius. Šis "minkštos atramos" patikrinimas turėtų būti atliekamas ties kiekviena montavimo atrama, kai kitos atramos pritvirtintos, kol visi mikrometro rodmenų pokyčiai bus mažesni nei 0,025 mm. Jei yra tarpinių pagrindų, šis patikrinimas turėtų būti atliekamas kiekvienoje sandūroje tarp mechanizmo ir bandymo pagrindo.

Surinkto mechanizmo bandymo metu bus atlikti vibracijos matavimai, kai tinkamai sureguliuoti tarpikliai ir mechanizmas saugiai pritvirtintas prie masyvaus pagrindo arba bandymo pagrindo stovo. Elastiniai montavimo elementai naudojami tik tada, jei galima.

5.5 Transportavimo sutvirtinimas



pav. 5-1 Transportavimo sutvirtinimas (slydimas guolis)



pav. 5-2 Transportavimo sutvirtinimas

Atsargiai nuimkite apsauginę dangą nuo mechaniškai apdirbtų paviršių. Šiam tikslui nenaudokite jokių metalinių objektų, pavyzdžiui, grandiklio, trintuvo arba metalinės juostelės. Tiesiog nuplaukite apsauginę dangą su žibalu arba panašiu tirpikliu (pvz., "Aral 4005" arba "Shell A151"). Guolių nereikia atidaryti, kadangi juose esanti apsauginė danga tirpsta alyvoje.

5.6 Išlygiavimas



PERSPĖJIMAS

Sankabos gaubtas – generatoriaus (variklio) išlygiavimas su varomuoju mechanizmu

Elektrinio mechanizmo išlygiavimas su varomuoju mechanizmu ir sankabos uždengimas turi būti atliktas taip, kad sankaba kartu su gaubtu niekada nesukurtų neigiamo slėgio guolio priekinėje pusėje. Jei neatsižvelgsite į šią sąlygą, iš guolio gali būti imama alyva, atsirasti alyvos nuotėkis ir ji gali imti lašėti per guolio tarpiklius.



PERSPĖJIMAS

Prieš išlygiuodami mechanizmą, turi būti įjungtas alyvos tepimo įrenginys ir alyvos hidrostatinis įrenginys (kur sumontuotas).

Naudojant savitepius guolius, jie turi būti sutepti pagal skyrių: "Iš anksto sutepkite guolius alyva – jei tepimo įrenginys neveikia" (puslapyje 44).

Kad mechanizmas veiktų sklandžiai ir be kliūčių, būtina atidžiai sulygiuoti su varomąja krumpline pavara.

Generatorius sulygiuotas su jau sureguliuotu ir tvirtai pritvirtintu rotoriumi. Būtina gauti raštišką patvirtinimą apie tinkamą mechanizmo sulygiavimą ir tinkamą movos jungės padėtį (aukštį).



PERSPĖJIMAS

Generatorius turi būti sulygiuotas geometriškai.

Lygiuodami pagal ašį įsitikinkite, kad rotorius yra geometriniam centre.

Atlikdami ašinį lygiavimą nepamirškite, kad D galo guolyje rotorius nukreipiamas pagal ašį (taip pat žr. matmenų brėžinį / tekstą). Lygiuojant būtina užtikrinti simetrišką guolio korpuso veleno padėtį.

Kalbant apie ašinį lygiavimą, svarbu užtikrinti, kad rotorius būtų geometriniam centre. Rotorius turi būti sulygiuotas geometriškai.

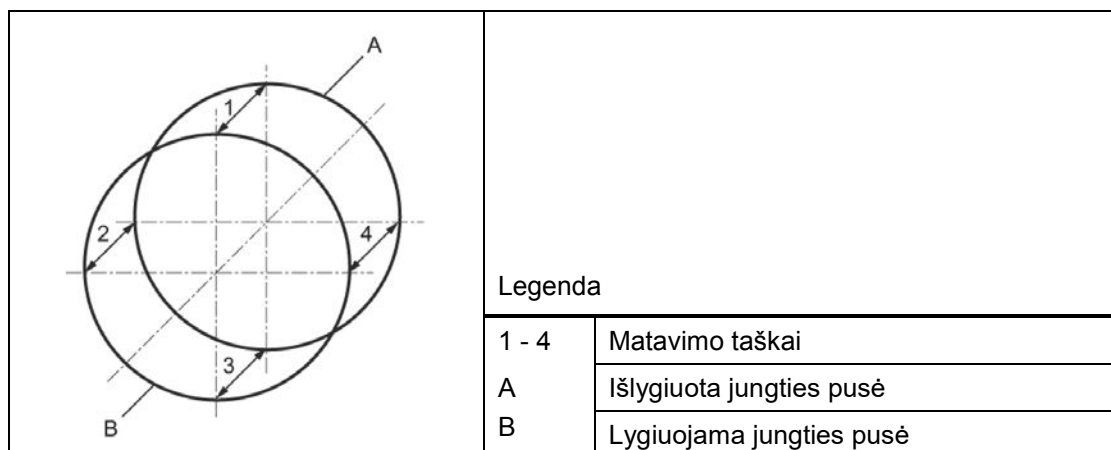
Ant guolio esanti rodyklė turi būti nukreipta į vidurinę apskritą veleno griovelį (žr. matmenų brėžinio tekstą). Du išoriniai grioveliai nurodo leistiną nuokrypio intervalą.

Išmatuokite ašinį nuokrypį tarp jungties pusių keturiuose taškuose 1, 2, 3 ir 4, kurie išdėstyti tolygiais tarpais aplink perimetrą pvz. žr. pav. 5-3).

Užsirašykite pirmojo matavimo duomenis.

lent. 5-1 Matavimo palei ašį pavyzdys

	Matavimo taškas			
	1	2	3	4
1. Išmatavimas:	95	92	85	100
2. Išmatavimas:	95	92	90	100
3. Išmatavimas:	93	87	85	102
4. Išmatavimas:	100	95	98	98
Vidurkis:	97	91,5	89,5	100



pav. 5-3 Matavimo taškai išlygiavimui palei ašį

$$1^{\text{asis}} \text{ įvertinimas } \frac{97 - 89,5}{2} = 3,75$$

$$2^{\text{asis}} \text{ įvertinimas } \frac{100 - 91,5}{2} = 4,25$$

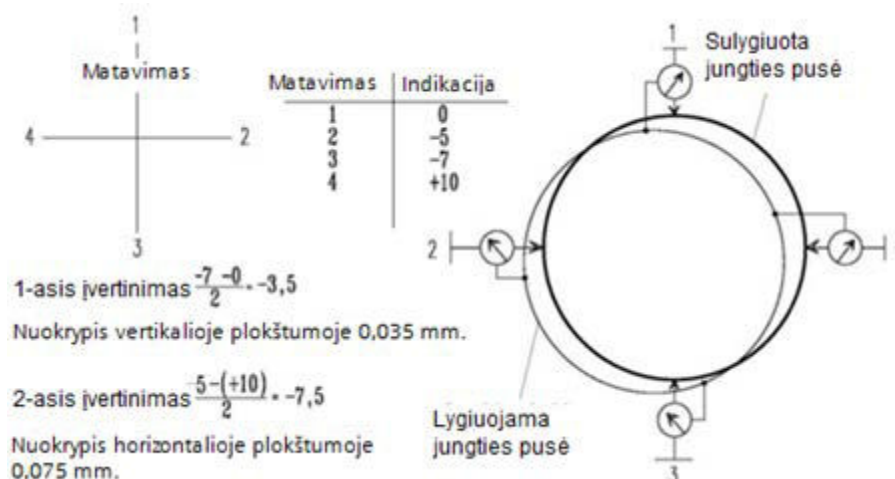
Nuokrypis vertikaloje plokštumoje 0,0375 mm Nuokrypis horizontalioje plokštumoje 0,0425 mm

Pakartokite ir užsirašykite matavimo rezultatus pasukę abu velenus (kartu kiek įmanoma daugiau) 90° į 90°, 180° ir 270° padėtis.

PRANEŠIMAS

1 matavimo taškas yra visada viršuje; t. y. sąlyginė matavimo kryžmė nėra pasukta.

Apskaičiuokite keturių matavimo taškų vidutines vertes. Išmatuokite radialinį nuokrypį tarp jungties pusių keturiuose taškuose 1, 2, 3 ir 4, kurie išdėstyti tolygiai aplink perimetrą (pav. 5-4), ir užsirašykite išmatuotas vertes.



pav. 5-4 Matavimo taškai radialiniam išlygiavimui

Nustatykite ašinį ir radialinį nuokrypį (lent. 5-2) pradedant nuo verčių, išmatuotų priešinguose matavimo taškuose (2 ir 4 taškai horizontaliai plokštumai bei 1 ir 3 taškai vertikaliai plokštumai).

Priklausomai nuo nuokrypių mechanizmas turi būti perkeltas vertikaliai pašalinus arba padėjus pleištus po mechanizmo atramomis ir horizontaliai pastūmus mechanizmą šonu. Šios operacijos turi būti kartojamos, kol ašinis ir radialinis nuokrypiai bus leidžiamose nuokrypių ribose.

lent. 5-2 Leidžiami nuokrypiai

Leidžiami nuokrypiai	Radialinis nuokrypis mm	Ašinis nuokrypis mm
Standi jungtis	0,03	0,02
Lanksti jungtis	0,05	0,05

Sujungimo priėmimas

Sujungimo priėmimas turėtų būti atliekamas kartu su kliento atstovu ir varomojo mechanizmo gamintoju.

Sujungimo apžiūros rezultatai turėtų būti užrašyti ir šis įrašas saugomas. Prieš sujungdami mechanizmus, patikrinkite sukimosi kryptį.

Sujungimo pusės turėtų būti jungiamos pagal jungties gamintojo instrukcijas.

5.7 Pripildykite guolius alyva

Norėdami daugiau informacijos, žr. skyrių "Techninės priežiūros ir apžiūros instrukcijos" gamintojo pridėtame mechanizmo vadove. Naudokite tik alyvą, nurodytą tekste šalia brėžinio su matmenimis arba ant guolio tipo plokštelės.

Jeigu nėra jokios informacijos apie alyvą, žr. informaciją, pateiktą skyriuje "Alyvos švarumas" (puslapyje 45).

Savitepis guolis turi būti pripildytas taip, kad guolis būtų pakankamai suteptas, taip bus išvengta alyvos nuotėkio ir užsikirtimo pavojaus. Alyvos lygis turi būti nustatytas tiksliai pagal šiame skyriuje esančią informaciją.



PERSPĖJIMAS

Pildymo procedūra

Šią pildymo procedūrą taikykite guoliams prieš atlikdami guolių gamintojo nurodytą procedūrą.

Alyvos temperatūra turi būti nustatyta pagal alyvos gamintoją prieš pildant guolį (žemesnė temperatūra -> didesnis alyvos klampumas). Laikykitės ant alyvos pakuotės nurodytų sandėliavimo sąlygų.



PAVOJUS

Nesilaikant šiame skyriuje pateiktų instrukcijų, darbo metu galima pažeisti guolio žalvarinę dangą arba guolį.

5.7.1 Savitepis guolis

Bendroji savitepių guolių pildymo alyva procedūra, žr. pav. 5-5 ir pav. 5-6 (puslapyje 42)

- Išimkite srieginius kamščius iš alyvos pildymo angos. Pildymo anga turi būti švari ir joje neturi būti jokių dalelių.
- Naudokite tepalą, kurio klampumas toks, koks nurodytas ant guolio tipo plokštelės arba brėžinio su matmenimis tekste.
- Pilkite tepalą per alyvos pildymo angą, esančią viršutinėje pusėje, ir pripildykite trečdalį alyvos stebėjimo langelio (stebėjimo langelio vieta aprašyta guolio gamintojo instrukcijose).

Taip pat galite naudoti šią formulę: Alyvos talpa = guolio bako talpa – 2 litrai

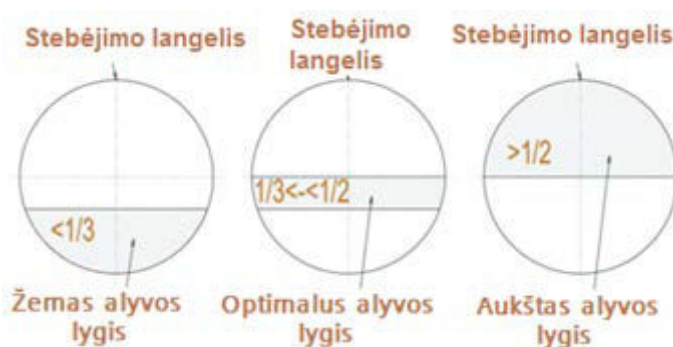
- Palaukite mažiausiai 10 minučių. Alyva pripildo guolio vidų ir stebėjimo langelį lėtai.
- Pildykite tiksliai, kad likusi alyva pasiektų reikiamą alyvos lygį, žr. pav. 5-5 ir pav. 5-6 (puslapyje 42)
- Uždėkite srieginį kamštį ir priveržkite.

Alyvos lygio ribos yra tokios:

Minimali alyvos riba: trečdalis stebėjimo langelio

Maksimali alyvos riba: pusė stebėjimo langelio

Lygis	Stebėjimo langelio alyvos talpa	Rezultatas
1 lygis	$<1/3$	Guolio užsikirtimo pavojus
2 lygis	$1/3 < - < 1/2$	Reikiamas alyvos lygis
3 lygis	$>1/2$	Alyvos nuotėkio pavojus



pav. 5-5 Alyvos lygio schemos aprašymas (savitepis)



pav. 5-6 Optimalus alyvos lygis (savitepis)

5.7.2 Iš išorės sutepamas guolis

Bendroji iš išorės sutepamų guolių pildymo alyva procedūra

- Išimkite srieginius kamščius iš alyvos pildymo angos. Pildymo anga turi būti švari ir joje neturi būti jokių dalelių.
- Naudokite tepalą, kurio klampumas toks, koks nurodytas ant guolio tipo plokštelės arba brėžinio su matmenimis tekste.
- Pilkite tepalą per alyvos pildymo angą. Alyvos lygį guolyje nurodo barjerinė plokštelė, esanti alyvos išleidimo vamzdyje, žr.pav. 5-8. Daugiausiai trečdalis alyvos stebėjimo langelio (stebėjimo langelio vieta aprašyta guolio gamintojo instrukcijose).
- Palaukite mažiausiai 10 minučių. Alyva pripildo guolio vidų ir stebėjimo langelį lėtai.
- Pildykite tiksliai, kad likusi alyva pasiektų reikiamą alyvos lygį.
- Uždėkite srieginį kamštį ir priveržkite.

Alyvos lygio ribos yra tokios:

Minimali alyvos riba: trečdalis stebėjimo langelio (prieš darbą)

Maksimali alyvos riba: apytiksl. du trečdaliai stebėjimo langelio – (darbo metu) žr. pav. 5-7

Lygis	Stebėjimo langelio alyvos talpa	Rezultatas
1 lygis	<1/3	Guolio užsikirtimo pavojus
2 lygis	Reikiamas alyvos lygis	Reikiamas alyvos lygis
3 lygis	>2/3	Alyvos nuotėkio pavojus



pav. 5-7 Maksimalus alyvos lygis darbo metu (išorinis sutepimas)



pav. 5-8 Alyvos sklendė

5.8 Iš anksto sutepkite guolius alyva – jei tepimo įrenginys neveikia



PERSPĖJIMAS

Prieš rotoriaus išlygiavimą reikia užtikrinti alyvos tiekimą į guolius. Jei tepimo įrenginys neveikia, rekomenduojama iš anksto sutepti abu guolius. Stenkitės kuo mažiau judinti guolius (pvz., 1/4–1/2 pasukimais). Nuolatinis sukimasis leidžiamas tik tada, kai užtikrinamas alyvos tiekimas į guolius.



PERSPĖJIMAS

Naudojant nesuteptą rotorių, žymiai sumažėja guolio įdėklo naudojimo laikas.

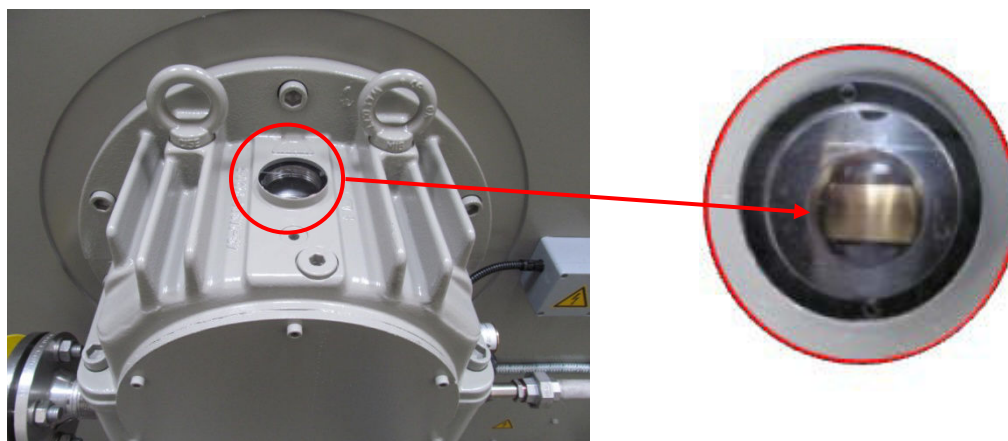


PERSPĖJIMAS

Pildant guolį alyva, būtina laikytis švaros. Imkitės apsauginių priemonių, kad dulės ir kitos dalelės nepatektų į guolį.

Atlikite toliau nurodytus veiksmus:

1. Naudokite reguliuojamą kaištinį raktą pav. 5-10, kad saugiai išmontuotumėte stebėjimo langelį, kuris yra viršutinėje guolio dalyje pav. 5-9.
2. Įpilkite nedidelį kiekį (apie 0,5 l) alyvos per angą, esančią tiesiai ant veleno.
3. Pritvirtinkite stebėjimo langelį atgal – priveržkite ranka.



pav. 5-9 Stebėjimo langelis



pav. 5-10 Reguliuojamas kaištinis raktas

5.9 Alyvos švarumas

Jei brėžinio su matmenimis tekste nenurodyta kitaip, naudokite alyvą su alyvos grynumo kodu (ISO 4406 arba NAS standartinė rūšis) pagal lent. 5-3. Jei brėžinio su matmenimis tekste nurodytas kitas grynumo kodas, šis kodas turi būti naudojamas kaip pageidaujama.

lent. 5-3 Alyvos švarumo reikalavimai

Specifikacija	ISO kodas	NAS kodas
ISO numeris / NAS rūšis	ISO 17/15/12	NAS6

5.10 Alyvos tiekimo sistemos prijungimas

Visą informaciją apie alyvos tiekimo sistemos prijungimą prie guolių galima rasti mechanizmo brėžinyje su matmenimis / brėžinio su matmenimis tekste ir instrukcijose, kurias pateikė guolių ir alyvos tiekimo sistemos gamintojai. Be to, turėtumėte laikytis toliau pateiktos informacijos.

1. Įsitikinkite, kad izoliuoto guolio termometrai negadina guolio izoliacijos.
2. Srieginiais kamščiais uždarykite visas nenaudojamas išgręžtas angas. Išimtis: atmosferos jungtis lieka atidaryta.
3. Tieskite vamzdžius taip, kad guolio korpuso jungtims nebūtų jokios apkrovos ir vibracijos.
4. Prieš montuodami alyvos vamzdžius, plaukite alyvos cirkuliacinę sistemą, kol pradės bėgti tik švari alyva. Tam naudokite tokios kokybės alyvą, kokia nurodyta naudoti vėliau darbo metu.
5. Įsitikinkite, kad alyvos tiekimo sistema veikia pakankami ilgai prieš varikliui pradedant ir toliau veikiant tam tikrą laiką po to, kai variklis sustoja. Taip neleisite guoliui veikti sausam, kai variklis pagreitėja ir sulėtėja.
6. Prijunkite alyvos tiekimo sistemą prie guolių.

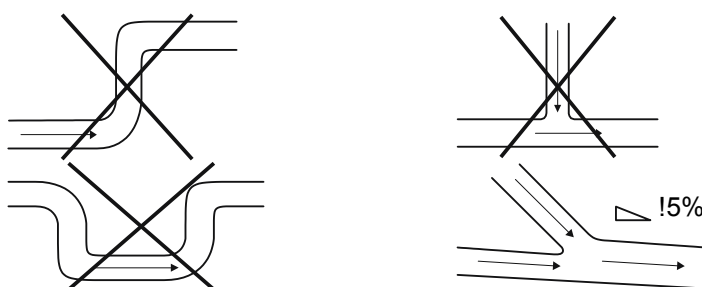
5.11 Cirkuliacinės alyvos tepimo sistemos prijungimas

Visada laikykitės alyvos tiekimo sistemos gamintojo kliento dokumentacijos priede pateiktų pastabų. Šios instrukcijos yra tik bendroji informacija.

Alyvos tiekimo sistemos montavimas

Montuodami alyvos tiekimo sistemą, užtikrinkite, kad laikomasi šių sąlygų.

- Alyvos grįžtamosios linijos yra nutiestos taip, kad būtų tiesios.
- Alyvos grįžtamosios linijos yra nutiestos su mažiausiai 5 proc. nuolydžiu.
- Alyvos grįžtamosiose linijose gali nebūti sifonų.
- Negalima leisti, kad alyva užkimštų linijas.
- Išleidimo vamzdžiai yra didesni nei įleidimo vamzdžiai.



pav. 5-11 Kaip nutiesti alyvos grįžtamosias linijas

Pastaba

Vėdinimo angos alyvos grąžinimo linijoje

Jei naudojate alyvos aušinimo baką, bako alyvos grąžinimo linijoje arba pačiame bake įrenkite vėdinimo angą. Vėdinimo angose būtinai turi būti orą praleidžiantis dangtelis su filtru (pakankamo dydžio, kad būtų užtikrintas geras vėdinimas), kad alyva nebūtų užteršta priemaisomis.

Įsitikinkite, kad vėdinimo angos yra virš bako alyvos lygio.

Pastaba

Alyvos garų ištraukimo įtaiso įrengimas alyvos bake

Jei alyvos bake sumontavote aktyvią alyvos garų ištraukimo sistemą, įsitikinkite, kad sistema sukuria reikiamas sumažintojo slėgio sąlygas alyvos grąžinimo linijoje. Tokiu būdu užtikrinama, kad bet kokie alyvos garai / rūkas iš grąžinimo linijos specialiai nukreipiamas atgal į alyvos baką. Taip alyvos garai neišgaruoja per guolių sandarinimo spragas ir išvengiama alyvos nutekėjimo.

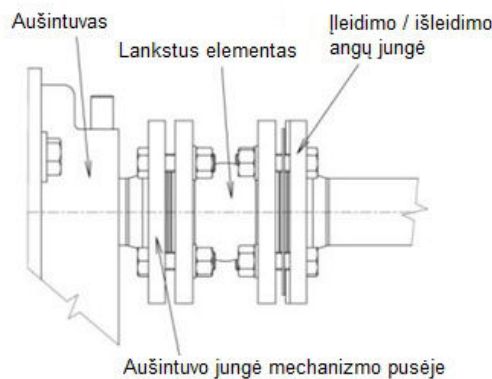
Taip pat turite atsižvelgti į alyvos tiekimo sistemos gamintojo D priede "Papildomi dokumentai" pateiktoje dokumentacijoje nurodytas pastabas.

5.12 Aušinimo vamzdyno (oro-vandens aušintuvas, aušinimo tepimo sistema) prijungimas

Ant vandens aušintuvų arba tepimo alyva įrenginių esančios jungės turi būti jungiamos naudojant lanksčius elementus (žr. pav. 5-12) dėl abipusės sąveikos tarp dviejų nepriklausomų vamzdinių. Lankstusis elementas apsaugo nuo dėl judėjimo galinčio laisvumo, mažina triukšmą, izoliuoja virpesius, kompensuoja nesutapimus mechanizmo veikimo metu.

Aušinimo skysčio vamzdyno reikalavimai:

- Užtikrinkite, kad aušinimo skysčio linijos nutiestos ir prilaikomos taip, kad jungiamosioms jungėms nebūtų taikomos įtampos, deformacijos arba vibracijos apkrovos.
- Reikiami duomenys jungiamosioms jungėms pateikti mechanizmo brėžinyje su matmenimis / brėžinio su matmenimis tekste.



pav. 5-12 Jungčių lankstaus jungimo pavyzdys

5.13 Aušinimo skysčio tiekimo sistemos prijungimas

Visada laikykitės alyvos tiekimo sistemos gamintojo kliento dokumentacijos priede pateiktų pastabų. Šios instrukcijos yra tik bendroji informacija.

5.13.1 Prijungimas

1. Nutieskite ir paremkite linijas taip, kad jungiamosioms jungėms nebūtų taikomos įtampos, deformacijos arba vibracijos apkrovos.
2. Prieš prijungdami aušinimo skysčio tiekimo sistemą prie variklio, išplaukite aušinimo sistemos grandinę. Tokiu būdu pašalinsite nuosėdas bei svetimkūnius, kad jie nepatektų į aušinimo grandinę. Naudokite plovimui nurodytą aušinimo skystį.
3. Jei aušinimo skystyje gali būti nešvarumų ir svetimkūnių, aušinimo skysčio tiekimo linijoje naudokite tinkamus filtrus.
4. Prijunkite aušinimo skysčio tiekimo sistemą prie mašiną.

5.13.2 Pildymas

1. Pildykite aušinimo grandinę aušinimo skysčiu tol, kol oras bus visiškai išstumtas iš aušinimo grandinės. Naudokite tik nurodytos sudėties ir kokybės aušinimo skystį.
2. Atlikite slėgio patikrinimą, kad įsitikintumėte, jos aušinimo skysčio jungtys nepraleidžia vandens. Negalima viršyti maksimalaus slėgio. Maksimalus leidžiamas slėgis yra nurodytas brėžinio su matmenimis tekste.

5.14 Rotoriaus įžeminimo šepetėlių montavimas

Pastaba

Standartinėje konstrukcijoje rotoriaus velenas neįžemintas. Projektuodami visą sistemą patikrinkite, ar velenas įžemintas naudojant varomąją apkrovą.



PERSPĖJIMAS

Prieš montuodami įžeminimo šepetėlius, nuo šepetėlio laikiklio ir kontaktinio paviršiaus pašalinkite apsaugą nuo korozijos (tepalą, vazeliną).



ĮSPĖJIMAS

Veleno įžeminimo defektas

Netinkamai veikiant veleno įžeminimui, gali būti aukšta veleno įtampa, kuri, mechanizmui sustojus, mažėja nepakankamai greitai. Dėl elektros smūgio gali ištikti mirtis arba galima patirti rimtų sužalojimų, taip pat dėl guoliu tekančios srovės gali būti pažeistas guolis.

- Reguliariai tikrinkite veleno įžeminimą ir užtikrinkite jį iki kitos techninės priežiūros procedūros. Laikykitės šių naudojimo instrukcijų.

Naudojant įžeminimo šepetėlius, įtampa tarp guolio bei veleno apribojama iki kontaktinės įžeminimo įtampos. Įžeminimo šepetėliai montuojami neizoliuoto guolio DE gale.

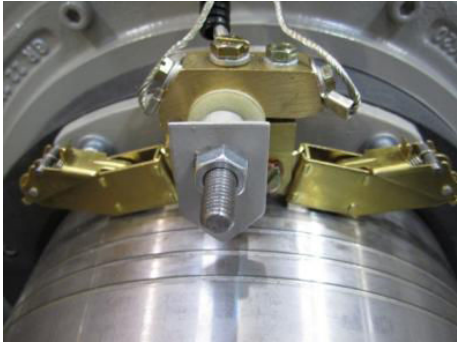
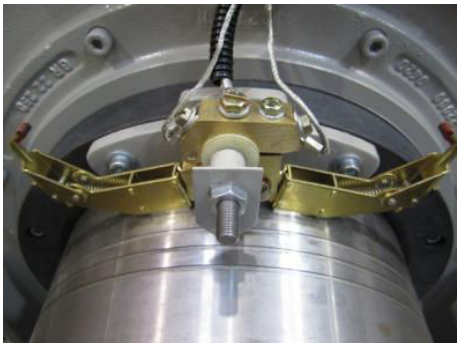
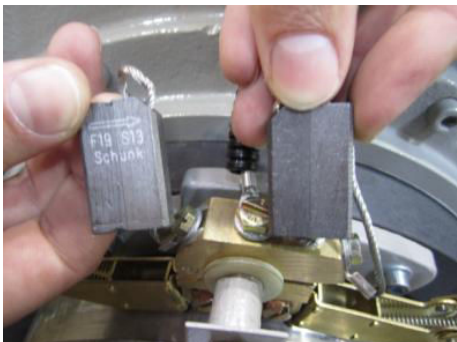
Šepetėliai užstumiami ant veleno ir elektriniu būdu prijungiami prie guolio / guolio įdėklo. Įžeminimo šepetėliai sujungiami ir supakuojami apsauginiame maišelyje transportavimo ir sandėliavimo metu. Prieš pirmąjį paleidimą arba eksploatavimą įžeminimo šepetėliai turi būti surinkti pagal toliau nurodytą procedūrą.

Pastaba

Techninės priežiūros intervalai

Techninės priežiūros intervalai turėtų būti pritaikyti, kad atitiktų šepetėlių nusidėvėjimą, kuris kinta pagal naudojimo sąlygas. Techninės priežiūros intervalo ir tikrinamų vietų ieškokite skyriuje "Techninė priežiūra" (puslapyje 81).

Įžeminimo šepetėlių montavimo procedūra

Mechanizmo pristatymas – šepetėliai yra supakuoti	
Suveržimo įtaisų pradinė padėtis	
Sulenkite suveržimo įtaisus	
Išpakuokite šepetėlius ir įstatykite juos į laikiklius  PERSPĖJIMAS Visada laikykitės sukimosi krypties. Ant kiekvieno šepetėlio yra rodyklė. Ši rodyklė turi atitikti mechanizmo sukimosi kryptį.	 

Paslėpkite suveržimo įtaisus. Įtaisai prispaudžia šepetėlius prie veleno	
Galutinė veleno įžeminimo padėtis	

pav. 5-13 Įžeminimo šepetėlių montavimas

5.15 Montavimo darbų užbaigimas

Pastaba

Sutvarkykite mechanizmą

Baigę montavimo darbus, pašalinkite visus objektus, pavyzdžiui, įrankius, šluostes, nešvarumų likučius, drėgmės nuosėdas ir pan., iš mechanizmo.

1. Uždarykite visus darbo ir gnybtų dėžės dangčius.
2. Pašalinkite visus įrankius ir priemones. Liepkite darbuotojams pasitraukti nuo mechanizmo.
3. Nuvalykite mechanizmą ir pašalinkite visus nešvarumus, kurie galėjo susikaupti montavimo darbų metu.
4. Įsitikinkite, kad visos atviros besisukančios dalys apsaugotos nuo darbuotojų prisilietimo.
5. Įsitikinkite, kad ant mechanizmo arba jo besisukančiuose elementuose nėra jokių atsilaisvinusių dalių. Stebėkite visus kryptinius sprausčius, kurie gali būti laisvajame veleno gale.
6. Įsitikinkite, kad prijungtos visos įžeminimo jungtys (ekvipotencialusis sujungimas).

Visus atliktus montavimo darbus užsirašykite į registracijos žurnalą.

6 Elektrinis sujungimas

6.1 Statoriaus apvijų izoliacijos varžos tikrinimas

Besisukančio mechanizmo apvijų izoliacijos varža yra naudojamos izoliacinės medžiagos rūšies ir būsenos funkcija bei jų taikymo metodas. Gera izoliacijos būseną užtikrina saugų ir patikimą mechanizmo veikimą.

- Statoriaus ir rotorius apvijų izoliacijos varža turi būti išmatuota prieš pirmąjį mechanizmo paleidimą, po ilgo nenaudojimo ir atliekant bendruosius techninės priežiūros darbus.
- Izoliacijos varža suteikia informacijos apie elektrinio mechanizmo izoliacijos būseną. Izoliacijos varžą gali paveikti drėgmė, susidariusi izoliacijoje ar ant jos, arba apvijoje susikaupę nešvarumai.
- Per mažą izoliacijos varžą gali nurodyti drėgmė, susidariusi izoliacijoje ar ant jos, arba apvijoje susikaupę nešvarumai.
- Šiuo atveju mechanizmą reikia išdžiovinti arba išvalyti prieš atliekant dielektrinius bandymus arba prieš pastatant mechanizmą.
- Tikrinimo procedūra turėtų atitikti IEEE stand. 43-2000 "Praktinės rekomendacijos rotacinių mašinų izoliacijos varžai patikrinti", žr. skyrių "Statoriaus apvijų izoliacijos tikrinimas" (puslapyje 54).



PERSPĖJIMASv

Matavimus turėtų atlikti tik kvalifikuoti darbuotojai besilaikantys saugos priemonių!



PERSPĖJIMAS

Jei išmatuotos vertės per žemos, apvija reikia išdžiovinti – žr. skyrių "Apvijų džiovinimas(puslapyje 61)

6.1.1 Statoriaus apvijos izoliacijos tikrinimas

Izoliacijos varža matuojama naudojant atitinkamą izoliacijos varžos matuoklį (pvz., "Megger MIT410").

Tikrinimo įtampa: žr. lent. 6-1 (puslapyje 54)

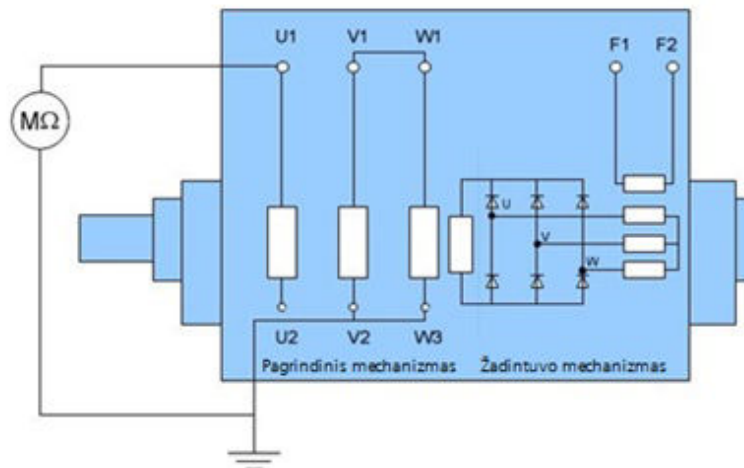
Tikrinimo trukmė: 1 minutė

Tikrinimo sąlygos:

- Visi elektros energijos tiekimo kabeliai atjungti
- 1 – poliaus įtampos transformatoriai atjungti
- Žaibolaidžiai ir kondensatoriai atjungti
- Visi laidai, skirti varžiniams termometrams (RTD), termoporoms arba kitiems stebėjimo prietaisams, įrengtiems ritėse arba apvijoje, turi būti sujungti kartu bei įžeminti kaip ir papildomos apvijos, jei tokių yra.
- Mechanizmo rėmas ir statoriaus apvijos, kurios netikrinamos, turi būti įžemintos.
- Apvijos temperatūra užrašoma

Izoliacijos varžos matavimas paprastai atliekamas gnybtų dėžėje. Visos apvijos kaip grupė paprastai matuojamos tuo pačiu metu. Izoliacijos varžos matuoklis prijungiamas prie tikrinamo mechanizmo apvijos ir jo rėmo. Fazės sujungiamos su generatoriaus neutraliuoju tašku.

Po 1 minutės užrašoma izoliacijos varžos vertė.



pav. 6-1 Vienos apvijos fazės izoliacijos varžos matavimas

lent. 6-1 Apvijų ir priedų matavimo įtampa

Vardinė įtampa	Un ≤1000 V	Un ≥1000 V
	Matavimo įtampa NS	
Statoriaus apvija	500 V	1000 V *
Rotoriaus apvija	500 V *	
Apvijos temperatūros jutikliai	500 V	
Patalpų šildytuvai	500 V	
Kiti priedai (pvz., oro ir guolio temperatūros jutikliai, PMG, ...)	100 V	
Izoliuoti guoliai	100 V	

*) Pagal kliento reikalavimus arba kitas taisykles aukštos įtampos mechanizmo statoriaus ir rotoriaus apvijos gali būti tikrinamos su aukštesne įtampa. Ši įtampa negali viršyti vardinės mechanizmo įtampos.

6.1.2 Izoliacijos varžos minimalios vertės

Paprastai naujų mechanizmų su sausomis apvijomis izoliacijos varža yra labai didelė ir žymiai viršija minimalias vertes. Izoliacijos varžą veikia mechanizmo amžius ir naudojimas.

Pakilus oro drėgmei arba temperatūrai, gali būti išmatuota mažesnė izoliacijos varža.

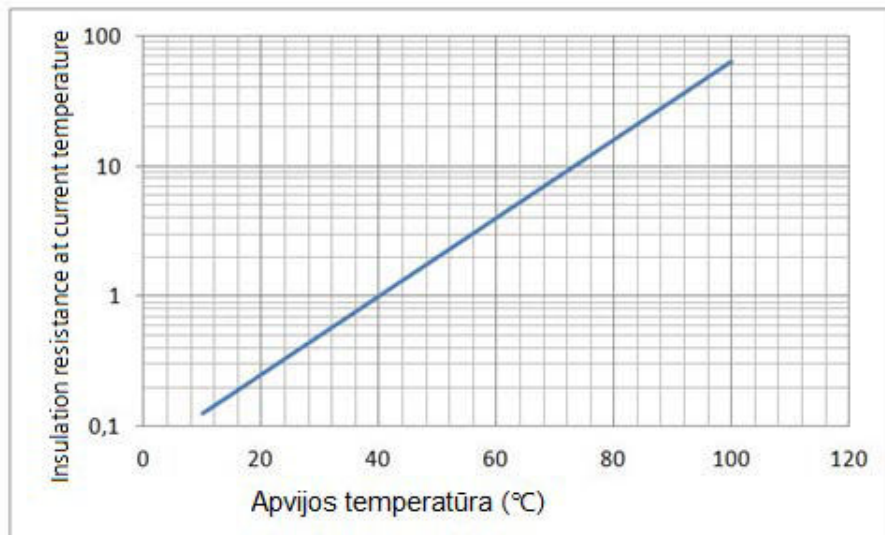
Toliau pateikti skaičiai turėtų būti laikomi orientaciniais.

lent. 6-2 Izoliacijos varžos minimali vertė

Nauji mechanizmai (išbandyti gamykloje)	Riso1min/ 40°C	> 1000 MΩ
Mechanizmas darbo vietoje	Riso1min/ 40°C	> 100 MΩ
Naudojamas mechanizmas	Riso1min/ 40°C	> 100 MΩ

6.1.3 Izoliacijos varžos temperatūros korekcija

Izoliacijos varžos vertė paprastai nustatyta 40 °C temperatūrai. Faktinė matavimo vertė turėtų būti paversta į 40 °C temperatūrą naudojant šią diagramą:



R = izoliacijos varža esant dabartinei temperatūrai

R40 = izoliacijos varža 40 °C nuorodinei temperatūrai

$R_{40} = K_t \times R$

pav. 6-2 Izoliacijos varžos temperatūros korekcija

6.1.4 Rotoriaus ir žadintuvo statoriaus apvijos izoliacijos varžos matavimas

Izoliacijos varža matuojama naudojant atitinkamą izoliacijos varžos matuoklį (pvz., "Megger MIT410").

Tikrinimo įtampa: žr. lent. 6-1 (puslapyje 54)
Tikrinimo trukmė: 1 minutė

Tikrinimo sąlygos:

- Visi diodai yra prijungti
- Pagrindinė žadinimo apvija sujungta su bekontakčio žadintuvo 3 fazių KS apvija
- Mechanizmo statorius ir statoriaus apvijos, kurios netikrinamos, turi būti įžemintos
- Apvijos temperatūra užrašoma

6.1.5 Izoliacijos varžos minimalios vertės

Toliau pateikti skaičiai turėtų būti laikomi orientaciniais.

Rotorius (pagr. + žadintuvas)	Riso1min/ 40°C	> $U_{2n}(kV)+1M\Omega$
Žadintuvo statorius	Riso1min/ 40°C	> 100 MΩ



PERSPĖJIMAS

Po patikrinimo trumpojo jungimo grandinės laidai turi būti pašalinti nuo puslaidininkių!

6.2 Guolio izoliacijos matavimas

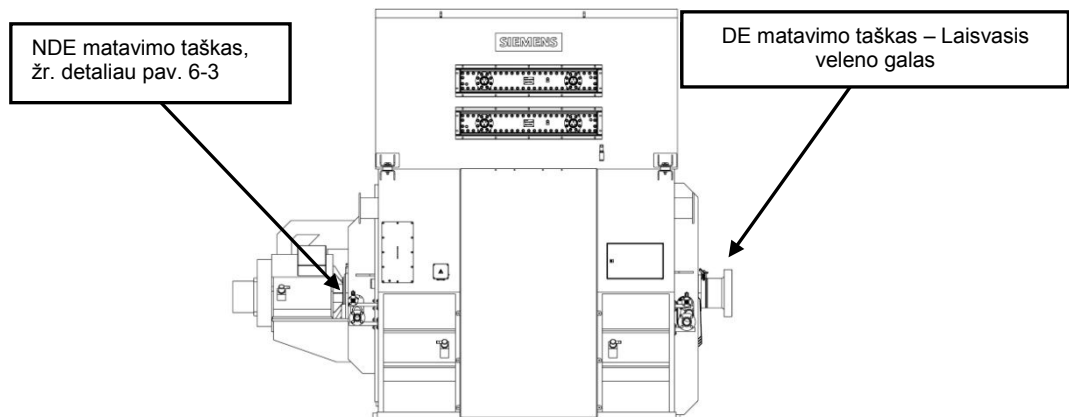
Matuodami guolio izoliaciją, išvengiate guolio bei panaudotos alyvos sukeltų pažeidimų.

Abu guoliai yra izoliuoti. DE guolio izoliacija prijungta prie generatoriaus rėmo. Guolio izoliacija matuojama ant mechanizmo veleno, atremto į žemę.

Guolio izoliacijos jungiamieji laidai prijungti prie gnybtų dėžių, kurios yra dešinėje pusėje, šalia guolio (atsuktos į kiekvieną guolį).

Matavimo taškai:

DE pusė	Laisvasis veleno galas
NDE pusė	Anga gaubte tarp NDE guolio ir PMG korpuso. Kaištis su šešiakampiu antgaliu pažymėtas etikete. Nuimkite veržlę naudodami šešiakampį veržliaraktį..



pav. 6-3 Matavimo taškas NDE pusėje

Matavimo sąlygos

Prieš matuojant ir siekiant tinkamai įvertinti guolio būseną, reikia atlikti toliau nurodytus veiksmus:

- Jungtis nesumontuota
- Įžeminimo šepetėliai DE pusėje turi būti nuimti nuo laikiklių
- Guolio izoliacijos jungiamieji laidai atjungti, žr. skyrių "Jungės atjungimas" (puslapyje 58).

6.2.1 Jungės atjungimas

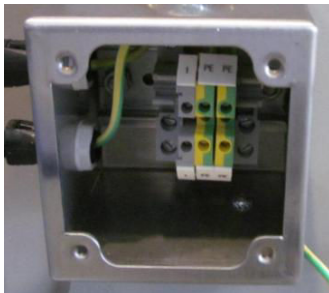
Abejoms gnybtų dėžėms taikoma tokia pati laidų atjungimo procedūra.



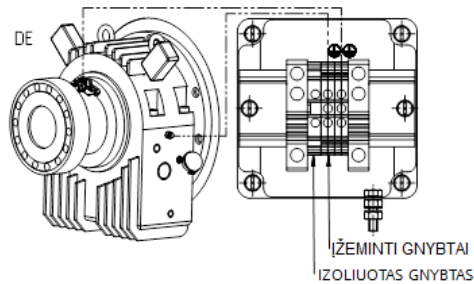
ĮSPĖJIMAS

Įsidėmėkite, kad abiejų guolių jungiamasis laidas prijungtas prie skirtingų gnybtų.
Žr. aprašymą pav. 6-5 ir pav. 6-7.

- Atidarykite gnybtų dėžės dangtį atsukdami varžtą
- Atjunkite jungiamąjį laidą, žr. schemą pav. 6-5 ir pav. 6-7



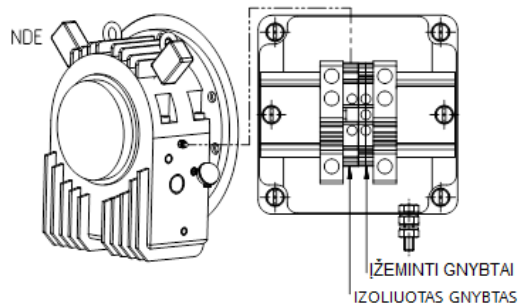
pav. 6-4 DE gnybtų



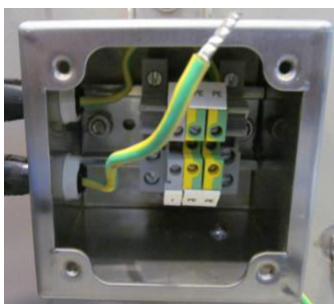
pav. 6-5 DE gnybtų dėžės jungimo schema



pav. 6-6 NDE gnybtų dėžė



pav. 6-7 NDE gnybtų dėžės jungimo schema



pav. 6-8 Atjungtas laidas

6.2.2 Guolio izoliacijos matavimo procedūra

PRANEŠIMAS

Prieš atliekant guolių izoliacijos matavimą būtina peržiūrėti skyrių "Matavimo sąlygos" (57 psl.) ir atlikti veiksmą "Jungės atjungimas" (58 psl.).

Matuokite izoliaciją naudodami 100 V visos skalės prietaisą (pavyzdžiui, MIT410). Kai aplinkos temperatūra pakankama, išmatuokite guolio izoliacijos varžą; temperatūra turėtų būti tarp 20–30 °C.

Rekomenduojama matavimo trukmė yra 1 minutė (kad išmatuotoji varžos vertė nebesikeistų).

Matuokite guolio izoliacijos varžą naudodami 100 V NS matavimo įtampą.

Pastaba

Prieš pradėdami matuoti izoliacijos varžą, perskaitykite naudojamo izoliacijos varžos matuoklio vadovą.



pav. 6-9 Guolio izoliacijos matavimo pavyzdys

Palyginkite išmatuotąsias vertes su toliau pateiktoje lentelėje pateiktomis vertėmis.

lent. 6-3 Reikiamos izoliacijos vertės

Varža (priklausomai nuo temp.)	Minimali reikiama vertė
$R_{20^{\circ}\text{C}}$	$\geq 10 \text{ k}\Omega$
$R_{40^{\circ}\text{C}}$	$\geq 2,5 \text{ k}\Omega$

PRANEŠIMAS

Įprastas varžos intervalas naujam mechanizmui yra apie 1 M Ω – 1 G Ω .

Jei varžos vertės mažesnės negu reikalaujamos vertės, kreipkitės į "Siemens" techninės priežiūros centrą (skyrius "Techninė priežiūra ir pagalba") (97 psl.).

6.2.3 Guolio izoliacijos matavimo užbaigimas

- Išmatavę guolio izoliaciją, prijunkite jungiamuosius laidus ir uždarykite gnybtų dėžių dangčius.
- NDE matavimo vietoje įstatykite kaištį

6.3 Džiovinimas, valymas, gedimų sekimas

Jei nepasiekiamos aukščiau minėtos minimalios izoliacijos varžos vertės, priežastis gali būti drėgmė, užteršimas arba izoliacijos pažeidimas.

Būtina išdžiovinti statoriaus apviją, jei

- išorinė drėgmė, užteršimas arba pažeidimas yra žemesnės nei minimali izoliacijos varžos vertės priežastis;
- išorinė drėgmė pastebima ant apvijos paviršiaus, nepriklausomai nuo to, ar pasiekta minimali izoliacijos vertė;
- pašalinus nuosėdas arba nešvarumus, minimali izoliacijos varža vis tiek nepasiekama;
- nevisiškai suketėjusios dervos arba lakai yra laikomi žemos izoliacijos varžos vertės priežastimi suremontuoto mechanizmo atveju.

6.3.1 Apvijų džiovinimas

Apvijų džiovinimui reikalinga šiluma gali būti tiekama toliau nurodytais būdais.

- Iš išorinių maitinimo šaltinių tiekiant srovę, siekiant sukurti apvijų šiluminių nuostolių, pvz., naudojant variklio generatoriaus apvijų rinkinius arba kintamą didelio stiprio srovės lygintuvą (srovės vertė atitinka 50–70 % nominaliosios srovės vertės).
- Nukreipiant šiltą orą į apviją, suformavus tinkamą uždangą iš brezentų, medienos plokščių ir pan.

Reikia pasirūpinti, kad oras galėtų cirkuliuoti, kad išsklaidytų drėgmę. Vykstant džiovinimo procesui apvijų temperatūra turi siekti apie 60 °C. Tačiau ši pastovios temperatūros būklė pasiekama tik džiovinant maždaug keturias valandas. Iš pradžių apvijomis tekanti srovė nestipri ir įeinančio šilto oro kiekis nedidelis, bet kylant temperatūrai srovė turi stiprėti ir kiekis didėti arba jie turi būti sureguliuojami taip, kad atitiktų šią pastovios temperatūros būklę.

Išmatuokite temperatūrą naudodami į apvijų lizdus įmontuotus varžos temperatūros termometrus. Rotoriaus apvija paprastai pakankamai sušyla nuo aplinkos oro, kai statoriumi tekanti srovė sušildo statorių.

Vykstant džiovinimo procesui kas valandą pasukite rotorį apie 90°.

Praėjus 4 valandoms nuo džiovinimo proceso pradžios, patikrinkite izoliacijos būklę (žr. skyrių "Statoriaus apvijų izoliacijos varžos tikrinimas") (53 psl.).

Norėdami sužinoti, kaip išdžiovinti apvijas arba išspręsti kilusias problemas, kreipkitės į techninės priežiūros centrą (97 psl.).

Jei norite džiovinti šiltu oru, atlikite toliau nurodytus veiksmus.

- Šildytuvai turi būti išdėstyti taip, kad naudojant tinkamus dangčius šildoma apvija būtų karšto oro sraute ir kad nesusidarytų toks karštis, jog būtų pasiekta per didelė temperatūra. Tam reikia, kad vyktų nuolatinė cirkuliacija ir oro kaita.
- Mechanizmo NDE ir DE pusėje yra šilto oro įleidimo ir išleidimo angos.
- Nuimkite angų dangčius ir uždėkite ant mechanizmo DE pusėje esančios išorinio šildymo įleidimo angos.
- Įleidžiamo oro temperatūra neturi būti aukštesnė negu 60 °C, o išleidžiamo oro temperatūra turi būti mažiausiai 10 K aukštesnė už aplinkos temperatūrą.
- Neleiskite, kad mechanizmo oro temperatūra nukristų žemiau rasos taško, t. y. ties išleidimo anga neturi formuotis kondensacijos drėgmė.
- Pasirinkus šį džiovinimo būdą būtinas nuolatinis stebėjimas, kadangi kyla gaisro pavojus.
- Taip pat laikykitės pirmiau išvardytų bendrųjų taisyklių.

Pastaba

Antikondensacinis šildymas (Antikondensacinis šildytuvas)

Atkreipkite dėmesį į tai, kad antikondensacinis šildymas neskirtas apvijoms džiovinti ir turi būti naudojamas norint išvengti kondensacijos.

6.4 Įžeminimo prijungimas

Mechanizmo įžeminimas

Prijunkite mechanizmą prie įžeminimo sistemos, naudojamos montavimo vietoje.

Kruopščiai laikykitės nacionalinių ir jūsų sektoriaus taisyklių bei standartų, taikomų montavimo vietoje.

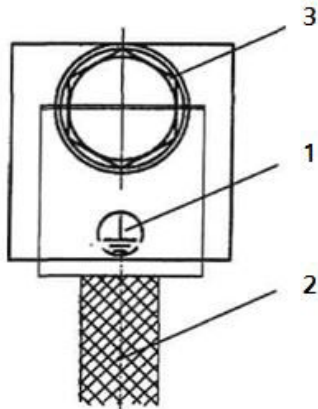
Įžeminkite mechanizmą naudodami įžeminimo gnybtus, esančius ant mechanizmo korpuso arba gnybtų dėžutėse. Taip išvengsite žalos dėl trumpojo jungimo srovių.

Kiekvienas įžeminimo gnybtas pažymėtas įžeminimo simboliu.

Įžeminimo gnybtų vieta parodyta mechanizmo matmenų brėžinyje.

Prijunkite įžeminimo laidininkus taip, kad būtų sudaryta tinkama elektros jungtis.

Gamintojas rekomenduoja prijungti taip, kaip parodyta pav. 6-10.



1	Įžeminimo gnybtas
2	Jungtis prie mechanizmo įžeminimo (įžeminimo laidininkas su kabelio antgaliu)
3	Tvirtinimo elementai:
	Šešiakampis varžtas M16 x 25, ISO 4017, 8.8-A3A
	Spyruoklinė poveržlė A16, DIN 128
	Paprasta poveržlė ¹⁾

¹⁾ Pasirinkę paprastą poveržlę, atkreipkite dėmesį į kabelio antgalio kontaktinio paviršiaus dydį. Paprasta poveržlė turi visiškai uždengti paviršių.

pav. 6-10 Įžeminimo prijungimas

Įžeminimo laidininkas turi užtikrinti gera kontaktą, todėl:

- ant kontakto paviršiaus neturėtų būti jokių nelygumų;
- kontakto paviršius turėtų būti šviesus (t. y. paviršius turėtų būti nuvalytas švariu, vidutinės kokybės plieno vielos šepetėiu;
- kontakto paviršius turėtų būti suteptas savo sudėtyje rūgšties neturinčiu vazelinu;
- spyruoklinė poveržlė turėtų būti nepriekaištingos būklės;
- šešiakampis varžtas turėtų būti priveržtas nurodytu sukimo momentu (žr. lent. A- 1).

Prijungimo prie įžeminimo skerspjuvio pasirinkimas

Rinkdamiesi jungiamuosius kabelius mechanizmui įžeminti įsitikinkite, kad laikomasi nacionalinių ir (arba) jūsų sektoriui taikomų taisyklių.

Minimalių įžeminimo laidininko skerspjuvių pavyzdžiai priklausomai nuo skirtingų maitinimo laidininko skerspjuvių kiekviename prijungimo gnybte išvardyti lent. 6-4.

lent. 6-4 Įžeminimo laidininko minimalus skerspjuvis

Elektrinio laidininko skerspjuvis mm ²	185	240	300	400
Minimalus įžeminimo laidininko skerspjuvis mm ² pagal VDE 0530, 1 d.	95	120	150	185
Kabelio antgalio dydis ¹⁾ pagal DIN 46235	16 – 95	16 – 120	16 – 150	16 – 185

¹⁾ Dydis = gnybto varžto skersmuo - laidininko skerspjuvis

6.5 Maitinimo prijungimas

Toliau pateikti mechanizmo prijungimo duomenys yra apibrėžti šio mechanizmo techniniuose duomenyse:

- Sukimosi kryptis
- Gnybtų dėžučių skaičius ir išdėstymas
- Statoriaus apvijos grandinė ir jungtis

Mechanizmo sukimosi kryptis

Mechanizmo sukimosi kryptis parodyta mechanizmo matmenų brėžinyje arba nurodyta matmenų brėžinio tekste. Sukimosi kryptis rodykle pažymėta ant mechanizmo ir vardinių parametrų lentelėje. Reikiamą gnybtų priskyrimą žr. matmenų brėžinio tekste.

PRANEŠIMAS

Mechanizmo sugadinimas dėl netinkamos sukimosi krypties

Šis mechanizmas suprojektuotas sukis viena konkrečia kryptimi. Jei naudosite mechanizmą netinkama sukimosi kryptimi, kyla pavojus jį sugadinti.

Vadovaukitės sukimosi krypties duomenimis, pateiktais matmenų brėžinio tekste.

Pagrindinės gnybtų dėžutės montavimas

Pagrindinė gnybtų dėžė (PGD) pristatoma atskirai nuo generatoriaus. Montuokite pagrindinę gnybtų dėžutę, kai baigsite visus generatoriaus montavimo darbus. PGD vieta parodyta mechanizmo matmenų brėžinyje.

Prijunkite statoriaus laidus prie išorinės pagrindinės gnybtų dėžutės.

Norėdami prijungti tinkamai, perskaitykite PGD gamintojo pateiktus dokumentus ir vadovaukitės šio vadovo instrukcijomis.

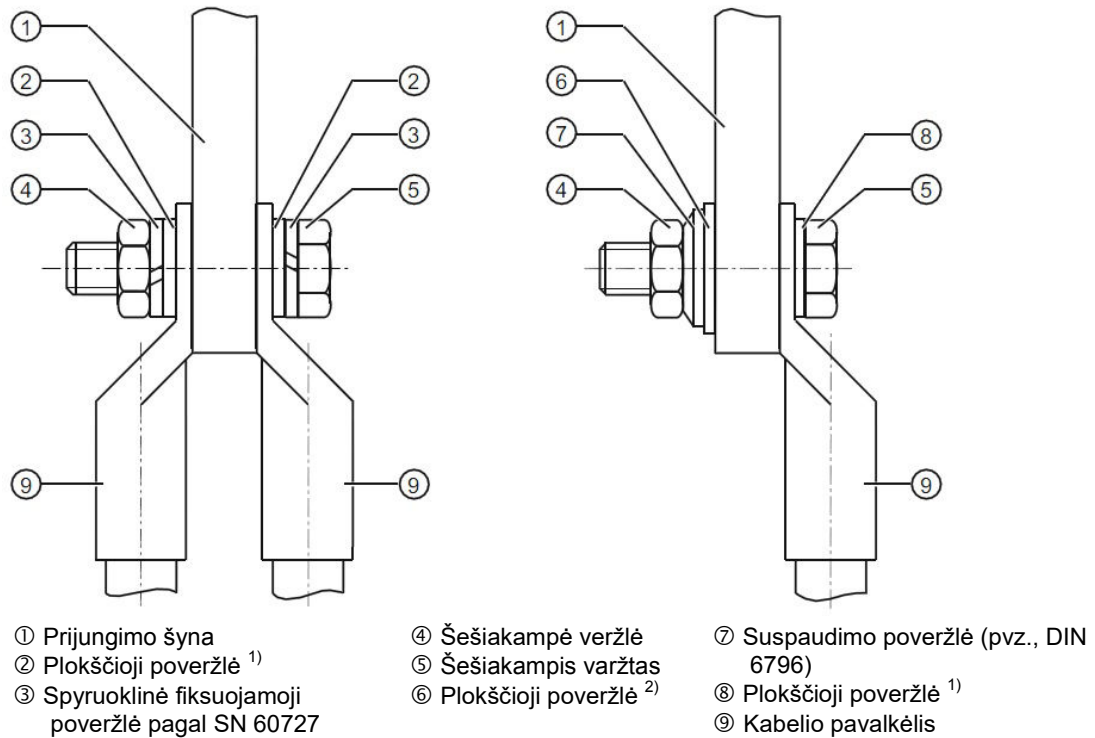
PRANEŠIMAS

Prijungimo taškuose venkite tempimo ir gniuždymo jėgų

Kabelius tieskite taip, kad prijungimo taškų neveiktų tempimo ir gniuždymo jėgos. Įsitikinkite, kad kabelių šiluminis plėtimasis nesukels papildomų tempimo ir gniuždymo jėgų prijungimo taškuose. Priešingu atveju kyla pavojus, kad prijungimo taškai bus sugadinti.

Elektros kabelių prijungimas

Gamintojas rekomenduoja prijungti taip, kaip parodyta toliau.



¹⁾ Rinkdamiesi plokščiąją poveržlę patikrinkite kabelio pavalkėlio kontaktinio paviršiaus dydį. Plokščioji poveržlė turi už dengti visą paviršių.

²⁾ Plokščiosios poveržlės išorinis skersmuo turi būti didesnis nei spyruoklinės poveržlės (maždaug 2,5 x vardinis varžto skersmuo). Spyruoklinė poveržlė turi tiesiogiai liesti prijungimo šynos.

pav. 6-11 Statoriaus gnybto schema

- Varžtus ir veržles reikia priveržti dinamometrinio veržliarakčiu. Priveržiama dviem veržliarakčiais.
- Jungčių su kabelių pavalkėliais priveržimo momento vertės nurodytos lent. A- 1.
- Jungtys kabelių apvalkalams įžeminti yra gnybtų dėžutėje.
- Jungtys ir galų sandarinimas turi atitikti vietines taisykles.

Tarpų ir paviršinio nuotėkio atstumų išlaikymas

Pastaba

Tarpai ir paviršinio nuotėkio atstumai

Montuodami jungtis išlaikykite būtinus tarpus ir paviršinio nuotėkio atstumus. Vadovaukitės taisyklėmis, taikomomis montavimo vietoje. Atidžiai tikrinkite naujai sumontuotas laidžias dalis, pvz., varžtus arba išlindusius kabelių galus.

Jei nėra kitų vietinių ar konkrečiam sektoriui taikomų reikalavimų, patikrinkite, ar tarpai ir paviršinio nuotėkio atstumai išlaikyti, vadovaudamiesi toliau pateiktomis vertėmis.

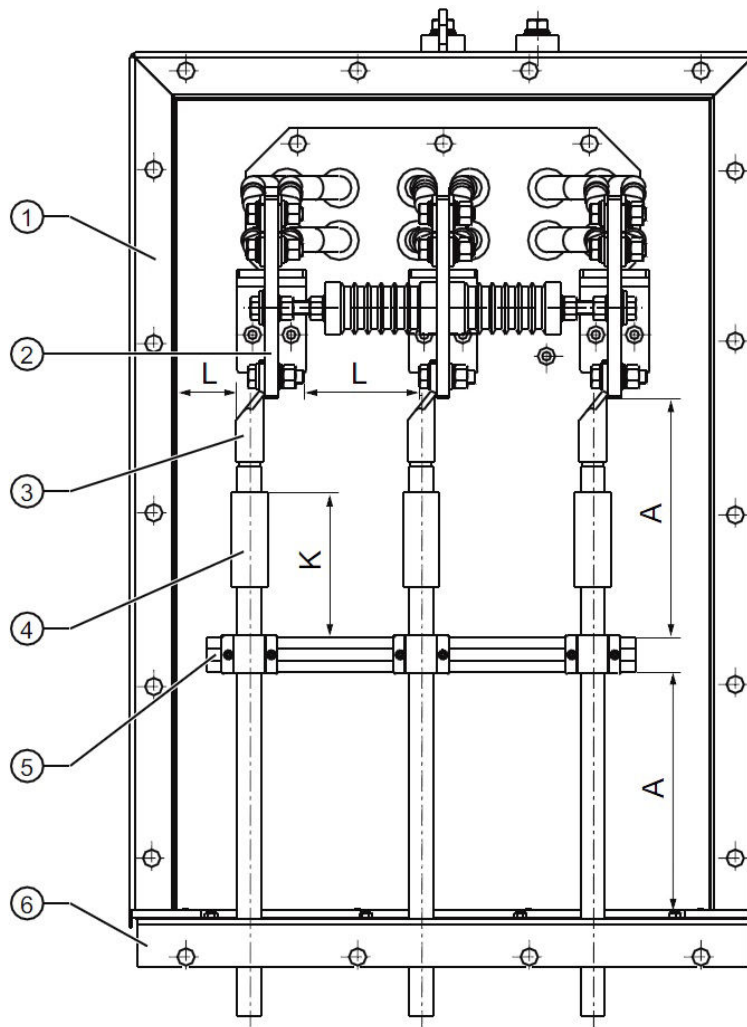
lent. 6-5 Tarpai ir paviršinio nuotėkio atstumai

Vardinė įtampa	Gnybto bandymo įtampa IEC60034-1	Paviršinio nuotėkio atstumas	Tarpas
UST [kV]	UP [kV]	K [mm]	L [mm]
≤ 0.6	3.3	30	15
≤ 1.1	4.8	35	20
≤ 2.3	8.4	50	35
≤ 3.3	11.4	75	40
≤ 4.4	14.7	85	50
≤ 5.5	18.0	95	55
≤ 6.6	21.3	110	65
≤ 8.0	25.5	130	80
≤ 9.0	28.5	145	90
≤ 10.0	31.5	160	100
≤ 11.0	34.5	175	110
≤ 12.5	39.0	195	125
≤ 13.8	42.9	215	140
≤ 15.0	46.5	230	150
≤ 16.5	51.0	250	165
≤ 18.0	55.5	270	180
≤ 20.0	61.5	300	200
≤ 22.0	67.5	330	220
≤ 25.0	76.5	370	250

Minimalios tarpų, paviršinio nuotėkio atstumų ir atskyrimo atstumų vertės

Tarpas L	Mažiausias atstumas oru tarp dviejų laidžių neizoliuotų skirtingo potencialo dalių.
Paviršinio nuotėkio atstumas K	Mažiausias atstumas izoliuotos dalies paviršiumi tarp dviejų laidžių neizoliuotų skirtingo potencialo dalių.

Vadovaukitės kabelių gamintojo pateikta informacija apie būtinus atstumus tarp dviejų izoliuotų komponentų arba tarp izoliuotos ir neizoliuotos metalinės dalies, kuria teka srovė.



- A Tarpas tarp maitinimo prijungimo strypo ir skersinės sąvaržos arba tarpas tarp skersinės sąvaržos ir kabelių įvedimo plokštės
 K Paviršinio nuotėkio atstumas $\geq L$, taikomas tik montuojant kabelių skersinę sąvaržą
 L Tarpas
 ① Gnybtų dėžutė
 ② Gnybtų strypas
 ③ Kabelio pavalkėlis
 ④ Kabelis su sandarinimo galu
 ⑤ Kabelio skersinė sąvarža, žr. pirmiau pateiktą schemą
 ⑥ Kabelių įvedimo plokštė

pav. 6-12 Tarpai ir paviršinio nuotėkio atstumai, schematiškai parodyti naudojant kabelio pavalkėlio jungtį kaip pavyzdį

Kabelių sandarinimo galų nustatymas

Jei naudojate kabelių sandarinimo galus (galines movas), išlaikykite reikiamus oro ir paviršinio nuotėkio atstumus bei vadovaukitės sandarinimo galų (galinių movų) gamybos taisyklėmis.

Pastaba

Sandarinimo galų nustatymas

Montavimo vietoje išlaikykite sąlygas, reikalingas sandarinimo galų prijungimui ir nustatymui.

Gnybtų dėžutės uždarymas

1. Prieš uždarydami gnybtų dėžutę patikrinkite, ar:
 - Srieginės elektros jungtys sumontuotos tinkamai.
 - Sandarinimo ir slėgio mažinimo membranos yra sveikos ir tinkamai užsandarintos.
 - Gnybtų dėžutės vidus yra švarus ir joje neliko nukirptų laidų galiukų.
 - Laikomasi minimalių oro tarpų, nurodytų montavimo vietoje taikomose taisyklėse.
Atkreipkite dėmesį į visus išlindusius varžtų ir laidų galus.
 - Nenaudojami kabelių įvadai uždaryti, o jų dangteliai tinkamai prisukti.
2. Uždarykite gnybtų dėžutę.
3. Tarp gnybtų dėžutės ir dangčio pritvirtinkite įžeminimo juostelę.

6.6 Pagalbinių grandinių prijungimas

Pagalbinių grandinių gnybtų dėžutės

Gamykloje sumontuoti maitinimo ir stebėjimo įrangos kabeliai mechanizmo viduje yra nutiesti į atskiras gnybtų dėžutes su gnybtų plokštelėmis, prie kurių jie prijungti. Pagalbinių gnybtų dėžučių skaičius ir vieta nurodyti mechanizmo matmenų brėžinyje ir matmenų brėžinio tekste. Gnybtų priskyrimą žr. pagalbinių gnybtų schemoje.

Kabelių įvedimo plokštės gręžimas

Jei gnybtų dėžutės pristatomos su nepragręžta kabelių įvedimo plokšte, pragręžkite reikiamas kabelių įvedimo angas riebokšlių plokštėje.

Kabelių įvedimas

Pastaba

Pasirinkus standartinę konfigūraciją, gnybtų dėžutės pristatomos be kabelių įvadų.

Kabeliams įvesti pateikiami kabelių riebokšliai. Išoriniai kabelių skersmenys, tinkami konkrečioms vardiniam riebokšlių dydžiams, nurodyti toliau pateiktoje lentelėje.

lent. 6-6 Kabelių išoriniai skersmenys ir kabelių riebokšliai

Vardinis dydis	Tinkamas kabelio skersmuo	
	nuo	iki
M20 x 1,5	6 mm	12 mm
M25 x 1,5	9 mm	16 mm
M32 x 1,5	16 mm	20 mm
M40 x 1,5	19 mm	28 mm
M50 x 1,5	26 mm	35 mm

Kabelių įvedimo plokštės gręžimas

Antikondensacinės šildymo sistemos paskirtis – užtikrinti, kad aktyvūs mechanizmo komponentai visada būtų šiltesni už aplinką. Tai apsaugo nuo kondensacijos. Reikalinga šildymo galia buvo nustatyta projektuojant elektrinį mechanizmą. Galios ir maitinimo įtampos vardinius parametrus žr. matmenų brėžinio tekste.

1. Prieš pradėdami naudoti antikondensacinę šildymo sistemą įsitikinkite, kad iš mechanizmo buvo išimti visi pakavimo elementai.
2. Prijunkite antikondensacinę šildymo sistemą, kaip nurodyta matmenų brėžinio tekste / pagalbinių gnybtų schemoje. Įsitikinkite, kad montavimo vietoje yra reikiamas įžeminimas. Trijų fazių maitinimo sistemos valdymo pusėje taip pat turi būti elektros jungtis.
3. Įsitikinkite, kad antikondensacinio šildymo neįmanoma įjungti, kai mechanizmas veikia.
4. Įjunkite antikondensacinį šildymą prieš mechanizmo naudojimo pradžią.

Statoriaus apvijos temperatūros stebėjimo įrangos prijungimas

Statoriaus apvijos šiluminė apkrova stebima naudojant varžinius termometrus, įtaisytus statoriaus apvijoje. Šiluminė perkrova reiškia, kad ilgai laikosi per aukšta temperatūra, galinti sunaikinti apvijos izoliaciją arba pastebimai sumažinti izoliacijos tinkamumo naudoti laiką. Jei apvijos temperatūra pasiekia arba viršija leistiną ribinę temperatūrą temperatūros jutiklio srityje, siunčiamas pasiektą temperatūrą atitinkantis signalas. Naudodamasi šiuo signalu mechanizmo valdymo sistema gali suaktyvinti pavojaus signalą arba išjungti naudojamą mechanizmą.

Temperatūros jutiklių jungiamieji laidai nuvesti į pagalbinių gnybtų dėžutę. Gnybtų perjungimas ir priskyrimas aprašytas pagalbinių gnybtų schemoje. Pagalbinių gnybtų schema taip pat pateikta pagalbinių gnybtų dėžutėje. Termometrų tipas ir kiekis nurodyti matmenų brėžinio tekste.

Jei naudojami ne visi termometrai, užtikrinkite, kad būtų tenkinamos toliau nurodytos sąlygos:

- Turi būti aprėpiamos visos trys fazės: U, V ir W.
- Paskirstymas aplink periferiją turi būti tolygus.

Pastaba

Temperatūros jutiklių negalima pakeisti

Temperatūros jutikliai sumontuoti separatoriuose ir impregnuoti kartu su statoriaus apvija. Todėl sugedusio temperatūros jutiklio pakeisti negalima.

Pastaba

Viso mechanizmo apsauga ne visada yra pakankama

Statoriaus apvijos temperatūros stebėjimo sistema neužtikrina visapusiškos viso mechanizmo apsaugos. Jei apkrova keičiasi greitai, dėl skirtingų laiko konstantų rotorius apvijos dalyse aukšta temperatūra gali būti pasiekta anksčiau nei matavimo taškuose statoriaus apvijoje.

Guolių temperatūros stebėjimo sistemos prijungimas

Temperatūros jutiklių jungiamieji laidai nuvesti į pagalbinių gnybtų dėžutę. Grandinė ir gnybtų priskyrimas parodyti pagalbinių gnybtų schemoje priede „Techniniai duomenys ir brėžiniai“. Pagalbinių gnybtų schema taip pat pateikta pagalbinių gnybtų dėžutėje.

Gnybtų dėžučių uždarymas

Prieš uždarydami gnybtų dėžutę įsitikinkite, kad tenkinamos toliau nurodytos sąlygos.

- Įvedami kabeliai atitinka mechanizmo pusės gnybtų priskyrimą pagal gnybtų schemą.
- Gnybtų dėžutės vidus yra švarus ir joje neliko nukirptų laidų galiukų.
- Nenaudojami kabelių įvadai uždaryti, o jų dangteliai tinkamai prisukti.

7

Eksploatacijos pradžia

Pastaba

Techninės priežiūros centras

Prireikus bet kokių montavimo darbų kreipkitės į techninės priežiūros centrą (97 psl.) arba kvieskite „Siemens“ išmokytus ir atitinkamą užduotį atlikti įgaliotus techninės priežiūros inžinierius.

7.1 Pasirengimas eksploatacijos pradžiai

Prieš pradėdami eksploatuoti mechanizmą patikrinkite, ar tenkinamos toliau nurodytos sąlygos. Paruošiamųjų darbų rezultatus ir perdavimą eksploatuoti registruokite ataskaitoje. Paruoškite atitinkamą ataskaitą.

Pastaba

Toliau pateiktas sąrašas nėra išsamus. Atlikite papildomus tikrinimus ir bandymus, kurie reikalingi atsižvelgiant į konkrečios sistemos situaciją. Dalis tikrinimų gali netikti jūsų mechanizmo konfigūracijai, tokiu atveju ignoruokite juos.

- Mechanizmas tinkamai sumontuotas ir sulygiuotas.
- Mechanizmo viduje ir išorėje nėra jokių didesnių nešvarumų ir palaidų dalių, pvz., varžtų ar atplaišų.
- Įžeminimo ir ekvipotencialiojo sujungimo jungtys yra tinkamos.
- Transportavimo sąvarža nuimta.
- Įžeminimo įtaisas paruoštas naudoti (jei naudojamas).
- Mechanizmo maitinimo kabeliai yra tinkamo skerspjūvio.
- Visi maitinimo kabeliai tinkamai ir išsamiai pažymėti.
- Gnybtų dangteliai ir kabelių sandarinimo galai tinkamai uždėti.
- Maitinimo kabelių elektrinės ir mechaninės jungtys yra tinkamos.
- Izoliacijos varžos minimalios vertės yra pasiektos.
- Mechanizmo sukimosi kryptis tinkama.
- Eksploatacijos sąlygos atitinka duomenis, nurodytus pavadinimo / vardinių parametrų lentelėje.
- Papildomi mechanizmo stebėjimo įtaisai tinkamai prijungti ir tinkamai veikia, o jų trumpojo jungimo grandinė panaikinta.
- Tinkamai konfigūruotas valdiklis ir greičio stebėjimo sistema užtikrina, kad greitis negali būti didesnis, nei nurodyta pavadinimo / vardinių parametrų lentelėje (jei taikoma).
- Įvesties / išvesties elementų nustatymo sąlygos yra tinkamos įvertinus jų tipą.
- Visi tvirtinimo varžtai, jungiamieji elementai ir elektros jungtys priveržtos nurodytu priveržimo momentu.

- Yra visos apsaugos priemonės, neleidžiančios paliesti judančių dalių arba dalių, kuriomis teka srovė.

Pastaba

Papildoma įranga

Patikrinkite, ar papildoma su mechanizmu nepristatoma įranga prijungta tinkamai ir paruošta darbui. Pavyzdžiui, tai gali būti:

- Apgęžikliai
 - Perjungimo įrenginiai
 - Transformatoriai
 - Apsauginiai įtaisai
-

- Dangčiai, neleidžiantys paliesti besisukančių dalių ir dalių, kuriomis teka srovė, turi būti uždaryti.
- Guoliai yra paruošti naudoti ir patepti pagal šiame vadove pateiktas instrukcijas bei guolių gamintojo instrukcijas.
- Savitepiei slydimo guoliai turi atlikti tepimo ciklą prieš pirmąjį mechanizmo įjungimą. Žr. skyrių "Iš anksto sutepkite guolius alyva – jei tepimo įrenginys neveikia" (44 psl.).
- Guolio korpuso izoliacija yra be tiltelio viename gale. Galas, kurio negalima sujungti jungė, nurodytas matmenų brėžinio tekste.
- Laikomasi konkrečių guolių gamintojo pateiktų instrukcijų dėl guolių eksploatacijos pradžios. Guolių gamintojo dokumentai pateikti priede "Papildomi dokumentai".
- Cirkuliuojančios alyvos kiekis yra atskirai nustatytas kiekvienam guoliui vadovaujantis duomenimis, pateiktais matmenų brėžinio tekste arba guolio tipo lentelėje.
- Alyvos tiekimo sistemos vožtuvai yra apsaugoti, ir jų negalima pasiekti bei neapdairiai pajudinti.
- Patikrinkite, ar visos jungtys sandarios ir nėra nuotėkio.
- Aušinimo skysčio tiekimo sistema prijungta ir paruošta darbui.
- Aušinimo skysčio yra, jo kokybė ir kiekis atitinka specifikaciją.
- Oras pašalintas iš aušinimo sistemos.
- Aušinimo skysčio tiekimo vožtuvas atidarytas.

7.2 Prieš įjungiant

Table 7-1 Paruošimas

▼			po pradinio sumontavimo arba apžiūros	
	▼		tikrinti sustabdytiems, bet darbui paruoštiems mechanizmams	
		▼	paleisti pagal techn. priežiūros sąlygas	
			Mechanizmo dalis	Darbai
■	■	■	Visas mechanizmas	Vizuali mechanizmo apžiūra (išorės ir vidaus). Vadovaujantis lent. 9-2 (84 psl.).
■	■		Statorius	Išmatuokite statoriaus apvijos elektrinį atsparumą prie statoriaus šerdies ir rėmo izoliacijos. Išmatuokite izoliacijos varžą, kaip aprašyta "Statoriaus apvijos izoliacijos varžos tikrinimas" (puslapyje 53).
	■		Jungtys	Patikrinkite, ar visos elektros jungtys saugiai pritvirtintos. Apžiūrėkite visas žeminimo jungtis.
■	■	■	Alyvos tiekimo sistema	Ijunkite alyvos tiekimą. Patikrinkite tinkamą veikimą.
■			Stebėjimo įrenginiai	Patikrinkite, ar stebėjimo įrenginiai tinkamai prijungti ir tinkamai veikia. Patikrinkite nuorodines vertes pradiniam kontaktinių paviršių nustatymui (žr. tekstą šalia brėžinio su matmenimis).
■	■		Oro ir vandens aušintuvai	Atidarykite išleidimo vožtuvus. Pildykite vamzdžių sistemą švariu vandeniu tol, kol vanduo ims bėgti per vožtuvus. Uždarykite išleidimo vožtuvus. Apžiūrėkite, ar jungtyse nėra nuotėkio. Atsižvelkite į slėgį techninės priežiūros metu. Laikykite gamintojo naudojimo instrukciją.
■	■	■		Atidarykite vandens tiekimo sistemą prie aušintuvo.
■	■	■	Guoliai	Patikrinkite alyvos pildymo angą.
■				Prieš pirmą kartą paleidžiant mechanizmą, reikia sutepti savitepius alkūninius guolius. Žr. skyrių "Iš anksto sutepkite guolius alyva – jei tepimo įrenginys neveikia" (puslapyje 44).
■			Alyvos tiekimo	Prieš pirmą kartą paleisdami mechanizmą, atidarykite reduktoriaus vožtuvus iki galo.
■				Kai mechanizmas pasiekia vardinį greitį, alyvos srautą reguliuokite tik pagal brėžinio su matmenimis tekstą. Sureguliuavę alyvos srautą, užblokuokite reduktoriaus vožtuvus.
■	■	■	Antikondensacinis šildymas	Įsitikinkite, kad antikondensacinis šildymas išjungtas.

7.3 Jungimas

Table 7-2 Jungimas

▼	po pradinio sumontavimo arba apžiūros	
	▼	paleidimui pagal techn. priežiūros sąlygas
		Darbai
■	■	Leiskite generatoriui veikti lėtai.
■		Palyginkite mechanizmo sukimosi kryptį su nurodytąją matmenų brėžinio tekste arba vardinių parametrų lentelėje. Įsitikinkite, kad mechanizmas sukasi tik leidžiama kryptimi.
■	■	Kurį laiką stebėkite, ar mechanizmas veikia sklandžiai ir tolygiai.. Patikrinkite guolių veikimo sklandumą. Patikrinkite, ar nesigirdi neįprastų garsų. Patikrinkite alyvos žiedų veikimą.
■		Patikrinkite, ar nepakilo guolių temperatūra. ¹⁾
■	■	Jei mechaniškai generatoriaus veikia patenkinamai, palaipsniui pradėkite žadinimą. Sumažėjęs veikimo sklandumas nurodo magnetinį gedimą, pavyzdžiui, netolygų oro tarpą arba tarpinio prasisukimo sukeltą trumpąjį jungimą.
■	■	Kai generatorius veikia patenkinamai, jį galima sinchronizuoti su tiekimo sistema ir apkrauti.

¹⁾ Atsiradus staigiems pokyčiams arba dideliems svyravimams be jokios aiškios priežasties, nedelsdami išjunkite mechanizmą ir raskite gedimą (taip pat žr. "Gedimų diagnostikos lentelė" 78 psl. Taip gali nutikti dėl montavimo klaidų arba transportavimo metu atsiradusių pažeidimų).

8 Eksploataavimas

8.1 Saugos informacija ir instrukcijos



ĮSPĖJIMAS

Gaubtai, apsaugantys nuo sąlyčio su besisukančiomis dalimis ir dalimis, kuriomis teka elektros srovė, negali būti atidaryti arba nuimti darbo metu.

Reikia atminti, kad tam tikrose mechanizmo dalyse, pvz., guolių korpusuose, gali susidaryti aukšta paviršiaus temperatūra; todėl saugokitės, kad jų nepaliesumėte, arba imkitės reikiamų prevencijos priemonių.

Nesilaikydami šio nurodymo galite patirti sunkių sužalojimų arba didelę turtinę žalą.

Dirbti su šiuo mechanizmu arba šalia jo turėtų tik kvalifikuoti darbuotojai.

Reguliarus stebėjimas

Reguliarus stebėjimas būtinas siekiant greitai aptikti gedimus ir išvengti žalos. Bet kokie įprastos būklės pokyčiai rodo, kad mechanizmas veikia netinkamai. Siekiant išvengti tolesnės žalos, reikia nedelsiant nustatyti priežastį.

8.2 Įjungimas

Norėdami įjungti mechanizmą, skaitykite "Prieš įjungiant" (72 psl.).

8.3 Paleidimas

Rekomenduojama atlikti toliau nurodytas apžiūras fiksuotais intervalais (taip, kad būtų pasiekiamos stebėjimo sistemos) ir užsirašyti vertes:

Srovė, įtampa, elektros sąnaudos

Apvijų temperatūros

Aušinimo oro temperatūros

Tiekiamos aušinimo medžiagos temperatūros

Guolių temperatūros

Mechaninė vibracija

Nuotėkis (oro, alyvos)

Veleno įžeminimo šepetėlių nusidėvėjimas ir

Rotoriaus įžeminimo šepetėlių nusidėvėjimas

Išmatuotos vertės turėtų būti palygintos su nominaliomis vertėmis. Kontaktiniai paviršiai neturėtų būti nustatyti taip, kad sumažintų temperatūrą, kol temperatūros nenusistovėjo įprastomis darbo sąlygomis. Nuorodinės pavojaus signalo ir išjungimo vertės nurodytos tekste šalia brėžinio su matmenimis.



ĮSPĖJIMAS

Ilgalaikiai nuokrypiai nuo pastovių verčių, būdingų įprastai mechanizmo būsenai, aiškiai nurodo gedimą.

Nepaisymas gali lemti nuosavybės sugadinimą.

Pastaba

Stebėjimo įrangos nustatymas

Galutinį atjungimo verčių nustatymą stebėjimo įrangoje galima atlikti tik tada, kai darbinės vertės, pasiekiamos įprastos eksploatacijos metu, stabilizuojasi. Orientacinės pavojaus signalo ir išjungimo vertės pateiktos matmenų brėžinio tekste priede "Techniniai duomenys ir brėžiniai".

8.4 Išjungimas

lent. 8-1 Išjungimas

▼			Išjungimas
	▼		Paleisti paruošto mechanizmo išjungimas
		▼	Apžiūrai
			Darbai
■	■	■	Išjunkite mechanizmą su kuo mažesne statoriaus srovėmis ir užblokuokite, kad iš naujo nepasileistų.
■	■	■	Leiskite mechanizmui sustoti ir klausykitės, ar negirdite neįprastų garsų. Tai galima daryti taikant arba netaikant stabdžių.
■	■	■	Stebėkite alyvos žiedų veikimą, kol mechanizmas sustoja.
	■	■	Išjunkite visus pagalbinus įtaisus po to, kai mechanizmas sustoja (vandens ¹⁾ , alyvos).
		■	Išleiskite oro ir vandens aušintuvą
■	■	■	Išjunkite antikondensacinį šildymą.

¹⁾ Žr. informaciją, pateiktą "Paleisti paruošto stacionaraus mechanizmo saugos priemonės" (puslapyje 77).

8.5 Paleisti paruošto stacionaraus mechanizmo saugos priemonės

Paleisti paruoštas stacionarus mechanizmas reikalauja specialios apsaugos, jei yra atšiaurioje aplinkoje

Tokia situacija gali įvykti:

- tarp mechanizmo montavimo pabaigos ir
- mechanizmo eksploatacijos pradžios,
- tarp pauzių darbo metu,
- kai pristabdytas mechanizmas veikia tuščiąja eiga.

oliau pateiktų priemonių reikia imtis, kad mechanizmas galėtų būti pristabdytas be jokio žalingo poveikio:

- Įjunkite antikondensacinį šildymą, kai:
 - Mechanizmas išjungtas
 - Kai mechanizmo vidaus temperatūra nukrenta iki 3 K virš aplinkos temperatūros
- Apsaugokite oro ir vandens aušintuvą nuo korozijos (žr. naudojimo instrukcijas: "Oro ir vandens aušintuvai")
- Patikrinkite vandens kondensatą

8.6 Įrengto, tačiau nepristabdyto mechanizmo apsauga

Jei mechanizmas išjungiamas ilgesniam laikotarpiui ir nėra paruošiamas paleisti, jis turi būti apsaugotas taikant tinkamas apsaugos priemones. Statorius ir rotorius turi būti apsaugoti nuo mechanizmo viduje susidarančios kondensacijos, t. y. drėgmė turėtų būti mažesnė nei 50 proc., o tai galima pasiekti tokiu būdu:

- Apdenkite mechanizmą nuo drėgmės apsaugančia danga. Į suvirinto polietileno dangos vidų įdėkite didelį kiekį desikanto (nuorodinė vertė: 105 g/m² dangos paviršiaus ir mėn. sandėliavimo) ir naudokite drėgmės matuoklį. Reguliariai stebėkite desikantą ir atnaujinkite, jei reikia.
- Mechanizme įrenkite vandenį pašalinančius alsuoklius ir užtikrinkite, kad jame yra šildymas ir oro cirkuliacija.
- Padenkite plikus paviršius, esančius guolio išorėje, su nuo rūdijimo apsaugančiu junginiu, pvz., "Tectyl 506"¹⁾.

Siekiant apsaugoti guolius reikia imtis šių priemonių:

- Išleiskite alyvą iš guolių
- Padenkite veleno kakliukus ir guolio dalis su alyvoje tirpstančiu nuo rūdijimo apsaugančiu junginiu, pvz., "Tectyl 472"¹⁾.

¹⁾ "Valvoline Öl-Gesellschaft mbH" gaminy, Neuer Wall 75, D-20354 Hamburgas

Aušintuvai turėtų būti apsaugoti remiantis naudojimo instrukcijų skyriumi „Oro ir vandens aušintuvai“ (see Appendix D "Additional documents"). Saugokite visų įvykdytų apsaugos priemonių sąrašą.

Apsaugos priemonių veiksmingumą turėtų atnaujinti kvalifikuoti darbuotojai reguliariais intervalais. Dėl šių intervalų galima susitarti su gamykla, jei reikia.

Pastebėjus gedimo požymius, nedelsiant reikėtų juos ištaisyti ir pašalinti koroziją bei kitus pažeidimus.

Prieš vėl naudodami apsaugotą mechanizmą, pakartokite apsauginius veiksmus atvirkščia tvarka, kad mechanizmas grįžtų į eksploataavimo būseną.

8.7 Gedimų diagnostikos lentelė

	ĮSPĖJIMAS
Mechanizmo gedimų šaltinis turi būti nedelsiant pašalintas. Nepaisymas gali lemti nuosavybės sugadinimą gali lemti nuosavybės sugadinimą.	

8.7.1 Mechaninės priežastys

lent. 8-2 Mechaninės priežastys

▼				Džerškantis garsas	
	▼				Per didelė temperatūra
		▼			Radialiniai virpesiai
					Ašiniai virpesiai
				Galima priežastis	Sprendimas
■				Rotorius / velenas liečia fiksuotas dalis.	Raskite priežastį ir sutvarkykite susijusias dalis.
	■			Dėl aušinimo sistemos vamzdžiuose esančių dulkių sumažėjęs įeinančio oro tiekimas.	Patikrinkite ortakius.
	■			Pablogėjo aušintuvo veiksmingumas. Užsikimšusi vandens tiekimo sistema.	Išvalykite aušintuvą pagal gamintojo instrukcijas, apžiūrėkite vandens tiekimo sistemą. Išleiskite orą iš aušintuvo. ¹⁾
		■		Pusiausvyros nebuvimas rotoriuje.	Susiekite su gamintoju ir pasiteiraukite apie subalansavimą.
		■		Pusiausvyros nebuvimas transmisijoje.	Subalansuokite.
			■	Perkrovos iš sujungto mechanizmo.	Apžiūrėkite sujungtą mechanizmą.
		■	■	Pagrindo poslinkis arba pokyčiai jame.	Sulygiuokite mechanizmą. Apžiūrėkite pagrindą ir išsiaiškinkite, ar pokyčius sukėlė karštis. Apžiūrėkite jungtį.
		■	■	Pagrindo rezonansas.	Pasitarkite su statybininkais ir sutvirtinkite pagrindą.

¹⁾ Žr. naudojimo instrukcijas: "Oro ir vandens aušintuvai" norėdami išsamesnės informacijos.

8.7.2 Elektros priežastys

lent. 8-3 Elektros priežastys I

▼				Neveikia generatorius	
	▼			Nepasiekama vardinė įtampa, kai generatoriui taikoma apkrova	
		▼		Fazinė įtampa netolygi	
			▼	Generatorius gauna reaktyvinę indukcinę galią (VAR)	
				Galima priežastis	Sprendimas
■				Per mažas greitis.	Padidinkite pagrindinio variklio greitį.
■				Žadintuvas nėra sužadintas.	Patikrinkite žadintuvo KS apviją. Patikrinkite išorinį žadinimą.
■				Atidarykite grandinę besisukančioje žadintuvo dalyje.	Atlikite vizualią apžiūrą ir grandinės matavimą.
■				Diodų gedimas.	Patikrinkite ir, jei reikia, pakeiskite diodus, kaip aprašyta skyriuje "Techninė priežiūra" (puslapyje 81).
■			■	Atvira grandinė žadinimo grandinėje.	
		■		Išorinio laidininko pertrauktis tiekimo grandinėje.	Patikrinkite galios skirstytuvą ir tiekimo grandinę.
	■			Perkrova	Sumažinkite apkrovą.
■			■	Žadinimo sistemoje yra defektų.	Patikrinkite žadinimo sistemą.
		■		Tarpinio prasisukimo arba tarpinės apvijos gedimas statoriaus apvijoje.	Išmatuokite apvijos ir izoliacijos varžą; remontuokite pasitarę su gamintoju.
	■		■	Tarpinio prasisukimo arba tarpinės apvijos gedimas žadinimo apvijoje.	Patikrinkite temperatūros pakilimą: nublukęs lakas gali būti užuomina. Pašalinkite trumpąjį jungimą (dirbtuvėse).
		■		Nesubalansuota apkrova.	Sumažinkite apkrovos išbalansavimą.

lent. 8-4 Elektros priežastys II

▼				Galios tiekimo svyravimai	
	▼			Per didelė temperatūra	
		▼		Atskirų apvijos dalių perkaitimas	
				Galima priežastis	Sprendimas
	■	■		Perkrova	Sumažinkite apkrovą.
■				Žadinimo sistema netinkamai sureguliuota.	Patikrinkite galios skirstytuvą ir tiekimo grandinę.
		■		Tarpinio prasisukimo arba tarpinės apvijos gedimas statoriaus apvijoje.	Išmatuokite apvijos ir izoliacijos varžą; remontuokite pasitarę su gamintoju.
■				Kreipiamojo momento svyravimas.	Apžiūrėkite pagrindinį variklį.

8.7.3 Guolių priežastys

lent. 8-5 Guolių priežastys

▼					Guolių perkaitimas	
■	▼				Guoliai netenka alyvos	
	■	▼			Alyva mechanizme	
		■	▼		Alyva greitai tampa drumzlina	
			■	▼	Guolių temperatūra labai svyruoja	
				■		
					Galima priežastis	Sprendimas
■					Žemas alyvos lygis.	Patikrinkite alyvos lygį ir papildykite, jei reikia.
■				■	Priverstinis sutepimas mažėja.	Patikrinkite alyvos tiekimą.
■				■	Alyva pasenusi arba nešvari.	Išvalykite guolio korpusą, atnaujinkite alyvą.
■			■	■	Alyvos žiedai veikia netolygiai.	Pakeiskite alyvos žiedus naujais. ¹⁾
■			■		Per didelė radialinė ir ašinė apkrova.	Patikrinkite išlygiavimą ir sujungimą.
■					Alyvos klampumas per didelis.	Patikrinkite klampumą su informacija, pateikta šalia brėžinio su matmenimis, pakeiskite alyvą, jei reikia.
			■	■	Alyvos klampumas per mažas.	
	■	■			Alyva utoja.	Pasitarkite su gamintoju.
			■	■	Guolių paviršiai pažeisti.	Pakeiskite guolių įdėklus naujais. ¹⁾
	■	■			Alyvos srautas per didelis.	Nustatykite tinkamą alyvos srautą; žr. tekstą šalia brėžinio su matmenimis. Patikrinkite, ar išleidimo angoje nėra kliūčių. Patikrinkite alyvos lygį.
	■	■			Pažeisti peilių briaunų tarpikliai.	Pakeiskite peilių briaunas naujomis. ¹⁾
	■	■			Alyva netinkamai grįžta iš sandarinimo žiedų.	Išvalykite alyvos grįžtamuosius kanalus. Patikrinkite mechanizmo tarpiklius. ¹⁾
		■			Mechanizmo tarpikliai netinkamai veikia (per didelis tarpas).	Patikrinkite mechanizmo tarpiklius. ¹⁾

¹⁾ Išsamesnės informacijos ieškokite "Alkūniniai guoliai" D priede "Papildomi dokumentai".

9 Techninė priežiūra

Pastaba

Techninės priežiūros centras

Prireikus bet kokių montavimo / priežiūros darbų kreipkitės į techninės priežiūros centrą (97 psl.) arba kvieskite „Siemens“ išmokytus ir atitinkamą užduotį atlikti įgaliotus techninės priežiūros inžinierius.

Saugos priemonės

Šios instrukcijos "Saugos instrukcijos" (puslapyje 12) skyriuje pateikta svarbi saugos informacija, kurios reikia dirbant su stiprios srovės įranga.



PAVOJUS

Prieš pradėdami darbą su mechanizmu ir ypač atidarydami dalių, kuriomis teka elektros srovė, gaubtus, įsitikinkite, kad mechanizmas arba įranga buvo tinkamai izoliuota nuo elektros energijos tiekimo šaltinio.

Atkreipkite dėmesį ne tik į pagrindines grandines, bet ir į papildomas grandines, ypač patalpų šildytuvų!

9.1 Techninės priežiūros intervalas

Atliekant kruopščią techninę priežiūrą ir apžiūrą, galima anksti atpažinti gedimus, kad būtų galima juos ištaisyti prieš jiems sukeltiant žalą. Techninė priežiūra ir apžiūra padeda išlaikyti mechanizmo vertę, išvengti brangių avarių ir padidinti patikimumą bei pasiekiamumą.

Neįmanoma nurodyti griežtų ir greitų techninės priežiūros intervalų, kadangi darbo sąlygos labai skiriasi, tačiau apžiūrą būtina atlikti rekomenduojamais intervalais. Priklausomai nuo patirties, įgytos montavimo metu, šį intervalą reiktų keisti taip, kad jis atitiktų tokius veiksnius, kaip užteršimas, perjungimo dažnis, apkrova ir pan. Atidi mechanizmo apžiūra rekomenduojama pagal lent. 9-1.

Techninės priežiūros intervalai rekomenduojami remiantis sklandžiu veikimu. Jei gedimai arba neįprastos veikimo sąlygos (pvz., perkrova, trumpasis jungimas) perkrauna mechanizmą elektriniu arba mechaniniu būdu, reikia nedelsiant atlikti apžiūrą.

Toliau pateikti rekomenduojami intervalai apžiūrai ir remonto darbams:

lent. 9-1 Techninės priežiūros intervalai

Apžiūros tipas inspection	Veikimas su pertrūkiais ¹⁾		Nuolatinis veikimas ^{1) 2)}	
Pirmosios apžiūros po eksploatavimo	500	darbo valandų		
	1	mėnuo		
Antroji apžiūra	4000	darbo valandų arba	8000	darbo valandų
	1000	perjungimo operacijų		
	1	m. po naudojimo	1	m. po naudojimo
Tolėsnes apžiūros po	8000	darbo valandų arba	16000	darbo valandų arba
	2	m. po naudojimo	2	m. po naudojimo

¹⁾ Atsižvelgiant į tai, kas įvyks pirmiau (Pastaba: kontaktinio žiedo skyriui taikomas specialus intervalas)

²⁾ Nuolatinis veikimas: nuolatinis veikimas pastoviu greičiu ir maždaug pastovia apkrova.



PAVOJUS

Prieš pradėdant techninės priežiūros darbus, pagrindinis jungiklis turi būti išjungtas ir užblokuotas, kad neįsijungtų.
To nepaisant sąlytis su dalimis, kuriomis teka elektros srovė, gali lemti mirtį arba rimtą sužeidimą.

PASTABA

Skirtingi komponentų priežiūros intervalai

Skirtingų komponentų priežiūros intervalai gali skirtis.

Vadovaukitės komponento gamintojo pateiktomis priežiūros instrukcijomis. Komponentų dokumentai, pvz., naudojimo instrukcijos ir priežiūros rekomendacijos, pateikti D priede "Papildomi dokumentai".

Jei nesivadovausite šiais dokumentais, komponentams gali būti padaryta žala.

9.2 Apžiūros ir techninės priežiūros darbai

The covers to the service openings (see dimension drawing or text to dimension drawing) and the terminal box cover are to be removed for inspecting the interiors.

NOTICE

Viršutinė korpuso dalis (aušintuvo korpusas), jei įmanoma, turi būti pakelta atliekant techninę priežiūrą. Jei ji pakelta, reikia atjungti viduje esančius kabelius ir sriegines jungtis. Prieš vėl surinkdami pakeiskite visus sugadintus sandariklius.

PASTABA

Rotoriaus išmontavimas

Norint išimti rotorių iš generatoriaus, reikia naudotis specialiais įrankiais ir procedūra. Prieš pradėdami techninės priežiūros darbus, susijusius su rotoriaus išmontavimu, aptarkite darbų eigą su "Siemens" techninės priežiūros centru (kontaktiniai duomenys nurodyti 97 psl.).
Netinkamas išmontavimas gali padaryti didelę žalą mechanizmui!

PASTABA

Vadovaukitės komponentų priežiūros instrukcijomis

Taip pat svarbu laikytis komponentų gamintojų pateiktų priežiūros instrukcijų. Atitinkamos naudojimo ir priežiūros instrukcijos pateiktos D priede „Papildomi dokumentai“. Jei nesilaikysite šių instrukcijų, kyla pavojus sugadinti atitinkamus komponentus.

lent. 9-2

Apžiūros ir techninės priežiūros darbai

Elementas	Tikrinamos vietos	Apžiūros ir techninės priežiūros darbai
Vizuali mechanizmo apžiūra (išorės ir vidaus)	Mechaninis pažeidimas, nusidėvėjimas, dažų pažeidimas, korozija, nuotėkiai, nešvarumai, svetimkūniai, akyti tarpikliai..	Jei pastebite kokio nors pažeidimo požymių, imkitės priemonių pašalinti arba sumažinti pažeidimą. Jei reikia, informuokite „Siemens“ priežiūros centrą, puslapyje 97. Aptikus drėgmės būtina ją išmatuoti pagal skyrius "Statoriaus apvijos izoliacijos varžos tikrinimas" (puslapyje 53) ir "Džiovinimas, valymas, gedimų sekimas" (puslapyje 60).
Pagrindas	Pagrindo nusėdimas, įtrūkimai jame.	Apie tai informuokite statybos rangovą.
Mechanizmo tvirtinimo	Patikrinkite, ar mechanizmo tvirtinimo detalės tinkamai pritvirtintos.	Priveržkite mechanizmo tvirtinimo elementus.
Išlygiavimas	Patikrinkite sujungimo išlygiavimą ir palyginkite su paskutinės sujungimo apžiūros ataskaita. Vizuali apžiūra.	Nustatykite šio pokyčio priežastį ir pašalinkite ją, iš naujo išlygiuokite sujungimą, žr. "Išlygiavimas" (puslapyje 38).
Priedai	Patikrinkite, ar dalys tinkamai pritvirtintos.	Priveržkite tvirtinimo elementus, patikrinkite apsauginius elementus, atnaujinkite, jei reikia.
Gnybtų dėžės	Laidininkų pritvirtinimas ir įžeminimo laidininkų pritvirtinimo tikrinimas.	
	Gnybtų dėžės pritvirtinimas.	Pašalinkite nešvarumų ir drėgmės likučius. Išdžiovinkite vidų. Nuvalykite izoliacinių dalių paviršius. Patikrinkite tarpiklius.
Guoliai	Nešvarumų ir drėgmės likučiai.	
	Alyvos keitimas	Alyvą keiskite nurodytais intervalais, vadovaukitės guolių gamintojo instrukcijomis, pateiktomis D priede "Papildomi dokumentai". Taip pat skaitykite skyrių "Guolių priežiūra" (86 psl.).
	Guolių įdėklų būseną. Alyvos žiedų būseną. Guolių tarpiklių būseną.	Techninės priežiūros darbai turėtų būti atlikti pagal "Renk"- "Apžiūros ir techninės priežiūros instrukcijos" " D priede „Papildomi dokumentai“.
	Patikrinkite, ar mechanizmo tarpikliai saugiai pritvirtinti.	Priveržkite tvirtinimo elementus arba pakeiskite juos, jei reikia.
	Temperatūros jutiklių būseną ir, jei reikia, jų izoliaciją.	Pakeiskite sugedusius temperatūros jutiklius lygiaverčiais jutikliais ir, jei reikia, pakeiskite izoliaciją.
	Jei reikia, veleno vibracijos jutiklio būseną ir nustatymą.	Sureguliuokite veleno vibracijos jutiklius. Jei reikia, pakeiskite sugedusį jutiklį lygiaverčiu jutikliu.

Alyvos tiekimo sistema	Užteršimas, nuotėkiai, žala, veikimas	Atlikite priežiūros darbus vadovaudamiesi alyvos tiekimo sistemos gamintojo pateiktais dokumentais.
Mechanizmo vidus	Patikrinkite, ar šalto ir šilto oro tarpuose bei bekontakčiame žadintuve nėra nešvarumų.	Pašalinkite nešvarumus ir dulkes.
	Patikrinkite, ar pasiekiamoje statoriaus apvijos dalyje (N gale) nėra nešvarumų, išblukimų ir pažeidimų.	Jei yra išblukimų ir pažeidimų, kreipkitės į "Siemens" priežiūros centrą, žr. 97 psl.
	Vizuali statoriaus išskyšos apžiūra	Patikrinkite apvijos išskyšas (ar nėra pažeidimų, užteršimų, svetimkūnių) Jei yra pažeidimų arba svetimkūnių, nustatykite priežastį ir imkitės jos pašalinimo priemonių.
	Patikrinkite, ar oro nukreipimo žiedai saugiai pritvirtinti.	Priveržkite tvirtinimo elementus arba pakeiskite juos, jei reikia. Patikrinkite fiksavimo elementus ir pakeiskite juos, jei reikia.
	Patikrinkite stebėjimo įrenginių būseną.	Pakeiskite pažeistus stebėjimo įrenginius lygiaverčiais įrenginiais. Žr. matmenų brėžinio tekstą arba skyrių "Atsarginės dalys" (94 psl.).
	Lygintuvo atraminis ratas: elektroninių komponentų būseną.	Pakeiskite pažeistas mechanizmo dalis lygiaverčiais įrenginiais, žr. skyrius "Lygintuvo atraminio rato komponentų trikčių diagnostika ir šalinimas" (86 psl).
	Patikrinkite statoriaus apvijos izoliacijos varžą.	Žr. skyrių "Statoriaus apvijos izoliacijos varžos tikrinimas" (53 psl).
	Elektrinių konduktorių būseną ir tvirtinimą.	Saugiai pritvirtinkite konduktorius.
	Patikrinkite, ar tarpikliai, guminiai komponentai ir slopinimo elementai nėra deformuoti, nusidėvėję, poringi ir juose nėra įtrūkimų.	Pakeiskite deformuotus, pažeistus arba poringus tarpiklius, guminius komponentus ir slopinimo elementus.
Oro ir vandens aušintuvas	Aušintuvo linijų ir ortakių būseną	Atlikite techninės priežiūros darbus pagal naudojimo instrukcijose esantį skyrių "Aušintuvas".
	Nuotėkiai	Nustatykite nuotėkio priežastį. Iš naujo izoliuokite sistemą.
	Antikorozinė apsauga	Jei reikia, patobulinkite antikorozinę apsaugą.
Aušinimo vamzdžiai	Patikrinkite, ar saugiai pritvirtinti tvirtinimo elementai.	Jei reikia, iš naujo juos pritvirtinkite.
	Patikrinkite, ar aušinimo sistemos vamzdžiuose nėra nuotėkio.	Pakeiskite tarpiklius arba aušinimo vamzdžius, jei reikia.
Kontaktiniai žiedai	Ekspluatavimo paviršiaus būseną (patikrinkite, ar nėra netolygumų ir išblukimų). Izoliacijos tarp kontaktinių žiedų būseną. Patikrinkite šepetėlių dulkių nuosėdas.	Atsargiai pašalinkite dulkes nuo paviršių tarp kontaktinių žiedų ir gnybtų kontaktų. Jei yra eksploatavimo paviršiaus pažeidimo požymių, kreipkitės į "Siemens" priežiūros centrą, žr. 97 psl. Išvalykite šepetėlių korpusą dulkių siurbliu

Rotoriaus įžeminimo šepetėlių gedimo aptikimas	Patikrinkite šepetėlių nusidėvėjimą.	Jei reikia, pakeiskite naujais. Dėl šepetėlių keitimo žr. "Įranga, skirta rotoriaus įžeminimo gedimo aptikimui" (90 psl).
Šepetėlių laikikliai	Laikiklių būseną, sklandus jungčių judėjimas, šepetėlių kontaktų išlygiavimas ir tvirtinimas. Ranka patikrinkite, ar spyruoklės poveikis yra toks pats visuose šepetėlio laikikliuose. Būseną ir pritvirtinimą.	Išlygiuokite. Iš naujo priveržkite visus tvirtinimo elementus. Pakeiskite pažeistus šepetėlių laikiklius. Priveržkite tvirtinimo elementus. Patikrinkite tvirtinimo elementus ir pakeiskite juos, jei reikia.
Šepetėliai	Šepetėlių ilgis. Sklandus judėjimas šepetėlių laikikliuose. Susuktų vielų tvirtinimas šepetėliuose.	Pakeiskite nusidėvėjusius arba pažeistus šepetėlius. Pakeiskite šepetėlius, kurių originalus ilgis sumažėjo apie 30 proc. arba kurie yra pažeisti. Įtvirtinkite juos, jei reikia.
Šepetėlio kontaktinis paviršius	Patikrinkite, ar šepetėlio kontaktiniame paviršiuje nėra įdubimų bei nešvarumų.	Kruopščiai nuvalykite šepetėlio kontaktinį paviršių. Jei šepetėlio kontaktinis paviršius pažeistas, kreipkitės į gamintoją.

9.3 Guolių priežiūra

Slydimo guolių priežiūra išsamiai aprašyta gamintojo vadove, kuris įtrauktas į D priedą "Papildomi dokumentai".

Pasirūpinkite šiais dalykais:

- reguliariai keiskite alyvą nurodytais intervalais;
- patikrinkite sriegines jungtis;
- patikrinkite temperatūros jutiklius.

9.4 Pataisykite pažeistų dažų sluoksnį

Jei dažų sluoksnis pažeistas, jį reikia sutvarkyti, kad apsaugotumėte įrenginį nuo korozijos.

	PERSPĖJIMAS
Dažų sistema Prieš tvarkydami pažeistą dažų sluoksnį, susisieki su "Siemens" priežiūros centru (97 psl). Susisiekę gausite daugiau informacijos apie tinkamą dažų sistemą ir dažų sluoksnio sutvarkymo būdą.	

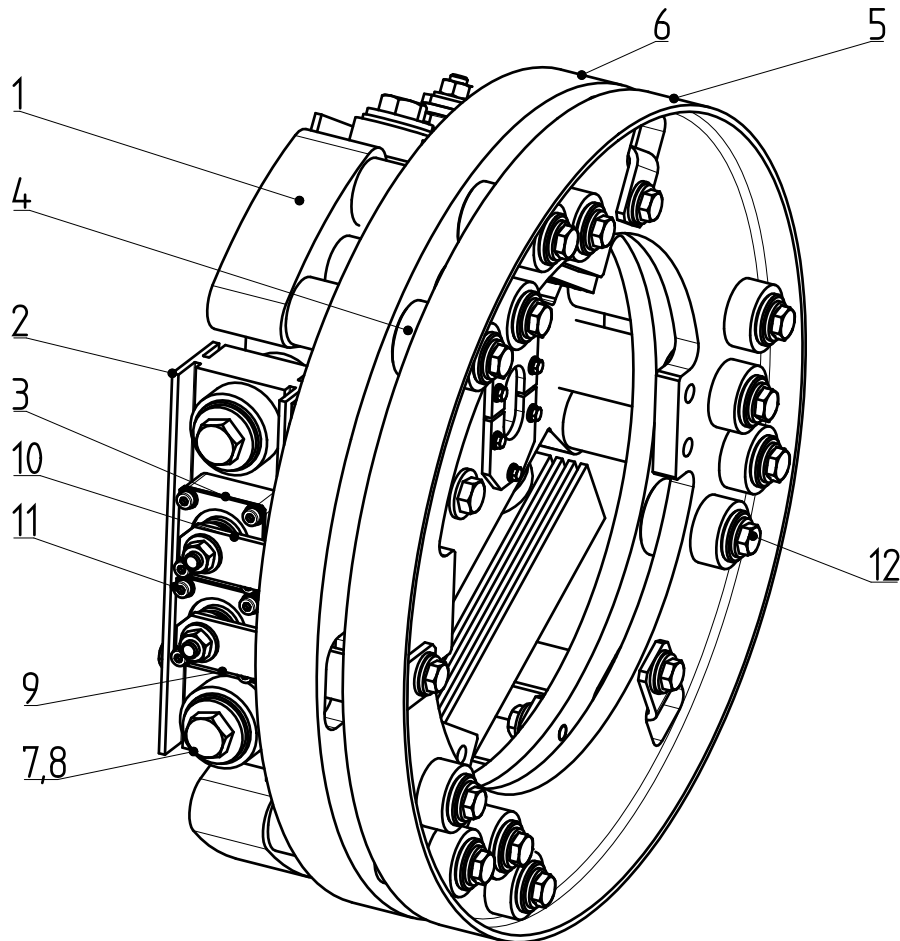
9.5 Lygintuvo atraminio rato komponentų trikčių diagnostika ir šalinimas

Atsiradus gedimui, rekomenduojama kreiptis į gamyklą, kadangi tai vienintelė vieta, iš kurios galima gauti papildomų ir atsarginių dalių. Tam tikrais atvejais geriausia paprašyti įgaliojimo iš "Siemens" darbuotojų.

Norint remontuoti lygintuvo atraminį ratą, būtina atidaryti techninės priežiūros gaubtus, esančius viršutinės korpuso dalies N gale.

9.6 Besisukantis lygintuvas – žadinimo sistema su PMG

Besisukantis lygintuvas sudarytas iš silikoninių diodų, prijungtų prie trifazės pilnos grandinės lygintuvo grandinės. Perjungimo perkrovas sugeria varistoriai, kurie yra lygiagrečiai su diodais.



1	Stebulė
2	Šilumos šalintuvas
3	Rutulinis dangtelis, diodas
4	Varistoriaus diskas
5	Kolektoriaus žiedas +
6	Kolektoriaus žiedas -
7	Šilumos šalintuvo tvirtinimo varžtas M16
8	Izoliacinė poveržlė
9	Jungiamasis strypas +
10	Jungiamasis strypas -
11	Rutulinio dangtelio tvirtinimo varžtas M6
12	Kolektoriaus žiedų tvirtinimo varžtas M12

pav. 9-1 Lygintuvo rato su diodais montavimas

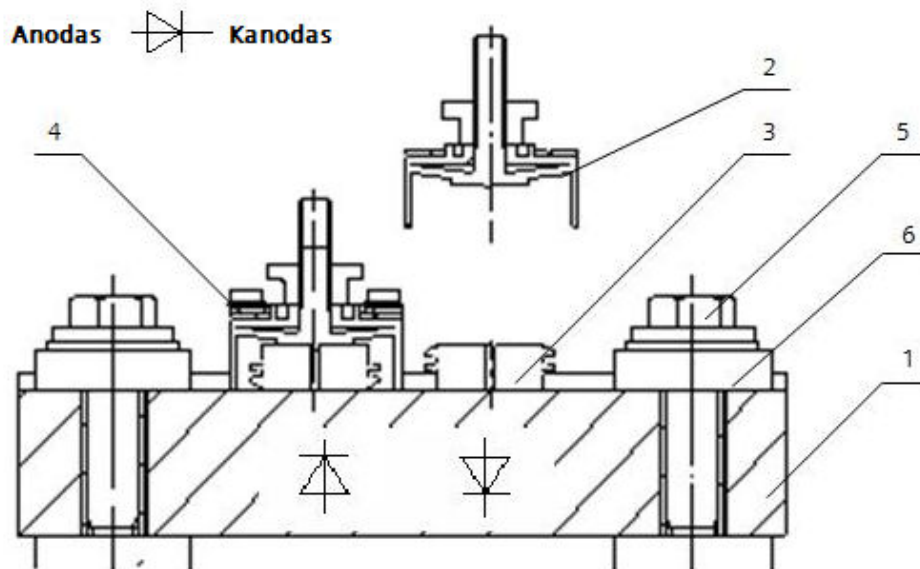
9.6.1 Lygintuvo diodų keitimas

Lygintuvo diodai (disko formos diodai) yra rutulinių dangtelių viduje, kurie išdėstyti poromis ant šilumos šalintuvo. Šilumos šalintuvai izoliuoti ir pritvirtinti ant stebulės.

Jei diodus reikia keisti, nauji diodai turėtų būti išpakuoti tik prieš atliekant montavimą ir nedelsiant sumontuoti. Būkite atidūs, kad išvengtumėte stiprių smūgių, kurie gali pažeisti naujus diodus.

Norėdami pakeisti diodus, atlikite toliau nurodytus veiksmus:

1. Nuimkite priekinį žadintuvo korpuso gaubtą;
2. Atsukite jungiamuosius strypus ir rutulinio dangtelio tvirtinimo varžtus;
3. Atsargiai nuimkite dangtelį ir pakeiskite diodus;
4. Padenkite naujų diodų kontaktinius paviršius kontaktine alyva;
5. Uždėkite diodą ant šilumos šalintuvo. Laikykites poliškumo, nurodyto ženklais ant šilumos šalintuvų ir jungiamųjų strypų;
6. Atsargiai sumontuokite rutulinius dangtelius ir prispaudžiamus dangčius atvirkštine tvarka.



1	Šilumos šalintuvas
2	Rutulinis dangtelis
3	Diodas
4	Rutulinio dangtelio tvirtinimo varžtas M6
5	Šilumos šalintuvo tvirtinimo varžtas M16
6	Izoliacinė poveržlė

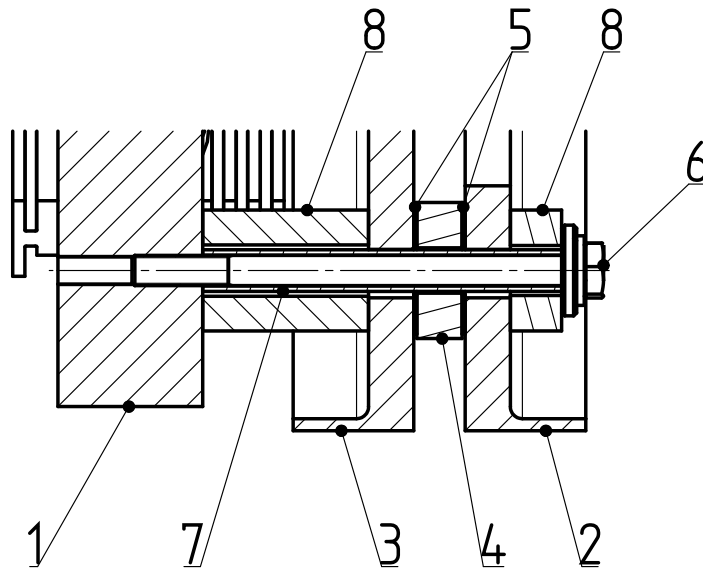
pav. 9-2 Diodai (matoma iš kolektoriaus žiedų pusės)

9.6.2 Varistorių keitimas

Varistoriaus diskai skirti apsaugoti lygintuvo diodus ir yra įrengti palei ašį tarp lygintuvo atraminio rato šynos žiedų.

Norėdami pakeisti varistorių, atlikite toliau nurodytus veiksmus:

1. Išsukite atitinkamą tvirtinimo varžtą ir ištraukite izoliacinę įvorę;
2. Tada varistoriaus diskas gali būti nuimtas nuo kolektoriaus žiedų;
3. Keisdami varistoriaus diską, taip pat pakeiskite tarpiklius.



1	Stebulė
2	Kolektoriaus žiedas +
3	Kolektoriaus žiedas -
4	Varistoriaus diskas
5	Tarpiklis
6	Kolektoriaus žiedų tvirtinimo varžtas M16
7	Izoliacinė įvorė
8	Izoliacinė poveržlė

pav. 9-3 Varistorius

9.7 Įranga, skirta rotoriaus įžeminimo gedimo aptikimui

Rotoriaus įžeminimo gedimo apsaugos tikslas – aptikti įžeminimo gedimus generatoriaus žadinimo sistemoje.



PERSPĖJIMAS

Šepetėlių kontrolė turi būti atliekama kiekvieną savaitę. Viršijus maksimalų leidžiamą šepetėlio nusidėvėjimo ribą, jį reikia pakeisti, žr. procedūrą, nurodytą lent. 9-3.



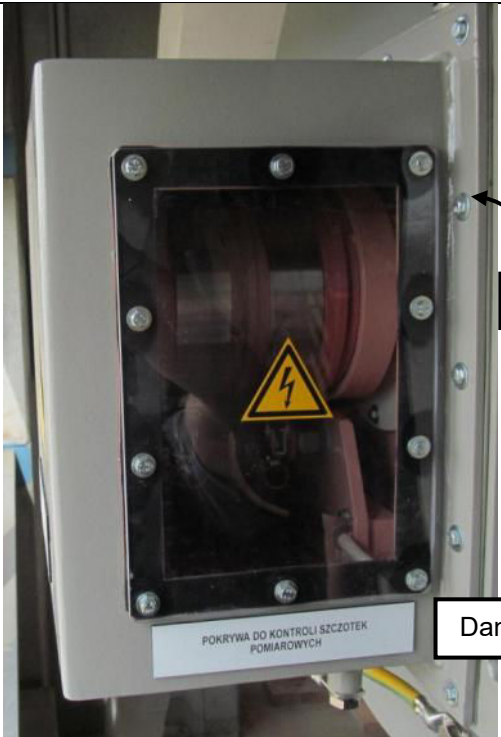
PERSPĖJIMAS

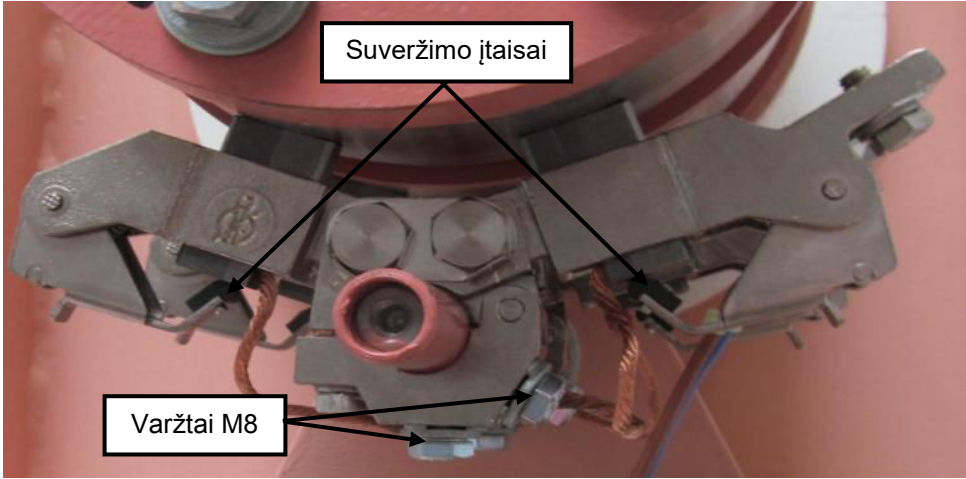
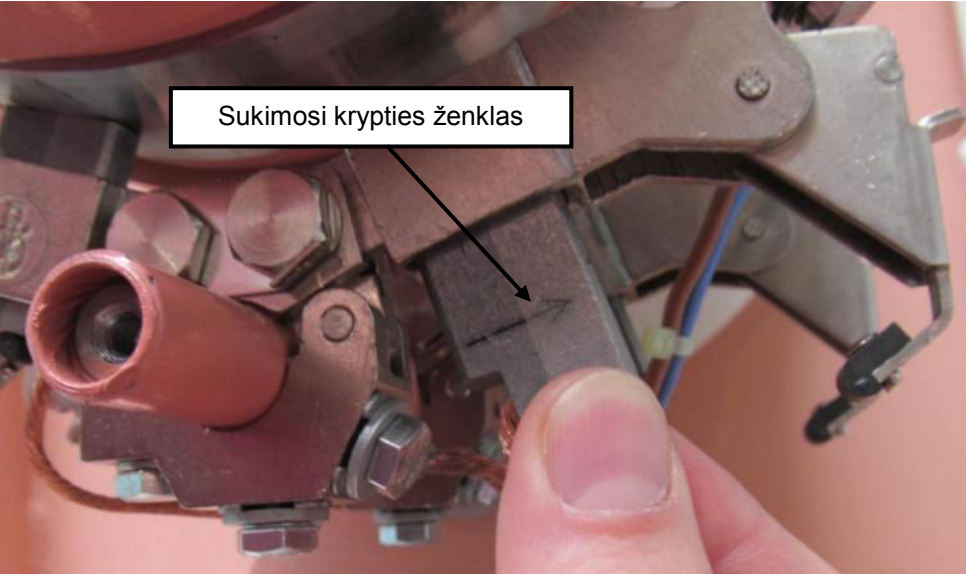
Pakeiskite šepetėlių ašinę padėtį ir įstatykite juos kontaktinio žiedo viduryje.

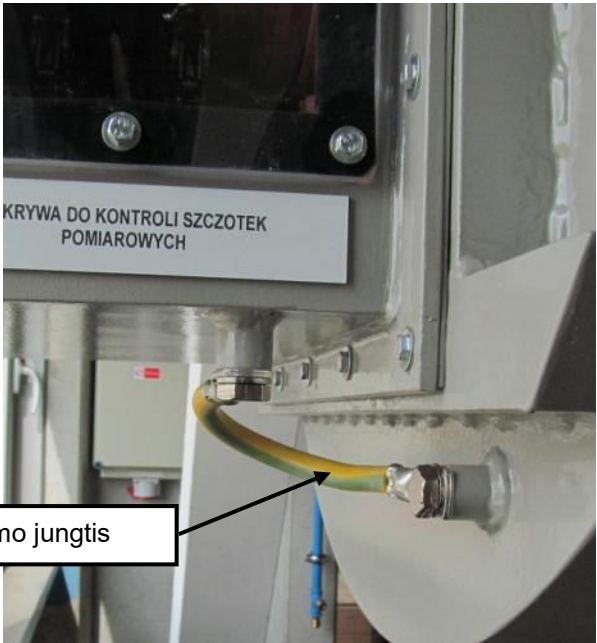
9.7.1 Įžeminimo gedimą aptinkančių šepetėlių keitimo procedūra

Patikrinkite anglies šepetėlių nusidėvėjimo lygį ir pakeiskite juos, kai šepetėlio aukštis siekia maždaug pusę originalaus ilgio – ilgis siekia mažiau nei 16 mm.

lent. 9-3 Šepetėlių montavimo procedūra

1.	Išimkite varžtus M5 ir nuimkite kontaktinio žiedo dangtį.	
2.	Dulkių siurbliu ir valymo šluoste nuvalykite dulkes.	

3.	Sulenkite suveržimo įtaisus. Atjunkite šepetėlius pašalindami varžtą M8.	
4.	Pakeiskite šepetėlius – šepetėliai turi būti naudojami taip, kad rotoriaus veleno sukimosi kryptimi sidabrine spalva padengtas šepetėlis eitų po anglies sluoksniu padengtu šepetėliu. Sukimosi kryptis pažymėta rodykle ant šepetėlio.	
5.	Prijunkite šepetėlius ir uždenkite suveržimo įtaisus. Įtaisai prispaudžia šepetėlius prie žiedo.	
6.	Patikrinkite šepetėlių ašinę padėtį ir įstatykite juos kontaktinio žiedo viduryje (rotorius nustatytas darbinėje padėtyje). Jei reikia, pakartokite veiksmus atlikę galutinę rotoriaus išlygiavimą.	

7.	Vėl uždėkite dangtį ir prijunkite įžeminimą ant žadintuvo korpuso.	 Įžeminimo jungtis
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9.8 Techninės priežiūros darbų baigimas

Baigę visus techninės priežiūros darbus, uždarykite techninės priežiūros angas ir gnybtų dėžės dangtį.

Prijunkite maitinimą pagal DIN VDE 0105-100 taip, kaip nurodyta toliau:

- Pašalinkite įrankius ir pagalbines priemones, įsitikinkite, kad visi asmenys stovi atokiau.
- Pašalinkite apsaugines užtvaras ir pan.
- Paruoškite įrangą darbui.
- Informuokite darbuotojus.
- Vėl įjunkite maitinimą.
- Pašalinkite apsaugines priemones, esančias prijungimo vietose.

Paruoškite raštišką protokolą ir jame nurodykite datą, kai buvo baigti techninės priežiūros darbai.

10 Atsarginės dalys

10.1 Bendroji informacija

Šiame mechanizme yra dalių, kurios dėvisi, jas reikia pakeisti, kai pasiekama nusidėvėjimo riba. Labiausiai dėvisi tie komponentai, kuriuos veikia mechaninės apkrovos. Pasirūpinkite konkrečių dėvimųjų komponentų ir atsarginių dalių atsargomis, kad išvengtumėte ilgalaikių mechanizmo prastovų. Informacijos apie tai, kokių dėvimųjų ir atsarginių dalių turėtumėte turėti sandėlyje, teiraukitės techninės priežiūros centro (97 psl.).

Pastaba

Išankstinis planavimas

Tam tikrų komponentų pasiūla gali būti ribota. Todėl atsarginių dalių ir dėvimųjų komponentų įsigijimą planuokite iš anksto.

Jei norite užsakyti dėvimųjų arba atsarginių dalių, kreipkitės į techninės priežiūros centrą (97 psl.). Taip užtikrinsite, kad galėtumėte pakeisti naudotas dalis ir būtų laikomasi reikalaujamų kokybės charakteristikų.

Atviroje rinkoje pirkite tik dalis, kurių aprašyme aiškiai nurodyta, kad jos atitinka taikomus standartus ir specifikacijas.

Galite naudoti kitų pardavėjų siūlomus standartinius komponentus, bet įsitikinkite, kad atitinka jų konstrukcijos tipas, matmenys, stiprio klasę ir pan.

"Siemens" mechanizmui skirtų originalių atsarginių dalių sąrašas pateiktas B priede "Techniniai duomenys ir brėžiniai" dokumente "Atsarginių dalių sąrašas".

10.2 Užsakymo duomenys

Užsakant atsargines dalis reikia nurodyti ne tik tikslus jų pavadinimus, bet ir generatoriaus tipą bei serijos numerį. Įsitikinkite, kad atsarginės dalies pavadinimas atitinka pavadinimą atsarginių dalių sąrašė, ir nurodykite susijusios dalies numerį. Dokumentą "Atsarginių dalių sąrašas" rasite B priede "Techniniai duomenys ir brėžiniai".

Pavyzdys:

Pavadinimas:	Guolio termometras
Dalies numeris:	5944 0085
Mechanizmo tipas:	1DU1747-8AN02-Z
Serijos numeris:	FQ1234567890

Generatoriaus tipą ir serijos numerį rasite vardinių parametrų lentelėje ir skyriuje "Elektros sistemos duomenys" B priede "Techniniai duomenys ir brėžiniai".

11 Utilizavimas

11.1 Įžanga

Svarbiausi mūsų tikslai – aplinkos apsauga ir jos išteklių saugojimas. Mūsų pasaulinė aplinkosaugos valdybos sistema atitinka ISO 14001 bei teisės aktų reikalavimus ir šiuo atžvilgiu nustato aukštus standartus. Aplinką tausojantis dizainas, techninis saugumas ir sveikatos apsauga yra nuolatiniai įmonės tikslai, net gaminio plėtros etape. Aplinkai nekenksmingos mechanizmo ir jo komponentų šalinimo rekomendacijos pateiktos tolesniame skyriuje. Užtikrinkite vietos utilizavimo reikalavimų laikymąsi.

11.2 Pasiruošimas išmontuoti

Mechanizmo išmontavimo procedūrą turėtų atlikti arba prižiūrėti kvalifikuoti darbuotojai, turintys atitinkamų profesinių žinių.

1. Susisiekite su vietos sertifikuota atliekų utilizavimo organizacija. Paaiškinkite, ko tikėtės kalbant apie mechanizmo montavimo ir komponentų pateikimo kokybę.
2. Laikykitės penkių saugos taisyklių.
3. Atjunkite visas elektros jungtis.
4. Pašalinkite visus skysčius, pvz., alyvą, vandenį, ...
5. Pašalinkite visus kabelius.
6. Atjunkite mechanizmo tvirtinimo detales.
7. Transportuokite mechanizmą į tinkamą išmontavimo vietą.

Taip pat žr. informaciją, pateiktą skyriuje "Techninė priežiūra" (puslapyje 81).

11.3 Mechanizmo išmontavimas

Išmontuokite mechanizmą naudodami bendrąsias procedūras, dažniausiai naudojamas mašinų gamybos sektoriuje.



ĮSPĖJIMAS

Mechanizmo detalės gali nukristi

Mechanizmas pagamintas iš sunkių detalių. Šios detalės išmontavimo metu gali nukristi. Dėl to galima rimtai susižeisti, mirti arba sugadinti nuosavybę. Apsaugokite išmontuojamas mechanizmų detales, kad jos nenukristų.

11.4 Komponentų utilizavimas

Komponentai

Didžioji dalis mechanizmo sudaryta iš plieno, o likusi dalis – vario ir aliuminio. Metalai paprastai laikomi perdirbamais.

Surūšiuokite komponentus perdirbimui pagal tai, ar jie:

- Geležiniai ar plieniniai;
- Aliumininiai;
- Pagaminti iš spalvotųjų metalų, pvz., apvijos. Apvijos izoliacija sudeginama vario perdirbimo metu;
- Izoliacinės medžiagos;
- Kabeliai;
- Elektroninės atliekos.

Proceso medžiagos ir cheminės medžiagos

Surūšiuokite proceso medžiagas ir chemines medžiagas perdirbimui pagal tai, ar jos:

- Alyva;
- Tepalas;
- Valymo medžiagos ir tirpikliai;
- Dažų likučiai;
- Antikorozinė priemonė.

Atskirtus komponentus utilizuokite pagal vietos reikalavimus arba naudodamiesi specialios utilizavimo įmonės paslaugomis. Tas pats taikoma šluostėms ir valymo medžiagoms, kurias naudojate dirbdami su mechanizmu.

Pakavimo medžiaga

- Jei reikia, susisiekite su atitinkama utilizavimo įmone.
- Medinę pakuotę, skirtą transportavimui jūra, sudaro impregnuota mediena. Laikykitės vietos reikalavimų.
- Vandens nepraleidžiančiai pakuotei naudojama folija yra aliumininė folija. Ją galima utilizuoti terminiu būdu. Nešvarią foliją reikia sudeginti.

A Techninė priežiūra ir pagalba

Kontaktinė informacija norint išsamesnės informacijos

Informacija, susijusi su šio elektrinio mechanizmo dizainu ir leidžiamomis darbo sąlygomis, pateikta šiose naudojimo instrukcijose.

Jei norite užsisakyti atsarginių dalių, susisiekitė su klientų aptarnavimo centru arba kitais nurodytais kontaktais.

Jei turite techninių klausimų arba norite papildomos informacijos, susisiekitė su "Siemens" elektrinių mechanizmų arba klientų aptarnavimo centru – gamintoju. Būkite pasiruošę mechanizmo duomenis ir ypač mechanizmo serijos numerį.

Mechanizmo duomenys nurodyti ant mechanizmo duomenų plokštelės.

Adresas

Drásov 126

664 24 Drásov

Czech Republic (Čekijos Respublika)

Tel.: 420 549 426 103

Faks.: 420 541 231 028

Svetainė: <http://www.siemens.cz/sem�>

A.1 "Siemens" techninės priežiūros centras

Klientų aptarnavimo centras – gamintojas

Tel: 420 549 426 440

Faks: 420 549 426 450

El. paštas: servicedrasov.cz@siemens.com

Svetainė:

<http://www.siemens.cz/sem�>

<https://www.cee.siemens.com/web/cz/en/corporte/portal/Siemens/industry/sem�/service/Pages/servis.aspx>

Veiklos koordinavimo centras ir pagalbos linija – visame pasaulyje

Intranetas: http://portal.automation.siemens.com/ld_servicemeldung

El. paštas: ld-service.i-cs@siemens.com

Faks: 49 911 433 61 6666

Pasaulinė pagalbos linija

Vokietija: 49 (0)911 895 7222

Amerika: 1 423 262 2522

Azija: 86 1064 757575

I CS LS LD – JAV teritorija

Techninė pagalba

1-800-333-7421 (JAV)

1-423-262-5710 (Už JAV ribų)

Atsarginės dalys ir remontas

1-800-241-4453 (JAV)

1-423-262-5710 (Už JAV ribų)

<http://support.automation.siemens.com/us>

A.2 Gamybos vieta

Šį mechanizmą pagamino

Siemens Electric Machines Drásov s.r.o.
PD LD AP MG MF-DSV
Drásov 126
664 24 Drásov
Czech Republic (Čekijos Respublika)
European union (EU)

A.3 Metrinų varžtų priveržimo momento vertės

Srieginių jungčių priveržimo momento vertės

Toliau pateiktoje lent. A- 1 (101 psl.) nurodytos srieginių jungčių, kurių stiprio klasė **5.6** ir **8.8**, priveržimo momento vertės, taikomos, jei dokumentuose nenurodyta kitaip. Jungtys skirstomos į tris klases pagal medžiagos, kurią jos sujungia, tipą:

- **A klasė**
- **B klasė**
- **C klasė**

Siekiant užtikrinti tolygų pradinį įtempimą, sukurtą priveržimo momento, sriegiai turi būti švarūs (reikia nuvalyti nešvarumus ir alyvos likučius).

Pastaba

Srieginių jungčių keitimas arba koregavimas

- Jei pakeičiate sriegines jungtis arba priveržiate atlaisvintas sriegines jungtis, būtinai naudokite naujus fiksavimo elementus.
- Jei srieginė jungtis susijusi su besisukančia dalimi, pakeiskite ir jungiamuosius elementus, pvz., varžtus ir veržles.
- Naudokite tik jungiamuosius ir fiksavimo elementus, kurių tipas ir charakteristikų klasė yra tokie patys kaip gamykloje padarytos pradinės srieginės jungties.

Priveržimo momento verčių išimtis

Čia nurodytos priveržimo momento vertės netaikomos, jei techniniuose dokumentuose nurodytos kitokios priveržimo momento vertės. Jei dokumente nurodomas priveržimo momentas, priveržiant reikia naudoti dinamometrinį veržliaraktį.

Jei jungties dalis yra guminis ar kitoks sandariklis, priveržimo momento vertės taip pat netaikomos.

Tokiu atveju galite apytiksliai laikytis priveržimo momento verčių, nurodytų **C klasei** (jei prijungiate aušintuvo korpusą ir rėmą naudodami elastingus atspariuosius tarpiklius, pvz., "Sylomer" arba "Sylodyn"); svarbiausias veiksnys yra elastingo atspariojo tarpiklio deformacijos koeficientas. Priveržimo norma turi būti lygi



ĮSPĖJIMAS

Nurodytos vertės taikomos, jei varžto (veržlės) judėjimui netrukdo kitos parazitinės jėgos, pvz., surinktų dalių sukimasis, nešvarumai sriegyje, sriegio deformacija, nesulygiavimas ir pan.

Jei montuoti sriegines jungtis prieš priveržiant nurodytu priveržimo momentu yra sunku ir reikia naudoti jėgą, 20 % didesnę už lentelėje nurodytą priveržimo momentą, reikia imtis taisomųjų veiksmų.

Leidžiamosios paklaidos

Priveržimo nurodytu priveržimo momentu leidžiamoji paklaida yra –10 %, +10 %.

A klasė

Dalių iš plieno ir ketaus stacionarių srieginių jungčių priveržimo momento vertės.

Ši klasė apima toliau nurodytas dalis:

- skydas
- guolių mazgas
- maišytuvas
- aušintuvas (netaikoma aušintuvo korpuso ir rėmo sujungimui lanksčiąja jungtimi)
- plieniniai dangčiai
- galinė kabelio jungtis
- slydimu guolio jungtis su skydu
- žadintuvo jungtis su skydu
- rotorius apvijos tarpikliai iš plieno ir ketaus
- ventiliatoriaus mentės (maišytuvo jungtis su stebule, atsvaras ant ventiliatoriaus menčių)
- šynų (varinių) jungtys, kabelių nuo apvijos iki šynų jungtis
- įrankių ir laikiklių tvirtinimas

B klasė

Varžtų, kuriais sujungti mažos stiprumo ribos elementai, pvz., iš aliuminio, vario ir žalvario, priveržimo momento vertės.

Ši klasė apima toliau nurodytas dalis:

- rotorius apvijos tarpikliai iš aliuminio
- dangčiai iš stiklo pluošto, diodų laikikliai, magistralės atramos iš stiklo pluošto
- kabelių prijungimas prie izoliatorių

C klasė

Varžtų, kuriais sujungtos labai mažos stiprumo ribos dalys, priveržimo momento vertės.

Ši klasė apima toliau nurodytas dalis:

- izoliatoriai
- plastikinės ir keraminės dalys
- lygintuvai
- plastikinės arba keraminės gnybtų dėžutės prijungimas

lent. A- 1 Srieginių jungčių priveržimo momento vertės

5.6 ir 8.8 stiprio klasės priveržimo momento vertės [Nm] ¹⁾			
Vardinis sriegio skersmuo	A klasė	B klasė	C klasė
M4	3	1,3	1,2
M5	5	2,6	2,5
M6	8	4,5	4
M8	20	10	8
M10	40	20	13
M12	70	34	20
M14	110	54	
M16	170	83	40
M18	240	115	
M20	340	160	110
M22	480	220	
M24	600	280	
M27	890	420	
M30	1200	560	
M33	1600		
M36	2100	990	
M42	2700		
M45	3400		

¹⁾ Leidžiamoji paklaida $\pm 10\%$

Atrinktų mechanizmo dalių priveržimo momento vertės

Dalis	Sriegis	Priveržimo momentas [Nm]
Diodas (D170U25C, D17S25C...)		20
Gnybtų plokštelė gnybtų dėžutėje (Rišikliai – 8.8 stiprio klasė)	M10	40
	M12	70
	M16	155

Pastaba

Daugiau informacijos teiraukitės "Siemens" techninės priežiūros centre (97 psl.).

B Techniniai duomenys ir brėžiniai

Pastaba

Kur rasti techninius duomenis ir brėžinius

Šio generatoriaus techninius duomenis ir reikiamus brėžinius rasite B priede "Techniniai duomenys ir brėžiniai".

C Kokybės dokumentai

Pastaba

Kur rasti kokybės dokumentus

Visus su mechanizmo tipu susijusius kokybės patvirtinimus rasite C priede "Kokybės dokumentai".

Visi konkrečių mechanizmų projektavimo kokybę patvirtinantys dokumentai išvardyti atskiroje gamybos duomenų knygoje (MDB). Sukurta specialiai kiekvienam mechanizmui skirta MDB.

D Papildomi dokumentai

Pastaba

Kur rasti papildomus dokumentus

Konkrečių mechanizmo komponentų papildomus dokumentus rasite D priede "Papildomi dokumentai".

E

Kontroliniai sąrašai ir formos

Pastaba

Kur rasti kontrolinius sąrašus ir formas

Visus reikalingus kontrolinius sąrašus ir formas rasite E priede "Kontroliniai sąrašai ir formos".

Jei E priedas "Kontroliniai sąrašai ir formos" nepateiktas, vadovaukitės dokumente "Naudojimo instrukcija / Montavimo instrukcija" pateiktais nurodymais.

F

Montavimo dokumentai

Pastaba

Kur rasti montavimo dokumentus

Montuojant komponentus reikalingus dokumentus rasite E priede "Montavimo dokumentai".



ĮSPĖJIMAS

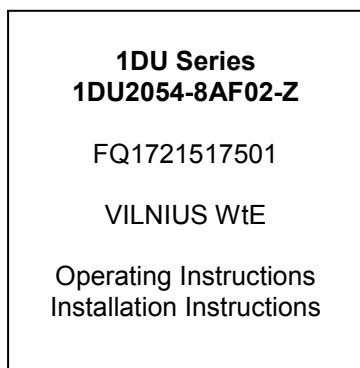
Žala, padaryta dėl neleistinių veiksmų

Jei šiuos dokumentus gavote netyčia, gražinkite juos "Siemens" partneriui arba sunaikinkite. Tai padės užtikrinti, kad darbus jūsų sistemoje atliktų tik kvalifikuoti darbuotojai, ir išvengti turtinės žalos ar kūno sužalojimų, jei darbus atliks nepakankamos kvalifikacijos personalas.

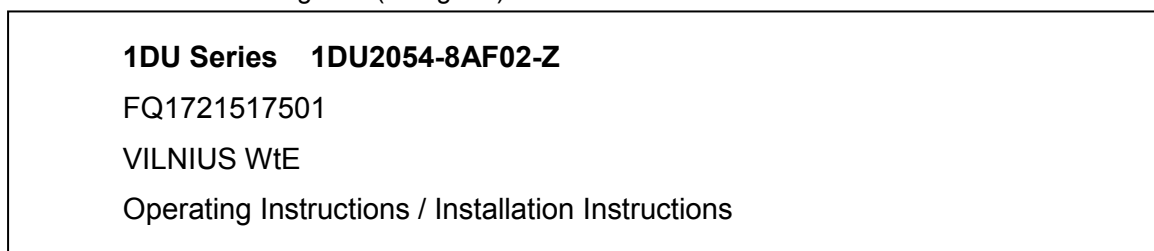
Siemens Electric Machines Drásov s.r.o.
Drásov 126
664 24 Drásov
Czech republic

www.siemens.cz/sem�

Nugarėlės etiketė 50 mm segtuvui (120 g/m²)



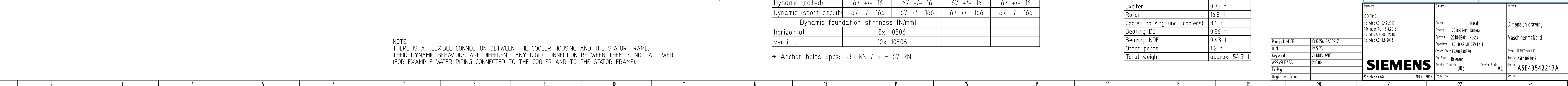
Nugarėlės etiketė 162 mm segtuvui (120 g/m²)

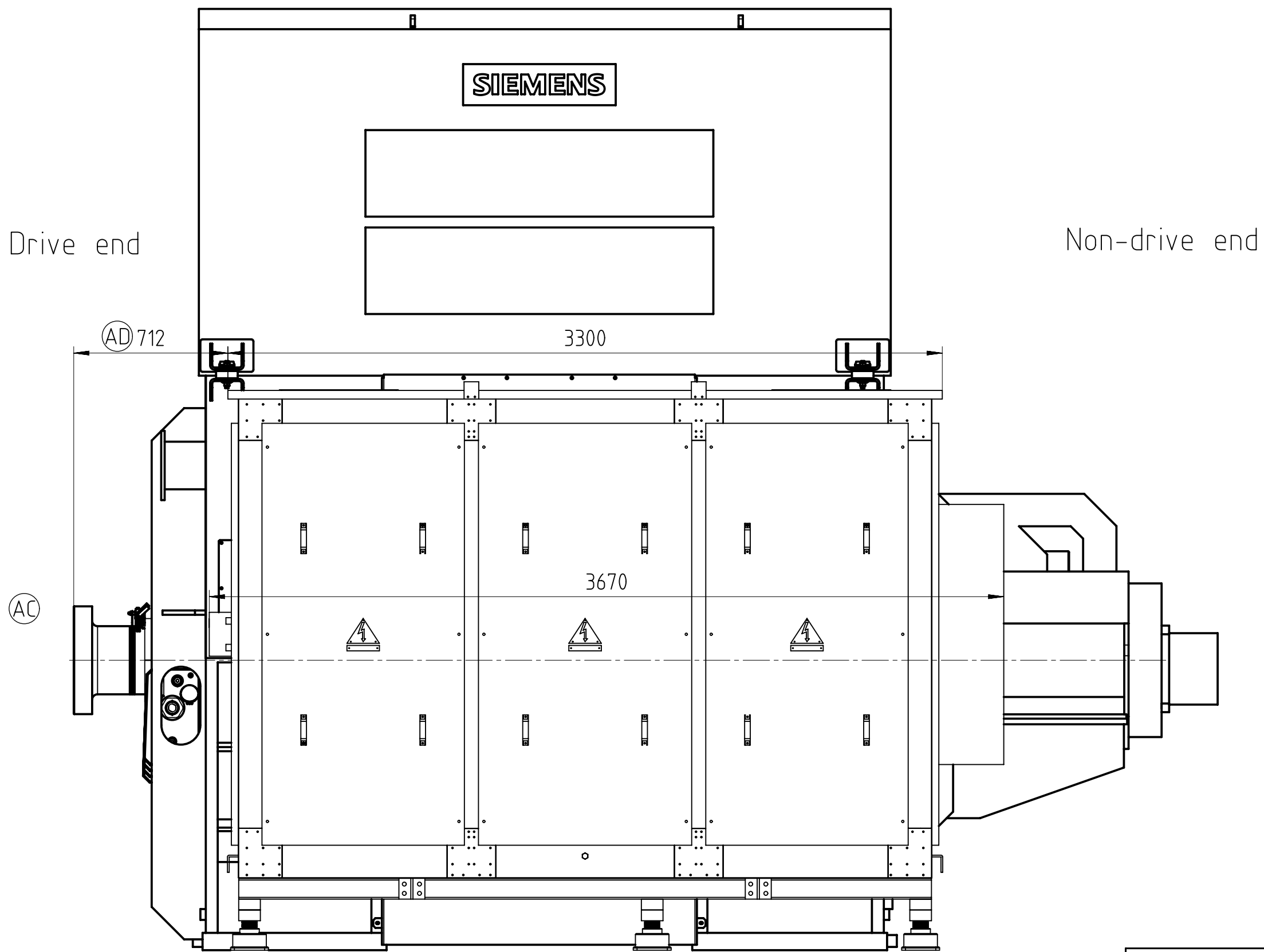
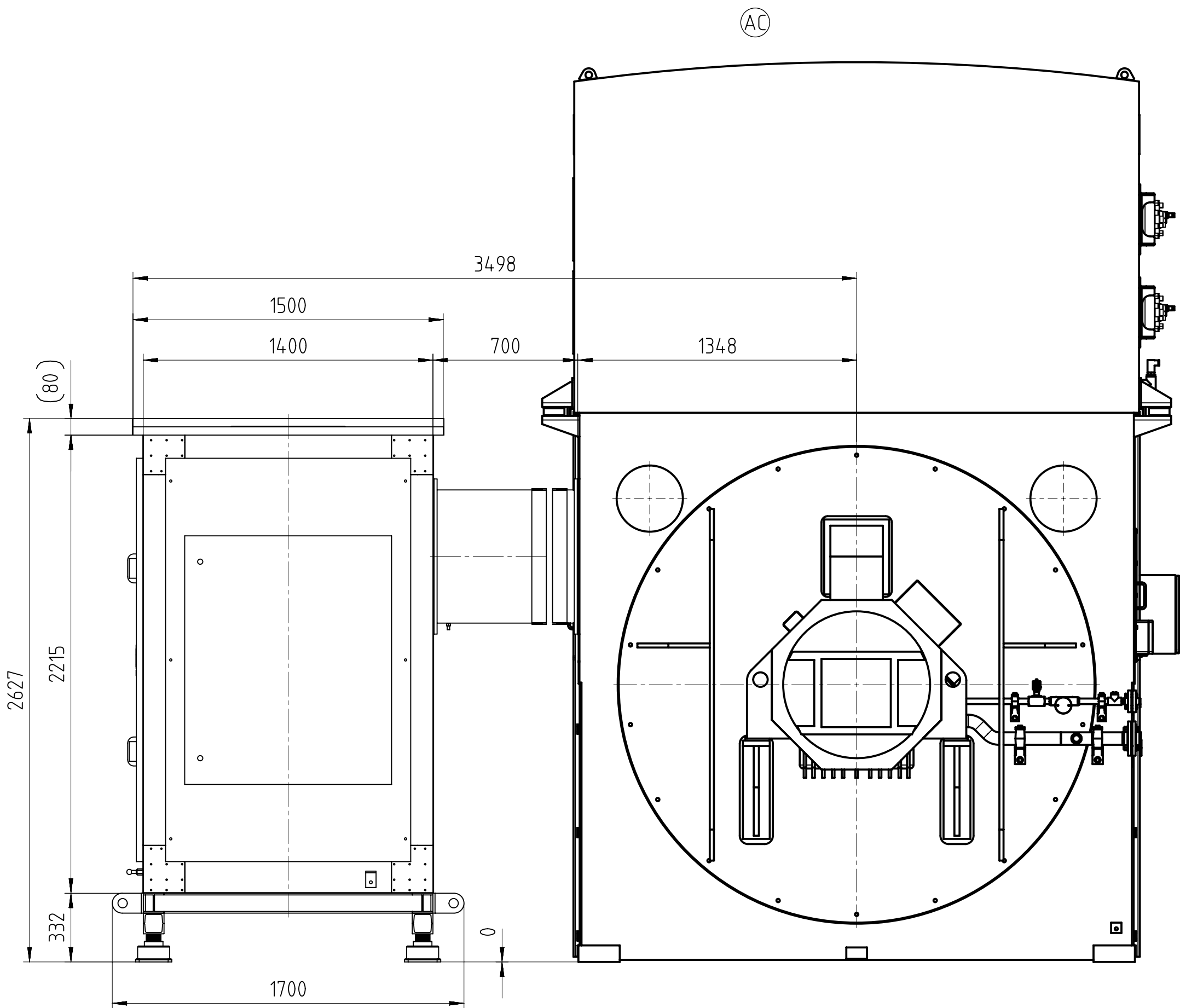
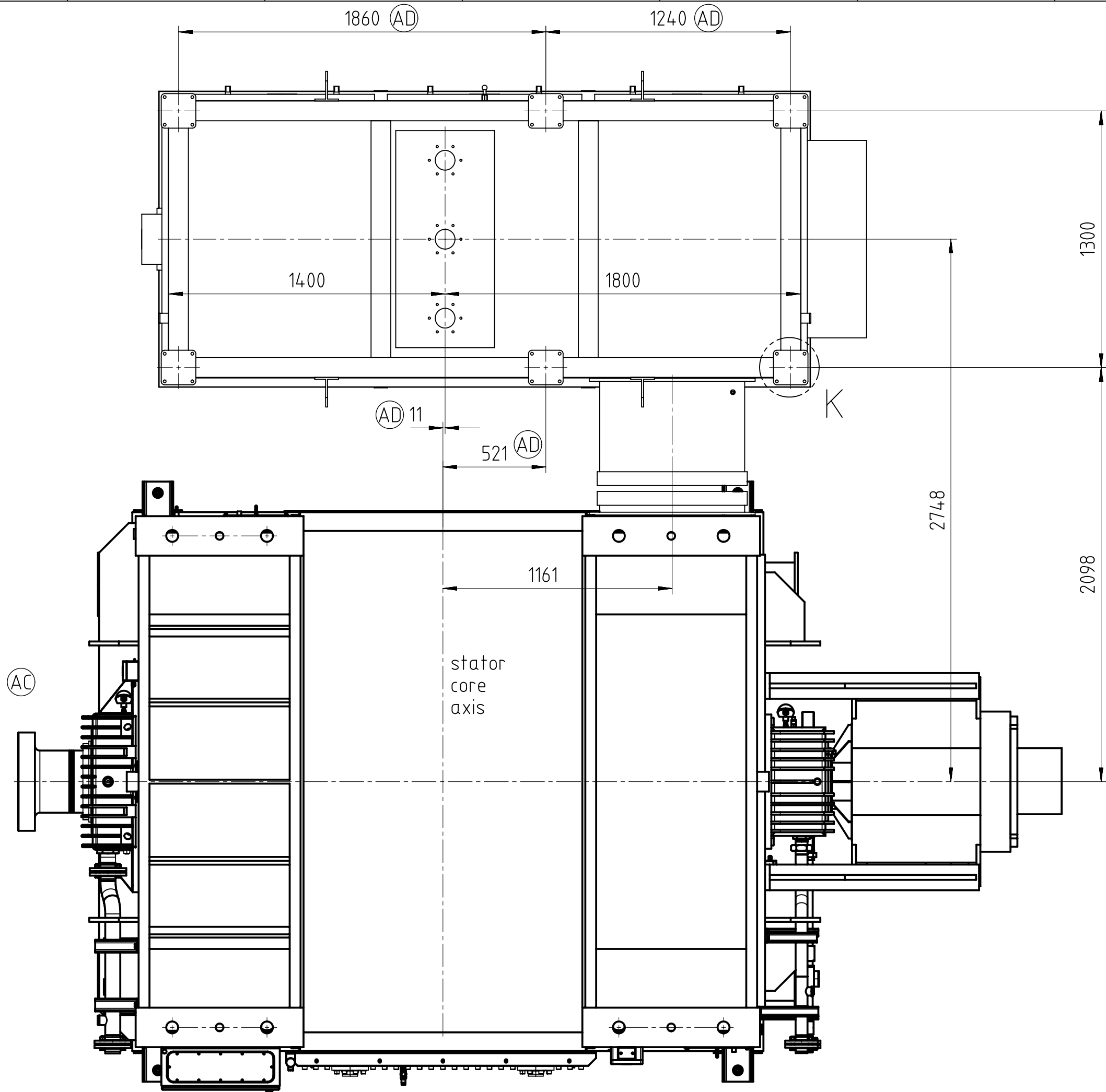
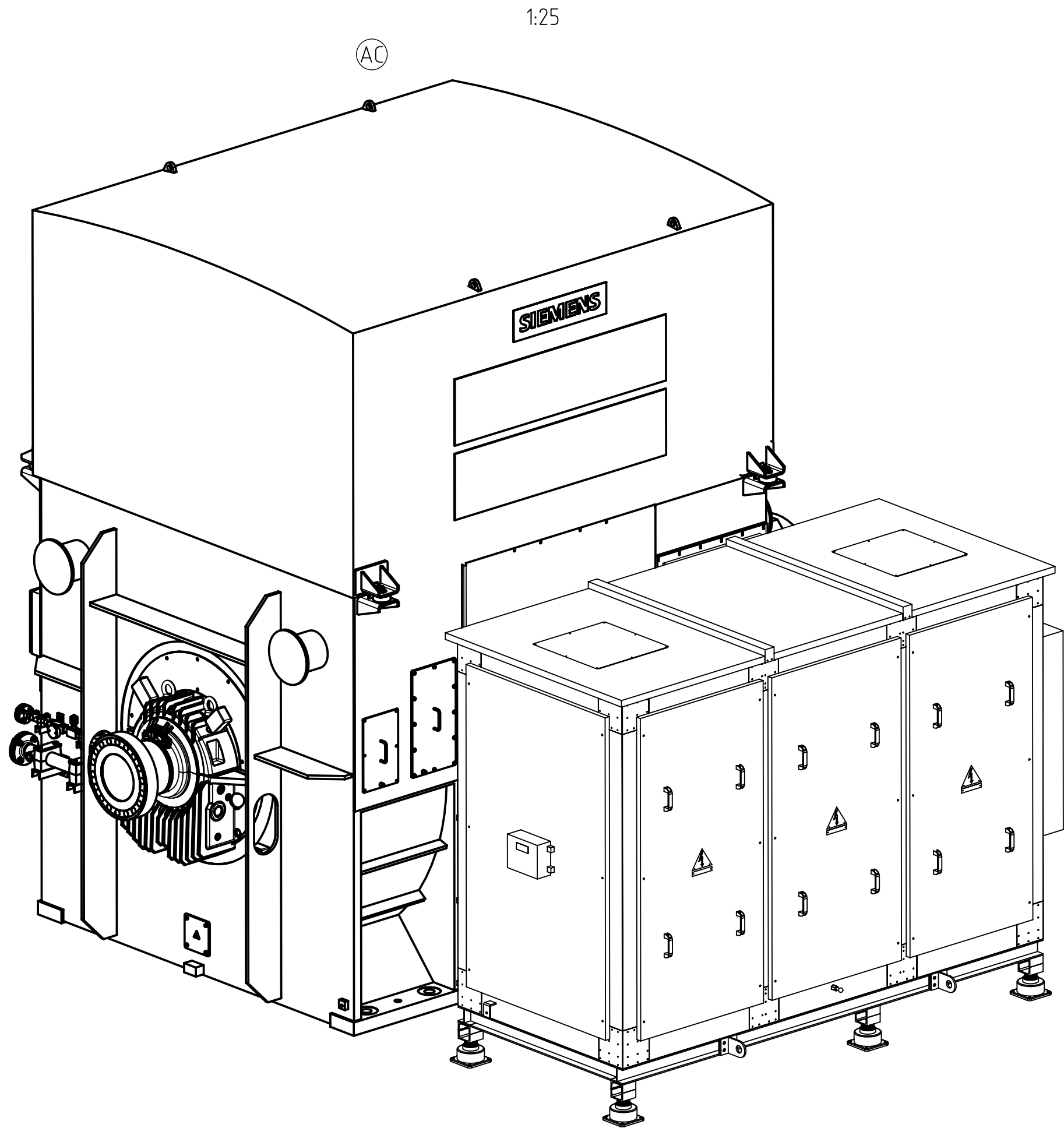


Technical data and drawings

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[illegible]



Project MLFB	1DU2054-BAF02-Z
D-Nr.	3215175
Keyword	VLMUS WHE
ASS/SUBASS	0100.00
ExtPrg	
Originated from	

Tolerance	Surface	Material	Weight	Scale
ISO 8015			54300 kg	1:20
1x index AB: 6.12.2017	Author	Husak	Dimension drawing	
10x index AD: 16.4.2018	Creator	2018-08-01 Kurera		
6x index AD: 28.6.2018	Approval	2018-08-01 Husak	Maschinenmaßbild	
1x index AE: 1.8.2018	Department	PD LD AP MF-BSV EN 1		
Charge Order P5A00288370	Doc. State	Released	Product MLFB/Product-ID	Doc. Type TB / Z
	Revision (Externe)	006	Item No ASE44094019	Paper Size A1
			Doc. No ASE43542217A	1st Language en
			Ref. No	2nd Language de
				Sheet 2 of 2

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Project No

Revision State

AE

Ref. No

ASE43542217A

Sheet

2 of 2

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Dimension dwg. text

Type	:	1DU2049-8AE02-Z
Project.-No.	:	3215175
Serial-No.	:	FQ1721517501
Code	:	VILNIUS WtE
Dimension dwg. text	:	A5E43554017A
Dimension drawing	:	A5E43542217A

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Revision

Items	Revised	Rev.
30,33,34,35,36,70	3.9.2018, Kučera	AB

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0 Machine data

Type of construction	:	IM1005
Degree of protection	:	IP54
Power rating	:	25 530 kVA
Power factor	:	0,85 -
Rated current	:	983 A
Rated voltage	:	15 000 V
Insulation class design // utilization	:	F/B
Frequency range	:	50 Hz
Speed	:	1 500 rpm
Total weight	:	ca. 54,3 t (without mounting components)
Weight of rotor removal components	:	ca. 1,1 t
Weight of foundation components	:	290 kg
Weight of cooler housing	:	ca. 3,1 t (with cooler elements)
Weight of rotor	:	16 810 kg
Moment of inertia	:	2 730 kg.m ²
Break away torque (with jacking oil, friction coef. 0,005)	:	125 Nm
Cooling method	:	IC81W
Cooling water temp.	:	max. 45 °C
Allowed ambient temp.	:	0 - 50 °C
Noise level	:	80 +2 dB(A) at no-load operation and sinusoidal voltage, ISO1680 / 1999

Electrical values : Refer to electrical data sheet

Note:

Siemens recommends that a dynamic analysis and examination of the complete shaft train acc. to VDI-3840 is conducted.

Transient torques will be supplied on request.

Service, Siemens Electric Machines, s.r.o.

Email: servicedrasov.cz@siemens.com

Tel.: +420 549 426 440

Fax: +420 549 426 450

Web:

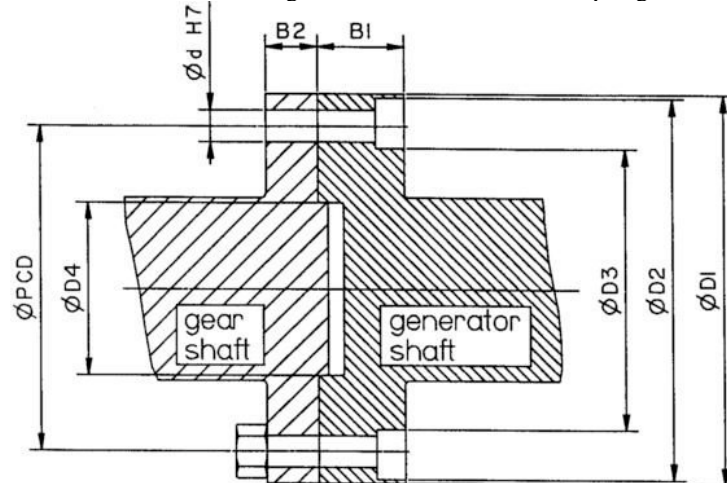
<https://www.cee.siemens.com/web/cz/en/corporte/portal/Siemens/industry/sem/Service.aspx>

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1 Drive end shaft extension

Shaft flange LS4 acc. to K-31310-2.

Rotor is dynamically balanced acc. to ISO 1940-1 grade G 0,63 without coupling half.



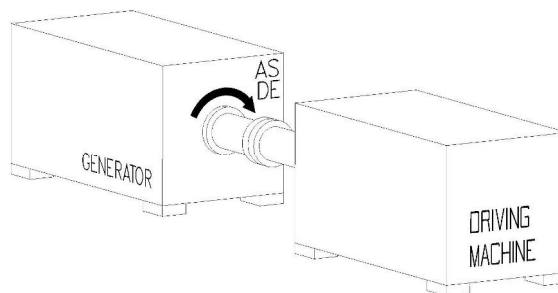
D1	D2	D3	D4	d	No.	PCD	B1	B2
498	490	377	275H6	37	18	425	85	60

2 Direction of rotation

Direction of rotation facing drive end.

The generator is only suitable for **CLOCKWISE** direction of rotation.

Connection of the system phases in the positive sequence to the machine terminals **U1 V1 W1**.



5 Recommended lubricants of sleeve bearings

Type of lubricant	Code	Standard	Notes
Lubricating oils	CL	DIN 51517/2	Well suited
Lubricating oils	CLP	DIN 51517/3	Suitable, if NZ (Neutralization number) is not too high. Use of EP additives has to be avoided.
Hydraulic oils	HL	DIN 51524/1	Suitable, use of VI improvers has to be considered
Hydraulic oils	HLP	DIN 51524/2	Suitable, use of VI improvers has to be considered

This table shows general recommendation about which lubricant class shall be used for bearings and jacking oil. For further details refer to chapter 6 and 7.

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6 Sleeve bearing- Drive end

Supplier	:	RENK
Type of bearing	:	EMZLB 28
Size of bearing	:	315
Oil reservoir capacity	:	44,4 l
Viscosity of oil	:	ISO VG 46
Purity class acc. to ISO 4406	:	18/16/13
Power dissipation	:	8,5 kW
Flow rate	:	13 l/min at a temperature rise of 20,2 K
Max. allowed oil inlet temperature	:	49 °C + 2 / - 5 °C
Nominal oil inlet pressure	:	2,5 ± 0,1 bar
Min. pressure in oil supply pipe	:	2 bar
Max. pressure in oil supply pipe	:	4 bar
Jacking oil parameters		
Flow rate	:	0,8 l/min
Starting pressure	:	95 bar
Operating pressure	:	60 bar

Axial bearing clearance see item 10

The bearing is insulated. Connection point white metal, wired to a terminal box item 72.

The generator shall **only be driven while being bridged**.

Forced oil lubrication **without lubrication ring**.

Generator bearings are shipped without oil.

7 Sleeve bearing- Non-drive end

Supplier	:	RENK
Type of bearing	:	EFZLQ 22
Size of bearing	:	280
Oil reservoir capacity	:	21 l
Viscosity of oil	:	ISO VG 46
Purity class acc. to ISO 4406	:	18/16/13
Power dissipation	:	6,3 kW
Flow rate	:	10 l/min at a temperature rise of 19,1 K
Max. allowed oil inlet temperature	:	49 °C + 2 / - 5 °C
Nominal oil inlet pressure	:	2,5 ± 0,1 bar
Min. pressure in oil supply pipe	:	2 bar
Max. pressure in oil supply pipe	:	4 bar
Jacking oil parameters		
Flow rate	:	0,8 l/min
Starting pressure	:	130 bar
Operating pressure	:	80 bar

The bearing is insulated. Connection point white metal, wired to a terminal box item 73.

Insulation of the NDE bearing **may not be bridged**.

Forced oil lubrication **without lubrication ring**.

Generator bearings are shipped without oil.

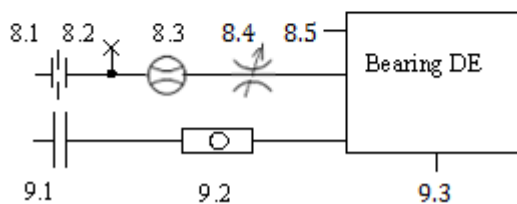
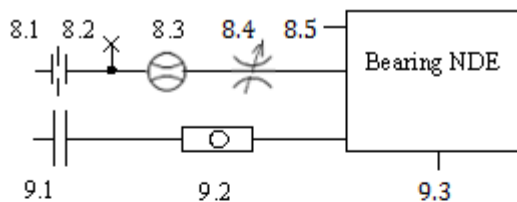
It is recommended to use mineral oil only. Other oils or additives cannot be used without manufacturer confirmation.

For further information, how to fill bearings with oil, see RENK's
„Instruction for Maintenance and Inspection“ or Operation manual chapter Installation.

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8 Oil inlet connection

Material	:	Stainless steel 1.4571
8.1 Oil inlet	DE :	Flange DN20 PN16 EN1092-1/11 – with counter flange
	NDE :	Flange DN20 PN16 EN1092-1/11 – with counter flange
8.2 Fast coupling	:	G1/4" female with plug
Tag. No – DE / NDE	:	- / -
8.3 Flow meter	DE :	RW5/15/K3/SPP
	NDE :	RW5/15/K3/SPP
8.4 Throttle valve	:	NDV-DN16-G3/4-4A
8.5 Jacking oil	:	G1/4" female with plug



9 Oil outlet connection

Material	:	Stainless steel 1.4571
9.1 Oil outlet DE	:	Flange DN60 PN16 EN1092-1/11 – with counter flange
	NDE :	Flange DN50 PN16 EN1092-1/11 – with counter flange
9.2 Sight glass	:	
9.3 Oil drain	:	Screw plug G3/4"

Oil drain pipes have to be installed with a slope of at least 5% and adequately vented (avoid oil sacks).

The cross-sections of the oil manifold connections should be equal to the sum of the cross-sections of all pipes connected to it.

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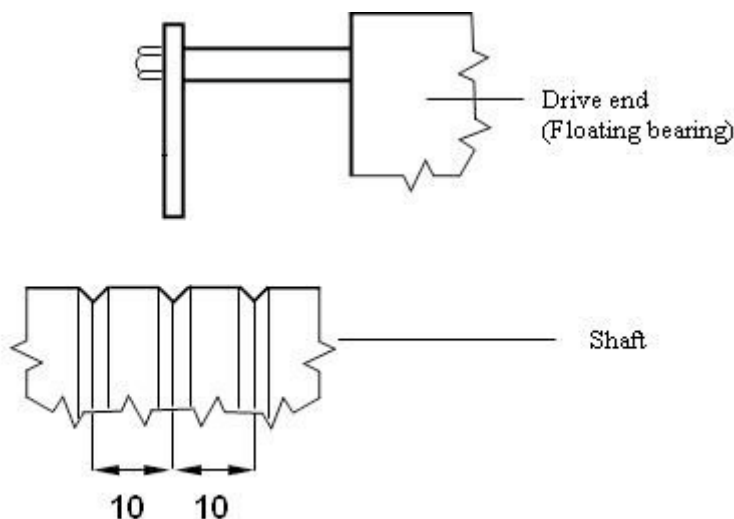
10 Rotor position indicator / Axial clearance

The bearings are non-locating. The axial movement of the rotor has to be limited by a locating bearing in the driven machine or in the gearbox via the coupling. It must be ensured that only a coupling with fixed axial clearance is used.

The generator has to be aligned geometrically. When the pointer on the bearing is positioned over the middle groove in the shaft, the specified bearing clearance is available.

If the rotor is pulled out of **the geometric centre** during operation, axial forces of **up to 7,61 kN will occur**.

The generator may be run uncoupled for brief trial operations.



11 Minimum turning speed

The lowest admissible turning speed : > 62 rpm

Lower speed is permitted only during the run-up and the stopping of the turbine. Time of this phase should be the shortest possible and the bearing lubrication have to be ensured. The damage of the bearing brass can be incurred in the long-term running under the minimum allowed speed.

In all cases both bearings must be lubricated before shaft turning.

For operation below minimum turning speed the jacking oil system must be activated. Parameters of the jacking oil for each bearing are stated in items 6 and 7.

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30 Air-to-water cooler

To obtain optimum noise reduction of the generator, it is recommended to use expansion-joints for the cooler connection.

Supplier	:	Kelvion		
Type	:	2642/1344/24-VSv-S119-32T163		
Specification of tube	:	single		
Water reservoir	:	30	l	AB
Weight	:	434	kg	AB
Connection for cooling water	:	machined steel plate, flange DN65 pattern is drilled into this plate		
Glycol	:	0	%	
Fouling factor	:	0,00009	m ² °C/W	
Operation with	:	1 cooler	2 coolers	
Capacity/Losses to dissipate	:	275	330	kW
Flow rate of cooling water	:	20,48	41,04	m ³ /h
Water inlet temperature	:	45	°C	
Water outlet temperature	:	56,72	52	°C
Pressure drop	:	0,92	0,92	barg
Max. operation pressure	:	25	barg	
Test pressure	:	37,5	barg	

Material

Tubes	:	Stainless steel
Fins	:	Al
Water boxes	:	Carbon steel coated with Rilsan
Tube sheet	:	Stainless steel
Flanges	:	Carbon steel coated with Rilsan
Tag No. – Bottom / Top cooler	:	- / -

If only one cooler is in operation the power output of the generator must be reduced to **67%** of the nominal value.
Up to **3%** of the losses are dissipated by the machine surface in nominal operation.

33 Ventilation valve

Type	:	KNMOT MF 1/2", DN15, PN30	AB
Size inlet	:	G 1/2" – male with plug	
Bottom / Top cooler - Tag No.	:	- / -	
Temperature range	:	-20°C – 95°C	AB
Design pressure	:	30 bar	AB

34 Water drain valve

Type	:	MNMOT MF 1/2", DN15, PN30	AB
Size inlet	:	G 1/2" – male with plug	
Bottom / Top cooler - Tag No.	:	- / -	
Temperature range	:	-20°C – 95°C	AB
Design pressure	:	30 bar	AB

35 Water leakage detector

Quantity	:	1	
Type	:	ASH/V/GN-1-V/U-L65/08-1	
Tag No.	:	V10MKA10CLI10	AB

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36 Safety valve

Quantity per cooler	:	1	
Type	:	SF05	AB
Size inlet	:	G1/2" - female	AB
Size outlet	:	G1" - female	AB
Opening pressure	:	25 barg	
Temperature range	:	-30°C - 130°C	AB
Bottom / Top cooler - Tag No.	:	- / -	
Water exhaust at overpressure 10%	:	12,6 m³/h	AB

40 Winding resistance temperature detector (RTD)

Single Pt100, 100 Ω at 0°C, DIN IEC 751

Type	:	NWT-ST
Quantity	:	6 + 3
Trip temperature	:	see item 48

Position in stator core viewed onto drive end. RTD with connection ident.-no. 20:1 – 20:3 is located at the top of the stator. Arrangement clockwise.

Tag No.	RTD with connection-no.	slot	phase
MKA10CT010	20:1 – 20:3	3	U
MKA10CT020	20:4 – 20:6	43	V
MKA10CT030	20:7 – 20:9	11	W
MKA10CT011	20:10 – 20:12	27	U
MKA10CT021	20:13 – 20:15	67	V
MKA10CT031	20:16 – 20:18	35	W
MKA10CT012	20:19 – 20:21	75	U
MKA10CT022	20:22 – 20:24	91	V
MKA10CT032	20:25 – 20:27	59	W

42 Bearing resistance temperature detector

Double Pt100, 100 Ω at 0°C, DIN IEC 751

Quantity per bearing	:	1
Type DE	:	2PT100/B-265x6S-G1/2-3/0-N
Type NDE	:	2PT100/B-190x6S-G1/2-3/0-N
DE - Tag No.	:	MKD10CT010
NDE - Tag No.	:	MKD20CT010
Trip temperature	:	see item 48

44 Warm-air resistance temperature detector

Double Pt100, 100 Ω at 0°C, DIN IEC 751

Quantity per air path	:	1
Type	:	PT31
Air flow - Tag No.	:	MKA10CT060
Exciter air flow - Tag No.	:	MKA10CT062
Trip temperature	:	see item 48

46 Cold-air resistance temperature detector

Double Pt100, 100 Ω at 0°C, DIN IEC 751

Quantity per air path	:	1
Type	:	PT31
DE - Tag No.	:	MKA10CT050
NDE - Tag No.	:	MKA10CT055

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Trip temperature : see item 48

48 Guide values for adjustment of tripping temperatures

	Maximum setting values		Settings after commissioning (T: measured value at rated point)	
	Alarm	Trip	Alarm	Trip
Stator winding EID	125 °C	130 °C	T + 5 K	T + 10 K
Bearing	90 °C	95 °C	T + 5 K	T + 10 K
Warm –air	80 °C	85 °C	T + 5 K	T + 10 K
Cold –air *	60 °C	65 °C	T + 5 K	T + 10 K
Cold –air **	73 °C	78 °C	T + 5 K	T + 10 K

* Related to 100% power output and 2 coolers in operation

** Related to 67% power output and 1 cooler in operation

49 Anti-condensation heater – Main machine

Type : DEW 8,5-400-460 V/1000 W/3 Y
 Voltage : 400 V
 No. of phases : 3
 Power rating : 2 x 750 W
 DE - Tag No. : MKA10AH110A
 NDE - Tag No. : MKA10AH110B

50 Anti-condensation heater – Exciter

Quantity : 1
 Type : DEW 8,5-400-600 V/900 W/3 Y
 Voltage : 400 V
 No. of phases : 3
 Power rating : 400 W
 Tag No. : MKC10AH110A

60 Exciter

Type : 1JG2813-4AV06-Z
 Electrical values : Refer to electrical data sheet

61 PMG

Type : RE315-40
 Electrical values : Refer to electrical data sheet

62 Rectifier

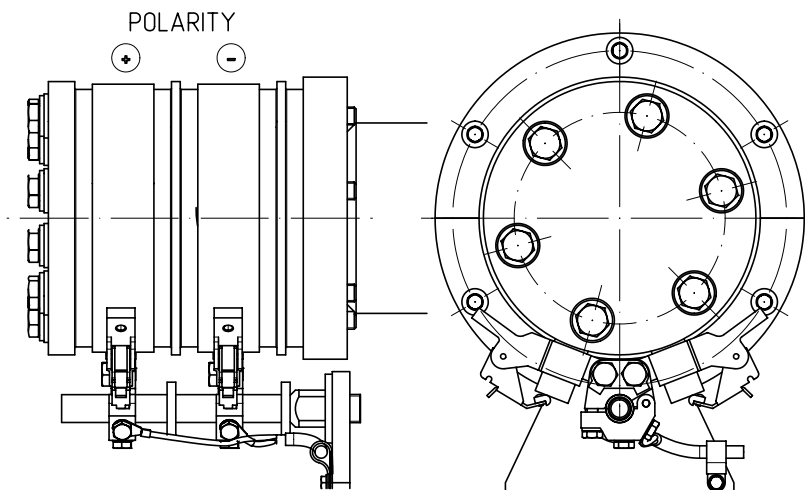
Quantity : 6
 Diode : D950N
 Quantity : 12
 Protective varistor : C13-270 V

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65 Measuring slip ring

Brushes for rotor earth-fault monitoring

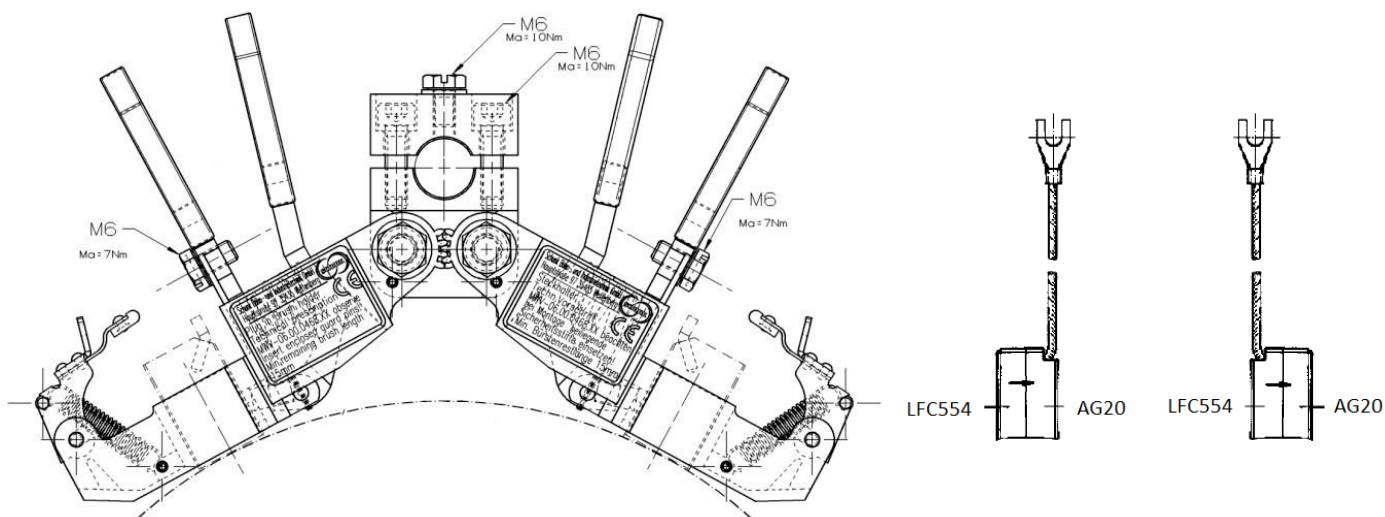
	Brush holders	Brushes
Quantity	2	4
Type	DK208-2	74729
Material	Brass	LFC554-AG20



After generator alignment it is necessary to check if the brushes are placed in the middle of the collector rings.

67 Rotor grounding brush

	Brush holders	Brushes
Quantity	1	2
Type	06.00.0468.06	74729
Material	Brass	LFC554-AG20



Cable outlet from brushes is connected to terminal box item 73.

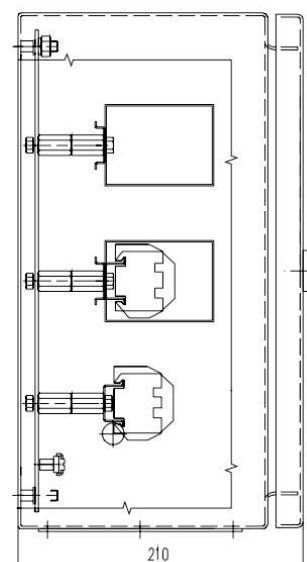
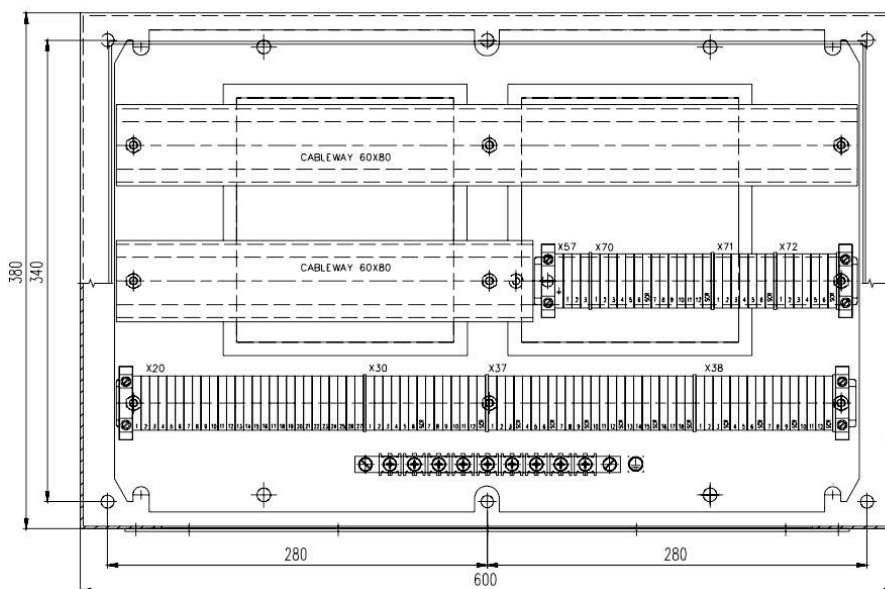
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70 Terminal box of the RTD's, leakage, shaft and brg. housing vibr. detectors

Type of terminal box	: 1039.500
Supplier	: Rittal
Material	: Coated steel
Degree of protection	: IP66
Dimensions	: 600x380x210 mm
Undrilled gland plate	: 534x150x2 mm
Tag No.	: MKA10GA010

		Terminal type	mm ²	AWG
Slot temperature detectors	X20	UK5 N	0,2 – 6	24 – 10
Bearing temperature detectors	X30	UK5 N	0,2 – 6	24 – 10
Cooling air temperature detectors	X70,X71	UK5 N	0,2 – 6	24 – 10
Hot air from exciter	X72	UK5 N	0,2 – 6	24 – 10
Bearing housing vibrat. detectors	X37	UK5 N	0,2 – 6	24 – 10
Shaft vibration detectors	X38	UK5 N	0,2 – 6	24 – 10
Leakage detector	X57	UK5 N	0,2 – 6	24 – 10

AB



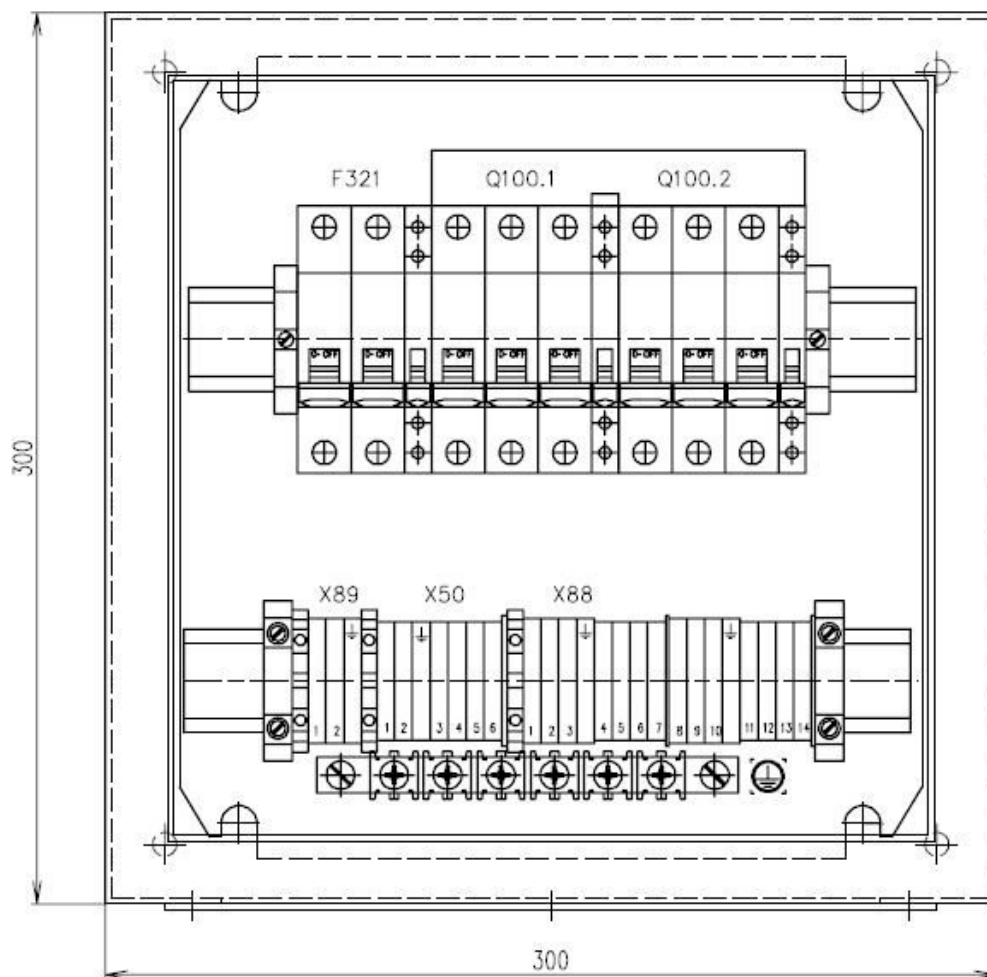
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71 Terminal box of the exciter, PMG, rotor earth fault detection

Type of terminal box	: 1036.500
Supplier	: Rittal
Material	: Coated steel
Degree of protection	: IP66
Dimensions	: 300x300x155 mm
Undrilled gland plate	: 260x72x2 mm
Tag No.	: MKC10GE010

		Terminal type	mm ²	AWG
PMG	X88	UK6 N	0,2 – 10	24 – 8
Auxiliary contacts -Q100.1,-Q100.2	X88	UK5 N	0,2 – 6	24 – 10
Exciter	X89	UK6 N	0,2 – 10	24 – 8
Brushes + auxiliary contacts -F321	X50	UK5 N	0,2 – 6	24 – 10
MCB -F321	5SY5204-7	4A		
Auxiliary contacts -F321	5ST3010			
MCB -Q100.1,-Q100.2	5SY4316-7	16A		
Auxiliary contacts -Q100.1,-Q100.2	5ST3010			



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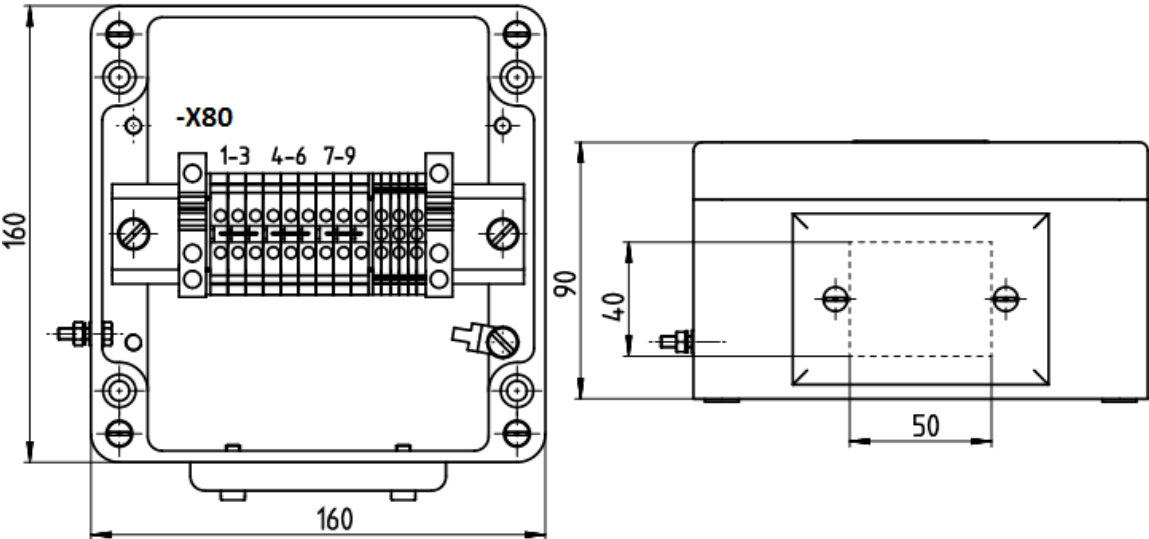
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72 Terminal box of the heaters

Type of terminal box : 01.161609
Supplier : ROSE
Material : Al
Degree of protection : IP65
Cable entry plate undrilled
Tag No. : MKA10GE030

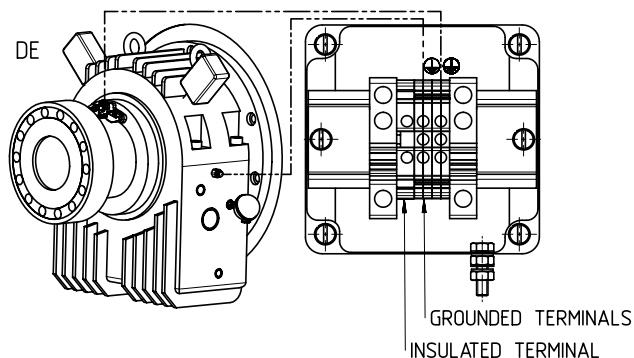
Heaters X80 Terminal type UK5 N mm2 0,2 – 6 AWG 24 – 10



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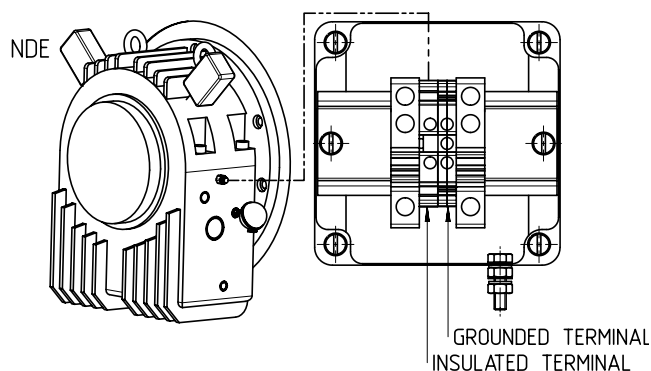
73 Terminal box of the bearings shell DE and the rotor earthing

Type of terminal box	: 01.101008		
Supplier	: ROSE		
Material	: Al		
Degree of protection	: IP66		
Terminal type	: UK 5 N	0,2 – 6 mm ²	24 – 10 AWG
	: USLKG 16 N	2,5 – 25 mm ²	12 – 4 AWG
Tag No.	: MKD10GA020		



74 Terminal box of the bearings shell NDE

Type of terminal box	: 01.080806		
Supplier	: ROSE		
Material	: Al		
Degree of protection	: IP66		
Terminal type	: VS 4PAM	0,2 – 4 mm ²	24 – 12 AWG
Tag No.	: MKA10GA030		



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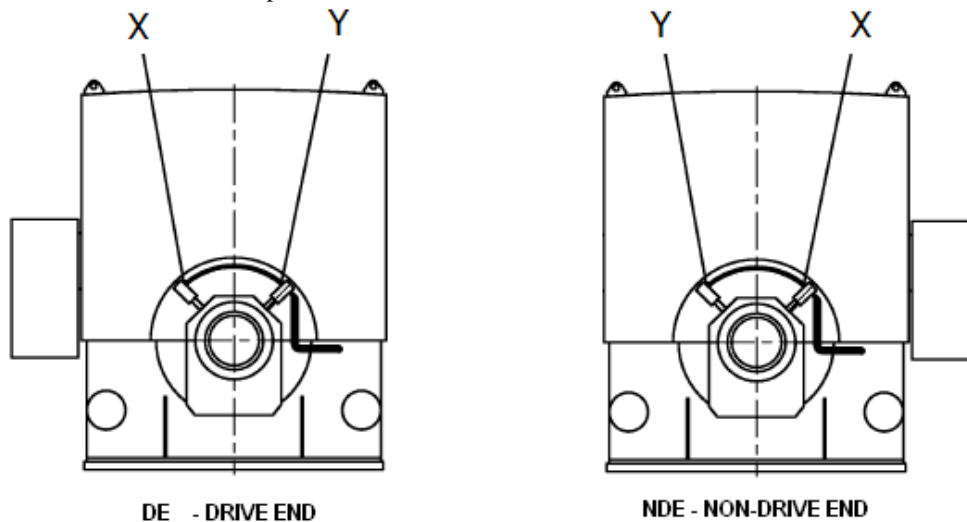
80 Shaft vibration monitoring system

Supplier : Bently Nevada
 Probe DE : 330881-16-04-175-03-02
 Probe NDE : 330881-16-04-130-03-02
 DE (X-axis, Y-axis) - Tag No. : MKD10CY011, MKD10CY012
 NDE (X-axis, Y-axis) - Tag No. : MKD20CY011, MKD20CY012

Recommended values for the set points (acc. to IEC 60034-14):

1. operating (max. 90 μm p.t.p.)
 2. alarm (max. 160 μm p.t.p.)
 3. trip (max. 225 μm p.t.p.)
- the amplitude of oscillation which is measured at normal operation.

Position of the vibration probes:



81 Bearing housing vibration monitoring system

Manufacturer : Bently Nevada
 Type : 330400-02-00
 Power supply : -24 $\pm$ 0,5 V, DC
 Quantity per bearing : 3 – horizontal, vertical, axial
 DE - Tag No. : MKD10CY020, MKD10CY010, MKD10CY030
 NDE - Tag No. : MKD20CY020, MKD20CY010, MKD20CY030

Recommended values for the set points (acc. to ISO 10816-3):

1. operating (max. 2,3 mm/s)
2. alarm (max. 4,5 mm/s)
3. trip (max. 7,1 mm/s)

Operating values are valid for generator measured in the testfield (factory Drasov/Berlin).

Above mentioned alarm and trip values are just recommendation for turbo-generator set.

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90 Foundation load

The foundation load on each generator side is composed of the short-circuit torque and the mass-components. The forces occur alternately on either side, independent of direction of rotation. Design of the foundation is the responsibility of others.

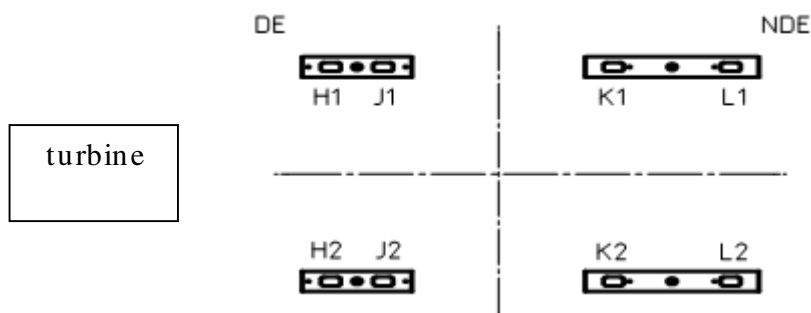
For safe operation of the generator mounted on skid or foundation a structural analysis of the complete system - to ensure normal operation free from critical vibration modes - would be recommended by Siemens. We must highlight that all determinations and analysis exceeding the generator test by conditions (mounted on rigid floor, uncoupled) are not within the generator vendors scope unless mutually agreed by the contract. According to DIN 4024 Part 1/1988 the first natural frequency of the foundation after erection of the machine must differ by at least +25% and -20% from one and two times running speed frequency and two times the electric line frequency.

Rotor design based on testfield foundation stiffness

horizontal: 5E+06 N/mm

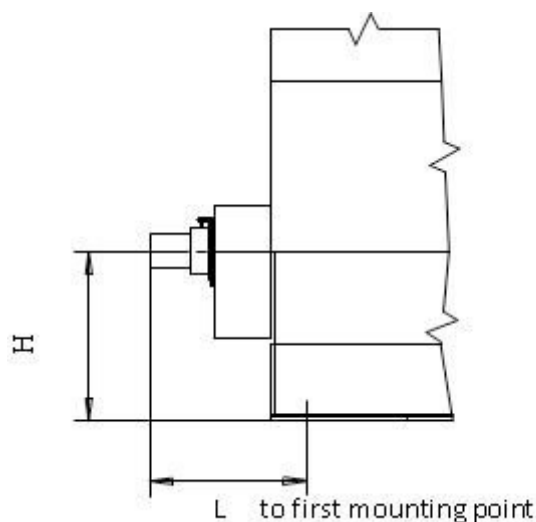
vertical: 1E+07 N/mm

	Static load [kN]	Dynamic load – rated [kN]	Dynamic load * – short-circuit [kN]
H1	67	67 ±16	67 ±166
H2	67	67 ±16	67 ±166
J1	67	67 ±16	67 ±166
J2	67	67 ±16	67 ±166
K1	67	67 ±16	67 ±166
K2	67	67 ±16	67 ±166
L1	67	67 ±16	67 ±166
L2	67	67 ±16	67 ±166
*) Dynamic load from maximum 2-phase short-circuit torque.			



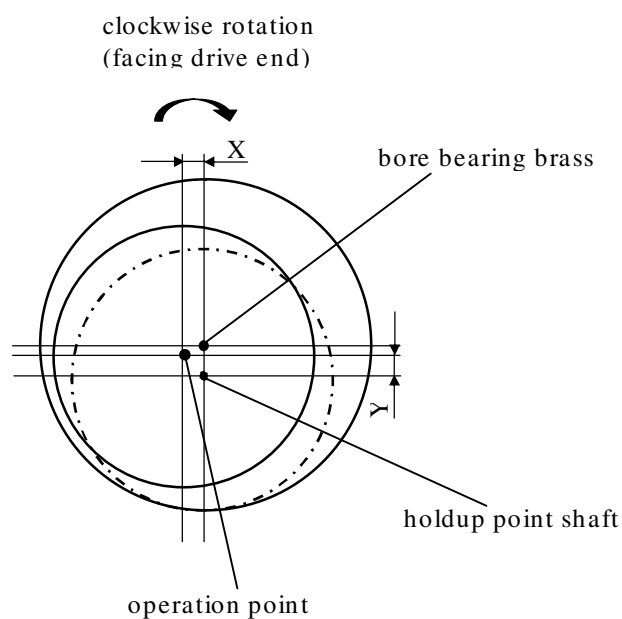
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93 Thermal expansion



Ambient temperature [°C]		min. 0	25	max. 50
Vertical thermal expansion related to H [mm]	1340	0,610	0,409	0,208
Axial thermal expansion related to L [mm]	780	0,355	0,238	0,121

94 Displacement



Horizontal displacement $s_x = -0,081$ mm

Vertical displacement $s_y = 0,102$ mm

95 Protection against corrosion

Paint System	:	C4	
		<u>inside</u>	<u>outside</u>
Primary coat	:	Colour RAL 3012	Colour RAL 3012
Top coat	:	-	Colour RAL 7030

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PROJECT: WILNIUS WtE

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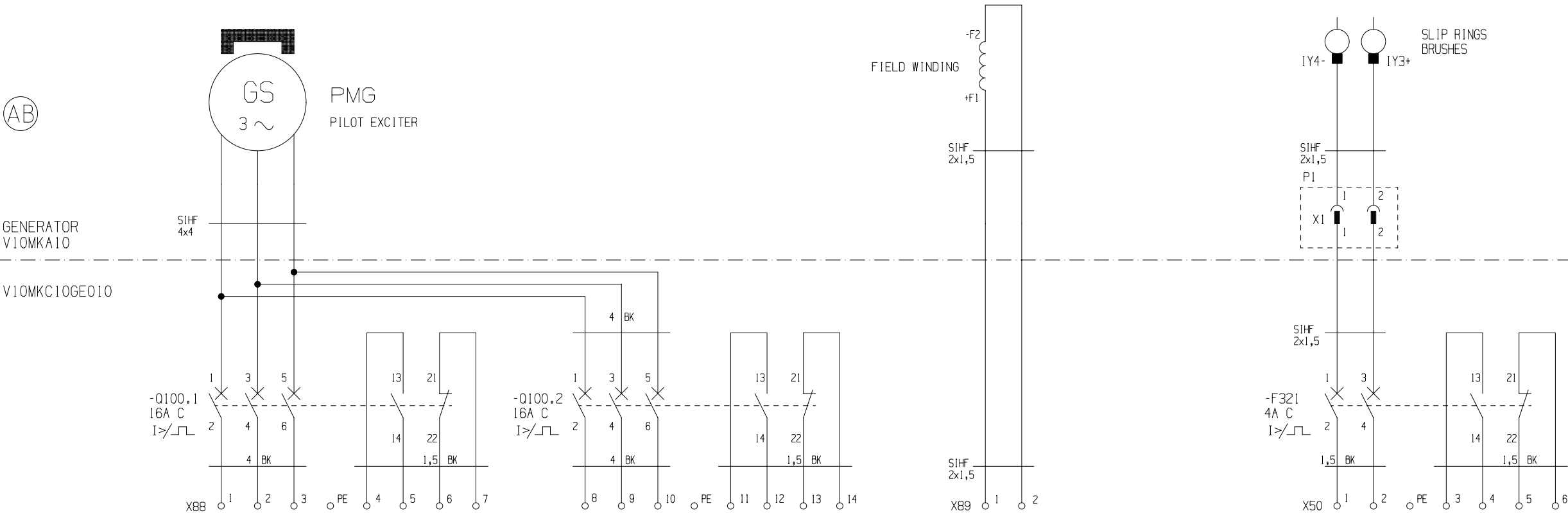
PRELIMINARY

AC	3.4.2018	KUCERA	KUCERA	HUSAK	CORRECT OF STATOR SLOT NUMBER
AB	20.3.2018	GELLER	GELLER	HUSAK	UPDATE KKS
00	28.11.2017	KUCERA	KUCERA	HUSAK	FIRST ISSUE
STA. REV.	DATE	PREP.	CHK.	APPR.	COMMENT
EMPLOYER Contract Number VKJ_S_2016-92		EMPLOYER Project Code VKJ01		 VILNIAUS KOGENERACINĖ JĖGAINĖ	
EMPLOYER DOCUMENT DESIGNATION PROJECT CODE VKJ01		LOT ID 1		DOC. COUNTER	LANGUAGE EN
CODE WORD CHP - Vilnius		FILENAME		VIEW	STATUS P
PREP.	DATE 28.11.2017	NAME KUCERA			
CHECKED	28.11.2017	KUCERA			
APPROV.	28.11.2017	HUSAK			
SCALE	TITLE GENERATOR CIRCUIT DIAGRAM				
DESIGN COMPANY				DRAWING NO. 730053	
				FORMAT	

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EXCITATION SYSTEM

ROTOR EARTH FAULT DETECTION



TERMINALS TYPE:
PHOENIX UK6N

Project	MLFB	1DU2054-8AF02-Z
O-Nr.		3215175
Keyword		VILNIUS WfE
ASS./SUBASS		6644.00
ExtPrg		
Originated from		

Tolerance	Surface	Material	Weight	Scale
ISO 8015			0.02 kg	- mm
14x Index AB	Author	Kucera	Circuit diagram	
1x Index AC	Creator	2018-04-03 Kucera		
	Approval	2018-04-03 Husak		
	Department	PD LD AP MF-DSV EN 1		
	Change Order	P5A00271479	Product MLFB/Product-ID	Doc Type TB / Z
	Doc State	Released	Item No	Paper Size A3
	Revision (Counter)	003	Revision State AC	Doc No A5E43589974A
	Project No		Ref No	1st Language en
				2nd Language de
				Sheet 2 of 11

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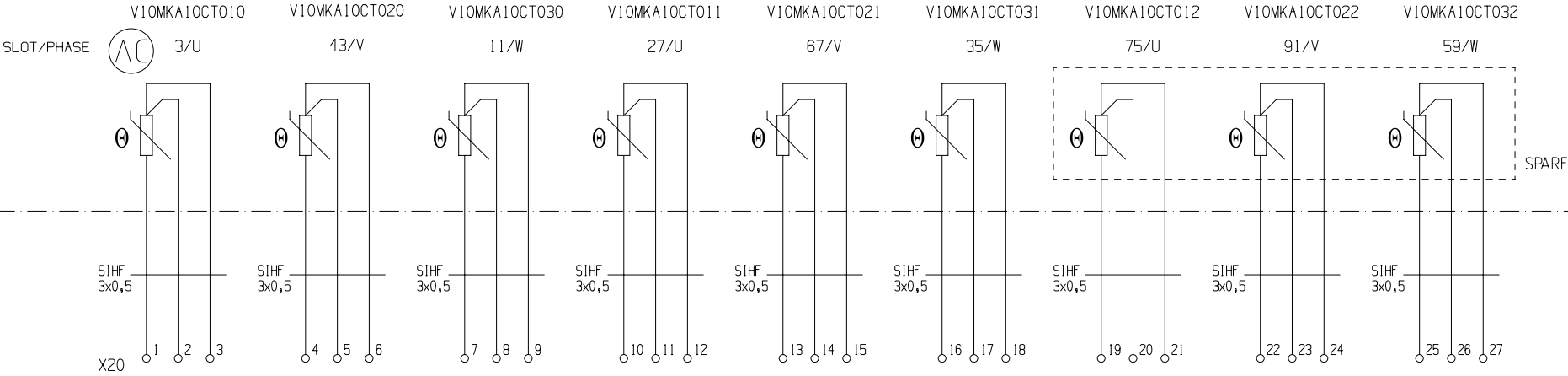
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WINDING TEMPERATURE DETECTORS



GENERATOR
VIOMKA10

VIOMKA10GA010



Project	MLFB	1DU2054-8AF02-Z
O-Nr.		3215175
Keyword		VILNIUS WTE
ASS./SUBASS		6644.00
ExtPrg		
Originated from		

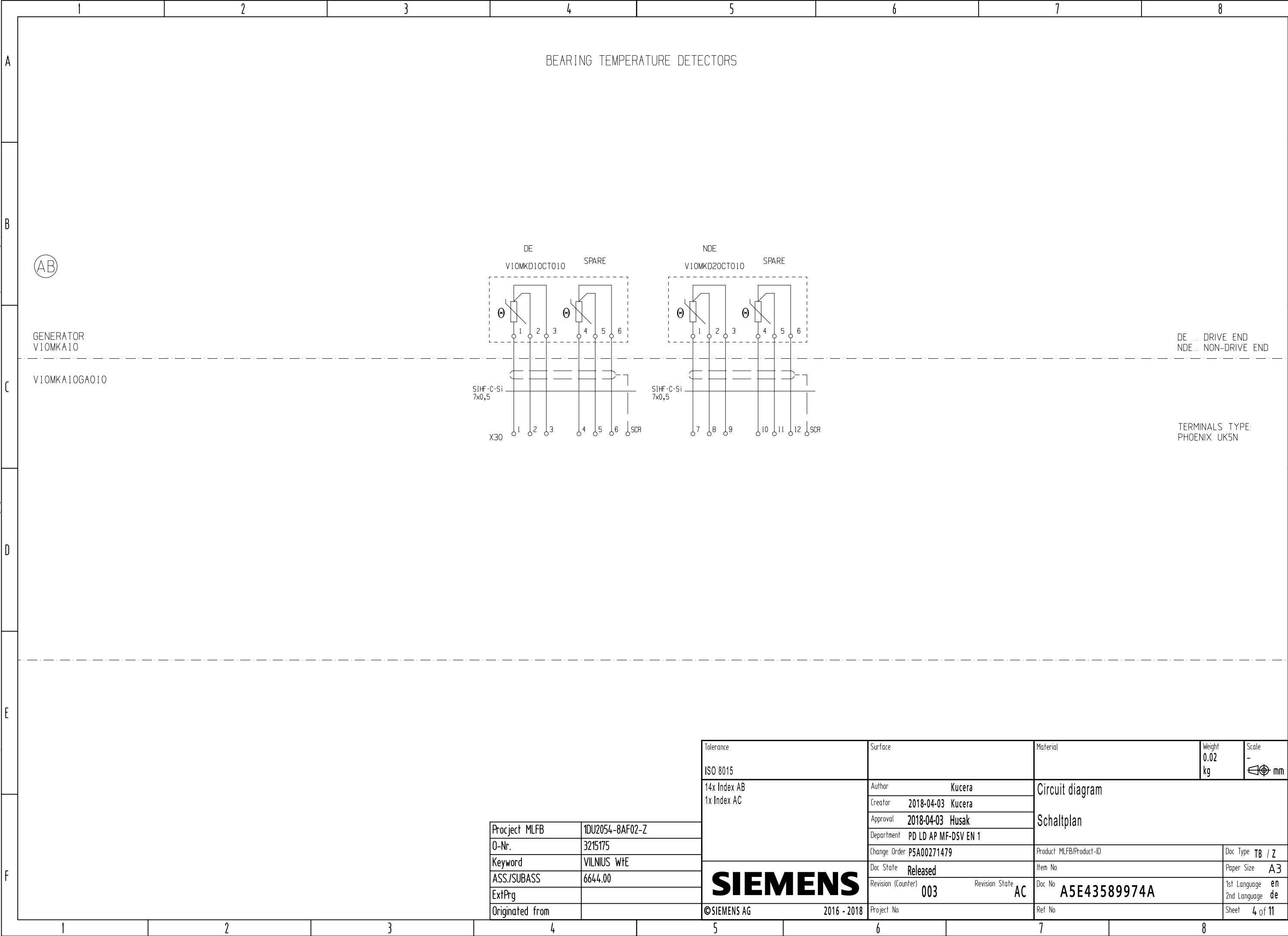
Tolerance	Surface	Material	Weight	Scale
ISO 8015			0.02 kg	- mm
14x Index AB 1x Index AC	Author	Kucera	Circuit diagram Schaltplan	
	Creator	2018-04-03 Kucera		
	Approval	2018-04-03 Husak		
	Department	PD LD AP MF-DSV EN 1		
SIEMENS	Change Order	P5A00271479	Product MLFB/Product-ID	Doc Type TB / Z
	Doc State	Released	Item No	Paper Size A3
	Revision (Counter)	003	Revision State AC	Doc No A5E43589974A
	Project No		Ref No	1st Language en 2nd Language de
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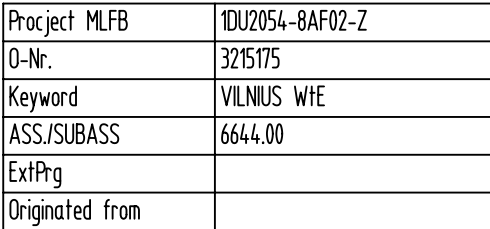
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TB 002



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BEARING HOUSING VIBRATION MONITORING



GENERATOR
VIOMKA10

VIOMKA10GA010

HORIZONTAL - DE
VIOMKD10CY020

VERTICAL - DE
VIOMKD10CY010

AXIAL - DE
VIOMKD10CY030

HORIZONTAL - NDE
VIOMKD20CY020

VERTICAL - NDE
VIOMKD20CY010

AXIAL - NDE
VIOMKD20CY030

DE ... DRIVE END
NDE... NON-DRIVE END

TERMINALS TYPE:
PHOENIX UK5N

16710-15
3x0,5
BENTLY NEVADA

X37

1 2 3 SCR

16710-23
3x0,5
BENTLY NEVADA

4 5 6 SCR

16710-23
3x0,5
BENTLY NEVADA

7 8 9 SCR

16710-27
3x0,5
BENTLY NEVADA

10 11 12 SCR

16710-27
3x0,5
BENTLY NEVADA

13 14 15 SCR

16710-27
3x0,5
BENTLY NEVADA

16 17 18 SCR

Project MLFB	1DU2054-8AF02-Z
O-Nr.	3215175
Keyword	VILNIUS WfE
ASS./SUBASS	6644.00
ExtPrg	
Originated from	

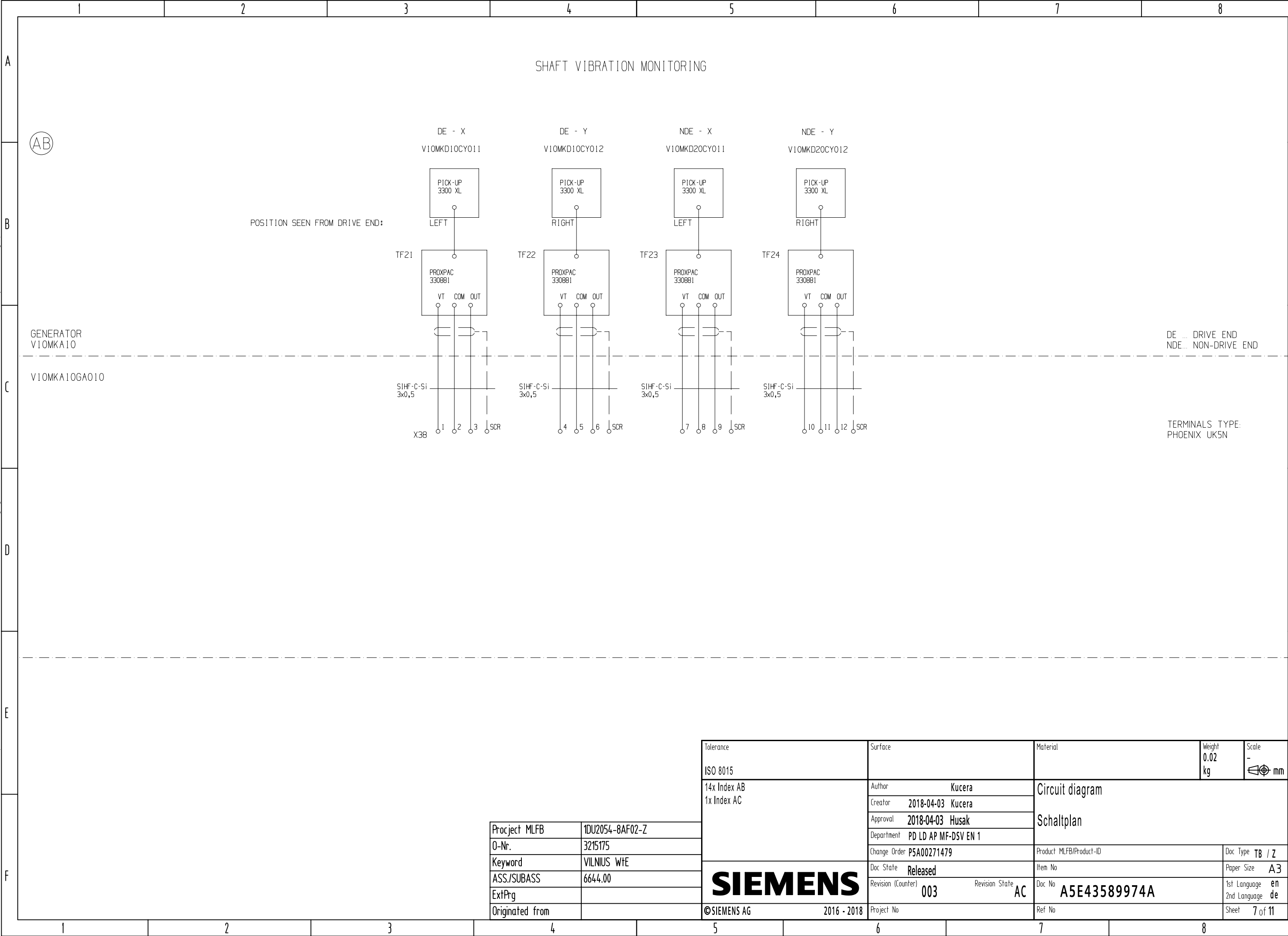
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ISO 8015				
14x Index AB 1x Index AC	Author	Kucera		
	Creator	2018-04-03 Kucera		
	Approval	2018-04-03 Husak		
	Department	PD LD AP MF-DSV EN 1		
	Change Order	P5A00271479		Product MLFB/Product-ID
	Doc State	Released		Doc Type TB / Z
	Revision (Counter)	003		Revision State AC
	Doc No	A5E43589974A		Item No
©SIEMENS AG 2016 - 2018			Project No	Ref No
				1st Language en 2nd Language de
				Sheet 6 of 11

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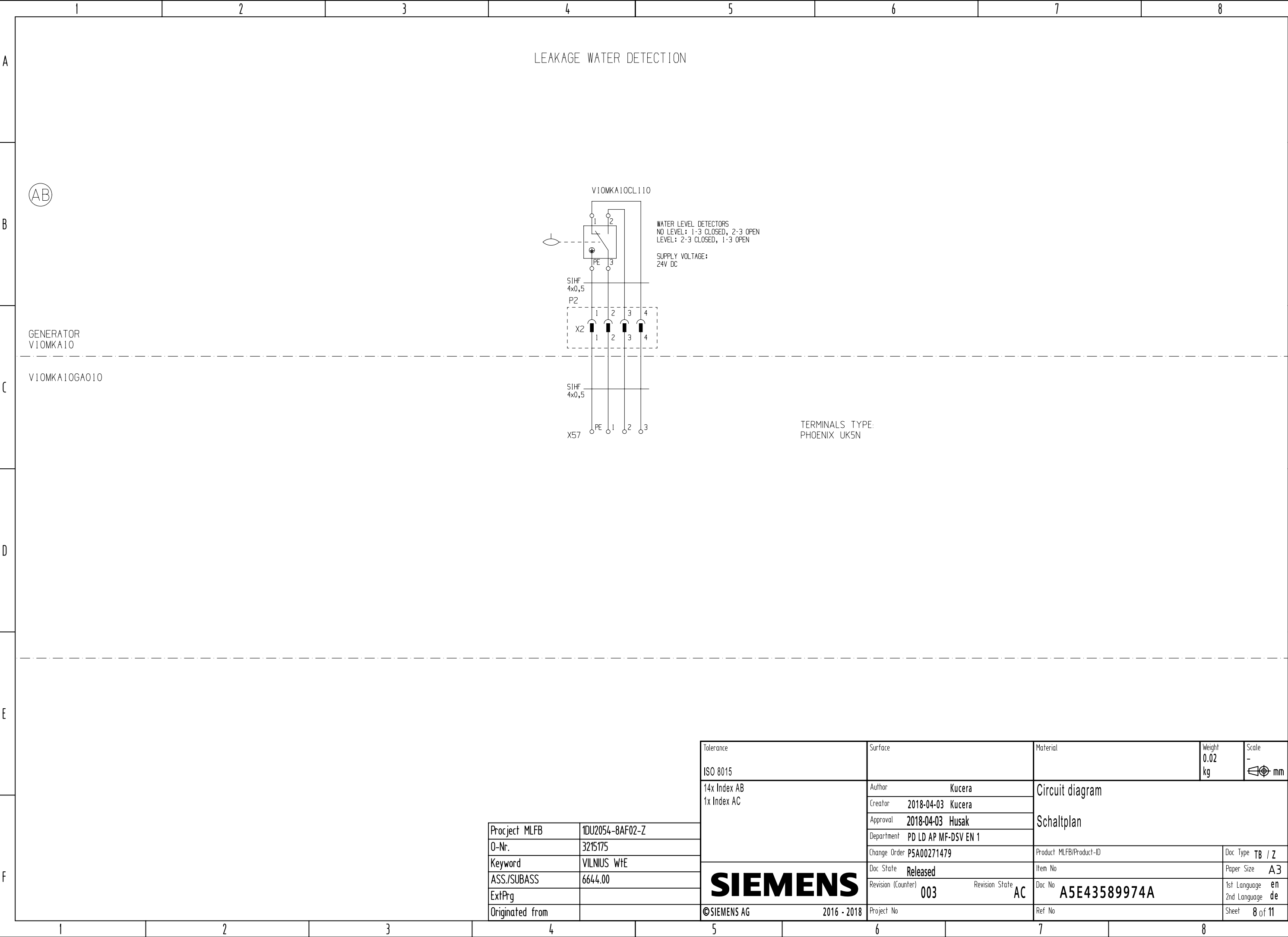


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Procject MLFB

0-Nr.

Keyword

ASS./SUBASS

ExtPrg

Originated from

1DU2054-8AF02-Z

3215175

VILNIUS WfE

6644.00

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2016 - 2018

Tolerance

ISO 8015

14x Index AB

1x Index AC

Surface

Author Kucera

Creator 2018-04-03 Kucera

Approval 2018-04-03 Husak

Department PD LD AP MF-DSV EN 1

Change Order P5A00271479

Doc State Released

Revision (Counter) 003

Revision State AC

Material

Circuit diagram

Schaltplan

Product MLFB/Product-ID

Item No

Doc No A5E43589974A

Ref No

Weight 0.02 kg

Scale - mm

Doc Type TB / Z

Paper Size A3

1st Language en

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Sheet 8 of 11

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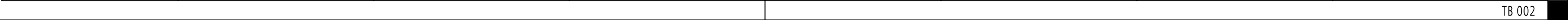
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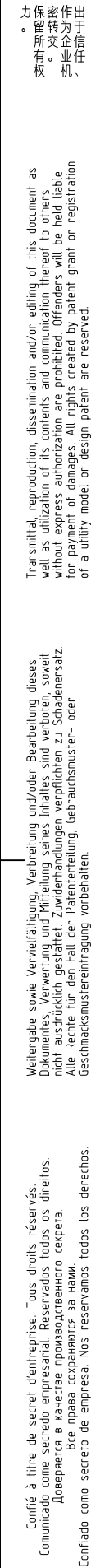
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 Lietuvos energija			VILNIAUS KOGENERACINĖ JĖGINĖ			 budimex KDS					
 SIEMENS Industrial Turbomachinery		Project CHP Vilnius		 SIEMENS							
Employer Contract No. VKJ_S_2016-92		Employer Project Code VKJ01		Employer Document No. VKJ01-1730050			Language Code EN		Revision No. 01		
Title Generator Electrical Data Sheet											
Remarks											
Name Department Date											
Name Department Date											
Name Department Date											
Name Department Date		M. Skalka		M. Havranek		M. Skalka		P01	Second Edition		
Name Department Date		M. Skalka		M. Havranek		M. Skalka		P00	First edition		
		prepared		reviewed		released		Rev.	Remark		
Cc for information									Page 1 of 18		
Cc for comments											
Cc for application											

Three-Phase Synchronous Generator with Cylindrical Pole Rotor (Laminated Pole)

Synchronous Generator

Output Voltage Frequency	Sn Un fn	25530 kVA 15000 V 50 Hz	Power factor Current Speed	p.f. In nn	0.85 983 A 1500 min⁻¹
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Page 2		Front page
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Project: **CHP Vilnius**
Employer Contract No.: **VKJ_S_2016-92**
Employer Project Code: **VKJ01**
Employer Document No.: **VKJ01-1730050**

01	07.12.2017	Skalka	Update datasheet
00	04.12.2017	Skalka	Title Page
AA	15.11.2017	Skalka	Issued
Change	Date	Name	Description

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AA	issued	15.11.2017	Skalka		3215175	VILNIUS WtE
00	Title page	04.12.2017	Skalka		Job No.	Document No.
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Three-Phase Synchronous Generator with Cylindrical Pole Rotor (Laminated Pole)

Nominal data			Type	1DU2054-8AF02-Z
Output	S_n	25530 kVA	Standard	IEC 60034
Voltage	U_n	15000 V	Marine classification	---
Frequency	f_n	50 Hz	Ex-Protect	---
Power factor	p.f.	0.85	Ex-Standard	---
Current	I_n	983 A	Cooling system	IC81W
Speed	n_n	1500 min ⁻¹	Ambient temperature	50 °C
Torque in air gap	M_n	162.5 kNm	Cooling water temperature	45 °C
			Installation altitude	≤ 1000 m
Excitation	brushless with AVR and PMG		Insulation class	155 (F)
Mounting	IM1005		Stator Winding Temperature	≤ 122 °C (ETD)
Enclosure	IP54		Field Winding Temperature	≤ 130 °C (R)

Operating data			Generator driven by: Steam turbine		
		Apparent output	Electrical output	Mechanical input	Shaft input torque
Power factor	0.85	25530 kVA	21701 kWe	22031 kWm	140.26 kNm
Power factor	1.00	21756 kVA	21756 kWe	22031 kWm	140.26 kNm

Reactances and time constants						Z_n	8.813 Ω
	unsat.	sat.		unsat.	sat.		
x_d	189.2	158.0 %	x_q	171.4	143.4 %	T_{d0}'	6.225 s
x_d'	23.6	19.5 %	x_q'	171.4	143.4 %	T_d'	0.778 s
x_d''	15.5	12.1 %	x_q''	17.2	12.9 %	T_d''	0.050 s
x_2	16.3	12.5 %	x_0	8.3	8.3 %	T_a	0.185 s

Efficiencies							
S/S_n		25	50	75	100	110	%
Power factor	0.85	96.25	97.90	98.35	98.50	98.50	%
Power factor	1.00	96.35	98.05	98.55	98.75	98.80	%

Short circuit data			
I_k''	8.12 kA	Initial short circuit current (3 ~)	
I_s	20.63 kA	Max. peak current (3 ~)	
I_k	≥ 2.95 kA	Sustained short circuit current	
k_c	0.63	Short circuit ratio	
M_{2k}	1656 kNm	Initial short circuit torque (2~)	
M_{3k}	1274 kNm	Initial short circuit torque (3~)	

Other data			
Losses to be dissipated		330 kW	Axial force at nominal run* 4.15 kN
* In case of non-locating bearings this will have effect on the shaft end.			Eccentric radial magnetic force CM 29 kN·mm ⁻¹

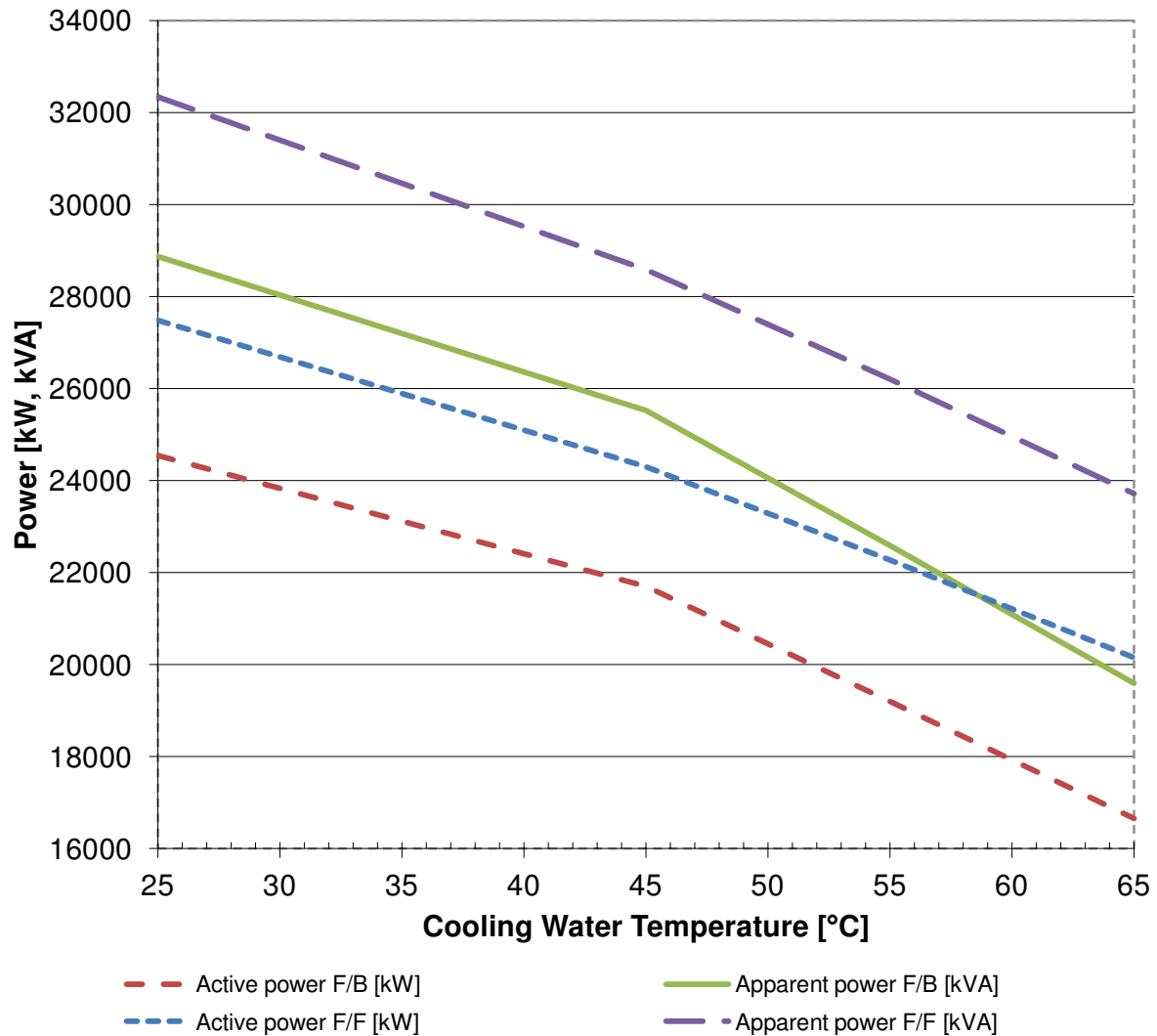
Remarks			
Voltage and frequency deviation combined max. 10 % allowed. Voltage tolerance acc. to IEC60034-1 , section 7.3. Machine can operate with active power output 21701kW and power factor from 0.85 overexcited to 0.95 underexcited.			

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Three-Phase Synchronous Generator with Cylindrical Pole Rotor (Laminated Pole)

TEMPERATURE - POWER DEPENDENCE

Output	Sn	25530 kVA	Power factor	p.f.	0.85
Voltage	Un	15000 V	Current	In	983 A
Frequency	fn	50 Hz	Speed	nn	1500 min ⁻¹



Curves indicate the permissible electr. load, but no mech. torque capability.

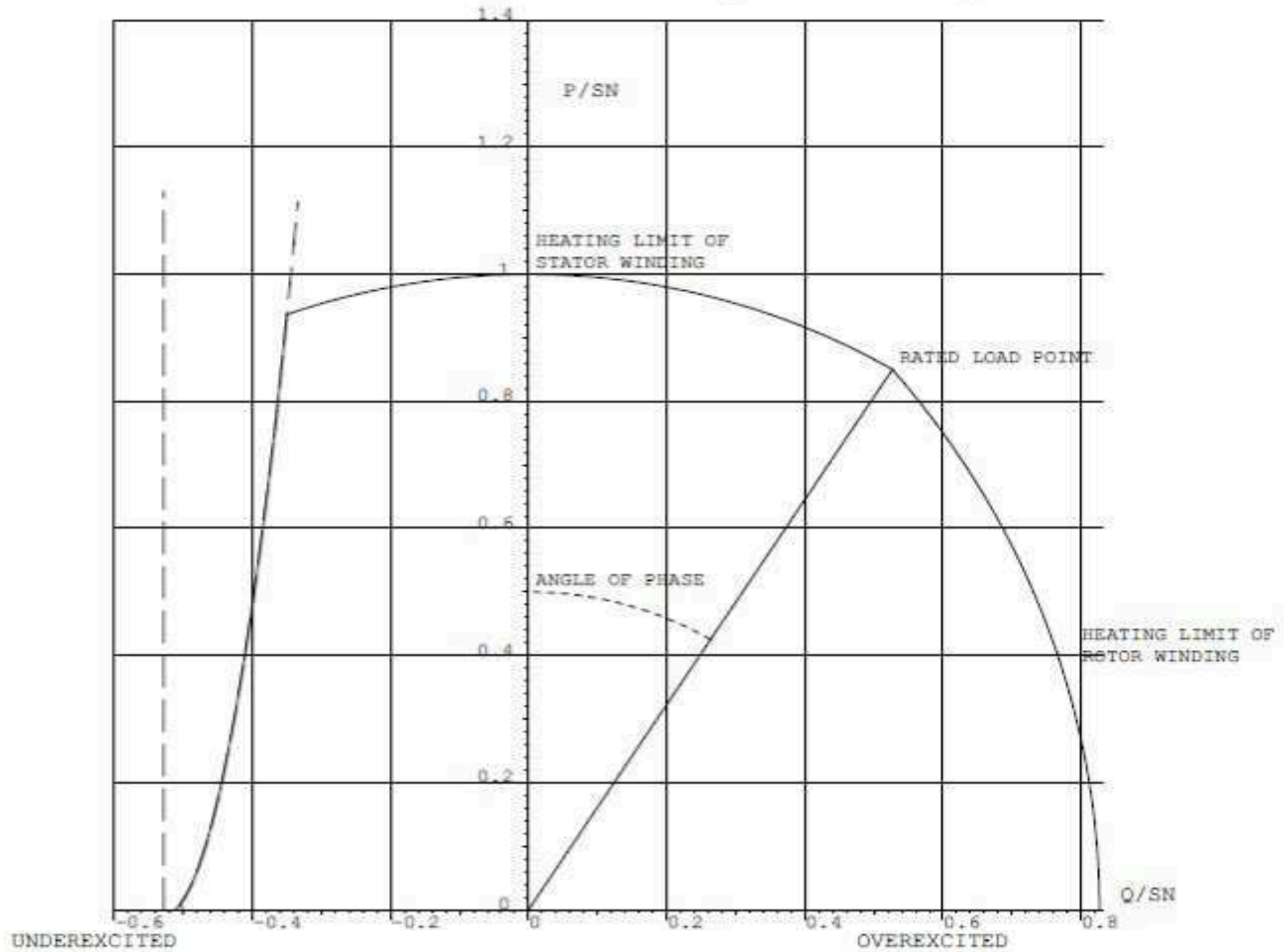
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Three-Phase Synchronous Generator with Cylindrical Pole Rotor (Laminated Pole)

REACTIVE CAPABILITY CURVE

Output	Sn	25530 kVA	Power factor	p.f.	0.85
Voltage	Un	15000 V	Current	In	983 A
Frequency	fn	50 Hz	Speed	nn	1500 min ⁻¹

THE POWER CHART INDICATES THE PERMISSIBLE ELECTR. LOAD, BUT NO MECH. TORQUE CAPABILITY



RATED LOAD POINT: 25530kVA => 21701kWe (22031kWm)
13480kVAr

MAX. POWER AT PF=0 --> UNDEREXCITED: 13100kVAr
OVEREXCITED: 21140kVAr

Max. underexcited power factor at const. rated mechanical input: 0.91

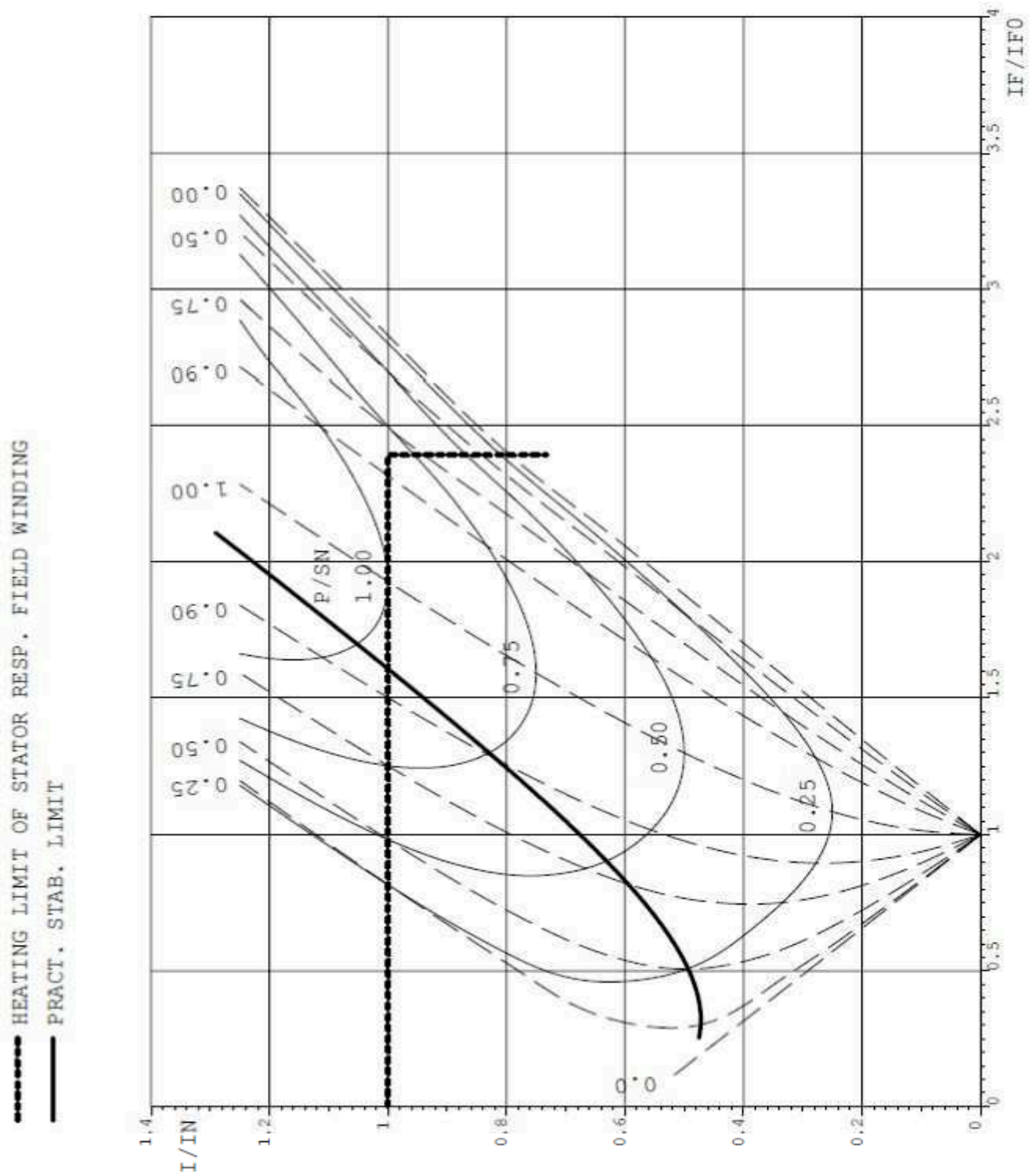
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Three-Phase Synchronous Generator with Cylindrical Pole Rotor (Laminated Pole)

V - CURVES

Output	Sn	25530 kVA	Power factor	p.f.	0.85
Voltage	Un	15000 V	Current	In	983 A
Frequency	fn	50 Hz	Speed	nn	1500 min ⁻¹

IF0 = 271 A



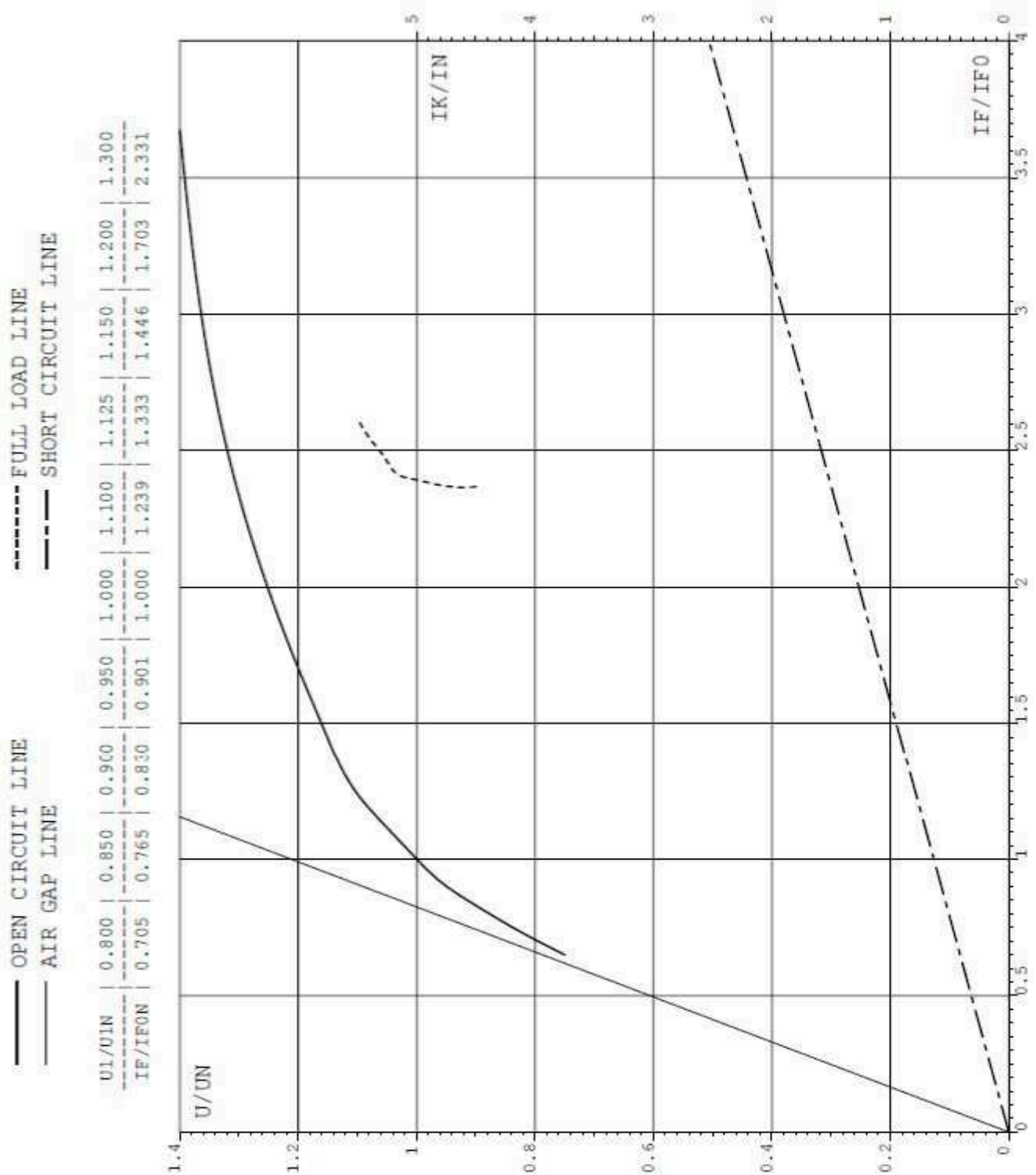
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Three-Phase Synchronous Generator with Cylindrical Pole Rotor (Laminated Pole)

SATURATION CURVES

Output	Sn	25530 kVA	Power factor	p.f.	0.85
Voltage	Un	15000 V	Current	In	983 A
Frequency	fn	50 Hz	Speed	nn	1500 min ⁻¹

IF0 = 271 A

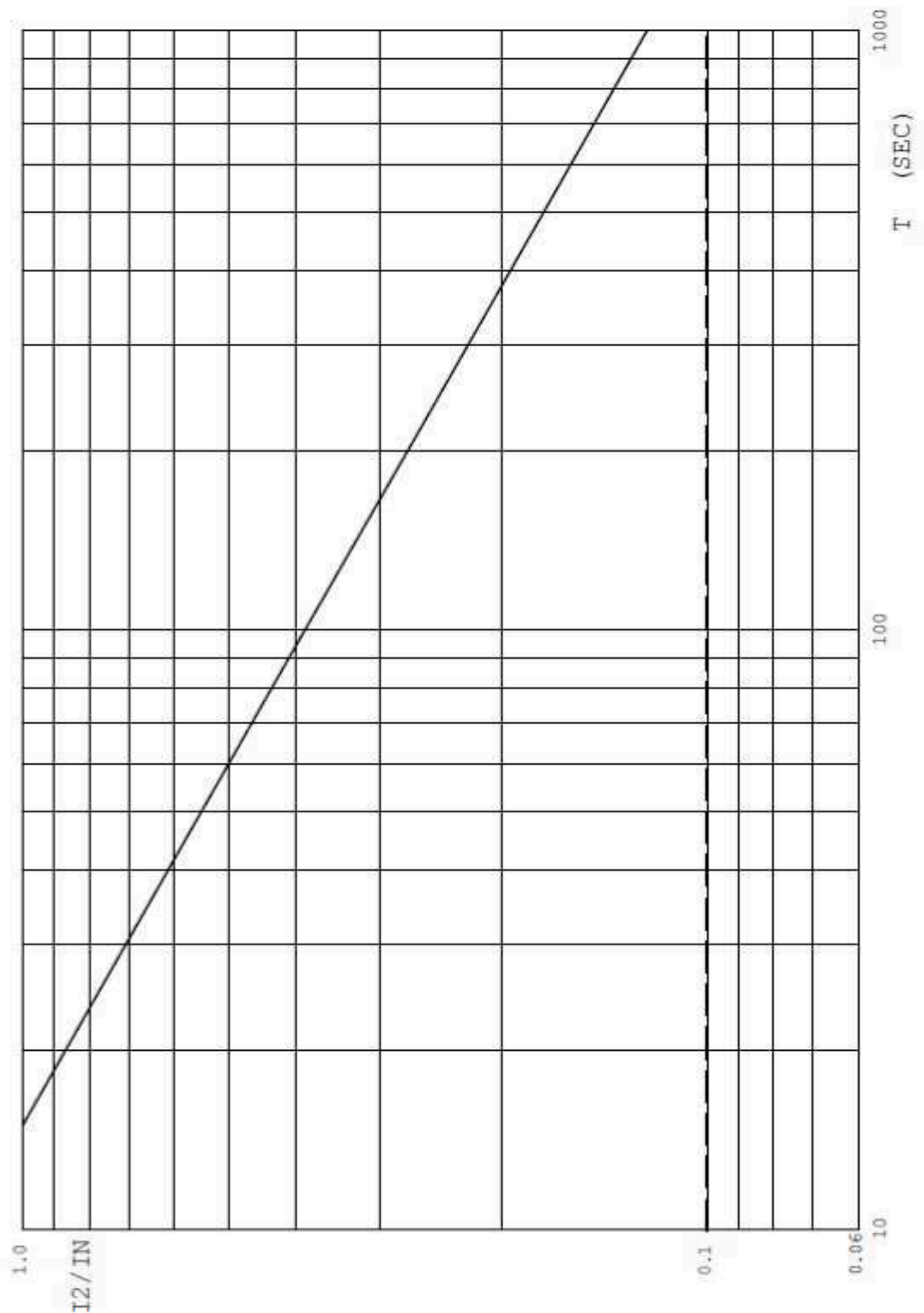


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UNBALANCE LOAD CURVES

Output	Sn	25530 kVA	Power factor	p.f.	0.85
Voltage	Un	15000 V	Current	In	983 A
Frequency	fn	50 Hz	Speed	nn	1500 min ⁻¹

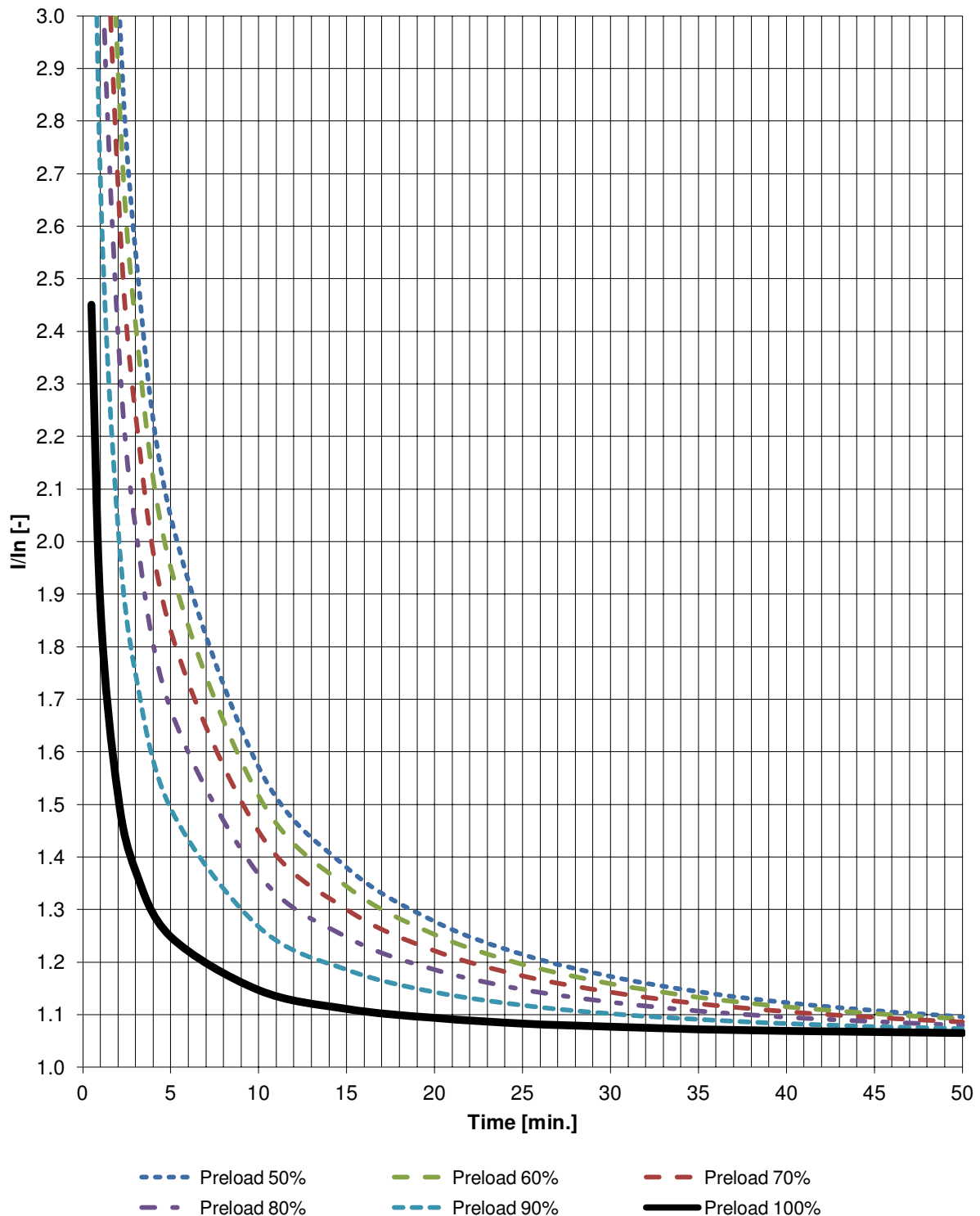
--- MAX. I2/IN FOR CONTINUOUS OPERATION
 — MAX. I2/IN FOR OPERATION UNDERFAULT CONDITIONS



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OVERLOAD CAPABILITY (THERMAL DAMAGE CURVES)

Output	Sn	25530 kVA	Power factor	p.f.	0.85
Voltage	Un	15000 V	Current	In	983 A
Frequency	fn	50 Hz	Speed	nn	1500 min ⁻¹



The curves display the possible temperature overload of the generator, but they do not ensure that the voltage regulator will provide the necessary excitation current.

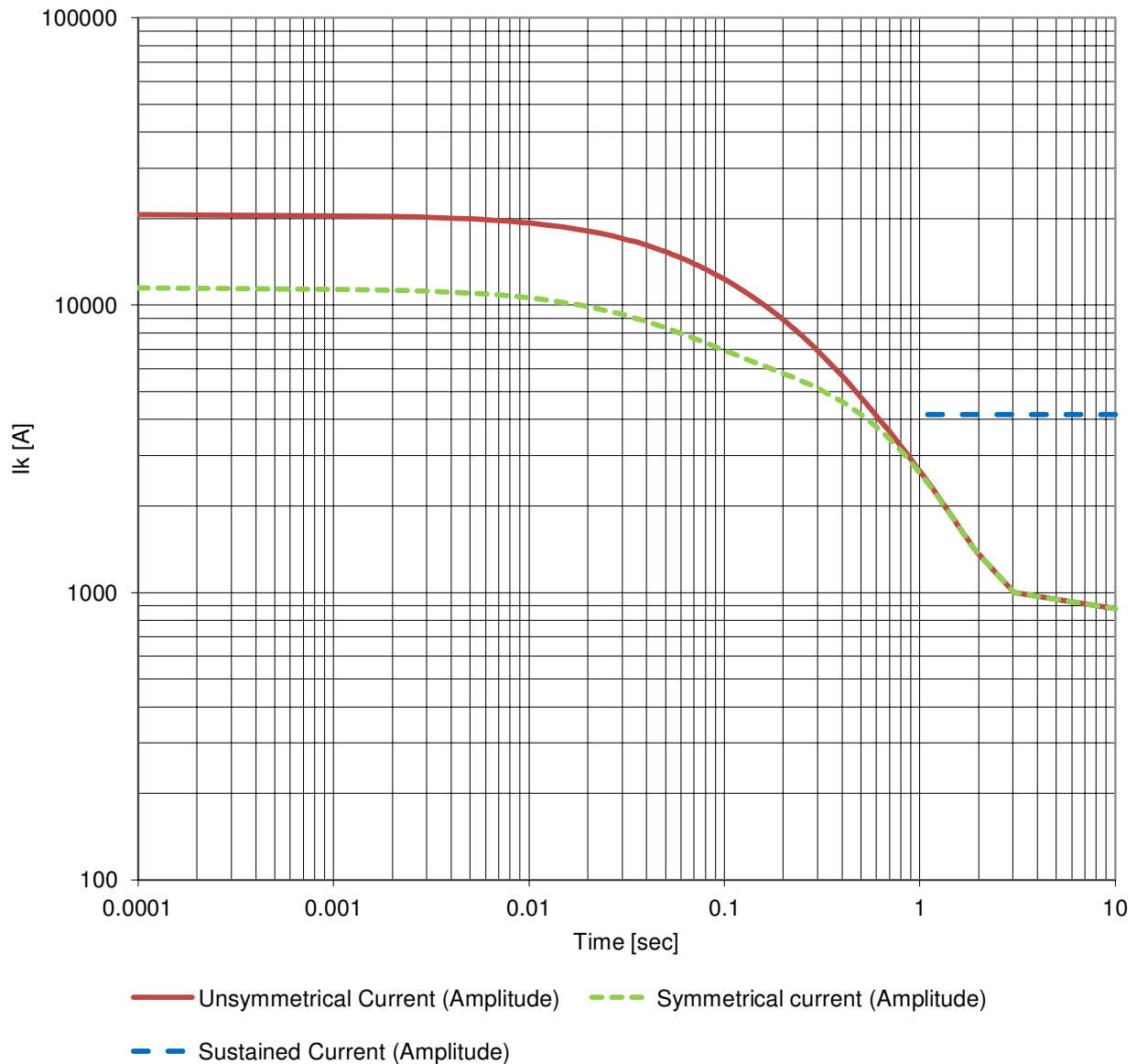
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Three-Phase Synchronous Generator with Cylindrical Pole Rotor (Laminated Pole)

THREE PHASE SHORT CIRCUIT CURVES (ENVELOPE OF PEAK VALUES)

Output	Sn	25530 kVA	Power factor	p.f.	0.85
Voltage	Un	15000 V	Current	In	983 A
Frequency	fn	50 Hz	Speed	nn	1500 min ⁻¹

Terminal Voltage	1.00 p.u.
Asymmetrical Current (Peak):	20.63 kA
Symmetrical Current (Peak):	11.48 kA
Sustained Short Circuit Current (Amplitude):	4.17 kA



Symmetrical Current is Short Circuit Current without Direct Current Component.

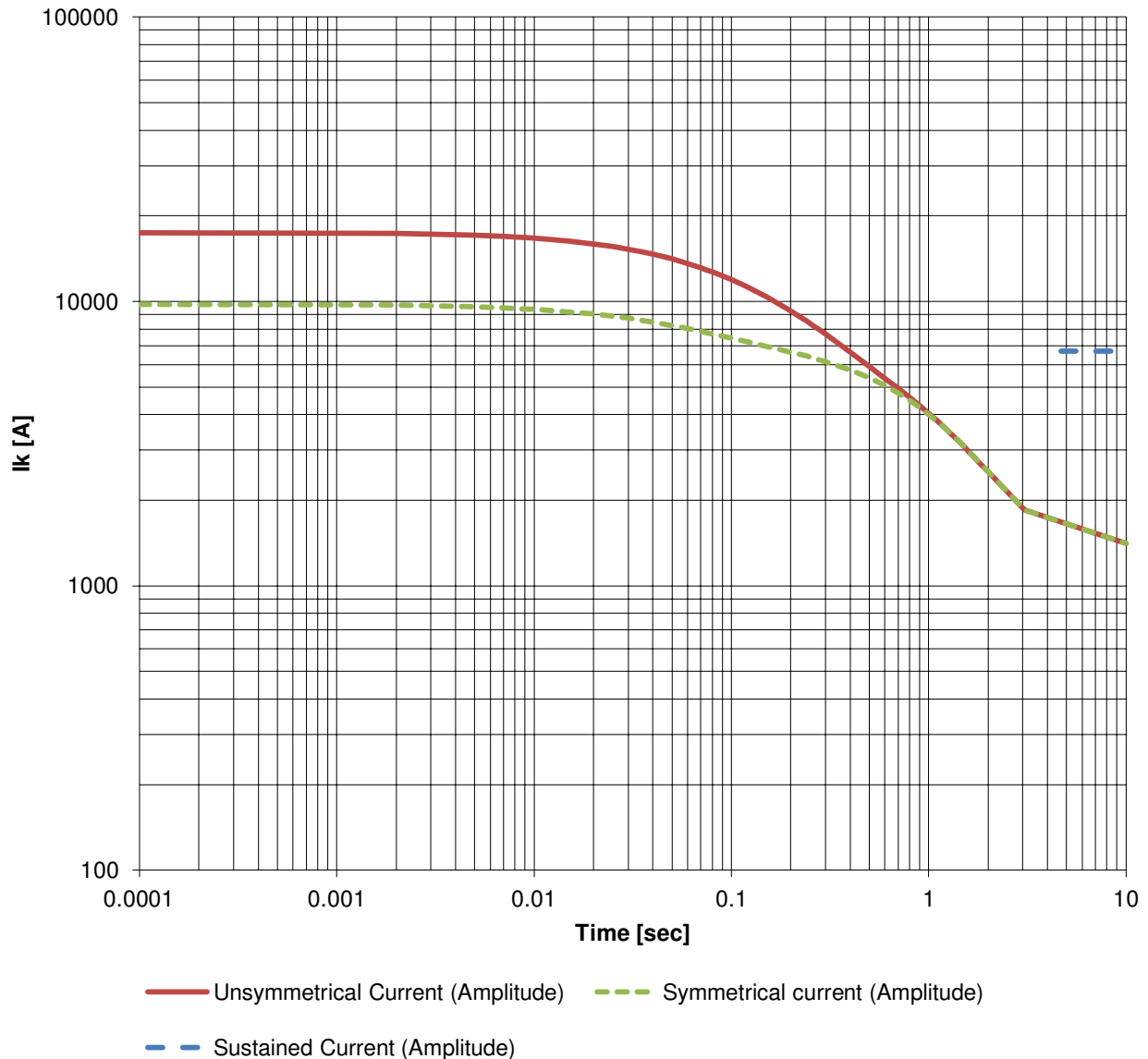
Unsymmetrical Current is Short Circuit Current with Maximal Direct Current Component.

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LINE TO LINE SHORT CIRCUIT CURVES (ENVELOPE OF PEAK VALUES)

Output	Sn	25530 kVA	Power factor	p.f.	0.85
Voltage	Un	15000 V	Current	In	983 A
Frequency	fn	50 Hz	Speed	nn	1500 min ⁻¹

Terminal Voltage	1.00 p.u.
Asymmetrical Current (Peak):	17.48 kA
Symmetrical Current (Peak):	9.78 kA
Sustained Short Circuit Current (Amplitude):	6.69 kA



Symmetrical Current is Short Circuit Current without Direct Current Component.
 Unsymmetrical Current is Short Circuit Current with Maximal Direct Current Component.

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AIR GAP TORQUE AT THREE POLE SHORT CIRCUIT

Output	Sn	25530 kVA	Power factor	p.f.	0.85
Voltage	Un	15000 V	Current	In	983 A
Frequency	fn	50 Hz	Speed	nn	1500 min ⁻¹

Equation for the Three Pole Short Circuit

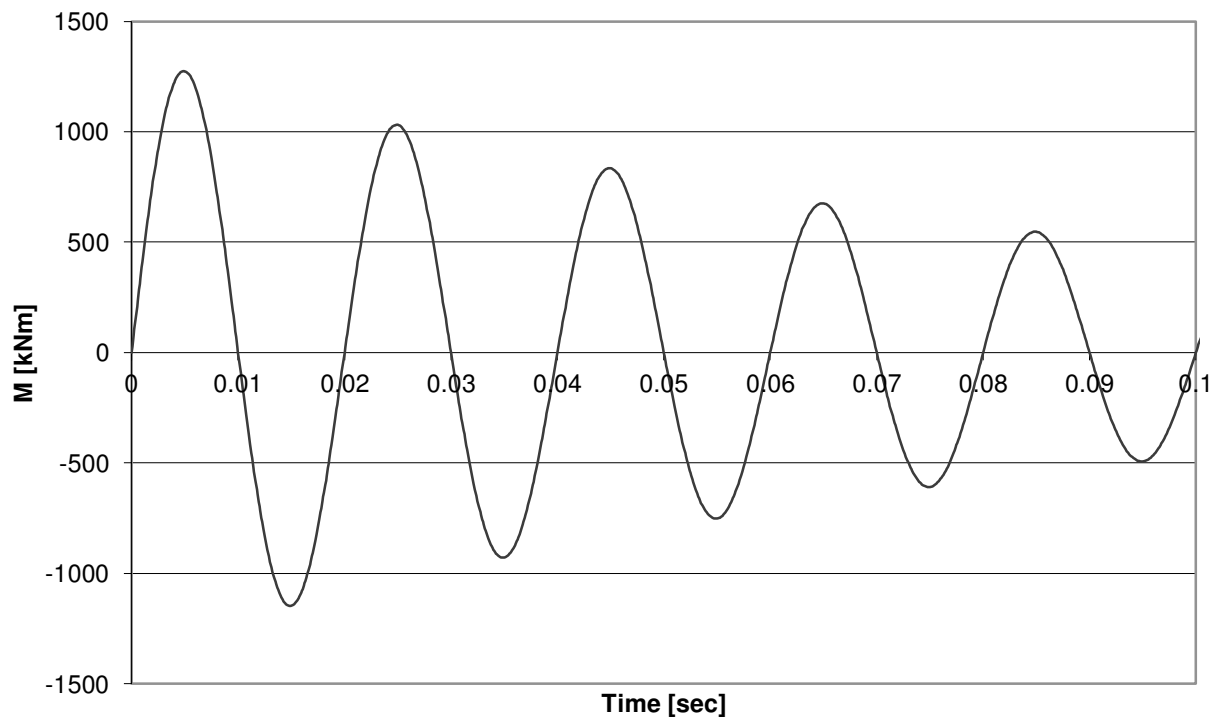
$$M_{(3k)}(t) = u^2 \cdot M_{(3k)t=0} \cdot e^{-t \left(\frac{1}{T_a} + \frac{1}{T_{(3k)}} \right)} \cdot \sin(2\pi \cdot f \cdot t)$$

$$u = 1.00 \text{ p. u.} \quad T_a = 0.185 \text{ s}$$

$$M_{(3k)t=0} = 1343.2 \text{ kNm} \quad T_{(3k)} = 0.194 \text{ s}$$

$$f = 50 \text{ Hz}$$

Maximal three pole short circuit torque is 1274kNm.



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AIR GAP TORQUE AT TWO POLE SHORT CIRCUIT

Output	Sn	25530 kVA	Power factor	p.f.	0.85
Voltage	Un	15000 V	Current	In	983 A
Frequency	fn	50 Hz	Speed	nn	1500 min ⁻¹

Equation for the Two Pole Short Circuit

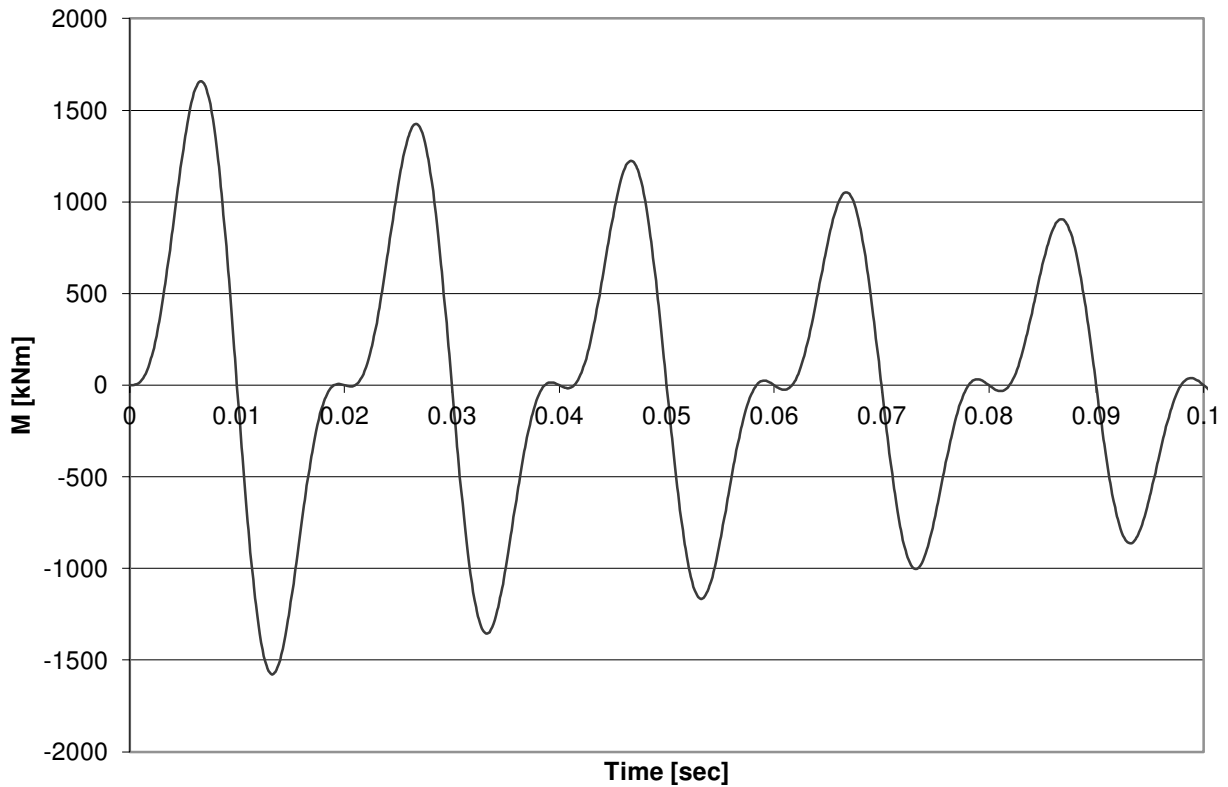
$$M_{(2k)}(t) = u^2 \cdot M_{(3k)t=0} \cdot \left[e^{-t \cdot \left(\frac{1}{T_a} + \frac{1}{T_{(2k)}} \right)} \cdot \sin(2\pi \cdot f \cdot t) - \frac{1}{2} \cdot e^{\frac{-2t}{T_{(2k)}}} \cdot \sin(4\pi \cdot f \cdot t) \right]$$

$$u = 1.00 \text{ p. u.} \quad T_a = 0.185 \text{ s}$$

$$M_{(3k)t=0} = 1343.2 \text{ kNm} \quad T_{(2k)} = 0.331 \text{ s}$$

$$f = 50 \text{ Hz}$$

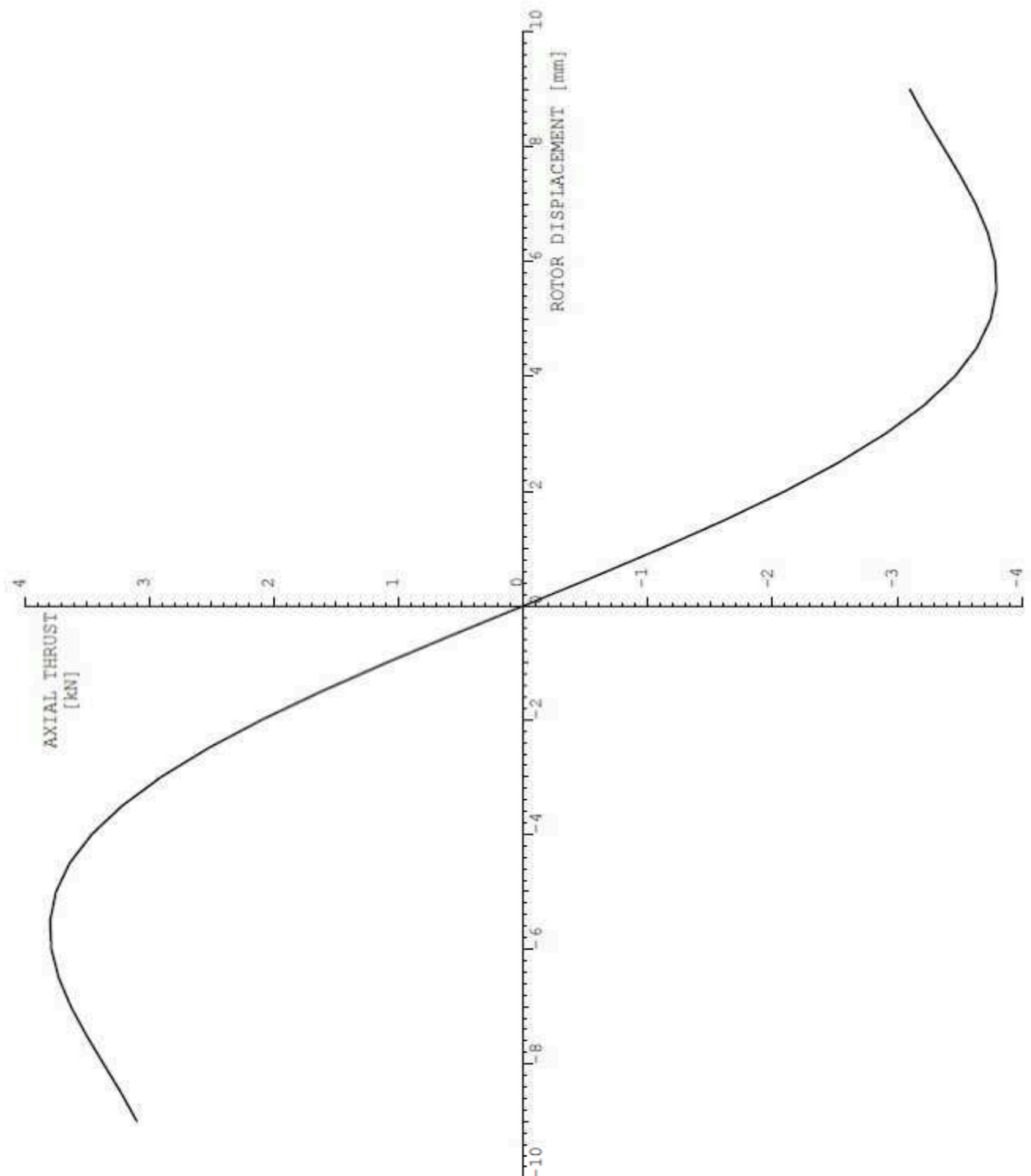
Maximal two pole short circuit torque is 1656kNm.



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AXIAL FORCE AT ROTOR DISPLACEMENT FROM GEOMETRIC CENTER

Output	Sn	25530 kVA	Power factor	p.f.	0.85
Voltage	Un	15000 V	Current	In	983 A
Frequency	fn	50 Hz	Speed	nn	1500 min ⁻¹



Machine has axial force from slot skewing 4.15 kN.

Axial force for displacement DI = 1mm from geometric center is 1.1 kN.

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SHORT TIME VOLTAGE/FREQUENCY CAPABILITY

Output	Sn	25530 kVA	Power factor	p.f.	0.85
Voltage	Un	15000 V	Current	In	983 A
Frequency	fn	50 Hz	Speed	nn	1500 min ⁻¹

Continuous Operation Limits (S1)

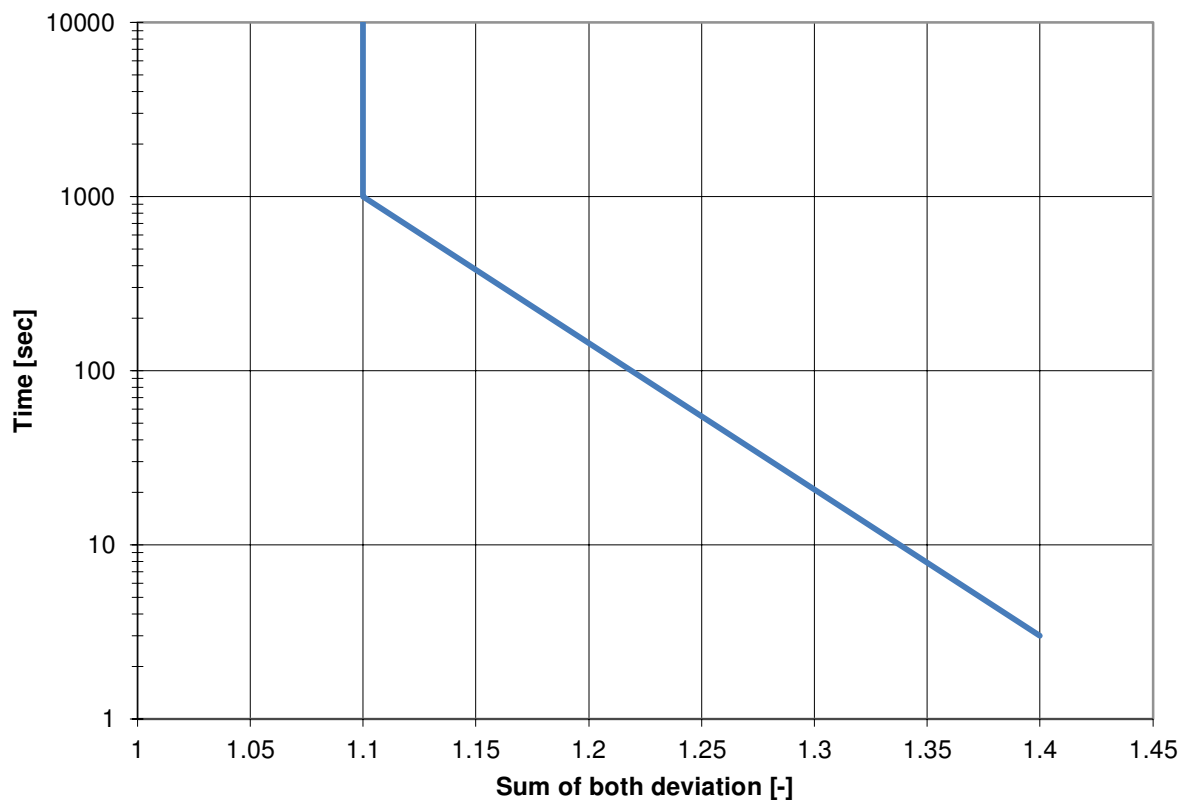
Voltage max.: + 5%

Frequency max.: + 5%

Voltage min.: - 5%

Frequency min.: - 5%

Maximal Sum of Both Deviation is 10%.



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Three-Phase Synchronous Generator with Cylindrical Pole Rotor (Laminated Pole)

EXCITATION SYSTEM

Output	Sn	25530 kVA	Power factor	p.f.	0.85
Voltage	Un	15000 V	Current	In	983 A
Frequency	fn	50 Hz	Speed	nn	1500 min ⁻¹

Main machine rotor resistance	20°C	0.1243 Ω
	warm	0.1777 Ω

Main exciter **Type:** **1JG2813-4AV06-Z**

Number of phase	3	Frequency	150 Hz
-----------------	---	-----------	--------

Capability:

115 V (DC)	647 A (DC)	74.4 kW	S1
240 V (DC)	1350 A (DC)	324.0 kW	10 sec.

Exciter stator resistance	20°C	6.339 Ω		
	warm	7.862 Ω	x _d	268.0 %
No-load Time Constant	T' _{d0}	0.566 s	x _q	138.2 %
Load Time Constant	T' _{dL}	0.217 s	x _d '	39.8 %
Excitation nominal response	Ve	2.65 s ⁻¹		

Characteristics:	Winding Temp.	Generator		Exciter	
		If	Uf	IE	UE
Generator load		[A]	[V]	[A]	[V]
No-load; 50% UN	20°C	148	18	1.8	11
No-load; 80% UN	20°C	191	24	2.3	15
No-load; 95% UN	20°C	244	30	3.0	19
No-load; 100% UN	20°C	271	34	3.3	21
No-load; 100% UN	warm	271	48	3.4	27
Rated load; 100% UN	warm	647	115	8.1	64
125% Generator load; 100% UN	warm	756	134	9.5	75
Ceiling excitation (10sec.)	warm	1350	240	17.9	140

Pilot exciter: **Type:** **RE 315-40**

Number of phase	3
Frequency	200 Hz
Power factor	0.95

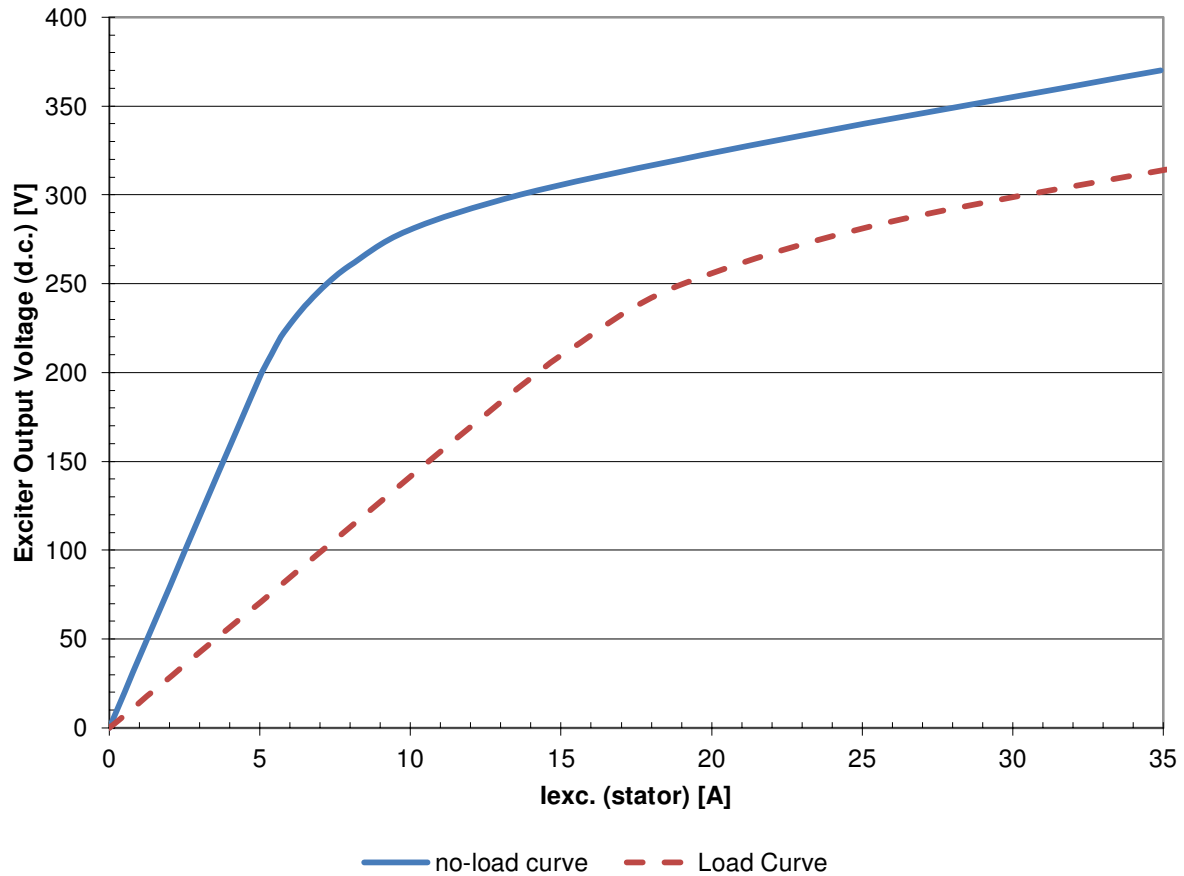
Capability:

No-load:	max.	230 V	0 A	0 kVA	S1
Rated load:		200 V	10.0 A	3.47 kVA	S1
Over-load:	min.	170 V	25.0 A	7.37 kVA	10sec.

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EXCITER MACHINE

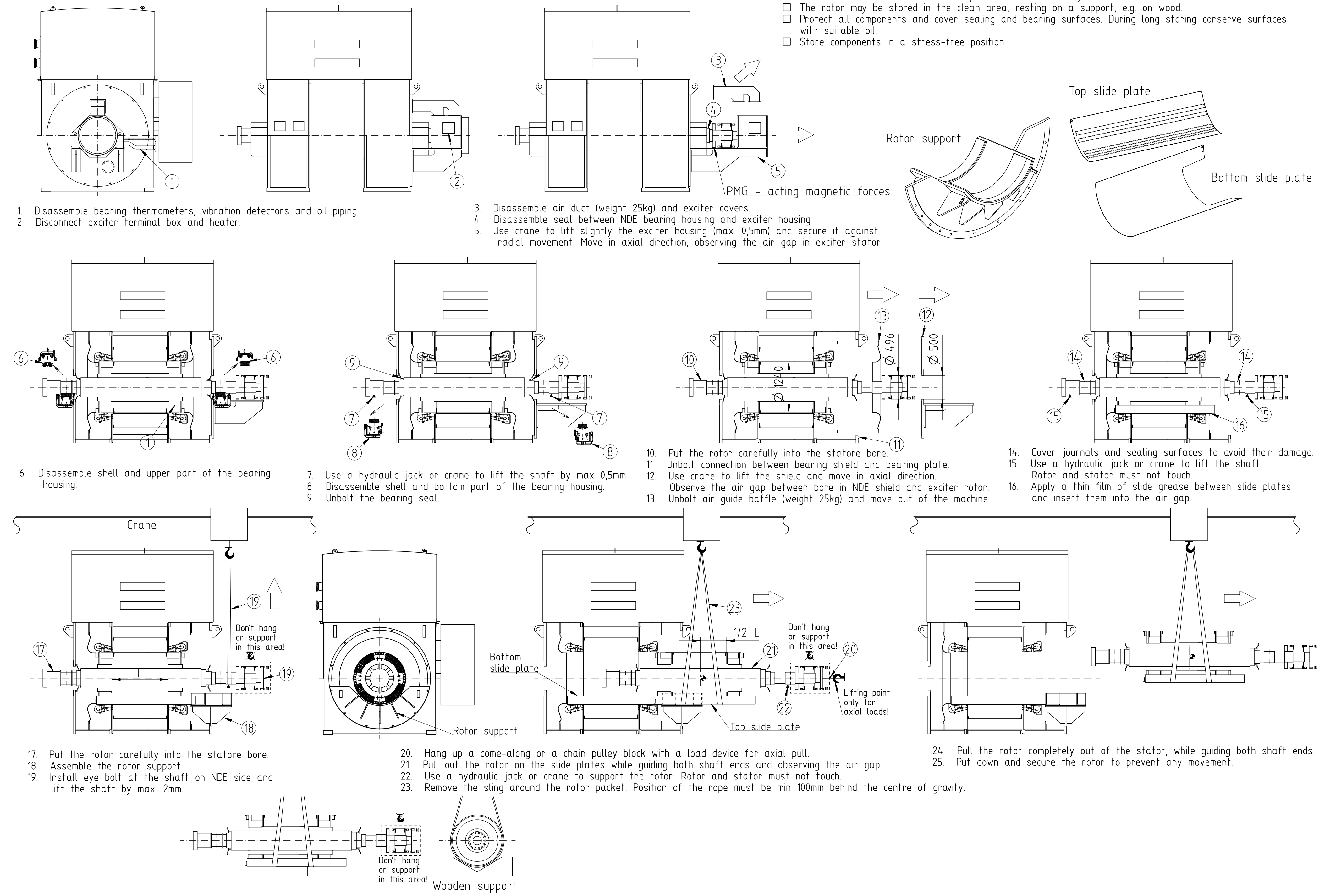
Output	Sn	25530 kVA	Power factor	p.f.	0.85
Voltage	Un	15000 V	Current	In	983 A
Frequency	fn	50 Hz	Speed	nn	1500 min ⁻¹

No - load Curve and load Curve**Load Curve at 0.1777 Ω**

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For generator and rotor weights and dimensions refer to general arrangement and shaft drawing.

- NOTES:
- ☐ Only briefed and skilled personnel is authorized to perform any disassembly or assembly work on the generator.
 - ☐ Lifting and slinging equipment must be dimensioned acc. to the required carrying loads.
 - ☐ Copper shims should be inserted whenever using jacks to prevent pressure marks on the shaft.
 - ☐ Cover the PMG rotor to reduce magnetic forces interacting with other steel components.
 - ☐ The rotor may be stored in the clean area, resting on a support, e.g. on wood.
 - ☐ Protect all components and cover sealing and bearing surfaces. During long storing conserve surfaces with suitable oil.
 - ☐ Store components in a stress-free position.

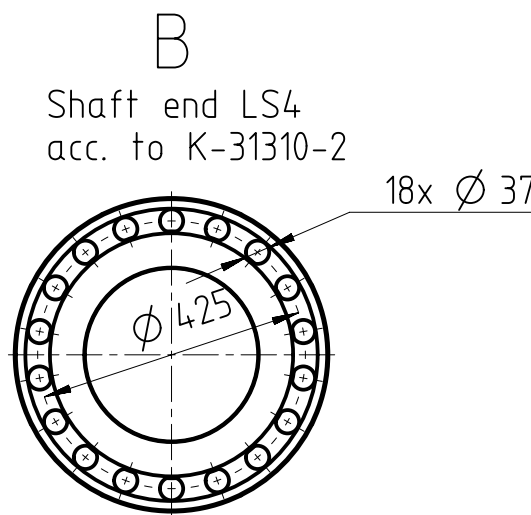
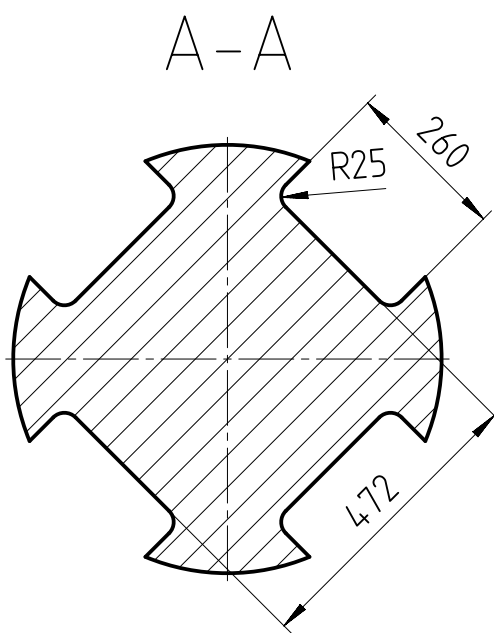
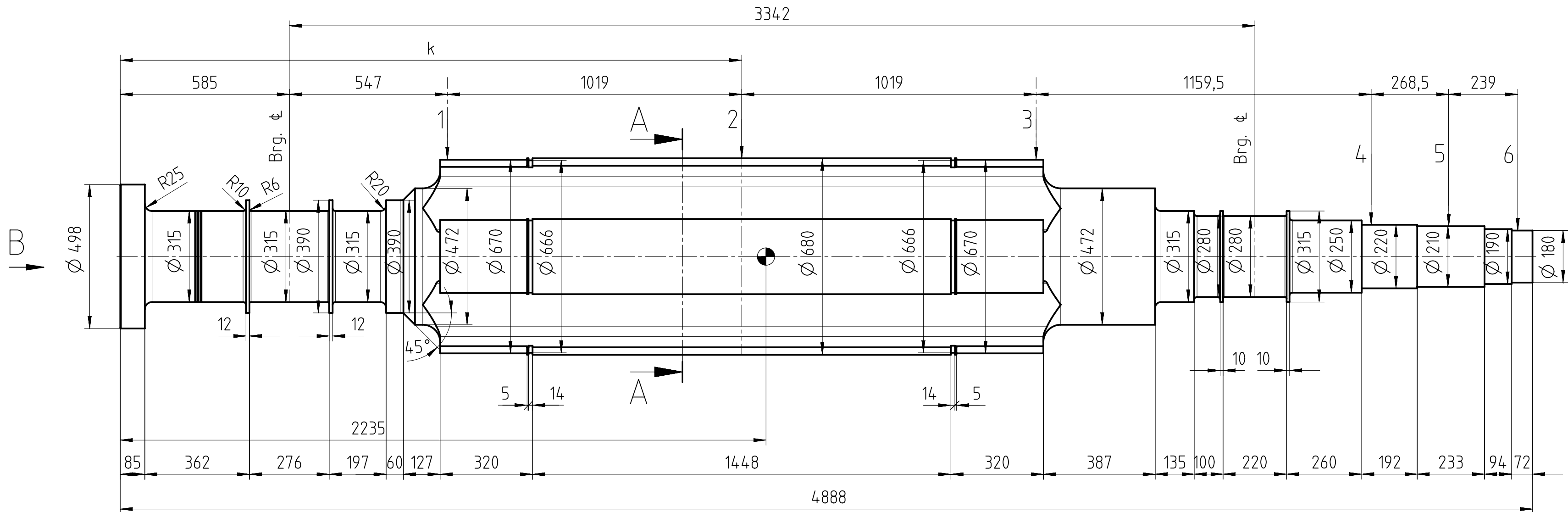


Siemens scope of supply:
Rotor support, slide plates

To be provided:
Crane rated to 120% of the rotor weight, sling equipment, supports, shims
spacer, hydraulic jack, beams, wooden wedges

P 00 08.12.2017 STR. HUS. HUS. FIRST ISSUE					
STA. REV.	DATE	PREP.	CHK. APPR.	COMMENT	
EMPLOYER Contract Number VKJ_S_2016-92		EMPLOYER Project Code VKJ01		Lietuvos energija VILNIAUS KOGENERACINĖ JĖGAINĖ	
EMPLOYER DOCUMENT DESIGNATION PROJECT CODE LOT ID DOC COUNTER		LANGUAGE REV NO STATUS			
VKJ01 - 1 730054		EN 00 P			
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APPROV.	08.12.2017	HUSAK	Steinmüller Baubock Environment		
SCALE	TITLE				
- GENERATOR ROTOR WITHDRAWAL PROCEDURE					
DESIGN COMPANY			DRAWING NO.		FORMAT
SIEMENS			A5E43589994A		A1
Tolerance ISO 8015		Surface		Material	Weight 0
Project MLFB 1DU2054-BAF02-Z		Author Straka		Rotor demounting	
D-No. 3215175		Creator 2017-11-28 Straka		Lfr.montagel-demont	
Keyword VILNUS WIE		Approval 2017-12-07 Husak			
ASS/SUBASS 1100.00		Department PD LD AP MF-BSV EN 1			
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		Project No		2nd Language de	
		Ref No		Sheet 1 of 1	
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	1	2	3	4	5	6		
	FAN	ROTOR CORE	FAN	PMG	EXCITER	RECTIFIER	SHAFT	SUM
MASS [kg]	200	9761	200	65	330	70	6184	16810
INERTIA TORQUE [kg.m2]	50,4	2380	50,4	3,5	8,2	2,3	235,3	2730

Material shaft	C45E+N
Ultimate tensile strenght	min 590 - 720 MPa
Yield point	min 320 MPa
Torsion stiffness k	7,570 x10 ⁷ Nm/rad
Magnetic elasticity constant	29,2 kN/mm
1st Critical speed	2414 rpm
2nd Critical speed	4634 rpm
Rated torque	162,53 kNm
Short-circuit rated torque	1656,18 kNm
Break-away torque (friction coef. 0,005)	125 Nm
Break-away torque (friction coef. 0,25)	6257 Nm
Rated power output	25530 kVA at 0,85 p.f.
Speed	1500 rpm
Frequency	50 Hz

Project MLFB	1DU2054-8AF02-Z
O-Nr.	3215175
Keyword	VILNIUS WIE
ASS/SUBASS	1005.00
ExtPrg	
Originated from	

Tolerance	ISO 8015	Surface		Material		Weight	16810 kg	Scale	1:12
		Author	Husak	Torsional calc. data					
		Creator	2017-11-21 Husak	Ang. zur Torsionsb.					
		Approval	2017-11-22 Palenik						
		Department	PD LD AP MF-DSV EN 1						
		Change Order	PSA00249891	Product MLFB/Product-ID			Doc Type TB / Z		
		Doc State	Released	Item No			Paper Size A2		
		Revision (Counter)	001	Revision State AA			Doc No A5E43542221A		
		1st Language	en				2nd Language de		
		Ref No					Sheet 1 of 1		

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LIST OF SPARE PARTS

Type : 1DU2054-8AF02-Z

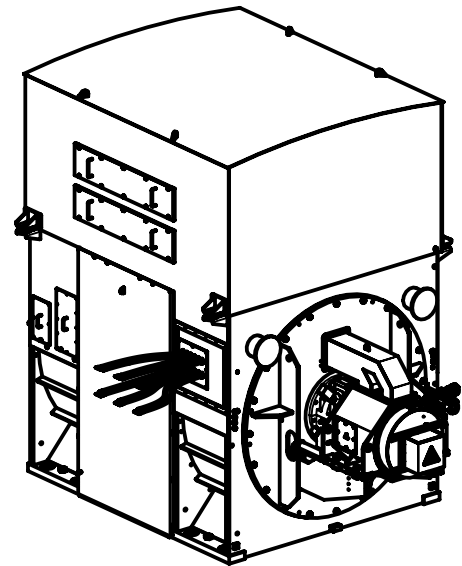
Serial-No. : FQ1721517501

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Drawing of rotor.....	4
Drawing of shield DE.....	5
Drawing of shield NDE.....	6
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Drawing of lubrication unit.....	8
Drawing of auxiliary terminal boxes.....	9



Project MLFB	1DU2054-8AF02-Z
O-Nr.	3215175
Keyword	VILNIUS WTE
ASS/SUBASS	0250.00
ExtPrg	
Originated from	

Tolerance DIN ISO13715/ISO8015/ISO2768-mK(cutting)	Surface	Material	Weight 0 kg	Scale mm
SIEMENS ©SIEMENS AG 2018	Author Micanek	List of equipment Reserveteile Product MLFB/Product-ID Doc Type TB / Z		
	Creator 2018-10-18 Micanek			
	Approval 2018-11-12 Snepfenberg			
	Department PD LD AP MF-DSV CS			
SIEMENS ©SIEMENS AG 2018	Change Order P5A00249891	Item No A5E46034057	Paper Size A4	
	Doc State Released	Doc No A5E46034057A	1st Language en	
	Revision (Counter) 001	Revision State AA	2nd Language de	
	Project No	Ref No	Sheet 1 of 9	

LIST OF SPARE PARTS

Contacts

Customer Service - Manufacturer:

Tel: +420 549 426 440

E-Mail: servicedrasov.cz@siemens.com

Local contact partners:

See the tag "contacts" on www.sow.siemens.com

Spare parts on web:

- 1) Open link: www.sow.siemens.com
- 2) Enter the type of the machine to the field "article no.:" (no blanks)
- 3) Enter the serial number to the field "serial number:" (no blanks)
- 4) Press "Search" button or enter

Legend of tables:

Packages SoW / PMD - Recommended spare parts

Package CONS - Consumable spare parts

Package COMM - Commissioning spare parts

Package 5 YEARS - Spare parts for 5 years of operation

Package BACK UP - Back up spare parts (all spare parts)

Remark:

Type of the machine and the serial number can be found on the rating plate of the machine.

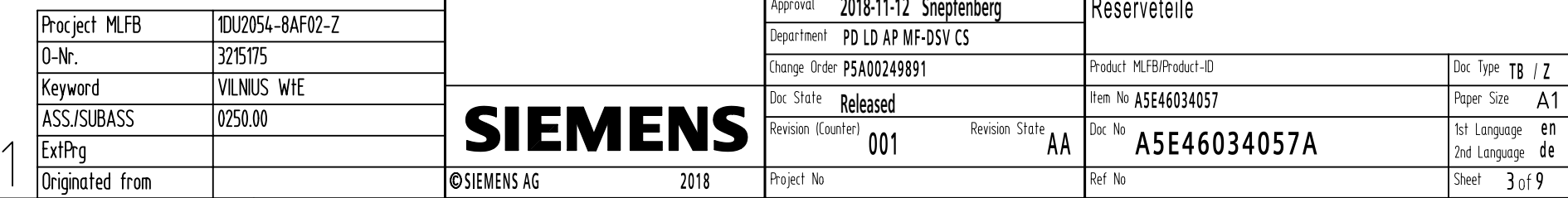
Project MLFB	1DU2054-8AF02-Z
O-Nr.	3215175
Keyword	VILNIUS WtE
ASS/SUBASS	0250.00
ExtPrg	
Originated from	

Tolerance DIN ISO13715/ISO8015/ISO2768-mK(cutting)		Surface	Material	Weight 0 kg	Scale  mm
SIEMENS		Author MicaneK	List of equipment Reserveteile		
		Creator 2018-10-18 MicaneK			
		Approval 2018-11-12 Snepfenberg			
		Department PD LD AP MF-DSV CS			
		Change Order P5A00249891	Product MLFB/Product-ID	Doc Type TB / Z	
		Doc State Released	Item No A5E46034057	Paper Size A4	
		Revision (Counter) 001	Revision State AA	Doc No A5E46034057A	1st Language en
					2nd Language de
©SIEMENS AG 2018		Project No	Ref No	Sheet 2 of 9	

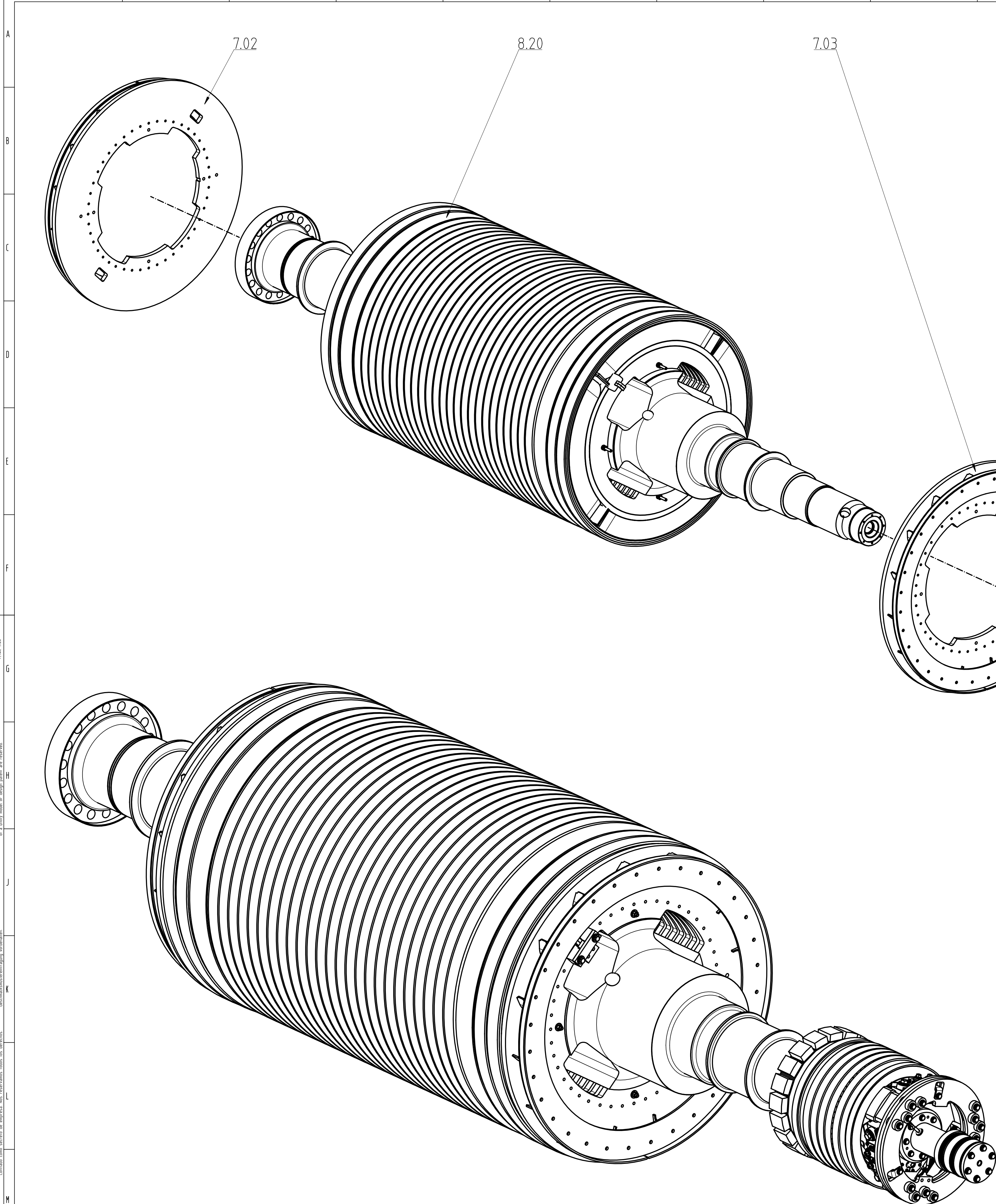
¹⁾ Jedna se o metrazni materialy, urcene k naslednemu opracovani dle dispozic stroje. /
These are the materials distributed in meters, intended for subsequent processing according to the machine design.

²⁾ Externi rozvadec je pribalen ke stroji /
External terminal box is packed with the machine

	Pouzita tesneni / "Used gaskets"	Packages SoW / PMD	
		5 YEARS	BACK UP
G1	DVY:82751007	-	yes
G2	DVY:82755029	-	yes
G3	DVY:82752505	yes	yes
G4	DVY:82772515	yes	yes
G5	DVY:82773030	yes	yes
G6	9LD9100-0AG04-0AA0	yes	yes
G7	DVY:82780117	yes	yes
G8	DVY:82720020	yes	yes
G9	DVY:82720031	yes	yes

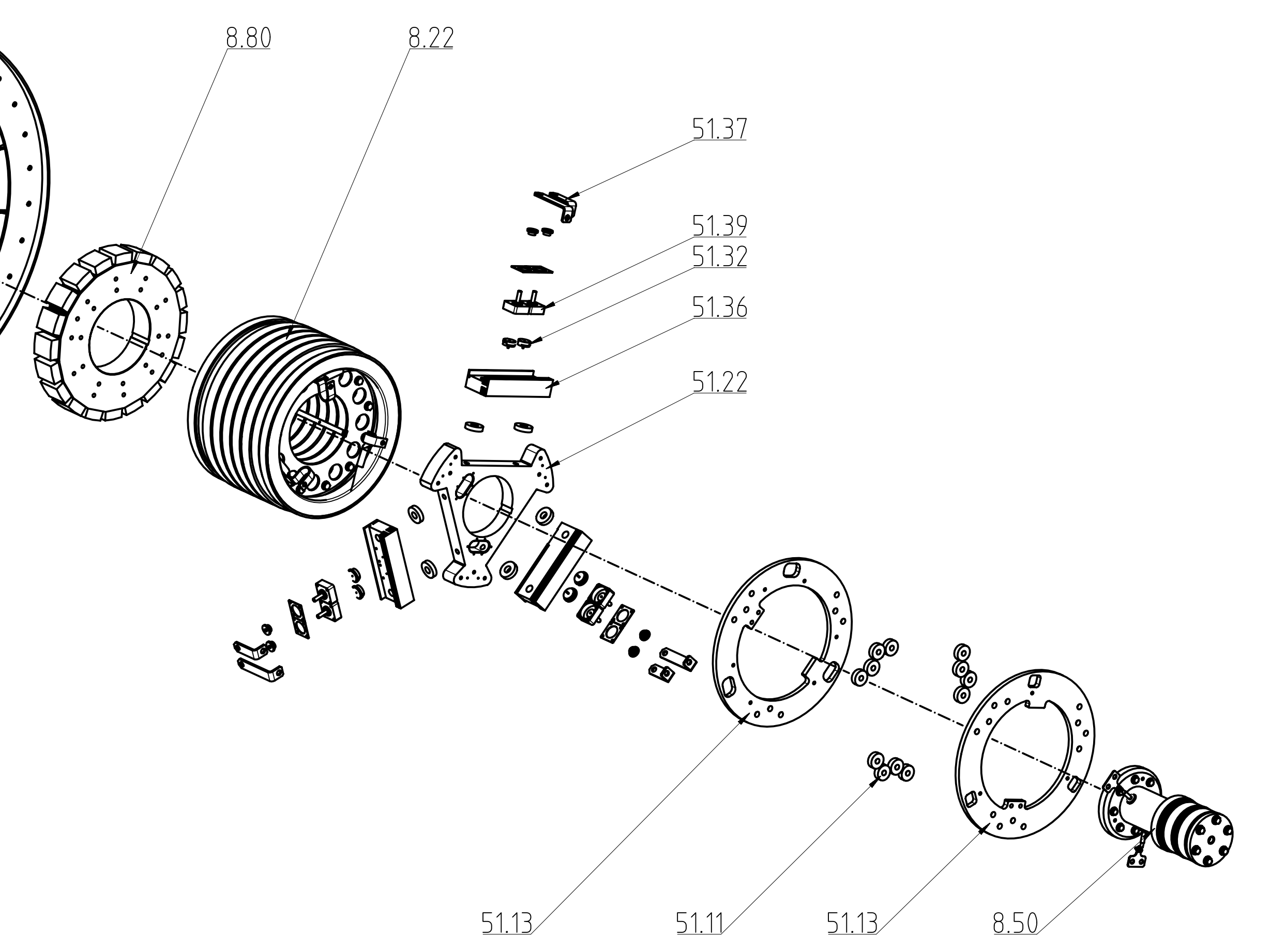


TB 002



LT1031	Name	Material number	QTY	SEE LEGEND ON SHEET 2			
				CON	COMM	5 YEARS	BACK UP
7.02 ^{*)}	Ventilator, DE / Fan, DE	DVY:A5E43020147	1	-	-	-	-
8.20 ^{*)}	Rotor navinuty / Rotor wounded	DVY:A5E43680376	1	-	-	-	-
7.03 ^{*)}	Ventilator, NDE / Fan, NDE	DVY:A5E43021846	1	-	-	-	-
8.80	Rotor PMG / PMG rotor	DVY:DRF-742993	1	-	-	-	-
8.22	Budic rotoru navinuty / Exciter rotor wounded	DVY:DRE-650941	1	-	-	-	-
51.37	Pripojovací svorka, dlouha / Contact link, long	DVY:DRF-641899	3	-	-	-	-
51.37	Pripojovací svorka, kratka / Contact link, short	DVY:DRF-641896	3	-	-	-	-
51.39	Přislusensvi diod / Diode accessories	DVY:54701480	6	-	-	-	yes
51.32	Dioda / Diode	DVY:53951950	6	-	yes	yes	yes
51.36	Chladic diod / Diode cooler	DVY:A5E42555426	3	-	-	-	-
51.22	Nosic usmernovace / Rectifier carrier	DVY:A5E42556518	1	-	-	-	-
51.13	Sberny kruh, minus / Connector ring, minus	DVY:A5E42556210	1	-	-	-	-
51.11	Varistor / Varistor	DVY:53625327	12	-	yes	yes	yes
51.13	Sberny kruh, plus / Connector ring, plus	DVY:A5E42556457	1	-	-	-	-
8.50	Krouzkova souprava / Slip ring set	DVY:DRE-738270	1	-	-	-	-

^{*)} Ventilatory na pozicich 7.02 a 7.03 jsou soucasti sestavy rotoru navinuteho na pozici 8.20 a jsou s ni dodavany, ale je mozne objednat je samostatne. / Fans on the pos. 7.02 and 7.03 are parts of rotor wounded assembly on the pos. 8.20 and are delivered with it, but it is possible to order these parts separately.

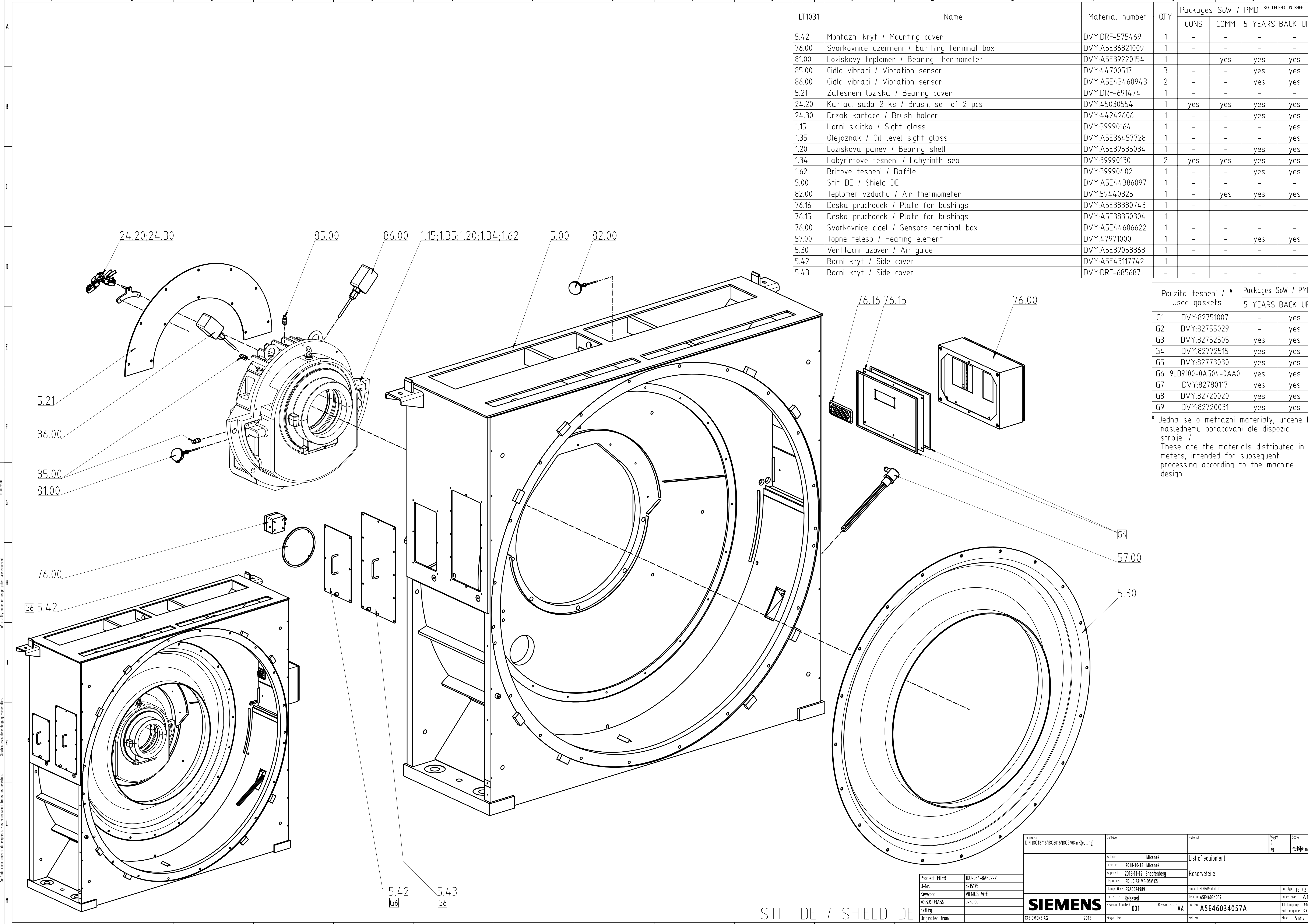


Project MLFB	10U2054-BAF02-Z
D-Nr.	3215175
Keyword	VLMUS WHE
ASS/SUBASS	0250.00
ExtPg	
Originated from	

Tolerance DIN ISO13715/ISO8015/ISO2768-mK(cutting)	Surface	Material	Weight 0 kg	Scale mm
Author Ereiter 2018-10-18 MicaneK		List of equipment		
Approval 2018-11-12 Snejpenberg		Reservetelle		
Department PD LD AP MF-BSV CS		Product MLFB/Product-Id		
Charge Order PSA00249891		Doc. Type TB / Z		
Doc. State Released		Item No A5E46034057		
Revision (Externer) 001		Paper Size A1		
Revision State AA		1st Language en		
Project No		2nd Language de		
Ref No		Sheet 4 of 9		

SIEMENS

ROTOR / ROTOR



LT1031	Name	Material number	QTY	Packages SoW / PMD SEE LEGEND ON SHEET 2			
				CONS	COMM	5 YEARS	BACK UP
5.42	Montazni kryt / Mounting cover	DVY:DRF-575469	1	-	-	-	-
76.00	Svorkovnice uzemneni / Earthing terminal box	DVY:ASE36821009	1	-	-	-	-
81.00	Loziskovy teplomer / Bearing thermometer	DVY:ASE39220154	1	-	yes	yes	yes
85.00	Cidlo vibraci / Vibration sensor	DVY:44700517	3	-	-	yes	yes
86.00	Cidlo vibraci / Vibration sensor	DVY:ASE43460943	2	-	-	yes	yes
5.21	Zatesneni loziska / Bearing cover	DVY:DRF-691474	1	-	-	-	-
24.20	Kartac, sada 2 ks / Brush, set of 2 pcs	DVY:45030554	1	yes	yes	yes	yes
24.30	Drzak kartace / Brush holder	DVY:44242606	1	-	-	yes	yes
1.15	Horni sklicko / Sight glass	DVY:39990164	1	-	-	-	yes
1.35	Olejoznak / Oil level sight glass	DVY:ASE36457728	1	-	-	-	yes
1.20	Loziskova panev / Bearing shell	DVY:ASE39535034	1	-	-	yes	yes
1.34	Labyrintove tesneni / Labyrinth seal	DVY:39990130	2	yes	yes	yes	yes
1.62	Britove tesneni / Baffle	DVY:39990402	1	-	-	yes	yes
5.00	Stit DE / Shield DE	DVY:ASE44386097	1	-	-	-	-
82.00	Teplomer vzduchu / Air thermometer	DVY:59440325	1	-	yes	yes	yes
76.16	Deska pruchodek / Plate for bushings	DVY:ASE38380743	1	-	-	-	-
76.15	Deska pruchodek / Plate for bushings	DVY:ASE38350304	1	-	-	-	-
76.00	Svorkovnice cidel / Sensors terminal box	DVY:ASE44606622	1	-	-	-	-
57.00	Topne teleso / Heating element	DVY:47971000	1	-	-	yes	yes
5.30	Ventilacni uzavrer / Air guide	DVY:ASE39058363	1	-	-	-	-
5.42	Bocni kryt / Side cover	DVY:ASE43117742	1	-	-	-	-
5.43	Bocni kryt / Side cover	DVY:DRF-685687	-	-	-	-	-

Pouzita tesneni / Used gaskets		Packages SoW / PMD	
		5 YEARS	BACK UP
G1	DVY:82751007	-	yes
G2	DVY:82755029	-	yes
G3	DVY:82752505	yes	yes
G4	DVY:82772515	yes	yes
G5	DVY:82773030	yes	yes
G6	9LD9100-0AG04-0AA0	yes	yes
G7	DVY:82780117	yes	yes
G8	DVY:82720020	yes	yes
G9	DVY:82720031	yes	yes

¹⁾ Jedna se o metrazni materialy, urcene k naslednemu opracovani dle dispozic stroje. / These are the materials distributed in meters, intended for subsequent processing according to the machine design.

Project MLFB	10U2054-BAF02-Z
D-Nr.	3215175
Keyword	VLMUS WIE
ASS/SUBASS	0250.00
ExtPg	Released
Originated from	

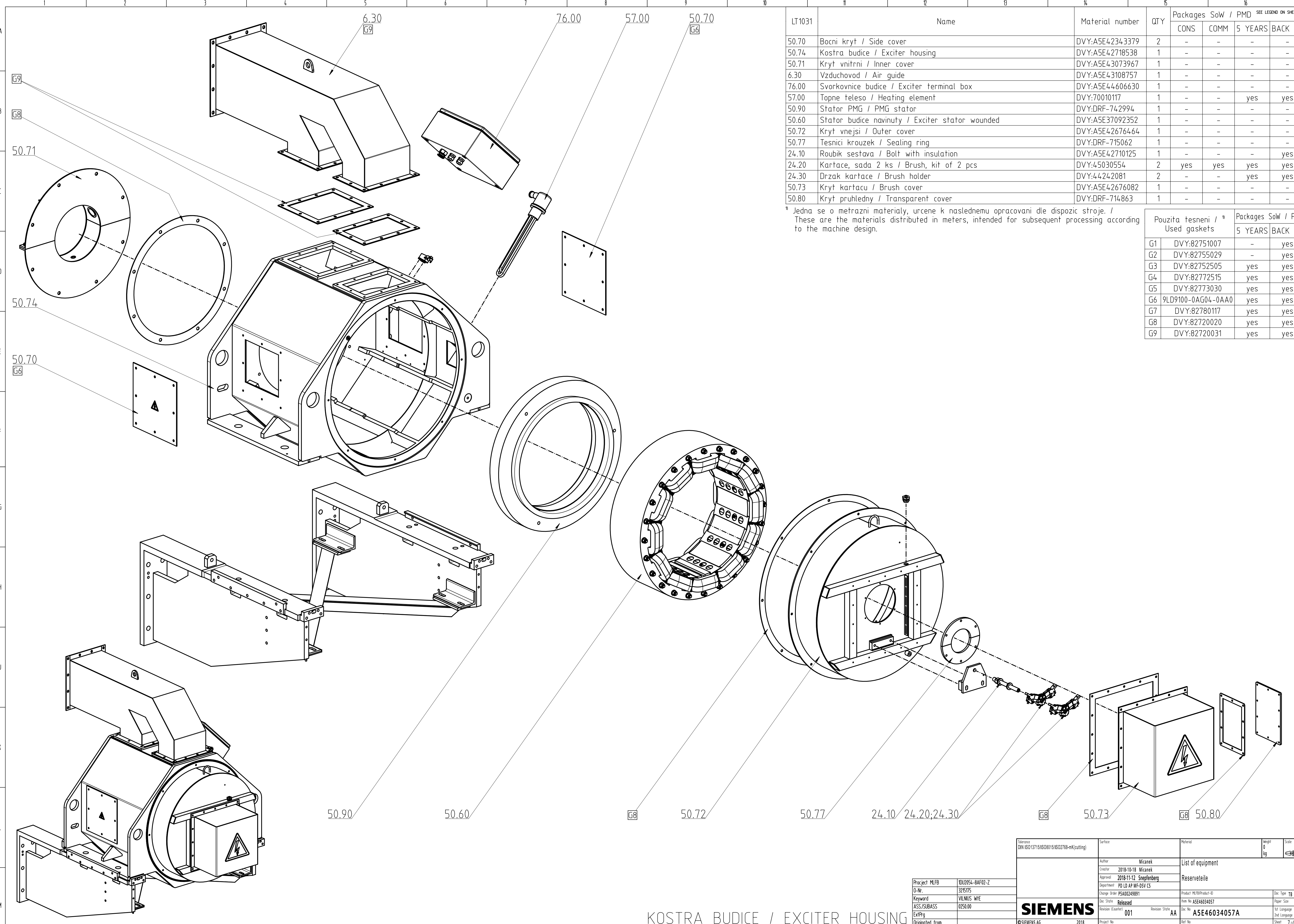
Tolerance DIN ISO 13715/ISO 8015/ISO 22768-mk(cutting)	Surface	Material	Weight 0 kg	Scale mm
Author 2018-10-18 MicaneK Approval 2018-11-12 Snejfenberg Department PD LD AP MF-BSV CS		List of equipment		
		Reservetelle		
Charge Order PSA00249891	Doc. State Revision (Excerpt)	Product MLFB/Product-Id	Item No ASE46034057	Doc. Type TB / Z
SIEMENS		Revision State AA	Doc. No ASE46034057A	Paper Size A1
		Project No	Ref. No	1st Language en
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				Sheet 5 of 9

STIT DE / SHIELD DE

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Tolrance DIN ISO13175/ISO8015/ISO2788-m(cutting)	Surface		Material	Weight 0 kg	Scale  mm
	Author Micanek Creator 2018-10-18 Micanek Approval 2018-11-12 Sneglenberg Department PD LO AP MF-DSV CS Change Order P5400249891 Drawn Released Revision (English) 001 Revision State AA	List of equipment Reserveretelle	Product MZF8Product-ID Ref No A5E46034057	Doc type TS / Z Paper Size A1	1st Language de 2nd Language de
	©SIEMENS AG 2018	Project No	Ref No A5E46034057A	Sheet	6 of 9



LT1031	Name	Material number	QTY	Packages SoW / PMD SEE LEGEND ON SHEET			
				CONS	COMM	5 YEARS	BACK
50.70	Bocni kryt / Side cover	DVY:A5E42343379	2	-	-	-	-
50.74	Kostrá budice / Exciter housing	DVY:A5E42718538	1	-	-	-	-
50.71	Kryt vnitřní / Inner cover	DVY:A5E43073967	1	-	-	-	-
6.30	Vzduchovod / Air guide	DVY:A5E43108757	1	-	-	-	-
76.00	Svorkovnice budice / Exciter terminal box	DVY:A5E44606630	1	-	-	-	-
57.00	Topné těleso / Heating element	DVY:70010117	1	-	-	yes	yes
50.90	Stator PMG / PMG stator	DVY:DRF-742994	1	-	-	-	-
50.60	Stator budice navinutý / Exciter stator wound	DVY:A5E37092352	1	-	-	-	-
50.72	Kryt vnější / Outer cover	DVY:A5E42676464	1	-	-	-	-
50.77	Těsnicí kroužek / Sealing ring	DVY:DRF-715062	1	-	-	-	-
24.10	Řoubík sestava / Bolt with insulation	DVY:A5E42710125	1	-	-	-	yes
24.20	Kartace, sada 2 ks / Brush, kit of 2 pcs	DVY:45030554	2	yes	yes	yes	yes
24.30	Držák kartace / Brush holder	DVY:44242081	2	-	-	yes	yes
50.73	Kryt kartáče / Brush cover	DVY:A5E42676082	1	-	-	-	-
50.80	Kryt průhledný / Transparent cover	DVY:DRF-714863	1	-	-	-	-

¹⁾ Jedna se o metrazni materialy, urcene k naslednemu opracovanu dle dispozic stroje. / These are the materials distributed in meters, intended for subsequent processing according to the machine design.

Pouzita tesneni / " Used gaskets		Packages SoW / P	
		5 YEARS	BACK
G1	DVY:82751007	-	yes
G2	DVY:82755029	-	yes
G3	DVY:82752505	yes	yes
G4	DVY:82772515	yes	yes
G5	DVY:82773030	yes	yes
G6	9LD9100-0AG04-0AA0	yes	yes
G7	DVY:82780117	yes	yes
G8	DVY:82720020	yes	yes
G9	DVY:82720031	yes	yes

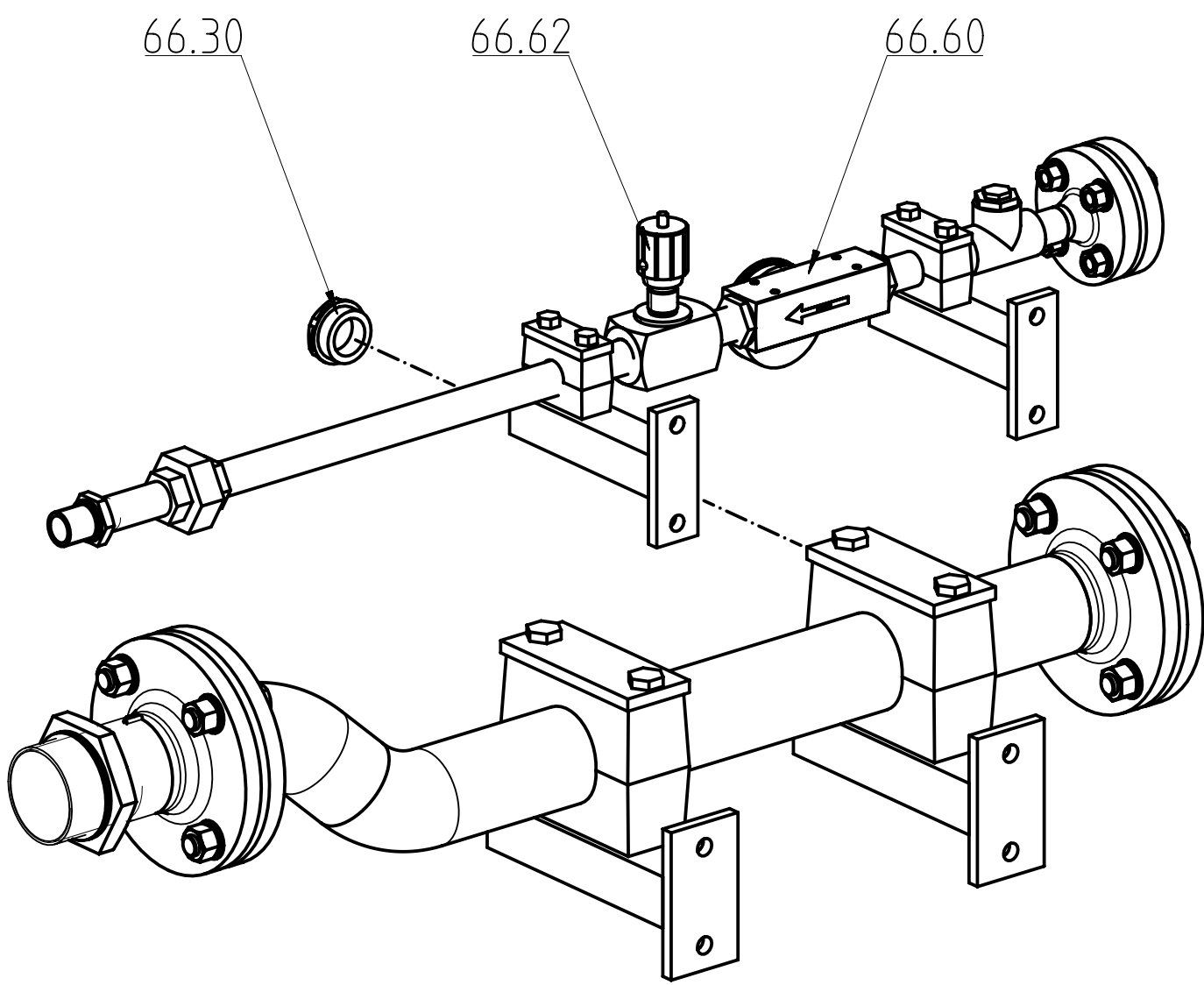
Project MLFB	1DU2054-8AF02-Z
O-Nr.	3215175
Keyword	VILNIUS WFE
ASS.SUBASS	0250.00
ExtPrg	
Originated from	

Tolerance DIN ISO 13715/ISO8015/ISO2768-mS(cutting)	Surface	Material	Weight 0 kg	Scale 
	Author Micanek	List of equipment		
	Creator 2018-10-18 Micanek			
	Approval 2018-11-12 Snejpenberg	Reserveteile		
	Department PD LD AP MF-DSV CS			
	Change Order PS40024981	Product MEBAProdukt-ID		Doc. type TB
	Doc. State Released	Item No A5E46034057		Paper Size
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 SIEMENS	Project No	Ref No		Sheet 7 of 7
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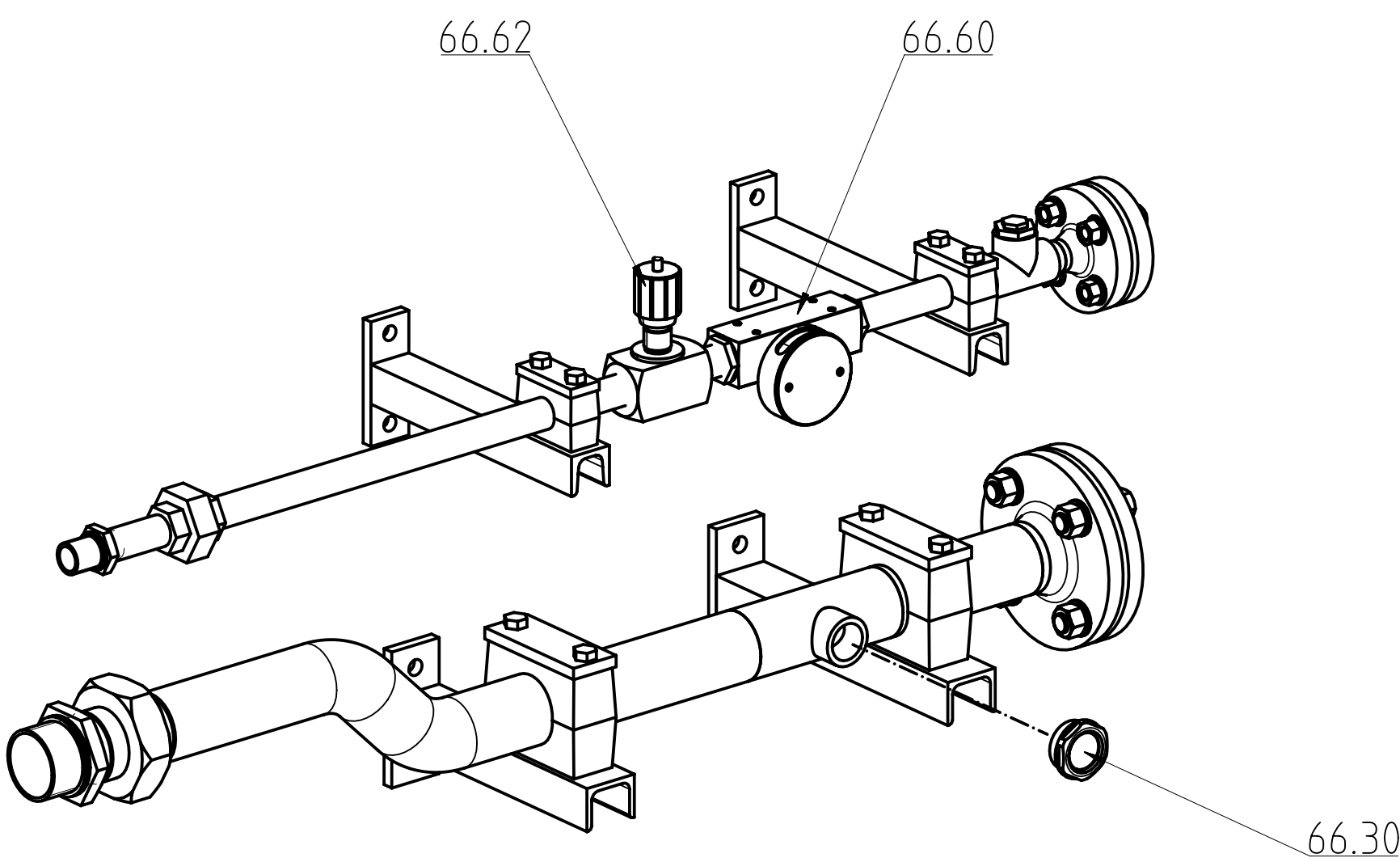
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		Circled		2018-10-18		Micanek	
		Approval		2018-11-12		Sneppenberg	
		Department		PD LD AP MF-DSV CS		Reserveville	
		Change Order		PSA00249891		Product MFSD/Produce-I	
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Revision (Owner)		001		AA		Page Size	
Project No				ASE46034057A		1st Language	
Sheet No						2nd Language	
Sheet		7				Sheet	

LT1031	Name	Material number	QTY	SEE LEGEND ON SHEET 2			
				CON	COMM	5 YEARS	BACK UP
66.30	Prhledne sklicko / Transparent glass	DVY:ASE45025633	2	-	-	-	yes
66.62	Skrnici ventil / Throttle valve	DVY:ASE37170395	2	-	-	yes	yes
66.60	Prtokomer, DE strana / Oil-flow meter, DE side	DVY:ASE44129610	1	-	yes	yes	yes
66.60	Prtokomer, NDE strana / Oil-flow meter, NDE side	DVY:ASE44132747	1	-	yes	yes	yes

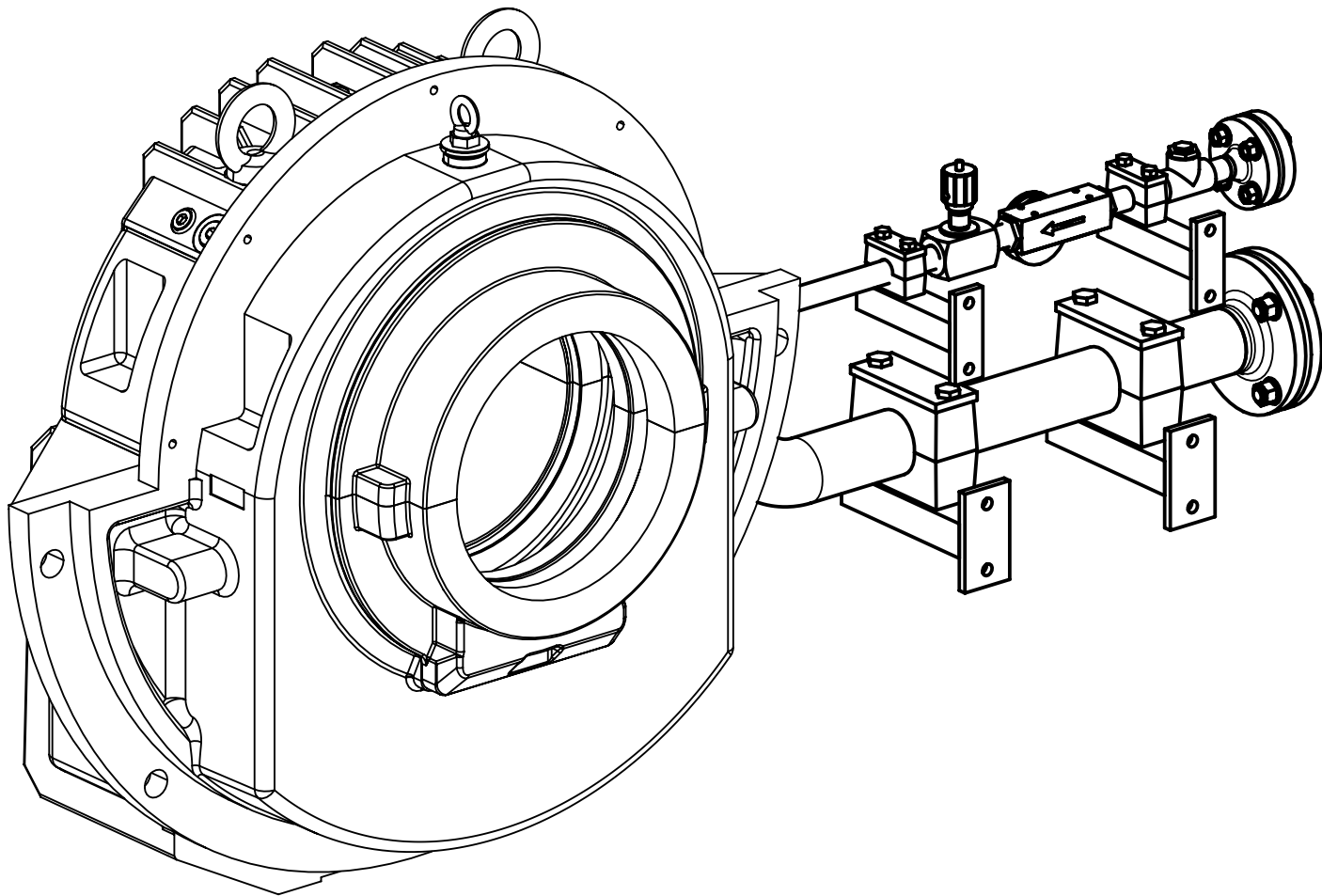
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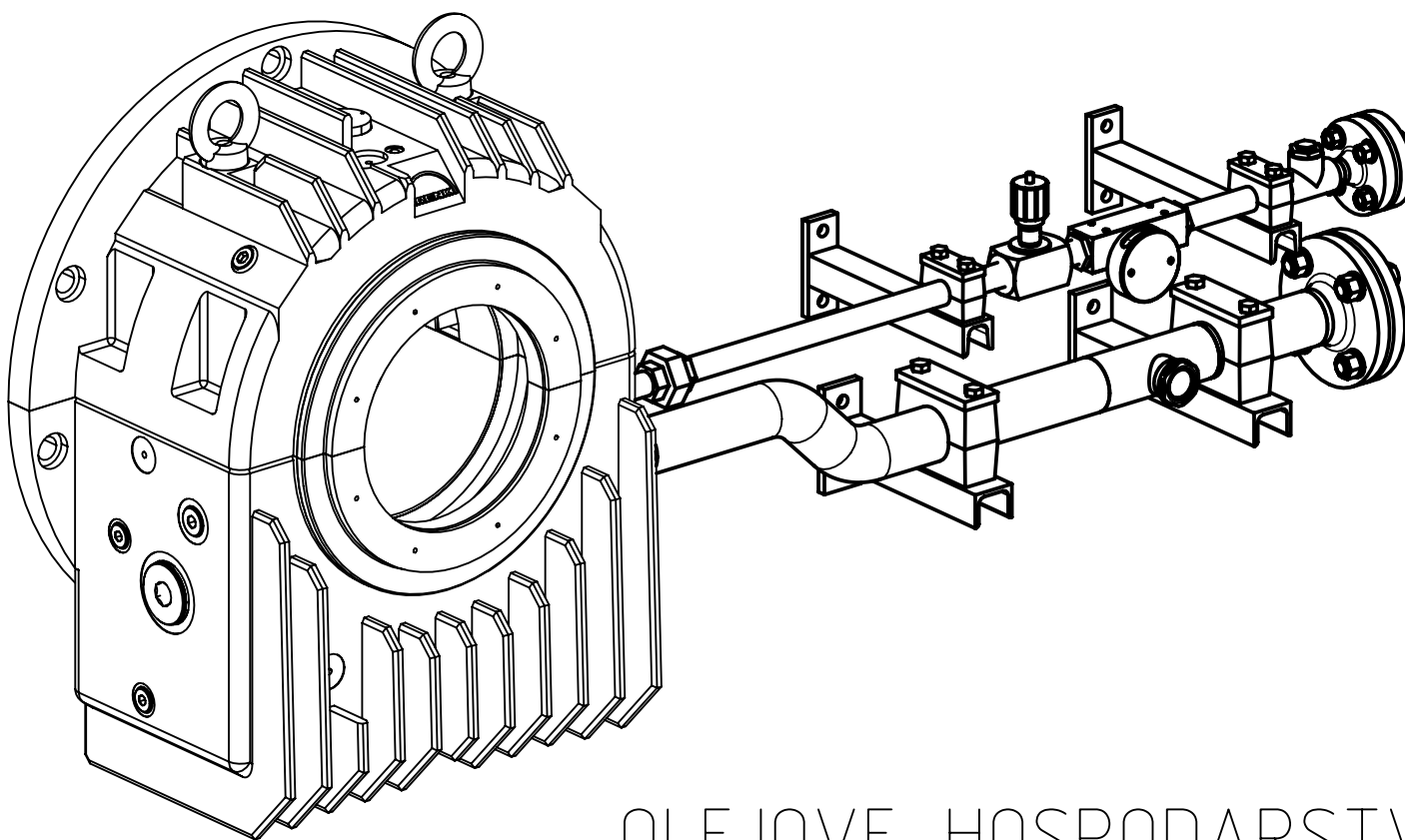
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STRANA DE / DE SIDE



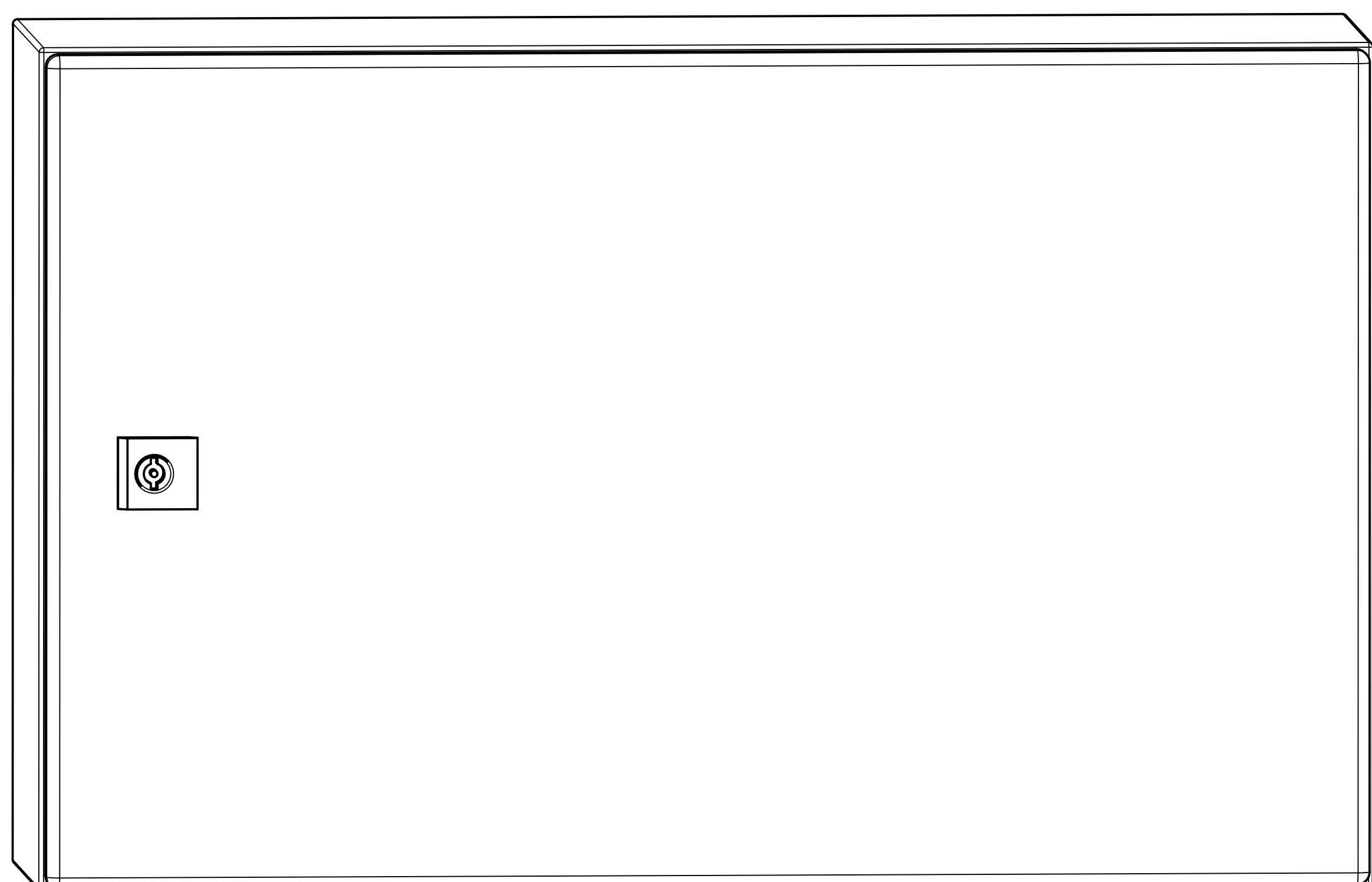
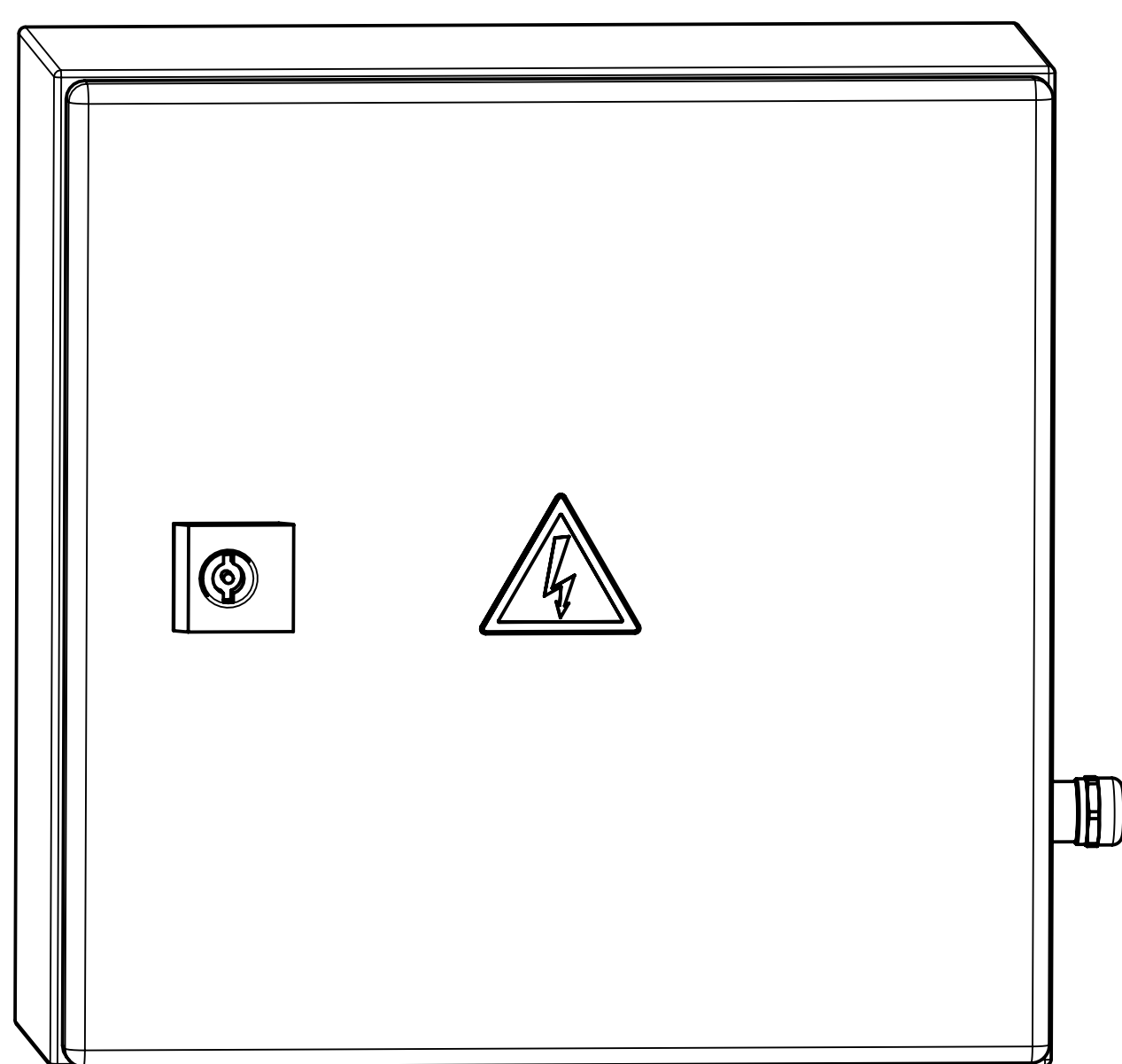
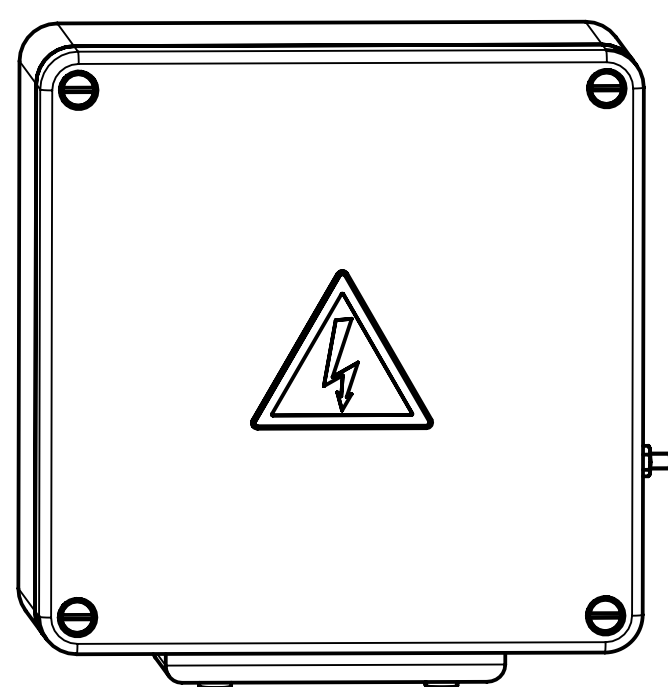
STRANA NDE / NDE SIDE



OLEJOVE HOSPODARSTVI / LUBRICATION UNIT

Project MLFB	10U2054-BAF02-Z
O-Nr.	3215175
Keyword	VLMUS WHE
ASS/SUBASS	0250.00
ExtPg	
Originated from	

Tolerance DIN ISO 13715/ISO 8015/ISO 2768-mK(cutting)	Surface	Material	Weight 0 kg	Scale mm
Author 2018-10-18 MicaneK		List of equipment		
Approval 2018-11-12 Snepfenberg		Reservetelle		
Department PD LD AP MF-BSV CS		Product MLFB/Product-Id		
Charge Order P5A00249891		Item No ASE46034057		Doc. Type TB / Z
Doc. State Released		Revision State AA		Paper Size A1
Revision (Earlier)		1st Language en		2nd Language de
Ref No		ASE46034057A		Sheet 8 of 9
©SIEMENS AG 2018		Project No		Ref No



SVORKOVNICE VYHRIVANI / HEATING TERMINAL BOX
DVI: A5E44611343

LT1031	Name	Material number	QTY	Packages SoW / PMD SEE LEGEND ON SHEET 2			
				CONS	COMM	5 YEARS	BACK UP
76.84	Svorka radova / Terminal clamp	DVY:43232030	9	-	-	-	-
76.85	Svorka zemnici / Terminal clamp, earthing	DVY:43232007	3	-	-	-	-
76.86	Svorka koncova / Terminal clamp, ending	DVY:43227011	2	-	-	-	-

SVORKOVNICE BUDICE / EXCITER TERMINAL BOX
DVY:A5E44606630

LT1031	Name	Material number	QTY	Packages SoW / PMD SEE LEGEND ON SHEET 2			
				CONS	COMM	5 YEARS	BACK UP
76.80	Jistic 16 A / Circuit breaker 16 A	DVY:ASE36405547	2	-	-	-	yes
76.80	Jistic 4 A / Circuit breaker 4 A	DVY:ASE36405711	1	-	-	-	yes
76.92	Pomocny spinac / Auxiliary switch	DVY:47508055	3	-	-	-	yes
76.84	Svorka radova / Terminal clamp	DVY:43232030	16	-	-	-	-
76.84	Svorka radova / Terminal clamp	DVY:43232037	6	-	-	-	-
76.85	Svorka zemnici / Terminal clamp, earthing	DVY:43232007	1	-	-	-	-
76.85	Svorka zemnici / Terminal clamp, earthing	DVY:70010015	2	-	-	-	-
76.86	Svorka koncova / Terminal clamp, ending	DVY:43227011	4	-	-	-	-

SVORKOVNICE CIDEL / SENSORS TERMINAL BOX
DVY:A5E44606622

LT1031	Name	Material number	QTY	Packages SoW / PMD SEE LEGEND ON SHEET 2			
				CONS	COMM	5 YEARS	BACK UP
76.84	Svorka radova / Terminal clamp	DVY:43232030	112	-	-	-	-
76.85	Svorka zemnici / Terminal clamp, earthing	DVY:43227040	1	-	-	-	-
76.86	Svorka koncova / Terminal clamp, ending	DVY:43227011	4	-	-	-	-

Project MLFB	1DU2054-BAF02-Z
O-Nr.	3215175
Keyword	VILNIUS WTE
ASS.SUBBASS	0250.00
ExtPrg	
Originated from	

Telephone DIN ISO 13715/ISO8081/ISO2768-mk(cutting)	Surface	Material	Weight kg	Scale  mm
Author Creator 2018-10-18 Micanek Approval 2018-11-12 Snejfenberg Department PD LD AP MF-DSV CS Change Order PSAD00249891	Micanek Micanek Snejfenberg PD LD AP MF-DSV CS	List of equipment Reserveteile		
Doc State Released Revision Number 001 Revision State AA		Product MLFB/Part-ID Item No A5E46034057 Doc No A5E46034057A	Doc Type TB / Z Paper Size A1	1st Language en 2nd Language de
©SIEMENS AG 2018	Project No	Ref No	Sheet 9 of 9	

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C

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Erklärung für den Einbau einer unvollständigen Maschine

(nach Anhang II, Teil 1, Abschnitt B der EG-Richtlinie 2006/42/EG Maschinenrichtlinie)

Originalsprachversion

Hersteller: Siemens Aktiengesellschaft
Sector Industry Drive Technologies Large Drives I DT LD
Anschrift: Postfach 4743 Vogelweiherstr. 1-15
D-90025 Nürnberg D-90441 Nürnberg

Produktbezeichnung: 1DT..., 1DU..., 1DB...

Dokument-Nr. D-655947

Für das bezeichnete Produkt bestätigen wir folgendes:

- Die Anwendung und Einhaltung folgend genannter Sicherheits- und Gesundheitsanforderungen nach Anhang I der Richtlinie 2006/42/EG des Europäischen Parlaments und Rates vom 17. Mai 2006:
1.1.2, 1.1.3, 1.1.5, 1.2.3, 1.2.4.1, 1.2.4.2, 1.2.4.3, 1.3.1, 1.3.2, 1.3.3, 1.3.4, 1.3.7, 1.3.8, 1.3.8.1, 1.4.1, 1.4.2.1, 1.5.1, 1.5.2, 1.5.4, 1.5.5, 1.5.6, 1.5.7, 1.5.8, 1.5.8.1, 1.5.12, 1.5.13, 1.5.14, 1.6.1, 1.6.3, 1.7.1, 1.7.2, 1.7.3, 1.7.4, 1.7.4.1, 1.7.4.2, 1.7.4.3
- Die Erstellung der speziellen technischen Unterlagen gemäß Anhang VII, Abschnitt B der Richtlinie 2006/42/EG

Hiermit verpflichten wir uns, dass die folgend genannte Person, bevollmächtigt ist die relevanten speziellen technischen Unterlagen zusammenzustellen und im Bedarfsfall auf begründetes Verlangen den einzelstaatlichen

Stellen zu übermitteln. Name: Martin Vořechovský, I DT LD DW SEM EN4

Anschrift: Siemens Electric Machines, Drásov 126, 66424, Drásov

Form der Übermittlung: digital form

Das bezeichnete Produkt ist ausschließlich zum Einbau in eine Maschine bestimmt. Die Inbetriebnahme der unvollständigen Maschine ist solange untersagt, bis eine EG-Konformitätserklärung zur Richtlinie 2006/42/EG, Anhang II, Teil 1, Abschnitt A für eine Maschine vorliegt.

Wir bestätigen die Konformität des oben genannten Produktes mit den Normen:

DIN EN ISO 12100 (Ausgabedatum 2011-03-01)

DIN EN 60204-1 (Ausgabedatum 2007-06-01), -11 (Ausgabedatum 2001-05-01)

Information: Familienreferenzen zu ergänzen nach abgeschlossener Risikobewertung. Relevante Normen mit dem Vertriebspartner, Auftraggeber abstimmen. Sie sind vom Produkt, dessen Einsatzziel und dem erforderlichen Informationsbedarf des Anwenders abhängig. Text kursiv sollte im Kundendokument entfernt werden.

Drásov, den 1.5.2011

Siemens Electric Machines s.r.o.

i.V. IVOTAVELEC

Name, Funktion CEO

Unterschrift/Signature

KOTLÁN

Name,

Unterschrift/Signature

Produktsicherheitsbeauftragter

Product safety representative

Siemens Aktiengesellschaft: Chairman of the Supervisory Board: Gerhard Cromme; Managing Board: Peter Loescher, Chairman, President and Chief Executive Officer; Roland Busch, Brigitte Ederer, Klaus Helmrich, Joe Kaeser, Barbara Kux, Hermann Requardt, Siegfried Russwurm, Peter Y. Solmssen, Michael Suess; Registered offices: Berlin and Munich, Germany; Commercial registries: Berlin Charlottenburg, HRB 12300, Munich, HRB 6684; WEEE-Reg.-No. DE 23691322

I DT LD

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Diese Erklärung bescheinigt die Übereinstimmung mit den genannten Richtlinien, ist jedoch keine Beschaffenheits- oder Haltbarkeitsgarantie nach §443 BGB.
Die Sicherheitshinweise der mitgelieferten Produktdokumentation sind zu beachten.

Übersetzungen der Originalsprachversion / Translations of the Original language version

Englisch

Declaration of incorporation of partly completed machinery

(in accordance with Annex II, Part 1, Section B of EC Directive 2006/42/EC Machinery Directive)

Manufacturer:	Siemens Aktiengesellschaft	
	Sector Industry Drive Technologies Large Drives	I DT LD
Address:	P.O. Box 4743	Vogelweiherstrasse 1-15
	D-90025 Nuremberg	D-90441 Nuremberg

Product denomination: The product name can be found on page 1 of the document, underneath the address.

For the product denominated above, we confirm the following:

- The application and observance of the following specified health and safety requirements according to Annex I of Directive 2006/42/EC, see page 1.
- Compilation of the relevant technical documentation in accordance with Annex VII, Section B of Directive 2006/42/EC

We herewith engage to ensure that the person named below is authorized to compile the relevant technical documentation and to present it on duly reasoned request to the relevant national authorities when necessary.

Name: see page 1

Address: see page 1

Form of presentation: see page 1

The product denominated above is exclusively intended for incorporation into a machine. Commissioning of the partly completed machine shall be prohibited until an EC Declaration of Conformity to Directive 2006/42 EC, Annex II, Part 1, Section A for a machine is available.

We confirm that the above-mentioned product is in conformity with the following standards:

DIN EN ISO 12100 (Output date 2011-03-01)

DIN EN 60204-1 (Output date 2007-06-01), -11 (Output date 2001-05-01)

Information: Family references completing after completed Risk assessment. Relevant standards are to be coordinated with the sales partner / customer. They depend on the product, its operational aim and the amount of information required by the user. Text italic should be removed in the customer document.

This declaration certifies the conformance with the directives specified, but is no guarantee of quality or guarantee of durability in accordance with Section 443 of the German Civil Code (BGB).

The safety instructions of the product documentation supplied must be complied with.

The signatures of the authorized persons can be seen on page 1 of the document.

Siemens Aktiengesellschaft: Chairman of the Supervisory Board: Gerhard Cromme; Managing Board: Peter Loescher, Chairman, President and Chief Executive Officer; Roland Busch, Brigitte Ederer, Klaus Helmrich, Joe Kaeser, Barbara Kux, Hermann Requardt, Siegfried Russwurm, Peter Y. Solmssen, Michael Suess; Registered offices: Berlin and Munich, Germany; Commercial registries: Berlin Charlottenburg, HRB 12300, Munich, HRB 6684; WEEE-Reg.-No. DE 23691322

Französisch

Déclaration d'incorporation d'une quasi-machine

(selon Annexe II, Partie 1, Paragraphe B de la Directive Européenne 2006/42/CE relative aux machines)

Fabricant : Siemens Aktiengesellschaft
Sector Industry Drive Technologies Large Drives I DT LD
Adresse : Postfach 4743 Vogelweiherstr. 1-15
DE-90025 Nürnberg DE-90441 Nürnberg

La désignation du produit se trouve en page 1 du document, en dessous de l'adresse.

Pour le produit désigné, nous certifions ce qui suit :

- L'application et le respect des prescriptions en matière de sécurité et de protection des personnes mentionnées ci-dessous selon Annexe I de la Directive 2006/42/CE, see Page 1.
- L'établissement de la documentation technique pertinente conformément à l'Annexe VII, Paragraphe B de la Directive 2006/42/CE

Nous déclarons par la présente que la personne désignée est habilitée à constituer la documentation technique pertinente et à la remettre aux autorités nationales compétentes sur demande dûment motivée.

Le produit désigné est exclusivement conçu pour l'incorporation dans une machine. La mise en service de la quasi machine est interdite tant que la déclaration CE de conformité à la Directive 2006/42/CE, Annexe II, Partie I, Paragraphe A n'est pas présente.

Nous confirmons la conformité du produit susmentionné avec les normes suivantes : voir page 1.

La présente déclaration atteste la conformité aux directives mentionnées, mais ne saurait tenir lieu de garantie de propriétés ni de garantie de durabilité au sens du paragraphe §443 BGB du code civil allemand.

Respecter les consignes de sécurité figurant dans la documentation produit fournie.

Les signatures des personnes habilitées sont en page 1 du document.

Spanisch

Declaración de incorporación de una cuasi máquina

(según anexo II, parte 1, sección B de la Directiva 2006/42/CE (directiva relativa a máquinas))

Fabricante: Siemens Aktiengesellschaft
Sector Industry Drive Technologies Large Drives I DT LD
Dirección: Postfach 4743 Vogelweiherstr. 1-15
D-90025 Nürnberg D-90441 Nürnberg

El nombre del producto puede leerse en la página 1 del documento, debajo de la dirección.

Por la presente certificamos lo siguiente para el producto mencionado:

- La aplicación y respeto de los requisitos de seguridad y salud contemplados en el anexo I de la Directiva 2006/42/CE que se indican seguidamente, see Page 1
- La elaboración de la documentación técnica pertinente según el anexo VII, sección B de la Directiva 2006/42/CE

Por la presente confirmamos que la persona que se indica a continuación está facultada para elaborar la documentación técnica pertinente y transmitirla a las autoridades nacionales cuando éstas lo soliciten con la debida justificación.

Siemens Aktiengesellschaft: Chairman of the Supervisory Board: Gerhard Cromme; Managing Board: Peter Loescher, Chairman, President and Chief Executive Officer; Roland Busch, Brigitte Ederer, Klaus Helmrich, Joe Kaeser, Barbara Kux, Hermann Requardt, Siegfried Russwurm, Peter Y. Solmssen, Michael Suess; Registered offices: Berlin and Munich, Germany; Commercial registries: Berlin Charlottenburg, HRB 12300, Munich, HRB 6684; WEEE-Reg.-No. DE 23691322

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El producto mencionado está destinado exclusivamente para su incorporación en una máquina. Se prohíbe la puesta en servicio de una cuasi máquina hasta que se presente una declaración de conformidad CE con la Directiva 2006/42/CE, anexo II, parte 1, sección A de la máquina final en la cual vaya a ser incorporada.
Por la presente confirmamos la conformidad del producto arriba indicado con las normas: ver página 1.

Spanisch

La presente declaración certifica los requisitos de las mencionadas directivas que se han aplicado y cumplido, pero no representa una garantía de propiedad o durabilidad según el §443 del Código Civil alemán.

Es necesario respetar las consignas e instrucciones de seguridad que figuran en la documentación que acompaña al producto.

Las firmas de las personas autorizadas pueden verse en la página 1 del documento.

Italianisch

Dichiarazione di incorporazione di quasi-macchine

(sec. Allegato II, Parte 1, Sezione B della Direttiva CE 2006/42/EG Direttiva Macchine)

Fabbricante: Siemens Aktiengesellschaft
Sector Industry Drive Technologies Large Drives I DT LD
Indirizzo: Postfach 4743 Vogelweiherstr. 1-15
D-90025 Nürnberg D-90441 Nürnberg

La denominazione del prodotto è riportata a pagina 1 del documento, sotto l'indirizzo.

In riferimento al prodotto indicato si dichiara quanto segue:

- Applicazione ed osservanza dei requisiti essenziali di sicurezza e di tutela della salute citati di seguito secondo l'Allegato I della Direttiva 2006/42/CE, see Page 1.
- La documentazione tecnica specifica pertinente è stata compilata secondo quanto prescritto nell'Allegato VII, Sezione B della Direttiva 2006/42/EG.

Con la presente ci assumiamo l'impegno di conferire alla persona nominata qui di seguito l'autorizzazione a compilare la documentazione tecnica pertinente e di trasmetterla su richiesta adeguatamente motivata alle singole autorità nazionali.

Il prodotto indicato è destinato esclusivamente all'incorporazione in una macchina finale. La messa in servizio della quasi-macchina è vietata finché non è munita della dichiarazione di conformità CE alla Direttiva 2006/42/EG, Allegato II, Parte 1, Sezione A per macchine.

Con la presente confermiamo la conformità del prodotto sopra nominato con le norme seguenti: vedi pagina 1.

Questa dichiarazione certifica la conformità con le direttive indicate, ma non costituisce una garanzia di qualità o di durata ai sensi dell'articolo 443 BGB (codice civile tedesco).

Vanno osservate le avvertenze di sicurezza contenute nella documentazione di prodotto allegata.

Le firme delle persone autorizzate sono riportate a pagina 1 del documento.

Schwedisch

Försäkran för inmontering av en ofullständig maskin

(enligt bilaga II, del 1, avsnitt B i EG-direktiv 2006/42/EG maskindirektiv)

Tillverkare: Siemens Aktiengesellschaft
Sector Industry Drive Technologies Large Drives I DT LD

Siemens Aktiengesellschaft: Chairman of the Supervisory Board: Gerhard Cromme; Managing Board: Peter Loescher, Chairman, President and Chief Executive Officer; Roland Busch, Brigitte Ederer, Klaus Helmrich, Joe Kaeser, Barbara Kux, Hermann Requardt, Siegfried Russwurm, Peter Y. Solmssen, Michael Suess; Registered offices: Berlin and Munich, Germany; Commercial registries: Berlin Charlottenburg, HRB 12300, Munich, HRB 6684; WEEE-Reg.-No. DE 23691322

SIEMENS

Adress: Postfach 4743 Vogelweiherstr. 1-15
D-90025 Nürnberg D-90441 Nürnberg

Produktbeteckningen kan läsas på sida 1 i dokumentet under adressen.

För den märkta produkten intygar vi följande:

- Följande nämnda säkerhetsoch hälsoskyddskrav enligt bilaga I i direktivet 2006/42/EG tillämpas och uppfylls, see Page 1.
- Upprättandet av de speciella tekniska dokumenten enligt bilaga VII, avsnitt B i direktiv 2006/42/EG

Schwedisch

Härmed intygar vi att den i det följande nämnda personen är befullmäktigad att sammanställa de relevanta speciella tekniska dokumenten och vid behov efter motiverad begäran förmedla dessa till platserna i de enskilda länderna.

Den märkta produkten är uteslutande avsedd för inmontering i en maskin. Idrifttagandet av den ofullständiga maskinen är förbjudet tills en EG-försäkran om överensstämmelse med direktivet 2006/42/EG, bilaga II, del 1, avsnitt A för en maskin föreligger.

Vi försäkrar överensstämmelsen av den ovan nämnda produkten med standarderna: se sidan 1.

Denna försäkran intygar överensstämmelsen med de nämnda direktiven men är inte någon beskaftenhets- eller hållbarhetsgaranti enligt §443 BGB.
Säkerhetsanvisningarna i den bifogade produktdokumentationen ska beaktas.

Underskrifterna för de befullmäktigade personerna finns på sida 1 i dokumentet.

Finnisch

Puolivalmisteiden liittämismakuutus

(EY-konedirektiivin 2006/42/EY liitteen II osan B mukaan)

Valmistaja: Siemens Aktiengesellschaft
Sector Industry Drive Technologies Large Drives I DT LD
Osoite: Postfach 4743 Vogelweiherstr. 1-15
D-90025 Nürnberg D-90441 Nürnberg

Tuotenimi on asiakirjan sivulla 1 osoitteen alla.

Vakuutamme, että nimetty tuote:

- Seuraavassa mainittujen turvallisuus- ja terveystaakimusten soveltaminen ja noudattaminen direktiivin 2006/42/EY liitteen I mukaisesti, see Page 1.
- noudattaa direktiivin 2006/42/EY liitteen VII osassa B annettuja erityisten teknisten asiakirjojen laatimista koskevia määräyksiä

Sitoudumme siihen, että jäljempänä mainittu henkilö on täysivaltainen laatimaan erityiset tekniset asiakirjat ja tarvittaessa perustellusta pyynnöstä toimittamaan ne kansallisille viranomaisille.

Nimetty tuote on tarkoitettu vain koneeseen asennettavaksi. Epätäydellisen koneen käyttöönotto on kielletty siihen asti kunnes koneella on direktiivin 2006/42/EY liitteen II osan 1 kappaleen A mukainen EY-vaatimustenmukaisuusvakuutus.

Vakuutamme, että edellä mainittu tuote on seuraavien standardien mukainen: ks. sivu 1.

Siemens Aktiengesellschaft: Chairman of the Supervisory Board: Gerhard Cromme; Managing Board: Peter Loescher, Chairman, President and Chief Executive Officer; Roland Busch, Brigitte Ederer, Klaus Helmrich, Joe Kaeser, Barbara Kux, Hermann Requardt, Siegfried Russwurm, Peter Y. Solmssen, Michael Suess; Registered offices: Berlin and Munich, Germany; Commercial registries: Berlin Charlottenburg, HRB 12300, Munich, HRB 6684; WEEE-Reg.-No. DE 23691322

SIEMENS

Tämä vakuutus todistaa tuotteen noudattavan mainittuja direktiivejä mutta ei anna takuita laadusta tai kestävydestä (§443 BGB).

Tuotteen mukana tulevien asiakirjojen sisältämiä turvallisuusohjeita on noudatettava.

Valtuutettujen henkilöiden allekirjoitukset ovat asiakirjan sivulla 1.

Dänisch

Erklæring til montering af en ufuldstændig maskine

(iht. bilag II, del 1, afsnit B i EF-direktivet 2006/42/EF Maskindirektiv)

Producent: Siemens Aktiengesellschaft
Sector Industry Drive Technologies Large Drives I DT LD
Adresse: Postboks 4743 Vogelweiherstr. 1-15
D-90025 Nürnberg D-90441 Nürnberg

Produktbetegnelsen kann læses på side 1 i dokumentet under adressen.

Vi bekæfter følgende i forbindelse med det betegnede produkt:

- Anvendelse og overholdelse af efterfølgende nævnte sikkerheds- og sundhedskrav iht. bilag I i direktivet 2006/42/EF, see Page 1.
- Oprettelse af speciel teknisk dokumentation iht. bilag VII, afsnit B i direktivet 2006/42/EG

Hermed forpligter via os til at give den efterfølgende nævnte person fuldmagt til at oprette relevant teknisk dokumentation og i tilfælde af behov overdrage den til enkelte statslige myndigheder efter anmodning.

Det betegnede produkt er udelukkende beregnet til montering i en maskine. Ibrugtagning af den ufuldstændige maskine er forbudt, indtil der foreligger en EF-overensstemmelseserklæring til direktivet 2006/42/EF, bilag II, del 1, afsnit A til en maskine.

Vi bekræfter overensstemmelsen af den ovennævnte produkt med normerne: se side 1.

Denne erklæring attesterer overensstemmelsen med de nævnte direktiver men er dog ingen egenskabs- eller holdbarhedsgaranti iht. §443 BGB.

Sikkerhedshenvisningerne i den medleverede produktdokumentation skal overholdes.

Underskriften fra de berettigede personer kan ses på side 1 i dokumentet.

Niederländisch

Verklaring inzake de inbouw van een onvolledige machine

(volgens bijlage II, Deel 1, lid B van de EG-richtlijn 2006/42/EG Machinerichtlijn)

Producent: Siemens Aktiengesellschaft
Sector Industry Drive Technologies Large Drives I DT LD
Adres: Postfach 4743 Vogelweiherstr. 1-15
D-90025 Nürnberg D-90441 Nürnberg

De productbenaming staat vermeld op pagina 1 van het document, onder het adres.

Voor het vermelde product bevestigen wij het volgende:

Siemens Aktiengesellschaft: Chairman of the Supervisory Board: Gerhard Cromme; Managing Board: Peter Loescher, Chairman, President and Chief Executive Officer; Roland Busch, Brigitte Ederer, Klaus Helmrich, Joe Kaeser, Barbara Kux, Hermann Requardt, Siegfried Russwurm, Peter Y. Solmssen, Michael Suess; Registered offices: Berlin and Munich, Germany; Commercial registries: Berlin Charlottenburg, HRB 12300, Munich, HRB 6684; WEEE-Reg.-No. DE 23691322

SIEMENS

- De toepassing en de naleving van de volgende genoemde vereisten inzake veiligheid en gezondheid volgens Bijlage I van de Richtlijn 2006/42/EG, see Page 1.
- De opstelling van speciale technische documenten volgens Bijlage II, lid B van de Richtlijn 2006/42/EG.

Hiermee verbinden we ons ertoe dat de hierna vermelde persoon gemachtigd is om de relevante, speciale technische documenten samen te stellen en om deze indien nodig op gemotiveerd verzoek aan de staatsinstanties te bezorgen.

Niederländisch

Het vermelde product is uitsluitend voor de inbouw in een machine bedoeld. De inbedrijfstelling van de onvolledige machine is verboden tot een EG-conformiteitsverklaring volgens de Richtlijn 2006/42/Eg, Bijlage II, Deel 1, hoofdstuk A voor een machine voorhanden is.

Wij bevestigen de conformiteit van het hierboven genoemde product met de normen: zie pagina 1.

Deze verklaring bevestigt de overeenstemming met de genoemde richtlijnen, maar geeft geen garantie betreffende de gesteldheid of een houdbaarheidsgarantie volgens § 443 van het BWB. De veiligheidsaanwijzingen van de meegeleverde productdocumentatie moeten in acht worden genomen.

De handtekeningen van de geautoriseerde personen zijn te zien op pagina 1 van het document.

Portugiesisch

Declaração para a montagem de uma máquina incompleta

(conforme Anexo II, Parte 1, Ponto B da Directiva CE 2006/42/CE relativa a máquinas)

Fabricante: Siemens Aktiengesellschaft
Sector Industry Drive Technologies Large Drives I DT LD
Endereço: Postfach 4743 Vogelweiherstr. 1-15
D-90025 Nürnberg D-90441 Nürnberg

A designação do produto pode ser consultada na página 1 do documento, por baixo do endereço.

Relativamente ao produto designado atestamos o seguinte:

- A aplicação e observância dos seguintes requisitos impostos à segurança e saúde, em conformidade com o anexo I da Directiva 2006/42/CE, see Page 1.
- Elaboração da documentação técnica específica em conformidade com o Anexo VII, ponto B da Directiva 2006/42/CE

Pela presente nos responsabilizamos que a pessoa em seguida designada possui plenos poderes para elaborar a documentação técnica específica e relevante e, se necessário, para transmitir as mesmas às entidades dos Estados-Membros, caso seja justificadamente solicitada.

O produto designado serve exclusivamente para montagem numa máquina. A colocação em funcionamento da máquina permanece interdita, até ser apresentada uma declaração de conformidade CE relativa à Directiva 2006/42/CE, Anexo II, Parte 1, Ponto A relativamente a uma máquina.

Atestamos a conformidade do produto acima designado com as normas: ver página 1.

A presente declaração certifica a conformidade com as directivas designadas, no entanto, não constitui uma garantia de qualidade ou de validade nos termos do §443 do BGB (código civil alemão).

As indicações de segurança da documentação do produto juntamente fornecida têm de ser respeitadas.

As assinaturas das pessoas autorizadas encontram-se na página 1 do documento.

Siemens Aktiengesellschaft: Chairman of the Supervisory Board: Gerhard Cromme; Managing Board: Peter Loescher, Chairman, President and Chief Executive Officer; Roland Busch, Brigitte Ederer, Klaus Helmrich, Joe Kaeser, Barbara Kux, Hermann Requardt, Siegfried Russwurm, Peter Y. Solmssen, Michael Suess; Registered offices: Berlin and Munich, Germany; Commercial registries: Berlin Charlottenburg, HRB 12300, Munich, HRB 6684; WEEE-Reg.-No. DE 23691322

Griechisch

Δήλωση για την εγκατάσταση ενός ημιτελούς μηχανήματος

(σύμφωνα με το παράρτημα II, μέρος 1, ενότητα B της οδηγίας 2006/42/EK σχετικά με τα μηχανήματα)

Κατασκευαστής: Siemens Aktiengesellschaft
Sector Industry Drive Technologies Large Drives I DT LD
Διεύθυνση : Postfach 4743 Vogelweiherstr. 1-15
D-90025 Nürnberg D-90441 Nürnberg

Η ονομασία προϊόντος είναι διαθέσιμη στη σελίδα 1 του εγγράφου, κάτω από τη διεύθυνση.

Για το ως άνω αναφερόμενο προϊόν βεβαιώνουμε τα εξής:

- Η εφαρμογή και τήρηση των παρακάτω απαιτήσεων ασφάλειας και υγείας συμφωνεί με το παράρτημα I της Οδηγίας 2006/42/EK, see Page 1.
- Σύνταξη της ειδικής τεχνικής τεκμηρίωσης σύμφωνα με το παράρτημα VII, μέρος B της οδηγίας 2006/42/EK

Δια της παρούσης βεβαιώνουμε ότι το παρακάτω άτομο είναι εξουσιοδοτημένο να καταρτίσει τον οικείο τεχνικό φάκελο και αν χρειαστεί να τον διαβιβάσει, μετά από δεόντως αιτιολογημένο αίτημα των εθνικών αρχών.

Το αναφερόμενο προϊόν προορίζεται αποκλειστικά για εγκατάσταση σε ένα μηχάνημα. Η έναρξη λειτουργίας του ημιτελούς μηχανήματος απαγορεύεται πριν την προσκόμιση δήλωσης συμμόρφωσης EK ως προς την οδηγία 2006/42/EK, παράρτημα II, μέρος 1, ενότητα A για το μηχάνημα.

Βεβαιώνουμε τη συμμόρφωση του παραπάνω προϊόντος με τα πρότυπα: βλ. σελίδα 1.

Η δήλωση αυτή επιβεβαιώνει τη συμμόρφωση με τις αναφερθείσες οδηγίες, ωστόσο δεν αποτελεί εγγύηση για τις ιδιότητες του προϊόντος ή

τη διάρκεια ζωής του σύμφωνα με το §443 BGB.

Τηρείτε τις οδηγίες ασφαλείας που αναφέρονται στη συνοδευτική τεκμηρίωση του προϊόντος.

Οι υπογραφές των εξουσιοδοτημένων ατόμων βρίσκονται στη σελίδα 1 του εγγράφου.

Polnisch

Deklaracja dotycząca wbudowania niekompletnej maszyny

(zgodnie z załącznikiem II, część 1, ustęp B Dyrektywy WE 2006/42/WE w sprawie maszyn)

Producent: Siemens Aktiengesellschaft
Sector Industry Drive Technologies Large Drives I DT LD
Adres: Postfach 4743 Vogelweiherstr. 1-15
D-90025 Nürnberg D-90441 Nürnberg

Oznaczenie produktu należy odczytać ze strony 1 dokumentu, pod adresem.

Dla oznaczonego produktu potwierdzamy, co następuje:

- Zastosowanie i przestrzeganie niżej wymienionych wymagań w zakresie bezpieczeństwa i ochrony zdrowia zgodnie z załącznikiem I dyrektywy 2006/42/WE, see page 1.
- Sporządzenie specjalnej dokumentacji technicznej zgodnie z załącznikiem VII, ustęp B Dyrektywy WE 2006/42/WE

Niniejszym zobowiązujemy się, że niżej wymieniona osoba upoważniona jest do zestawienia istotnej, specjalnej dokumentacji technicznej i przekazania jej w razie potrzeby na uzasadnione żądanie instytucji poszczególnych państw.

Siemens Aktiengesellschaft: Chairman of the Supervisory Board: Gerhard Cromme; Managing Board: Peter Loescher, Chairman, President and Chief Executive Officer; Roland Busch, Brigitte Ederer, Klaus Helmrach, Joe Kaeser, Barbara Kux, Hermann Requardt, Siegfried Russwurm, Peter Y. Solmssen, Michael Suess; Registered offices: Berlin and Munich, Germany; Commercial registries: Berlin Charlottenburg, HRB 12300, Munich, HRB 6684; WEEE-Reg.-No. DE 23691322

SIEMENS

Polnisch

Oznaczony wyrób przeznaczony jest wyłącznie do wbudowania w maszynie. Uruchomienie niekompletnej maszyny jest zabronione do momentu przedłożenia dla maszyny Deklaracji zgodności WE do Dyrektywy 2006/42/WE, załącznik II, część 1, ustęp A.

Potwierdzamy zgodność wyżej wymienionego produktu z normami: patrz strona 1.

Niniejsza deklaracja potwierdza zgodność z wymienionymi dyrektywami, nie jest jednak gwarancją jakości lub trwałości zgodnie z §443 niemieckiego kodeksu cywilnego (BGB).

Należy przestrzegać wskazówek dotyczących bezpieczeństwa zawartych w dostarczonej dokumentacji wyrobu.

Podpisy osób uprawnionych widoczne są na stronie 1 dokumentu.

Litauisch

Ne iki galo sukomplektuotos mašinos montavimo deklaracija

(pagal 2006/42/EB Mašinų direktyvos II priedo 1 dalies B skirsnį)

Gamintojas: „Siemens Aktiengesellschaft“
Sector Industry Drive Technologies Large Drives I DT LD
Adresas: Postfach 4743 Vogelweiherstr. 1-15
D-90025 Nürnberg D-90441 Nürnberg

Gaminio pavadinimą galima rasti 1-jame dokumento puslapyje po adresu.

Patvirtiname, kad šiam gaminiui:

- Toliau nurodytų saugos ir sveikatos reikalavimų pagal Direktyvos 2006/42/EB I priedą naudojimas ir laikymasis, see Page1.
- buvo parengti specialūs techniniai dokumentai pagal 2006/42/EB direktyvos VII priedą B skirsnį.

Šiuo mes patvirtiname, kad toliau nurodytas asmuo yra įgaliotas parengti svarbius specialius techninius dokumentus ir, prireikus, pagrįstu reikalavimu pateikti juos atskirų valstybių įstaigoms.

Nurodytas gaminys skirtas tik montuoti į mašiną. Ne iki galo sukomplektuotą mašiną draudžiama pradėti eksploatuoti tol, kol mašinai nebus suteikta EB atitikties deklaracija pagal 2006/42/EB direktyvos II priedo 1 dalies A skirsnį.

Mes patvirtiname, kad pirmiau nurodytas gaminys atitinka šiuos standartus: žr. 1 psl.

Šia deklaracija patvirtinamas atitikimas nurodytoms direktyvoms, tačiau nėra kokybės arba tinkamumo naudoti garantija pagal Vokietijos Civilinio kodekso (BGB) 443 str.
Būtina atkreipti dėmesį į saugos nuorodas, pateiktas pristatytoje gaminio dokumentacijoje.

Įgaliojimų asmenų parašai matomi 1-ajame dokumento puslapyje.

Lettisch

Iekārtas sastāvdaļas iebūvēšanas deklarācija

(saskaņā ar EK Direktīvas 2006/42/EK par mašīnām II. pielikumu, 1. daļu, B punktu)

Siemens Aktiengesellschaft: Chairman of the Supervisory Board: Gerhard Cromme; Managing Board: Peter Loescher, Chairman, President and Chief Executive Officer; Roland Busch, Brigitte Ederer, Klaus Helmrich, Joe Kaeser, Barbara Kux, Hermann Requardt, Siegfried Russwurm, Peter Y. Solmssen, Michael Suess; Registered offices: Berlin and Munich, Germany; Commercial registries: Berlin Charlottenburg, HRB 12300, Munich, HRB 6684; WEEE-Reg.-No. DE 23691322

SIEMENS

Ražotājs: Siemens Aktiengesellschaft
Sector Industry Drive Technologies Large Drives I DT LD

Adrese: Postfach 4743 Vogelweiherstr. 1-15
D-90025 Nürnberg D-90441 Nürnberg

Produkta nosaukums ir izlasāms dokumenta 1.lappusē, zem adrese.

Attiecībā uz minēto izstrādājumu mēs apliecinām, ka:

- Šādu tālāk minēto drošības un veselības prasību piemērošana un ievērošana saskaņā ar Direktīvas 2006/42/EK I. Pielikumu, see Page 1.
- ir ievērotas speciālās tehniskās dokumentācijas atbilstoši Direktīvas 2006/42/EK VII. pielikumam, B punktam

Ar šo mēs apliecinām, ka zemāk minētā persona ir tiesīga sastādīt nepieciešamās speciālās tehniskās dokumentācijas un vajadzības gadījumā pēc pamatota pieprasījuma nodot tās atsevišķām valsts institūcijām.

Norādītais izstrādājums ir paredzēts vienīgi iebūvēšanai citā iekārtā. Iekārtas sastāvdaļas ekspluatācijas sākšana ir aizliegta tik ilgi, līdz ir pieejama visas iekārtas EK deklarācija atbilstoši Direktīvas 2006/42/EK II. pielikumam, 1. daļai, A punktam.

Mēs apliecinām augstāk minētā izstrādājuma atbilstību kvalitātes standartiem: skatīt 1. lpp.

Šī deklarācija apliecina atbilstību minētajām direktīvām, tomēr tā nav uzskatāma par aprakstīto īpašību vai derīguma termiņa atbilstības garantiju atbilstoši Vācijas Civillkodeksa (BGB) 443. pantam. Ievērot klāt pievienotajā izstrādājuma dokumentācijā sniegtās drošības norādes.

Pilnvaroto personu paraksti ir redzami dokumenta 1. lappusē.

Estnisch

Deklaratsioon mittetervikliku masina paigaldamise kohta

(EÜ direktiivi 2006/42/EÜ Masinate direktiiv lisa II, osa 1, lõigu B alusel)

Tootja: Siemens Aktiengesellschaft
Sector Industry Drive Technologies Large Drives I DT LD

Aadress: Postfach 4743 Vogelweiherstr. 1-15
D-90025 Nürnberg D-90441 Nürnberg

Tootenimetuse leiate käesoleva dokumendi leheküljelt 1, aadressi alt.

Me kinnitame nimetatud toote kohta alljärgnevat:

- Alljärgnevalt mainitud ohutus- ja tervisekaitsenõudeid rakendatakse ning järgitakse vastavalt direktiivi 2006/42/EÜ lisale I, see Page 1.
- Direktiivi 2006/42/EÜ lisa VII, lõigu B alusel spetsiaalsete tehniliste dokumentide koostamist

Käesolevaga võtame endale kohustuse, et alljärgnevalt nimetatud isik on volitatud koostama olulise tähtsusega spetsiaalseid tehnilisi dokumente ning neid põhjendatud nõudmise korral üksikute riikide ametkondadele edasi andma.

Estnisch

Nimetatud toode on ette nähtud eranditult masinasse paigaldamiseks. Mittetervikliku masina käikuvõtmine on keelatud seni, kuni masina kohta on olemas direktiivi 2006/42/EÜ, lisa II, osa 1, lõigu A alusel EÜ vastavusdeklaratsioon.

Siemens Aktiengesellschaft: Chairman of the Supervisory Board: Gerhard Cromme; Managing Board: Peter Loescher, Chairman, President and Chief Executive Officer; Roland Busch, Brigitte Ederer, Klaus Helmrich, Joe Kaeser, Barbara Kux, Hermann Requardt, Siegfried Russwurm, Peter Y. Solmssen, Michael Suess; Registered offices: Berlin and Munich, Germany; Commercial registries: Berlin Charlottenburg, HRB 12300, Munich, HRB 6684; WEEE-Reg.-No. DE 23691322

SIEMENS

Me kinnitame ülalnimetatud toote vastavust normidele: vt lk 1.

Käesolev deklaratsioon tõendab kooskõla nimetatud direktiividega, ei kujuta endast aga omadusi või vastupidavust sätetestavat garantiid §443 BGB (Saksa tsiviilseadustik) alusel.

Kaasapandud tootedokumentatsioonis äratoodud ohutusjuhistest tuleb kinni pidada.

Allkirjaõiguslike isikute allkirjad on toodud ära käesoleva dokumendi leheküljel 1.

Tschechisch

Prohlášení o zabudování neúplného strojního zařízení

(podle Přílohy II, část 1., odstavec B Směrnice o strojních zařízeních 2006/42/ES)

Výrobce: Siemens Aktiengesellschaft
Sector Industry Drive Technologies Large Drives I DT LD
Adresa: Postfach 4743 Vogelweiherstr. 1-15
D-90025 Nürnberg D-90441 Nürnberg

Označení výrobku je uvedeno v dokumentu na straně č. 1 pod adresou.

Pro uvedený výrobek potvrzujeme následující:

- Aplikace a dodržování níže uvedených požadavků na ochranu zdraví a bezpečnost podle Přílohy I směrnice 2006/42/ES, see Page 1.
- Sestavení zvláštní technické dokumentace podle Přílohy VII, odstavec B Směrnice 2006/42/ES

Tímto se zavazujeme, že níže uvedená osoba je zplnomocněna sestavovat relevantní zvláštní technickou dokumentaci a v případě potřeby a na odůvodněnou žádost ji předat úřadům jednotlivých zemí.

Uvedený výrobek je určen výlučně k zabudování do strojního zařízení. Zprovoznění neúplného strojního zařízení je zakázáno do té doby, dokud pro strojní zařízení nebude k dispozici ES prohlášení o shodě k Směrnici 2006/42/ES, Příloha II, část 1., odstavec A.

Potvrzujeme shodu výše uvedeného výrobku s normami: viz strana č. 1.

Toto prohlášení osvědčuje shodu s uvedenými směrnici, neposkytuje však záruku na kvalitu a životnost podle §443 německého občanského zákoníku (BGB).

Nutno dodržovat bezpečnostní pokyny uvedené v dodané dokumentaci k výrobku.

Podpisy oprávněných osob v dokumentu jsou patrné ze strany č. 1.

Siemens Aktiengesellschaft: Chairman of the Supervisory Board: Gerhard Cromme; Managing Board: Peter Loescher, Chairman, President and Chief Executive Officer; Roland Busch, Brigitte Ederer, Klaus Helmrich, Joe Kaeser, Barbara Kux, Hermann Requardt, Siegfried Russwurm, Peter Y. Solmssen, Michael Suess; Registered offices: Berlin and Munich, Germany; Commercial registries: Berlin Charlottenburg, HRB 12300, Munich, HRB 6684; WEEE-Reg.-No. DE 23691322

Prehlásenie o zabudovaní neúplného strojového zariadenia

(podľa Prílohy II, časť 1., odsek B Smernice o strojových zariadeniach 2006/42/ES)

Výrobca: Siemens Aktiengesellschaft
Sector Industry Drive Technologies Large Drives I DT LD

Adresa: Postfach 4743 Vogelweiherstr. 1-15
D-90025 Nürnberg D-90441 Nürnberg

Označenie výrobku je uvedené v dokumente na strane č. 1 pod adresou.

Pre uvedený výrobok potvrdzujeme nasledovné:

- Aplikácia a dodržiavanie nižšie uvedených požiadaviek na ochranu zdravia a bezpečnosť podľa Prílohy I smernice 2006/42/ES, see Page 1.
- Zostavenie osobitnej technickej dokumentácie podľa Prílohy VII, odsek B Smernice 2006/42/ES

Týmto sa zaväzujeme, že nižšie uvedená osoba je splnomocnená zostavovať relevantnú osobitnú technickú dokumentáciu a v prípade potreby a na základe odôvodnenej žiadosti ju odovzdať úradom jednotlivých krajín.

Uvedený výrobok je určený výlučne na zabudovanie do strojového zariadenia. Spreádzkovanie neúplného strojového zariadenia je zakázané do doby, kým pre strojové zariadenie nebude k dispozícii prehlásenie ES o zhode so Smernicou 2006/42/ES, Príloha II, časť 1., odsek A.

Potvrdzujeme zhodu hore uvedeného výrobku s normami: pozri strana č. 1.

Toto prehlásenie potvrdzuje zhodu s uvedenými smernicami, neposkytuje však záruku na kvalitu a životnosť podľa §443 nemeckého občianskeho zákonníka (BGB).

Je nevyhnutné dodržiavať bezpečnostné pokyny uvedené v dodanej dokumentácii k výrobku.

Podpisy oprávnených osôb v dokumente sú zrejmé zo strany č. 1.

Ungarisch

Nyilatkozat nem teljes gép beépítéséhez

(a gépekről szóló 2006/42/EK sz. EU-irányelv B fejezet, 1. rész, II. melléklete szerint)

Gyártó: Siemens Aktiengesellschaft
Sector Industry Drive Technologies Large Drives I DT LD

Cím: Postfach 4743 Vogelweiherstr. 1-15
D-90025 Nürnberg D-90441 Nürnberg

A termékmegnevezést a dokumentum 1. oldalán, a cím alatt olvassa el.

Nevezett termékkel kapcsolatban igazoljuk a következőket:

- Az alább megnevezett biztonsági- és egészségi követelmények alkalmazása és betartása a 2006/42/EK irányelv I. melléklete szerint, see Page 1.
- A 2006/42/EK irányelv B fejezet, VII. melléklete szerinti speciális műszaki dokumentumok elkészítését

Ezúton kötelezettséget vállalunk arra, hogy az alább megnevezett személy fel van hatalmazva arra, hogy a fontos, speciális műszaki dokumentumokat összeállítsa és szükség esetén, megalapozott kérésre az egyes állami helyeknek átadja.

Siemens Aktiengesellschaft: Chairman of the Supervisory Board: Gerhard Cromme; Managing Board: Peter Loescher, Chairman, President and Chief Executive Officer; Roland Busch, Brigitte Ederer, Klaus Helmrich, Joe Kaeser, Barbara Kux, Hermann Requardt, Siegfried Russwurm, Peter Y. Solmssen, Michael Suess; Registered offices: Berlin and Munich, Germany; Commercial registries: Berlin Charlottenburg, HRB 12300, Munich, HRB 6684; WEEE-Reg.-No. DE 23691322

SIEMENS

Ungarisch

A nevezett termék kizárólag egy gépbe történő beépítésre szolgál. A nem teljes gép üzembe helyezése mindaddig tilos, míg a 2006/42/EK irányelv A fejezet, 1. rész, II. melléklet szerint az EK megfelelőségi nyilatkozat egy gépre rendelkezésre nem áll.

Ezennel kijelentjük, hogy a fent nevezett termék megfelel a következő szabványoknak: lásd az 1. oldalt.

Ez a nyilatkozat tanúsítja a nevezett irányelveknek való megfelelőséget, de semmilyen minőségi- vagy tartóssági garanciát nem jelent a Német Polgári Törvénykönyv (BGB) §443-a szerint.

A csatolt termékdokumentációban szereplő biztonsági utasításokat figyelembe kell venni.

A jogosult személyek aláírásai a dokumentum 1. oldalán láthatók.

Slowenisch

Izjava za vgradnjo nepopolnega stroja

(v skladu z dodatkom II, del 1, poglavje B ES-direktive za stroje 2006/42/ES)

Proizvajalec: Siemens Aktiengesellschaft
Sector Industry Drive Technologies Large Drives I DT LD
Naslov: Postfach 4743 Vogelweiherstr. 1-15
D-90025 Nürnberg D-90441 Nürnberg

Oznako proizvoda je treba razbrati na strani 1 dokumenta, pod naslovom.

Za označeni proizvod potrjujemo naslednje:

- Uporaba in upoštevanje naslednjih navedenih varnostnih in zdravstvenih zahtev v skladu z dodatkom I Direktive 2006/42/ES, see Page 1.
- Izdelavo specialne tehnične dokumentacije v skladu z dodatkom VII, poglavje B Direktive 2006/42/ES

S tem v zvezi se zavezujemo, da je v nadaljevanju navedena oseba pooblaščenca za sestavljanje relevantne specialne tehnične dokumentacije in po potrebi za prenos ustreznih zahtev na mesta posameznih držav.

Opisani proizvod je predviden izključno za vgradnjo na stroj. Zagon nepopolnega stroja je prepovedan tako dolgo, dokler ni predložena ES izjava o skladnosti z direktivo 2006/42/ES, dodatek II, del 1, poglavje A za stroj.

Potrjujemo skladnost zgoraj navedenega proizvoda s standardi: glej stran 1.

Ta izjava potrjuje skladnost z navedenimi direktivami, vendar pa ni garancija za samo sestavo ali garancija za vsebnost v skladu z §443 BGB (nemški civilni zakonik).

Treba je upoštevati varnostna opozorila priložene dokumentacije proizvoda.

Podpisi pooblaščenih oseb so razvidni iz strani 1 dokumenta.

Siemens Aktiengesellschaft: Chairman of the Supervisory Board: Gerhard Cromme; Managing Board: Peter Loescher, Chairman, President and Chief Executive Officer; Roland Busch, Brigitte Ederer, Klaus Helmrich, Joe Kaeser, Barbara Kux, Hermann Requardt, Siegfried Russwurm, Peter Y. Solmssen, Michael Suess; Registered offices: Berlin and Munich, Germany; Commercial registries: Berlin Charlottenburg, HRB 12300, Munich, HRB 6684; WEEE-Reg.-No. DE 23691322



Rumänisch

Declarație de încorporare a unei mașini incomplete

(conform Anexei II, Partea 1, Secțiunea B din Directiva CE referitoare la mașini 2006/42/CE)

Producător: Siemens Aktiengesellschaft
Sector Industry Drive Technologies Large Drives I DT LD
Adresa: Postfach 4743 Vogelweiherstr. 1-15
D-90025 Nürnberg D-90441 Nürnberg

Descrierea produsului este prezentată pe pagina 1 a documentului, sub adresă.

În legătură cu produsul menționat confirmăm următoarele:

- Utilizarea și respectarea normelor de siguranță și sănătate specificate în continuare, conform anexei I din Directiva 2006/42/CE, see page 1.
- Elaborarea documentației tehnice speciale conform Anexei VII, Secțiunea B din Directiva 2006/42/CE

Prin prezenta ne angajăm să împuternicim persoana numită în continuare cu elaborarea documentației tehnice speciale și, dacă este necesar, transmiterea acesteia la cererea îndreptățită a autorităților naționale.

Produsul menționat este destinat exclusiv pentru încorporarea într-o mașină. Punerea în funcțiune a mașinii incomplete este interzisă atâta timp cât nu există o Declarație de conformitate CE conform Directivei 2006/42/CE, Anexa II, Partea 1, Secțiunea A pentru mașina respectivă.

Confirmăm conformitatea produsului mai sus menționat cu următoarele norme: vezi pagina 1.

Această declarație atestă conformitatea cu directivele menționate, însă nu reprezintă o garanție a caracteristicilor sau durabilității, în conformitate cu art. 443 din Codul Civil German (BGB).

Trebuie respectate indicațiile de siguranță din documentația livrată cu produsul.

Semnăturile persoanelor autorizate apar pe pagina 1 a documentului.

Siemens Aktiengesellschaft: Chairman of the Supervisory Board: Gerhard Cromme; Managing Board: Peter Loescher, Chairman, President and Chief Executive Officer; Roland Busch, Brigitte Ederer, Klaus Helmrich, Joe Kaeser, Barbara Kux, Hermann Requardt, Siegfried Russwurm, Peter Y. Solmssen, Michael Suess; Registered offices: Berlin and Munich, Germany; Commercial registries: Berlin Charlottenburg, HRB 12300, Munich, HRB 6684; WEEE-Reg.-No. DE 23691322



Bulgarisch

Декларация за монтаж в една неокомплектована машина

(съгласно приложение II, част 1, раздел В на ЕО-директива 2006/42/ЕО Директива за машините)

Производител: Siemens Aktiengesellschaft
Sector Industry Drive Technologies Large Drives I DT LD
Адрес: Postfach 4743 Vogelweiherstr. 1-15
D-90025 Nürnberg D-90441 Nürnberg

Обозначението на продукта може да се прочете на страница 1 на документа, под адреса.

За обозначения продукт ние потвърждаваме следното:

- Прилагането и спазването на посочените по-долу изисквания за безопасност и опазване на здравето съгласно приложение I на директива 2006/42/ЕО, see page 1.
- Изготвянето на специална техническа документация съгласно приложение VII, раздел В на ЕО-директива 2006/42/ЕО

С настоящето се задължаваме, че посоченото по-долу лице е упълномощено да състави релевантните специални технически документи и в случай на нужда при обосновано поискване да ги представи на службите в съответните държави.

Обозначеният продукт е предназначен изключително за монтаж в машина. Пускането в експлоатация на неокомплектованата машина е забранено, докато не е налице ЕО-декларация за съответствие към директива 2006/42/ЕО, приложение II, част 1, раздел А за машината.

Ние потвърждаваме съответствието на горепосочените продукти със стандартите: виж страница 1.

Тази декларация удостоверява съответствието с посочените директиви, но не е гаранция за характеристиката на продукта или гаранция за трайност съгласно §443 от немския гражданско процесуален кодекс (BGB). Трябва да се спазват указанията за безопасност от доставената документация на продукта.

Подписите на упълномощените лица се виждат на страница 1 на документа.

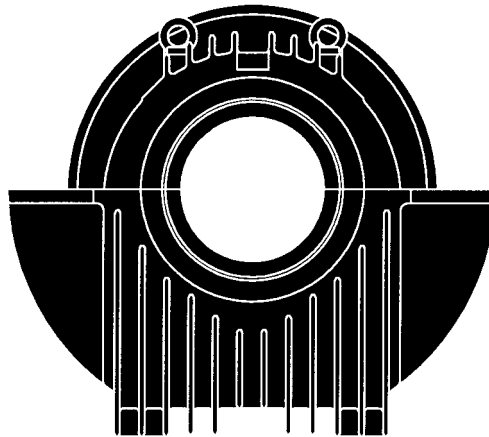
Siemens Aktiengesellschaft: Chairman of the Supervisory Board: Gerhard Cromme; Managing Board: Peter Loescher, Chairman, President and Chief Executive Officer; Roland Busch, Brigitte Ederer, Klaus Helmrich, Joe Kaeser, Barbara Kux, Hermann Requardt, Siegfried Russwurm, Peter Y. Solmssen, Michael Suess; Registered offices: Berlin and Munich, Germany; Commercial registries: Berlin Charlottenburg, HRB 12300, Munich, HRB 6684; WEEE-Reg.-No. DE 23691322

en	Machine specific certificates → see MDB (Manufacturing Data Book) All the documents verifying quality and certificates concerning the manufacturing process of the machine can be found in the separate Manufacturing Data Book (MDB). The MDB is created specifically for each machine.
de	Maschinenspezifische Zertifikate → siehe MDB (Manufacturing Data Book) Alle Dokumente bezüglich der Qualität und Zertifikate bezüglich des Fertigungsprozesses der Maschine sind in dem für die gegebene Maschine aufgestellten Dokument MDB zu finden.
cs	Specifické certifikáty stroje → viz MDB (Manufacturing Data Book) Všechny dokumenty týkající se jakosti a certifikáty vztahující se k výrobnímu procesu stroje naleznete v samostatném dokumentu MDB sestaveném pro daný stroj.
fr	Certificats spécifiques aux machines → voir MDB (Manufacturing Data Book) Les justificatifs de qualité convenus provenant du processus de fabrication de la machine se trouvent dans le MDB constitué spécifiquement pour la machine.
pl	Specyficzne certyfikaty maszynowe → widzieć MDB (Manufacturing Data Book) Wszystkie dokumenty potwierdzające jakość konstrukcyjną poszczególnych maszyn znajdują się w odrębnej książce danych produkcyjnych (MDB). Książka MDB jest tworzona dla każdej maszyny z osobna.
ru	Специальные сертификаты для машин → смотрите MDB (Manufacturing Data Book) Согласованные сертификаты качества, относящиеся к производственному процессу, можно найти в специальном MDB.
it	Certificati specifici di macchina → vedi MDB (Manufacturing Data Book) Gli attestati di qualità concordati e relativi al processo di fabbricazione della macchina si trovano nel MDB compilato specificamente per la macchina.
es	Certificados específicos de máquina → ver MDB (Manufacturing Data Book) Los certificados de calidad acordados y relativos al proceso de fabricación de la máquina pueden encontrarse en los MDB preparados específicamente para cada máquina.
nl	Machinespecifieke certificaten → zie MDB (Manufacturing Data Book) De overeengekomen kwaliteitscertificaten voor het productieproces van de machine vindt u in het specifieke MDB van de betreffende machine.
pt	Certificados específicos da máquina → vide MDB (Manufacturing Data Book) Você encontrará os certificados de qualidade do processo de fabricação da máquina no MDB elaborado especificamente para a máquina.
zh	机器专有证书 → 见 MDB (Manufacturing Data Book) 双方约定的生产过程质量证书可以参见机器专有的MDB。

Additional documents

D

Sleeve bearing DE	1
Sleeve bearing NDE	139
Oil inlet/outlet connection – Flow meter	273
Air-to-water cooler	280
Water leakage detector	291
Safety valve	318
Shaft vibration monitoring system	321
Bearing housing vibration monitoring system	334



Slide Bearings Type EM with external oil supply

Maintenance and Inspection



RENK AKTIENGESELLSCHAFT
Werk Hannover
Weltausstellungsallee 21
D - 30539 Hannover
Telephone: (0511) 8601-0
Telefax: (0511) 8601-266
e-mail: gleitlager.hannover@renk-ag.com
<http://www.renk.de>

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EM with external oil supply

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EM with external oil supply

Bearing Coding

Maintenance and Inspection

①	②	③	④	⑤	⑥
Type	Housing	Heat Dissipation	Shape of Bore and Type of Lubrication	Thrust part	Size - Diameter
E	M - centre flange - mounted bearing	Z - lubrication by oil circulation with external oil cooling	C - plain cylindrical bore without oil ring	Q - without thrust part (non locating bearing)	9 80≤D≤100
		X - lubrication by oil circulation with external oil cooling for high oil throughput	L - plain cylindrical bore with loose oil ring	B - plain sliding surfaces with oil grooves (locating bearing)	11 100≤D≤125
					14 125≤D≤160
		U - circulating pump and natural cooling	Y - two-lobe bore (lemon shape) without oil ring	E - taper land faces for one sense of rotation (locating bearing)	18 160≤D≤200
		T - circulating pump and water cooling (finned cooler in oil sump)	V - four-lobe bore without oil ring		22 200≤D≤250
					K - taper land faces (locating bearing)
				A - elastically supported circular tilting pads (RD - thrust pads) (locating bearing)	

Example for bearing coding:

① ② ③ ④ ⑤ ⑥
 E M Z L K 22-200

Type E slide bearing with centrally flanged - mounted housing, lubrication by oil circulation with external oil cooling, plain cylindrical bore with loose oil ring, locating bearing with taper land faces, size 22, diameter 200.

Shaft seals

Type 10 - floating labyrinth seal (IP 44)
 Type 11 - floating labyrinth seal with dust flinger (IP 54)
 Type 12 - floating labyrinth seal with baffle (IP 55)

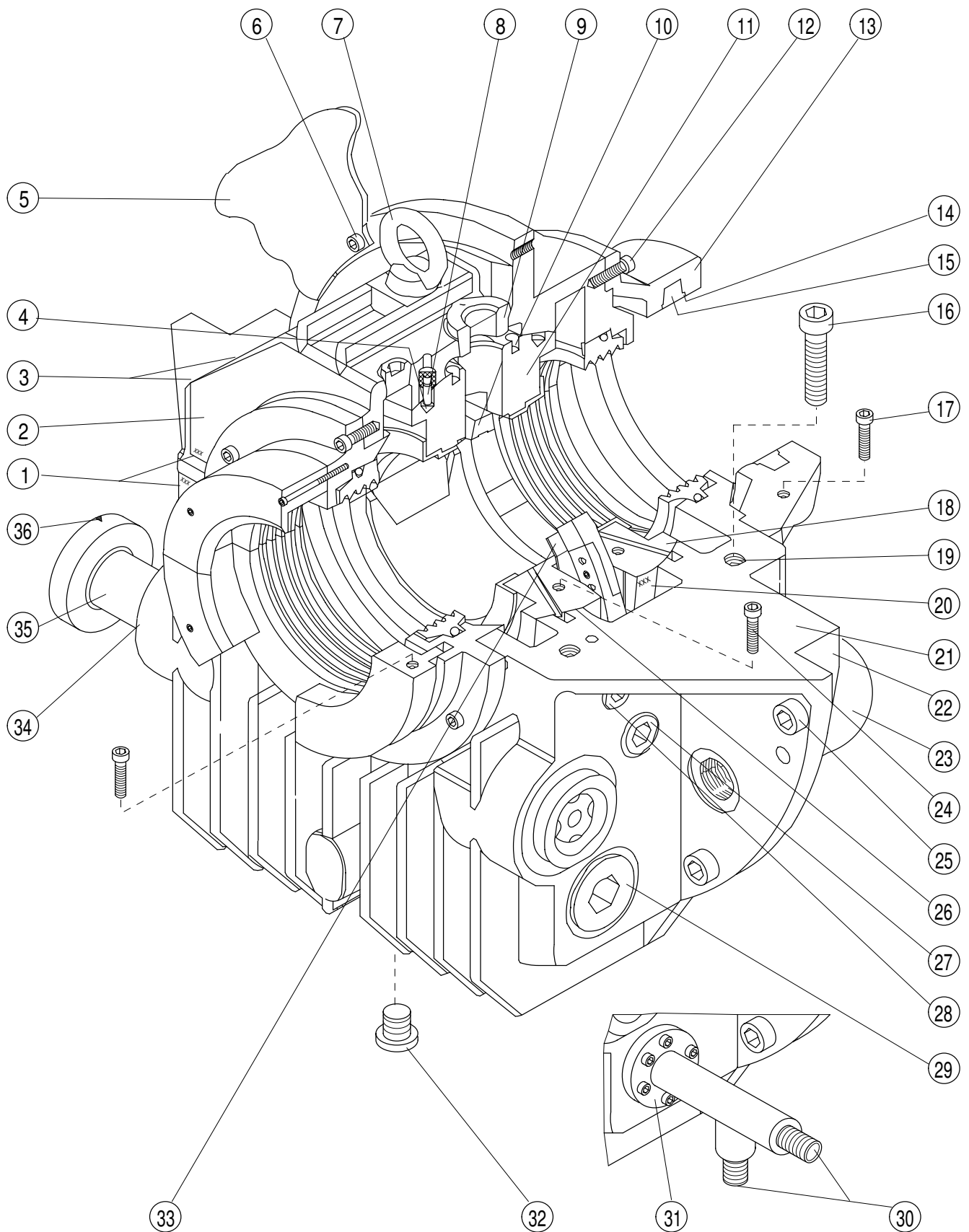
 Type 20 - rigid labyrinth seal (IP 44)
 Type 21 - rigid labyrinth seal with dust flinger (IP 54)
 Type 22 - rigid labyrinth seal with baffle (IP 55)

EM with external oil supply

General Drawing

Slide Bearing EM

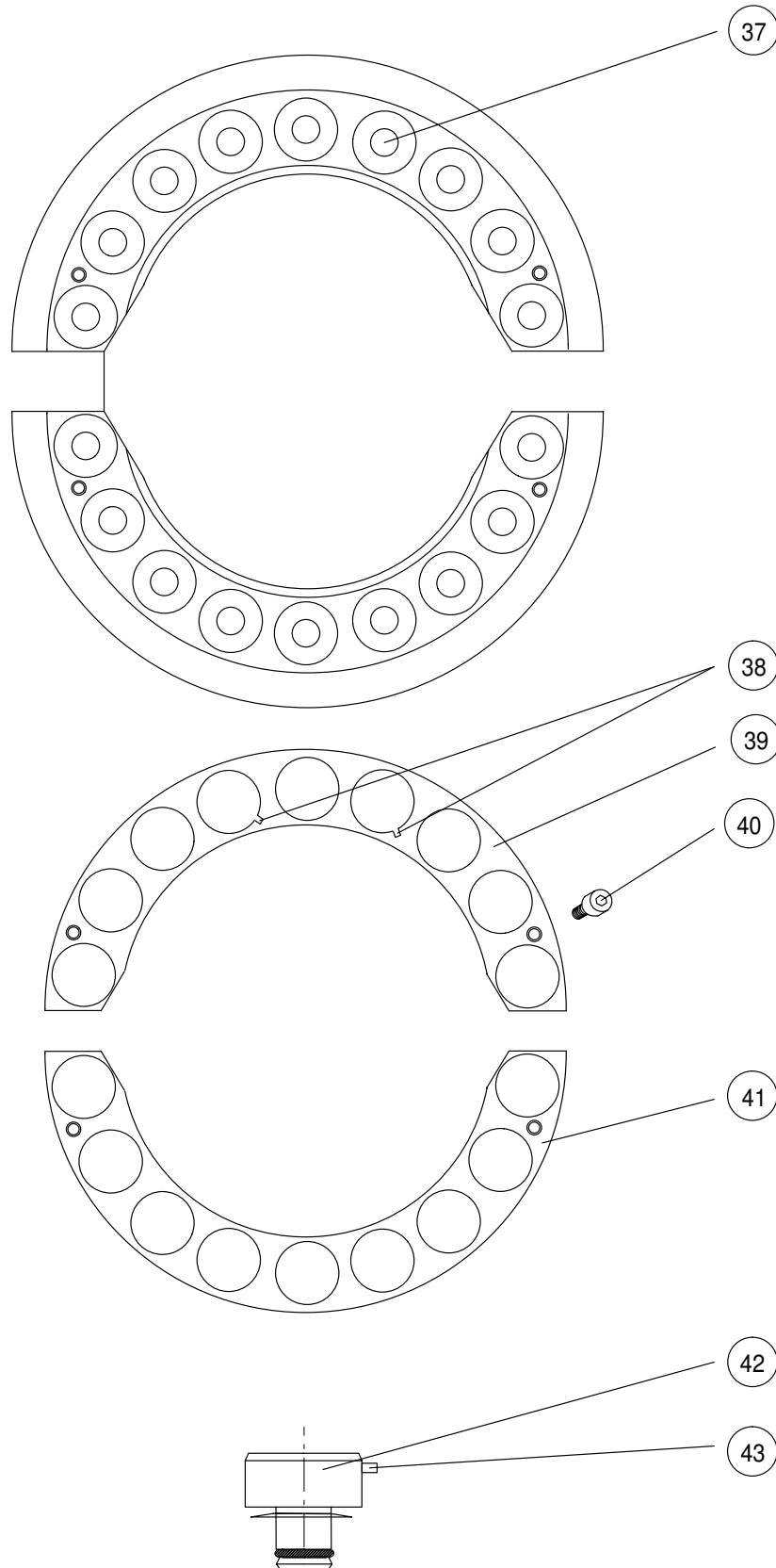
with external oil supply



- 1 Engraved numbers - housing
- 2 Top half of the housing
- 3 Tapped hole for the thrust part oil supply (optional)
- 4 Positioning pin nut
- 5 Plate (Assembly opening)
- 6 Screw
- 7 Eye bolt
- 8 Positioning pin
- 9 Top sight glass
- 10 Tapped hole (in the top and bottom halves of the shell, up size 14)
- 11 Top half of the shell
- 12 Screw
- 13 Machine seal
- 14 Hamp packing seal groove
- 15 Hamp packing
- 16 Screw (split line of the housing)
- 17 Screw (split line of the machine seal)
- 18 Bottom half of the shell
- 19 Tapped hole
- 20 Engraved number - shell
- 21 Bottom half of the housing
- 22 Recess
- 23 Pressure equalizing hose
- 24 Screw (split line of the shell)
- 25 Screw
- 26 Spherical seating
- 27 Tapped hole for temperature measurement of the journal part
- 28 Oil inlet connection hole
- 29 Tapped hole for the oil sump temperature measurement
- 30 Outlet/Inlet cooling water (Type E.T..)
- 31 Cooler (Type E.T..)
- 32 Hexagon head plug (Oil drain plug)
- 33 Metal tabs (optional for EMZL.)
- 34 Oil outlet connection hole
- 35 Oil outlet pipe with lock nut and lead seal
- 36 Marking

EM with external oil supply

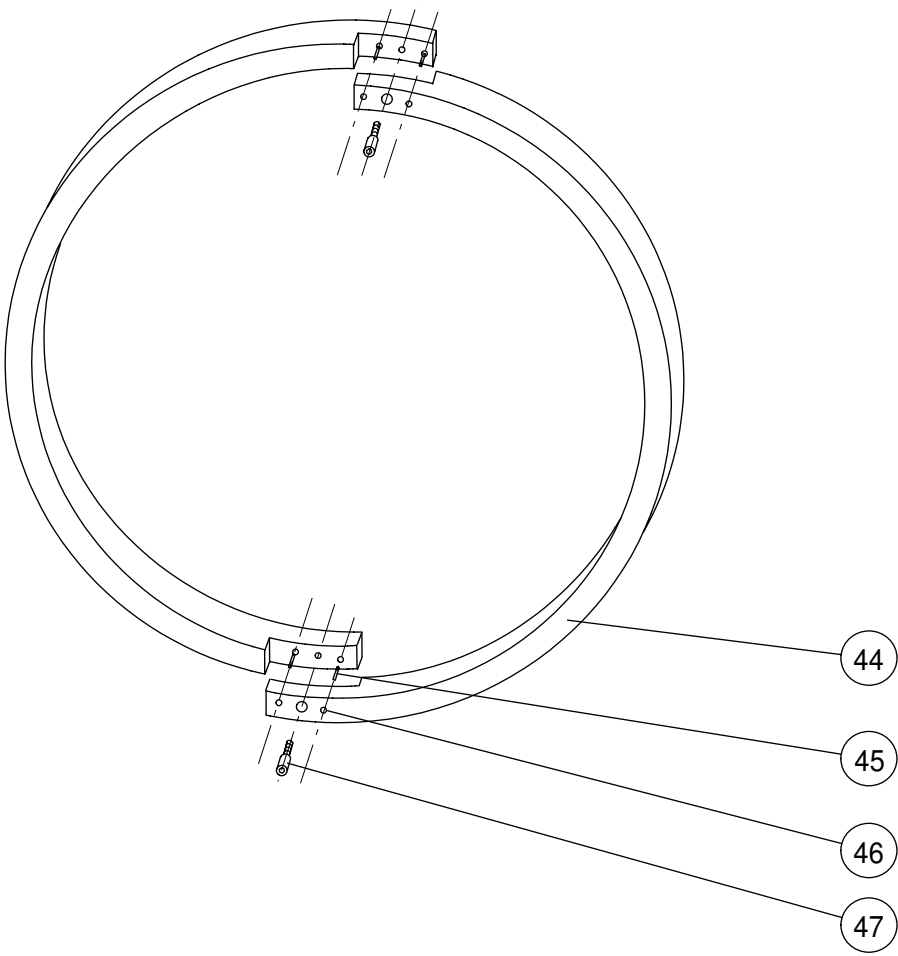
General Drawing of the Thrust Part with Circular Tilting Pads (RD-Thrust Pads)



- 37 Carrier ring
- 38 Location groove
- 39 Shroud ring top half
- 40 Screw
- 41 Shroud ring bottom half
- 42 Circular tilting pad (RD-thrust pad)
- 43 Anti - Rotation pin

EM with external oil supply

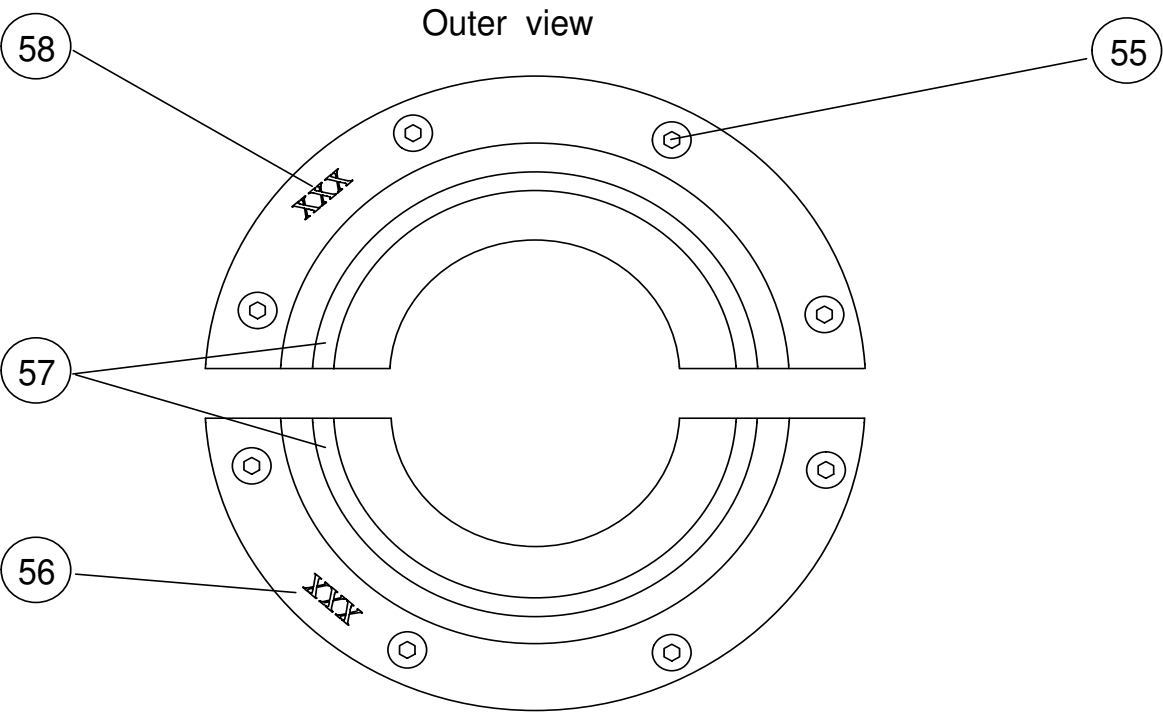
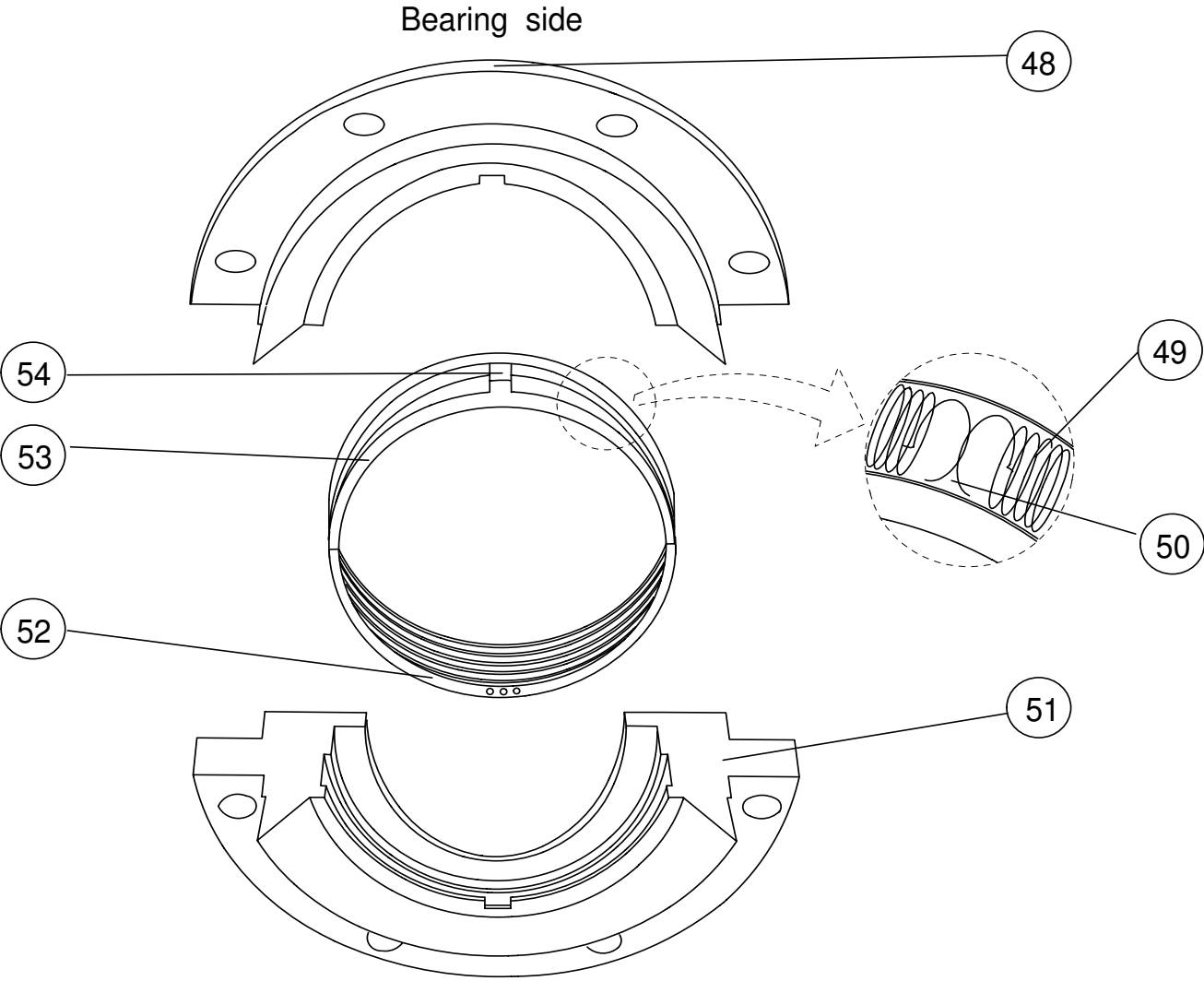
General Drawing of the Loose Oil Ring



- 44 Loose Oil Ring
- 45 Dowel pin
- 46 Hole
- 47 Screw

EM with external oil supply

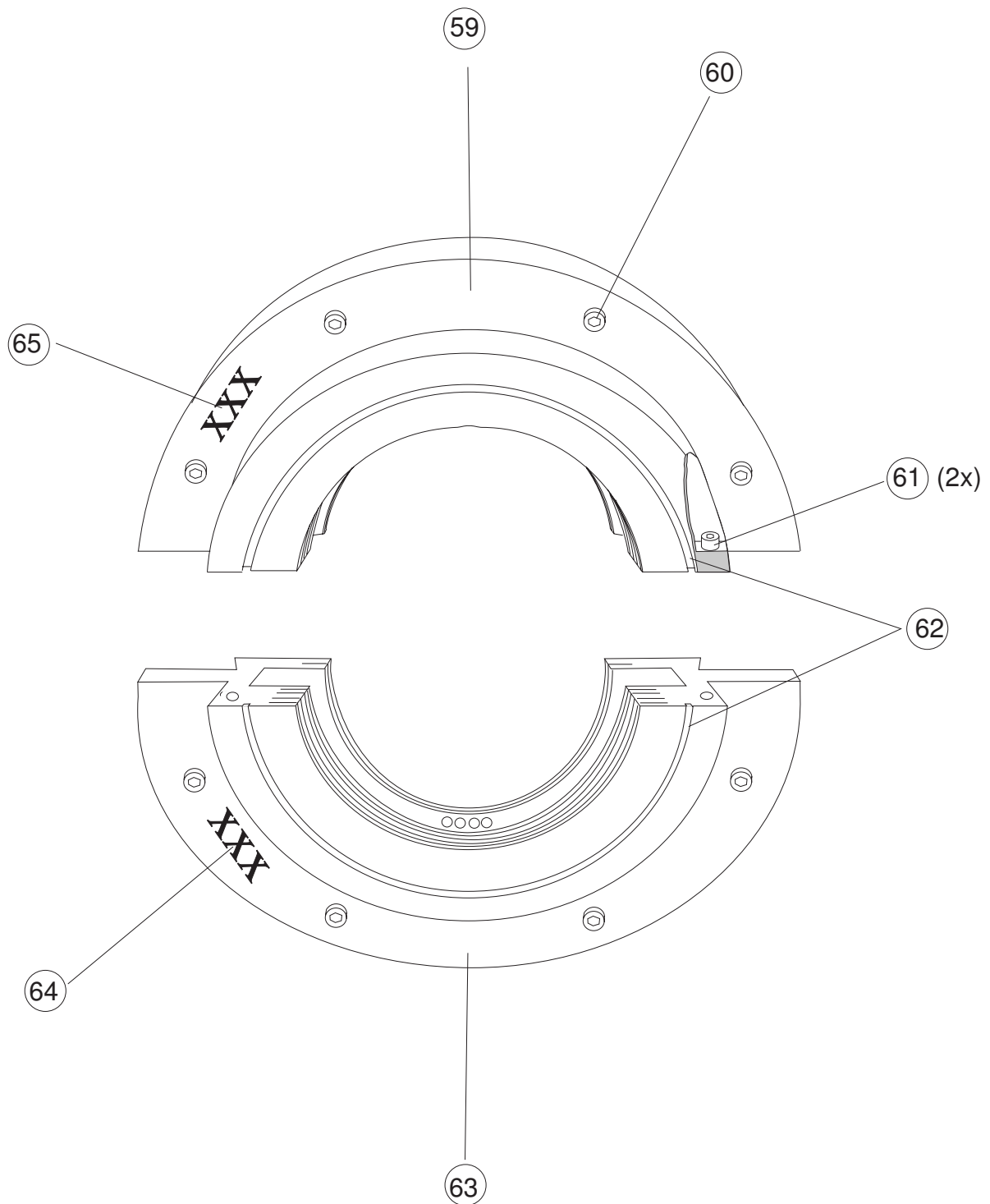
General Drawing of the Floating Labyrinth Seal with Seal Carrier



48	Seal carrier - top half
49	Garter spring
50	Groove
51	Seal carrier - bottom half
52	Bottom half of the seal
53	Top half of the seal
54	Anti - rotation pin
55	Screw
56	Engraved number
57	Groove (Type 11)
58	Engraved number

EM with external oil supply

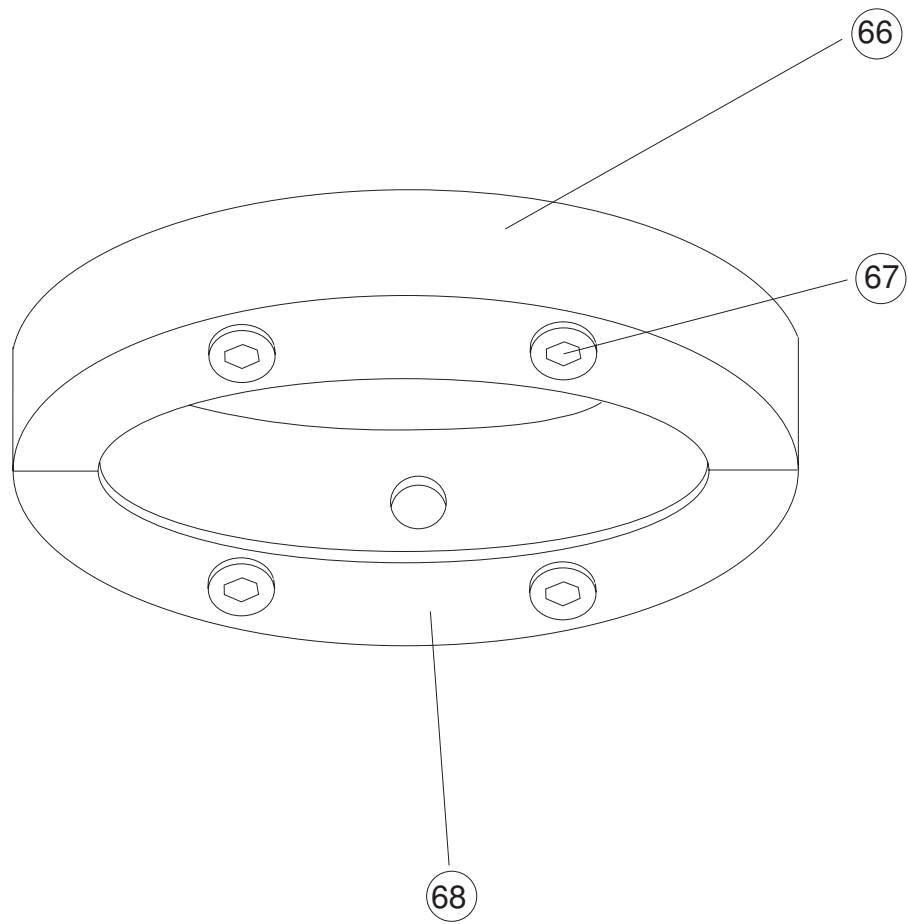
General drawing of the Rigid Labyrinth Seal



- 59 Rigid labyrinth seal - top half
- 60 Screw
- 61 Screw (split line)
- 62 Groove (Type 21)
- 63 Rigid labyrinth seal - bottom part
- 64 Engraved number
- 65 Engraved number

EM with external oil supply

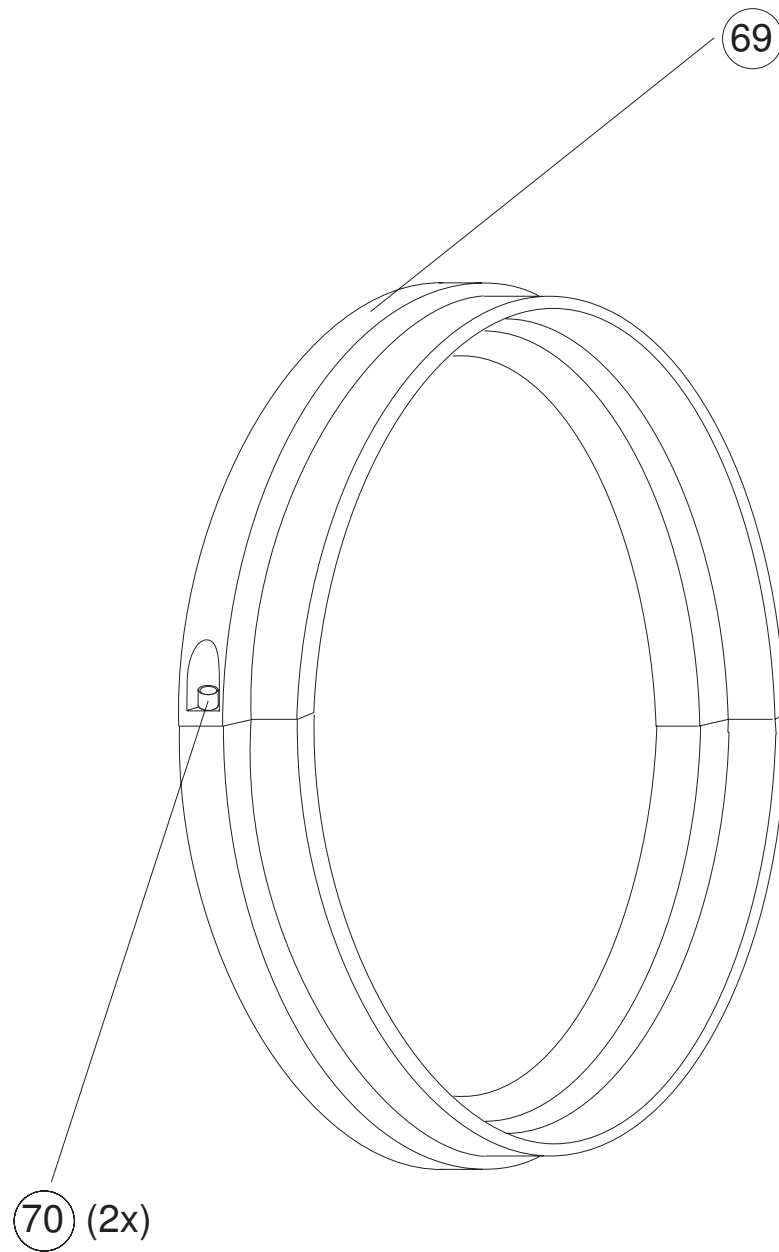
General Drawing of the Baffle



- 66 Baffle - top half
- 67 Screw
- 68 Baffle - bottom half

EM with external oil supply

General Drawing of the Dust Flinger



- 69 Dust flinger
- 70 Screw (split line)

EM with external oil supply

1 Considerations for Use

The instructions for maintenance and inspection are addressed to qualified technical personnel (fitters, mechanic installers, mechanical engineers).

Read these instructions carefully before starting assembly.

Slide bearings of type EM are almost universally used in the engineering industry. Therefore it is not possible to provide detailed information on all possible types and range of applications for these bearing types. For instance, the position of the connection points for supply and monitoring equipment is determined by the place of application (in the following called " installation "). Please keep ready the guidelines with the technical documentation before starting maintenance and inspection of the slide bearings.

Additional technical documentation with detailed information is supplied in case of special design bearings. Please contact RENK Export or Domestic Department for supplementary information on bearings. Please indicate the bearing coding and the full reference number, too.

Following indications should be observed when reading these instructions.

Safety instructions are marked as follows:



Danger!

Warning of dangers for personnel.
Example: Warning of injury

Attention!

Warning of damage for the bearing or installation.

Useful recommendations and additional information are framed.

EM..Q

This is how chapters, instructions or recommendations are marked when referring to a single type or size of a bearing.

Example: Slide bearing type E without thrust part (non-locating bearing)

- Instruction follows.
- Beginning of an enumeration.
- () This is how the different parts of a bearing as described in the general drawings (numbers) are marked in the text.
- Use the enclosed check-list before starting assembly or operation. Copies available on request.
- The check list provides the experienced mechanical fitters of RENK bearings with the necessary instructions for installation and operation.

Maintenance and Inspection

2 Safety Instructions



Danger!

The maintenance and inspection of the slide bearings should be carried out by:

- persons nominated by the safety representative
- persons correspondingly trained and instructed
- persons with knowledge on appropriate standards, regulations and accident prevention rules
- persons with knowledge on first-aid measures and local rescue centres.



Warning of injury!

Before starting work on the bearing:

- Switch off the installation.
- Make sure the installation is not in operation.
- Never lift or transport machines, etc. by the bearing eye bolts. These are only intended for assembly and dismantling of the bearing !



Warning of injury!

Do not grab such heavy bearing parts as the housing during assembly or dismantling work. This could result in bruising or injury to hands !

Attention!

All metal parts of a slide bearing consisting of top and bottom part such as the housing, shells, shaft seals are marked by engraved numbers. Fit together only the parts with the same number.

Attention!

In case • the admissible bearing temperature exceeds 15 K

- inadmissible vibrations occur
- unusual noises or odours are noticed
- monitoring equipment triggers alarm

shut down the installation and inform the maintenance personnel in charge.

Attention!

Do not operate the bearing below the transition speed values indicated in the bearing calculation, thus avoiding inadmissible operating conditions, which could lead to damage to the bearing.

Attention!

Please observe our leaflet Technical Information No. 85 which refers to various sealing compounds for extended technical applications.

EM with external oil supply

3 Operating Instructions after Standstill

- Clean the external parts of the bearing. Dust and dirt impede the radiation of the heat.
- Check with the instructions to determine if an oil change is necessary. Depending on the duration of the standstill an oil change is either prescribed or recommended. Carry out the oil change as indicated in Chapter 5.
- Retighten the screws (16) to the following torque rates:

Bearing Size	9	11	14	18	22	28
Torque [Nm] for $\mu_{\text{tot}} = 0,1$ (lightly oiled)	40	69	170	330	570	1150

- Check the firm position of the top sight glass (9).
- Retighten the tapped holes for oil inlets and outlets, the oil supply hole for the thrust part (optional). The necessary torque rates depend on the used pipe joints.

In case a thermo sensor or/and an oil sump thermometer are used:

- Check that they are well fitted (see also the manufacturer's instructions).
- Retighten all screw plugs in the connection holes (27), (28), (32), (34) to the necessary torque rates:

Screw plug threads	G 3/8	G 1/2	G 3/4	G 1	G 1 1/4	G 1 1/2	G 2	G 2 1/2
Torque [Nm] for plugs with moulded on plastic seal	30	40	60	110	160	230	320	500
Torque [Nm] for plugs with elastic seal	34	60	85	130	240	300	330	410

- Start operating the oil supply system and check its functioning (see also the Technical Documentation of the Installation). The supplied oil quantity at the bearing oil inlet must correspond to the values indicated in the EDP-calculations.
- Check that the temperature monitoring equipment is functioning correctly.

EMT..

Check that the water cooler is functioning correctly

The bearing is now ready to work.

Maintenance and Inspection

4 Maintenance Schedule

Maintenance work	Deadline
Exterior cleaning of the bearing	every 100-1000 hours
Oil change	Bearing in reversing operation every 5000 operating hours. Bearing in continuous operation every 20.000 operating hours (please observe also the indications for the use of the lubricating oil).
Bearing inspection	During prevention maintenance work for the installation. Immediately if: • the bearing temperature exceeds 15 K over the indicated value (see the EDP-calculations) • unusual operating noises occur • unusual changes of the lubricating oil become visible • increased oil level in the case of bearing type EMT....

EM with external oil supply

5 Oil Change

Risk of pollution!

Please observe the instructions for the use of the lubricating oil. The manufacturer can provide information on waste oil disposal.

- Shut down the installation and secure it against unintended operation.
- Shut down the oil supply system.
- Take all necessary measures to collect the whole quantity of the lubricating oil.
- Drain off the lubricating oil while still in a warm condition. Impurities and residues will thus be scavenged. Go ahead as follows:
Let off and collect the lubricating oil of the oil supply system.
- Unscrew the hexagon head plug (32). Drain off the lubricating oil and collect it.

Attention!

In case the lubricating oil contains unusual residues or is visibly changed, eliminate the causes. If necessary, carry out an inspection.

- Tighten the hexagon head plug (32) to the following torque rates:

Bearing size	9	11	14	18	22	28
Torque [Nm]	30	30	30	40	60	60

- Clean the oil tank.
- Fill up the oil supply system with lubricating oil. Use a lubricant with the viscosity indicated on the bearing type plate.
- Start the oil supply system in order to fill up the bearing with lubricating oil.

The bearing is ready to work when the quantity of oil supplied at the bearing oil inlet corresponds to the values indicated in the EDP-calculations.

Maintenance and Inspection

6 Dismantling of the Bearing

6.1 Tools and equipment

- Following tools and equipment are necessary:
 - Allan key set
 - Wrenching key set
 - Open-jawed spanner set
 - Feeler gauges (up 0,05 mm)
 - Caliper gauge
 - Emery paper, plain scraper
 - Oil stone
 - Lifting equipment
 - Permanent sealing compound
 - Clean (cloth weave) rags
 - Oil with the correct viscosity (see bearing type plate)
 - Detergents
 - Liquid screw locking compound (e.g. LOCTITE 242)
 - Liquid sealing compound and Teflon tape.

6.2 Use of lifting equipment



Risk of injury!

Before transport or lifting check if the eye bolts are tight! Insecure eye bolts could result in bearing becoming loose.

Before moving the bearing by the eye bolts make sure that the split line screws are tightened, otherwise the bottom half of the bearing could become detached.

Make sure that the eye bolts are not exposed to bending stress, otherwise the bolts could break.

Follow exactly the instructions for the use of the lifting equipment.

- Use lifting equipment for following assembly and transport works:

Transport/Assembly of:	Use lifting equipment for the following bearing sizes
Whole bearing unit	9-28
Top half of the housing	14-28
Bottom half of the housing	11-28
Shells	14-28

EM with external oil supply

- Following steps are to be observed before using the lifting equipment:

Whole bearing unit

- Check if the screws are tight (16):

Bearing size	9	11	14	18	22	28
Torque value [Nm] for $\mu_{\text{tot}} = 0,1$ (lightly oiled)	40	69	170	330	570	1150

- Check if the eye bolts are tight (7).
- Connect the lifting equipment to the eye bolts (7).

Size 22 and 28

Sizes 22 and 28 are delivered equipped with an assembly device.

When not in use this assembly device is located in the "parking position" behind the flange and as such it is not allowed to use it as transport device.

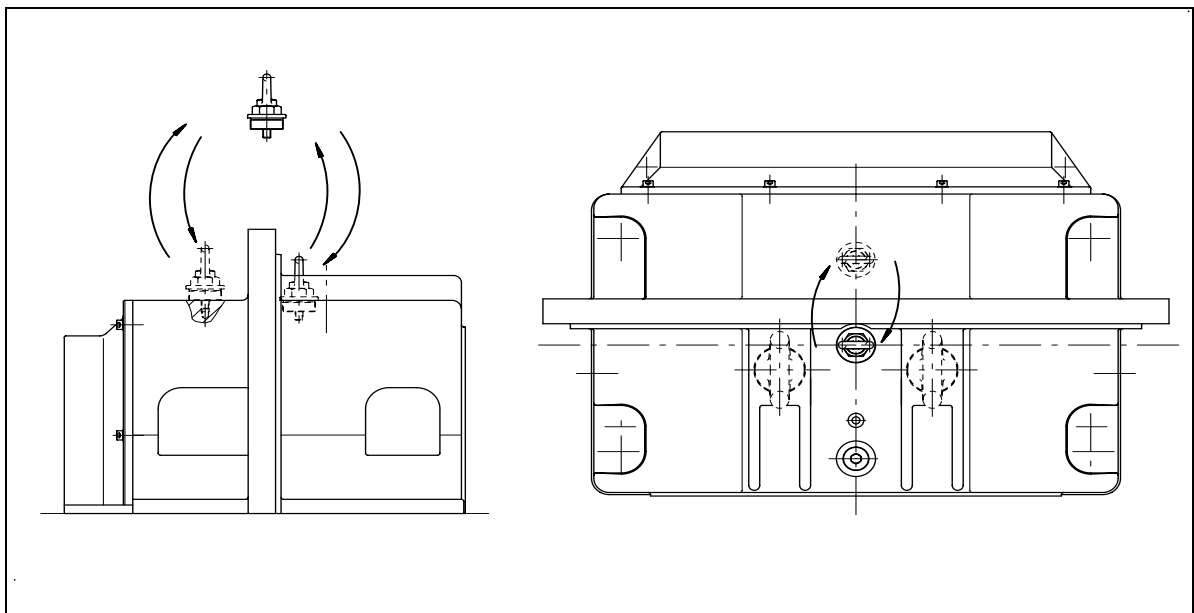


Illustration 1: Assembly device

To mount the top half of the housing remove the top sight glass and screw in the assembly device.

By using the appropriate lifting equipment and with the help of the assembly device it is possible to lift and mount the top half of the housing in a straight position.

After assembling the top half of the housing put the assembly device back into the "parking position" behind the flange and screw in the top sight glass.

Maintenance and Inspection

Top half of the housing

- Check if the eye bolts are tight (7).
- Connect the lifting equipment to the eye bolts (7).

Bottom half of the housing

- Screw two eye bolts (7) with suitable threads tight into the cross-placed opposite tapped holes (19).

Bearing size	9	11	14	18	22	28
Tapped hole	M 10	M 12	M 16	M 20	M 24	M 30

- Connect the lifting equipment to the eye bolts (7).

Shells

- Screw two eye bolts or screw hooks with suitable threads tight into the tapped holes (10):

Bearing size	14	18	22	28
Tapped hole	M 8	M 12	M 12	M 16

- Connect the lifting equipment to the screw hooks.

EM with external oil supply

6.3 Preparation for dismantling

Attention!

Make sure that the work place is clean. Contamination and damage to the bearing, especially to the working surfaces, have a negative influence on the operating quality and could lead to premature failure.

Attention!

Do not use any violence or force!

- Shut down the installation and ensure it against unintended operation.
- Shut down the oil supply system.

EM.T.

- Interrupt the cooling water supply.
- Dismantle all thermo sensors from the connection holes.
- Take all necessary measures to collect the lubricating oil.
- Unscrew the hexagon head plug (32) and collect the lubricating oil.

Risk of pollution!

Please observe the instructions for the use of the lubricating oil. The manufacturer can provide necessary information on waste oil disposal.

- Remove the thin metal plate (5) to get access to the assembly opening or, in the case of the split machine shield, dismantle the top half of the shield.
- Tighten the hexagon head plug (32) to the following torque rates

Bearing size	9	11	14	18	22	28
Torque (Nm]	30	30	30	40	60	60

- Inform yourself about maintenance and inspection of the oil supply system (see also the Technical Documentation Oil Supply System). Carry out all necessary maintenance and inspection works.

Maintenance and Inspection

6.4 Dismantling of the shaft seal - outboard side

- Dismantle the outboard side seals of the bearing.
Proceed correspondingly to the seal type:
- Floating labyrinth seal (Type 10) Chapter 6.4.1
- Floating labyrinth seal with dust flinger (Type 11) Chapter 6.4.2
- Floating labyrinth seal with baffle (Type 12) Chapter 6.4.3
- Rigid labyrinth seal (Type 20) Chapter 6.4.4
- Rigid labyrinth seal with dust flinger (Type 21) Chapter 6.4.5
- Rigid labyrinth seal with baffle (Type 22) Chapter 6.4.6

Type 10

6.4.1 Floating labyrinth seal (Type 10)

- Loosen all screws (55) and take them out.
- Remove simultaneously in axial direction both top half (48) and bottom half (51) of the seal carrier from the housing.
- Shift a little (about 20 mm) the top half (53) of the seal. Tilt it over carefully until the garter spring (49) unbends.



Warning of injury!

During dismantling of the floating labyrinth seal hold tight the garter spring (49) which is under tension and could bounce back and lead to injury.

- Open the garter spring (49) and remove the bottom half of the seal (52) from the shaft.

Type 11

6.4.2 Floating labyrinth seal with dust flinger (Type 11)

- Dismantle the dust flinger (69). Loosen the screws (70) and take out the dust flinger (69) from the groove (57) of the seal carrier. Remove both halves of the dust flinger.
- Go on as indicated for type 10 (see Chapter .4.1).

Type 12

6.4.3 Floating labyrinth seal with baffle (Type 12)

- Disconnect both top (66) and bottom (68) halves of the baffle by untightening the screws (67).
- Go on as indicated for type 10 (see Chapter 6.4.1).

Type 20

6.4.4 Rigid labyrinth seal (Type 20)

- Loosen all screws (60) and take them out.
- Take out the screws (61).
- Remove simultaneously in axial direction both top (59) and bottom (63) halves of the rigid labyrinth seal.

Type 21

6.4.5 Rigid labyrinth seal with dust flinger (Type 21)

- Dismantle the dust flinger (69). Loosen the screws (70) and take out the dust flinger (69) from the groove (62) of the rigid seal. Remove both halves of the dust flinger.
- Go on as indicated for type 20 (see Chapter 6.4.4).

Type 22

6.4.6 Rigid labyrinth seal with baffle (Type 22)

- Unscrew the top half (66) and the bottom half (68) of the baffle by untightening the screws (67).
- Go on as indicated for type 20 (see Chapter 6.4.4).

EM with external oil supply

6.5 Opening of the machine seal

- Loosen the screws (17) at the split line of the machine seal.

6.6 Dismantling of the top half of the housing

EM.V.

Size 22 and 28

- Unscrew the screw plug with the welded-on positioning pin.
- Replace the top sight glass (9) by the assembly device. The top half of the housing can be lifted and transported by using the assembly device, well tight, and the appropriate lifting equipment.
- Remove the screws (16) and lift the top half of the housing.
- Lift the top part of the housing in axial direction until the top part of the flange becomes free.
- Go on lifting until the top part of the housing can be moved in axial line over the shell, without touching it.

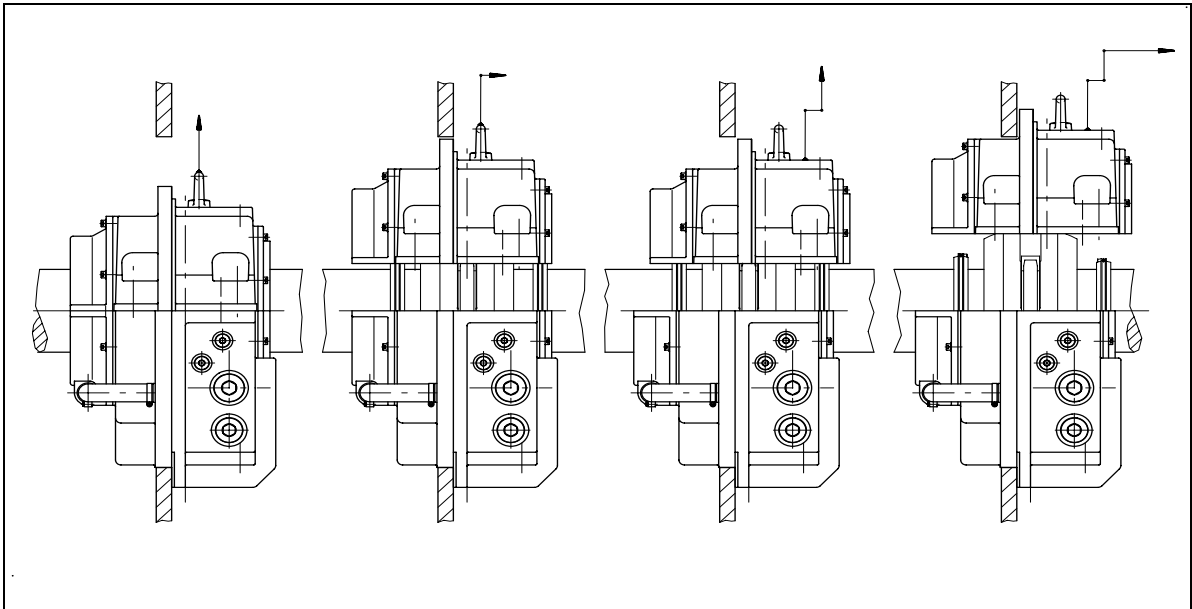


Illustration 2: Dismantling of the housing - top half

Maintenance and Inspection

6.7 Removal of the top half of the shell

- Unscrew the screws (24) and lift the top half of the shell (11).

Attention!

Do not damage the thrust and radial working surfaces.

Attention!

In the case of insulated housings (white plastic insulating foil) avoid any jamming of the top half of the shell when you lift it up.
Jamming could lead to damage of the insulating foil in the bottom half of the housing.

EM.L.

6.7.1 Dismantling of the loose oil ring

- Open both split lines of the loose oil ring (44) by untightening and taking out the screws (47).
Separate both halves of the loose oil ring (44) carefully without using any tools or other devices.

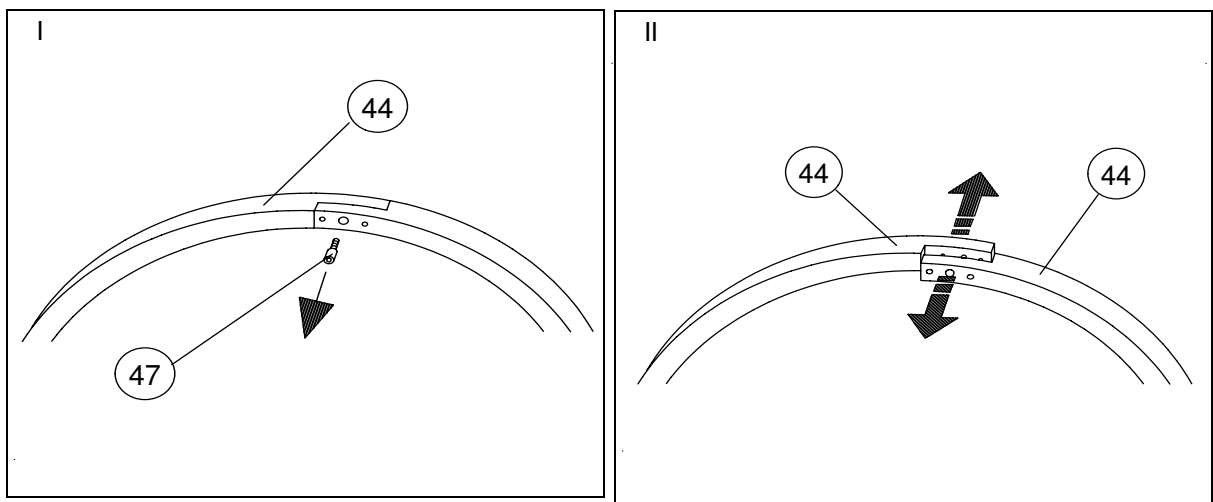


Illustration 3 Opening of the loose oil ring

To check the geometry of the loose oil ring put it together as follows:

- Press the positioning pin (45) into the holes (46).
- Adjust both halves of the loose oil ring till the split lines match each other.
- Tighten the screws (47).

6.7.2 Dismantling the machine side shaft seal

- Shift a little (about 20 mm) the top half (53) of the seal. Tilt it over carefully until the garter spring (49) unbends.



Warning of injury!

During dismantling of the floating labyrinth seal hold tight the garter spring (49) which is under tension and could bounce back and lead to injury.

- Open the garter spring (49) and turn the bottom half of the seal (52) in opposite direction from the anti-rotation pin out of the integrated seal groove of the bottom half of the housing.

EM with external oil supply

6.8 Removal of the bottom half of the shell

Attention!

Make sure that all bearings mounted on a shaft line are opened. Loosen the screws at the split line of the housings.

Attention!

The lifting equipment should not come into touch with the seal and working surfaces of the shaft.

- Lift the shaft up to the point where shaft and bottom half of the shell (18) do not touch each other any more. Protect the shaft against unintended movement.
- Turn the bottom half of the shell (18) out of the bottom half of the housing (21) and remove it from the shaft.

Attention!

If the bottom half of the shell (18) is provided with metal tabs (33) do not remove them. They regulate the oil level in the oil pockets.

6.9 Dismantling of the machine seal

Usually it is not necessary to dismantle the machine seal if maintenance works are carried out. However in case the machine seal must be dismantled , dismantle the bottom half of the housing.

Attention!

The assembly and dismantling of the bottom half of the bearing are fully described in the **Instructions for Installation and Operation**. Please observe these instructions.

After dismantling the bottom half of the housing both halves of the machine seal can be unscrewed. In the case the machine seal is equipped with a hamp packing (15), some visible changes can be noticed, such as : tallow excess, black colour of the seal due to temperature development. Even in such cases it is not necessary to renew the hamp packing (15). Colour changes will appear with a new hamp packing too, until the seal clearance adjusts during operation.

Maintenance and Inspection

7 Cleaning and Checking of the Bearing

Attention!

Use only non-aggressive detergents such as for instance

- VALVOLINE 150
- Alkaline cleaning compounds (pH-value 6 to 9, short reaction time).



Warning of injury!

Please observe the instructions for the use of the detergents.

Attention!

Never use cleaning wool or cloth. Residues of such materials left in the bearing could lead to excessive temperatures.

- Clean the following parts thoroughly:
 - top half of the housing (2)
 - bottom half of the housing (21)
 - top half of the shell (11)
 - bottom half of the shell (18)
 - sealing surfaces of the top half (48) and bottom half (51) of the seal carrier or of the rigid labyrinth seal
- loose oil ring (44).

EM.L.

EM.T.

- Check the condition of the water cooler (31).

In case the water cooler (31) is incrustated with oil sludge:

- Dismantle the water cooler. Remove the incrustation by using for instance a wire brush.
- Install the water cooler (31) into the bearing.

EM with external oil supply

- Carry out a visual check of the wear condition of all bearing parts. The following table provides information on the parts that must be replaced in case of wear. The right evaluation of the wear condition, especially of the running surfaces of the shell, implies a lot of experience. If in doubt, replace the worn part with new ones.

Bearing part	Wear condition	Maintenance procedure
Shell	Scoring	Bearing temperature before inspection: • not increased - no new shells • increased - new shells
	White metal lining damaged	New shell
	Bow wave ridges	New shells
Shaft seal	Baffles broken or damaged	New shaft seal
Loose oil ring	Geometrical form (roundness, flatness) visibly changed	New loose oil ring

EM.C. EM.L. EM.Y. Size 9-14

- Check the projection of the positioning pin (8) according to the values indicated below:

Bearing size	9	11	14	18	22	28
Projection of the positioning pin (4) mm	7	8	10	12	14	16

In case the projection is less than indicated,

- drive the positioning pin (8) into the top half of the housing (2) until the indicated value is reached.

insulated bearings

- Check the insulating layer of the spherical seating (26) of the top half (2) and bottom half (21) of the housing. In case of damage contact the RENK-sales agency in charge.

EM..A

- Check the mobility of all circular tilting pads (42).

Maintenance and Inspection

8 Assembly of the Bearing

Attention!

Remove all impurities or other objects such as screws, nuts, etc. from inside the bearing. If left inside they could lead to damage of the bearing. Cover up the opened bearing during work breaks.

Attention!

Carry out all assembly operations without making use of force.

Attention!

Secure all screws of the housing at the split line and flange with a liquid screw locking compound (e.g. LOCTITE 242).

8.1 Fitting in the bottom half of the shell

EM..E

Attention!

Mounting the bottom half of the shell (not marked with an arrow) correctly will ease the assembly of the top half shell (marked with an arrow) (see chapter 4.6).

- Apply some lubricant to the spherical seating (26) in the bottom half of the housing (21) and to the working surfaces of the shaft. Use the same type of lubricant as indicated for bearing operation (see type plate).
- Place the bottom half of the shell (18) on the working surface of the shaft. Turn the bottom half of the shell (18) into the bottom half of the housing (21) with the split line surfaces of both halves in true alignment.

In case the bottom half of the shell doesn't turn in easily, check the position of the shaft and the alignment of the housing

EM..B, EM..K, EM..E, EM..A

Attention!

These operations should be carried out most carefully. The thrust parts of the bottom shell must not be damaged.

- Lower down the shaft till it sits on the bottom half of the shell (18).

EM with external oil supply

8.2 Assembly of the shaft seal - machine-side

The machine-side shaft seal is, as standard, a floating labyrinth seal. The integrated seal groove is in the top and bottom halves of the housing.



Warning of injury!

During assembly hold the garter spring ends (49) securely to avoid them suddenly releasing and causing possible injury!

Check the movement of the floating labyrinth seal on the shaft in the seal area outside the housing:

- Put the garter spring (49) around the shaft and hook both ends into each other.
- Put both halves of the seal (52), (53) in their place on the shaft.
- Put the garter spring (49) into the groove (50).
- Turn the floating labyrinth seal on the shaft.

Attention!

The floating labyrinth seal should turn easily on the shaft. A jammed seal could lead to overheating during operation and even to shaft wear.

If the floating labyrinth seal jams,

- dismantle the seal
- remove the worn parts of the seal carefully, by using emery paper or a plain scraper.

- Dismantle the floating labyrinth seal.
- Apply sealing compound to the guide surfaces of the integrated seal groove in the bottom half of the housing.

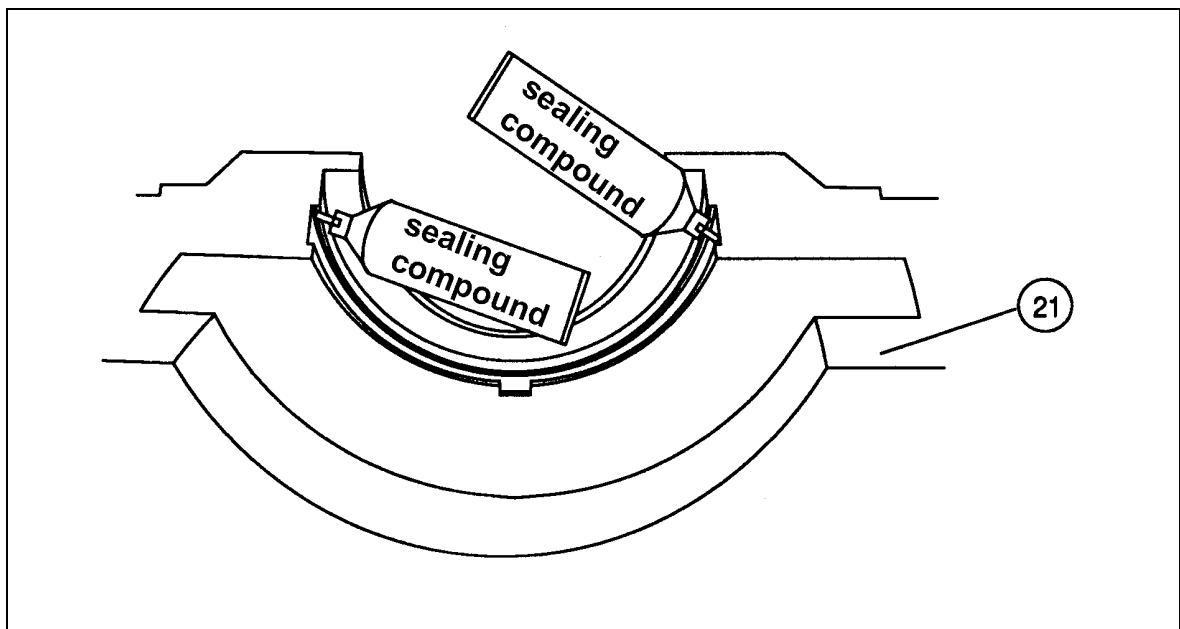


Illustration 4: Application of sealing compound to the integrated seal groove

Maintenance and Inspection

- Apply a uniform layer of sealing compound to the seal surfaces and on the split line surfaces of both halves of the seal (52), (53).

Please observe the instructions for the use of sealing compound.

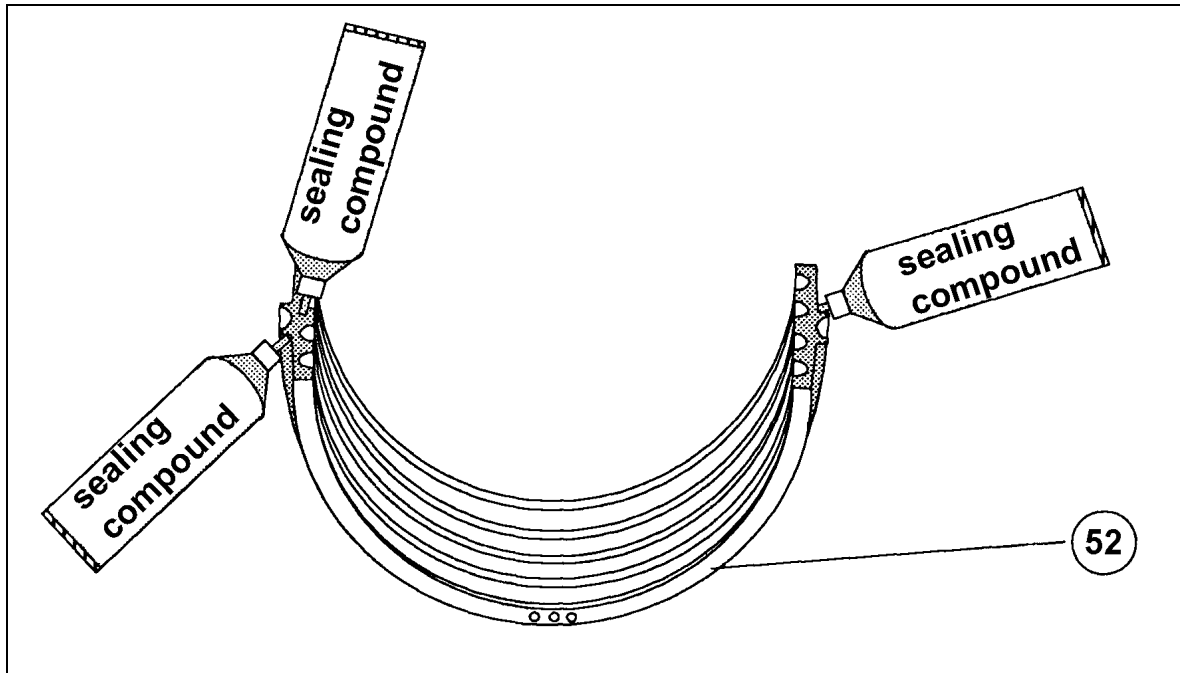


Illustration 5: Application of sealing compound to the floating labyrinth seal

- Place the bottom half of the seal (52)) with the labyrinths onto the shaft.
- The oil return holes at the bearing side must be clear and open.
- Turn the seal in opposite direction from the anti-rotation pin into the groove of the housing until the split lines of the bottom half of the housing and the bottom half of the seal match each other.
- Remove the residue of sealing compound.
- Push the garter spring into the integrated seal groove between the bottom half of the housing and the seal until both ends jut out from the split line.
- Place the top half of the seal with the cam facing the inside of the bearing on the bottom half of the seal.
- Stretch the garter spring till both ends can be hooked.

EM with external oil supply

EM.L.

8.3 Installation of the loose oil ring

- Open both split lines of the loose oil ring (44) by untightening and removing the screws (47). Separate both halves of the loose oil ring (44) carefully without using any tools or other devices.

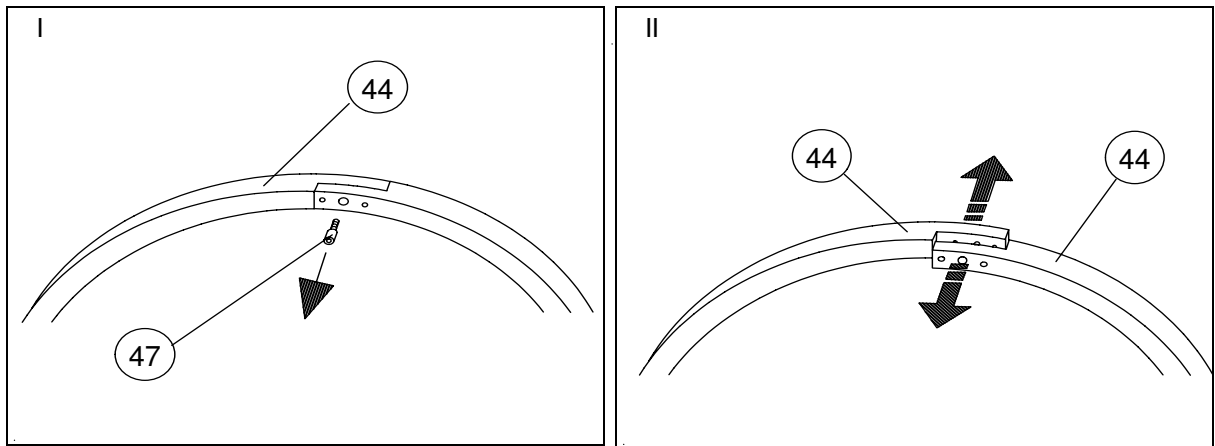


Illustration:6 Opening of the loose oil ring

- Place both halves of the loose oil ring into the shell groove (18) encircling the shaft. Press the positioning pin (45) of each split line into the corresponding hole (46).
- Adjust both halves of the loose oil ring till the split lines match each other.

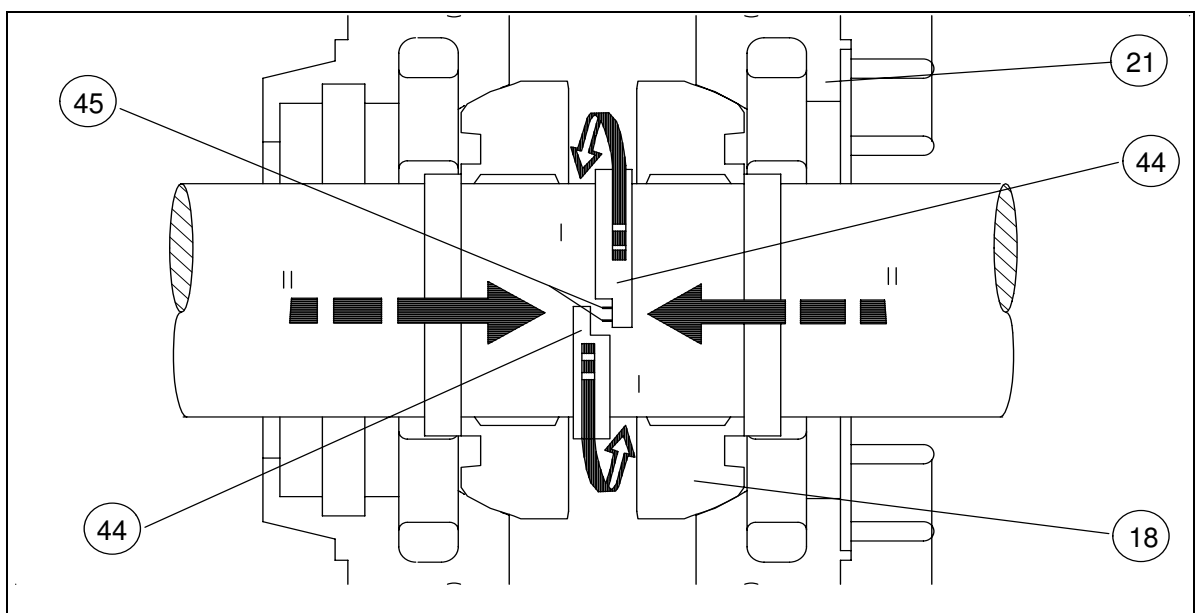


Illustration 7: Installation of the loose oil ring

- Tighten the screws (47) to the following torque rates:

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

Maintenance and Inspection

8.4 Fitting in the top half of the shell

- Apply some lubricant to the working surfaces of the shaft. Use the same type of lubricant as indicated for bearing operation (see type plate).
- Check if the engraved numbers (20) on the bottom and top halves of the shell correspond.
- Place the top half of the shell (11) on the shaft; both engraved numbers (20) should be on the same side.

Attention!

An incorrectly placed shell could jam the shaft thus leading to the damage of both shaft and bearing.

EM..B,
EM..K,
EM..E,
EM..A

Attention!

Place the top half of the shell carefully on the shaft. The thrust parts of the top half of the shell must not be damaged.

insulated
bearings

In the case of bearings arranged for insulation monitoring, connect the black cable for insulation monitoring to the shell.

According to the bearing type, there are two possibilities of connection.

1. The black cable is provided with a cable connector.

- Plug the cable with the cable connector into the counterpart available on the top of the shell.
- Lead the cable through the cable gland in the bottom half of the housing and out of the bearing.
- Tighten the cable gland oil-tight.

2. The black cable is provided with an eyelet.

- Fasten the cable with the eyelet to the split line of the shell, by using one of the shell joint bolts.
- Lead the cable through the cable gland in the bottom half of the housing and out of the bearing.
- Tighten the cable gland oil-tight.

- Tighten up the screws (24) to the following torque rates:

Bearing size	9	11	14	18	22	28
Torque [Nm]	8	8	20	69	69	170

- Check the split line of the shell by using a feeler gauge. The split line gap should be less than 0,05 mm. If the split line is greater than this, dismantle both top and bottom (11),(18) halves of the shell. Rework the split line surfaces of the top half (11) and bottom half (18) of the shell with an oil stone.

EM.L.

- Check the mobility of the loose oil ring (44).

EM.L.
Marine
Bearing

A guide bush in the top half of the shell secures the function of the loose oil ring.

- Check the mobility of the loose oil ring (44) in the guide bush.

EM with external oil supply

EM..E

Shells with taper land faces suitable only for one direction of rotation are marked with an arrow on the top half shell, which indicates the sense of rotation of the shaft.

The arrow indicates the allowed direction of shaft rotation after completion of the bearing assembly.

- Before mounting the top half of the housing check that the proposed direction of rotation of the shaft corresponds to the direction indicated by the arrow on the top half of the shell.
- If the directions match, continue the assembly of the bearing.
- If the directions do not match, the shell must be disassembled, re-aligned and mounted again.

Attention!

A wrongly placed shell, without observance of the direction of rotation of the shaft, impairs the operational safety of the bearing.

8.5 Closing of the bearing

EM.C. EM.L. EM.Y.

- Check the true alignment of the shell (11), (18) and bottom half (21) of the housing.

The positioning pin (8) in the top half of the housing fits in the corresponding hole (4). The shell is thus placed into its right position.

- Check if the engraved numbers (1) on the top and bottom halves of the housing correspond.
- Clean the split line surfaces of the top and bottom halves (2), (21) of the housing.
- Apply sealing compound to the whole surface of the split line of the bottom half (21) of the housing.

Please observe the instructions for the use of sealing compound.

- Place the top half of the housing carefully into the machine shield, without touching the seals or the shell.

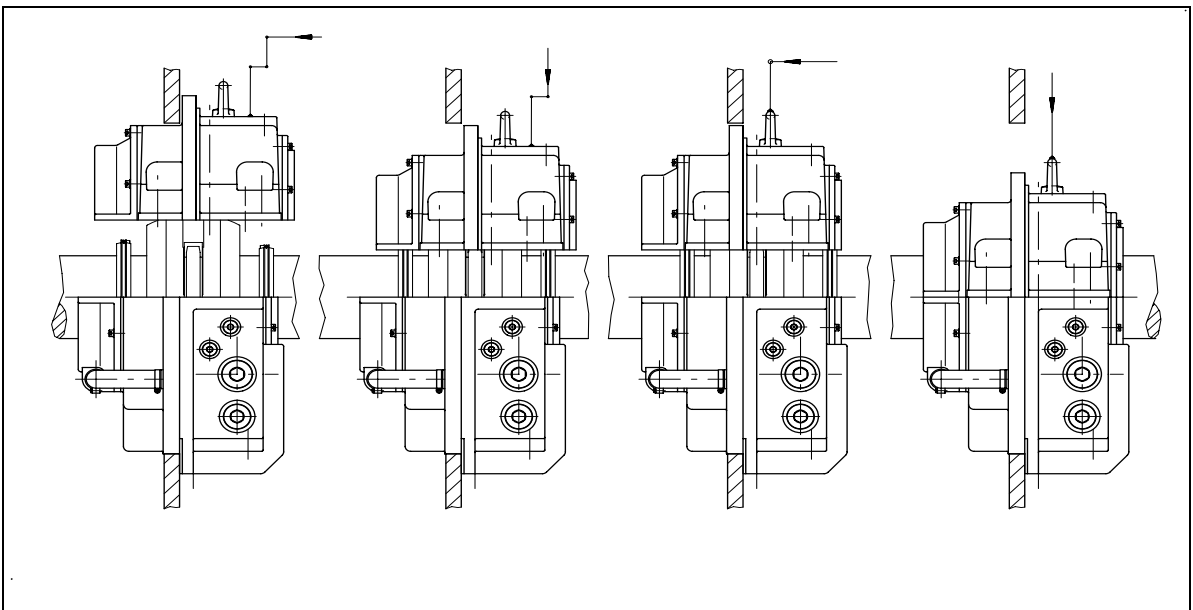


Illustration 8: Assembly of the top half of the housing

Maintenance and Inspection

- Lower the top half of the housing (2) vertically on the bottom half of the housing (21). Lower the top half of the housing (2) till the split line of the housing is not visible any more.
- Gently hit the bottom half of the housing (21) with a nylon hammer, thus ensuring the alignment of the spherical seating.
- Insert the screws (16). Tighten them crosswise to the following torque rates:

Bearing size	9	11	14	18	22	28
Torque [Nm] $\mu_{\text{tot}} = 0,1$ (lightly oiled)	40	69	170	330	570	1150

- Hand-tighten the screws at the split line of the machine seal.
- Unscrew the assembly device and put it back into its "parking position" behind the flange. Tighten the assembly device to the following torque: 40 Nm.
- Replace the top sight glass and screw it hand-tight.
- Tighten the screw plug with the welded-on positioning pin into the top half of the housing.

**Size 22
and 28.**

EM.V.

insulated
bearings

Insulation monitoring

In the case of electric insulated bearings provided with insulation monitoring, the cable coming out of the housing must be connected in a professional manner.

According to the type supplied, please follow the assembly instructions given below.

- The cable is very short and provided with a further cable connector at the end of it.
This cable is ready for connection to the housing.
The bottom half of the housing is provided with the counterpart.
- Plug the cable connector into the counterpart.

Attention!

This connection bypasses the electrical insulation of the bearing.
In the case of electric machines, make sure at least one bearing is electrically insulated.

To check the electrical insulation, interrupt the connection cable - housing. Check the electrical resistance with a suitable measuring instrument. Make sure that both bearings and the coupling are electrically insulated.

- The cable has a free end. In this case the customer has to make the connection.

Attention!

If only one bearing is insulated, the end of the cable must not be earthed.

Any further connection depends on the customer's requirements related to the insulation monitoring and can not therefore be described here.

EM with external oil supply

8.6 Assembly of the Seals - Outboard Side

- Assemble the outboard side seals.
Proceed according to the seal type used:
- Floating labyrinth seal (Type 10) Chapter 8.6.1
- Floating labyrinth seal with dust flinger (Type 11) Chapter 8.6.2
- Floating labyrinth seal with baffle (Type 12) Chapter 8.6.3
- Rigid labyrinth seal (Type 20) Chapter 8.6.4
- Rigid labyrinth seal with dust flinger (Type 21) Chapter 8.6.5
- Rigid labyrinth seal with baffle (Type 22) Chapter 8.6.6

Type 10

8.6.1 Floating labyrinth seal (Type 10)



Warning of injury!

During assembly hold the garter spring ends (49) securely to avoid them suddenly releasing and causing possible injury!

Check the movement of the floating labyrinth seal on the shaft in the seal area outside the housing.

- Put the garter spring (49) around the shaft and hook both ends into each other.
- Put both halves of the seal (52), (53) in their place on the shaft.
- Put the garter spring (49) into the groove (50).
- Turn the floating labyrinth seal on the shaft.

Attention!

The floating labyrinth seal should turn easily on the shaft. A jammed seal could lead to overheating during operation and even to shaft wear.

If the floating labyrinth seal jams,

- dismantle the seal
- remove the worn parts of the seal carefully, by using emery paper or a plain scraper.

- Dismantle the floating labyrinth seal.

Maintenance and Inspection

- Apply a uniform layer of sealing compound to the seal surfaces and on the split line surfaces of both halves of the seal (52), (53).

Please observe the instructions for the use of sealing compound.

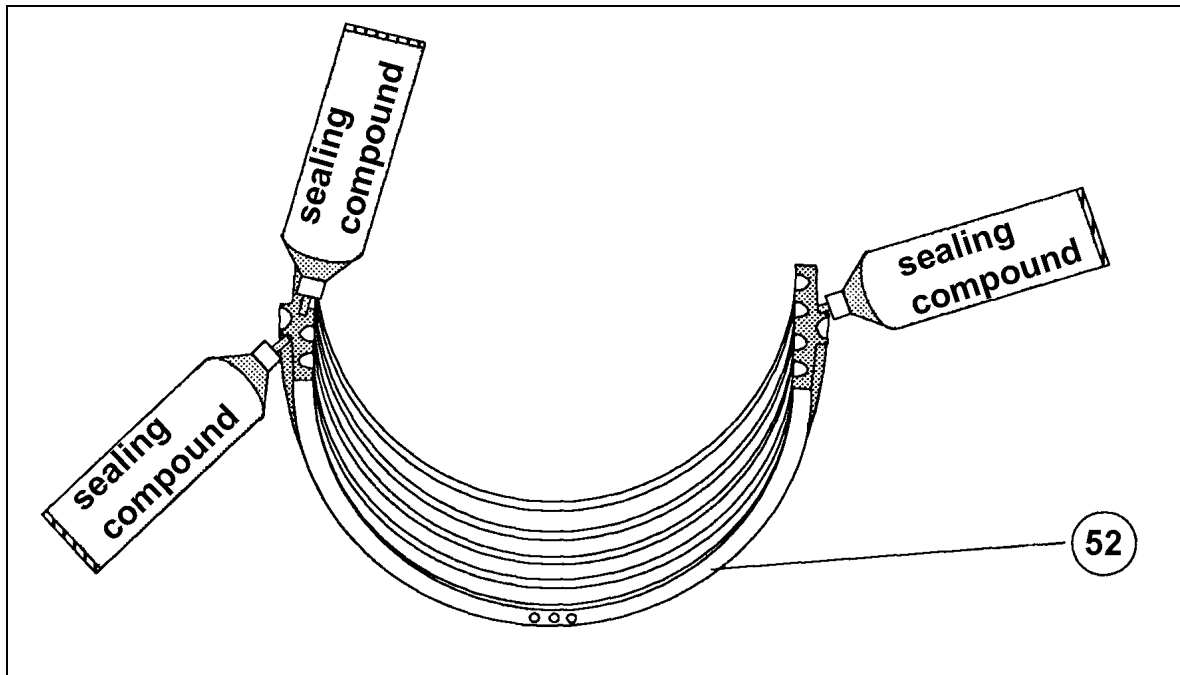


Illustration 9: Application of sealing compound to the floating labyrinth seal

- Press the bottom half of the seal (52) against the shaft.
- Place the top half of the seal (53) on the shaft and align both halves of the seal to each other.
- Place the garter spring (49) into the groove (50) and stretch until both ends can be hooked.

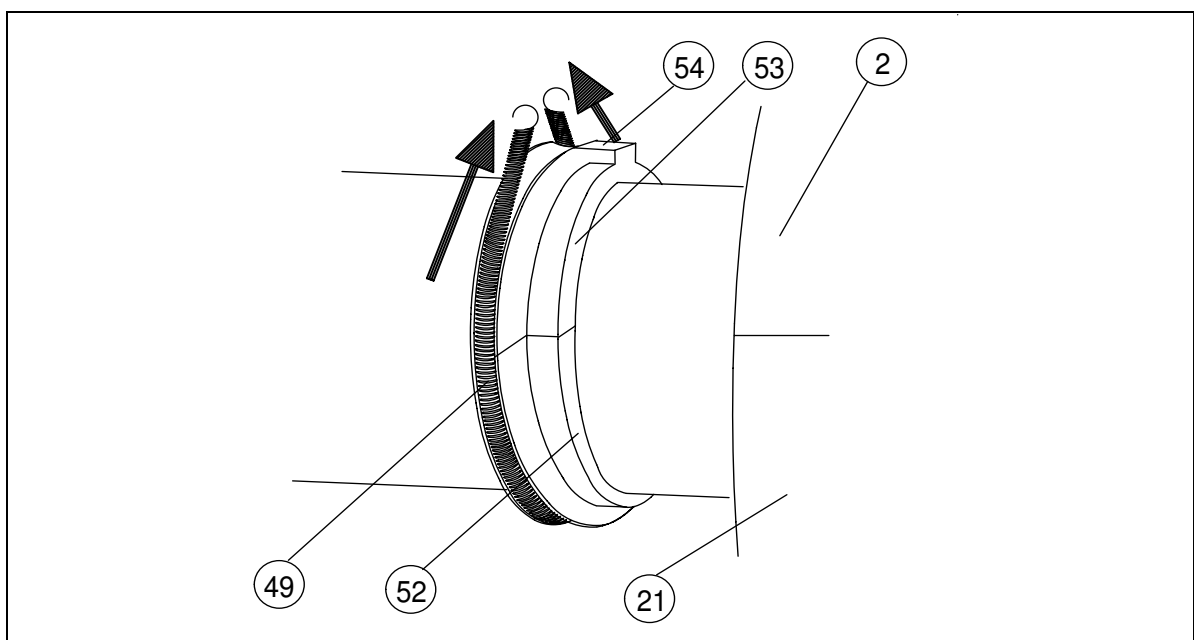


Illustration 10: Assembly of the floating labyrinth seal

EM with external oil supply

- Place in true alignment the split line of the floating labyrinth seal and the split line of the seal carrier.
- Check that both engraved numbers (56) and (58) on top and bottom halves of the seal carrier (48), (51) correspond.
- Clean the following
 - the seal surfaces of the top (48) and bottom (51) half of the seal carrier (the groove of the floating labyrinth seal, the flange surfaces)
 - the split line surfaces of the top (48) and bottom (51) half of the seal carrier
 - the flange surfaces of the housing.
- Apply a uniform layer of sealing compound to:
 - the lateral surfaces of the groove at the top (48) and bottom (51) half of the seal carrier
 - the flange surfaces of the top (48) and bottom (51) half of the seal carrier
 - the split line surfaces of the bottom half of the seal carrier (51).

Please observe the instructions for the use of sealing compound.

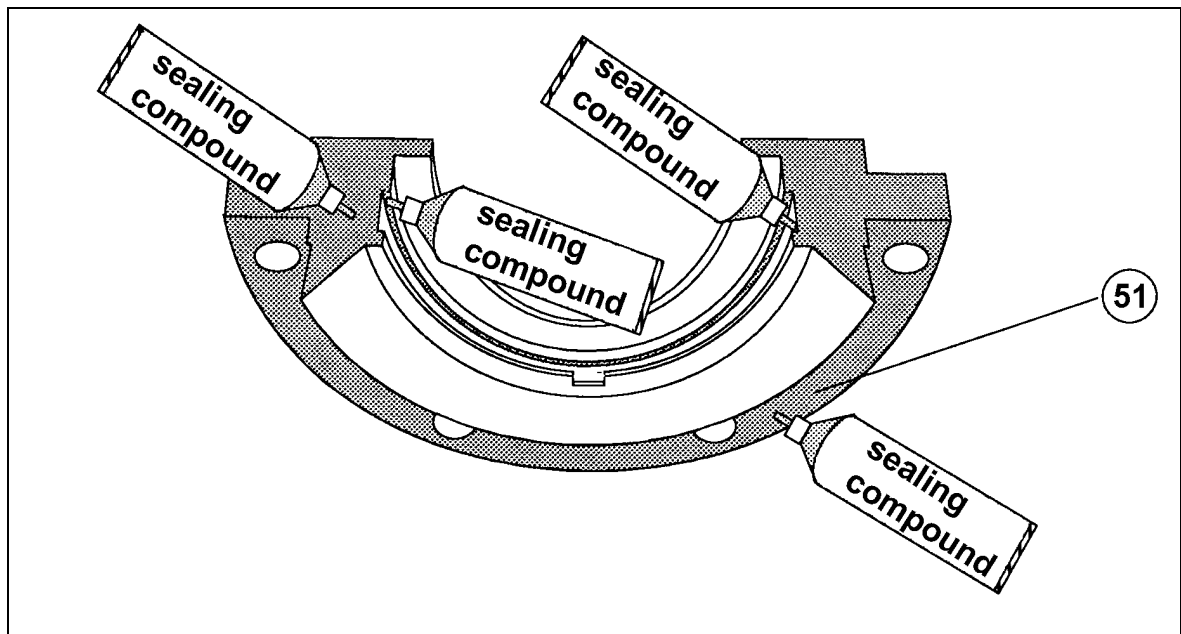


Illustration 11: Application of sealing compound to the seal carrier

Maintenance and Inspection

- Place the top half of the seal carrier (48) on the top half of the seal (53). Press the bottom half (51) of the seal carrier against it. Push the shaft seal completely into the housing.

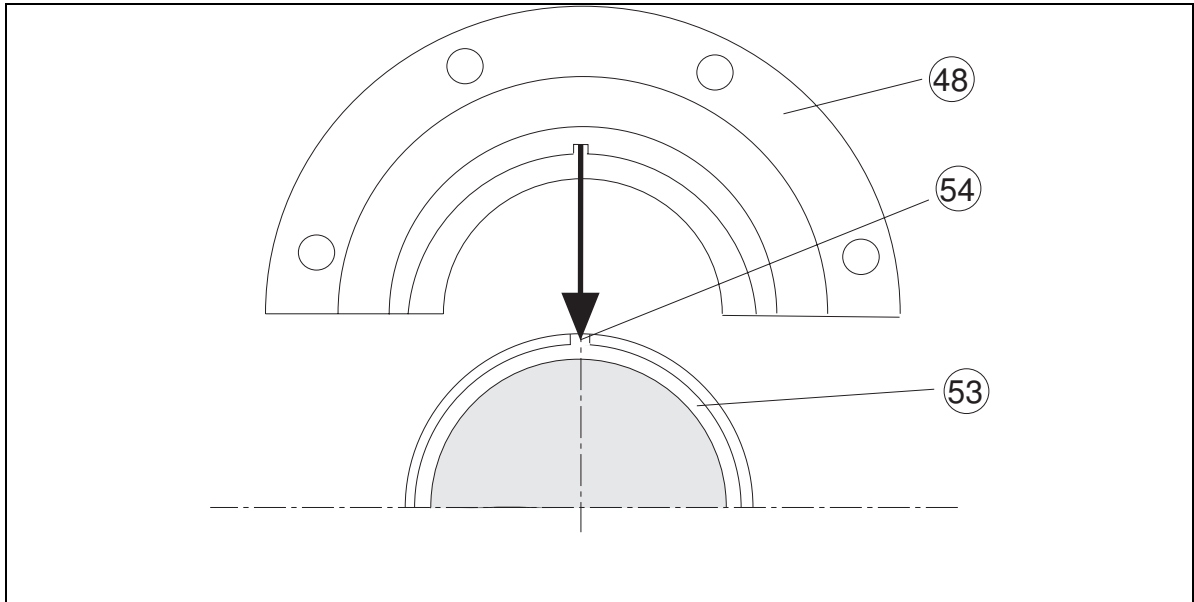


Illustration 12: Assembly of the seal carrier

- Place in true alignment the split lines of the seal carrier and the housing.
- Tighten up the screws (55) to the following torque rates:

Bearing size	9	11	14	18	22	28
Torque [Nm]	8	8	8	20	20	20

EM with external oil supply

Type 11

8.6.2 Floating labyrinth seal with dust flinger (Type 11)

- Assemble the floating labyrinth seal with dust flinger as described in Chapter 8.6.1, Floating labyrinth seal type 10.
- Place both halves of the dust flinger (69) in front of the shaft seal around the shaft. Loosely screw in the screws (70) at the split line of the flinger.

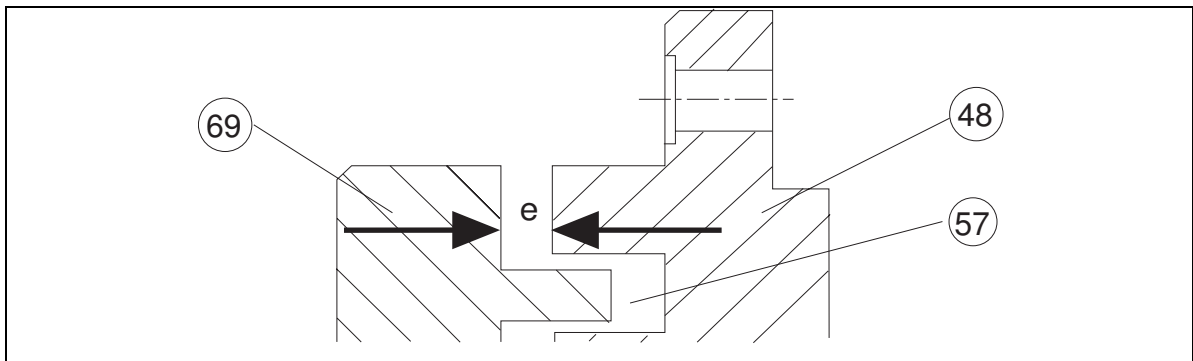


Illustration 13: Clearance between dust flinger and seal carrier

EM..Q

- Push the dust flinger (69) into the groove (57) of the seal carrier.
- Set the clearance "e" at the following figure around the whole unit:

maximum longitudinal extension of the shaft in operation + 1 mm

(Parameters indicated in the Technical Documentation of the Installation).

- Tighten up the screws (70) to the following torque rates:

Seal diameter [mm]	80-140	>140
Torque [Nm]	7	18

EM..B, EM..K, EM..E, EM..A

- Push the dust flinger (69) into the groove (57) of the seal carrier.
- Set the clearance "e" at **1 mm** around the whole unit.
- Tighten the screws (70) to the following torque rates:

Seal diameter [mm]	80-140	>140
Torque [Nm]	7	18

Maintenance and Inspection

Type 12

8.6.3 Floating labyrinth seal with baffle (Type 12)

- Assemble the floating labyrinth seal with baffle as in Chapter 8.6.1, Type 10.
- Apply a uniform layer of sealing compound to the flange surfaces of the top half (66) and bottom half (68) of the baffle.
- Screw
 - the top half of the baffle (66) to the top half of the seal carrier (48)
 - the bottom half of the baffle (68) to the bottom half of the seal carrier (51).
- Tighten the screws (67) to the following torque rates:

Seal diameter [mm]	80-140	>140
Torque [Nm]	4	10

Type 20

8.6.4 Rigid labyrinth seal (Type 20)

- Check if the engraved numbers (64) and (65) on the bottom half (63) and top half (59) of the rigid labyrinth seal correspond.
- Clean
 - the flange surfaces of the top half (59) and bottom half (63) of the rigid labyrinth seal
 - the split line surfaces of the top half (59) and bottom half (63) of the rigid labyrinth seal
 - the flange surfaces of the housing.
- Apply a uniform layer of sealing compound to the following parts:
 - the flange surfaces of the top half (59) and bottom half (63) of the rigid labyrinth seal
 - the split lines of the bottom half (63) of the rigid labyrinth seal.

Please observe the instructions for the use of sealing compound.

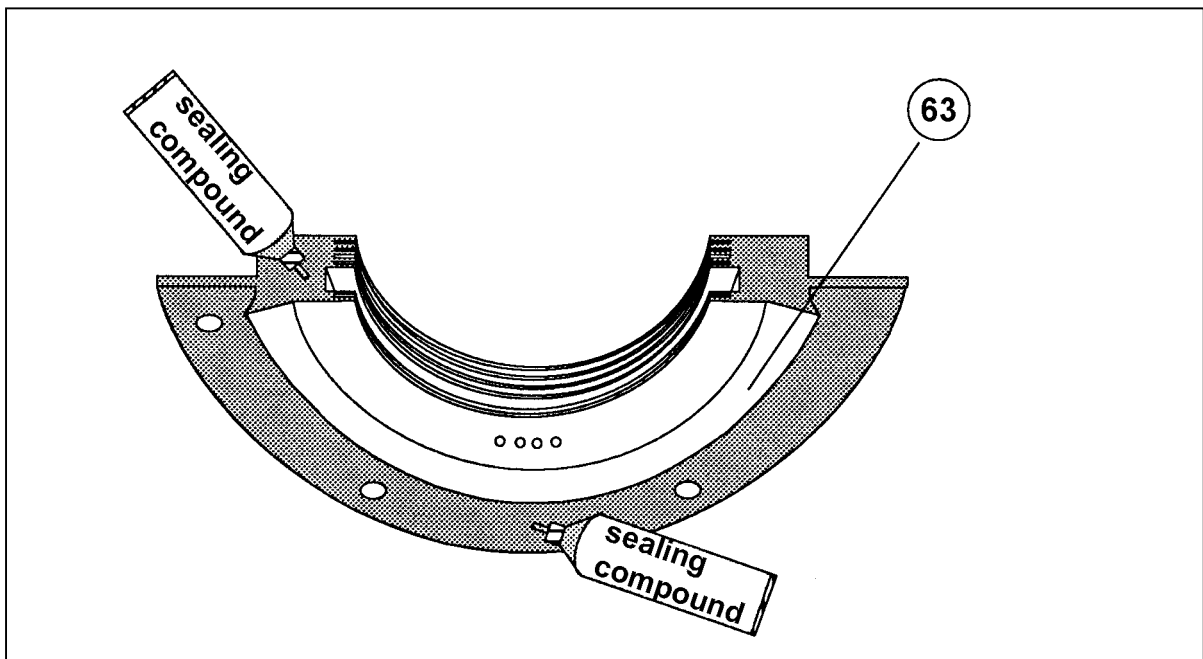


Illustration 14: Application of sealing compound to the rigid labyrinth seal

EM with external oil supply

- Place the top half (59) of the rigid labyrinth seal on the shaft and press slightly the bottom half (63) of the rigid labyrinth seal from below against it. Lightly push the rigid labyrinth seal completely into the housing.
- Tighten the screws (61) at the split line of the labyrinth seal.
- Place in parallel alignment the split line of the rigid labyrinth seal and the split line of the housing. Press the rigid labyrinth seal slightly from below against the shaft. Adjust the rigid labyrinth seal in such a way that the clearance "f" between the shaft and the rigid labyrinth seal at both split lines has the same figure.

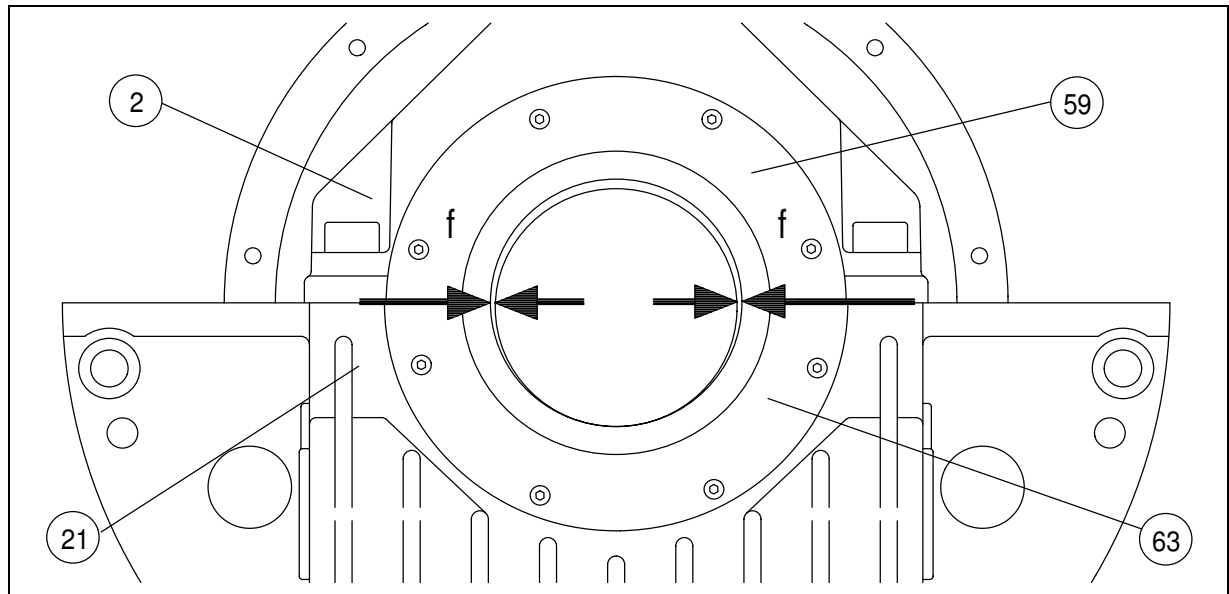


Illustration 15: Alignment of the rigid labyrinth seal

- Tighten the screws (60) to the following torque rates:

Bearing size	9	11	14	18	22	28
Torque [Nm]	8	8	8	20	20	20

Maintenance and Inspection

Type 21

8.6.5 Rigid labyrinth seal with dust flinger (Type 21)

- Assemble the rigid labyrinth seal with dust flinger as indicated in Chapter 8.6.4, Type 20.
- Place both halves of the dust flinger (69) round the shaft, in front of the rigid labyrinth seal. Mount the screws (70) loose.

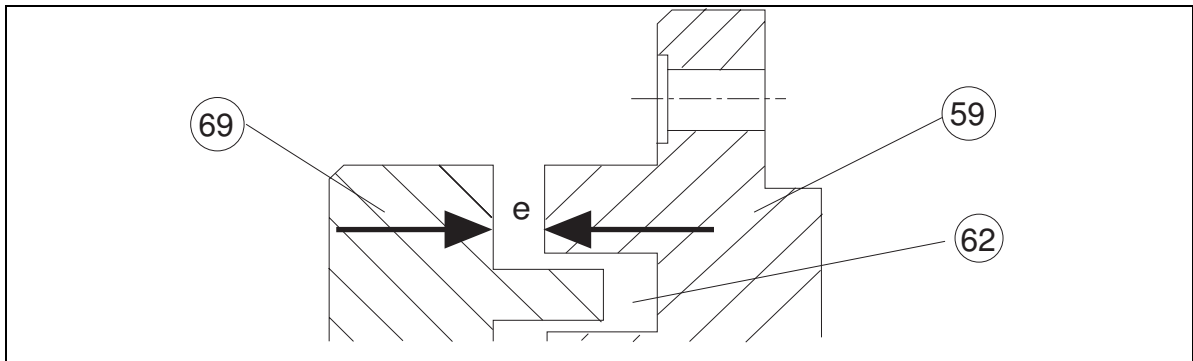


Illustration 16: Clearance between dust flinger and rigid labyrinth seal

EM..Q

- Push the dust flinger (69) into the groove (62) of the rigid labyrinth seal.
- Set the clearance "e" at the following figure around the whole unit:

maximum longitudinal extension of the shaft in operation + 1 mm

(Parameters are indicated in the Technical Documentation of the Installation).

- Tighten the screws (70) to the following torque rates:

Seal diameter [mm]	80-140	>140
Torque [Nm]	7	18

EM..B, EM..K, EM..E, EM..A

- Push the dust flinger (69) into the groove (62) of the rigid labyrinth seal.
- Set the clearance "e" at **1 mm** around the whole unit.
- Tighten the screws (70) to the following torque rates:

Seal diameter [mm]	80-140	>140
Torque [Nm]	7	18

Type 22

8.6.6 Rigid labyrinth seal with baffle (Type 22)

- Assemble the rigid labyrinth seal with baffle as described in Chapter 8.6.4.
- Apply a uniform layer of sealing compound on the flange surfaces of the top half (66) and bottom half (68) of the baffle.
- Tighten
 - the top half of the baffle (66) on the top half (59) of the rigid labyrinth seal
 - the bottom half of the baffle (68) on the bottom half (63) of the rigid labyrinth seal.
- Tighten the screws (67) to the following torque rates:

Seal diameter [mm]	80-140	>140
Torque [Nm]	4	10

EM with external oil supply

9 Starting Operation after Inspection

- Fit the thermo sensors for:
 - temperature measurement of the journal part in the connection holes (27)
 - temperature measurement of the thrust part in the connection holes (optional).
- Retighten all screw plugs in the tapped holes (27), (28), (32), (34) to the following torque rates:

Screw plug threads	G 3/8	G 1/2	G 3/4	G 1	G 1 1/4	G 1 1/2	G 2	G 2 1/2
Torque [Nm] for plugs with moulded on plastic seal	30	40	60	110	160	230	320	500
Torque [Nm] for plugs with elastic seal	34	60	85	130	240	300	330	410

- Check if the top sight glass (9) is tight.
- Retighten the connection holes for oil inlet and oil outlet and the holes for the thrust part oil supply system (optional). The torque depends on the threaded joints used.
- Carry out a visual check of the assembled bearing.
- Fill up the oil supply system with lubricant. Use the same type of lubricant as indicated on the type plate.
- Start operating the oil supply system in order to fill up the bearing with lubricant.
- Check
 - the way the oil supply system works (see also the Technical Documentation of the Installation).The lubricant quantity at the bearing oil inlet must correspond to the values indicated in the EDP-calculations.
 - that the temperature monitoring equipment works.

Attention!

- Not enough lubricant leads to temperature rises and thus to damage to the bearing.
- Too much lubricant leads to leakages.

EMT..

- Start operating the cooling water supply system and check its functioning.

The bearing is ready for operation.

- Close the assembly opening of the machine shield (with the thin metal plate (5))
- Supervise the bearing during the trial run (5 - 10 operating hours).
Pay special attention to:
 - the way the oil supply system works (necessary lubricant quantity, lubricant pressure before entering the bearing)
 - bearing temperature
 - sliding noises of the shaft seals
 - tightness
 - occurrence of inadmissible vibrations.

Attention!

If the bearing temperature exceeds the calculated value by 15 K (see the EDP-bearing calculations) stop the installation immediately. Carry out an inspection of the bearing and find out the causes.

Maintenance and Inspection

10 Corrosion Protection for Longer Standstill Periods

If you want to protect the bearing mounted on an installation against corrosion proceed as follows:

- Dismantle the bearing (see Chapter 6).
- Clean the bearing (see Chapter 7).
- Paint or spray the top half of the shell (11), the bottom half of the shell (18) and the shaft with TECTYL 511.
- Assemble the bearing (see Chapter 8).
- Close all connection holes with screw plugs.
- Seal the gaps between
 - shaft seal and housing
 - shaft seal and shaft
 by using a self-adhesive, permanent tape.
- Remove the top sight glass (9). Spray some anti-corrosive such as TECTYL 511 or VALVOLINE into the bearing.
- Put a bag of dessicant (silicate gel) inside. The dessicant absorbs the humidity and prevents the formation of condensation water into the bearing.
- Close the bearing tight with the top sight glass (9).

In case the standstill period is **longer than 1/2 year**:

- Repeat the preservation procedures.
- Put a new bag of dessicant into the bearing.

In case the standstill period **lasts more years**:

- Dismantle the shells.
- Preserve and store the bearing parts.

11 Transport Protection

In case of a machine equipped with slide bearings type EM:

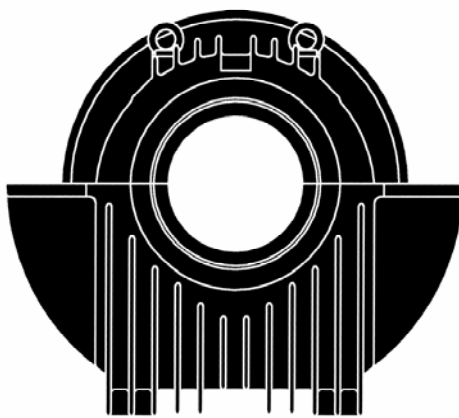
- Carry out the corrosion protection as described in Chapter 10 and apply enough lubricant on the working surfaces of the bearing.
- Secure the shaft against thrust and radial movements during transport.

EM with external oil supply

12 Glossary

Baffle	With bearing types 10 and 20 the baffles are assembled externally in front of the shaft seals. The baffle, made of reinforced polyamide, protects the bearing from dust and water.
Rigid labyrinth seal	The rigid labyrinth seal (type 20) is used with slide bearings type E with high oil throughput. It corresponds to the protective system IP44 and is made of an aluminium alloy. The rigid labyrinth seal is built of two halves, flanged at the housing. The labyrinths that wipe out the lubricant are arranged into two groups. The first two labyrinths, installed inside keep back most of the lubricant. Five further labyrinths protect the bearing from outside. They prevent the lubricant overflow and the ingress of impurities. The overflow lubricant is collected into a chamber between the both groups of labyrinths. Through the return bores the lubricant flows back into the bearing.
Spherical seating	The spherical seating is a special feature enabling the alignment of the shell in the housing. The shell is seated on two spherical seatings. The advantages of the spherical seating are: • easy at assembly • good heat transfer from the shell to the housing • suitable for such applications with high thrust or journal loads.
Dust flinger	In the case of bearing types 10 and 20 a light alloy ring is clamped on the shaft in front of the shaft. This ring fits into a groove in the seal carrier or the rigid labyrinth seal, thus building a labyrinth. The labyrinth protects the shaft exit against low pressure that could otherwise "absorb" the lubricant. Low pressure occurs for instance in the case of rotating discs, such as couplings or cooling discs.
Floating labyrinth seal	The floating labyrinth seal (type 10) in the seal carrier is used as a shaft seal in the case of bearings type E operating under normal conditions. It prevents the lubricant and lubricant mist coming out and the ingress of impurities. The floating seal has a high capacity of resistance to wear. It is made of a high-performance, high temperature stability and electrically insulated plastic material. The floating seal consists of two halves held together by a garter spring. Both ends of the spring are hooked together. In the case of slide bearings type EM the floating seal is mounted into a two-piece seal carrier. The groove allows for radial movement of up to 1 mm. The seal is thus insensitive to shaft radial displacement or deflection. The sealing effect is produced by the baffles wiping off the lubricant from the shaft. The lubricant flows back into the bearing via oil return opening.
Machine seal	In the case of the flange mounted bearings, the machine seal reduces the influence of positive and negative pressure in the machine thus preventing leakages at the inner seal area. The space between the machine seal and the bearing housing must always be vented to atmospheric pressure. The size of the gap between shaft and machine seal influences the sealing effect.

Instructions For Installation and Operation



Slide Bearings TYPE EM **with external oil supply**

Installation and Operation



RENK AKTIENGESELLSCHAFT
Werk Hannover
Weltausstellungsallee 21
D - 30539 Hannover
Telephone: (0511) 8601-0
Telefax: (0511) 8601-266
e-mail: gleitlager.hannover@renk-ag.com
<http://www.renk.de>

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EM with external oil supply

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EM with external oil supply

Bearing Coding

Installation and Operation

①	②	③	④	⑤	⑥
Type	Housing	Heat Dissipation	Shape of Bore and Type of Lubrication	Thrust part	Size - Diameter
E	M - centre flange - mounted bearing	Z - lubrication by oil circulation with external oil cooling	C - plain cylindrical bore without oil ring	Q - without thrust part (non locating bearing)	9 80≤D≤100
		X - lubrication by oil circulation with external oil cooling when oil throughput is high	L - plain cylindrical bore with loose oil ring	B - plain sliding surfaces with oil grooves (locating bearing)	11 100≤D≤125
		U - circulating pump and natural cooling	Y - two-lobe bore ("lemon bore") without oil ring	E - taper land faces for one sense of rotation (locating bearing)	14 125≤D≤160
		T - circulating pump and water cooling (finned cooler in oil sump)	V - four-lobe bore without oil ring	K - taper land faces (locating bearing)	18 160≤D≤200
					22 200≤D≤250
				A - elastically supported circular tilting pads (RD-thrust pads) (locating bearing)	28 250≤D≤315

Example for bearing coding:

①	②	③	④	⑤	⑥
E	M	Z	L	K	22-200

Type EM slide bearing with centre flange-mounted housing, lubrication by oil circulation with external oil cooling, plain cylindrical bore with loose oil ring, locating bearing with taper land faces, size 22, diameter 200.

Shaft seals

Type 10 - floating labyrinth seal (IP 44)
 Type 11 - floating labyrinth seal with dust flinger (IP 54)
 Type 12 - floating labyrinth seal with baffle (IP 55)

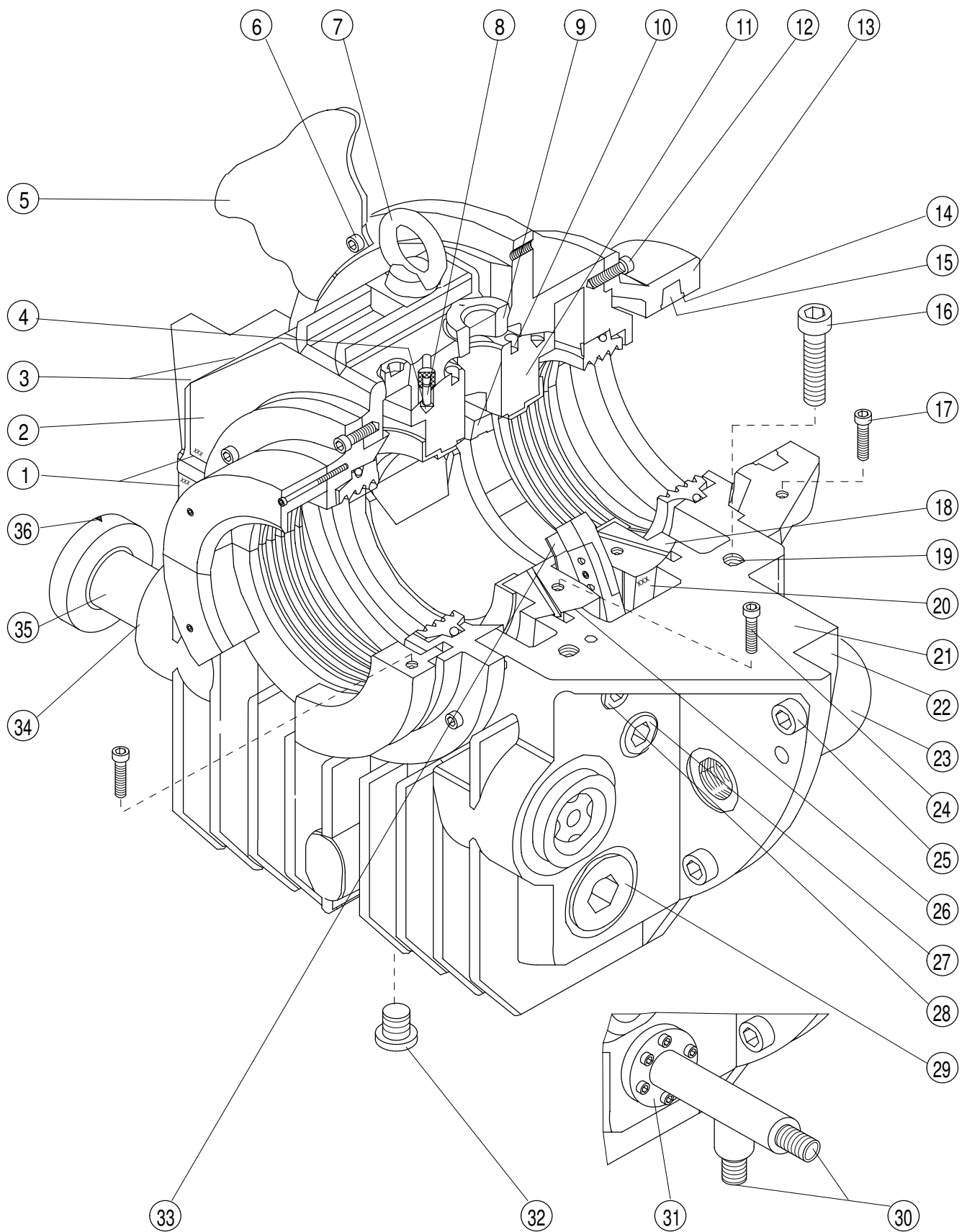
Type 20 - rigid labyrinth seal (IP 44)
 Type 21 - rigid labyrinth seal with dust flinger (IP 54)
 Type 22 - rigid labyrinth seal with baffle (IP 55)

EM with external oil supply

General Drawing

Slide Bearing EM

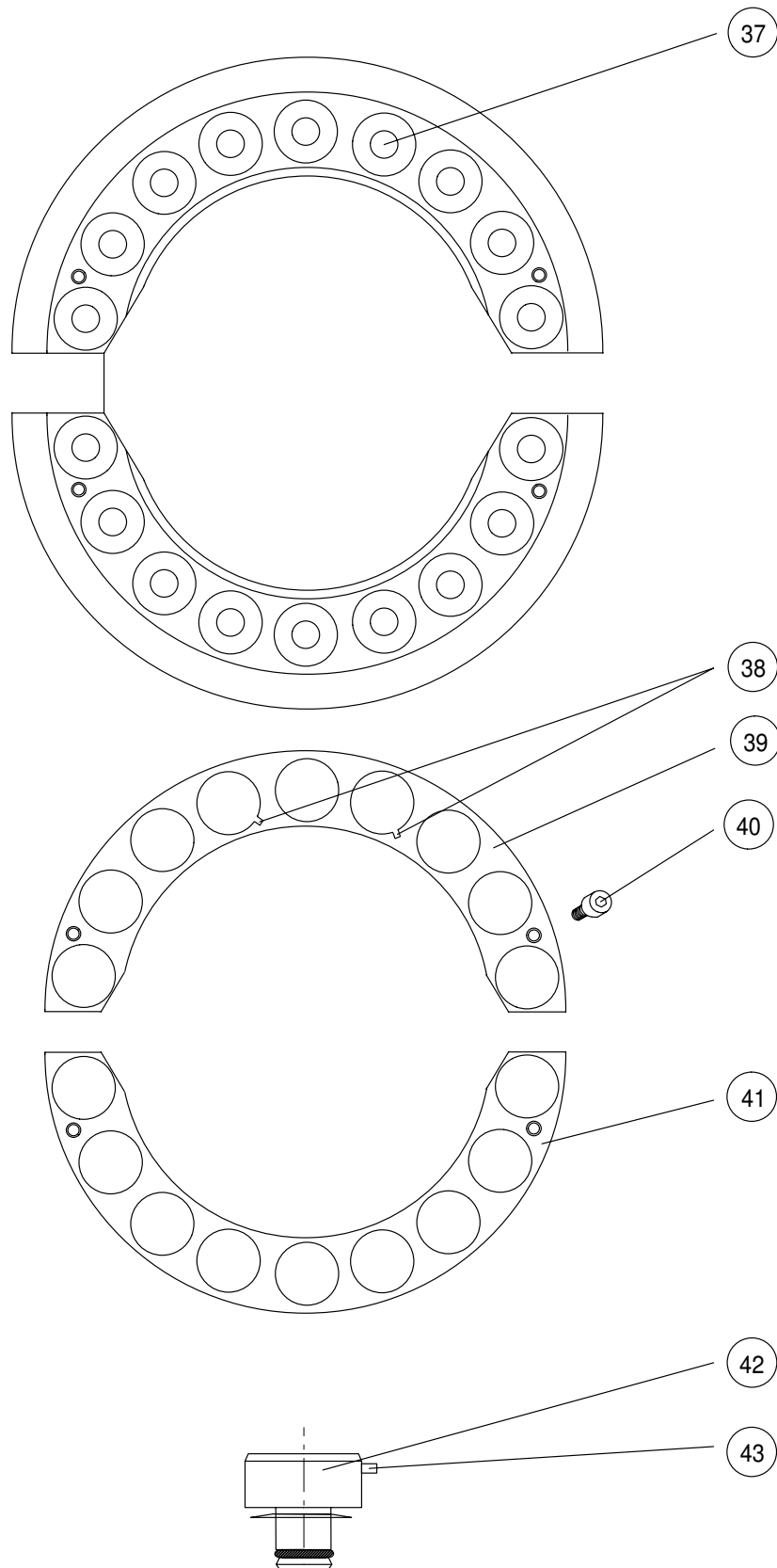
with external oil supply



- 1 Engraved numbers - housing
- 2 Top half of the housing
- 3 Tapped hole for the thrust part oil supply (optional)
- 4 Positioning pin nut
- 5 Plate (Assembly opening)
- 6 Screw
- 7 Eye bolt
- 8 Positioning pin
- 9 Top sight glass
- 10 Tapped hole (in the top and bottom halves of the shell, up size 14)
- 11 Top half of the shell
- 12 Screw
- 13 Machine seal
- 14 Hamp packing seal groove
- 15 Hamp packing
- 16 Screw (split line of the housing)
- 17 Screw (split line of the machine seal)
- 18 Bottom half of the shell
- 19 Tapped hole
- 20 Engraved number - shell
- 21 Bottom half of the housing
- 22 Recess
- 23 Pressure equalizing hose
- 24 Screw (split line of the shell)
- 25 Screw
- 26 Spherical seating
- 27 Tapped hole for temperature measurement of the journal part
- 28 Oil inlet connection hole
- 29 Tapped hole for the oil sump temperature measurement
- 30 Outlet/Inlet cooling water (Type E.T..)
- 31 Cooler (Type E.T..)
- 32 Hexagon head plug (Oil drain plug)
- 33 Metal tabs (optional for EMZL.)
- 34 Oil outlet connection hole
- 35 Oil outlet pipe with lock nut and lead seal
- 36 Marking

EM with external oil supply

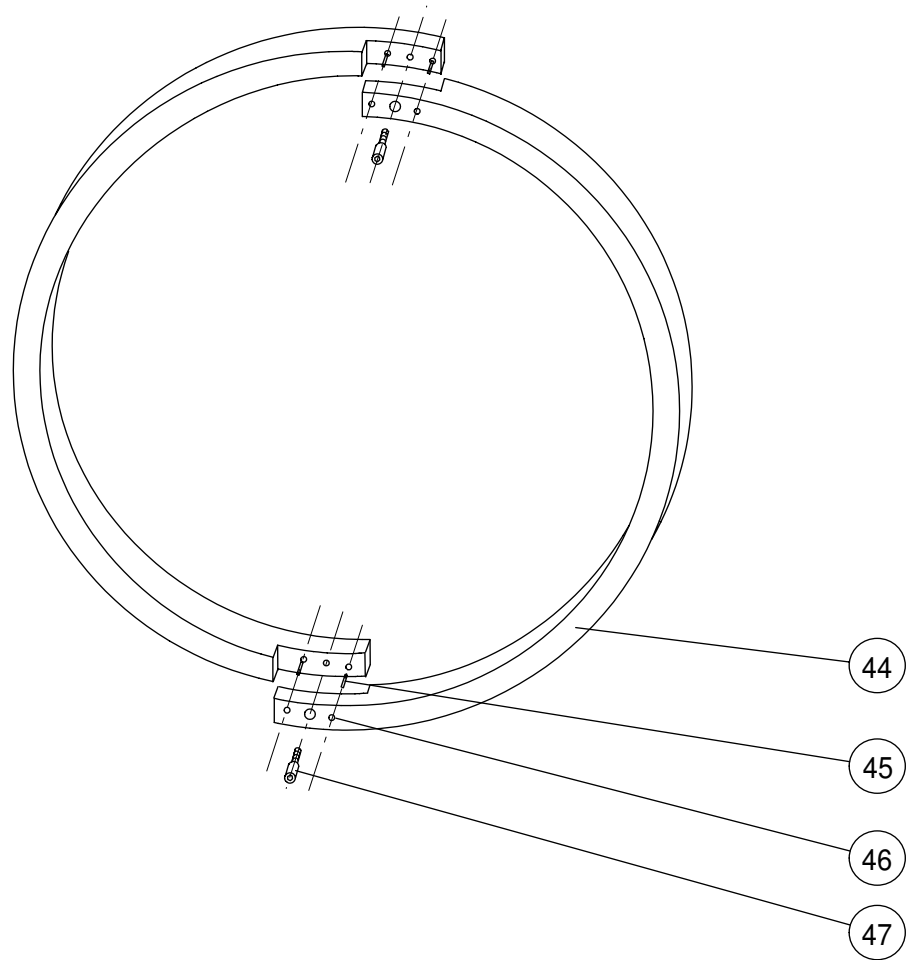
General Drawing of the Thrust Part with Circular Tilting Pads (RD-Thrust Pads)



- 37 Carrier ring
- 38 Location groove
- 39 Shroud ring top half
- 40 Screw
- 41 Shroud ring bottom half
- 42 Circular tilting pad (RD-thrust pad)
- 43 Anti - Rotation pin

EM with external oil supply

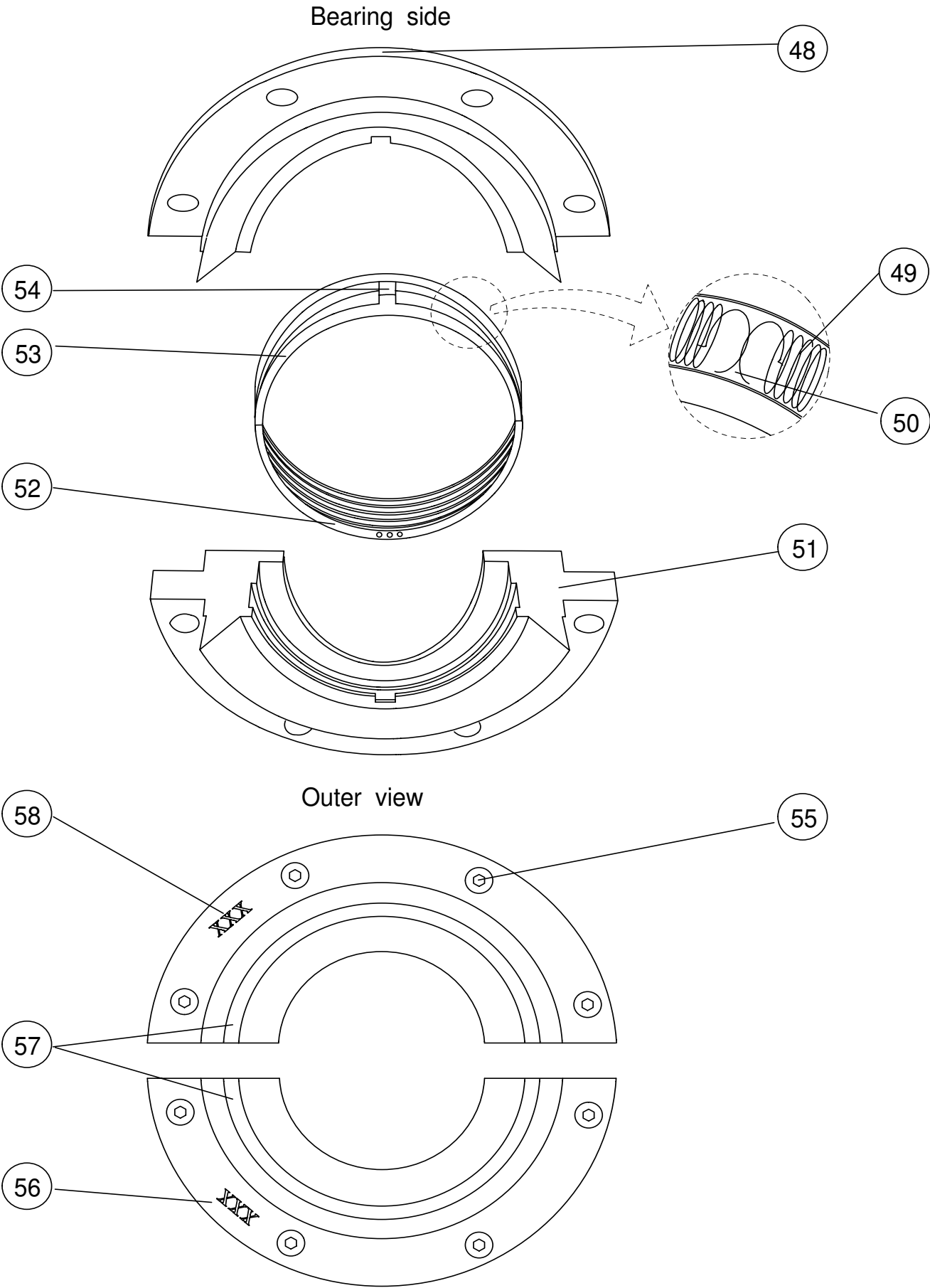
General Drawing of the Loose Oil Ring



- 44 Loose Oil Ring
- 45 Dowel pin
- 46 Hole
- 47 Screw

EM with external oil supply

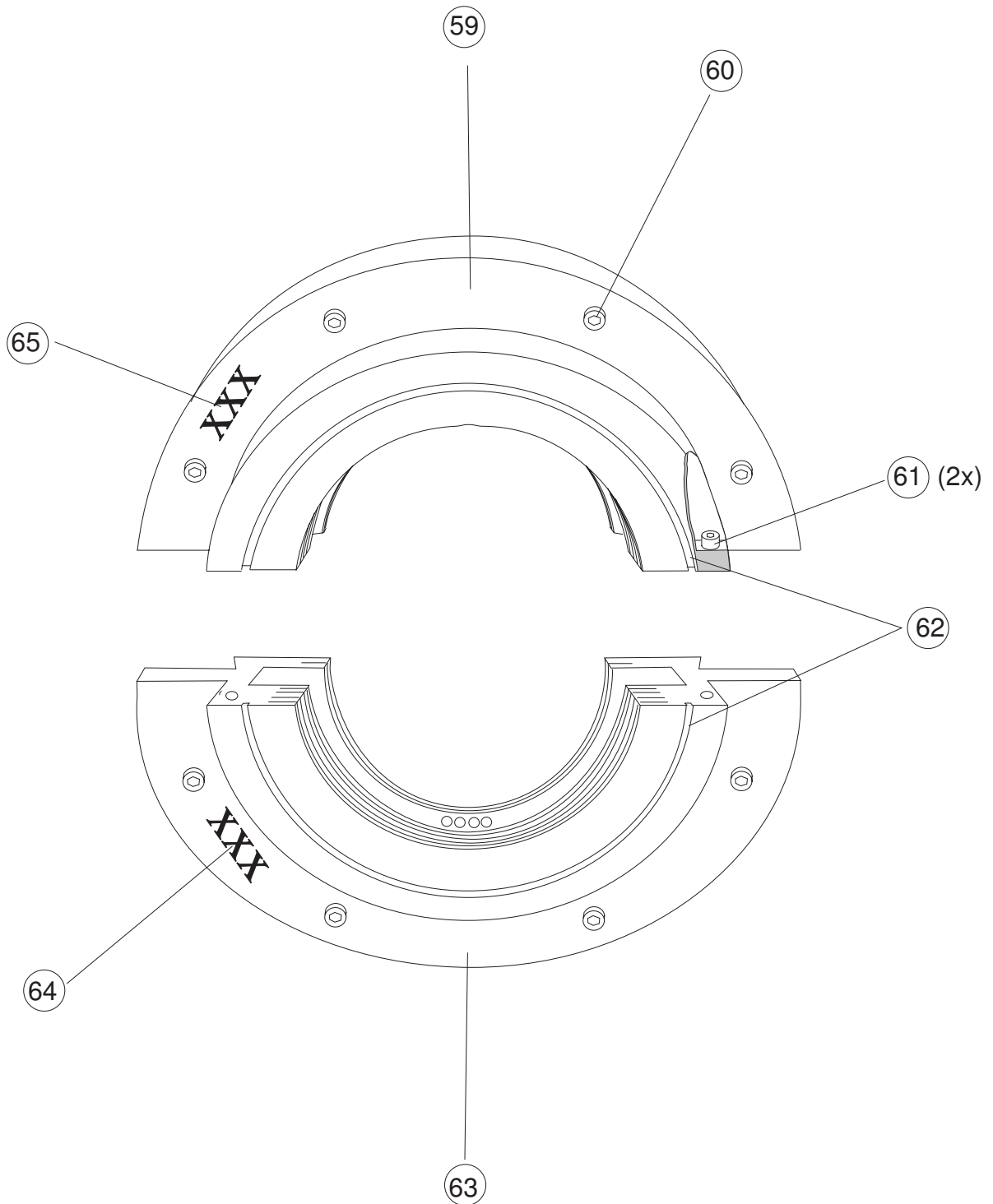
General Drawing of the Floating Labyrinth Seal with Seal Carrier



48	Seal carrier - top half
49	Garter spring
50	Groove
51	Seal carrier - bottom half
52	Bottom half of the seal
53	Top half of the seal
54	Anti - rotation pin
55	Screw
56	Engraved number
57	Groove (Type 11)
58	Engraved number

EM with external oil supply

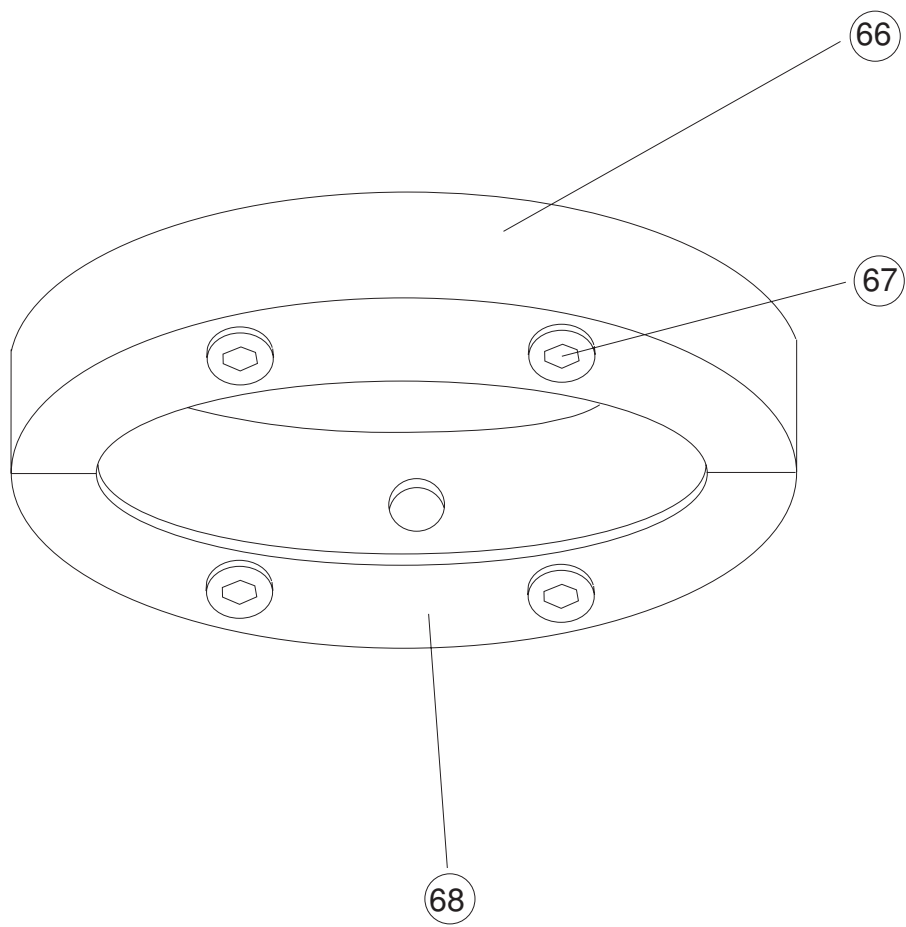
General drawing of the Rigid Labyrinth Seal



- 59 Rigid labyrinth seal - top half
- 60 Screw
- 61 Screw (split line)
- 62 Groove (Type 21)
- 63 Rigid labyrinth seal - bottom part
- 64 Engraved number
- 65 Engraved number

EM with external oil supply

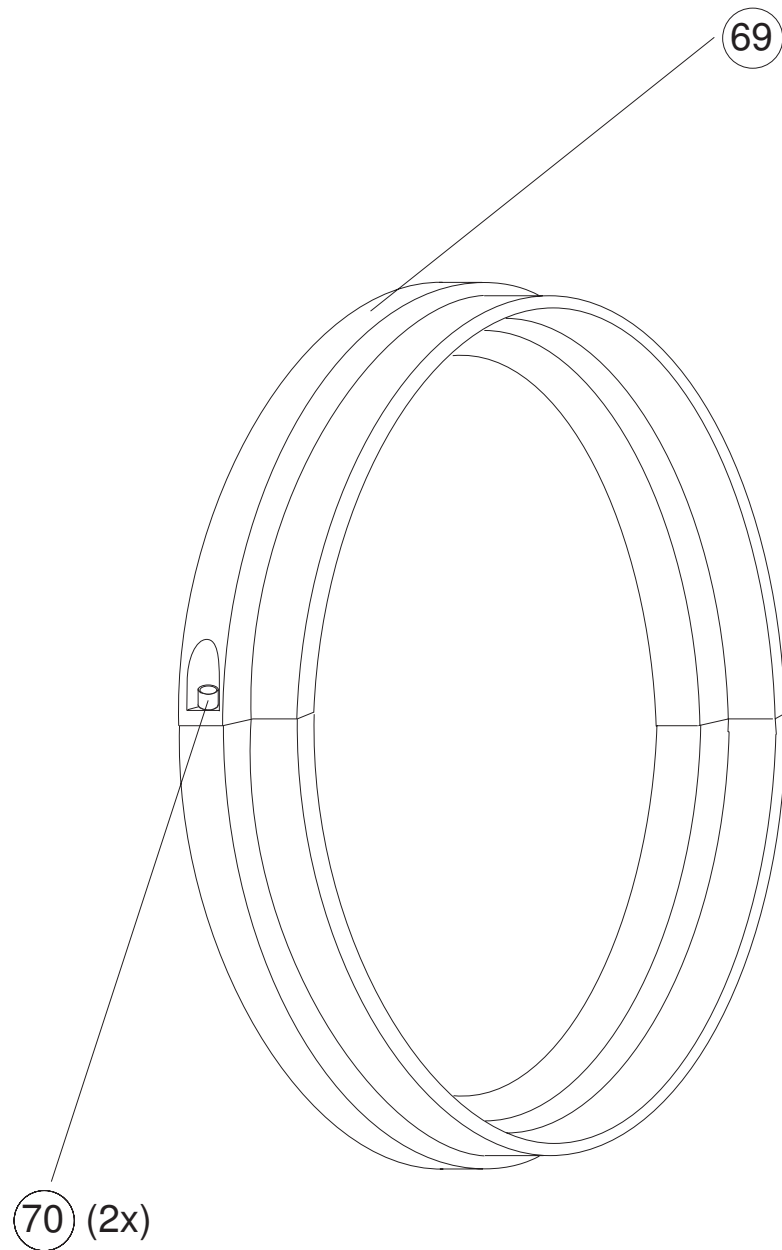
General Drawing of the Baffle



- 66 Baffle - top half
- 67 Screw
- 68 Baffle - bottom half

EM with external oil supply

General Drawing of the Dust Flinger



- 69 Dust flinger
- 70 Screw (split line)

EM with external oil supply

1 Considerations for Use

The instructions for installation and operation are addressed to qualified technical personnel (fitters, mechanic installers, mechanical engineers).

Read these instructions carefully before starting assembly.

Slide bearings of type EM are almost universally used in the engineering industry. Therefore it is not possible to provide detailed information on all possible types and range of applications for these bearing types. For instance, the position of the connection points for supply and monitoring equipment is determined by the place of application (in the following called " installation "). Please keep ready the guidelines with the technical documentation before starting assembly and operation of the slide bearings.

Additional technical documentation with detailed information is supplied in case of special design bearings. Please contact RENK Export or Domestic Department for supplementary information on bearings. Please indicate the bearing coding and the full reference number, too.

Following indications should be observed when reading these instructions.

Safety instructions are marked as follows:



Danger!

Warning of dangers for personnel.
Example: Warning of injury

Attention!

Warning of damage for the bearing or installation.

Useful recommendations and additional information are framed.

EM...Q

This is how chapters, instructions or recommendations are marked when referring to a single type or size of a bearing.

Example: Slide bearing type EM without thrust part (non-locating bearing)

- Instruction follows.

• Beginning of an enumeration.

() This is how the different parts of a bearing as described in the general drawings (numbers) are marked in the text.

- Use the enclosed check-list before starting assembly or operation. Copies available on request.
- The check list provides the experienced mechanical fitters of RENK bearings with the necessary instructions for installation and operation.

Installation and Operation

2 Safety Instructions



Danger!

The maintenance and inspection of the slide bearings should be carried out by:

- persons nominated by the safety representative
- persons correspondingly trained and instructed
- persons with knowledge on appropriate standards, regulations and accident prevention rules
- persons with knowledge on first-aid measures and local rescue centres.



Warning of injury!

Before starting work on the bearing:

- Switch off the installation.
- Make sure the installation is not in operation.
- Never lift or transport machines, etc. by the bearing eye bolts. These are only intended for assembly and dismantling of the bearing !



Warning of injury!

Do not grab such heavy bearing parts as the bearing housing during assembly or dismantling works. This could result in bruising or injury to hands !

Attention!

All metal parts of a slide bearing consisting of top and bottom part such as the housing, shells, shaft seals are marked by engraved numbers. Fit together only the parts with the same number.

Attention!

In case • the admissible bearing temperature exceeds 15 K

- inadmissible vibrations occur
- unusual noises or odours are noticed
- ☐ monitoring equipment triggers alarm

shut down the installation and inform the maintenance personnel in charge.

Attention!

Do not operate the bearing below the transition speed values indicated in the bearing calculation, thus avoiding inadmissible operating conditions, which could lead to damage to the bearing.

Attention!

Please observe our leaflet Technical Information No. 85 which refers to various sealing compounds for extended technical applications.

EM with external oil supply

3 Preparatory Work

3.1 Tools and equipment

- Following tools and equipment are necessary:
 - Allan key set
 - Wrenching key set
 - Open-jawed spanner set
 - Feeler gauges (up 0,05 mm)
 - Caliper gauge
 - Emery paper, plain scraper
 - Oil stone
 - Lifting equipment
 - Permanent sealing compound
 - Clean (close weave) rags
 - Oil with the correct viscosity (see bearing type plate)
 - Detergents
 - Liquid screw locking compound (e.g. LOCTITE 242)
 - Liquid sealing compound and Teflon-tape

3.2 Use of lifting equipment



Warning of injury!

Before transport or lifting check if the eye bolts are tight ! Insecure eye bolts could result in bearing becoming loose.

Before moving the bearing by the eye bolts make sure that the split line screws are tightened, otherwise the bottom half of the bearing could become detached.

Make sure that the eye bolts are not exposed to bending stress, otherwise the bolts could break.

Follow exactly the instructions for the use of lifting equipment.

- Use lifting equipment for assembly or transport of the following items:

Transport/Assembly of:	Use lifting equipment for the following bearing sizes
Whole bearing unit	9-28
Top half of the housing	14-28
Bottom half of the housing	11-28
Bearing shells	14-28

Installation and Operation

- Following steps are to be observed before using the lifting equipment:

Whole bearing unit

- Check if the screws at the split line are tight (16):

Bearing size	9	11	14	18	22	28
Torque [Nm]	40	69	170	330	570	1150

- Check if the eye bolts (7) are tight.
- Connect the lifting equipment to the eye bolts (7).

Top half of the housing

- Check if the eye bolts (7) are tight.
- Connect the lifting devices to the eye bolts (7).
- Sizes 22 and 28 are delivered equipped with an assembly device.
When not in use, this assembly device is located in the "parking position" behind the flange and as such it is not allowed to use it as transport device.

**Size
22 and
28**

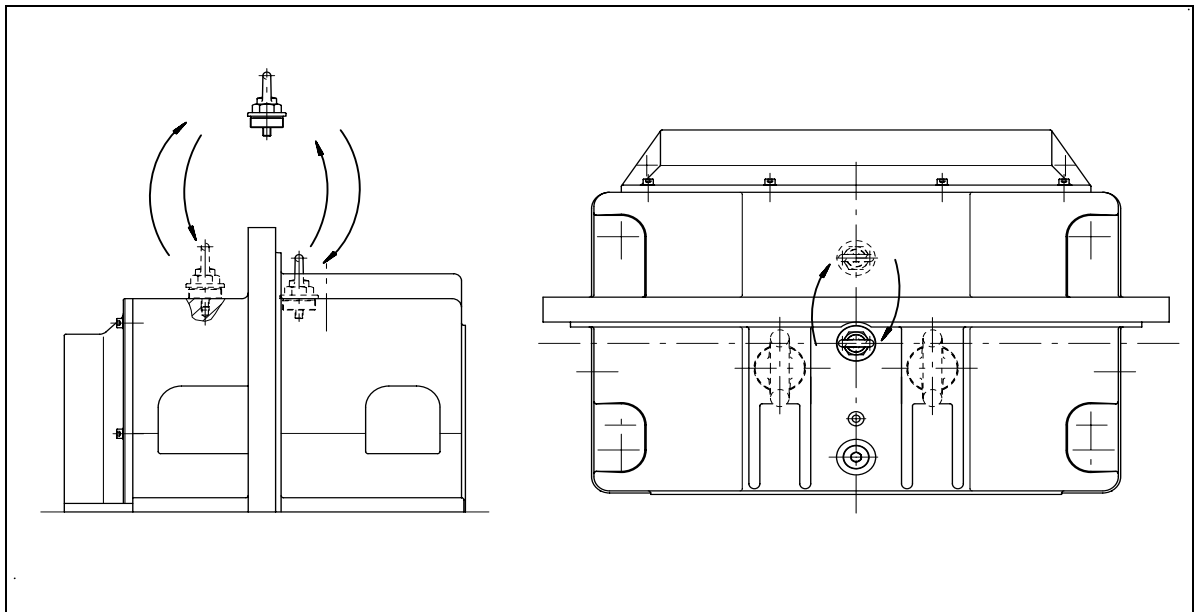


Illustration 1: Assembly device

EM with external oil supply

To mount the top half of the housing remove the top sight glass and screw in the assembly device.

By using the appropriate lifting equipment and with the help of the assembly device it is possible to lift and mount the top half of the housing in a straight position.

After assembling the top half of the housing put the assembly device back into the "parking position" behind the flange and screw in the top sight glass.

Bottom half of the housing

- Screw two eye bolts (7) with suitable threads tight into the cross-placed opposite tapped holes (19).

Bearing size	9	11	14	18	22	28
Tapped hole	M 10	M 12	M 16	M 20	M 24	M 30

- Connect the lifting equipment to the eye bolts (7).

Bearing shells

- Screw two eye bolts or screw hooks with suitable threads tight into the tapped holes (10):

Bearing size	14	18	22	28
Tapped hole	M 8	M 12	M 12	M 16

- Connect the lifting equipment to the eye bolts or to the screw hooks.

Installation and Operation

3.3 Dismantling of the bearing

Attention

Make sure that the work place and the parts to be assembled are clean. Contamination and damage to the bearing, especially to the working surfaces, have a negative influence on the operating quality and could lead to premature failure.

3.3.1 Dismantling of the shaft seal - outboard side

- Dismantle the shaft seals of the bearing. Proceed according to the sealing type:

Type 12

Floating labyrinth seal with baffle (Type 12):

- Disconnect the top half of the baffle (66) and the bottom (68). To do so, loosen the screws (67).
- Further proceed as in the case of type 10 and 11 seal.

Type 10 Type 11

Floating labyrinth seal (Type 10)

Floating labyrinth seal with dust flinger (Type 11)

- Loosen and remove all screws (55).
- Simultaneously take away in axial direction both top half (48) and bottom half (51) of the seal carrier from the housing.
- Lift off the top half of the seal carrier (48) and take out the floating labyrinth seal from the bottom half of the seal carrier (51).
- Remove the protective cardboard (for transport protection) from the floating labyrinth seal.
Proceed as indicated for sizes
 - 9-11
 - 14-28

Size 9 -11

- Take hold of the floating labyrinth seal with both hands. Press out the protective cardboard with both thumbs.

Size 14-18

- Take both halves of the seal (52), (53) by the split line. Pull both halves apart, till you can press out the protective cardboard. Remove carefully by pressing along the edge of the split line.



Warning of injury!

During dismantling of the floating labyrinth seal hold on tight to the tensioned garter spring (49) which otherwise could bounce back and lead to injury.

- Take both seal halves (52),(53) and pull them apart by approximately 20 mm.
- Open the garter spring (49).

Type 22

Rigid labyrinth seal with baffle (type 22)

- Separate the top and bottom half (66), (68) of the baffle, by untightening the screws (67).
- Further proceed as in the case of types 20 and 21.

Type 20 Type 21

Rigid labyrinth seal (type 20)

Rigid labyrinth seal with dust flinger (type 21)

- Untighten all screws (60) and remove them.
- Simultaneously remove in axial direction both top and bottom (59), (63) halves of the rigid labyrinth seal.
- Remove the screws (61) at the split line.
- Separate the top half of the rigid labyrinth seal (59) from the bottom half (63) and take out the protective cardboard (used for safe transport).

EM with external oil supply

3.3.2 Dismantling of the machine seal

- Loosen the hose clamps at the bottom half of the housing.
- Pull off the pressure equalizing hose (23).
- Loosen the split line screws (17) of the machine seal and turn them out.
- Loosen the screws (12) and remove the seal parts.

3.3.3 Dismantling of the housing

EM.V.

- Unscrew the screw plug with the welded-on positioning pin.

**Size 22
and 28**

- Replace the top sight glass (9) by the assembly device. The top half of the housing can be lifted and transported by using the assembly device, well tight, and the appropriate lifting equipment.
- Unscrew the screws (16) at the split line and lift the top half of the housing (2).
- Take out both top (11) and bottom (18) halves of the shell from the bottom half of the housing (21).

Attention!

Do not damage the thrust and radial working surfaces!

- Unscrew the screws (24) at the split line and separate the top and bottom halves of the shell (11), (18) without using any tools or other devices.

Attention!

If the bottom half of the shell (18) is provided with metal tabs (33) do not remove them. They regulate the oil level in the oil pockets.

EMT..

The oil cooler (31) is already assembled and does not have to be removed for cleaning purposes.

3.3.4 Dismantling of the shaft seal - machine-side

The machine side seal is of Type 10, floating labyrinth seal.

- Remove the floating labyrinth seal from the bottom half of the housing.
- Notice the anti-rotation pin at the split line of the bottom half of the housing.
- Remove the protective cardboard (for transport protection) from the floating labyrinth seal.

Proceed as indicated for sizes

- 9-11
- 14-28

**Size
9 -11
Size
14-18**

- Take hold of the floating labyrinth seal with both hands. Press out the protective cardboard with both thumbs.
- Take both halves of the seal (52), (53) by the split line. Pull both halves apart, till you can press out the protective cardboard. Remove carefully by pressing along the edge of the split line.



Warning of injury!

During dismantling of the floating labyrinth seal hold on tight to the tensioned garter spring (49) which otherwise could bounce back and lead to injury.

- Take both seal halves (52), (53) and pull them apart by approximately 20 mm.
- Open the garter spring (49).

Installation and Operation

3.4 Cleaning of the bearing

Attention!

Use only non-aggressive detergents, such as for instance:

- ☐ VALVOLINE 150.
- ☐ Alkaline cleaning compounds (pH-value 6 to 9, short reaction time).



Warning of injury!

Please observe the instructions for the use of the detergents.

Attention!

Never use cleaning wool or fibrous cloth. Residues of such materials left in the bearing could lead to excessive temperatures.

- Clean the following parts thoroughly, to remove all residues of preservation :
 - inside the top half of the housing (2)
 - inside the bottom half of the housing (21)
 - all plain parts of the top and bottom half of the housing (2),(21)
 - top half of the shell (11)
 - bottom half of the shell (18)
 - sealing surfaces of the top (48) and bottom (51) half of the seal carrier or of the rigid labyrinth seal
- loose oil ring (44).

EM.L.

3.5 Checks

- Please check if there is any visible damage. Check the split line and the working surfaces in particular.

EM.L.

The loose oil ring (44) should show absolutely no burrs or have no shoulders.

Insulated
Bearings

- Check the insulating layer of the spherical seating (26).
- If necessary, change the damaged parts.

EM with external oil supply

EM..A

3.6 Assembly of the RD-thrust pads

- Clean both top (39) and bottom (41) halves of the shroud ring and all RD-thrust pads (42). Proceed as described under chapter 3.4 (Cleaning of the bearing).

Bearing size	Diameter	Number of RD-thrust pads per bearing [Pieces]
9	80	14
	90	16
	100	20
11	100	16
	110	18
	125	22
14	125	18
	140	20
	160	24
18	160	18
	180	20
	200	24
22	200	18
	225	20
	250	24
28	250	18
	280	20
	300	24

- Check if the parts show any visible damage.

Carry out the assembly of both thrust parts of the top (11) and bottom (18) half of the shell according to the following instructions:

One RD-thrust pad on both sides of the top half of the shell has a bore for the insertion of a thermo sensor (thrust part temperature measurement).

Installation and Operation

To mount the RD-thrust pad into the correct position proceed as follows:

- Find the position of the location groove (38) on the top half of the shroud ring (39). Insert the RD-thrust pad (42) with the anti-rotation pin (43) into the corresponding thrust pad location hole (37).
- Insert all other RD-thrust pads (42) into the corresponding thrust pad holes (37) of the top and bottom half of the shell (11), (18).

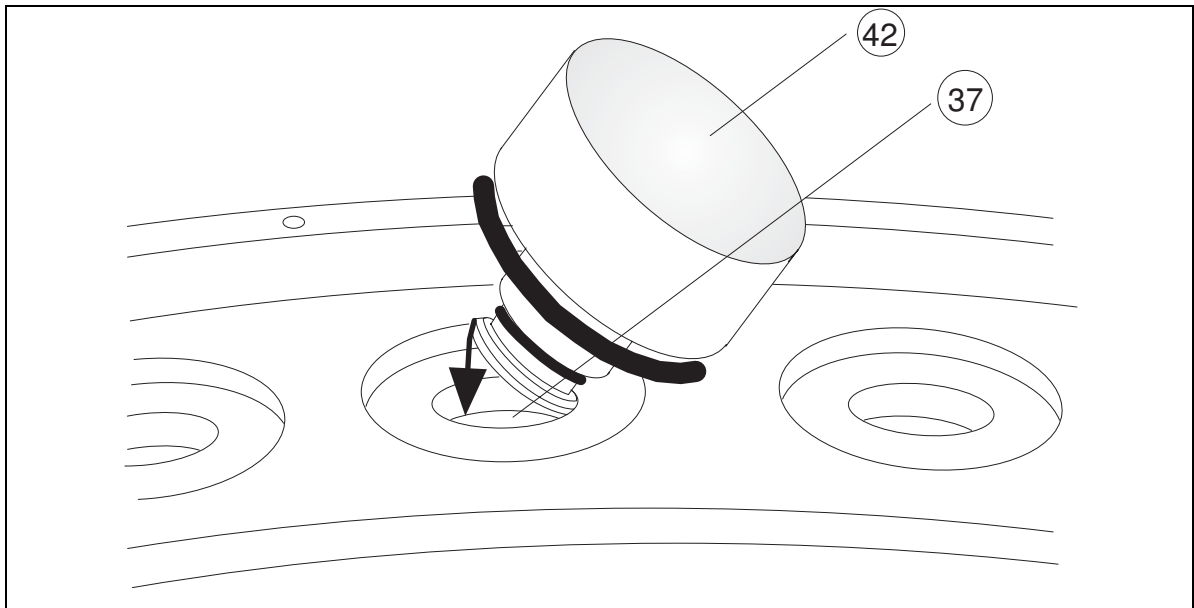


Illustration 2: Assembly of the RD-thrust pads

- Place the top half of the shroud ring (39) into the the top half of the shell (11) by inserting the anti-rotation pin (43) into the location hole (38). Match the split line of the top half of the shell (11) with the split line of the top half of the shroud ring (39) in true alignment.

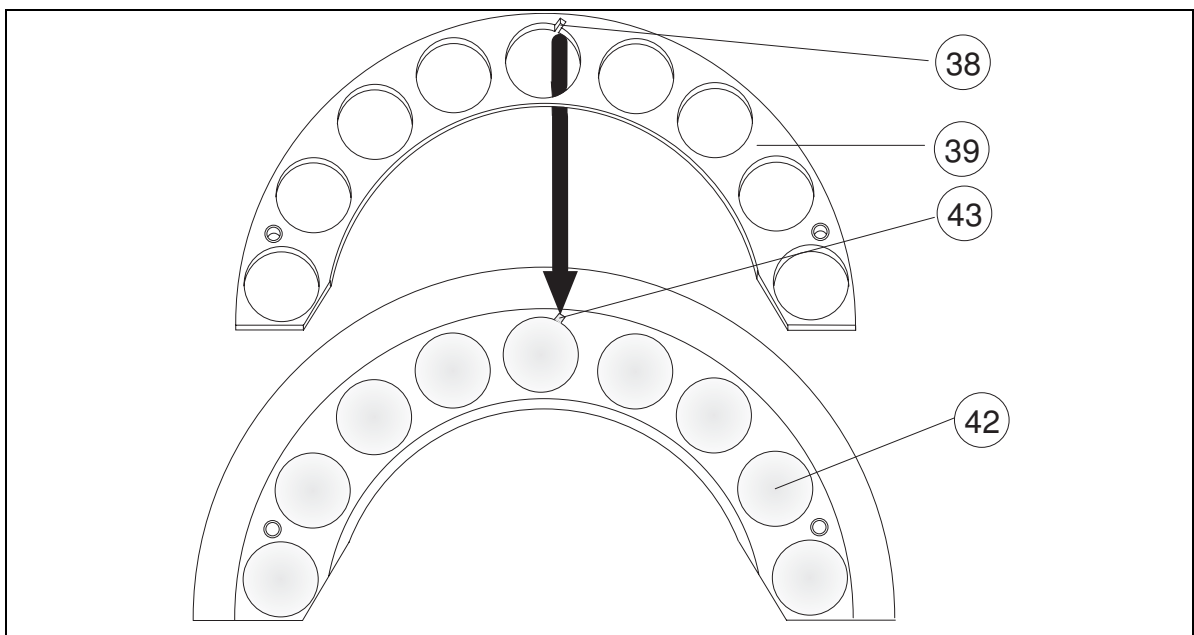


Illustration 3: Assembly of the shroud ring

EM with external oil supply

- Tighten the screws (40) to the following torque rates:

Bearing size	9	11	14	18	22	28
Tapped hole	M 4	M 4	M 5	M 6	M 8	M 10
Torque [Nm]	1,4	1,4	2,7	8	20	40

- Place the bottom half of the shroud ring (41) into the bottom half of the shell (18). Match the corresponding split lines in true alignment. Tighten the screws (40) to the same torque value as valid for the top half of the shell (11).
- Check the mobility of all RD-thrust pads (42).
If the RD-thrust pads jam, realign the top (39) and bottom half (41) of the shroud ring.

Attention!

Insufficient mobility of the RD-thrust pads will cause damage of the bearing.

Both top and bottom halves of the shells are prepared for assembly.

Installation and Operation

4 Assembly of the Bearing

Attention!

Remove all impurities or other objects such as screws, nuts, etc. from inside the bearing. If left inside they could lead to damage to the bearing. Cover up the opened bearing during work breaks.

Attention!

Carry out all assembly operations without making use of force.

Attention!

Secure all screws of the housing at the split line and flange with a liquid screw locking compound (e.g. LOCTITE 242).

4.1 Assembly of the machine seal

- Fit the bottom half of the machine seal around its locating spigot on the bottom half of the housing.
- Align the split lines of the housing and of the seal in true alignment.
- Tighten the screws (12) by using the following torque value:

Bearing size	9	11	14	18	22	28
Tapped hole	M 6	M 6	M 6	M 8	M 8	M 8
Torque [Nm]	8	8	8	20	20	20

- Fit the top half of the machine seal around its locating spigot on the top half of the housing.
- Align the split lines of the housing and of the seal in true alignment.
- Tighten the screws (12) by using the following torque value:
- Place the pressure equalizing hoses (23) between the machine-side seal (13) and the bottom half of the housing into the clamps and tighten them.

4.2 Assembly opening for bearing fitting

The machine shield is designed in two versions:

• Split machine shield:

In this case the bottom half has a thick wall and is provided with the recess to permit the fitting of the housing. The top half of the machine shield can have either the thick wall or only a thin sheet. In both cases, after completed bearing installation, the top half of the machine shield is fastened to the top half of the bearing housing.

• Non-split machine shield

In this case the bottom half is provided with the recess to permit the fitting of the bottom half of the housing. The top half is provided with a greater opening which is used as assembly opening for the bearing. The following graph shows the minimum values necessary for the different bearing sizes.

EM with external oil supply

EM..Q,
EM..B,
EM..K,
EM..E

Bearing size	9	11	14	18	22	28
Diameter of the mounting recess Z [mm]	375	450	530	630	800	1000
Flat surface of the bottom half / Radius Ru_{min} [mm]	215	255	305	360	455	565
Flat surface of the top half / Radius Ro_{min} [mm]	240	280	310	360	455	565
Opening height H [mm]	195	230	280	330	415	515
Opening width A [mm]	135	150	85	95	120	155

EM..A,

Bearing size	9	11	14	18	22	28
Diameter of the mounting recess Z [mm]	375	450	530	630	800	1000
Flat surface of the bottom half / Radius Ru_{min} [mm]	215	255	305	360	455	565
Flat surface of the top half / Radius Ro_{min} [mm]	250	285	310	365	470	570
Opening height H [mm]	205	240	290	350	440	540
Opening width A [mm]	135	150	85	95	120	155

Attention!

The flat surface of the bottom half **Ru_{min}** must not be lower than 4 mm.

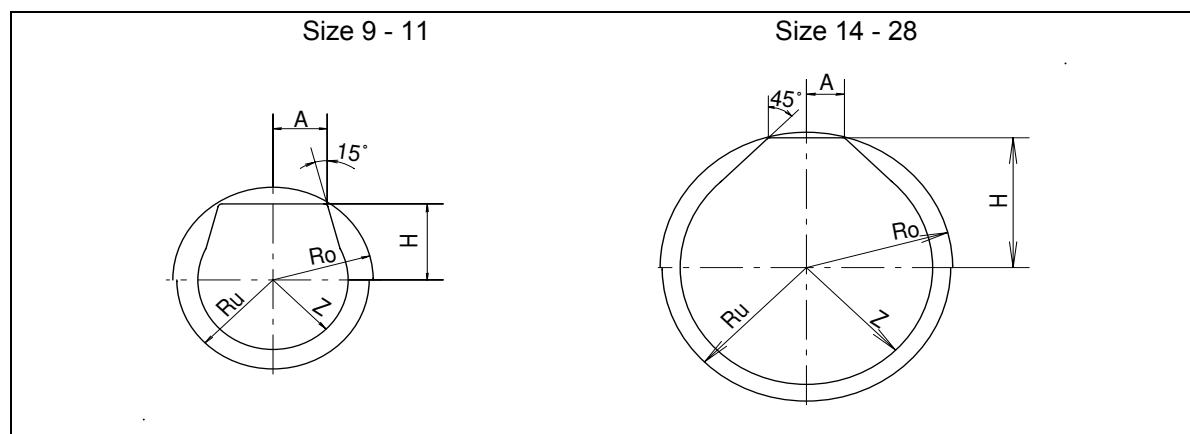


Illustration 4: Assembly opening slide bearing type EM

After completed bearing installation the remaining opening is covered by a thin metal plate (5).

Installation and Operation

4.3 Assembly of the bottom half of the housing into the machine shield

Attention!

The lifting equipment should not come to contact with the seal and working surfaces of the shaft.

- Lift the shaft high enough to give room for the assembly operations.
- Protect the shaft against unintended movement.
- Place the bottom half of the housing with the spigot (22) into the mounting recess of the machine shield.
- Tighten the flange screws to the following torque rates. Use only 8.8 quality screws.

Bearing size	9	11	14	18	22	28
Suitable flange screws	M 10	M 12	M 16	M 20	M 24	M 30
Torque [Nm] for μ_{tot} (lightly oiled)	40	69	170	330	570	1150

4.4 Fitting in the bottom half of the shell

EM..E

Attention!

Mounting the bottom half of the shell (not marked with an arrow) correctly will ease the assembly of the top half shell (marked with an arrow) (see chapter 4.7).

- Apply some lubricant to the spherical seating (26) in the bottom half of the housing (21) and to the working surfaces of the shaft. Use the same type of lubricant as indicated for bearing operation (see type plate).
- Place the bottom half of the shell (18) on the working surface of the shaft. Turn the bottom half of the shell (18) into the bottom half of the housing (21) with the split line surfaces of both halves in true alignment.

In case the bottom half of the shell doesn't turn in easily, check the position of the shaft and the alignment of the bearing housing

EM..B,
EM..K,
EM..E,
EM..A

Attention!

These operations should be carried out most carefully. The thrust parts of the bottom shell must not be damaged.

- Lower down the shaft till it sits on the bottom half of the shell (18).

EM with external oil supply

4.5 Assembly of the shaft seal - machine-side

The machine-side shaft seal is, as standard, a floating labyrinth seal. The integrated seal groove is in the top and bottom halves of the housing.



Warning of injury!

During assembly hold the garter spring ends securely to avoid them suddenly releasing and causing possible injury !

Check the movement of the floating labyrinth seal on the shaft in the seal area outside the housing.

- Put the garter spring (49) around the shaft and hook both ends into each other.
- Put both halves of the seal (52),(53) in their place on the shaft.
- Put the garter spring (49) into the groove (50).
- Turn the floating labyrinth seal on the shaft.

Attention!

The floating labyrinth seal should turn easily on the shaft. A jammed seal could lead to overheating during operation and even to shaft wear.

If the floating labyrinth seal jams,

- dismantle the seal
- remove the worn parts of the seal carefully, by using emery paper or a plain scraper.

- Dismantle the floating labyrinth seal.
- Apply sealing compound to the guide surfaces of the integrated seal groove in the bottom half of the housing.

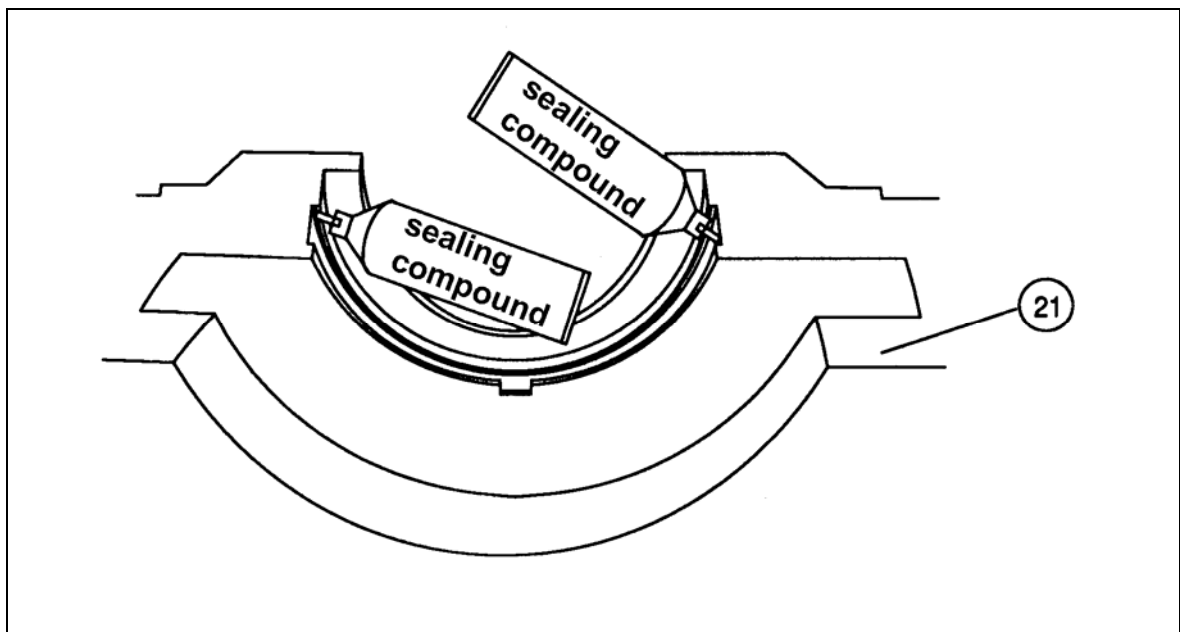


Illustration 5: Application of sealing compound to the integrated seal groove

Installation and Operation

- Apply a uniform layer of sealing compound to the guide surfaces and on the split line surfaces of both halves of the seal (52), (53).

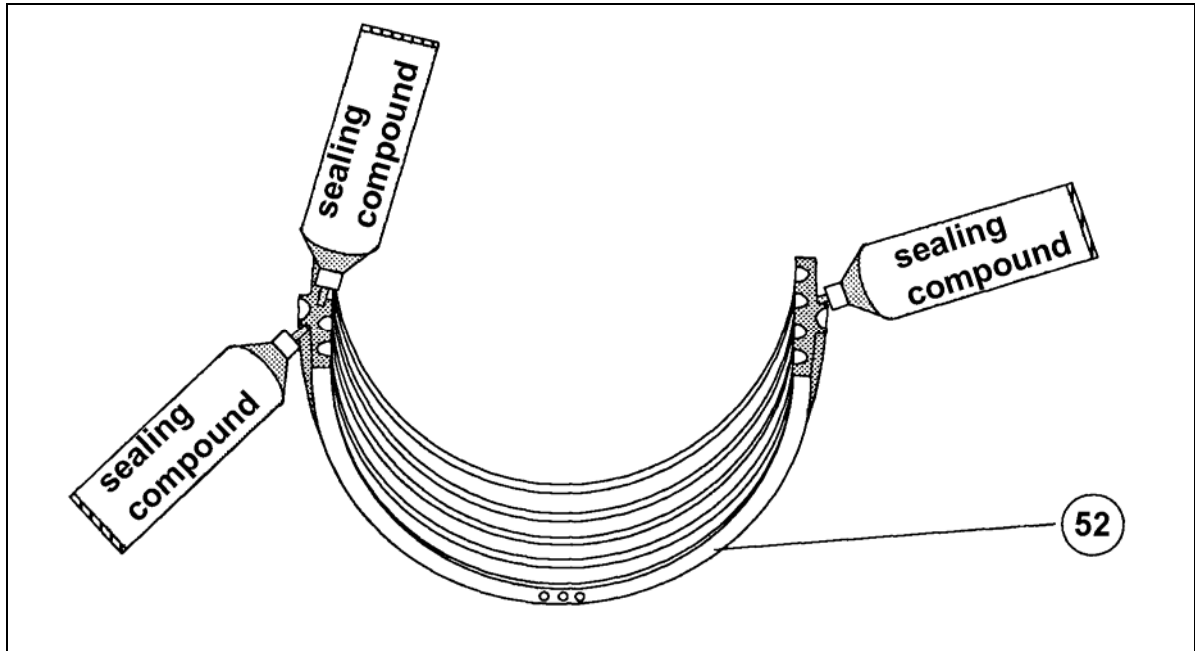


Illustration 6: Application of sealing compound to the floating labyrinth seal

Please observe the instructions for the use of sealing compound.

- Place the bottom half of the seal (52) with the labyrinths onto the shaft.
- The oil return holes at the bearing side must be clear and open.
- Turn the seal in opposite direction from the anti-rotation pin into the groove of the housing until the split lines of the bottom half of the housing and the bottom half of the seal match each other.
- Remove the residue of sealing compound.
- Push the garter spring into the integrated seal groove between the bottom half of the housing and the seal until both ends jut out from the split line.
- Place the top half of the seal with the cam facing the inside of the bearing on the bottom half of the seal.
- Stretch the garter spring till both ends can be hooked.

EM with external oil supply

4.6 Installation of the loose oil ring

- Open both split lines of the loose oil ring (44) by untightening and removing the screws (47).
Separate both halves of the loose oil ring (44) carefully without using any tools or other devices.

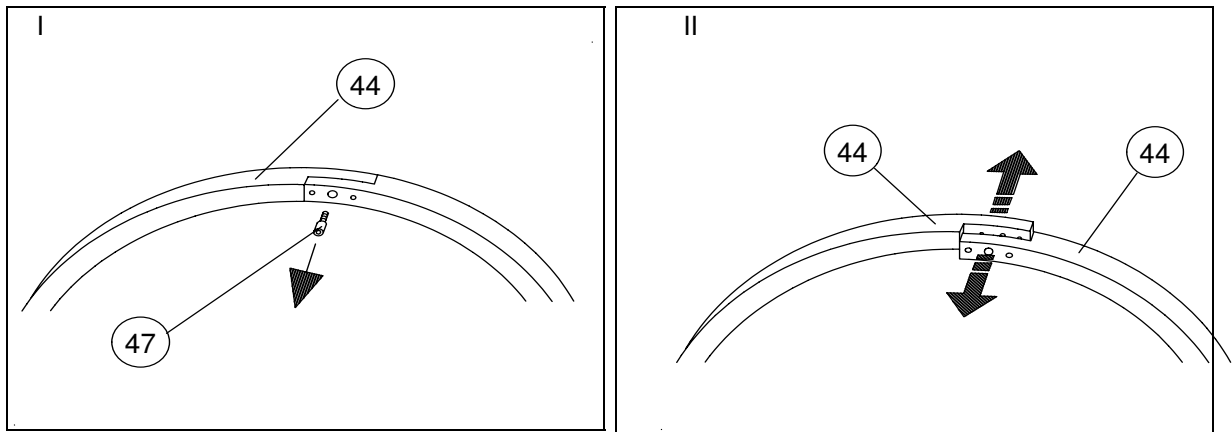


Illustration 7: Opening of the loose oil ring

- Place both halves of the loose oil ring into the shell groove encircling the shaft. Press the positioning pin (45) of each split line into the corresponding hole (46).
- Adjust both halves of the loose oil ring till the split lines match each other.

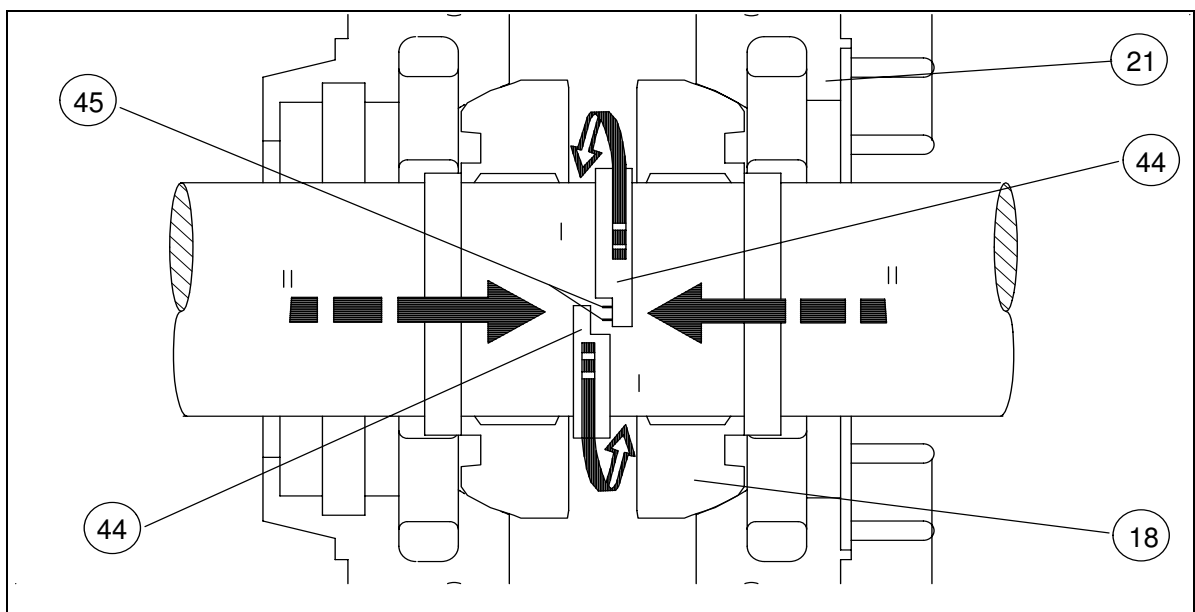


Illustration 8: Installation of the loose oil ring

- Tighten the screws (47) to the following torque rates:

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

Installation and Operation

4.7 Fitting in the top half of the shell

- Apply some lubricant to the working surfaces of the shaft. Use the same type of lubricant as indicated for bearing operation (see type plate).
- Check if the engraved number (20) on the bottom half of the shell corresponds with the engraved number (20) on the top half of the shell.
- Place the top half of the shell (11) on the shaft; both engraved numbers(20) should be on one side.

Attention!

An incorrectly placed shell could jam the shaft thus leading to the damage of both shaft and bearing.

**EM..B,
EM..K,
EM..E,
EM..A**

Attention!

Place the top half of the shell carefully on the shaft. The thrust parts of the top half of the shell should not be damaged.

insulated
bearing

In the case of bearings arranged for insulation monitoring, connect the black cable for insulation monitoring to the bearing shell.

According to the bearing type, there are two possibilities of connection.

1. The black cable is provided with a cable connector.

- Plug the cable with the cable connector into the counterpart available on the top of the shell.
- Lead the cable through the cable gland in the bottom half of the housing and out of the bearing.
- Tighten the cable gland oil-tight.

2. The black cable is provided with an eyelet.

- Fasten the cable with the eyelet to the split line of the shell, by using one of the shell joint bolts.
- Lead the cable through the cable gland in the bottom half of the housing and out of the bearing.
- Tighten the cable gland oil-tight.

- Tighten up the screw (24) at the split line of the shell to the following torque rates:

Bearing size	9	11	14	18	22	28
Torque [Nm]	8	8	20	69	69	170

- Check the split line of the bearing shell by using a feeler gauge. The split line gap should be less than 0,05 mm. If the split line is greater than this, dismantle both top (11) and bottom (18) halves of the shell. Rework the split line surfaces of the top (11) and bottom (18) half of the shell with an oil stone.

EM.L.

- Check the mobility of the loose oil ring (44).

Marine
bearings

A guide bush in the top half of the shell secures the function of the loose oil ring.

- Check the mobility of the loose oil ring (44) in the guide bush.

EM with external oil supply

EM..E

Shells with taper land faces suitable only for one direction of rotation are marked with an arrow on the top half shell, which indicates the sense of rotation of the shaft.

The arrow indicates the allowed direction of shaft rotation after completion of the bearing assembly.

- Before mounting the top half of the housing check that the proposed direction of rotation of the shaft corresponds to the direction indicated by the arrow on the top half of the shell.
- If the directions match, continue the assembly of the bearing.
- If the directions do not match, the shell must be disassembled, re-aligned and mounted again.

Attention!

A wrongly placed shell, without observance of the direction of rotation of the shaft, impairs the operational safety of the bearing.

4.8 Assembly of the top half of the housing

- Check the true alignment of the split lines of the shell (11), (18) and bottom (21) half of the housing.

EM.C. EM.L. EM.Y.

The positioning pin (8) in the top half of the housing fits in the corresponding hole (4) in the shell.

- Check if the engraved numbers (1) on the top and bottom halves of the housing correspond.
- Clean the split line surfaces of the top and bottom halves of the housing.
- Apply sealing compound over the whole surface of the split line of the bottom half (21) of the housing.

Please observe the instructions for the use of sealing compound.

- Place the top half of the housing carefully into the machine shield, without touching the seals or the bearing shell.

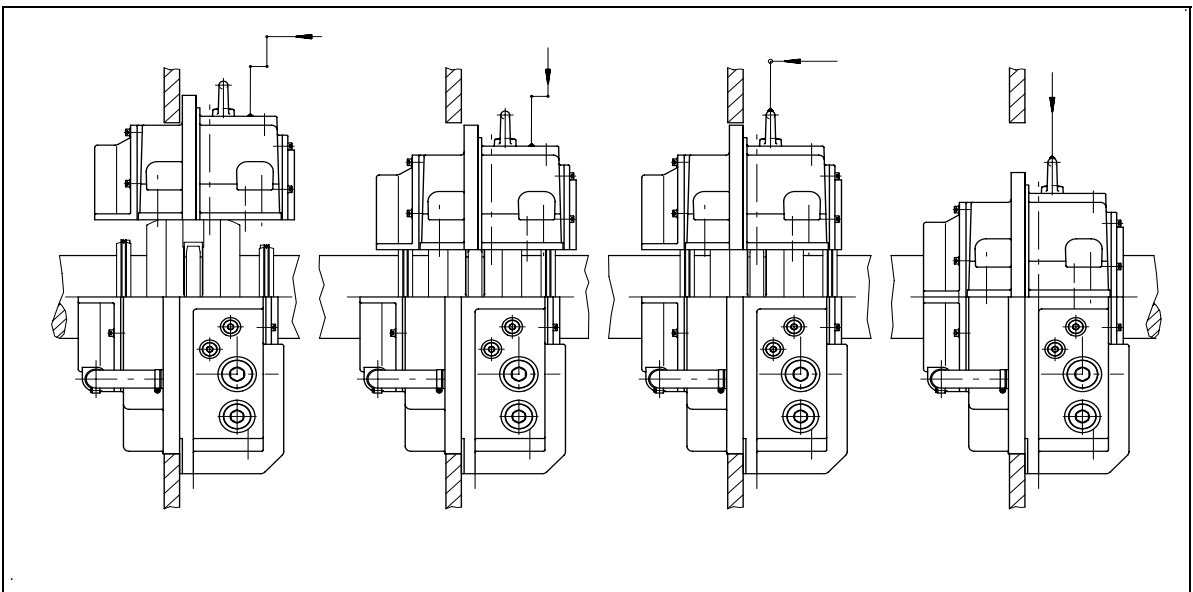


Illustration 9: Assembly of the top half of the housing

Installation and Operation

- Lower the top half of the housing (2) vertically on the bottom half of the housing (21). Lower the top half of the housing (2) till the split line of the housing is not visible any more.
- Gently hit the bottom half of the housing (21) with a nylon hammer, thus ensuring the alignment of the spherical seating.
- Insert the screws (16) at the split line of the housing. Tighten them crosswise to the following torque rates:

Bearing size	9	11	14	18	22	28
Torque [Nm]	40	69	170	330	570	1150

- Hand-tighten the screws at the split line of the machine seal.
- Unscrew the assembly device and put it back into its "parking position" behind the flange. Tighten the assembly device by using the following torque: 40 Nm.
- Replace the top sight glass and screw it hand-tight into place.
- Tighten the screw plug with the welded-on positioning pin into the top half of the housing (2).

**Size 22
and 28.**

EM.V.

insulated
bearing

Insulation monitoring

In the case of electric insulated bearings provided with insulation monitoring, the cable coming out of the bearing housing must be connected in a professional manner.

According to the type supplied, please follow the assembly instructions given below.

- The cable is very short and provided with a further cable connector at the end of it. This cable is ready for connection to the bearing housing. The bottom half of the bearing housing is provided with the counterpart.

- Plug the cable connector into the counterpart.

Attention!

This connection bypasses the electrical insulation of the bearing.
In the case of electric machines, make sure at least one bearing is electrically insulated.

To check the electrical insulation, interrupt the connection cable - bearing housing. Check the electrical resistance with a suitable measuring instrument. Make sure that both bearings and the coupling are electrically insulated.

- The cable has a free end. In this case the customer has to make the connection.

Attention!

If only one bearing is insulated, the end of the cable must not be earthed.

Any further connection depends on the customer's requirements related to the insulation monitoring and can not therefore be described here.

EM with external oil supply

5 Assembly of the Seals - Outboard Side

- Assemble the outboard side seals.
Proceed according to the seal type used.
- Floating labyrinth seal (Type 10) Chapter 5.1
- Floating labyrinth seal with dust flinger (Type 11) Chapter 5.2
- Floating labyrinth seal with baffle (Type 12) Chapter 5.3
- Rigid labyrinth seal (Type 20) Chapter 5.4
- Rigid labyrinth seal with dust flinger (Type 21) Chapter 5.5
- Rigid labyrinth seal with baffle (Type 22) Chapter 5.6

Type 10

5.1 Floating labyrinth seal (Type 10)



Warning of injury!

During assembly hold the garter spring ends securely to avoid them suddenly releasing and causing possible injury !

Check the movement of the floating labyrinth seal on the shaft.

- Put the garter spring (49) around the shaft and hook both ends into each other.
- Put both halves of the seal (52),(53) in their place on the shaft.
- Put the garter spring (49) into the groove (50).
- Turn the floating labyrinth seal on the shaft.

Attention!

The floating labyrinth seal should turn easily on the shaft. A jammed seal could lead to overheating during operation and even to shaft wear.

If the floating labyrinth seal jams,

- dismantle the seal
- remove the worn parts of the seal carefully, by using emery paper or a plain scraper.

- Dismantle the floating labyrinth seal.

Installation and Operation

- Apply a uniform layer of sealing compound to the guide surfaces and on the split line surfaces of both halves of the seal (52), (53).

Please observe the instructions for the use of sealing compound.

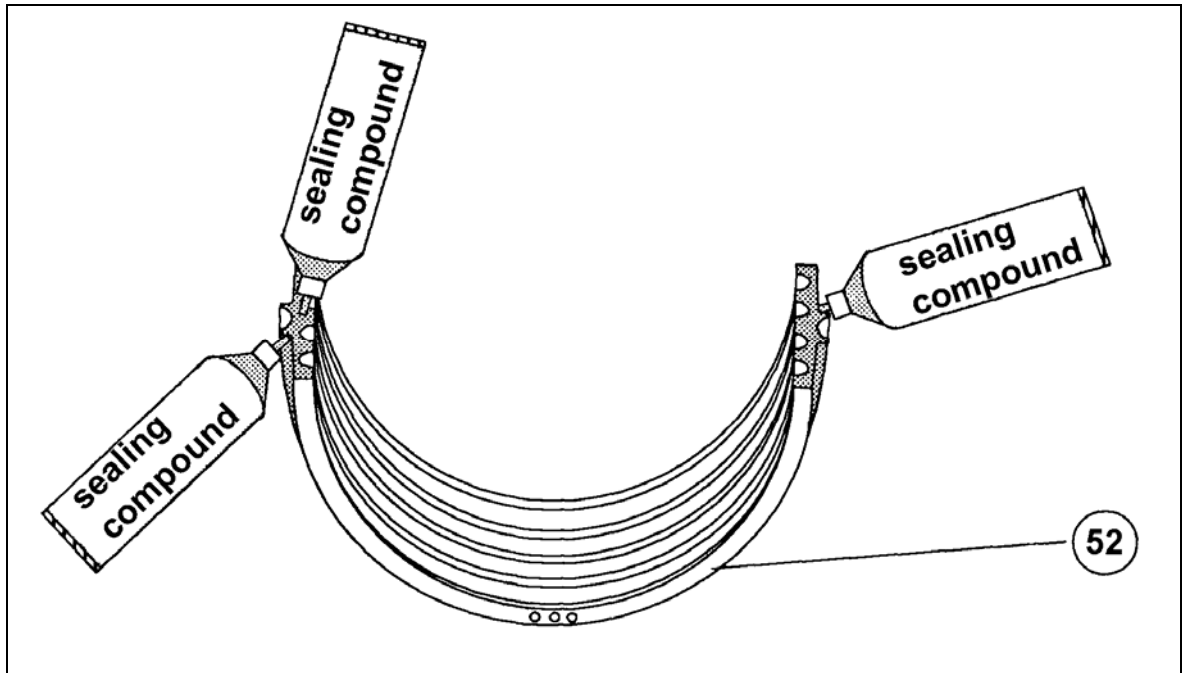


Illustration 10: Application of sealing compound to the floating labyrinth seal

- Press the bottom half of the seal (52) against the shaft.
- Place the top half of the seal (53) on the shaft and align both halves of the seal to each other.
- Place the garter spring (49) into the groove (50) and stretch until both ends can be hooked.

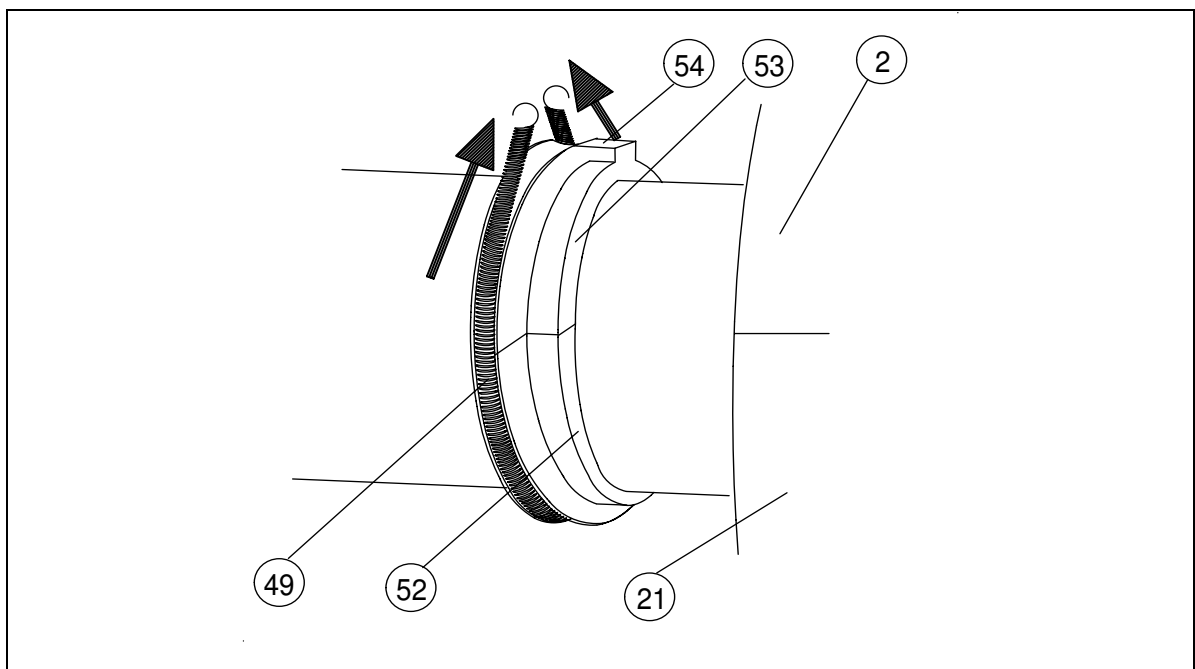


Illustration 11: Assembly of the floating labyrinth seal

EM with external oil supply

- Place in true alignment the split line of the floating labyrinth seal and the split line of the seal carrier.
- Check that both engraved numbers (56) and (58) on top and bottom halves of the seal carrier (48), (51) correspond.
- Clean the following parts:
 - the seal surfaces of the top (48) and bottom (51) half of the seal carrier (the groove of the floating labyrinth seal, the flange surfaces)
 - the split line surfaces of the top (48) and bottom half (51) of the seal carrier
 - the flange surfaces of the housing.
- Apply a uniform layer of sealing compound to:
 - the lateral surfaces of the groove at the top (48) and bottom half (51) of the seal carrier
 - the flange surfaces of the top (48) and bottom (51) half of the seal carrier
 - the split line surfaces of the bottom half of the seal carrier (51).

Please observe the instructions for the use of sealing compound.

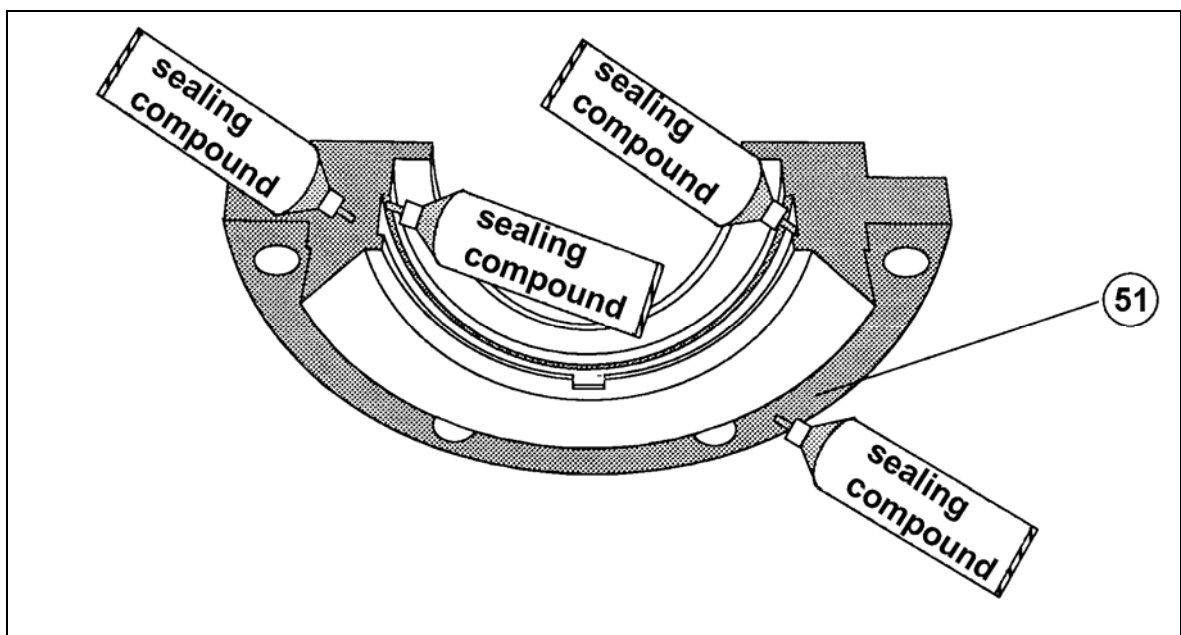


Illustration 12: Application of sealing compound on the seal carrier

Installation and Operation

- Place the top half of the seal carrier (48) on the top half of the seal (53). Press the bottom half (51) of the seal carrier against it. Push the shaft seal completely into the housing.

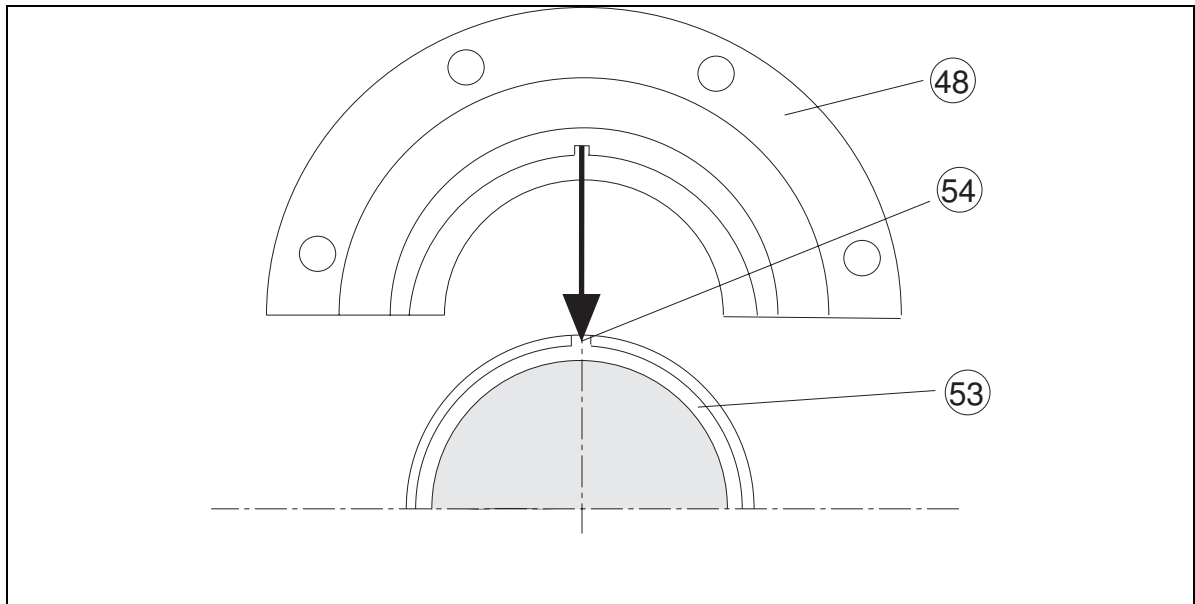


Illustration 13 Assembly of the seal carrier

- Place in true alignment the split lines of the seal carrier and the housing.
- Tighten up the screws (55) to the following torque rates:

Bearing size	9	11	14	18	22	28
Torque [Nm]	8	8	8	20	20	20

EM with external oil supply

Type11

5.2 Floating labyrinth seal with dust flinger (Type 11)

- Assemble the floating labyrinth seal with dust flinger as described in Chapter 5.1, Floating labyrinth seal type 10.
- Place both halves of the dust flinger (69) in front of the shaft seal around the shaft. Loosely screw in the screws (70) at the split line of the flinger.

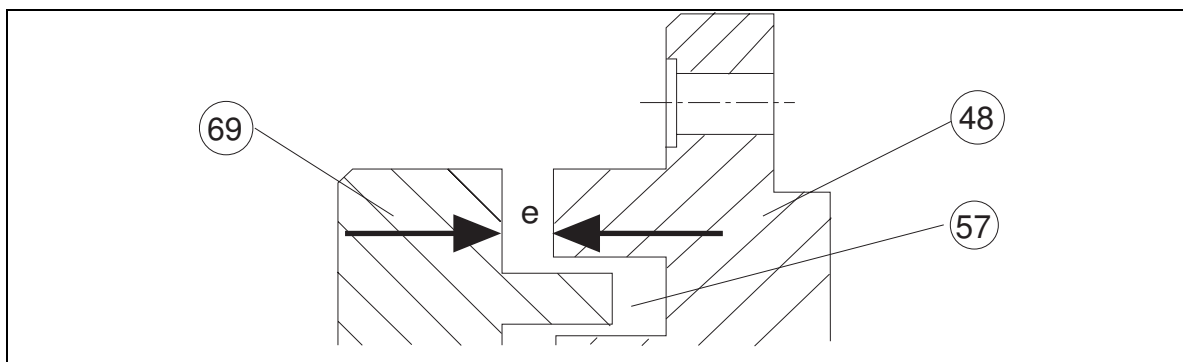


Illustration 14: Clearance between dust flinger and seal carrier

EM..Q

- Push the dust flinger (69) into the groove (57) of the seal carrier.
- Set the clearance "e" at the following figure around the whole unit:

maximum longitudinal extension of the shaft in operation + 1 mm

(Parameters indicated in the Technical Documentation of the Installation).

- Tighten up both screws (70) to the following torque rates:

Seal diameter [mm]	80-140	>140
Torque [Nm]	7	18

EM..B, EM..K, EM..E, EM..A

- Push the dust flinger (69) into the groove (57) of the seal carrier.
- Set the clearance "e" at **1 mm** around the whole unit.
- Tighten both screws (70) to the following torque rates:

Seal diameter [mm]	80-140	>140
Torque [Nm]	7	18

Installation and Operation

Type 12

5.3 Floating labyrinth seal with baffle (Type 12)

- Assemble the floating labyrinth seal with baffle as described in Chapter 5.1, type10.
- Apply a uniform layer of sealing compound to the flange surfaces of the top half (66) and bottom half (68) of the baffle.
- Screw
 - the top half of the baffle (66) onto top half of the seal carrier (48)
 - the bottom half of the baffle (68) onto bottom half of the seal carrier (51).
- Tighten the screws (67) to the following torque rates:

Seal diameter [mm]	80-140	>140
Torque [Nm]	4	10

Type 20

5.4 Rigid labyrinth seal (Type 20)

- Check if the engraved numbers (64) and (65) on the bottom half (63) and top half (59) of the rigid labyrinth seal correspond.
- Clean
 - the flange surfaces of the top half (59) and bottom half (63) of the rigid labyrinth seal
 - the split line surfaces of the top half (59) and bottom half (63) of the rigid labyrinth seal
 - the flange surfaces of the housing.
- Apply a uniform layer of sealing compound to the following parts:
 - the flange surfaces of the top (59) and bottom half (63) of the rigid labyrinth seal
 - the split lines of the bottom half (63) of the rigid labyrinth seal.

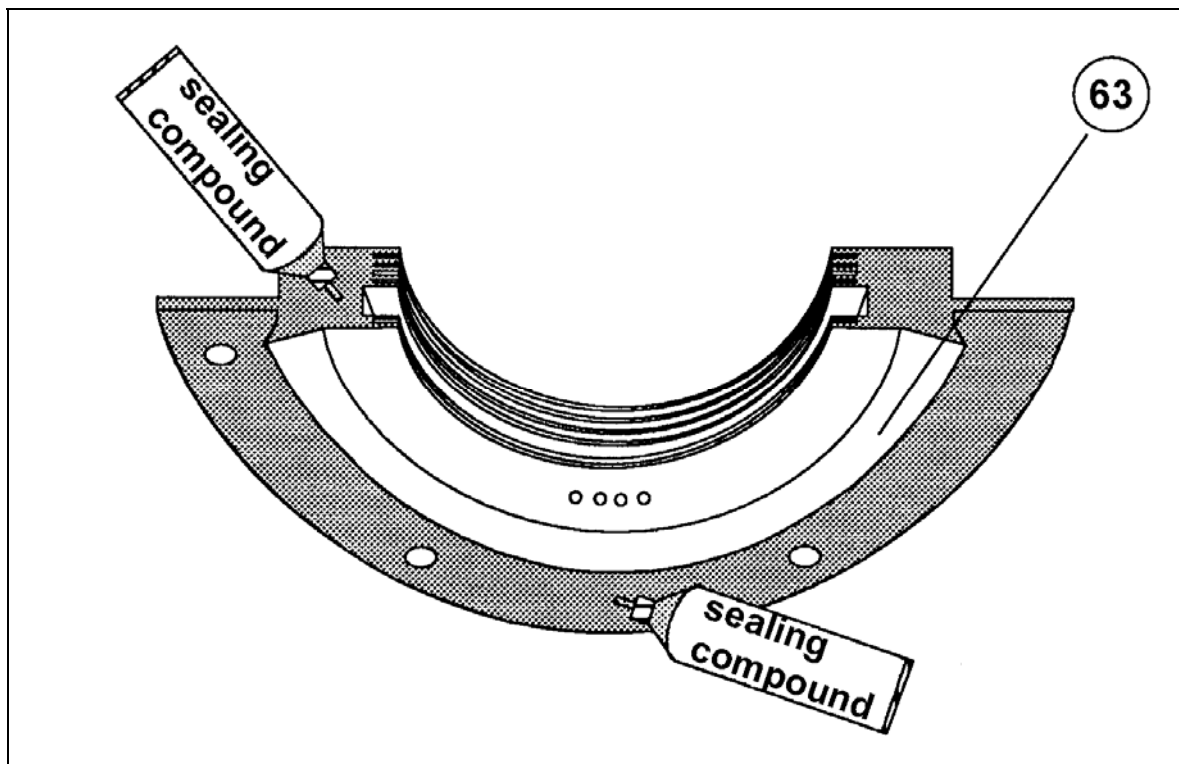


Illustration 15: Application of sealing compound to the rigid labyrinth seal

EM with external oil supply

- Place the top half (59) of the rigid labyrinth seal on the shaft and press slightly the bottom half (63) of the rigid labyrinth seal from below against it. Lightly push the rigid labyrinth seal completely into the housing.
- Tighten the screws (61) at the labyrinth seal split line.
- Place in parallel alignment the split line of the rigid labyrinth seal and the split line of the housing. Press the rigid labyrinth seal slightly from below against the shaft. Adjust the rigid labyrinth seal in such a way that the clearance "f" between the shaft and the rigid labyrinth seal at both split lines has the same figure.

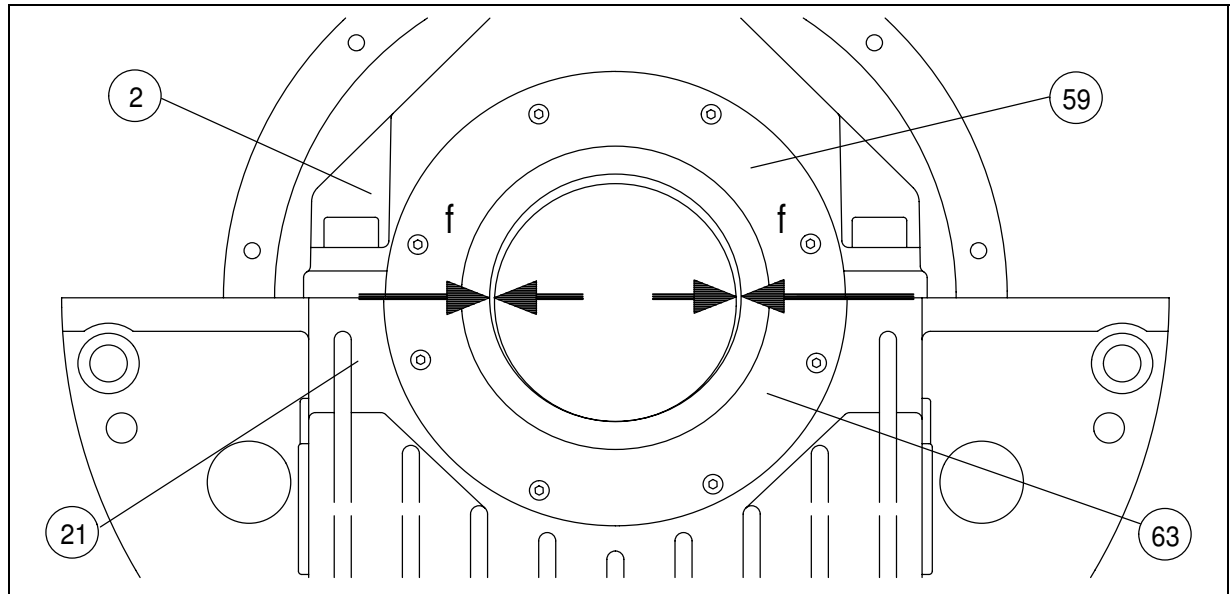


Illustration 16: Alignment of the rigid labyrinth seal

- Tighten the screws (60) to the following torque rates:

Bearing size	9	11	14	18	22	28
Torque [Nm]	8	8	8	20	20	20

Installation and Operation

Type 21

5.5 Rigid labyrinth seal with dust flinger (Type 21)

- Assemble the rigid labyrinth seal with dust flinger as described in Chapter 5.4, type 20.
- Place both halves of the dust flinger (69) round the shaft, in front of the rigid labyrinth seal. Mount both screws (70) at the split line loose.

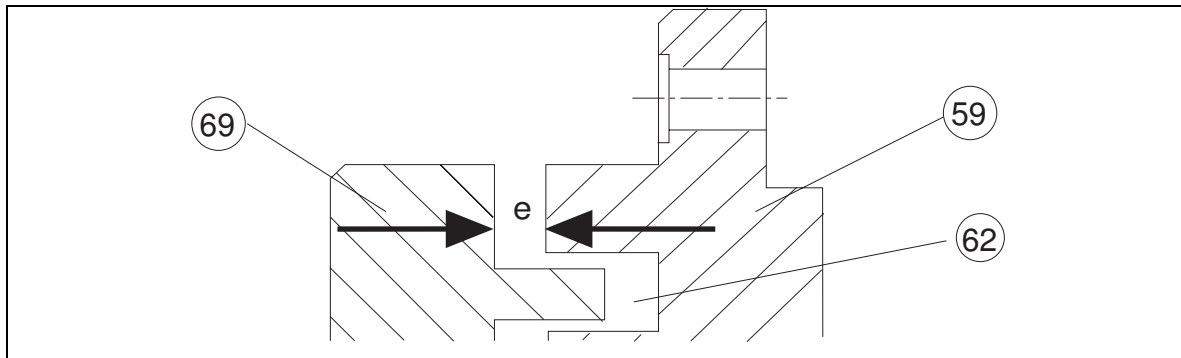


Illustration 17: Clearance between dust flinger and rigid labyrinth seal

EM..Q

- Push the dust flinger (69) into the groove (62) of the rigid labyrinth seal.
- Set the clearance "e" at the following figure around the whole unit.

maximum longitudinal extension of the shaft in operation + 1 mm

(Parameters are indicated in the Technical Documentation of the Installation).

- Tighten both screws (70) to the following torque rates:

Seal diameter [mm]	80-140	>140
Torque [Nm]	7	18

EM..B, EM..K, EM..E, EM..A

- Push the dust flinger (69) into the groove (62) of the rigid labyrinth seal.
- Set the clearance "e" at **1 mm** around the whole unit.
- Tighten both screws (70) to the following torque rates:

Seal diameter [mm]	80-140	>140
Torque [Nm]	7	18

EM with external oil supply

Type 22

5.6 Rigid labyrinth seal with baffle (Type 22)

- Assemble the rigid seal with baffle as described in Chapter 5.4, type 20.
- Apply a uniform layer of sealing compound on the flange surfaces of the top half (66) and bottom half (68) of the baffle.
- Screw
 - the top half of the baffle (66) to the top half (59) of the rigid labyrinth seal
 - the bottom half of the baffle (68) to the bottom half (63) of the rigid labyrinth seal.
- Tighten the screws (67) to the following torque rates:

Seal diameter [mm]	80-140	>140
Torque [Nm]	4	10

Installation and Operation

6 Instructions for Assembly of Peripheral Equipment

6.1 Assembly of the oil supply equipment

The oil supply equipment together with the pressure, temperature and flow measuring instruments are usually provided by the user. The oil quantity and viscosity necessary for the operation of the bearing are specified in the bearing calculations. This manual contains only indications on the connection points with the bearing. The connection bores for the oil inlets in-and outlets are on both lateral sides of the bearing, closed with screw plugs. Remove only those plugs where pipes are to be connected.

Connection conditions

	Pipelines	Flow speed	Indications
Inlet	Precision steel pipe DIN 2391 Steel pipe DIN 2448	about 1,5 m/s	Place the throttle valve in the inlet pipeline directly in front of the bearing
Outlet	Steel pipe DIN 2448	max. 0,15 m/s	15° inclination - if 15° inclination is not possible enlarge correspondingly the cross sections of the pipeline directly behind the bearing. Too low inclination or / and too small cross-section lead to oil back pressure in the bearing. Leakage or overflowing are the consequences.

- Before starting assembly pickle all pipes which
 - have been welded
 - have been bent hot
 - are contaminated and rusty inside.



Warning of injury!

Please observe the instructions for the use of the pickling fluid. Wear rubber gloves, rubber apron, rubber boots and safety glasses.

EM with external oil supply

Rinsing of the oil circuit

- Rinse the whole oil circuit to remove all impurities. **The bearing must not be connected to the oil circuit during rinsing operations.** The rinsing should be done before connecting the oil supply to the bearing or the bearing should be disconnected from the oil circuit. If this is not possible, dismantle the top half of the housing and remove the shells.

To avoid damage to the fittings:

- Remove all measuring and switching fittings.
- Close all connections (see also the Technical Documentation of the Installation).
- Fill up the oil supply system with lubricant. Use the type with the viscosity indicated on the bearing type plate.
- Start operating the oil supply system. Collect the first charge of high contaminated oil separately. Continue rinsing until the lubricant contains no impurities.
- Drain off the oil supply system completely. Clean the oil tank and the filters.

Warning of environmental pollution!

Please observe the instructions for the use of the lubricant. The manufacturer could provide information on waste oil disposal.

- Assemble all fittings.

Oil inlet

- Connect the inlet pipe at the connection hole (28) for the oil inlet. Seal with Teflon tape or liquid sealing compound.

Depending on the bearing size, the connection hole has the following threads:

Bearing size	9	11	14	18	22	28
Connection hole / Oil inlet (28)	G 3/8	G 3/8	G 3/8	G 1/2	G 3/4	G 3/4

If the bearing calculation specifies a separate supply source for the thrust parts:

- connect the inlet pipes to the connection hole of the thrust part supply (3) on the lateral side of the bearing. Seal with Teflon tape or liquid sealing compound.

Installation and Operation

Oil outlet

**EMZ...
EMX..**

- Screw the oil outlet with special nut and lead sealing ring (35) into the oil outlet connection hole (34) . Connect the oil outlet pipe to the flange.
Depending on the bearing size the connection hole for the oil outlet (35) has the following standard threads (larger threads are possible):

Bearing size	9	11	14	18	22	28
Connection hole for oil outlet (35)	G 1 1/4	G 1 1/4	G 1 1/2	G 1 1/2	G 2	G 2 1/2

EM.L.

- Screw the oil outlet with special nut and lead sealing ring (35) into the corresponding hole (34) with the marking at top dead centre. The spillover oil weir then ensures the minimum oil level for the emergency lubrication by means of the loose oil ring. Connect the oil outlet pipe to the flange.

**EMU...
EMT..**

- Screw in the outlet pipe to the selected oil sump temperature measurement connection hole (29) and seal with Teflon tape or liquid sealing compound. The slide bearing type EM is provided with a tapped hole (G11/4) on both sides for the installation of an oil cooler and oil sump thermometer. Use an adapter with the necessary thread to connect suction pipes or oil sump thermometers.

6.2 Temperature measurement

- Fix suitable thermo sensors:
 - into one of the tapped holes (27) for temperature measurements of the journal parts
 - into one of the tapped holes (29) for temperature measurements of the oil sump
 - into one of the tapped holes (optional) for temperature measurement of the thrust parts.

Proceed as follows:

- Take out the screw plugs from the connection holes.
- Place the thermo sensor into the bore by using Teflon tape or sealing compound.
- Connect the thermo sensor at the temperature monitoring equipment of the installation (see the Technical Documentation of the Installation for connecting and adjustment).

EMT..

6.3 Water supply

Following requirements should be observed before connecting the oil cooler (31):

- water velocity of maximum 1,5 m/s in the cooling water inlet
- water pressure of maximum 5 bar
- adjusting tap on inlet
- outlet of cooling water under no pressure.

The direction of the cooling water passage in the oil cooler (31) is arbitrary.

6.4 Closing of the assembly opening

After completed bearing assembly and before starting operation close the assembly opening of the machine shield (with the thin metal plate (5)).

EM with external oil supply

7 Bearing Insulation

These bearings are delivered insulated. The electrical insulation is assured by:

- plastic coating of the spherical seatings (26)
- shaft seals made out of non-conducting materials
- insulated positioning pin (8)
- insulated screwed connections for thermometers.

It is not necessary to insulate the pipelines.

- Mark the insulated bearing with the delivered plate "Insulated bearing shells". Install the plate in a visible place by using two grooved drive studs.

8 Operation

8.1 Filling up with lubricating oil

Attention!

Make sure that no impurities get into the bearing.

- Tighten all screw plugs in the connection holes (27), (28), (32), (34) to the necessary torque rates:

Screw plug threads	G 3/8	G 1/2	G 3/4	G 1	G 1 1/4	G 1 1/2	G 2	G 2 1/2
Torque [Nm] for plugs with injection-moulded plastic sealing ring	30	40	60	110	160	230	320	500
Torque [Nm] for plugs with flexible sealing ring	34	60	85	130	240	300	330	410

- Check that:
 - the top sight glass (9) is tight, the screws should be hand-tight.
- Retighten the screws for oil inlet and outlet, and for the thrust parts (if existing). The necessary torque rates depend on the screw connections used.

In case thermo sensor or/and oil sump thermometer are used:

- Check if they are tight (according the the manufacturer's instructions).
- Fill up the oil supply system with lubricant. Use a lubricant with a viscosity as indicated for the specific bearing operation.
- Start operating the oil supply system in order to fill the bearing with lubricant.
- Remove the protective layer from the top sight glass (9). Continue as already mentioned above.

**EM.C.,
EM.L.,
EM.Y.**

Installation and Operation

8.2 Trial run

- Before the trial run, check the following:
 - the way the oil supply system functions (see also the Technical Documentation of the Installation).The lubricant quantity at the bearing oil inlet must correspond to the values indicated in the EDP-calculations.
 - if the temperature monitoring equipment works.
 - if the water cooling installation works.

EMT..

Attention!

Not enough lubricant leads to

- ☐ temperature rises and thus damage of the bearing.

Too much lubricant leads to

- ☐ leakages.

The bearing is ready for operation.

- Supervise the bearing during the trial run (5-10 operating hours).
Pay special attention to:
 - the way the oil supply installation works (necessary lubricant quantity, lubricant temperature, lubricant pressure before entering the bearing)
 - bearing temperature
 - sliding noises of the shaft seals
 - tightness
 - occurrence of inadmissible vibrations.

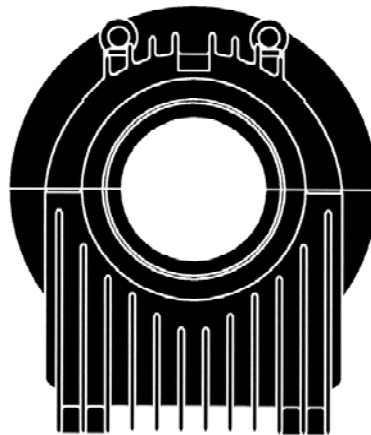
Attention!

If the bearing temperature exceeds the calculated value by 15 K (see bearing calculation) stop the installation immediately. Carry out an inspection of the bearing as described under Instructions for Service and Inspection of the Slide Bearings Type EM with External Oil Supply.

EM with external oil supply

9 Glossary

Baffle	With bearing types 10 and 20 the baffles are assembled externally in front of the shaft seals. The baffle, made of reinforced polyamide, protects the bearing from dust and water.
Rigid labyrinth seal	The rigid labyrinth seal (type 20) is used with slide bearings type E with high oil throughput. It corresponds to the protective system IP44 and is made of an aluminium alloy. The rigid labyrinth seal is built of two halves, flanged at the housing. The labyrinths that wipe out the lubricant are arranged into two groups. The first two labyrinths, installed inside keep back most of the lubricant. Five further labyrinths protect the bearing from outside. They prevent the lubricant overflow and the ingress of impurities. The overflow lubricant is collected into a chamber between the both groups of labyrinths. Through the return bores the lubricant flows back into the bearing.
Spherical seating	The spherical seating is a special feature enabling the alignment of the shell in the housing. The shell is seated on two spherical seatings. The advantages of the spherical seating are: • easy at assembly • good heat transfer from the shell to the housing • suitable for such applications with high thrust or journal loads.
Dust flinger	In the case of bearing types 10 and 20 a light alloy ring is clamped on the shaft in front of the shaft. This ring fits into a groove in the seal carrier or the rigid labyrinth seal, thus building a labyrinth. The labyrinth protects the shaft exit against low pressure that could otherwise "absorb" the lubricant. Low pressure occurs for instance in the case of rotating discs, such as couplings or cooling discs.
Floating labyrinth seal	The floating labyrinth seal (type 10) in the seal carrier is used as a shaft seal in the case of bearings type E operating under normal conditions. It prevents the lubricant and lubricant mist coming out and the ingress of impurities. The floating seal has a high capacity of resistance to wear. It is made of a high-performance, high temperature stability and electrically insulated plastic material. The floating seal consists of two halves held together by a garter spring. Both ends of the spring are hooked together. In the case of slide bearings type EM the floating seal is mounted into a two-piece seal carrier. The groove allows for radial movement of up to 1 mm. The seal is thus insensitive to shaft radial displacement or deflection. The sealing effect is produced by the baffles wiping off the lubricant from the shaft. The lubricant flows back into the bearing via oil return opening.
Machine seal	In the case of the flange mounted bearings, the machine seal reduces the influence of positive and negative pressure in the machine thus preventing leakages at the inner seal area. The space between the machine seal and the bearing housing must always be vented to atmospheric pressure. The size of the gap between shaft and machine seal influences the sealing effect.



Slide Bearings Type EF with external oil supply

Maintenance and Inspection



RENK AKTIENGESELLSCHAFT
Werk Hannover
Weltausstellungsallee 21
D - 30539 Hannover
Telephone: (0511) 8601-0
Telefax: (0511) 8601-266
e-mail: gleitlager.hannover@renk-ag.com
<http://www.renk.de>

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EF with external oil supply

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EF with external oil supply

Bearing Coding

Maintenance and Inspection

①	②	③	④	⑤	⑥	
Type	Housing	Heat Dissipation	Shape of Bore and Type of Lubrication	Thrust part	Size - Diameter	
E	F - flange mounted bearing	Z - lubrication by oil circulation with external oil cooling	C - plain cylindrical bore without oil ring	Q - without thrust part (non locating bearing)	9	80≤D≤100
		X - lubrication by oil circulation with external oil cooling when oil throughput is high	L - plain cylindrical bore with loose oil ring	B - plain sliding surfaces (locating bearing)	11	100≤D≤125
					14	125≤D≤160
		U - circulating pump and natural cooling	Y - two-lobe bore ("lemon bore") without oil ring	E - taper land faces for one sense of rotation (locating bearing)	18	160≤D≤200
					22	200≤D≤250
		T - circulating pump and water cooling (finned cooler in oil sump)	V - four-lobe bore without oil ring	K - taper land faces for both senses of rotation (locating bearing)	28	250≤D≤315
			A - elastically supported circular tilting pads (locating bearing)			

Example for bearing coding:

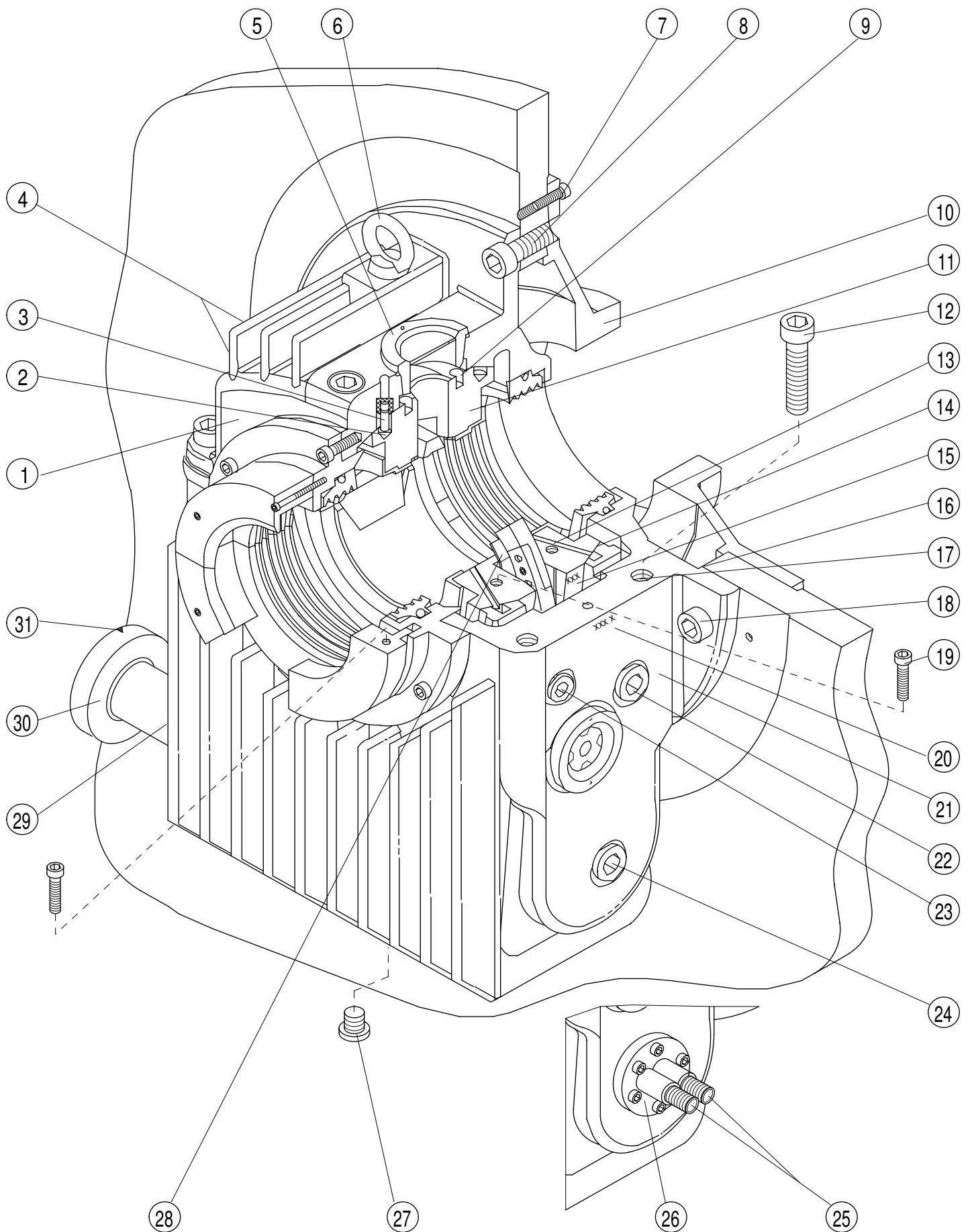
①	②	③	④	⑤	⑥
E	F	Z	L	K	22-200

Type E slide bearing with flanged mounted housing, lubrication by oil circulation with external oil cooling, plain cylindrical bore with loose oil ring, locating bearing with taper land faces, size 22, diameter 200.

Shaft seals

- Type 10 - floating labyrinth seal (IP 44)
- Type 11 - floating labyrinth seal with dust flinger (IP 54)
- Type 12 - floating labyrinth seal with baffle (IP 55)
- Type 20 - rigid labyrinth seal (IP 44)
- Type 21 - rigid labyrinth seal with dust flinger (IP 54)
- Type 22 - rigid labyrinth seal with baffle (IP 55)

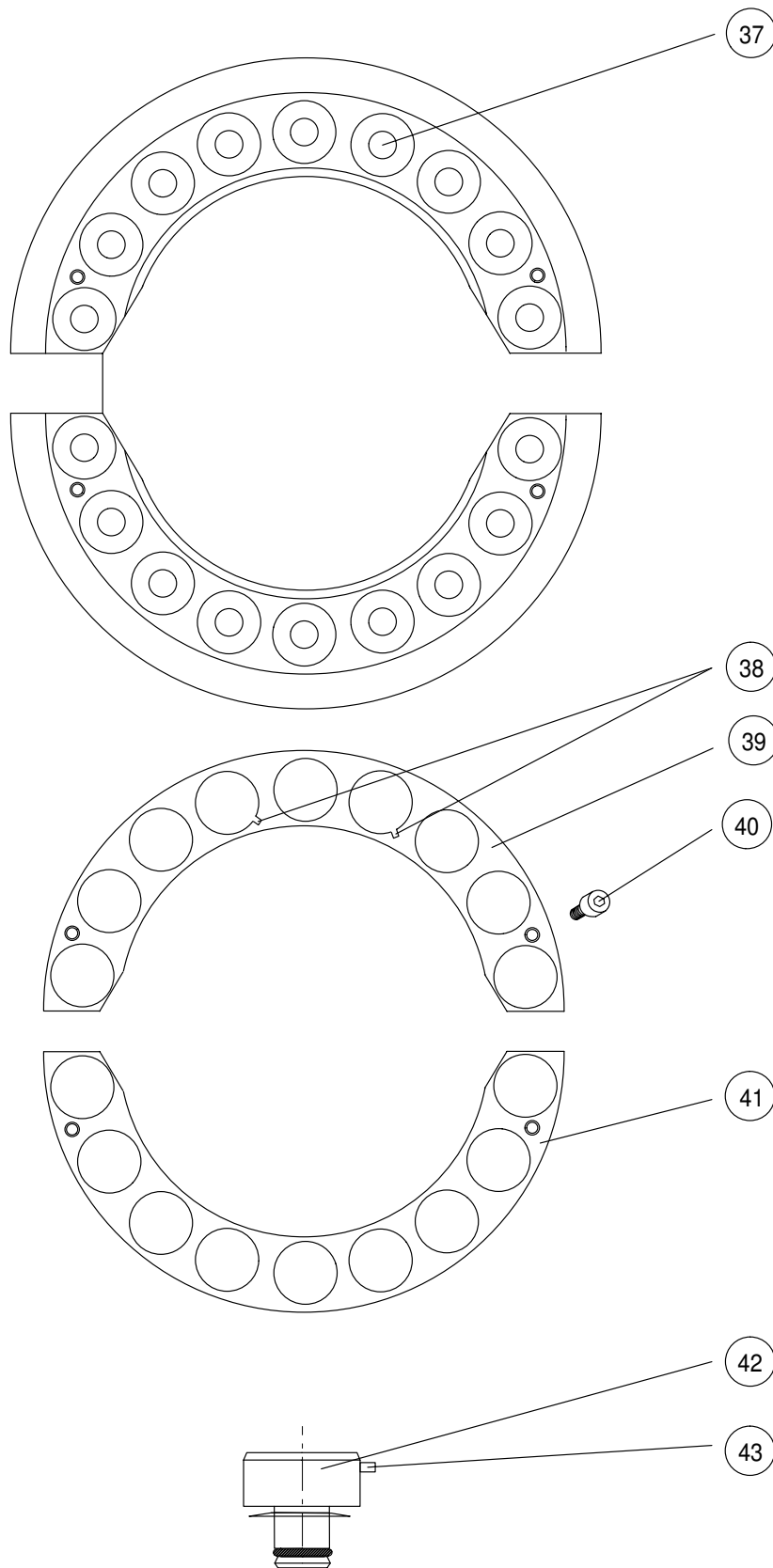
General Drawing of the
EF Slide Bearing
with external oil supply



- 1 Top half of the housing
- 2 Hole for positioning pin
- 3 Positioning pin
- 4 Connection hole for the oil supply of the thrust part
- 5 Top sight glass
- 6 Eye bolt
- 7 Screw (not included in delivery)
- 8 Screw
- 9 Tapped hole (in the top and bottom halves of the shell, up size 14)
- 10 Machine seal
- 11 Top half of the shell
- 12 Screw (split line of the housing)
- 13 Bottom half of the shell
- 14 Spherical seating
- 15 Engraved number - shell
- 16 Spigot
- 17 Tapped hole
- 18 Screw (not included in delivery)
- 19 Screw (split line of the shell)
- 20 Engraved numbers - housing
- 21 Bottom half of the housing
- 22 Tapped hole for temperature measurement of the journal part
- 23 Oil inlet connection hole
- 24 Tapped hole for the oil sump temperature measurement
- 25 Outlet/Inlet cooling water (Type E.T..)
- 26 Cooler (Type E.T..)
- 27 Hexagon head plug (Oil drain plug)
- 28 Metal tabs (optional for EFZL.)
- 29 Oil outlet connection hole
- 30 Oil outlet pipe with lock nut and lead seal
- 31 Marking

external oil supply

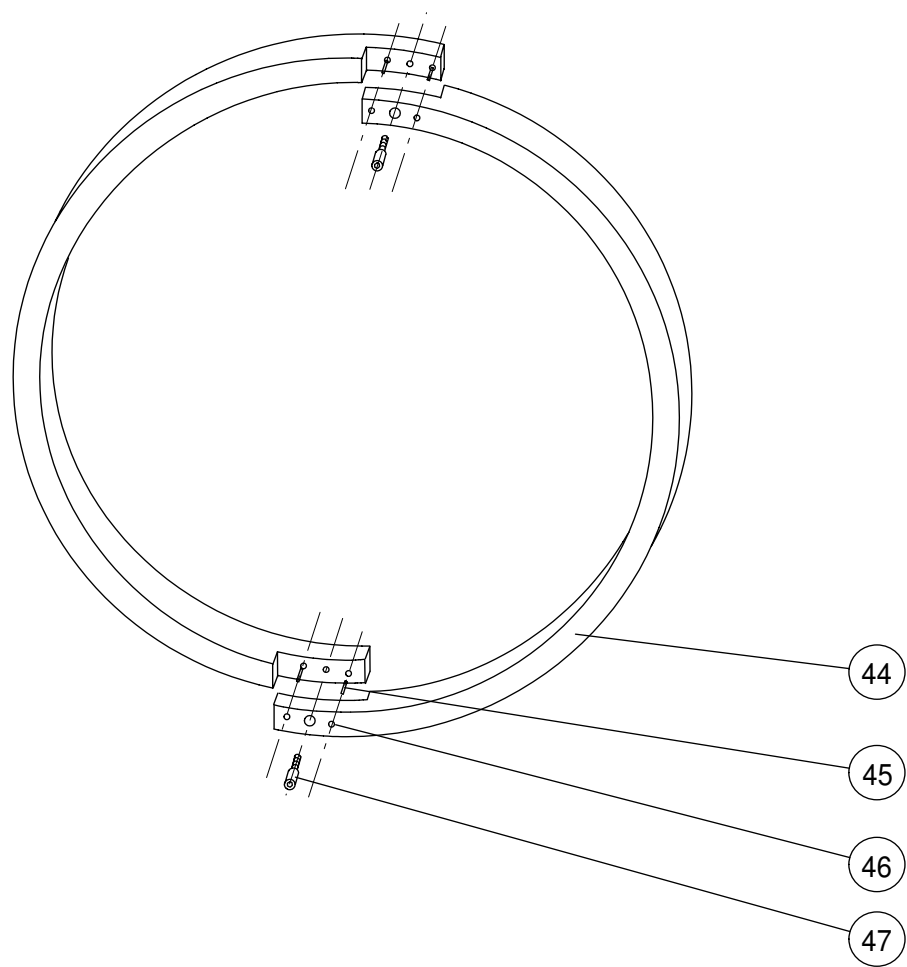
**General Drawing of the
Thrust Part with Circular Tilting Pads
(RD-Thrust Pads)**



- 37 Carrier ring
- 38 Location groove
- 39 Shroud ring top half
- 40 Screw
- 41 Shroud ring bottom half
- 42 Circular tilting pad (RD-thrust pad)
- 43 Anti - Rotation pin

external oil supply

**General Drawing of the
Loose Oil Ring**

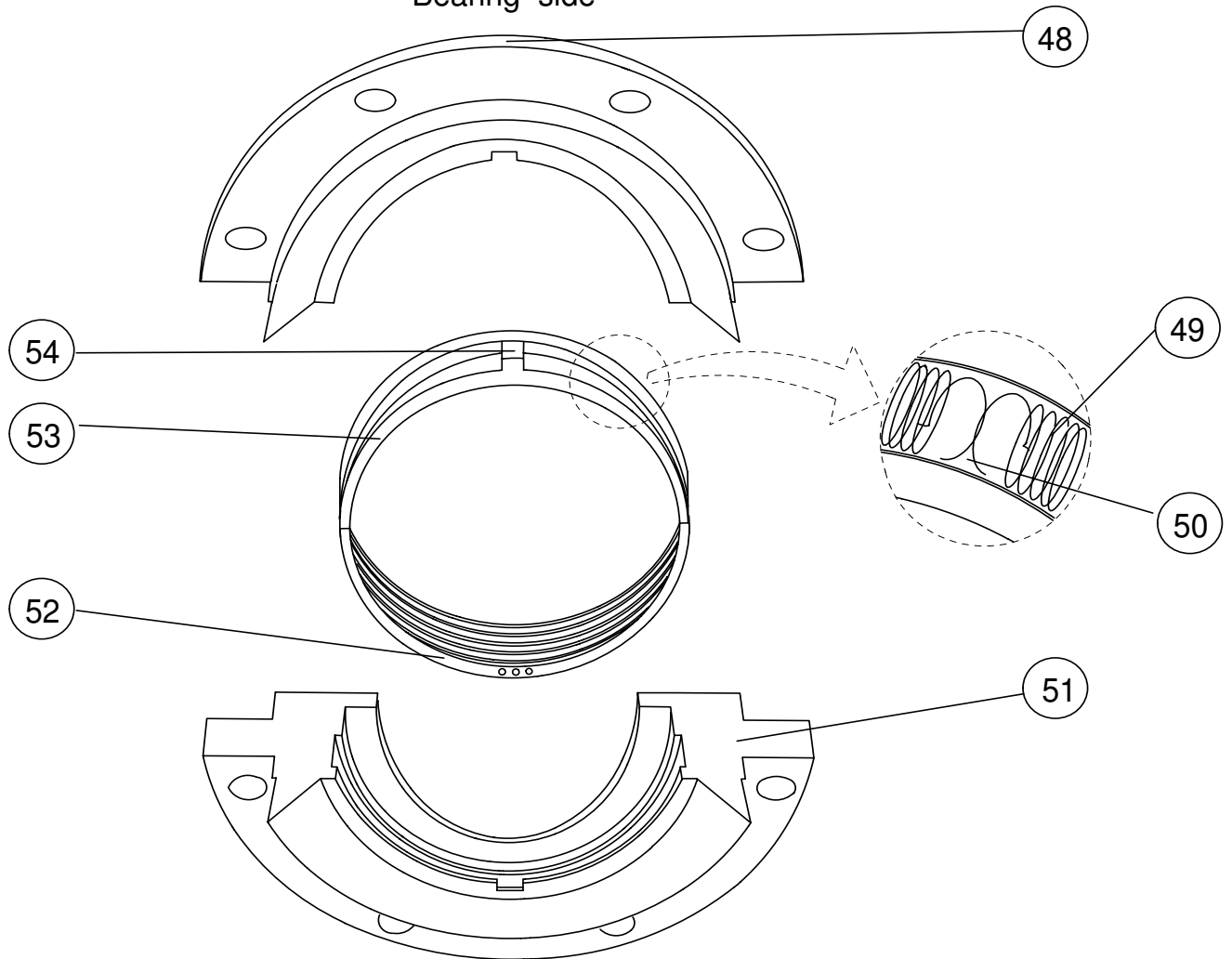


- 44 Loose Oil Ring
- 45 Dowel pin
- 46 Hole
- 47 Screw

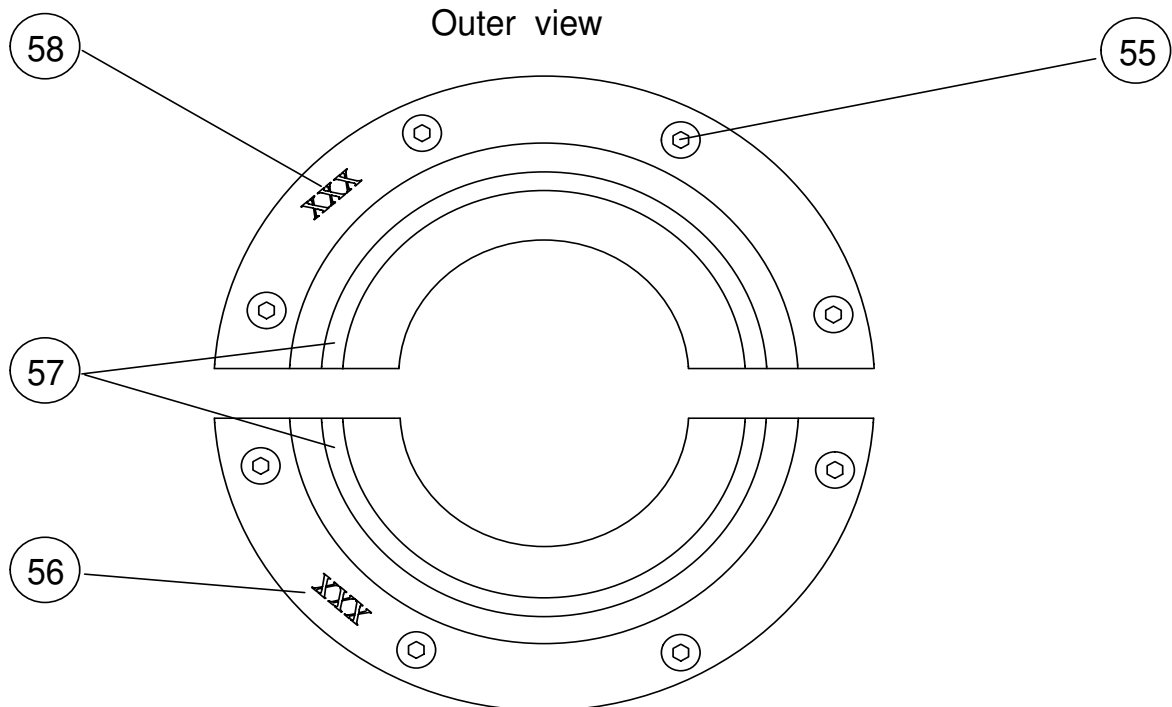
external oil supply

**General Drawing of the
Floating Labyrinth Seal
with Seal Carrier**

Bearing side



Outer view

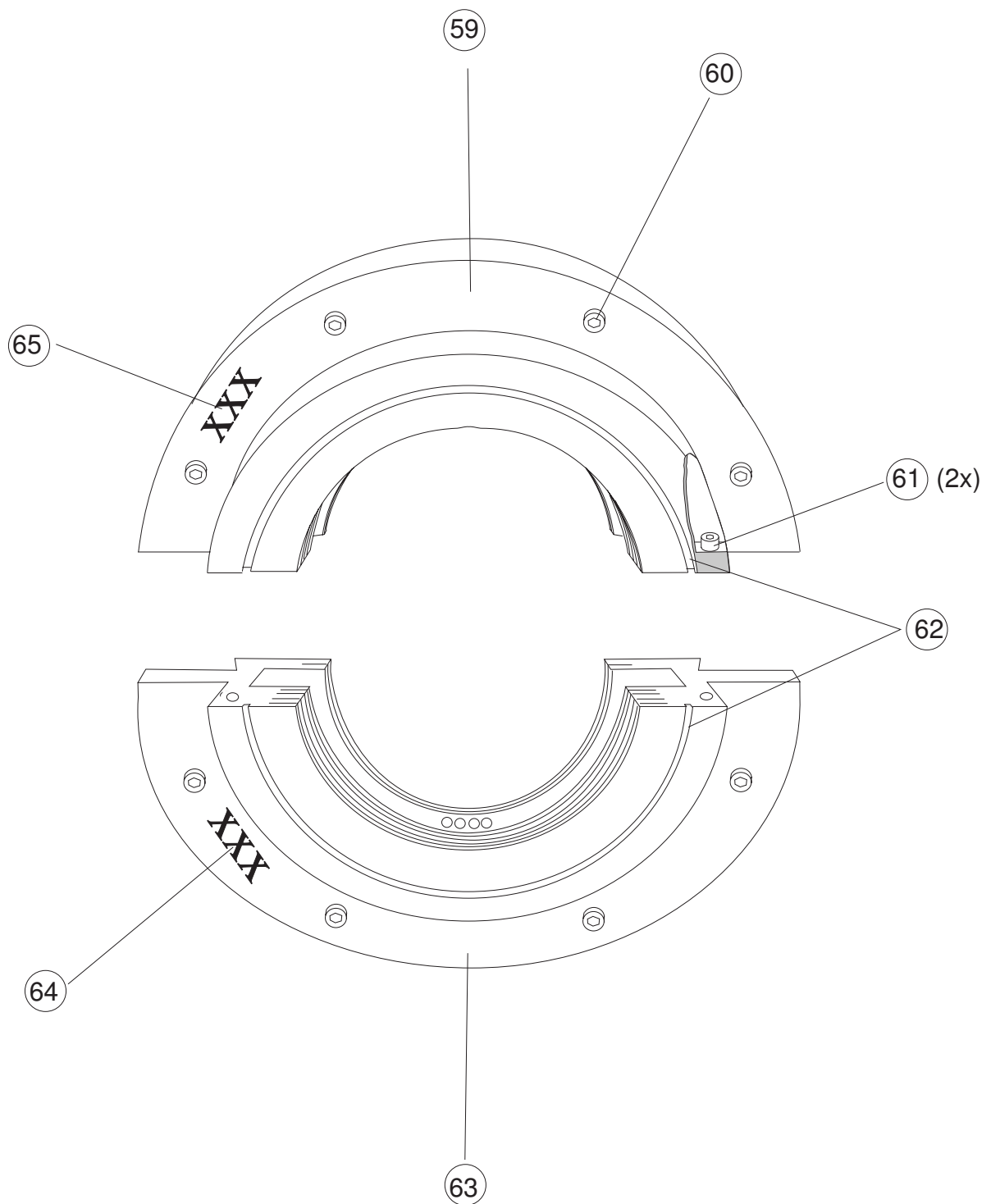


48	Seal carrier - top half
49	Garter spring
50	Groove
51	Seal carrier - bottom half
52	Bottom half of the seal
53	Top half of the seal
54	Anti - rotation pin
55	Screw
56	Engraved number
57	Groove (Type 11)
58	Engraved number

external oil supply

General drawing of the

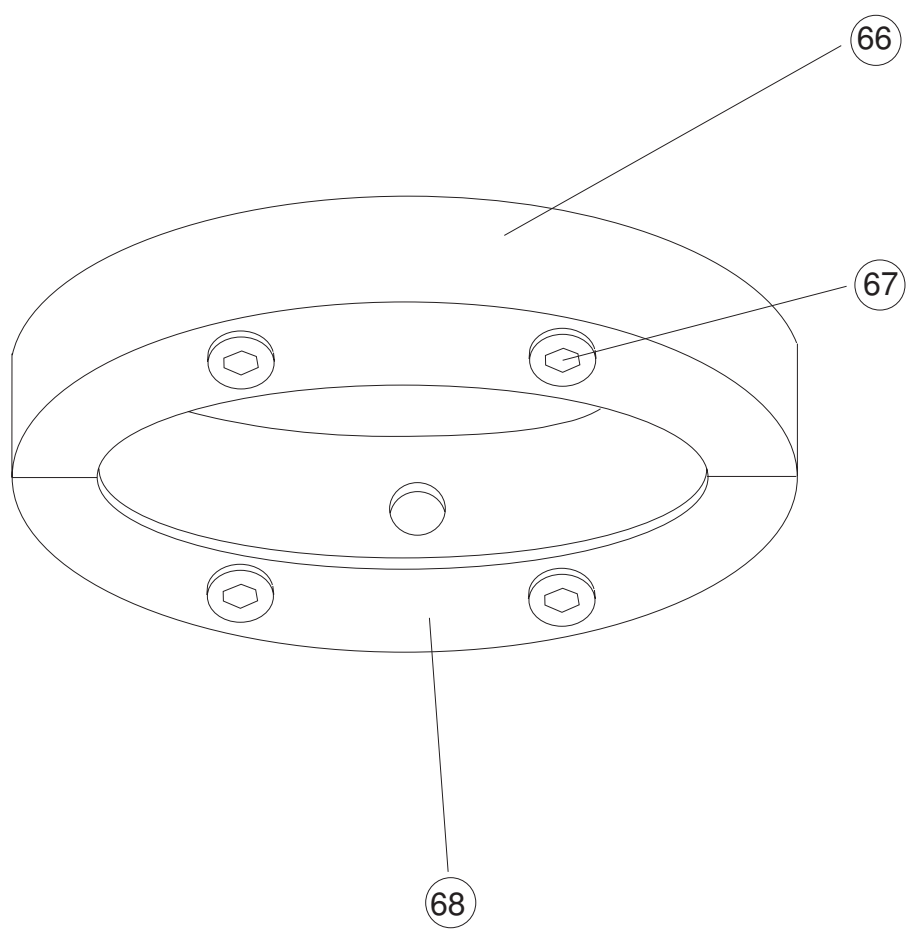
Rigid Labyrinth Seal



- 59 Rigid labyrinth seal - top half
- 60 Screw
- 61 Screw (split line)
- 62 Groove (Type 21)
- 63 Rigid labyrinth seal - bottom part
- 64 Engraved number
- 65 Engraved number

external oil supply

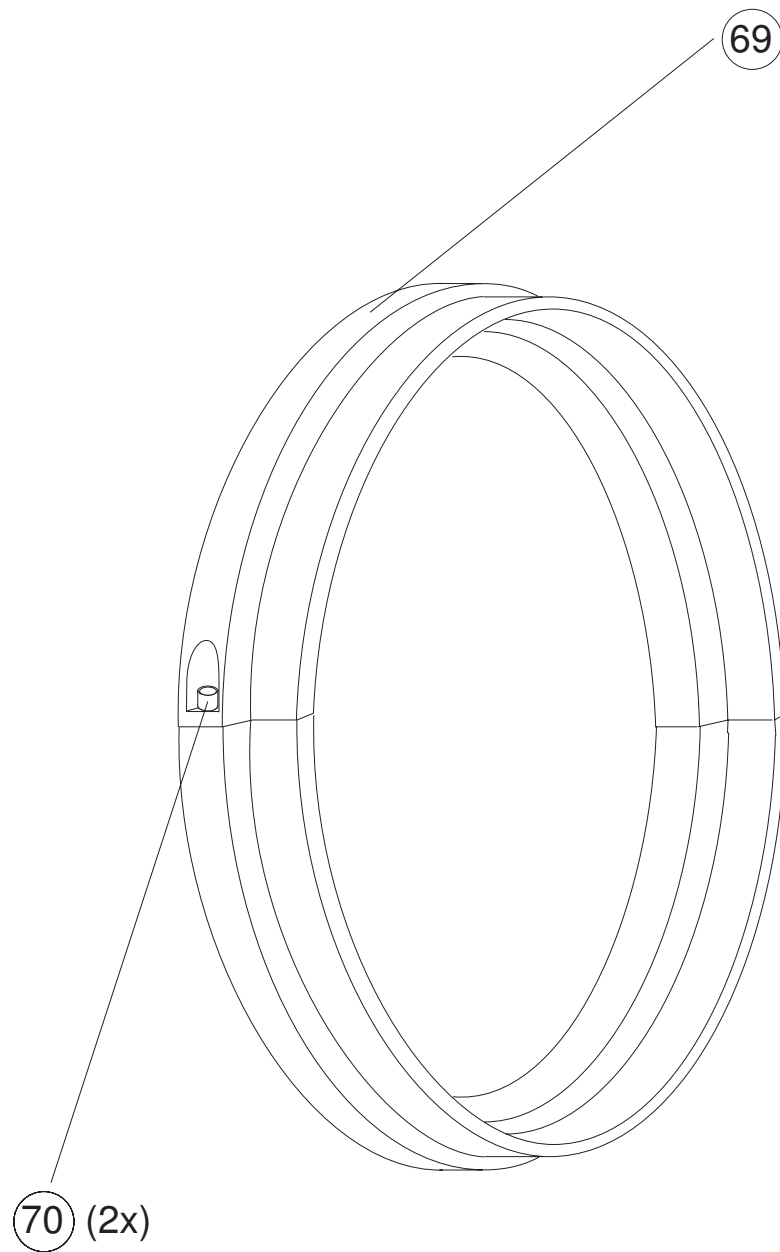
**General Drawing of the
Baffle**



- 66 Baffle - top half
- 67 Screw
- 68 Baffle - bottom half

external oil supply

**General Drawing of the
Dust Flinger**



- 69 Dust flinger
- 70 Screw (split line)

EF with external oil supply

1 Considerations for Use

The instructions for maintenance and inspection are addressed to qualified technical personnel (fitters, mechanic installers, mechanical engineers).

Read these instructions carefully before starting assembly.

Slide bearings of type EF are almost universally used in the engineering industry. Therefore it is not possible to provide detailed information on all possible types and range of applications for these bearing types. For instance, the position of the connection points for supply and monitoring equipment is determined by the place of application (in the following called " installation "). Please keep ready the guidelines with the technical documentation before starting assembly and operation of the slide bearings.

Additional technical documentation with detailed information is supplied in the case of special design bearings. Please contact RENK Export or Domestic Department for supplementary information on bearings. Please indicate the bearing coding and the full reference number, too.

Following indications should be observed when reading these instructions.

Safety instructions are marked as follows:



Danger!

Warning of dangers for personnel.

Example: Warning of injury

Attention!

Warning of damage for the bearing or installation.

Useful recommendations and additional information are framed.

EF..Q

This is how chapters, instructions or recommendations are marked when referring to a single type or size of a bearing.

Example: Slide bearing type EF without thrust part (non-locating bearing)

- Instruction follows.
- Beginning of an enumeration.
- () This is how the different parts of a bearing as described in the general drawings (numbers) are marked in the text.
- Use the enclosed check-list before starting assembly or operation. Copies available on request.
- The check list provides the experienced mechanical fitters of RENK bearings with the necessary instructions for installation and operation.

Maintenance and Inspection

2 Safety Instructions



Danger!

The maintenance and inspection of the slide bearings should be carried out by:

- persons nominated by the safety representative
- persons correspondingly trained and instructed
- persons with knowledge on appropriate standards, regulations and accident prevention rules
- persons with knowledge on first-aid measures and local rescue centres.



Warning of injury!

Before starting work on the bearing:

- Switch off the installation.
- Make sure the installation is not in operation.

Never lift or transport machines, etc. by the bearing eye bolts. These are only intended for assembly and dismantling of the bearing !



Warning of injury!

Do not grab such heavy bearing parts as the housing during assembly or dismantling work. This could result in bruising or injury to hands !

Attention!

All metal parts of a slide bearing consisting of top and bottom part such as the housing, shells, shaft seals are marked by engraved numbers. Fit together only the parts with the same number.

Attention!

In case • the admissible bearing temperature exceeds by 15 K

- inadmissible vibrations occur
- unusual noises or odours are noticed
- monitoring equipment triggers alarm

shut down the installation and inform the maintenance personnel in charge.

Attention!

Do not operate the bearing below the transition speed values indicated in the bearing calculation, thus avoiding inadmissible operating conditions, which could lead to damage of the bearing.

Attention!

Please observe our leaflet Technical Information No. 85 which refers to various sealing compounds for extended technical applications.

EF with external oil supply

3 Operating Instructions after Standstill

- Clean the external parts of the bearing. Dust and dirt impede the radiation of the heat.
- Check with the instructions to determine if an oil change is necessary. Depending on the duration of the standstill an oil change is either prescribed or recommended. Carry out the oil change as indicated in Chapter 5.
- Retighten the screws (8), (18), (12) at the split line and flange to the following torque rates:

Bearing Size	9	11	14	18	22	28
Torque [Nm] for $\mu_{\text{tot}} = 0,1$ (lightly oiled)	69	69	170	330	570	1150

- Check that the top sight glass (5) is firmly in position.
- Retighten the connection holes for oil inlets and outlets, the oil supply hole for the thrust part (optional). The necessary torque rates depend on the used pipe joints.
- In case a thermo sensor or/and an oil sump thermometer are used:
- Check that they are correctly fitted (see also the manufacturer's instructions).
- Retighten all screw plugs in the connection holes (22), (24), (27), (29) to the necessary torque rates:

Screw plug threads	G 3/8	G 1/2	G 3/4	G 1	G 1 1/4	G 1 1/2	G 2	G 2 1/2
Torque [Nm] for plugs with injection-moulded plastic sealing ring	30	40	60	110	160	230	320	500
Torque [Nm] for plugs with flexible sealing ring	34	60	85	130	240	300	330	410

- Start operating the oil supply system and check its functioning (see also the Technical Documentation of the Installation). The supplied oil quantity at the bearing oil inlet must correspond to the values indicated in the EDP-calculations.
- Check that the temperature monitoring equipment is functioning correctly
- Check that the cooler is functioning correctly.

EFT..

The bearing is now ready to work.

Maintenance and Inspection

4 Maintenance Schedule

Maintenance work	Deadline
Exterior cleaning of the bearing	every 100-1000 hours
Oil change	Bearing in reversing operation every 5000 operating hours. Bearing in continuous operation every 20.000 operating hours (please observe also the indications for the use of the lubricating oil).
Bearing inspection	During prevention maintenance work for the installation. Immediately if: • the bearing temperature exceeds 15 K over the indicated value (see the EDP-calculations) • unusual operating noises occur • unusual changes of the lubricating oil become visible • increased oil level in the case of bearing type EFT....

EF with external oil supply

5 Oil Change

Risk of pollution!

Please observe the instructions for the use of the lubricating oil. The manufacturer can provide information on waste oil disposal.

- Shut down the installation and secure it against unintended operation.
- Shut down the oil supply system.
- Take all necessary measures to collect the whole quantity of the lubricating oil.
- Drain off the lubricating oil while still in a warm condition. Impurities and residues will thus be scavenged. Go ahead as follows:
- Drain off and collect the lubricating oil of the oil supply system.
- Unscrew the hexagon head plug (27). Drain off the lubricating oil and collect it.

Attention!

In case where the lubricating oil contains unusual residues or is visibly changed, eliminate the causes. If necessary, carry out an inspection.

- Tighten the hexagon head plug (27) to the following torque rates:

Bearing size	9	11	14	18	22	28
Torque [Nm]	30	30	30	40	60	60

- Clean the oil tank.
- Fill up the oil supply system with lubricating oil. Use a lubricant with the viscosity indicated on the bearing type plate.
- Start the oil supply system in order to fill up the bearing with lubricating oil.

The bearing is ready to work when the quantity of oil supplied at the bearing oil inlet corresponds to the values indicated in the EDP-calculations.

Maintenance and Inspection

6 Dismantling of the Bearing

6.1 Tools and equipment

- Following tools and equipment are necessary:
 - Allan key set
 - Wrenching key set
 - Open-jawed spanner set
 - Feeler gauges (up 0,05 mm)
 - Caliper gauge
 - Emery paper, plain scraper
 - Oil stone
 - Lifting equipment
 - Permanent sealing compound
 - Clean (close weave) rags
 - Oil with the viscosity indicated (see bearing type plate)
 - Detergents
 - Liquid screw locking compound (e.g. LOCTITE 242)
 - Liquid sealing compound and Teflon tape.

6.2 Use of lifting equipment



Risk of injury!

Before transport or lifting check if the eye bolts are tight! Insecure eye bolts could result in bearing becoming loose.

Before moving the bearing by the eye bolts make sure that the split line screws are tightened, otherwise the bottom half of the bearing could become detached.

Make sure that the eye bolts are not exposed to bending stress, otherwise the bolts could break.

Follow exactly the instructions for the use of the lifting equipment.

- Use lifting equipment for following assembly and transport works:

Transport/Assembly of:	Use lifting equipment for the following bearing sizes
Whole bearing unit	9-28
Top half of the housing	14-28
Bottom half of the housing	11-28
Shells	14-28

EF with external oil supply

- Following steps are to be observed before using the lifting equipment:

Whole bearing unit

- Check if the screws are tight (12):

Bearing size	9	11	14	18	22	28
Torque value [Nm] for $\mu_{\text{tot}} = 0,1$ (lightly oiled)	69	69	170	330	570	1150

- Check if the eye bolts are tight (6).
- Connect the lifting equipment to the eye bolts (6).

Top half of the housing

- Check if the eye bolts are tight (6).
- Connect the lifting equipment to the eye bolts (6).

Bottom half of the housing

- Screw two eye bolts (6) with suitable threads tight into the cross-placed opposite tapped holes (17).

Bearing size	9	11	14	18	22	28
Tapped hole	M 12	M 12	M 16	M 20	M 24	M 30

- Connect the lifting equipment to the eye bolts (6).

Shells

- Screw two eye bolts or screw hooks with suitable threads tight into the tapped holes (9):

Bearing size	14	18	22	28
Tapped hole	M 8	M 12	M 12	M 16

- Connect the lifting equipment to the screw hooks.

Maintenance and Inspection

6.3 Preparation for dismantling

Attention!

Make sure that the work place is clean. Contamination and damage to the bearing, especially to the working surfaces, have a negative influence on the operating quality and could lead to premature failure.

Attention!

Do not use any violence or force!

EFT..

- Shut down the installation and ensure it against unintended operation.
- Shut down the oil supply system.
- Interrupt the cooling water supply.
- Disconnect all thermo sensors from the tapped holes.
- Take all necessary measures to collect the lubricating oil.
- Unscrew the hexagon head plug (27) and collect the lubricating oil.

Risk of pollution!

Please observe the instructions for the use of the lubricating oil. The manufacturer can provide necessary information on waste oil disposal.

- Tighten the hexagon head plug (27) to the following torque rates

Bearing size	9	11	14	18	22	28
Torque (Nm]	30	30	30	40	60	60

- Inform yourself about maintenance and inspection of the oil supply system (see also the Technical Documentation Oil Supply System). Carry out all necessary maintenance and inspection works.

6.4 Dismantling of the shaft seal - outboard side

- Dismantle the outboard side seals of the bearing.
Proceed correspondingly to the seal type:

- | | |
|---|---------------|
| • Floating labyrinth seal (Type 10) | Chapter 6.4.1 |
| • Floating labyrinth seal with dust flinger (Type 11) | Chapter 6.4.2 |
| • Floating labyrinth seal with baffle (Type 12) | Chapter 6.4.3 |
| • Rigid labyrinth seal (Type 20) | Chapter 6.4.4 |
| • Rigid labyrinth seal with dust flinger (Type 21) | Chapter 6.4.5 |
| • Rigid labyrinth seal with baffle (Type 22) | Chapter 6.4.6 |

EF with external oil supply

Type 10

6.4.1 Floating labyrinth seal (Type 10)

- Loosen all screws (55) and take them out.
- Remove simultaneously in axial direction both top half (48) and bottom half (51) of the seal carrier from the housing.
- Shift a little (about 20 mm) the top half (53) of the seal. Tilt it over carefully until the garter spring (49) unbends.



Warning of injury!

During dismantling of the floating labyrinth seal hold tight the garter spring (49) which is under tension and could bounce back and lead to injury.

- Open the garter spring (49) and remove the bottom half of the seal (52) from the shaft.

Type 11

6.4.2 Floating labyrinth seal with dust flinger (Type 11)

- Dismantle the dust flinger (69). Loosen the screws (70) and take out the dust flinger (69) from the groove (57) of the seal carrier. Remove both halves of the dust flinger.
- Go on as indicated for type 10 (see Chapter 4.1).

Type 12

6.4.3 Floating labyrinth seal with baffle (Type 12)

- Disconnect both top (66) and bottom (68) halves of the baffle by untightening the screws (67).
- Go on as indicated for type 10 (see Chapter 6.4.1).

Type 20

6.4.4 Rigid labyrinth seal (Type 20)

- Loosen all screws (60) and take them out.
- Take out the screws (61).
- Remove simultaneously in axial direction both top (59) and bottom (63) halves of the rigid labyrinth seal.

Type 21

6.4.5 Rigid labyrinth seal with dust flinger (Type 21)

- Dismantle the dust flinger (69). Loosen the screws (70) and take out the dust flinger (69) from the groove (62) of the rigid seal. Remove both halves of the dust flinger.
- Go on as indicated for type 20 (see Chapter 6.4.4).

Type 22

6.4.6 Rigid labyrinth seal with baffle (Type 22)

- Unscrew the top half (66) and the bottom half (68) of the baffle by untightening the screws (67).
- Go on as indicated for type 20 (see Chapter 6.4.4).

Maintenance and Inspection

6.5 Dismantling of the top half of the housing

EF.V.

- Unscrew the screw plug with the welded-on positioning pin.
- Remove the screws (8).
- Remove the screws (12).
- Lift the top part of the housing (1) until the top part of the housing can be moved in axial line over the shell, without touching it.

6.6 Removal of the top half of the shell

- Unscrew the screws (19) and lift the top half of the shell (11).

Attention!

Do not damage the thrust and radial working surfaces.

Attention!

In the case of insulated housings (white plastic insulating foil) avoid any jamming of the top half of the shell when you lift it up. Jamming could lead to damage of the insulating foil in the bottom half of the housing.

EF.L.

6.6.1 Dismantling of the loose oil ring

- Open both split lines of the loose oil ring (44) by untightening and taking out the screws (47). Separate both halves of the loose oil ring (44) carefully without using any tools or other devices.

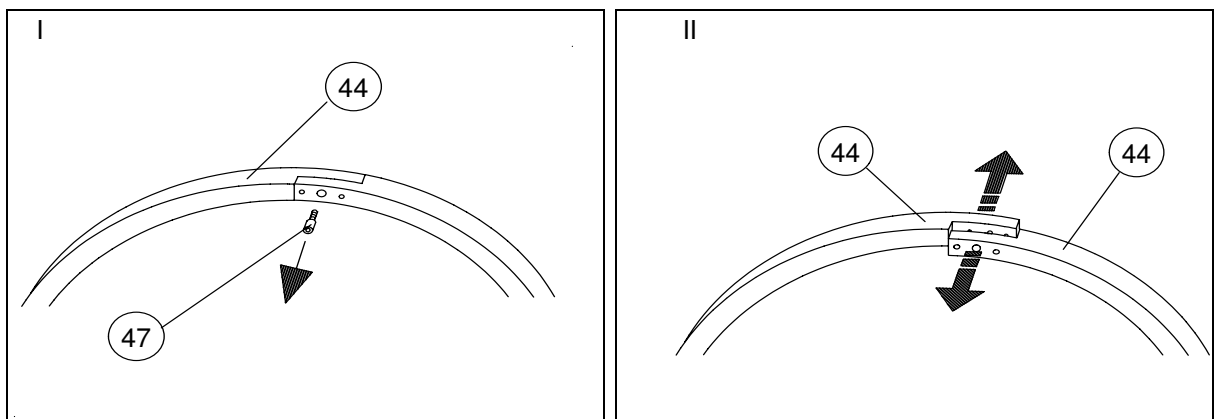


Illustration 1 Opening of the loose oil ring

To check the geometry of the loose oil ring put it together as follows:

- Press the positioning pin (45) into the holes (46).
- Adjust both halves of the loose oil ring till the split lines match each other.
- Tighten the screws (47).

EF with external oil supply

6.6.2 Dismantling the machine side shaft seal

- Shift a little (about 20 mm) the top half (53) of the seal. Tilt it over carefully until the garter spring (49) unbends.



Warning of injury!

During dismantling of the floating labyrinth seal hold tight the garter spring (49) which is under tension and could bounce back and lead to injury.

- Open the garter spring (49) and turn the bottom half of the seal (52) in opposite direction from the anti-rotation pin out of the integrated seal groove of the bottom half of the housing.

6.7 Removal of the bottom half of the shell

Attention!

Make sure that all bearings mounted on a shaft line are opened. Loosen the screws at the split line of the housings.

Attention!

The lifting equipment should not come into contact with the seal and working surfaces of the shaft.

- Lift the shaft up to the point where shaft and bottom half of the shell (13) do not touch each other any more. Protect the shaft against unintended movement.
- Turn the bottom half of the shell (13) out of the bottom half of the housing (21) and remove it from the shaft.

Attention!

If the bottom half of the shell (13) is provided with metal tabs (28) do not remove them. They regulate the oil level in the oil pockets.

6.8 Dismantling of the machine seal

Usually it is not necessary to dismantle the machine seal (10) if maintenance works are carried out.

If due to certain reasons the split machine seal must be dismantled please observe that this operation can be carried out only from the inner part of the machine. Loosen the screws at the split line of the machine seal and remove the screws (7).

Non-split machine seals can be dismantled only after dismantling the machine shield or the shaft completely.

In the case the machine seal is equipped with a hamp packing, some visible changes can be noticed, such as : tallow excess, black colour of the seal due to temperature development. Even in such cases it is not necessary to renew the hamp packing. Colour changes will appear with a new hamp packing too, until the seal clearance adjusts during operation.

Maintenance and Inspection

7 Cleaning and Checking of the Bearing

Attention!

Use only non-aggressive detergents such as for instance

- VALVOLINE 150
- Alkaline cleaning compounds (pH-value 6 to 9, short reaction time).



Warning of injury!

Please observe the instructions for the use of the detergents.

Attention!

Never use cleaning wool or cloth. Residues of such materials left in the bearing could lead to excessive temperatures.

– Clean the following parts thoroughly:

- top half of the housing (1)
- bottom half of the housing (21)
- top half of the shell (11)
- bottom half of the shell (13)
- sealing surfaces of the top half (48) and bottom half (51) of the seal carrier or of the rigid labyrinth seal
- loose oil ring (44).

EF.L.

EFT..

– Check the condition of the cooler (26).

In case the cooler (26) is incrustated with oil sludge:

- Dismantle the cooler. Remove the incrustation by using for instance a wire brush.
- Install the cooler (26) into the bearing.

EF with external oil supply

- Carry out a visual check of the wear condition of all bearing parts. The following table provides information on the parts that must be replaced in case of wear. The right evaluation of the wear condition, especially of the working surfaces of the shell, implies a lot of experience. If in doubt, replace the worn part with new ones.

Bearing part	Wear condition	Maintenance procedure
Shell	Scoring	Bearing temperature before inspection: • not increased - no new shells • increased - new shells
	White metal lining damaged	New shell
	Bow wave ridges	New shells
Shaft seal	Baffles broken or damaged	New shaft seal
Loose oil ring	Geometrical form (roundness, flatness) visibly changed	New loose oil ring

EF.C. EF.L. EF.Y. Size 9-14

- Check the projection of the positioning pin (3) according to the rates indicated below:

Bearing size	9	11	14	18	22	28
Projection of the positioning pin (4) mm	7	8	10	12	14	16

In case the projection is less than indicated,

- drive the positioning pin (3) into the top half of the housing (1) until the indicated value is reached.
- Check the insulating layer of the spherical seating (14) of the top half (1) and bottom half (21) of the housing. In case of damage contact the RENK-sales agency in charge.
- Check the mobility of all RD-thrust pads (42).

insulated bearings

EF..A

Maintenance and Inspection

8 Assembly of the Bearing

Attention!

Remove all impurities or other objects such as screws, nuts, etc. from inside the bearing. If left inside they could lead to damage of the bearing. Cover up the opened bearing during work breaks.

Attention!

Carry out all assembly operations without making use of force.

Attention!

Secure all screws at the split line, of the housing and flange with a liquid screw locking compound (e.g. LOCTITE 242).

8.1 Fitting in the bottom half of the shell

EF..E

Attention!

Mounting the bottom half of the shell (not marked with an arrow) correctly will ease the assembly of the top half shell (marked with an arrow) (see chapter 8.4).

- Apply some lubricant to the spherical seating (14) in the bottom half of the housing (21) and to the working surfaces of the shaft. Use the same type of lubricant as indicated for bearing operation (see type plate).
- Place the bottom half of the shell (13) on the working surface of the shaft. Turn the bottom half of the shell (13) into the bottom half of the housing (21) with the split line surfaces of both halves in true alignment.

In case the bottom half of the shell doesn't turn in easily, check the position of the shaft and the alignment of the housing

EF..B,
EF..K,
EF..E,
EF..A

Attention!

These operations should be carried out most carefully. The thrust parts of the bottom shell must not be damaged.

- Lower down the shaft till it sits on the bottom half of the shell (13).

EF with external oil supply

8.2 Assembly of the shaft seal - machine-side

The machine-side shaft seal, as standard, a floating labyrinth seal. The integrated seal groove is in the top and bottom halves of the housing.



Warning of injury!

During assembly hold the garter spring ends (49) securely to avoid them suddenly releasing and causing possible injury!

Check the movement of the floating labyrinth seal on the shaft in the seal area outside the housing:

- Put the garter spring (49) around the shaft and hook both ends into each other.
- Put both halves of the seal (52), (53) in their place on the shaft.
- Put the garter spring (49) into the groove (50).
- Turn the floating labyrinth seal on the shaft.

Attention!

The floating labyrinth seal should turn easily on the shaft. A jammed seal could lead to overheating during operation and even to shaft wear.

If the floating labyrinth seal jams,

- dismantle the seal and
- remove the worn parts of the seal carefully, by using emery paper or a plain scraper.

- Dismantle the floating labyrinth seal.
- Apply sealing compound to the guide surfaces of the integrated seal groove in the bottom half of the housing.

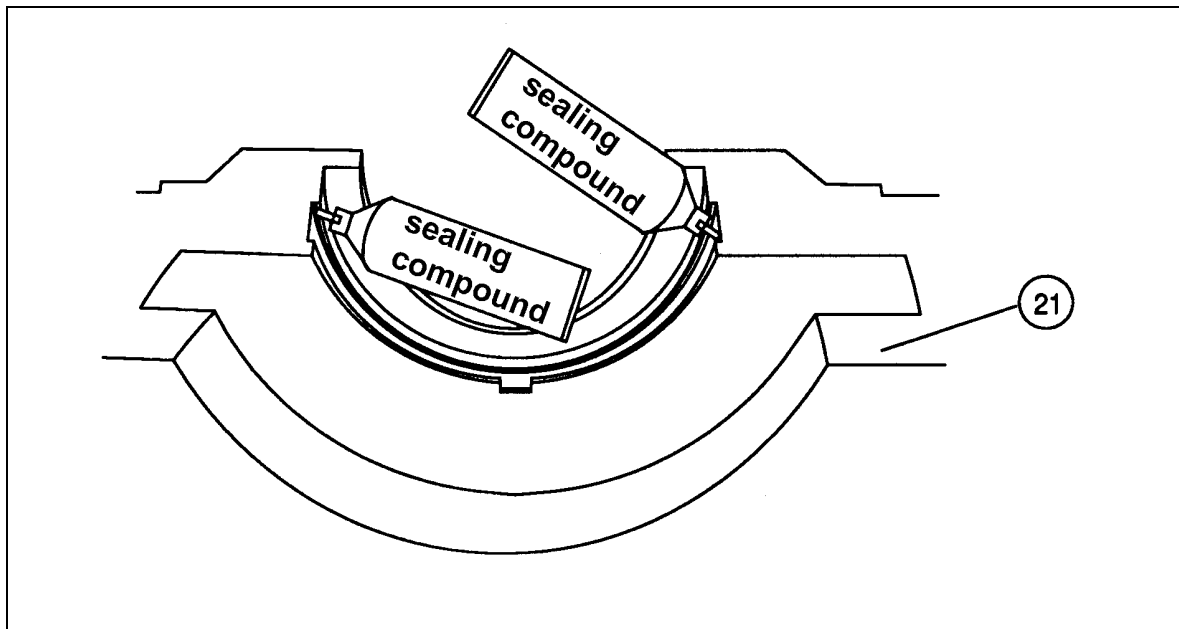


Illustration 2: Applikation of sealing compound to the integrated seal groove

Maintenance and Inspection

- Apply a uniform layer of sealing compound to the seal surfaces and to the split line surfaces of both halves of the seal (52), (53).

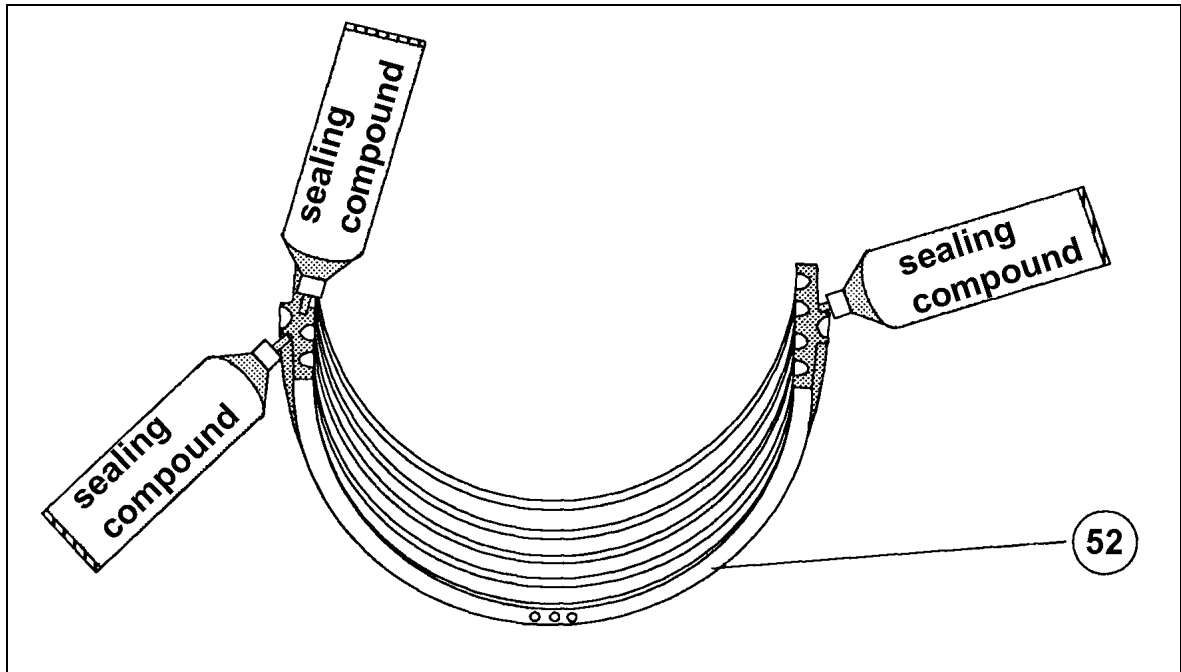


Illustration 3: Application of sealing compound to the floating labyrinth seal

Please observe the instructions for the use of sealing compound.

- Place the bottom half of the seal (52) with the labyrinths onto the shaft.
- The oil return holes at the bearing side must be clear and open.
- Turn the seal in opposite direction from the anti-rotation pin into the groove of the housing until the split lines of the bottom half of the housing and the bottom half of the seal match each other.
- Remove the residue of sealing compound.
- Push the spring hook into the integrated groove between the bottom half of the housing and the seal until both ends jut out from the split line.
- Place the top half of the seal with the cam facing the inside of the bearing on the bottom half of the seal.
- Stretch the garter spring till both ends can be hooked.

EF with external oil supply

EF.L.

8.3 Installation of the loose oil ring

- Open both split lines of the loose oil ring (44) by untightening and removing the screws (47). Separate both halves of the loose oil ring (44) carefully without using any tools or other devices.

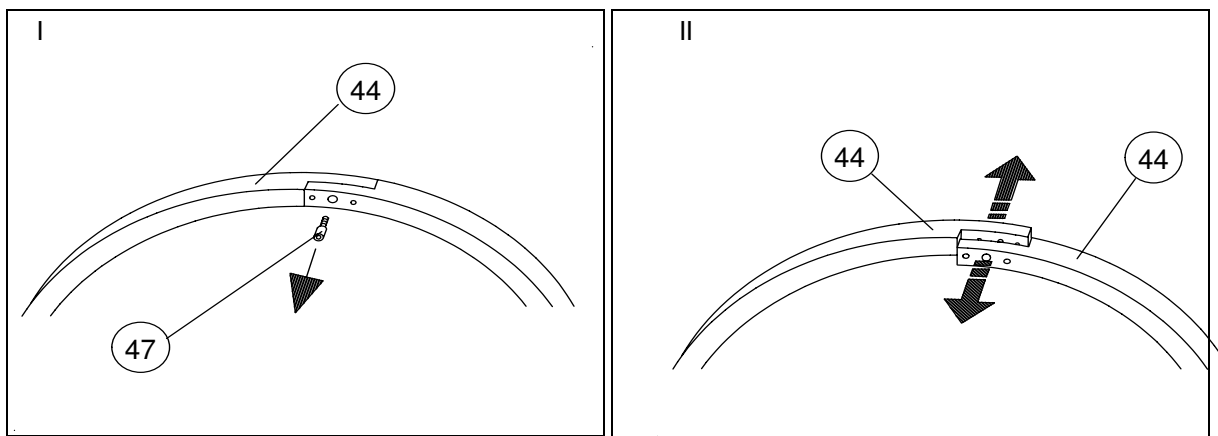


Illustration:4 Opening of the loose oil ring

- Place both halves of the loose oil ring into the shell groove (13) around the shaft. Press the positioning pin (45) of each split line into the corresponding hole (46).
- Adjust both halves of the loose oil ring till the split lines match each other.

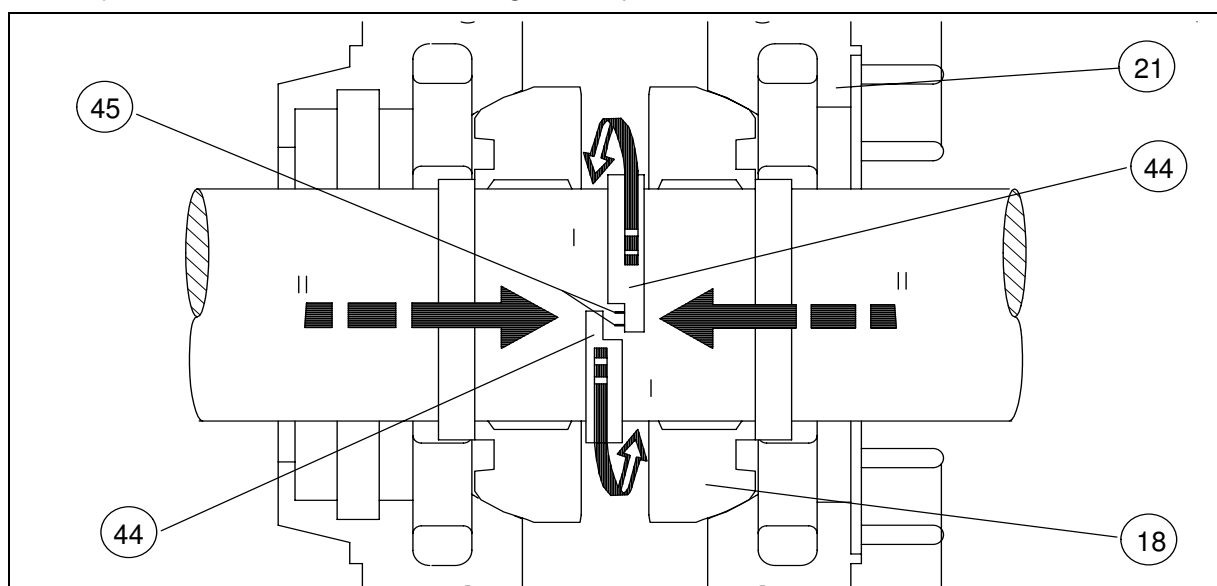


Illustration 5: Installation of the loose oil ring

- Tighten the screws (47) to the following torque rates:

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

Maintenance and Inspection

8.4 Fitting in the top half of the shell

- Apply some lubricant to the working surfaces of the shaft. Use the same type of lubricant as indicated for bearing operation (see type plate).
- Check if the engraved numbers (15) on the bottom and top halves of the shell correspond.
- Place the top half of the shell (11) on the shaft; both engraved numbers (15) should be on the same side.

Attention!

An incorrectly placed shell could jam the shaft thus leading to the damage of both shaft and bearing.

EF..B,
EF..K,
EF..E,
EF..A

Attention!

Place the top half of the shell carefully on the shaft. The thrust parts of the top half of the shell must not be damaged.

insulated
bearings

In the case of bearings arranged for insulation monitoring, connect the black cable for insulation monitoring to the shell.

According to the bearing type, there are two possibilities of connection.

1. The black cable is provided with a cable connector.

- Plug the cable with the cable connector into the counterpart available on the top of the shell.
- Lead the cable through the cable gland in the bottom half of the housing and out of the bearing.
- Tighten the cable gland oil-tight.

2. The black cable is provided with an eyelet.

- Fasten the cable with the eyelet to the split line of the shell, by using one of the shell joint bolts.
- Lead the cable through the cable gland in the bottom half of the housing and out of the bearing.
- Tighten the cable gland oil-tight.

- Tighten up the screws (19) to the following torque rates:

Bearing size	9	11	14	18	22	28
Torque [Nm]	8	8	20	69	69	170

- Check the split line of the shell by using a feeler gauge. The split line gap should be less than 0,05 mm. If the split line is greater than this, dismantle both top and bottom (11), (13) halves of the shell. Rework the split line surfaces of the top half (11) and bottom half (13) of the shell with an oil stone.

EF.L.

- Check the mobility of the loose oil ring (44).

EF.L.
Marine
Bearing

A guide bush in the top half of the shell secures the function of the loose oil ring.

- Check the mobility of the loose oil ring (44) in the guide bush.

EF with external oil supply

EF..E

Shells with taper land faces suitable only for one direction of rotation are marked with an arrow on the top half shell, which indicates the sense of rotation of the shaft.

The arrow indicates the allowed direction of shaft rotation after completion of the bearing assembly.

- Before mounting the top half of the housing check that the proposed direction of rotation of the shaft corresponds to the direction indicated by the arrow on the top half of the shell.
- If the directions match, continue the assembly of the bearing.
- If the directions do not match, the shell must be disassembled, re-aligned and mounted again.

Attention!

A wrongly placed shell, without observance of the direction of rotation of the shaft, impairs the operational safety of the bearing.

8.5 Closing of the bearing

- Check the true alignment of the shell (11), (13) and bottom half (21) of the housing.

EF.C. EF.L. EF.Y.

The positioning pin (3) in the top half of the housing fits in the corresponding hole (2). The shell is thus placed into its right position.

- Check if the engraved numbers (20) on the top and bottom halves of the housing correspond.
- Clean the split line surfaces of the top and bottom halves (1), (21) of the housing.
- Apply sealing compound to the whole surface of the split line of the bottom half (21) of the housing.

Please observe the instructions for the use of sealing compound.

- Place the top half of the housing carefully into the machine shield, without touching the seals or the shell.
- Lower the top half of the housing (1) vertically on the bottom half of the housing (21). Lower the top half of the housing (1) till the split line of the housing is not visible any more.
- Gently hit the bottom half of the housing (21) with a nylon hammer, thus ensuring the alignment of the spherical seating.
- Insert the screws (12). Tighten them hand-tight.
- Insert the screws (8). Tighten them to the following torque rates:

Bearing size	9	11	14	18	22	28
Torque [Nm] $\mu_{\text{tot}} = 0,1$ (lightly oiled)	69	69	170	330	570	1150

- Tighten the screws (12) of the housing crosswise to the same torque rates.
- Tighten the screw plug with the welded-on positioning pin into the top half of the housing.

EF.V.

Maintenance and Inspection

insulated
bearings

Insulation monitoring

In the case of electric insulated bearings provided with insulation monitoring, the cable coming out of the housing must be connected in a professional manner.

According to the type supplied, please follow the assembly instructions given below.

- a) The cable is very short and provided with a further cable connector at the end of it.
This cable is ready for connection to the housing.
The bottom half of the housing is provided with the counterpart.
- Plug the cable connector into the counterpart.

Attention!

This connection bypasses the electrical insulation of the bearing.

In the case of electric machines, make sure at least one bearing is electrically insulated.

To check the electrical insulation, interrupt the connection cable - housing. Check the electrical resistance with a suitable measuring instrument. Make sure that both bearings and the coupling are electrically insulated.

- b) The cable has a free end. In this case the customer has to make the connection.

Attention!

If only one bearing is insulated, the end of the cable must not be earthed.

Any further connection depends on the customer's requirements related to the insulation monitoring and can not therefore be described here.

EF with external oil supply

8.6 Assembly of the Seals - Outboard Side

- Assemble the outboard side seals.

Proceed according to the seal type used:

- | | |
|---|---------------|
| • Floating labyrinth seal (Type 10) | Chapter 8.6.1 |
| • Floating labyrinth seal with dust flinger (Type 11) | Chapter 8.6.2 |
| • Floating labyrinth seal with baffle (Type 12) | Chapter 8.6.3 |
| • Rigid labyrinth seal (Type 20) | Chapter 8.6.4 |
| • Rigid labyrinth seal with dust flinger (Type 21) | Chapter 8.6.5 |
| • Rigid labyrinth seal with baffle (Type 22) | Chapter 8.6.6 |

Type 10

8.6.1 Floating labyrinth seal (Type 10)



Warning of injury!

During assembly hold the garter spring ends (49) securely to avoid them suddenly releasing and causing possible injury!

Check the movement of the floating labyrinth seal on the shaft in the seal area outside the housing.

- Put the garter spring (49) around the shaft and hook both ends into each other.
- Put both halves of the seal (52), (53) in their place on the shaft.
- Put the garter spring (49) into the groove (50).
- Turn the floating labyrinth seal on the shaft.

Attention!

The floating labyrinth seal should turn easily on the shaft. A jammed seal could lead to overheating during operation and even to shaft wear.

If the floating labyrinth seal jams,

- dismantle the seal and
- remove the worn parts of the seal carefully, by using emery paper or a plain scraper.

- Dismantle the floating labyrinth seal.

Maintenance and Inspection

- Apply a uniform layer of sealing compound to the seal surfaces and to the split line surfaces of both halves of the seal (52), (53).

Please observe the instructions for the use of sealing compound.

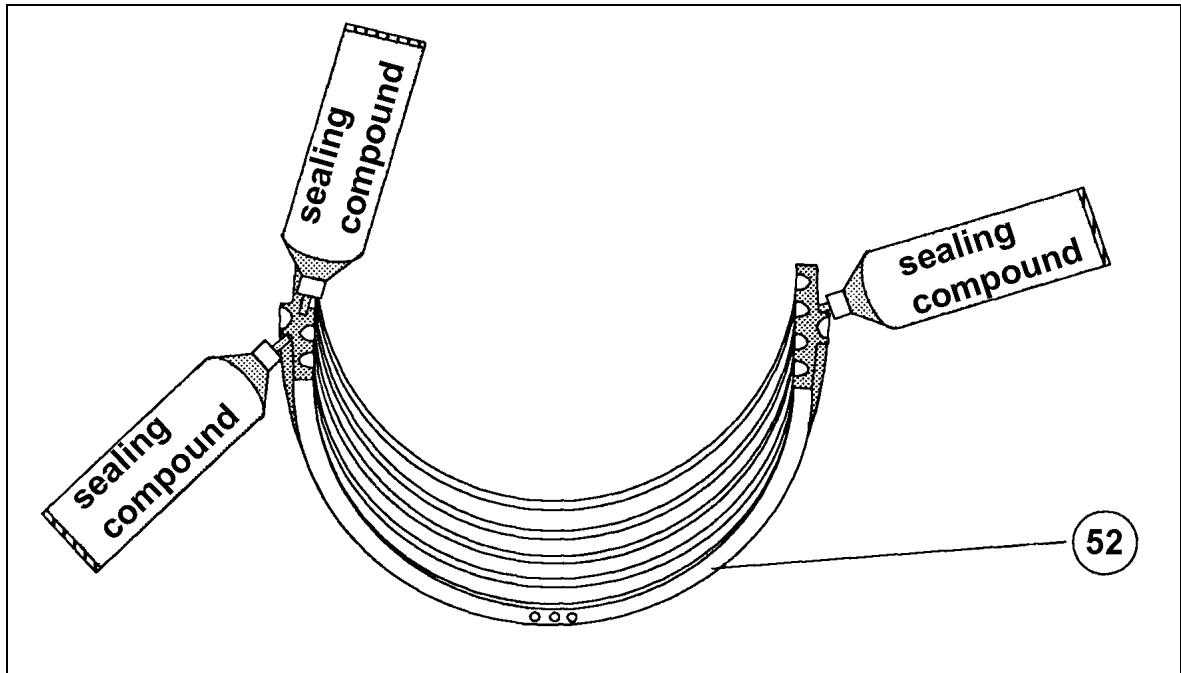


Illustration 6: Application of sealing compound to the floating labyrinth seal

- Press the bottom half of the seal (52) against the shaft.
- Place the top half of the seal (53) on the shaft and align both halves of the seal to each other.
- Place the garter spring (49) into the groove (50) and stretch until both ends can be hooked.

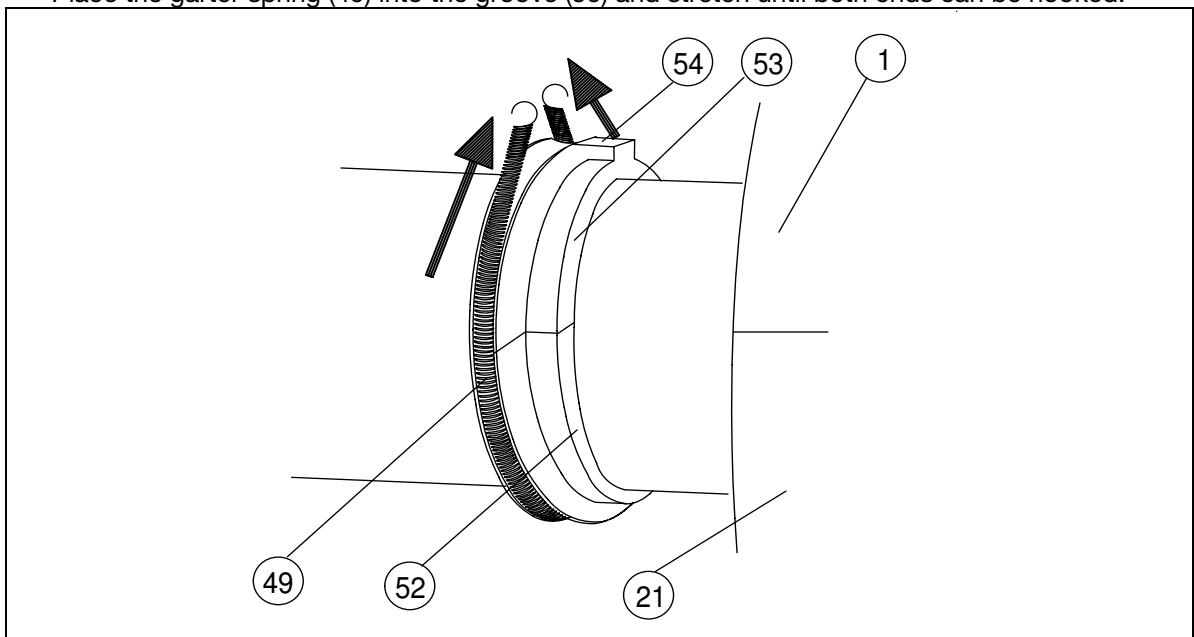


Illustration 7: Assembly of the floating labyrinth seal

EF with external oil supply

- Place in true alignment the split line of the floating labyrinth seal and the split line of the seal carrier.
- Check that both engraved numbers (56) and (58) on top and bottom halves of the seal carrier (48), (51) correspond.
- Clean the following parts:
 - the seal surfaces of the top (48) and bottom (51) half of the seal carrier (the groove of the floating labyrinth seal, the flange surfaces)
 - the split line surfaces of the top (48) and bottom (51) half of the seal carrier
 - the flange surfaces of the housing.
- Apply a uniform layer of sealing compound to:
 - the lateral surfaces of the groove at the top (48) and bottom (51) half of the seal carrier
 - the flange surfaces of the top (48) and bottom (51) half of the seal carrier
 - the split line surfaces of the bottom half of the seal carrier (51).

Please observe the instructions for the use of sealing compound.

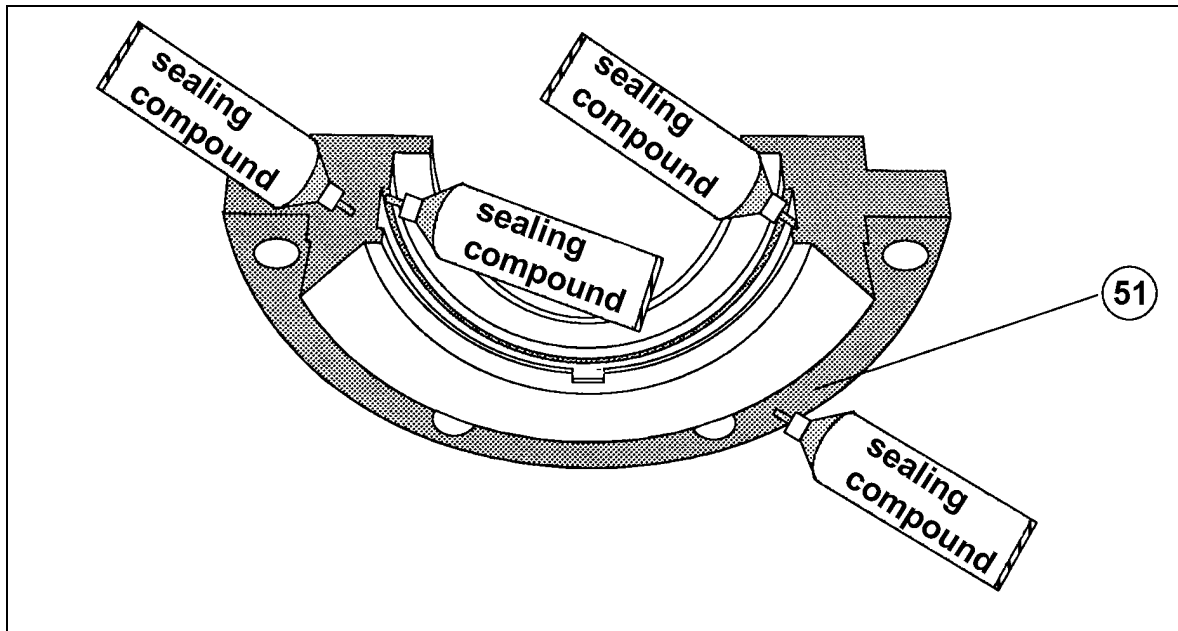


Illustration 8: Application of sealing compound to the seal carrier

Maintenance and Inspection

- Place the top half of the seal carrier (48) on the top half of the seal (53). Press the bottom half (51) of the seal carrier against it. Push the shaft seal completely into the housing.

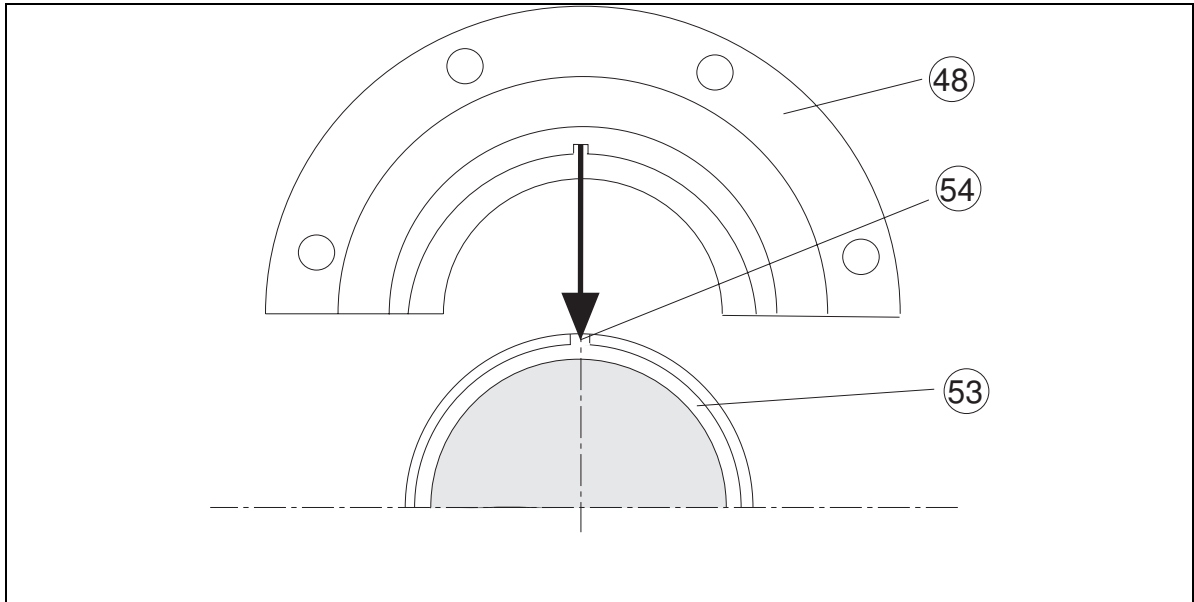


Illustration 9: Assembly of the seal carrier

- Place in true alignment the split lines of the seal carrier and the housing.
- Tighten up the screws (55) to the following torque rates:

Bearing size	9	11	14	18	22	28
Torque [Nm]	8	8	8	20	20	20

EF with external oil supply

Type 11

8.6.2 Floating labyrinth seal with dust flinger (Type 11)

- Assemble the floating labyrinth seal with dust flinger as described in Chapter 8.6.1, Floating labyrinth seal type 10.
- Place both halves of the dust flinger (69) in front of the shaft seal around the shaft. Loosely screw in the screws (70).

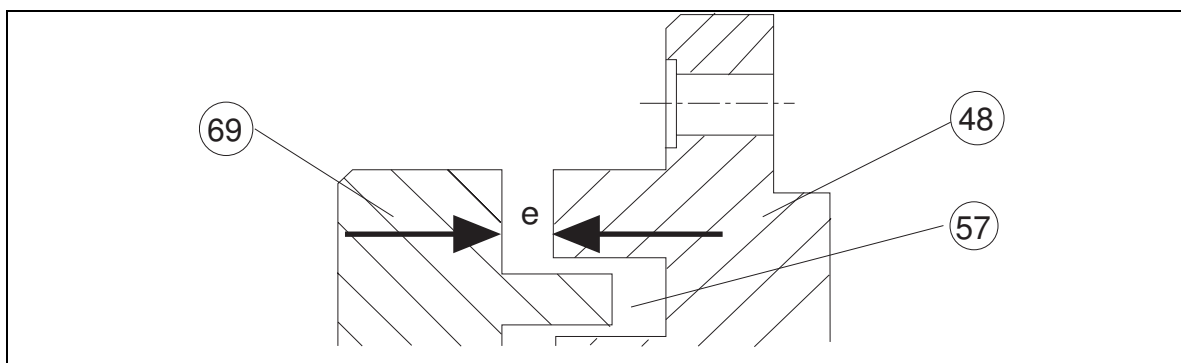


Illustration 10: Clearance between dust flinger and seal carrier

EF..Q

- Push the dust flinger (69) into the groove (57) of the seal carrier.
- Set the clearance "e" at the following figure around the whole unit:

maximum longitudinal extension of the shaft in operation + 1 mm

(Parameters indicated in the Technical Documentation of the Installation).

- Tighten up the screws (70) to the following torque rates:

Seal diameter [mm]	80-140	>140
Torque [Nm]	7	18

EF..B, EF..K, EF..E, EF..A

- Push the dust flinger (69) into the groove (57) of the seal carrier.
- Set the clearance "e" at **1 mm** around the whole unit.
- Tighten the screws (70) to the following torque rates:

Seal diameter [mm]	80-140	>140
Torque [Nm]	7	18

Maintenance and Inspection

Type 12

8.6.3 Floating labyrinth seal with baffle (Type 12)

- Assemble the floating labyrinth seal with baffle as in Chapter 8.6.1, Type 10.
- Apply a uniform layer of sealing compound to the flange surfaces of the top half (66) and bottom half (68) of the baffle.
- Screw
 - the top half of the baffle (66) to the top half of the seal carrier (48)
 - the bottom half of the baffle (68) to the bottom half of the seal carrier (51).
- Tighten the screws (67) to the following torque rates:

Seal diameter [mm]	80-140	>140
Torque [Nm]	4	10

Type 20

8.6.4 Rigid labyrinth seal (Type 20)

- Check if the engraved numbers (64) and (65) on the bottom half (63) and top half (59) of the rigid labyrinth seal correspond.
- Clean
 - the flange surfaces of the top half (59) and bottom half (63) of the rigid labyrinth seal
 - the split line surfaces of the top half (59) and bottom half (63) of the rigid labyrinth seal
 - the flange surfaces of the housing.
- Apply a uniform layer of sealing compound to the following parts:
 - the flange surfaces of the top half (59) and bottom half (63) of the rigid labyrinth seal
 - the split lines of the bottom half (63) of the rigid labyrinth seal.

Please observe the instructions for the use of sealing compound.

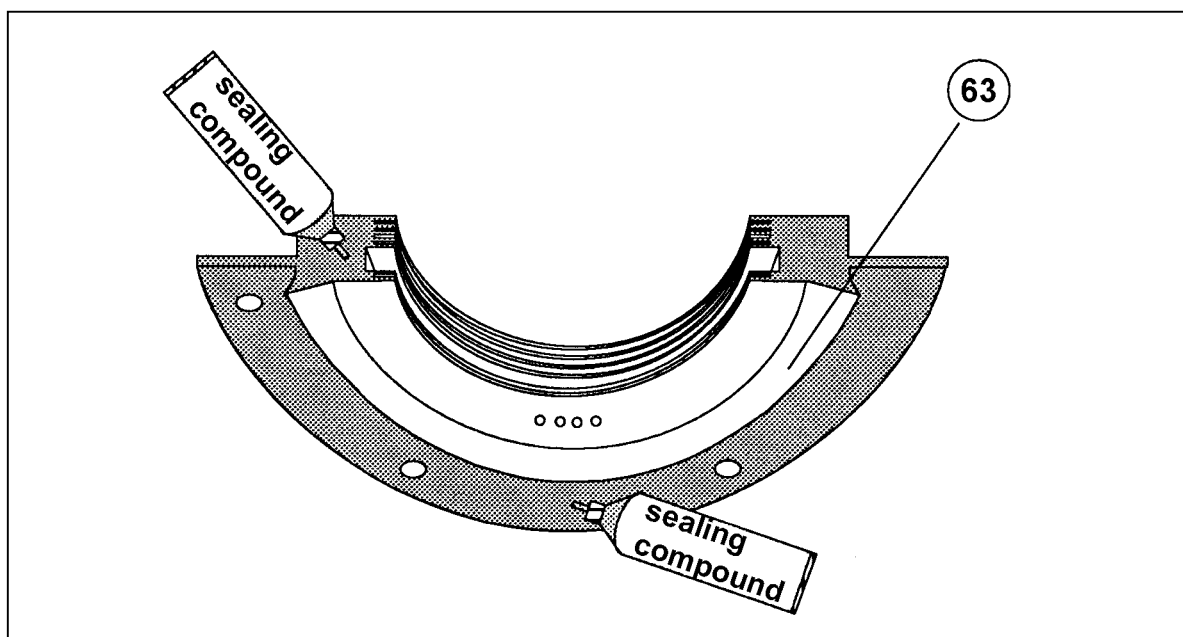


Illustration 11: Application of sealing compound to the rigid labyrinth seal

EF with external oil supply

- Place the top half (59) of the rigid labyrinth seal on the shaft and press slightly the bottom half (63) of the rigid labyrinth seal from below against it. Lightly push the rigid labyrinth seal completely into the housing.
- Tighten the screws (61).
- Place in parallel alignment the split line of the rigid labyrinth seal and the split line of the housing. Press the rigid labyrinth seal slightly from below against the shaft. Adjust the rigid labyrinth seal in such a way that the clearance "f" between the shaft and the rigid labyrinth seal at both split lines has the same figure.

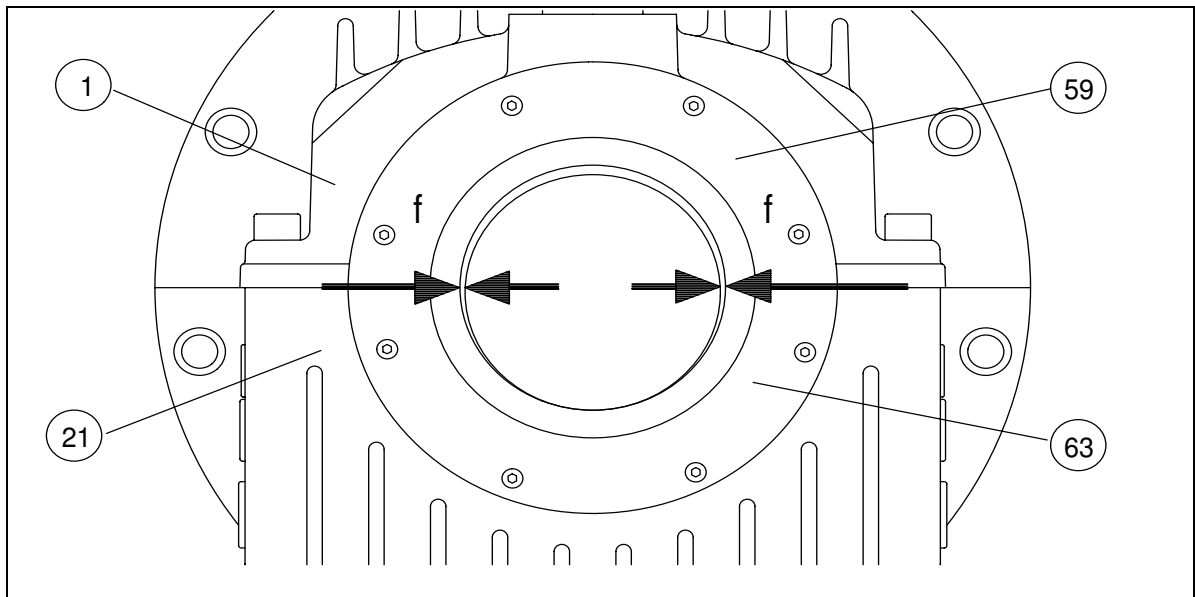


Illustration 12: Alignment of the rigid labyrinth seal

- Tighten the screws (60) to the following torque rates:

Bearing size	9	11	14	18	22	28
Torque [Nm]	8	8	8	20	20	20

Maintenance and Inspection

Type 21

8.6.5 Rigid labyrinth seal with dust flinger (Type 21)

- Assemble the rigid labyrinth seal with dust flinger as indicated in Chapter 8.6.4, Type 20.
- Place both halves of the dust flinger (69) round the shaft, in front of the rigid labyrinth seal. Mount the screws (70) loose.

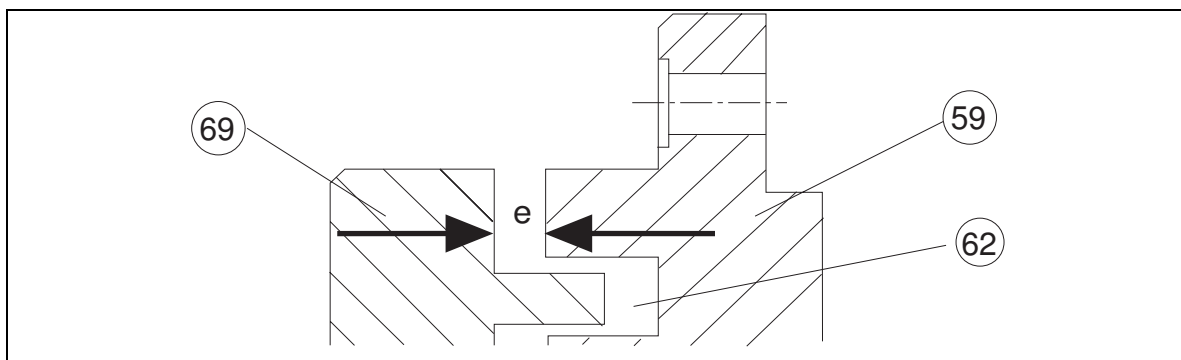


Illustration 13: Clearance between dust flinger and rigid labyrinth seal

EF..Q

- Push the dust flinger (69) into the groove (62) of the rigid labyrinth seal.
- Set the clearance "e" at the following figure around the whole unit:

maximum longitudinal extension of the shaft in operation + 1 mm

(Parameters are indicated in the Technical Documentation of the Installation).

- Tighten the screws (70) to the following torque rates:

Seal diameter [mm]	80-140	>140
Torque [Nm]	7	18

EF..B, EF..K, EF..E, EF..A

- Push the dust flinger (69) into the groove (62) of the rigid labyrinth seal.
- Set the clearance "e" at **1 mm** around the whole unit.
- Tighten the screws (70) to the following torque rates:

Seal diameter [mm]	80-140	>140
Torque [Nm]	7	18

Type 22

8.6.6 Rigid labyrinth seal with baffle (Type 22)

- Assemble the rigid labyrinth seal with baffle as described in Chapter 8.6.4.
- Apply a uniform layer of sealing compound to the flange surfaces of the top half (66) and bottom half (68) of the baffle.
- Screw
 - the top half of the baffle (66) to the top half (59) of the rigid labyrinth seal.
 - the bottom half of the baffle (68) to the bottom half (63) of the rigid labyrinth seal.
- Tighten the screws (67) to the following torque rates:

Seal diameter [mm]	80-140	>140
Torque [Nm]	4	10

EF with external oil supply

9 Starting Operation after Inspection

- Fit the thermo sensors for:
 - temperature measurement of the journal part in the tapped holes (22)
 - temperature measurement of the thrust part in the tapped holes (optional).
- Retighten all screw plugs in the tapped holes (22), (24), (27), (29) to the following torque rates:

Screw plug threads	G 3/8	G 1/2	G 3/4	G 1	G 1 1/4	G 1 1/2	G 2	G 2 1/2
Torque [Nm] for plugs with injection-moulded plastic sealing ring	30	40	60	110	160	230	320	500
Torque [Nm] for plugs with flexible sealing ring	34	60	85	130	240	300	330	410

- Check that the top sight glass (5) is tight.
- Retighten the connection holes for oil inlet and oil outlet and the holes for the thrust part oil supply system (optional). The torque depends on the threaded joints used.
- Carry out a visual check of the assembled bearing.
- Fill up the oil supply system with lubricant. Use the same type of lubricant as indicated on the type plate.
- Start operating the oil supply system in order to fill up the bearing with lubricant.
- Check
 - the way the oil supply system functions (see also the Technical Documentation of the Installation).The lubricant quantity at the bearing oil inlet must correspond to the values indicated in the EDP-calculations.
 - that the temperature monitoring equipment functions.

Attention!

- Not enough lubricant leads to temperature rises and thus to damage to the bearing.
- Too much lubricant leads to leakages.

EFT..

- Start operating the cooling water supply system and check its functioning.

The bearing is ready for operation.

Maintenance and Inspection

- Supervise the bearing during the trial run (5 - 10 operating hours).
Pay special attention to:
 - the way the oil supply system works (necessary lubricant quantity, lubricant pressure before entering the bearing)
 - bearing temperature
 - sliding noises of the shaft seals
 - tightness
 - occurrence of inadmissible vibrations.

Attention!

If the bearing temperature exceeds the calculated value by 15 K (see the EDP-bearing calculations) stop the installation immediately. Carry out an inspection of the bearing and find out the causes.

10 Corrosion Protection for Longer Standstill Periods

If you want to protect the bearing mounted on an installation against corrosion proceed as follows:

- Dismantle the bearing (see Chapter 6).
- Clean the bearing (see Chapter 7).
- Paint or spray the top half of the shell (11), the bottom half of the shell (13) and the shaft with TECTYL 511.
- Assemble the bearing (see Chapter 8).
- Close all tapped holes with screw plugs.
- Seal the gaps between
 - shaft seal and housing
 - shaft seal and shaft
 by using a self-adhesive, permanent tape.
- Remove the top sight glass (5). Spray some anti-corrosive such as TECTYL 511 or VALVOLINE into the bearing.
- Put a bag of dessicant (silicate gel) inside. The dessicant absorbs the humidity and prevents the formation of condensation water inside the bearing.
- Close the bearing tight with the top sight glass (5).

In case the standstill period is **longer than 1/2 year**:

- Repeat the preservation procedures.
- Put a new bag of dessicant into the bearing.

In case the standstill period **lasts more years**:

- Dismantle the shells.
- Preserve and store the bearing parts.

11 Transport Protection

In case of a machine equipped with slide bearings of type EF:

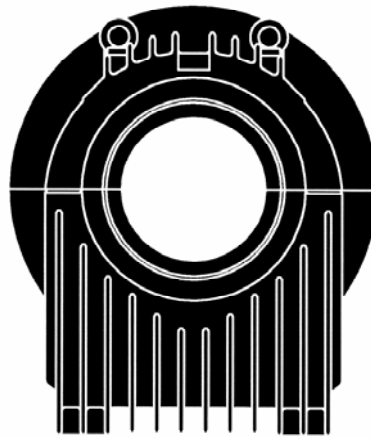
- Carry out the corrosion protection as described in Chapter 10 and apply enough lubricant on the working surfaces of the bearing.
- Secure the shaft against thrust and radial movements during transport.

EF with external oil supply

12 Glossary

Baffle	With bearing types 10 and 20 the baffles are assembled externally in front of the shaft seals. The baffle, made of reinforced polyamide, protects the bearing from dust and water.
Rigid labyrinth seal	The rigid labyrinth seal (type 20) is used with slide bearings type E with high oil throughput. It corresponds to the protective system IP44 and is made of an aluminium alloy. The rigid labyrinth seal is built of two halves, flanged at the housing. The labyrinths that wipe out the lubricant are arranged into two groups. The first two labyrinths, installed inside keep back most of the lubricant. Five further labyrinths protect the bearing from outside. They prevent the lubricant overflow and the ingress of impurities. The overflow lubricant is collected into a chamber between the both groups of labyrinths. Through the return bores the lubricant flows back into the bearing.
Spherical seating	The spherical seating is a special feature enabling the alignment of the shell in the housing. The shell is seated on two spherical seatings. The advantages of the spherical seating are: • easy at assembly • good heat transfer from the shell to the housing • suitable for such applications with high thrust or journal loads.
Dust flinger	In the case of bearing types 10 and 20 a light alloy ring is clamped on the shaft in front of the shaft. This ring fits into a groove in the seal carrier or the rigid labyrinth seal, thus building a labyrinth. The labyrinth protects the shaft exit against low pressure that could otherwise "absorb" the lubricant. Low pressure occurs for instance in the case of rotating discs, such as couplings or cooling discs.
Floating labyrinth seal	The floating labyrinth seal (type 10) in the seal carrier is used as a shaft seal in the case of bearings type E operating under normal conditions. It prevents the lubricant and lubricant mist coming out and the ingress of impurities. The floating seal has a high capacity of resistance to wear. It is made of a high-performance, high temperature stability and electrically insulated plastic material. The floating seal consists of two halves held together by a garter spring. Both ends of the spring are hooked together. In the case of slide bearings type EM the floating seal is mounted into a two-piece seal carrier. The groove allows for radial movement of up to 1 mm. The seal is thus insensitive to shaft radial displacement or deflection. The sealing effect is produced by the baffles wiping off the lubricant from the shaft. The lubricant flows back into the bearing via oil return opening.
Machine seal	In the case of the flange mounted bearings, the machine seal reduces the influence of positive and negative pressure in the machine thus preventing leakages at the inner seal area. The space between the machine seal and the bearing housing must always be vented to atmospheric pressure. The size of the gap between shaft and machine seal influences the sealing effect.

Instructions
For Installation and Operation



Slide Bearings TYPE EF
with external oil supply

Installation and Operation



RENK AKTIENGESELLSCHAFT
Werk Hannover
Weltausstellungsallee 21
D - 30539 Hannover
Telephone: (0511) 8601-0
Telefax: (0511) 8601-266
e-mail: info.hannover@renk.biz
<http://www.renk.biz>

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EF with external oil supply

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EF with external oil supply

Bearing Coding

Installation and Operation

①	②	③	④	⑤	⑥
Type	Housing	Heat Dissipation	Shape of Bore and Type of Lubrication	Thrust part	Size - Diameter
E	F - flange mounted bearing	Z - lubrication by oil circulation with external oil cooling	C - plain cylindrical bore without oil ring	Q - without thrust part (non locating bearing)	9 80□D□100
		X - lubrication by oil circulation with external oil cooling when oil throughput is high	L - plain cylindrical bore with loose oil ring	B - plain sliding surfaces (locating bearing)	1 100□D□125
		U - circulating pump and natural cooling	Y - two-lobe bore ("lemon bore") without oil ring	E - taper land faces for one sense of rotation (locating bearing)	14 125□D□160
		T - circulating pump and water cooling (finned tubes in oil sump)	V - four-lobe bore without oil ring	E - taper land faces for one sense of rotation (locating bearing)	18 160□D□200
				K - taper land faces for both senses of rotation (locating bearing)	22 200□D□250
				A - elastically supported circular tilting pads (locating bearing)	28 250□D□315

Example for bearing coding:

①	②	③	④	⑤	⑥
E	F	Z	L	K	22-200

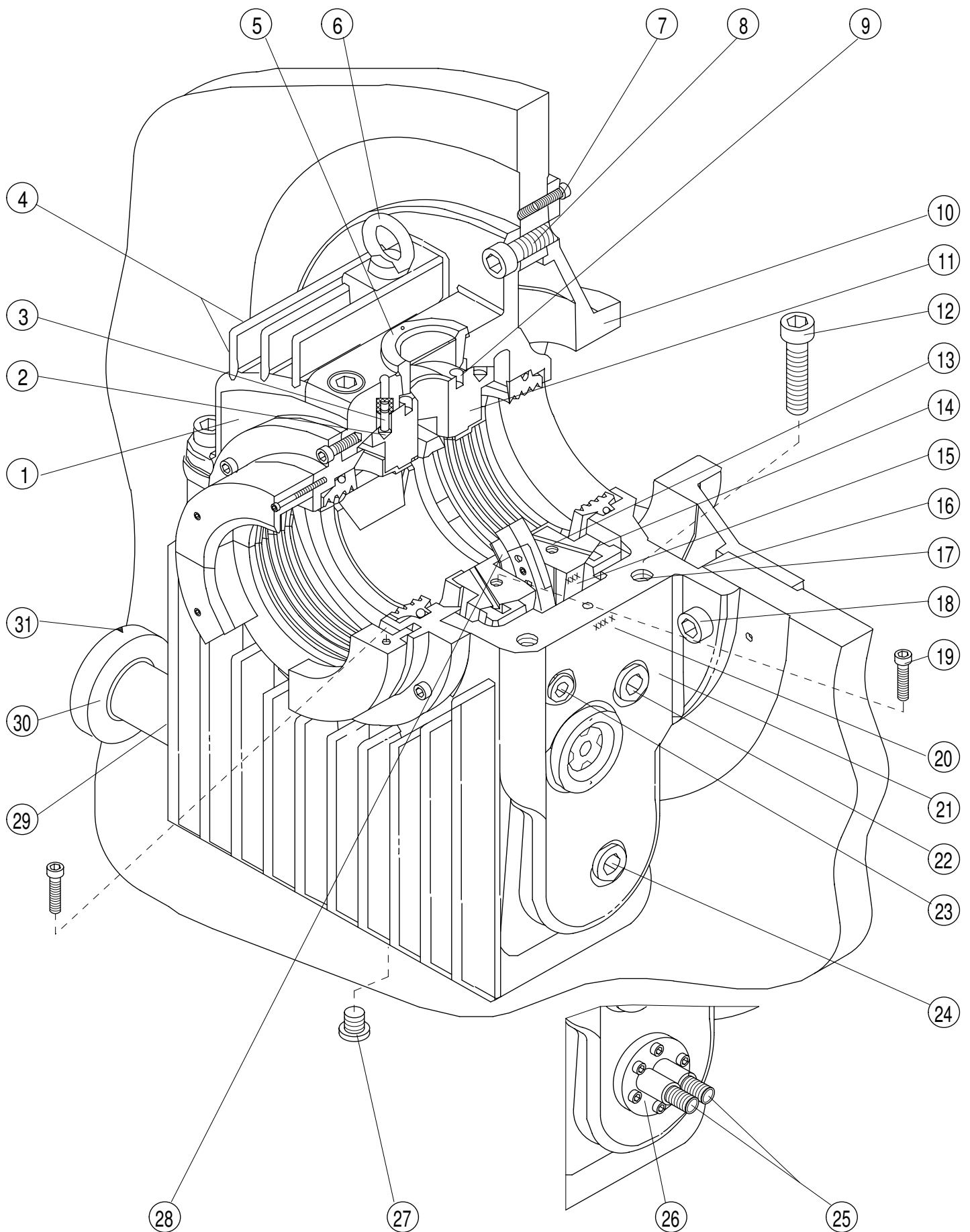
Type EF slide bearing with flange-mounted housing, lubrication by oil circulation with external oil cooling, plain cylindrical bore with loose oil ring, locating bearing with taper land faces for both senses of rotation, size 22, dia meter 200.

Shaft seals

Type 10 - floating labyrinth seal (IP 44)
 Type 11 - floating labyrinth seal with dust flinger (IP 54)
 Type 12 - floating labyrinth seal with baffle (IP 55)

 Type 20 - rigid labyrinth seal (IP 44)
 Type 21 - rigid labyrinth seal with dust flinger (IP 54)
 Type 22 - rigid labyrinth seal with baffle (IP 55)

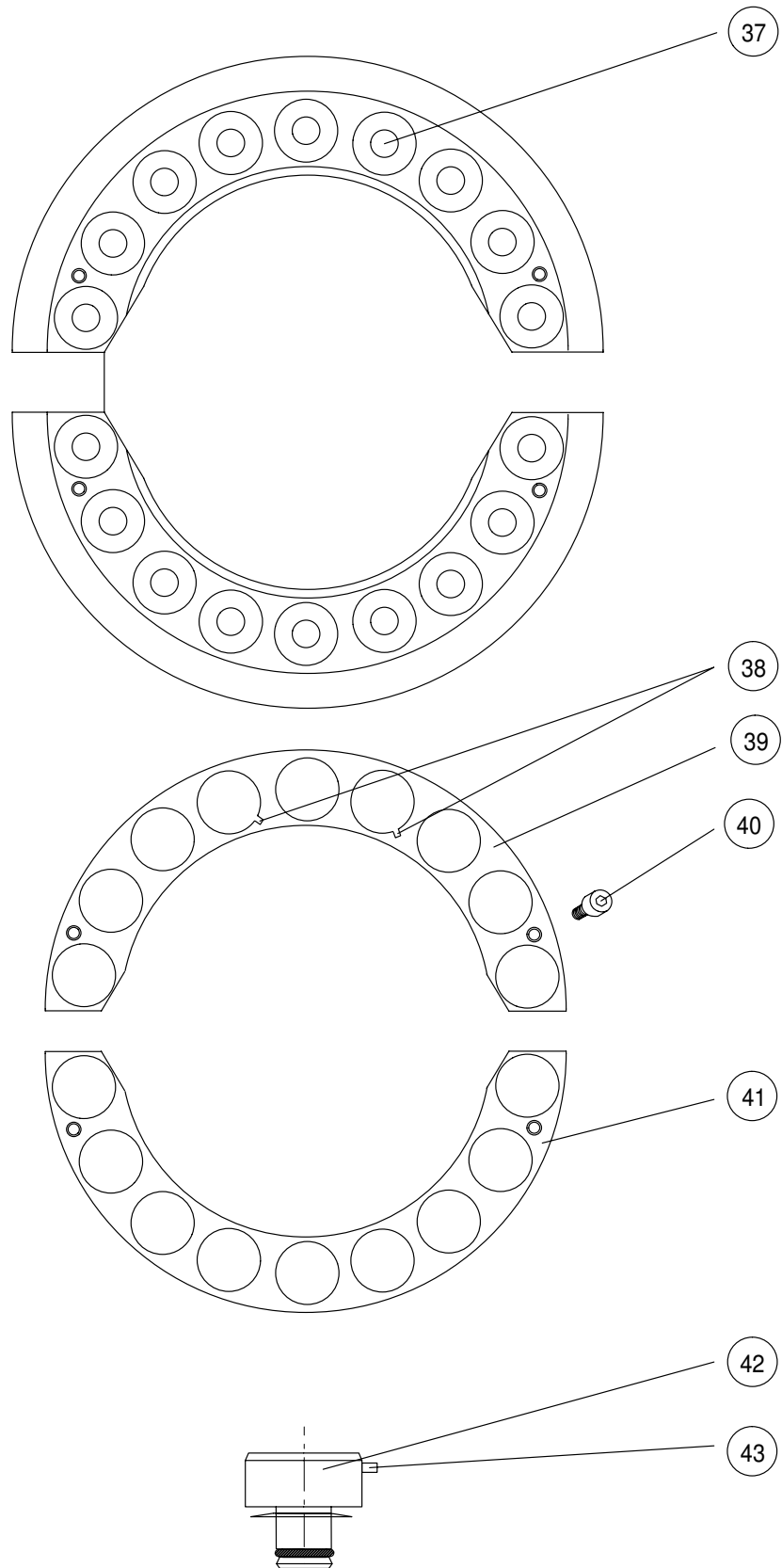
**General Drawing of the
EF Slide Bearing
with external oil supply**



- 1 Top half of the housing
- 2 Hole for positioning pin
- 3 Positioning pin
- 4 Connection hole for the oil supply of the thrust part
- 5 Top sight glass
- 6 Eye bolt
- 7 Screw (not included in delivery)
- 8 Screw
- 9 Tapped hole (in the top and bottom halves of the shell, up size 14)
- 10 Machine seal
- 11 Top half of the shell
- 12 Screw (split line of the housing)
- 13 Bottom half of the shell
- 14 Spherical seating
- 15 Engraved number - shell
- 16 Spigot
- 17 Tapped hole
- 18 Screw (not included in delivery)
- 19 Screw (split line of the shell)
- 20 Engraved numbers - housing
- 21 Bottom half of the housing
- 22 Tapped hole for temperature measurement of the journal part
- 23 Oil inlet connection hole
- 24 Tapped hole for the oil sump temperature measurement
- 25 Outlet/Inlet cooling water (Type E.T..)
- 26 Cooler (Type E.T..)
- 27 Hexagon head plug (Oil drain plug)
- 28 Metal tabs (optional for EFZL.)
- 29 Oil outlet connection hole
- 30 Oil outlet pipe with lock nut and lead seal
- 31 Marking

external oil supply

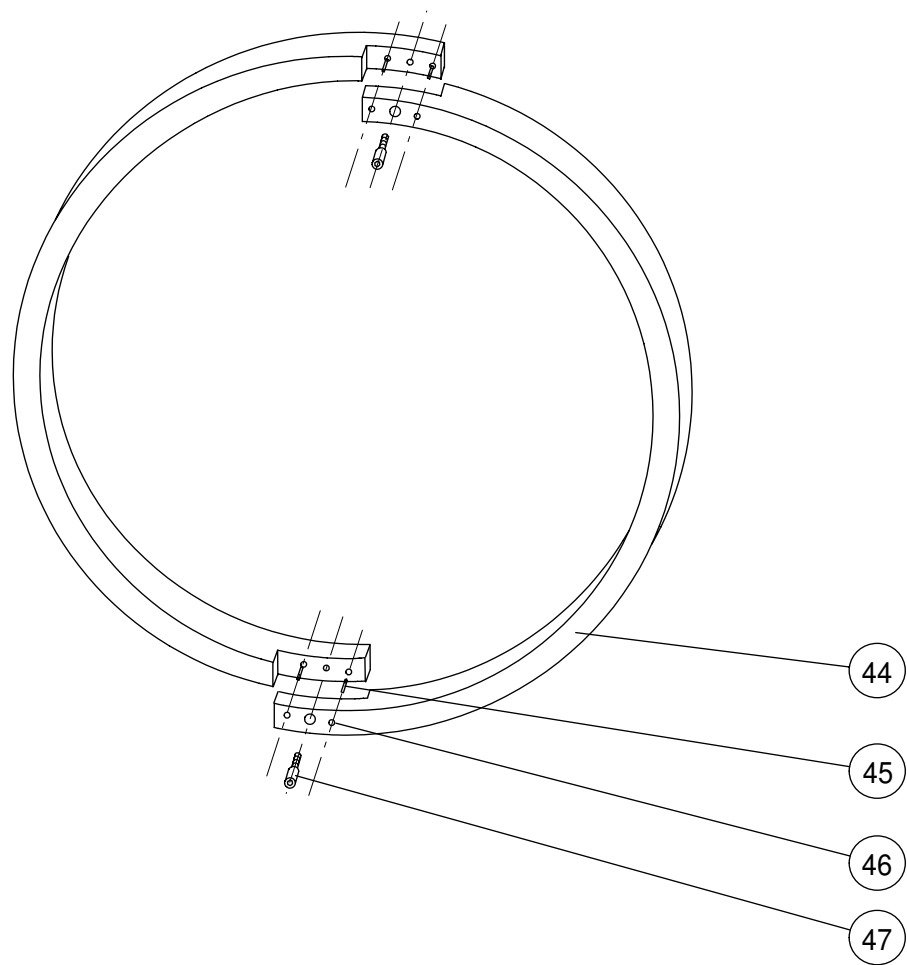
**General Drawing of the
Thrust Part with Circular Tilting Pads
(RD-Thrust Pads)**



- 37 Carrier ring
- 38 Location groove
- 39 Shroud ring top half
- 40 Screw
- 41 Shroud ring bottom half
- 42 Circular tilting pad (RD-thrust pad)
- 43 Anti - Rotation pin

external oil supply

**General Drawing of the
Loose Oil Ring**

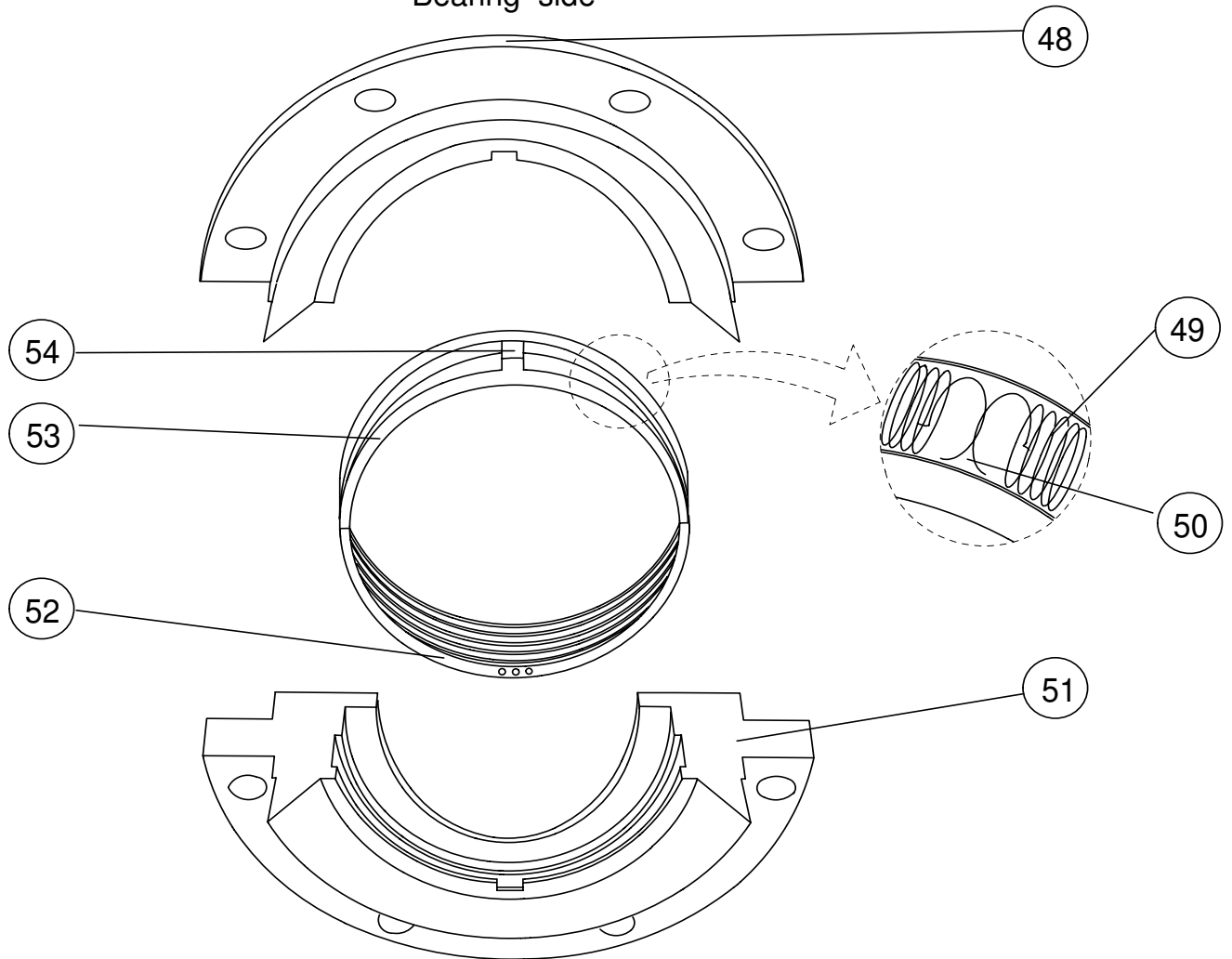


- 44 Loose Oil Ring
- 45 Dowel pin
- 46 Hole
- 47 Screw

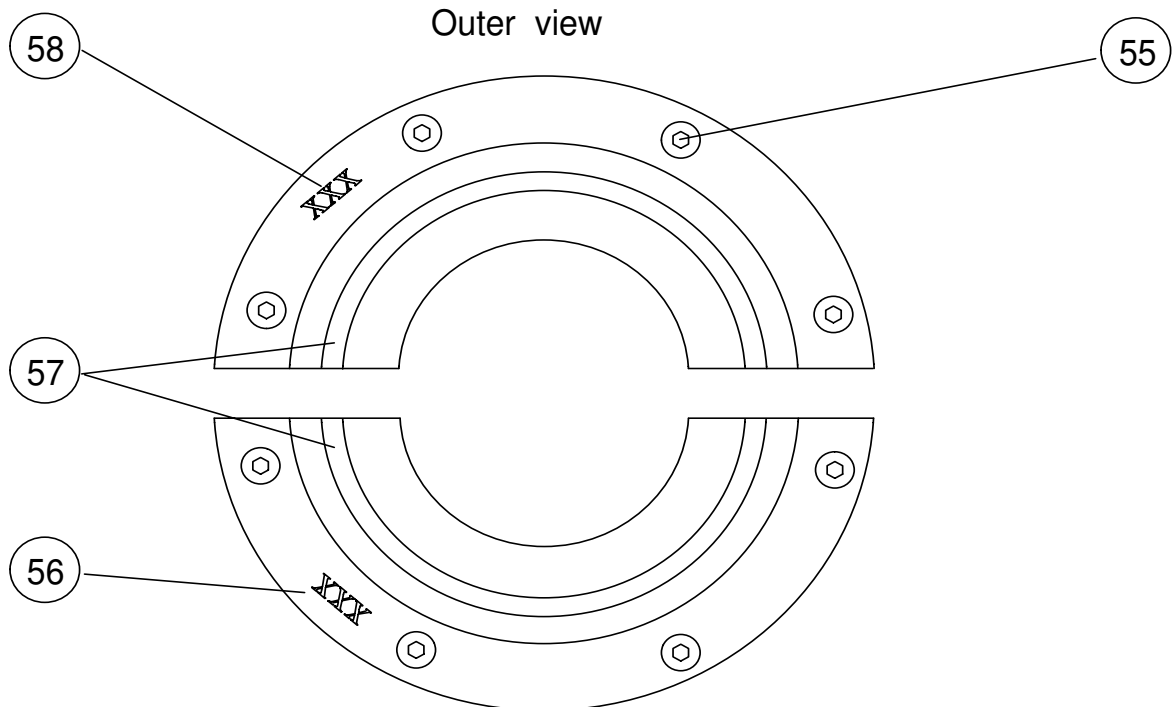
external oil supply

**General Drawing of the
Floating Labyrinth Seal
with Seal Carrier**

Bearing side



Outer view

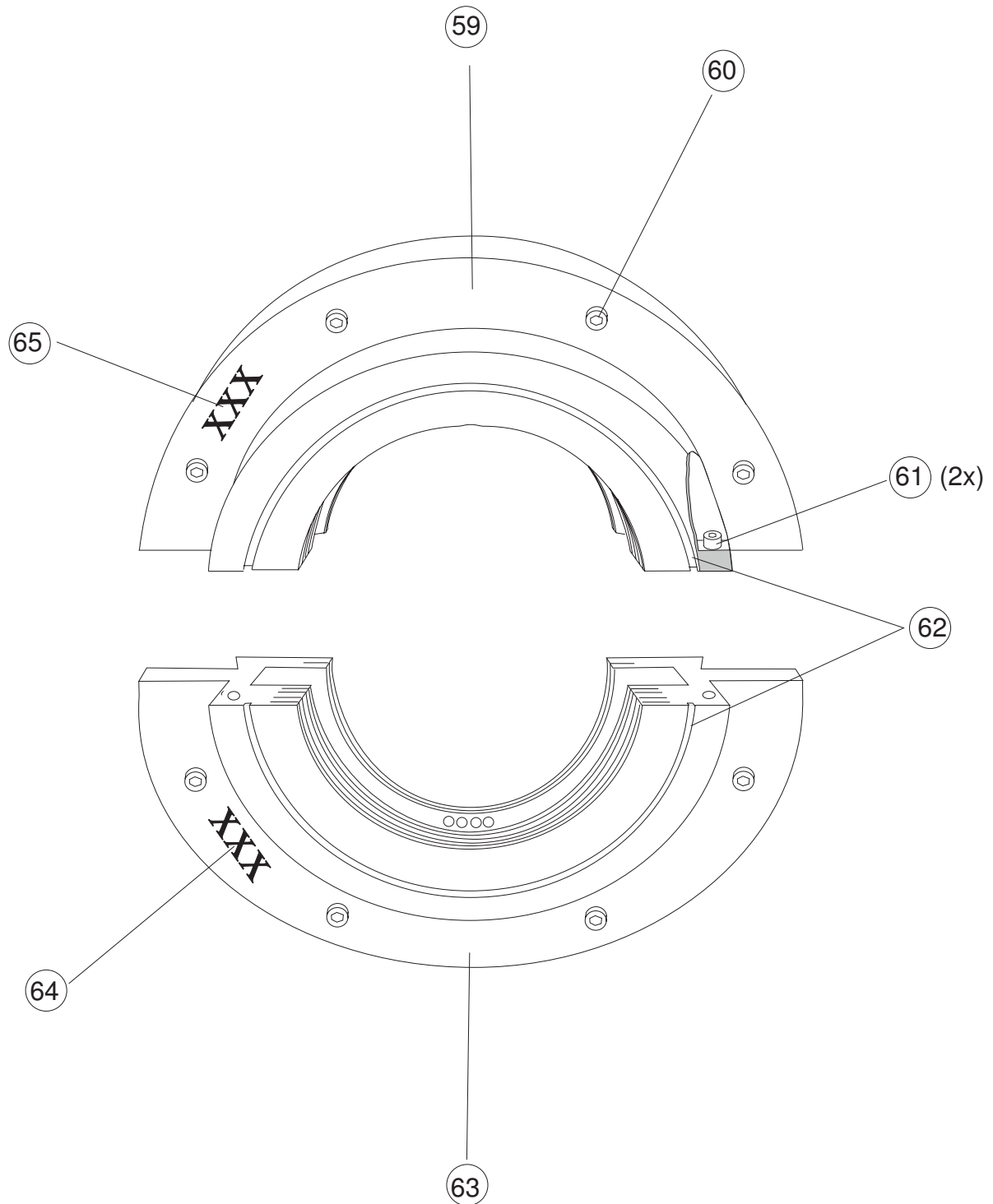


48	Seal carrier - top half
49	Garter spring
50	Groove
51	Seal carrier - bottom half
52	Bottom half of the seal
53	Top half of the seal
54	Anti - rotation pin
55	Screw
56	Engraved number
57	Groove (Type 11)
58	Engraved number

external oil supply

General drawing of the

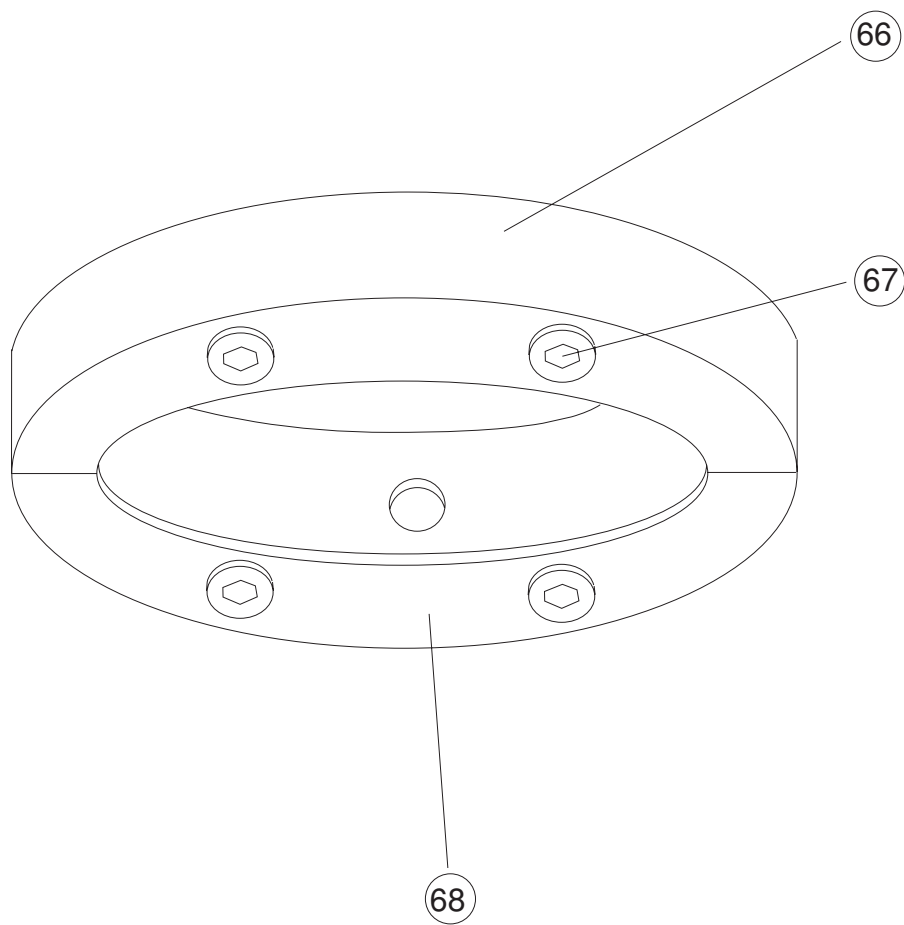
Rigid Labyrinth Seal



- 59 Rigid labyrinth seal - top half
- 60 Screw
- 61 Screw (split line)
- 62 Groove (Type 21)
- 63 Rigid labyrinth seal - bottom part
- 64 Engraved number
- 65 Engraved number

external oil supply

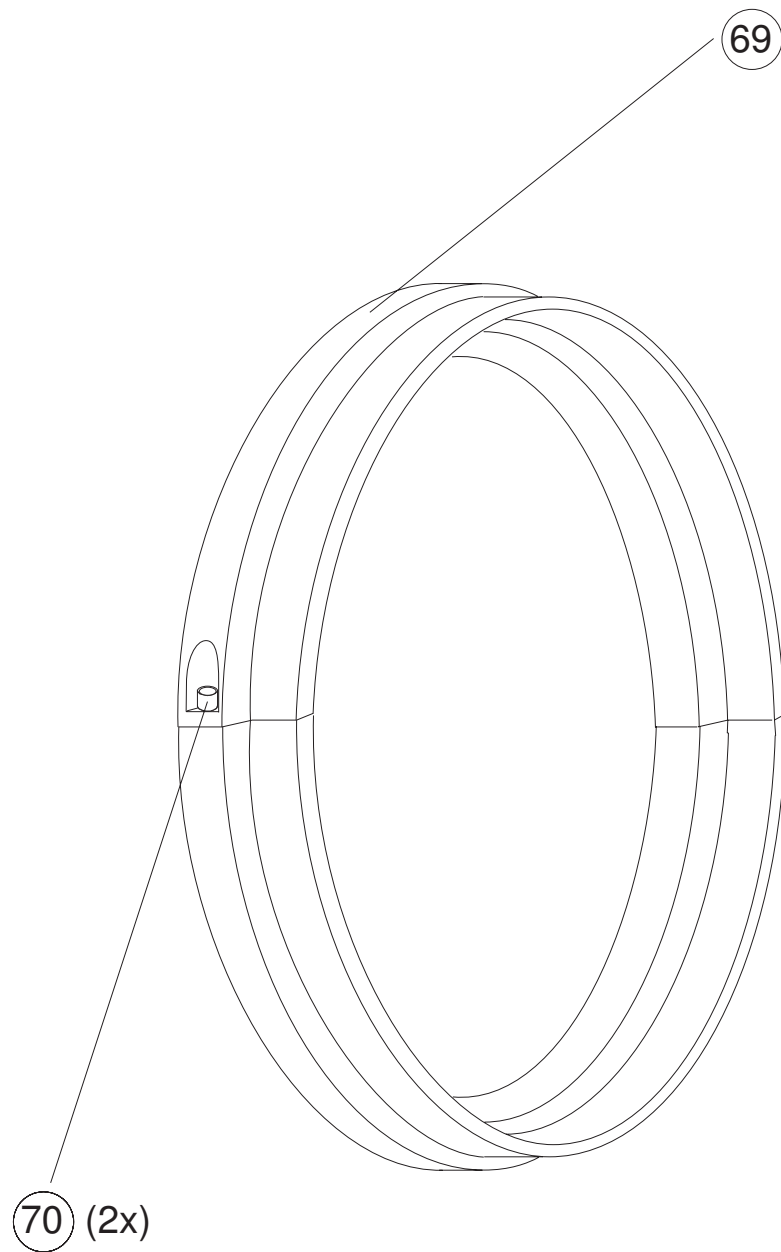
**General Drawing of the
Baffle**



- 66 Baffle - top half
- 67 Screw
- 68 Baffle - bottom half

external oil supply

**General Drawing of the
Dust Flinger**



- 69 Dust flinger
- 70 Screw (split line)

EF with external oil supply

1 Considerations for Use

The instructions for installation and operation are addressed to qualified technical personnel (fitters, mechanic installers, mechanical engineers).

Read these instructions carefully before starting assembly.

Slide bearings of type EF are almost universally used in the engineering industry. Therefore it is not possible to provide detailed information on all possible types and range of applications for these bearing types. For instance, the position of the connection points for supply and monitoring equipment is determined by the place of application (in the following called " installation "). Please keep ready the guidelines with the technical documentation before starting assembly and operation of the slide bearings.

Additional technical documentation with detailed information is supplied in the case of special design bearings. Please contact RENK Export or Domestic Department for supplementary information on bearings. Please indicate the bearing coding and the full reference number, too.

Following indications should be observed when reading these instructions.

Safety instructions are marked as follows:



Danger!

Warning of dangers for personnel.

Example: Warning of injury

Attention!

Warning of damage for the bearing or installation.

Useful recommendations and additional information are framed.

EF...Q

This is how chapters, instructions or recommendations are marked when referring to a single type or size of a bearing.

Example: Slide bearing type EF without thrust part (non-locating bearing)

- Instruction follows.
- Beginning of an enumeration.
- () This is how the different parts of a bearing as described in the general drawings (numbers) are marked in the text.
- Use the enclosed check-list before starting assembly or operation. Copies available on request. The check list provides the experienced mechanical fitters of RENK bearings with the necessary instructions for installation and operation.

Installation and Operation

2 Safety Instructions



Danger!

The maintenance and inspection of the slide bearings should be carried out by:

- ☐ persons nominated by the safety representative
- ☐ persons correspondingly trained and instructed
- ☐ persons with knowledge on appropriate standards, regulations and accident prevention rules
- ☐ persons with knowledge on first-aid measures and local rescue centers.



Warning of injury!

Before starting work on the bearing:

- Switch off the installation.
- Make sure the installation is not in operation.

Never lift or transport machines, etc. by the bearing eye bolts. These are only intended for assembly and dismantling of the bearing !



Warning of injury!

Do not grab such heavy bearing parts as the housing during assembly or dismantling work. This could result in bruising or injury to hands !

Attention!

All metal parts of a slide bearing consisting of top and bottom part such as the housing, shells, shaft seals are marked by engraved numbers. Fit together only the parts with the same number.

Attention!

In case

- the admissible bearing temperature exceeds by 15 K,
- inadmissible vibrations occur,
- unusual noises or odours are noticed,
- ☐ monitoring equipment triggers alarm,

shut down the installation and inform the maintenance personnel in charge.

Attention!

Do not operate the bearing below the transition speed values indicated in the bearing calculation, thus avoiding inadmissible operating conditions, which could lead to damage to the bearing.

Attention!

Please observe our leaflet Technical Information No. 85 which refers to various sealing compounds for extended technical applications.

EF with external oil supply

3 Preparatory Work

3.1 Tools and equipment

– Following tools and equipment are necessary:

- Allan key set
- Wrenching key set
- Open-jawed spanner set
- Feeler gauges (up 0,05 mm)
- Caliper gauge
- Emery paper, plain scraper
- Oil stone
- Lifting equipment
- Permanent sealing compound
- Clean (close weave) rags
- Oil with the correct viscosity (see bearing type plate)
- Detergents
- Liquid screw locking compound (e.g. LOCTITE 242)
- Liquid sealing compound and Teflon-tape

3.2 Use of lifting equipment



Warning of injury!

Before transport or lifting, check if the eye bolts are tight ! Insecure eye bolts could result in bearing becoming loose.

Before moving the bearing by the eye bolts make sure that the split line screws are tightened, otherwise the bottom half of the bearing could become detached.

Make sure that the eye bolts are not exposed to bending stress, otherwise the bolts could break.

Follow exactly the instructions for the use of lifting equipment.

– Use lifting equipment for assembly or transport of the following items:

Transport/Assembly of:	Use lifting equipment for the following bearing sizes
Whole bearing unit	9-28
Top half of the housing	14-28
Bottom half of the housing	11-28
Shells	14-28

Installation and Operation

- Following steps are to be observed before using the lifting equipment:

Whole bearing unit

- Check if the screws are tight (12):

Bearing size	9	11	14	18	22	28
Torque [Nm]	69	69	170	330	570	1150

- Check if the eye bolts (6) are tight.
- Connect the lifting equipment to the eye bolts (6).

Top half of the housing

- Check if the eye bolts (6) are tight.
- Connect the lifting devices to the eye bolts (6).

Bottom half of the housing

- Screw two eye bolts (6) with suitable threads tight into the cross-placed opposite tapped holes (17).

Bearing size	9	11	14	18	22	28
Tapped hole	M 12	M 12	M 16	M 20	M 24	M 30

- Connect the lifting equipment to the eye bolts (6).

Shells

- Screw two eye bolts or screw hooks with suitable threads tight into the tapped holes (9):

Bearing size	14	18	22	28
Tapped hole	M 8	M 12	M 12	M 16

- Connect the lifting equipment to the eye bolts or to the screw hooks.

EF with external oil supply

3.3 Dismantling of the bearing

Attention

Make sure that the work place and the parts to be assembled are clean. Contamination and damage to the bearing, especially to the working surfaces, have a negative influence on the operating quality and could lead to premature failure.

3.3.1 Dismantling of the shaft seal - outboard side

- Dismantle the shaft seals of the bearing. Proceed according to the sealing type:

Type
10
Type
11

Floating labyrinth seal (Type 10)

Floating labyrinth seal with dust flinger (Type 11)

- Loosen and remove all screws (55).
- Simultaneously take away in axial direction both top half (48) and bottom half (51) of the seal carrier from the housing.
- Lift off the top half of the seal carrier (48) and take out the floating labyrinth seal from the bottom half of the seal carrier (51).
- Remove the protective cardboard (for transport protection) from the floating labyrinth seal.
- Proceed as indicated for sizes
 - 9-11
 - 14-28

Size
9 -11

- Take hold of the floating labyrinth seal with both hands. Press out the protective cardboard with both thumbs.

Size
14-18

- Take both halves of the seal (52), (53) by the split line. Pull both halves apart, till you can press out the protective cardboard. Remove carefully by pressing along the edge of the split line.



Warning of injury!

During dismantling of the floating labyrinth seal hold on tight to the tensioned garter spring (49) which otherwise could bounce back and lead to injury.

- Take both seal halves (52), (53) and pull them apart by approximately 20 mm.
- Open the garter spring (49).

Type
12

Floating labyrinth seal with baffle (Type 12):

- Disconnect the top half of the baffle (66) and the bottom (68). To do so, loosen the screws (67).
- Further proceed as in the case of type 10 and 11 seal.

Type
20
Type
21

Rigid labyrinth seal (type 20)

Rigid labyrinth seal with dust flinger (type 21)

- Untighten all screws (60) and remove them.
- Simultaneously remove in axial direction both top and bottom (59), (63) halves of the rigid labyrinth seal.
- Remove the screws (61).
- Separate the top half of the rigid labyrinth seal (59) from the bottom half (63) and take out the protective cardboard (used for safe transport).

Type
22

Rigid labyrinth seal with baffle (type 22)

- Separate the top and bottom half (66), (68) of the baffle, by untightening the screws (67).
- Further proceed as in the case of types 20 and 21.

Installation and Operation

3.3.2 Dismantling of the housing

EF.V.

- Unscrew the screw plug with the welded-on positioning pin.
- Unscrew the screws (12) and lift the top half of the housing (1).
- Take out both top (11) and bottom (13) halves of the shell from the bottom half of the housing (21).

Attention!

Do not damage the thrust and radial working surfaces!

- Unscrew the screws (19) and separate the top and bottom halves of the shell (11), (13) without using any tools or other devices.

Attention!

If the bottom half of the shell (13) is provided with metal tabs (28) do not remove them. They regulate the oil level in the oil pockets.

EFT..

The cooler (26) is already assembled and does not have to be removed for cleaning purposes.

3.3.3 Dismantling of the shaft seal - machine-side

The machine side seal is of Type 10, floating labyrinth seal.

- Remove the floating labyrinth seal from the bottom half of the housing.
- Notice the anti-rotation pin at the split line of the bottom half of the housing.
- Remove the protective cardboard (for transport protection) from the floating labyrinth seal.
- Proceed as indicated for sizes
 - 9-11
 - 14-28

**Size
9 -11**

- Take hold of the floating labyrinth seal with both hands. Press out the protective cardboard with both thumbs.

**Size
14-18**

- Take both halves of the seal (52), (53) by the split line. Pull both halves apart, till you can press out the protective cardboard. Remove carefully by pressing along the edge of the split line.



Warning of injury!

During dismantling of the floating labyrinth seal hold on tight to the tensioned garter spring (49) which otherwise could bounce back and lead to injury.

- Take both seal halves (52), (53) and pull them apart by approximately 20 mm.
- Open the garter spring (49).

EF with external oil supply

3.4 Cleaning of the bearing

Attention!

Use only non-aggressive detergents, such as for instance:

- ☐ VALVOLINE 150.
- ☐ Alkaline cleaning compounds (pH-value 6 to 9, short reaction time).



Warning of injury!

Please observe the instructions for the use of the detergents.

Attention!

Never use cleaning wool or fibrous cloth. Residues of such materials left in the bearing could lead to excessive temperatures.

- Clean the following parts thoroughly, to remove all residues of preservation :
 - inside the top half of the housing (1)
 - inside the bottom half of the housing (21)
 - all plain parts of the top and bottom half of the housing (1), (21)
 - top half of the shell (11)
 - bottom half of the shell (13)
 - sealing surfaces of the top (48) and bottom (51) half of the seal carrier or of the rigid labyrinth seal
- EF.L.** |
 - loose oil ring (44).

3.5 Checks

- Please check if there is any visible damage. Check the split line and the working surfaces in particular.

EF.L.

The loose oil ring (44) should show absolutely no burrs or have no shoulders.

Insulated Bearings

- Check the insulating layer of the spherical seating (14).
- If necessary, change the damaged parts.

Installation and Operation

EF..A

3.6 Assembly of the circular tilting pads (RD-thrust pads)

- Clean both top (39) and bottom (41) halves of the shroud ring and all RD-thrust pads (42). Proceed as described under chapter 3.4 (Cleaning of the bearing).

Bearing size	Diameter	Number of RD-thrust pads per bearing [Pieces]
9	80	14
	90	16
	100	20
11	100	16
	110	18
	125	22
14	125	18
	140	20
	160	24
18	160	18
	180	20
	200	24
22	200	18
	225	20
	250	24
28	250	18
	280	20
	300	24

- Check if the parts show any visible damage.

Carry out the assembly of both thrust parts of the top (11) and bottom (13) half of the shell according to the following instructions:

One RD-thrust pad on both sides of the top half of the shell has a bore for the insertion of a thermo sensor (thrust part temperature measurement).

EF with external oil supply

To mount the RD-thrust pad into the correct position proceed as follows:

- Find the position of the location groove (38) on the top half of the shroud ring (39). Insert the RD-thrust pad (42) with the anti-rotation pin (43) into the corresponding thrust pad location hole (37).
- Insert all other RD-thrust pads (42) into the corresponding thrust pad holes (37) of the top and bottom half of the shell (11), (13).

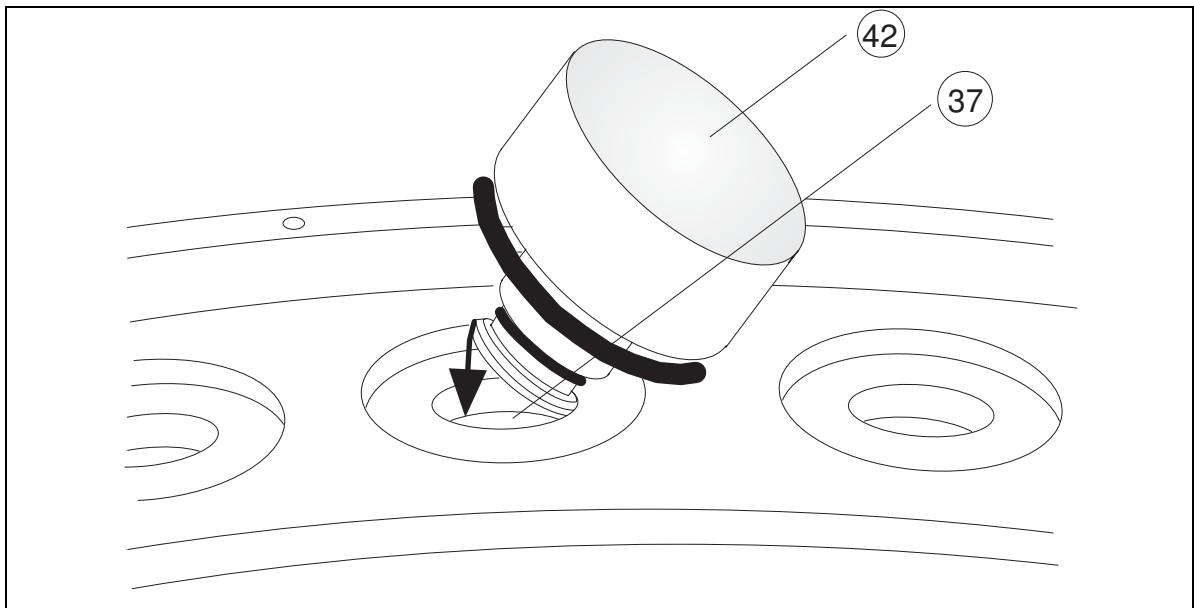


Illustration 1: Assembly of the RD-thrust pads

- Place the top half of the shroud ring (39) into the the top half of the shell (11) by inserting the anti-rotation pin (43) into the location hole (38). Match the split line of the top half of the shell (11) with the split line of the top half of the shroud ring (39) in true alignment.

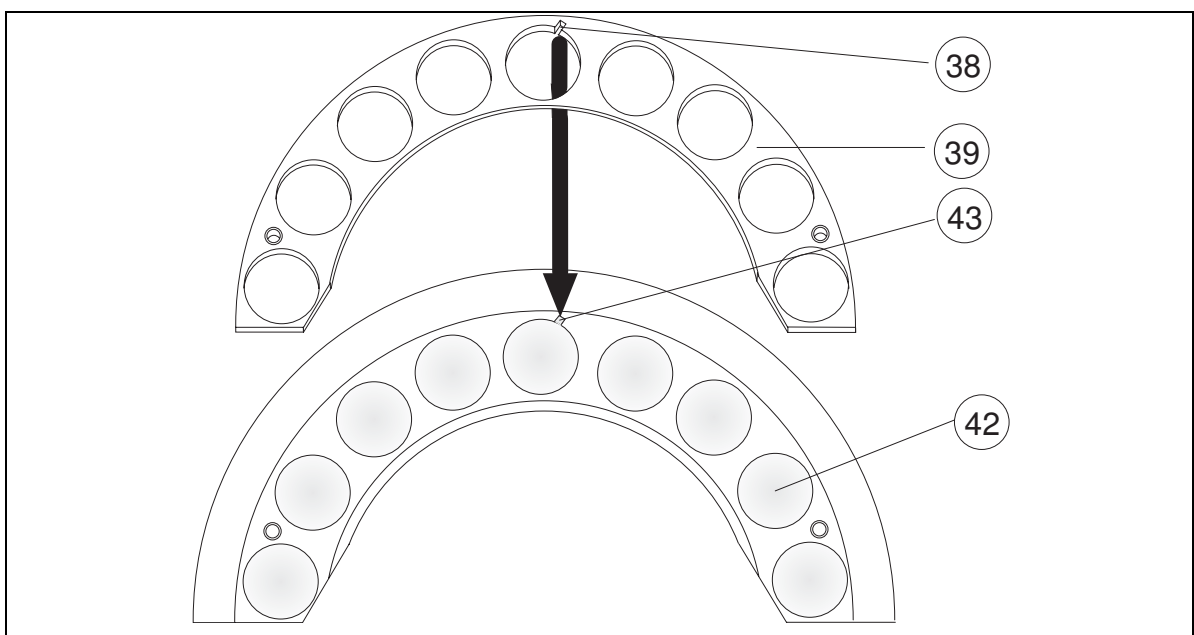


Illustration 2: Assembly of the shroud ring

Installation and Operation

- Tighten the screws (40) to the following torque rates:

Bearing size	9	11	14	18	22	28
Tapped hole	M 4	M 4	M 5	M 6	M 8	M 10
Torque [Nm]	1,4	1,4	2,7	8	20	40

- Place the bottom half of the shroud ring (41) into the bottom half of the shell (13). Match the corresponding split lines in true alignment. Tighten the screws (40) to the same torque rates as specified for the top half of the shell (11).
- Check the mobility of all RD-thrust pads (42).
If the RD-thrust pads jam, realign the top (39) and bottom half (41) of the shroud ring.

Attention!

Insufficient mobility of the RD-thrust pads will cause damage of the bearing.

Both top and bottom halves of the shells are prepared for assembly.

EF with external oil supply

4 Assembly of the Bearing

Attention!

Remove all impurities or other objects such as screws, nuts, etc. from inside the bearing. If left inside they could lead to damage to the bearing. Cover up the opened bearing during work breaks.

Attention!

Carry out all assembly operations without making use of force.

Attention!

Secure all screws of the housing, at the split line and flange with a liquid screw locking compound (e.g. LOCTITE 242).

4.1 Assembly of the the machine seal

Before assembly of the bearing screw the split and non-split machine seal (10) into the machine shield. The non-split machine seal must be assembled before starting the assembly of the shaft.

- Fit the machine seal with the recess onto the machine shield.
- In the case of a split machine seal insert the split line screws and tighten them hand tight.
- Tighten the screws (7) to the following torque rates:

Bearing size	9	11	14	18	22	28
Tapped hole	M 6	M 6	M 6	M 8	M 8	M 8
Torque [Nm]	8	8	8	20	20	20

Installation and Operation

4.2 Fitting the bottom half of the housing into the machine shield

Attention!

The lifting equipment should not come to contact with the seal and working surfaces of the shaft.

- Lift the shaft high enough to give room for the assembly operations.
- Protect the shaft against unintended movement.
- Place the bottom half of the housing with the spigot (16) into the mounting recess of the machine shield.
- Tighten the flange screws to the following torque rates.

EF..A

- In case the bearings type EF are operating under high axial loads tighten the third flange screw mounted on the inner part of the machine shield into the bottom half of the housing to the following torque rates.
- Use only 8.8 quality screws.

Bearing size	9	11	14	18	22	28
Suitable flange screws	M 10	M 12	M 16	M 20	M 24	M 30
Torque [Nm] for μ_{tot} (lightly oiled)	69	69	170	330	570	1150

4.3 Fitting in the bottom half of the shell

EF..E

Attention!

Mounting the bottom half of the shell (not marked with an arrow) correctly will ease the assembly of the top half shell (marked with an arrow) (see chapter 4.6).

- Apply some lubricant to the spherical seating (14) in the bottom half of the housing (21) and to the working surfaces of the shaft. Use the same type of lubricant as indicated for bearing operation (see type plate).
- Place the bottom half of the shell (13) on the working surface of the shaft. Turn the bottom half of the shell (13) into the bottom half of the housing (21) with the split line surfaces of both halves in true alignment.

In case the bottom half of the shell doesn't turn in easily, check the position of the shaft and the alignment of the housing

EF..B, EF..K EF..E EF..A

Attention!

These operations should be carried out most carefully. The thrust parts of the bottom shell must not be damaged.

- Lower down the shaft till it sits on the bottom half of the shell (13).

EF with external oil supply

4.4 Assembly of the shaft seal - machine-side

The machine-side shaft seal is, as standard, a floating labyrinth seal. The integrated seal groove is in the top and bottom halves of the housing.



Warning of injury!

During assembly hold the garter spring ends securely to avoid them suddenly releasing and causing possible injury !

Check the movement of the floating labyrinth seal on the shaft in the seal area outside the housing.

- Put the garter spring (49) around the shaft and hook both ends into each other.
- Put both halves of the seal (52),(53) in their place on the shaft.
- Put the garter spring (49) into the groove (50).
- Turn the floating labyrinth seal on the shaft.

Attention!

The floating labyrinth seal should turn easily on the shaft. A jammed seal could lead to overheating during operation and even to shaft wear.

If the floating labyrinth seal jams,

- dismantle the seal and
- remove the worn parts of the seal carefully, by using emery paper or a plain scraper.

- Dismantle the floating labyrinth seal.
- Apply sealing compound to the guide surfaces of the integrated seal groove in the bottom half of the housing.

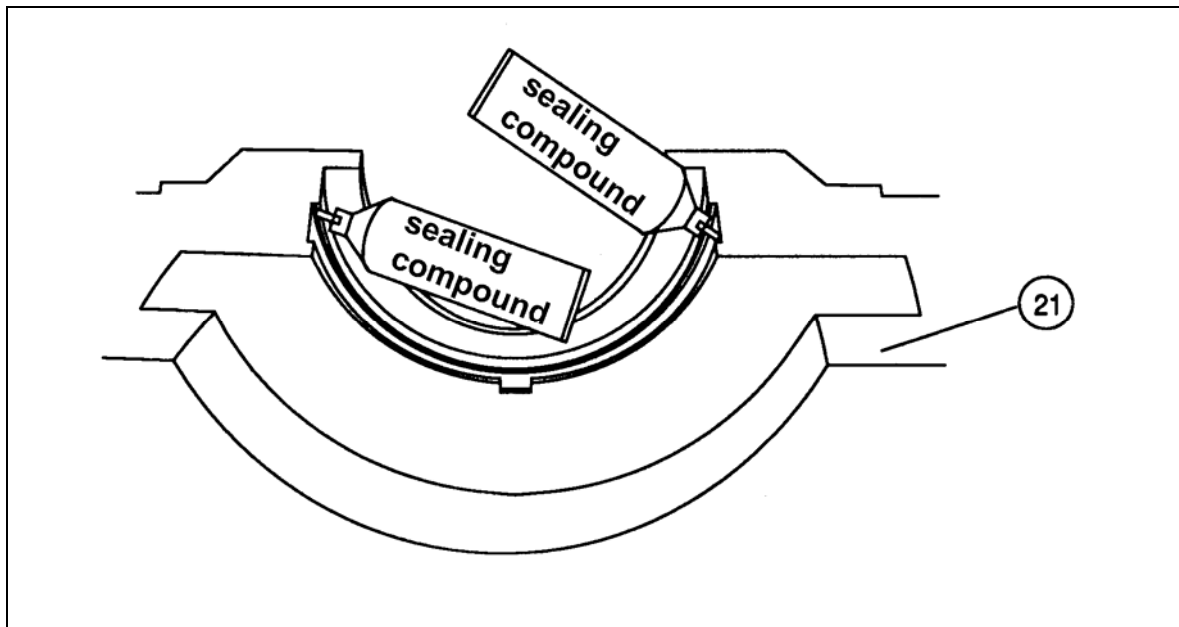


Illustration 3: Application of sealing compound to the integrated seal groove

Installation and Operation

- Apply a uniform layer of sealing compound to the guide surfaces and to the split line surfaces of both halves of the seal (52), (53).

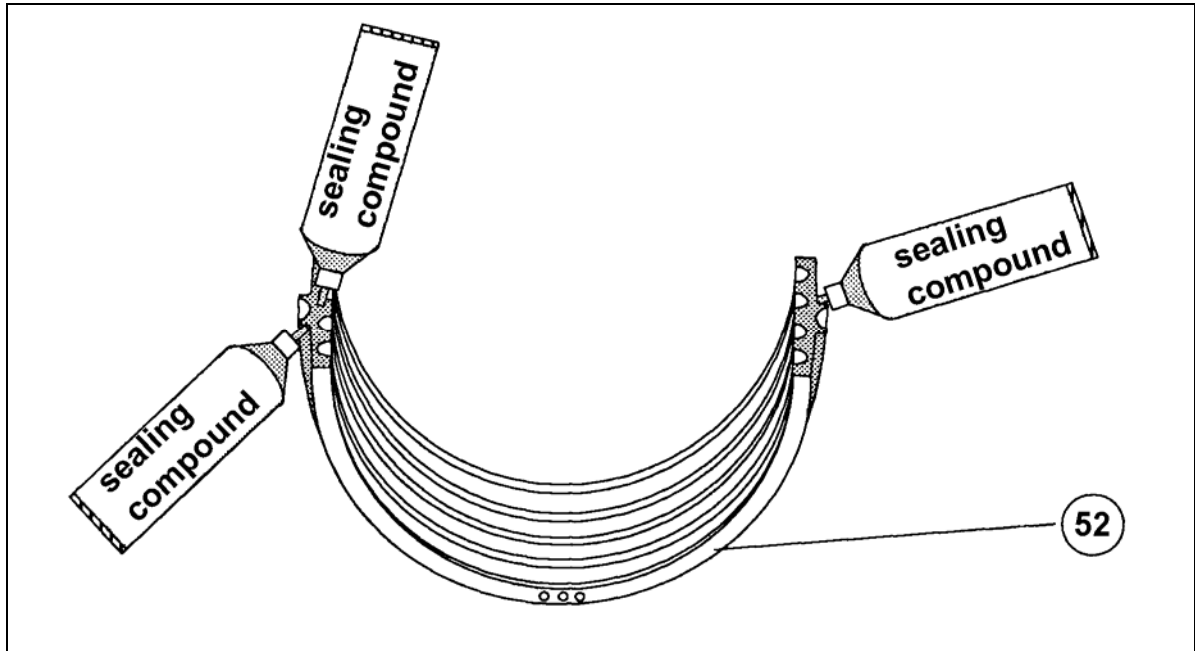


Illustration 4: Application of sealing compound to the floating labyrinth seal

Please observe the instructions for the use of sealing compound.

- Place the bottom half of the seal (52) with the labyrinths onto the shaft.
- The oil return holes at the bearing side must be clear and open.
- Turn the seal in opposite direction from the anti-rotation pin into the groove of the housing until the split lines of the bottom half of the housing and the bottom half of the seal match each other.
- Remove the residue of sealing compound.
- Push the garter spring into the integrated seal groove between the bottom half of the housing and the seal until both ends jut out from the split line.
- Place the top half of the seal with the cam facing the inside of the bearing on the bottom half of the seal.
- Stretch the garter spring till both ends can be hooked.

EF with external oil supply

EF.L.

4.5 Installation of the loose oil ring

- Open both split lines of the loose oil ring (44) by untightening and removing the screws (47). Separate both halves of the loose oil ring (44) carefully without using any tools or other devices.

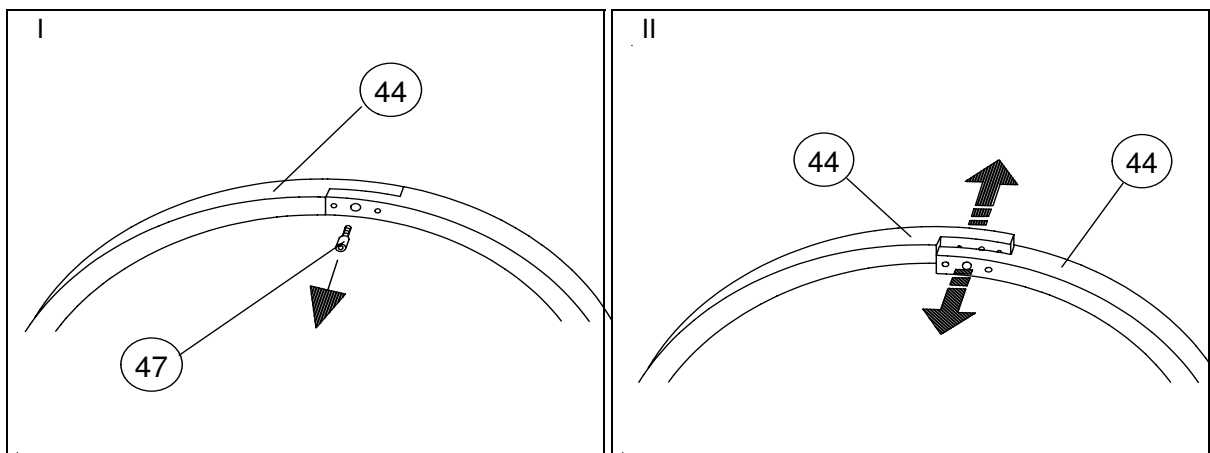


Illustration 5: Opening of the loose oil ring

- Place both halves of the loose oil ring into the shell groove around the shaft. Press the positioning pin (45) of each split line into the corresponding hole (46).
- Adjust both halves of the loose oil ring till the split lines match each other.

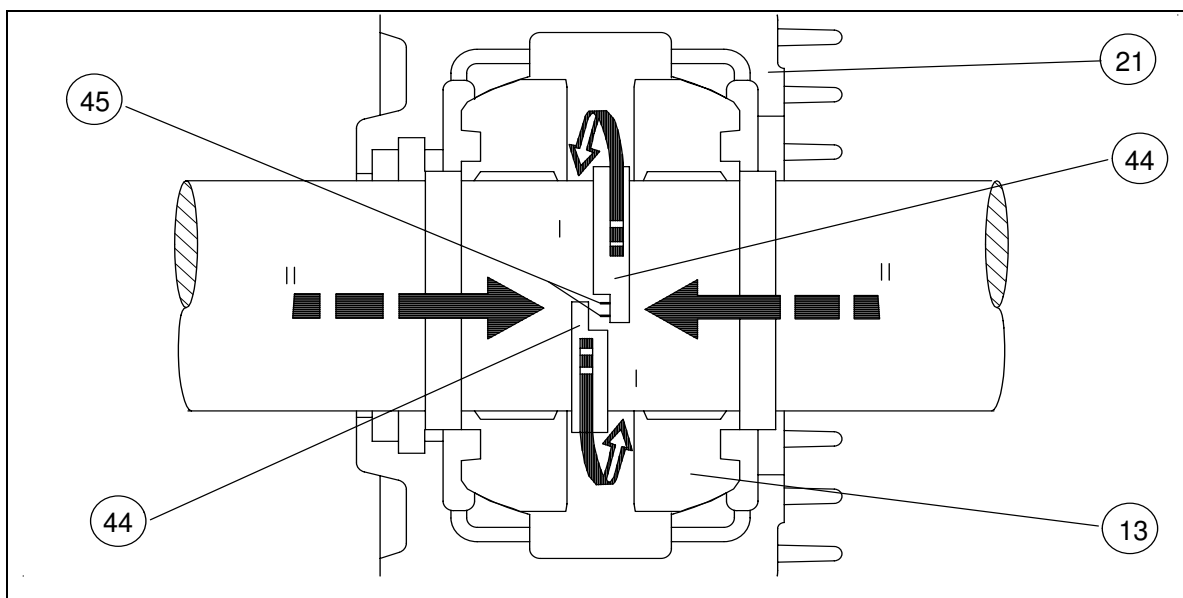


Illustration 6: Installation of the loose oil ring

- Tighten the screws (47) to the following torque rates:

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

Installation and Operation

4.6 Fitting in the top half of the shell

- Apply some lubricant to the working surfaces of the shaft. Use the same type of lubricant as indicated for bearing operation (see type plate).
- Check if the engraved number (15) on the bottom half of the shell corresponds with the engraved number (15) on the top half of the shell.
- Place the top half of the shell (11) on the shaft; both engraved numbers (15) should be on one side.

Attention!

An incorrectly placed shell could jam the shaft thus leading to the damage of both shaft and bearing.

EF..B,
EF..K,
EF..E,
EF..A

Attention!

Place the top half of the shell carefully on the shaft. The thrust parts of the top half of the shell must not be damaged.

insulated
bearings

In the case of bearings arranged for insulation monitoring, connect the black cable for insulation monitoring to the shell.

According to the bearing type, there are two possibilities of connection.

1. The black cable is provided with a cable connector.

- Plug the cable with the cable connector into the counterpart available on the top of the shell.
- Lead the cable through the cable gland in the bottom half of the housing and out of the bearing.
- Tighten the cable gland oil-tight.

2. The black cable is provided with an eyelet.

- Fasten the cable with the eyelet to the split line of the shell, by using one of the shell joint bolts.
- Lead the cable through the cable gland in the bottom half of the housing and out of the bearing.
- Tighten the cable gland oil-tight.

- Tighten up the screw (19) at the split line of the shell to the following torque rates:

Bearing size	9	11	14	18	22	28
Torque [Nm]	8	8	20	69	69	170

- Check the split line of the shell by using a feeler gauge. The split line gap should be less than 0,05 mm. If the split line is greater than this, dismantle both top (11) and bottom (13) halves of the shell. Rework the split line surfaces of the top (11) and bottom (13) half of the shell with an oil stone.

EF.L.

- Check the mobility of the loose oil ring (44).

Marine
bearings

A guide bush in the top half of the shell secures the function of the loose oil ring.

- Check the mobility of the loose oil ring (44) in the guide bush.

EF with external oil supply

EF..E

Shells with taper land faces suitable only for one direction of rotation are marked with an arrow on the top half shell, which indicates the sense of rotation of the shaft.

The arrow indicates the allowed direction of shaft rotation after completion of the bearing assembly.

- Before mounting the top half of the housing check that the proposed direction of rotation of the shaft corresponds to the direction indicated by the arrow on the top half of the shell.
- If the directions match, continue the assembly of the bearing.
- If the directions do not match, the shell must be disassembled, re-aligned and mounted again.

Attention!

A wrongly placed shell, without observance of the direction of rotation of the shaft, impairs the operational safety of the bearing.

4.7 Assembly of the top half of the housing

- Check the true alignment of the split lines of the shell (11), (13) and bottom (21) half of the housing.

EF.C. EF.L. EF.Y.

The positioning pin (3) in the top half of the housing fits in the corresponding hole (2) in the shell.

- Check if the engraved numbers (20) on the top and bottom halves of the housing correspond.
- Clean the split line surfaces of the top and bottom halves of the housing.
- Apply sealing compound over the whole surface of the split line of the bottom half (21) of the housing.

Please observe the instructions for the use of sealing compound.

- Place the top half of the housing carefully into the machine shield, without touching the seals or the shell.
- Lower the top half of the housing (1) vertically on the bottom half of the housing (21). Lower the top half of the housing (1) till the split line of the housing is not visible any more.
- Gently hit the bottom half of the housing (21) with a nylon hammer, thus ensuring the alignment of the spherical seating.
- Insert the screws (12) at the split line of the housing. Tighten them hand-tight.
- Insert the screws (8). Tighten them to the following torque rates:

Bearing size	9	11	14	18	22	28
Torque [Nm]	69	69	170	330	570	1150

- Insert the screws (12) at the split line of the housing. Tighten them crosswise to the same torque rates.

EF.V.

- Tighten the screw plug with the welded-on positioning pin into the top half of the housing (1).

Installation and Operation

insulated
bearings

Insulation monitoring

In the case of electric insulated bearings provided with insulation monitoring, the cable coming out of the housing must be connected in a professional manner.

According to the type supplied, please follow the assembly instructions given below.

- a) The cable is very short and provided with a further cable connector at the end of it.
This cable is ready for connection to the housing.
The bottom half of the housing is provided with the counterpart.
- Plug the cable connector into the counterpart.

Attention!

This connection bypasses the electrical insulation of the bearing.
In the case of electric machines, make sure at least one bearing is electrically insulated.

To check the electrical insulation, interrupt the connection cable - housing. Check the electrical resistance with a suitable measuring instrument. Make sure that both bearings and the coupling are electrically insulated.

- b) The cable has a free end. In this case the customer has to make the connection.

Attention!

If only one bearing is insulated, the end of the cable must not be earthed.

Any further connection depends on the customer's requirements related to the insulation monitoring and can not therefore be described here.

EF with external oil supply

5 Assembly of the Seals - Outboard Side

- Assemble the outboard side seals.
Proceed according to the seal type used.
- Floating labyrinth seal (Type 10) Chapter 5.1
- Floating labyrinth seal with dust flinger (Type 11) Chapter 5.2
- Floating labyrinth seal with baffle (Type 12) Chapter 5.3
- Rigid labyrinth seal (Type 20) Chapter 5.4
- Rigid labyrinth seal with dust flinger (Type 21) Chapter 5.5
- Rigid labyrinth seal with baffle (Type 22) Chapter 5.6

Type 10

5.1 Floating labyrinth seal (Type 10)



Warning of injury!

During assembly hold the garter spring ends securely to avoid them suddenly releasing and causing possible injury !

Check the movement of the floating labyrinth seal on the shaft.

- Put the garter spring (49) around the shaft and hook both ends into each other.
- Put both halves of the seal (52),(53) in their place on the shaft.
- Put the garter spring (49) into the groove (50).
- Turn the floating labyrinth seal on the shaft.

Attention!

The floating labyrinth seal should turn easily on the shaft. A jammed seal could lead to overheating during operation and even to shaft wear.

If the floating labyrinth seal jams,

- dismantle the seal and
- remove the worn parts of the seal carefully, by using emery paper or a plain scraper.

- Dismantle the floating labyrinth seal.

Installation and Operation

- Apply a uniform layer of sealing compound to the guide surfaces and to the split line surfaces of both halves of the seal (52), (53).

Please observe the instructions for the use of sealing compound.

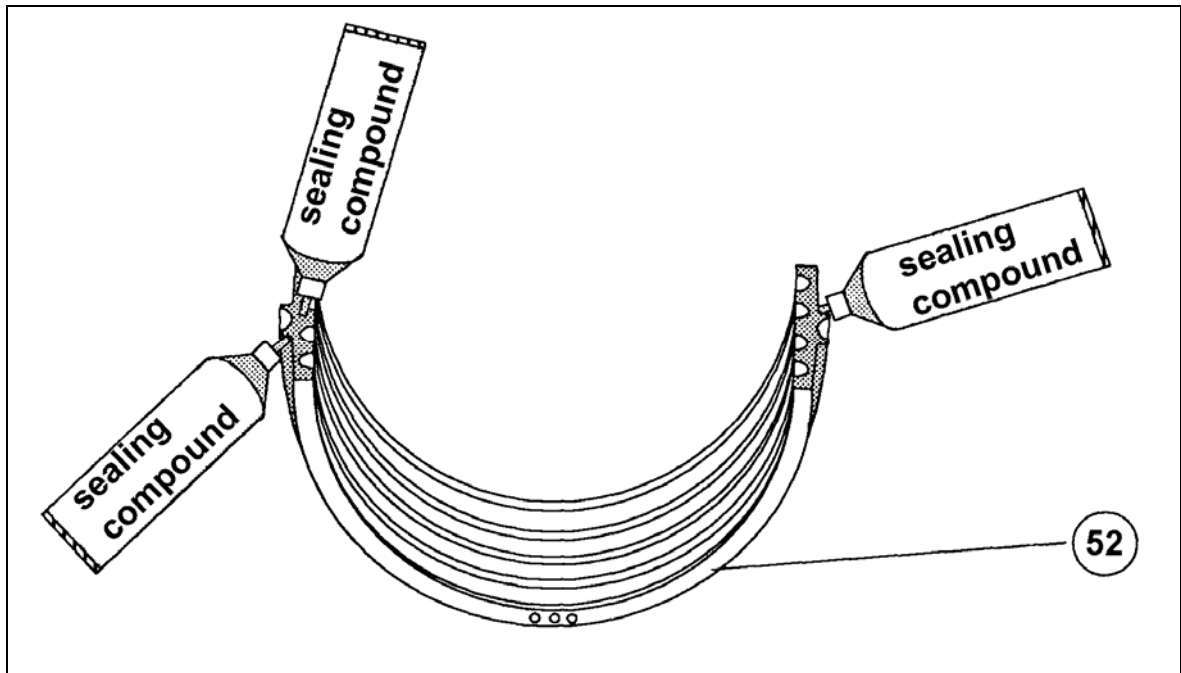


Illustration 7: Application of sealing compound to the floating labyrinth seal

- Press the bottom half of the seal (52) against the shaft.
- Place the top half of the seal (53) on the shaft and align both halves of the seal to each other.
- Place the garter spring (49) into the groove (50) and stretch until both ends can be hooked.

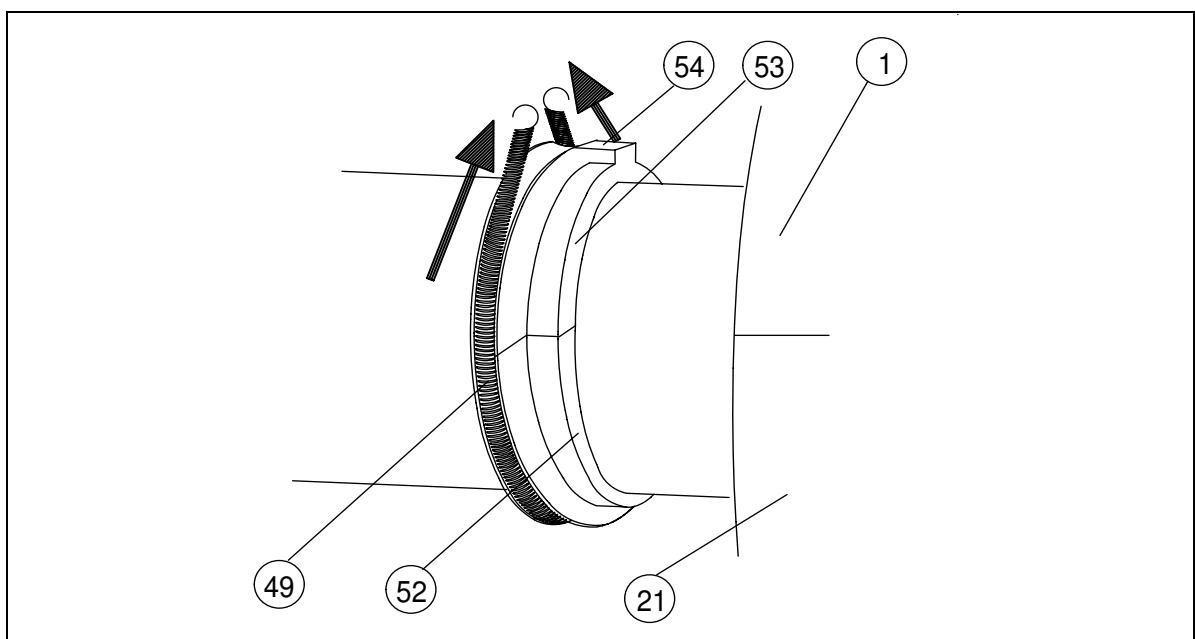


Illustration 8: Assembly of the floating labyrinth seal

EF with external oil supply

- Place in true alignment the split line of the floating labyrinth seal and the split line of the seal carrier.
- Check that both engraved numbers (56) and (58) on top and bottom halves of the seal carrier (48), (51) correspond.
- Clean the following parts:
 - the seal surfaces of the top (48) and bottom (51) half of the seal carrier (the groove of the floating labyrinth seal, the flange surfaces)
 - the split line surfaces of the top (48) and bottom half (51) of the seal carrier
 - the flange surfaces of the housing.
- Apply a uniform layer of sealing compound to:
 - the lateral surfaces of the groove at the top (48) and bottom half (51) of the seal carrier
 - the flange surfaces of the top (48) and bottom (51) half of the seal carrier
 - the split line surfaces of the bottom half of the seal carrier (51).

Please observe the instructions for the use of sealing compound.

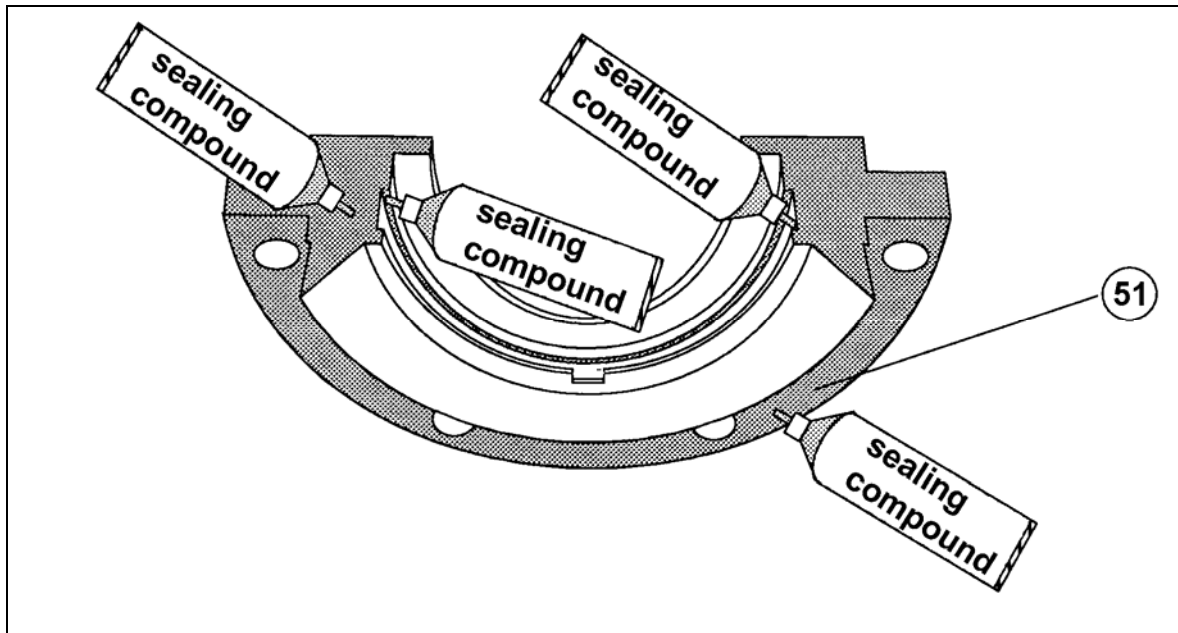


Illustration 9: Application of sealing compound to the seal carrier

Installation and Operation

- Place the top half of the seal carrier (48) on the top half of the seal (53). Press the bottom half (51) of the seal carrier against it. Push the shaft seal completely into the housing.

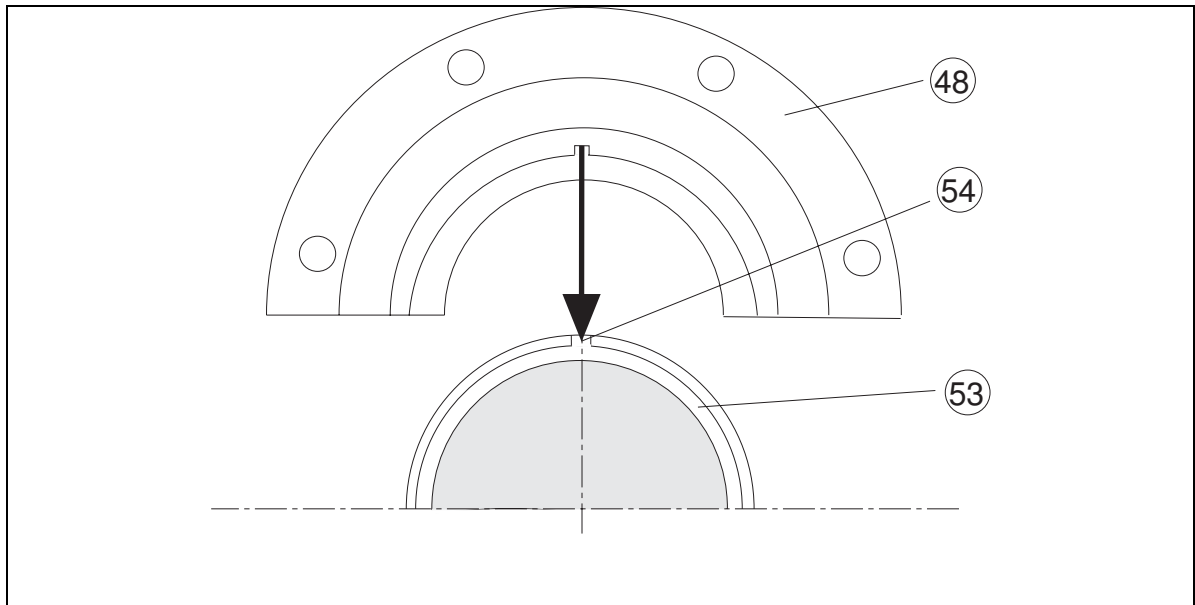


Illustration 10 Assembly of the seal carrier

- Place in true alignment the split lines of the seal carrier and the housing.
- Tighten up the screws (55) to the following torque rates:

Bearing size	9	11	14	18	22	28
Torque [Nm]	8	8	8	20	20	20

EF with external oil supply

Type11

5.2 Floating labyrinth seal with dust flinger (Type 11)

- Assemble the floating labyrinth seal with dust flinger as described in Chapter 5.1, Floating labyrinth seal type 10.
- Place both halves of the dust flinger (69) in front of the shaft seal around the shaft. Loosely screw in the screws (70) of the flinger.

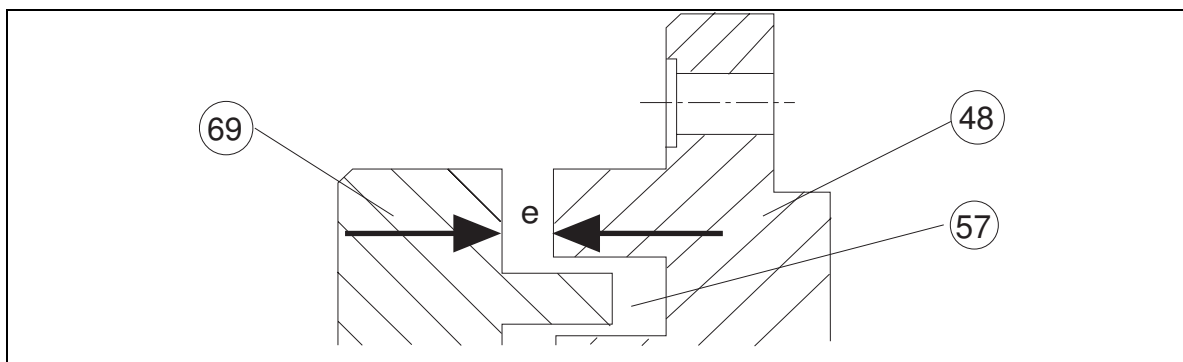


Illustration 11: Clearance between dust flinger and seal carrier

EF..Q

- Push the dust flinger (69) into the groove (57) of the seal carrier.
- Set the clearance "e" at the following figure around the whole unit:

maximum longitudinal extension of the shaft in operation + 1 mm

(Parameters indicated in the Technical Documentation of the Installation).

- Tighten up both screws (70) to the following torque rates:

Seal diameter [mm]	80-140	>140
Torque [Nm]	7	18

EF..B, EF..K, EF..E, EF..A

- Push the dust flinger (69) into the groove (57) of the seal carrier.
- Set the clearance "e" at **1 mm** around the whole unit.
- Tighten both screws (70) to the following torque rates:

Seal diameter [mm]	80-140	>140
Torque [Nm]	7	18

Installation and Operation

Type 12

5.3 Floating labyrinth seal with baffle (Type 12)

- Assemble the floating labyrinth seal with baffle as described in Chapter 5.1, type10.
- Apply a uniform layer of sealing compound to the flange surfaces of the top half (66) and bottom half (68) of the baffle.
- Screw
 - the top half of the baffle (66) to top half of the seal carrier (48)
 - the bottom half of the baffle (68) to bottom half of the seal carrier (51).
- Tighten the screws (67) to the following torque rates:

Seal diameter [mm]	80-140	>140
Torque [Nm]	4	10

Type 20

5.4 Rigid labyrinth seal (Type 20)

- Check if the engraved numbers (64) and (65) on the bottom half (63) and top half (59) of the rigid labyrinth seal correspond.
- Clean
 - the flange surfaces of the top half (59) and bottom half (63) of the rigid labyrinth seal
 - the split line surfaces of the top half (59) and bottom half (63) of the rigid labyrinth seal
 - the flange surfaces of the housing.
- Apply a uniform layer of sealing compound to the following parts:
 - the flange surfaces of the top (59) and bottom half (63) of the rigid labyrinth seal
 - the split lines of the bottom half (63) of the rigid labyrinth seal.

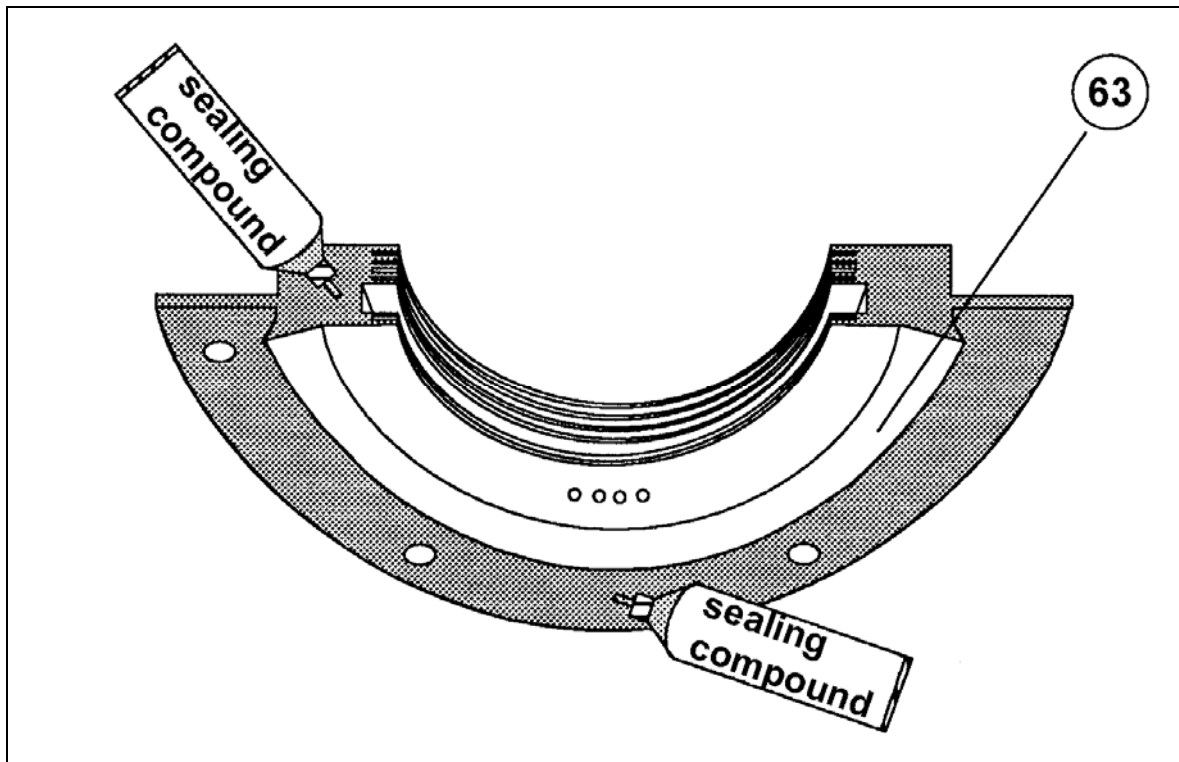


Illustration 12: Application of sealing compound to the rigid labyrinth seal

EF with external oil supply

- Place the top half (59) of the rigid labyrinth seal on the shaft and press slightly the bottom half (63) of the rigid labyrinth seal from below against it. Lightly push the rigid labyrinth seal completely into the housing.
- Tighten the screws (61) at the split line of the labyrinth seal.
- Place in parallel alignment the split line of the rigid labyrinth seal and the split line of the housing. Press the rigid labyrinth seal slightly from below against the shaft. Adjust the rigid labyrinth seal in such a way that the clearance "f" between the shaft and the rigid labyrinth seal at both split lines has the same figure.

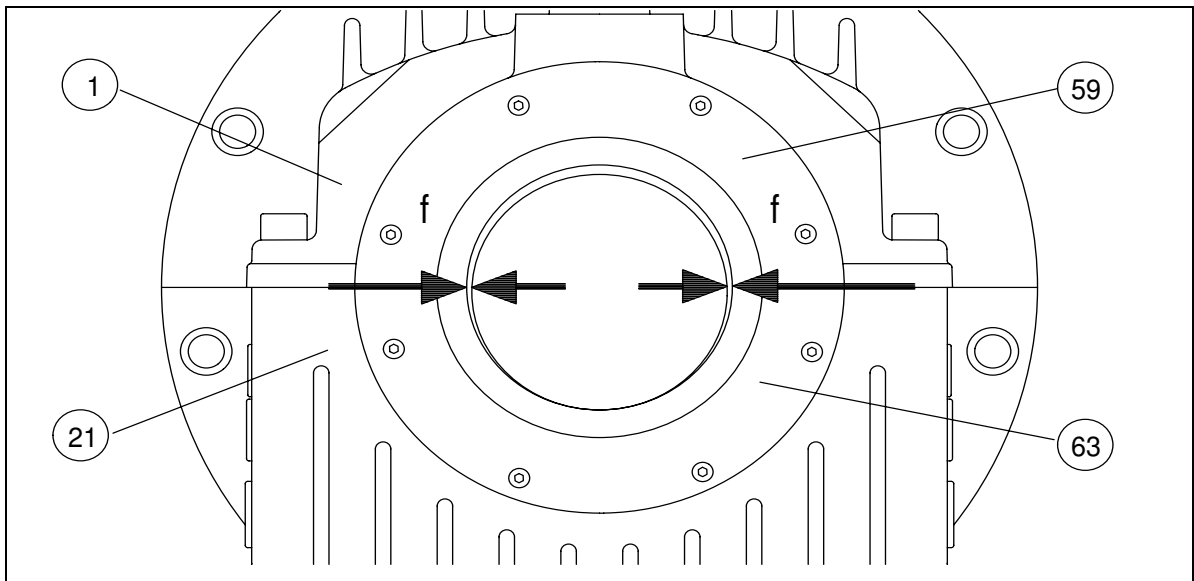


Illustration 13: Alignment of the rigid labyrinth seal

- Tighten the screws (60) to the following torque rates:

Bearing size	9	11	14	18	22	28
Torque [Nm]	8	8	8	20	20	20

Installation and Operation

Type 21

5.5 Rigid labyrinth seal with dust flinger (Type 21)

- Assemble the rigid labyrinth seal with dust flinger as described in Chapter 5.4, type 20.
- Place both halves of the dust flinger (69) round the shaft, in front of the rigid labyrinth seal. Mount both screws (70) loose.

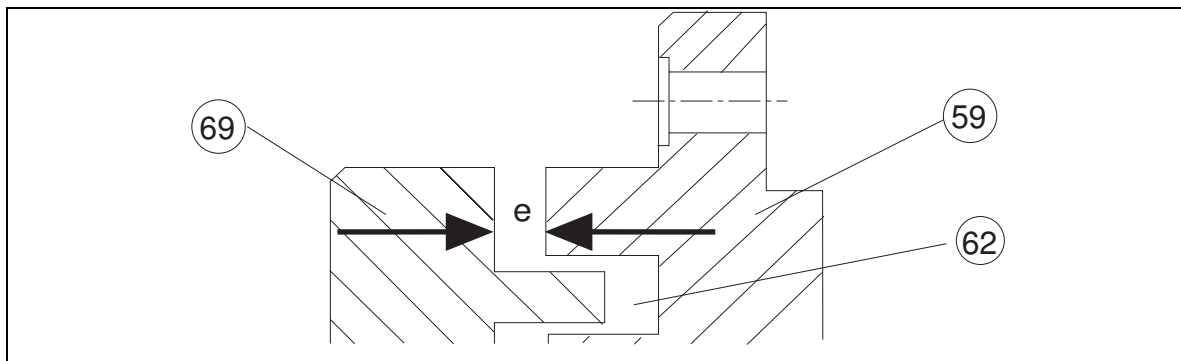


Illustration 14: Clearance between dust flinger and rigid labyrinth seal

EF..Q

- Push the dust flinger (69) into the groove (62) of the rigid labyrinth seal.
- Set the clearance "e" at the following figure around the whole unit.

maximum longitudinal extension of the shaft in operation + 1 mm

(Parameters are indicated in the Technical Documentation of the Installation).

- Tighten both screws (70) to the following torque rates:

Seal diameter [mm]	80-140	>140
Torque [Nm]	7	18

EF..B, EF..K, EF..E, EF..A

- Push the dust flinger (69) into the groove (62) of the rigid labyrinth seal.
- Set the clearance "e" at **1 mm** around the whole unit.
- Tighten both screws (70) to the following torque rates:

Seal diameter [mm]	80-140	>140
Torque [Nm]	7	18

EF with external oil supply

Type 22

5.6 Rigid labyrinth seal with baffle (Type 22)

- Assemble the rigid seal with baffle as described in Chapter 5.4, type 20.
- Apply a uniform layer of sealing compound to the flange surfaces of the top half (66) and bottom half (68) of the baffle.
- Screw
 - the top half of the baffle (66) to the top half (59) of the rigid labyrinth seal
 - the bottom half of the baffle (68) to the bottom half (63) of the rigid labyrinth seal.
- Tighten the screws (67) to the following torque rates:

Seal diameter [mm]	80-140	>140
Torque [Nm]	4	10

Installation and Operation

6 Instructions for Assembly of Peripheral Equipment

6.1 Assembly of the oil supply equipment

The oil supply equipment together with the pressure, temperature and flow measuring instruments are usually provided by the user. The oil quantity and viscosity necessary for the operation of the bearing are specified in the bearing calculations. This manual contains only indications on the connection points with the bearing. The connection bores for the oil inlets and outlets are on both lateral sides of the bearing, closed with screw plugs. Remove only those plugs where pipes are to be connected.

Connection conditions

	Pipelines	Flow speed	Indications
Inlet	Precision steel pipe DIN 2391 Steel pipe DIN 2448	about 1,5 m/s	Place the throttle valve in the inlet pipeline directly in front of the bearing
Outlet	Steel pipe DIN 2448	max. 0,15 m/s	15° inclination - if 15° inclination is not possible enlarge correspondingly the cross sections of the pipeline directly behind the bearing. Too low inclination or / and too small cross-section lead to oil back pressure in the bearing. Leakage or overflowing are the consequences.

- Before starting assembly pickle all pipes which
 - have been welded
 - have been bent hot
 - are contaminated and rusty inside.



Warning of injury!

Please observe the instructions for the use of the pickling fluid. Wear rubber gloves, rubber apron, rubber boots and safety glasses.

EF with external oil supply

Rinsing of the oil circuit

- Rinse the whole oil circuit to remove all impurities. **The bearing must not be connected to the oil circuit during rinsing operations.** The rinsing should be done before connecting the oil supply to the bearing or the bearing should be disconnected from the oil circuit. If this is not possible, dismantle the top half of the housing and remove the shells.

To avoid damage to the fittings:

- Remove all measuring and switching fittings.
- Close all connections (see also the Technical Documentation of the Installation).
- Fill up the oil supply system with lubricant. Use the type with the viscosity indicated on the bearing type plate.
- Start operating the oil supply system. Collect the first charge of high contaminated oil separately. Continue rinsing until the lubricant contains no impurities.
- Drain off the oil supply system completely. Clean the oil tank and the filters.

Warning of environmental pollution!

Please observe the instructions for the use of the lubricant. The manufacturer could provide information on waste oil disposal.

- Assemble all fittings.

Oil inlet

- Connect the inlet pipe to the tapped hole (23) for the oil inlet. Seal with Teflon tape or liquid sealing compound.
- Depending on the bearing size, the tapped hole has the following threads:

Bearing size	9	11	14	18	22	28
Tapped hole / Oil inlet (23)	G 3/8	G 3/8	G 3/8	G 1/2	G 3/4	G 3/4

If the bearing calculation specifies a separate supply source for the thrust parts:

- connect the inlet pipes to the tapped hole of the thrust part supply (4) on the lateral side of the bearing. Seal with Teflon tape or liquid sealing compound.

Installation and Operation

Oil outlet

EFZ...
EFX..

- Apply sealing compound (i.e. Loctite 572) to the thread of the oil outlet.
- Screw the oil outlet with special nut and lead sealing ring (30) into the oil outlet connection hole (29).
- Tighten the special nut with the lead sealing ring.
- Connect the oil outlet pipe to the flange.
- Depending on the bearing size the connection hole for the oil outlet (29) has the following standard threads (larger threads are possible):

Bearing size	9	11	14	18	22	28
Tapped hole for oil outlet (29)	G 1 1/4	G 1 1/4	G 1 1/2	G 1 1/2	G 2	G 2 1/2

EF.L.

- Apply sealing compound (i.e. Loctite 572) to the thread of the oil outlet.
- Screw the oil outlet with special nut and lead sealing ring (30) into the corresponding hole (29) with the marking (31) at top dead centre. Tighten the special nut with the lead sealing ring. The spillover oil weir then ensures the minimum oil level for the emergency lubrication by means of the loose oil ring. Connect the oil outlet pipe to the flange.

EFU...
EFT..

- Screw in the outlet pipe to the selected oil sump temperature measurement connection hole (24) and seal with Teflon tape or liquid sealing compound.

6.2 Temperature measurement

- Fix suitable thermo sensors:
 - into one of the tapped holes (22) for temperature measurements of the journal parts
 - into one of the tapped holes (24) for temperature measurements of the oil sump
 - into one of the tapped holes (optional) for temperature measurement of the thrust parts.

Proceed as follows:

- Take out the screw plugs from the connection holes.
- Place the thermo sensor into the bore by using Teflon tape or sealing compound.
- Connect the thermo sensor at the temperature monitoring equipment of the installation (see the Technical Documentation of the Installation for connecting and adjustment).

EFT..

6.3 Water supply

Following requirements should be observed before connecting the cooler (26):

- water velocity of maximum 1,5 m/s in the cooling water inlet
- water pressure of maximum 5 bar
- adjusting tap on inlet
- outlet of cooling water is under no pressure.

The direction of the cooling water passage in the cooler (26) is arbitrary.

EF with external oil supply

7 Bearing Insulation

These bearings are delivered insulated. The electrical insulation is assured by:

- plastic coating of the spherical seatings (14)
- shaft seals made of non-conducting materials
- insulated positioning pin (3)
- insulated screwed connections for thermometers.

It is not necessary to insulate the pipelines.

- Mark the insulated bearing with the delivered plate "Insulated shells". Install the plate in a visible place by using two grooved drive studs.

8 Operation

8.1 Filling up with lubricating oil

Attention!

Make sure that no impurities get into the bearing.

- Tighten all screw plugs in the tapped holes (22), (23), (24),(27) to the necessary torque rates:

Screw plug threads	G 3/8	G 1/2	G 3/4	G 1	G 1 1/4	G 1 1/2	G 2	G 2 1/2
Torque [Nm] for plugs with injection-moulded plastic sealing ring	30	40	60	110	160	230	320	500
Torque [Nm] for plugs with flexible sealing ring	34	60	85	130	240	300	330	410

- Check that
 - the top sight glass (5) is tight, the screws should be hand-tight.
- Retighten the screws for oil inlet and outlet, and for the thrust parts (if existing). The necessary torque rates depend on the screw connections used.

In case thermo sensor or/and oil sump thermometer are used:

- Check if they are tight (according the manufacturer's instructions).
- Fill up the oil supply system with lubricant. Use a lubricant with a viscosity as indicated for the specific bearing operation.
- Start operating the oil supply system in order to fill the bearing with lubricant.

EF.C.,
EF.L.,
EF.Y.

- Remove the protective layer from the top sight glass (5).
Continue as already mentioned above.

Installation and Operation

8.2 Trial run

- Before the trial run, check the following:
 - the way the oil supply system functions (see also the Technical Documentation of the Installation). The lubricant quantity at the bearing oil inlet must correspond to the values indicated in the EDP-calculations.
 - that the temperature monitoring equipment works.
 - that the water cooling installation works.

EFT..

Attention!

Not enough lubricant leads to

- ☐ temperature rises and thus damage of the bearing.

Too much lubricant leads to

- ☐ leakages.

The bearing is ready for operation.

- Supervise the bearing during the trial run (5-10 operating hours).
Pay special attention to:
 - the way the oil supply installation works (necessary lubricant quantity, lubricant temperature, lubricant pressure before entering the bearing)
 - bearing temperature
 - sliding noises of the shaft seals
 - tightness
 - occurrence of inadmissible vibrations.

Attention!

If the bearing temperature exceeds the calculated value by 15 K (see bearing calculation) stop the installation immediately. Carry out an inspection of the bearing as described under Instructions for Service and Inspection of the Slide Bearings Type EF with External Oil Supply.

EF with external oil supply

9 Glossary

Baffle	With bearing types 10 and 20 the baffles are assembled externally in front of the shaft seals. The baffle, made of reinforced polyamide, protects the bearing from dust and water.
Rigid labyrinth seal	The rigid labyrinth seal (type 20) is used with slide bearings type E with high oil throughput. It corresponds to the protective system IP44 and is made of an aluminium alloy. The rigid labyrinth seal is built of two halves, flanged at the housing. The labyrinths that wipe out the lubricant are arranged into two groups. The first two labyrinths, installed inside keep back most of the lubricant. Five further labyrinths protect the bearing from outside. They prevent the lubricant overflow and the ingress of impurities. The overflow lubricant is collected into a chamber between the both groups of labyrinths. Through the return bores the lubricant flows back into the bearing.
Spherical seating	The spherical seating is a special feature enabling the alignment of the shell in the housing. The shell is seated on two spherical seatings. The advantages of the spherical seating are: • easy at assembly • good heat transfer from the shell to the housing • suitable for such applications with high thrust or journal loads.
Dust flinger	In the case of bearing types 10 and 20 a light alloy ring is clamped on the shaft in front of the shaft. This ring fits into a groove in the seal carrier or the rigid labyrinth seal, thus building a labyrinth. The labyrinth protects the shaft exit against low pressure that could otherwise "absorb" the lubricant. Low pressure occurs for instance in the case of rotating discs, such as couplings or cooling discs.
Floating labyrinth seal	The floating labyrinth seal (type 10) in the seal carrier is used as a shaft seal in the case of bearings type E operating under normal conditions. It prevents the lubricant and lubricant mist coming out and the ingress of impurities. The floating seal has a high capacity of resistance to wear. It is made of a high-performance, high temperature stability and electrically insulated plastic material. The floating seal consists of two halves held together by a garter spring. Both ends of the spring are hooked together. In the case of slide bearings type EM the floating seal is mounted into a two-piece seal carrier. The groove allows for radial movement of up to 1 mm. The seal is thus insensitive to shaft radial displacement or deflection. The sealing effect is produced by the baffles wiping off the lubricant from the shaft. The lubricant flows back into the bearing via oil return opening.
Machine seal	In the case of the flange mounted bearings, the machine seal reduces the influence of positive and negative pressure in the machine thus preventing leakages at the inner seal area. The space between the machine seal and the bearing housing must always be vented to atmospheric pressure. The size of the gap between shaft and machine seal influences the sealing effect.

RW Flow Switch

DESCRIPTION

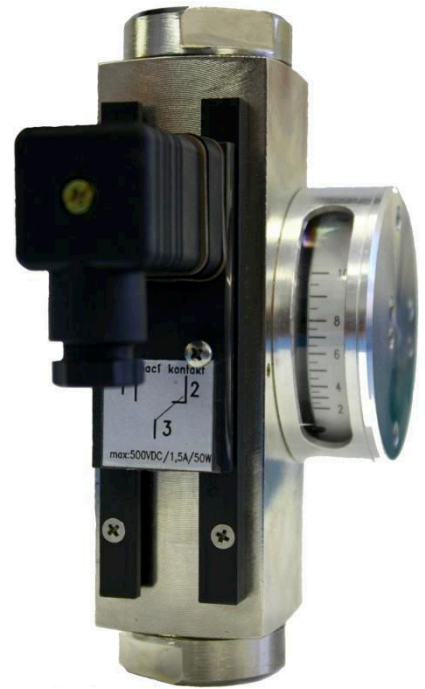
The RW flow switch includes a spring, pressed by a float in the flowing medium. This flow switch operates in all working positions due to a spring that acts on the float by the opposite force compared to the flowing medium. The float includes a permanent magnet, actuating a sensor or a needle in the indicator housing.

USE

RW Flow switches are used to control the flow of oil and other viscous media. Due to their design, the threshold accuracy is acceptable whenever the medium viscosity changes. The kinematic viscosity of the medium may range from 1 cSt to 1000 cSt.

FEATURES

- reliable operation and easy handling
- designed for all working positions
- viscosity compensation
- low hysteresis of local indications and el. contacts
- easy adjustment of switching points by the operator
- optional connections according to the customers' requirements
- high-pressure resistance



ELECTRICAL OUTPUTS

Contact type:	SPP (change-over switch)
Max. voltage	400 VDC
Max. switching current:	2.1 A
Contact load:	60 W
Max. temperature:	-40 to +150 ° C
Contact type:	SP (switch)
Max. voltage	400 VDC
Max. switching current:	2.1 A
Contact load:	60 W
Max. temperature:	-40 to +150 ° C
Sensor type:	SP6M

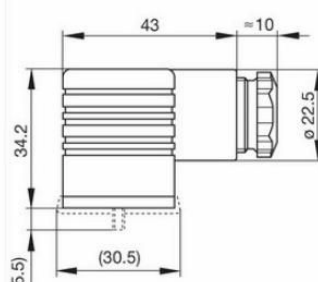
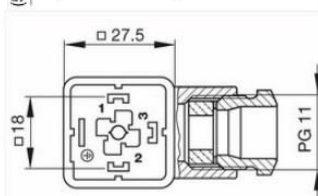
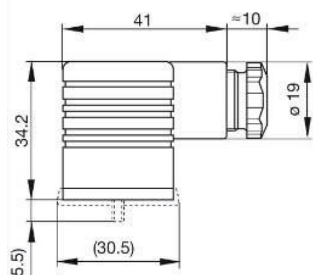
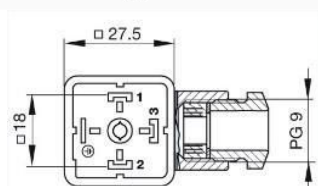
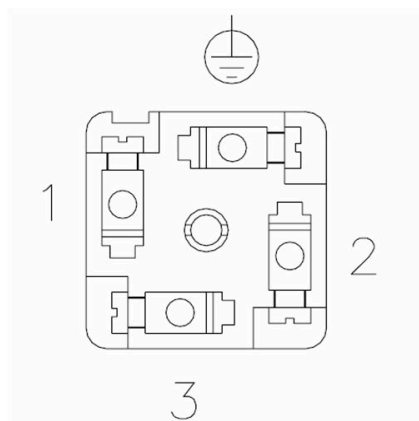
EMKOMETER

Measurement and Control
www.emkometer.cz

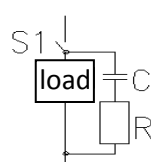
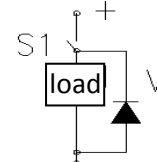
Operating voltage: 10 to 30 V DC
Max. temperature: 80 °C
Output: 4 to 20 mA

Max. operating pressure 300 bar (stainless steel), 250 bar (brass)

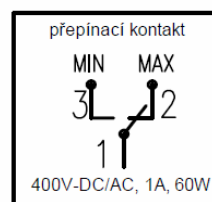
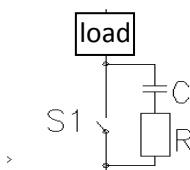
Dimensions and wiring diagram (sensor)



Recommended contact protection under inductive load

 $U \sim VAC$

 $U = VDC$


Inductive or resistive load

 $U \sim VAC$
 $U = VDC$


Product Marking:

RW ... / ... / ... / ... / ...
1. 2. 3. 4. 5th

Ex. RW05 / 5 / K3 / SPP / BL / HL

1. Measuring range:

RW0.1/1:	0.1 to 1 liter / min
RW0.5/2:	0.1 to 1 liter / min
RW1/4:	1 to 4 l / min
RW 0.5/5:	0.5 to 5 l / min
RW 2.8:	2 to 8 l / min
RW 3/10:	3 to 10 l / min
RW 5/15:	5 to 15 l / min
RW 5/20:	5 to 20 l / min
RW 8/24:	8 to 24 l / min
RW 10/30:	10 to 30 l / min
RW 15/45:	15 to 45 l / min
RW 20/60:	20 to 60 l / min
RW 30/90:	30 to 90 l / min
RW 35/110:	35 to 110 l / min
Other ranges on request.	

2. Material:

K1 - DIN 1.4541 stainless steel
K2 - DIN 1.4571 stainless steel
K3 - brass
K4 - different materials on request

3. Sensor type:

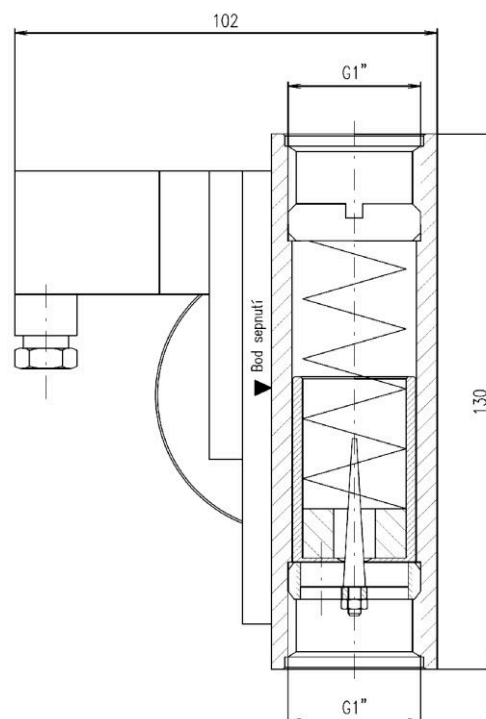
SP - switching contact
SPP - change-over
contact
SP6M

4. Location of display housings:

AL
AR
BL
BR
CL
CR

5. Operating position according to

VB - vertical position, bottom inlet
VT - vertical position, top inlet
HR- horizontal position, left-to-right





Measurement and Control

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**the flow
direction:**

inlet

HL - horizontal position, right-to-left
inlet

FTZU 02 ATEX 0454X Ex Version Approval

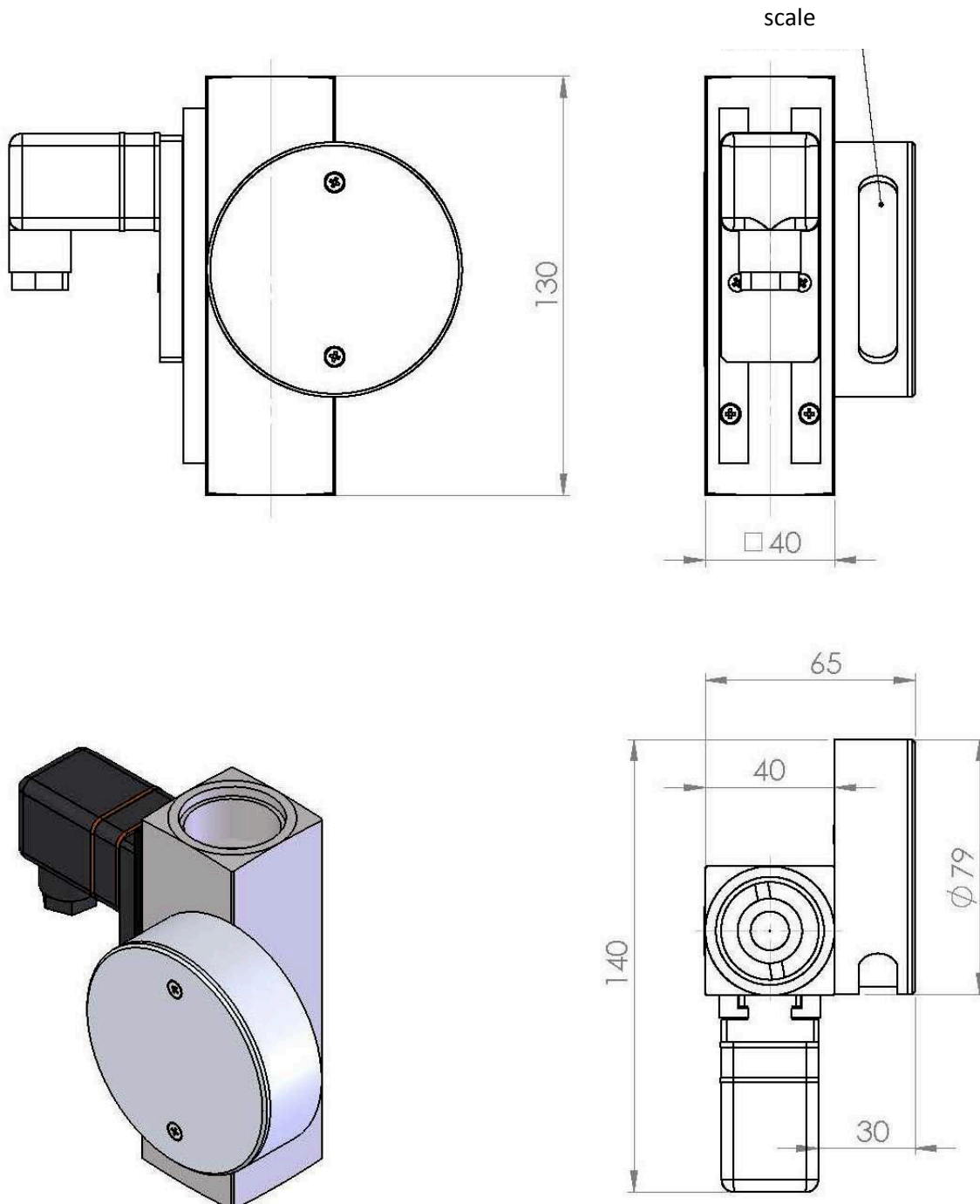
Note: Customized process connections

Installation

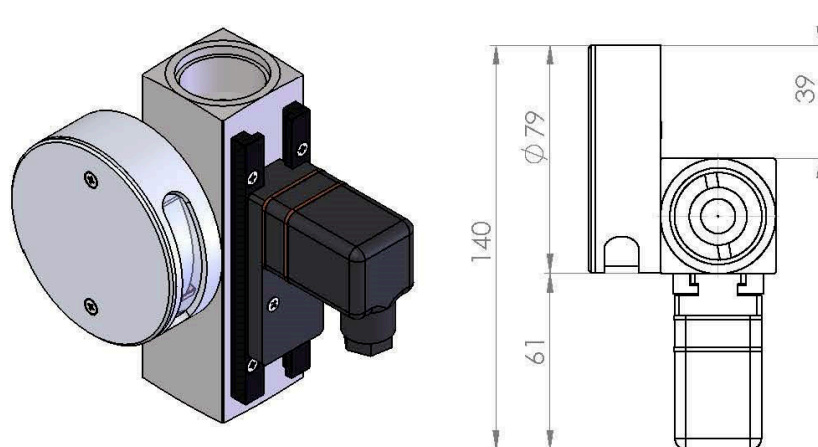
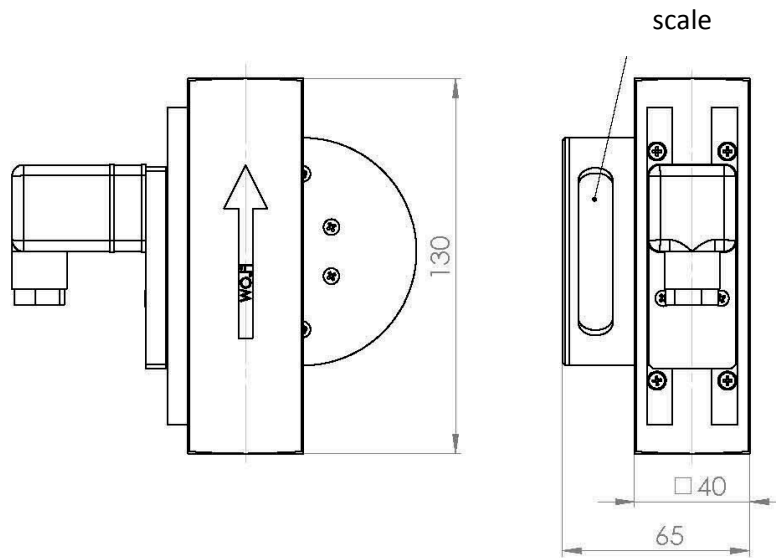
- the flow switch may be installed at any point in the system
- keep the flow direction (see the arrow on the switch body)
- the device must not be used as a pipeline support or console
- the medium must not include solid particles which might damage the unit
- do not install the flow switch near ambient magnetic fields (e.g. motors) affecting its correct operation

Sensor set-up:

1. Loosen two M3 set-screws on the sensor.
2. Move the sensor so that the scale-line indicates the desired value of the flow rate.
3. After setting the switching point, tighten the M3 set-screws.

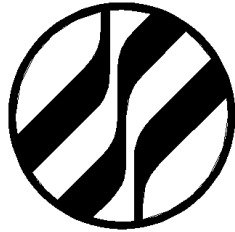


BR – flow direction ↑



BL – flow direction ↑

Kelvion



Kelvion Machine Cooling GmbH

Betriebs- und Wartungsanleitung
Operation and Maintenance Instruction

KELVION Kreislaufkühler

KELVION Circuit Cooler

für Elektromotoren und Generatoren
for Electric Motors and Generators

Deutsch/English

11 49 0156 01
Ausgabe/Edition: 3.4
Version 1.2005
Vöge K

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1. Allgemein

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

2. Konstruktionsbeschreibung

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

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

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

Zur Wasserführung dienen Stutzen- und Umlenkwasserkammer. Die Kammern sind mit Flachdichtungen auf den Rohrböden verschraubt. Die Trennsteg für die Wasserwege werden durch Profildichtungen abgedichtet. In Abhängigkeit von der Kühlwasserqualität oder/und Anforderungen des Kunden werden die Wasserkammern aus den Materialien Titan, CuNi, Edelstahl oder Stahl beschichtet gefertigt. Standardausführung ist eine mit Polymer (Rilsan) beschichtete Stahlkammer. Die Rilsanbeschichtung zeichnet sich durch eine hohe chemische Beständigkeit sowie einer sehr guten Abriebfestigkeit aus und ist somit für den Einsatz bei nahezu allen Kühlmedien geeignet.

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

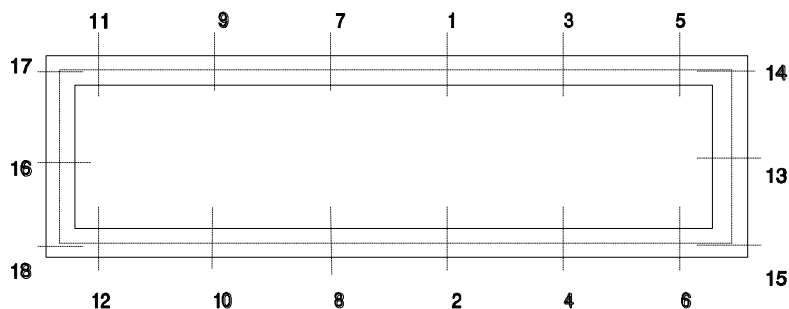
The cooler consists in accordance with the thermal requirements out of one or more single bundles. The design of the cooler arrangement is adapted together with the electric engine builder to the layout of the plant. Normally the air flows in a closed circuit through the engine and the cooler. The air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

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

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

Nozzle and reverse headers at the cooler ends arrange the water flow through the cooler. The headers are bolted to the tube sheets by insertion of gaskets. The separating baffles are sealed by a profile seal. In reference to the quality of the cooling water or/and to customer requirements headers could be made out of materials like Titanium, CuNi, Stainless Steel or coated carbon steel. Standard headers are made out of carbon steel protected by the polymer coating Rilsan. Rilsan coating is characterized by a high chemical resistance and a high resistance against abrasion. Therefore Rilsan coating is applicable for almost all types of cooling water.

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 Anzugvorgangs:

The threads have to be oiled. Other lubricant is not allowed. In case of an elastomer gasket out of EPDM (rubber quality) the three steps of the fastening procedure are:

Gewinde/thread	M12	- 25	- 50	Nm	+ 90°	Drehwinkel angle of twist
Gewinde/thread	M16	- 40	- 80	Nm	+ 90°	Drehwinkel angle of twist

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

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

Gewinde/thread	M12	- 25	- 50	- 73	Nm
Gewinde/thread	M16	- 60	- 120	- 180	Nm

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

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

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

The bundles can be drained or vented by plugs.

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

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

3. Lagerung, Ein- und Ausbau des Kühlers

3.1 Lagerung

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.

3.2 Einbau des Kühlers

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.

3.3 Ausbau des Kühlers

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.

3. Storage, Installation and Removing of Cooler Bundles

3.1 Storage

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 Installation of Cooler Bundles

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 Removing of Cooler Bundles

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 to 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 ist die Vorspannung der Kammerschrauben generell zu überprüfen. Im Fall von Elastomerdichtungen (Gummiqualität) empfehlen wir die Kammerschrauben einmalig mit einem Drehwinkel von 60° (1 Sechskant) nachzuziehen. Im Fall von Dichtungen aus gebundenem Aramidfasermaterial ist das Drehmoment zu überprüfen und die Schrauben sind bei Bedarf nachzuziehen. Der Kühler ist danach auf Dichtigkeit zu überprüfen. Sollten die Bündel im Bereich der Dichtung dann undicht sein, sind die Dichtungen auszuwechseln (siehe Konstruktionsbeschreibung Artikel 2).

4.2 Entlüftung

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

4.3 Offener Kühlkreislauf

4.3.1 Kühlwassermengenstrom

Der Mengenstrom ist entsprechend den Auslegungsdaten einzustellen.

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

Folgende Grenzggeschwindigkeiten sind einzuhalten:

Material	DIN Material Nr./No.	vergleichbar comparable ASTM-Nr./No.	zulässige Grenzggeschwindigkeit m/s admissible Cooling Water Velocity m/s	
			min	max
CuNi10Fe1Mn	2.0872	B-111 C70600	1,5	2,5
CuNi30Mn1Fe	2.0882	B-111 C71500	1,5	3,0
CuZn28Sn1	2.0470	B-111.C44300	1,0	2,0
CuZn20Al	2.0460	B-111.C68700	1,0	2,2
Edelstahl Stainless Steel	1.4404 1.4571	A-249 TP316L A-249 TP316Ti	1,5	3,0
Titan/Titanium Grad 1	3,7025	B-338 Gr. 1	1,0	4,0

4. Commissioning

4.1 Pressure Test

After the water pipes have been connected KELVION, 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. In case of an elastomer gasket out of EPDM (rubber quality) we recommend to tighten the header screws one-time with a 60° (1 hexagon) angle of twist. In case of an aramidfibre gasket torque of the bolts has to be checked 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:

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:

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	3,0

4.4.2 Schutzschicht

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

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

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

4.3.2 Protective Film

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

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

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

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

4.4 Closed Water Circuit

4.4.1 Cooling Water Flow

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

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

The following water velocities have to be observed:

4.4.2 Protective Film

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

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

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

5. Betriebsstillstand

5.1 Betriebsstillstand bei offenem Kühlkreislauf

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

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

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

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

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

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

5.2 Betriebsstillstand bei geschlossenem Kühlkreislauf

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

5.3 Betriebsstillstand bei Frostgefahr

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

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 pre dried 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 these 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. Wartung und Reinigung

Die Luftseite unterliegt unter normalen Betriebsverhältnissen keiner Verschmutzung.

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

Bei offenem Kühlkreislauf sind die Wartungsintervalle auf der Wasserseite von der eingesetzten Wasserqualität abhängig. KELVION 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.

6.3 Inspektion der Wasserkammern

In Abhängigkeit der Kühlwasserqualität, insbesondere des Feststoffanteils im Kühlwasser, sollten die Kammern in regelmäßigen Abständen auf Ablagerungen, Korrosionsspuren und mechanischen Beschädigung der Schutzschicht – bei Titan- oder CuNi Kammern der Patinaschicht, bei Stahlkammern der Rilsanbeschichtung – visuell untersucht werden.

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 an immediate cleaning of the water side is necessary and the water must be exchanged

The cleaning interval of the water side in case of open cooling water circuits depends on the quality of the cooling water is used. KELVION 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 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 those deposits at the tube inside are found during the maintenance the tubes have to be cleaned.

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

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

6.2 Chemical Cleaning of the Tubes

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

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

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

6.2 Inspection of water headers

In reference to quality of the cooling water, especially to the solid particles inside the cooling water, headers should be visually inspected frequently to check inner surface of the header regarding deposits, corrosion or mechanical damages of the protection layer like the patina layer for Titanium and CuNi headers or the Rilsan coating at carbon steel headers.

7. Reparatur bei Wasserleckage

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

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

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.

7. Repair of Water Leakages

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).

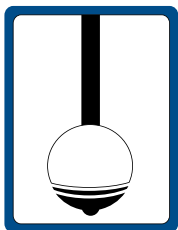
In case of need, especially of a leaking rolled in tube end, it is recommended to find out the leaking tube by floating the bundle in a tank filled up with clean water (drinking water quality). The water side has to put under air over pressure of 0,5 bar. The remained water in the coil has to be blown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

SCHWIMMERSCHALTER

MAGNETIC FLOAT SWITCHES



Technische Dokumentation

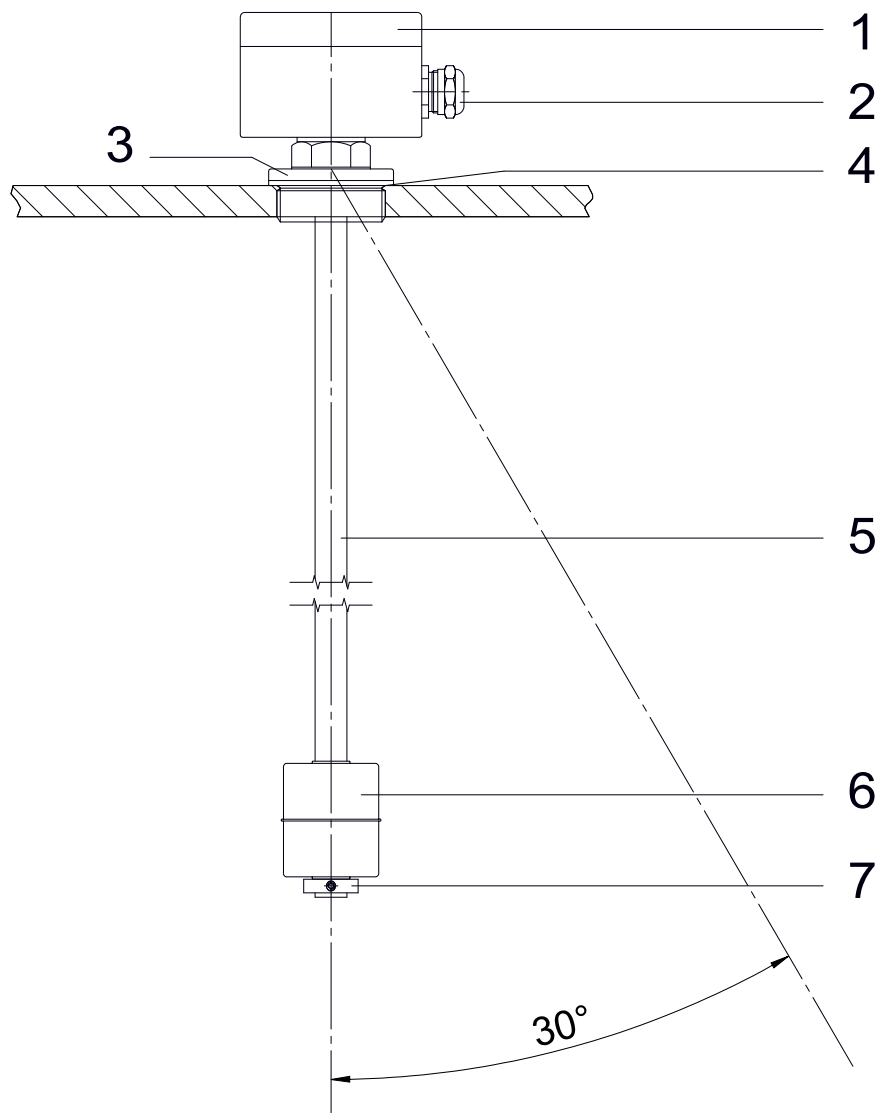
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Technical Documentation

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1. Funktionsprinzip

Der Schwimmerschalter (siehe Seite 2) arbeitet nach dem Schwimmerprinzip. Ein oder mehrere Schwimmer (6) mit eingebautem Magnetsystem werden an einem unmagnetischen Gleitrohr (5) geführt. Durch das Magnetfeld des Dauermagneten, der sich im Innern des Schwimmers befindet, wird beim Erreichen einer definierten Höhe ein im Gleitrohr befindlicher Reedschalter (Schutzgaskontakt), betätigt. Dadurch wird der Stromkreis, je nach Funktion des Schalters, geschlossen oder unterbrochen.

2. Anwendungsbereich

Schwimmerschalter werden zur Füllstandsüberwachung und Steuerung von flüssigen Medien verwendet. Sie dürfen in Behälter und Tanks eingebaut werden, die den technischen Anforderungen genügen, d.h. für die entsprechenden Betriebsparameter ausgelegt sind.

Die Flüssigkeiten müssen feststofffrei oder feststoffarm sein und nicht zum Verharzen, Verkleben oder Auskristallisieren neigen. Die Feststoffteilchen dürfen nicht magnetisierbar sein oder wenn sie magnetisierbar sind, nicht in die Nähe des Magneten gelangen.

3. Montage

Schwimmerschalter sind nur für den senkrechten Einbau in Behälter und Tanks vorgesehen. Maximale Abweichung von der Vertikalen $\pm 30^\circ$. Die Geräte sind soweit vormontiert, dass sie vor Ort eingeschraubt (Einschraubgewinde 3) oder angeflanscht werden können. Es ist darauf zu achten, dass die Dichtflächen und Dichtungen mechanisch einwandfrei sind. Zum Abdichten muss entsprechend des Mediums, dem Druck und der Temperatur die richtige Dichtung (4) eingesetzt werden. Die Abmessung der Dichtung ist abhängig vom Prozessanschluss.

Geräte, bei denen der Durchmesser des Schwimmkörpers größer ist als der Kerndurchmesser des Einschraubgewindes oder der Innendurchmesser des Anschlussflansches, werden mit Stellringen (7) versehen. Die Stellringe zusammen mit den Schwimmern vor der Montage des Gerätes demontieren. Nun das Gerät einschrauben oder anflanschen und die Schwimmer und die Stellringe wieder montieren. Es ist darauf zu achten, dass die Schwimmer in der gleichen Einbaulage eingefahren und die Stellringe an derselben Stelle wie vor der Demontage arretiert werden. Weiter ist darauf zu achten, dass die Schrauben der Stellringe das Gleitrohrmaterial leicht eindrücken.

Bei der Montage nach 3A Sanitary Standard muss auf folgende Punkte geachtet werden:

- Wenn das Gerät eine 3/8" Einschraubverbindung aufweist, ist darauf zu achten, dass das Gerät verschweißt und die Schweißnaht verschliffen wird. Die Rauheit muss feiner als 0,4 μm sein.

4. Gefahrenhinweise

- Es darf keine provisorische Installation durchgeführt werden, wenn Komponenten oder ganze Geräte fehlerhaft oder falsch sind, resp. wenn Komponenten fehlen.
- Geräte und deren Zusatzeinrichtungen dürfen nicht als Hebeeinrichtung, Trittbrett oder Transportvorrichtung benutzt werden.
- Bei Gefahren müssen nach Richtlinien und nationalen Vorschriften Sicherheitssymbole, Informationen, Warneinrichtungen, geeignete Schutzeinrichtungen oder Isolationen, angebracht werden. Beim Einsatz von Isolationen müssen diese für den spezifischen Einsatz definiert werden.
- Bedienpersonal muss entsprechend den örtlichen Gegebenheiten und Vorschriften Schutzbekleidung tragen. Bedienpersonal muss geschult, instruiert und im Besitz der technischen Unterlagen sein.
- Der Betreiber ist verantwortlich, dass unbefugte Personen keinen Zutritt zu Anlagen, Geräten und deren Bedienung haben.
- Bei Weitergabe von Geräten und Einrichtungen an Dritte müssen alle Dokumentationen mitgeliefert werden, um auf die richtige Montage, Bedienung und Anwendung sowie auf die Gefahren hinzuweisen.

05/2016

5. Elektrischer Anschluss

Der elektrische Anschluss ist entsprechend der im Errichtungsland geltenden Sicherheitsbestimmungen zur Errichtung elektrischer Anlagen durchzuführen und darf nur von Fachpersonal ausgeführt werden.

Der Schwimmerschalter ist entsprechend dem Anschlussschema im Anschlussgehäuse (1) oder am Anschlusskabel anzuschließen. Bei Geräten mit Anschlussgehäuse wird das Kabel durch die Kabelverschraubung (2) eingeführt und abgedichtet, der Deckel des Anschlussgehäuses ist gut zu verschließen.

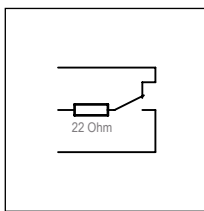
6. Optionen

Zusätzlich zu den Reedschaltern können Temperaturkontakte mit den Schaltfunktionen Öffner oder Schließer ins Gleitrohr (5) eingebaut werden. Weiter ist der Einbau von Temperaturfühlern mit oder ohne Messumformer möglich. Dabei wandelt der Messumformer den Widerstandswert in ein Analogsignal von 4-20 mA um. Eine Kombination von Reedschalter mit Temperaturkontakt und Temperaturfühler ist möglich. Beim Temperaturfühler handelt es sich standardmäßig um einen PT100, es kann aber auch eine andere Größe eingesetzt werden (z.B. PT1000).

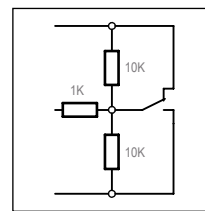
Der Temperaturkontakt wird anhand der Temperaturangaben des Kunden ausgewählt und kann mit oder ohne Hysterese eingesetzt werden.

Optional können die Schwimmerschalter mit nachfolgender Beschaltung bestückt werden:

Beschaltung für den Betrieb
an SPS mit 22 Ω Widerstand



Namurbeschaltung nach EN 60947



Beim Einsatz von zusätzlichen Steuergeräten aus dem KFG Sortiment müssen die entsprechenden Montage- und Betriebsanleitungen vorhanden sein.

7. Achtung

- Der Betreiber muss sicherstellen, dass die Geräte, die einen Erdungsanschluss aufweisen, geerdet werden.
- Geräte mit Anschlusskabel sind nicht geerdet und können im Fehlerfall spannungsführend sein. Diese Geräte dürfen nur mit einer Kleinspannung betrieben werden.
- Geräte, die in einer Anlage zum Einsatz kommen, die eine Innenbeschichtung aufweisen, sind außerhalb der Anschlussdose mit einer Erdungslasche oder Schraube versehen, damit eine Erdungsbrücke zur Anlage gelegt werden kann.
- Beim Anschluss an induktive Last kann eine Zerstörung des Schalters auftreten. Es sollte eine Beschaltung mit einem RC-Glied oder einer Freilaufdiode vorgesehen werden. Beim Anschluss an kapazitive Last ist zur Begrenzung des Spitzenstromes ein Schutzwiderstand in Serie zu schalten.
- Eine elektrische Überlastung kann eine Zerstörung des Schalters zur Folge haben. Dies führt zu einer Fehlfunktion des Schwimmerschalters und der nachgeschalteten Steuerung und kann zu Sach- und Personenschäden führen. Es sind die maximalen elektrischen Schaltleistungen einzuhalten.
- Es ist auf eine fehlerfreie und ausreichende Energiezufuhr zu achten.

8. Wartung

Die Geräte sind fachgerecht zu installieren und in Betrieb zu nehmen. Im Einsatz arbeiten die Geräte wartungsfrei, sofern die Parameter wie die Art des Mediums, Dichte, Temperatur und Druck eingehalten werden. Das Material des Schwimmerschalters ist entsprechend dem Medium zu wählen.

9. Funktionsprüfung

Es liegt in der Verantwortung des Betreibers, periodisch eine Funktionsprüfung oder eine Sichtkontrolle durchzuführen. Eine Funktionsprüfung der Kontakte kann im eingebauten oder ausgebauten Zustand durchgeführt werden, mit manueller Verschiebung des Schwimmers oder durch eine Befüllung des Behälters. Es soll beachtet werden, dass durch die Funktionsprüfung keine Prozessabläufe ausgelöst werden. Mit einer Sichtprüfung werden die Geräteteile, die mit der Lagerflüssigkeit, deren Dämpfen oder Kondensat in Berührung kommen, auf eventuelle Korrosionseinwirkungen überprüft. Diese Prüfung kann nur von Innen des Lagerbehälters oder nach Ausbau des Gerätes ausgeführt werden.

10. Hinweise

- Schwimmerschalter nicht in unmittelbarer Nähe von starken elektromagnetischen Feldern betreiben, Abstand min. 1m.
- Der Schwimmerschalter darf keinen mechanischen Belastungen, Vibrationen und Stosseinwirkungen ausgesetzt werden. Sind diese Belastungen vorhanden, müssen Dämmelemente eingesetzt werden.
- Es dürfen keine mechanischen Stöße durch das Medium auf das Gerät einwirken.
- Die Schaltpunkte des Schwimmerschalters können nicht verstellt werden.
- Bei Entzündungs- und Explosionsgefahr des Mediums, müssen Geräte mit der ATEX-Richtlinie 2014/34/EU eingesetzt werden.
- Die Umgebungsbedingungen müssen so sein, dass alle Anzeigeinstrumente vor Ort fehlerfrei abgelesen werden können, möglichst in einem horizontalen Blickwinkel.
- Entsorgen der Geräte nach regionalen und nationalen Vorschriften und Richtlinien.
Beim Entsorgen können Mediumsrückstände am Gerät vorhanden sein.

TRANSPORTVORSCHRIFTEN:

Beim Verpacken für den Transport ist darauf zu achten, dass es sich bei den Geräten um Messsysteme mit elektronischen Komponenten handelt. Dementsprechend sind die Geräte zu verpacken. Das äußere Verpackungsmaterial, Holz-, Kartonkisten usw., sind mit Gefahrenhinweisschilder zu versehen.

11. Nenndaten für Ex-Geräte

ATEX				
Zündschutzart Eigensicherheit Ex ia IIC Schalter bzw. Temperaturschalter	$I_i \leq 100 \text{ mA}$			
Zündschutzart Eigensicherheit Ex ia IIC Schalter bzw. Temperaturschalter m. Option /R22	$I_i \leq 100 \text{ mA}$			
Zündschutzart Eigensicherheit Ex ia IIC Temperaturfühler	$U_i \leq 28 \text{ V}$	$I_i \leq 100 \text{ mA}$	$P_i \leq 700 \text{ mW}$	
Zündschutzart Eigensicherheit Ex ia IIC Drucktransmitter	siehe zugehörige gesonderte Bescheinigung			
Zündschutzart Eigensicherheit Ex ia IIC mit Option /N (Namurbeschaltung)	$U_i \leq 15 \text{ VDC}$	$I_i \leq 60 \text{ mA}$		
Zündschutzart „Druckfeste Kapselung“	$U_N \leq 250 \text{ VDC/AC}$	$P_{SN} \leq 50 \text{ W/VA}$	$P_{FN} \leq 700 \text{ mW}$	
Zündschutzart „Druckfeste Kapselung“ mit Option /N (Namurbeschaltung)	$U_N \leq 15 \text{ VDC}$	$I_N \leq 60 \text{ mA}$		
Zündschutzart „Druckfeste Kapselung“ mit Option /R22 (Schutzwiderstand)	$U_N \leq 250 \text{ VDC/AC}$	$I_N \leq 100 \text{ mA}$	$P_V \leq 0.21 \text{ W}$	

Zündschutzart Eigensicherheit

- Die wirksamen inneren Induktivitäten und Kapazitäten sind vernachlässigbar klein.
- Nur zum Anschluss an einen oder mehrere bescheinigte(n) eigensichere(n) Stromkreis(e).
- Beim Einbau eines oder mehrerer Messumformer(s) sind die elektrischen Kennwerte der zugehörigen gesonderten Bescheinigung(en) zu beachten.

Zündschutzart „Druckfeste Kapselung“

- Nur zum Anschluss an einen Stromkreis mit sicherer Begrenzung der elektrischen Kenngrößen der oben genannten Werte.
- Wenn das Gerät ohne Kabelverschraubung angeliefert wird, darf nur eine Kabelverschraubung montiert werden, die der Norm EN 60079-1 (Druckfeste Verkapselung Exd) entspricht.

12. Hinweise für Ex-Geräte

- Der Schwimmerschalter ist nach RL 2014/34/EU Anhang I ein Gerät der Gerätegruppe II Kategorie 1G bzw. 2G, das nach RL 99/92/EG (ATEX 137) in den Zonen 0, 1 und 2 bzw. 1 und 2 sowie den Gerätegruppen IIA, IIB und IIC, die durch brennbare Stoffe im Bereich der Temperaturklassen T1 bis T6 bzw. der in den untenstehenden Ziffern der Hinweise aufgeführten Werte explosionsgefährdet sind, eingesetzt werden darf. Bei der Verwendung sind die Anforderungen nach EN 60079-14 einzuhalten.
- Bei der Ausführung in der Zündschutzart „Eigensicherheit“ darf nur der Prozessanschluss, das Gleitrohr und der Schwimmer des Schwimmerschalters, Typ gemäß Typenschlüssel, in der Zone 0 verwendet werden.
Dabei sind diese Teile in die wiederkehrende Druckprüfung der Anlage einzubeziehen.
- In Werkstoffen von Teilen der Kategorie 1G dürfen die Legierungsanteile insgesamt die folgenden Werte nicht überschreiten:
< 10% für: Aluminium + Magnesium + Titan + Zirkonium, oder
< 7.5% für: Magnesium + Titan + Zirkonium.
- Der Schwimmerschalter ist nach RL 2014/34/EU Anhang I ein Gerät der Gerätegruppe II Kategorie 2D, das nach RL 99/92/EG (ATEX 137) in den Zonen 21 und 22 von brennbaren Stäuben eingesetzt werden darf. Bei der Verwendung sind die Anforderungen nach EN 60079-1 und EN 60079-14 einzuhalten. Der Schwimmerschalter bzw. die Komponenten müssen der Schutzart IP6* entsprechen.

Ergänzungen, Komplettierungen sowie Reparaturarbeiten am Messsystem (wie z.B. Austausch eines Messumformers, Anschlussdose) dürfen nur durch instruiertes Fachpersonal (nach ATEX 137) durchgeführt werden. Der Betreiber ist verantwortlich, dass das Messsystem der ursprünglichen Bauart entspricht. Die Typenkennzeichnung darf nicht verändert werden.

- Die Zuordnung zwischen der Temperaturklasse bzw. Oberflächentemperatur und der höchstzulässigen Umgebungstemperatur ist der nachfolgenden Tabelle zu entnehmen, inkl. Einbau mit Temperaturschaltern.

Temperaturklasse / Oberflächentemperatur		Umgebungstemperatur			
		Ex c ia IIC Ex c tb IIIC IP6*		Ex c d IIC Ex c tb IIIC IP6*	
		Basis	Option /N /R	Basis	Option /N /R
T6	80°C	80°C	75°C	80°C	75°C
T5	95°C	95°C	90°C	95°C	90°C
T4	130°C	130°C	125°C	120°C	120°C
T3	180°C	180°C	175°C	-	-

- Die Zuordnung zwischen Temperaturklasse bzw. Oberflächentemperatur, der höchstzulässigen Umgebungstemperatur für den Bereich des Anschlusskopfes sowie der maximalen Mediumtemperatur ist beim Einbau von Temperaturfühlern der nachfolgenden Tabelle zu entnehmen:

Rohrdurchmesser des Messwertaufnehmers d = 8 mm

Gesamtleistung aller Fühlerstromkreise: $P_i \leq 700 \text{ mW}$			
Temperaturklasse / Oberflächentemperatur		Umgebungstemperatur	Mediumtemperatur
T6	80°C	$\leq 75^\circ\text{C}$	$< 10^\circ\text{C}$
T5	95°C	$\leq 95^\circ\text{C}$	$< 20^\circ\text{C}$
T4	130°C	$\leq 100^\circ\text{C}$	$< 45^\circ\text{C}$
T3	195°C	$\leq 100^\circ\text{C}$	$< 95^\circ\text{C}$

Gesamtleistung aller Fühlerstromkreise: $P_i \leq 270 \text{ mW}$			
Temperaturklasse / Oberflächentemperatur		Umgebungstemperatur	Mediumtemperatur
T6	80°C	$\leq 75^\circ\text{C}$	$< 40^\circ\text{C}$
T5	95°C	$\leq 95^\circ\text{C}$	$< 55^\circ\text{C}$
T4	130°C	$\leq 100^\circ\text{C}$	$< 85^\circ\text{C}$
T3	195°C	$\leq 100^\circ\text{C}$	$< 140^\circ\text{C}$

Rohrdurchmesser des Messwertaufnehmers d = 21,3 mm

Gesamtleistung aller Fühlerstromkreise: $P_i \leq 700 \text{ mW}$			
Temperaturklasse / Oberflächentemperatur		Umgebungstemperatur	Mediumtemperatur
T6	80°C	$\leq 75^\circ\text{C}$	$< 70^\circ\text{C}$
T5	95°C	$\leq 95^\circ\text{C}$	$< 85^\circ\text{C}$
T4	130°C	$\leq 100^\circ\text{C}$	$< 120^\circ\text{C}$
T3	195°C	$\leq 100^\circ\text{C}$	$< 180^\circ\text{C}$

Gesamtleistung aller Fühlerstromkreise: $P_i \leq 270 \text{ mW}$			
Temperaturklasse / Oberflächentemperatur		Umgebungstemperatur	Mediumtemperatur
T6	80°C	$\leq 75^\circ\text{C}$	$< 75^\circ\text{C}$
T5	95°C	$\leq 95^\circ\text{C}$	$< 90^\circ\text{C}$
T4	130°C	$\leq 100^\circ\text{C}$	$< 125^\circ\text{C}$
T3	195°C	$\leq 100^\circ\text{C}$	$< 185^\circ\text{C}$

Für Zwischengrößen des Rohrdurchmessers können die zulässigen Werte aufgrund des Verhältnisses der aktiven Rohroberflächen (Umfang) beim Fühler ermittelt werden.

- Beim Einbau eines Messumformers sind die thermischen Kennwerte der zugehörigen gesonderten Bescheinigung zu beachten.
- Beim Einbau eines Drucktransmitters sind die thermischen Kennwerte der zugehörigen gesonderten Bescheinigung zu beachten: Temperaturklasse T4 bei T_{amb} -40°C bis +80°C
- Treten an der Kabeleinführung höhere Temperaturen als 70°C bzw. an der Adernverzweigung 80°C auf, darf nur ein geprüftes wärmebeständiges Kabel angeschlossen sein. Die Kabeleinführung muss für diese Temperatur geeignet sein.
- Der Schwimmerschalter, Typ gemäß Typenschlüssel, in der Ausführung in der Zündschutzart „Druckfeste Kapselung“ bzw. „Vergusskapselung“ ist nur zum Anschluss an einen Stromkreis mit sicherer (externer) Begrenzung der elektrischen Kenngrößen auf die vorgegebenen Werte bestimmt.
- Das Gehäuse des Schwimmerschalters, Typ gemäß Typenschlüssel, muss mit dem Potentialausgleich der Anlage leitend verbunden sein.
- Ex-Geräte sind mit einem speziellen Typenschild gekennzeichnet, auf dem alle Ex-relevanten Daten ersichtlich sind.

13. Hinweise für Ex-Geräte mit Bergbauzulassung

- Der Schwimmerschalter Typ EMR1-MOS-L130-SB26A-M/Ex ist nach RL 2014/34/EU Anhang I ein Gerät der Gerätegruppe I Kategorie M1, das nach RL 99/92/EG (ATEX 137) in den Gefährdungsbereichen 1 und 2 von Bergwerken eingesetzt werden darf.
- Die Mediums- bzw. Umgebungstemperatur ist bei Verwendung als Gerät der Gruppe I so zu begrenzen, dass die Oberflächentemperatur der Geräte 150°C nicht übersteigt. Die dazu notwendigen Angaben sind den bisherigen Hinweisen zu entnehmen.

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14. Typenschlüssel

Code 1

Schlüssel 1 ... / ... / ... -	Schlüssel 2 ... / ... / ... -	Schlüssel 3 ... / ... / ... -
Elektrischer Anschluss	Prozessanschlusswerkstoff	Prozessanschlussart
ALE Aluminium Anschlussdose 64 x 58 x 34 mm	V ¹ Edelstahl	E ¹ Gewinde nach oben verlaufend, G/BSP
ALF Aluminium Anschlussdose 80 x 75 x 57 mm	VP ¹ Edelstahl poliert / Oberflächenrauheit ca. 0,8µm (nicht attestierbar)	R ¹ Gewinde nach unten verlaufend, G/BSP
ALG Aluminium Anschlussdose 100 x 100 x 81 mm	TI ¹ Titan	ENPT ¹ Gewinde nach oben verlaufend, NPT
ALDA ¹ Aluminium Anschlussdose Ø 95 x 84 mm	HC ¹ Alloy C	RNPT ¹ Gewinde nach unten verlaufend, NPT
AVA Edelstahl Anschlussdose Ø 82 x 110 mm	ME Messing	EM ¹ Gewinde nach oben verlaufend, metrisch
AVDA ¹ Edelstahl Anschlussdose Ø 82 x 110 mm	VEEC ¹ Edelstahl ECTFE beschichtet	RM ¹ Gewinde nach unten verlaufend, metrisch
APA Polyester Anschlussdose 80 x 75 x 55 mm	VPFA ¹ Edelstahl PFA beschichtet	FE ¹ Flansche nach EN
APB Polyester Anschlussdose 80 x 75 x 55 mm / Exm	P PVC	FA ¹ Flansche nach ANSI
ABA ABS Anschlussdose 80 x 82 x 55 mm	PP Polypropylen	F ¹ Flansche nach ...
K Anschlusskabel	PF PVDF	FM74 Flansch (Messing) Ø 74 mm
K68 Anschlusskabel IP 68 (≥ G 3/8")	PA Polyamid	FS ¹ Sonderflansche nach Zeichnung
ASH Gerätestecker Hirschmann DIN 43650	ST Stahl	SO Standard Ovalflansch 80 x 50 mm
ASHAA Kunststoffstecker HTS gerade		OP ¹ ohne Prozessanschluss
ASHAB Kunststoffstecker HTS gewinkelt		TC ¹ Try-Clamp nach ISO 2852
ASHBA Aluminiumstecker HTS gerade		BK ¹ Blindkegel nach DIN 11851
ASHBB Aluminiumstecker HTS gewinkelt		BKN ¹ Blindkegel nach DIN 11851 mit Nutmutter
ASQ Quick-On Gerätestecker		BK64 ¹ Blindbundstutzen nach DIN 11864/1 Form A
ASMA Gerätestecker M12 3-polig		BKN64 ¹ Blindbundstutzen nach DIN 11864/1 Form A mit Nutmutter
ASMB Gerätestecker M12 8-polig		BKD ¹ Try-Clamp nach DIN 32676
ASC Gerätestecker C091D 7-polig		BKND ¹ Try-Clamp nach DIN 32676 mit Spannring
		GM ¹ Innengewinde G (nur Bypassgehäuse)
		NPTM ¹ Innengewinde NPT (nur Bypassgehäuse)
		GN ¹ Aussengewinde G (nur Bypassgehäuse)
		NPTN ¹ Aussengewinde NPT (nur Bypassgehäuse)
		SE ¹ Schweissenden (nur Bypassgehäuse)
		ERVE Schneidringverschraubung

Code 2

Schlüssel 1 ... -	Schlüssel 1 ... -
Gewindeanschluss	Try-Clamp / Blindkegel
... Gewindegrösse	... Nennweite

Code 2

Schlüssel 1.1 (nur für Flansche) ... / ... / ... -	Schlüssel 1.2 (nur für Flansche) ... / ... / ... -	Schlüssel 1.3 (nur für Flansche) ... / ... / ... -
Flanschanschluss	Flanschanschluss	Flanschanschluss
... Nennweite	... Druckstufe	... Dichtfläche

Beispiel

Code	1	2	3	4	5
Schlüssel	1 / 2 / 3 - 1.1 / 1.2 / 1.3 - 1 / 2 / 3 / 4 - 1 / 2 / 3 / 4 - 1 / 2 /				
Beispiel	ALE / V / FE - 80 / 16 / B1 - V / U / R22 / TO - 1 / TFA2 / TPAT / 050 - L1000 / 18 /				

Schwarz = nicht möglich nach Atex / Blau = möglich nach Atex Exia / Blau¹ = möglich nach Atex Exia und Exd / Schwarz¹ = möglich nach Atex Exd

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Code 3

Schlüssel 1 ... / ... / ... - Gleitrohrwerkstoff	Schlüssel 2 ... / ... / ... - Niveau-Kontaktfunktion	Schlüssel 3 ... / ... / ... - Zusatzoption
V ¹ Edelstahl	U ¹ Umschalter bei steigendem Niveau*	R22 ¹ mit Schutzwiderstand 22 Ohm / 0.21 W
VP ¹ Edelstahl poliert / Oberflächenrauheit ca. 0,8µm (nicht attestierbar)	S ¹ Schliesser bei steigendem Niveau*	N ¹ mit Namurbeschaltung
TI ¹ Titan	O ¹ Öffner bei steigendem Niveau*	HT Hochtemperatur 180-250°C
HC ¹ Alloy C	* Mehrfachnennungen möglich z.B. ' OSS '	
ME Messing		
VEEC ¹ Edelstahl ECTFE beschichtet		
VPFA ¹ Edelstahl PFA beschichtet		
P PVC		
PP Polypropylen		
PF PVDF		
PA Polyamid		

Code 3

Schlüssel 4 ... / ... / ... / ... - Temperatur-Kontaktfunktion	
TS ¹	Temperaturkontakt Schliesser bei steigender Temperatur*
TO ¹	Temperaturkontakt Öffner bei steigender Temperatur*
TPS ¹	Temperaturkontakt Schliesser bei steigender Temperatur*
TPO ¹	Temperaturkontakt Öffner bei steigender Temperatur*
* Mehrfachnennungen möglich z.B. ' TSTO '	

Code 4

Schlüssel 1 ... / ... / ... / ... - Stückzahl	Schlüssel 2 ... / ... / ... / ... - Temperaturfühler	Schlüssel 3 ... / ... / ... / ... - Temperaturmessumformer
...	Anzahl der gewünschten Temperaturfühler	
	TFA2 ¹ Pt 100 Fühler / 2-Leiter	TPAT ¹ TP5333A
	TFA3 ¹ Pt 100 Fühler / 3-Leiter	TPBT ¹ TP5333D Ex
	TFA4 ¹ Pt 100 Fühler / 4-Leiter	TDAT ¹ TD5335A
	TFB2 ¹ Pt 1000 Fühler / 2-Leiter	TDBT ¹ TD5335D Ex
	TFB3 ¹ Pt 1000 Fühler / 3-Leiter	PAATP ¹ TP5350AP / PROFIBUS® PA
	TFB4 ¹ Pt 1000 Fühler / 4-Leiter	PABTP ¹ TP5350BP Ex / PROFIBUS® PA
	TF ¹ Temperaturfühler verschiedene	PAATF ¹ TP5350AF / FOUNDATION™ Fieldbus
		PABTF ¹ TP5350BF Ex / FOUNDATION™ Fieldbus

Code 4

Schlüssel 4 ... / ... / ... / ... - Messbereich für Temperaturmessumformer
050 ¹ 0°C ... 50°C / 4 ... 20 mA
100 ¹ 0°C ... 100°C / 4 ... 20 mA
150 0°C ... 150°C / 4 ... 20 mA
200 0°C ... 200°C / 4 ... 20 mA
000 ..°C ... °C / 4 ... 20 mA

Beispiel

5	6	7	8	9	Code
3 / 4 / 5 - 1 / 2 / 3 / 4 - 1 / 2 / 3 - 1 / 2 / 3 - 1 / 2 / 3					Schlüssel
- 1	SV72 / 24 / V -			- EXIAG / PEDII	Beispiel

Schwarz = nicht möglich nach Atex / Blau = möglich nach Atex Exia / Blau¹ = möglich nach Atex Exia und Exd / Schwarz¹ = möglich nach Atex Exd

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KFG Level AG

Ruessenstrasse 4 | CH-6340 Baar | Telefon +41 (0)41 766 62 82 | Fax +41 (0)41 766 62 83 | E-Mail info@kfg-level.com | Internet www.kfg-level.com

Code 5

Schlüssel 1 ... / ... / ... / ... - Gleitrohrlänge / Mittenabstand	Schlüssel 2 ... / ... / ... / ... - Gleitrohrdurchmesser (Gleitrohrwerkstoff)	Schlüssel 3 ... / ... / ... / ... - Werkstoff des Bypassgehäuse
L... ¹ Gleitrohrlängenangabe in mm (Schlüssel 3 - 5 entfällt)	08 ¹ Ø 08 mm (V / VP / M / P / PP) 11 ¹ Ø 11 mm (VEEC / VPFA)	V ¹ Edelstahl VP ¹ Edelstahl poliert / Oberflächenrauheit ca. 0,8µm (nicht attestierbar)
M... ¹ Mittenabstand in mm (Bypassgehäuse)	12 ¹ Ø 12 mm (V / VP / M / TI / HC / PA / P / PP / PF) 14 ¹ Ø 14 mm (V / VP / M / TI) 16 ¹ Ø 16 mm (V / VP / P / PP / PF) 17 ¹ Ø 17 mm (VEEC / VPFA) 18 ¹ Ø 18 mm (V / VP / TI / HC) 20 ¹ Ø 20 mm (P / PP / PF) 40 ¹ Ø 40 mm (V / VP)	TI ¹ Titan HC ¹ Alloy C AL ¹ Aluminium Silafont-35 VEEC ¹ Edelstahl ECTFE beschichtet VPFA ¹ Edelstahl PFA beschichtet P PVC PP Polypropylen PF PVDF

Code 5

Schlüssel 4 ... / ... / ... / ... - Aussendurchmesser des Bypassgehäuse	Schlüssel 5 ... / ... / ... / ... - Wandstärke des Bypassgehäuse
60 ¹ Ø 60.30 mm (V / VP) 61 ¹ Ø 60.33 mm (V / VP / TI / HC) 63 Ø 63.00 mm (P / PP / PF) 63 ¹ Ø 63.50 mm (V / VP / VEEC / VPFA) 64 ¹ Ø 64.00 mm (AL) 73 ¹ Ø 73.03 mm (V / VP) 88 ¹ Ø 88.90 mm (V / VP) 114 ¹ Ø 114.30 mm (V / VP)	... Wandstärke in mm

Code 6

Schlüssel 1 ... / ... / ... / ... - Stückzahl	Schlüssel 2 ... / ... / ... / ... - Schwimmer	Schlüssel 3 ... / ... / ... / ... - Innenrohrdurchmesser d. Schwimmers
... Anzahl der Schwimmer	... nach Schwimmertabelle 1003	... nach Schwimmertabelle 1003

Code 6

Schlüssel 4 ... / ... / ... / ... - Magnetsystem
... nach Schwimmertabelle 1003

Beispiel

Code	1	2	3	4	5
Schlüssel	1 / 2 / 3 - 1.1 / 1.2 / 1.3 - 1 / 2 / 3 / 4 - 1 / 2 / 3 / 4 - 1 / 2 /				
Beispiel	ALE / V / FE - 80 / 16 / B1 - V / U / R22 / TO - 1 / TFA2 / TPAT / 050 - L1000 / 18 /				

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Code 7

Schlüssel 1 ... / ... / ... - Zusatzdesign	Schlüssel 2 ... / ... / ... - Montagehinweis	Schlüssel 3 ... / ... / ... - Verstelleinheit
FG ¹ flexibles Gleitrohr NT mit Testfunktion WG ¹ Winkelausführung HFF Hubschwimmer mit Stab (Code 5 Schlüssel 3 - 5 entfällt) HSF Hubschwimmer mit Seil (Code 5 Schlüssel 2 - 5 entfällt) PSS Pendelschalter mit Schwimmer (Code 5 Schlüssel 3 - 5 entfällt) PSP Pendelschalter mit Paddel (Code 5 Schlüssel 3 - 5 entfällt)	GU ¹ Gerät wird von unten montiert HH ¹ Prozessanschlüsse Bypassgeh. seittl. / seittl. HV ¹ Prozessanschlüsse Bypassgeh. seittl. / unten	VE mit Schneidringverschraubung / verstellbar (nach ATEX 2014/34/EU nur einmal positionierbar)

Code 8

Schlüssel 1 ... / ... / ... - Kabellänge	Schlüssel 2 ... / ... / ... - Anschlusskabel	Schlüssel 3 ... / ... / ... - Anschlusskabelzusatz
... Kabellänge in Meter	PVC ¹ PVC Anschlusskabel PVCB ¹ PVC Anschlusskabel mit blauem Mantel SIL ¹ Silikon Anschlusskabel PUR ¹ PUR Anschlusskabel RAD ¹ Radox Anschlusskabel FTEF ¹ Teflon Litzen FPVC ¹ PVC Litzen	KA ¹ abgeschirmt KB ¹ abgeschirmt / ölbeständig KC ¹ abgeschirmt / ölbeständig / halogenfrei KD ¹ ölbeständig KE ¹ ölbeständig / halogenfrei KF ¹ halogenfrei

Code 9

Schlüssel 1 ... / ... / ... - Zulassungen / 1	Schlüssel 2 ... / ... / ... - Zulassungen / 2	Schlüssel 3 ... / ... / ... - Zulassungen / 3
EXIAG nach Exia, Atmosphäre Gas EXIAGD nach Exia, Atmosphäre Gas und Staub EXDG ¹ nach Exd, Atmosphäre Gas EXDGD ¹ nach Exd, Atmosphäre Gas und Staub EXIADG ¹ nach Exia und Exd, Atmosphäre Gas EXIADGD ¹ nach Exia und Exd, Atmosphäre Gas und Staub	PEDII ¹ nach Richtlinie PED 2014/68/EU, Kategorie II PEDIV ¹ nach Richtlinie PED 2014/68/EU, Kategorie IV PEDIWW ¹ nach Richtlinie PED 2014/68/EU, Kategorie IV und WHG Zulassung W ¹ WHG Zulassung	3A ¹ 3A Sanitary Standard ABS ¹ Schiffsbauzul. American Bureau of Shipping BV ¹ Schiffsbauzulassung Bureau Veritas GL ¹ Schiffsbauzulassung Germanischer Lloyd LR ¹ Schiffsbauzulassung Lloyd's Register EAC1 ¹ Zulassung EAC TR CU 004/2011 & 012/2011 & 020/2011

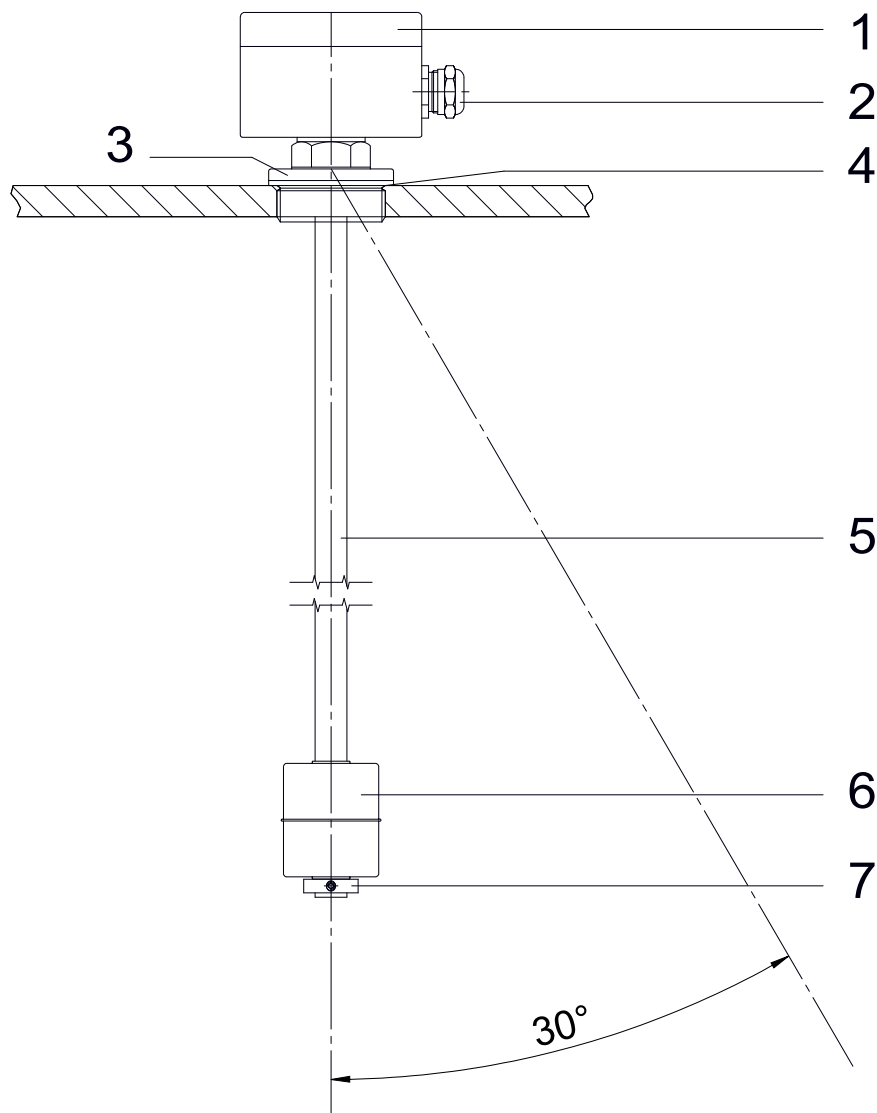
Beispiel

5	6	7	8	9	Code
3 / 4 / 5 - 1 / 2 / 3 / 4 - 1 / 2 / 3 - 1 / 2 / 3 - 1 / 2 / 3					Schlüssel
- 1	SV72 / 24 / V -			- EXIAG / PEDII	Beispiel

Schwarz = nicht möglich nach ATEX / Blau = möglich nach ATEX Exia / Blau¹ = möglich nach ATEX Exia und Exd / Schwarz¹ = möglich nach ATEX Exd

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1. Functional description

The magnetic float switch (see page 14) works according to the float principle. One or several float(s) (6) with an integrated magnet system is/are placed into a non-magnetic guide tube (5).

Due to the magnetic field of the permanent magnet that is inside the float, when a defined height is reached, a reed switch (protective gas contact) that is located in the guide tube is actuated. The current circle is closed or interrupted depending on the function of the switch.

2. Application area

Magnetic float switches are used to monitor the fill level and to control liquids. They are permitted to be integrated into containers and tanks that meet the technical requirements, i.e. that are designed for the relevant operating parameters. The liquids must be free of or low in solids and not be susceptible to gumming, conglomeration or crystallisation. The solid particles may not be magnetisable or, if they are magnetisable, may not get close to the magnet.

3. Installation

Magnetic float switches are only intended for vertical installation in containers and tanks. The maximum deviation from the vertical may be $\pm 30^\circ$. The devices are pre-assembled so that they can be screwed in on-site (screw-in thread 3) or flange-mounted. Ensure that the mating surfaces and seals are mechanically faultless.

To seal the device, the correct seal (4) must be used according to the liquid, the pressure and the temperature. The measurement of the seal depends on the process connection.

Devices with a float body whose diameter is greater than the core diameter of the screw-in thread or the inner diameter of the connection flange is provided with adjusting rings (7). These adjusting rings are removed together with the floats before installation.

The device is now screwed in or flange-mounted and the float and adjusting rings re-installed.

Ensure that the floats are inserted in the same installation position and the adjusting rings are locked into the same place as before they were removed. In addition, ensure that the screws of the adjustment rings push gently into the guide tube material.

When installing according to 3A sanitary standard, pay attention to the following points:

- If the device has a 3/8" male connector, ensure that the device is welded and that the weld seam is sanded down. The abrasiveness must be lower than 0.4 μm .

4. Hazard information

- Provisional installation may not be carried out if components or entire devices are faulty or incorrect, or if components are missing
- Devices and their auxiliary devices may not be used as lifting gear, steps or handling devices
- If there are hazards, then safety signs, information, warning devices, suitable protective equipment or isolators must be affixed according to directives and national regulations. If isolators are used, these must be defined for the specific usage.
- Operating personnel must wear protective clothing in accordance with the local conditions and regulations. Operating personnel must be trained, instructed and in possession of the technical documents.
- The operator is responsible for preventing unauthorised persons from accessing systems and devices, and operating them.
- When devices and equipment are handed over to third parties, all documentation must also be supplied together with these, in order to inform the third party of how to install, operate and use them

5. Electrical connection

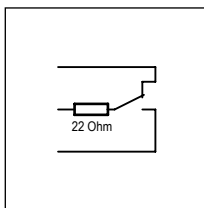
The electrical connection must be set up in accordance with the safety regulations for installation of electrical systems, which are applicable in the country of installation, and may only be carried out by specialists. The magnetic float switch must be connected in accordance with the connection diagram in the connection housing (1) or on the connection cable. For devices with a connection housing, the cable is inserted through the cable fitting (2) and tightened; the connection housing's cover must be closed well.

6. Options

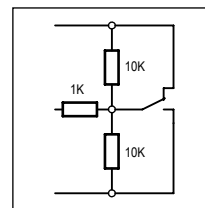
In addition to the reed switches, temperature contacts with normally open (NO) or normally closed (NC) contacts can be integrated into the guide tube (5). In addition, temperature sensors with or without transducers can be integrated. The transducer converts the resistance into an analogue signal of 4-20 mA. A combination consisting of a reed switch with a temperature contact and a temperature sensor is possible. The standard temperature sensor is a PT100, but different sensors can also be used (e.g. PT1000). The temperature contact is selected using the customer's temperature specifications and can be used with or without a hysteresis.

In addition, the magnetic float switches can be fitted with the following circuitry:

Circuitry for the operation
on PLC with 22 Ω resistance



Namur circuitry acc. to EN 60947



When using additional control devices from the KFG range, the relevant installation and operating instructions must be present.

7. Attention

- The operator must ensure that devices that have an earth connection are earthed.
- Devices with a connection cable are not earthed and may be live if faults occur. These devices may only be operated at low voltage.
- Devices that are used in a system that has an internal coating must be provided with an earthing bracket or a screw outside the connection box so that an earthing connection to the system can be established.
- Damage to the switch may occur when connecting to an inductive load. A circuit with an RC member or a free-wheeling diode must be provided. When connecting to a capacitive load, a protective resistor must be switched in series, in order to limit the peak current.
- An electrical overload may result in damage to the switch. This causes the magnetic float switch and the control connected in the outgoing circuit to malfunction and results in damage to property and injury to persons.
The maximum electrical switching capacities must be retained.
- Ensure that the energy input is correct and sufficient.

8. Maintenance

The devices must be installed and commissioned by an expert. In use, the devices do not require maintenance as long as the parameters such as the type of liquid, density, temperature and pressure are maintained. The magnetic float switch's material is to be selected according to the liquid.

9. Functional inspection

A functional inspection of the contacts can be carried out in an installed or a dismantled state by pushing the float manually or by filling the container. Ensure that no process flows are triggered by the functional inspection. During a visual inspection, the device parts that come into contact with the storage liquids, their vapours or condensates, must be inspected for possible corrosive actions. This inspection can only be carried out from inside the storage container or after dismantling the device.

10. Notes

- Do not operate magnetic float switches near strong electromagnetic fields. (Minimum distance 1 m)
- The magnetic float switch may not be exposed to mechanical load, vibrations and impacts. If these loads are present, damping elements must be used.
- The liquid must not have any mechanical impacts on the device.
- The switching points for the magnetic float switch must not be blocked.
- If there is a risk that the liquid could ignite or explode, then devices that conform to the ATEX directive 2014/34/EU must be used.
- The environmental conditions must be such that all display instruments can be read without errors on-site, and if possible, at a horizontal angle.
- The devices must be disposed of according to regional and national regulations and directives. When the device is being disposed of, liquid residues may remain in it.

TRANSPORT REGULATIONS:

When packing for transport, be aware that the devices are measurement systems with electronic components. The devices must be packed accordingly. The outer packing material such as wood, cardboard, etc. must be marked with hazard warning signs.

11. Nominal data for ex-devices

ATEX				
Type of protection intrinsic safety Ex ia IIC switch or temperature switch	$I_i \leq 100 \text{ mA}$			
Type of protection intrinsic safety Ex ia IIC switch or temperature switch with option /R22	$I_i \leq 100 \text{ mA}$			
Type of protection intrinsic safety Ex ia IIC temperature sensor	$U_i \leq 28 \text{ V}$	$I_i \leq 100 \text{ mA}$	$P_i \leq 700 \text{ mW}$	
Type of protection intrinsic safety Ex ia IIC pressure transmitter	see appropriate special certificate			
Type of protection intrinsic safety Ex ia IIC with /N (NAMUR circuitry)	$U_i \leq 15 \text{ VDC}$	$I_i \leq 60 \text{ mA}$		
Type of protection "flameproof enclosure"	$U_N \leq 250 \text{ VDC/AC}$	$P_{SN} \leq 50 \text{ W/VA}$	$P_{FN} \leq 700 \text{ mW}$	
Type of protection "flameproof enclosure" with /N (NAMUR circuitry)	$U_N \leq 15 \text{ VDC}$	$I_N \leq 60 \text{ mA}$		
Type of protection "flameproof enclosure" with /R22 (protective resistor)	$U_N \leq 250 \text{ VDC/AC}$	$I_N \leq 100 \text{ mA}$	$P_V \leq 0.21 \text{ W}$	

Type of protection “INTRINSIC SAFETY”

- The effective inner inductances and capacities are negligibly small.
- Only to be connected to one or several certified, intrinsically safe current circle(s).
- When installing one or several transducer(s), the electrical parameters for the relevant special certificate(s) are to be adhered to.

Type of protection “FLAMEPROOF ENCLOSURE”

- Only to be connected to a current circle with safe limitation of the electrical parameters to the values specified above.
- If the device is delivered without a cable fitting, only a cable fitting that conforms to standard EN 60079-1 (Equipment protection by pressure-resistant enclosures “Exd”) may be installed.

12. Notes for ex-devices

- According to RL 2014/34/EU, annex I, the magnetic float switch is a device of device group II, category 1G or 2G, which, according to RL 99/92/EC (ATEX 137), may be used in zones 0, 1 and 2 or 1 and 2 as well as device groups IIA, IIB and IIC, which are explosive due to inflammable substances in the range of temperature classes T1 to T6 or the values listed in the note figures below.
When using, the requirements defined in EN 60079-14 are to be adhered to.
- In the design with the “intrinsic safety” type of protection, only the process connection, the guide tube and the float of the magnetic float switch, type according to the type key, may be used in zone 0.
These parts are to be included in the system's periodic pressure inspection.
- In part materials with category 1G, the total of the alloy portions may not exceed the following values:
< 10% for: Aluminium + magnesium + titanium + zirconium, or
< 7.5% for: Magnesium + titanium + zirconium.
- According to RL 2014/34/EU, annex I, the magnetic float switch is a device of device group II, category 2D, which, according to RL 99/92/EC (ATEX 137), may be used in zones 21 and 22 for flammable coating powder.
When using, the requirements according to EN 60079-1 and EN 60079-14 are to be adhered to.
The magnetic float switch and the components must correspond to protection category IP6*.

Additions, completion and repair tasks to the measurement system (such as replacing a transducer, the connection box) may only be carried out by trained specialists (according to ATEX 137). The operator is responsible for ensuring that the measurement system corresponds to the original design. The type designation may not be changed.

- The correlation between the temperature class or the surface temperature and the highest permitted ambient temperature is listed in the following table, including installation with temperature switches

Temperature class / Surface temperature		Ambient temperature			
		Ex c ia IIC Ex c tb IIIC IP6*		Ex c d IIC Ex c tb IIIC IP6*	
		Base	Option /N /R	Base	Option /N /R
T6	80°C	80°C	75°C	80°C	75°C
T5	95°C	95°C	90°C	95°C	90°C
T4	130°C	130°C	125°C	120°C	120°C
T3	180°C	180°C	175°C	-	-

- The correlation between the temperature class or the surface temperature, the highest permitted ambient temperature for the connecting head's area and the maximum liquid temperature when installing temperature sensors is listed in the following table:

Tube diameter of the measuring element d = 8 mm

Total power of all sensor circuits: $P_i \leq 700 \text{ mW}$			
Temperature class / Surface temperature		Ambient temperature	Liquid temperature
T6	80°C	$\leq 75^\circ\text{C}$	$< 10^\circ\text{C}$
T5	95°C	$\leq 95^\circ\text{C}$	$< 20^\circ\text{C}$
T4	130°C	$\leq 100^\circ\text{C}$	$< 45^\circ\text{C}$
T3	195°C	$\leq 100^\circ\text{C}$	$< 95^\circ\text{C}$

Total power of all sensor circuits: $P_i \leq 270 \text{ mW}$			
Temperature class / Surface temperature		Ambient temperature	Liquid temperature
T6	80°C	$\leq 75^\circ\text{C}$	$< 40^\circ\text{C}$
T5	95°C	$\leq 95^\circ\text{C}$	$< 55^\circ\text{C}$
T4	130°C	$\leq 100^\circ\text{C}$	$< 85^\circ\text{C}$
T3	195°C	$\leq 100^\circ\text{C}$	$< 140^\circ\text{C}$

Tube diameter of the measuring element d = 21,3 mm

Total power of all sensor circuits: $P_i \leq 700 \text{ mW}$			
Temperature class / Surface temperature		Ambient temperature	Liquid temperature
T6	80°C	$\leq 75^\circ\text{C}$	$< 70^\circ\text{C}$
T5	95°C	$\leq 95^\circ\text{C}$	$< 85^\circ\text{C}$
T4	130°C	$\leq 100^\circ\text{C}$	$< 120^\circ\text{C}$
T3	195°C	$\leq 100^\circ\text{C}$	$< 180^\circ\text{C}$

Total power of all sensor circuits: $P_i \leq 270 \text{ mW}$			
Temperature class / Surface temperature		Ambient temperature	Liquid temperature
T6	80°C	$\leq 75^\circ\text{C}$	$< 75^\circ\text{C}$
T5	95°C	$\leq 95^\circ\text{C}$	$< 90^\circ\text{C}$
T4	130°C	$\leq 100^\circ\text{C}$	$< 125^\circ\text{C}$
T3	195°C	$\leq 100^\circ\text{C}$	$< 185^\circ\text{C}$

For intermediate sizes of tube diameters, the permitted values can be determined on the sensor due to the relationship between the active tube surfaces (scope).

- When installing a transducer, the thermal parameters of the appropriate special certificate are to be adhered to.
- When installing a pressure transmitter, the thermal parameters of the appropriate special certificate are to be adhered to: Temperature class T4 for T_{amb} -40°C for +80°C
- If temperatures higher than 70°C occur at the cable inlet or 80°C at the conductor junction, only a checked, heat-resistant cable may be connected. The cable inlet must be suitable for this temperature.
- The magnetic float switch, type according to the type key, in the design with the "Flameproof enclosure" or "intrinsic safety" type of protection is only designated for connection to a current circle with safe (external) imitation of the electrical parameters to the specified values.
- The magnetic float switch's housing, type according to the type key, must be connected electrically to the system's potential equalisation.
- Ex-devices are indicated by a special type plate on which all ex-relevant data is visible.

13. Notes for ex-devices with approval for mining

- According to RL 2014/34/EU, annex I, the magnetic float switch type EMR1-MOS-L130-SB26A-M/Ex is a device of device group I, category M1, which, according to RL 99/92/EC (ATEX 137), may be used in hazard areas 1 and 2 in mines.
- When the device is being used as a device in group I, the liquid or ambient temperature is to be limited to ensure that the device's surface temperature does not exceed 150°C.
The specifications required for this are listed in the previous notes.



14. Type key

Code 1

Key 1 ... / ... / ... -	Key 2 ... / ... / ... -	Key 3 ... / ... / ... -
Electrical connection	Process connection material quality	Process connection
ALE Aluminium terminal box 64 x 58 x 34 mm	V ¹ Stainless steel	E ¹ Thread to electrical direction, G/BSP
ALF Aluminium terminal box 80 x 75 x 57 mm	VP ¹ Stainless steel electropolished / Ra ca. 0,8µm (not attestable)	R ¹ Thread to float direction, G/BSP
ALG Aluminium terminal box 100 x 100 x 81 mm	TI ¹ Titanium	ENPT ¹ Thread to electrical direction, NPT
ALDA ¹ Aluminium terminal box Ø 95 x 84 mm	HC ¹ Alloy C	RNPT ¹ Thread to float direction, NPT
AVA Stainless steel terminal box Ø 82 x 110 mm	ME Brass	EM ¹ Thread to electrical direction, metric
AVDA ¹ Stainless steel terminal box Ø 82 x 110 mm	VEEC ¹ Stainless steel ECTFE coated	RM ¹ Thread to float direction, metric
APA Polyester terminal box 80 x 75 x 55 mm	VPFA ¹ Stainless steel PFA coated	FE ¹ Flange according to EN
APB Polyester terminal box 80 x 75 x 55 mm / Exm	P PVC	FA ¹ Flange according to ANSI
ABA ABS terminal box 80 x 82 x 55 mm	PP Polypropylene	F ¹ Flange according to ...
K Connection cable	PF PVDF	FM74 Flange (Brass) Ø 74 mm
K68 Connection cable IP 68 (≥ G 3/8")	PA Polyamide	FS ¹ Flange according to drawing
ASH Connector Hirschmann DIN 43650	ST Steel	SO Standard oval flange 80 x 50 mm
ASHAA Plastic connector HTS straight		OP ¹ Without process connection
ASHAB Plastic connector HTS angulate		TC ¹ Try-Clamp according to ISO 2852
ASHBA Aluminium connector HTS straight		BK ¹ Aseptic blind cone according to DIN 11851
ASHBB Aluminium connector HTS angulate		BKN ¹ Aseptic blind cone according to DIN 11851 with groove nut
ASQ Quick-On Connector		BK64 ¹ Aseptic blind cone acc. to DIN 11864/1 form A
ASMA Connector M12 3-pins		BKN64 ¹ Aseptic blind cone acc. to DIN 11864/1 form A with groove nut
ASMB Connector M12 8-pins		BKD ¹ Try-Clamp according to DIN 32676
ASC Connector C091D 7-pins		BKND ¹ Try-Clamp according to DIN 32676 with clamp
		GM ¹ Female thread G (only bypass chamber)
		NPTM ¹ Female thread NPT (only bypass chamber)
		GN ¹ Male thread G (only bypass chamber)
		NPTN ¹ Male thread NPT (only bypass chamber)
		SE ¹ Welding stub end (only bypass chamber)
		ERVE Cutting ring union

Code 2

Key 1 ... -	Key 1 ... -
Threaded connection	Try-Clamp / Aseptic cone
... Threaded connection size	... Nominal size

Code 2

Key 1.1 (only for flange) ... / ... / ... -	Key 1.2 (only for flange) ... / ... / ... -	Key 1.3 (only for flange) ... / ... / ... -
Flange connection	Flange connection	Flange connection
... Flange nominal bore	... Flange pressure rating	... Flange facing

Example

Code	1	2	3	4	5
Key	1 / 2 / 3 - 1.1 / 1.2 / 1.3 - 1 / 2 / 3 / 4 - 1 / 2 / 3 / 4 - 1 / 2 /				
Example	ALE / V / FE - 80 / 16 / B1 - V / U / R22 / TO - 1 / TFA2 / TPAT / 050 - L1000 / 18 /				

Black = not possible according to Atex / Blue = possible according to Atex Exia / Blue¹ = possible according to Atex Exia and Exd / Black¹ = possible according to Atex Exd

Code 3

Key 1 ... / ... / ... / ... - Guide tube material quality	Key 2 ... / ... / ... / ... - Level switch function	Key 3 ... / ... / ... / ... - Level switch option
V ¹ Stainless steel	U ¹ Change over (SPDT)*	R22 ¹ Switch protective circuit with 22 ohm / 0.21 W resistor
VP ¹ Stainless steel electropolished / Ra ca. 0,8µm (not attestable)	S ¹ Normally open (NO)*	N ¹ Switch protective circuit according to NAMUR EN 60947
TI ¹ Titanium	O ¹ Normally closed (NC)*	HT High temperature version 180-250°C
HC ¹ Alloy C	* Multiple selections possible e.g. ' OSS '	
ME Brass		
VEEC ¹ Stainless steel ECTFE coated		
VPFA ¹ Stainless steel PFA coated		
P PVC		
PP Polypropylene		
PF PVDF		
PA Polyamide		

Code 3

Key 4 ... / ... / ... / ... - Temperature switch function
TS ¹ Temperature switch normally open (NO)*
TO ¹ Temperature switch normally closed (NC)*
TPS ¹ Temperature switch normally open (NO)*
TPO ¹ Temperature switch normally closed (NC)*
* Multiple selections possible e.g. ' TSTO '

Code 4

Key 1 ... / ... / ... / ... - Number of probes	Key 2 ... / ... / ... / ... - Temperature probe	Key 3 ... / ... / ... / ... - Temperature control unit
... Number of temperature probes	TFA2 ¹ Pt 100 Probe / 2-wire	TPAT ¹ TP5333A
	TFA3 ¹ Pt 100 Probe / 3-wire	TPBT ¹ TP5333D Ex
	TFA4 ¹ Pt 100 Probe / 4-wire	TDAT ¹ TD5335A
	TFB2 ¹ Pt 1000 Probe / 2-wire	TDBT ¹ TD5335D Ex
	TFB3 ¹ Pt 1000 Probe / 3-wire	PAATP ¹ TP5350AP / PROFIBUS® PA
	TFB4 ¹ Pt 1000 Probe / 4-wire	PABTP ¹ TP5350BP Ex / PROFIBUS® PA
	TF ¹ Temperature probe (acc. to customers device)	PAATF ¹ TP5350AF / FOUNDATION™ Fieldbus
		PABTF ¹ TP5350BF Ex / FOUNDATION™ Fieldbus

Code 4

Key 4 ... / ... / ... / ... - Temperature measuring range
050 ¹ 0°C ... 50°C / 4 ... 20 mA
100 ¹ 0°C ... 100°C / 4 ... 20 mA
150 0°C ... 150°C / 4 ... 20 mA
200 0°C ... 200°C / 4 ... 20 mA
000 ..°C°C / 4 ... 20 mA

Example

5	6	7	8	9	Code
3 / 4 / 5 -	1 / 2 / 3 / 4 -	1 / 2 / 3 -	1 / 2 / 3 -	1 / 2 / 3	Key
- 1	SV72 / 24 / V -		- EXIAG / PEDII		Example

Black = not possible according to Atex / Blue = possible according to Atex Exia / Blue¹ = possible according to Atex Exia and Exd / Black¹ = possible according to Atex Exd

Code 5

Key 1 ... / ... / ... / ... - Length of instrument / Centre distance	Key 2 ... / ... / ... / ... - Guide tube diameter (material quality)	Key 3 ... / ... / ... / ... - Bypass chamber material quality
L... ¹ Length of instrument in mm (Key 3 - 5 not applicable)	08 ¹ Ø 08 mm (V / VP / M / P / PP) 11 ¹ Ø 11 mm (VEEC / VPFA)	V ¹ Stainless steel VP ¹ Stainless steel electropolished / Ra ca. 0,8µm (not attestable)
M... ¹ Centre distance in mm (Chamber)	12 ¹ Ø 12 mm (V / VP / M / TI / HC / PA / P / PP / PF) 14 ¹ Ø 14 mm (V / VP / M / TI) 16 ¹ Ø 16 mm (V / VP / P / PP / PF) 17 ¹ Ø 17 mm (VEEC / VPFA) 18 ¹ Ø 18 mm (V / VP / TI / HC) 20 ¹ Ø 20 mm (P / PP / PF) 40 ¹ Ø 40 mm (V / VP)	TI ¹ Titanium HC ¹ Alloy C AL ¹ Aluminium Silafont-35 VEEC ¹ Stainless steel ECTFE coated VPFA ¹ Stainless steel PFA coated P PVC PP Polypropylene PF PVDF

Code 5

Key 4 ... / ... / ... / ... - Bypass chamber outside diameter	Key 5 ... / ... / ... / ... - Bypass chamber wall thickness
60 ¹ Ø 60.30 mm (V / VP) 61 ¹ Ø 60.33 mm (V / VP / TI / HC) 63 Ø 63.00 mm (P / PP / PF) 63 ¹ Ø 63.50 mm (V / VP / VEEC / VPFA) 64 ¹ Ø 64.00 mm (AL) 73 ¹ Ø 73.03 mm (V / VP) 88 ¹ Ø 88.90 mm (V / VP) 114 ¹ Ø 114.30 mm (V / VP)	... Bypass chamber wall thickness in mm

Code 6

Key 1 ... / ... / ... / ... - Number of floats	Key 2 ... / ... / ... / ... - Float	Key 3 ... / ... / ... / ... - Inner bore of float
... Number of floats	... Acc. to float table 1003	... Acc. to float table 1003

Code 6

Key 4 ... / ... / ... / ... - Magnetic system
... Acc. to float table 1003

Example

Code	1	2	3	4	5
Key	1 / 2 / 3 - 1.1 / 1.2 / 1.3 - 1 / 2 / 3 / 4 - 1 / 2 / 3 / 4 - 1 / 2 /				
Example	ALE / V / FE - 80 / 16 / B1 - V / U / R22 / TO - 1 / TFA2 / TPAT / 050 - L1000 / 18 /				

Black = not possible according to Atex / Blue = possible according to Atex Exia / Blue¹ = possible according to Atex Exia and Exd / Black¹ = possible according to Atex Exd

Code 7

Key 1 ... / ... / ... - Additional design	Key 2 ... / ... / ... - Instruction for installation	Key 3 ... / ... / ... - Adjusting mechanism
FG ¹ Guide tube in flexible design	GU ¹ Installation from bottom site	VE Adjustable version with cutting ring union
NT With test function	HH ¹ Process connection of displacer side-side	(only one time positioning possible on
WG ¹ Angled design	HV ¹ Process connection of displacer	ATEX 2014/34/EU applications)
HFF Hub float with pipe (Code 5 key 3 - 5 not applicable)	top side - bottom Vertical	
HSF Hub float with wire (Code 5 key 2 - 5 not applicable)		
PSS Pendular switch with float (Code 5 key 3 - 5 not applicable)		
PSP Pendular switch with paddle (Code 5 key 3 - 5 not applicable)		

Code 8

Key 1 ... / ... / ... - Length of cable	Key 2 ... / ... / ... - Connection cable	Key 3 ... / ... / ... - Connection cable option
... Length of cable in meter	PVC ¹ PVC connection cable	KA ¹ Shielded
	PVCB ¹ PVC connection cable with blue coating	KB ¹ Shielded / oil-resistant
	SIL ¹ Silicone connection cable	KC ¹ Shielded / oil-resistant / halogen-free
	PUR ¹ PUR connection cable	KD ¹ Oil-resistant
	RAD ¹ Radox connection cable	KE ¹ Oil-resistant / halogen-free
	FTEF ¹ Teflon strands	KF ¹ Halogen-free
	FPVC ¹ PVC strands	

Code 9

Key 1 ... / ... / ... - Approvals / 1	Key 2 ... / ... / ... - Approvals / 2	Key 3 ... / ... / ... - Approvals / 3
EXIAG Acc. to Exia, atmosphere gas	PEDII ¹ Acc. to PED 2014/68/EU category II	3A ¹ Approval 3A Sanitary Standard
EXIAGD Acc. to Exia, atmosphere gas and dust	PEDIV ¹ Acc. to PED 2014/68/EU category IV	ABS ¹ Approval American Bureau of Shipping
EXDGD ¹ Acc. to Exd, atmosphere gas	PEDIWW ¹ Acc. to PED 2014/68/EU, category IV and	BV ¹ Approval Bureau Veritas
EXDGD ¹ Acc. to Exd, atmosphere gas and dust	approval federal water act §19	GL ¹ Approval Germanischer Lloyd
EXIADG ¹ Acc. to Exia and Exd, atmosphere gas	W ¹ Approval federal water act §19	LR ¹ Approval Lloyd's Register
EXIADGD ¹ Acc. to Exia and Exd, atmosphere gas and dust		EAC1 ¹ Approval EAC TR CU 004/2011 &
		012/2011 & 020/2011

Example

5	6	7	8	9	Code
3 / 4 / 5 -	1 / 2 / 3 / 4 -	1 / 2 / 3 -	1 / 2 / 3 -	1 / 2 / 3	Key
- 1	SV72 / 24 / V -		- EXIAG / PEDII		Example

Black = not possible according to Atex / Blue = possible according to Atex Exia / Blue¹ = possible according to Atex Exia and Exd / Black¹ = possible according to Atex Exd

WIR SIND AUF DER WELT ZUHAUSE - FÜR SIE.
 WE ARE AT HOME ALL OVER THE WORLD – FOR YOU.



Nahrungsmittel-
industrie



Food industry

Maschinen
& Anlagenbau



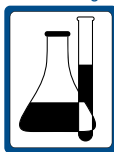
Machine &
plant engineering

Schiffbau



Shipbuilding

Chemieanlagen



Chemical plants

Wasser-
aufbereitung



Water treat-
ment

Pharmain-
dustrie



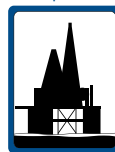
Pharmaceutical
industry

Klima
& Kältetechnik



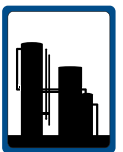
Air-conditioning
technology

Erdölplattform



Oil rigs

Raffinerie



Oil refineries



KFG Level AG

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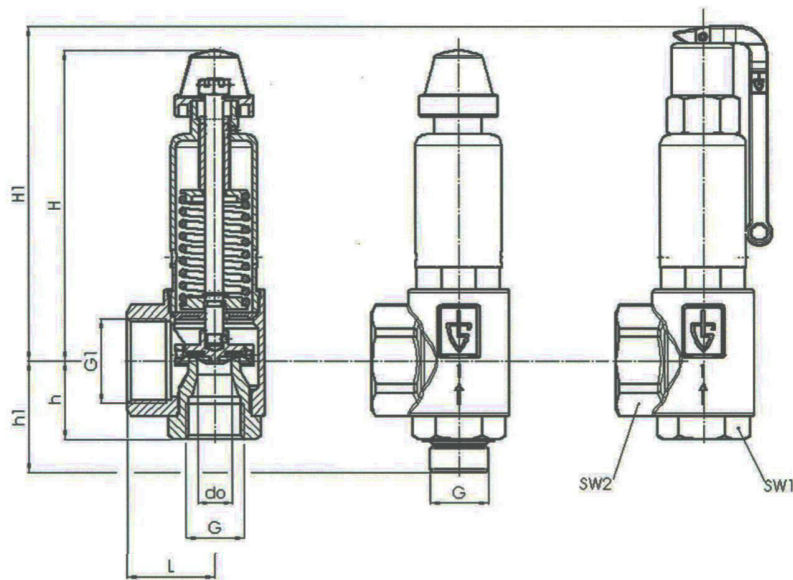
**safety valve, full stroke made of bronze with TÜV inspection number
series SF01 **SF05****



design	spring-loaded fully stroke safety valves by turning the knurled nut the valves can be exhausted. this types are not back pressure compensated - occuring back pressure during the blow process does affect to the set pressure. the set pressure is protected against adjustments through a seal cap.
connection	female thread G1/2"...G11/4"
materials	valve body bronze, inner parts brass, spring stainless steel AISI 301
medium temperature	see table
range of adjustment	see table
type of fixing	installed into rigid pipework
mounting position	vertical only
application	see table
order information	specify set pressure by order
special versions	set pressure 25,1...50bar, with lifting lever instead of twist lifting, inlet with male thread, valve in ATEX

table:

range of adjustment	seal	application	medium temperature [°C]	type
0,5 - 25	NBR	air, non-toxic gases and steams	-30...+130	SF01
0,5 - 25	PTFE	air, non-toxic gases and steams	-60...+225	SF01-...T
0,5 - 25	NBR	neutral liquids	-30...+130	SF05



G	G1	L	H	H1	h	h1	SW1	SW2	d ₀	weight [app. kg]	type	type	type
G1/2"	G1"	40	77	91	30	45	30	40	15,8	0,4	SF01-12W-15.8-XX	SF01-12W-15.8-XX-T	SF05-12W-15.8-XX
G3/4"	G1 1/4"	43	138	158	39	55	36	50	18	1,0	SF01-34W-18-XX	SF01-34W-18-XX-T	SF05-34W-18-XX
G1"	G1 1/2"	50	178	192	45	63	46	58	23	1,8	SF01-10W-23-XX	SF01-10W-23-XX-T	SF05-10W-23-XX
G1 1/4"	G2"	61	241	264	55	75	55	70	30	4,0	SF01-114W-30-XX	SF01-114W-30-XX-T	SF05-114W-30-XX

XX - set pressure

discharge capacity at 10% overpressure for Typ SF01 air [Nm³/h]

size	set pressure [bar]														
	0,5	1	2	4	6	8	10	12	14	16	18	20	22	24	25
G1/2"	56	87	141	238	335	431	528	625	722	819	916	1013	1109	1206	1255
G3/4"	127	189	316	561	790	1018	1247	1475	1704	1932	2161	2390	2618	2847	2961
G1"	199	291	489	855	1203	1552	1900	2248	2596	2945	3293	3641	3990	4338	4512
G1 1/4"	353	515	832	1484	2088	2693	3297	3902	4506	5111	5715	6320	6924	7529	7831

discharge capacity at 10% overpressure for Typ SF01 steam [kg/h]

size	set pressure [bar]														
	0,5	1	2	4	6	8	10	12	14	16	18	20	22	24	25
G1/2"	42	69	111	184	257	329	401	472	544	616	686	757	829	900	936
G3/4"	96	151	249	435	608	777	947	1115	1284	1453	1619	1787	1956	2125	2209
G1"	150	232	385	663	926	1184	1443	1699	1957	2214	2467	2723	2981	3238	3366
G1 1/4"	266	411	656	1151	1607	2056	2504	2948	3396	3842	4281	4726	5173	5619	5842

discharge capacity at 10% overpressure for Typ SF05 water [m³/h]

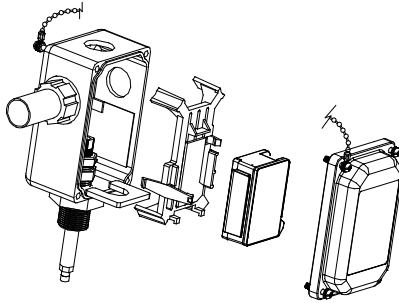
size	set pressure [bar]														
	0,5	1	2	4	6	8	10	12	14	16	18	20	22	24	25
G1/2"	2,3	3,1	4,4	6,3	7,7	8,9	9,9	10,9	11,8	12,6	13,3	14,0	14,7	15,4	15,7
G3/4"	5,4	7,3	10,4	14,7	18,0	20,8	23,2	25,4	27,5	29,4	31,1	32,8	34,4	35,9	36,7
G1"	8,8	12,0	16,9	24,0	29,3	33,9	37,9	41,5	44,8	47,9	50,8	53,6	56,2	58,7	59,9
G1 1/4"	15,4	20,8	29,4	38,9	50,9	58,8	65,8	72,0	77,8	83,2	88,2	93,0	97,5	101,9	104,0

illustrations are non-binding

all designs, configurations, measurements and materials are subject to change without prior notice

PROXPAC XL Proximity Transducer Assembly

Bently Nevada* Asset Condition Monitoring



Description

The design of the PROXPAC XL* Proximity Transducer Assembly is similar to our 31000/32000 Proximity Probe Housing Assemblies. The assembly offers the same advantages and features as the 31000 and 32000 housings for accessing and externally adjusting proximity probes. However, the housing cover of the PROXPAC XL Assembly also contains its own 3300 XL Proximitor* sensor. This design makes the PROXPAC XL Assembly a completely self-contained proximity probe system, and eliminates the need for an extension cable between the probe and its associated Proximitor sensor. It also eliminates the need for a separate Proximitor housing, as the field wiring connects directly between the monitors and PROXPAC XL Assemblies.

The PROXPAC XL housing is made of Polyphenylene Sulfide (PPS), which is an advanced, molded thermoplastic. This material replaces the steel and aluminum in previous housings offered in the Bently Nevada* product line. It also incorporates glass and conductive fibers in the PPS to strengthen the housing and more effectively dissipate electrostatic charges. The PROXPAC XL housing is rated for Type 4X and for IP66 environments and provides extra protection in severe environments.

Specifications

Electrical

Proximitior Sensor Input

3300 XL 8 mm Proximity Probe with a 1-metre cable length installed in the probe sleeve.

Power

Requires -17.5 Vdc to -26 Vdc without barriers at 12 mA maximum consumption, -23 Vdc to -26 Vdc with barriers. Operation at a more positive voltage than -23.5 Vdc can result in reduced linear range.

Supply Sensitivity

Less than 2 mV change in output voltage per volt change in input voltage.

Output resistance:

50 Ω

Nominal Probe DC Resistance (R_{PROBE}):

See Table 1.

Table 1: Resistance from the Center Conductor to the Outer Conductor

Probe Length (m)	R_{PROBE} (Ω)
1.0	7.59 ± 0.50

Field wiring:

0.2 to 1.5 mm² (16 to 24 AWG) . Recommend using 3-conductor shielded triax cable and tinned field wiring. Maximum length of 305 metres (1,000 feet) between the 3300 XL Proximitior Sensor and the monitor. See the frequency response graph (Figure 1, page 7) for signal rolloff at high

frequencies when using longer field wiring lengths.

Linear Range:

2 mm (80 mils). Linear range begins at approximately 0.25 mm (10 mils) from target and is from 0.25 mm to 2.3 mm (10 mils to 90 mils) (approximately -1 Vdc to -17 Vdc).

Recommended Gap Setting:

1.27 mm (50 mils)

Incremental Scale Factor (ISF)

7.87 V/mm (200 mV/mil) $\pm 5\%$ including interchangeability error when measured in increments of 0.25 mm (10 mils) over the 80 mil linear range from 0 °C to +45 °C (+32 °F to +113 °F).

Deviation from best fit straight line (DSL)

Standard 1 metre system

Less than ± 0.025 mm (± 1 mil) with components at 0 °C to +45 °C (+32 °F to +113 °F).

Frequency Response

0 to 10 kHz: +0, -3 dB, with up to 305 metres (1000 feet) of field wiring.

Minimum Target Size

15.2 mm (0.6 in) diameter (flat target)

Shaft Diameter

Minimum

50.8 mm (2.0 in)

Recommended minimum

76.2 mm (3.0 in)

When gapped at the center of the linear range, the interaction between two separate transducer systems (cross-talk) will be less than 50 mV on shaft diameters of at least 50 mm (2.0 in) or greater. Care should be taken to maintain minimum separation of transducer tips, generally at least 40 mm (1.6 in) for axial position measurements or 38 mm (1.5 in) for radial vibration measurements to limit cross-talk to 50 mV or less. Radial vibration or position measurements on shaft diameters smaller than 76.2 mm (3.0 in) will generally result in a change in scale factor. Consult Performance Specification 159484 for additional information.

Effects of 60 Hz Magnetic Fields Up To 300 Gauss

See Table 2.

Table 2: Output Voltage in Millivolts/Gauss

Gap (mils)	1-metre Proximity Sensor	Probe
10	0.0124	0.0004
50	0.0110	0.0014
90	0.0126	0.0045

Electrical Classification:

Complies with the European CE mark.

Hazardous Area Approvals**North America:**

Ex ia IIC T4/T5; Class I Zone 0 or Class 1 Division 1; Groups A, B, C, and D, when installed with

intrinsically safe zener barriers per drawing 141092 or when installed with galvanic isolators. Certificate number 1109248 (LR 26744-222)

Ex nA IIC T4/T5 Class I Zone 2 or Class I, Division 2, Groups A, B, C, and D when installed without barriers per drawing 140979. T5 @ Ta = -35 °C to +85 °C. T4 @ Ta = -51 °C to +100 °C. Certificate number 1109248 (LR 26744-222)

Europe:

 II 1 G EEx ia IIC T4/T5. EC certificate number BAS99ATEX1101, when installed per drawing 141092.

 II 3 G EEx nAII T4/T5. EC certificate number BASEEFA 07 ATEX 0189 X, when installed per drawing 140979. T5 @ Ta = -35 °C to +85 °C. T4 @ Ta = -51 °C to +100 °C.

IEC Ex

3300 XL Proximity Sensor, ia
IECEx BAS04.0055X

Ex ia IIC T4 / T5 (-51°C ≤ Ta ≤ +100°C / -35°C ≤ Ta ≤ +85°C)

Terminal Block Connections

Ui = -28 V Ci = 0 nF
Ii = 140 mA Li = 10 µH
Pi = 0.84 W

Coaxial Connection

Ui = -28 V Ci = 5.7 nF
Ii = 140 mA Li = 0.85 mH
Pi = 0.84 W

Load Parameters

The capacitance and either the inductance or the inductance to resistance (L/R) ratio of the load connected to the probe coaxial

terminal, must not exceed the values in Table 3.

Table 3: Maximum Load Parameters

Group	Capacitance (μF)	Inductance (mH)	L/R Ratio (μH/Ω)
IIC	0.077	0.99	35
IIB	0.644	7.41	142
IIA	2.144	15.6	295

3300 XL
Proximitör
Sensor, nA

IECEX BAS04.0057X

AEx nA II T4 / T5 (-51 °C ≤ Ta ≤ +100 °C / -35 °C ≤ Ta ≤ +85 °C)

Ui = -28 V

3300 XL 8mm
Eddy Current
Probe, ia

IECEX BAS04.0056

AEx ia IIC Temperature
Classification per Table 4 below.

Table 4: Aex ia IIC Temperature Classifications

Temperature Classification	Ambient Temperature
T1	-51 °C to +232 °C
T2	-51 °C to +177 °C
T3	-51 °C to +120 °C
T4	-51 °C to +80 °C
T5	-51 °C to +40 °C

Ui = -28 V Ci = 1.5 nF

Ii = 140 mA Li = 200 μH

Pi = 0.84 W

3300 XL 8mm
Eddy Current
Probe, nA

IECEX BAS04.0058X

Ex nA II Temperature
Classification per the table above.

Must be supplied from a voltage
limited source.

EEx nA for Zone 2, Group IIC, EC
certificate number
BAS99ATEX3100U.

Brazil:

3300 XL 8mm
Eddy Current
Probe,

Br-EX ia IIC

MC, AEX-8102

3300 XL
Proximitör
Sensor,

Br-EX ia IIC

MC, AEX-8294

Mechanical

Housing Ratings

IP66 rating verified by BASEEFA
report number T07/0709.

Probe Tip Material

Polyphenylene Sulfide (PPS)

Probe Case Material

AISI 304 stainless steel

Probe Cable

1-metre length, 75 Ω triaxial,
fluoroethylene propylene (FEP)
insulated.

Probe Connector

Gold-plated brass ClickLoc*
connector.

Probe Tensile Strength

330 N (75 lb) between probe cable and case, maximum.

Housing Material

Ultraviolet (UV) resistant, glass-reinforced polyphenylene sulfide (PPS) thermoplastic containing conductive fibers.

Sleeve Material and Retaining Chain

AISI 304 stainless steel

Outer Sleeve and Retaining Screws

AISI 303 stainless steel

Sleeve O-Ring Material

Neoprene

Grounding Liner and Retaining Plate Material

AISI 304 Stainless Steel

Vibration Isolation Material

Extra Soft Cellular Silicone

Lid Label Material

Gloss Radiant White Polyester

Recommended Torque**Retaining Nut**

29.5 N·m (260 in·lb)

Probe Sleeve Locknut

39.3 N·m (350 in·lb)

Housing Strength Typical

Outer sleeve was mounted on a test stand with its axis parallel to horizontal and the housing mounted on the outer sleeve through an end hole. The housing supported 912 N (205 lbf) placed approximately 38 mm (1.5 in) from the unsupported end with the cover fastened in place and grounding liner installed.

Housing Impact Strength

Certified by BASEEFA to withstand two separate 4 Joule (5.4 ft·lb) impacts at -39°C (-38°F) and at 115°C (239°F). CSA verified that samples of the housing and cover could withstand a 7 Joule (9.5 ft·lb) impact at ambient room temperature.

Total System Weight

1.44 kg (3.2 lbm) typical with 0.3 metre (12 in) sleeve length.

Environmental Limits**Probe Temperature Range****Operating Temperature:**

-51 °C to +177 °C (-60 °F to +350 °F).

Note: Exposing the probe to temperatures below -34 °C (-29 °F) may cause premature failure of the pressure seal.

**Probe Housing
and Proximity
Sensor****Operating
Temperature:**

-51 °C to +100 °C (-60 °F to +212 °F).

**Proxpac
Storage
Temperature:**

-51 °C to +105 °C (-60 °F to +221 °F).

**Relative
Humidity
(PROXPAC XL
Sensor and
probe):**

100% condensing, non-submersible when connectors are protected. When properly sealed, moisture should not enter the housing. Users should take precautions to prevent moisture from traveling through the conduit into the housing.

**Hot Water and
Steam Exposure
Effects:**

(Specification not guaranteed)
Brief periods (up to one week) of contact with hot water 95 °C (203 °F) and/or condensing steam should not significantly affect the strength of the plastic housing. Longer contact with hot water or steam may weaken the plastic housing during the first 6 to 8 weeks of exposure and ultimately reduce the housing strength to approximately half of the initial value. Tests of actual housing performance after contact with hot water and condensing steam have not been conducted.

Probe Pressure:

The PROXPAC XL design seals differential pressure between the

probe tip and the housing main body when used with a 3300 XL 8 mm probe. The sealing material inside the probe case consists of a Viton O-ring, whereas the O-ring between the sleeve and the housing is Neoprene. The plastic housing design is certified to seal against hose-directed water according to Type 4X and IP66 standards but will not resist internal or external pressure. Probes are not pressure tested prior to shipment.

Contact our custom design department if you require a test of the pressure seal for your application.

Note: It is the responsibility of the customer or user to ensure that their installation will contain and safely control all liquids and gases should the PROXPAC XL transducer leak. Solutions with high or low pH values may erode the tip assembly of the probe, causing media to leak into surrounding areas. Bently Nevada LLC will not be held responsible for any damages resulting from leaking Proximity Probe Housing Assemblies. In addition, PROXPAC XL transducers will not be replaced under the service plan due to probe leakage.

Patents

One or more of the following patents apply to this product: 5,016,343; 5,126,664; 5,351,388; and 5,685,884

**Frequency Response with Different Field Wiring Lengths
without Barriers (1 m System)**

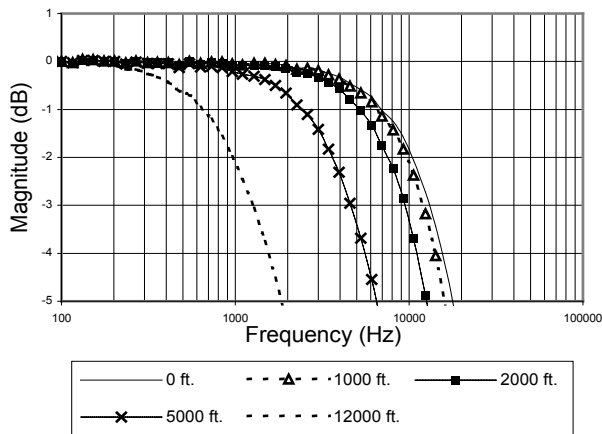


Figure 1

Ordering Information

Notes:

Order **-00** or **-01** (for multi approvals) for the **A** option and **-00** or **-000** for all other options to receive just a spare housing with Proximitor Sensor.

PROXPAC XL Proximity Transducer, English

330880-AXX-BXX-CXXX-DXX-EXX

A: Probe and Approvals Option

- 00** No probe; Proximitor Sensor without approvals
- 01** No probe; Proximitor sensor with Multiple Approvals
- 16** 3300 XL 8 mm probe without approvals
- 28** 3300 XL 8 mm probe with Multiple Approvals

B: Standoff Adapter Option (B Dimension)

Order in increments of 0.5 in (13 mm).

Minimum length: 1.5 in (38 mm)

Maximum length: 7.5 in (191 mm)

Examples:

00 = No standoff adapter

15 = 1.5 in (38 mm)

C: Probe Penetration Option (C Dimension)

For penetration lengths between 1.0 and 2.0 inches, counterbore may be required in machine case to reduce probe side view and/or rear view effects.

Order in increments of 0.1 in (2 mm).

Minimum length: 1.0 in (25 mm)

Maximum length: 30 in (762 mm)

Examples:

000 = No probe sleeve

037 = 3.7 in (94 mm)

224 = 22.4 in (569 mm)

D: Fittings Option

For 1/2-14 NPT fittings, order option -03 or spare 26650-01 reducers for either option -01 or -02.

- 00** No fittings; two plugs and two washers
- 01** One 3/4-14 NPT fitting, two plugs
- 02** Two 3/4-14 NPT fittings, one plug
- 03** One 3/4-14 NPT fitting, one 3/4-14 NPT to 1/2-14 NPT SST reducer and two plugs

E: Mounting Thread Option

- 00** No outer sleeve assembly
- 02** 3/4-14 NPT (Required if ordering Standoff Adapter Option.)
- 05** 7/8-14 UNF-2A

PROXPAC XL Proximity Transducer, Metric

330881-AXX-BXX-CXXX-DXX-EXX

A: Probe and Approvals Option

- 00** No probe; Proximitor sensor without approvals
- 01** No probe; Proximitor sensor with Multiple Approvals
- 16** 3300 XL 8 mm probe without approvals
- 28** 3300 XL 8 mm probe with Multiple Approvals

B: Standoff Adapter Option (B Dimension)

Order in increments of 10 mm.

Minimum length: 40 mm**Maximum length:** 200 mm**Examples:****0 0** = No standoff adapter**0 4** = 40 mm**2 0** = 200 mm**C: Probe Penetration Option (C Dimension)**

For penetration lengths between 25 and 50 mm, counter bore may be required in machine case to reduce probe side view and/or rear view effects.

Order in increments of 1 mm.

Minimum length: 25 mm**Maximum length:** 760 mm**Examples:****0 0 0** = No probe sleeve**0 5 0** = 50 mm**7 6 0** = 760 mm**D: Fittings Option (supplied as a kit)****0 0** No fittings; two plugs and two washers**0 1** One M25 fitting, two plugs**0 2** Two M25 fittings, one plug**0 3** One M20 fitting, two plugs**0 5** One PG21 to PG11 reducer, two plugs**0 6** One 3/4-14 NPT fitting, one 3/4-14 NPT to 1/2-14 NPT SST reducer and two plugs**0 7** One PG21 x M20 fitting, two plugs**0 8** Two PG21 x M20 fittings, one plug

Conduit fittings are necessary when hardline conduit or metal piping is brought into the housing. If using flexible conduit, you should order with integral 3/4-14 NPT fittings so that you do not require additional conduit fittings with the housing. If using flexible conduit, order the D = 0 0 option.

E: Mounting Thread Option**0 0** No outer sleeve assembly**0 1** M24 X 3**0 2** 3/4-14 NPT (required if ordering Standoff Adapter Option)

Accessories**159484**

Performance Specification - 3300 XL Proximity Transducer System

178761-01

Operation manual

178850-00

Upgrade Kit, Non-approved (Includes housing lid, 1-metre Proximitor sensor, and support table)

178850-05

Upgrade Kit, Multi-Approvals (Includes housing lid, 1-metre Proximitor sensor, and support table)

178644-01

Proximitor sensor support table

330180-12-00

Spare 3300 XL Proximitor sensor, non-approved

330180-12-05

Spare 3300 XL Proximitor sensor, Multiple Approvals

330105-02-12-10-02-00

Spare 3300 XL 8 mm probe, English, non-approved

330105-02-12-10-02-05

Spare 3300 XL 8 mm probe, English, approved

330106-05-30-10-02-00

Spare 3300 XL 8 mm probe, metric, non-approved

330106-05-30-10-02-05

Spare 3300 XL 8 mm probe, metric, approved

02120015**Bulk Field Wire**1.0 mm² (18 AWG), 3-conductor, twisted shielded cable with drain wire. Specify length in feet.

37948-01

Probe Support / Oil Sleeve

Provides seal along probe sleeve.
May be used as a probe sleeve support in certain installations.

English Probe Sleeve (Spare)

108883 -AXXX

This is the measured probe sleeve length. Order in increments of 0.1 in (3 mm). Note that the individual probe sleeve length **does not** include the distance from the end of the sleeve to the probe tip or the gap from the probe tip to the target material. If only the part number of the original housing is known and the sleeve cannot be measured, use the following formula to determine the sleeve length:

- A:** Standoff Adapter Option from original housing (330800 option **B**) + Probe penetration option from original housing (330800 option **C**) + 025.

Example: Original part number is 330800-16-15-035-03-02. **A** option for replacement sleeve is (015 + 035 + 025) = **0 7 5**.

Minimum Probe Sleeve Length:3.5 in (89 mm) = **0 3 5****Maximum Probe Sleeve Length:**32.5 in (826 mm) = **3 2 5****Metric Probe Sleeve (Spare)**

108882 -AXXX

This is the measured probe sleeve length. Order in increments of 1 mm. Note that the individual probe sleeve length **does not** include the distance from the end of the sleeve to the probe tip or the gap from the probe tip to the target material. If only the part number of the original housing is known and the sleeve cannot be measured, use the following formula to determine the sleeve length:

- A** Standoff Adapter Option from original housing (330801 option **B**) * 10 + Probe penetration option from original housing (330801 option **C**) + 063.

Example: Original part number is 330801-16-08-205-03-02. **A** option for replacement sleeve is (080 + 205 + 063) = **3 4 8**.

Minimum Probe Sleeve Length:88 mm (3.5 in) = **0 8 8****Maximum Probe Sleeve Length:**823 mm (32.4 in) = **8 2 3****English Standoff Adapter (Spare)**

Hex = 1-3/8 in; threads = 3/4-14 NPT

109319 -AXXX

Order in increments of 0.5 in (13 mm).

Minimum length: 1.5 in (38 mm)**Maximum length:** 7.5 in (191mm)**Example:** 0 2 0 = 2 in (51 mm)**Metric Standoff Adapter (Spare)**

Wrench flats = 35 mm; threads = 3/4-14 NPT.

109318 -AXX

Order in increments of 10 mm.

Minimum length: 40 mm**Maximum length:** 200 mm**Example:** 0 5 = 50 mm

104968-01

English sleeve plug threaded, 303 stainless steel.

104968-02

Metric Sleeve Plug Threaded, 303 stainless steel.

Plugs fill opening when sleeve is removed from machine case.

104288-01

English Blanking Plug

104288-02

Metric Blanking Plug.

Blanking plugs are included with the Fittings Option "D". Spare plugs fill conduit holes in plastic housing where needed.

Heavy Duty Cable Fittings

03813103

Chrome-plated zinc conduit fitting, 3/4-14 NPT

03818100

AISI 316 stainless steel conduit
fitting, 3/4-14 NPT

03818101

AISI 316 stainless steel conduit
fitting, PG21 x M25

03818102

AISI 316 stainless steel conduit
fitting, PG21 x M20

03818111

Nickel-plated brass conduit fitting,
PG21 x M20

26650-01

AISI 303 stainless steel reducer
3/4-14 NPT to 1/2-14 NPT

Sealtite Flexible Conduit

14847-AXX

1/2-14 NPT assembly

14848-AXX

3/4-14 NPT assembly

A: Length Option

Order in increments of 1 ft (0.3 m).

Minimum length: 1 ft (0.3 m).

Maximum length: 99 ft (30.2 m)

Example: 0 5 = 5 ft (1.5 m)

Figures and Drawings

Note: All dimensions in millimeters (inches) except as noted.

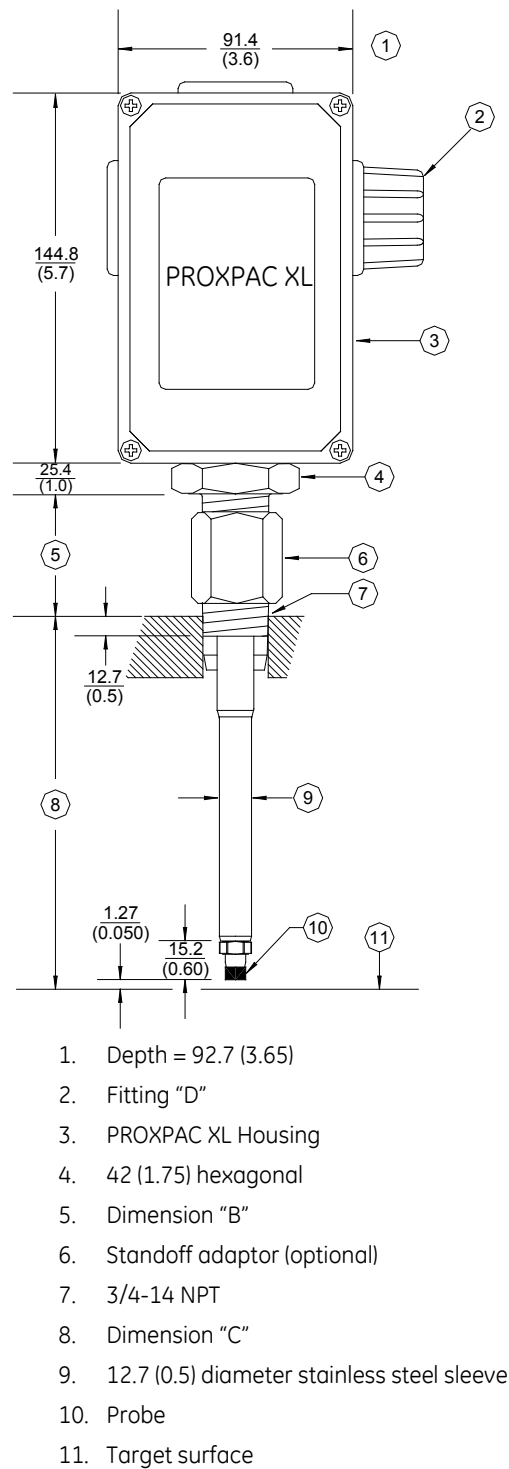


Figure 1: Dimensions for PROXPAC XL Proximity Transducer Assembly

Figure information

- "B" plus "C" dimensions greater than 305 mm (12.0 in) require additional sleeve support near the probe to stiffen the assembly and avoid the influence of resonance.
- For desired probe penetration lengths of less than 51 mm (2.0 in), order a separate Individual Standoff Adapter. The effective probe penetration length will then be reduced by the length of the Individual Standoff Adapter, plus an additional 13 mm (0.5 in) due to the NPT thread engagement.

Example: The customer desires a probe penetration length of 25 mm (1.0 in). To do this, they order a 330800 housing with CXXX (probe penetration) option of 0 3 0 [76 mm (3 in)] and a separate individual standoff adapter that is 38 mm (1.5 in) in length (part number 109319-015). The standoff adapter would cover 38 mm (1.5 in) of the probe sleeve, plus an additional 13 mm (0.5 in). Therefore, the effective probe penetration length would drop to 25 mm (1.0 in).

- "B" plus "C" dimension represents mid-setting distance between mounting surface and target surface. Threaded sleeve allows ± 12.7 mm (0.5 in) adjustment from this point. "B" plus "C" dimension is 760 mm (30 in) maximum.

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Sealtite is a trademark of Aldi Corporation.

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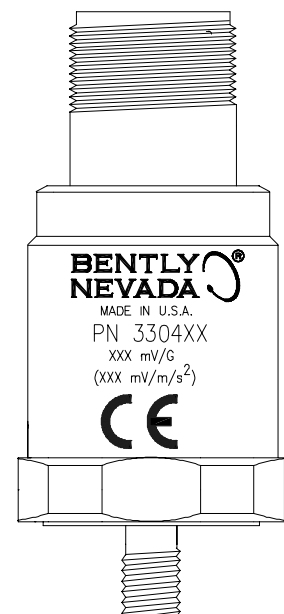
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1631 Bently Parkway South, Minden, Nevada USA 89423
Phone: 775.782.3611 Fax: 775.215.2873
www.ge-mcs.com/bently

Part Number 127088-01
Revision F, March 2004

330400 and 330425 Accelerometer User's Guide



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The following ways of contacting Bently Nevada are provided for those times when you cannot contact your local Bently Nevada representative:

Mailing Address	1631 Bently Parkway South Minden, NV 89423 USA
Telephone	1 775 782 3611 1 800 227 5514
Fax	1 775 215 2876
Internet	www.bently.com

Foreword

The 330400 and 330425 Accelerometers are piezo-acceleration transducers designed mainly for high frequency applications. This manual describes how the transducers work, how to install and maintain the system.

This manual is intended for use by those experienced in the use of electronic instrumentation and machinery monitoring equipment.

Section 1 - Operating Information - describes the applications, the principle of operation and the monitoring compatibility of the Accelerometer systems.

Section 2 - Installation - provides instructions for receiving inspection, installing the sensor, connecting power and routing interconnect cable for the Accelerometers.

Section 3 - Maintenance - explains how to maintain the Accelerometers by describing the test procedures and equipment needed to verify that the transducer is operating properly.

Section 4 - Field Testing and Troubleshooting - contains instructions for field testing and troubleshooting problems with the Accelerometers and compatible Bently Nevada monitoring systems.

Section 5 – Specifications - provides detailed specifications and sensitivity curves representing typical 330400 and 330425 Accelerometer performance.

Section 6 – Accessories and spare parts.

Related Documents

3300/25 Dual Accelerometer Input Monitor (Peak) Maintenance Manual, part number 80181-01

3300/26 Dual Accelerometer Input Monitor (RMS) Maintenance Manual, part number 86800-01

2201 Operation and Maintenance Manual, part number 100875-01

3500/42 Proximito®/Seismic Monitor Module Operation and Maintenance Manual, part number 129773-01.

Safety Notices

Bently Nevada has attempted to identify areas of risk created by improper installation and operation of this product. These areas of information are noted as WARNING or CAUTION for your protection and as an aid for the safe and effective operation of this equipment. Read all instructions before installing or operating this product.

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Section 1 — Operating Information

This section contains information that will help you prepare for the installation of the Accelerometer Systems. General information for typical applications, principles of operation, and monitoring compatibility of the Accelerometers are presented in this section.

Application

Accelerometers are very effective when used for the measurement of high frequency vibrations. Supplemental high frequency casing measurements are typically required for measuring gear mesh and blade pass frequencies. Section 2 explains the proper installation of the Accelerometers.

Application Advisory: If casing acceleration measurements are being made for the overall protection of a machine, thought should be given to the usefulness of the measurement for each application. Most common machine malfunctions, such as unbalance, misalignment, etc., occur on the rotor and originate as an increase or a change in rotor vibration. For any casing measurement alone to be effective for overall machine protection, a significant amount of rotor vibration must be faithfully transmitted to the machine casing or mounting location of the transducer. In addition, care should be exercised in the physical installation of the acceleration transducer on the bearing housing or machine casing. Improper installation may result in a decrease of the transducer amplitude and frequency response and the generation of false signals that do not represent vibration on that particular machine.

Principle of Operation

The Accelerometer is made up of a piezoelectric shear-mode element and electronics. When subjected to machinery vibration, this mass/spring system exerts a force on the piezoelectric ceramic, which generates a charge proportional to that force. The electronics converts the charge to a voltage that can be sent to a Bently Nevada monitoring system.

The 330400 and 330425 Accelerometers are designed to monitor vibration frequencies ranging from 10 Hz to 15 kHz. The calibrated scale factor and maximum acceleration for the Accelerometers are shown in Table 1.

Table 1-1.

Transducer Model	Scale Factor (mV/g $\pm$ 5%)	Maximum Acceleration
330400	100	50
330425	25	75

The 330400 and 330425 Accelerometers are three-wire transducers which require external power supplies. The power supply voltage is -24 Vdc. A simplified schematic block diagram of the 330400 and 330425 Accelerometer appears in Figure 1-1.

The internal circuitry of the 330400 and 330425 accelerometers automatically sets the output dc bias when power is supplied. The dc bias and ac signal appears across pin "A" and "C".

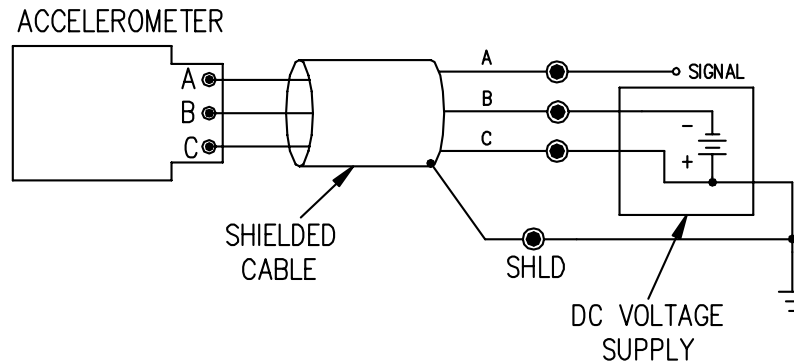


Figure 1-1 Schematic Block Diagram

Compatible Monitoring Systems

Compatible Bently Nevada monitoring systems can power the 330400 and 330425 Accelerometer without additional external circuitry.

The flexibility of the 3300 Dual Accelerometer Monitor, the 2201 Monitor and 3500/42 (or 3500/42M) Monitor makes them ideally suited for use with the 330400 and 330425 Accelerometers. The Alert and Danger setpoints and filtering can be adjusted to isolate, eliminate, or emphasize specific vibration frequencies. The monitor can also be configured to integrate each channel to provide output in terms of velocity. OK circuitry continuously monitors field wiring for open and short circuits and for Accelerometer malfunctions.

The monitoring systems and full-scale range options that are compatible with the 330400 and 330425 Accelerometers are shown in Table 1-1 and Table 1-2.

Table 1-2. Compatible Full-Scale Range Options for the 330400 Accel

Monitoring System	Compatible Full-scale with No Integration		Full-Scale with Integration	
	pk	rms	pk	rms
3300/25	Compatible with all full-scale range options		Compatible with all full-scale range options	
3300/26	0 to 5 g	0 to 2 g	0 to 1 in/s	
			0 to 2 in/s	
		0 to 10 g	0 to 25 mm/s	
		0 to 20 m/s ²	0 to 50 mm/s	
		0 to 50 m/s ²		
		0 to 100 m/s ²		
2201	0 to 2 g	0 to 2 g	0 to 1 in/s	0 to 1 in/s
	0 to 5 g	0 to 5 g	0 to 2 in/s	0 to 2 in/s
	0 to 10 g	0 to 10 g	0 to 25 mm/s	0 to 25 mm/s
	0 to 20 m/s ²	0 to 20 m/s ²	0 to 50 mm/s	0 to 50 mm/s
	0 to 50 m/s ²	0 to 50 m/s ²		
	0 to 100 m/s ²	0 to 100 m/s ²		
3500/42 or 3500/42M	See manual part number 129773-01 for more details			

Table 1-3. Compatible Full-scale Range Options for the 330425 Accel

Monitoring System	Compatible Full-Scale with No Integration		Full-Scale with Integration	
	pk	rms	pk	rms
3300/26	0 to 20 g			0 to 100 mm/s
	0 to 25 g			
	0 to 40 g			
	0 to 50 g			
	0 to 200 m/s ²			
	0 to 250 m/s ²			
	0 to 400 m/s ²			
	0 to 500 m/s ²			
2201	0 to 20 g	0 to 20 g	0 to 100 mm/s	0 to 100 mm/s
	0 to 25 g	0 to 25 g		
	0 to 40 g	0 to 40 g		
	0 to 50 g	0 to 50 g		
	0 to 200 m/s ²	0 to 200 m/s ²		
	0 to 250 m/s ²	0 to 250 m/s ²		
	0 to 400 m/s ²	0 to 400 m/s ²		
	0 to 500 m/s ²	0 to 500 m/s ²		
3500/42 or 3500/42M	See manual part number 129773-01 for more details			

Section 2 — Installation

Receiving Inspection

Inspect the components of the order when they are received to see if there was any damage during shipping. Keep all shipping forms and invoices. If any shipping damage is apparent, file a claim with the carrier and submit a copy to Bently Nevada. Include all model numbers and serial numbers with the claim. We will either repair or replace damaged parts according to the terms and conditions of the sale.

The Accelerometers are shipped in a protected box and the connector is protected with a plastic cap. The Accelerometers are sensitive instruments and these precautions help to prevent damage during shipping.

Installing the Accelerometer

Positioning

For optimum performance and accurate measurements, place the accelerometer at a position on the machine casing that is most responsive to vibration. Proper placement often depends on the application. Bently Nevada offers Machinery Diagnostic Services that can help you find the optimum location for your application.

Mounting

Follow these steps to install the Accelerometer:

Step 1: Check that the ambient and surface temperatures of the installation location are within the temperature rating of the Accelerometer: -55° to 121°C (- 67° to 250°F).

Step 2: Check that the mounting site is flat, clean and dry. The accelerometer requires a flat area that is 28.6 mm dia. (1.125 in. dia.) for mounting. For best results the mounting surface should have a roughness of no more than 0.813 µm (32 µin) rms and a flatness of at least 25.4 µm (0.001 in) TIR.

Step 3: Drill and tap a hole in the mounting center of the prepared surface as required by the integral mounting stud. The 330400 and 330425 Accelerometers have two mounting stud options: 1/4-28 UNF-2B X 0.35 in and M8X1-6g X 8.89 mm thread. The hole should be perpendicular to the mounting surface within ± 6 minutes.

Step 4: This step only required for accelerometers with a serial number not preceded by the letter “G”. Lightly grease the lower face of the mounting adapter with Dow Corning 340 or equivalent grease and then screw the adapter into the mounting surface. The grease is required to ensure good coupling between the adapter and the mounting surface at high frequencies. A light oil may also be used.

Step 5: This step only required for accelerometers with a serial number not preceded by the letter “G”. Use a torque wrench with a 1” hex socket. Tighten the adapter to the mounting surface with a torque of 6.8 ± 1.4 N·m (60 ± 12 inAlb). To remove the adapter, apply a counterclockwise torque to its hex base.

Step 6: Lightly grease the accelerometer mating surface with Dow Corning 340 or equivalent grease and then screw the accelerometer into the mounting surface. The grease is required to ensure good coupling between the accelerometer and the mounting surface at high frequencies. A light oil may also be used.

Step 7: Use a torque wrench with a 15/16" hex socket. Tighten the accelerometer to the mounting surface with a torque of $3.3 \pm 0.56 \text{ N}\cdot\text{m}$ ($30 \pm 5 \text{ in}\cdot\text{lb}$). To remove the accelerometer, apply a counterclockwise torque to its hex base.

Routing Cable

When installing the interconnect cable, route it away from the moving components of the machine and avoid small bending radii. To minimize noise, avoid routing cables near or in the same conduit, raceway, or cable tray with power lines. Prevent the cable from bending sharply, twisting, knotting, or straining. Route the cable through the conduit to prevent physical damage. If the cable must be routed inside lubrication oil lines, be sure it will not be subjected to temperatures exceeding its specified operating range.

Routing Conduit

To route cable through the conduit, connect one end of the conduit to the protective enclosure or other structure in which the monitor is mounted. Connect the other end of the conduit rigidly to a structure near the accelerometer. Before pulling cable through the conduit, protect the terminal lugs by wrapping the cable with tape or a similar covering. Be sure that the cable does not rub against rough or sharp surfaces.

Routing Armored Cable

Use armored cable if the cable is not routed inside conduit. Secure the cable to the supporting surfaces with clips or similar devices. Connect one end of the armor directly to the enclosure or other structure in which the monitor is mounted. Connect the other end of the armor rigidly to a structure near the 330400 and the 330425 Accelerometer. The recommended minimum bend radius for armored cable is 38.1 mm (1.5 in).

Sealing the Interconnect Cable

	CAUTION
When the conduit is routed through hazardous areas, the ends of the conduit must be sealed to prevent hazardous gases from escaping into non-hazardous areas. Consult local authorities for approved sealing methods in hazardous areas.	

If the differential pressure between the ends of the connector cable is less than one atmosphere, use one of the following cable sealing techniques:

1. ZY5 cable seal similar to Bently Nevada part number 10076-AA.
2. Bently Nevada low-pressure cable seal, part number 43501.

Power and Signal Connections

Bently Nevada supplies interconnect cables with terminal lugs and a 3-socket mating connector for the 330400 and the 330425 Accelerometer. Interconnect cables are sold separately (see Section 6 for the cable options).

At the accelerometer end, tighten the 3-socket mating connector to the accelerometer's MIL-C-5015 connector. At the monitor end of the cable, use the wiring instructions for the appropriate monitoring system below.

Note: the wiring instructions assume that the interconnect cable is the standard Bently Nevada cable part number 16925 - XX.

3300 MONITORING SYSTEM

Connect the cable "A" lead to the "IN" terminal on the monitor, the "B" lead to the "PWR" terminal, and the "C" lead to the "COM" terminal. The terminal connections for the 3300 Dual Acceleration Monitor appear in Figure 2-1. Refer to the 3300/25 Peak and 3300/26 RMS Dual Acceleration Input Monitor Maintenance Manual (part number 80181-01 and 86801-01) for further information.

2201 MONITORING SYSTEM

Connect the cable "A" lead to "SIG/A" terminal on the monitor, the "B" lead to "PWR/B", and the "C" lead to "COM". The terminal connections for the 2201 Monitoring System appear in Figure 2-2. Refer to the 2201 Monitoring System Operation and Maintenance Manual (part number 100875-01) for further information.

3500 MONITORING SYSTEM

Connect the cable "A" lead to "SIG/A" terminal on the monitor, the "B" lead to "PWR/B", and the "C" lead to "COM". The terminal connections for the 3500/42 Monitoring System appear in Figure 2-3 and Figure 2-4. Refer to the 3500/42 Operation and Maintenance Manual (part number 129773-01) and 3500 Field Wiring Diagram Package (part number 130432-01) for further information.

Application Alert: Miswiring the accelerometer to an external power supply without limiting the current to be less than 15 mA will permanently damage the accelerometer.

EXTERNAL POWER SUPPLY

Using the 16925 interconnect cable, connect the "B" lead to the " - " terminal of the power supply and the "C" lead to the " + " terminal of the power supply. The "A" lead of the cable is the output of the Accelerometer. Turn on the power supply. Adjust the voltage to -24 ± 0.5 Vdc. Set the current limit of the power

supply to be less than 15 mA. Measure the dc voltage across the "A" and "C" lead. The voltage should be between -8 and -9 Vdc. If it is not, turn off the power supply immediately and check for proper connections. The terminal connections of the external power supply appear in figure 2-4.

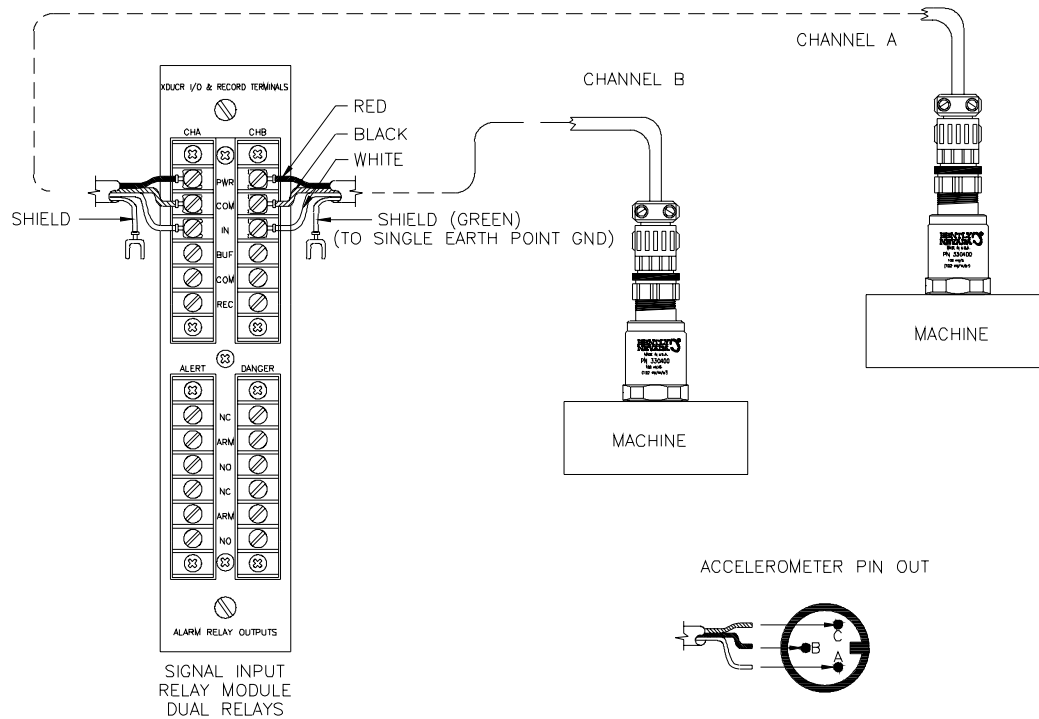


Figure 2-1 Accelerometer/3300 System Connections Using 16925 Interconnect Cable

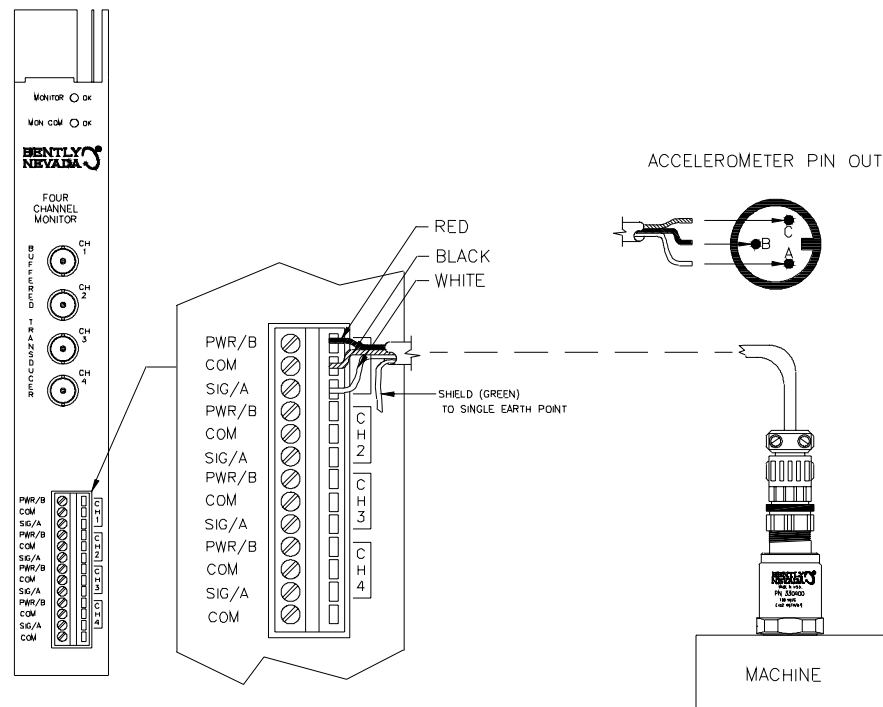


Figure 2-2 Accelerometer/2201 System Connections Using 16925 Interconnect Cable

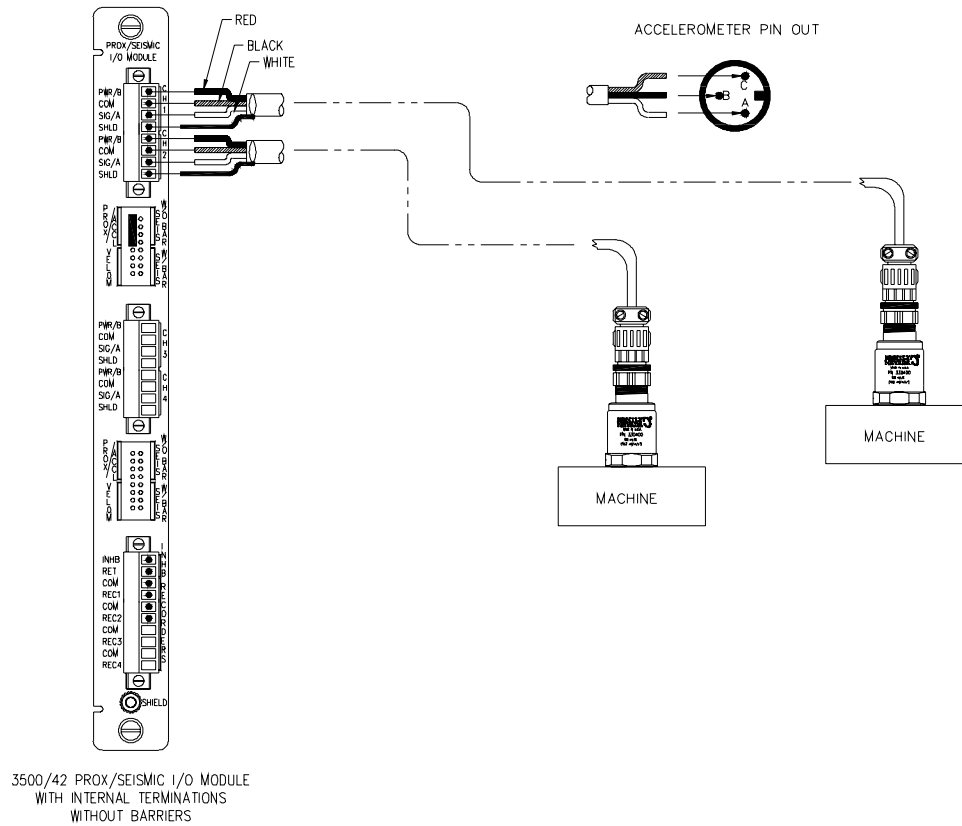


Figure 2-3 Accelerometer/3500 System Connections Using 16925 Interconnect Cable

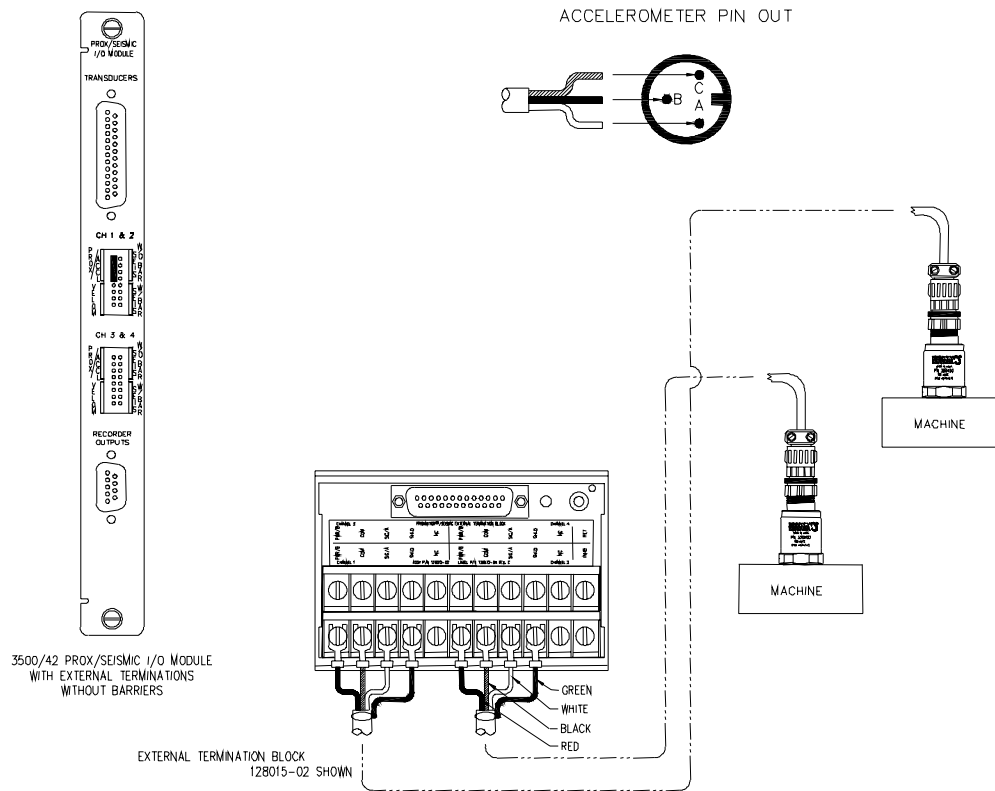


Figure 2-4 Accelerometer/3500 System Connections Using 16925 Interconnect Cable and External Termination Block.

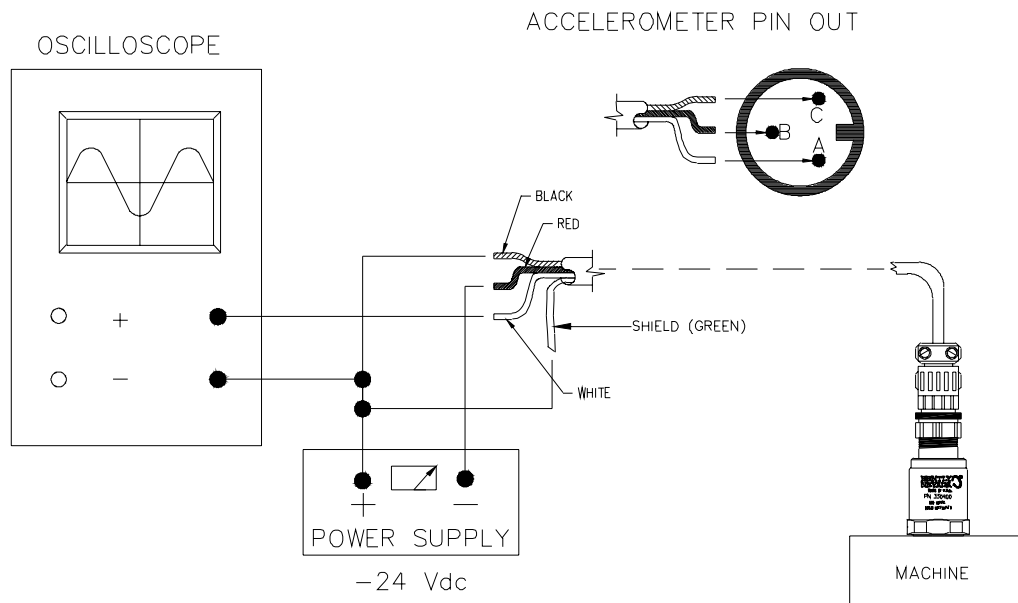


Figure 2-5 Accelerometer/External Power Supply Connections Using 16925 Interconnect Cable

Section 3 — Maintenance

This section shows how to check the performance of the 330400 and 330425 Accelerometers. Table 3-1 lists the recommended maintenance equipment. If the equipment is not available, contact the nearest Bently Nevada field office, or return the transducer to the factory or a testing laboratory for testing.

Table 3-1. Recommended Maintenance Equipment

Recommended Equipment	Specification
A Shake Table	
Bently Nevada Monitoring Systems: 3300, 2201, or 3500	
A Voltmeter	

Performance Test Procedure

Step 1: Mount the accelerometer on a shake table.

Step 2: Connect the cable to the accelerometer and the monitor as shown in section 2.

Step 3: Shake the accelerometer at 100 Hz with a known acceleration level.

Step 4: Verify the accelerometer output on the monitor or a Voltmeter.

Note: The accuracy of the system can be improved by calibrating the monitor and the shake table separately before performing the system loop check.

Polarity Test Procedure

Use this test to verify the proper phase response. An improper phase will adversely affect the use of the accelerometer for machinery diagnostics.

Step 1: Power up the accelerometer as shown in Figure 2-5.

Step 2: Set the time base on the oscilloscope to 20 milliseconds/division.

Step 3: Hold the transducer in hand and tap the bottom. Observe that the waveform on the oscilloscope first goes positive as shown in Figure 3-1. If the wave form goes negative first, contact the nearest Bently Nevada office for assistance.

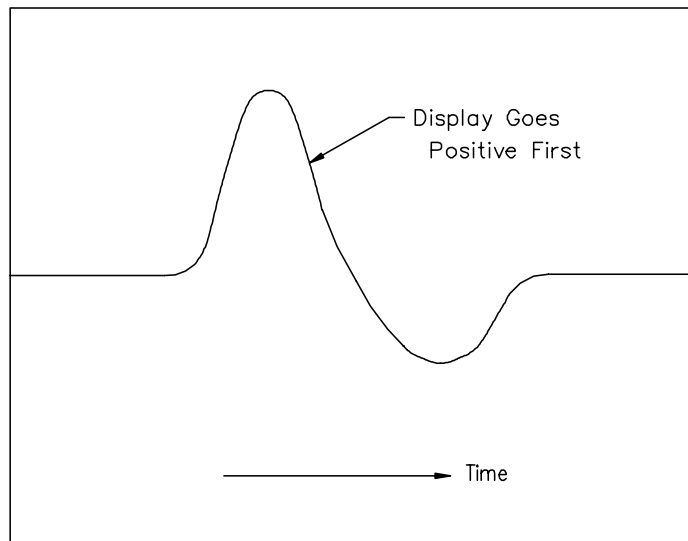


Figure 3-1 Polarity Check Oscilloscope Display

Section 4 — Field Testing and Troubleshooting

Use the following procedures to test an installed 330400 and 330425 Accelerometer and isolate a suspected malfunction. The 330400 and 330425 Accelerometers are hermetically-sealed units with no adjustments or field repairable components. If you determine that the accelerometer is not functioning properly, contact the nearest Bently Nevada office for assistance.

When the 330400 and 330425 Accelerometers are used with a Bently Nevada monitoring system, a fault may be due to an accelerometer malfunction, a malfunction in the field wiring, a malfunction in the monitor itself, or a level of vibration that exceeds the OK limit. Before placing a call to our service group, use the steps below to troubleshoot the suspected problems.

Fault Indication #1 Cause/Solution

Bently Nevada Monitor OK LED is off

The vibration level has exceeded the OK limit

Connect a voltmeter to the "IN" and "COM" on the SIRM terminals on the back of the monitor rack. Measure the dc voltage. The voltage should be between -8.0 and -9.0 Vdc.

Monitor Power is off.

Check that the monitor power supply is plugged in and that the power is on.

Interconnect cable is disconnected, connected loosely, connected to the wrong monitor or mis-wired.

Verify that the accelerometer is connected to the correct monitor and to the correct monitor terminals. Check that the screws on the Signal Input Relay Module are tight.

Interconnect cable is not connected or connection is loose at the accelerometer.

Verify that the accelerometer is connected to the cable.

Interconnect Cable is Damaged: Shorted

Visually inspect the interconnect cable for apparent damage. Disconnect the interconnect cable at both ends and measure the resistance among the three conductors of the interconnect cable. If intermittent or shorted, replace the cable.

Interconnect Cable is Damaged: Open

Disconnect the interconnect cable at both ends. Short two conductors together at one end at a time and measure the resistance of the cable at the other end. If open circuited, replace the cable.

Cable conductors are switched

With the accelerometer and the interconnect cable connected to the monitor measure the DC voltage across terminals "IN" and "COM" for the 3300 Monitoring System and "SIG/A" and "COM" for the 2201 and 3500 Monitoring Systems. The voltage should be between -8.0 and -9.0 Vdc. If it is not, check for proper connections.

Fault Indication #2 Cause/Solution

Monitor showing vibration on the front panel when the machine is off line.

Noise is coupled to the Accelerometer signal.

Check that the shield wire is connected to earth or chassis ground.

Check that the accelerometer and the machine case are properly grounded.

Section 5 — Specifications

330400 Accelerometer

Parameters are specified at 25°C (77°F) unless otherwise specified.

Note: Operation outside the specified limits will result in false readings or loss of machine monitoring.

Electrical

Scale factor

10.2 mV/(m/s²) (100 mV/g) ± 5% @ 100Hz

Frequency Response

± 10%, 30 Hz to 10 kHz
± 3.0 dB, 10 Hz to 15 kHz

Acceleration Range

490 m/s² pk (50 g pk)

Transverse Sensitivity

5% maximum of axial

Amplitude linearity

± 1% to 490 m/s² pk (50 g pk), above noise floor

Mounted Resonant Frequency

30 kHz minimum

Power Requirement

DC Voltage

-24 ± 4 Vdc.

Bias Current

2 mA

Output Bias Voltage

-8.5±0.5 Vdc, Pin A referenced to Pin C

Dynamic Output Impedance

50 ohms, typical

Broadband Noise Floor (10 to 15k Hz)

0.020 m/s² rms (0.002 g rms), typical

Grounding

Internal electronics are isolated from case

Maximum Cable Length

305 m (1000 ft) with no degradation of signal

Base Strain Sensitivity

0.005 g/με

330425 Accelerometer

Parameters are specified at 25°C (77°F) unless otherwise specified.

Note: Operation outside the specified limits will result in false readings or loss of machine monitoring.

Electrical

Scale factor

2.55 mV/(m/s²) (25 mV/g) ±5% @ 100Hz

Frequency Response

± 10% 30 Hz to 10 kHz
± 3.0 dB 10 Hz to 15 kHz

Acceleration Range

735 m/s² pk (75 g pk)

Transverse Sensitivity

5% maximum of axial

Amplitude linearity

± 1% to 735 m/s² pk (75 g pk), above noise floor

Mounted Resonant Frequency

30 kHz minimum

Power Requirement

DC Voltage

-24 ± 4 Vdc

Bias Current

2 mA

Output Bias Voltage

-8.5±0.5 Vdc, Pin A referenced to Pin C

Dynamic Output Impedance

50 ohms, typical

Broadband Noise Floor (10 to 15k Hz)

0.078 m/s² rms (0.008 g rms), Typical

Grounding

Internal electronics are isolated from case

Maximum Cable Length

305 m (1000 ft) with no degradation of signal

Base Strain Sensitivity

0.005 g/με

Environmental for the 330400 and the 330425 Accelerometer

Operating Temperature Range	-55° to 121°C (-67° to 250°F)
Shock Limit	49030 m/s ² pk (5000 g pk) maximum
Humidity Limit	100% condensing, non-submerged. Case is hermetically-sealed

Mechanical for the 330400 and 330425 Accelerometer

Dimensions	See Figure 5-1
Mounting Surface	28.6 mm (1.125 in) diameter
Mounting Torque of Accelerometer	3.3 ± 0.6 N-m (30 ± 5 in-lb)
Case Material	304L stainless steel
Connector	3 pin, MIL-C-5015, hermetically-sealed
Polarity	Pin A goes positive with respect to pin C when acceleration is from base to connector of the transducer.
Weight	3.5 oz. typical
Mounting angles	Any Orientation

Interconnect Cable for the 330400 and 330425 Accelerometer

Standard Interconnect Cable:

Size	0.5 mm ² (22 AWG)
Materials	
<i>Conductor</i>	Silver Tinned Copper
<i>Insulation</i>	Teflon Jacket
<i>Shield</i>	Braided Silver Tinned Copper
<i>Jacket</i>	Teflon

Voltage Rating	600 V
Bend Radius (Unarmored)	25.4 mm (1.00 in)
Operating Temperature Range	-55° to 200°C (-67° to 392°F)
Maximum O.D	4.06 mm (0.0160 in)

Standard Armored Interconnect Cable:

Armored Materials

<i>Hose Material</i>	AISI 302 or 304 Stainless Steel
<i>Joint Material</i>	Silver Solder or Welded

Hose Diameter

<i>Outside Diameter</i>	Max. 6.99 mm (0.275 in)
	Min. 6.68 mm (0.263 in)
<i>Inside Diameter</i>	Max. 5.16 mm (0.203 in)
	Min. 4.65 mm (0.183 in)

Bend Radius

38.1 mm (1.50 in)

Operating Temperature Range

-34° to 204°C (-29° to 400°F)

Cable

See the cable specifications for the standard interconnect cable.

Splash Resistance Cable/Connector

Cable Size

1.00 mm² (18 AWG)

Materials

<i>Connector</i>	Silver Tinned Copper
<i>Insulation</i>	Teflon Jacket
<i>Shield</i>	Braided Silver Tinned Copper
<i>Jacket</i>	Teflon

Voltage Rating	600 V
Bend Radius <i>Unarmored</i>	25.4 mm (1.00 in)
Operating Temperature Range	-55° to 200°C (-67° to 392°F)
Boot Material	Fluorosilicone Elastomer
Operating Temperature	-57° to 177°C (-70° to 350°F)
Maximum I.D	21.34 mm (0.840 in)
Maximum O.D	28.19 mm (1.11 in)
Maximum Length	95.25 mm (3.75 in)

Mechanical Outline

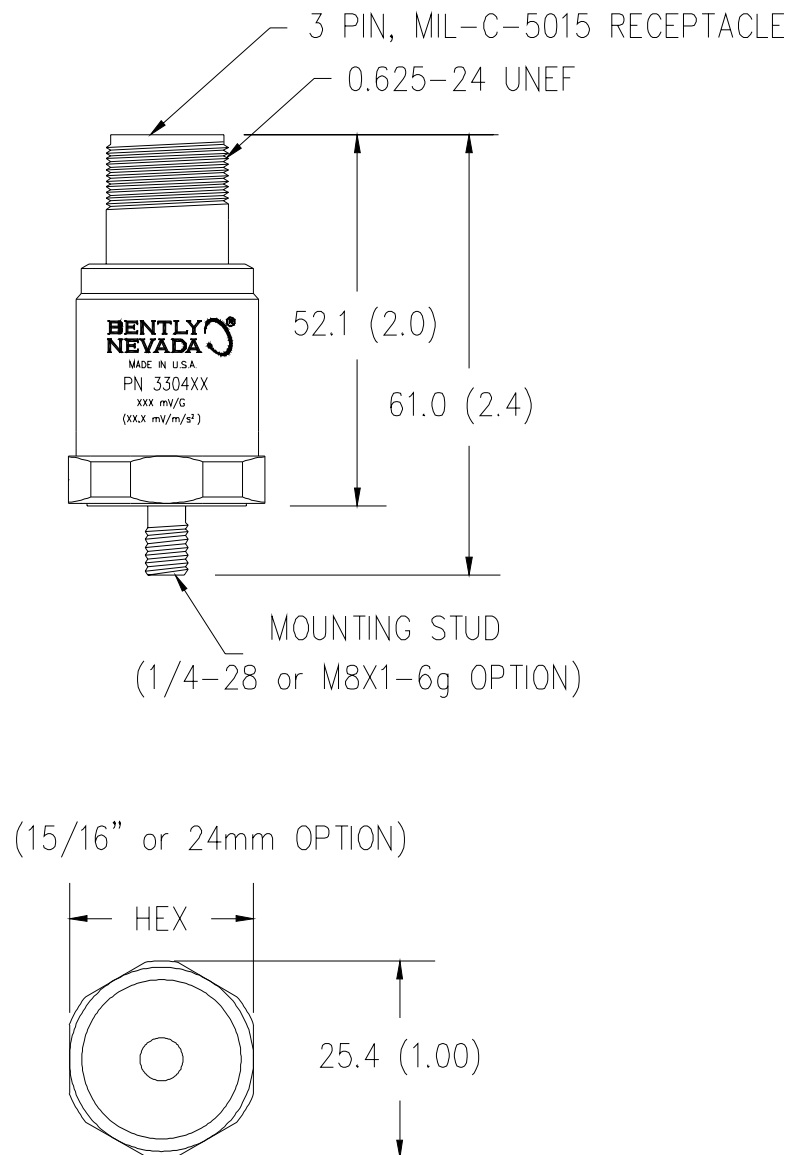


Figure 5-1

Note: The units in this drawing are mm (in).

330400 Accelerometer Frequency Response

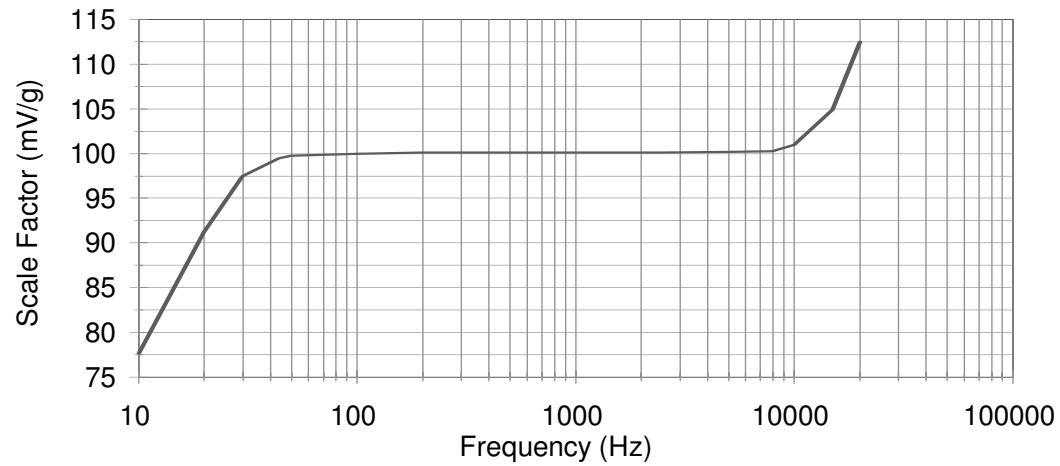


Figure 5-2 Typical 330400 Accelerometer Frequency Response (English Units)

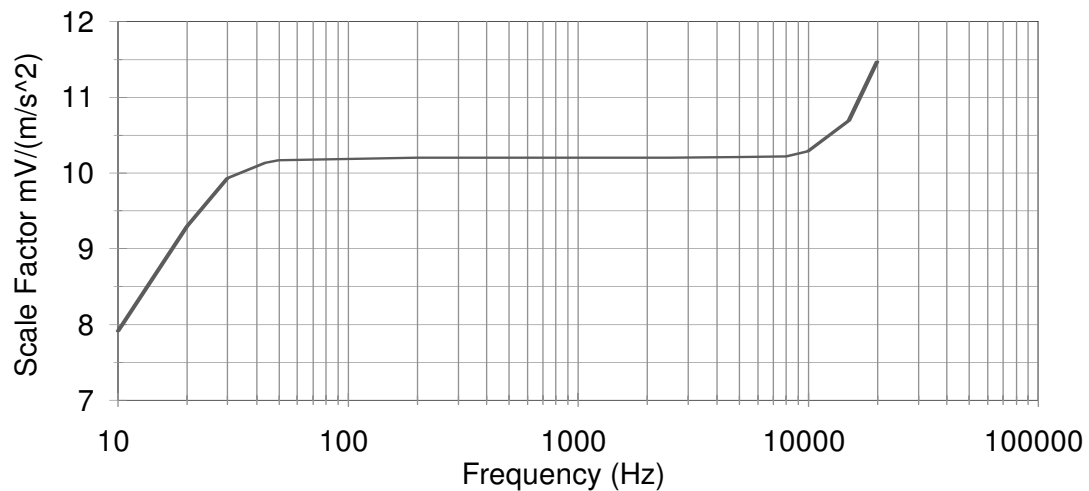


Figure 5-3 Typical 330400 Accelerometer Frequency Response (Metric Units)

330425 Accelerometer Frequency Response

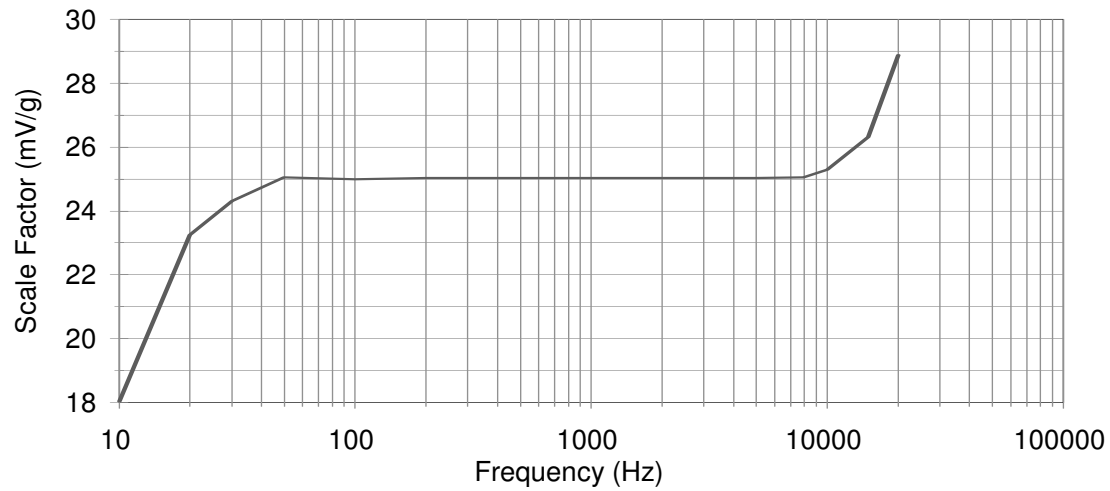


Figure 5-4 Typical 330425 Accelerometer Frequency Response (English Units)

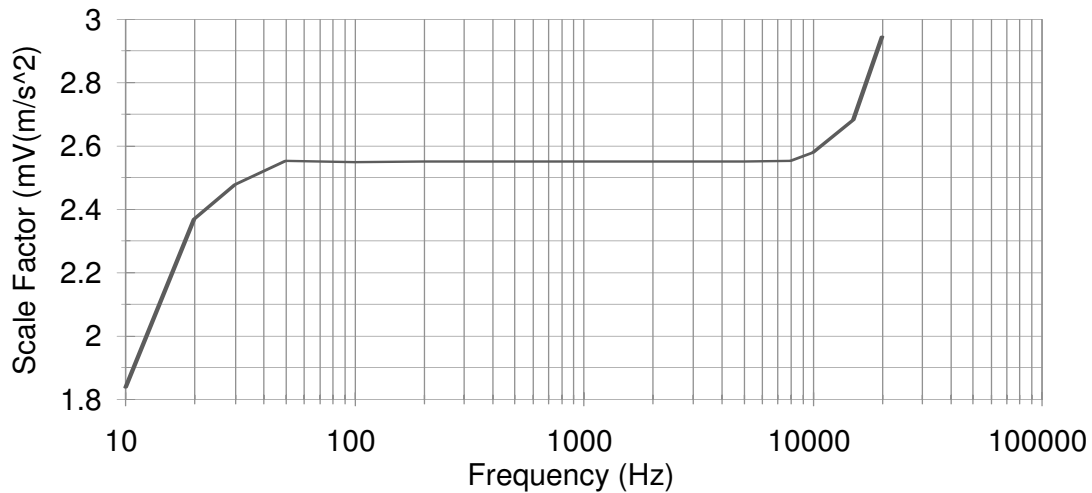


Figure 5-5 Typical 330425 Accelerometer Frequency Response (Metric Units)

Section 6 — Accessories and Spare Parts

330400 Accelerometer Options

When ordering the 330400 Accelerometer, you may choose from the following list of options:

330400 Accelerometer

330400-AXX-BXX

A: Mounting Stud

0 1 1/4- 28 Integral Stud

0 2 M8X1-6g integral Stud

B: Agency Approval Option

0 0 Not required

0 5 Multiple Approvals

Mounting Stud: Option A

The 330400 Accelerometer provides two mounting stud options, the English 1/4-28 UNF-2A and Metric M8X1-6g stud.

Agency Approvals: Option B

The 330400 Accelerometer is agency approved. Consult with your local Bently Nevada sales representative for information regarding approvals.

330425 Accelerometer Options

When ordering the 330425 Accelerometer, you may choose from the following list of options:

330425 Accelerometer

330425-AXX-BXX

A: Mounting Stud

0 1 1/4- 28 Integral Stud

0 2 M8X1-6g integral Stud

B: Agency Approval Option

0 0 Not required

0 5 Multiple Approvals

Mounting Stud C Option A

The 330425 Accelerometer provides two mounting stud options, the English 1/4-28 UNF-2A and Metric M8X1-6g stud.

Agency Approvals C Option B

The 330425 Accelerometer is agency approved. Consult with your local Bently Nevada sales representative for information regarding approvals.

Transducer Housing

The 330400 and 330425 Accelerometers are compatible with the 43217-02 Accelerometer Housing. Other versions of the 43217 do not include the necessary extension.

Interconnect Cable Options

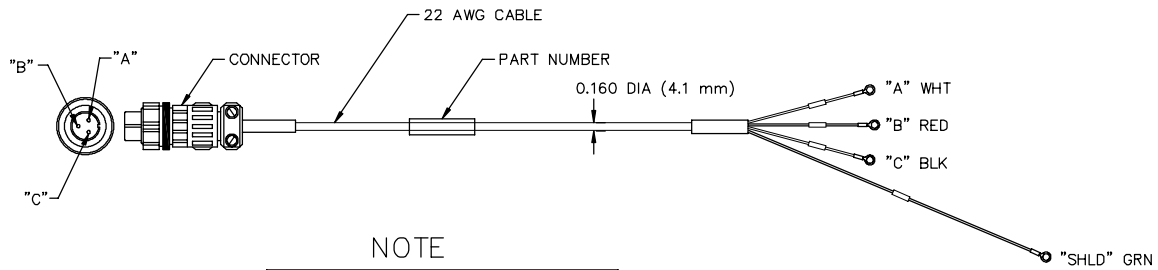
The Accelerometers require a three-conductor cable. We recommend using shielded cable to minimize noise interference. You may use the Bently Nevada cable or another comparable cable. Table 6-1 shows all of the Bently Nevada cables that are compatible with the Accelerometers.

Table 6-1 Interconnect Cable

APPLICATION	PART NUMBER	DESCRIPTION
Standard Interconnect Cable (see Figure B-1)	16925 – XX	3-wire shielded 0.5 mm ² (22 AWG) cable with a female connector at the 330400 Accelerometer end and terminal lugs at the monitor end.
Standard Amored Interconnect Cable (see Figure B-2)	16710 – XX	3-wire stainless steel armor over shielded 0.5 mm ² (22 AWG) cable with a female connector at the 330400 Accelerometer end and terminal lugs at the monitor end.
Standard Interconnect with splash proof environmental boot (see Figure B-3)	130539 - XX	3-wire shielded 1.00 mm ² (18 AWG) cable with a female connector and a splash proof environmental boot at the 330400 Accelerometer end and terminal lugs at the monitor end.
XX – Specifies the length of cable required in feet		

Section 6 — Accessories and Spare Parts

PART NUMBER 16925 – (SEE NOTE)



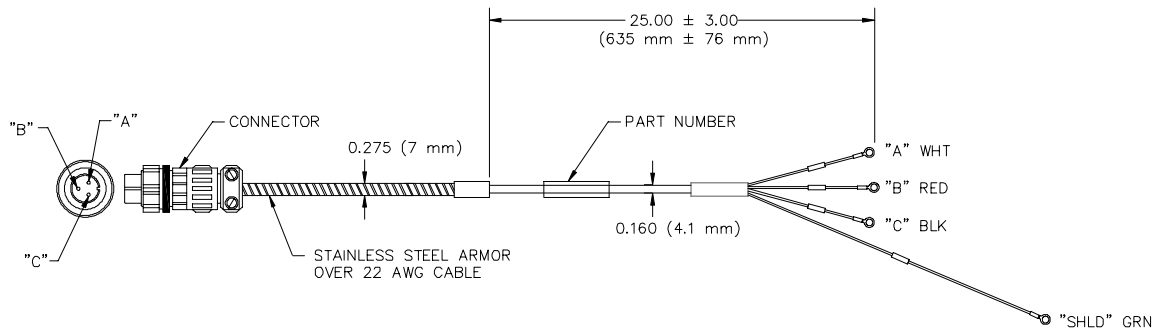
NOTE

INCREMENTS OF 1.0 FOOT (0.30 Metres)
EXAMPLE: 02 = 2 FEET (0.61 Metres)
25 = 25 FEET (7.62 Metres)
MIN LENGTH = 2.0 FEET (0.61 Metres)
MAX LENGTH = 99 FEET (30.18 Metres)

*ALL DIMENSION ARE IN INCHES (MILLIMETRES) UNLESS OTHERWISE SPECIFIED.

Figure 6-1 Standard Interconnect Cable

PART NUMBER 16710 – (SEE NOTE)



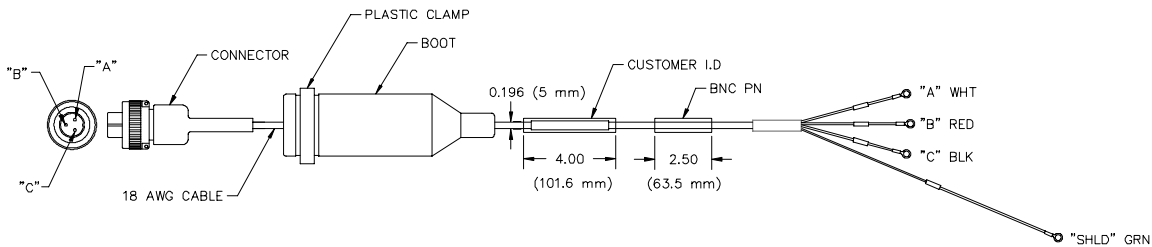
NOTE

INCREMENTS OF 1.0 FOOT (0.30 Metres)
EXAMPLE: 03 = 3 FEET (0.91 Metres)
25 = 25 FEET (7.62 Metres)
MIN LENGTH = 3.0 FEET (0.91 Metres)
MAX LENGTH = 99 FEET (21.34 Metres)

*ALL DIMENSIONS ARE IN INCHES (MILLIMETRES) UNLESS OTHERWISE SPECIFIED.

Figure 6-2 Standard Armored Interconnect Cable

PART NUMBER 130539 – (SEE NOTE)



NOTE

INCREMENTS OF 1.0 FOOT (0.30 Metres)
EXAMPLE: 12 = 12 FEET (3.66 Metres)
25 = 25 FEET (7.62 Metres)
MIN LENGTH = 2.0 FEET (0.61 Metres)
MAX LENGTH = 99 FEET (30.18 Metres)

*ALL DIMENSIONS ARE IN INCHES (MILLIMETRES) UNLESS OTHERWISE SPECIFIED

Figure 6-3 Splash Resistant Interconnect Cable

Installation documents

F

Assembly Instructions 1

**SIEMENS**

This document pertains to
FQ1721517501
VILNIUS WtE

Three-phase synchronous generator

1DU Series

Type 1DU2054-8AF02-Z

Assembly Instructions

Edition

11/2018

Answer for industry.

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1 Introduction

This assembly instruction describes assembly of machine components on the generator and explains best practices for this assembly.

Read this assembling manual before you handle with machine parts and before assembly of other components.

If you find any mistakes or have suggestions for improvements, please contact SIEMENS Electric Machines.

General information

- The weights of the machine particular parts are specified in the dimension drawing text
- The center of gravity is specified in the dimension drawing. For packed machines, the center of gravity is indicated on the packaging.
- Machines may only be transported and handled in a position appropriate for their construction type.

Siemens Service center

Note

Service Center

For any installation work that is required, contact the Service Center or commission service engineers trained by Siemens and authorized for this task.

Tel: 420 549 426 440

Fax: 420 549 426 450

E-Mail: servicedrasov.cz@siemens.com

Internet:

<http://www.siemens.cz/sem�>

<https://www.cze.siemens.com/web/cz/en/corpozte/portal/Siemens/industry/sem�/service/Pages/servis.aspx>

2 Safety instructions

2.1 The Five safety rules

For personal safety and to prevent material damage when carrying out any work, always observe the safety instructions and the following five safety rules, according to EN 50110-1 "Working in a voltage-free state". Apply the five safety rules in the sequence stated before starting work.

Five safety rules

1. Disconnect the system.
Also disconnect the auxiliary circuits, for example anti-condensation heating.
2. Secure against reconnection.
3. Verify absence of operating voltage.
4. Ground and short-circuit.
5. Provide protection against adjacent live parts.

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

2.2 Safe handling

Workplace safety depends on the attentiveness, care, and common sense of the personnel who install, operate, and maintain the machine. In addition to the safety measures cited, as a matter of principle, the use of caution is necessary when you are near the machine. Always pay attention to your safety.

Also observe the following to prevent accidents:

- General safety regulations applicable in the country where the machine is deployed
- Manufacturer-specific and applicable-specific regulations
- Special agreements made with the operator
- Separate safety instructions supplied with the machine
- Safety symbols and instructions on the machine and its packing



DANGER

Live parts

Electric machines contain live parts.

Fatal or severe injuries and substantial material damage can occur if the covers are removed or if the machine is not handled, operated, or maintained properly.

- Always observe the "The Five safety rules" (Page 5) when carrying out any work on the machine.
- Only remove the covers using the methods described by these operating instructions.
- Operate the machine properly.
- Regular and professionally maintain the machine according to the instructions provided in the "Maintenance" chapter of the operating instructions.

**DANGER****Rotating parts**

Electric machines contain dangerous rotating parts. Fatal or severe injuries and substantial material damage can occur if the covers are removed or if the machine is not handled, operated, or maintained properly.

- Only remove the covers using the methods described by these operating instructions.
- Operate the machine properly.
- Regularly and correctly maintain the machine.
- Secure free-standing shaft extensions and other rotating part such as couplings and pulley belts so that they cannot be touched.

**WARNING****Hot surfaces**

Electric machines have hot surfaces. Touching hot surfaces can result in severe burns.

- Allow the machine to cool before starting work on the machine.
- Only remove the covers using the methods described by these operating instructions.
- Operate the machine properly.

**WARNING****Hazardous substances**

Chemical substances required for the setup, operation and maintenance of machines can present a health risk.

Poisoning, skin damage, cauterization of the respiratory tract, and other health damage may result.

- Read the information in these operating instructions and the product information supplied by the manufacturer.
- Observe the relevant safety regulations and wear the personal protective equipment specified.

**WARNING****Flammable substances**

Chemical substances required for the setup, operation and maintenance of machines may be flammable.

Burns and other damage to health and material may result.

- Read the information in these operating instructions and the product information supplied by the manufacturer.
- Observe the relevant safety regulations and wear the personal protective equipment specified.

**WARNING****Qualified personnel**

All work at the machine should be carried out by qualified personnel only.

For the purpose of this instructions, qualified personnel is taken to mean people who fulfill the following requirements:

- Through appropriate training and experience, they are able to recognize and avoid risks and potential dangers in their particular field of activity.
- They have been instructed to carry out work on the machine by the appropriate person responsible.

**WARNING****Falling persons**

Installation, commissioning and maintenance of the machine sometimes require working at dangerous height. This put people at risk of falling.

If you have to work at a height exceeding one meter, take appropriate measures to eliminate the risk of falling.

Suitable measures include:

- Erecting scaffolding, work platforms or lifting platforms.
- Wearing personal protective equipment that prevents falling.

**WARNING****Falling objects**

Installation, commissioning and maintenance of the machine sometimes require working at dangerous height. This involves a risk of components or tools falling.

If you have to work at such a height, take appropriate measures to ensure that no objects can fall down, and that falling objects cannot injure anyone.

Suitable measures include:

- Installing intermediate ceilings.
- Securing loose components and tools to prevent them falling.
- Wearing personal protective equipment.
- Prevent people from entering the danger area.

**CAUTION****Lifting of the machine parts**

The lifting lugs on the machine particular part can be used for lifting this part only!
Observe the lifting capacity of the hoisting mechanism.

**DANGER****Danger from incorrect installation**

To ensure proper functioning of the machine, it must be properly installed by qualified personnel in compliance with the information provided in these instructions.

Failure to heed these requirements can lead to improper work of the machine or substantial material damage.

Respect cables and terminal marking.

NOTICE**Assembly procedure**

Use a sequence of assembling parts according to the tables detailing the fasteners for proper installation of the machine components.

For example: Figure 4-5 Grounding of the Cooler housing (Page 13): Brass hexagon screw M10X25 → Curved spring lock washer A10 → Brass plain washer 10 → Grounding Cord

3 Description

3.1 Basic information for proper installation

Note

During machine installation read Operating instructions / Installation Instructions.

All components are delivered with its fasteners.

After components arrival unpack all components and check it if the goods are undamaged.

Before installation of machine parts (e.g.: cooler housing, main terminal box -MTB,...), machine has to stand on the flat foundation and machine has to be secured against any motion.

When machine part has been assembled it must be grounded immediately.

Machine parts must be installed by qualified personnel, taking into account of the information given in this instruction, in order to assure proper functioning of the complete machine.

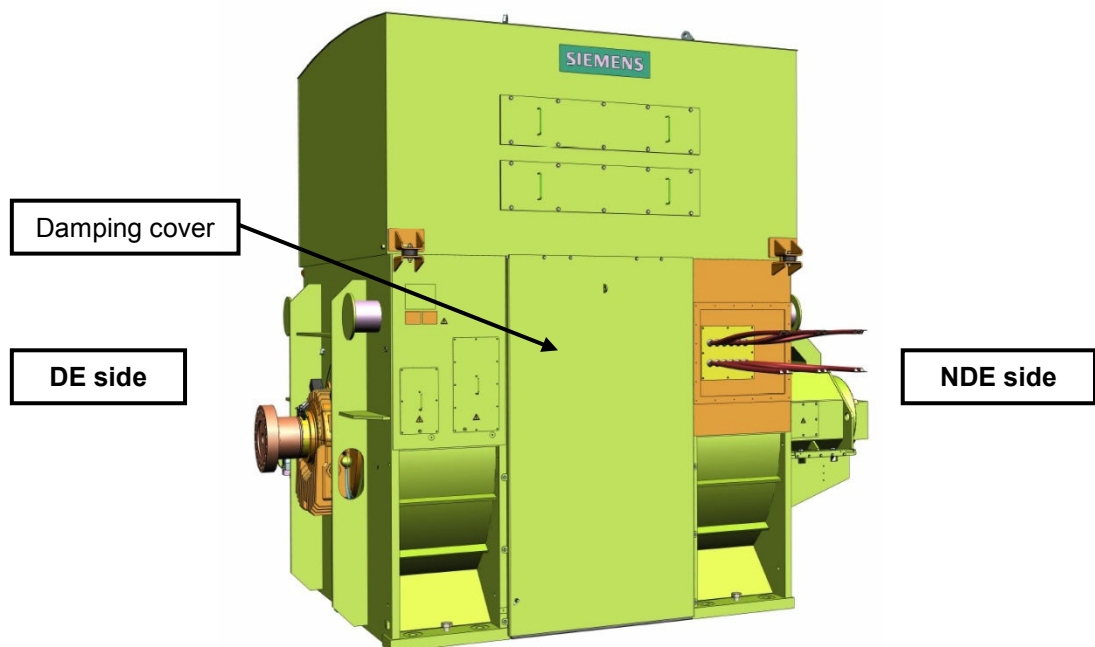


Figure 3-1 Description of machine sides

3.2 Machine components dispatch

Delivered package contain these components:

- Synchronous generator body
- Cooler housing (include water coolers)

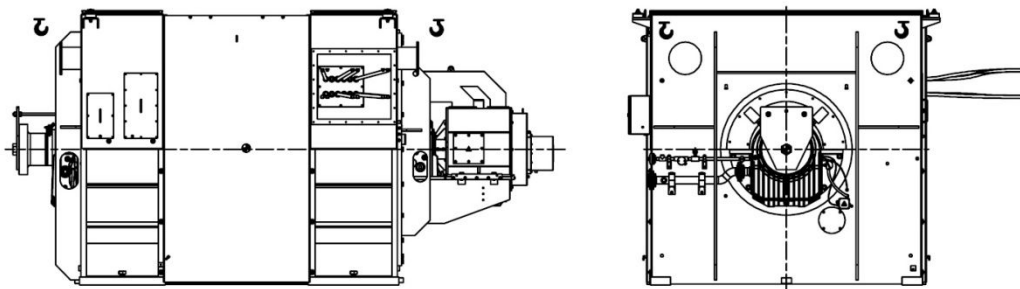


Figure 3-2 Synchronous generator body

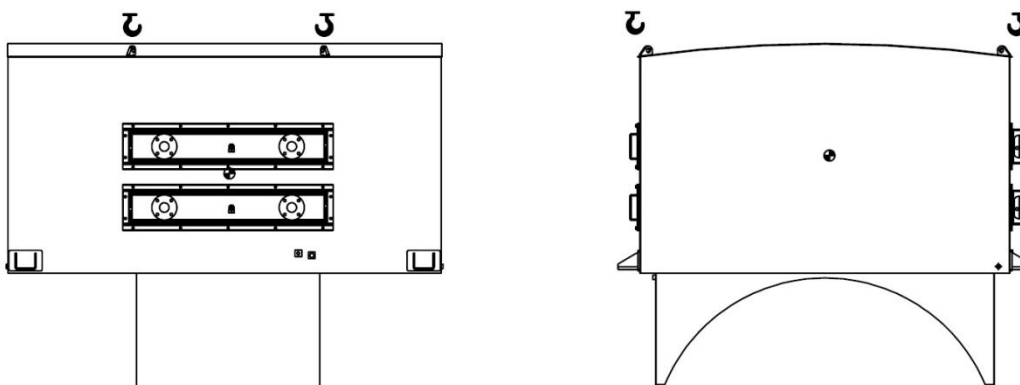


Figure 3-3 Cooler housing (include water coolers)

Table 3-1 Approximate weight of particular parts

Part	Weight (kg)
Synchronous generator	51 930
Cooler housing (include water coolers)	3 030
Total	54 960

Note

Fasteners for machine parts

Fasteners for machine parts assembly are placed on its final position during whole transport period and are covered by protection. This protection must be removed before the assembling process is being started.

4 Assembly procedure for Cooler housing

1. Put the generator onto the straight and steady foundation, read chapter "Preparation for use" and "Installation" in Operating instructions.
For manipulation with the generator use lifting lugs for lifting of entire machine, see Figure 3-2. Lifting lugs for entire machine are placed on each shield.
2. There is used the flexible connection between the cooler housing and generator.
Before establishing of the cooler housing onto generator remove fasteners on the top side of the damping elements which are on the damping elements whole transport, see Figure 4-1.



CAUTION

Placing of the Cooler housing

Facing to the drive end, flanges of the water coolers must be on the left side (in accordance with Figure 3-1, Page 8).
Compare the correct position of the cooler housing with the machine dimension drawing.

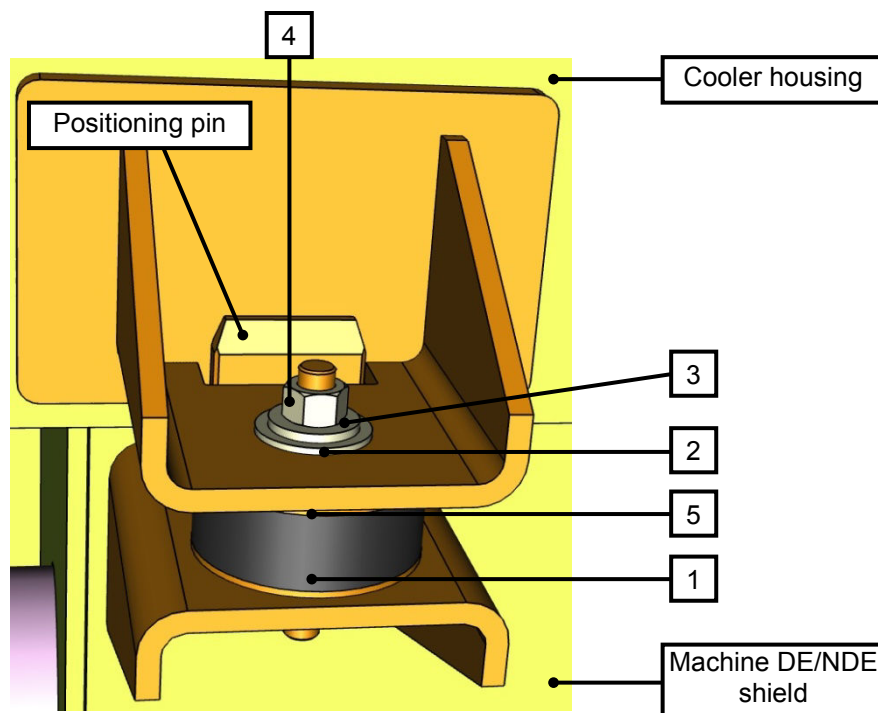
3. Prepare both damping covers for proper installation of the cooler housing. Damping covers are mounted on the both sides of the machine, see Figure 3-1, Page 8.
Loosen all screws – position 1.1 (Figure 4-3, Page 12) for preparation of the maximal gap between the damping cover and its clamps to ensure easy installation of the cooler housing.
4. Put the 3 pieces of shims on each damping element, see Figure 4-1 (position 5). Shims are used for the settlement of the Cooler housing. In case of need, it is possible to remove or add the shims for proper settlement.
5. Lift the cooler housing using lifting lugs placed on the top side, see Figure 3-3.
6. Place the cooler housing carefully onto the machine.
Lower section of the cooler housing must be inserted to the installation gap between the damping cover and its clamps see Figure 4-3.
Damping covers are fixed on the machine shields, using fasteners described on the Figure 4-4 and Table 4-1.

Note

All screws and nuts must be tightened with the required tightening torque.

7. Secure the cooler housing to the generator.
Use fasteners in accordance with Figure 4-1 (Page 11).
8. Assemble grounding connection between cooler housing and NDE shield of the machine, see Figure 4-5 (Page 13).
One end of the grounding cord is mounted on the generator from machine manufacturer.
9. Tighten all screws position 1.1 (Figure 4-3) to complete installation of the cooler housing.
10. Connect flexible part of the water leakage detector from DE shield to the fixed connector on the cooler housing.
See procedure under chapter "Water leakage detector connection" (Page 14).

4.1 Cooler housing – Figures



Position	Description	Tight. Torque [Nm]
1	Damping element M16	
2	Plain washer 16	
3	Conical spring washer 16	
4	Hexagonal nut M16	170 Nm
5	Shims for settlement (3-6 pcs.)	

Figure 4-1 Flexible connection

4 Assembly procedure for Cooler housing

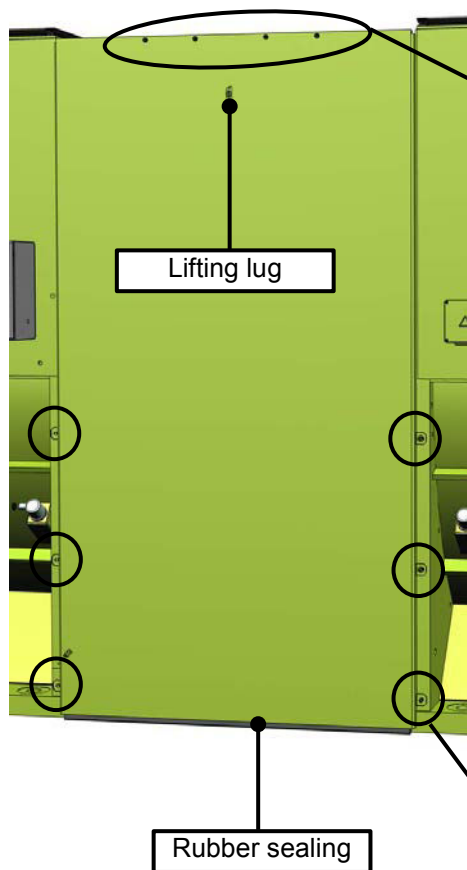


Figure 4-2 Damping cover

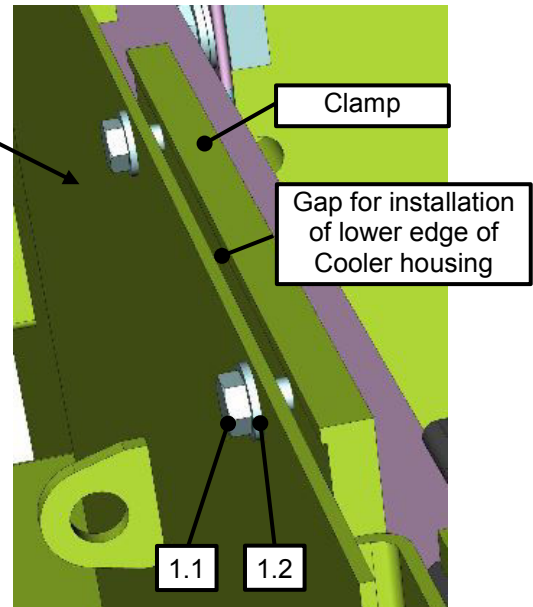


Figure 4-3 Preparation for installation of Cooler housing

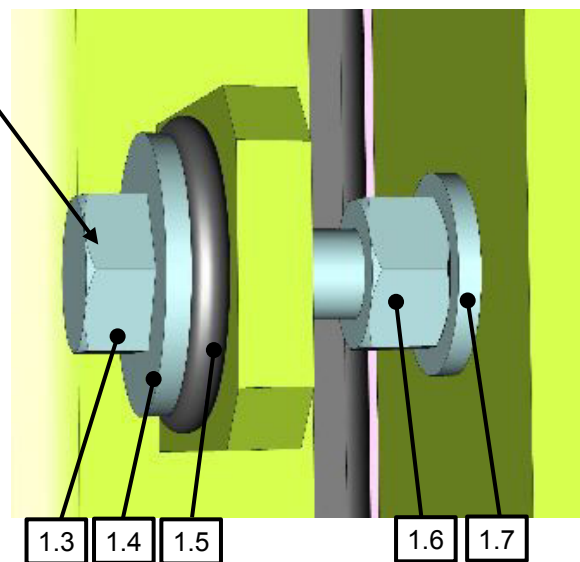
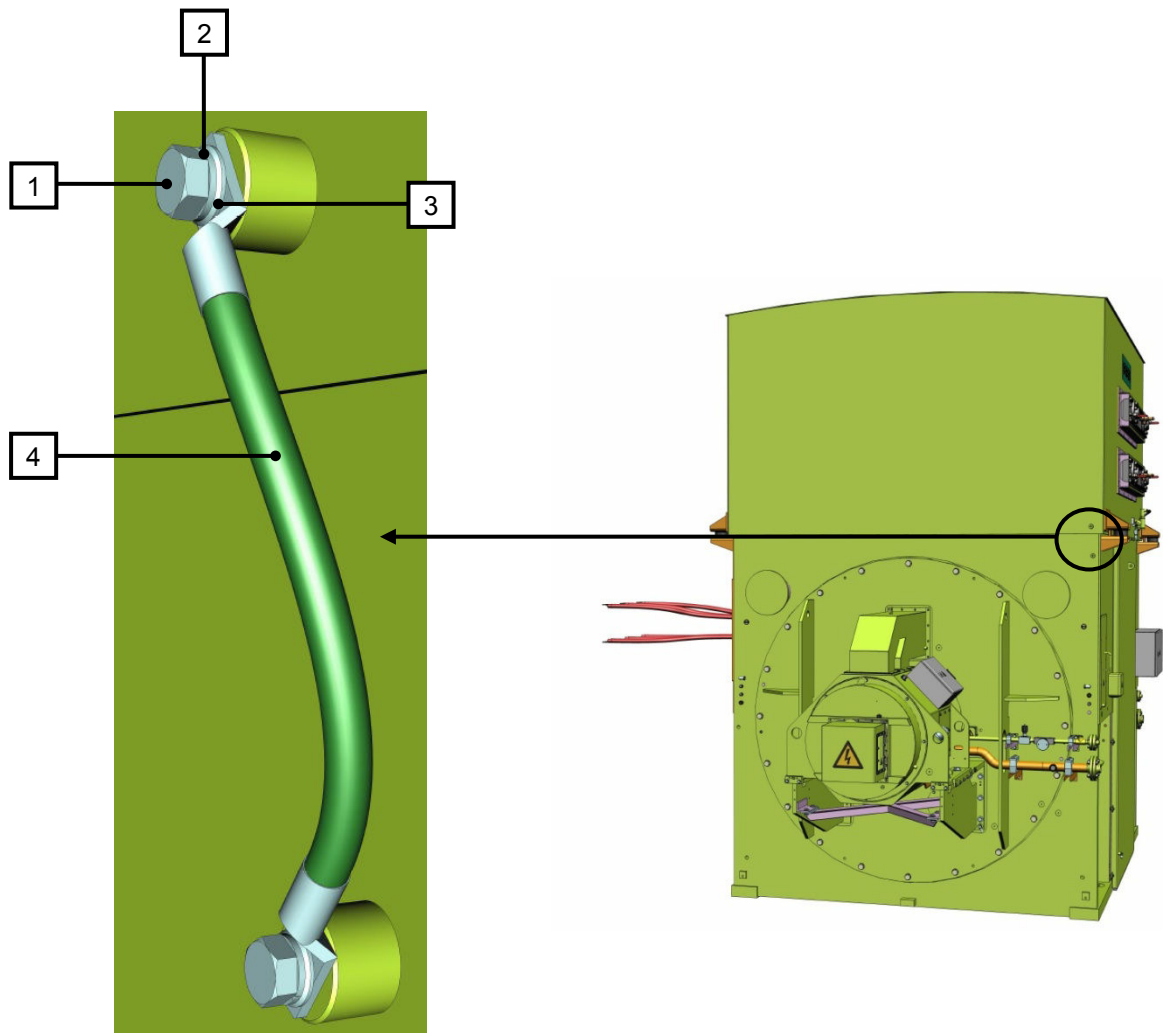


Figure 4-4 Damping cover - fasteners

Table 4-1 Damping cover – fasteners

Position	Description	Tight. Torque [Nm]
1.1	Hexagon head screw M10X50	40 Nm
1.2	Conical spring washer 10	
1.3	Hexagon head screw M8X40	20 Nm
1.4	Plain washer 8.4	
1.5	Rubber bushing 10X26	
1.6	Hexagonal nut M8	20 Nm
1.7	Conical spring washer 8	

4 Assembly procedure for Cooler housing



Position	Description	Tight. Torque [Nm]
1	Brass hexagon head screw M10X25	20 Nm
2	Curved spring lock washer A10	
3	Brass plain washer 10	
4	Grounding cord	

Figure 4-5 Grounding of the Cooler housing

4.2 Water leakage detector connection

When the cooler housing is mounted on the generator, water leakage detector must be connected using cable connector on the DE machine shield close to the probe itself, see Figure 4-6.

Connect flexible part of connector from DE machine shield to the fixed connector on the cooler housing. See procedure shown in Figure 4-7.



Figure 4-6 Position of water leakage detector

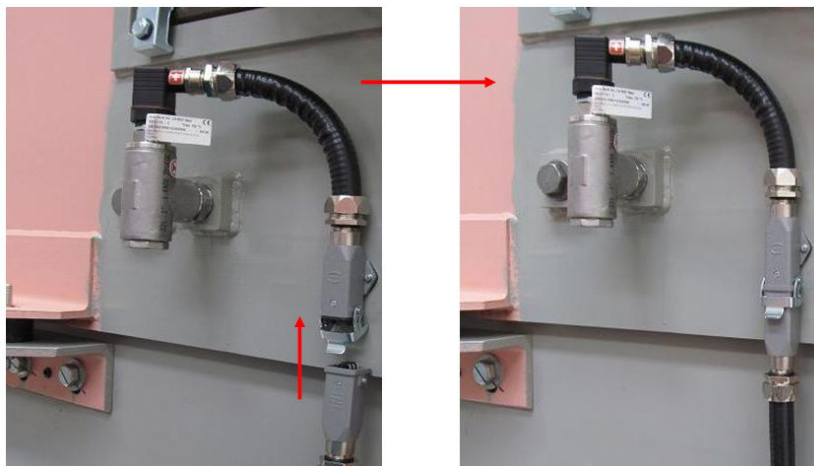


Figure 4-7 Water leakage detector connection (illustrative picture)

Notes

Siemens Electric Machines Drásov s.r.o.
Drásov 126
664 24 Drásov
Czech republic

www.siemens.cz/sem�