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Title

Instruction Manual

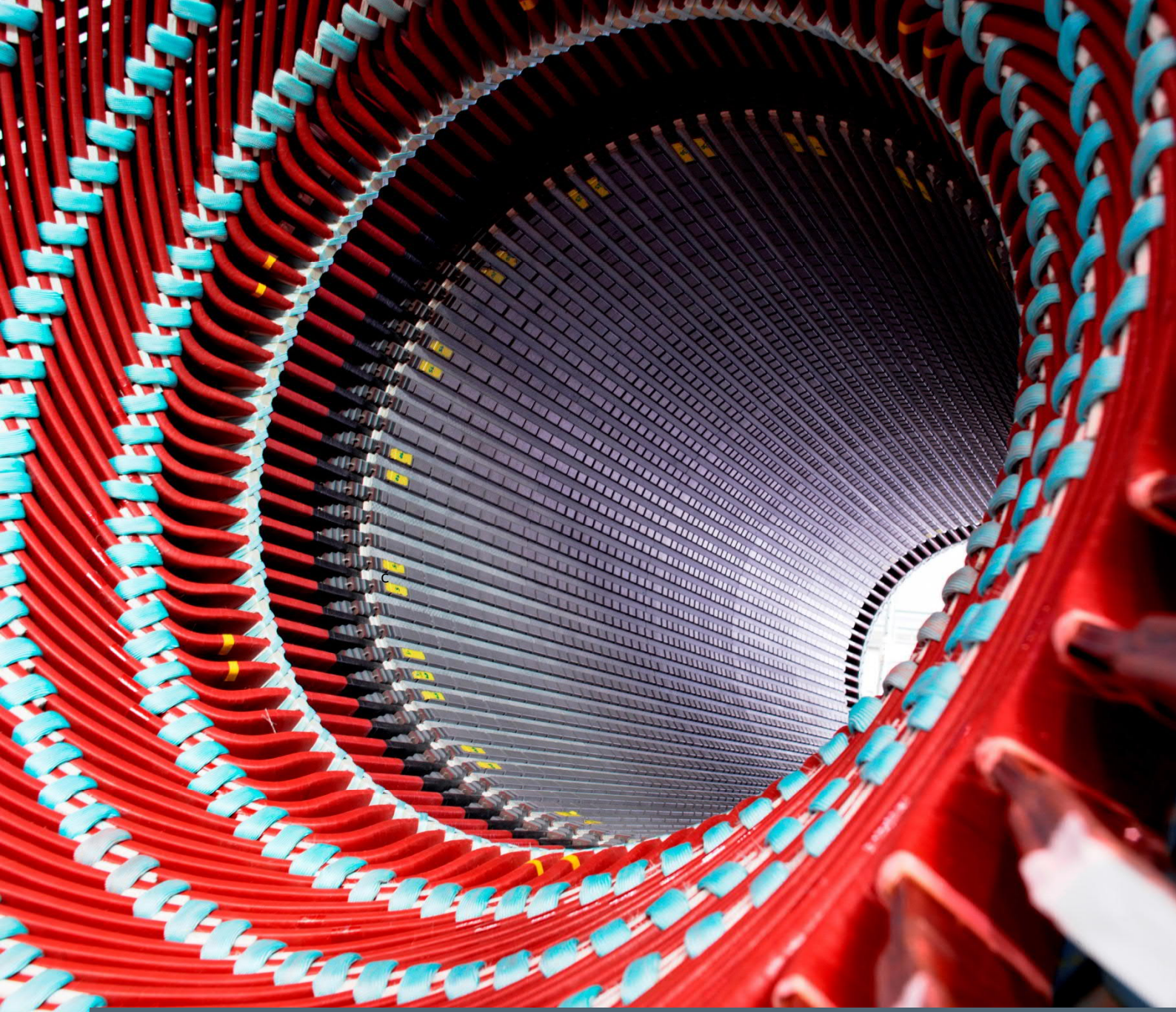
Turbogenerator
Operating and Maintenance Manual

Remarks

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Turbogenerator Vilnius Biomass

Operating and Maintenance Manual

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Operating and Maintenance Manual

Vilnius Biomass

Project name

Generator type SGen5-100A-2P

Two-Pole Turbogenerator
with Directly Air-Cooled Rotor Winding
and Indirectly Air-Cooled Stator Winding

Order no. 3000018595

Machine no. EG000367

Project ID FERT00574216

Siemens Document no. DPSDES-00002587 en

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Original manual

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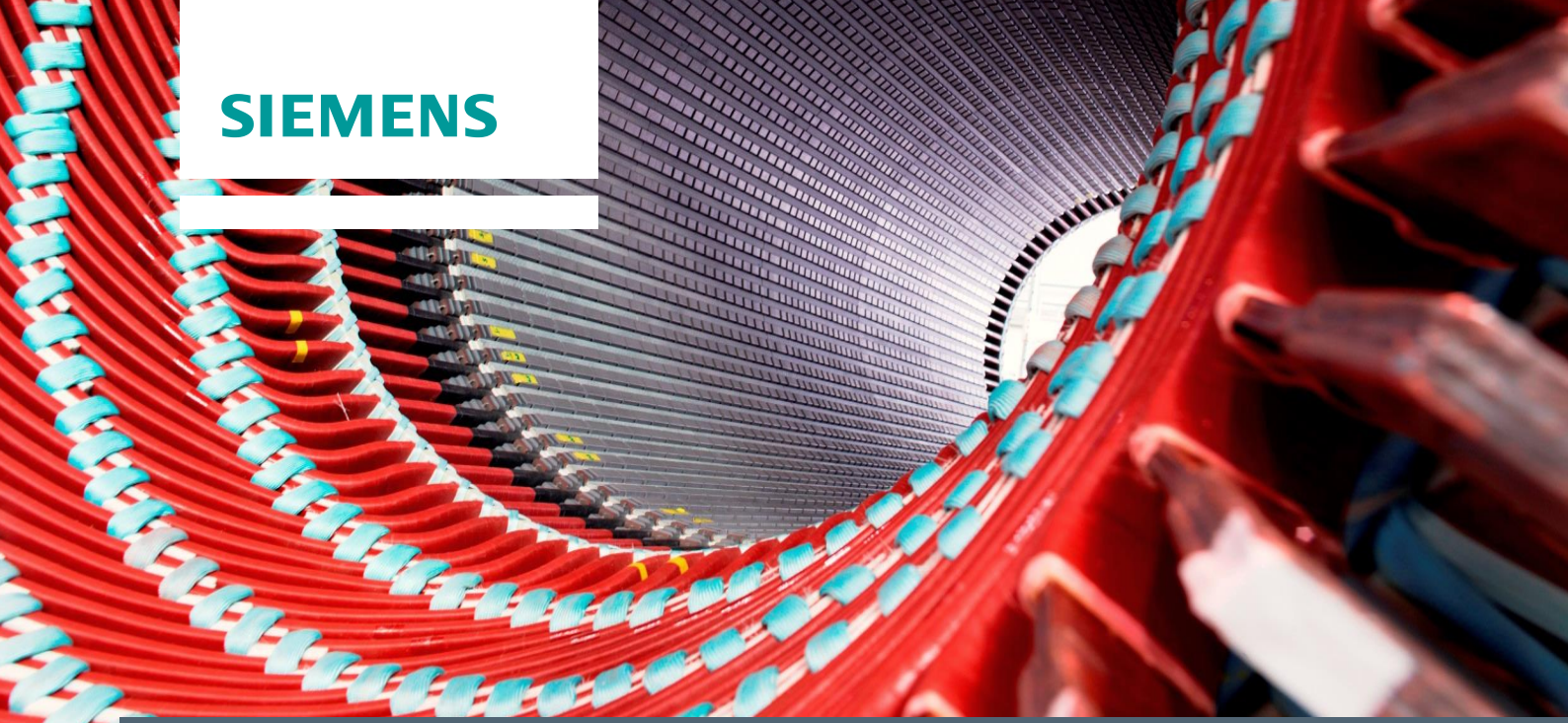
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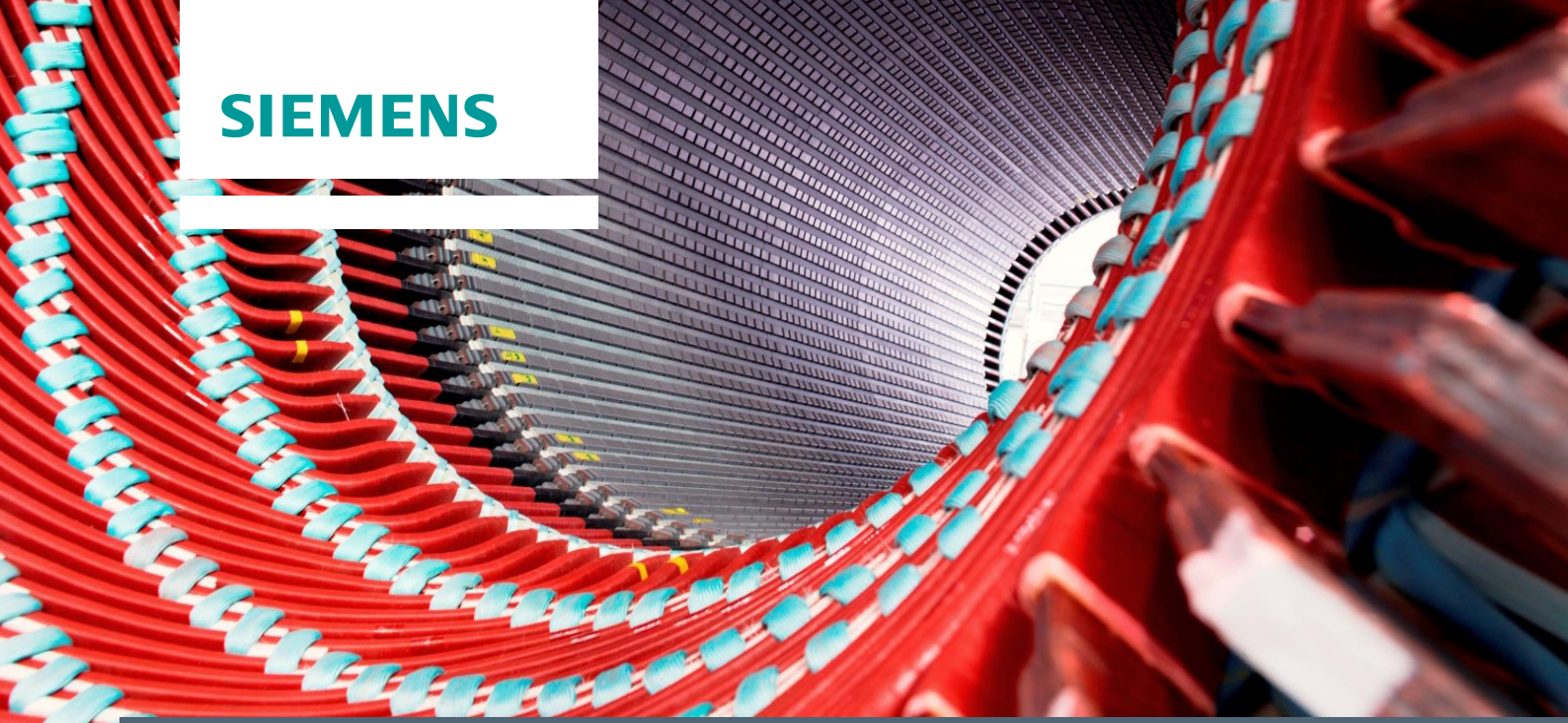
Turbogenerator | Operating and Maintenance Manual

General Information 1

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1.2 General



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Turbogenerator | Operating and Maintenance Manual

General Information 1

Declarations 1.1

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Declaration of Incorporation of Partly Completed Machinery

Pursuant to Machinery Directive 2006/42/EC, Annex II, Letter B

The machinery described hereafter, including associated control and supply equipment, is partly completed machinery in accordance with article 1, paragraph 1, letter g), in conjunction with article 2, and letter g) of Directive 2006/42 /EC.

It is exclusively intended to be incorporated into or assembled with other machinery or machineries.

Generator

Type: SGen5-100A-2P

Year of Manufacture: 2018

Machinery–No.: EG000367

See rating plate and product technical documentation for performance data

We hereby declare, that the following essential requirements of directive 2006/42/EC are applicable to and/or fulfilled by the partly completed machinery described below:

Essential requirement according to Annex I of Directive 2006/42/EC	Is Fulfilled
1. ESSENTIAL HEALTH AND SAFETY REQUIREMENTS	
1.1. GENERAL	
1.1.1. Definitions	not relevant
1.1.2. Principles of Safety Integration	YES
1.1.3. Materials and Products	YES
1.1.4. Lighting	further measures necessary
1.1.5. Design of Machinery to facilitate its handling	YES
1.1.6. Ergonomics	further measures necessary
1.1.7. Operation Positions	not relevant
1.1.8. Seating	not relevant

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Managing Board: Joe Kaeser, Chairman, President and Chief Executive Officer; Roland Busch, Lisa Davis, Klaus Helmrich, Janina Kugel, Cedrik Neike, Michael Sen, Ralf P. Thomas
Registered offices: Berlin and Munich, Germany; Commercial registries: Berlin Charlottenburg, HRB 12300, Munich, HRB 6684
WEEE-Reg.-No. DE 23691322

Essential requirement according to Annex I of Directive 2006/42/EC	Is Fulfilled
1.2. CONTROL SYSTEMS	
1.2.1. Safety and Reliability of Control Systems	further measures necessary
1.2.2. Control Devices	further measures necessary
1.2.3. Starting	further measures necessary
1.2.4. Stopping	
1.2.4.1. Normal Stop	further measures necessary
1.2.4.2. Operational Stop	further measures necessary
1.2.4.3. Emergency Stop	further measures necessary
1.2.4.4. Assembly of Machinery	further measures necessary
1.2.5. Selection of Control or Operation Modes	further measures necessary
1.2.6. Failure of the Power Supply	further measures necessary
1.3. PROTECTION AGAINST MECHANICAL HAZARDS	
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1.3.2. Risk of break-up during Operation	YES
1.3.3. Risks due to Falling or ejected Objects	further measures necessary
1.3.4. Risks due to Surfaces, Edges or Angles	YES
1.3.5. Risks related to Combined Machinery	not relevant
1.3.6. Risks related to Variations in operating conditions	not relevant
1.3.7. Risks related to Moving Parts	YES
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1.4.2.2. Interlocking Movable Guards	further measures necessary
1.4.2.3. Adjustable Guards restricting Access	further measures necessary
1.4.3. Special Requirements for Protective Devices	further measures necessary

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Essential requirement according to Annex I of Directive 2006/42/EC	Is Fulfilled
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1.5.8. Noise	further measures necessary
1.5.9. Vibrations	YES
1.5.10. Radiation	further measures necessary
1.5.11. External radiation	further measures necessary
1.5.12. Laser radiation	not relevant
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1.5.16. Lightning	further measures necessary
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1.6.2. Access to operating positions and servicing points	further measures necessary
1.6.3. Isolation of energy sources	further measures necessary
1.6.4. Operator intervention	YES
1.6.5. Cleaning of internal parts	YES
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1.7.1.2. Warning devices	further measures necessary
1.7.2. Warning of residual risks	further measures necessary
1.7.3. Marking of machinery	YES
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1.7.4.2. Contents of the instructions	further measures necessary

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Essential requirement according to Annex I of Directive 2006/42/EC	Is Fulfilled
1.7.4.3. Sales literature	not relevant
4. HAZARDS DUE TO LIFTING OPERATIONS	
4.1.2.1 Risks due to lack of stability	further measures necessary

NOTE: The entry "further measures necessary" means, that in order to finally fulfill the relevant essential requirement, additional measures are to be taken after the partly completed machinery has been placed on the market. These additional measures (e.g. during assembly or commissioning) are described in the documentation supplied with the partly completed machinery. However, the execution of these measures is beyond the control of the manufacturer of the partly completed machinery.

The entry „not relevant" means, that – related to that essential requirement – no hazards, hazardous situations or events are emerging from the scope of delivery covered by this declaration, and hence no measures for risk mitigation are necessary in that respect.

In addition, we hereby declare, that the relevant technical documentation has been compiled in accordance with part B of annex II of directive 2006/42/EC. We hereby undertake to transmit the relevant information on the partly completed machinery in response to a reasoned request by national authorities. The information will be transmitted by mail on electronic data storage media.

The partly completed machinery described in this document has been designed and manufactured in compliance with the provisions of the following further directives:

- Directive 2014/68/EU of the European Parliament and of the Council of 15 May 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of pressure equipment
- Directive 2014/30/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to electromagnetic compatibility
- Directive 2014/35/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of electrical equipment designed for use within certain voltage limits

The conformity of the designated product with the provisions of the applied Directives is proved by compliance with the following harmonized standards:

EN 547-1; EN 547-2; EN ISO 12100; EN ISO 13732-1; EN ISO 13857; EN 60034-1; EN 60034-5; EN 60034-6; EN 60034-7; EN 60034-8; EN ISO 60204-1; EN 60529; EN 62061.

Other technical standards:

EN 60034-3; EN 61508-1; EN 61511

The partly completed machinery, as described in this document, must not be put into service until the final machinery into which it is to be incorporated has been declared in conformity with the provisions of directive 2006/42/EC.

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Name and address of the person established in the community authorized to compile the relevant technical documentation:

Name, First Name: **Deutscher, Frank**

Company address:

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City	D-99086 Erfurt
Country	Germany
Telephone	**+49 (361) 753 0**

Any changes to the partly completed machinery described in this declaration without our written consent will void the validity of this declaration.

Date: 2018-11-26 Signature: .....

Andreas Konschak

Identity of signer: **Head of Erfurt Generator Works**

SIEMENS

Final Declaration

according to Siemens process instruction
for ensuring product safety (P10-040)

Generator

Type:	SGen5-100A-2P
Year of manufacture:	2018
Machine no.:	EG000367

Performance data – see rating plate and product technical documentation

More detailed information about the performance of the products as well as the standards and legal regulations that have been complied with can be found in the technical documentation of the product.

This declaration shall lose its validity if the machine described here is modified without our written authorization.

Location: Erfurt Date: November 26, 2018

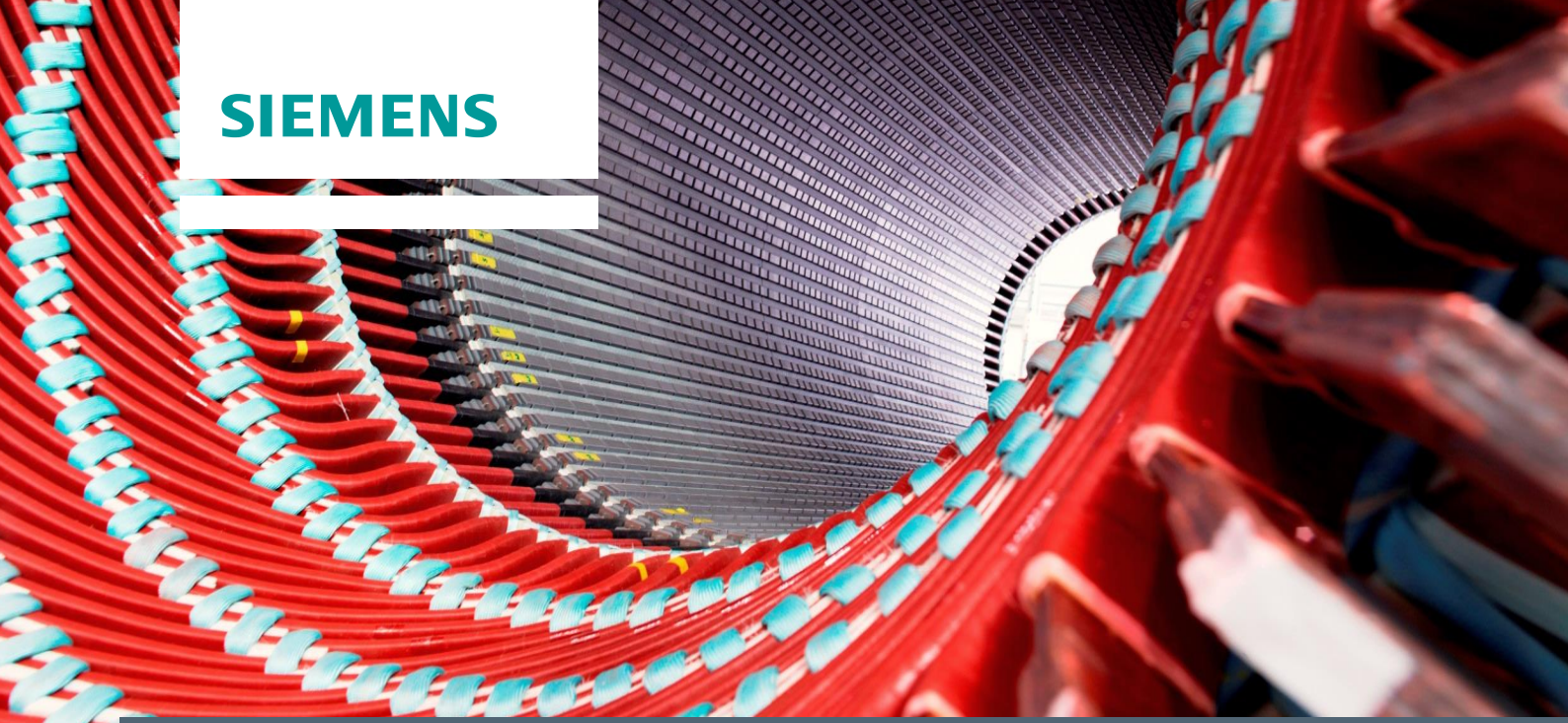
Issued on behalf of the management of Erfurt Generator Works

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SIEMENS

Turbogenerator | Operating and Maintenance Manual

General Information 1

General 1.2

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Preface

Please note the following information about this Operating and Maintenance Manual (OMM).



⚠ CAUTION

Knowledge of the information provided in the OMM is an essential condition for the proper operation and maintenance of the turbogenerator, and for avoiding any personal injury or damage to property.

- Read this manual through carefully and thoroughly.

Intended use of the OMM

This manual has been prepared for operating and maintenance personnel who has comprehensive knowledge of power plant technology and power plant operation, and who has already received a briefing on the operation and maintenance of the system by instructed personnel.

The present manual cannot contain comprehensive information about all aspects of the turbogenerator, its operation and maintenance. Furthermore, it does not provide instructions or information about every eventuality that can arise during the assembly, operation or maintenance of the generator. All questions that cannot be clearly answered with the aid of this manual must be referred to Siemens AG.

All the information contained in this manual is intended solely for the use of the buyer and for the specific purpose stated by the buyer to Siemens AG for the purchase of the generator. The use by other persons, entities and bodies for other purposes is not authorized. Siemens AG does not accept any liability for any consequences due to any type of such unauthorized use.

This manual is not a guarantee or contractual document. The obligations of Siemens AG are regulated solely in the purchase contract. The information contained in this manual cannot be interpreted in any way to change or extend the obligations of Siemens AG.



NOTE

The manual must be kept up to date in order to ensure safe operation. Accordingly, the supplements and updates provided by Siemens AG should be inserted in the documentation promptly after their receipt.

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Contact

1 Product service

The Siemens AG operates agencies in all larger cities at home and in most countries of the world. Please contact the agency applicable to you with regard to replacement-part orders, requirements of personnel as well as requests for technical information.

2 Returns

Returning address

When returning parts to the supplier's works it is essential to use the proper address and forwarding mode and to include the necessary supplementary information in the consignment to ensure the smooth initiation of processing. Returns to the Erfurt works should be addressed as follows:

Siemens AG
Generatorenwerk Erfurt
Wareneingang
Werner-von-Siemens-Straße 1
D-99086 Erfurt

Accompanying information

In the event of questions concerning the proper address and forwarding mode, please contact the Erfurt works for detailed information. Every component which is returned to the works should be accompanied by the following information:

- Name of sender
- Company, department and name of person who made the arrangements for the return

In addition, the consignment should be accompanied by the following information:

- Reason for return
- Department of Siemens AG which is already dealing with the matter
- Number of the machine to which the component belongs (see generator rating plate or the cover sheet of this manual)
- Part number or order number

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Safety Instructions

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1 General

This section contains the relevant information necessary for safe operation of a generator.

Although the generator is designed to state-of-the-art technology and complies with the applicable safety standards, hazards which could result in personal injury to the user or third parties and damage to the generator or other property cannot be ruled out completely.

Please read this section carefully and make sure that you comply with the instructions in order to safeguard against personal injury and damage to the generator.

Please note that the safety information in this section is general and applies to different types of generators. In the individual chapters of this document, you will find safety notes that must be obeyed absolutely, for your own safety, to protect other people and to avoid damage to property.

Apart from the safety instructions in this section observe all indications on safety in the supplier documentations included in this manual.

2 Warnings

The operating instructions use a range of key words and symbols to identify information which is of particular importance. The key words **Danger**, **Warning**, **Caution** and **Notice** give you a better idea of the significance of the warning notices:

⚠ **DANGER** ... indicates an imminently hazardous situation which, if not avoided, **will** result in death or serious injury.

⚠ **WARNING** ... indicates a potentially hazardous situation which, if not avoided, **could** result in death or serious injury.

⚠ **CAUTION** ... indicates a potentially hazardous situation which, if not avoided, **may** result in minor or moderate injury.

NOTICE ... indicates a potentially hazardous situation which, if not avoided, **may** result in property damage.

NOTE Additionally, the signal word NOTE is used to identify any information relevant to ensure maximum generator efficiency.



Such kind of information can be complemented by the pictograph Information.

In order to emphasize the above mentioned warning notices, these are used together with pictographs. In this manual you will find the following hazard warning signs, mandatory signs and prohibition signs, which in each case are followed by an explanatory remark.

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Warning signs

A black graphical symbol inside a yellow triangle with a black triangular band defines a safety sign that indicates a hazard. For example:



General warning sign



Warning: Electricity

Prohibition signs

A black graphical symbol inside a red circular band with a red diagonal bar defines a safety sign that indicates that an action shall not be taken or shall be stopped.
For example:



General prohibition sign



No access

Mandatory signs

A white graphical symbol inside a blue circle defines a safety sign that indicates that an action shall be taken to avoid a hazard. For example:



General mandatory sign



Ear protection required

3 Proper Usage of the Generator

The function of a generator is to convert rotating mechanical energy to electrical energy. Alternatively generators are used as synchronous condensers.

To ensure normal and trouble-free operation of the generator, it is necessary to comply with the operating instructions as well as the inspection and maintenance intervals specified for the generator.

Siemens AG do not accept any liability for any damage which may occur as a result of use of the generator for any other purpose or noncompliance with the aforementioned operating instructions or inspection and maintenance intervals.

4 General Organization

The following instructions must be followed to ensure safe and reliable operation:

- Based on this technical documentation shift procedures must be prepared with additional information regarding responsibilities, work organization and workflows.
- Any personnel working on the generator and its auxiliary systems must be familiarized with the operating instructions and shift procedures and in particular with the safety instructions and regulations before starting work. This particularly ap-

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plies to personnel such as maintenance personnel who do not work on the generator on a regular basis.

- In addition to the operating instructions, the general legal provisions and other regulations for employment protection, the prevention of accidents and fire as well as the protection of the environment must be observed. The operator is responsible for the implementation and the correct adherence of the staff. Protective apparel and equipment must be used.
- Note safety data sheet when using hazardous material.
- Place signs at the entrance to the operating room of the generator according to the local legal and employment protection requirements. Every person who enters the operating room must wear personal protective equipment according to these local requirements and the requirements stated in this documentation.
- In case that equipment, protection systems or instrumentation and control components are damaged or defect, the generator must be handled as specified (shut down if necessary) and the supervisor must be informed. In some cases local authorities must be informed as well. The local authorities can conduct extraordinary examinations in an event of damage in some individual cases.
- It must be ensured that work on oil carrying systems and piping must be conducted after emptying. Switch off procedures must be strictly adhered. Special procedures for environmental and employment protection must also be considered.
- If work is done on several systems at the same time, it must be coordinated in a way to avoid mutual endangering.
- During start-up and synchronization of the generator only authorized staff with defined task is allowed to stay within the machine room.
- Only use suitable and faultless climbing equipment (e.g. ladders) for work in larger heights. Scaffolding can be necessary and further safeguards like anti-fall guard. Do not step on armatures, thermometers and the bearing.
- The use of pipes, cables, terminal boxes and fittings as a kick or hold is inadmissible. Parts get visible or invisible damages which may lead to a failure beside the danger of injury.
- The operating instructions must always be kept on hand.



NOTE

We recommend engaging the support and services of your local Siemens service center for all planning, installation, commissioning and maintenance work.

5 Personnel

With regard to personnel working on the generator, compliance must be ensured with the following:

- Work on the generator and its auxiliary systems is to be performed by authorized personnel only. Activities and associated responsibilities are to be clearly defined for the personnel.
- Staff must be trained on the basis of the manufacturer technical documentation. They must be physically and mentally suitable for the tasks and must have the required expertise. Staff must be able to carry out maintenance measures inde-

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pendently and to take decisions in the case of disturbances or deviations from the stated operation condition independently. Depending on local regulations it can be required that these people have a certification from special trainings.

- Personnel requiring or undergoing training must only be allowed to perform work on the generator or its auxiliary systems under the constant supervision of an appropriately qualified member of staff.
- Work on the electrical systems of the generator may only be performed by electrical engineers or by suitably qualified personnel under the supervision of an electrical engineer in compliance with the relevant electrical engineering standards.
- The staff has to avoid dangers or reduce them as far as possible. This also contains the self-control of completed work. In addition, it has to be checked before work execution whether all necessary safety measures are taken.
- The operator's position during operation of the generator is the control room. Abidance near the generator is only permitted for inspection and attendance purposes which are required for the operation.

6 Lifting and Working Posture

When working on the generator make sure to comply with the local rules regarding lifting and working posture. All work shall be planned in order to be executed in a safe and healthy manner.

Lifting that can be a risk to health and safety shall be avoided. The usage of lifting equipment should be preferred for all lifting workings at the generator. This applies to all generator equipment such as filters, manhole covers etc. Observe the local requirements regarding the recommended lifting weight and carrying distance.

7 Modifications to Generator

Do not carry out any modifications to the generator or perform any other work on the generator which might impair safety. Any changes must be approved by Siemens AG prior to their implementation.

8 Spare Parts and Special Tools

Spare parts and special tools must comply with the technical standards set forth by Siemens and other suppliers. Compliance with the aforementioned standards is only ensured if original parts and tools are used. Special tools should only be used as intended by Siemens or the supplier.

Spare parts and special tools must be stored in a way to ensure quality and functionality. Further requirements from the supplier documentations must be fulfilled including the guarantee conditions. The spare parts and special tools should be checked at regular intervals.

Do not remove any blocks, braces, anchors and/or cushions used during shipment until just before erection or installation of spare parts.

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9 Environment Protection and Waste Disposal

Waste products of any kind (e.g. lubricants) must be disposed of in compliance with the applicable waste disposal regulations. An environmentally friendly disposal (recycling e.g.) has to be striven.

For the de-installation and professional disposal of the generator experts of Siemens AG have to be contacted.

10 Safety Instructions Regarding Special Operating Phases

10.1 Shipment, Transport and Storage

The following safety instructions apply during generator shipment, transport and storage:



⚠ WARNING

Suspended load

Falling loads may cause injury to persons.

- Keep safe distance. Place barriers if necessary.
- Only use specified load attachment points. Only use suitable lifting equipment. The lifting equipment must be in good condition and have a sufficient load carrying capacity.

- Refer to the shipping documents for information about the dimensions and weights of generator components.
- For transportation of heavy machine parts in buildings a sufficient load-capacity of the building has to be guaranteed along the complete transport route as well as at the operation or stock location.
- Prevent generator rotor from rope-induced damage by using suitable cushions at load attachment points. Hitch ropes to fully extracted bollards only. Insert and lock bollards during transport.
- Carefully check components for evidence of damage, moisture and corrosion on arrival. Notify manufacturer in written and photo documentation of any damage.
- If transport locks must be removed for the purpose of control of the components, these guards must be reattached and removed just before installation of the components.
- Adhere to all measures for protection during transport described in this manual.
- Take appropriate measures to protect and preserve the generator at standstill. Observe the storage instructions in this manual.
- Fill in the generator packing checklist for long time storage, if necessary. Storage goods must be checked monthly.

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10.2 Erection

The following safety instructions apply during generator erection:



⚠ CAUTION

Crushing hazard

These may cause injury to persons.

- Installation, raising, transporting of heavy objects only with the help of hoists.

- Before erection remove protective coating and any other protective material from components using a suitable cleaning agent. Observe environmental regulations.
- Check the generator for foreign objects. Even minimal-size metallic particles left inside after work on the generator can lead to large-scale damage during generator operation.
- If it is necessary to open parts of the system the openings must be covered. The used covers must be sufficiently exact and stable to prevent a contamination with foreign material.
- Use only suitable lubrication and seal material for the respective purpose. They must comply with the later operation conditions.

10.3 Start-up

The following safety instructions apply during generator start-up:



⚠ WARNING

Rotating components

These may cause injury to persons.

- Before commencing with generator start-up ensure that personnel are not exposed to any hazards. The start-up sequence must be adhered.

- All mechanical and hydraulic components as well as the generator protection system must be checked with regard to function and settings.
- Before start-up/ re-commissioning all components must be checked for safety and for recognizable defects. Defective parts and systems must be repaired before start-up.
- Obligatory documentation requirement: Prepare start-up record. Record all operating data after allowing sufficient time for steady-state conditions to be established.

10.4 Operation

The following safety instructions apply during generator operation:



⚠ CAUTION

Hot surface.

Parts of the generator can be very hot and may cause serious burns.

- Do not touch.

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⚠ CAUTION

Operating noise of generator may damage hearing.

- Wear ear plugs when staying next to the operating generator.

- Any irregular events which occur during operation must be reported directly, and the generator shut down if necessary.
- In the event of loss of control voltage the generator must be shut down immediately.
- Only qualified staff with a specified work order should stay near the running generator.
- Obligatory documentation requirement: Record requisite checks during generator operation.

10.5 Maintenance in Operation

The following safety instructions apply during generator maintenance in operation:



⚠ WARNING

Rotating components

These may cause injury to persons.

- Ensure compliance with the scope of work set forth in the maintenance instructions.
- Do not remove any safeguard during operation.

- Operating personnel must be notified before starting any maintenance work. Appoint a suitably qualified supervisor.
- Empty pockets before starting maintenance work. Remove jewelry and other metal objects. Record all tools used in a list and check that tools have been completely removed from generator when finishing work.

10.6 Maintenance at Standstill

The following safety instructions apply during generator maintenance at standstill:



⚠ WARNING

Danger of serious injuries and substantial material damage.

- The machine must be electrically disconnected.
- Identify all additional dangerous sources of energy e.g. compressed air, hydraulic systems, water.
- The machine must be secured against being switched on accidentally.
- A notice must be attached in the control room that work is in progress.

- Parts which are undergoing inspection or repair activities must be de-energized. Disconnected parts must be checked for voltage, grounded and short-circuiting. Neighboring energized parts must be isolated and covered.
- It must be ensured that the generator cannot be switched on if somebody is working on it. It has to be made sure that no one stays in an area where it could come to injuries during start-up process.

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- The removal of safeguards must be avoided. It is only allowed when it is required for the work and does not endanger the staff. Removed safeguards must be re installed and checked just after the work task.
- Switch pressurized systems off before starting to work on it. Take care of ram pressures. Loosen screw connections carefully.
- Disconnect cable connections to electrical devices and ground terminals before lifting any cover. Remove electrical devices before dismantling components.
- Check the generator for foreign objects. Even minimal-size metallic particles left inside after work on the generator can lead to large-scale damage during generator operation.

10.7 Shutdown

The following safety instructions apply during generator shutdown:



⚠ WARNING

Rotating components

These may cause severe injury to persons.

- Ensure that rotor has coasted down.
- Do not remove any guards until generator has come to a full standstill.

- Obligatory documentation requirement: Record requisite checks during and following generator shutdown.

11 Special Hazards

11.1 Electric Current

Ensure compliance with the following instructions:



⚠ DANGER

Electrical hazard

Touching electrical equipment during operation can result in damage to property, serious injury and even death.

- Do not remove any safeguards or open cabinets during operation.

- Work on the electrical systems of the generator may only be performed by electrical engineers or by suitably qualified personnel under the supervision of an electrical engineer in compliance with the relevant electrical engineering standards.
- Local requirements regarding work on electrical installations must be strictly adhered to.
- For all work on electrical installations observe the five safety rules:

  1 Disconnect from the mains

  2 Secure against reconnection

  3 Verify that the system is dead

  4 Carry out earthing and short circuiting

  5 Provide protection from adjacent live parts.

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- During operation very high voltages occur, which can remain in existence for long periods of time even after switching off due to remanence or discharge of capacitors. As long as the generator is still rotating it carries a dangerous voltage. Do not touch the equipment before all 5 rules are fulfilled.
- Regularly check the electrical equipment, grounding system and isolation levels. Immediately repair any defects.

11.2 Electromagnetic Fields



⚠ WARNING

Electromagnetic fields are generated during the operation of the generator.

Electromagnetic fields can interfere with electronic devices. This could lead to malfunction of such devices.

- Therefore persons with active medical implants must not enter these areas.

- The system operator must put appropriate measures, markings and warnings into effect so that the personnel working there are sufficiently protected against possible injury. Also observe the local requirements.

11.3 Heat



⚠ WARNING

Hot surface

Parts of the generator can be very hot and may cause serious burns.

- Do not touch.

- The surface of oil lines, covers etc. become hot during operation.
- The surface of anti-condensation heaters switched on automatically during standstill becomes hot.

11.4 Noise



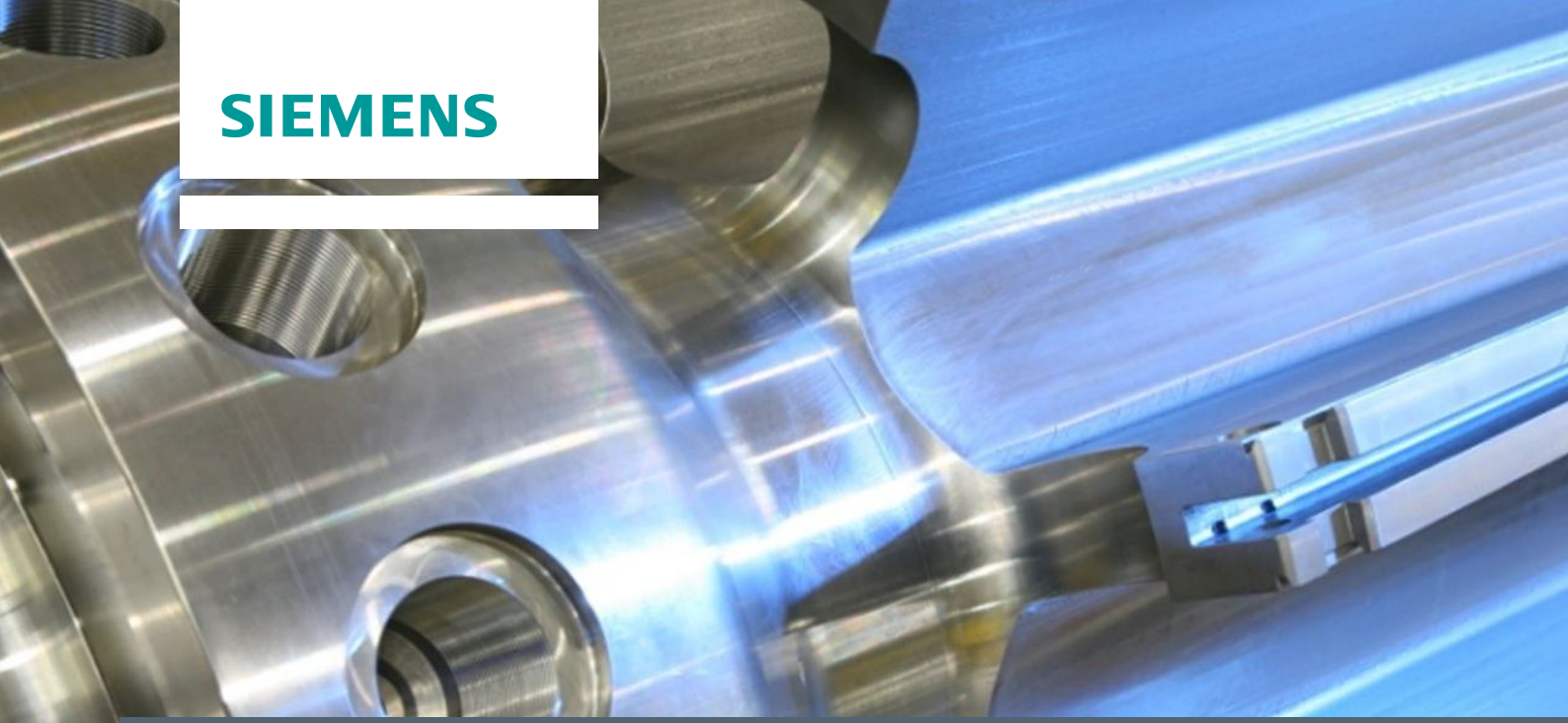
⚠ CAUTION

Operating noise of generator may damage hearing.

- Wear ear plugs when staying next to the operating generator.

- The generator may produce noise levels of approx. 90 dB(A) depending on model and type. In the long term such noise levels may result in damage to hearing.

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Description of the System/ Plant Section 2

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2.1 Technical Data

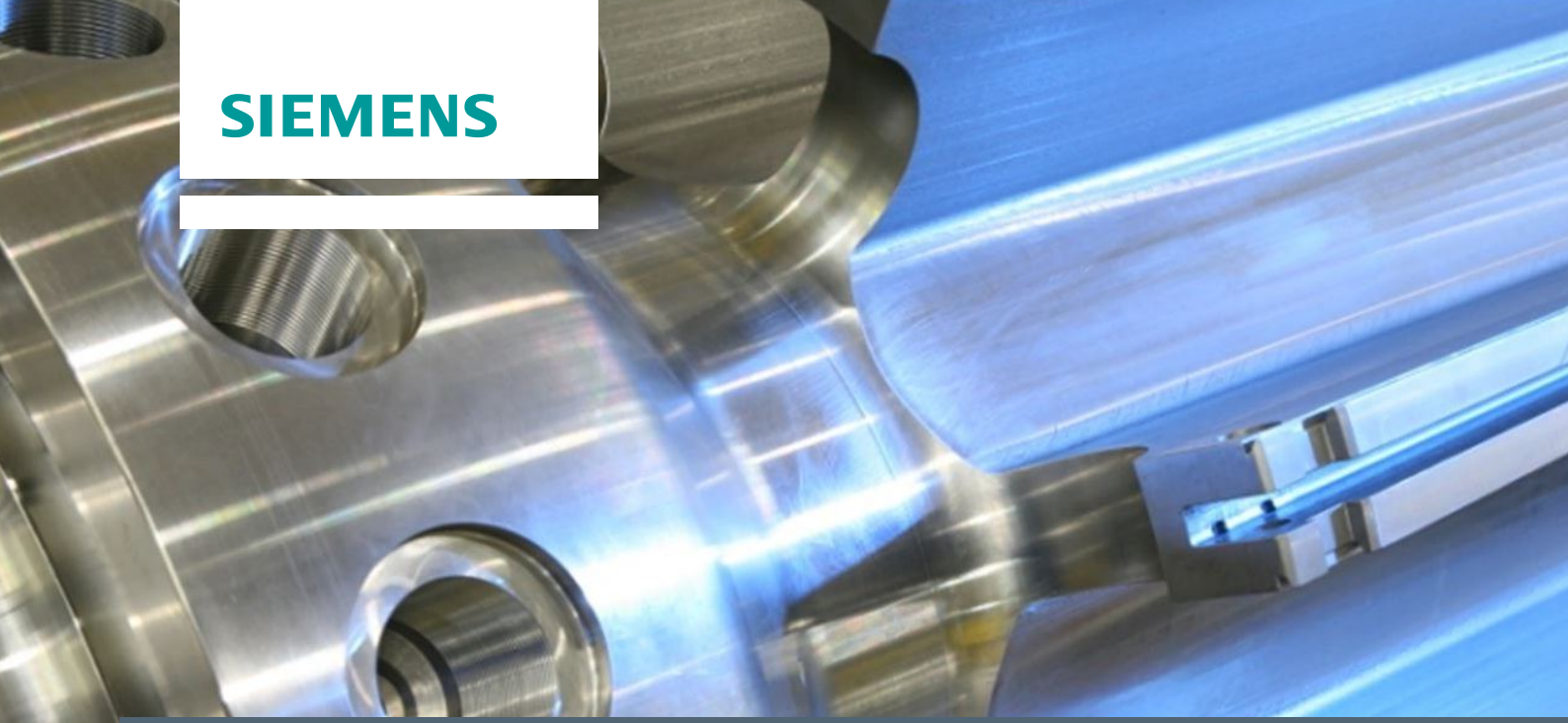
2.2 Description of the Main Assemblies

2.3 Components and Purchased Parts

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Turbogenerator | Operating and Maintenance Manual

Description of the System/ Plant Section 2

Technical Data 2.1

Contents

- Identification Data
- Rating Plate Data
- Extract of Technical Data
- Excitation Data Sheet
- Mechanical Data
- Oil Specification
- Coat of Paint
- Generator Labels

Identification Data	Generator
Code word	Vilnius Biomass
Type	SGen5-100A-2P
Year of construction	2018
Machine number	EG000367
Serial number of rotor	31149061
Serial number of stator	31129867

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Rating Plate Data

Kind of machine:	Generator	Serial no.	31129867	Year of manufacture:	2018
Machine code:	SGen5-100A-2P	Machine No.:	EG000367	Direction of rotation:	CCW
No. of phases: Connection:	3 Y	Frequency:	50 Hz	Rated speed:	3000 rpm
Range of rated voltage:	15000 V +5/-5%	Phase sequence:	U1 V1 W1	Operating mode:	S1
Rated power:	93176 kVA	Rated current:	3586 A		
Type of excitation:	Self-excitation	Rated power factor:	cos φ = 0,85	Type of construction:	IM 7215
Insulation class:	F	Type of cooling:	Air cooling	Degree of protection:	IP 54
Temperature rise corresponds to class:	B	Cooling air temperature:	50 °C		
Total weight:	141700 kg	Standard:	IEC 60034		
Rotor weight:	24800 kg	Stator active part + base frame weight:	96000 kg		

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GENERATORS

for Steam- and Gas-Turbines

TECHNICAL DATA FOR GENERATOR OFFER WE16284

Type: SGen5-100A-2P 092-30 M07

FOR THE PROJECT

Vilnius Biomass

S_N =	93,176 MVA	PF =	0,85		
U_N =	15,00 kV	f_N =	50 Hz	Design corresponds to:	
I_N =	3,586 kA	n_N =	3000 rpm	IEC 60034	

CONTENT OF THIS FILE

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US and EU Export Controls		
Technology Classification: ECCN: **EAR99**	AL: **N**	US-Content: **No**
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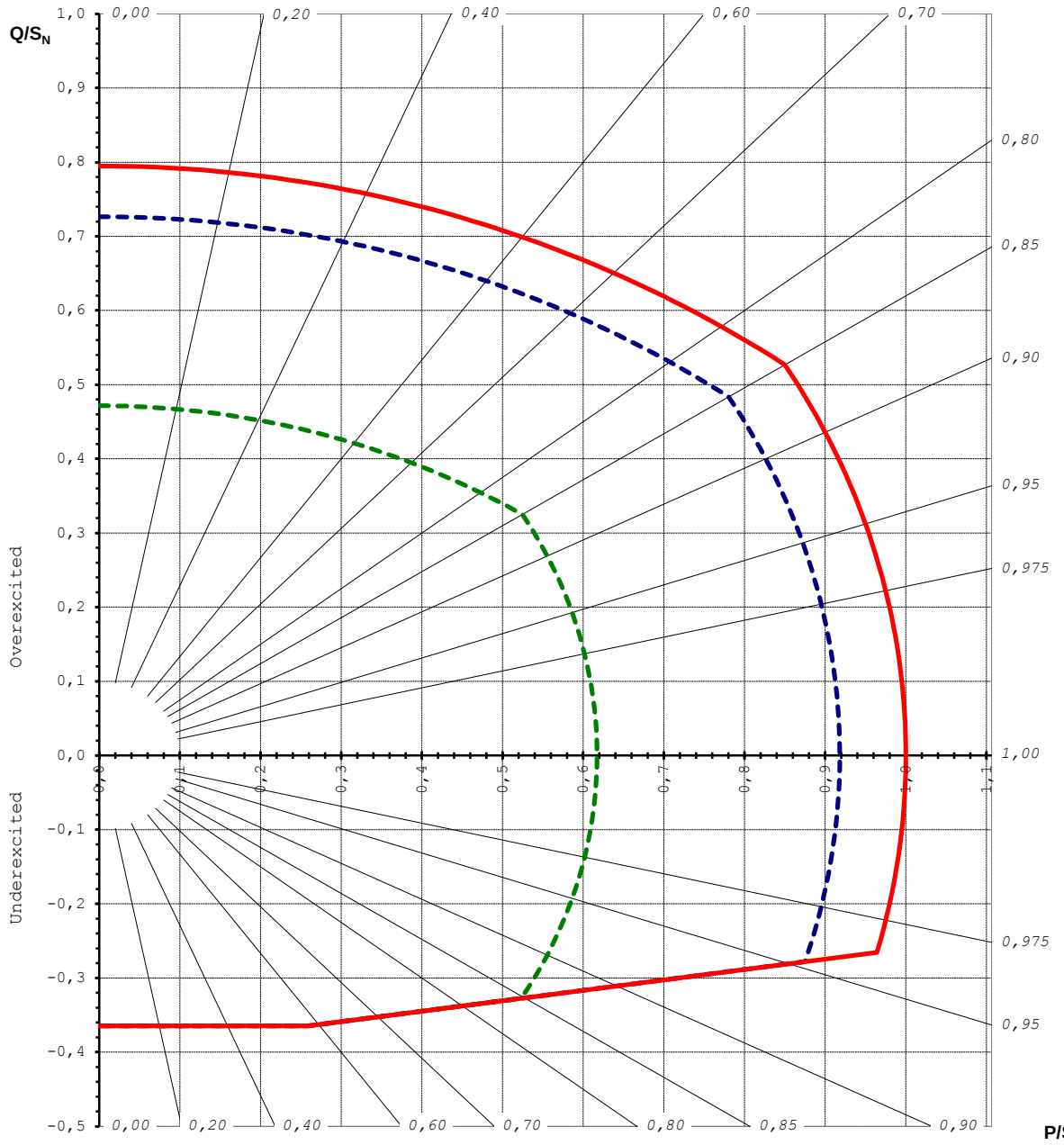
The given data are calculated values (if not indicated differently)

Generator Type: **SGen5-100A-2P 092-30 M07**

Load Point						N		A		B	
Standard						IEC 60034		IEC 60034		IEC 60034	
Thermal Classification: Design / Using						F / B		F / B		F / B	
Apparent Power	Active Power			MVA	MW	93,176	79,20	85,541	72,71	57,50	48,875
Cold Air Temp.	Cooling Water Temp.			°C	°C	50,0	45,0	50,0	45,0	66,0	61,0
Voltage				kV		15,00		15,00		15,00	
Voltage Deviation		+	-	%		5,0	5,0	5,0	5,0	5,0	5,0
Armature Current				kA		3,586		3,292		2,213	
Frequency	Speed			Hz	rpm	50	3000	50	3000	50	3000
Power Factor				-		0,85		0,85		0,85	
Excitation Requirements	No load	I_{f0}	U_{f0}	A	V	274	67	274	66	274	65
	4/4-load	I_{fN}	U_{fN}	A	V	875	213	817	195	614	146
	5/4-load	$I_{f5/4}$	$U_{f5/4}$	A	V	1059	258	982	235	716	171
Cooling Air	Losses			kW		1051		964		708	
	Air flow	Temp. rise		m^3/s	K	24,0	41,9	24,0	38,4	24,0	28,2
Sudden-SCC at No-Load and Nominal Voltage	I_S: 3-phase (peak)			kA		53		53		53	
	I_{K3}: 3-ph. (sustained at I_{fN})			kA		4,8		4,5		3,4	
	I_{K2}: 2-ph. (sustained at I_{fN})			kA		7,7		7,2		5,4	
Short Circuit Ratio				(tol. ± 5%)		**0,42**	(≥ 0,40)	0,46		0,68	
Reactances	x''_d	unsat.	sat.	%	%	21,1	**17,1**	19,4	15,7	13,0	10,5
	x'_d	unsat.	sat.	%	%	30,3	27,3	27,9	25,1	18,7	16,8
calculated values, tolerance **+/-15%** acc. IEC 60034-3 (**+/-10%** for x"d)	x_d	unsat.	sat.	%	%	255	238	234	218	157	147
	x''_q	unsat.	sat.	%	%	23,2	18,8	21,3	17,2	14,3	11,6
	x'_q	unsat.	sat.	%	%	54,4	49,2	49,3	44,6	32,9	29,8
	x_q	unsat.	sat.	%	%	242	206	222	189	150	127
	x_2	unsat.	sat.	%	%	22,1	17,9	20,3	16,5	13,7	11,1
	x_0	unsat.		%		11,0		10,1		6,8	
	x_{leak}	unsat.		%		16,6		15,2		10,2	
Time constants at 95°C winding temperature	T''_d	T_q''		s	s	0,029	0,073	0,029	0,075	0,029	0,075
	T'_d	T_q'		s	s	1,005	0,442	1,005	0,436	1,005	0,432
	T'_{d0}	T_{q0}'		s	s	9,079	2,500	9,079	2,500	9,079	2,500
	T''_{d0}	T_{q0}''		s	s	0,043	0,150	0,043	0,150	0,043	0,150
	T_a			s		0,329		0,329		0,329	
Resistance at 20°C	Stator winding / phase			mΩ		3,00		3,00		3,00	
	Rotor winding			mΩ		182,88		182,88		182,88	
Voltage regulation	PF = rated P.F.			%		42,7		40,7		32,8	
	PF = 1,00			%		37,0		35,0		26,0	
Max. unbalanced load	Continuous			%		8		8		8	
	Short time $i_2^2 * t$			s		8		8		8	
Power at PF = 0	Underexcited			Mvar		34,0		34,0		34,0	
	Overexcited			Mvar		74,1		67,7		43,9	
Winding temp. rise	Stator (RTD)			K	°C	66	116	59	109	39	105
Winding temp.	Rotor (average)			K	°C	55	105	49	99	32	98
Losses	Bearing losses			kW		60		60		60	
	Windage losses			kW		260		260		260	
	Core losses			kW		169		169		169	
	Short circuit losses			kW		398		336		152	
	Rotor I^2R losses			kW		190		166		93	
	Total losses			kW		1077		990		734	
Efficiencies with / without tol.	4/4-load			%	%	**98,66**	**98,55**	98,66		98,52	
at brushless excitation	3/4-load			%	%	98,61	98,49	98,58		98,28	
and rated P.F.	2/4-load			%	%	98,36	98,20	98,27		97,71	
(incl. bearing losses)	1/4-load			%		97,29	---	97,08		95,86	

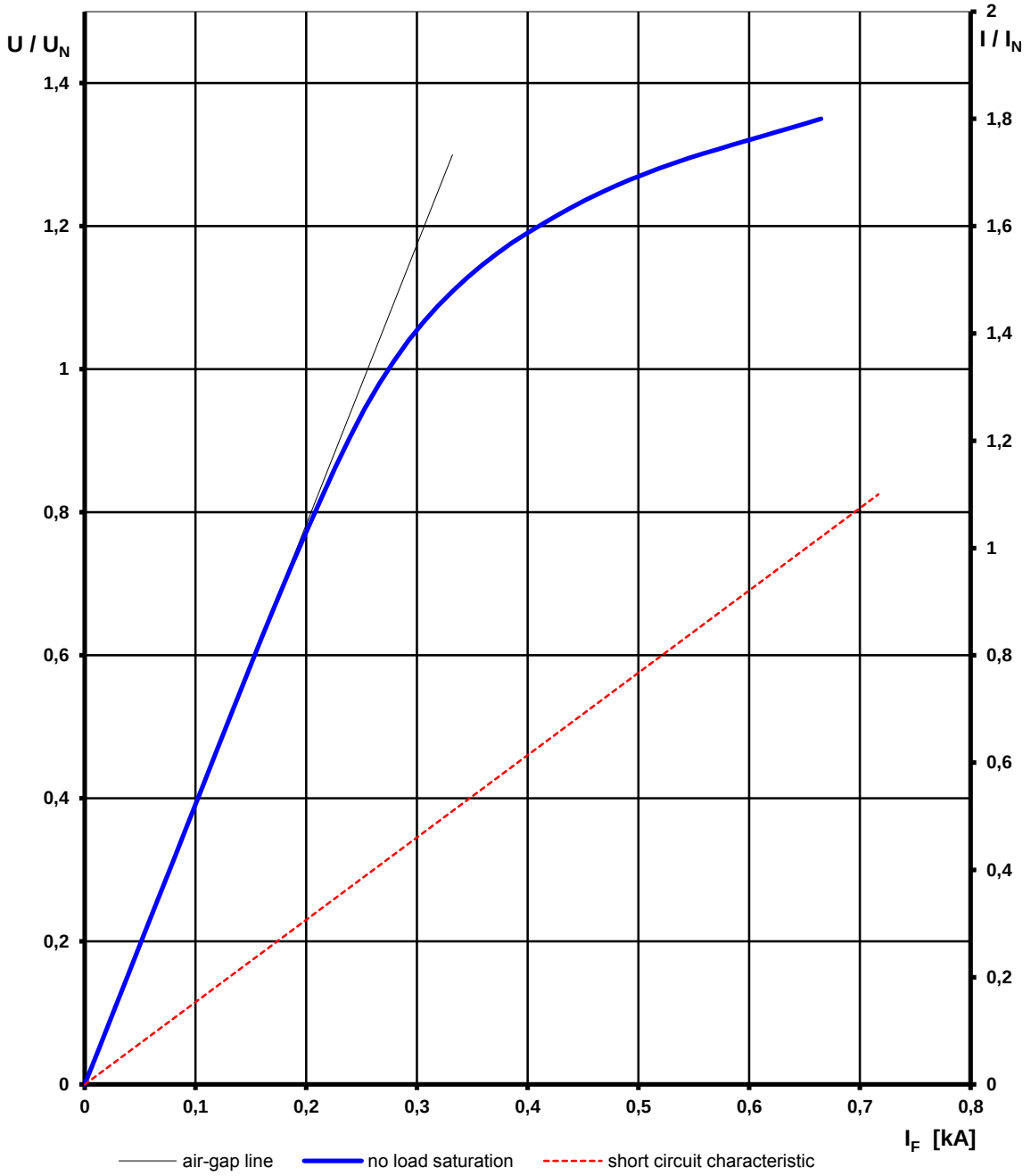
Generator - Type: SGen5-100A-2P 092-30 M07

Load Point	Rated	A	B
S_N =	93,176 MVA	85,541 MVA	57,50 MVA
U_N =	15,00 kV	15,00 kV	15,00 kV
I_N =	3,586 kA	3,292 kA	2,213 kA
f_N =	50 Hz	50 Hz	50 Hz
PF =	0,85	0,85	0,85
$T_{Cold\ Air}$ =	50,0 °C	50,0 °C	66,0 °C



Generator - Type: SGen5-100A-2P 092-30 M07

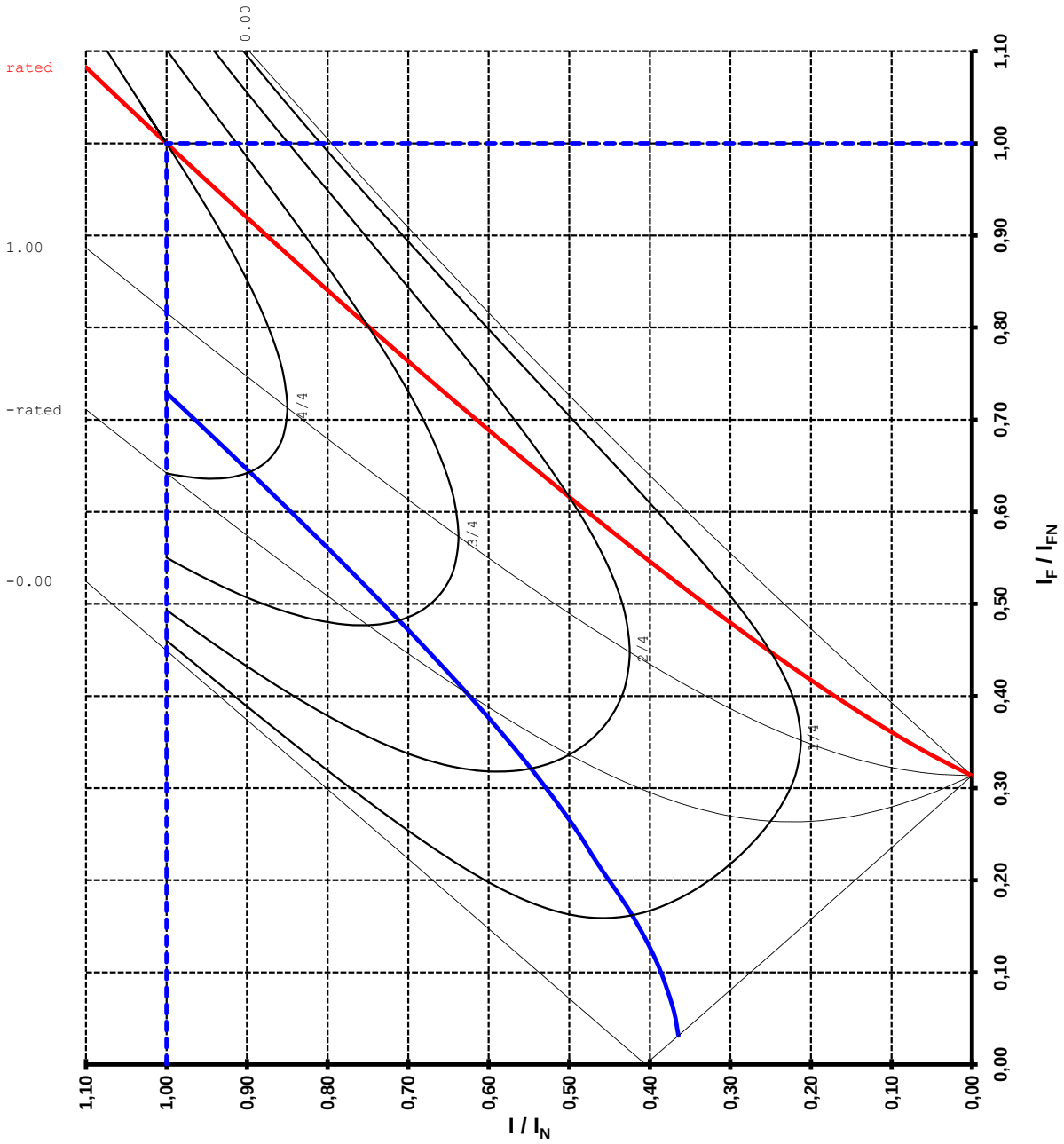
S_N =	93,176 MVA	PF =	0,85	S(1,0) =	7,3 %
U_N =	15,00 kV	SCR =	0,42	S(1,2) =	33,8 %
I_N =	3,586 kA	I_{f0} =	274 A		
f_N =	50 Hz	I_{fk} =	651 A		



Generator - Type: SGen5-100A-2P 092-30 M07

S_N =	93,176 MVA	PF =	0,85	I_{f0} =	274 A
U_N =	15,00 kV	f_N =	50 Hz	I_{fN} =	875 A
I_N =	3,586 kA	$T_{Cold\ Air}$ =	50,0 °C		

V-Curves Refer to Apparent Power

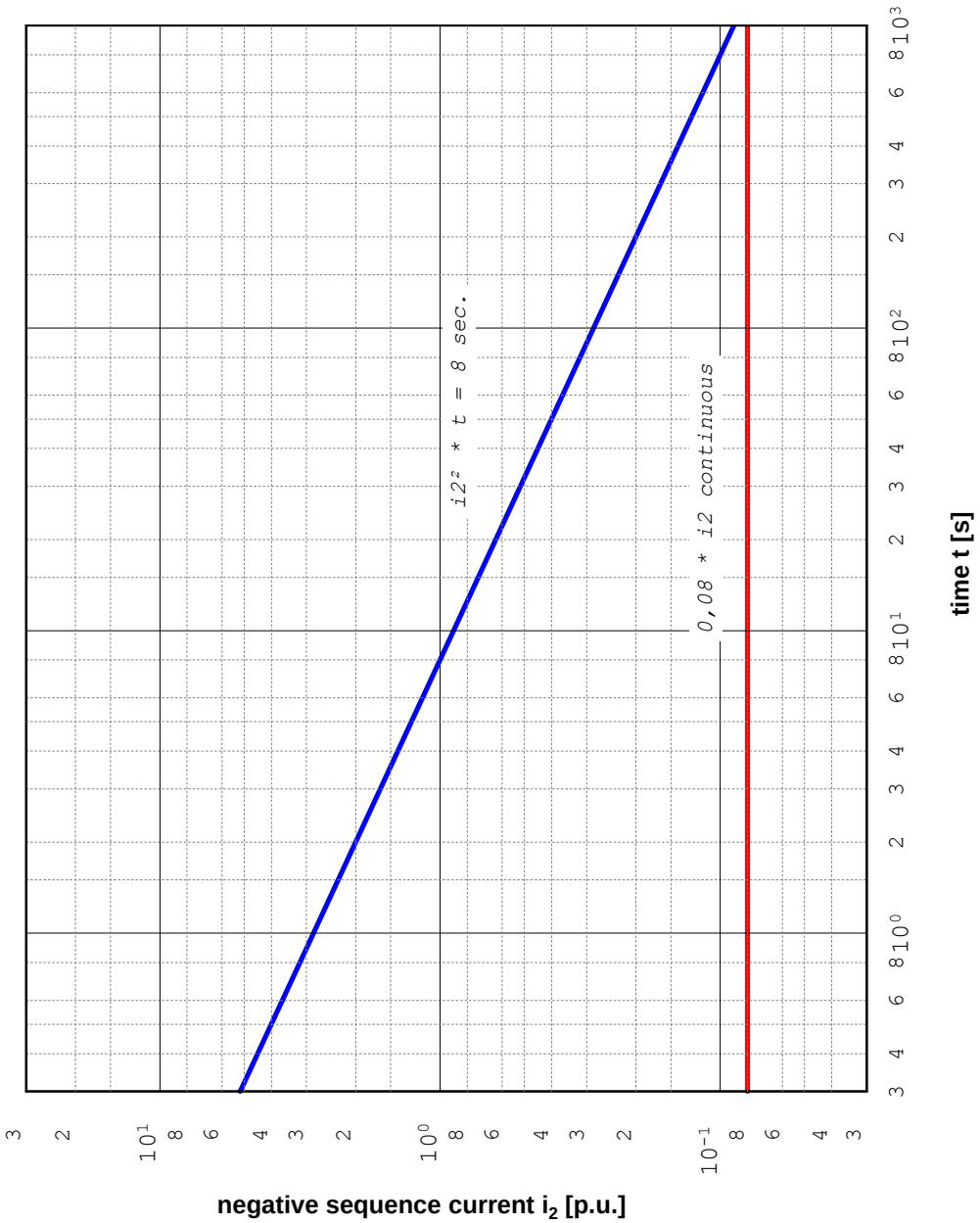


practical stability limit (rotor angle safety margin at 82 degrees)

heating limit of stator and rotor winding

Generator - Type: SGen5-100A-2P 092-30 M07

S_N =	93,176 MVA	PF =	0,85	$T_{Cold\ Air}$ =	50,0 °C
U_N =	15,00 kV	f_N =	50 Hz		
I_N =	3,586 kA	n_N =	3000 rpm		



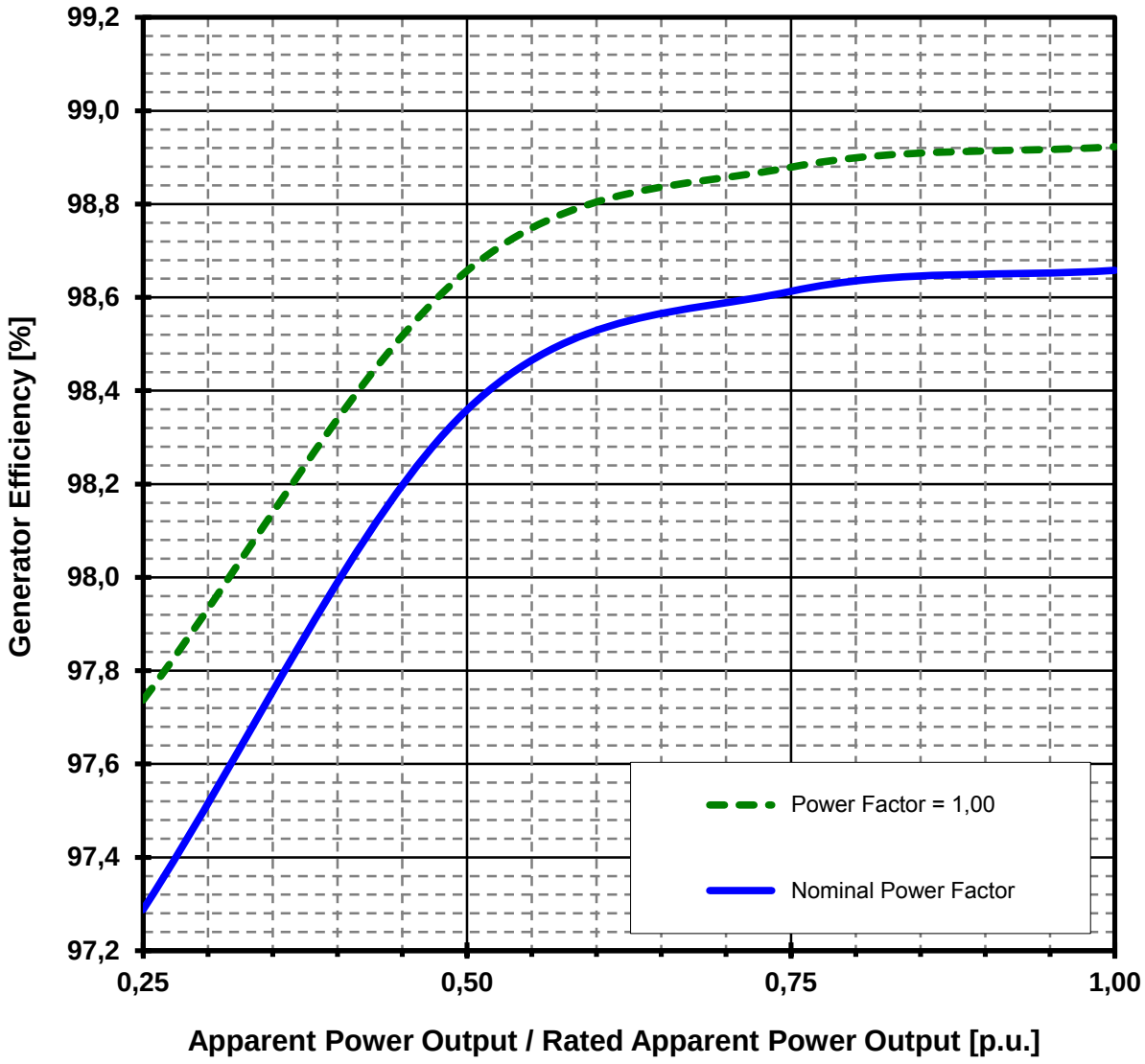
Max. permitted values of negative sequence current incl. percentage caused by harmonic load.

None of the phase currents may exceed the nominal current.

Generator - Type: SGen5-100A-2P 092-30 M07

S_N =	93,176 MVA	PF =	0,85	$T_{Cold\ Air}$ =	50,0 °C
U_N =	15,00 kV	f_N =	50 Hz	Efficiency acc. to:	
I_N =	3,586 kA	n_N =	3000 rpm	IEC 60034	

Apparent Power Output		MVA	23,3	46,6	69,9	93,2
		p.u.	0,25	0,50	0,75	1,00
Efficiency at P.F. =	1,00	%	97,74	98,66	98,88	98,92
	0,85	%	97,29	98,36	98,61	98,66

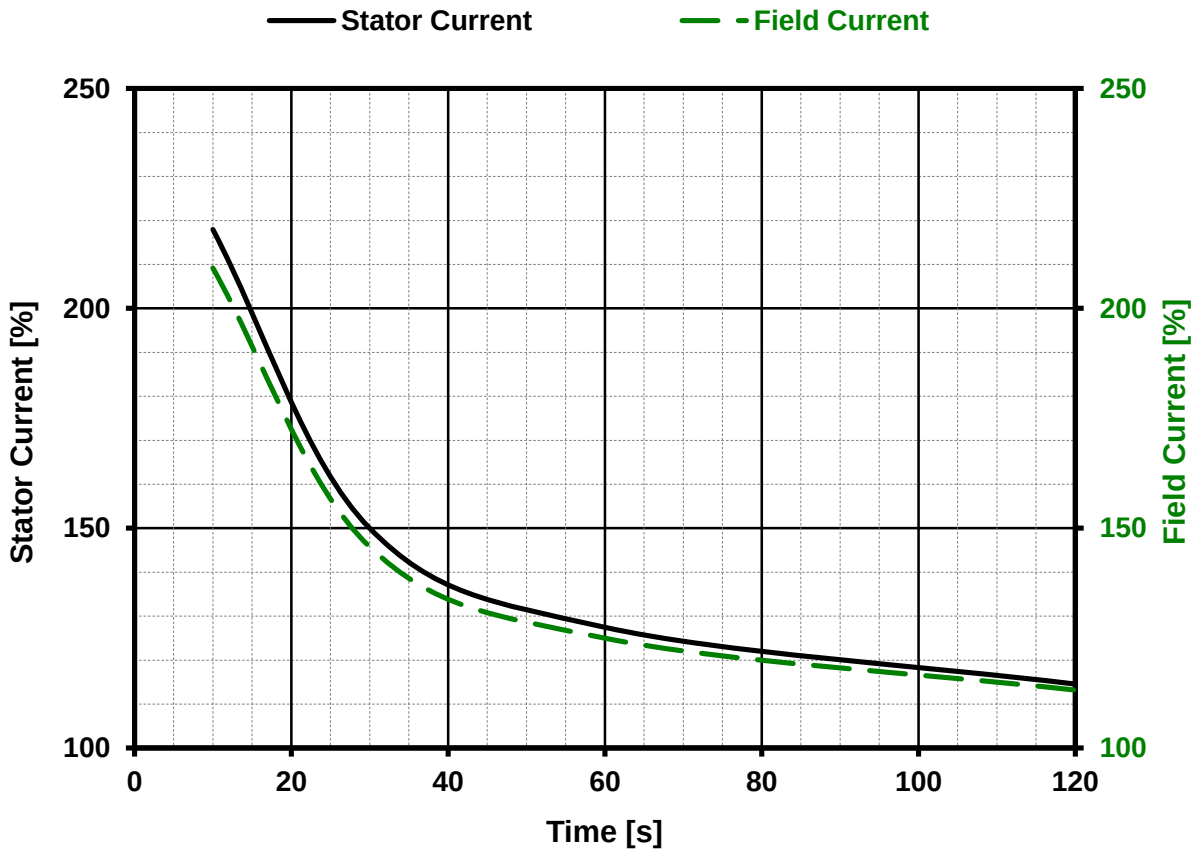


Generator - Type: SGen5-100A-2P 092-30 M07

S_N =	93,176 MVA	PF =	0,85	$T_{Cold\ Air}$ =	50,0 °C
U_N =	15,00 kV	f_N =	50 Hz	I_{fN}=	875 A
I_N =	3,586 kA	n_N =	3000 rpm		

Time [s]	10	30	60	120
Stator Current I/I_N [%]	218	150	127	115
Field Current I_f/I_{fN} [%]	209	146	125	113

Fullfills IEC and ANSI requirements



The generator is capable of operating at 150 percent of rated stator current for 30 sec.

The generator field winding is capable of operating at 125 percent of rated load field current for 1 min.

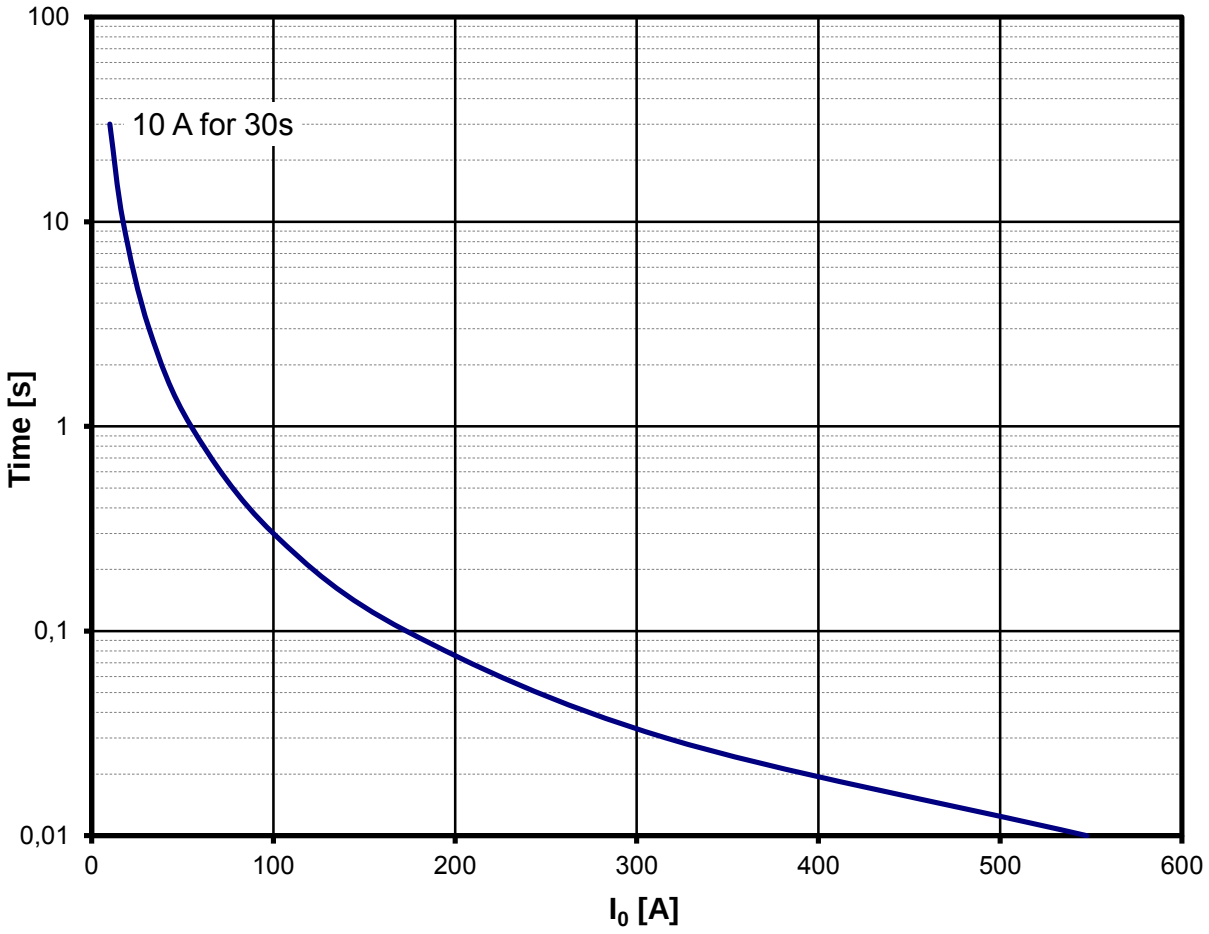
Both requirements are fullfilled starting from stabilized temperatures at rated conditions.

It is recognized that winding temperatures under these conditiones will exceed rated-load values.

Number of such operations should be limited to two times a year (corresponds to ANSI and IEC).

Generator - Type: SGen5-100A-2P 092-30 M07

S_N =	93,176 MVA	PF =	0,85	$T_{Cold\ Air}$ =	50,0 °C
U_N =	15,00 kV	f_N =	50 Hz		
I_N =	3,586 kA	n_N =	3000 rpm		



I_0 [A] Ground fault current over neutral point to earth

Time [s] Limitation time for I_0 to prevent damage from stator iron core

Diagram basis is $I^2 * t$ = const.; 10 A for 30 s is Siemens standard for dimensioning earthing.

When exceeding limitation curve, stator iron is endangered melting in the fault region.

Worst case is earth fault on phase side (opposite to neutral point side) of winding.

In that case the potential of neutral point changes from zero to phase-to-phase-voltage / √3.

Fault current and recommended trip time depend on earthing resistance.

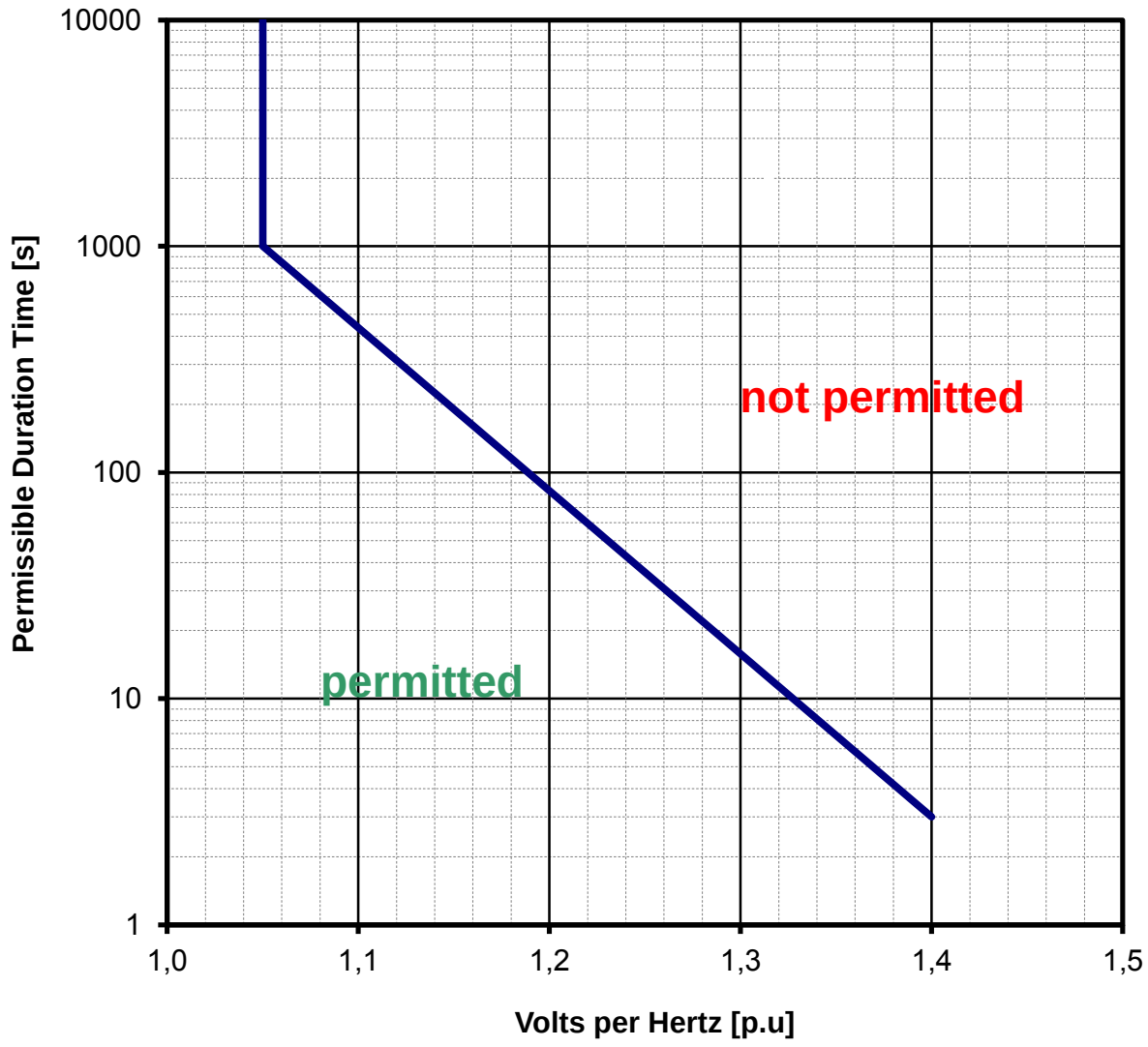
Generator - Type: SGen5-100A-2P 092-30 M07

S_N =	93,176 MVA	PF =	0,85	$T_{Cold\ Air}$ =	50,0 °C
U_N =	15,00 kV	f_N =	50 Hz		
I_N =	3,586 kA	n_N =	3000 rpm		

Limits for continuous operation with nominal load (S1)

Voltage max.:	+5,0 % 1)	**Frequency max.:**	+2,0 %
Voltage min.:	-5,0 %	**Frequency min.:**	-2,0 % 1)

1) In case of overvoltage and underfrequency at the same time the sum of both deviations for continuous operation is limited to: 5,0 %



Siemens AG	Excitation Data Sheet *Erreger- und Reglerangaben*	Rev.	Printed at *Druck am*
E F PR GN ERF EN 3	**Vilnius Biomass**	**A**	19.12.2017

Generator — SGen5-100A-2P 092-30 M07

Generator-Number / *Generator-Nummer*: **EG000367**

S_N =	93,18	MVA	
U_N =	15,00	kV	+5/-5%
I_N =	3,586	kA	
f =	50	Hz	
n =	3000	min-1	
cos φ =	0,85		

Cold Air Temp. / *Kaltlufttemperatur*: Generator 50 °C; Exciter 50 °C 1)

Rotor Resistance / *Läuferwiderstand*: 20°C 183 mΩ; warm 243 mΩ

Direction of Rotation (view from turbine to generator) / *Drehrichtung bei Sicht von Turbine auf Generator*: **Counterclockwise** / *gegen UZS*

Main Exciter Type — ELR 62/19-30/8-2S

Capability at 50 °C cold air temperature:

400 V	1400 A	560 kW	S1	
560 V	1820 A	1019 kW	10 sec.	

No Load Time Constant / *Leerlaufzeitkonstante*: 1,02 s (T'_{D0})

Load Time Constant / *Belastungszeitkonstante*: 0,68 s (T'_{DL})

Field-Resistance / *Feldwiderstand*: 20°C 4,268 Ω; warm 5,121 Ω

Pilot Exciter Type — ATE DC190/90/6

Frequency 150 Hz

Capability at 50 °C cold air temperature:

248 V	23,0 A	9,9 kVA	S1	
244 V	30,0 A	12,7 kVA	10 sec.	

Commut. Reactance (XCom) / *Kommutierungsreaktanz*: 0,114 Ω

1) Depending on cooling air circuit; Cold air temperature of exciter can be different from cold air temperature of generator.

Characteristics (Project Data) / *Kennlinien (projektbezogen)*

Generator- Load / *Generator-Belastungszustand*		Winding temp. / *Wicklungstemp.*	Generator I_f [A]	Generator U_f [V]	Main Exciter I_E [A]	Main Exciter U_E [V]	
No Load (0,50*U_N)	*Leerlauf (0,50*U_N)*	20°C	128	23	1,6	7	
No Load (0,80*U_N)	*Leerlauf (0,80*U_N)*	20°C	208	38	2,5	11	
No Load (0,95*U_N)	*Leerlauf (0,95*U_N)*	20°C	255	47	3,1	13	
No Load (1,00*U_N)	*Leerlauf (1,00*U_N)*	20°C	274	50	3,3	14	
No Load (1,00*U_N)	*Leerlauf (1,00*U_N)*	warm	274	67	3,7	19	
Rated Load	*Nennlast*	warm	875	213	11,8	60	S1
25% Overcurrent	*25% Überstrom*	warm	1059	258	14,3	73	S2 60 sec.
Peak Load (2-times)	*Stoßerregung*	warm	1750	426	23,7	122	S2 10 sec.

Excitation Response / *Auferregungsgeschwindigkeit*: 3,09 s^{-1} *acc. to IEC 60034* at 275 V Controller Voltage / *Reglerausgangsspannung*

Voltage rise at sudden discharge and rated excitation / *Generatorspannungsüberhöhung bei Entlastung und Nennerregung*: 42,7 %

Generated from order data table / *Erzeugt aus der Auftragsdatentabelle*	Checked / *Geprüft*
K:\ALLE\DATEI\S472\GENDATEN.XLS **Steiger, Enrico**	St/ 2017-12-19

Moments and Critical Speeds	**Moments and Speeds**	**Unit**
Maximal short-circuit torque of stator in single-phase two-winding short-circuit	2432	kNm
Polar mass moment of inertia for generator rotor	2374,9	kgm²
Critical speeds of rotor (calculated)	nk1 = 1233 nk2 = 3577	min^{-1}

Flow of Cooling Air Volume	**Volume**	**Unit**
Flow of cooling air	26	m³/s

Parts	**Weight**	**Unit**
Rotor complete	24800	kg
Stator active part	69000	kg
Base frame	27000	kg
Exciter	1000	kg
Bearing, intermediate frame	2900	kg
Cover	7000	kg
Cooling elements, cooler cover	6000	kg
Accessories mounted, anchoring	4000	kg
Total weight – generator	**141700**	**kg**
Max. shipment weight without weight of packing	131700	kg
Line side- and neutral point cubicle	4000	kg

Brushes, Brush Holders and Limits of Wear		**Rotor Grounding System**	**Rotor Ground Fault Protection**
Brush holders	drawing no.	06.00.0468.00	06.00.0468.00
	quantity	2	2
Carbon brush	drawing no.	EMT 513-005	EMT 513-005
	quantity	4	2
	new size	32 mm	32 mm
	smallest size	16 mm	16 mm

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1 Introduction

The present specification deals with the requirements concerning the mineral oils which may be used.

The respective oils are mineral oils on a paraffin basis, containing additives to increase protection against corrosion and resistance to aging.

Oils of other viscosity may be used only subject to our consent.

2 Requirements

Oils of viscosity classes ISO VG 32, ISO VG 46 and ISO VG 68 are used in accordance with DIN ISO 3448.

The oil must not contain additives which result in negative effects on the materials of the oil system. Moreover, the additives must not contain any metal-organic compounds (e.g. organic zinc compounds).

The oil should be of such quality that bearing temperatures of max. 120°C and oil temperatures of max. 90°C will not cause negative changes of the oil properties.

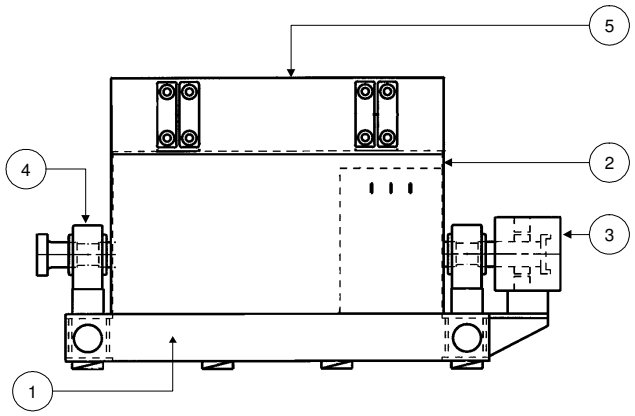
The oil must be of such quality that the persons working with the oil will not suffer any injury to their health as long as the necessary hygienic measures are taken and observed.

3 Requirements for State as Supplied

Test Criteria			Value	Unit	DIN Test	ASTM Test
Air-separation ability	at 50 °C	max.	5	min	DIN ISO 9120	D3427
Neutralization number		max.	0.20	mgKOH/g	51558	D974
Water content		max.	0.1	weight-%	51777	D1744
Foam behavoir	at 25 °C					
Foam formation		max.	400	cm³	-	D892
Foam stability	0 cm³	max.	450	s		
Water-separation ability		max.	300	s	51589	-
Kinematic viscosity	at 40 °C					
a) ISO VG 32		min.	28.8	mm²/s (cSt)	53019	D445
		max.	35.2			
b) ISO VG 46		min.	41.4			
		max.	50.6			
c) ISO VG 68		min.	61.2			
		max.	74.8			
Density	at 15 °C	max.	0.900	g/cm³	51757	D1298
Flash point						
a) ISO VG 32		min.	160	°C	ISO 2592	D92
b) ISO VG 46		min.	185	°C		
c) ISO VG 68		min.	240	°C		
Pour point, equal to or lower than			-5	°C	ISO 3016	D97
Degree of purity according to ISO 4406		min.	17/15/12	Code	ISO 4406	-
De-emulsification capability		max.	20	min.	DIN ISO 6614	D1401
Colour		max.	2	-	ISO 2049	D1500
Corrosive effect on copper		max.	2-100A3	-	-	-
Corrosive effect on steel		max.	O-B	-	-	-
Aging behavior						
Increase of neutralization number after 2500 h		max.	2.0	mgKOH/g	51587	D943

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Fig. 1: Generator components coated with paint (example illustration)



1 Base frame
2 Cover
3 Exciter machine
4 Bearing pedestal
5 Cooler cover
- Junction boxes

Application range:	According to DIN EN ISO 12944-5, category of corrosivity **C3 high**
Temperature range:	-30…120°C
Product properties:	• without lead, without chromium • temperature-stable: up to 100°C continuously, up to 120°C discontinuously • tropicalized • universally overcoatable
Surface preparation:	According to standard purity grade Sa 2 ½ - DIN EN ISO 12944-4

Coating:	**A**	**B**	**C**
Supplier, product:	International ® Intercure 200	International ® Intercure 420	International ® Interthane 990
Coating type:	2-components primer coating 2-K EP	2-components intermediate coating 2-K EP	2-components final coating 2-K PUR
Material:	Epoxy resin zinc phosphate/ micaceous iron ore	Epoxy resin-micaceous iron ore	Polyurethane laquer
No. of layers:	see product description	see product description	see product description
Dry film thickness:	60 µm	80 µm	60 µm
Application method:	see product description	see product description	see product description
Shade:	Red brown	Silver grey	RAL7030 (stone grey)
Surface gloss:	Matt	Matt	High gloss

Generator component	**Coating inside**	**Coating outside**	**Painted at**
Base frame	A + B + C		Workshop (manufacturer)
Cover	A + B + C		Workshop (manufacturer)
Exciter unit	A + B + C		Workshop (manufacturer)
Bearing pedestal	-	A + B + C	Workshop (manufacturer)
Cooler cover	A + B + C		Workshop (manufacturer)
Junction boxes (stainless steel)	-		-
Zinc - plated doors	-		-

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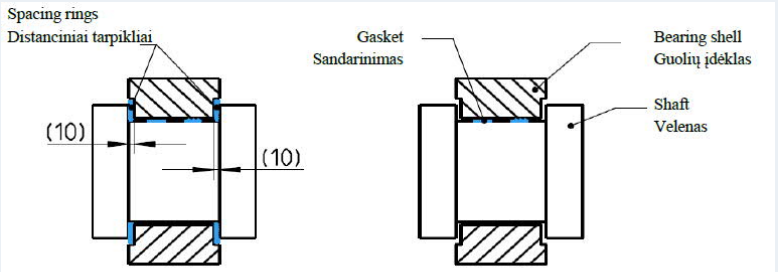
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SIEMENS AG Energy Sector	Zeichnungsnummer/DRAWING NUMBER: **DPPPG-70150703**		Index: **A**
	Datum/DATE:	Name/NAME:	ALTERNATE IDENTIFIER/ alternativer Identifizierer:
	geprueft/CHECKED: 19-04-2017	Goetz	22-SFA5100-70150703

For location of labels and signs see following drawings:

Generator Labels – General Drawing	DPPPG-70124658
Generator Labels – Exciter	DPPPG-70116685
Generator Labels – Cooler Cover	DPPPG-70033284

Pos. no.	Material	Label text / Sign meaning	Sign
10	Company nameplate	SIEMENS	-
20 / 25	Rating plate	*(see document 4.1-1001)*	-
30	Label	Guolio izoliacija NEprispausta BEARING INSULATION NOT SHORT-CIRCUITED.	-
40	Label	Guolio izoliacija prispausta BEARING INSULATION SHORT-CIRCUITED.	-
50	Label	Sukimo kryptis: DIRECTION OF ROTATION	
60	Label	Eksploatacijos metu priėjimo nėra! Pavojus dėl įtampingųjų dalių. Išjungus įrangą priėjimas tik apmokytam personalui. NO ACCESS DURING OPERATION! RISK DUE TO ELECTRICALLY LIVE PARTS. DURING MACHINE STANDSTILL ACCESS FOR TRAINED PERSONNEL ONLY!	-
80	Label	ATSARGIAI! Besisukančios dalys. ATSARGIAI! Pavojus paslysti. CAUTION! ROTATING PARTS. CAUTION! RISK OF SLIPPING.	-

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Pos. no.	Material	Label text / Sign meaning	Sign
100	Paper label on bearing (removed after installation)	 **Notice!** Remove transportation securing device (packing and spacing rings) from the bearings. **Dėmesio!** Prieš paleidžiant, iš guolių pašalinti transportavimo apsaugas (padėklus ir distancinis žiedus).	
110	Label	Prieš pakeliant aušintuvo gaubtą, atsukti įžeminimo ir viduje esančias elektrines jungtis. DISCONNECT GROUND TERMINALS AND INTERNAL ELECTRICAL DEVICES BEFORE LIFTING COOLER COVER.	-
120	Paper label on shipping top plate (removed after installation)	**Notice!** Strictly remove top plate during assembly! (Before setting in place of cooler cover / air filter unit) **Max. live load: 150 kg** **Dėmesio!** Paleidžiant būtinai nuimti lakštą! (prieš uždarant aušintuvo gaubtą / oro filtro bloką) **Maks. eismo apkrova: 150 kg**	
130	Label	Prieš atidarant guoljnuimti termometrą ir veleno vibracijosdaviklį. Nelipti antarmatūrų, termometrų ir guolių. REMOVE THERMOMETERS AND SHAFT VIBRATION SENSORS BEFORE DISMANTLING BEARING! DO NOT STEP ON AUXILIARY EQUIPMENT, THERMOMETERS AND BEARING PARTS!	-

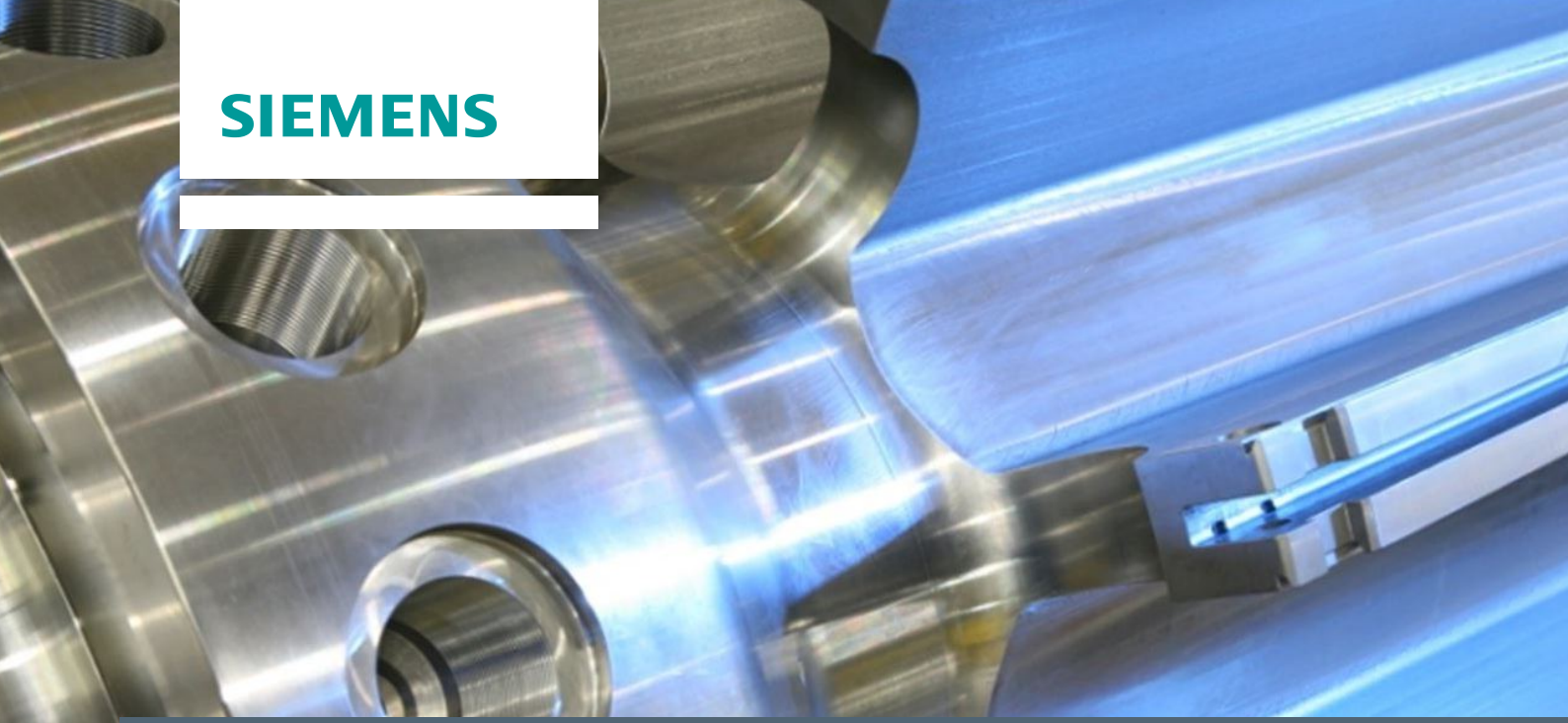
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Pos. no.	Material	Label text / Sign meaning	Sign
170	Paper label on labyrinth ring (removed after installation)	**Notice!** Adjust labyrinth rings as per drawing Axial and radial rotor clearances. **Dėmesio!** Nustatyti šukų žiedus pagal planą Ašiniai ir spinduliniai rotoriaus ciklai	
190	Label	Prieš nuimant gaubtą atsukti išplėtimo jungtis, apsaugas nuo žemės drebėjimo (jei yra), įžeminimo jungtis ir apsauginius varžtus. DISCONNECT FLEXIBLE LINKS, SEISMIC TIE-DOWN (IF EXISTING), GROUND TERMINALS AND LOCKING SCREWS BEFORE LIFTING COVER.	-
200	Paper label on Exciter	**Notice!** Before commissioning check and adjust every air gap of the exciter and secure the screwing connections of the labyrinth rings.	
230	Label	DĖMESIO! Aušinimo bloko inkaravimo taškas. NOTICE! LIFTING POINT FOR COOLER UNIT.	-
231	Label	Nenaudoti šios kėlimo kilpos visos mašinos kėlimui! Kėlimo kilpa pagrindinio gaubto: transportavimui / Pagrindinis gaubtas su papildomu gaubtu EG. Už kėlimo kilpos saugiai galima kelti tik komponentus, kurie yra tiesiogiai prie jos pritvirtinti. DO NOT USE THESE LIFTING EYES TO LIFT THE ENTIRE MACHINE. USE THE LIFTING EYE TO LIFT: MAIN COVER / MAIN COVER WITH EXTRA EE COVER. ONLY THE COMPONENT TO WHICH THE LIFTING EYE IS DIRECTLY ATTACHED CAN BE LIFTED SAFELY BY THE LIFTING EYE.	-
250	Label	Aušintuvosausoji masė iš viso: 7430kg COOLER UNIT TOTAL DRY WEIGHT: 7430 kg	-
280	Sign	*Danger: hot surface*	
290 / 295	Rating plate – exciter	*(see document 4.1-9021)*	

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Pos. no.	Material	Label text / Sign meaning	Sign
310	Sign	*Danger: magnetic field*	

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Description of the System/ Plant Section 2

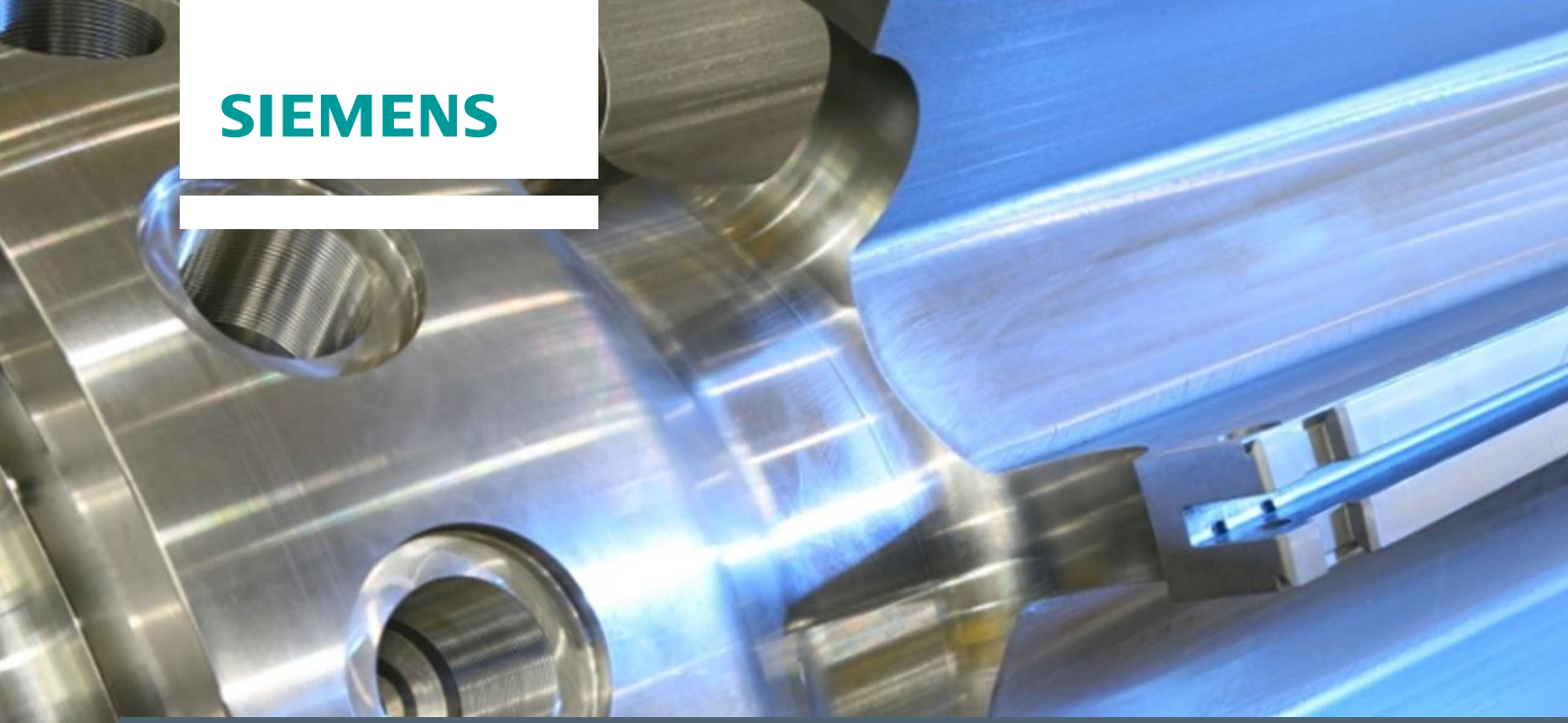
Description of the Main Assemblies 2.2

Contents

2.2.1 Generator – General

2.2.2 Stator

2.2.3 Rotor



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Description of the System/ Plant Section 2

Description of the Main Assemblies 2.2

Contents

2.2.1 Generator – General

- Design and Cooling System
- Design – Exploded View
- Generator Cooling Air Circuit

2.2.2 Stator

2.2.3 Rotor

1 General

The international standard **IEC 60034** is basis for the generator design. The insulation system is designed in heat resistance class F but used in class B.

The type of contruction is **IM 7215** (IEC 60034-7). The machine is placed on a base plate; the inductor runs in two pedestal bearings and has a coupling flange at the turbine end.

The cooling-air circulation is closed. The cooling elements are located above the core-and-coil assemblies.

The generator's degree of protection provided by the enclosure is **IP 54** (IEC 60034-5).

The exploded view (see document 4.1-1102) shows the schematic design of the machine. The machine's main component parts are described in detail in the corresponding sections of this manual.

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2 Main Design Groups

The generator basically consists of the following main parts:

- Base frame
- Stator core
- Stator winding
- Cover
- Rotor shaft
- Rotor winding
- Rotor retaining rings
- Bearings
- Field connections
- Exciter machine
- Cooler

Turbogenerator operation requires the following additional equipment:

- Lubrication oil supply
- Excitation equipment / voltage regulator
- Protection and monitoring system
- Synchronization equipment

3 Cooling System

The heat losses arising in the generator interior are dissipated through air.

Direct cooling of the rotor essentially eliminates hot spots and differential temperatures between adjacent components which could result in mechanical stresses.

Indirect air cooling is used for the stator winding.

4 Air Cooling Circuit

The cooling air for the generator is drawn by axial-flow fans arranged on the shaft legs via lateral openings in the housing.

The cooling air flow is divided into three flow paths after each fan:

Flow path 1 is directed into the rotor end winding space for cooling the rotor winding.

One part of the cooling air flows past the individual coils for cooling the rotor end windings and then leaves the end winding space via bores in the rotor teeth at the ends of the rotor body.

The other portion of the cooling air is directed from the rotor end winding space into the slot-bottom ducts where it is discharged into the air gap via a large number of radial ventilating slots in the coils and bores in the rotor wedges. Along these paths the heat of the rotor winding is directly transfered to the cooling air.

Flow path 2 is directed over the stator end windings to cold air ducts and into the cold air compartments in the stator frame space between the generator housing and the stator core. The air then flows into the air gap through slots in the core where it absorbs the heat from the stator core and stator winding.

Flow path 3 is directed into the air gap via the rotor retaining rings. The air then flows past the clamping fingers and via ventilating slots in the stator core into the hot air compartments in the stator frame. This flow path mainly coils the rotor retaining rings, the ends of the rotor body and the ends of the stator core.

Flows 2 and 3 mix in the air gap with flow 1 leaving the rotor. The cooling air then flows radially outward through ventilating slots in the core within the range of the hot air compartments for cooling further portions of the stator core and stator winding. The hot air is discharged to the cooling elements or to the air filter unit via exhaust ducts.

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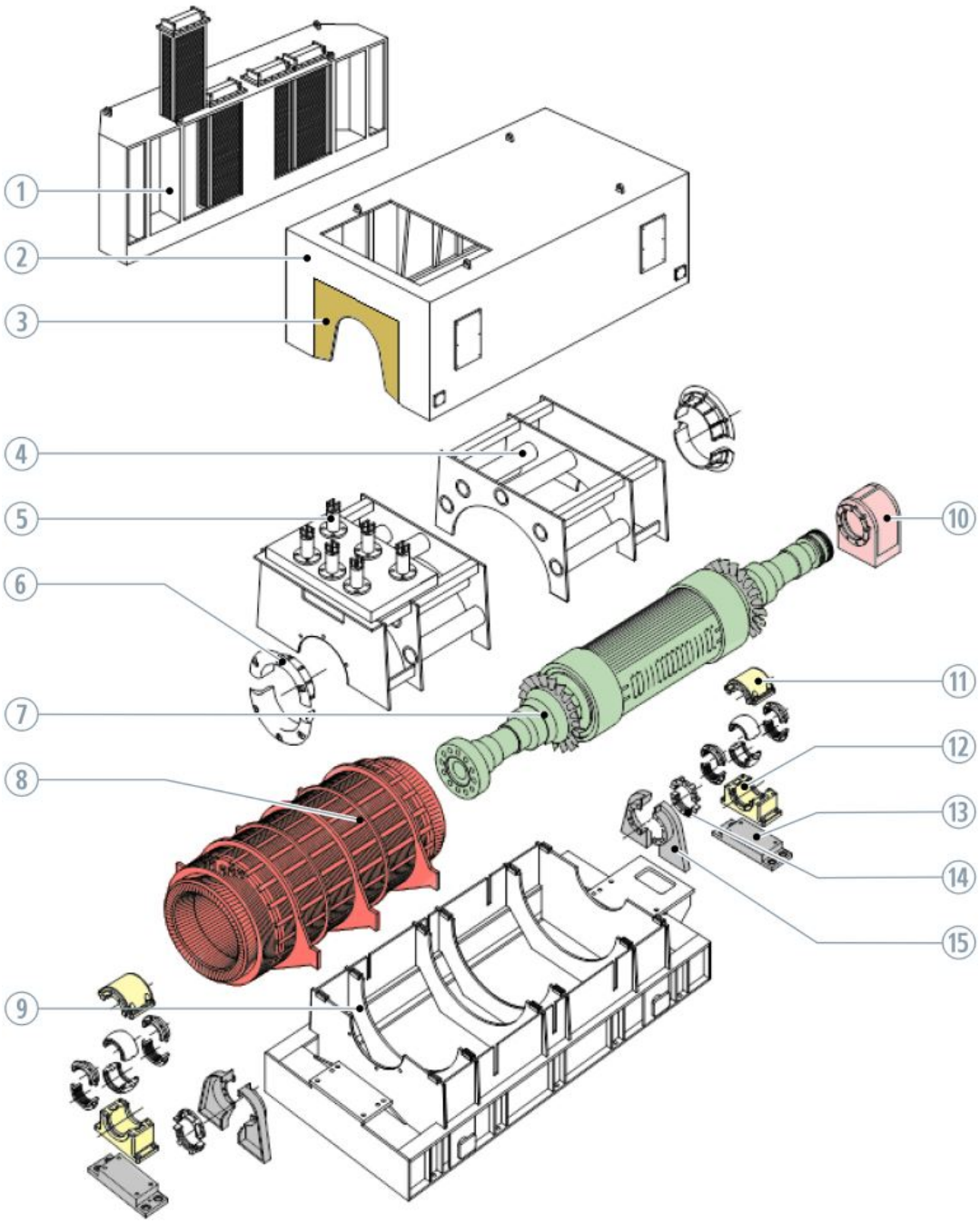


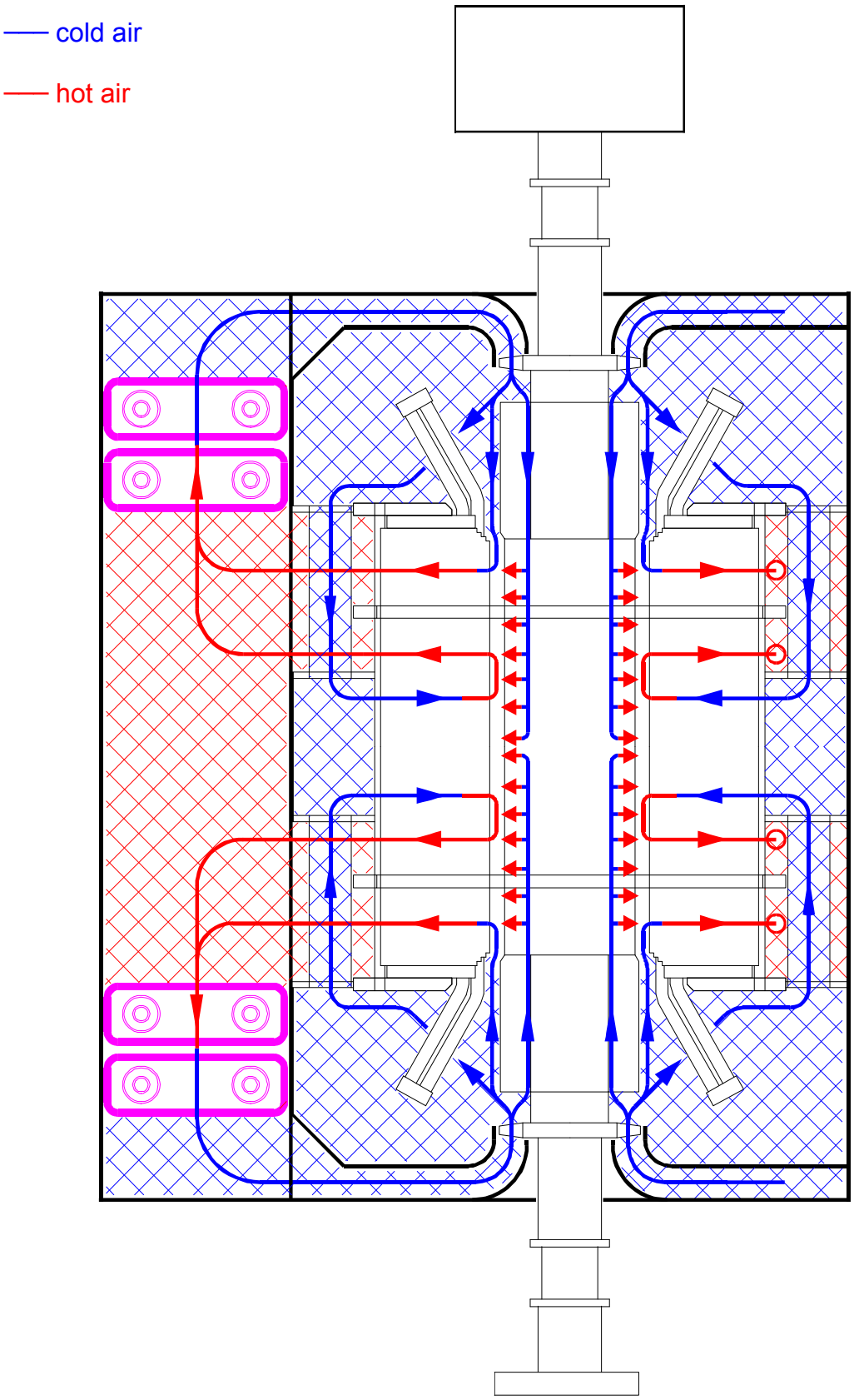
Fig. 1: Example of a two-pole generator, exploded view

1 *Cooler*
2 *Cover*
3 *End wall segment*
4 *Upper air guide*
5 *Outbound lines*
6 *Air baffle ring*
7 *Rotor*
8 *Inner stator with core*
9 *Base frame*
10 *Exciter set*
11 *Bearing pedestal, cover*
12 *Bearing pedestal, base*
13 *Intermediate frame*
14 *Labyrinth ring*
15 *Shaft bushing*

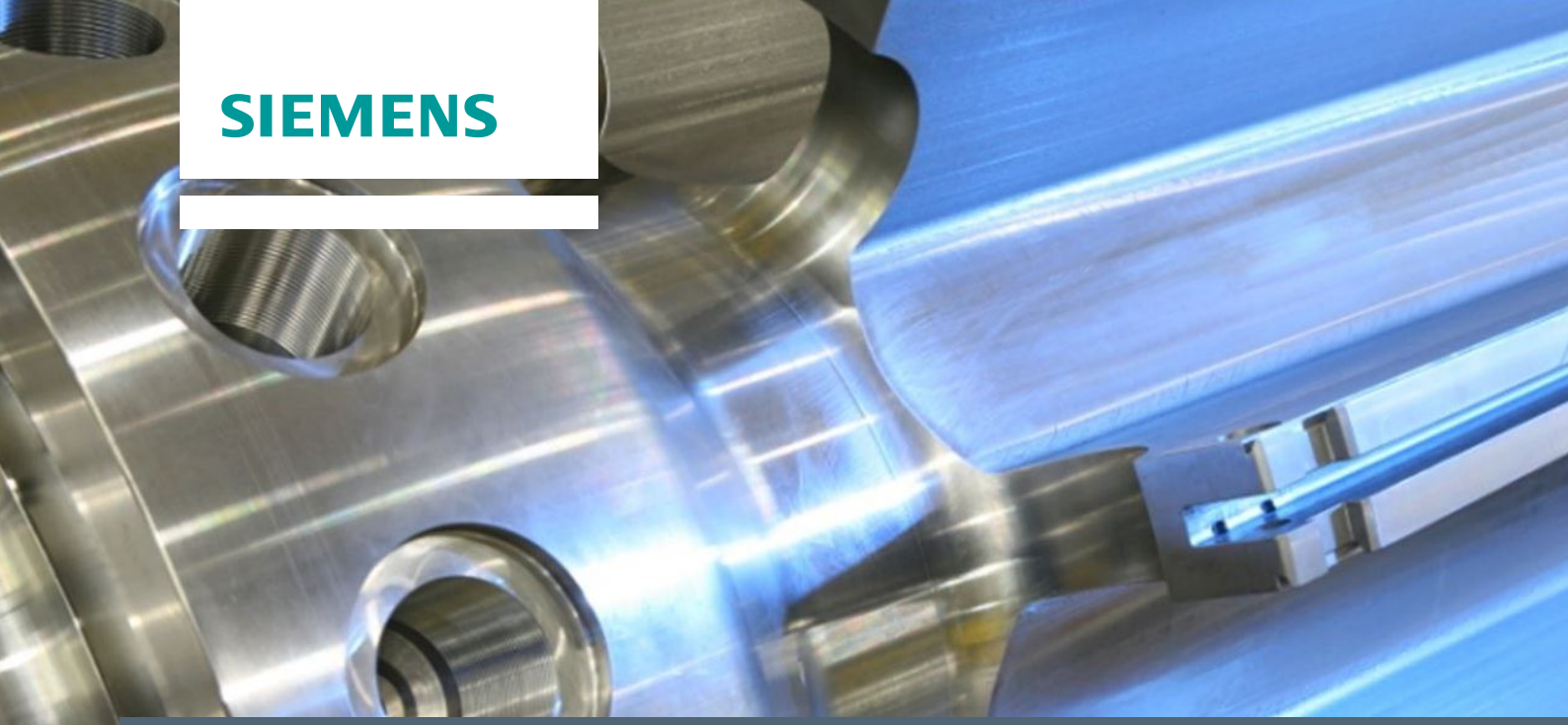
NOTE

The generator design shown in this graph is to be considered as example, showing a two-pole generator with laterally arranged cooling units, brushless exciter and outbound lines on top. The design of these assemblies described in this manual can diverge.

Generator Cooling Air Circuit
Totally Enclosed Water to Air Cooling System
(TEWAC top mounted)



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SIEMENS

Description of the System/ Plant Section 2

Description of the Main Assemblies 2.2

Contents

2.2.1 Generator – General

2.2.2 Stator

- Base Frame
- Inner Stator with Core
- Stator Winding – Conductor Design
- Stator Slot
- Micalastic® High Voltage Insulation – Post-Impregnated Stator Windings
- Anti-Condensation Heating
- Bolting Bus Bars
- Stator Winding, Post-Impregnation

2.2.3 Rotor

The baseframe carries the stator, the bearings, the enclosure, the brushgear or stator of exciting machine (what provided) and the machine accessories.

The baseframe and anchoring elements transmit the forces occuring in the machine during operation and on short-circuits to the foundation.

The method of anchoring provided is shown in the Generator Dimensional Drawing.

Basis for the dimensional design of the base frame are the loads during operation and in case of failure (short-circuit) as well as the conditions during shipment of the complete generator including the rotor.

Further functions:

- Vibration- and noise-damping
- Realization of the cooling air circulation together with the upper enclosure
- Wiring and cable arrangement for supervising equipment and anticondensation heating system

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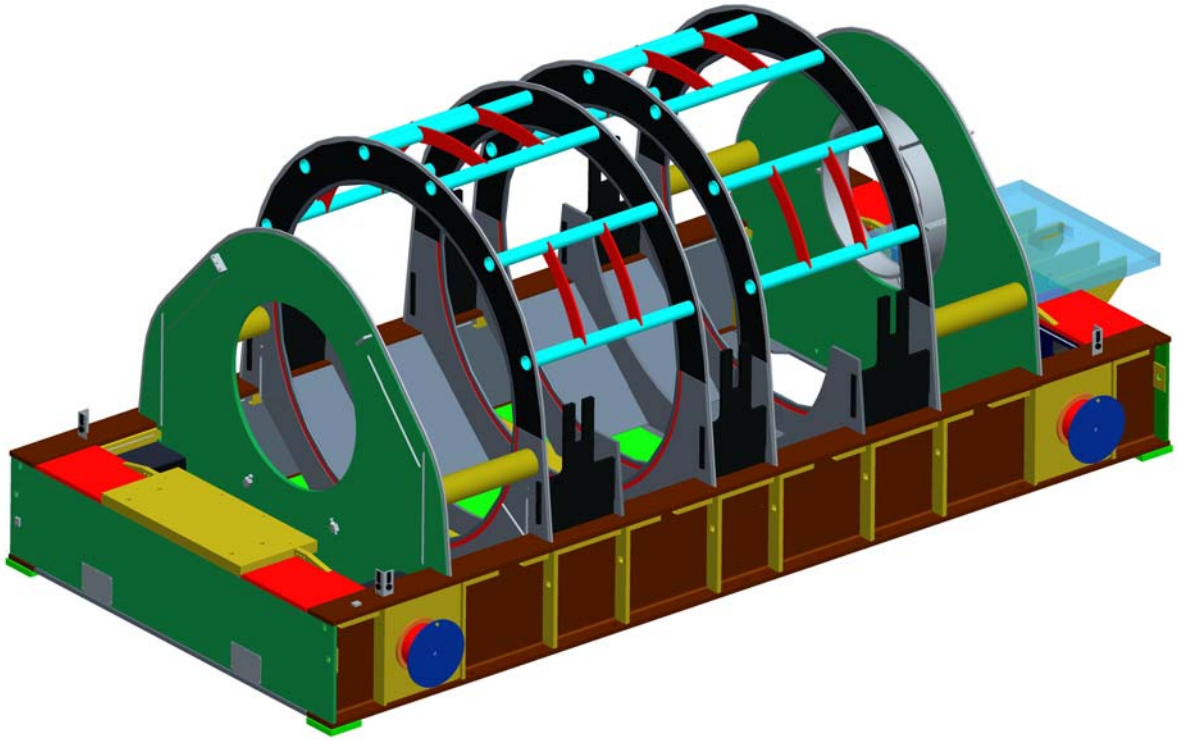


Fig. 1: Stator, base frame (schematic illustration)

The stator is manufactured as a three-part structure: the base frame, the inner stator and the enclosure.

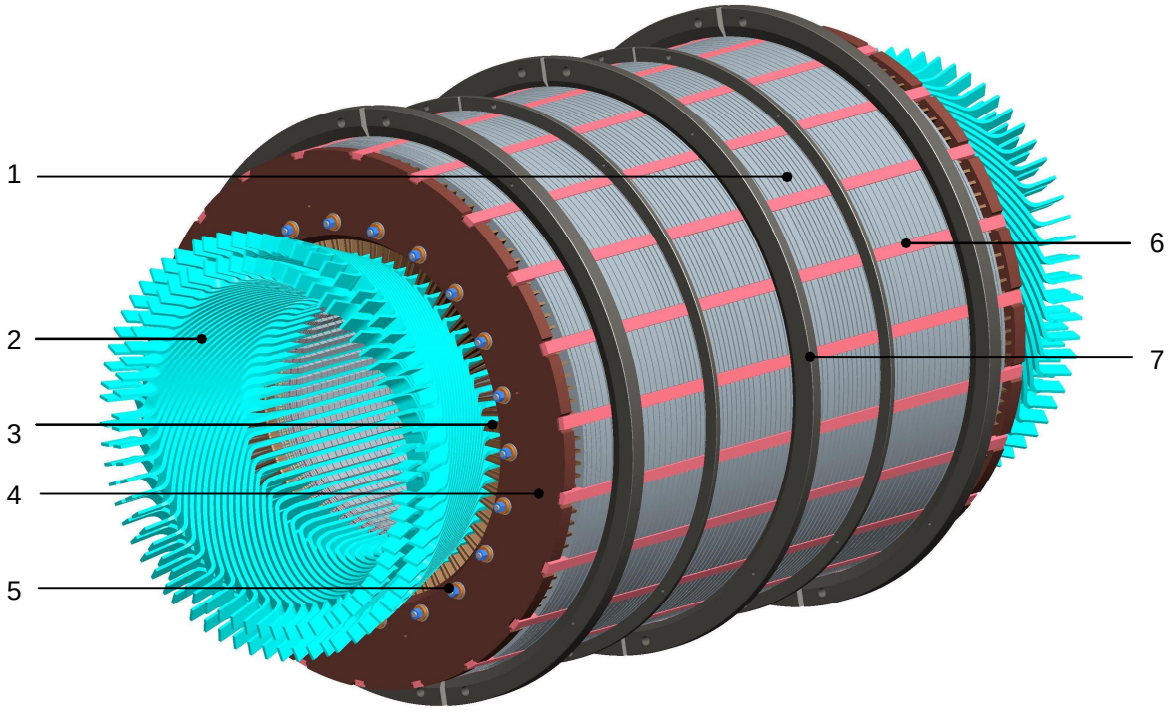
The inner stator consists of the core and the stator winding. The stator core is stacked with insulated electrical sheet-steel laminations with a low loss index and is supported in the base frame by means of guide bars and rings. Inner stator and base frame are welded together.

The axial compression of the stator core is obtained by clamping fingers, pressure plates, bolts and beams. The arrangement of the clamping fingers ensures a uniform clamping pressure, especially within the range of the teeth.

After stacking the stator core the core key bars are installed in the respective slots. Clamping rings welded to the core key bars and the pressure plate further increase the stiffness obtained by compression and maintained by the bond between clamping bolts, key bars and pressure plate. The connection between pressure plate and bar can vary depending on the pressure plate material.

The two outer and if required further clamping rings of the inner stator are thicker. In the normal operation and in the case of failure they ensure safe transmission of the mechanical forces via connecting elements welded to the base frame.

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1 Stator core
2 Stator winding (bar winding)
3 Clamping finger
4 Pressure plate
5 Clamping bolt
6 Core key bar
7 Clamping ring

Fig. 1: Inner stator of a two-pole generator

1 General, Connection

The three-phase stator winding is a fractional-pitch two-layer type consisting of individual bars. Each stator slot accommodates two bars.

The slot bottom bars (bottom layer bars) and top bars (top layer bars) are displaced from each other by one winding pitch and connected at their ends to form coil groups. The coil groups are connected together with phase connectors inside the stator frame as shown in the connection diagram.

Impregnating the stator by total immersion improves the stiffness and electrical strength of the end winding.

2 Conductor Construction

The bar is a twisted transposed bar to reduce the skin effect losses. It consists of a large number of separately insulated strands.

The strands of small rectangular cross-section are provided with a braided glass fiber insulation. In the straight slot portion the strands are transposed by 540° or 360°. At the Roebel crossover points, the insulation is reinforced with epoxy resin flooded gaps (540°) or with insulating strip inserts (360°).

Prior to applying the bar insulation, the bar ends are bent with a special device which shapes the involutes over a cone shell. This ensures a uniform spacing of the bars over the entire length of the end turns after installation.

Bars for generators with a nominal voltage $U_N \geq 10$ kV get a Inner Corona Protection (see Fig. 1). The order of the Inner Corona Protection (ICP) is to constant the electrical bar potential.

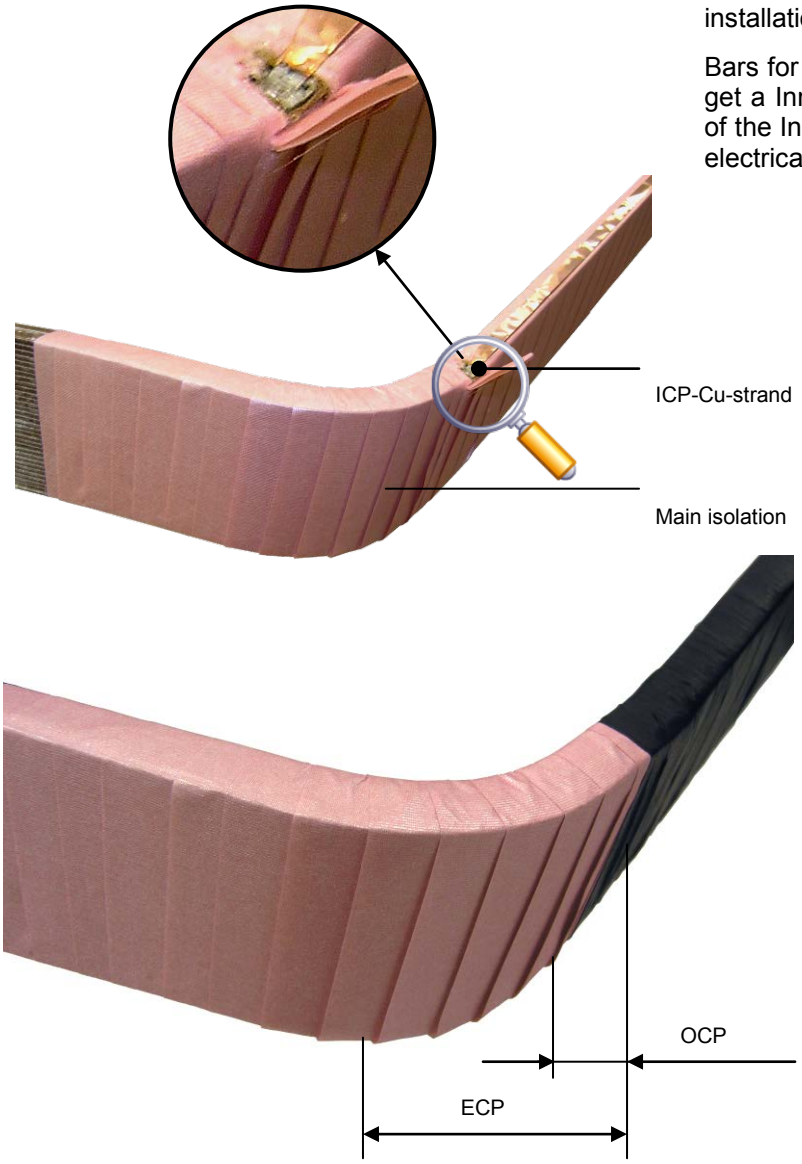


Fig. 1: Inner Corona Protection

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The high voltage insulation along the straight bar section consists of the specified number of half overlapped, continuous layers of dry mica tape applied from end to end on the stator bars. A semiconducting tape applied as a final wrapping in the slot section provides the electrical contact to the grounded stator core (outer corona protection - OCP, see Fig. 2). Specially treated tapes are applied to the bar portions just outside the slot to provide a corona grading system which ensures uniform control of the electric field without corona discharges (end corona protection - ECP). The end turns are provided with an outer cover of highly flexible armoring tape in order to obtain a smooth surface.

In the course of manufacture, the bars are subjected to numerous electrical tests for quality control.

3 Winding Assembly

The pre-insulated and pre-shaped bars are carefully placed into the slots of the stator core. In the end windings, dry glass fabric pads are inserted between the coils as spacers, and the end turns are then lashed to each other and to the end winding support structure with glass fabric tapes. The insulated bars in the slot section are covered with prefabricated glass fabric pads and locked in plan by inserting slot wedges.

The phase connectors are likewise insulated with mica tapes. They are secured to the support brackets, using spacer blocks and lashings similar to those in the end windings, and then connected to the respective stator bars. The stator bars and all phase connectors are then taped with dry mica tape and with an outer cover of armoring tape as used on the end turns.

4 High Voltage Insulation

The high-voltage insulation is provided according to the proven Micalastic® system (see section 4.1-2320).

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1 Outer OCP
2 Double Fleece - Micanite Tape
3 OCP Tape
4 Inner OCP
5 Main Taping
Fine Mica Glass Fabric Tape

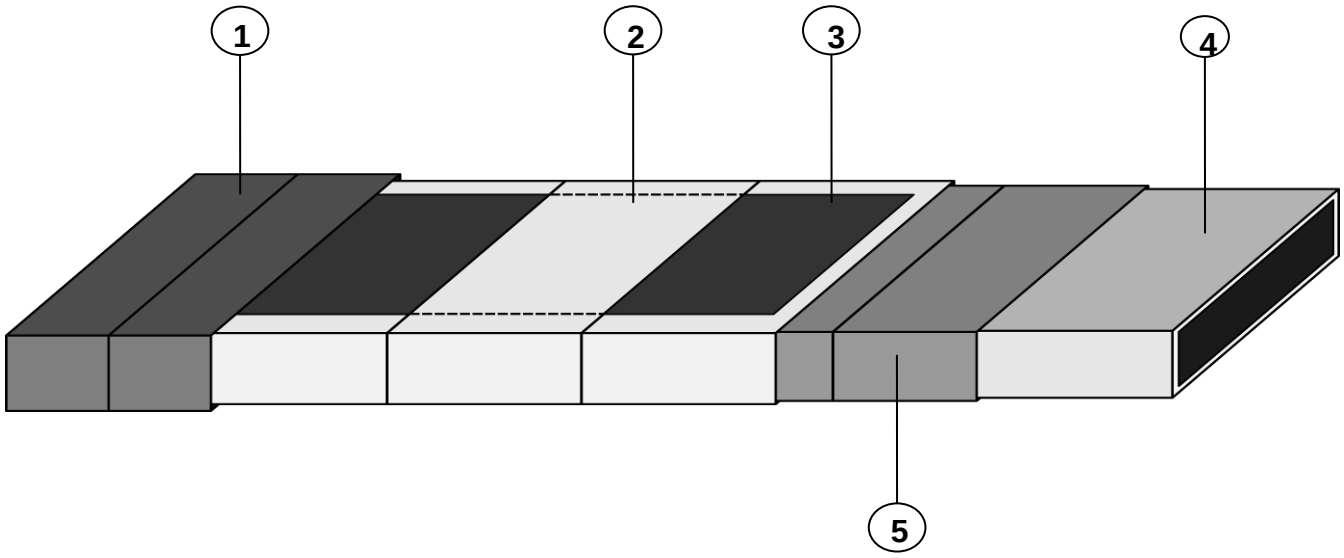
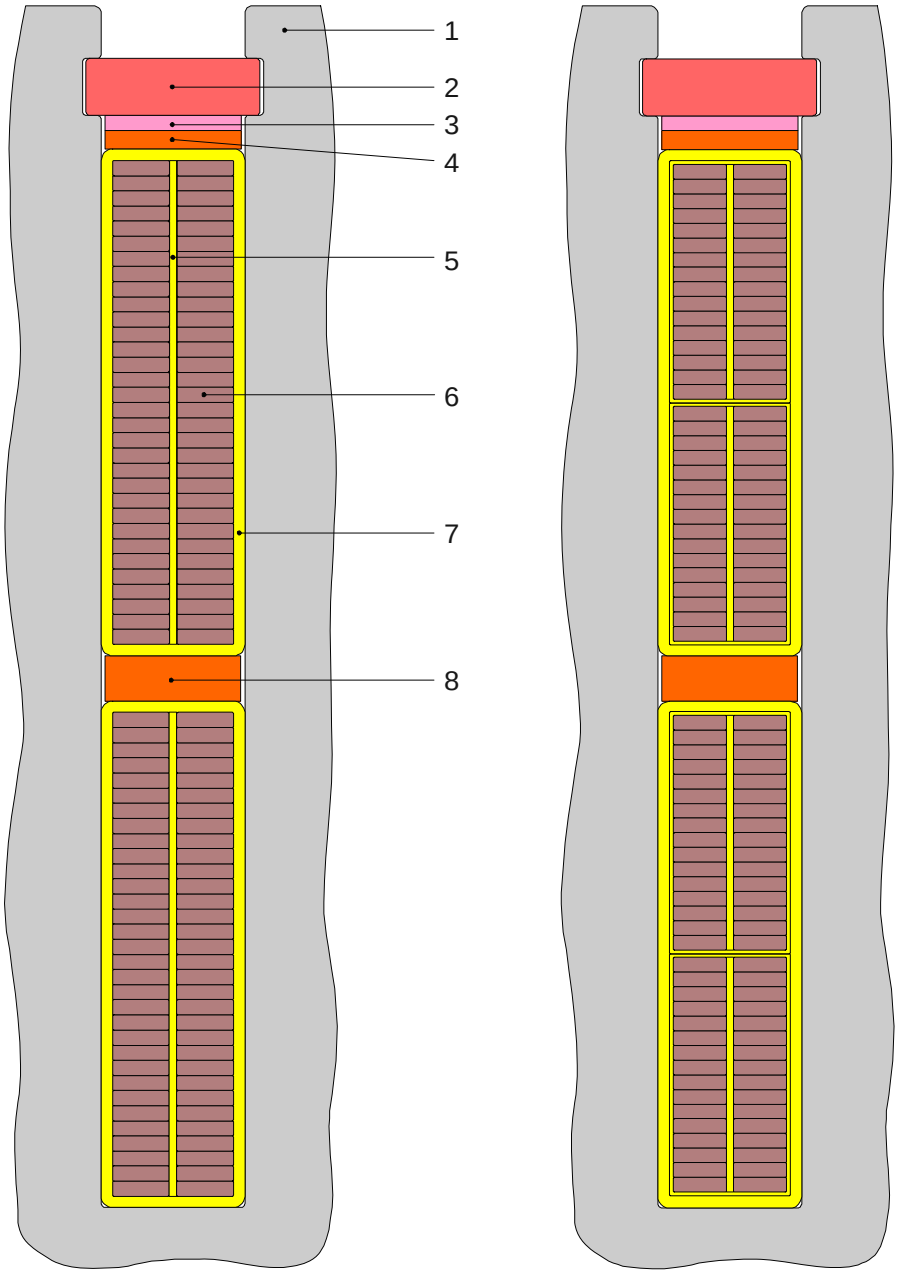


Fig. 2: Outer corona protection



two-bar design
540°

four-bar design
360°

1	Stator core
2	Slot wedge
3	Slide strip
4	Top strip
5	Separator int the main body iron
6	Roebel bar
7	High voltage insulation
8	Center filler

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1 General

High-quality mica, selected epoxy resins and a matching vacuum impregnation process are the characteristic features of the *Micalastic*® insulation for large turbogenerators. This insulation system is the result of systematic development.

The first 10.5 kV winding of a turbogenerator to be impregnated in vacuum with a solventless synthetic resin and cured was completed in 1958. Since that time, this insulation system has been used on all direct cooled windings and also on indirect cooled windings of more than 350 turbogenerators with a total rating of 150000 MVA. Since 1960, this insulation system has been registered under the trademark *Micalastic*® for Siemens AG.

Today, this system can be used for the post-impregnation and curing of a fully wound-stator.

2 Impregnation and Curing

The stator core with the coils installed in place is predried in a vacuum tank, evacuated and impregnated by being flooded with epoxy resin. After this extensive impregnation cycle involving the application of pressure, the surplus impregnating resin is drained. The complete stator is then placed in an oven for curing. All mica tapes and parts to be impregnated for achieving an improved mechanical strength include an accelerator to speed up the curing process. The impregnating resin itself contains no accelerator and can thus drain off from the non-insulated surfaces of the core as heat is applied so that all cooling passages remain free from resin.

The application of appropriate monitoring methods ensures adherence to the specified conditions and limits during evacuation, heating, impregnation and curing of the fully wound stator. As a final treatment, a varnish coating is applied to the stator winding.

3 Tests

During bar manufacture, the standard strand tests according to IEC/VDE specifications are performed. Only bars without short-circuits between strands are released for further processing.

After installation of the taped bars in the core slots, dc-tests are carried out in order to promptly identify and eliminate any defects and weak points produced in the winding during installation without causing damage to other parts of the insulation.

After impregnation and curing of the winding a dissipation factor vs. voltage measurement as stipulated in the applicable national and international standard specifications is performed for each bar between all individual phase windings and to ground.

Guiding values for the dissipation factor and its rise with the voltage are merely given in the KEMA specifications. According to these specifiations, the maximum value shall not exceed 0.04 at 20% of rated voltage, and the rise shall not be greater than 0.006 per 20% of rated voltage up to 60% of rated voltage and 0.008 per 20% of rated voltage up to rated voltage. Windings manufactured by the *Micalastic*® post-impregnation process comply with these limits.

The higher rise of the dissipation factor as compared to the limit values established for individual conductor insulations using a guard electrode arrangement results from the loss attributable to the voltage grading material applied at the slot ends.

A final dielectric strength test performed at 105% of the winding test voltage ($U_P = 2 \cdot U_N + 1$ kV) serves to verify proper impregnation and the electrical quality of the insulation before the stator is installed in the base frame.

4 Properties of Micalastic®

The *Micalastic*® post-impregnation process ensures a mechanically firm bond between all winding components and between the winding and the stator which is capable of withstanding the various temperature rises occurring during operation. The *Micalastic*® system thus provides for reliable insulation of the windings at all machine voltages. The insulation is applied continuously from end to end on the stator bars providing effective protection against overvoltages arising during normal operation and against the high stresses that may occur at the slot ends when high test voltages are applied.

Micalastic® has a long electrical life as determined on hundreds of experimental bars and verified on numerous fullsize bars.

Micalastic® is a good conductor of heat by reason of its high mica content and the voidfree synthetic resin. Efficient heat transfer is particulary important for dissipation of the copper losses in machines that require thick insulation because of the high voltages and are not designed with direct cooled windings.

Micalastic® features a high thermal stability. The resin-impregnated and cured insulation permits the machine to be operated continuously under conditions corresponding to those for Class F insulation.

Micalastic® insulation shows only a small dissipation factor tip-up with increasing temperature, which is

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also affected by the loss attributable to the voltage grading material applied at the slot ends.

Micalastic® features an elastic response to thermomechanical stresses. Alternate heating and cooling with large differences in temperature are endured without detrimental effects on quality. The *Micalastic*® insulation remains firmly bonded to the copper conductors and the stator. This is confirmed by dissipation factor measured with rising voltage within the operating temperature range.

Micalastic® owes its insensitivity to high temperatures and temperature changes to the cured synthetic resin. This favorable performance under thermal stress is particularly advantageous for machines subject to frequent load changes, e.g. generators driven by gas turbines or peak-load generators in steam power plants.

Micalastic® does not burn. The insulation features such a low flammability that even on arcing it does not continue to burn once the arc has been extinguished. Fire extinguishing systems, such as CO_2 bottle racks, are therefore not necessary for *Micalastic*®-insulated windings.

Micalastic® provides protection against moisture due to its impregnation with synthetic resin which seals the winding completely.

Micalastic® is highly resistant to chemical action. Corrosive gases, vapors, lubricating oil, weak acids, to which the windings may be exposed under unfavorable conditions, do not attack the insulation; the impregnating resin does not react with chemicals.

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1 Description

1.1 Application

The generator is fitted with an anti-condensation heating system. This system is designed in a way that makes sure the temperature of the active parts of the machine is always higher than the ambient temperature and condensation is prevented. The heating power required is determined when designing the generator.

1.2 Design

The anti-condensation heating system consists of one or two heating tubes (fig. 1) which are connected to each other and arranged in the machine that way the warm air rises to the active parts and the winding insulation is not damaged by the high surface temperature of the heaters.

For rating and supply voltage, please refer to the dimensional drawing text.

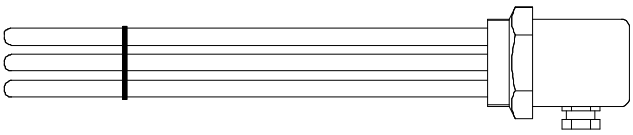


Fig. 1: Heating tube

2 Installation

2.1 Connection

The heater connecting leads are brought to an auxiliary terminal box situated according to the position specified in the circuit book for a specific project. The supply leads should be connected according to the applicable circuit book.



⚠ WARNING

Danger of injury from electric shock.
Connect to earthing system.

2.2 Switching On

The anti-condensation heater must be switched off when the generator is running. Therefore an interlocking circuit is necessary which prevents the generator from being started while the heater is switched on.

On the other hand, it is advisable to make the switching-on of the heater dependent on the shut-down of the generator.

Attend to the generator startup / shut down diagram details.

3 Maintenance

3.1 Replacement

When replacing defective heating tubes, only use tubes of the same type.

It is advisable to order spare heating tubes from the machine manufacturer stating type and serial number which can be taken from the rating plate.

3.2 Cleaning

Remove dirt and dust deposits from the heaters and test for proper functioning when machine inspections are carried out.

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1 Recommended nominal tightening torques for bus bar boltings

NOTE:

Use table data only if there are no special values given by the neutral point/line side cubicles' supplier.

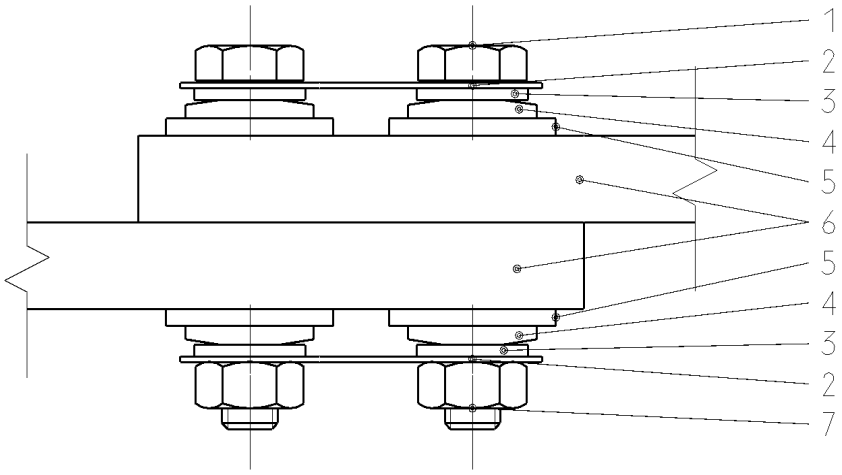
Table data are valid for DC and AC up to 60 Hz. Screws and nuts have to be made of austenitic steel (e.g. A2-70 or A4-70), all other connecting and locking elements should be made of nonmagnetic material as well.

Thread size	Indoor	Indoor & outdoor
	Lubricant: Oil or grease	Lubricant: MoS_2
	Tightening torque [Nm]	Tightening torque [Nm]
M4	1,5	2
M5	2,5	3
M6	4,5	5,5
M8	10	15
M10	20	30
M12	40	60
M16	80	120

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2 Connection bus bar – bus bar, version 1

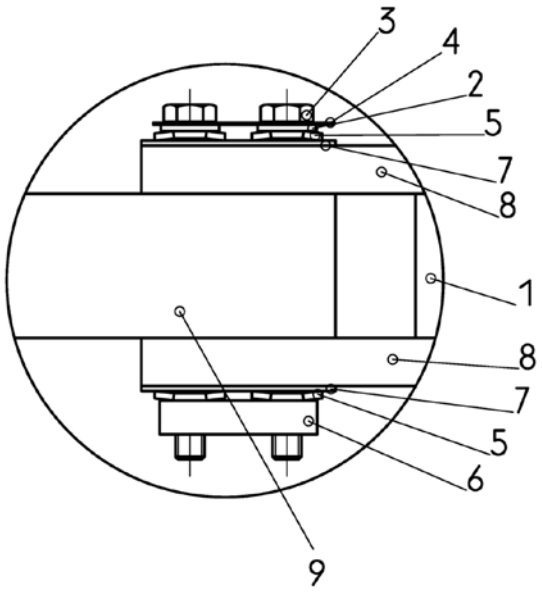
(Principal drawing, for details see Installation Manual, chapter Drawings)



1 Hexagon screw
2 Double-locking plate
3 Tab washer DIN 125
4 Clamping disk DIN 6796
5 Tab washer DIN 9021
6 Bus bars
7 Hexagon nut

3 Connection bus bar – bus bar, version 2

(Principal drawing, for details see Installation Manual, chapter Drawings)

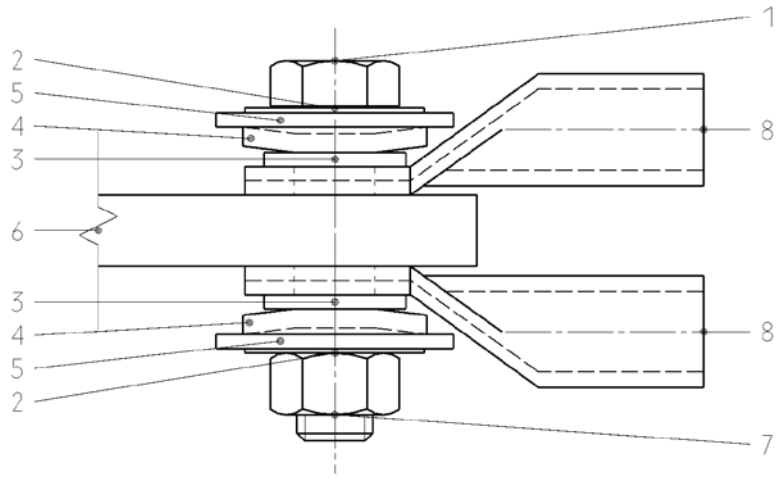


1 Bus bar
2 Tab washer ISO7090
3 Hexagon screw
4 Double-locking plate
5 Clamping disk DIN 6796
6 Twin nut
7 Steel sheet
8 Connecting piece
9 Feed-through bar

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4 Connection cable bus bar – terminal lugs, version 1

(Principal drawing, for details see Installation Manual, chapter Drawings)

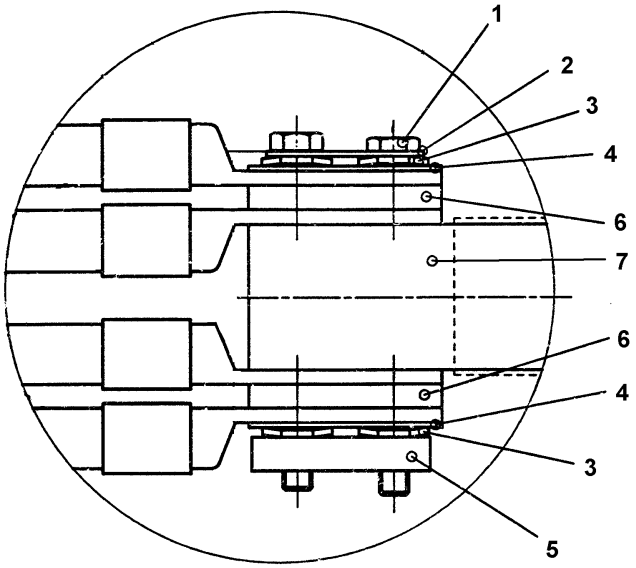


two terminal lugs arranged on each bus bar side

1 Hexagon screw
2 Double-locking plate
3 Tab washer DIN 125
4 Clamping disk DIN 6796
5 Tab washer DIN 9021
6 Bus bar
7 Hexagon nut
8 Cable lug

5 Connection cable bus bar – terminal lugs, version 2

(Principal drawing, for details see Installation Manual, chapter Drawings)



1 Hexagon screw
2 Double-locking plate
3 Clamping disk DIN 6796
4 Steel sheet
5 Twin nut
6 Plate
7 Bus bar

two terminal lugs arranged on each bus bar side

After final assembly, the bolt heads are secured by bending up the double-locking plates.

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The inner stator with inserted and fastened winding is pre-dried in a vacuum tank, evacuated and impregnated by being immersed in epoxy resin.

After this extensive impregnation cycle involving pressurizing according to the VPI method (Vacuum Pressure Impregnation), the surplus resin is drained until all cooling air passages are free from impregnating resin. The complete stator is then placed in an oven for curing at a temperature of 140°C.

All mica tapes and pads of glass fabric mat to be impregnated for improving their mechanical strength contain a catalyst in order to accelerate curing.

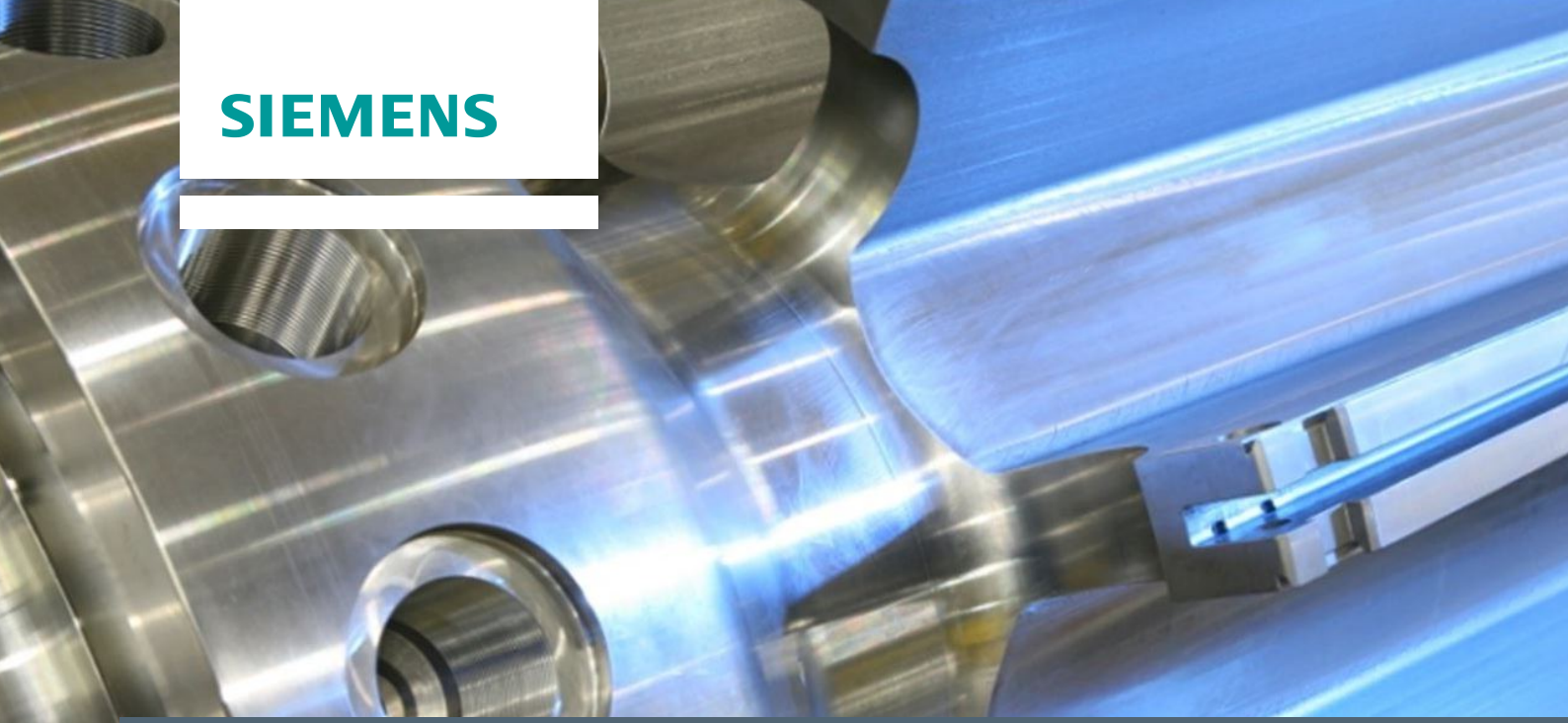
The epoxy resin contains no catalyst and thus freely drains off the exposed areas of the stator core on heating without blocking any cooling air passages.

Numerous control measures are performed during evacuation, impregnation and curing for quality assurance of the various treatment steps.

Prior to installation of the inner stator in the lower housing part, a dissipation factor measurement of each phase winding is performed, dependent on the machine voltage and as stipulated in the applicable national and international specifications.

A final dielectric test provides evidence of proper impregnation and confirms the electrical quality of the stator winding insulation.

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SIEMENS

Description of the System/ Plant Section 2

Description of the Main Assemblies 2.2

Contents

2.2.1 Generator – General

2.2.2 Stator

2.2.3 Rotor

- Rotor Shaft
- Cooling of Rotor Winding
- Rotor Winding
- Rotor Slot
- Rotor End Winding
- Rotor Retaining Ring
- Exciter Current Conductor
- Rotor Fan

The rotor shaft is forged from a vacuum cast steel ingot.

The rotor consists of an electrically active portion and the two shaft ends. An integrally forged flange coupling to connect the rotor to the turbine is located outboard of the bearing.

Approximately 60% of the rotor body circumference is provided with longitudinal slots which hold the field winding. Slot pitch is selected so that the two solid poles are displaced by 180°.

Due to the non-uniform slot distribution on the circumference, different moments of inertia are obtained in the main axes of the rotor. This in turn causes oscillating shaft deflections at twice the system frequency. To reduce these vibrations, the deflections in the direction of the pole axis and the neutral axis are compensated by transverse slotting of the poles.

The rotor teeth at the end of the rotor body are provided with axial and radial ducts, enabling the cooling air to be discharged into the air gap for intensive cooling of the end windings.

After completion, the rotor is balanced in various planes at different speeds and then subjected to an overspeed test at 120% of rated speed for two minutes.

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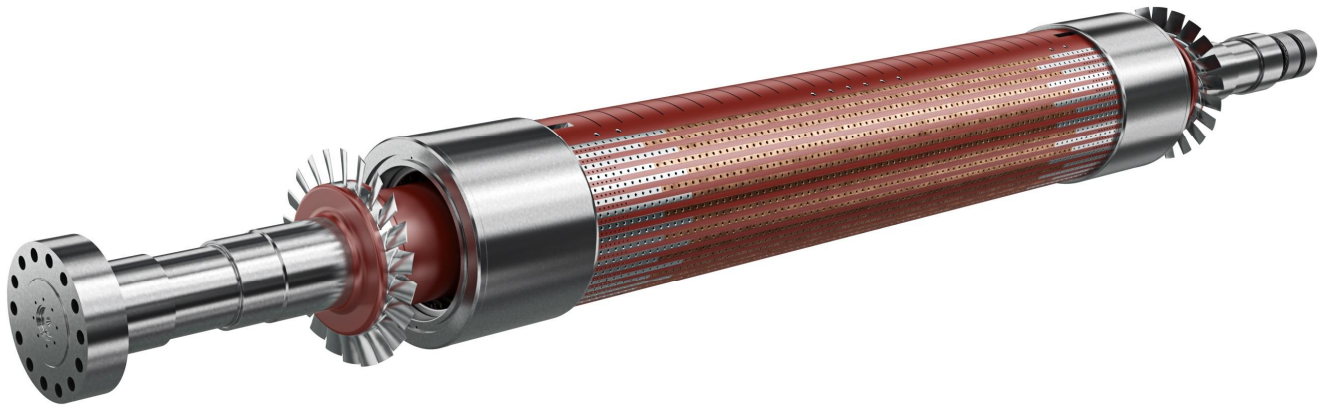


Fig. 1: Rotor shaft, schematical drawing

1 General

The rotor winding is symmetrical relative to the machine centre and the pole axis. The coils in each quarter obtained by the symmetrical configuration are subdivided into two cooling zones, the ***slot*** cooling zone and the ***end winding*** cooling zone, which in turn is subdivided into two separate cooling sections.

2 Slot Cooling Zone

The cooling air for the slot portion is admitted into the bottom ducts below the rotor winding at the end of the rotor body. As the rotor turns, the cooling air is passed through the radial ducts in the winding, insulating layers, slot-top fillers and rotor wedges by autocirculation due to the centrifugal pumping head developed by the rotor and then discharged into the air gap.

3 End Winding Cooling Zone

The cooling air for the end winding is drawn from below the rotor retaining ring by the self-pumping rotor. An appropriate system of insulating pieces ensures intensive cooling of the rotor coils in the end windings.

The ***axial conductor cooling air*** enters the spaces between the coils at the axial-to-transverse conductor transitions and is discharged to the air gap via ducts in the ends of the rotor teeth.

The ***transverse conductor air*** is whirled by fillers between the coils. Continuously flowing-in cooling air displaces the warmed-up air into below the rotor retaining ring because of the density differences (thermosiphon principle). In the following the cooling air is discharged via slots in the pole area to the air gap.

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1 Construction

The field winding consists of several series connected coils inserted into the longitudinal slots of the rotor body. The coils are wound and electrically series-connected so that one north and one south magnetic pole are obtained.

The solid axial conductors arranged in the slots have a rectangular cross-section and are provided with axial slots for radial discharge of the cooling gas. The transverse conductors of the end winding have no axial slots and are wider than the axial conductors. As a result, a decreased heating by reason of current flow is obtained.

After insertion into the rotor slots, the individual conductors are combined to form full turns.

2 Conductor Material

The conductors are made of copper with a silver content of approximately 0.1%. As compared to electrolytic copper, silver-alloyed copper features high strength properties at higher temperatures so that coil deformations due to thermal stresses are eliminated.

3 Insulation

The insulation between the individual turns is made of layers of glass fiber laminate. The coils are insulated from the rotor body with L-shaped strips of glass fiber laminate with ***Nomex*** filler.

To obtain the required creepage paths between the coil and the grounded shaft, top strips of glass fiber laminate are inserted below the slot wedges. The top strips are provided with axial slots of the same cross-section and spacing as used on the rotor winding.

4 Rotor Slot

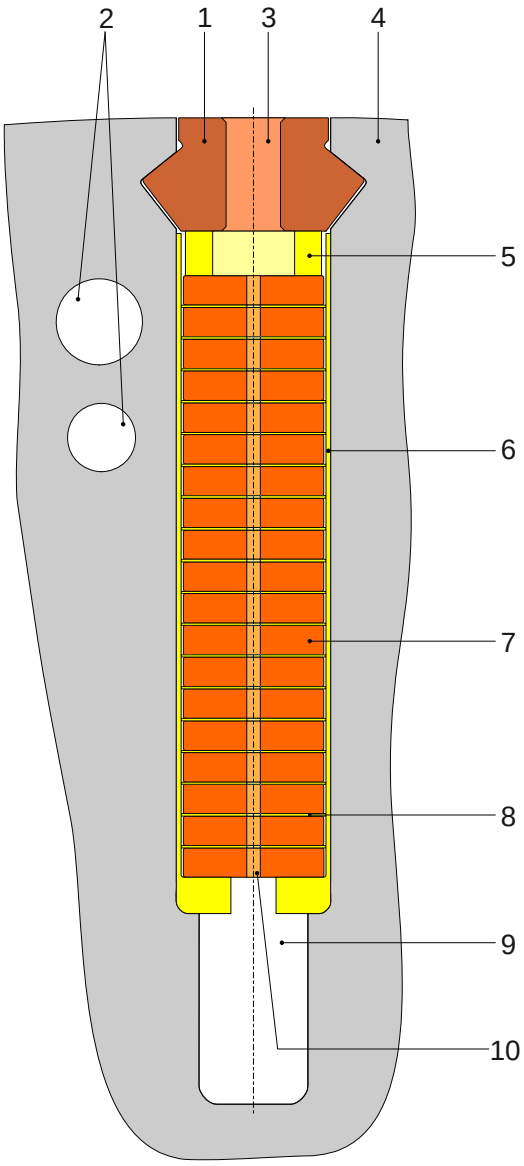
(see also 4.1-3301)

To protect the winding against the effects of the centrifugal force, the winding is secured in the slots with wedges. The slot wedges are made from an alloy featuring high strength and good electrical conductivity, and are used as damper winding bars. The slot wedges extend below the shrink seats of the retaining rings. The rings act as short-circuit rings to induced currents in the damper winding.

5 End Winding Bracing

The spaces between the individual coils in the end winding are provided with insulating members. The insulating members prevent coil movement and are used for intensive cooling of the rotor end winding.

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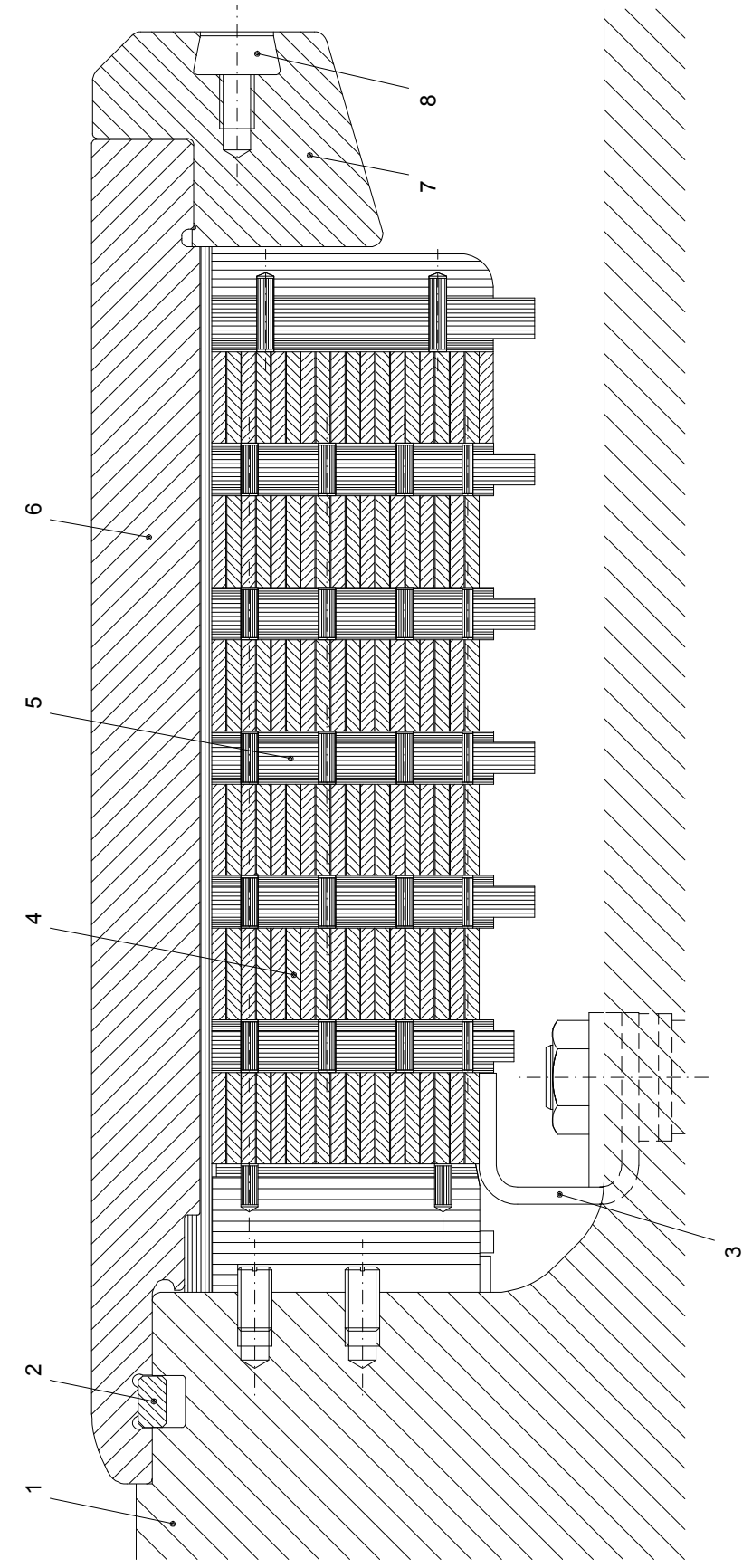


1 Rotor slot wedge
2 Cooling air duct at ends of rotor body (cooling air for end winding)
3 Cooling air outlet duct in rotor slot wedge
4 Rotor shaft
5 Top strip
6 Slot liner
7 Conductor
8 Winding insulation
9 Slot bottom duct
10 Ventilation slot through conductors

Note: The number of conductors shown does not necessarily correspond to the number of conductors of the generator described.

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Rotor End Winding



1 Rotor body
2 Snap ring
3 Terminal lug
4 Rotor winding
5 Insulating piece
6 Retaining ring
7 End ring
8 Balancing nut

Note: The number of conductors/coils shown does not necessarily correspond to the number of conductors/coils of the generator described.

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The single-piece rotor retaining rings contain the centrifugal forces due to the end windings. One end of each ring is shrunk on the rotor body, while the other end of the ring overhangs the end windings without contacting the shaft. This ensures an unobstructed shaft deflection at the end windings.

The shrunk-on end ring at the free end of the retaining ring serves to reinforce the retaining ring and secures the end winding in the axial direction at the same time.

A locking ring is provided for additional protection against axial displacement of the retaining ring.

To reduce the stray losses and retain strength, the rings are made of non-magnetic, cold-worked material.

Comprehensive tests, such as control of the mechanical properties, ultrasonic examination and liquid penetrant examination, ensure adherence to the specified mechanical properties.

The retaining ring shrink-fit areas act as short-circuit rings to induced currents in the damper system.

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The field current is supplied to the rotating rotor through a exciter machine arranged at the exciter-end shaft end. The electrical connection between the rotating rectifier bridge of the exciter machine and the rotor winding is established by means of radial bolts and conductors located in the hollow bore of the shaft end by terminal lugs at the exciter end.

1 Terminal Lug

The terminal lug consists of a copper conductor of rectangular cross section. One end of the terminal lug is brazed to the rotor winding, while the other end is screwed to the radial bolt.

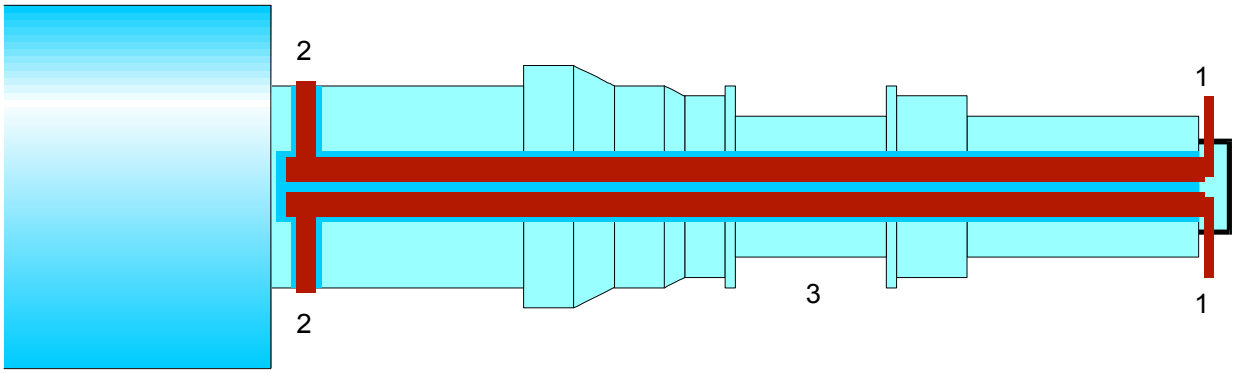
2 Radial Bolt

The field current lead in the shaft bore is connected to the terminal lug at the end winding through a radial bolt. The radial bolt is made from chrome copper and screwed into the field current lead.

3 Field Current Lead in Shaft Bore

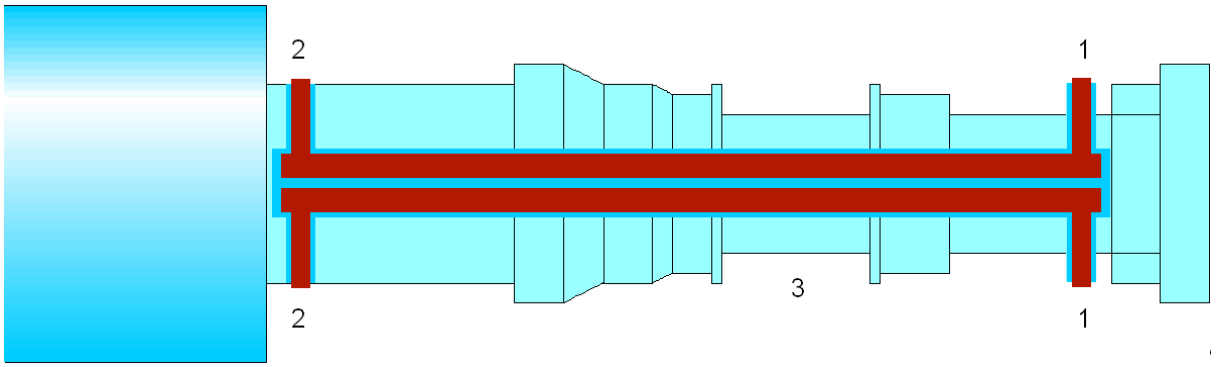
The leads stretch in the axial direction from the radial bolt to the exciter end of the rotor. They consist of two semicircular steel sections insulated from each other and from the shaft.

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1 Terminal lug to the rotating rectifier bridge
2 Radial bolt to the terminal lug of the rotor winding
3 Bearing position

Fig. 1 Field connections with exciter



1 Radial bolt to the rotating rectifier bridge
2 Radial bolt to the terminal lug of the rotor winding
3 Bearing position

Fig. 2 Field current lead with exciter and coupling on the exciter end

Rotor Fan

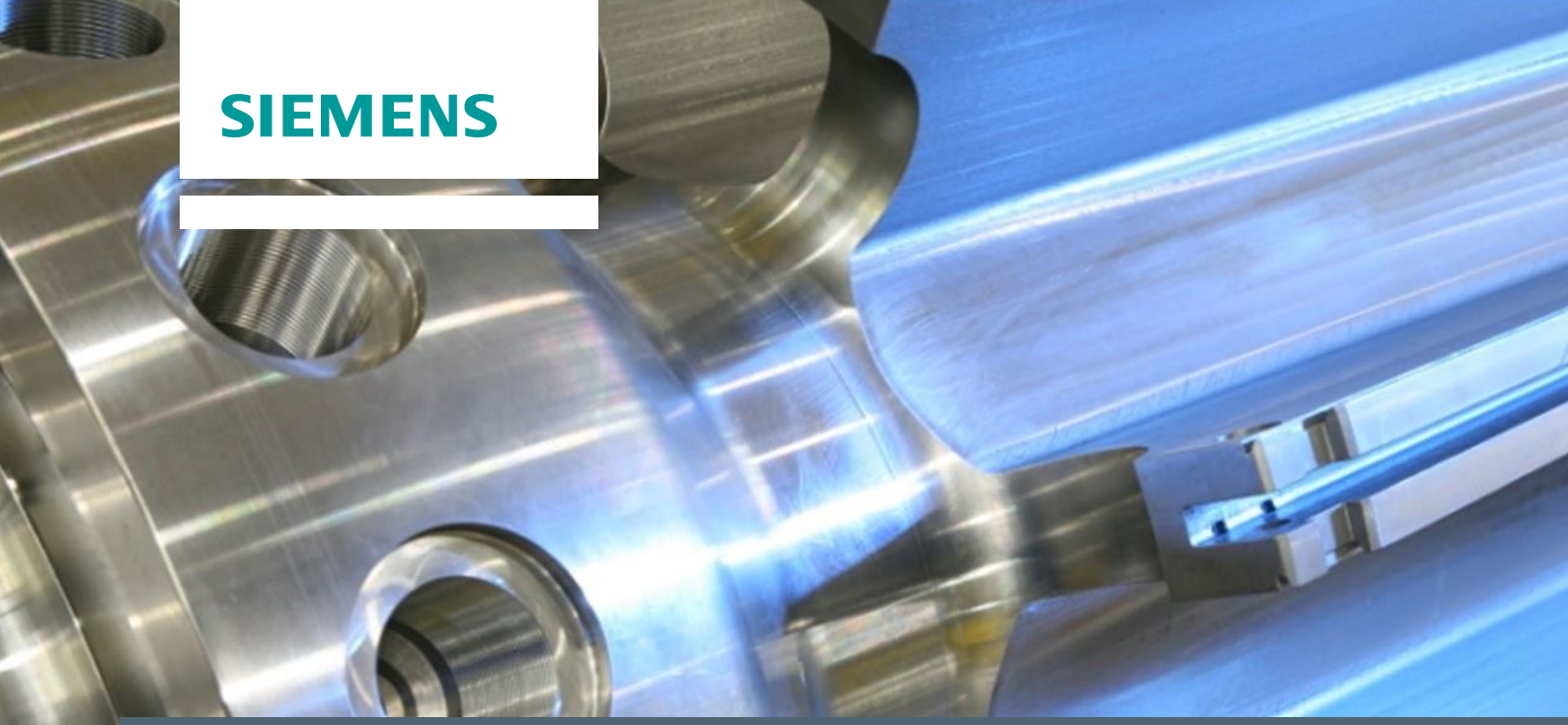
The generator cooling air is circulated by two axial flow fans located on the two shaft ends.

To augment the cooling of the rotor winding, the pressure established by the fan works in conjunction with the air expelled from the discharge ports along the rotor.

The moving blades of the fan have threaded roots for being screwed into the rotor shaft. The blades are drop forged from an aluminium alloy. Threaded root fastening permits the blade angle to be changed. Each blade is fixed and secured at its root.

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Description of the System/ Plant Section 2

Components and Purchased Parts 2.3

Contents

2.3.1 Cooler

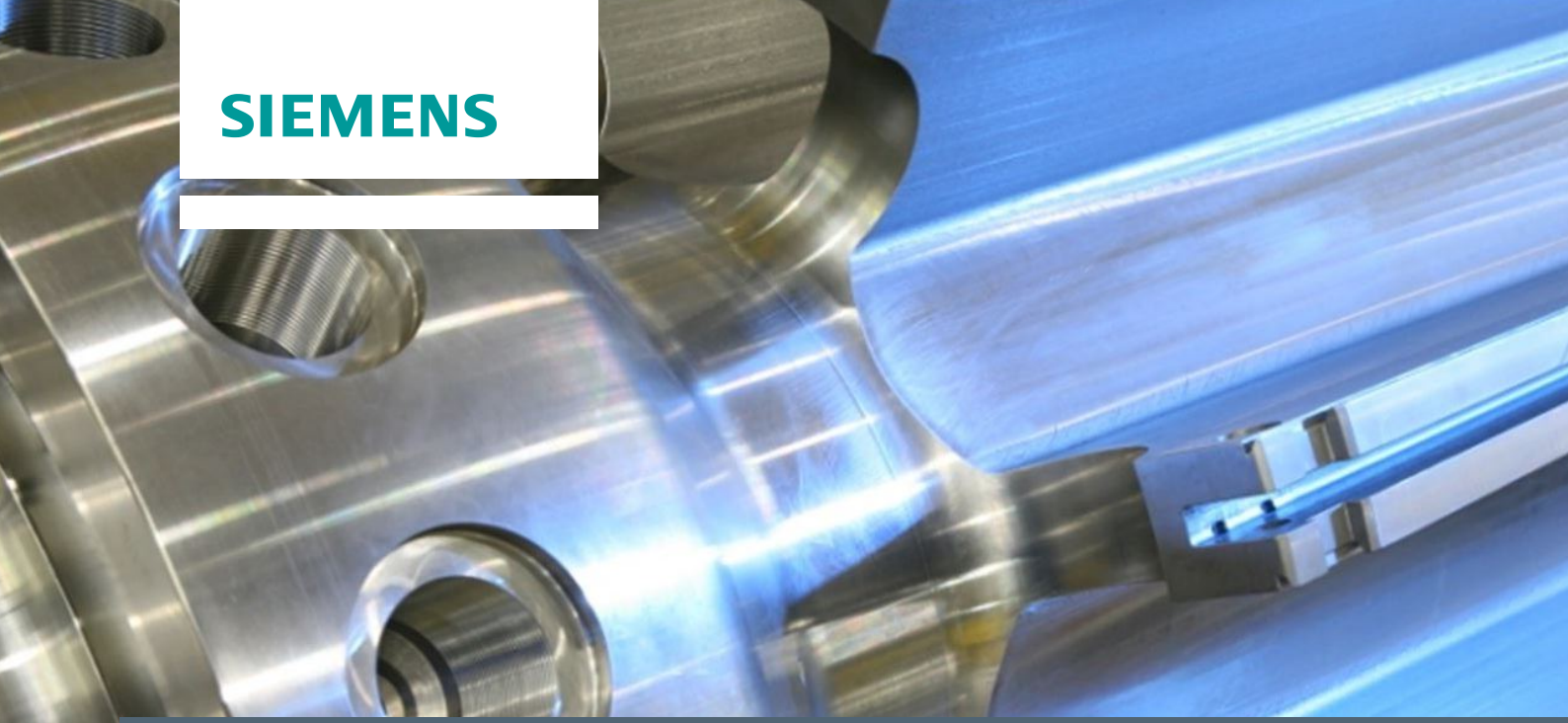
2.3.2 Bearings

2.3.3 Lubrication Oil Supply

2.3.4 Excitation

2.3.5 Neutral Point / Line Side Cubicle

2.3.6 Generator Control Panel / Automatic Voltage Regulation (AVR)



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Installation, Operation and Maintenance Instructions

For

CACW Elements



Sterling
thermal technology

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1. General Information

1.1 Overview

This manual supplies information and instructions for the correct and safe installation, use and maintenance of the CACW Elements Heat Exchanger. It must be carefully read in conjunction with the General Arrangement Drawing(s) for the equipment and fully understood prior to the installation of the equipment. If questions still exist after reading this manual, you must contact the manufacturer / supplier / contractor for more information.

Many accidents occur due to incorrect or inappropriate use of equipment, therefore the instructions in this manual must always be fully understood and correctly carried out.



The equipment must not be put into use until all unclear issues have been resolved

1.2 Pictograms Used in this Manual



Reference to important, useful or supplementary information regarding the use of the equipment



Warning of a dangerous situation which could cause personal injury or damage to the equipment

1.3 Documentation



The following documents will be sent to the originator of the order by STT:-

- General Arrangement Drawing(s), Certificate of Conformity, Certificate of Test, plus Data Dossier if specified in the order.
- Other documentation as requested in the order to STT
- Invoice

The following will be delivered with the cooler:-

- These Installation, Operation and Maintenance Instructions
- Delivery note

The following documentation will be provided at no charge if it is requested at the time of order:-

- Pressure Equipment Directive Statement
- Instrument manufacturers documentation (where applicable)

1.4 Important Notes



The following important notes must be taken into account when using the equipment:-

- Do not pass air across the element unless the heat exchange medium is circulating
- The warranty will be made void if the equipment is not maintained as detailed in this manual.
- The equipment must be earthed if it is used in explosive areas.
- The ingress protection (IP) rating of the element will not be maintained unless appropriate seals are installed as detailed in this manual.
- This manual must be read in conjunction with the drawing(s) for the equipment
- Read the label on the element and ensure that the equipment is suitable for the required use before installation.
- Element fins are fragile and can be easily damaged; they must be handled with care. If damage does occur to fins, the heat exchange properties of the element may be affected.
- Damaged fins can be straightened with the use of a proprietary fin comb.

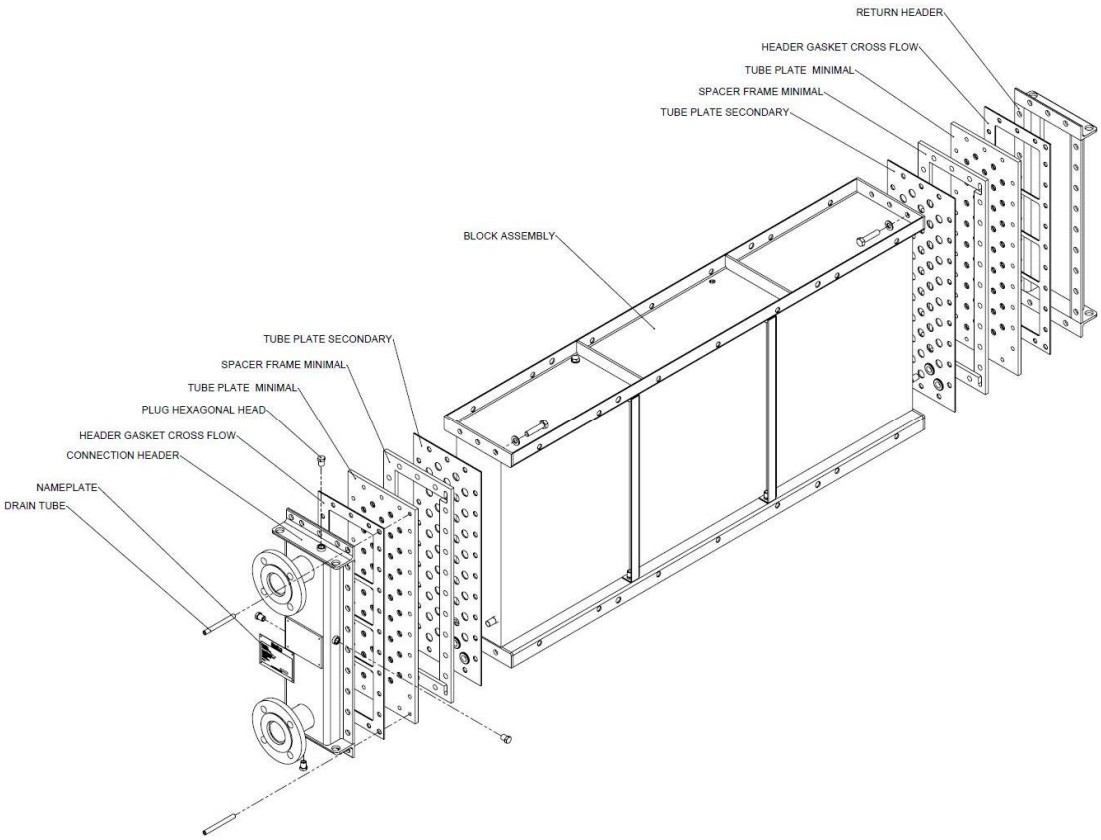
2. Description

2.1 Product Information

Product: Heat Exchanger element with removable covers

Type: See information plate on heat exchanger, technical specification and General Arrangement Drawings

Typical Assembly:



2.2 Product Use

CACW Elements heat exchangers are primarily used to exchange heat between a liquid and a gas; the liquid flowing through the tubes and the gas passing across the finned surface. A typical example is a motor or generator cooler where they are used to remove the excess heat created by the motor or generator; in this instance, the hot air created flows over the finned tubes and the heat contained within it is passed to the cooling water running through the tubes.

Although supplied “stand-alone” the CACW Elements heat exchangers are often built into purpose made heat exchange enclosures.

The properties of the fluid flowing through the tubes may create erosion, corrosion or internal fouling of the tubes necessitating a regular planned cleaning strategy. A filter / strainer installed in the system pipework will greatly lessen the chance of damage due to erosion.

2.3 Product Conformity

The equipment conforms to the following:-

- EU Directives
- Machinery Directive
- Pressure Equipment Directive
- Hazardous Areas Usage

- CE Marking (if specified)
- IEC Specifications (if specified)

2.4 Guarantee

Sterling TT guarantees all products supplied by them to be sound and suitable for the given specification for a period of 12 months after being put into operation or 12 months from delivery (whichever is the sooner) unless covered by a separate agreement.



The guarantee will be voided if the equipment is not stored, handled, used and maintained in accordance with the information given within this manual; if it is utilised with an incorrect medium (i.e. not the design / specified medium); or any adaptions / changes are made.

3. Safety, Storage, Inspection and Handling

3.1 Preservation and Shipping of Equipment



Sterling TT drain all water cooler heat exchangers prior to despatch. However, under normal circumstances some residual water may remain in the tubeside areas due to the circuit configuration. Full drying can be executed where requested as part of the contract requirements. If not specified additional steps need to be taken where equipment is being packed for extended storage and/or shipped through a range of climatic conditions. These steps may include drying and/or evacuating followed by pressurisation with a dry gas. Please refer to STT for advice on these long term preservation requirements.

Where silica gel is used to protect against moisture ingress it must not be placed above or in direct contact with the finned area of the equipment.



Following any operation of the equipment (e.g. string tests) the water passages must be drained before onward shipment. The extent to which further drying is necessary will be dependent of time scales and shipping methods employed.

3.2 Receipt of Goods



On receipt of the equipment, inspect and check that the goods are undamaged. It is important that any damage is noted on the delivery note which you will be asked to sign. If any further damage or omissions are subsequently noticed then you should advise STT immediately.

3.3 Loose Items



Some components, such as leak detectors, will be packaged separately. This is generally for safety and to prevent damage. Any such items will be identified on the delivery note. Please ensure they are present and undamaged. If problems are found note them on the delivery note at the time of signing it.

3.4 Storage



- Where possible keep the equipment in the packing case in which it was delivered until it is to be installed.
- Do not climb on heat exchangers.
- Keep all connection pipes, drains etc. covered and/or plugged to protect them from the ingress of insects, vermin or foreign bodies.
- Coolers designed for an ‘indoor application’ must not be left outdoors as they may not have the sealing, paint system, or general corrosion resistance for such conditions.
- Finned surfaces must always be protected from the ingress of foreign bodies.
- Relaxation of gaskets may occur during storage. The bolts/nuts of the water box should be re-torqued to the final assembly figure when the element is installed, starting at the centre and working towards the corners (ref to para 4.4 & 6.15). This may also be required if the cooler has been subjected to vibration or large temperature deviations during transport to site. (See installation).

- If the cooler elements have been stored for more than 1 year before putting into service, they must be hydrostatically tested to the pressure shown on the cooler nameplate and special attention should be given to the gasketed joints. If a leakage is observed, then it is recommended that the header bolts / nuts are re-torqued as indicated above. (See “Tightening of Bolts” for details para 4.4 & 6.15).
- If the cooler element has been filled for thermal or other testing at any stage, it must be fully drained and the connections covered and plugged before being put into storage.
- If the cooler element has been subjected to occasional use or left drained for extended periods the headers must be re-torqued as above.
- The cooler element must be stored at a temperature above freezing point and protected from mechanical contact. Where the possibility of being below zero exists, it must be examined to ensure it is emptied of water to the extent that only a few droplets may remain.
- The fins must be protected such that there is no risk of damage or fouling to them.

3.5 Handling



The General Arrangement drawing(s) supplied before delivery contain important information regarding the safe handling of the equipment, including:-

- Dry weight
- Position of lifting points
- Angle of chains to be used (if relevant)
- Size and thread of eyebolts (if required)



Personnel involved in handling the equipment must be suitably authorised, trained and qualified and have access to and review the supplied General Arrangement drawing(s) before handling. Lifted or handling must not be carried out at temperatures below -29°C

3.6 Safety



Paint Finish

The equipment is painted to customer specification. Please refer to the paint specification and obtain the correct material safety data sheets for the paint prior to carrying out touching up or paint removal procedures especially in the case of two pack epoxy paints.



Design Parameters

Do not operate the unit beyond the design conditions given on the identification technical specification. If these parameters are exceeded, the equipment must not be used without prior consultation with the manufacturer. Usage of the equipment in a non-design situation will invalidate the warranty. In addition, Sterling TT WILL NOT be held responsible for any material damage or personal injury resulting from such use; this risk is solely the responsibility of the equipment owner / user.



Safety of Personnel

Physical injuries can be caused to personnel by the incorrect handling, operating or maintenance of the equipment.

- Always use suitable personal protective equipment (PPE) for the task being carried out. Safety glasses, gloves, boots and protective clothing should be used as a minimum.
- Burns can be caused by touching the heat exchanger when it is in use.
- The element fins are sharp and can cut.
- The accidental release of a medium under pressure (especially steam and medium or high temperature hot water) presents a risk of burns, scalds and other injuries.
- Even after switching off the installation, the heat exchanger may remain hot. A cool down period of at least 30 minutes should be allowed.
- Maintenance must only be carried out when the equipment is shut down.



Damage to the Equipment

Damage can be caused to the equipment by the following:-

- External forces
- Atmospheric and Chemical Corrosion
- Erosion
- Fatigue
- Steam or thermal shock
- Too high a pressure or temperature
- Impact load
- Freezing
- Incorrect transport / storage / lifting or handling

All of the above parameters must be taken into account when handling, operating and maintaining the equipment.



Working at Height Regulations

If the heat exchanger is located above ground level, due attention must be paid to the Working at Height Regulations when handling, operating or maintaining the equipment.



Danger of Freezing

The heat exchanger must be drained down when not in use; the pipe contents may freeze when exposed to low ambient conditions, leading to burst pipes and deformation of the element



Legionnaires Disease

If the heat exchanger is used in a situation where stagnant water can form i.e. with a drain pan and / or condensate removal system or for dehumidification purposes, a Legionella Risk Assessment must be carried out. Appropriate steps must be taken as dictated by legislation local to the installation; e.g the Health and Safety Executive document HSE L8 “The control of legionella bacteria water systems” and The CIBSE publication TM13:2013 “Minimising the Risk of Legionnaires Disease” in the UK.



Pressure System Safety Regulations

If the heat exchanger is used with a pressurised medium, the recommendations given within the Pressure Systems Regulations 2000 must be followed.

4. Installation

4.1 Siting



- Unless specifically designed otherwise, coolers must be fitted flat and level
- Gaskets (supplied by others) must be fitted between the cooler and the enclosure which ensures the specified ingress protection (IP) level for the system is met.
- The gasket must be compliant enough to seal between the mating faces.
- All pipework attached to the heat exchanger must be supported so that no load is applied via the connections either statically or dynamically (as a result of thermal expansion or vibration).
- Flexible connections / couplings must be fitted wherever vibration transfer may occur to or from pipework.
- It is recommended that pressure and temperature access fittings are installed for the purpose of commissioning and checking the system operating parameters
- If regular venting of the system is difficult or inconvenient then STT recommend that automatic air release valves are fitted to the cooler and other high points in the system.
- The torque on header bolts must be in accordance with Appendix 1 (note that the return end header may be under a bolted cover box)
- Access must be provided for maintenance, withdrawal and cleaning of the element.

4.2 Preparation



- It is expected that recirculating water supplies will be treated with one or more of the following as appropriate to the actual site conditions:-

  1. Corrosion inhibitors
  2. PH regulators
  3. Anti-freeze agent

- The user is responsible for ensuring that the circulated fluid is compatible with the materials offered on the contract data sheet.
- All loose fittings supplied must be attached prior to installation.
- The installation must only be carried out by suitably qualified personnel.
- Remove all packaging and cover caps etc. prior to installation.

4.3 Installation



- The instructions for transport and hoisting must be followed when placing or moving the equipment,
- The weights given on the General Arrangement Drawing(s) are for guidance purposes only.
- All pipes and flanges must not be mounted under stress to the equipment
- Pipes must be able to expand. Flexible connections, anchors and expansion joints should be fitted to the pipes to suit the actual installation.
- Bolt : nut connections must be clean and lightly oiled
- The correct gasket for the application must be installed
- Do not install the equipment at temperature below -29°C

4.4 Tightening of Bolts



The bolts for the removable covers must be tightened with a torque wrench in the manner shown below. Standard bolting tensile is Steel grade 8.8 and stainless steel grade 80. The figures given below are based on those materials.

Header Style	Gasket Material	Bolt Size	Initial Torque	2nd pass	Final Torque
Grid & Cover	1.5 mm Klingersil C4106	M12 or ½"	45	60	80
Grid & Cover	1.5mm Klingersil C4106	M16 or 5/8"	50	80	100
Praxair Style	1.5mm Novus 34	M16 or 5/8"	50	80	100
Formed	3mm EPDM	M12 or ½"	25	35	40
Fabricated	3mm EPDM	M12 or ½"	25	35	40
Oil Coolers	3mm Nitrile	M12 or ½"	25	35	40

Klingersil C4106 is a non-asbestos material consisting of premium quality cork and with a nitrile binder and aramid fibre reinforcement, Compressibility ASTM F36A 20%-30%, Recovery 50%

Novus 34 is a blend of aramid / inorganic fibres and special additives, with a high quality nitrile rubber binder, Compressibility ASTN F36 9%, Recovery ASTM F36 55%.

EPDM has 70-80 Shore hardness

NB. In a small number of instances grade A2-70 or grade A4-70 may be used for M12 bolting of headers. In these instances, a final torque value of 75Nm should be used for Grid and Cover construction using C4106 Klingersil or Novus 34 gaskets.

5. Operation



The installation must be inspected, operated, maintained and repaired only by authorised and suitably trained personnel.

5.1 Inspection Before Use



The unit has been tested by Sterling TT in accordance with the test pressures stamped on the type plate attached to the equipment.

- The element fins must be undamaged and straight to ensure the design heat exchange takes place. If problems are found, use a fin comb to remedy them.
- Burrs must be removed from element connections.
- The element must be flushed to remove all swarf and other foreign bodies that may be present.
- The correct gasket for the application must be installed.
- The correct seals for the application must be used.
- The connected systems (fluid and gas) circuits much be checked to ensure they are complete, suitable for the application and correctly installed.
- The connected systems (fluid and gas) must be operating at the correct temperature and pressure.

5.2 Filling and Venting



When first filling the heat exchanger with water ensure that:-

- the pumps are turned off
- the vent plug is open
- the drain plug is closed
- the flow and return valves are cracked open to allow slow filling. (opening a pressurized supply when the block is full of air could displace inter-pass gaskets)
- Turn on the pumps and allow water to circulate for 5-10 minutes
- Either stop pump or close supply valve and release the air vent plug to release any air bubbles in the headers. (This may need to be repeated on new installations until all trapped air escapes)



If a cold medium is present in the heat exchanger but is not circulating whilst a hot medium is flowing through the heat exchanger, the cold medium may start boiling and the heat exchanger will be damaged.

5.3 Re-tightening of Bolts



The bolts on the gasket and the connecting flanges must be re-tightened to the correct torque after the heat exchanger has cooled down for the first time (ref to para 4.4 & 6.15).

5.4 Testing and Commissioning



Fluid Flow

It is important to set the water flow rate accurately as it is crucial to performance to attain the optimal tube velocity. It is also important to avoid the onset of destructive cavitation by ensuring that excessive velocities are avoided. If in doubt contact STT for advice on maxima and minima for your installation

STT recommends the installation of commissioning valves in the pipework circuit to allow flows to be trimmed as necessary.



Fluid Temperature

Water temperature can generally be measured reliably with a probe inserted at a self-seal test point (Binder or similar) or using fixed pocketed RTD's. Facilities for this are not supplied by STT unless specifically requested.

STT do not fit tappings for air temperature measurement unless specifically requested. Where probes are inserted for the purpose of commissioning it is important to ensure that they are positioned in the fully mixed airflow.



Vibration

STT heat exchangers are generally resistant to vibrations up to 20mm/sec and every effort is made to avoid key frequencies at 50 Hz and 60 Hz. However it is impossible to design a completely rigid cooler and still permit efficient heat transfer.

If when commissioning, it is found that a particular forcing frequency is affecting the cooler, it is important that you contact STT for advice on how to deal with it.

Note that Coolers for machines with Diesel drives, particularly common bed plate mounted are particularly affected. A special execution is available for these cases.



Performance

When commissioning a cooler, it is important to compare the estimated duty on the machine circuit with the extracted heat. A balance within 10% would indicate a reasonable set of results.

5.5 Inspection During Operation



Inspect the element itself and all connections for leakage during the first hour of operation and at regular intervals thereafter.

5.6 Shut Down



To shut down for maintenance purposes:-

- Display appropriate warning notices.
- Ensure heat input has stopped
- Close element flow isolating valve.
- Allow water in element to cool to ambient temperature.
- Close element return double regulating valve.



Drain the element if it is to be shut down for a lengthy period of time to prevent frost protection unless the fluid medium contains an anti-freeze solution.

Flush the element with clean filtered water if it is anticipated that corrosive residues may be present. Chlorination may be appropriate if bio-fouling is a risk.

Drain the element if it is to be shut down for over 48 hours to prevent corrosion.

5.7 Gaskets



If an element has been:-

- in long term storage
- has remained unused for 12 months from manufacture
- has been outside recommended storage temperatures

It is advisable to re-torque the header bolts (see block reassembling for details) prior to being pressurised in service. All polymer gaskets are susceptible to long term creep when under stress.

5.8 Standby Service



Where coolers are on standby for long periods, it is essential that certain actions are taken to ensure that they will perform correctly when called on. Unless frost is anticipated, keep filled with water, even if the supply is isolated.

Note that in the case of seawater, the system must be protected from the potential for marine growths. This may dictate alternative standby arrangements.

6 monthly
- Check for relaxation of gaskets and tighten as necessary
- Vent coolers to ensure no trapped air
- Follow actions as laid out in the Maintenance section.

6. Maintenance

6.1 General



The installation must be inspected, operated, maintained and repaired only by authorised and suitably trained personnel.



Maintenance and cleaning must be carried out when the equipment is shut down and is at ambient temperature.



Physical injuries can be caused to personnel by the incorrect handling, operating or maintenance of the equipment.

- Always use suitable personal protective equipment (PPE) for the task being carried out. Safety glasses, gloves, boots and protective clothing should be used as a minimum.
- Burns can be caused by touching the heat exchanger when it is in use.
- The elements fins are sharp and can cut.
- The accidental release of a medium under pressure (especially steam and medium or high temperature hot water) presents a risk of burns, scalds and other injuries.
- Even after switching off the installation, the heat exchanger may remain hot. The metal temperature should be checked before maintenance activities commence.



The installation must be inspected, operated, maintained and repaired only by authorised and suitably trained personnel.

6.2 Maintenance Frequency



It is recommended that the equipment is maintained at least once every 8000 hours of operation or 12 months, whichever is the shorter period. This frequency may need to be varied due to specific site conditions e.g. exposure to salt water.

6.3 Inspection - Equipment



The following must be inspected at the maintenance frequency given above to ensure the correct operation of the equipment:-

- Ensure fin surfaces are not damaged, dirty or blocked
- Ensure that there is no evidence of leakage from header gaskets
- Ensure there is no fluid leakage from the equipment / pipework connections
- The primary and secondary medium temperate and pressure are within the correct limits

6.3 Inspection – Equipment Continued



- Ensure condensate drains away adequately if applicable
- Check for fouling of the heat exchanger (this will give a drop in capacity).
- Ensure there are no strange noises or vibration at the equipment.
- Check the general condition of the equipment and repair any damage found
- Check for corrosion and carry out remedial work as necessary
- Ensure all safety devices function correctly
- Check the torque of all bolts and re-tighten accordingly
- Check that there is no evidence of leakage from the vent / drain fittings
- Check the leakage detector pipe where fitted to see that it is clear
- With the flow stopped, open the vent plug to release trapped air.

6.4 Inspection - Ducting / Gas Side



The following must be inspected at the maintenance frequency given above to ensure the correct operation of the equipment:-

- that all external fasteners are tight
- that the ducting remains free from corrosion
- that there are no new resonances or vibration which might indicate component failure

6.5 Inspection – Pipework / Fluid Side

The following must be inspected at the maintenance frequency given above to ensure the correct operation of the equipment:-

- Remove water supply pipe and through the connection flange, examine visible surfaces for corrosion, erosion, scaling.
- If anodes are fitted, remove and check that they are in good condition, replace as required.

6.6 Cleaning the Heat Exchanger – Liquid Side

A heat exchanger with straight tubes can be cleaned internally with a special brush available directly from Sterling TT. The covers must be disassembled. See “Header Removal”. After cleaning, the tubes must be thoroughly rinsed with a clean medium.

6.7 Cleaning the Heat Exchanger – Air Side

Protect adjacent equipment or remove element to an area where that equipment will not be adversely affected by cleaning operations. Blow the fins clean using compressed air in the opposite direction to the normal airflow. Take care that the fins do not deform. If further cleaning is deemed necessary, STT recommend the use of a proprietary foaming coil cleaner (see internet for your local vendor) and washed off with a *low pressure* hose using town water. Finned surfaces must be dried using warm air before putting back into service.

Under no circumstances may a pressure washer or steam cleaner be used as this is liable to drive the fouling into the centre of the matrix and / or deform the fins with permanent adverse effect.

6.8 Dissassembly of the Heat Exchanger

Isolate the hot medium first, then once the heat exchanger has cooled to the temperature of the cold medium, isolate the cold medium. Wait until the heat exchanger is cool before progressing any further.

- Isolate the hot and cold media on to and off the heat exchanger
- Drain the liquid medium with the heat exchanger vent open
- Note the location of parts to be disassembled.
- Remove the liquid media flow and return connections and disassemble the cover. The covers must be supported due to their weight.

During the disassembly process, it is possible that residual medium will seep from the heat exchanger. Use a drip tray or similar to catch any drips or leakage.

6.9 Assembly of the Heat Exchanger



- Always use new gaskets – never re-used old ones
- Make sure gasket faces are clean and undamaged
- Apply the gaskets
- Assemble the cover taking note of any markings made during the disassembly process and ensuring the bolts are tightened to the correct torque.

6.10 Straightening Fins



Bent fins can be straightened by careful use of long nosed pliers and a fin comb. Whilst sometimes unsightly, repaired fins do not adversely affect performance.

Fouled fins need to be cleaned, which in most cases require removal of the equipment from the ducting. In the first instance the fin leading and trailing edges should be cleaned with a soft bristle brush, and compressed air.

6.11 Gasket Leaks



Gasket leaks may be sealed by re-torquing in line with the data in Appendix 1 If this fails to seal, then the cooler must be stripped and new gaskets fitted. It is important to identify the type of gasket used and to replace with an equivalent. (Contact STT for gasket availability or advice on alternatives)

6.12 Tube Leaks



Tube to tube plate leaks at commissioning are rare, but if found can usually be sealed by reprocessing (expanding or welding). In service leaks can be sealed by use of a taper plug (contact STT for details). Leaks can usually indicate the end of the coolers useful life, although in the case of double tube coolers, it may be possible to run in a fault condition until a service replacement is available.

6.13 Corrosion



Ducting

Corrosion on the surface of ducting should be stopped as soon as seen by application of a proprietary conversion paint followed by touching up with the original paint system.

Tubes

Corrosion/erosion is most often found in the ‘vena-contracta’ area at the tube entrance. This is often the result of excessive velocity which should be corrected by controlling the water flow rates within the range specified on the STT data sheet. If found early enough it may be possible to extend the life of the tubes by installation of proprietary nylon sleeves.

If it is impossible to sufficiently control water velocities, then consideration should be given to replacing the heat exchanger with one employing velocity tolerant materials such as titanium.

Fins

Corrosion on fins is detrimental to the efficiency of the heat exchanger. If serious corrosion is encountered, the cause of such must be established and advised to STT before replacing the cooler.

Tube Plates

Surface corrosion of ferrous tubeplates can be repaired by shot blasting locally and treating with Zinga or a suitable epoxy paint. Corrosion in excess of 3mm depth will require replacement of the cooler matrix.

Corrosion of non-ferrous tubeplates is usually indicative of excessive velocity, poor water quality or anodic corrosion due to the component being the least noble metal in system

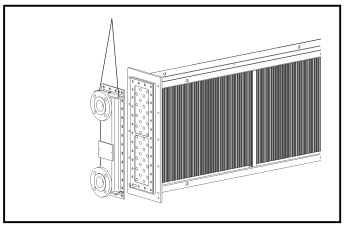
Fixings

Fixings supplied may be plated or coated to resist corrosion. It is not recommended to overcoat these with paint systems as such application may inhibit the maintenance of the equipment and in particular the correct torqueing of pressure bolts.



Tubes, Tubeplates and protective coatings can all be damage by particulates in the water. Whenever coolers are used with non-recirculated water (ie River water, Seawater, etc.) the filtration level should allow no particles larger than 250 microns.

6.14 Header Removal



Formed and fabricated headers:-

- Remove header to tubeplate fasteners leaving two at the top loosely fastened.
- Support weight of header
- Gently prise header away from tubeplate
- Remove last two bolts and remove.

Grid and cover:-

- Remove two bolts from the bottom run of bolts and replace with two temporary studs
- Remove the rest of the fasteners
- Gently prise the cover plate away from the tubeplate and remove
- Note position and handing of grid for replacement.
- Remove grid

All:-

- Remove all traces of gasket from both the tubeplate and header faces with care to prevent damage to the faces. A metal scraper can be used for this purpose if used with care.

- Note: On grid and cover plate header constructions the gasketed joints between tubeplate and grid, as well as between grid and cover plate will require careful removal.
- Inspect the surfaces to be gasketed paying particular attention to surface scratches, dents, and misalignments in machining or local undulations.
- If the gasket sealing surfaces are painted or otherwise coated, it is important that the coating is flat, continuous and without cracks or flakes.
- If the surfaces are damaged then STT should be consulted to recommend a suitable method of repair.

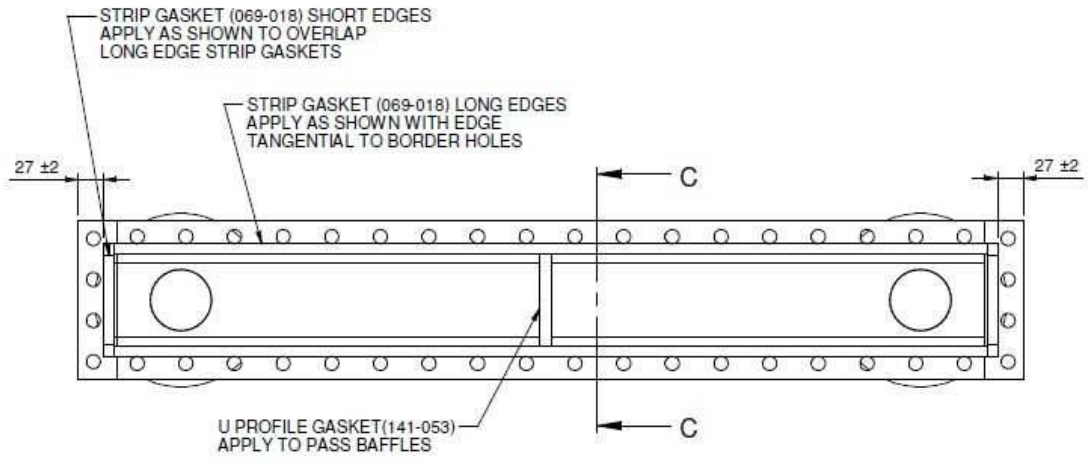
6.15 Header Reassembly

Formed and fabricated headers:-

- Lay a clean piece of paper larger than the grid on a flat surface and place the grid on it.
- Coat the gasket sealing surface with gasket dressing (Spraytack) by Industrial Adhesives Ltd or equivalent.
- Apply a new gasket to the tacky surface
- Ensure that the gasket is firmly held at the pass baffle positions

Note some coolers with formed headers are fitted with self adhesive strip gaskets

- Apply 1 row of strip gasket just touching the inside of the border holes and overlapping the strips slightly at the corners.
- The U-profile gasket should form a continuous flat upper face by butting sides. Do not try to mitre or take it round bends.
- The U-channel gasket improves the reliability of the seal in circumstances where centre baffle seals have been displaced due to sudden opening of water valves when the cooler is empty. If you would like to retro fit your cooler with this type of gaskets, please contact STT technical department for advice.



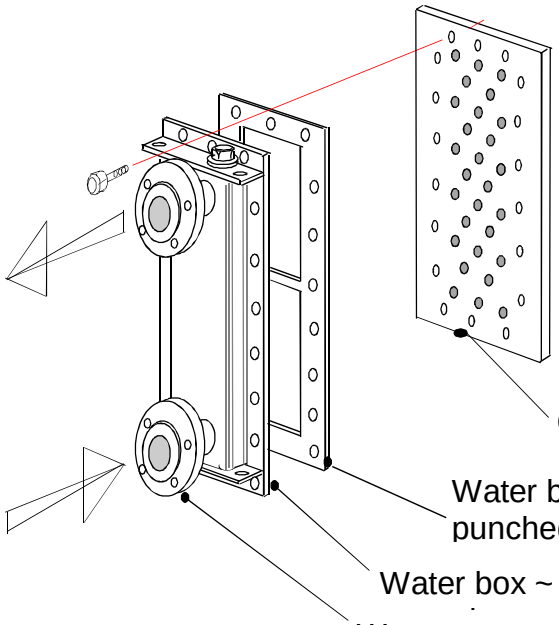
Grid and cover:-

- Fit two temporary studs in the tubeplate to support the grid during assembly.
- Fit two temporary studs coincident with the location tabs on the gasket to support gaskets during assembly. (if no tabs use spraytack as formed headers)
- Fit new gasket to tubeplate, ensuring correct orientation.
- Assemble the grid to the tubeplate, second new gasket and the coverplate to the grid in accordance with the drawing ensuring that any grid baffles are correctly orientated.

All:-

- Lubricate all bolts/studs threads prior to fitting. This will ease assembly and allow validation of the torque measurements.
- Mild steel fasteners - lubricate with a few drops of light oil. i.e. 3 in 1 type.
- Stainless fasteners- lubricate with copper slip. i.e. Rocol antisieze J 166.

Formed or Fabricated Header box



Assembly torque
40 Nm (M12)

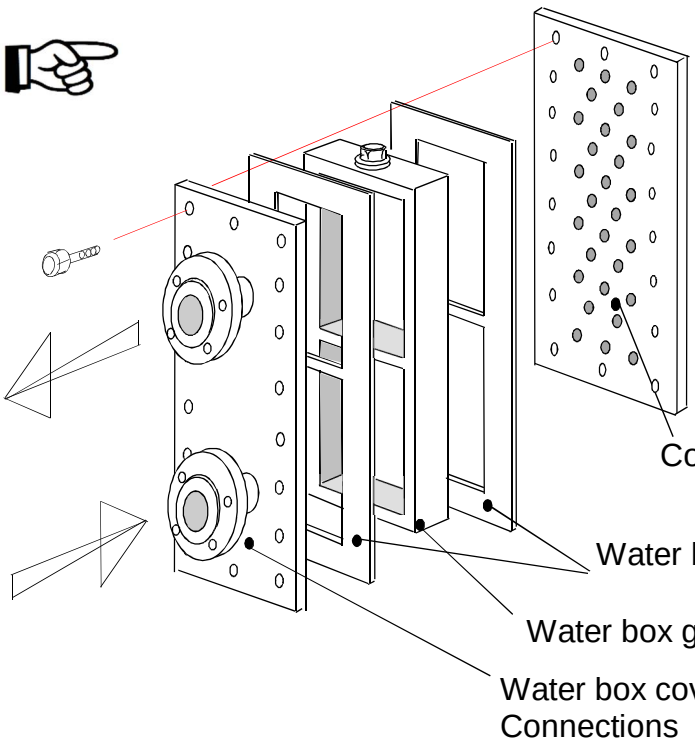
Connection end tubeplate

Water box gasket ~ EPDM may be punched or strip gasket

Water box ~ Carbon Steel Rilsan

Water connections

Grid & Coverplate Header Box



Assembly torque
80 Nm (M12)
(75Nm for Gr 70 fixings)

Connection end tubeplate

Water box gasket ~ Klinger C4106

Water box grid ~ Carbon Steel or Non ferrous

Water box cover plate.
Connections

Refer to section 4.4 for full tightening and torque details

- Assemble all bolts (or studs and nuts), nipping up to a light pressure.
- Tighten progressively to initial torque (section 4.4) in a symmetrical pattern starting at the centre and working toward each end as Figure 1

+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
46	43	42	39	38	35	34	31	5	4	1	7	10	11	14	15	18	19	22	23	26
+																				+
47																				27
+																				+
49																				29
+																				+
50																				30
+																				+
48																				28
+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
45	44	41	40	37	36	33	32	6	3	2	8	9	12	13	16	17	20	21	24	25

Figure 1

- Re tighten to 2nd pass torque using the same symmetrical pattern.
- Re tighten to final torque using the same symmetrical pattern.
- Finally, re tighten at same torque starting with a bolt on the centre line and working around clockwise.

6.16 Pressure Test



- Fit blanking plates to the connection flanges
- Fill with water
- Slowly increase pressure
- Check for leaks
- Pressure test to the pressure on the rating plate or as advised by STT for a period of 30 minutes.

After 24 hours EPDM gaskets should be re-torqued to allow for settling.

Follow commissioning guide for return to service.

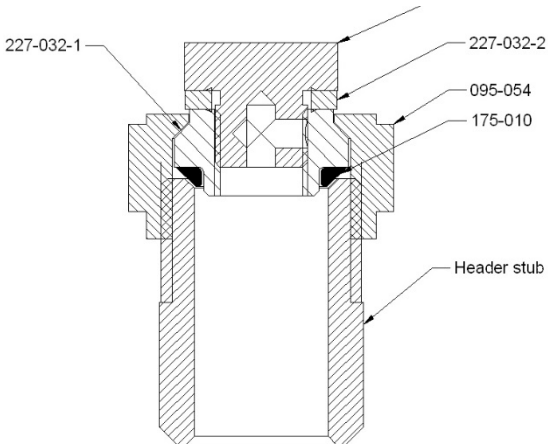
6.17 Vent and Drain Connections

Rilsan coated Formed and fabricated headers

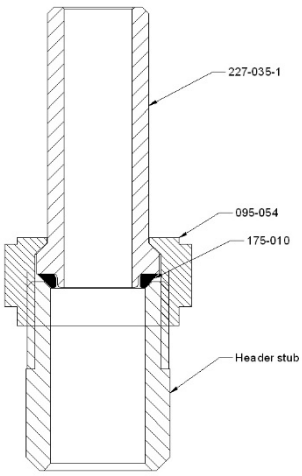
Subject to the application, two main differing types of vent and drain connection may be fitted:-

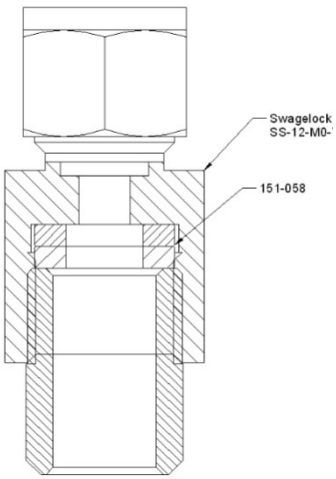
1. A non-ferrous boss silver soldered into the steel header. The boss is fitted with a ¼" BSP parallel plug with an o-ring seal under the head. Boss size and thread may vary subject to contract requirements.

2. Welded in stub pipe with an external thread, fitted with a non-ferrous ring nut which can employ several different fittings depending on application. Normally it is not necessary to undo the ring nut as venting/draining can be carried out on the fitting. See below.



Other attachments





It is not permissible to direct couple pipe work to the stub unless the fitting seals with a sealing washer on the end.

Grid and cover headers

The grid will have ¼" BSP threaded ports fitted with a parallel plug having an o-ring seal under the head. The plug is cross drilled so that venting can be safely carried out without completely removing the plug.

7. Fault Finding

Fault	Possible Cause	Remedy
Heat exchanger has insufficient capacity	There is air in the fluid side	Vent and top up as necessary
	Operating conditions are different to design	Adjust the operating conditions to the specified design
	The heat exchanger is fouled	Clean the heat exchanger
	The heat exchanger has been piped incorrectly	Check and remedy any problems found
	Gasket pass partition has been displaced	Reposition or replace gasket.
	The fins are damaged or dirty	Clean and re-align the fins
Heat exchanger is leaking	Gasket faces dirty or damaged	Check and clean gasket faces. If found to be damaged contact STT
	Defective gasket	Replace gasket
	Bolts incorrectly tightened	Check and re-tighten to the recommended torque
	Defective tube	When a tube is defective it can be blocked as an emergency measure using plugs on the inlet and outlet sides. This may only be done after consulting and obtaining permission from STT
	External forces / stresses	The installation must be stress and vibration free. Check cause and remedy any fault found.
	Defective tube to tube plate connection	Contact STT to replace a tube or repair the heat exchanger.

8. Spares

8.1 Ordering Spare Parts



Spare parts can be ordered directly from STT. The following information is required as a minimum:-

Project / order number
Description / model of product (see GA)
Description of part (see GA)
Equipment Serial Number (See Cooler Nameplate)

8.2 Recommended Spares



Please contact our Spares Department for an up to date spares listing:

t: +44 (0)1296 487171
f: +44 (0)1296 436805
mail@sterlingtt.com

9. Customer Service

9.1 How to Contact Us

Full contact details are given on the rear cover of this document

9.2 Complaints Procedure

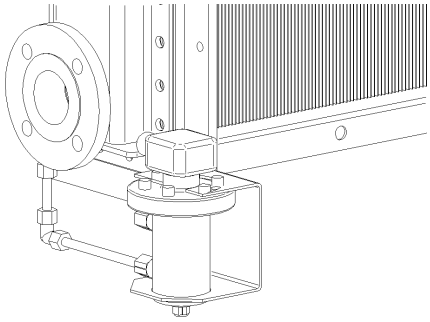
In the event of any malfunction, complaints or dissatisfaction with this equipment, please contact the STT Service Department using the contact details on the rear of this document

10. Optional Extras

10.1 Leak Detection Package

Float Type

Periodically open leakage detector sump and ensure that it is clean, test operation of alarm by manually lifting float. Inspect leak detector pipes to ensure they are not clogged.



Ultrasonic type

These are self-checking and have an indicator to show system health.

10.2 Pressure Relief Package

A pressure relief valve may be supplied to protect the equipment form over pressure. This will be set at an agreed value for the equipment – normally the design pressure. The discharge port must be kept free from any obstruction or foreign matter. If discharging during normal operation check system for overpressure and / or valve for failure with a view to replacement.

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SIEMENS

Cooling System – Top Mounting

Installation and Maintenance Guide

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1 Preliminary Remarks

This Installation and Maintenance Guide describes the structure and installation of the cooler hood on the generator, and provides instructions for inspecting and maintaining the air/water heat exchangers.

NOTE

In some cases, the structure of the hood and heat exchangers described in this guide may differ from the versions actually supplied.

Fig.1: Cooling system, deflection chamber side



Fig.2: Cooling system, water inlet side (left) and leakage air filter



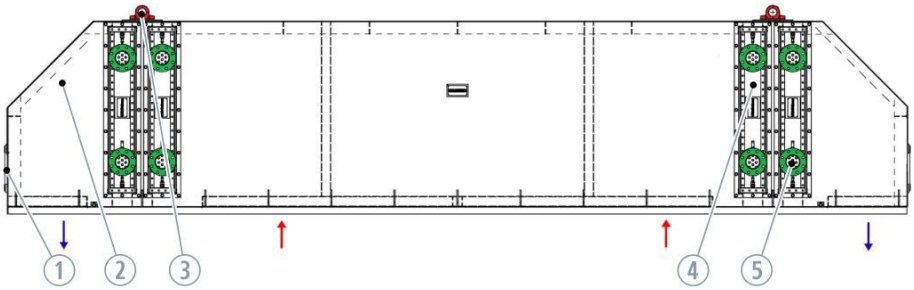
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2 General Safety Instructions

- Secure all loose and movable parts.
- Avoid impacts and suddenly changing stresses on the hood.
- Wear appropriate protective clothing, and hearing protection to prevent hearing impairment.
- Do not wear any jewelry or loose clothing.
- Adequately ground all connected electric circuits to prevent electric shocks.
- Do not drastically change the operating conditions.

3 Description of the Cooling System

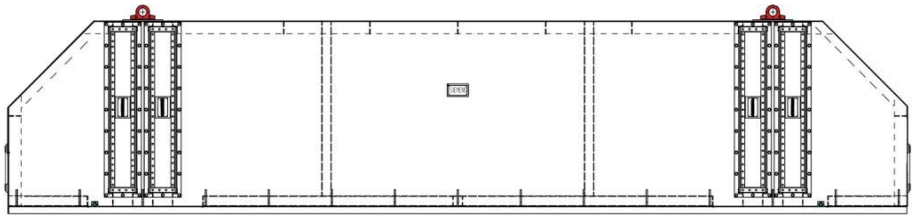
Fig.3: Cooling system, view of the water connection side



1 Inspection hatch with leakage air filter
2 Cooler hood
3 Eyebolt
4 Heat exchanger
5 Water connector

Warm air
Cold air

Fig.4: Cooling system, view of the deflection chamber side



3.1 General Information

The generator is equipped with a cooler hood to facilitate totally enclosed water-to-air cooling (TEWAC), which dissipates the operating heat from the interior of the generator.

The cooler hood is mounted on the sound attenuation cover of the generator. The cooling system consists of the heat exchangers and the hood. Any pre-installed electric wiring must be connected to the customer's corresponding terminal boxes. Follow the manufacturer's instructions.

Together the cooling system and the sound attenuation cover keep out dirt, sand, water and moisture. After the generator has been assembled, it is therefore important to mount the cooling system on the sound attenuation cover of the genera-

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tor as quickly as possible. Once the cooling system has been received and unpacked on site, any apertures should be temporarily sealed with foil to keep out dirt, sand, water and moisture.

3.2 Design

Cooler hood

The cooler hood consists of a welded profile frame structure with slide-in frames. Single or multiple, side-by-side heat exchangers are mounted in these frames.

Heat exchanger

Liquid coolant flowing through these heat exchangers absorbs the heat energy from the circulating air. The maximum working and test pressures are marked on the rating plates of the individual heat exchangers. The heat exchangers are housed vertically in the slide-in frames in the cooler hood, and can only be dismounted from one side.

The heat exchangers can be dismounted for maintenance and cleaning purposes. Rollers or sliding elements are mounted on the ends of long, heavy heat exchangers to make it easier to dismount them from the slide-in frames. Follow the manufacturer's detailed instructions when maintaining, cleaning, disassembling and reassembling the individual heat exchangers.

3.3 Enclosure

The enclosure of the cooling system is designed to ensure effective distribution of the cooling air to the heat exchangers and to minimize pressure losses. The interior lining is sound insulated and designed to match the local conditions of the particular customer.

Condensation water troughs

Condensation water troughs with drainage outlets are mounted under the heat exchangers in the cooler hood to prevent condensation water or water leaking uncontrolled from a pipe penetrating into the interior of the generator. The condensation water troughs are fitted with leakage water warning electrodes which signal the uncontrolled escape of cooling water inside the hood. The cabling and function of these warning electrodes must be tested after completion of installation.

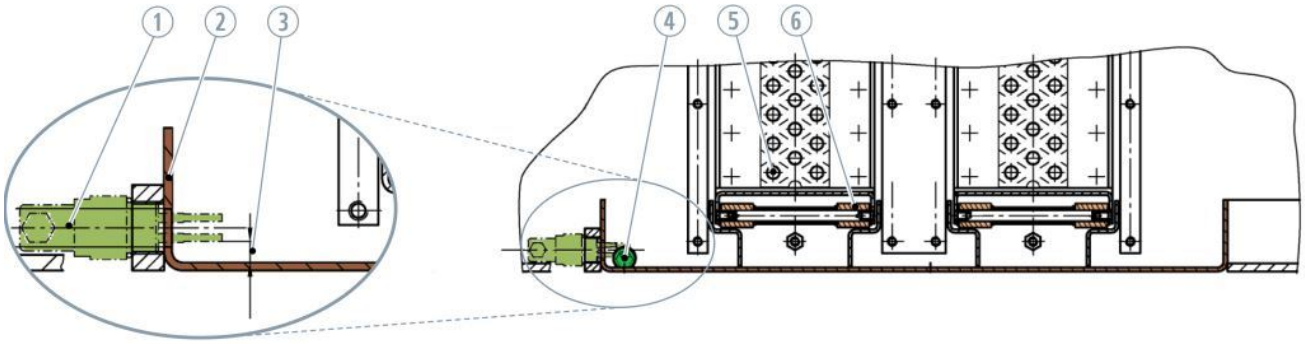


Fig.5: Condensation water trough

1 Leakage water warning electrode
2 Condensation water trough
3 Distance between sensor and trough, approx. 13 mm
4 Four drains for the condensation water trough
5 Heat exchanger
6 Rollers for dismounting the heat exchangers

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4 Transport and Storage

Transport

The cooling system is delivered packed in a transport crate, see Fig. 6.

Eyebolts are provided on the top of the cooler hood for transporting and mounting the cooling system after the packaging has been removed.



⚠ WARNING

Danger of crushing! Risk of damaging the cooling system and generator! The eyebolts are only designed for suspending the cooling system, not for lifting heavy loads.

- Only use the eyebolts for transporting and mounting the cooling system.

Storage

Check the moisture indicators on the packaging every month while the cooling system is in storage in its unopened packaging. No other action has to be taken as long as the indicators remain blue. If the indicators turn pink, the silica gel desiccant in the packaging must be renewed, that is it must be dried separately or replaced.

5 Assembly Instructions

5.1 Unloading the Cooling System from the Transport Truck

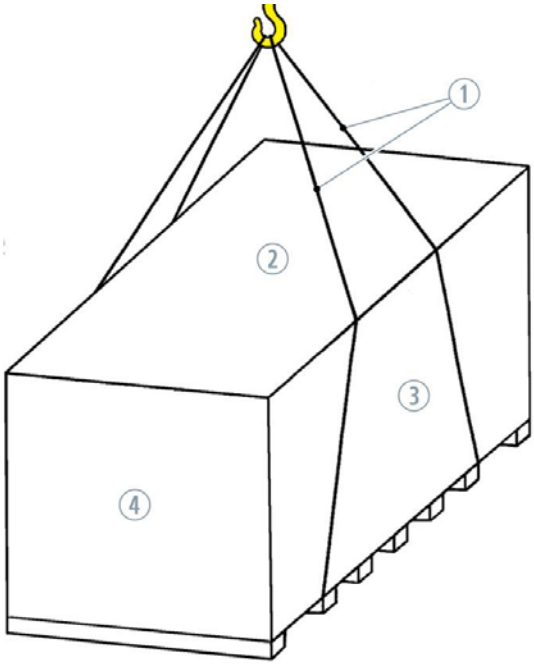


⚠ WARNING

Risk of crushing injuries caused by falling objects!

- Do not stand or walk under suspended loads during the transport work.

Fig. 6: Unloading from the transport truck



1 Steel ropes
2 Cover
3 Side wall
4 End wall

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Work steps

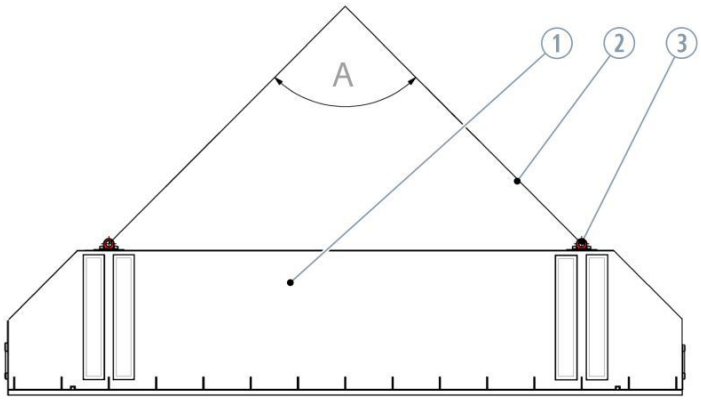
1. Use two steel ropes with an adequate loading capacity.
2. Hitch the transport crate at the marked hitching points (Fig. 6).
3. Lift the crate off the transport truck and lower it onto a flat surface so that it is evenly supported.
4. Check that the packaging and moisture indicators are undamaged.

5.2 Removing the Packaging

Work steps

1. Remove the metal edge protection profiles from the top and bottom of the packaging.
2. Use a nail puller and crowbar to force apart the sides, ends and roof of the packaging. Remove the roof of the crate with a crane.
3. Use a nail puller and crowbar to force apart one side wall from one end wall and the floor.
4. Carefully remove the side wall, the end wall, the second side wall and the second end wall one after the other with a crane.
5. Remove the tie-downs from the floor of the crate, as well as the aluminum and foam foils.
6. Remove the pallet holding the accessory cartons from the floor of the crate.
7. Check the accessory parts against the enclosed packing list for completeness.
8. Inspect the visible outer surfaces of the cooler hood.
9. Hitch each of two load bars or adequate spread angles (for long ropes) to two of the 4 eyebolts provided (Fig. 7). Closed-system load suspension devices, such as hook locks or shackles, must be used.
10. Lift the cooling system uniformly, until the chain slings or rope slings have been extended. The maximum spread angle must not exceed 90°.

Fig. 7: Diagram of the cooling system hitched for transport



1 Cooler hood
2 Four-strand steel rope
3 Eyebolt

A Spread angle of the steel ropes Max. 90°

11. Undo the screws connections holding the cooling system to the floor of the crate, and lift the cooling system carefully.
12. Remove the floor of the crate.

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13. Inspect the cooling system, including the heat exchangers and internal parts. Remove all desiccant bags.

5.3 Mounting the Cooling System

Prerequisites

- ✓ The sound attenuation cover of the generator must be clean and dry.
- ✓ All transport covers have been removed from the sound attenuation cover.
- ✓ Any necessary blind covers have been mounted on the sound attenuation cover (terminal board bushings/phase leads).
- ✓ The cooler hood must be clean and dry.
- ✓ The rubber seal in the flange area of the hood must be undamaged.

NOTICE

Dirt hazard!

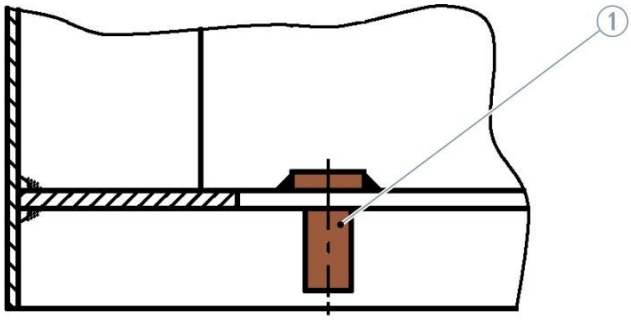
If the cooler hood is dirty, the required standard of cleanliness of all the air-carrying components is no longer ensured.

- ▶ Keep the cooler hood clean, and clean it thoroughly before mounting it on the generator.
- ▶ Do not leave any loose parts, such as nuts and bolts, in the cooler hood.
- ▶ Do not perform any work that creates dirt or chips, such as grinding and welding, near the open hood.

Work steps

1. With the cooling system in its normal orientation, attach the ropes to the 4 eyebolts with a maximum spread angle of 90°. Use four-strand load suspension devices with an adequate loading capacity (Fig. 7).
2. Lift the cooling system with the crane over the generator sound attenuation cover and, with it suspended horizontally, align it in the longitudinal direction with the flange of the sound attenuation cover.
3. Lower the cooling system carefully so that the 4 guide bolts go into the 4 guide-bolt holes at the corners of the sound attenuation cover (see Fig. 8).

Fig. 8: Guide bolt of the cooler cover



1 Guide bolt

4. After the cooling system has been lowered onto the sound attenuation cover, bolt the cooler hood air-tight with bolts which may have been provided (option if there is a higher risk of earthquakes).
5. Connect the supply and return pipes to the water connection side of the heat exchangers. Welding neck flanges, as counterflanges for the heat exchanger flanges, are optionally premounted or supplied loose together with corresponding hexagonal nuts, bolts and gaskets. Install shut-off valves in the supply and return pipes.

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NOTICE

- Check the direction of flow in the supply and return pipes to the flanges of the heat exchangers.
- Lay the pipes stress and torque-free, so that no forces are transmitted to the connectors. Use compensators. Install connecting pieces, for pressure and temperature tests during commissioning.

6. Mount the pipes for draining and venting the heat exchangers with appropriate holding clamps (Fig. 9).

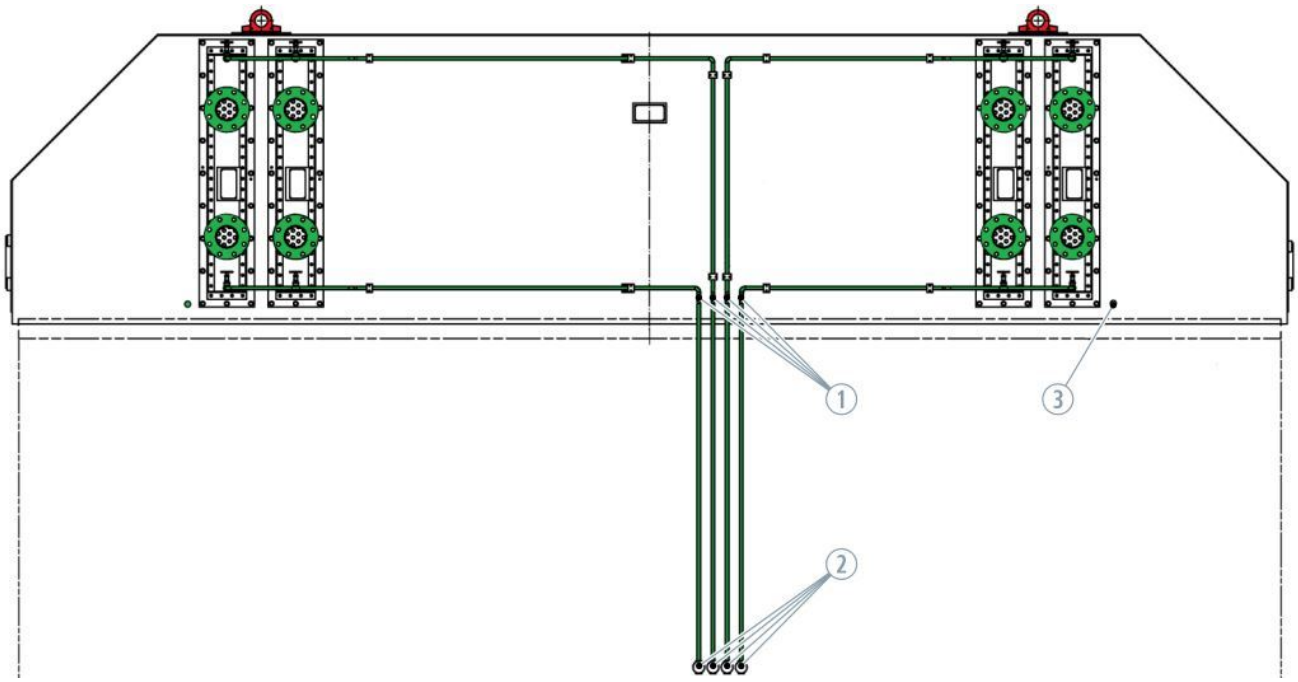


Fig. 9: Pipes for draining and venting the heat exchangers

1 4 x screw joint
2 2 drains, 2 vents
3 Condensation water trough drain (one on each side)

7. Mount or check the filter mats in the mounting frames of the leakage air filters.
8. Mount the leakage water warning electrodes and/or make the electrical connections. Check that the condensation water troughs are clean before installing the leakage water warning electrodes.
9. Safely ground all mounted components. Connect the intended grounding points between the cooler hood and generator cover.

NOTICE

- If necessary climb into the inside of the hood through the inspection hatches: Before doing so, empty all pockets, remove watches and jewelry.
- Do not leave any loose parts, such as nuts and bolts, in the cooler hood.

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5.4 Mounting the Heat Exchangers

The cooling system is usually delivered with the heat exchangers already mounted, however in exceptional cases they have to be mounted on site.

NOTE

When mounting and dismounting the heat exchangers observe the following without fail:

- The manufacturer's technical documentation
- Use the spare parts recommended in this documentation
- The available clearance above the cooling system

Trained personnel should perform the necessary water pressure tests on the heat exchangers, before the units are installed in the hood, and connected and commissioned (see page 14).

Measures during installation

- All pipes and flange connections must be laid stress and torque-free to the heat exchangers, and seals fitted that are appropriate for the water quality, pressure and temperature.
- The cooling water should be neutral and free from contamination. Prepare with anti-corrosion agents, pH regulator and/or antifreeze according to the on-site conditions.
- A suitable filter can be fitted on the cooling water inlet during the first commissioning to prevent blockages in the cooling pipes. Check or clean the filter, and remove after connecting the water unit.
- If necessary, vent and subject the cooling system to overpressure so that all heat exchangers can work optimally under all operating conditions.

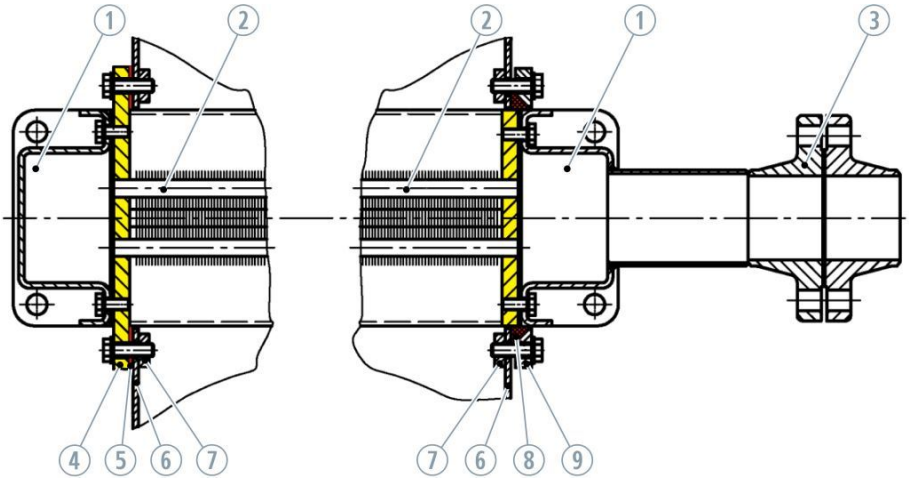
NOTE

When mounting and dismounting the heat exchangers and pipes, observe the following without fail:

The heat exchangers are only bolted tightly to the hood enclosure on one side of the cooler hood, and sealed with a rubber-frame gasket. The other side of the cooling unit is not bolted to the hood, but sealed to the flange of the hood by a rubber profile (e.g. an O-ring). A pressure frame holds the rubber profile in place. This arrangement allows the heat exchangers to expand and contract in response to changes in temperature (Fig. 10).

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Fig. 10: Heat exchanger, bolted connections



1 Water chambers
2 Cooling tube
3 Water inlet/water outlet flange
4 Projecting tube sheet
5 Flat gasket
6 Enclosure
7 Bolt-on strip
8 Round cord seal
9 Clamping frame

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6 Commissioning the Cooling System

Before commissioning

- Before commissioning the cooling system after a lengthy period of storage (over 3 months), retighten the bolted joints of the chambers of the individual units. Observe the sequence of work and torques specified by the corresponding manufacturers. Check all seals, and replace if they are more than two years old.
- Check that the cooler hood has been properly mounted with a seal on the generator to prevent the uncontrolled escape of cooling air.
- Check that all additional units, such as leakage water warning electrodes and thermometers, have been connected correctly.
- Fill the cooling system pipes with clean coolant, and vent the heat exchangers at the highest point above the vent lines. Open the supply valves little by little to avoid water hammer. The flow rate of the coolant should be regulated solely by the return valves, whereas the supply valves remain fully open. Close the venting valves when there is a smooth flow of water in the vent lines and they do not contain any air.

Checks and measures after the first commissioning

- Check the pressure and, if necessary, the flow rate to the heat exchangers.
- Check all connections and the heat exchangers for water leaks.
- Check the system for vibrations and unusual noises.
- Drain any condensed water from the condensation water troughs below the heat exchangers through the screwed drain plugs.

NOTE

If corrosive coolants (e.g. water) are used, continuous operation of at least 2 months is required to build up a passive protective coating on the metal surfaces.

7 Regular Inspections and Control List

Regular inspections and checks have to be made to ensure trouble-free operation of the cooling system. The times for inspections and checks are to be taken from the Maintenance and Inspection sections of this manual.

Inspection

In general, the following checks are recommended:

- Visual inspection of the general condition of the system
- Check for dirt and damage on the outside surfaces
- Check the surfaces of the cooling fins for blockages and damage
- Check the pipes for blockages and damage
- Check for water leaks in all areas
- Check the water pressure or, if necessary, the flow rate
- Check and clean the leakage air filters, if necessary Replace the filter mats
- Check for vibrations and unusual noises
- Check water-carrying parts for corrosion
- Check the function of the safety devices, such as the leakage water warning electrodes

8 Decommissioning the Cooling System

Work steps

1. Shut down the generator.



⚠ CAUTION

Danger of burns if the heat exchangers have not yet cooled down.

▶ After the generator has been shut down, the cooling water pumps should continue to run for some time to dissipate the residual heat.



NOTICE

▶ When necessary, climb into the inside of the hood through the inspection hatches: before doing so empty all pockets and take off watches and jewelry.

▶ Ensure that no loose parts, such as nuts and bolts, are left in the cooler hood.

2. Shut down cooling water pump.
3. Depressurize the system: first shut the return valves, and then the supply valves.
4. Disconnect the power supply to the leakage water warning electrodes.
5. Drain and vent the heat exchangers through the corresponding pipes.

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9 Maintenance and Cleaning

NOTE

When maintaining and cleaning the heat exchangers, follow the manufacturer's technical documentation and use the recommended spare parts without fail. The following sections contain only general instructions.

NOTICE

Risk of damaging the heat exchangers.

- Have the cleaning work done by an expert.

The heat exchangers have to be cleaned to maintain a good heat transfer and avoid corrosion. It is recommended to remove the heat exchangers for cleaning from the slide-in frames of the cooler hood. When refitting, ensure that there is a correct seal between heat exchangers and enclosures (see also the pipe fitting instructions on page 9).

The documentation of the manufacturer of the heat exchangers must be followed without fail.

Fig. 11: Dismounting the heat exchangers





9.1 Cleaning the Air-Side of the Heat Exchangers

The external hot surfaces of the heat exchangers, whether mounted or dismounted, are preferably vacuum cleaned. When dismounted, they can also be cleaned with dry compressed air. When blowing out, ensure that the cooling air is blown out in the opposite direction to the normal air flow.

If the external hot surfaces are cleaned with water and a pH-neutral cleanser, subsequently blow out the heat exchangers with compressed air, and dry with hot air.

NOTICE

The compressed air can damage the cooling fins.

- Use the compressed air carefully.

9.2 Cleaning the cooling pipes of the heat exchangers

Work steps before cleaning the cooling pipes

1. Drain the heat exchangers and remove all operating materials.
2. Dismount the heat exchangers from the hood.
3. Dismount the water chambers by undoing the screwed connections.
4. If there are tapped holes in the water chamber flange for screwing in forcing-off screws, use these screws to carefully force off the chamber.

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Cleaning the cooling pipes

Loosely adhering dirt is cleaned off the internal pipes by means of oil-free compressed air. Clean out firmly adhering dirt with a high-pressure water jet (maximum temperature: 90°C). The spray must be directed in the opposite direction to the flow of the coolant. Only use pH-neutral cleanser (pH 6.0 to 7.5) for cleaning. As a rule all, all washing up liquids lie within this range. A round nylon brush of the appropriate diameter can also be used for cleaning, here again use it against the direction of flow of the coolant.



NOTICE

Danger of damaging or removing the passive protective coatings from the surfaces of the heat exchangers during the cleaning process.

- A method that does not damage the protective coating is preferred for mechanically cleaning the internal pipes of the heat exchangers.
- Do not clean heat exchangers by poking mechanically or with a wire brush, and do not bore out blocked pipes.

If the usual mechanical methods are unsuccessful, chemical cleaning of the cooling pipes can be considered.



NOTICE

With chemical cleaning, there is a risk of burning the cooling pipes.

- The cleaning process should only be carried out under the supervision of a chemist, who specifies the concentration of the cleansing solution and the duration of application according to the degree of contamination and the pipe material.
- Alkaline and acidic cleansers must not be used.
- Ensure that all chemical residues are thoroughly flushed out with water after the cleaning process.

Work steps after cleaning the cooling pipes

1. When re-assembling the water chambers, ensure that the guide plates and diverter plates are correctly oriented in their correct places.
2. Fit the water chambers with new seals, and tighten the screwed connections with the specified torques. The screwed connections are tightened alternately, diagonally from the inside to the outside to ensure that the seals settle evenly.
3. After re-assembling the heat exchangers, ensure that seals used are fully functional. Make a water-pressure test to check the tightness of the heat exchangers (see page 14).

9.3 Cleaning the Water Chambers

Clean the water chambers with water, commercial, pH-neutral cleanser and a nylon brush. Follow the manufacturer's instructions.



NOTICE

Risk of damaging or removing the corrosion protection in the water chambers.

This may lead to pitting and irreparable damage to the water chambers.

- If the corrosion protection becomes detached it has to be renewed.

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9.4 Cleaning the Cooler Hood

Vacuum clean the insides of the cooler hood and the sound attenuation cover of the generator (in as far as they are accessible) and wipe down with a damp cloth. Add commercial pH-neutral cleanser to the wiping water. Finally, thoroughly dry the damp surfaces.

10 Reworking, Repairing and Testing the Heat Exchangers

If leaks occur in the heat exchangers, the procedures for testing and repairing the components should always be agreed with the responsible department of Siemens AG. Leaks in the area of the chambers, seals and shell can usually be localized from the outside. A leak should be repaired by skilled personnel according to its type and position.

If a leak cannot be found from the outside, it has to be localized by a leak test of the heat exchanger. Depending on the type of heat exchanger and the suspected position of the leak, test for leaks either from the outside (shell side) or the inside (chamber space). The leak test localizes the defective pipe or the position of the leak. If the heat exchanger has been dismounted, test for leaks with the medium suitable for the particular operating material of the shell or chamber space. The pipes and water chambers are tested for leaks from the inside by, for example, **water pressure tests**, and from the outside after, for example, weld repairs by the **dye penetration test**. The most frequent **leaks** are **in the weld seams of the water chambers** and **leaks in the pipes in the joints of the chamber floors**.

10.1 Water pressure test

The water pressure test on the heat exchanger ensures that there are no leaks in the expansion and connection elements, seals, welded chambers or fitted pipes.

Equipment

The following equipment is required to perform a water pressure test:

- A hand water pump with adequate capacity for the specific test pressure
- A calibrated manometer
- Connecting hoses or elements



NOTICE

Risk of damaging the heat exchanger.

▶ Allow the water pressure test to be performed only by trained personnel.

Work steps

1. Connect the pump to the inlet flange of the heat exchanger, and mount the manometer on the outlet flange.
2. Mount all other parts as shown in Fig. 12.
3. Fill the heat exchanger with water, and vent it through the air cocks on the water chambers.
4. Close the air cocks and gradually increase the water pressure to the specified test pressure.
5. Monitor the test pressure for at least 2 hours.
6. All parts of the heat exchanger - such as chambers, pipes, seals, welded seams - are tested during the pressure test. During the pressure test there should be no measurable pressure fall on the manometer.

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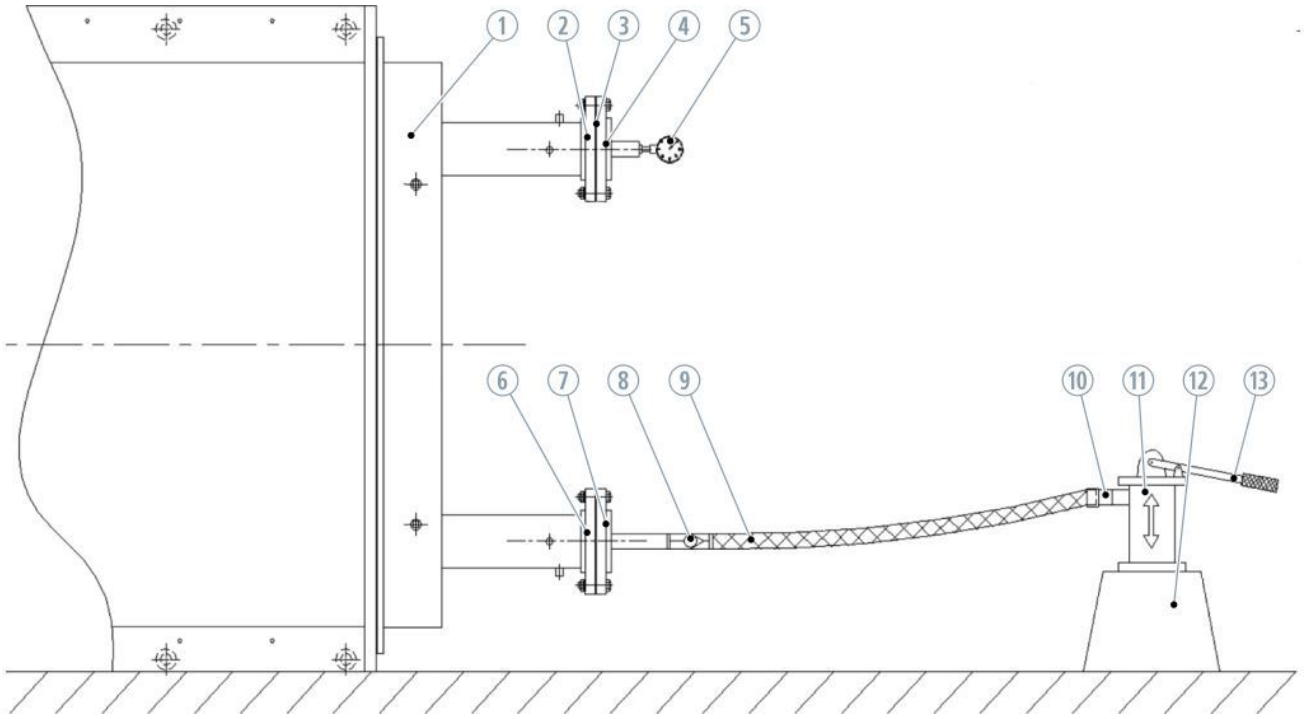


Fig. 12: Connecting the heat exchanger for the water pressure test

1 Heat exchanger
2 Water outlet flange
3 Gasket
4 Blind flange
5 Pressure gauge
6 Water inlet flange
7 Connecting flange
8 Non-return / cut-off valve
9 Hose
10 Hose union
11 Manual pump
12 Reservoir
13 Pump handle

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10.2 Dye Penetration Test after Weld Repairs

NOTICE

Risk of damaging the heat exchanger.

- Always have the dye penetration test performed by an expert.

The dye penetration test can test surfaces and weld seams for the smallest cracks and openings in the surface. It serves to prove that there are no leaks after weld repairs to the cooling system. The smallest faults are made visible by a colored penetration agent and a developer with high color contrast to the penetration agent.

10.3 Leaks in the Weld Seams of the Water Chambers

NOTICE

Risk of damaging the heat exchanger.

- Allow necessary tests of weld seams and weld repairs to be performed only by trained, authorized personnel.

Work steps

1. During the pressure test, mark possible leaks in weld seams with chalk or paint.

2. Reduce the pressure and drain the heat exchanger. If necessary, blow the heat exchanger dry with compressed air to remove all traces of moisture.
3. Use a dye penetration test to find whether there is a leak at the affected spot.
4. Regrind the defective spot and weld the crack.
5. Then perform another dye penetration test to check the weld seam.
6. Remount the heat exchanger, and perform another pressure test.

10.4 Leaks in Pipes in the Joints of the Chamber Floors



NOTICE

Risk of damaging the heat exchanger.

▶ Allow the repairs to be performed only by trained personnel.

Work steps

1. During the pressure test, mark pipe leaks with chalk or paint.
2. Reduce the pressure and drain the heat exchanger. If necessary, blow the heat exchanger dry with compressed air to remove all traces of moisture.
3. Remove the affected water chambers.
4. If the damaged spot is not obvious, search for the leak in the tube sheet with a light. If necessary, test the pipes individually.
5. Check the bore of the pipe at the joint, and widen the joint.
6. If the affected pipe still leaks after another pressure test, seal both ends of the pipe with conical copper plugs, and braze the pipe and plug together. A suitable two-component adhesive can also be used.



NOTE

Alternatively, the defective pipe can be replaced by a new one. Whether this exchange is made depends on whether a replacement is available, and the time frame involved. In this case contact Siemens AG.

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The cooler unit comprises four cooling elements, each of which contributes 25 percent of the cooling capacity.

The generator can be operated in emergency mode at 67 percent of rated power and with only three active cooling elements.

The damaged element has to be shut off. It is important that it remains in the cooler unit until it is replaced.

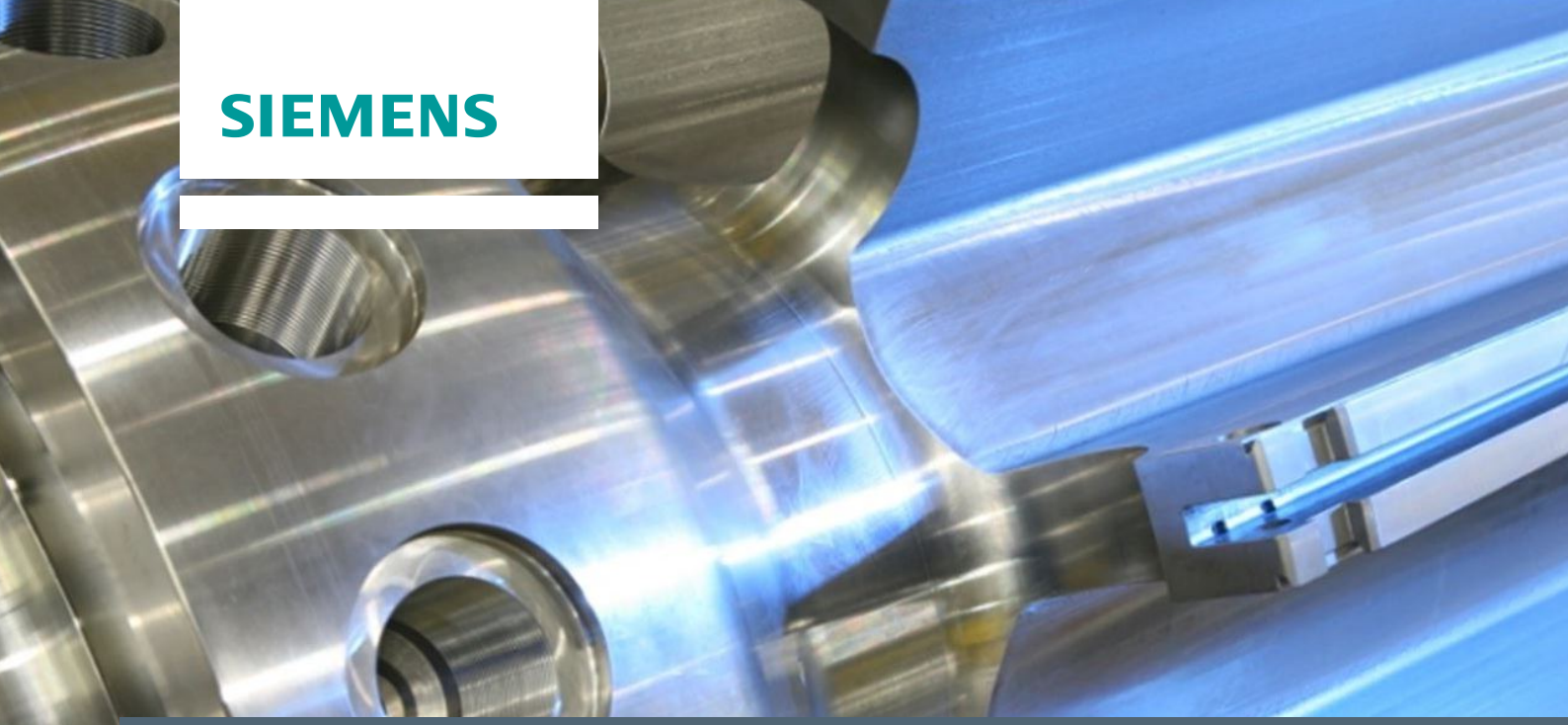


NOTICE

Damaged cooling elements must be replaced as early as possible!

The reported and protection values of the cold air temperature are invalid during emergency mode. All other values (especially the stator slot temperatures) remain valid during emergency mode.

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SIEMENS

Description of the System/ Plant Section 2

Components and Purchased Parts 2.3

Contents

2.3.1 Cooler

2.3.2 Bearings

2.3.3 Lubrication Oil Supply

2.3.4 Excitation

2.3.5 Neutral Point / Line Side Cubicle

2.3.6 Generator Control Panel / Automatic Voltage Regulation (AVR)

Manufacturer: GTW

Bearing designation: TE: WP-XYQ 28-315
EE: WP-XYQ 28-315

Shaft seals: **TE**

1 × Rigid labyrinth seal KD
type W28-335_S
protective system IP 55

1 × Rigid labyrinth seal MKD
type W28-355
protective system IP 44

EE

2× Rigid labyrinth seal KD
type W28-355
protective system IP 44

Temperature measurement: journal parts (radial)

Bearing insulation: insulated spherical seals

Bearing material: GTW 89

NOTE:
You will find more detailed information in the Dimensional Drawing Text.

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Manufacturer: **GTW Gleitlagertechnik Weißbacher GmbH**

Documentation: **Bearing Calculation**

No. of pages: 2

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Bearing Calculation Results
WPXYQ 28-315

Document: C17-1283-1-A	Customer: Siemens AG	Gleitlagertechnik Weißbacher GmbH Weseler Straße 32 46519 Alpen Germany
Project: Vilnius Biomass	Order no.:	

Calculation tool radial/axial:		COMBROS-R 1.2.1 / -		
Radial bearing main diameter [mm]:		315		
Radial bearing width [mm]:		215		
Relative radial clearance [‰]:		1,32		
Oil type:		ISO VG 46		
Nominal oil flow [l/min]:		60		
Oil inlet temperature [°C]:		49		
Oil supply pressure [bar]:		1,5		
Bias point:		**Nominal**	**Overspeed**	
Speed [rpm]:		3000,00	3600,00	
Circumferential speed [m/s]:		49,48	59,38	
Radial Load [kN]:		121,60	121,60	
Load angle with respect to vertical [°]:		0,00	0,00	
Average radial pressure [MPa]:		1,80	1,80	
Radial eccentricity [µm]:		204,91	191,96	
Attitude angle [°]:		66,13	70,69	
Minimum oil film thickness [µm]:		54,01	57,38	
Maximum oil film pressure [bar]:		72,15	68,39	
Power loss [kW]:		31,94	39,46	
Total oil flow [l/min]:		60,00	60,00	
Maximum oil film temperature [°C]:		101,05	107,95	
Maximum bearing shell temperature [°C]:		100,42	107,26	
PT100 temperature turnwise [°C]:		91,70	96,70	
PT100 temperature counterturnwise [°C]:		68,32	70,84	
Average oil outlet temperature [°C]:		67,54	72,45	
Stiffness coefficients [kN/mm]	c_{hh}:	461,33	490,12	
	c_{hv}:	235,20	198,79	
	c_{vh}:	1420,20	1423,22	
	c_{vv}:	2783,34	2657,07	
Damping coefficients [kNs/mm]	d_{hh}:	0,77	0,74	
	d_{hv}:	1,61	1,43	
	d_{vh}:	1,61	1,43	
	d_{vv}:	7,80	6,70	
Hydrostatics Data:				
Lift-off pressure [bar]:		118,00		
Static pressure [bar]:		77,00		
Oil flow [l/min]:		3,00		
Transition speed [rpm]:		240,00		
Other information:				
Profiling factor acc. DIN 31657, ΔRB/CR [-]:		2,603		
Shaft tolerances $^{max\,/\,min}$ acc. DIN 31698 [µm]:		$315^{-351/-383}$		
Bearing eccentricity [mm]:		0,315		
Babbitt material [-]:		GTW 89		
Bearing shell drawing number [-]:		303914		
Bearing shell geometry Parameters:				
BDIAM [mm]:		315,00		
BLNGTH [mm]:		215,00		
BCLEAR [µm]:		196,50		
BOFFST [µm]:		315,00		
BT(1) [mm]:		180,00		
BT (2) [mm]:		180,00		
THETA (1) [°]:		33,20		
THETA (2) [°]:		33,20		
PHIG (1) [°]:		90,00		
PHIG (1) [°]:		90,00		

GTW takes great care to provide calculation results according to the latest technical standards. However, actual values may slightly vary from the calculated ones due to calculation and measurement error.

Bearing Calculation Results
WPXYQ 28-315

Document: C17-1283-1-A	Customer: Siemens AG	Gleitlagertechnik Weißbacher GmbH Weseler Straße 32 46519 Alpen Germany
Project: Vilnius Biomass	Order no.:	

Additional Data for Rotordynamic Calculations:

Housing mass [kg]:	756
Axial stiffness [kN/mm]:	1160
Horizontal stiffness [kN/mm]:	3700
Vertical stiffness [kN/mm]:	5710
Effective Viscosity [mPas]:	11,38

		Stiffness coefficients [-]				Damping coefficients [-]			
S0 $_{eff}$ [-]	Speed [rpm]	$\chi_{11,eff}^*$	$\chi_{12,eff}^*$	$\chi_{21,eff}^*$	$\chi_{22,eff}^*$	$\beta_{11,eff}^*$	$\beta_{12,eff}^*$	$\beta_{21,eff}^*$	$\beta_{22,eff}^*$
0,000	6000,0	0,038	-0,223	0,086	0,429	0,073	-0,153	-0,153	0,546
0,100	6000,0	0,123	-0,248	0,069	0,574	0,072	-0,020	-0,020	0,517
0,200	6000,0	0,094	-0,029	0,324	0,592	0,064	0,116	0,116	0,689
0,300	6000,0	0,143	-0,027	0,500	1,081	0,090	0,173	0,173	1,015
0,400	6000,0	0,200	0,016	0,715	1,624	0,114	0,228	0,228	1,376
0,500	5250,4	0,308	0,081	0,987	2,279	0,157	0,333	0,333	1,811
0,600	4375,3	0,406	0,155	1,288	2,762	0,209	0,451	0,451	2,328
0,700	3750,3	0,499	0,218	1,568	3,292	0,256	0,556	0,556	2,797
0,800	3281,5	0,592	0,308	1,863	3,778	0,313	0,674	0,674	3,278
0,900	2916,9	0,667	0,380	2,136	4,393	0,344	0,752	0,752	3,705
1,000	2625,2	0,719	0,404	2,369	5,097	0,404	0,757	0,757	4,130
2,000	1312,6	1,472	1,037	5,348	12,991	0,758	1,714	1,714	9,626
3,000	875,1	2,224	1,844	8,737	23,317	1,051	2,730	2,730	16,050
4,000	656,3	2,918	2,859	12,169	35,913	1,254	3,593	3,593	22,532
5,000	525,0	3,625	4,304	16,206	52,318	1,369	4,269	4,269	29,550
6,000	437,5	4,540	5,205	21,088	68,429	1,790	5,963	5,963	39,992
7,000	375,0	5,017	7,407	24,549	90,102	1,639	5,718	5,718	44,240

GTW takes great care to provide calculation results according to the latest technical standards. However, actual values may slightly vary from the calculated ones due to calculation and measurement error.

Manufacturer: **GTW Gleitlagertechnik Weißbacher GmbH**

Documentation titles: **Installation and Operating Instructions**
Pedestal bearing Type WP

Repair Manual for ECTFE Coatings in GTW Bearing Housings

No. of pages: 9

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GTW Gleitlagertechnik Weißbacher GmbH

Installation and Operating Instructions

Pedestal bearing Type WP

Locating and non-locating bearings

Shape of bore: C, Y and V

Diameter range 80...900 mm

GTW Gleitlagertechnik Weißbacher GmbH

Weseler Straße 32 Tel.: 49(0)2802/1025-0
D-46519 Alpen Fax: 49(0)2802/7435
e-mail: office@gtwalpen.de

1. Safety advice

GTW foot mounted bearings WP can be used on a wide range of machines. Therefore, please pay attention to the safety instructions of the machines for your special application. The following points have to be observed in particular when operating the WP bearing and during installation, maintenance and repair in order to avoid accidents and injuries.

- Before maintenance and repair, make sure that the machine has come to a stop and the main switch is deactivated and secured against unintentional reactivation.

  Attention! risk of burning during maintenance at a bearing which is still warm from operation.

- The admissible loads and speeds according to our leaflets and our computer-calculation for your application must not be exceeded.
- Rotating parts have to be covered to avoid contact.
- The shaft dimensions and tolerances must be executed according to our catalogue and calculation.
- Incorrect installation and dismantling can cause damage to the bearing and injury.
- The WP bearing can fail due to screws getting loose. Therefore the specified tightening torques and specifications advised must be observed.
- Modifications to the WP bearing may only be made with the approval of the manufacturer.

On request our fitters will be at your disposal for repair and service work. This avoids faults which could be caused by improper workmanship.

2. Bearing types and coding

a) Manufacturer

W Gleitlagertechnik Weißbacher GmbH

b) Housing

G smooth pedestal bearing acc. to DIN 31 690

c) Heat dissipation

Z lubrication by circulating oil with external oil cooling
X lubrication by circulating oil with external oil cooling (high oil throughput)

d) Shape of bore and type of lubrication

C cylindrical bore without oil ring
Y two-lobe bore (lemon shape)
V four-lobe bore
S offset halves

e) Thrust part

Q without thrust surface
B plain white-metal lined shoulders with oil grooves (guide bearing)
K white-metal lined shoulders with taper land faces for each rotating direction
D white-metal lined shoulders with taper land faces for one direction of rotation
A WD-thrust pads (spring supported)

f) Size

g) Shaft diameter

Example:
Designation for a slide bearing for horizontal machines, with smooth pedestal housing, lubrication by oil circulation with external oil cooling (high oil throughput), four-lobe bore without thrust part, size 11, shaft diameter 110 mm:

Slide bearing WPXVQ 11-110

3. Introduction

All items of the installation and operation instructions have to be regarded in order to ensure the perfect operation of the slide bearing. Special importance should be dedicated to the cleanliness of the shop floor and the assembling parts.
At the housings there are provisions for different thermoprobes, oil inlet- and oil outlet tubes, hydrostatic oil inlet tubes and earthing cables depending on the special variation. The oil outlet tubes can be fixed to the housing either by a flange or by screwing-in.
The oil drain plugs are located in about the middle of the front walls at the lowest part of the bottom. By this, the oil sump can be drained totally.
The insulated bearing has a layer of HALAR-material on the spherical seat of the housing, which is particularly wear and temperature resistant.
As the whole inner surface is also coated by HALAR, sparkovers are avoided.
The anti-rotating pins are made of non-conducting material.
The thermoprobes for measuring the bearing temperature have to be suitably insulated (e.g. by using non-conducting fittings or protective tubes). Special technical solutions by GTW upon request.

For transportation of the bearing there are two holes in the casting of the upper part. In no case must these holes be used for transportation of the complete machine.

4. Despatch

The bearings are supplied fully assembled, but without oil filling. The bearings are sufficiently protected against corrosion by a primer. Machined surfaces without primer are protected by a removable coating.
The accessories like thrust pads, thermoprobes, or tubes with mastic are packed separately.
The bearing must be transported in such a way that it is not subjected to any shock loads, cannot slip and is protected against moisture.

5. Installation

First remove the upper part of the housing, the shaft seals and the shell. All items must be cleaned and checked for damages.

Please ensure that the shaft is clean, too, and in accordance with our recommendations for dimensions and tolerances.

Start with the installation as follows:

- Mount the bottom part of the housing on the foundation, but do not tighten the fixing screws to ensure a later aligning of the bearing housing.
- Now put the bottom half of the shell into the housing. (Align the shell to the split line of the housing). All different types of shells are mounted in the same way.
- Lower the shaft partially into position. Take care that the thrust part is not damaged. As soon as the shaft has reached a distance of approximately 1 mm from the bottom shell, the housing base can be precisely aligned. The gap between shaft and lateral bore of the housing may show max. differences of 0,3 to 0,4 mm. The more precise the alignment, the more efficient the seals will be.
- Tighten the fixing screws.
- Now apply oil to the shaft in way of the shell. Use the same type of oil as specified for this application. Then lower the shaft totally into place in the bottom shell.
- Coat the joint face of the lower part of the housing completely with non-hardening mastic.
- Now put on the upper half of the bearing shell. A twisted assembly of the shell is impossible due to eccentric position of the dowel pins.
- Now the upper part of the housing can be positioned. Both parts of the housing will close tightly.
- Now tighten the cap screws crosswise according to the table below:

Size	**7**	**9**	**11**	**14**	**18**	**22**
Thread	M 10		M 12	M 16	M 20	M 24
MA [Nm]	35		60	70	110	180
Size	**28**	**35**	**45**	**56**	**71**	**90**
Thread	M 30	M 42	M 48			
MA [Nm]	340	980	1480			

Tightening torque for cap screws

- In case the machine and bearings are subjected to vibrations during operation, it is necessary to secure the bolts by using screw-securing mastic.
- The rigid seals can now be mounted according to chapter 6. Tighten the fixing screws as indicated below:

Size	**7**	**9**	**11**	**14**	**18**	**22**
Thread	M 6				M 8	
MA [Nm]	10,5				26	
Size	**28**	**35**	**45**	**56**	**71**	**90**
Thread	M 8	M 10				
MA [Nm]	26	51				

Tightening torque for screws for sealings

5.1 Additional instructions for bearings with external oil supply system

When using an external oil supply system choose the cross sections of the tubes in such a way that the flow rates do not exceed 1,5 m/sec in the inlet and 0,15 m/sec in the outlet pipe.
The oil return pipes should be mounted with a gradient of about 10° to prevent a reflux which may lead to an overflow in the bearing and to leakage depending on this. If due to the system of construction the return pipes do not have a sufficient gradient, the cross-section of the tubes must be increased.
Welded and hot-bent, rusted or contaminated pipes must be pickled and then neutralised.
While assembling, all tube connections have to be mounted with sealing compound. A counternut is used to stay the threads of oil outlet pipe and housing. By this, the oil outlet pipe is additionally fixed. It is also advantageous to mount plugs (used for closing of not needed threaded holes) with sealing compound.
After assembly the complete oil supply system must be flushed in order to prevent bearing damages caused by contamination in the oil. Before flushing, the bearings and all gauges must be disconnected from the flushing oil circuit. Clean all filters after flushing. Ensure that all pipes and connections to the bearing housings are free of vibrations and loads.

5.2 Sleeve bearings with hydrostatic lift

If sleeve bearings are equipped with hydrostatic lift for operating reasons, the high pressure hose is to be mounted between shell and lead-through-bush in the housing wall. When dismantling the bearing supplied by GTW, the high pressure hose is loosened only at the bearing wall and the lower half of the shell is taken out.
The high pressure hose remains fitted at the lower half of the shell. When reassembling, this half has to be turned in the housing very carefully to avoid snapping or ripping-off. The hollow screws for the connection of the high pressure hose have to be tightened to prevent leakage.
Pay attention that the high pressure hose must be regarded as a wearing part and should be replaced after about 2 years when doing maintenance work.

6. Shaft seals

The GTW slide bearings in question can be assembled with different types of rigid labyrinth seals according to protection IP 44 or IP 55 (DIN 40050 / IEC 529).
The rigid seal IP 44 has two separate labyrinth systems. Between these a flinger on the shaft can be designed, if the axial movement of the rotor is small.
The rigid labyrinth seal IP 55 has an additional baffle which provides better protection against dirt or water ingress.
When assembling insulated bearings, the rigid labyrinth seals are mounted with insulating gaskets and bushes.
The lower part of the seal has to be pressed slightly from beneath against the shaft before tightening the fixing screws. After this, the upper part of the seal can be mounted.
During operation, the shaft is lifted by the hydrodynamic oil film, so that there is no metallic contact between shaft and rigid seal.
Non-insulated bearings are mounted without insulating gaskets between housing and seal. Instead of this, the flange of the rigid labyrinth seal has to be coated with a thin layer of non-hardening mastic.
Seals for special applications (e.g. protection IP 56 or higher) are available on request.

Attention! Rigid seals must be dismantled each time before assembling or disassem bling the bearings, otherwise they might be damaged by the shaft.

7. Putting into operation

Make sure that all holes are plugged and check the tightness of all connections in order to avoid oil leakage.
The circulated oil system should be switched on, and bearing and piping should be checked for tightness.

Attention! If the bearing temperature measured during test run exceeds the pre-calculated values by far, the machine must be stopped and the reasons investigated.

8. Maintenance

Take care that the bearing housing is clean on the outside because the heat transfer is reduced by deposits of dust and dirt.
If irregular oil levels and bearing temperatures are observed, the reasons have to be investigated.

8.1 Oil change

We recommend to change the lubricant in the oil supply system feeding the bearing after 20.000 hours of operation. If necessary, longer intervals may be admissible upon prior analysis
For filling and refilling use the same oil quality as specified for your application. The relevant oil type is indicated on the type plate of the bearing.
When carrying out the oil change, open the oil drain which is located on one side of the bearing (if possible, drain the oil when the bearing is still warm). If unusual alterations of the oil are noted, it is paramount to investigate the causes. If chemical detergents are used they have to be removed completely after cleaning process.
For filling and refilling use the same oil quality as specified for your application. The relevant oil type is indicated on the type plate of the bearing.

8.2 Inspections

Inspections are to be carried out if essential increases of the operating temperature or alterations of the lubrication are detected.

For an inspection it is necessary to remove the bearing housing cap while the bottom part remains fitted. Before disassembling clean the bearing and the work place.

8.3 Disassembly

- First remove the rigid seals, if this seal type is mounted.
- Unscrew the bolts of the housing cap and lift the housing cap off.
- Take off the upper half of the shell.
- Unscrew the bolts of the oil disc and take it off.
- Disconnect the thermometer and other monitoring instruments, if any exist.
- Raise the shaft just enough to relieve the bottom half of the bearing liner, which can now be turned until it can be removed.

8.4 Visual inspection

While dismantling the individual components check that all sliding surfaces are in perfect condition. Possible scorings should be smoothed before assembly.

Shaft seals have to be replaced if they show an irregular wear or if their edges are broken.

9. Storage

The storage area of the bearing must be dry and must not be subjected to major fluctuations in temperature. If properly stored the bearing can be kept in stock up to one year depending on the type of corrosion protection.

10. Ordering spare parts

Every bearing is provided with a production number and an order number on the type plate. In order to avoid failures when ordering spare parts, these numbers must always be quoted or the damaged part should be sent to us.

11. Service

Our service team is prepared to assist you in all problems occurring on request. Please do not hesitate to contact GTW.

Repair Manual for ECTFE Coatings in GTW Bearing Housings

This manual is aimed at service staff working with GTW bearing housings of types WP, WF and WM. It is assumed that the staff involved with this work has significant experience with installation and service works on GTW plain bearings. This procedure is applicable for defect sizes of 8 mm in length or width. In order to execute the repair, the affected bearing housing has to be dismounted and thoroughly cleaned with degreasing solvent, e.g. Isopropanol.
For defects larger than 8 mm, the housing has to be sent to GTW for repair.

1 Defect Identification

In the rare cases that they appear, defects in the ECTFE coating of GTW bearings are usually detected through failed electrical insulation measurement tests. Since these measurements are carried out with closed bearing housing, it is usually not clear where exactly the defect is located. The ECTFE coating is less than 1 mm thick, so even smaller metal chips between bearing shell and housing can lead to electrical insulation faults during shell assembly. In these cases, e.g. a metallic brush may be used advantageously for defect location. Larger defects may easily be visible, such as the exemplary defects shown in Figure 1.



Figure 1: Top view of exemplary defects in the ECTFE coating of a GTW bearing housing.

2 Defect Removal

The chemical properties of the ECTFE coating used in GTW bearings are such that although the coating bonds very well to the housing, adhesives bond very poorly to the ECTFE surface. It is therefore necessary to remove the defective area mechanically to create bonding of the adhesive with the bearing housing bulk. For this purpose, use a drill to remove an area of maximum diameter 10 mm including the defective area as shown in Figure 2. Drill about 2 mm deep into the cast iron of the bearing housing in order to have sufficient creep length and adhesive bonding. In order to improve bonding, the additional inclined holes with reduced diameter may be added at the bottom of the repair hole, or the sides of the repair holes may be executed with an undercut.

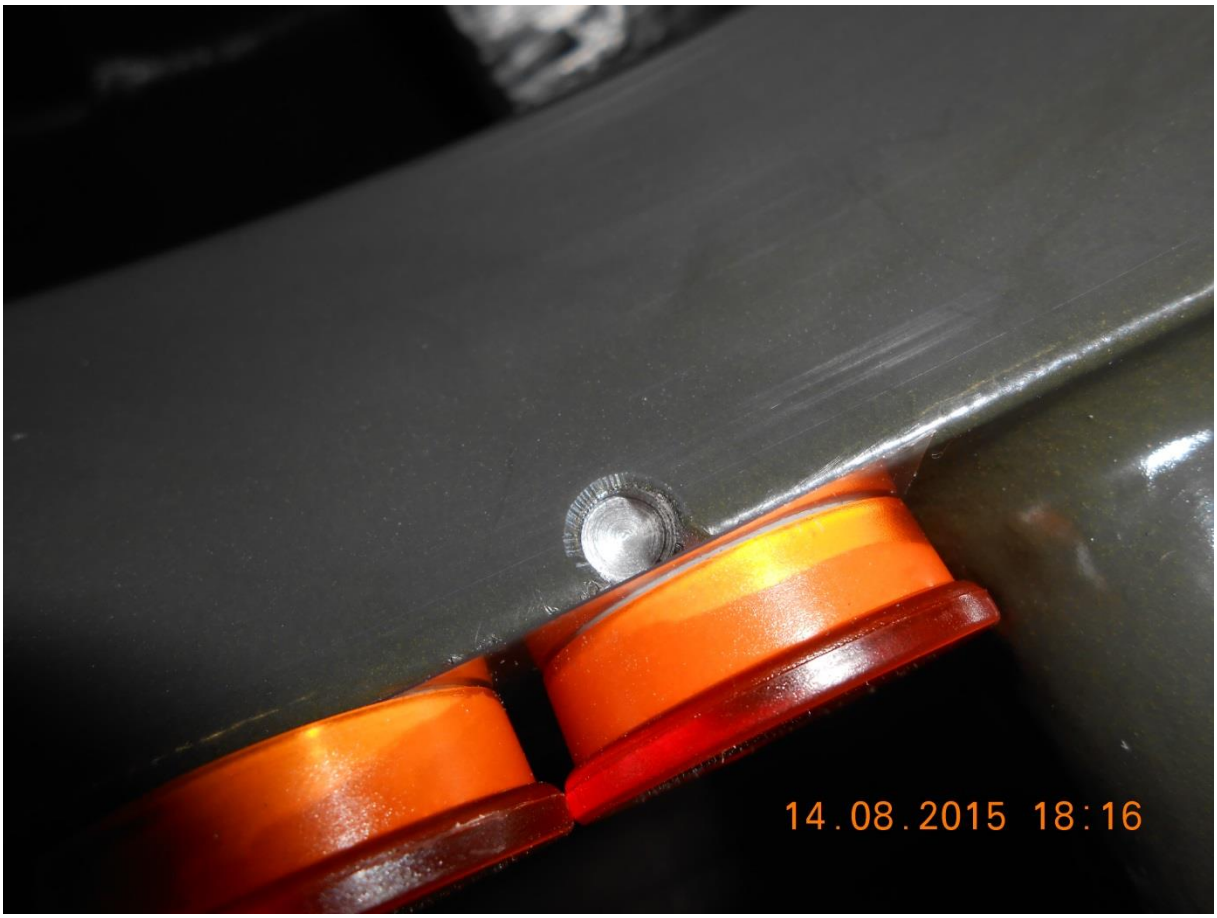


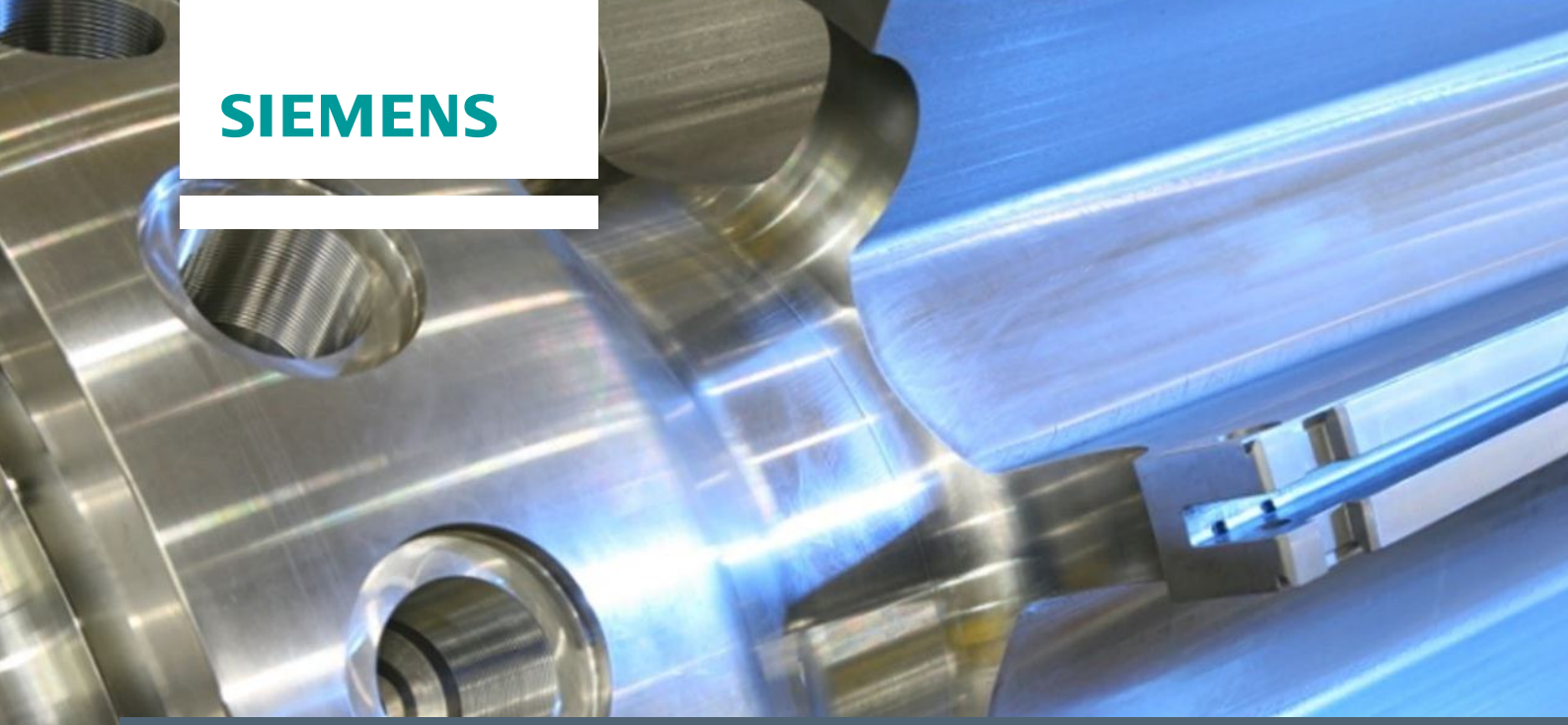
Figure 2: Top view of a hole drilled into the housing bulk material for ECTFE repair purposes.

3 Repair

Thoroughly clean the drilled hole and the surrounding area with degreasing solvent, e.g. Isopropanol. Then use epoxy glue Araldite AV138M-1 with Hardener HV998 to fill the hole. Make sure that the hole is thoroughly filled, e.g. by poking with a wire. The glue should protrude about 0.5 mm from the remaining ECTFE coating around it. Let the glue start hardening and remove any protruding glue so that the glued area does not stand out. It may stand back up to 0.05 mm from the ECTFE surface. An exemplary repaired housing is shown in Figure 3.



Figure 3: View of a bearing housing with repaired ECTFE coating.



SIEMENS

Description of the System/ Plant Section 2

Components and Purchased Parts 2.3

Contents

2.3.1 Cooler

2.3.2 Bearings

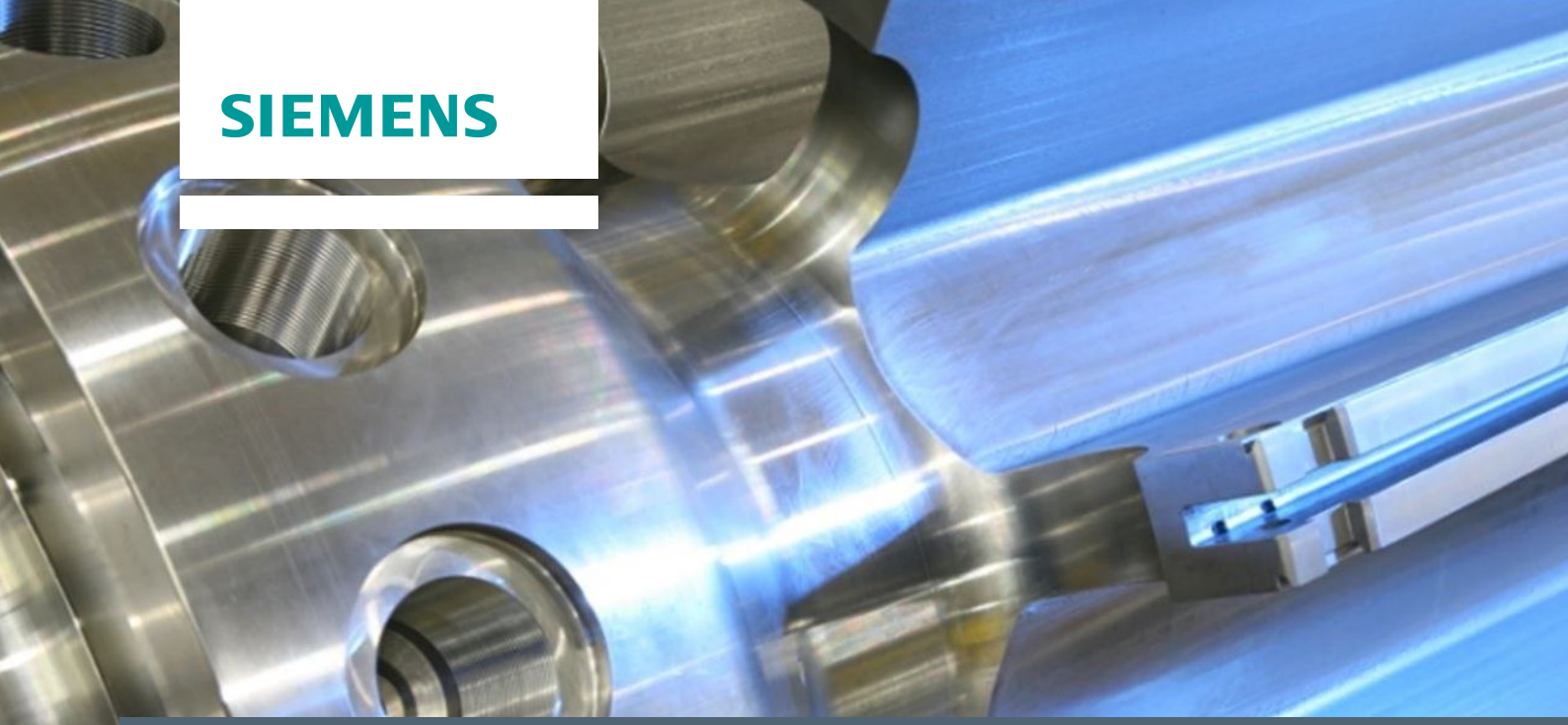
2.3.3 Lubrication Oil Supply

This component is not included in the generator's scope of delivery.

2.3.4 Excitation

2.3.5 Neutral Point / Line Side Cubicle

2.3.6 Generator Control Panel / Automatic Voltage Regulation (AVR)



SIEMENS

Description of the System/ Plant Section 2

Components and Purchased Parts 2.3

Contents

2.3.1 Cooler

2.3.2 Bearings

2.3.3 Lubrication Oil Supply

2.3.4 Excitation

2.3.5 Neutral Point / Line Side Cubicle

2.3.6 Generator Control Panel / Automatic Voltage Regulation (AVR)

SIEMENS					
KIND OF MACHINE:	MAIN EXCITER	MACHINE No.:	EG000367	YEAR OF MANUFACTURE:	2018
MACHINE CODE:	ELR 62/19-30/8-2S	RATED SPEED:	3000 rpm	DIRECTION OF ROTATION:	
GENERATOR:				CCW	
RATED VOLTAGE/ RATED CURRENT:	213 V / 875 A	RATED POWER:	186,4 kW	S1	DPPPG-70166425
CEILING VOLTAGE/ CEILING CURRENT:	426 V / 1750 A	CEILING POWER:	745,5 kW	S2 10s	
SELF-EXCITATION		RATED VOLTAGE/ RATED CURRENT:	60 V / 11,8 A		
		CEILING VOLTAGE/ CEILING CURRENT:	122 V / 23,7 A		
INSULATION CLASS: F	TYPE OF CONSTRUCTION: IM 5410	DEGREE OF PROTECTION: IP54			
STATOR TRANSPORTATION WEIGHT: 1660 kg				IEC 60034	
ROTOR TRANSPORTATION WEIGHT: 580 kg					
Siemens Power and Gas					

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SIEMENS

Brushless Exciter Machine ELR 62/10 | ELR 62/19

Technical Description

Contents

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1.4 Diodes 4
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2.1 Fault tracing 5
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1 Design and Operating mode

NOTE

For rotor ground fault detection the brushless exciter is equipped either with a pair of slip-rings with brushes or with a telemetric system. The figures refer to the slip-ring version.

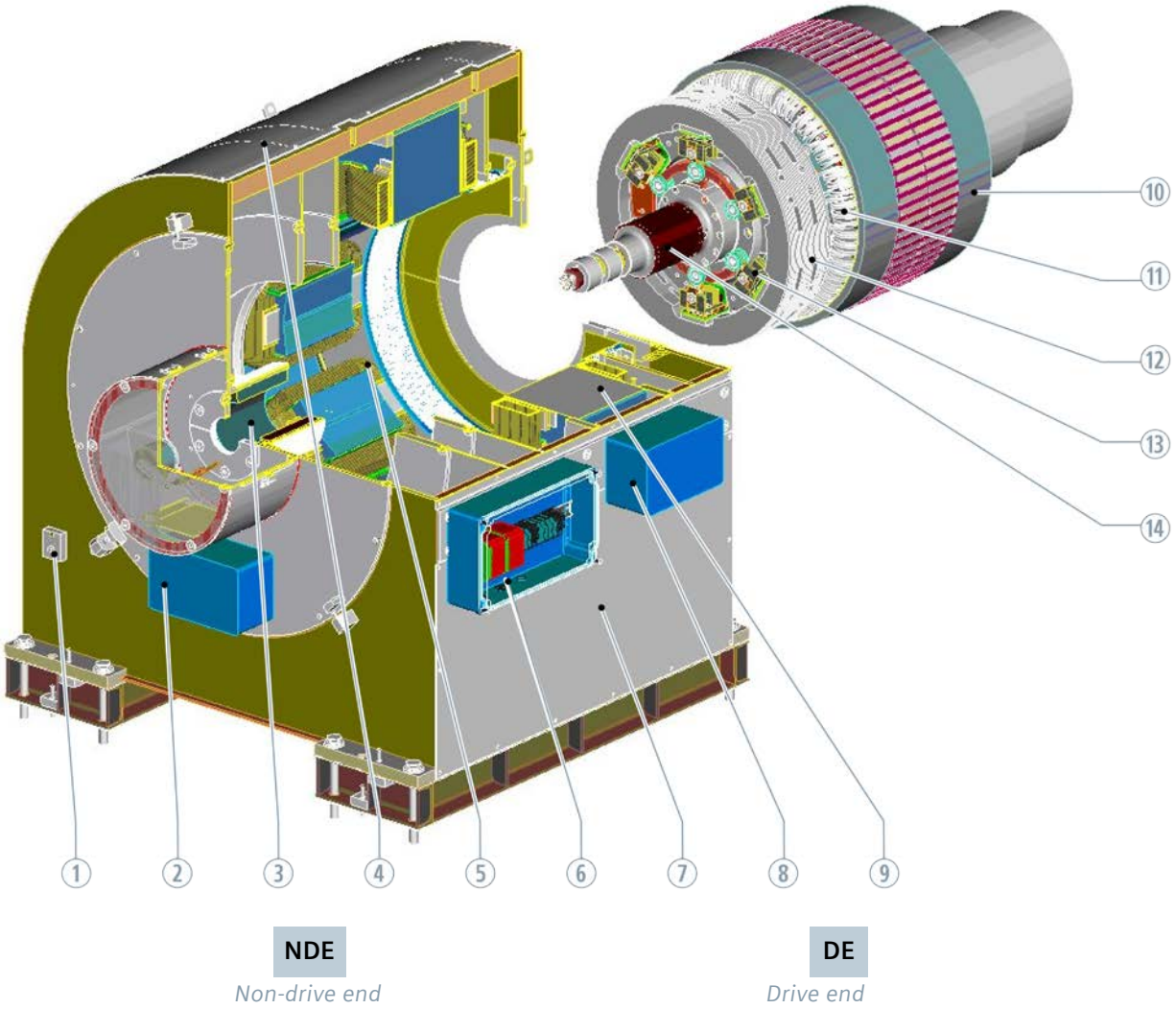


Fig. 1: Main components of the exciter machine

1 Earthing terminal
2 Junction box of ground fault detection
3 Pilot exciter, stator
4 Housing, upper cover
5 Stator winding (field coils)
6 Junction box of pilot exciter
7 Housing, side cover
8 Junction box of field coils and anti-condensation heating
9 Stator active part
10 Rotor active part
11 Rotor winding
12 Diode wheel
13 Rectifier unit with silicon diodes
14 Pilot exciter, rotor

1.1 General

The brushless exciter machine takes the form of an external-pole generator. Its rotor is overhung mounted on the shaft end of the generator. The stator is fixed to the base frame of the generator.

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The field of the external-pole generator is excited by the pilot exciter, which is part of the voltage regulator. Three-phase current flows through the rotor winding as a result. A rectifier unit made of silicon diodes (also see Fig. 3 and Fig. 4) is integrated into the rotor. It is used to rectify the three-phase current and conduct the resulting current through the exciter current conductor in the hollow drilled shaft of the generator to its rotor winding.

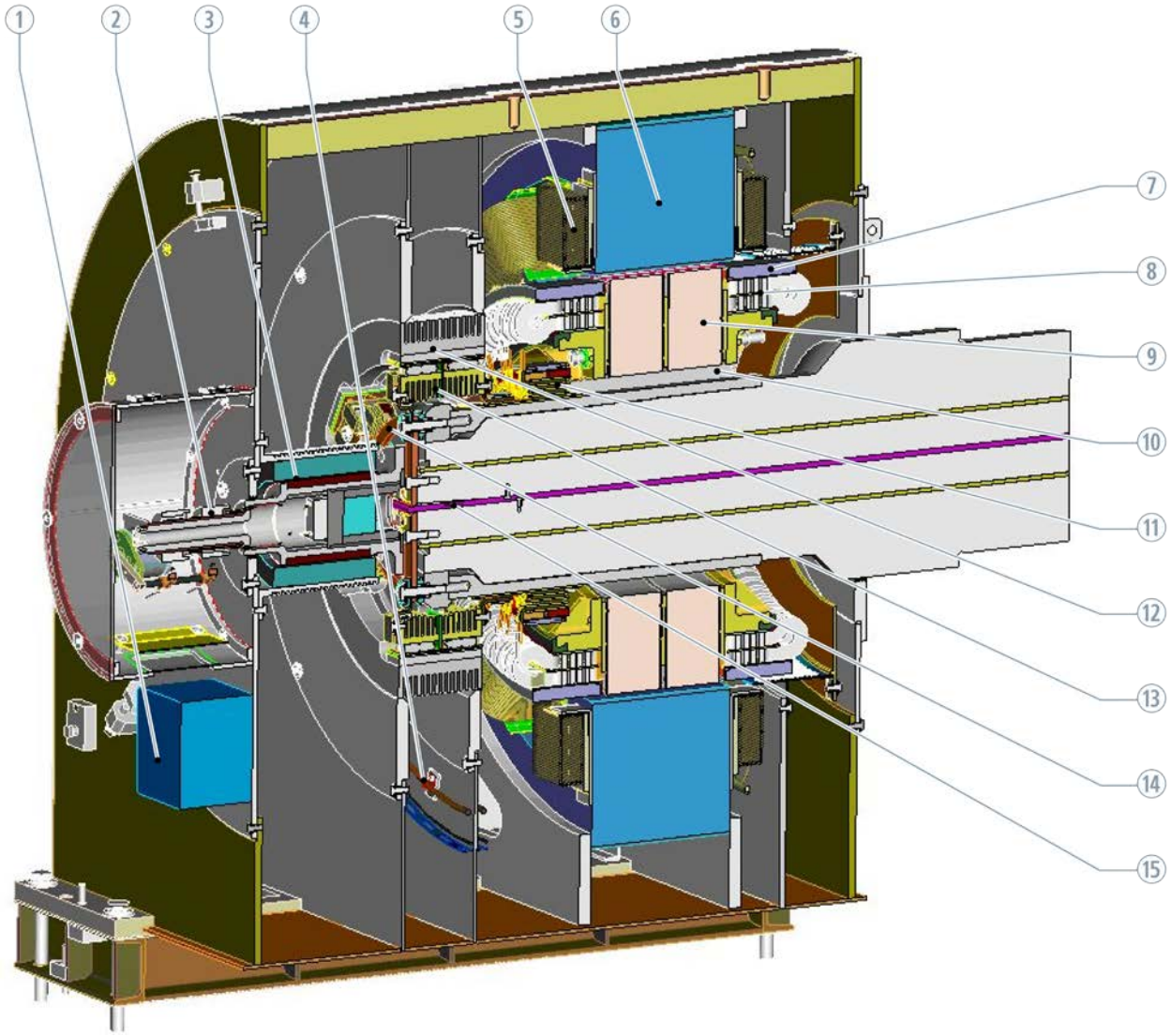


Fig. 2: Exciter machine in operation (longitudinal section)

1 *Junction box of ground fault detection*
2 *Measuring slip rings*
3 *Pilot exciter*
4 *Anti-condensation heater*
5 *Stator winding (field coils)*
6 *Stator core*
7 *End winding tape binding*
8 *Rotor winding*
9 *Rotor core*
10 *Rotor hub*
11 *U, V, W and neutral bus rings*
12 *Diode wheel*
13 *Diode module*
14 *DC power line*
15 *Cavity for field current lead*

1.2 Rotor

The rotor is shrunk onto the shaft extension of the main machine. The rotor hub carries the laminated core on the outer circumference. The diodes are integrated directly in the rotor.

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The three-phase rotor winding inserted into the slots of the laminated core is connected in star. It is a two-layer winding of insulated copper wire with multiple parallel conductors. The free ends of the individual windings are arranged at non-drive end and connected to the U, V, W and neutral bus rings arranged on the same side. The complete rotor is vacuum impregnated with epoxy resin. The winding overhangs are provided with bandings to afford protection against centrifugal forces.

1.3 Stator

The stator consists of a stacked and welded core with integrated poles and housing. The core is manufactured separately, and it is provided with the pole winding. Afterwards the coil ends are connected and the complete stator is vacuum impregnated. The core is welded with the finished housing. An earthing terminal is provided on the housing for the connection of an earth cable. The stator frame is fixed by means of hexagon bolts to the base frame of the main machine and taper dowel pins are used for locating the exciter on the substructure.

The housing base plate is simultaneously used for cooling air inlet and outlet. At both ends the housing has shields equipped with separately fastened fiberboard sealings.

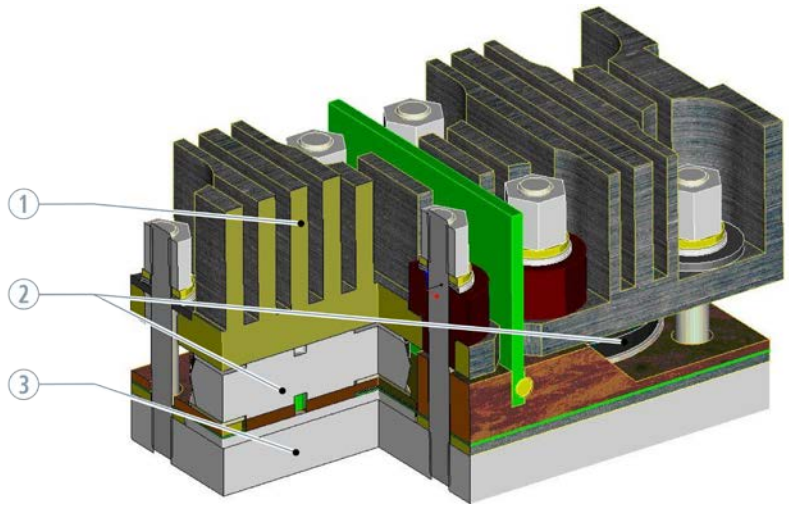
The switch box containing the connections for the earth/ground fault monitoring equipment is located at the end shield of the non-drive end. If a telemetric system is used, the box is arranged at side of the housing.

The control box, which contains the terminal connections for field coils and anti-condensation heater, is also installed at this side. If a pilot exciter is installed, its switch box is located next to the box for the field coils.

1.4 Diodes

The rectifier is designed as a 6-pulse bridge circuit. Two serially connected silicon diodes, in each case, form a module (Fig. 3). The diode modules, together with the current-carrying heat sinks, are insulated against the base plate and attached directly to the diode wheel. The respective polarity is defined by the mounting position of the modules in the diode wheel.

Fig. 3: Diode module



1 Current-carrying heat sinks
2 Diodes
3 Base plate

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The connection between the heat sink and the main rotor winding is established via connecting pieces.

1.5 Ventilation

The brushless exciter is of the closed-circuit cooled type. The stator core and the rotor permit the pas-sage of cooling air past the stator coils and rectifier heat sinks. The exciter machine is connected by air ducts in the base frame to the cooling circuit of the generator.

1.6 Surge Diverter

The rectifier bridge is protected against high-energy over-voltages as may occur in the event of faults by surge diverters situated between the positive and the negative pole.

2 Troubleshooting on Diode Failure

2.1 Fault Tracing

Defective diode modules can be located in standstill by means of a DC continuity tester. It should be noted, however, that owing to the low measuring voltage depending on the measuring range selected, measurements carried out with instruments of this type may provide greatly differing results, particularly in the forward direction.

With faultless diodes and with a measuring voltage of 3 V, the resistance in the forward direction may be about 100 Ohm to 10 kOhm, depending on the measuring range, and several 100 kOhm in the re-verse direction. Diodes can be tested for faults after the leads of all the diode modules have been disconnected – or even better – after all the diode modules have been completely dismounted.

Diode bridges are likely to give rise to two kinds of faults as follows:

- Loss of blocking capability (Diode failure)
- Loss of conductivity in the forward direction (Interruption)

Loss of blocking capability (diode failure)

In the event of failure of a single diode, the diode module is still working without any restrictions (redundancy). If both serial diodes in one module fail, only a low current flows through the exciter winding of the main machine, so that the machine under load can hyper-synchronously fall out of synchronization. To clear the fault, the generator must therefore immediately be de-excited and shut down. The resistance of faulty diodes is reduced to extremely low values in either direction.

Loss of conductivity in the forward direction (interruption)

Loss of diode conductivity occurs considerably less often than diode breakdown. It is indicated by a reduction of the voltage delivered by the bridge of approx. 15%. Thanks to the excitation reserve, the auxiliary excitation is able to fully compensate this loss of excitation voltage even though the machine requires a higher auxiliary excitation current at rated output and nominal power factor. Diodes which have become blocked have extremely high resistance values in both directions.

2.2 Replacing the Diode Module

The entire diode module needs to be replaced whenever a faulty diode has been identified.

Preparation

✓ To have access to the diode wheel and to the exciter rotor, remove the exciter non-drive end shield and the lateral cover plates.

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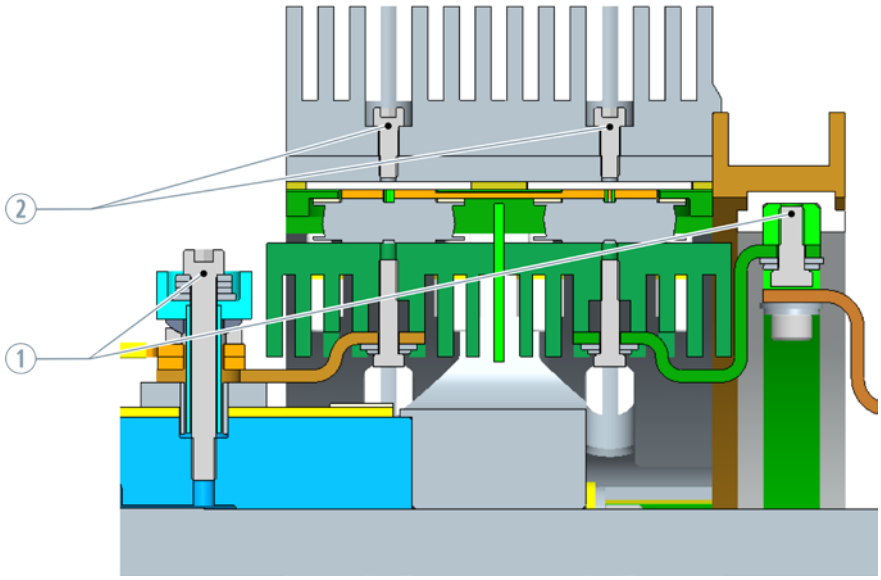
✓ The rotor must be mounted turnable.

Tools
- Standard tool set
- Insulation meter

Work steps

1. Undo the screw joints of the connecting leads.
2. Undo the screw connections from diode module to diode wheel.

Fig. 4: Diode wheel with diode module



1 Connecting lead screw joints

2 Screw connections from diode module to diode wheel

3. Remove the defective diode module in axial direction.
4. Proceed in reverse order to install the new diode module.

NOTICE

The exciter will break down and be damaged when the poles of the diode module are mixed up.

▶ Observe the proper fitting position of the diode module: Anode and cathode need to be in the correct positions. The poles of the diode module are identified by the letters *A* for anode and *K* for cathode.

5. To ensure the current flow, measure the insulation resistance.

3 Maintenance and Inspection

3.1 Cleaning Operation

The brushless exciter requires only a minimum of maintenance. It is advisable to inspect the machine during revisions for dust deposits and to clean it if necessary, above all the heat sinks.

Cleaning in the heat sink area

Blowing out with compressed air is sufficient (maximum: 4 bar), while the upper and lateral covers as well as the non-drive end shield must be demounted. To clean the heat sinks, the diode modules should be removed as described in chapter 2.2 Replacing the Diode Module.

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Checking for brush abrasion

If the brushless exciter is equipped with slip rings: it is advisable to inspect the area of the slip rings for brush abrasion and to clean it, if necessary.

If a telemetry system is available: No brush wear is created there as this is non-contacting.

3.2 Exciter Disassembly for Inspections

If the generator rotor must be withdrawn to allow an inspection, the exciter needs to be demounted beforehand.

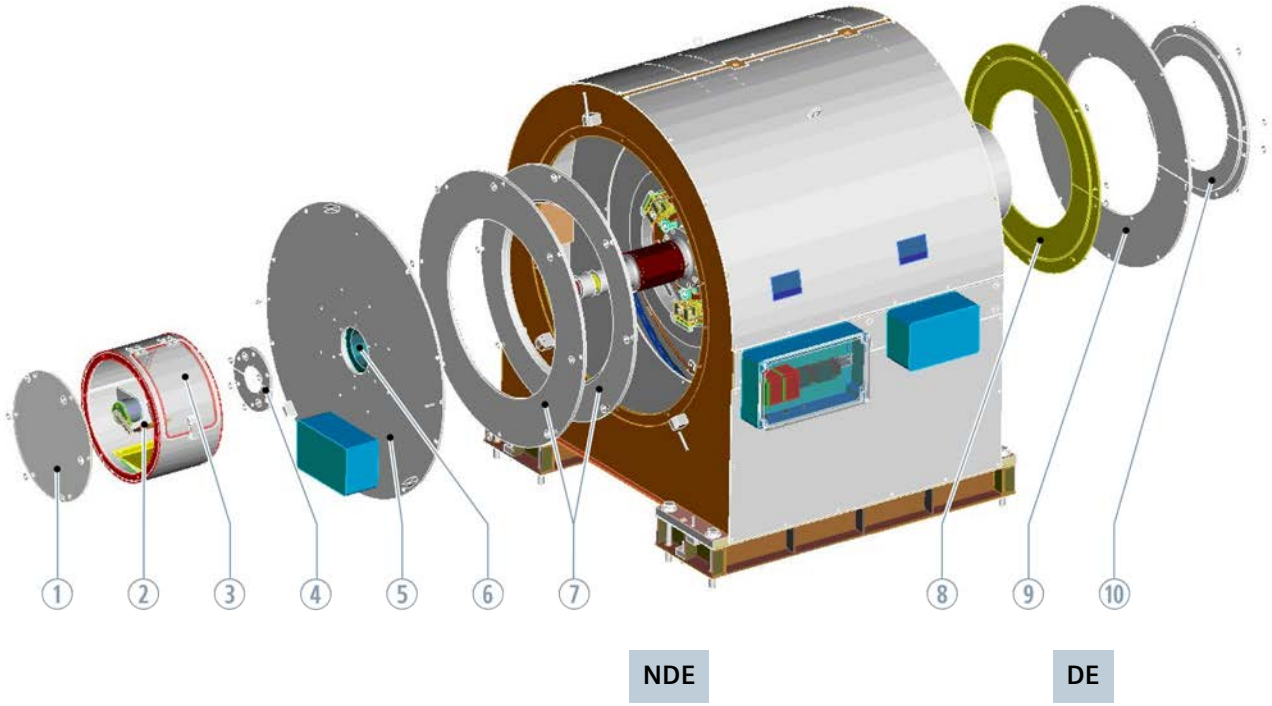


Fig. 5: Stator disassembly, exploded view

1 Fiberboard sealing
2 Measuring brushes covering / stator of telemetric system (receiver)
3 Fiberboard sealing
4 Measuring brushes
5 Housing shield NDE
6 Pilot exciter
7 Inner air-guide plates at NDE
8 Inner air-guide plate at DE
9 Housing shield AS
10 Fiberboard sealing

Stator disassembly

For **stator disassembly** proceed as follows:

Work steps

1. In order to avoid damages, dismount the ground fault detection:

1.1 If there are measuring brushes: dismount them in the box at the non-drive end.

1.2 If there is a telemetric system:
Loosen and remove the screws of the housing cover at the non-drive end.
Remove telemetric system stator (receiver) carefully from telemetric system rotor (sender).

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NOTICE

Protect sensitive electrical parts from damages!

- Carefully remove telemetric system stator from telemetric system rotor. Telemetric system rotor is particularly fragile and must be protected.

2. Dismount the fabric-base fiberboard sealing located at non-drive end.
3. Disassemble the drive-end fiberboard sealing and end shield.

⚠ **CAUTION**

Danger of tipping over.

There is a risk of people being injured when the stator housing end shield is dismounted.

- Secure the stator housing end shield by a supporting device before loosening the bolts.

4. In order to access the internal seals dismount the housing shield at the non-drive end. Therefore proceed as follows:
   - 4.1 Disconnect the cable connections to the ground fault detection.
   - 4.2 If a pilot exciter is present, disconnect also its cable connections and place a protective sleeve made of fabric-based laminate or plastic around the rotor of the pilot exciter (protection against damage to the carbon-fiber wrapping).
   - 4.3 Secure the housing shield by a hitch.
   - 4.4 Only then remove the shield-fixing screws and, carefully, the shield.
5. Dismount the three seals on the inner air-guide plates.
6. Disconnect all the cables lead to the terminal box.
7. Undo the screw joints to the base frame including the tapered pins.

NOTE

Please note: In addition to the external screw joints, two further ones are located under the cover.

8. Mark the shims.
9. Push the complete stator assembly in the axial direction as far as necessary to clear the rotor so that the stator can be lifted off.

Auxiliary equipment such as current measuring devices or anti-condensation heater need not be detached or disassembled when removing the stator.

Pulling off and heat shrinking the exciter rotor

If the **exciter rotor is to be removed** from the shaft of the main machine, detach the following components before the hub is heated by means of a welding torch:

- the slip ring shaft with the protective circuits
- the DC power line and
- the diode wheel.

To extract the rotor use an extractor device. To install the device, use the threaded holes of the disassembled diode wheel.

Before shrink fitting, heat up the completely assembled rotor with diode wheel, but without the protective circuits, to 130°C in a suitable oven.

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Manufacturer: **ATE Antriebstechnik und Entwicklungs GmbH**

Documentation title: **Technical Description**
Datasheet 249 0003 100, Type: DC 190/90/6
Permanent magnet generator PMG

Amount: 5 pages of documentation

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Technical Description

Datasheet 249 0003 100 Type: DC190/90/6
"Permanent magnet generator PMG" Customer: Siemens Power Generation

Change history

Date	Change	Responsible
20.08.09	Start	W. Thaler / ATE

Table of contents

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Installation	2
Maintenance	2
Magnetization	3
Safety checks before commissioning	3
Technical specifications	4

Necessary drawings und documents to take care of

Responsible	Title	Doc. number	Index
Siemens P. G.	Auxiliary Exciter Bushing	2-425258	B
Siemens P. G.	Slip Ring Shaft	1-425257	G
Siemens P. G.	PMG Outline	1-508817	B
ATE	Date sheet	249 0003 100	-
ATE	Product information	290_ATE_Technische Beschreibung_A6_090724	6

Introduction:

The "PMG" permanent magnet generator will be delivered as a permanent exciter generator – stator/rotor unit as defined in Siemens Power Generation drawing 1.508817. This drawing includes all relevant dimensions which are needed for the installation of the stator-rotor unit at the main unit. The "PMG" provides the excitation voltage for the exciter of a big brushless synchronous generator (or motor) via an automatic voltage regulator.

The nominal power may be generated on a permanent basis by the "PMG". The maximum nominal power is available for 10 seconds to cover the short-term demand during the fast-response excitation of the main generator. In general, the "PMG" has a three-phase design, and generates single-phase voltage through a rectifier. The three-phase connection is led out of the stator using three single cables with a cross-section of 2.5mm2 and a rough length of 1m.

The PMG consists of:

a) a 6 pole permanent magnet rotor unit to be installed on the shaft of a main generator (Siemens Power Generation drawing 1.508817)
b) a stator casing assembly with the wound stator and the cooler casing including the mounting flange complete with mounting holes and voltage cables (Siemens Power Generation drawing 1.508817)

Installation:

Before installation, the "PMG" should be stored in a clean and dry room. The PMG should be inspected thoroughly before it is used. This inspection should make sure in particular that the rotor magnet system is protected completely against any contact with metal particles, and that the insulation resistance of the stator windings is satisfactory. The insulation resistance may be tested using a 500V – insulation tester. A value of more than 10 MOhms is considered satisfactory.

The dimensions of the "PMG" (stator and rotor) are shown in the following drawing: Siemens Power Generation drawing 1.508817

The rotor must be pressed on slightly at the main generator, and be secured in this position in order to avoid its displacement with regard to the shaft under any circumstance. The temperature of the rotor assembly must never exceed 130°C. During installation, the unit must not be heated to more than 85°C. Caution: the rotor's reinforcement is made of CFRP. Make certain to protect this against any damage also during installation. (Use, e.g., plastic protective sheets or sleeves for storage and assembly.)

The stator housing should be installed at the matching surface of the main generator, and be fastened using bolts inserted in the mounting holes at the mounting flange. The air gaps should be inspected for equal spacing at all poles and positions, and be adjusted accordingly. The nominal radial air gap between stator and rotor is 2.5mm.

Maintenance:

The "PMG" (stator and rotor) does not contain any wearing parts. Accordingly, no routine maintenance and no spare parts are required.

Magnetization:

The permanent magnet rotor assembly is magnetized in its as-delivered condition. The magnets consist of high-energy NdFeB magnet material. The assembly is air-stabilized, and will not lose its magnetic properties. The assembly has also been stabilized against short circuits. This means that it will not lose its magnetic properties even when the "PMG" is short-circuited inadvertently.

Safety checks before commissioning:

Caution!!
The voltage which is applied in the terminal box when the unit is running may be dangerous to life. Never remove the cover of the terminal box when the unit is running.

The following **safety checks must** be performed before starting up the "PMG":

a) Check that the "PMG" is clean and dry.
b) Check the voltage cables or connection cables for any damage.
c) Check the rotor's firm seat.
d) Check the unit's earthing/grounding connection.
e) Check the rotor's bandage for any damage.
f) Check that the connecting cables are connected properly.

Technical Description

Datasheet 249 0003 100 Type: DC190/90/6
"Permanent magnet generator PMG" Customer: Siemens Power Generation

Technical specifications:
The data sheet 249 0003 100 contains the technical specifications.

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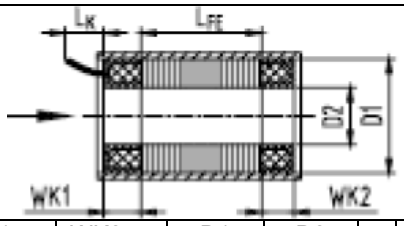
Technical data sheet
DC Motorelement

No.: 249 0003 100 **DC 190 / 90 / 6** **Siemens**

Stator

Direction of rotation

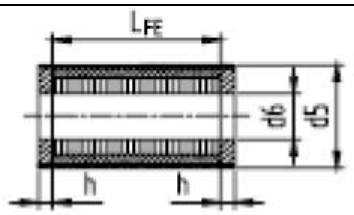
[X] left
[ ] right



	L_{FE} [mm]	$WK1_{max}$ [mm]	$WK2_{max}$ [mm]	D1 [mm]	D2 [mm]		
As-delivered dimensions	90	45	35	189,7	130		
Final dimensions	-	-	-	-	-		

	Lk [mm]	U [mm²]	V [mm²]	W [mm²]				
Motor strands	1000	2.5	2.5	2.5				
		brown	blue	black				
Strand diameter max. 4 [mm]								

Rotor



d5	d6	d	L_{FE}			
125	104	10**	140			

[1] Finishing by the customer

[X] ATE magnet system directly installed on shaft
[X] Soft magnetic shaft material

Max. peripheral speed 23.6 m/s

Cooling

[ ] Water cooling
[ ] Oil cooling
[ ] Air-cooling
[X] Air cooler
[ ]

Winding protection

[1] PTC 130° Drilling (series)
[2] KTY 84-130
[ ] Thermal switch 130°C
[ ] NTC K227
[ ] PT3C-51F-F!

Potting material

[X] Stator potted in cooling jacket

[ ] steel
[X] Aluminium

Insulation class

[F] Winding
[H] Strands

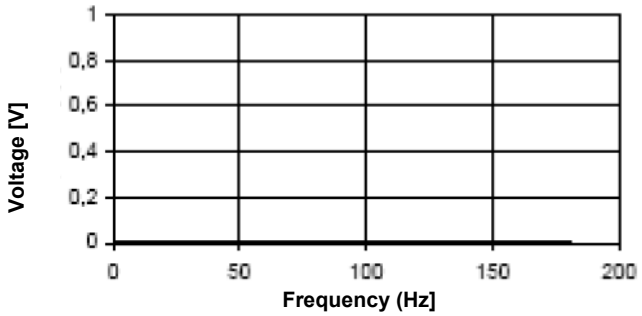
Maximum permissible phase current 65 A

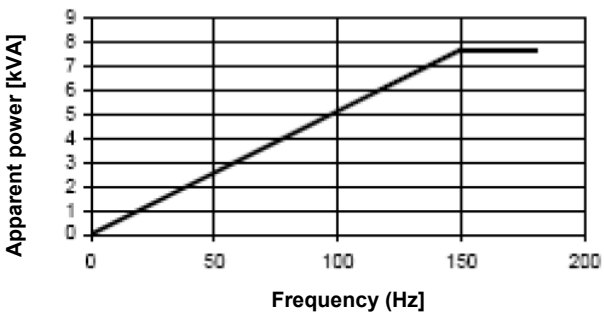
Choke - mH / phase

Phase circuit	Y							
Operating mode	S1 -100 % generatively						Short-time duty (10 sec)	
Converter voltage [V]	-	-		-	-		-	-
Motor voltage, ph to ph [Vrms]	262	316		261	314		257	312
Current [A]	17	14		23	23		42	35
Frequency (Hz)	150	180		150	180		150	180
Speed [rpm]	3000	3600		3000	3600		3000	3600
Shaft power [kW]	8	8		10.7	13		19.5	19.6
Torque [Nm]	25.5	21		34.3	34.4		62	52
Apparent power [kVA]	7.7	7.7		10.3*	12.5*		18.7	18.9.
P. F.	0.99	0.99		0.99	0.99		0.98	0.99

Technical Description

Datasheet 249 0003 100 Type: DC190/90/6
"Permanent magnet generator PMG" Customer: Siemens Power Generation





The data indicated apply to sinusoidal voltage and current.
For frequency converter operation, the effective fundamental voltage must correspond to the motor voltage indicated.
The current values measured may also be higher than the values indicated due to the harmonic component.

ATE motorelements are components for manufacturing synchronous motors. A test as defined in IEC 34-1 or in the applicable standards must be performed after completing the motor (assembly in its casing).

The spindle manufacturer is responsible for consulting with the converter manufacturer beforehand in order to make certain that the motor will work without any problem.

Note: *) For webbed stator housings and ventilation of stator housing **) End rings incorporated in shaft
Inductance per phase: 0.66 mH / Resistance ph to ph: 0.31 Ohm / EMF ph to ph: 89 Vrms per 1000 rpm

The brushless exciter is provided with a pair of slip rings required for rotor ground fault protection of the whole equipment.

The extension shaft is fitted to the front end of the exciter rotor. The two shrink-fitted slip rings are located there on an insulating base. Two connection cables run through the central bore in the extension shaft. They connect the slip rings each to the connection pieces of the positive and negative bus rings.

The brush holder consists of two brush holder bolts fastened in the EE end shield. The brush holders with the measuring brushes are fitted to an insulated section. The brushes are in permanent contact with the slip rings.

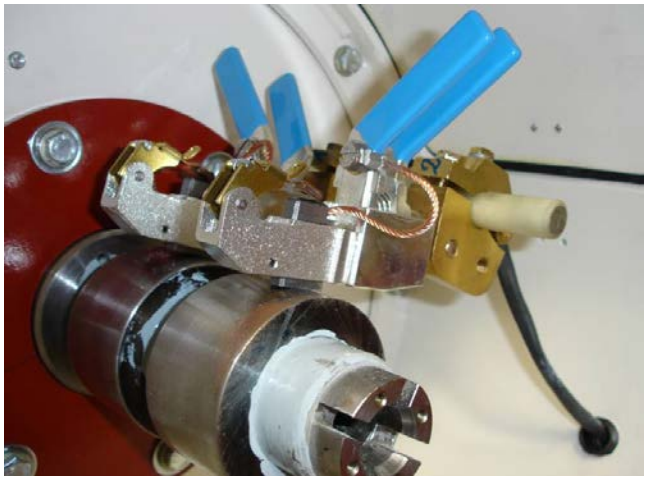


Fig. 1: Measuring slip rings with permanently applied measuring brushes in plug-in brush holders

The measuring brushes are connected to a terminal block located in a terminal box at the exciter end frame

The voltage measuring system enables measurement of the excitation voltage of the main machine while the equipment is in operation.

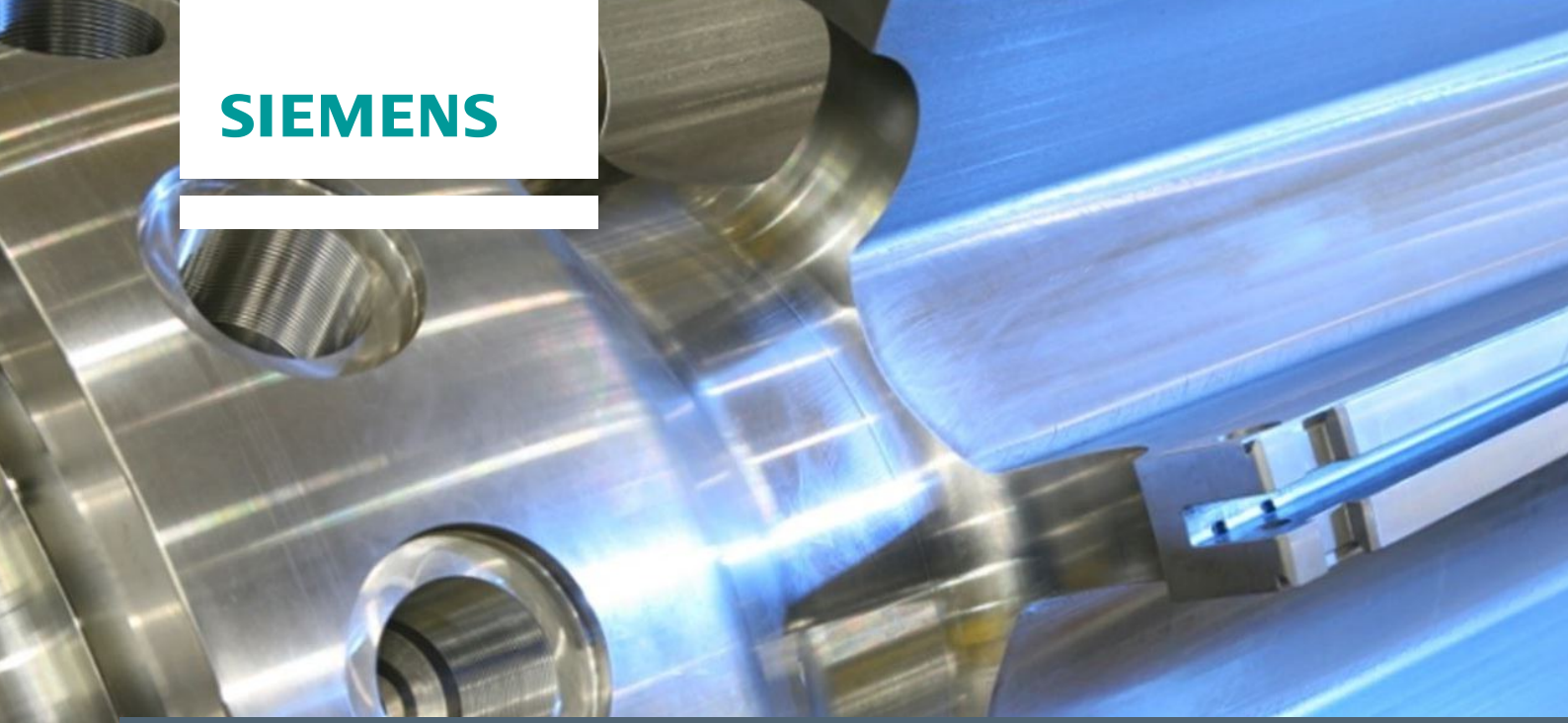
NOTICE

Corrosion can appear on the measuring slip rings after lengthy periods of standstill.

To avoid corrosion lift off the brushes when the generator is at standstill (pull out the plug-in brush holders).

Before any longer standstill apply a protective coating of acid-free grease (Vaseline) to the measuring slip rings. Remove this protective coating before starting-up the generator again.

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SIEMENS

Description of the System/ Plant Section 2

Components and Purchased Parts 2.3

Contents

2.3.1 Cooler

2.3.2 Bearings

2.3.3 Lubrication Oil Supply

2.3.4 Excitation

2.3.5 Neutral Point / Line Side Cubicle

2.3.6 Generator Control Panel / Automatic Voltage Regulation (AVR)

Manufacturer: **Powergear LTD**

Extract from documentation: **Instruction Manual for Line Side Cubicle**

A. Installation, operation and maintenance manual
B. Site assembly drawings

Amount: 20 pages of documentation incl. drawing

Extract from documentation: **Instruction Manual for Neutral Point Cubicle**

A. Installation, operation and maintenance manual
B. Site assembly drawings

Amount: 15 pages of documentation incl. drawing

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Instruction Manual

for

LINE SIDE CUBICLE

PURCHESE ORDER No. : E09-3010449826

SIEMENS SPEC. No. : TLV13-024

PROJECT NAME : VILNIUS BIOMASS

SERIAL No. : MP0650

DOCUMENT No. : IOM-LSC-MP0650

CONTENTS

A. INSTALLATION, OPERATION AND MAITENANCE MANUAL

B. SITE ASSEMBLY DRAWING

~~C. CONTRACT DRAWINGS~~

~~D. ROUTINE TEST CERTIFICATES~~

~~E. CERTIFICATE OF CONFORMANCE~~

A. INSTALLATION, OPERATION AND MAINTENANCE MANUAL

Line Side Cubicle

SIEMENS PROJECT No.	**: 3000018595**
SIEMENS ORDER No.	**: E09-3010449826**
MATERIAL No. Acc. TO PO	**: P00058032900**
CUBICLE IDENTIFICATION	**: +V20MKA10GD010**
PROECT NAME	**: VILNIUS BIOMASS**

Contact information :

M/s Powergear Limited,
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Email: engineering.mepz@powergearlimited.com
sbu@powergearlimited.com

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1. INTRODUCTION:

This manual covers the instructions for storage, handling, assembly, installation, operation and Maintenance of Line Side Cubicle supplied under this contract duly meets the requirement of "SIEMENS AG" specification.

2. DESCRIPTION OF EQUIPMENT:

Line side Cubicle is intended to mount on the structure by the side of generator and generator line leads are taken into Line Side Cubicle and terminated at the bottom side for IPB busduct connection.

2.1 Generator Line Accessory Compartment houses the following items:

2.1.1 Three phase busbars supported on Insulators.
2.1.2 Current Transformer (CT)
2.1.3 Voltage Transformer (VT)
2.1.4 Lightning Arrestors
2.1.5 Surge Capacitor
2.1.6 Spherical Point with earthing system (CATU make)
2.1.7 PDA coupler
2.1.8 PDA Termination Box
2.1.9 Junction box.
2.1.10 Heater junction box.

2.2. Construction:

2.2.1 Enclosure:

Line Side Cubicle is constructed with 4mm thick Aluminum Sheets welded over rigid Aluminum Channel frame work.
Provision for terminating the busduct is made at the bottom.

4 Nos. Lifting pad provided on top for lifting.

2 Nos. of Earth pads (PE) are provided at bottom for customer ground connection. These ground pads are connected internally by copper bus. Earth pads are identified by earthing symbol.

Rating plates are fixed near junction box on welded door in English & Lithuanian language.
Danger & Warning plates are provided on all access doors in English & Lithuanian language.

Junction box is mounted on the right side of the Line Side Cubicle, which houses CT, VT secondary terminals and VT secondary MCBs.

Heater junction box is mounted on the left side of the Line Side Cubicle, which houses heater terminals and thermostat.

PDA termination box is mounted on the left side of the line side cubicle wires from PDA couplers are terminated in this box. Refer PDA manual for detail.

Support structure is made of Mild steel channels and mounting holes are made on the structure for fixing the cubicle.

Rubber bellow is provided at Generator end connection busduct.

2.2.2 Bus bar:

Main current carrying bus bars are made out of 2 runs of 150x12mm copper bus bars and supported on epoxy insulators.

Tap-off busbars are made out of 1 run of 50x10mm copper busbars.

Bus bars are painted with matt black paint.
Generator end and IPB end (Flexible connection) are silver plated to 15 microns and other busbar joints are bare. Fasteners used for bus bar joints are of stainless steel A270 grade and are tightened to recommended torque value listed in Section – 6

Copper braid flexible are provided for Generator end connection.

2.3. ARRANGEMENT:

2.3.1 Line Side Bus bar system:

Consisting of 3 Main bus bars supported on epoxy insulators. One end of the bus is connected to Generator and the other side is terminated at the bottom for IPB bus duct connection.

Tap-off bus connection is taken from the main bus bar to connect Voltage Transformer, Lightning Arrestor and Surge Capacitor.

One No. of 3 cores Current Transformer per phase is mounted on these bus bar.

The CT, VT secondary terminals are brought out to LV BOX for external connection. Tap-off bus connection is taken from the main bus bars to connect Voltage Transformers.

The space heater terminals are brought out to HEATER BOX for external connection.

1 No lighting arrestor and surge capacitor per phase is connected in combination package to protect the equipment which is associated with generator cubicles by **Let-through-voltage.**

All equipments ground terminals are connected to main ground bus by means of copper bus/copper wire.

1 No. Spherical point per phase is provided on the main bus bars and 1 No. of spherical point is fixed to one of the grounding pad external to the enclosure.

3 Nos. PDA couplers are mounted inside the line side cubicle at generator end and connected to line bus to monitor the insulation system

4 Nos. Copper flexible (800 Sq.mm CSA) are provided for each phase (supplied as loose), meant for connection between the Generator terminal and the Line side Cubicle busbar.

3. INSTRUCTIONS IN METHODS OF RECEIVING, INSPECTION, STORAGE AND HANDLING PRIOR TO INSTALLATION

Line Side Cubicle is packed as per Powergear Standard for export packing in container shipments.

Packing slips are kept in a water proof envelop and are attached to the package.

All the packing cases shall be unloaded with “UP” facing upwards. While unloading the cases,

Extreme care shall be taken to prevent damages to equipment. Cases shall not be rolled From Container or subjected to impact under any circumstances.

After unloading, remove the packing with care, and keep the panel with the wooden pallets, which can be used during transport prior to installation. Check for any damages, incurred during transport and report damages on receipt.

To absorb the moisture inside the package during transit, dehumidifier bags are placed at bottom of the cubicle. Also VCI bags are placed at various locations and VCI is wrapped over the busbar joints. All these preservatives are to be removed and thrown-out prior to commissioning.

All the equipment / loose parts shall be verified with the packing slip. If there are any discrepancies, the same shall be reported immediately.

After inspection, the loose parts as Listed below shall be stored in a secured and covered storage yard / shed, protected from fire and weather until they are removed for installation.
It is preferred to keep the Line Side Cubicle along with the base pallet till it is erected.

LIST OF LOOSE ITEM:

SL.No.	Part NO.	Item Description	Qty.
1	5.3	Retainer Plate – 50 x 60 x 1300 (MS)	4 Nos.
2	5.3	Retainer Plate – 50 x 60 x 690 (MS)	4 Nos.
3	5.3	M10 x 45 Long + 1PW (SS)	16Nos.
4	5.4	Copper Braid Flexible – 50x25x380mm Long	12Nos.
5	5.4	M12x90 Bolt+NUT+2PW+1SW (SS)	12Nos.
6	5.4	M12x100 Bolt+NUT+2PW+1SW (SS)	12Nos.
7	2.1	ANCHOR BOLT-M12X140/50 HST, HILIT MAKE	24Nos
8	2.1	ANTI- VIBRATION MOUNT	6 Nos.
9	2.1	Packing Shim – 100x100mm Thickness: 15+6+6+3+2	6 No'S Each
10	2.1	M16 NUT+1PW+1SW (SS)	6 Nos.
11	1.1	M12X50LONG+NUT+2PW+1SW (SS)	20Nos.
12	4.2	Earthing System with kit	1 No.
13	5.3	RUBBER BELLOW (EPDM)	1 No.
14	5.3	M10X45N+2PW (SS)	16Nos.
15	2	SUPPORT STRUCTURE (MS)	1 No.
16	-	Epoxy Mica Capacitor (16kV, 80 pF)	3 Nos.
17	-	BNC Connector	6 Nos.
18	-	Coaxial Cable	30 Mtr.

SL.No.	Part NO.	Item Description	Qty.
19	-	PDA Name Plate (-C3L1, -C3L2, -C3L3)	3 Nos.
20	-	EMC Metal Clamp (for PDA) (SS)	6 Nos.
21	-	EMC Boot (For PDA)	3 Nos.
22	-	15kV Jumper Cable with angle lug(for PDA)	3 Nos.
23	-	Ground wire connection (for PDA)	10 ft.
24	-	HI - Voltage lug with heat shink + ground wire lug (for PDA)	3 Nos.
25	4.2.1	Shorting busbar – 1 (150x12th.) (Cu.)	4 Nos.
26	4.2.1	Shorting busbar – 2 (150x12th.) (Cu.)	4 Nos.
27	4.2.1	M12x60 Bolt+NUT+2PW+1SW (SS)	24 Nos.
28	2	12 th. Copper busbar	1 No.
29	2	Epoxy Insulator (95mm height)	2 Nos.
30	2	M12x40 Long+1PW (SS)	2 Nos.
31	2	M16x40 Long+1PW (SS)	2 Nos.

4. INSTRUCTIONS FOR ASSEMBLY AND INSTALLATION

Prior to undertake installation, please ensure the foundation arrangements and location for Line Side Cubicle is in line with the dimensions mentioned in the drawing.

After checking up of above carry out installation in the sequence mentioned below:

4.1 Fix the ANTI - VIBRATION MOUNT [SL No.:8 in Packing list] on the foundation using anchor bolt M12x140/50 [SL NO.: 7 in Packing list]. In line with drg DPPPG-70151868

4.2 Install the Structures [SL. No.:15 in Packing List] in line with drg.DPPPG-70151868. on the ANTI-VIBRATION MOUNT [SL No.:8 in Packing list] using M16 NUT +1PW+1SW SS [SL No.: 10 in Packing list] and align the structure using Packing shims [SL No: 9 in Packing list].

4.3 Lift the Line Side Cubicle using the Lifting lugs and place it over the structure after aligning Then connect cubicle base with support structure using the fastener M12X50L+NUT+2PW+1SW (SS) [SL No: 11 in Packing list].

4.4 Rubber bellow [SL No.: 13 in Packing list] and Retainer plate [SL No.: 1&2 in Packing list] are sending as loose items. After installation of Line Side Cubicle fix the rubber bellow M10X45N+2PW [SL No.:14 in Packing list]. Align and connect the other end of bellow to the Generator flange using Retainer Plate M10x45LONG+1PW [SL No.:3 in Packing list].

4.5 Connect the copper flexible in between Generator terminal and the Line Side Cubicle bus bar using the fastener – M12x100N+2PW+1SW (SS) [SL No.:6 in Packing list] near the generator end and M12x95N+2PW+1SW (SS) [SL No.: 5 in Packing list] in the opposite side.

4.6 In the event of doing site tests ensure to remove the copper flexible.

4.7 In LV BOX the CT terminals are provided with shorting plugs. Do not remove the plug till the end connections are made.

5. COMMISSIONING CHECKS:

The following commissioning checks are recommended on the Line Side Cubicle:

Physical inspection for any damage to insulators, CTs, VTs, LA, SC etc.

SL. No.	Equipment	Type of check
a.	Current Transformer	Ratio test verification, Polarity test
b.	Voltage Transformer	Ratio test verification, Polarity test
c.	Lightning Arrestor	Reference current measurement test
d.	Surge Capacitor	Capacitance measurement
e.	Grounding system	Electrical continuity, Tightness of joints
f.	HT Circuit	HV test at 75% of 38 KV for 1 minute
g.	Secondary wiring	HV test – 1.5 KV for 1 minute
h.	PDA Coupler	Check the cable connection tightness

Ensure the following before conducting the high voltage test on HT Circuit

- All CT, VT, secondary are to be shorted and connected to ground.
- Lightning Arrestor braid , PDA braid & extension flat to be removed during the test.
- Surge capacitor braid to be removed during testing.
- End terminations at generator are to be disconnected.

6. OPERATION INSTRUCTIONS:

Make sure that all the bus bar joints are correctly made by applying contact grease and tightened as per the torque recommendations given below :

	Bolt size	Torque
a.	M8	13 lbs (17 NM)
b.	M10	21 lbs (28 NM)
c.	M12	40 lbs (54 NM)
d.	M16	67 lbs (91 NM)

- Make sure that earth lead to station grid has been connected.
- Make sure to remove all hand tools from inside.
- Remove dust if any, using Vacuum Cleaner specifically on all Insulators.

7. LIST OF TOOLS AND TACKLES TO BE USED

1) **Open spanner** and **Box spanner** for M6, M8, M10, M12, and M16 Hex. Bolts and nuts
2) Torque Wrench with suitable adapters for above
3) Terminal Connector Screw Driver.

8. MAINTENANCE INSTRUCTION:

During annual shutdown the following preventive maintenance schedule is recommended.

Sl. No.	Equipment/Component	Period	Action	Remarks
1.	Current Transformer Voltage Transformer Surge Capacitor Lightning Arrestor	Yearly	Check for dust, clean with dry cotton cloth	
2.	Bus support insulator	Yearly	Check for dust, clean with dry cotton cloth	
3.	Bus bar joints	Yearly	Check for the bolt tightness: Tighten the bolts for required load, apply contact grease.	Use recommended contact grease*
4.	Insulation resistance	Yearly	Check for IR value between bus bars & enclosure. If IR value is not satisfactory when measured with 1000V mega ohm meter, find the source of any faults and rectify.	
5.	Check earth continuity	Yearly	Check for effective earth connection to plant.	

Recommended contact grease: OKS SW Electric (electrical contact) or equivalent.

9. TECHNICAL SPECIFICATION:

1. Rated voltage	: 15 kV
2. Rated frequency	: 50 Hz
3. Insulation level	: 17.5 kV/ 38 kV rms (1min) / 95 kV peak.
4. Rated current	: 3586 A at 55°C ambient
5. Short time current rating	: 80 kA rms for 1Sec. / 200 kA peak
6. Reference standard	: IEC 62271-200
7. Paint Finish:	
Enclosure - Outside and inside	: RAL 7030
Structure	: RAL 7030
8. Bus bar end and Generator end	: Silver Plated
Other Bus bar Joints	: Bare
Bus bar	: Black Matt.

.

B. SITE ASSEMBLY DRAWINGS

BILL OF MATERIALS FOR FIELD ASSEMBLY

POSITION	ITEM	DESCRIPTION	MATERIAL	QUANTITY	IDENTIFICATION
5.3	1	RETAINER PLATE – 50x6x1300	MS PAINTED	4 NO's	SHEET 4
5.3	2	RETAINER PLATE – 50x6x690	MS PAINTED	4 NO's	SHEET 4
5.3	3	M10 x 45 LONG + 1PW	SS A270	16 NO's	SHEET 4
5.4	4	COPPER BRAID FLEXIBLE–50x25x380mm LONG	COPPER	12 NO's	SHEET 4
5.4	5	M12x90 BOLT+NUT+2PW+1SW	SS A270	12 NO's	SHEET 4
5.4	6	M12x100 BOLT+NUT+2PW+1SW	SS A270	12 NO's	SHEET 4
2.1	7	ANCHOR BOLT – M12X140/50 HST, HILTI MAKE	STEEL (5.6 GR.)	24 NO's	SHEET 2
2.1	8	ANTI–VIBRATION MOUNT	–	6 NO's	SHEET 2
2.1	9	PACKING SHIM – 100x100mm THICKNESS : 15+6+6+3+2 (Per Mount)	GALVD.	6 NO's EACH	SHEET 2
2.1	10	M16 NUT + 1PW + 1SW	SS A270	6 NO's	SHEET 2
1.1	11	M12x50LONG+NUT+2PW+1SW	SS A270	20 NO's	SHEET 2
4.2	12	EARTHING SYSTEM WITH KIT	–	1 NO's	SHEET 3
5.3	13	RUBBER BELLOW	EPDM	1 NO's	SHEET 4
5.3	14	M10X45N+2PW	SS A270	16 NO's	SHEET 4
2	15	SUPPORT STRUCTURE	MS	1 NO's	SHEET 2
–	16	EPOXY MICA CAPACITOR (16kV, 80 pF)	–	3 NO's	LOOSE SUPPLY
–	17	BNC CONNECTOR	–	6 NO's	LOOSE SUPPLY
–	18	COAXIAL CABLE	–	30 Mtr.	LOOSE SUPPLY
–	19	PDA NAME PLATE (–C3L1, –C3L2, –C3L3)	SS	3 No's	LOOSE SUPPLY
–	20	EMC METAL CLAMP (FOR PDA)	SS	6 No's (3 Set)	LOOSE SUPPLY
–	21	EMC BOOT (FOR PDA)	–	3 No's	LOOSE SUPPLY
–	22	15kV JUMPER CABLE WITH ANGLE LUG(FOR PDA)	–	3 No's	LOOSE SUPPLY
–	23	GROUND WIRE CONNECTION (FOR PDA)	–	10 ft	LOOSE SUPPLY
–	24	HI – VOLTAGE LUG WITH HEAT SHINK + GROUND WIRE LUG (FOR PDA)	–	3 No's	LOOSE SUPPLY
4.2.1	25	SHORTING BUSBAR – 1 (150–12Th.)	COPPER	4 NO's	SHEET 4
4.2.1	26	SHORTING BUSBAR – 2 (150–12Th.)	COPPER	4 NO's	SHEET 4
4.2.1	27	M12x60 BOLT+NUT+2PW+1SW	SS A270	24 NO's	SHEET 4
2	28	12 Th. COPPER BUSBAR	COPPER	1 NO	SHEET 2
2	29	EPOXY INSULATOR (95mm HEIGHT)	SS A270	2 NO's	SHEET 2
2	30	M12 x 30 LONG + 1PW+1SW	SS A270	2 NO's	SHEET 2
2	31	M16 x 35 LONG + 1PW+1SW	SS A270	2 Set	SHEET 2

ALL DIMENSIONS ARE IN mm

REV. NO.	DESCRIPTION	DATE	APPD	REV.	DESCRIPTION	DATE	APPD.

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PROJECT VILNIUS BIOMASS

CUSTOMER SIEMENS AG

W .O. NO MP0650

TITLE LINE SIDE CUBICLE (LOOSE PARTS IDENTIFICATION)

SCALE 1 : 30

SIZE A3

POWERGEAR Experience The Power

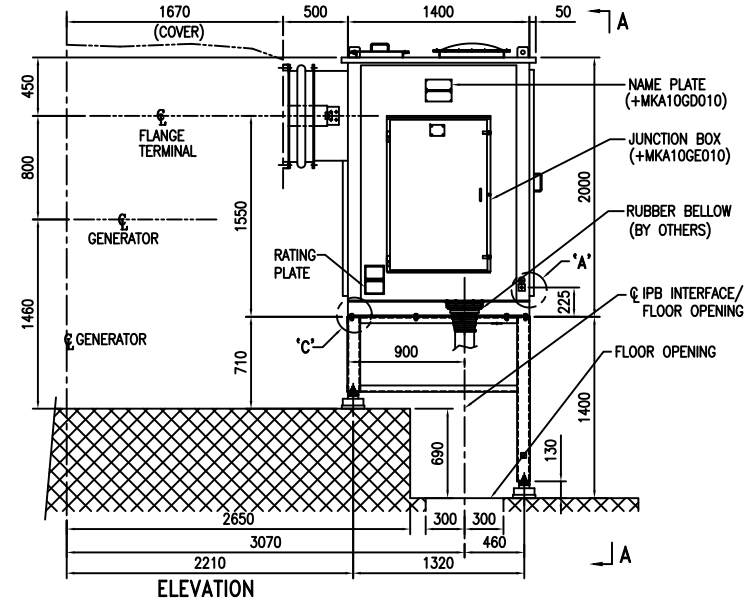
MEPZ, Tambaram, CHENNAI–600045 INDIA

	SIGN	DATE
DRN.	A.ANTONY	06.16.2018
CHD.	H.NARAYANAN	06.16.2018
APPD.	J.RAMASWAMY	06.16.2018

DRG. NO. LSC – MP0650

SHEET 1 OF 4 REV –

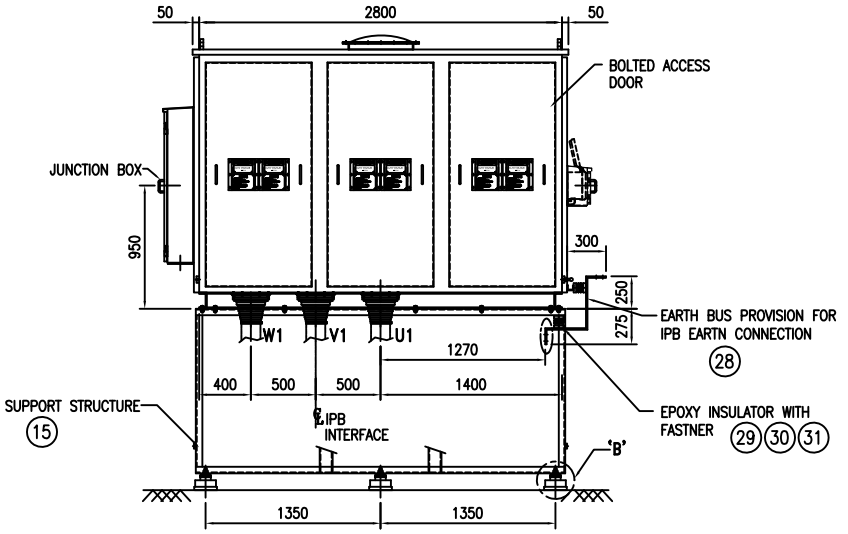
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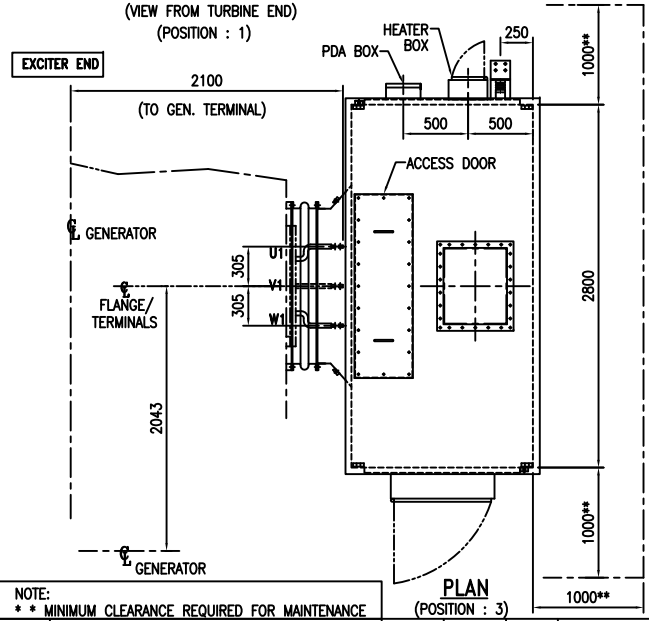
(VIEW FROM TURBINE END)

(POSITION : 1)



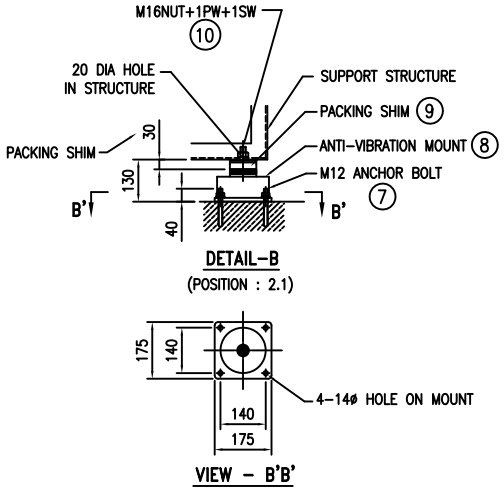
VIEW – AA

(POSITION : 2)



PLAN

(POSITION : 3)

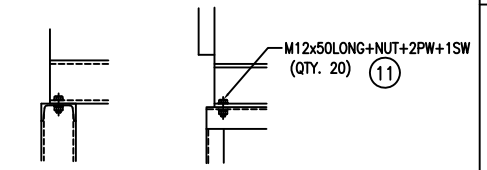


DETAIL–B

(POSITION : 2.1)

END VIEW

VIEW – B'B'



DETAIL–C

(CONNECTION BETWEEN
CUBICLE AND STRUCTURE)

(POSITION : 1.1)

END VIEW

NOTE:
* * MINIMUM CLEARANCE REQUIRED FOR MAINTENANCE

ALL DIMENSIONS ARE IN mm

REV. NO.	DESCRIPTION	DATE	APPD	REV.	DESCRIPTION	DATE	APPD.

PROJECT	VILNIUS BIOMASS
CUSTOMER	SIEMENS AG
W .O. NO	MP0650
TITLE	LINE SIDE CUBICLE (LOOSE PARTS IDENTIFICATION)
SCALE	1 : 40
SIZE	A3

POWERGEAR
Experience The Power

MEPZ, Tambaram, CHENNAI–600045 INDIA

	SIGN	DATE
DRN.	A.ANTONY	16.06.2018
CHD.	H.NARAYANAN	16.06.2018
APPD.	J.RAMASWAMY	16.06.2018

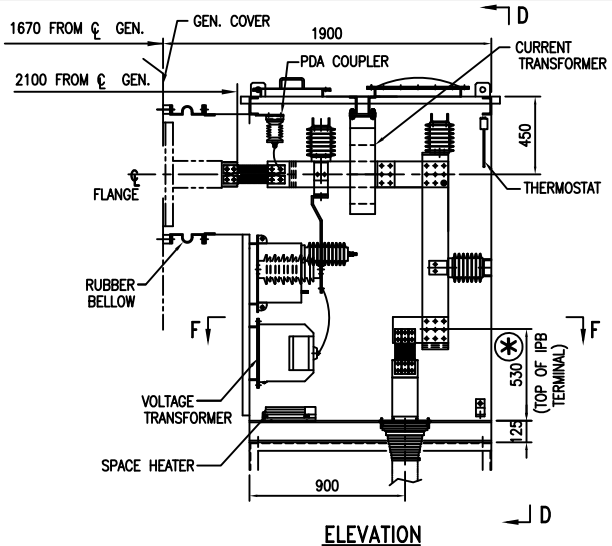
DRG. NO.

LSC – MP0650

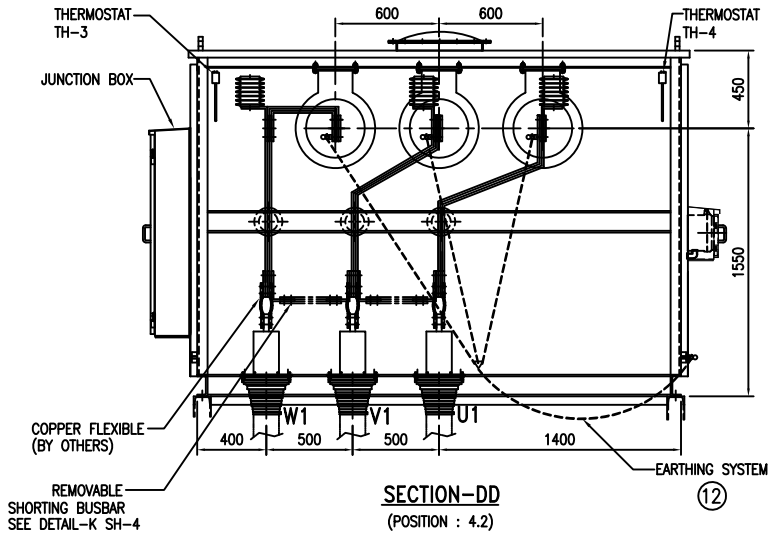
SHEET 2 OF 4 | REV -

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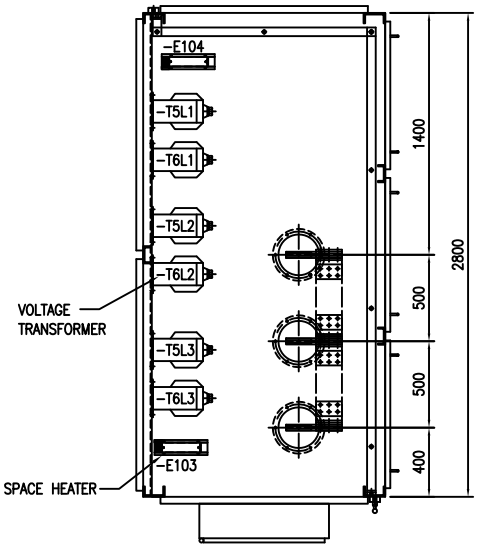
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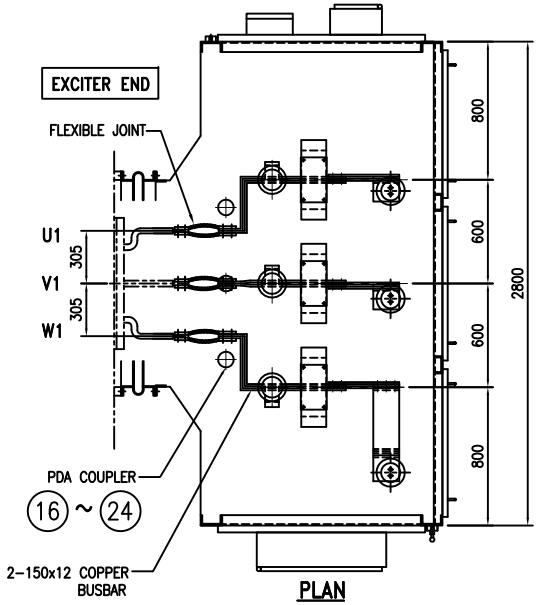
ELEVATION
(INTERNAL DETAILS)
(POSITION : 4)



SECTION-DD
(POSITION : 4.2)



SECTION-FF
(POSITION : 4.3)



PLAN
(POSITION : 4.1)

ALL DIMENSIONS ARE IN mm

REV. NO.	DESCRIPTION	DATE	APPD	REV.	DESCRIPTION	DATE	APPD.

PROJECT	VILNIUS BIOMASS
CUSTOMER	SIEMENS AG
W .O. NO	MP0650
TITLE	LINE SIDE CUBICLE (LOOSE PARTS IDENTIFICATION)
SCALE	1 : 30
SIZE	A3

POWERGEAR Experience The Power
MEPZ, Tambaram, CHENNAI-600045 INDIA

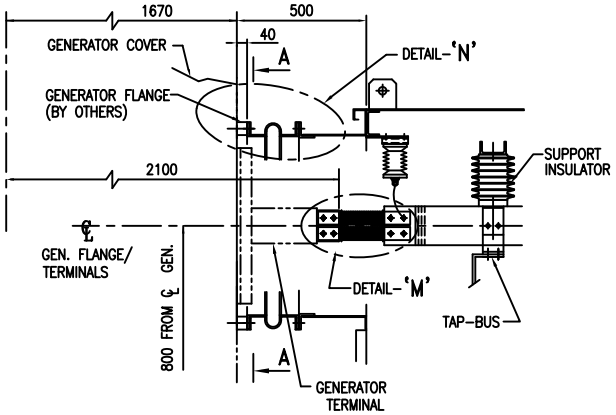
	SIGN	DATE
DRN.	A.ANTONY	06.16.2018
CHD.	H.NARAYANAN	06.16.2018
APPD.	J.RAMASWAMY	06.16.2018

DRG. NO.
LSC - MP0650

SHEET 3 OF 4 | REV -

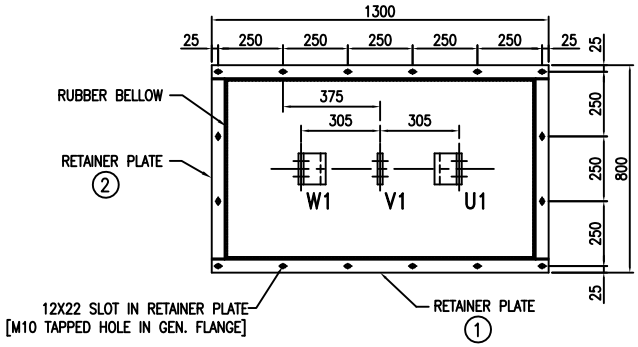
FILE NAME :

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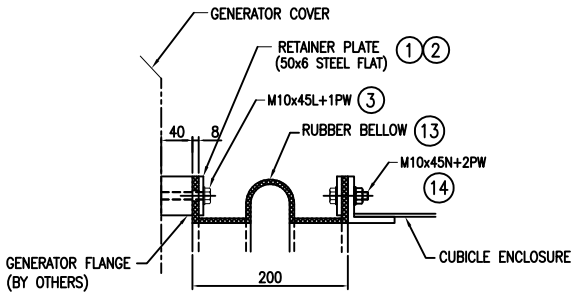
GENERATOR INTERFACE DETAILS

(POSITION : 5)



SECTION-AA

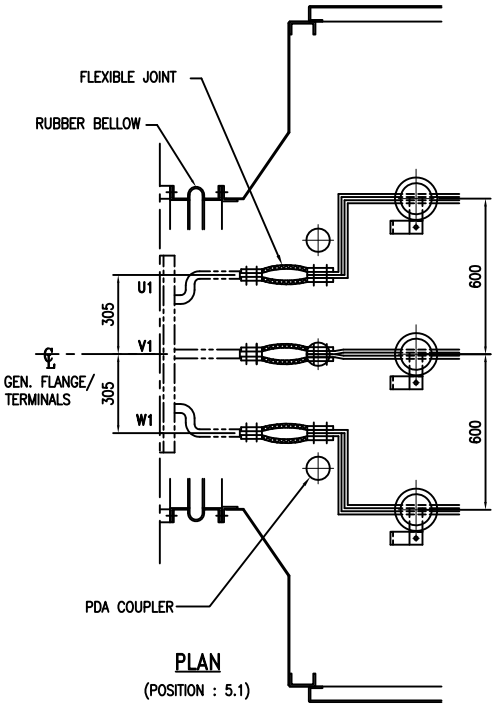
(POSITION : 5.2)



DETAIL-N

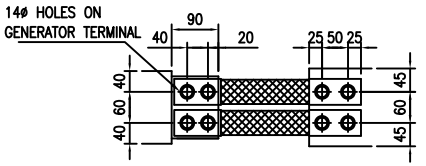
(POSITION : 5.3)

ENCLOSURE CONNECTION WITH GENERATOR

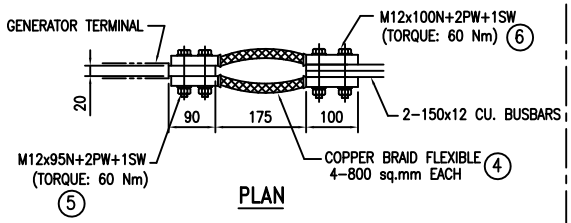


PLAN

(POSITION : 5.1)



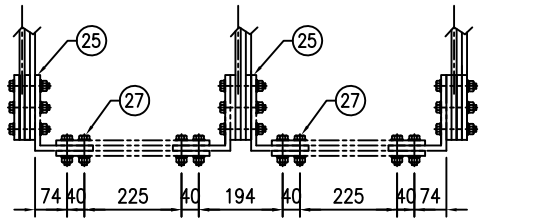
DETAIL-M



PLAN

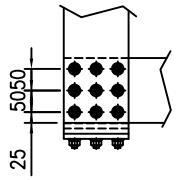
BUSBAR CONNECTION WITH GENERATOR LEAD

(POSITION : 5.4)

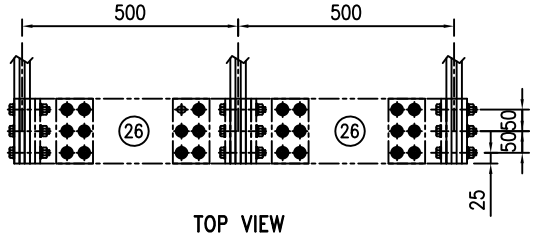


DETAIL - K

(POSITION : 4.2.1)



END VIEW



TOP VIEW

LINE SIDE SHORTING BUSBAR CONNECTING DETAILS

(REMOVABLE TYPE - SUPPLIED LOOSE)
(FOR TESTING PURPOSE ONLY)
(150x12Th. COPPER)

ALL DIMENSIONS ARE IN mm

REV. NO.	DESCRIPTION	DATE	APPD	REV.	DESCRIPTION	DATE	APPD.

PROJECT	VILNIUS BIOMASS
CUSTOMER	SIEMENS AG
W .O. NO	MP0650
TITLE	LINE SIDE CUBICLE (LOOSE PARTS IDENTIFICATION)
SCALE	1 : 40
SIZE	A3

POWERGEAR Experience The Power

MEPZ, Tambaram, CHENNAI-600045 INDIA

	SIGN	DATE
DRN.	A.ANTONY	16.06.2018
CHD.	H.NARAYANAN	16.06.2018
APPD.	J.RAMASWAMY	16.06.2018

DRG. NO.

LSC - MP0650

SHEET 4 OF 4 | REV -

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FILE NAME :

Bestellnummer (8) Purchase Order n°			E09 - 3010449826		*Bpos (4) PO Line*	20		*Materialalk (10) Product code*		*P0058032900*	*Zeichnungsnr. (15) Component doc. n°*	DPPPG-70151868	*Bestellnummer (8) Purchase Order n°*	E09 - 3010449826	*Bpos (4) PO Line*	20		*Materialalk (10) Product code*	P0058032900		*Zeichnungsnr. (15) Component doc. n°*	DPPPG-70151868								
Siemens-Auftrags-Nr. Plant SD number			3000018595		*Norm (18) Standard*	IEC		PO Line value		20	*Bestelltext Description*	LINE SIDE CUBICLE	*Siemens-Auftrags-Nr. Plant SD number*	3000018595	*Norm (18) Standard*	IEC		PO Line value	20		*Bestelltext Description*	LINE SIDE CUBICLE								
Job			LINE SIDE CUBICLE		*Projektname Project name*	VILNIUS BIOMASS					*Zeichnungsnr. DWG n°*	DPPPG-70151868	*Job*	LINE SIDE CUBICLE	*Projektname Project name*	VILNIUS BIOMASS					*Zeichnungsnr. DWG n°*	DPPPG-70151868								
Data of the goods for transport & storage, (INFORMATION TO BE COMPLETED by Supplier)														Administrative	INFORMATION TO BE COMPLETED by Supplier														
SKZ (1)	Posnr (4)	Materialp (10)	ME (2) Unit	Mengep (13) Qt.	MTART (4)	MKTXTD (40) Description	MKTXTE (40) Scope	Abmessung (20) Good dimensions [cm]			Norm (18) Standard	Werkstoff (20) Main primer material	Nettogewicht (10) Net weight	Zeichnungsnr. (15)	Preis (Stk.) (29) Cost	DR (1)	USR (1)	ALNR (8)	ECCN (8)	ULA (3)	URE (3)	PRA (1)	LERKEL (1)	STWN (11)	GEFST (1)	GEFKL (3)	UNSTN (4)	SDBL (1)	UNMBL (1)		
	Item			[D]				L	W	H			[Kg]																	
	5.3	1	Nos	4		Halteplatte	RETAINER PLATE	1300	6	50		MS Painted	-	DPPPG-70151868	-	N	N			INDIA	ASIA				N					
	5.3	2	Nos	4		Halteplatte	RETAINER PLATE	690	6	50		MS Painted	-	DPPPG-70151868	-	N	N			INDIA	ASIA				N					
	5.3	3	Set	16			HEX. BOLT M10x45 LONG+1PW	-	-	-		SS A270	-	DPPPG-70151868	-	N	N			INDIA	ASIA				N					
	5.4	4	Nos	12		KUPFERNE FLECHTE FLEXIBEL	COPPER BRAID FLEXIBLE-50x25x380mm LONG	-	-	-		Copper	-	DPPPG-70151868	-	N	N			INDIA	ASIA				N					
	5.4	5	Set	12		Edelst. Bolz. M. Unterlegsch. U. Mutter	HEX. BOLT M12x90BOLT+NUT+2PW+1SW	-	-	-		SS A270	-	DPPPG-70151868	-	N	N			INDIA	ASIA				N					
	5.4	6	Set	12		Edelst. Bolz. M. Unterlegsch. U. Mutter	HEX. BOLT M12x100BOLT+NUT+2PW+1SW	-	-	-		SS A270	-	DPPPG-70151868	-	N	N			INDIA	ASIA				N					
	2.1	7	Set	24		ANKERBOLZEN	ANCHOR BOLT - M12X140/50 HST, HILTI MAKE	-	-	-		STEEL (5.6 GR.)	-	DPPPG-70151868	-	N	N			INDIA	ASIA				N					
	2.1	8	Nos	6		ANTI-VIBRATION EINFASSUNG	ANTI-VIBRATION MOUNT	-	-	-		-	-	DPPPG-70151868	-	N	N			INDIA	ASIA				N					
	2.1	9	Nos	6No's EA		VERPACKUNG MESSPLÄTTCHEN	PACKING SHIM – 100x100mm 15+6+6+3+2	-	-	-		GALVD	-	DPPPG-70151868	-	N	N			INDIA	ASIA				N					
	2.1	10	Set	6		Edelst. Bolz. M. Unterlegsch. U. Mutter	M16 NUT+1PW+1SW	-	-	-		SS A270	-	DPPPG-70151868	-	N	N			INDIA	ASIA				N					
	1.1	11	Set	20		Edelst. Bolz. M. Unterlegsch. U. Mutter	HEX. BOLT M12x50BOLT+NUT+2PW+1SW	-	-	-		SS A270	-	DPPPG-70151868	-	N	N			INDIA	ASIA				N					
	4.2	12	Nos	1		Erdung system	EARTHING SYSTEM BOX WITH STICK	-	-	-		-	-	DPPPG-70151868	-	N	N			INDIA	ASIA				N					
	5.3	13	Nos	1		Gummibalg	RUBBER BELLOW	-	-	-		EPDM	-	DPPPG-70151868	-	N	N			INDIA	ASIA				N					
	5.3	14	Set	16			M10x45N+2PW	-	-	-		SS A270	-	DPPPG-70151868	-	N	N			INDIA	ASIA				N					
	2	15	Nos	1		Unterstützen Sie Strukturen	SUPPORT STRUCTURE	1410	2850	1270		MS	175	DPPPG-70151868	-	N	N			INDIA	ASIA				N					
	-	16	Nos	3			EPOXY MICA CAPACITOR (16kV, 80pF)	-	-	-		-	-	DPPPG-70151868	-	N	N			INDIA	ASIA				N					
	-	17	Nos	6		VERBINDER	BNC CONNECTOR	-	-	-		-	-	DPPPG-70151868	-	N	N			INDIA	ASIA				N					

Bestellnummer (8) Purchase Order n°			E09 - 3010449826		*Bpos (4) PO Line*	20		*Materialalk (10) Product code*		*P0058032900*	*Zeichnungsnr. (15) Component doc. n°*	DPPPG-70151868	*Bestellnummer (8) Purchase Order n°*	E09 - 3010449826	*Bpos (4) PO Line*	20		*Materialalk (10) Product code*	P0058032900		*Zeichnungsnr. (15) Component doc. n°*	DPPPG-70151868							
Siemens-Auftrags-Nr. Plant SD number			3000018595		*Norm (18) Standard*	IEC		PO Line value		20	*Bestelltext Description*	LINE SIDE CUBICLE	*Siemens-Auftrags-Nr. Plant SD number*	3000018595	*Norm (18) Standard*	IEC		PO Line value	20		*Bestelltext Description*	LINE SIDE CUBICLE							
Job			LINE SIDE CUBICLE		*Projektname Project name*	VILNIUS BIOMASS					*Zeichnungsnr. DWG n°*	DPPPG-70151868	*Job*	LINE SIDE CUBICLE	*Projektname Project name*	VILNIUS BIOMASS					*Zeichnungsnr. DWG n°*	DPPPG-70151868							
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	Item			[D]				L	W	H			[Kg]																	
	-	18	Mtr	30			Coaxial Cable (10Mtr. / Coupler)	-	-	-		-	-	DPPPG-70151868	-	N	N			INDIA	ASIA				N					
	-	19	Nos	3		NAMEN PLATE	PDA NAME PLATE (-C3L1, -C3L2, -C3L3)	-	-	-		-	-	DPPPG-70151868	-	N	N			INDIA	ASIA				N					
	-	20	Nos	6		METALL KLAMMER	EMC METAL CLAMP (FOR PDA)	-	-	-		-	-	DPPPG-70151868	-	N	N			INDIA	ASIA				N					
	-	21	Nos	3			EMC BOOT (FOR PDA)	-	-	-		-	-	DPPPG-70151868	-	N	N			INDIA	ASIA				N					
	-	22	Nos	3		Anschlusskabel mit WINKEL LUG	POWER CABLE WITH ANGLE LUG 15kV (FOR PDA)	-	-	-		-	-	DPPPG-70151868	-	N	N			INDIA	ASIA				N					
	-	23	ft	10		Schutzleiteranschluss	GROUND WIRE CONNECTION (FOR PDA)	-	-	-		-	-	DPPPG-70151868	-	N	N			INDIA	ASIA				N					
	-	24	Nos	3		HOCHSPANNUNGS LUG mit Schrumpf + BODEN DRAHT LUG	HI - VOLTAGE LUG WITH HEAT SHINK + GROUND WIRE LUG (FOR PDA)	-	-	-		-	-	DPPPG-70151868	-	N	N			INDIA	ASIA				N					
	4.2.1	25	Nos	4		Kurzschluss-Busstange	SHORTING BUSBAR-1 (150-12Th.)	-	-	-		Copper	-	DPPPG-70151868	-	N	N			INDIA	ASIA				N					
	4.2.1	26	Nos	4		Kurzschluss-Busstange	SHORTING BUSBAR-2 (150-12Th.)	-	-	-		Copper	-	DPPPG-70151868	-	N	N			INDIA	ASIA				N					
	4.2.1	27	Nos	24		Edelst. Bolz. M. Unterlegsch. U. Mutter	HEX. BOLT M12x60BOLT+NUT+2PW+1SW	-	-	-		SS A270	-	DPPPG-70151868	-	N	N			INDIA	ASIA				N					
	2	28	Nos	1			12Th. COPPER BUSBAR	-	-	-		Copper	-	DPPPG-70151868	-	N	N			INDIA	ASIA				N					
	2	29	Nos	2			INSULATOR (95 mm HEIGHT)	-	-	-		EPOXY	-	DPPPG-70151868	-	N	N			INDIA	ASIA				N					
	2	30	Nos	2		Edelst. Bolz. M. Unterlegsch. U. Mutter	HEX. BOLT M12x30BOLT+1PW+1SW	-	-	-		SS A270	-	DPPPG-70151868	-	N	N			INDIA	ASIA				N					
	2	31	Nos	2		Edelst. Bolz. M. Unterlegsch. U. Mutter	HEX. BOLT M16x35BOLT+1PW+1SW	-	-	-		SS A270	-	DPPPG-70151868	-	N	N			INDIA	ASIA				N					
	1	32	Nos	1		Line Seite Duschkabine	LINE SIDE CUBICLE	1720	2900	2000		ALUMINIUM	1500	DPPPG-70151868	-	N	N			INDIA	ASIA				N					

Instruction Manual

for

NEUTRAL SIDE CUBICLE

PURCHESE ORDER No. : E09-3010449826

SIEMENS SPEC. No. : TLV13-024

PROJECT NAME : VILNIUS BIOMASS

SERIAL No. : MP0650

DOCUMENT No. : IOM-NSC-MP0650

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B. SITE ASSEMBLY DRAWING

~~C. CONTRACT DRAWINGS~~

~~D. ROUTINE TEST CERTIFICATES~~

~~E. CERTIFICATE OF CONFORMANCE~~

A. INSTALLATION, OPERATION AND MAINTENANCE MANUAL

Neutral Side Cubicle

SIEMENS PROJECT No. **: 3000018595**

SIEMENS ORDER No. **: E09-3010449826**

MATERIAL No. Acc. TO PO **: P00058032800**

CUBICLE IDENTIFICATION **: +V20MKA10GD020**

PROECT NAME **: VILNIUS BIOMASS**

Contact information:

M/s Powergear Limited,
Plot No. B-33, 2nd phase,
5th main road, MEPZ,
Tambaram,
Chennai – 600 045. India.
Phone: +91 44 42901111
Fax: +91 44 22624434
Email: engineering.mepz@powergearlimited.com
sbu@powergearlimited.com

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1. INTRODUCTION:

This manual covers the instructions for storage, handling, assembly, installation, operation and Maintenance of Neutral Side Cubicle supplied under this contract duly meets the requirements of "SIEMENS AG" specification.

2. DESCRIPTION OF EQUIPMENT:

Neutral Side Cubicle is intended to mount on the structure by the side of Generator and Generator line leads are taken into Neutral Side Cubicle and star formed for neutral Side connection and connected to ground through NGT.

2.1 Generator Neutral Side Cubicle houses the following items:

2.1.1 Three Phase Busbars supported on Insulators.

2.1.2 Current Transformer (CT).

2.1.3 Neutral Grounding transformer (NGT).

2.1.4 Neutral Grounding Resistor (NGR).

2.1.5 Junction box.

2.1.6 Heater junction box.

2.2. Construction:

2.2.1 Enclosure:

Neutral Side Cubicle is constructed with 4mm thick Aluminum Sheets welded over rigid Aluminum Channel frame work.

4Nos. Lifting pad provided on top for lifting.

Provision for lifting is provided at the top corners of the panel.

2Nos. Earth pads (PE) are provided at bottom for customer ground connection. These Earth pads are connected internally by copper bus. Earth pads are identified by earthing symbol.

Rating plates are fixed near junction box on welded door in English & Lithuanian language. Danger & Warning plates are provided on all access doors in English & Lithuanian language.

Junction box is mounted on the right side of the Neutral Side Cubicle, which houses CT, NGR, and NGT, secondary terminals are wired up to this junction box.

Heater box is mounted on the left side of the Neutral Side Cubicle, which houses heater terminals and thermostat.

Support structure is made of Mild steel channels and mounting holes are made on the structure for fixing the cubicle.

Rubber bellow is provided at generator end connection busduct.

2.2.2 Bus bar:

Main current carrying bus bars are made out of 2 runs of 150x12mm copper bus bars and supported on Epoxy Insulators.

Neutral tie busbars are made out of 50X10mm copper busbar.

Bus bars are painted with matt black paint.

Generator end connection joints are silver plated to 15 microns and other busbar joints are bare. Fasteners used for bus bar joints are of stainless steel A270 grade and are tightened to recommended torque value listed in section – 6. Copper braid flexible is provided for generator end connection.

2.3. ARRANGEMENT:

2.3.1 Neutral Side Bus bar system:

Consisting of 3 phase bus bars supported on epoxy insulators one end left free for connecting with generator and other end star formed and neutral is connect to ground through NGT.

Two nos. 4 Core Current transformers per phase are mounted on these bus bars.

Disconnecting links are provided on each phase to facilitate replacement of ct's when required.

The CT secondary terminals are brought out to LV BOX for external connection.

The space heater terminals are brought out to HEATER BOX for external connection.

From Neutral star point, Neutral tie bus is taken and connected to Neutral grounding transformer (NGT). The Secondary of Neutral grounding transformer is connected to Neutral grounding resistor (NGR).

The Neutral terminal of Neutral grounding transformer is connected to common ground bus.

4 Nos. Copper flexible (800 Sq.mm CSA) are provided for each phase (supplied as loose), meant for connection between the Generator terminal and the Neutral Side Cubicle busbar.

3. INSTRUCTIONS IN METHODS OF RECEIVING, INSPECTION, STORAGE AND HANDLING PRIOR TO INSTALLATION

Neutral Side Cubicle is packed as per Powergear Standard for export packing in container shipments.

Packing slips are kept in a water proof envelop and are attached to the package.

All the packing cases shall be unloaded with "UP" facing upwards. While unloading the cases, Extreme care shall be taken to prevent damages to equipment. Cases shall not be rolled From container or subjected to impact under any circumstances.

After unloading, remove the packing with care, and keep the panel with the wooden pallets, which can be used during transport prior to installation. Check for any damages, incurred during transport and report damages on receipt.

To absorb the moisture inside the package during transit, dehumidifier bags are placed at bottom of the cubicle. Also VCI bags are placed at various locations and VCI is wrapped over the busbar joints. All these preservatives are to be removed and thrown-out prior to commissioning.

All the equipment / loose parts shall be verified with the packing slip. If there are any discrepancies, the same shall be reported immediately.

After inspection, the loose parts as Listed below shall be stored in a secured and covered storage yard / shed, protected from fire and weather until they are removed for installation.
It is preferred to keep the Neutral Side Cubicle along with the base pallet till it is erected.

LIST OF LOOSE ITEM:

SL.No.	Part No.	Item Description	Qty.
1	3.2	Retainer Plate – 50 x 60 x 1300 (MS)	4 Nos.
2	3.2	Retainer Plate – 50 x 60 x 690 (MS)	4 Nos.
3	3.2	M10 x 45 Long + 1PW (SS)	16 Nos.
4	3.3	Copper Braid Flexible – 50x25x380mm Long	12 Nos.
5	3.3	M12x90 Bolt+NUT+2PW+1SW (SS)	12 Nos.
6	3.3	M12x100 Bolt+NUT+2PW+1SW (SS)	12 Nos.
7	1.2	ANCHOR BOLT-M12X140/50 HST, HILIT MAKE	16 Nos.
8	1.2	ANTI- VIBRATION MOUNT	4 Nos.
9	1.2	Packing Shim – 100x100mm Thickness: 15+6+6+3+2	4 Nos Each
10	1.2	M16 NUT+1PW+1SW (SS)	4 Nos.
11	1.1	M12X50 Long+Nut+2PW+1SW (SS)	20 Nos.
12	3.2	RUBBER BELLOW (EPDM)	1 No.
13	3.2	M10X45N+2PW (SS)	16 Nos.
14	2	SUPPORT STRUCTURE (MS)	1 No.

4. INSTRUCTIONS FOR ASSEMBLY AND INSTALLATION:

Prior to undertake installation, please ensure the foundation arrangements and location for Neutral Side Cubicle is in line with the dimensions mentioned in the drawing.
After checking up of above carry out installation in the sequence mentioned below:

4.1 Fix the ANTI-VIBRATION MOUNT [SL No.:8 in Packing list] on the foundation using anchor bolt M12x140/50 [SL NO.: 7 in Packing list]. In line with drg DPPPG-70151867.

4.2 Install the Structures [SL. No.:14 in Packing List] in line with drg. DPPG-70151867 On the ANTI-VIBRATION MOUNT [SL No.:8 in Packing list] using M16 NUT +1PW+1SW SS [SL No.: 10 in Packing list] and align the structure using Packing shims [SL No: 9 in Packing list].

4.3 Lift the Neutral Side Cubicle using the Lifting lugs and place it on the structure. After align and Connect cubicle base with support structure using the fastener M12X50N+2PW+1SW. (SS) [SL No.: 11 in packing list].

4.4 Rubber bellow [SL No.: 12 in Packing list] and Retainer plate [SL No.: 1&2 in Packing list] are sending as loose items. After installation of Neutral Side Cubicle fix the rubber bellow with the cubicle using M10X45N+2PW [SL NO.: 13]. Align and connect the other end of bellow to the Generator flange using Retainer Plate M10x45LONG+1PW [SL No.:3 in Packing list].

4.5 Connect the copper flexible in between Generator terminal and the Neutral Side Cubicle busbar using the fastener – M12X100N+2PW+1SW (SS) [SL No.: 6 in Packing list]/M12X90 N+2PW+1SW (SS) [SL No.: 5 in Packing list].

4.6 In LV BOX the CT terminals are provided with shorting plugs. Do not remove the plug till the end connections are made.

5. COMMISSIONING CHECKS:

The following commissioning checks are recommended on the Neutral Side Cubicle:

Physical inspection for any damage to insulator, CTs, NGT, NGR.

SL. No.	Equipment	Type of check
a.	Current transformer	Ratio test verification, Polarity test
b.	Neutral grounding transformer	Ratio test verification, Polarity test
c.	Neutral grounding resistor	Resistance measurement, megger test
d.	Grounding system	Electrical continuity, Tightness of joints
e.	HT Circuit	HV test at 75% of 38 KV for 1 minute
f.	Secondary wiring	HV test – 1.5 KV for 1 minute

Ensure the following before conducting the high voltage test on HT Circuit

- All CT secondary are to be shorted and connected to ground.
- End terminations at generator are to be disconnected.
- Neutral tie bus and NGT primary is disconnected from the bus.

6. OPERATION INSTRUCTIONS:

Make sure that all the bus bar joints are correctly made by applying contact grease and tightened as per the torque recommendations given below :

	Bolt size	Torque
a.	M8	13 lbs (17 NM)
b.	M10	21 lbs (28 NM)
c.	M12	40 lbs (54 NM)
d.	M16	67 lbs (91 NM)

- Make sure that earth lead to station grid has been connected.
- Make sure to remove all hand tools from inside.
- Remove dust if any, using Vacuum cleaner specifically on all insulators.

7. LIST OF TOOLS AND TACKLES TO BE USED

1) **Open spanner** and **Box spanner** for M6, M8, M10, M12, M16 Hex. Bolts and nuts
2) Torque Wrench with suitable adapters for above
3) Terminal Connector Screw Driver.

8. MAINTENANCE INSTRUCTION:

During annual shutdown the following preventive maintenance schedule is recommended.

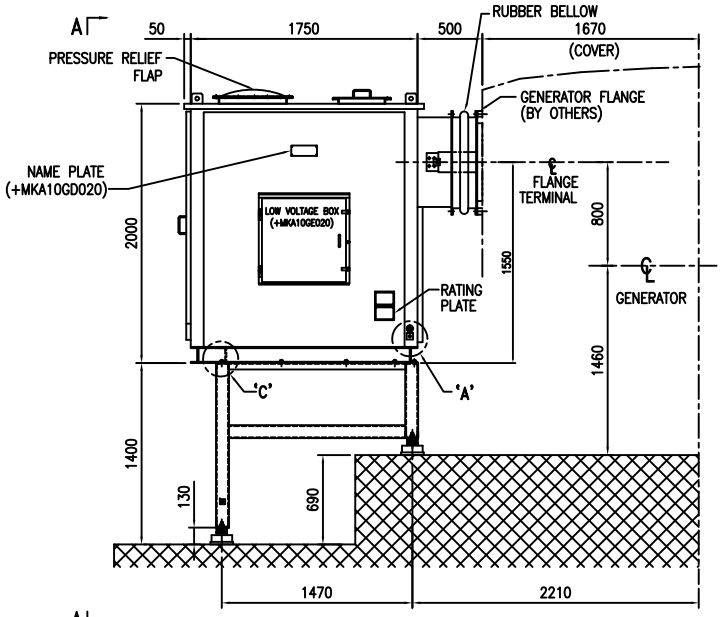
Sl. No.	Equipment/Component	Period	Action	Remarks
1.	Current transformer Neutral grounding transformer	Yearly	Check for dust, clean with dry cotton cloth	
2.	Bus support insulator	Yearly	Check for dust, clean with dry cotton cloth	
3.	Bus bar joints	Yearly	Check for the bolt tightness: Tighten the bolts for required load, apply contact grease.	Use recommended contact grease
4.	Insulation resistance	Yearly	Check for IR value between busbars & enclosure. If IR value is not satisfactory when measured with 1000V mega ohm meter, find the source of any faults and rectify.	
5.	Check earth continuity	Yearly	Check for effective earth connection to plant	

Recommended contact grease: OKS SW Electric (electrical contact) or equivalent.

9. TECHNICAL SPECIFICATION:

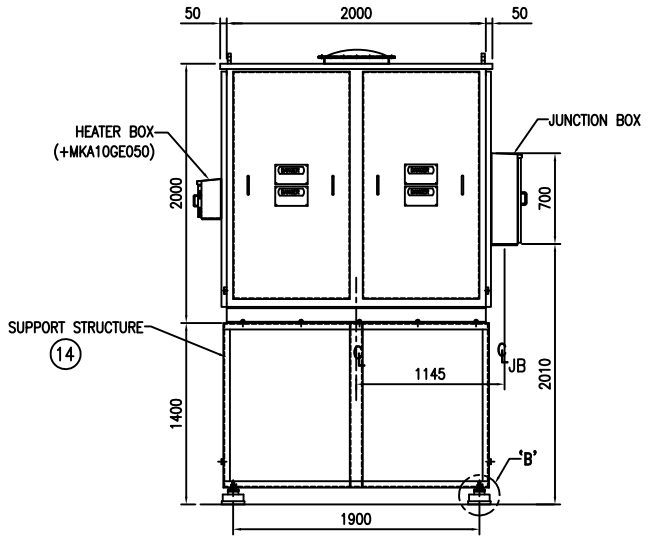
1. Rated voltage	: 15 kV
2. Rated frequency	: 50 Hz
3. Insulation level	: 17.5kV/ 38 kV rms (1min) / 95 kV peak
4. Rated current	: 3586 A @ 55° C
5. Short time current rating	: 80kA rms for 1Sec. (200 kA peak)
6. Reference standard	: IEC 62271-200
7. Paint Finish:	
Enclosure - Outside and inside	: RAL 7030
Structure	: RAL 7030
8. Bus bar joints at Generator end connection	: Silver Plated
Other Bus bar Joints	: Bare
Bus bar	: Black Matt

B. SITE ASSEMBLY DRAWINGS



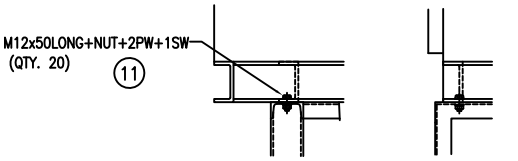
ELEVATION

(POSITION : 1)



VIEW – AA

(POSITION : 2)

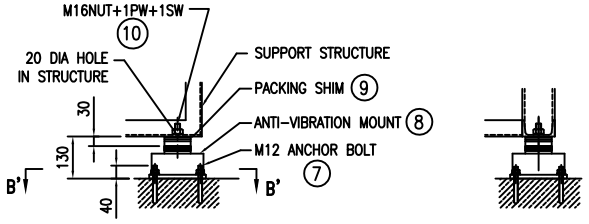


DETAIL–C

(CONNECTION BETWEEN CUBICLE AND STRUCTURE)

(POSITION : 1.1)

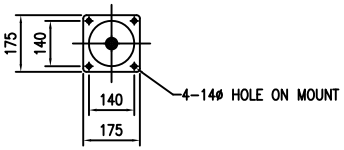
END VIEW



DETAIL–B

(POSITION : 1.2)

END VIEW



VIEW – B'B'

ALL DIMENSIONS ARE IN mm

BILL OF MATERIALS FOR FIELD ASSEMBLY

POSITION	ITEM	DESCRIPTION	MATERIAL	QUANTITY	IDENTIFICATION
3.2	1	RETAINER PLATE – 50x6x1300	MS PAINTED	4 NO's	SHEET 2
3.2	2	RETAINER PLATE – 50x6x690	MS PAINTED	4 NO's	SHEET 2
3.2	3	M10 x 45 LONG + 1PW	SS A270	16 NO's	SHEET 2
3.3	4	COPPER BRAID FLEXIBLE–50x25x385mm LONG	COPPER	12 NO's	SHEET 2
3.3	5	M12x90 BOLT+NUT+2PW+1SW	SS A270	12 NO's	SHEET 2
3.3	6	M12x100 BOLT+NUT+2PW+1SW	SS A270	12 NO's	SHEET 2
1.2	7	ANCHOR BOLT – M12X140/50 HST, HILTI MAKE	STEEL (5.6 GR.)	16 NO's	THIS SHEET
1.2	8	ANTI–VIBRATION MOUNT	–	4 NO's	THIS SHEET
1.2	9	PACKING SHIM – 100x100mm THICKNESS : 15+6+6+3+2 (Per Mount)	GALVD.	4 NO's EACH	THIS SHEET
1.2	10	M16 NUT + 1PW + 1SW	SS A270	4 NO's	THIS SHEET
1.1	11	M12x50LONG+NUT+2PW+1SW	SS A270	20 NO's	THIS SHEET
3.2	12	RUBBER BELLOW	EPDM	1 NO	SHEET 2
3.2	13	M10X45N+2PW	SS A270	16 NO's	SHEET 2
2	14	SUPPORT STRUCTURE	MS	1 NO	THIS SHEET

REV. NO.	DESCRIPTION	DATE	APPD	REV.	DESCRIPTION	DATE	APPD.

PROJECT VILNIUS BIOMASS

CUSTOMER SIEMENS AG

W .O. NO MP0650

TITLE NEUTRAL SIDE CUBICLE (LOOSE PARTS IDENTIFICATION)

SCALE 1 : 30

SIZE A3

POWERGEAR Experience The Power

MEPZ, Tambaram, CHENNAI–600045 INDIA

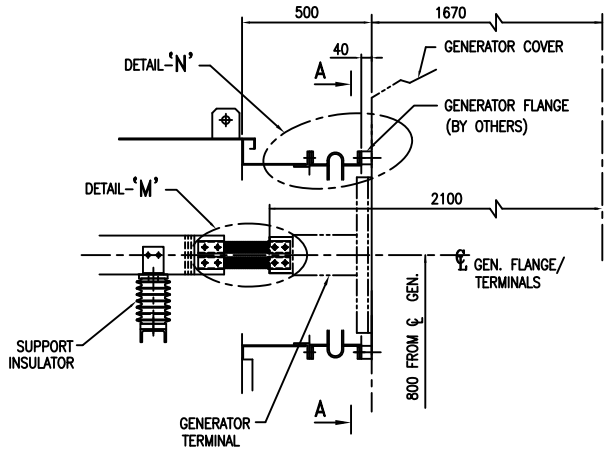
	SIGN	DATE
DRN.	A.ANTONY	16.06.2018
CHD.	H.NARAYANAN	16.06.2018
APPD.	J.RAMASWAMY	16.06.2018

DRG. NO. NSC – MP650

SHEET 1 OF 2 REV –

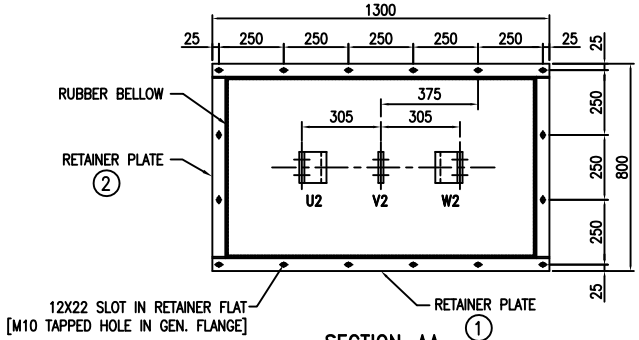
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FILE NAME :



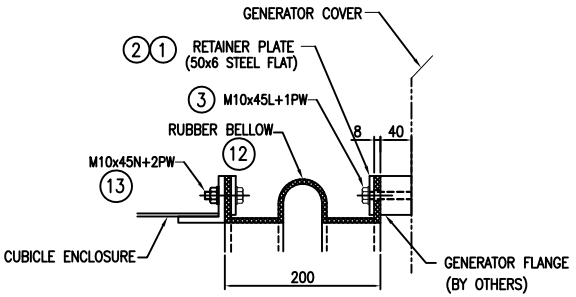
GENERATOR INTERFACE DETAILS

(POSITION : 3)



SECTION–AA

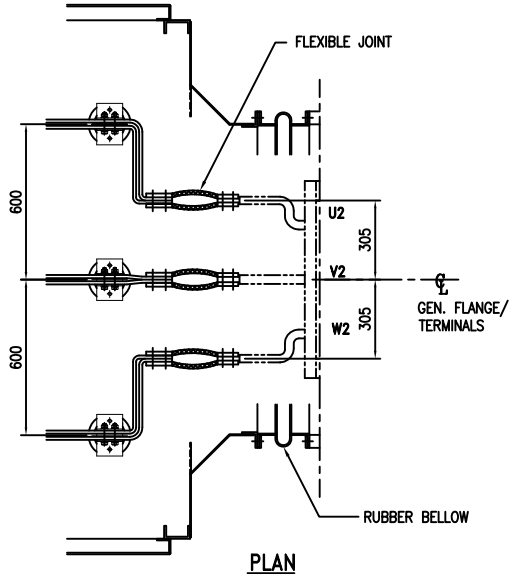
(POSITION : 3.1)



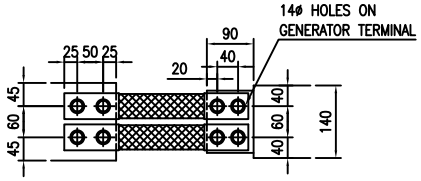
DETAIL–N

ENCLOSURE CONNECTION WITH GENERATOR

(POSITION : 3.2)

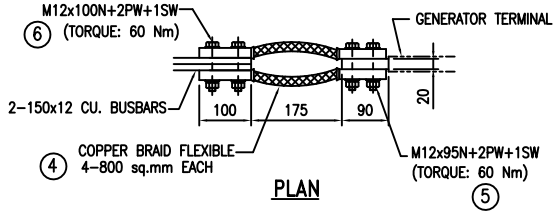


PLAN



DETAIL–M

(POSITION : 3.3)



PLAN

BUSBAR CONNECTION WITH GENERATOR LEAD

ALL DIMENSIONS ARE IN mm

REV. NO.	DESCRIPTION	DATE	APPD	REV.	DESCRIPTION	DATE	APPD.

PROJECT	VILNIUS BIOMASS
CUSTOMER	SIEMENS AG
W .O. NO	MP0650
TITLE	NEUTRAL SIDE CUBICLE (LOOSE PARTS IDENTIFICATION)
SCALE	1 : 30
SIZE	A3

POWERGEAR Experience The Power

MEPZ, Tambaram, CHENNAI–600045 INDIA

	SIGN	DATE
DRN.	A.ANTONY	16.06.2018
CHD.	J.RAMASWAMY	16.06.2018
APPD.	J.RAMASWAMY	16.06.2018

DRG. NO.

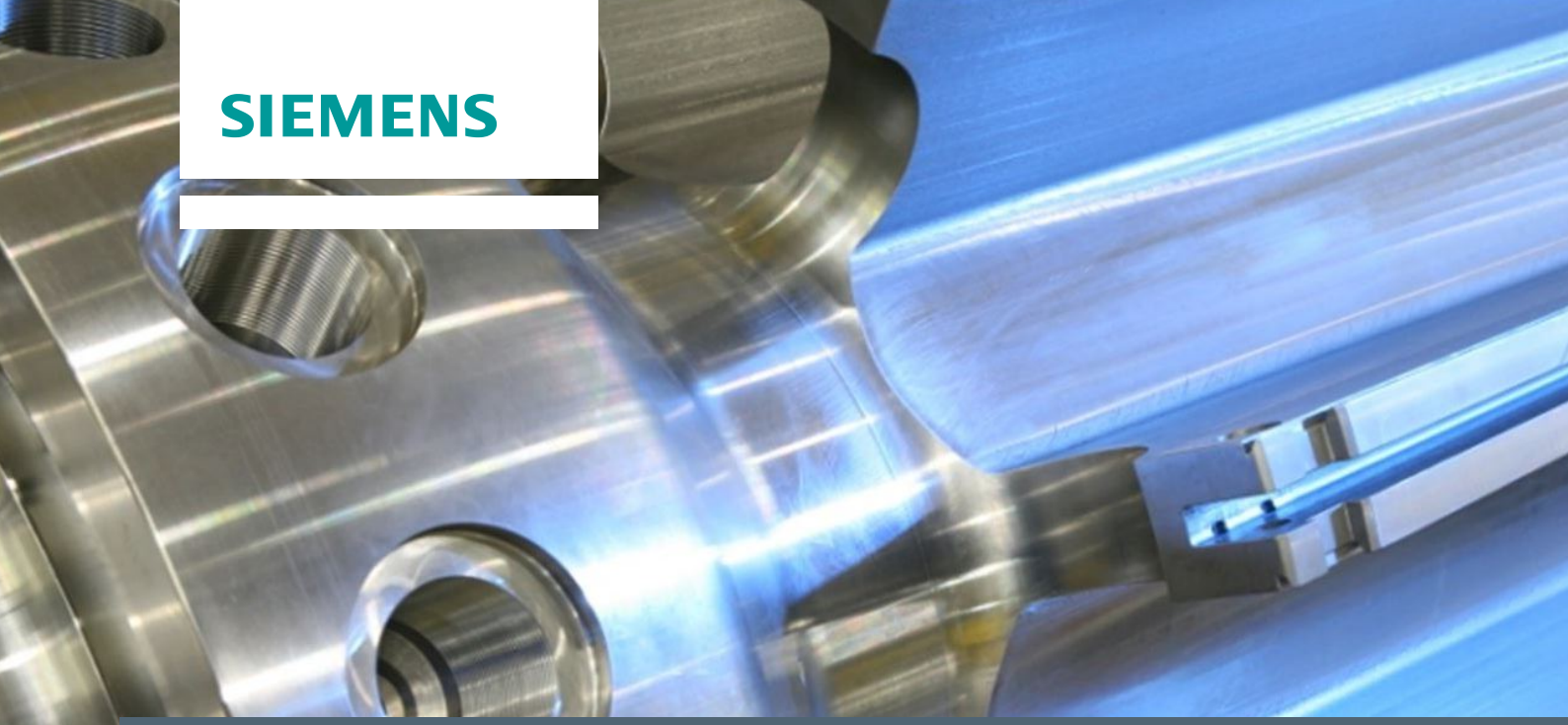
NSC – MP0650

SHEET 2 OF 2 | REV -

FILE NAME :

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Bestellnummer (8) Purchase Order n°			E09 - 3010449826	*Bpos (4) PO Line*	10	*Materialalk (10) Product code*	*P0058032800*	*Zeichnungsnr. (15) Component doc. n°*	DPPPG-70151867	*Bestellnummer (8) Purchase Order n°*	E09 - 3010449826	*Bpos (4) PO Line*	10	*Materialalk (10) Product code*	P0058032800	*Zeichnungsnr. (15) Component doc. n°*	DPPPG-70151867												
Siemens-Auftrags-Nr. Plant SD number			3000018595	*Norm (18) Standard*	IEC	PO Line value	10	*Bestelltext Description*	Neutral Side Cubicle	*Siemens-Auftrags-Nr. Plant SD number*	3000018595	*Norm (18) Standard*	IEC	PO Line value	10	*Bestelltext Description*	Neutral Side Cubicle												
Job			Neutral Side Cubicle	*Projektname Project name*	VILNIUS BIOMASS			*Zeichnungsnr. DWG n°*	DPPPG-70151867	*Job*	NEUTRAL SIDE CUBICLE	*Projektname Project name*	VILNIUS BIOMASS			*Zeichnungsnr. DWG n°*	DPPPG-70151867												
Data of the goods for transport & storage, (INFORMATION TO BE COMPLETED by Supplier)											Administrative	INFORMATION TO BE COMPLETED by Supplier																
SKZ (1)	Posnr (4)	Materialp (10) Item	ME (2) Unit	Mengep (13) Qt.	MTART (4)	MKTXTD (40) Description	MKTXTE (40) Scope	Abmessung (20) Good dimensions [cm]			Norm (18) Standard	Werkstoff (20) Main primer material	Nettogewicht (10) Net weight	Zeichnungsnr. (15)	Preis (Stk.) (29) Cost	DR (1)	USR (1)	ALNR (8)	ECCN (8)	ULA (3)	URE (3)	PRA (1)	LERKEL (1)	STWN (11)	GEFST (1)	GEFKL (3)	UNSTN (4)	SDBL (1)	UNMBL (1)		
				[D]				L	W	H			[Kg]																
	3.2	1	Nos	4		Halteplatte	RETAINER PLATE	1300	6	50		MS Painted	-	DPPPG-70151867	-	N	N			INDIA	ASIA				N				
	3.2	2	Nos	4		Halteplatte	RETAINER PLATE	690	6	50		MS Painted	-	DPPPG-70151867	-	N	N			INDIA	ASIA				N				
	3.2	3	Set	16		Edelst. Bolz. M. Unterlegsch. U. Mutter	HEX. BOLT M10x45 LONG+1PW	-	-	-		SS A270	-	DPPPG-70151867	-	N	N			INDIA	ASIA				N				
	3.3	4	Nos	12		KUPFERNE FLECHTE FLEXIBEL	COPPER BRAID FLEXIBLE-50x25x380mm LONG	-	-	-		Copper	-	DPPPG-70151867	-	N	N			INDIA	ASIA				N				
	3.3	5	Set	12		Edelst. Bolz. M. Unterlegsch. U. Mutter	HEX. BOLT M12x90BOLT+NUT+2PW+1SW	-	-	-		SS A270	-	DPPPG-70151867	-	N	N			INDIA	ASIA				N				
	3.3	6	Set	12		Edelst. Bolz. M. Unterlegsch. U. Mutter	HEX. BOLT M12x100BOLT+NUT+2PW+1SW	-	-	-		SS A270	-	DPPPG-70151867	-	N	N			INDIA	ASIA				N				
	1.2	7	Set	16		ANKERBOLZEN	ANCHOR BOLT - M12X140/50 HST, HILTI MAKE	-	-	-		STEEL (5.6 GR.)	-	DPPPG-70151867	-	N	N			INDIA	ASIA				N				
	1.2	8	Nos	4		ANTI-VIBRATION EINFASSUNG	ANTI-VIBRATION MOUNT	-	-	-		-	-	DPPPG-70151867	-	N	N			INDIA	ASIA				N				
	1.2	9	Nos	4No's EA		VERPACKUNG MESSPLÄTTCHEN	PACKING SHIM – 100x100mm 15+6+6+3+2	-	-	-		GALVD	-	DPPPG-70151867	-	N	N			INDIA	ASIA				N				
	1.2	10	Set	4		Edelst. Bolz. M. Unterlegsch. U. Mutter	M16 NUT+1PW+1SW	-	-	-		SS A270	-	DPPPG-70151867	-	N	N			INDIA	ASIA				N				
	1.1	11	Nos	20		Edelst. Bolz. M. Unterlegsch. U. Mutter	HEX. BOLT M12x50BOLT+NUT+2PW+1SW	-	-	-		SS A270	-	DPPPG-70151867	-	N	N			INDIA	ASIA				N				
	3.2	12	Nos	1		Gummibalg	RUBBER BELLOW	-	-	-		EPDM	-	DPPPG-70151867	-	N	N			INDIA	ASIA				N				
	3.2	13	Set	16			M10x45N+2PW	-	-	-		SS A270	-	DPPPG-70151867	-	N	N			INDIA	ASIA				N				
	2	14	Nos	1		Unterstützen Sie Strukturen	SUPPORT STRUCTURE	1560	2050	1270		MS	150	DPPPG-70151867	-	N	N			INDIA	ASIA				N				
	1	15	Nos	1		NEUTRALES SEITENKABEL	NEUTRAL SIDE CUBICLE	2068	2100	2000		ALUMINIUM	1000	DPPPG-70151867	-	N	N			INDIA	ASIA				N				



SIEMENS

Description of the System/ Plant Section 2

Components and Purchased Parts 2.3

Contents

2.3.1 Cooler

2.3.2 Bearings

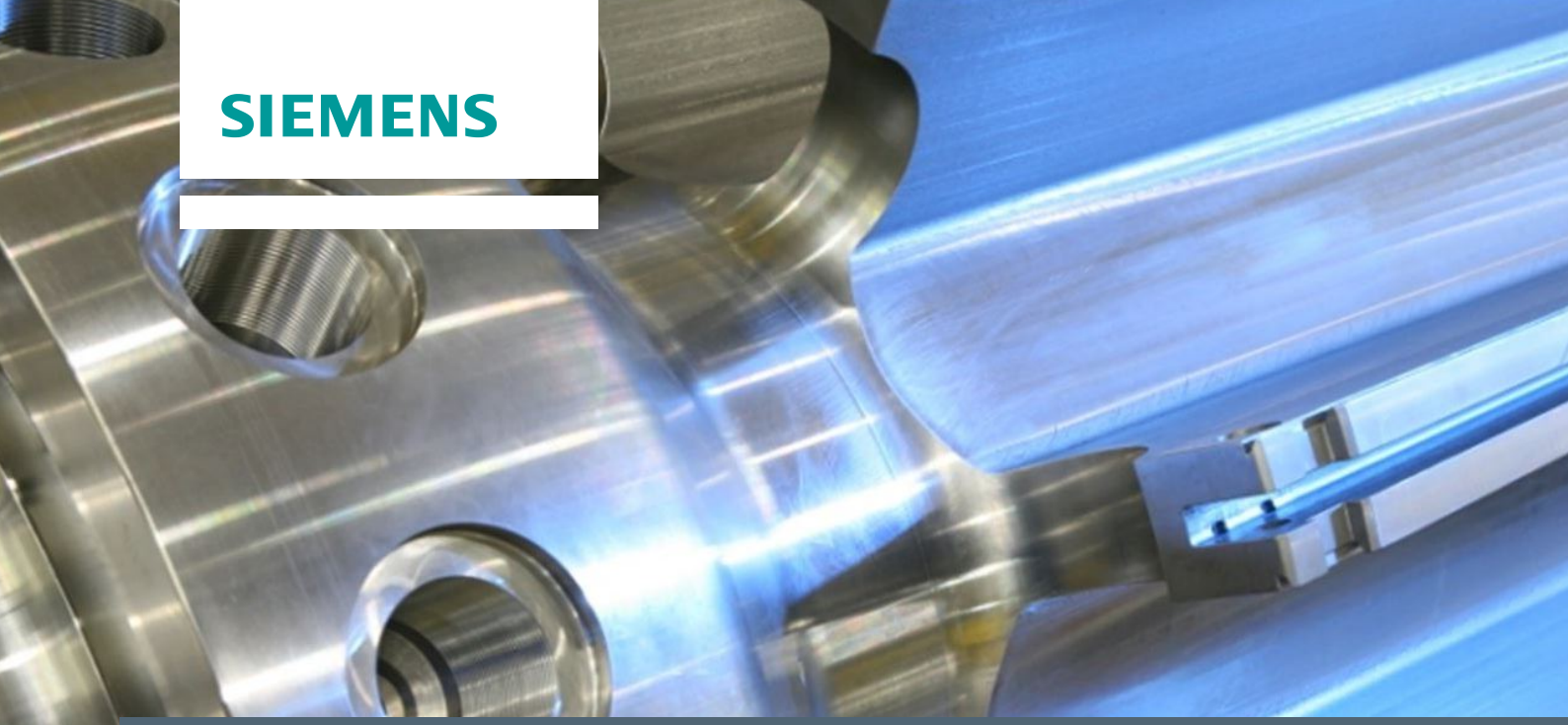
2.3.3 Lubrication Oil Supply

2.3.4 Excitation

2.3.5 Neutral Point / Line Side Cubicle

2.3.6 Generator Control Panel / Automatic Voltage Regulation (AVR)

This documentation is provided separately by the manufacturer.



SIEMENS

Description of the System/ Plant Section 2

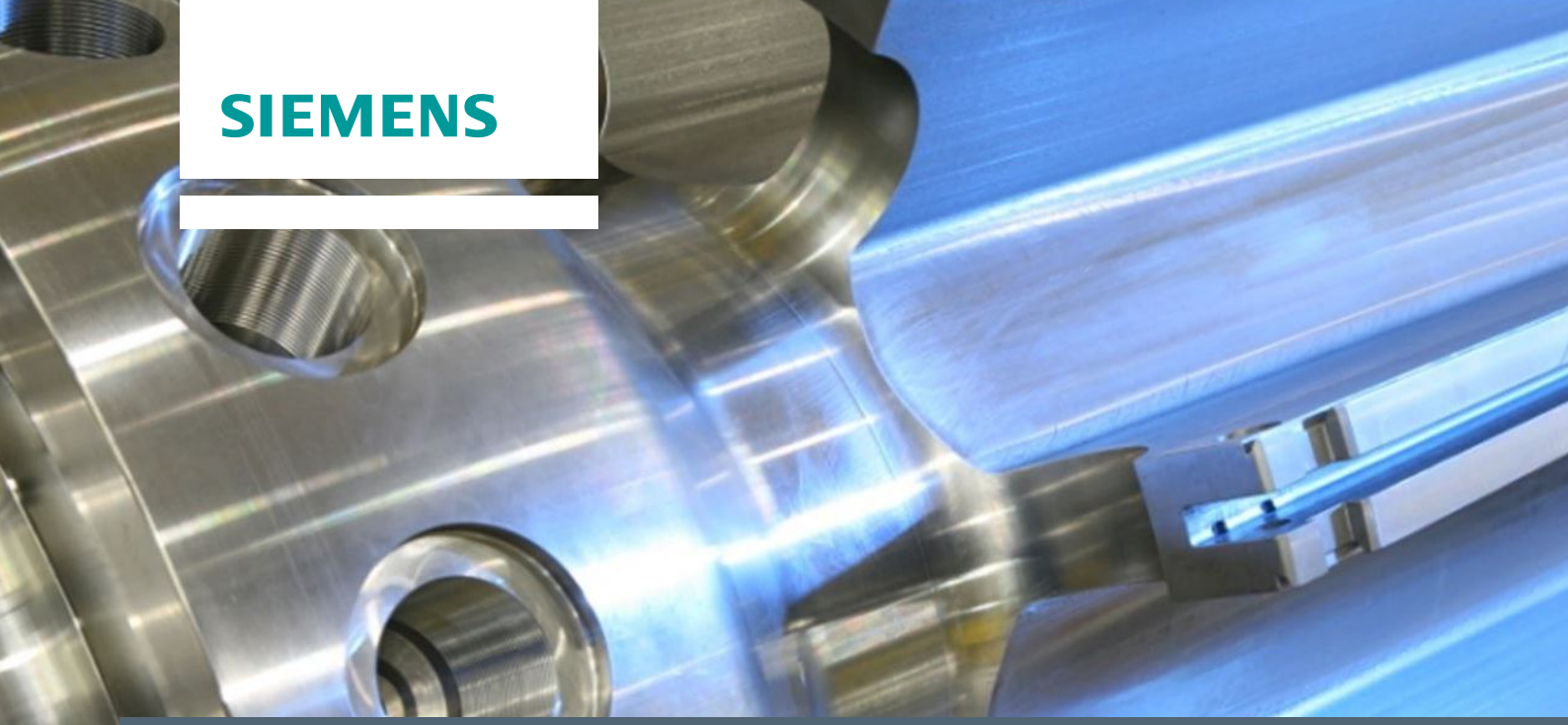
Protection and Monitoring 2.4

Contents

2.4.1 Generator Protection – General

2.4.2 Protective Devices and Supervisory Equipment

2.4.3 Auxiliary Wiring Diagrams



SIEMENS

Description of the System/ Plant Section 2

Protection and Monitoring 2.4

Contents

2.4.1 Generator Protection – General

2.4.2 Protective Devices and Supervisory Equipment

2.4.3 Auxiliary Wiring Diagrams

Generators are high-performance electrical machines for securing the best possible continuity of power supply. They may be endangered by short-circuits, ground faults, overvoltages, underexcitation and excessive thermal stresses.

For reasons of safety, it is necessary to provide automatic protection facilities. The task of these facilities is to ensure re a fast and selective detection of any faults in order to minimize the fault-related damage.

The protective equipment must be designed so that any serious fault will result in an immediate disconnection, de-excitation of the generator and in a turbine trip if necessary.

Faults which do not cause any direct damage must be brought to the attention of the operating staff. The personnel are responsible for initiating the essential activities on the basis of the messages output. The machine can be moved out of the critical area. If necessary, there is the possibility to take precautionary measures for shutdown.



NOTE:

The protective functions described below are recommended by the manufacturer. The project-related implementation of the generator protection must be documented by the supplier of the protective device.

1 Differential Protection

Breakdown of insulation between different stator phase windings results in an internal short-circuit. This fault is detected by a differential relay which initiates immediate disconnection, de-excitation of the generator and shut down of the turbine.

- Operating value: 0.2 IN
- Relay time: < 60 ms

In certain cases, the generator may also be included in the over all differential protection for the main transformer and station service feeder. Generator faults are then detected by two differential protection devices. The both protective devices are graduated according to the operating value.

2 Stator Ground Fault Protection

Breakdown of insulation between the stator winding and frame results in a stator ground fault. The stator ground fault protection must cover at least 80% of the stator winding. Its task is to initiate immediate disconnection, de-excitation of the generator and turbine trip.

The relay time is specified depending on admissible load curve. This and further information can be found in section “Technical Data”, curve “Limitation of Earth Fault Current versus Time".

The load resistance of a grounding transformer and any required boost to raise the neutral point potential should be selected in such way that the ground current in case of a fault will not exceed 15 A.

3 Rotor Ground Fault Protection

In case of machines with brushless excitation, the rotor winding is checked for ground faults approx. 3 times a day.

The first alarm message is output when the insulation resistance is less than 8 kΩ. A second alarm message follows if the value falls below 2 kΩ. The purpose of the protective device is to stop the machine as quickly as possible in the event of an alarm. The relay time is 5 seconds.

The manufacturer must be informed without delay in the event of a rotor ground-fault. It is absolutely essential to find the cause and eliminate the short circuit to ground in order to avoid consequential damage from double ground faults.

4 Underexcitation Protection

Failure of the voltage regulator, maloperation of the generator or transformer control systems, or generator operation in a system with capacitive load may result in a reduction of the excitation required to ensure system stability below a predetermined minimum value.

Short-circuits or interruptions in the field circuit result in a complete loss of field and in instability of the generator. This causes higher temperature rises in the rotor and core end portions, rotor overvoltage, system swings and torsional vibrations of the shaft.

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A momentary excursion beyond the steady-state stability limit must not necessarily result in a loss of stability. Therefore it is advisable to design the underexcitation protection so that a warning will be given when the steady-state stability limit is reached. The generator will be shut down after a few seconds only.

The protection must operate quickly if a loss of field occurs when the steady-state stability limit is reached.

If the loss of field cannot be detected directly (e.g. exciters with rotating diodes), a second stator criterion is to be introduced covering the range of the permeance values $1 / x_d$ and $1 / x'_d$. There will be a quick tripping when this criterion is exceeded.

The precise setting of the tripping is made considering the stability diagram.

5 Overcurrent Protection

System faults may result in inadmissible thermal stressing of the generator. Therefore an overcurrent protection should be provided which operates on failure of the line protection.

A definite-time delay overcurrent relay may be used for this purpose, however, its delay time should be longer than that of the system protection.

- Operating value: 1.4 IN
- Relay time: 3 s considering the overriding protective system of the plant

To avoid long relay times, it is recommended that generators larger than 50 MW should be equipped with the second limit-value stage I>> tripping after short time.

If connected to the generator neutral point, the overcurrent protection serves as back-up protection for the differential protection.

Further information can be found in chapter 2, document “Extract of Technical Data”, sheet “Short Time Voltage / Frequency Capability”.

6 Load Unbalance Protection

Generators operating in an interconnected system are normally subjected to small load unbalances only. However, all one-and two-line-to-ground faults occurring in the system, phase interruptions or circuit breaker failures are in fact load unbalances which may result in a thermal overstressing of the rotor.

It is therefore advisable to provide a two-stage load unbalance protection. When the continuously permissible load unbalance is reached, an alarm is given, whereas after a short delay isolation from the system occurs when this value is exceeded.

In case of large units, it is recommended to implement a protection with unbalanced load/time characteristic. Operation value and relay time should be matched to the load unbalance/time characteristic applicable to the particular generator

7 Overvoltage Protection

Rejection of partial or complete system loads causes a voltage rise, followed by an increase in the prime mover speed. This reason may endanger the generator and its connected apparatuses due to unacceptable high voltages.

Maloperation during manual voltage regulation of the generator may also result in inadmissible voltage stressing of these equipment. Due to the sudden voltage variations resulting from switching operations, it is advisable, at least in the case of large units, to provide a two-stage rise-in voltage protection, i.e:

a) with high operation value (1.3 UN) and tripping after 0.75 s.

b) with high operation value (1.15 UN) and tripping after 5 s.

8 Under-Frequency Protection

Major disturbances in an interconnected system may result in operation of the generator at under-frequency. At rated voltage, the generator can be continuously operated at rated apparent power down to 95% of rated frequency.

To avoid excessive magnetic and thermal stressing, an under-frequency protection is provided.

Since the frequency deviation due to a system disturbance is normally accompanied by a voltage deviation, the protection will be designed on the basis of the permissible load characteristic of the generator on frequency and voltage deviations.

9 Reserve Power Protection

The reverse power protection is a protective equipment for the turbine. Specific faults in the turboset interior initiate emergency trip.

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In this case the steam supply to the turbine is interrupted. A reliable criterion of perfectly tight closure of the emergency stop valves is the reverse flow of power from the system back into the generator.

Disconnection of the unit from the system by the generator circuit breaker with a time delay of 1 s is only permissible after the reserve power has been drawn by the generator (short-time setting). If the stop valves are still open but the control valves are closed there has to be a trip by reverse power after 10 s.

- Operating value:
  approx. 50% of the reserve power measured with closed valves
- Relay time:
  long-time setting: approx. 10 s, short-time setting: approx. 1 s

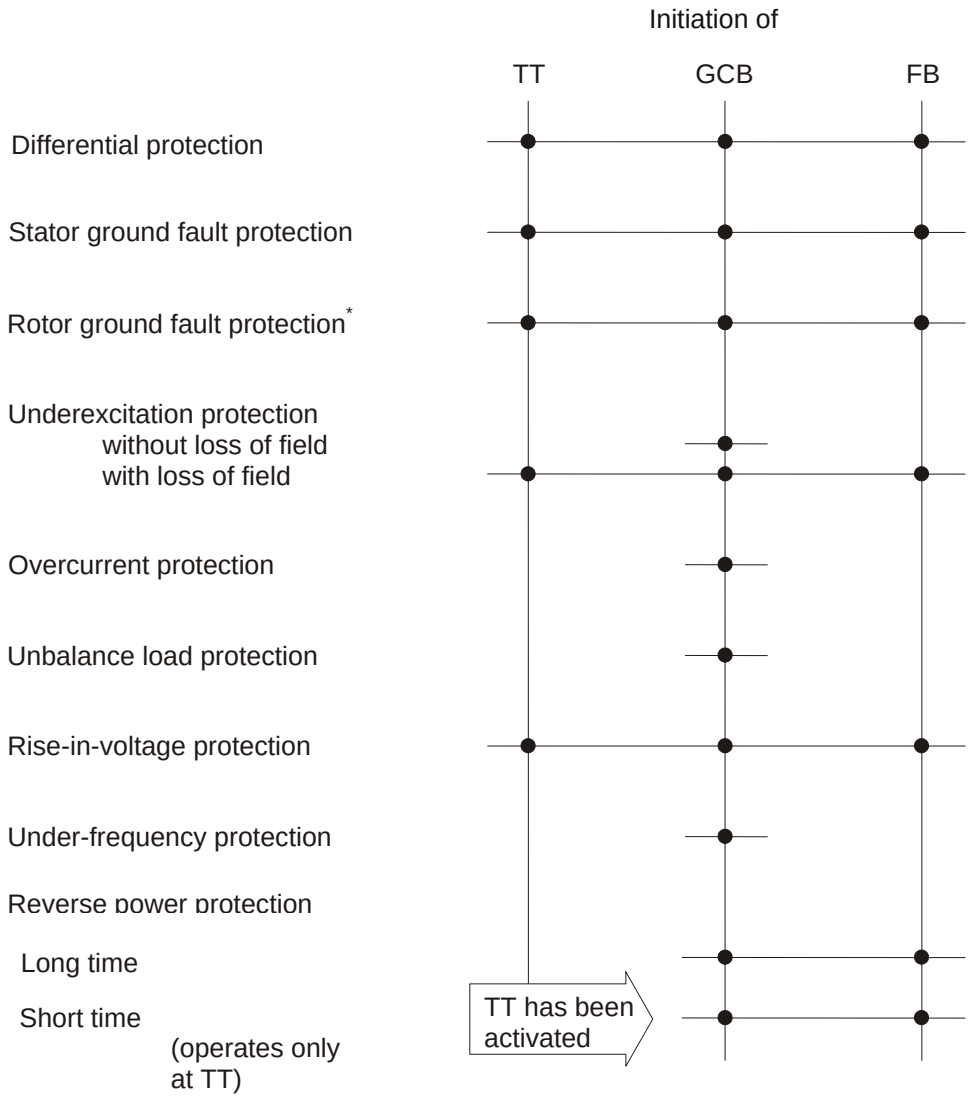
10 Overvoltage Protective Equipment

The use of surge arrestors on the high-voltage side of the unit transformer is considered sufficient for protecting the generator against atmospheric overvoltages and switching surges in the system.

If the generator voltage level is led into the open field (danger of lightning) or if there is a breaker mounted between unit transformer and generator, overvoltage stress of generator must be avoided by suitable measures.

In order to implement these measures, it is necessary to use explosion-proof devices or implement appropriate structural measures which, in the event of overload, will eliminate the risk to people and damage to nearby parts of the plant.

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TT = Turbine Trip
GCB = Generator Circuit Breaker
FB = Field Breaker

Alarm is initiated when the electrical generator protection system is tripped.
Individual alarms for each criterion are provided.

***** In case of a rotor ground fault only an alarm is initiated,
but the system does not trip.

Grounding brushes are fitted to the bearing or labyrinth ring to remove the static charges of the shaft train.

When the grounding brushes are fitted, the direction of rotation of the rotor must be observed. In anti-clockwise operation brushes are to be mounted as shown in fig. 1; for clockwise operation see fig. 2.

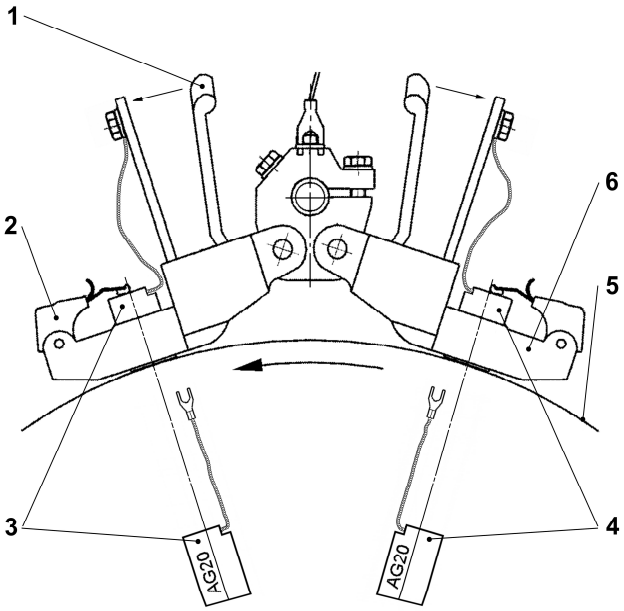


Fig. 1: Plug-in brush holder with grounding brushes in anti-clockwise operation

1 Handle lever (moveable)
2 Finger plate
3 Two-layer grounding brush (design A)
4 Two-layer grounding brush (design B)
5 Rotor surface
6 Plug-in brush holder

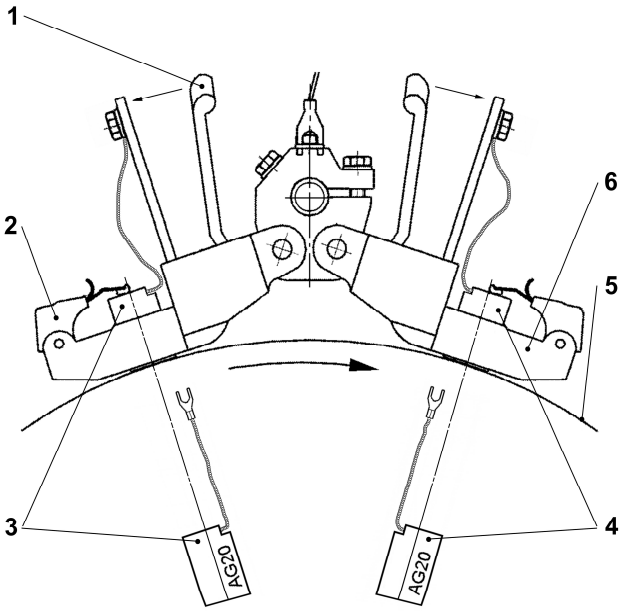


Fig. 2: Plug-in brush holder with grounding brushes in clockwise operation

1 Handle lever (moveable)
2 Finger plate
3 Two-layer grounding brush (design B)
4 Two-layer grounding brush design A)
5 Rotor surface
6 Plug-in brush holder

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The brush holders are arranged with 90° displacement. This arrangement ensures that at least one brush will make contact with the rotating shaft train.

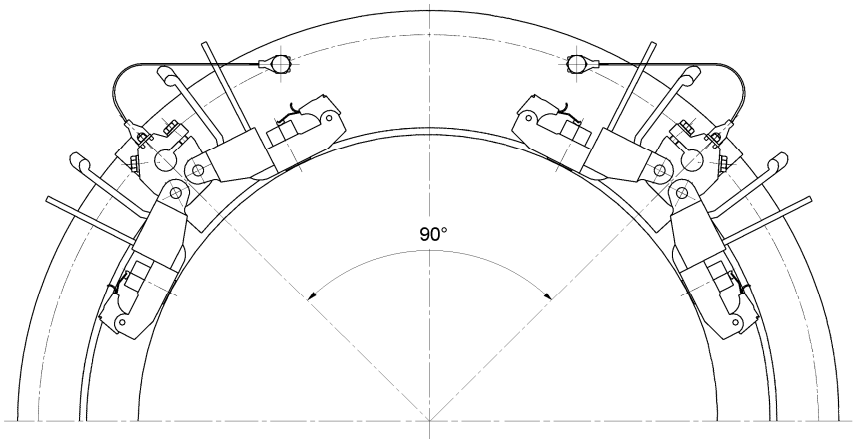


Fig. 3: Arrangement of plug-in brush holder with a 90° displacement

The monitoring of measured quantities relevant for every function is an essential condition for ensuring the reliable operation of a turbo-generator.

The number of measured quantities monitored should be sufficient to guarantee the comprehensive and unequivocal diagnosis of the operating condition on the one hand. But the number of measured quantities monitored must not exceed a certain amount in order to allow a quick and clear overview free of any doubt especially in critical operating situations on the other hand.

A relatively small number of measured quantities to be monitored will also reduce possible interference effects or the liability to interference of the measured quantity monitoring system.

The measuring and monitoring system to be installed on a generator depends on the wishes of its owner. An overview of the measuring and monitoring elements installed and of their locations may be obtained from the wiring manual.

Temperature and vibration are among the most important measured quantities that are monitored on a generator. The limit values applicable to temperature or vibration are indicated in the dimensional drawing text.

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1 Temperature monitoring

1.1 Stator Slot Temperature

Resistance temperature detectors (RTD`s) in the shape of long thin strips are used for measuring the slot temperatures.

The platinum measuring wire is embedded in an insulating moulding to insulate it and relieve it of stress. Single Pt-100 elements with integrally cast four wire Teflon connecting cables are used.

The slot resistance thermometers are directly embedded in the stator slots between the top and bottom bars at those positions where the highest temperatures are expected. The thermometers lie embedded in glass-fiber laminate strips, encased by the resin of the Micalastic® insulation.

The coil-side corona shielding of the winding, which has ground potential, is located between the thermometer and the intermediate voltage potential of the winding.

The thermometers have high mechanical strength and are not affected by electrical or magnetic fields.

To avoid both capacitive and inductive noise factors, a filter corresponding to the line frequency (50 Hz or 60 Hz) should be inserted in the circuit.

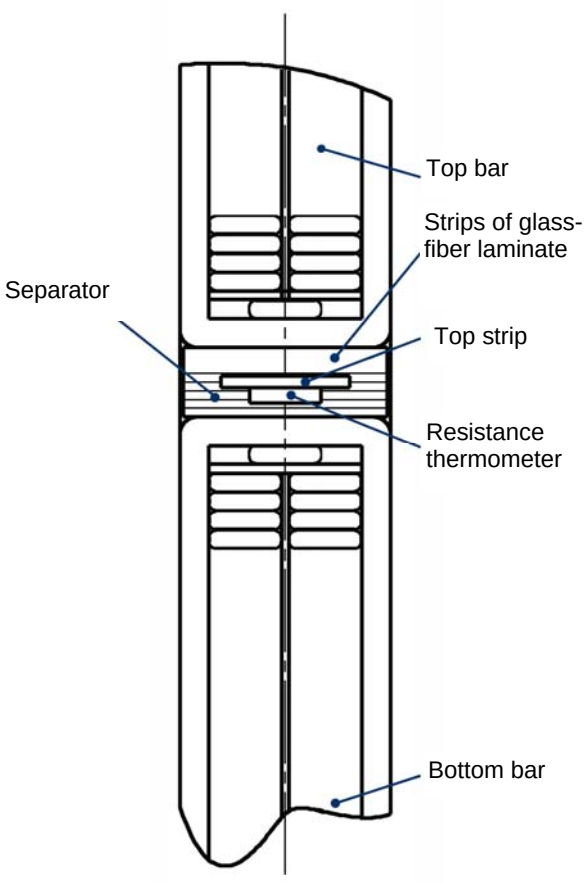


Fig. 1: Slot thermometer arrangement

1.2 Cold and Hot Air Temperatures

The temperatures of the cold and hot air flows are measured by resistance temperature detectors (RTD`s).

Pt100 resistance temperature detectors with double or triple elements and four wire circuitry, or type K thermocouples as double or triple elements are used according to customer requirements.

1.3 Bearing Temperature

The bearing temperature allows the detection and the evaluation of deviations from a normal operating status under defined operating conditions.

The measurement and registration of the temperatures normally is done in conjunction with the turbine monitoring. The extended turbine protection is

triggered if e.g. the maximum permissible bearing temperature is exceeded.

The measuring points of the bearing temperature are located in the lower bearing shell in the area of the joint of the bearing metal and the bearing shell. In addition, there is an option of fitting oil sump, radial and axial part sensors.

The temperature sensors are of screw-in resistance temperature detector of 2 x Pt100 type or thermo-couples.

2 Vibration monitoring

2.1 Bearing Pedestal Vibration

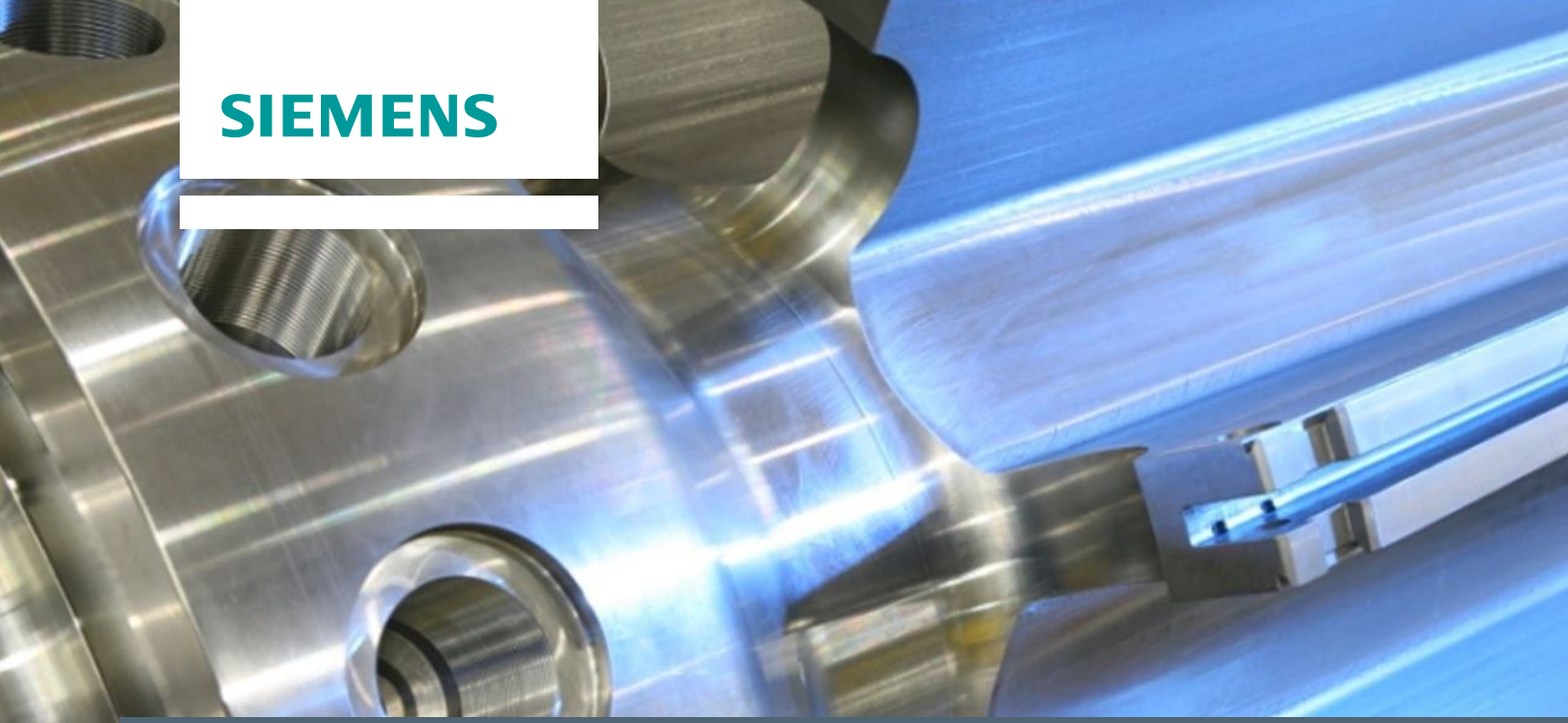
The absolute vibration of the bearing pedestal housing can be measured by sensors.

2.2 Shaft Vibration

Special sensors are fitted to detect the relative shaft vibrations. Boreholes are provided in the bearing cover for these sensors.

The measurement of the shaft vibration provides information about the running properties of the shaft (bearing play, unbalance etc.).

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Description of the System/ Plant Section 2

Protection and Monitoring 2.4

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2.4.2 Protective Devices and Supervisory Equipment

2.4.3 Auxiliary Wiring Diagrams

Manufacturer: **Bently Nevada**

Documentation title: **330500 Velomitor®**
330525 Velomitor® XA

User's Guide

No. of pages: 30

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Part Number 100076-01
Revision D, March 2004

330500 Velomitor®
330525 Velomitor® XA
User's Guide

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Bently Nevada Corporation has attempted to identify areas of risk created by improper installation and/or operation of this product. These areas of information are noted as **WARNING** or **CAUTION** for your protection and for the safe and effective operation of this equipment. Read all instructions before installing or operating this product. Pay particular attention to those areas designated by the following symbols.

CAUTION

A piezoelectric velocity transducer subjected to a sudden mechanical impulse may generate a low frequency signal that does not represent actual machinery vibration. This signal may change the state of alarm and/or danger relays.

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Internet	www.bently.com

Foreword

This manual describes the Bently Nevada Velomitor®, a piezo-velocity sensor, and contains instructions for its installation and maintenance. If you need additional assistance contact the nearest Bently Nevada Corporation office.

This manual is intended for technicians and engineers experienced in the use of electronic instrumentation and machinery monitoring equipment.

Section 1 describes the Velomitor®, tells how it works, and lists applications and optional accessories. This section also includes information on the Bently Nevada machinery monitoring systems that are compatible with the Velomitor®.

Section 2 gives instructions for receiving and inspecting the Velomitor®, choosing the proper monitoring points, and mounting the device. This section also shows how to install connecting cables.

Section 3 tells how to maintain the Velomitor® by describing the test procedures and equipment needed to verify that the device is operating properly.

Section 4 contains instructions for field testing and troubleshooting problems with the Velomitor® and compatible Bently Nevada monitoring systems.

Section 5 provides detailed specifications and sensitivity curves representing typical Velomitor® operation.

RELATED DOCUMENTS

3500/42M Proximitor®/Seismic Monitor Operation and Maintenance Manual, 143489-01

3300/55 Dual Velocity Monitor Maintenance Manual, 83965-01

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Section 1 — Operating Information

Application

Velocity sensors measure machinery casing vibration and are used on machines where using eddy current proximity transducers are not practical. Typical applications include pumps, electric motors, compressors, and fans.

The 330525 Velomitor xA is designed for applications where a transducer housing is either unnecessary or not desired.

Application Alert: Casing measurements may not be appropriate for some machinery protection applications.

If you measure the velocity of casing vibration to protect machinery, evaluate the usefulness of the measurement for each application. Most common machine malfunctions, such as unbalance or misalignment, occur on the rotor and originate as an increase (or at least a change) in rotor vibration. In order 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 sensor.

Care should be exercised in the physical installation of the sensor on the bearing housing or machine casing. Section 2 tells how to install the sensor.

Application Alert: Improper installation may result in a decrease in the velocity sensor's amplitude and frequency response and/or the generation of false signals, which do not represent actual vibration.

Principle of Operation

The Velomitor® is a piezoelectric velocity sensor. The sensing element of the device is a piezoelectric ceramic shear-mode element and electronics. When subjected to machinery vibration, this system exerts a force on the piezoelectric ceramic, which generates a signal proportional to that force. This signal is amplified and integrated within the sensor to produce a low-noise output signal proportional to velocity.

Application Advisory: A piezoelectric velocity sensor subjected to a sudden mechanical impulse may generate a low frequency signal that does not represent actual machinery vibration. This signal may change the state of alarm and/or danger relays.

The Velomitor® is designed to monitor vibration in frequencies ranging from:

- 330500: 4.5 Hz to 5 kHz
- 330525: 4.5 Hz to 2 kHz

It has a calibrated sensitivity of 100 mV/in/s (4 mV/mm/s) and can measure velocities up to 50 in/sec pk (1270 mm/s pk). Its stainless steel casing protects it in highly corrosive environments. The operating temperature range is from -67°F to 250°F (-55°C to 121°C).

Traditional velocity sensors are composed of either a moving wire coil surrounding a fixed magnet or a fixed wire coil surrounding a moving magnet. The Velomitor® is more durable and accurate then traditional velocity sensors. Because the Velomitor® contains no moving parts, it is more durable and less sensitive to transverse motion than traditional seismic transducers. Its

piezoelectric sensing element and solid-state circuitry let the Velomitor® withstand years of continuous use.

The Velomitor® is a two wire device which requires an external power supply. The power supply must provide a DC voltage of 22 to 30 Volts and a current of 10 mA. A constant current diode must be used to limit the current to the sensor to 2.5 to 6 mA. A simple block diagram of the Velomitor® system appears in Figure 1-1.

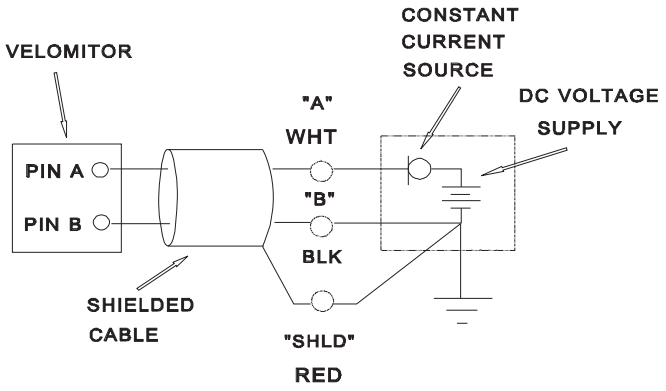


Figure 1-1.

The Velomitor® internal circuitry automatically sets the DC output bias when a constant current is supplied. The DC bias and AC signal appears between pins "A" and "B".

Application Alert: A constant current diode or other current regulating circuitry must be used to provide power to the Velomitor®. Failure to do so may result in damage to the device and/or improper operation.

Compatible Bently Nevada monitoring systems provide the power required by the Velomitor® without the need for additional external circuitry.

Ordering Options and Accessories

Velomitor® Options

When ordering a Velomitor® you may choose from the following list of options.

Table 1-1 Ordering Information

Part Number	Options		
330500	AA	BB	Description
	01		1/2 - 20 UNF P/N 89409-01
	02		M8 X 1 P/N 89410-01
	03		1/4 - 28 UNF P/N 89411-01
	04		1/4 - 20 UNC P/N 89412-01
	05		1/4 - 18 NPT P/N 89413-01
	06		5/8-18 UNF P/N 04300015
	07		3/8-16 UNC P/N 165025-01
		00	No Approvals
		04	Multiple Approvals

Part Number	Options	Description
330525	AA	
	00	No Approvals
	01	CSA Approvals
	02	ATEX Approvals

Mounting Adapters — Option AA

The base of the 330500 Velomitor® is machined with a 3/8-24 internal thread that will accommodate a variety of purchased or customer-manufactured mounting studs. Bently Nevada offers the 7 adapter studs listed in Table 1-1. You can order one stud with each transducer or purchase the studs separately. The Bently Nevada part numbers used for ordering separate adapter studs also appear in Table 1-1.

The base of the 330525 Velomitor® is machined with a ¼-18 NPT external thread.

Agency Approvals — Option BB

Consult with your local Bently Nevada sales representative for information regarding hazardous area approvals.

Compatible Monitoring Systems and Connections

The Velomitor® is compatible with the Bently Nevada 3500/42 Proximitor®/Seismic Monitor and 3300/55 Dual Velocity Monitor.

For more information on the 3500/42 and 3300/55 please reference Bently Nevada documents 143694 and 141516, respectively.

Connections are made to the "A" and "B" terminals of the Velomitor® through the terminal connector of the interconnect cable. At the monitor end of the cable, connect the cable "A" lead to the "A" terminal on the monitor and the "B" lead to the "B" terminal. The terminal connections appear in Figures 1-2 through 1-4. Refer to the 3500/42 and 3300/55 Monitor Manuals (p/n's 143489-01 and 83965-01, respectively) for further information.

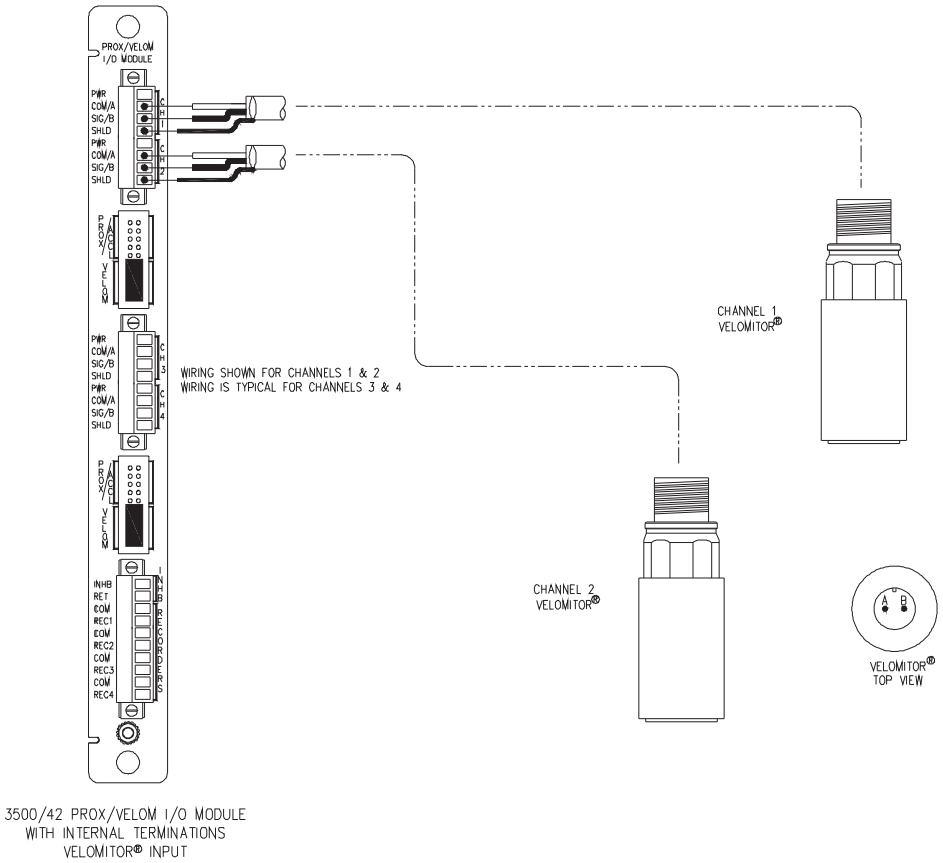


Figure 1-2. 3500/42 Monitor with Prox/Velom I/O Module

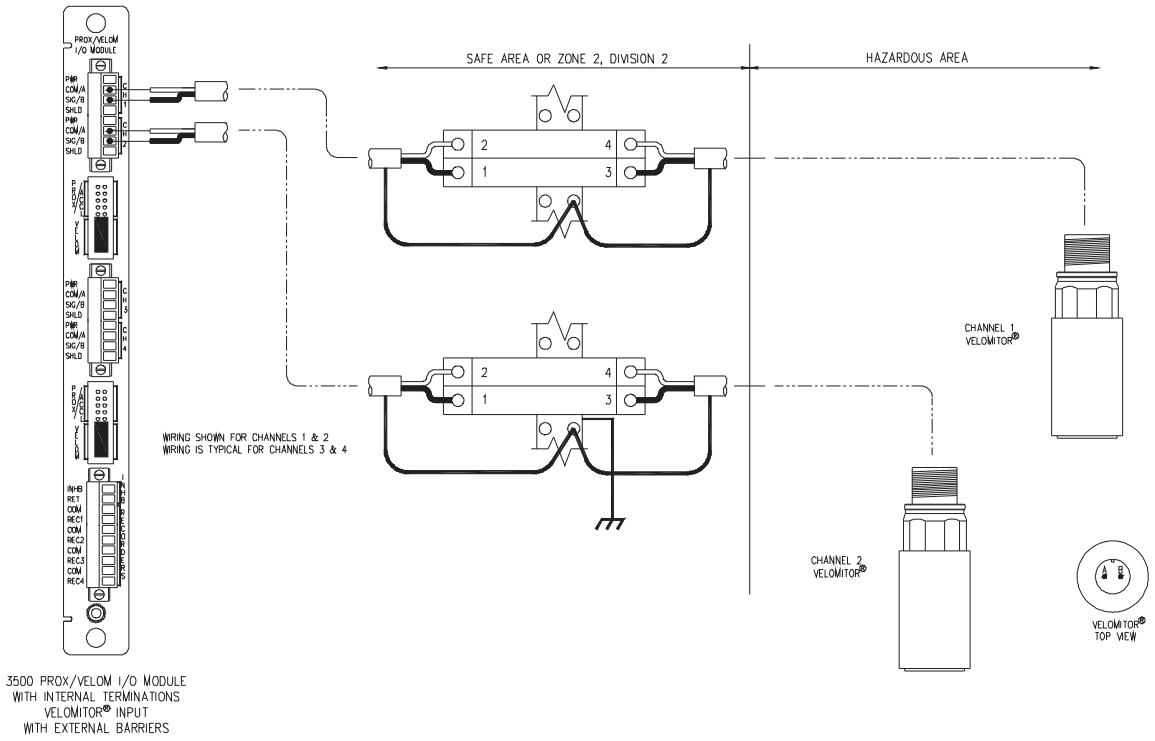


Figure 1-3. 3500/42 Monitor with Prox/Velom I/O Module with External Barriers

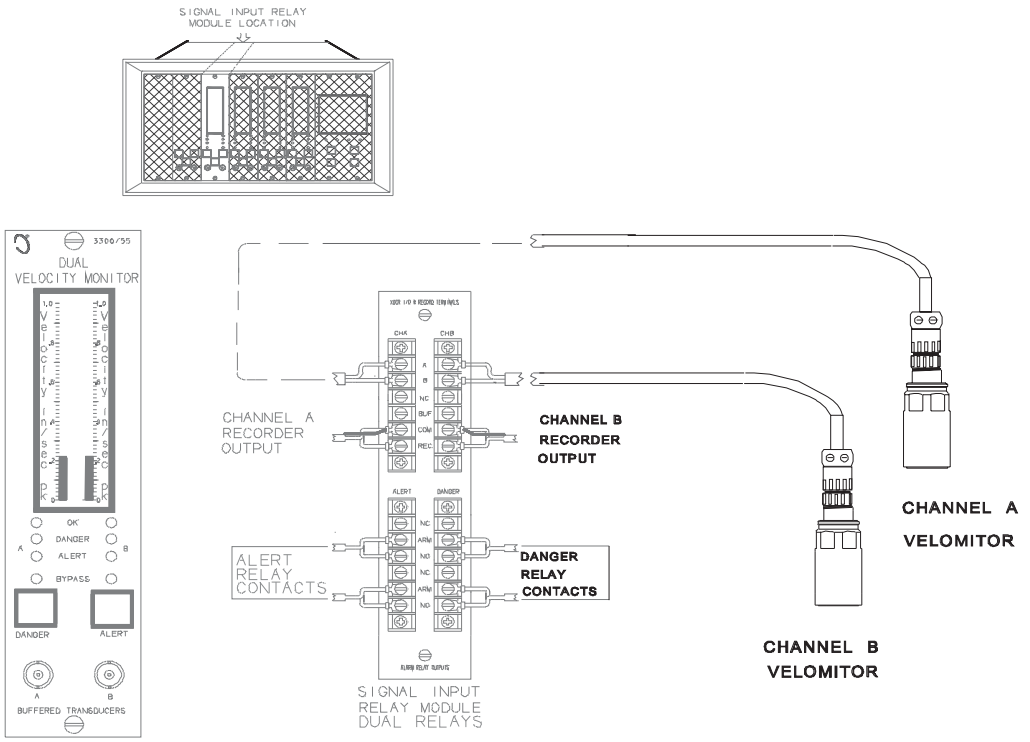


Figure 1-4. 3300 System Connections (3300/55 Monitor)

Cable Options

The Velomitor® requires a two-conductor cable. We recommend using shielded cable to minimize noise interference. Table 1-2 describes the Bently Nevada cables used with the 330500 Velomitor® and Table 1-3 describes the cables used with the 330525 Velomitor®. Figures 1-5 through 1-8 show the configuration of the cable and connector.

Table 1-2. 330500 Velomitor Interconnect Cable and Accessories

APPLICATION	P/N	CABLE DESCRIPTION
Standard Temperature Unarmored Cable	9571-AA	Shielded 22 AWG cable with moisture resistant female socket connector at transducer end, ring lugs at monitor end.
Standard Temperature Armored Cable	84661-AA	Same as 9571-AA but with flexible stainless steel armored cable.
Cable for use with weather-proof housing	89477-AA	Two conductor shielded cable with a connector adapted for use with the 21128 Velocity Transducer Housing Assembly.
Bulk Cable	02173006	Two conductor shielded 18 AWG bulk cable. Specify number of feet.
Spare Connector	00531061	Velomitor® Cable Connector
Spare Connector Clamp	00530574	Connector Clamp

Table 1-3. 330525 Velomitor Interconnect Cable and Accessories

APPLICATION	P/N	CABLE DESCRIPTION
Standard Temperature Armored Cable	106765-AA	Flexible Stainless Steel Armored Cable
Bulk Cable	02173007	Two conductor shielded 22 AWG bulk cable. Specify number of metres.
Spare Boot	03839144	Fluorosilicone Elastomer Boot
Spare Boot Clamps	03839142	Bottom Clamp
	03839143	Top Clamp

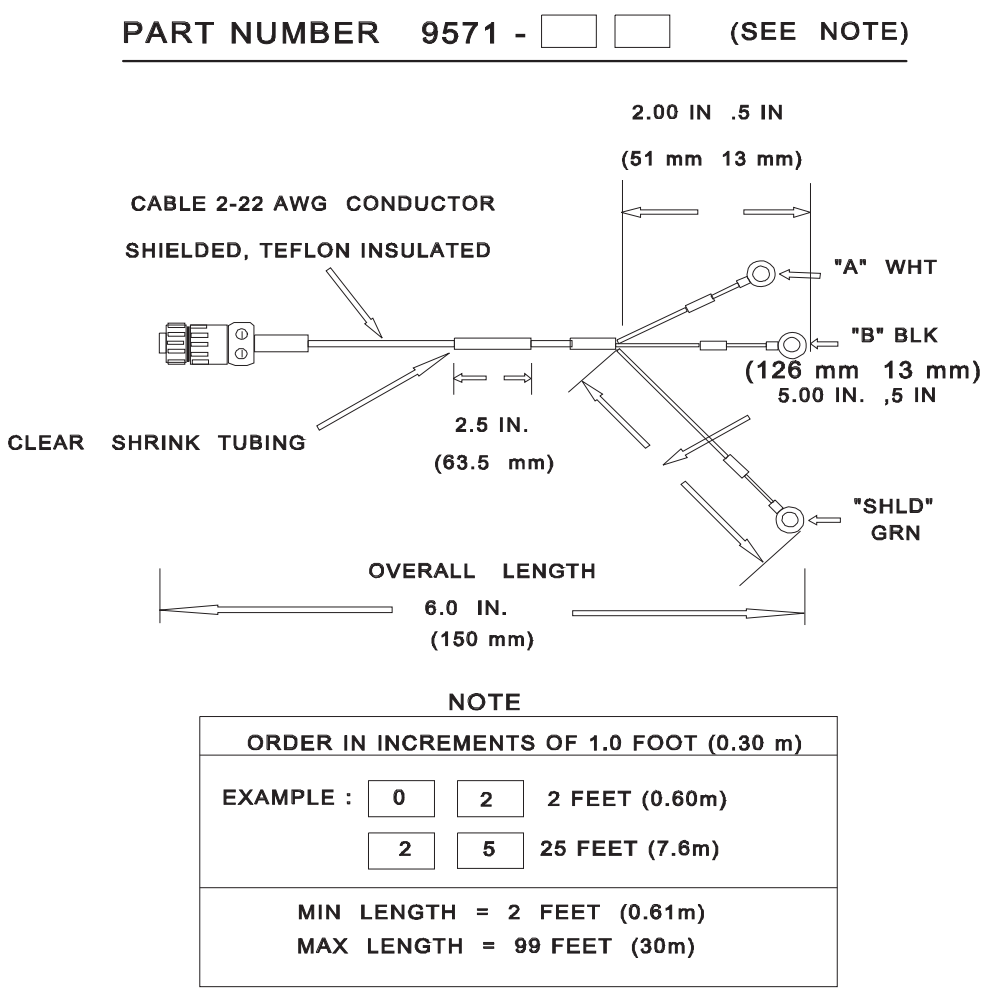


Figure 1-5. 9571 Cable for use with 330500 Velomitor

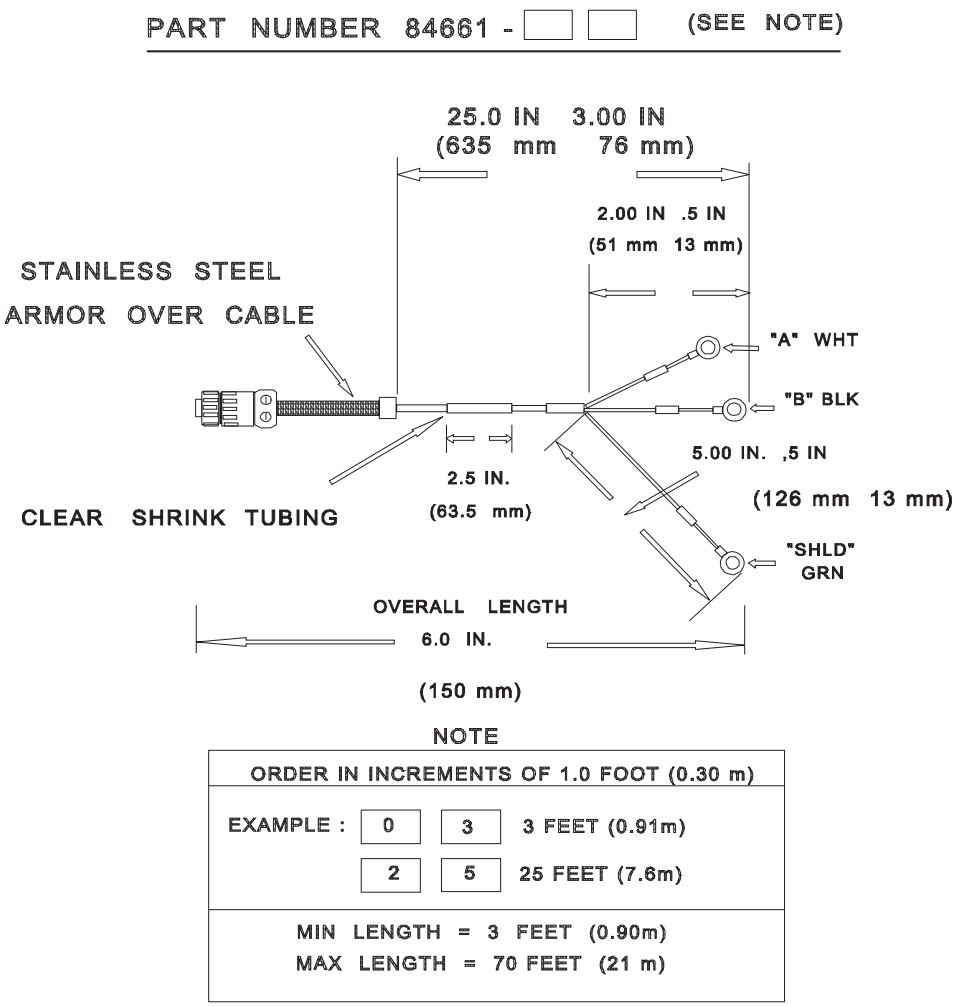


Figure 1-6. 84661 Cable for use with 330500 Velomitor

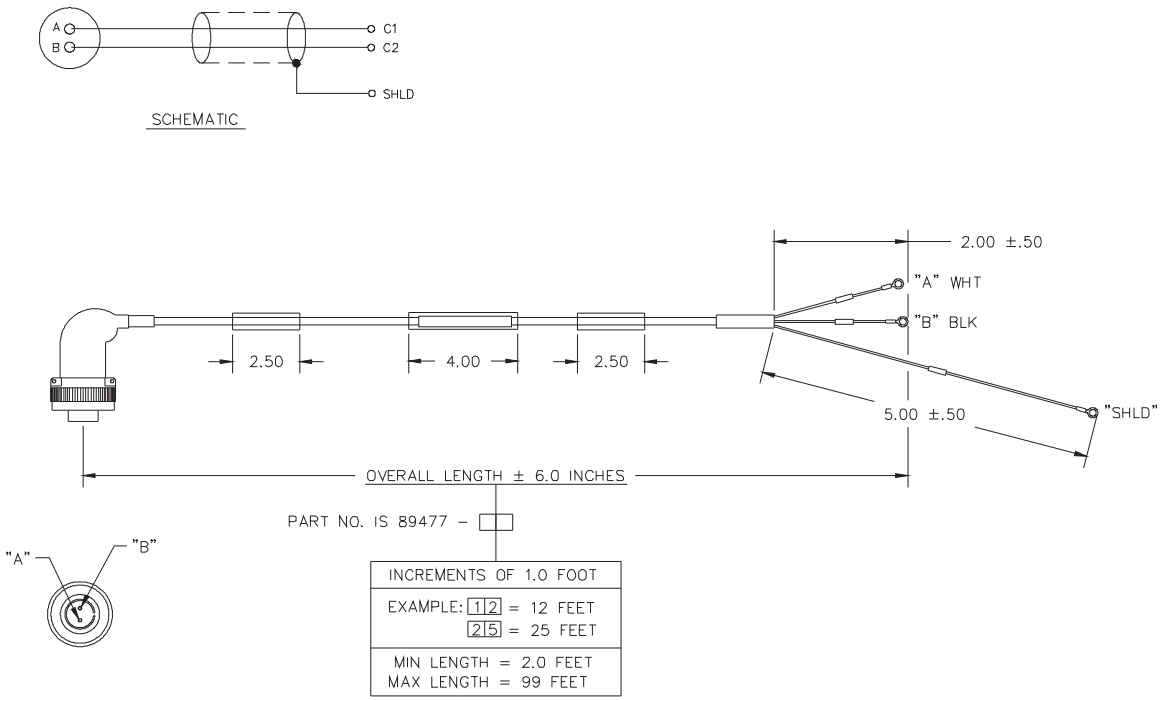


Figure 1-7. 89477 Cable for use with 330500 Velomitor

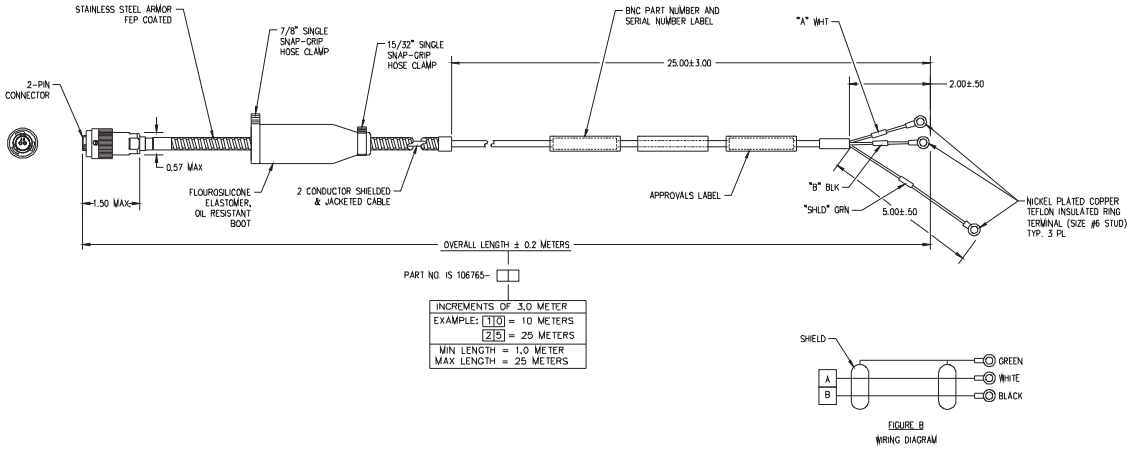


Figure 1-8. 106765 Cable for use with 330525 Velomitor

Transducer Accessories

ACCESSORY		BENTLY NEVADA PART NO.
Velocity Transducer Housing Assembly	Requires a 1/2 - 20 UNF Velomitor® adapter stud.	**21128**
Quick Connect Semi-permanent mounting method using permanently mounted bolts. Several bolts can be mounted and a single velocity transducer carried from bolt to bolt to measure vibration.	Requires a 1/2 - 20 UNF Velomitor® adapter stud.	**46122-01**
Super Mag 100 Quick temporary method for mounting a velocity transducer.	Requires a 1/4 - 28 UNF Velomitor® adapter stud.	**46000-01**
Junction Boxes Weather proof or explosion proof housing for making electrical connections to interconnect cables.		**03818016 (Body and Cover)** **03818022 (Cavity extension)** **03818065 (1/2 inch Conduit) (1.27 cm)** **03818066 (3/4 inch Conduit) (1.91 cm)**
Flexible Conduit 1/2 in. (1.27 cm) **3/4 in. (1.91 cm)** A convenient way to protect cables from moisture and abrasion.		**14847 - AA** **14848 - AA** AA - Specifies required length

(See Bently Nevada Catalog or your local Bently Nevada Sales Representative for details.)

Section 2 — Installation

Receiving Inspection

Inspect the components of the order as soon as you receive them 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 LLC. 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 velocity sensor is shipped in a protective package and the connector will be protected with a plastic cap. The Velomitor® is a sensitive instrument and these precautions help to prevent damage during shipping.

Installing the Transducer

Positioning the Sensor

For optimum performance and accurate measurements the velocity sensor should be placed at a position on the machine casing that is most responsive to vibration. Proper placement is often dependent on the application. Bently Nevada offers Machinery Diagnostic Services, which can help determine the best place to mount the sensor for your application.

Mounting

Follow these steps to install the Velomitor®:

Step 1— Check that the ambient temperature and the temperature of the installation surface is within the temperature rating of the transducer.

Step 2— Applies to the 330500 Velomitor. Decide if you need a protective housing for the sensor. We recommend using the Velocity Transducer Housing Assembly (P/N 21128) if the Velomitor® or its connecting cable will be exposed to possible physical damage during maintenance operations or by operating in an environment containing solvents, corrosives, or excessive moisture.

Step 3— 330500 Velomitor: Check that the mounting site is flat, clean, and dry. The sensor requires a flat surface at least 1.25 inches in diameter. For the best results the roughness of the mounting surface should be no more than 32 microinch RMS and its flatness should be at least .0008 inches TIR.

330525 Velomitor: Check that the mounting site will be suitable for drilling and tapping a hole for a ¼-18 NPT thread. Consider the hole depth and casing thickness when selecting a mounting site for the transducer.

Step 4— 330500 Velomitor: Drill and tap the mounting hole to the dimensions required by the adapter stud. Drill the hole so that the sensitive axis of the transducer will be perpendicular to a tangential plane on the machine casing. For the best results the perpendicularity of the hole should be no more then ± 6 minutes.

330525 Velomitor: Drill and tap the mounting hole to the dimensions required by the ¼-18 NPT stud. Standard drill size and depth is 7/16-inch and 0.90 inch,

respectively. Drill the hole so that the sensitive axis of the transducer will be perpendicular to a tangential plane on the machine casing. For the best results, the perpendicularity of the hole should be no more than ±30 minutes. When hand tight, the mounting stud of the transducer will have 2 or 3 threads exposed.

Step 5— 330500 Velomitor only: Apply one drop of Loctite 242 or an equivalent adhesive to both ends of the mounting stud.

Step 6— 330500 Velomitor only: Apply a small portion of Sperry Multi Purpose Ultrasonic Couplant (P/N 04567900) to the mounting surface.

Step 7— 330500 Velomitor: With the adapter stud tightened to the Velomitor® torque the sensor to the machine case to 40 in-lb (4.5 N.m).

330525 Velomitor: Using a Crescent or socket wrench, tighten the 330525 Velomitor to the mounting site ¼ to ½ turn past hand tight engagement. This corresponds to a mounting torque of approximately 400 in-lb.

Installing Connecting Cable

Routing Cable (330500)

Bently Nevada LLC supplies connecting cables with ring lugs or military-type circular connectors. The cable connector must be compatible with the Velomitor® connector.

When installing the connecting cable, route it away from the moving components of the machine and avoid sharp corners. To minimize noise, avoid routing cables in the same cable tray with high voltage power lines. Tie the cable to a stationary part of the machine to prevent it from whipping and eventual failure. Prevent the cable from bending sharply, twisting, kinking, knotting, or straining. To prevent physical damage route the cable through conduit. Before pulling cable through conduit, protect the connector or terminals by wrapping them with tape or a similar covering. Be sure that the cable does not rub against rough or sharp surfaces.

Application Alert: Improper routing of cables through conduit can cause frayed wiring, which may result in a short or loss of signal.

Routing Cable (330525)

Bently Nevada LLC supplies connecting cables with military-type circular connectors. The cable connector must be compatible with the 330525 Velomitor connector. The 106765-AA cable assembly includes a quick connect/disconnect connector and clamps to secure and seal the splash-resistant boot.

The cable assembly comes with the top clamp secured in position and the bottom clamp is looped around the boot. Open the clamps with a small screwdriver by prying the teeth of the clamps apart. Slide the boot back to reveal the connector. The cable assembly can now be easily installed on the transducer. Once the connector is engaged, slide the boot down over the connector assembly and top of the transducer. The groove on the inside bottom of the boot should fit neatly over the lip above the hex flats. The grooves on the outside of the boot at the top and bottom indicate the placement of the clamps. Secure the clamps with pliers.

Routing Conduit

To route cable through 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 Velomitor®. 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 Armored Cable

If the cable is not routed inside conduit, use armored cable and secure it to supporting surfaces with clips or similar devices. Route the cable through protected areas to reduce the chance of damage. 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 Velomitor®. The recommended minimum bend radius for armored cable is 1.5 inches (38.1 mm).

Sealing the Connecting Cable

When conduit-enclosed cable is routed through oil or gaseous environments, seal the ends of the conduit to prevent leakage into the protected enclosure. Table 2-1 describes the strategies that should be used to seal conduit and the differential pressures at which they apply.

Table 2-1. Conduit Sealing Techniques

Differential Pressure	Seal Type
less than one atmosphere	ZY5 cable seal similar to Bently Nevada P/N 10076-AA or duct seal putty.
greater than one atmosphere	Special interconnecting cable. (Contact Bently Nevada for details.)

Bently Nevada cable seals protect against splash and abrasion but they do not protect against immersion. Contact Bently Nevada if greater protection is required.

Section 3 — Maintenance

This section shows how to check the performance of the Velomitor®. Table 3-1 lists the recommended maintenance equipment. If the equipment is not available, contact the nearest Bently Nevada LLC field office, or return the transducer to the factory or a testing laboratory for testing.

Table 3-1. Recommended Maintenance Equipment

Recommended Equipment	Specification
MB Dynamics Model PM50 Exciter Shake Table	
MB Dynamics, Model 2250 Power Amplifier	
Krohn-Hite Model 1200A Function Generator (Bently Nevada P/N 02280852)	
Tektronix 2235 Oscilloscope, Bently Nevada P/N 02280741	
Bently Nevada LLC Model 330180-50-00 Proximitor® Model 330101-00-08-10-02-00 Probe Model 330130-040-00-00 Extension Cable	
Power Supply, Bently Nevada TK15	-24.0 Vdc with minimum output current of 20 mA and less than 5 mV peak-peak noise
AISI 4140 Steel Target Material	0.030 inch (0.762 mm) thick, 0.85 inch (21.6 mm) diameter, 16 µin pp (0.41 µm pp)
3 mA (Motorola P/N 1N5309) current diode Bently Nevada P/N 00643485	

Test Setup

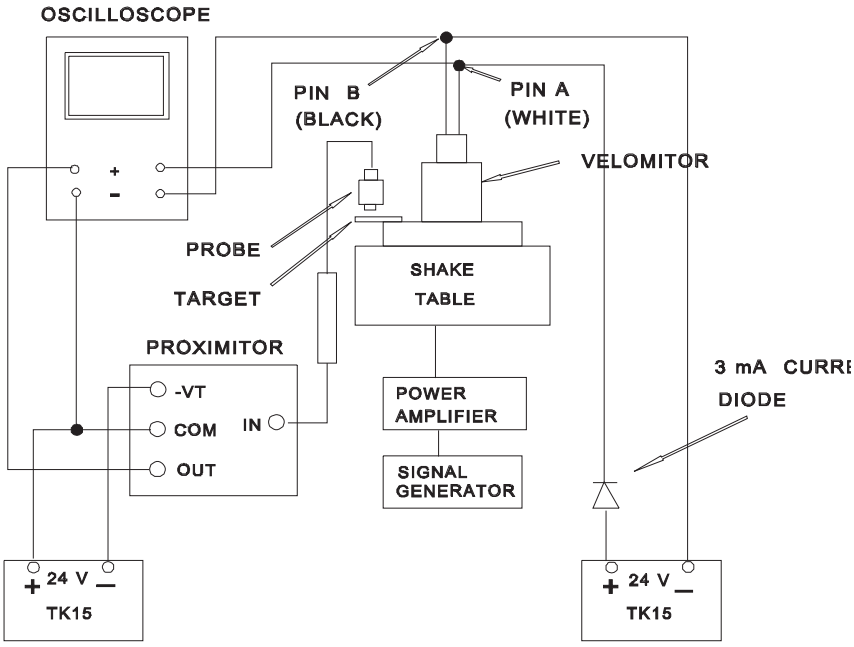


Figure 3-1

Step 1— Connect test equipment as shown in Figure 3-1.

Step 2— Mount the 4140 steel target to the shake table so that it is rigidly attached to the moving armature as shown in Figure 3-2.

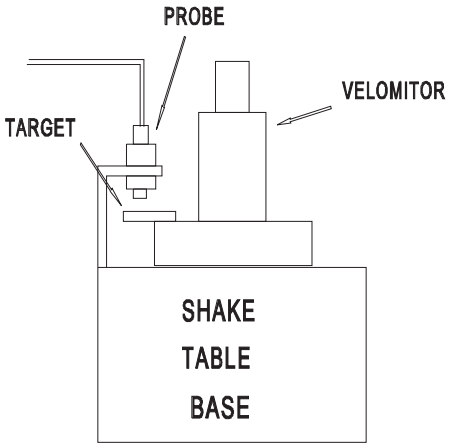


Figure 3-2

Step 3— Mount a 3300 XL 8mm, 1 meter probe (P/N 330101) such that it is isolated from the motion of the shake table.

Step 4— Connect the probe to a four meter extension cable (P/N 330130-040-00-00) and Proximitor® (P/N 330180-50-00).

Step 5— Apply -24 Vdc power to the Proximitor® and monitor the output with a voltmeter or oscilloscope.

Note: The accuracy of the system can be improved by mounting the probe and target on the same axis as the sensitive axis of the Velomitor® and by verifying that there is no mechanical resonance in the probe or target fixture at the frequency of calibration (100 Hz).

Step 6— Mount the velocity sensor to be checked on the shake table and tighten by hand.

Step 7— Adjust the probe-to-target gap so that the Proximitor® output is at midrange, -10.0 ± 0.5 Vdc.

Step 8— Connect the velocity transducer to the oscilloscope or voltmeter as shown in Figure 3-1.

Performance Test Procedure

Step 1— Set the signal generator to 100 ± 1 Hz and adjust the power amplifier gain so that the Proximitor® output is .318 ± .003 volts peak-to-peak (0.112 ± 0.001 volt RMS). This signal corresponds to a peak-to-peak displacement of 0.00159 inches (0.0404 mm) and a peak-to-peak velocity of 1.0 inch per second (25.4 mm/s).

Step 2— Verify that the output of the velocity sensor is between .095 and .105 volts peak-to-peak (.0336 to .0371 volts RMS). If the output is not in this range, return the unit to the factory.

Polarity Test Procedure

Use this test to verify the proper phase response. Any out of phase response will adversely affect machinery balancing.

Step 1— Connect the cable as shown in the setup in Figure 3-1.

Step 2— Set the time base on the oscilloscope to 20 milliseconds/division.

Step 3— Hold the velocity sensor in hand and tap the bottom. Observe that the wave-form on the oscilloscope first goes positive as shown in Figure 3-3. If it goes negative first, return the unit to the factory for replacement.

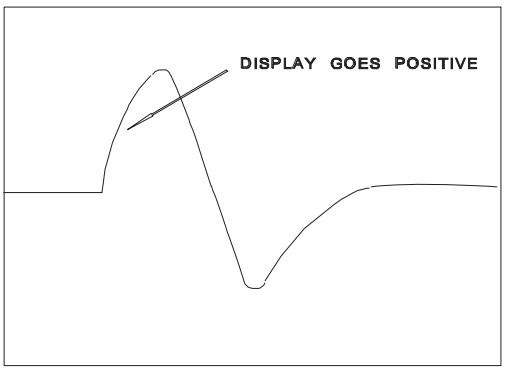


Figure 3-3

Section 4 — Field Testing and Troubleshooting

Use the following procedure to test an installed Velomitor® and isolate a suspected malfunction. The Velomitor® is a hermetically sealed unit with no adjustments or field repairable components. If you determine that the Velomitor® is not functioning properly, return it to a factory authorized repair center for further evaluation and disposition.

When the Velomitor® is used with a Bently Nevada monitoring system, a sensor fault is indicated when the monitor's OK LED goes OFF. A fault may be due to a sensor malfunction or a malfunction in the field wiring. Before troubleshooting a suspected problem, check that the sensor has been correctly installed, that all connections are secured and in the proper locations. If the sensor is properly installed, use the following steps to help identify the problem.

Fault Indication #1 Cause/Solution

Bently Nevada Monitor OK LED is off

Monitor Power is off.
Check that the monitor power supply is plugged in and power is on.

Interconnect cable is disconnected, connected loosely, or connected to the wrong monitor.
Verify that the sensor is connected to the correct monitor and to the correct monitor terminals. Check that the screws are tight.

Interconnect cable is not connected, connection is loose at the sensor, or sensor is open/shorted.
Verify that the sensor is connected either visually or by measuring the DC bias voltage between terminals “A” and “B” on the monitor (with the cable connected to the sensor and monitor). The absolute value should be 12±3 Vdc. If the measured DC bias voltage is not within the values indicated and the interconnect cable has been verified not to be a problem (by using the next two steps), then the sensor may be damaged.

Interconnect Cable is Damaged: Shorted
Visually inspect the interconnect cable for apparent damage. Disconnect the interconnect cable at both ends and measure the resistance between the two conductors, "A" to "B". If intermittent or shorted, replace the cable.

Interconnect Cable is Damaged: Open
Disconnect the interconnect cable at both ends. Then short the two conductors together at one end and measure the resistance of the cable at the other end. If open circuited, replace the cable.

Fault Indication #2 Cause/Solution

Unusually low vibration with non-machine related low level, broad band noise.

Sensor signal is not isolated, is shorted to the case or has noise coupled to the signal.

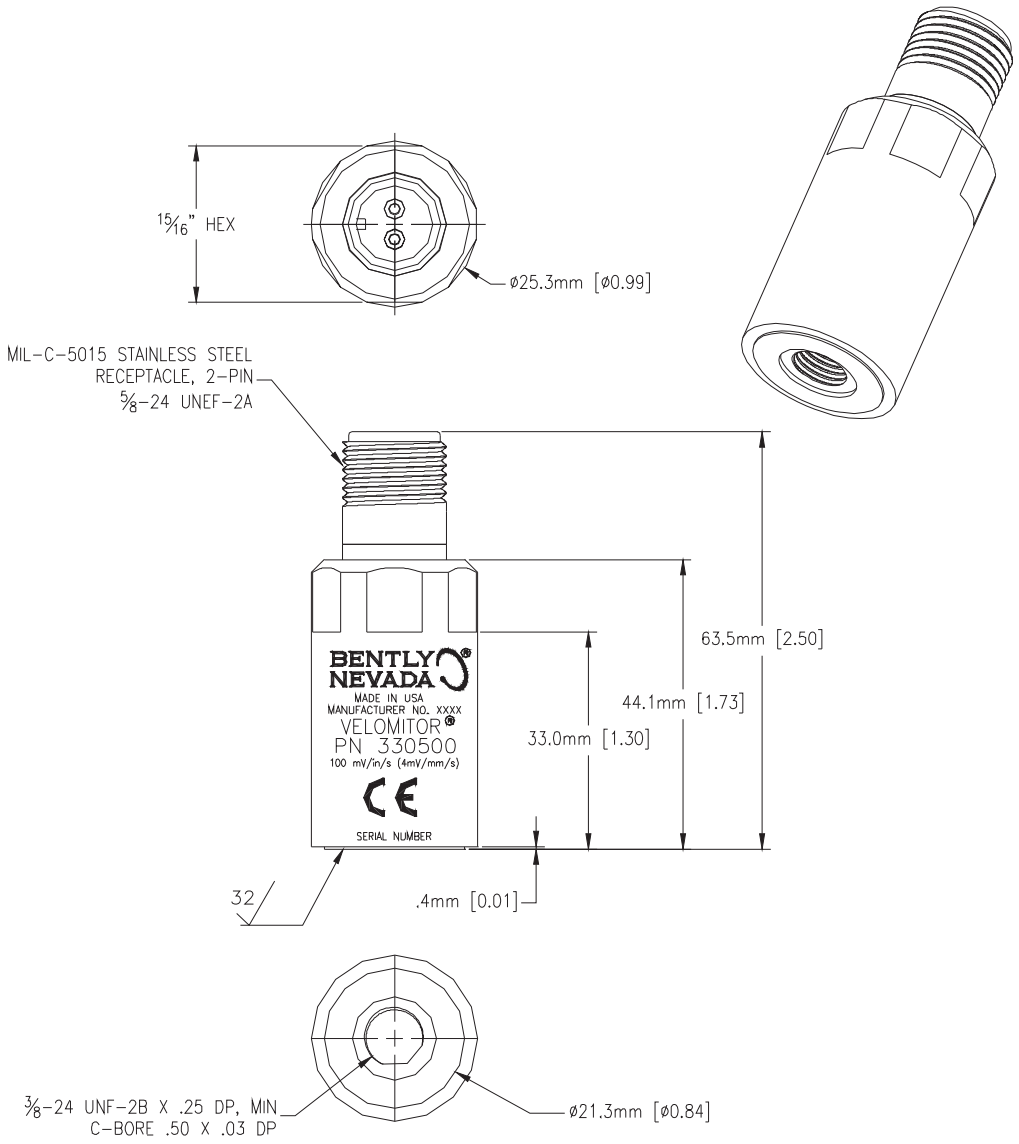
Measure the resistance between the "A" terminal and case and "B" terminal and case of the transducer. If the resistance is not 1 MΩ or greater then replace the sensor.

Section 5 — Specifications

Parameters are specified at 77° F (25° C) unless otherwise indicated.

	330500 Velomitor	330525 Velomitor xA
Electrical		
Sensitivity	100 mV/in/s (4 mV/mm/s) ±5% at 100 Hz	
Frequency Response	±0.9 dB, 6.0 Hz to 2.5 kHz ±3.0 dB, 4.5 Hz to 5.0 kHz	±0.9 dB, 6.0 Hz to 1.0 kHz ±3.0 dB, 4.5 Hz to 2.0 kHz
Velocity Range	50 in/s, peak	
Transverse Sensitivity	<5% of axial sensitivity	
Amplitude Linearity	±2% to 6.0 in/s, peak	
Mounted Resonant Frequency	12 kHz, minimum	
Power Requirements	DC Voltage: -22 to –30 Vdc Bias Current: 2.5 to 6.0 mA	
Output Bias Voltage	-12.0±3.0 Vdc, referenced to pin A	
Dynamic Output Impedance	<2400 Ω	
Broadband Noise Floor	<160 μin/s (0.004 mm/s)	
Grounding	Case Isolated	
Maximum Cable Length	1000 ft (305 m) with no signal degradation	
Environmental		
Operating Temperature Range	-67° F to 250° F (-55° to 121° C)	
Shock Limit	5000 g's, peak	
Humidity Limit	100% Relative (hermetically sealed)	
Mechanical		
Weight	5.3 oz, typical	
Dimensions	See Figures 5-1 and 5-2	
Case Material	304L Stainless Steel	316L Stainless Steel
Connector	2 pin Mil-C-5015, hermetically sealed, 304 stainless steel shell	2 pin Mil-C-26482, hermetically sealed, 304 stainless steel shell
Mounting Torque	40 in-lbs (4.5 N-m)	400 in-lbs (45.3 N-m)
Polarity	Pin A goes positive with respect to Pin B when the sensor case motion is toward the connector.	
Note: Operation outside the specified limits will result in false readings or loss of machine monitoring.		

Mechanical Drawing (330500)



NOTES:

1) DIMENSIONS ARE IN MM [INCHES]

2) FINISHED MACHINE SURFACES 64

3) TOLERANCES:
DECIMAL .XX = ±.3mm [.01]
.XXX = ±.13mm [.005]

Figure 5-1

Mechanical Drawing (330525)

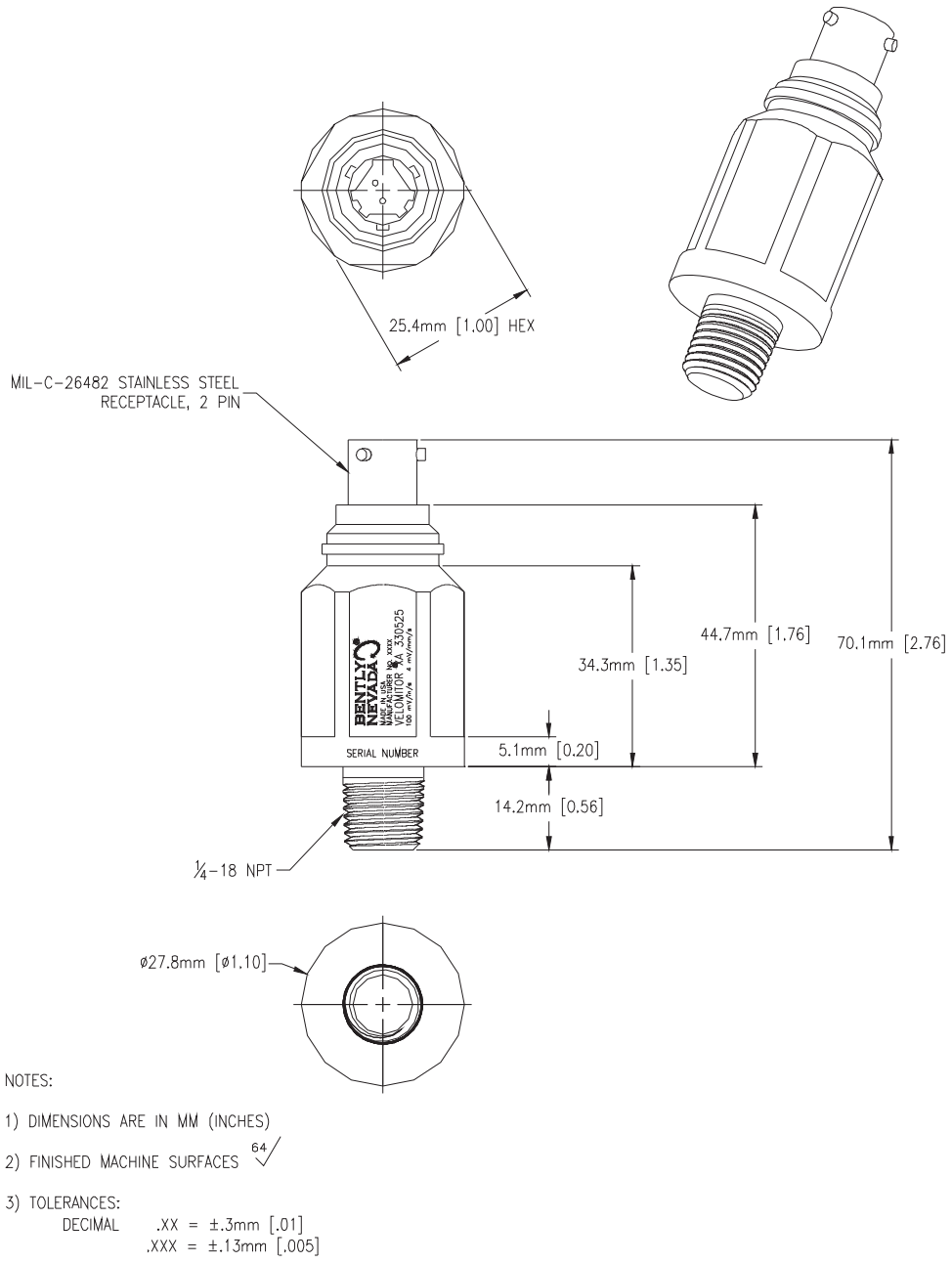


Figure 5-2

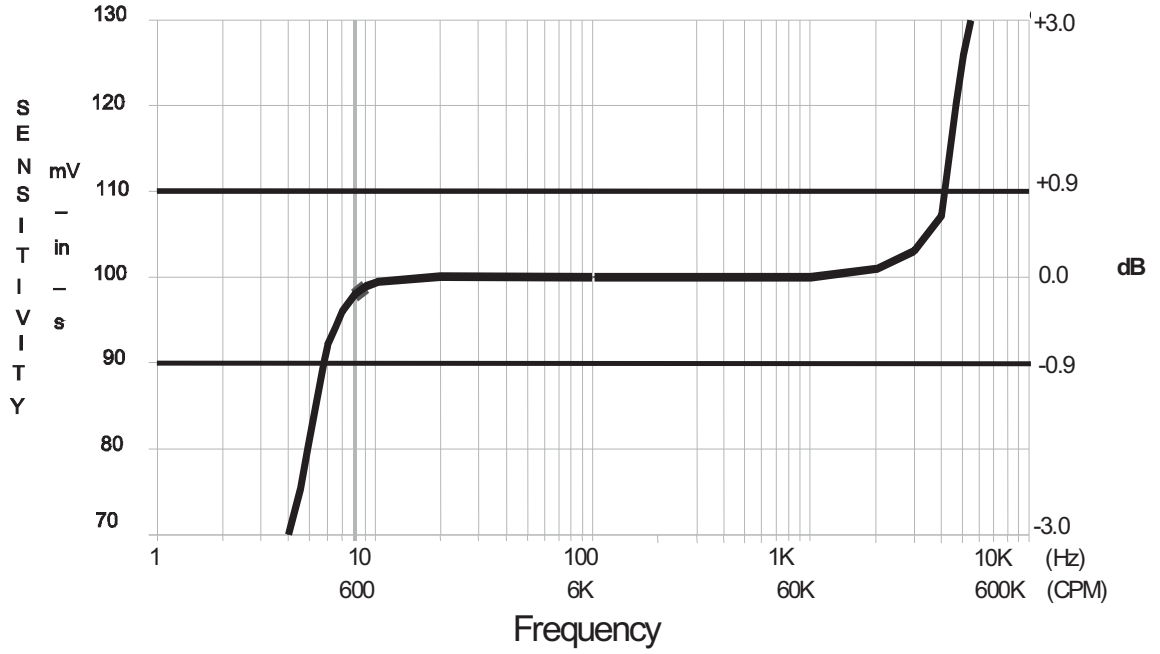


Figure 5-3 Velomitor® Frequency Response

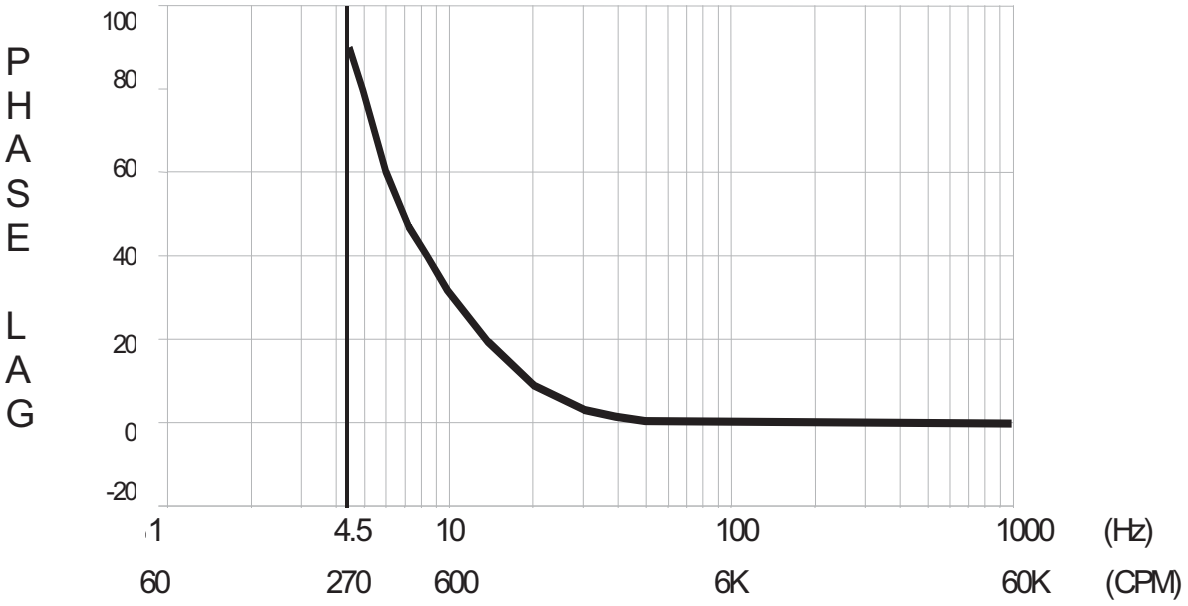


Figure 5-4 Velomitor® Phase Response

Manufacturer: **Bently Nevada Corporation**

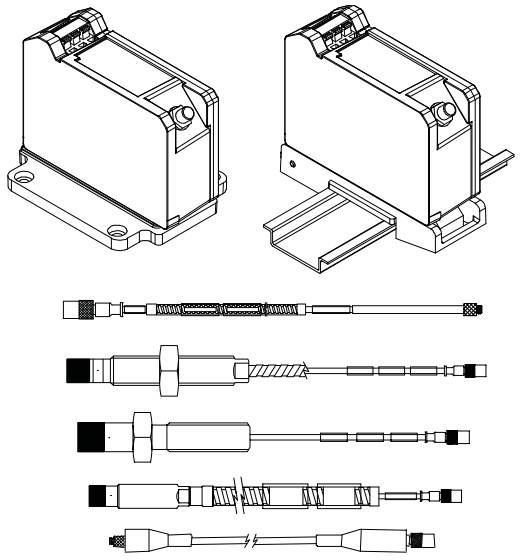
Documentation title: **Proximity Transducer System 3300 XL**
Installation Manual
Certificates of Compliance

No. of pages: 98

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Installation Manual

Bently Nevada™ Asset Condition Monitoring



3300 XL 8mm & 3300 5mm Proximity Transducer System

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Part Number 141078-01
Rev. K (11/07)

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The following are trademarks of the legal entities cited:

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Contact Information

The following contact information is provided for those times when you cannot contact your local representative:

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Telephone	1.775.782.3611 1.800.227.5514
Fax	1.775.215.2873
Internet	www.ge-energy.com/bently

Additional Information

Notice:

This manual does not contain all the information required to operate and maintain the product. Refer to the following manuals for other required information.

Installing the Transducer

Best Practices Document - Proximity Probes and Related Accessories: The Installation and Application of Eddy Current Proximity Transducers.

Guidelines for Grounding (Earthing) Bently Nevada Rotating Machinery Information Systems.

Installation of Electrical Equipment in Hazardous Areas.

Considerations when using Eddy Current Proximity Probes for Overspeed Protection Applications.

"Glitch": Definition of and Methods for Correction, Including Shaft Burnishing to Remove Electrical Runout.

Transducer Installation Accessories

31000/32000 Proximity Probe Housing Manual (Part Number 124200-01).

31000/32000 Proximity Probe Housing Data Sheet (Part Number 141610-01)

Housings for Proximitor® Sensors and Interface Modules Data Sheet (Part Number 141599-01)

3300 XL Monitor and Transducer Verification Kits Data Sheet (Part Number 141196-01)

Electrical and Mechanical Runout

API 670, Fourth Edition, Sections 6.1.1 (Location and Orientation – Radial Shaft Vibration Probes) and 6.1.2 (Location and Orientation – Axial Position Probes. Available from the American Petroleum Institute, Publications and Distribution, 1220 L Street NW, Washington DC, 20005, USA.

Reference (133055-01)

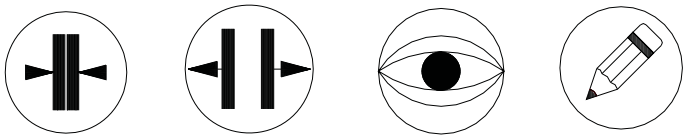
Bently Nevada Glossary.

Product Disposal Statement

Customers and third parties, who are not member states of the European Union, who are in control of the product at the end of its life or at the end of its use, are solely responsible for the proper disposal of the product. No person, firm, corporation, association or agency that is in control of product shall dispose of it in a manner that is in violation of any applicable federal, state, local or international law. Bently Nevada LLC is not responsible for the disposal of the product at the end of its life or at the end of its use.

Symbols

Procedures in this manual use the following symbols:



Connect Disconnect Observe Record Value

European CE mark for the Bently Nevada 3300 XL Transducer System

In this Document

is a list of the 3300 XL Transducer Assemblies that have the CE mark, applicable standards used for certification, and installation instructions required for compliance.

Proximity Transducer Systems

are electronic devices typically used in industrial applications. The 3300 XL Transducer System has been certified using the same Technical Construction File (TCF) and Declaration of Conformity as the 3300 8mm Transducer System because they are similar in design and application. The 3300 XL Proximity Transducer System consists of a Proximitor® Sensor, Proximity Probe, and Extension Cable.

TCF through TUV Rheinland of North America

A Technical Construction File has been prepared through TUV Rheinland of North America (TUV Rheinland File Number: P9472350.07). The Certificate of Compliance is for Directive 89/336/EEC (EMC Directive). The applicable Generic Norms are: EN50081-2 and EN50082-2.

Installation Instructions

These instructions are an addition to the Installation Instructions in Section 2.

Proximity Probes

All probe cases must have a solid connection to earth ground.

Compliant Systems and Component Part Numbers

#	Model	Model Numbers
1	3300 XL 8mm and 3300 5mm	330180, 330101*, 330102*, 330103*, 330104*, 330105*, 330106*, 330140, 330141, 330145, 330171, 330172, 330173, 330174, 330191, 330192, 330193, 330194, 330195, 330196, 330197, 330198, 330255, 330130, and 330190**

Includes all options and all approval versions of the base model numbers listed

*--Pre XL probes and cables may be used as part of a CE XL system.

**--any proximity probe, or extension cable that works correctly with the listed module.

Testing and Test Levels

Title	Test Levels	Criteria (See Note 6)
EN 55011 Emissions	Emission Class A	N/A
EN 61000-4-2 ESD	4 kV; 8 kV See Note 1	A
ENV 50140 (EN61000-4-3) Radiated RFI	10 V/m See Note 2	A
ENV 50204 Radiated RFI	10 V/m See Note 3	A
EN 61000-4-4 EFT	2 kV See Note 4	B
ENV 50142 (EN61000-4-5) Surge	0.5 kV See Note 4	A
ENV 50141 (EN 61000-4-6) Conducted RFI	10 V See Note 5	B
EN 61000-4-8 Magnetic Fields	30 A/m, 50 Hz	A

Notes for the table "Testing and Test Levels"

1. Discharge method: Contact; Air

2. 80-1000 MHz sweep with 80% 1 kHz sine wave amplitude modulation

3. 900 MHz dwell with 100% 200 Hz square wave modulation

4. Lines tested: I/O

5. 150 kHz-80 MHz sweep with 80% 1 kHz sine wave amplitude modulation

6. For the purposes of the 3300 XL 8mm and 3300 5mm System CE certification, the following criteria are defined as follows:

- Criteria A: Transducer system will output less than one third of a 3mil p-p meter scale (less than 1 mil p-p) and will return to steady state after test completion.
- Criteria B: Transducer system may react in any manner during test, but must self recover after test completion.
- Criteria C: N/A

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1. System Description

1.1 Transducer Systems

The 3300 XL 8 mm Proximity Transducer System consists of:

- a 3300 XL 8 mm probe
- a 3300 XL extension cable[1]
- a 3300 XL Proximitor® Sensor[2]

The 3300 XL 8 mm system represents our most advanced performance in an eddy current proximity transducer system. The standard 3300 XL 8 mm system is also 100% compliant with the American Petroleum Institute's (API) 670 Standard (4th Edition) for such transducers. All 3300 XL 8 mm Proximity Transducer Systems achieve this level of performance while allowing complete interchangeability of probe, extension cable, and Proximitor Sensor without the need for individual component matching or bench calibration.

Each component of the 3300 XL 8 mm Transducer System is backward compatible and interchangeable[4] with other non-XL 3300 series 5 and 8 mm transducer system components[5]. This includes the 3300 5 mm probe, which is used when an 8 mm probe is too large for the available mounting space[4, 5, and 6].

The 3300 5mm Proximity Transducer System consists of:

- a 3300 5 mm probe [5, 6, 7]
- a 3300 XL extension cable[1]
- a 3300 XL Proximitor® Sensor[2]

Like the 3300 XL 8mm, the 3300 5mm system also provides an accurate, stable signal output over a wide temperature range while allowing complete interchangeability of probe, extension cable, and Proximitor Sensor without the need for individual component matching or bench calibration.

Both systems provide an output voltage directly proportional to the distance between the probe tip and the observed conductive surface. They are capable of both static (position) and dynamic (vibration) measurements, and are primarily used for vibration and position measurement applications on fluid-film bearing machines, as well as Keyphasor® measurement and speed measurement applications[3].

1.2 Proximitor® Sensor

The 3300 XL Proximitor Sensor incorporates numerous improvements over previous designs. Its physical packaging permits high-density DIN-rail installation. It can also be mounted in a traditional panel mount configuration, where it shares an identical "footprint" to older 4-hole mounted 3300 Proximitor Sensor. The mounting base for either option provides electrical isolation, eliminating the need for separate isolator plates. The 3300 XL Proximitor Sensor is highly immune to radio frequency interference, allowing installation in fiberglass housings without adverse effects from nearby radio frequency signals. Improved RFI/EMI immunity allows the 3300 XL Proximitor Sensor to achieve European CE mark approvals without requiring special shielded conduit or metallic housings, resulting in lower installation costs and complexity.

The 3300 XL's SpringLoc terminal strips require no special installation tools and facilitate faster, more robust field wiring connections by eliminating screw-type clamping mechanisms that can loosen.

1.3 Proximity Probe and Extension Cable

The 3300 XL probe and XL extension cable also reflect improvements over previous designs. A patented TipLoc™ molding method provides a more robust bond between the probe tip and the probe body. The probe's cable is more securely attached as well, incorporating a patented CableLoc™ design that provides 330 N (75 lbf) pull strength where the probe cable attaches to the probe tip.

3300 XL 8 mm Probes and XL Extension Cables can also be ordered with an optional FluidLoc® cable option. This option prevents oil and other liquids from leaking out of the machine through the cable's interior.

1.4 Connectors

The 3300 XL 8mm and 3300 5mm probe, extension cable, and Proximitor Sensor have corrosion-resistant, gold-plated ClickLoc connectors. These connectors require only finger-tight torque (connectors will "click"), and the specially engineered locking mechanism prevents the connectors from loosening. They do not require any special tools for installation or removal.

3300 XL 8 mm Probes and Extension Cables can also be ordered with connector protectors already installed. Connector protectors can also be supplied separately for installation in the field (such as when the cable must be run through restrictive conduit). Connector protectors are recommended for all installations and provide increased environmental protection[8].

1.5 Extended Temperature Range Applications

An Extended Temperature Range (ETR) Probe and Extension Cable are available for applications where either the probe lead or extension cable may exceed the 177 °C (350 °F) temperature specification. The Extended Temperature Range Probe has an extended temperature rating for up to 260 °C (500 °F) for the probe lead and connector. The probe tip must remain below 177 °C (350 °F). The Extended Temperature Range Extension Cable is also rated for up to 260 °C (500 °F). Both the ETR probe and cable are compatible with standard temperature probes and cables. For example, you can utilize an ETR probe with the 330130 extension cable. The ETR system uses the standard 3300 XL Proximitor Sensor. When using any ETR component as part of your system, the accuracy is limited to the accuracy of the ETR system.

Notes:

1. 1-metre systems do not use an extension cable.
2. Proximitor® Sensors are supplied by default from the factory calibrated to AISI 4140 steel. Calibration to other target materials is available upon request.
3. Consult Bently Nevada Applications Note *Considerations when using Eddy Current Proximity Probes for Overspeed Protection Applications* when considering this transducer system for tachometer or overspeed measurements.
4. 3300 XL 8 mm components are both electrically and physically interchangeable with non-XL 3300 5 and 8 mm components. Although the packaging of the 3300 XL Proximitor® Sensor differs from its predecessor, it is designed to fit in the same 4-hole mounting pattern when used with the 4-hole mounting base, and will fit within the same mounting space specifications (when minimum permissible cable bend radius is observed).
5. When XL and non-XL 3300-series 5 and 8 mm system components are mixed, system performance is limited to the specifications for the non-XL 3300 5 and 8 mm Transducer System.
6. A 5 mm probe uses smaller physical packaging while providing the same linear range as a 3300 XL 8 mm probe (ref 141194-01); however, it does not permit reduced side view clearances or tip-to-tip spacing requirements compared to an XL 8 mm probe. It is used when physical (not electrical) constraints preclude the use of an 8 mm probe, such as mounting between thrust bearing pads or other constrained spaces. When narrow side view probes are required, use the 3300 XL NSv™ probe and extension cable with the 3300 XL NSv Proximitor® Sensor (refer to Specifications and Ordering Information p/n 147385-01).
7. XL 8 mm probes provide a thicker encapsulation of the probe coil in the molded PPS plastic probe tip. This results in a more rugged probe than the 3300 5 mm probe. The larger diameter of the probe body also provides a stronger, more robust case. Bently Nevada®, LLC recommends the use of XL 8 mm probes when possible to provide optimal robustness against physical abuse.
8. Silicone tape is also provided with each 3300 XL extension cable and can be used instead of connector protectors. Silicone tape is not recommended in applications where the probe-to-extension cable connection will be exposed to turbine oil.

1.6 Receiving, Inspecting, and Handling the System

The probe, extension cable and Proximitor Sensor are shipped as separate units and must be interconnected at the installation site by the user. Carefully remove all equipment from the shipping containers and inspect the equipment for shipping damage. If shipping damage is apparent, file a claim with the carrier and submit a copy to the nearest Bently Nevada LLC office. Include part numbers and serial numbers on all correspondence. If no damage is apparent and the equipment is not going to be used immediately, return the equipment to the shipping containers and reseal until ready for use.

Store the equipment in an environment free from potentially damaging conditions such as high temperature or a corrosive atmosphere. See on page 42 for environmental specifications.

1.7 Customer Service

We maintain numerous Sales and Service offices worldwide. To locate the office nearest you, visit our website http://www.bently.com. Here, you can also find specifications on all standard product offerings.

Support for products and services should be directed to one of these departments:

For product quotations, product applications, product ordering, scheduling on-site services, and questions regarding existing orders, please contact your nearby Bently Nevada, LLC Sales sales and service office.

For general product pricing, delivery, or other ordering information, contact your local BN office or contact Customer Service Department, Minden, Nevada, USA Phone: 1-775-215-1011 Fax: 1-775-215-2873.

For technical questions or problems regarding our products, contact our Technical Support Staff at:

techsupport@bently.com

or at the following locations:

Technical Support (North America)
Phone: 1-775-782-1818 Fax: 1-775-215-2890

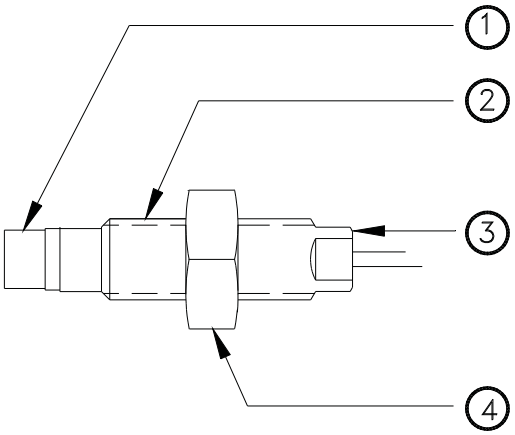
Technical Support (UK)
Phone: (44) 1925 818504 Fax: (44) 1925 817819

2. Installation

This section contains a checklist of items that you must consider when you install a 3300 XL Transducer system.

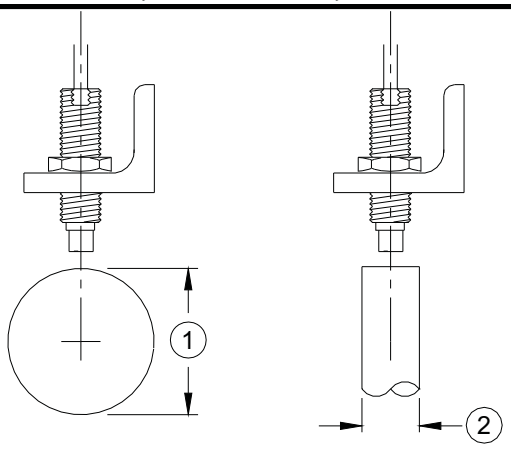
2.1 Installing the Probe

The following figures show the probe sizes and the minimum values for probe separation, side clearance and target configuration. Refer to Table 4-6 on page 41 for proper torque and the dimensions of the thread.



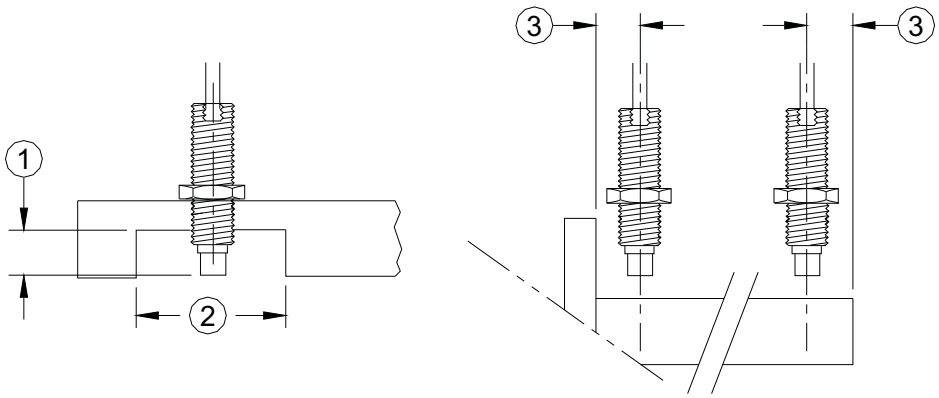
Callout	Description	XL 8 mm probe	5 mm probe
1	Probe tip	8 mm	5 mm
2	Thread types	M10x1, 3/8-24, or unthreaded	M8x1 or 1/4-28
3	Wrench Flats	8 mm or 5/16 in	7 mm or 7/32 in
4	Lock nut	17 mm or 9/16 in Hex	13 mm or 7/16 Hex

Figure 2-1: Probe Dimensions



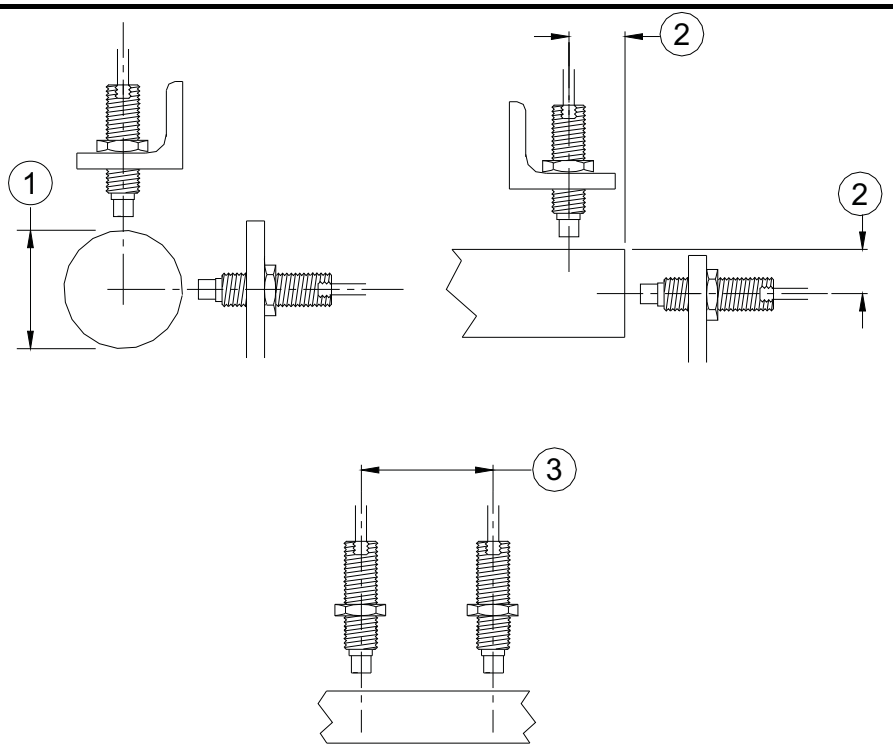
1. 76.2 mm (3.00 in) minimum (See Note 1 below)
2. 15.2 mm (0.60 in) minimum

Figure 2-2: 5mm and XL 8mm Probe Target Sizes



1. 6.4 mm (0.25 in) minimum
2. 17.8 mm (0.70 in) minimum
3. 8.9 mm (0.35 in) minimum

Figure 2-3: 5mm and XL 8mm Probe Mounting Dimensions



1. 50.8 mm (2.00 in) minimum (See Note 2 below)
2. 16.0 mm (0.63 in) minimum
3. 40.6 mm (1.60 in) minimum

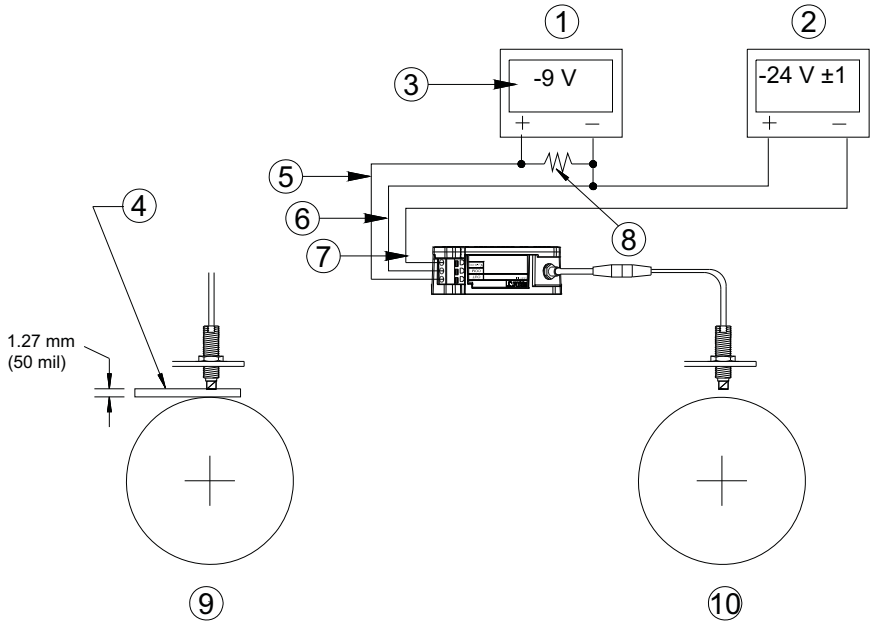
Figure 2-4: 5mm and XL 8mm Probe-to-Probe Separation Due To Cross Talk

NOTES

1. At or below 76.2 mm (3.00 in), scale factor will increase as the target size is reduced per performance specification 159484. See the application advisory below.
2. At or below 50.8 mm (2.00 in), cross talk will produce a small vibration signal per performance specifications 159484, due to cross talk.

Application Advisory
Mounting dimensions and target size affect the scale factor of proximity transducer systems. The minimum recommended dimensions above were chosen to minimize error yet retain flexibility for different mounting situations.

Adjust the distance between the probe tip and the shaft using one of the methods shown in Figure 2-5. The electrical method for setting the probe gap is preferred.



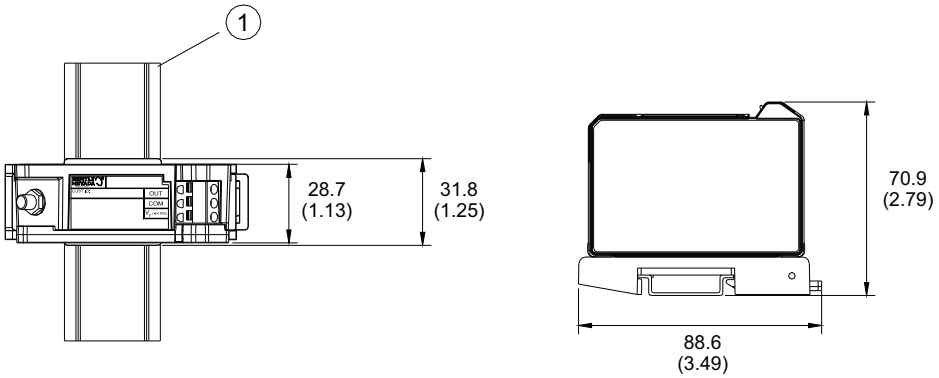
1. Voltmeter
2. Power supply
3. Voltage at center of the linear range (typically –9 V)
4. Space
5. OUT
6. COM
7. V_T
8. 10 kΩ, 1% resistor
9. Mechanical method
10. Electrical method

Figure 2-5: Methods for Setting the Probe Gap

2.2 Mounting the Proximitor® Sensor

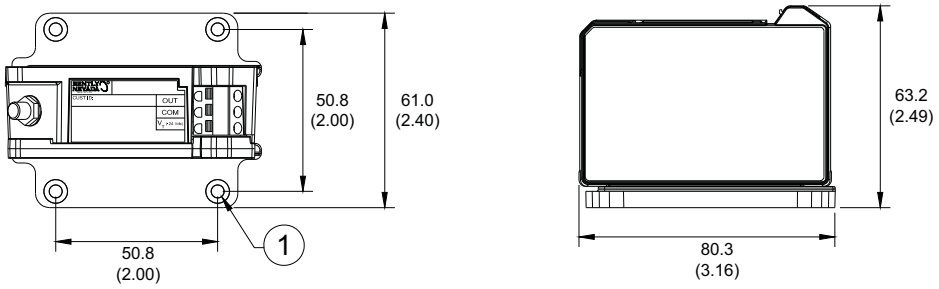
Mount the Proximitor Sensor in a location that is compatible with its environmental specifications (see Environmental Limits on page 42).

Consider the local electrical codes and the presence of hazardous or explosive gas at the installation site. (Refer to the document *Installation of Electrical Equipment in Hazardous Areas.)*



1. 35mm Din Rail

Figure 2-6: DIN Rail Mount Dimensions

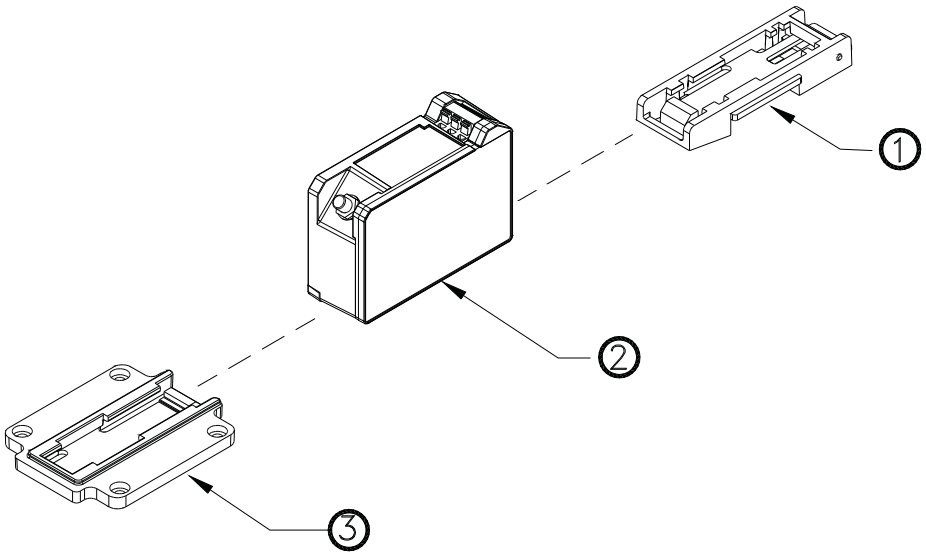


1. 4.0 mm (0.158 in) for M3.5 or #6 screw

Figure 2-7: Panel Mount Dimensions

2.3 Interchangeable Mounting Feet

The mounting feet for the 3300 XL Proximitor Sensor are interchangeable. If you purchase a Proximitor Sensor with one mounting option (either the DIN mount option or the panel mount option) you can change the mounting hardware simply by replacing the mounting foot that is currently on the Proximitor Sensor with the other type of mounting foot.



1. DIN Mount Part (part number 138493-01)
2. 3300 XL Proximitor® Sensor
3. Panel Mount Part (part number 138492-01)

Figure 2-8: Mounting Foot Options

2.4 Mounting the Proximitor® Sensor with DIN Mount Part

To mount the 3300 XL Proximitor Sensor with a DIN Mount Part on a DIN rail:

1. Install the Proximitor Sensor into the DIN Mount Part (if not already installed) as shown in Figure 2-9.

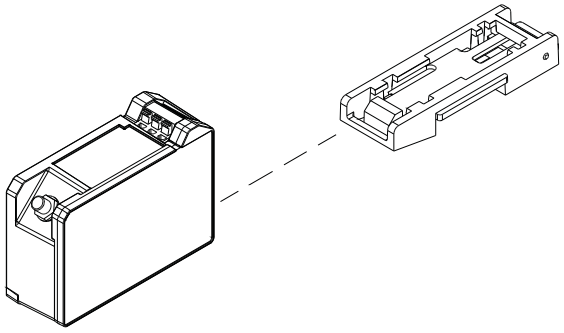
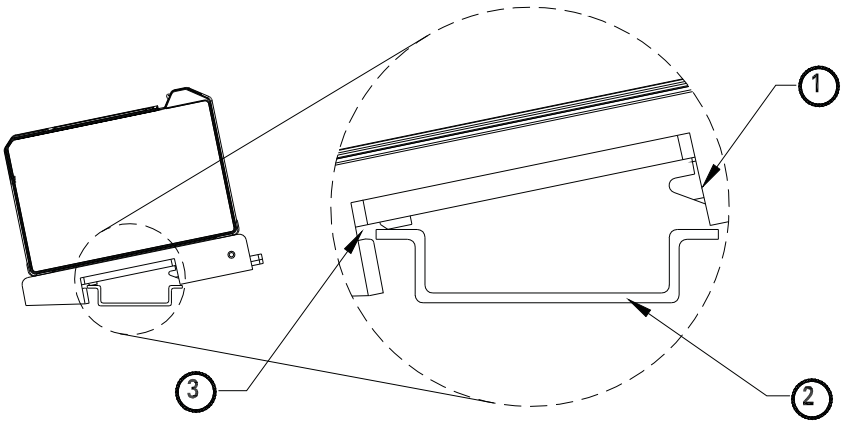


Figure 2-9: Installing the DIN Rail Mounting Foot

2. Examine the under side of the DIN Mounting Foot. This part has a spring-loaded clip on one side and two protrusions that will catch the edge of the DIN rail on the other side. You must install the side with the two protrusions so that the edge of the DIN rail fits into the gap as shown in Figure 2-10.



1. Spring-loaded clip
2. DIN rail
3. Edge of DIN rail must fit into this gap

Figure 2-10: Inserting the Mounting Foot Onto the DIN Rail

3. Push down on the Proximitor Sensor as shown in Figure 2-11 until the unit "snaps" into place. The unit is now installed.

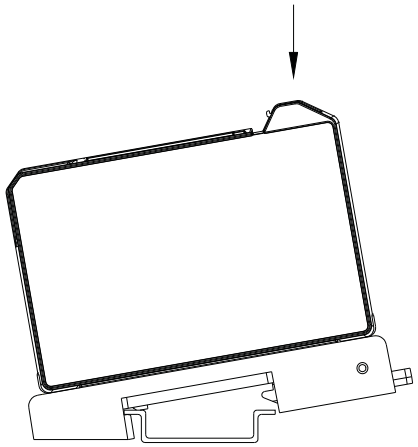


Figure 2-11: Snapping the Sensor Onto the DIN Rail

2.5 Removing the Proximitor Sensor from the DIN Rail

Use a regular screwdriver to remove the Proximitor Sensor from the DIN rail by using a regular screwdriver to unclip the unit from the rail.

Insert a regular screwdriver into the rear of the spring-loaded clip (see Figure 2-12). Push the top of the screwdriver towards the Proximitor Sensor to pry the spring-loaded clip back so that you can remove the Proximitor Sensor from the DIN rail.

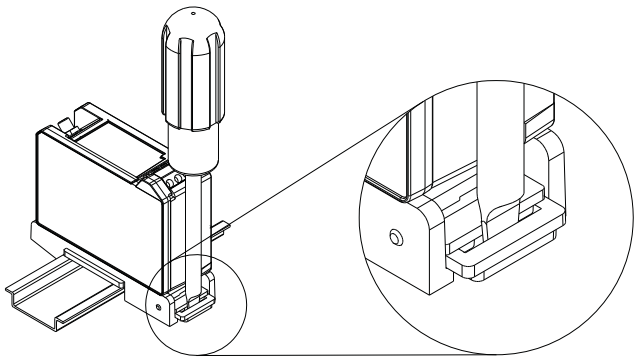


Figure 2-12: Retracting the Spring-Loaded Clip

2.6 Termination of Field Wiring in the Terminal Block

1. Strip the insulation from the field wiring you will install into the terminal block. The recommended strip length is 10 mm (0.4 in.).
2. You must twist the conductor strands together before installing the field wire into the terminal block (see Figure 2-13). We highly recommended that you tin the conductor strands as well.

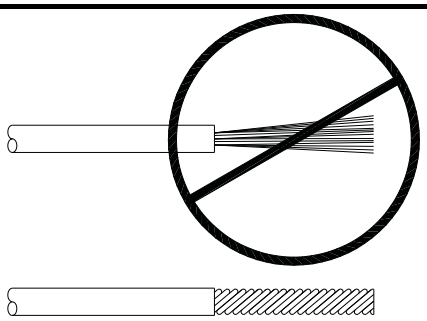
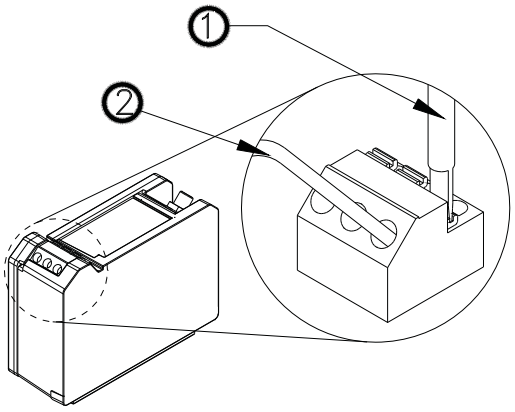


Figure 2-13: Proper Preparation of Wire Strands

3. The terminal block can accommodate field wiring conductor sizes of 0.2 – 1.5 mm^2 (16 – 24 AWG).

4. Use a small regular screwdriver to push down the orange lever that corresponds to the position in the terminal block where you will install the field wire and insert the field wire (see Figure 2-14).



1. Small screwdriver
2. Field wiring

Figure 2-14: Inserting Field Wiring Into Proximitor

To remove the field wire push down on the orange lever and pull on the field wire to remove it from the terminal block. If the field wiring uses a stranded wire and a strand break off inside the terminal block, turn the Proximitor Sensor upside down while pushing down the orange lever and remove the strand from the terminal block.

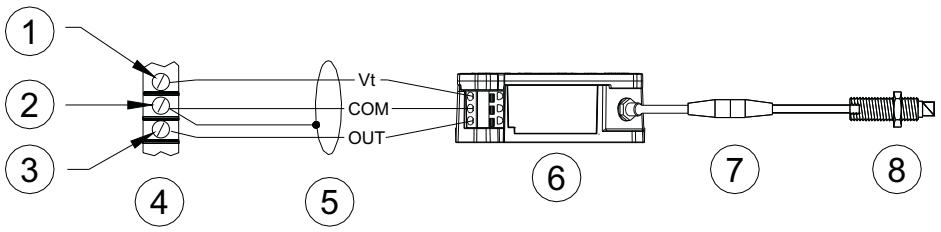
2.7 Routing the Extension Cable and Field Wiring

Route the extension cable using the following guidelines.

- Verify that the sum of the extension cable and probe lead lengths equal the Proximitor Sensor system length. (For example, a 9-metre Proximitor Sensor will work with an 8-metre extension cable and a 1-metre probe.)

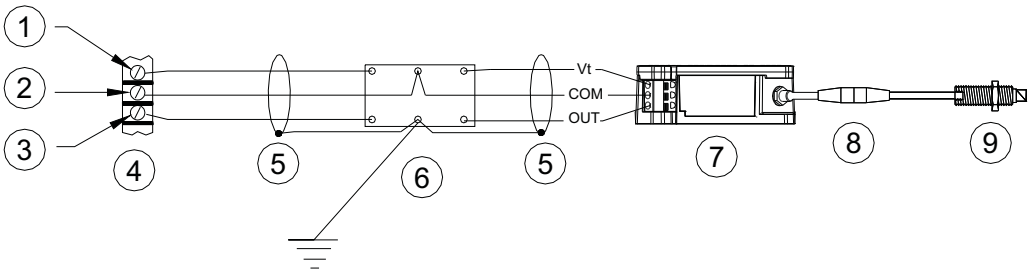
- Use the system color identification to verify component compatibility for all system components. For the 3300 XL 8 mm system and 3300 5 mm probe, components will be marked with a blue color code.
- Use mounting clips or similar devices to secure the extension cable to supporting surfaces.
- Identify the probe and both ends of the extension cable by inserting labels under the clear Teflon® sleeves and applying heat to shrink the tubing.
- Join the coax connectors between the Proximitor Sensor, extension cable and probe lead. Tighten connectors to finger tight.
- Use either a connector protector or self-fusing silicone tape to insulate the connection between the probe lead and the extension cable. **Do not use self-fusing silicone tape to insulate a connection at locations that may expose the silicone tape to turbine oil.**
- If the probe is in a part of the machine that is under pressure or vacuum, use appropriate cable seals and terminal boxes to seal the hole where the extension cable exits the machine.

Use Figure 2-15and Figure 2-16 to connect the field wiring between the Proximitor Sensor and the monitoring instruments. (Refer to the documents *Guidelines for Grounding (Earthing) Bently Nevada Rotating Machinery Information System* and *Installation of Electrical Equipment in Hazardous Areas*.)



1. Transducer power
2. Common (ground)
3. Input signal
4. Monitor terminal strip
5. Cable shield
6. Proximitor sensor
7. Connector protector
8. Probe

Figure 2-15: Installation With No Barriers or With 3300/3500 Internal Barriers



1. Transducer power
2. Common (ground)
3. Input signal
4. Monitor terminal strip
5. Cable shield
6. External barrier
7. Proximitor sensor
8. Connector protector
9. Probe

Figure 2-16: Installation With External Barriers

3. Maintenance and Troubleshooting

This section shows how to verify that the system is operating properly and identify parts of the system that are not working properly.

When properly installed and verified the 3300 XL Transducer System (probe, cable and Proximitor Sensor) does not need calibration or verification at regular intervals. If the monitor OK light (green) indicates a NOT OK condition (i.e., the light is **not** illuminated), then

- a fault has occurred in the field wiring/transducer system/power source,
- the probe is too close to target,
- the probe is detecting other material than the target,
- the target material is not AISI 4140, or
- the probe is too far from the target.

We recommend the following practices to ensure continued satisfactory operation of your 3300 XL system. Verify operation using the scale factor verification method on the following page, if you

- replace any of the system components (probe, cable or Proximitor Sensor),
- remove and reinstall or move and remount any of the components,
- determine that any of the components are damaged, or
- overhaul the machine being monitored.

Please note that a sudden change in the output of the transducer system or other output that is not consistent with the associated machinery's trended data is, in most instances, not a transducer problem but a machinery problem. You can verify the transducer system under these conditions at your discretion.

Under harsh operating conditions some users prefer to verify all transducers at a regular interval. As noted above, the 3300 XL Transducer System does not require this. Users who wish to verify the system on a regular interval should use an interval consistent with their own practices and procedures, which may or may not be based upon ISO 10012-1 "Quality Assurance Requirements for Measuring Equipment" (section 4.11).

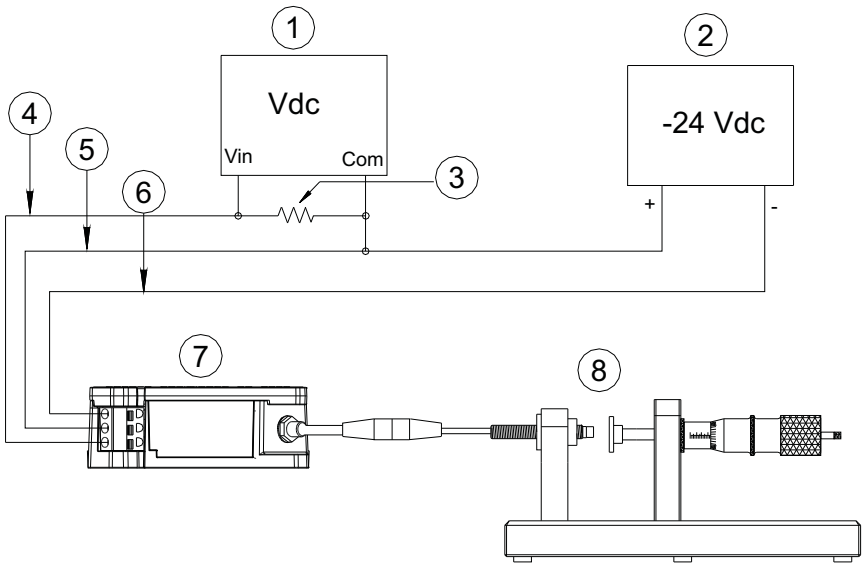
For target materials other than AISI 4140 steel and for other special applications, contact your local sales office.

NOTE
Hazardous location areas must be free of hazardous materials before any maintenance or troubleshooting can be performed.

The scale factor verification requires the following instruments and equipment:

- Digital multimeter
- Spindle micrometer
- 10 kΩ fixed resistor
- Power supply (-24 Vdc ± 1 V)

The scale factor verification uses the test setup shown in Figure 3-1.

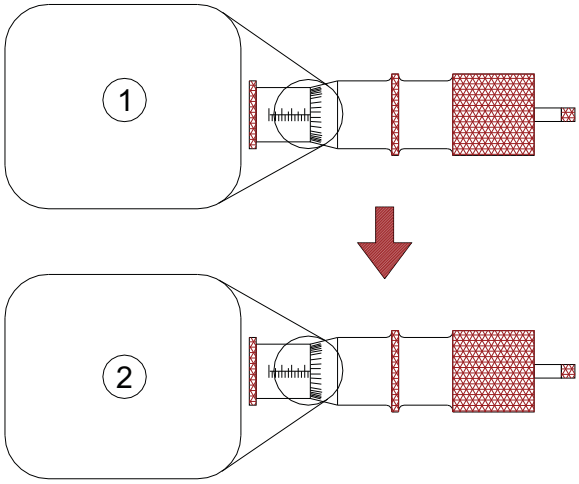


1. Multimeter
2. Power supply
3. 10 kΩ resistor
4. OUT
5. COM
6. VT
7. Proximitor sensor
8. Probe, target, and spindle micrometer

Figure 3-1: Scale Factor Verification Test Setup

3.1 Scale Factor Verification

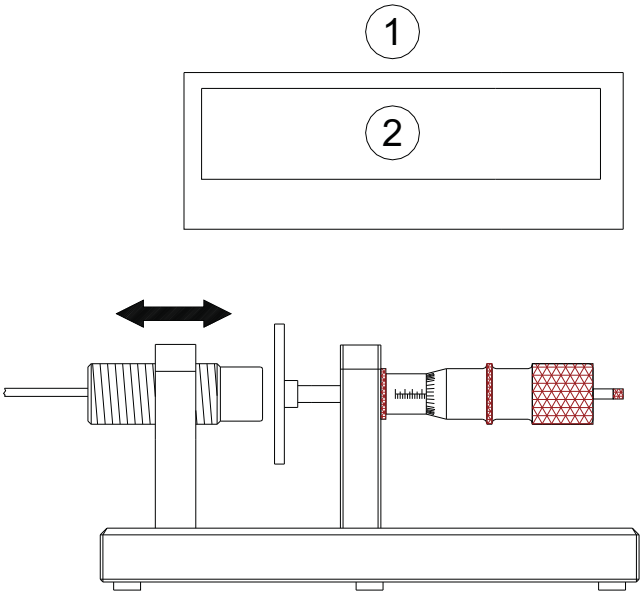
1. Compensate for mechanical backlash and adjust the spindle micrometer for electrical zero.



1. 0.46 mm (18 mils)
2. 0.50 mm (20 mils)

Figure 3-2: Adjusting Spindle Micrometer for Electrical Zero

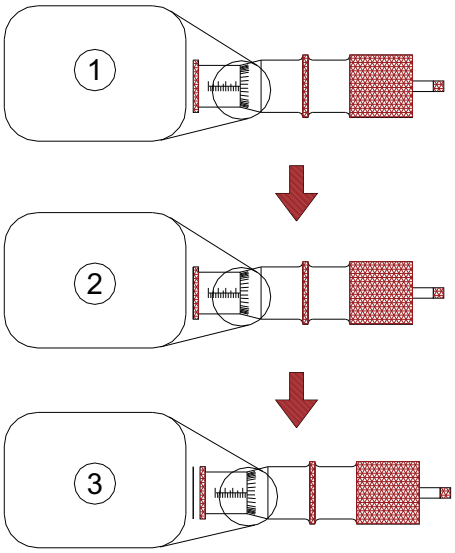
2. Adjust the gap to electrical zero by moving the probe.



1. Multimeter
2. –3.00 Vdc ± 0.1 Vdc

Figure 3-3: Adjusting Gap for Electrical Zero

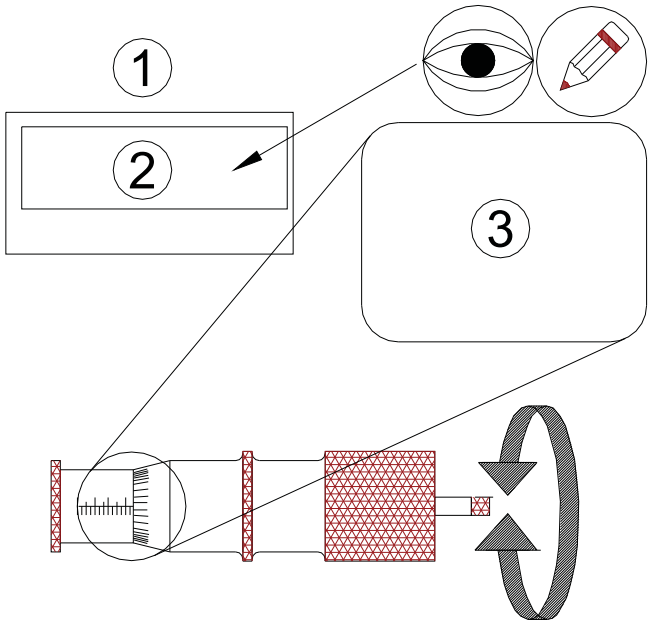
3. Compensate for mechanical backlash in the micrometer and adjust to the start of the linear range.



1. 0.50 mm (20 mils)
2. 0.20 mm (8 mils)
3. 0.25 mm (10 mils)

Figure 3-4: Compensating for Mechanical Backlash

4. Record voltages in Table 3-1 and calculate Incremental Scale Factors (ISFs) and Average Scale Factor (ASF) using the equations given below.



1. Multimeter
2. Vdc_n reading
3. Increments: 0.25 mm (10 mils)

Figure 3-5: Adjusting Spindle Micrometer for Recording Voltages

Table 3-1: Table for Recording Measurement Voltages

N	Adjust Micrometer to...		Record Voltages	Calculate Scale Factor	
	mm_n	mil_n	Vdc_n	ISF_n (Incremental Scale Factor)	$Vdiff_n$ (Difference Voltage)
1	0.25	10	>>		>>
2	0.50	20	>>	>>	>>
3	0.75	30	>>	>>	>>
4	1.00	40	>>	>>	>>
5	1.25	50	>>	>>	>>
6	1.50	60	>>	>>	>>
7	1.75	70	>>	>>	>>
8	2.00	80	>>	>>	>>
9	2.25	90	>>	>>	>>
>> = Enter values into these cells				**ASF (Average Scale Factor)**	
				>>	

$$ISF_{n\,(V/mm)} = \frac{Vdc_{n-1} \quad Vdc_n}{0.25} \qquad ASF_{(V/mm)} = \frac{Vdc_{0.25mm} \quad Vdc_{2.25mm}}{2}$$

$$ISF_{n\,(mV/mil)} = \frac{Vdc_{n-1} \quad Vdc_n}{0.01} \qquad ASF_{(mV/mil)} = \frac{Vdc_{10mil} \quad Vdc_{90mil}}{0.08}$$

$$Vdiff_n = Vdc_n + (mm_n \bullet 7.87) \qquad Vdiff_n = Vdc_n + (mil_n \bullet 0.2)$$

5. Use the following formula to determine maximum Deviation from Straight Line (DSL):

$$DSL(mm) = \frac{Vdif\,(max) \quad Vdif\,(min)}{15.74} = _____ mm$$

$$DSL(mil) = \frac{Vdif\,(max) \quad Vdif\,(min)}{0.4} = _____ mil$$

If the ISF or DSL of the system is out of tolerance, contact Bently Nevada LLC for further information on possible calibration problems.

The preceding pages indicate scale factor verification using a TK-3. This is suitable for rough verification. For API 670 system verification a more precise micrometer and target must be used. There are two different 3300 XL Micrometer Kits that you can use to verify the calibration of Bently Nevada transducer systems or to check the scale factor of specific shafts. Both micrometer kits will work with Bently Nevada eddy current transducers ranging in size from the 3300 XL NSv™ Transducer System up to the 3300 XL 11 mm Transducer Systems. Both micrometer kits also have options for either a metric or English micrometer.

The **3300 XL Precision Micrometer** (part number 330185) is a highly accurate verification device. You should use this device when performing acceptance testing on our transducer systems. All of our transducer systems have a specified linear range and average scale factor (ASF). The transducer systems also have a maximum deviation from straight line (DSL) and ISF tolerances for ambient and extended temperatures. The 3300 XL Precision Micrometer comes with a high precision 4140 steel target to make precise measurements and verify whether the transducer system is working properly and within published specifications.

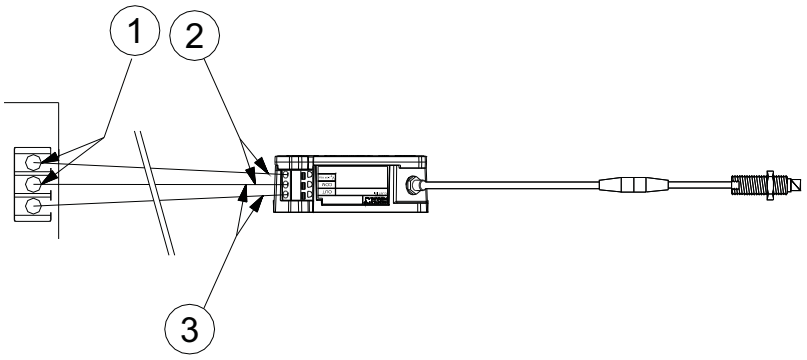
The **3300 XL Shaft Micrometer** (part number 330186) is used to check the scale factor of the transducer system directly on your shaft. You can compare the scale factor of your transducer system with that of a 4140 steel target supplied by Bently Nevada LLC to check whether errors in the measurement are due to runout, target material or a problem in the transducer system.

3.2 Troubleshooting

This section shows how to interpret a fault indication and isolate faults in an installed transducer system. Before beginning this procedure, be sure that you have installed the system correctly and properly secured all connectors in the correct locations.

When a malfunction occurs, locate the appropriate fault, check the probable causes for the fault indication and follow the given procedures to isolate and correct the fault. Use a digital voltmeter to measure voltage. If you find faulty transducers, contact your local sales and service office for assistance.

The troubleshooting procedures use measured voltages as shown in Figure 3-6, Table 3-2, and Table 3-3:



1. V_{PS}
2. V_{XDCR}
3. V_{SIG}

Figure 3-6: Troubleshooting Voltages

Table 3-2. Symbols for Measured Voltages

Symbol	Meaning	Voltage measured between...
V_{SIG}	Signal voltage from the transducer	OUT and COM
V_{PS}	Power supply voltage	Power Source and Common
V_{XDCR}	Supply voltage at transducer	$-V_T$ and COM

NOTE
V_{SIG}, V_{PS}, and V_{XDCR} are all negative voltage values.

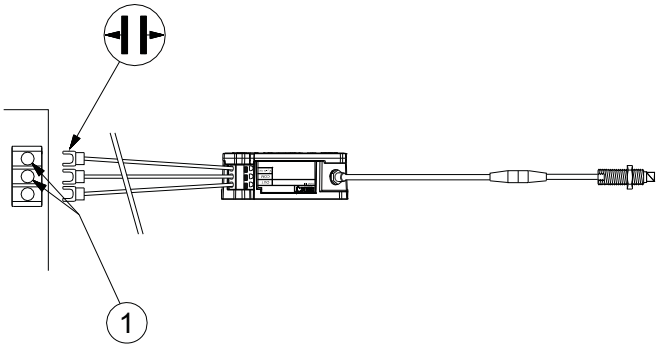
Table 3-3: Definitions

Symbol	Definition	Example
A > B	"A" value is more positive than "B"	-21 > -23
A < B	"A" value is more negative than "B"	-12 < -5
A = B	"A" same value (or very close) to "B"	-24.1 = -24.0

3.3 Fault Type 1: V_{XDCR} > -17.5 Vdc or V_{XDCR} < -26 Vdc

Possible causes:

- Faulty power source
- Faulty field wiring
- Faulty Proximitor Sensor



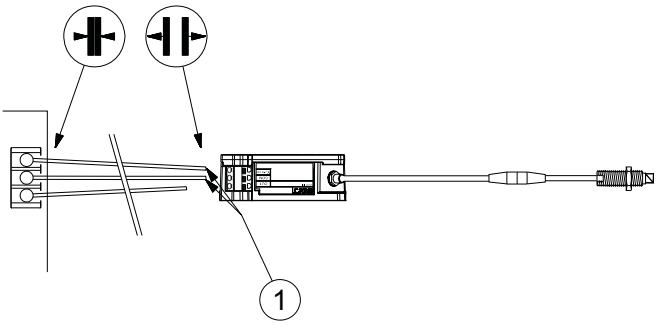
1. V_{PS}

Figure 3-7: Fault Type 1 Measurement 1

Measure V_{PS}: Is V_{PS} > -23 Vdc or V_{PS} < -26 Vdc?

Yes: Faulty power supply.

No: Go to next step.



1. V_{XDCR}

Figure 3-8: Fault Type 1 Measurement 2

Measure V_{XDCR}: Is V_{XDCR} > -23 Vdc or V_{XDCR} < -26 Vdc?

Yes: Faulty Field wiring.

No: Faulty Proximitor Sensor.

3.4 Fault Type 2: V_{SIG} = O Vdc

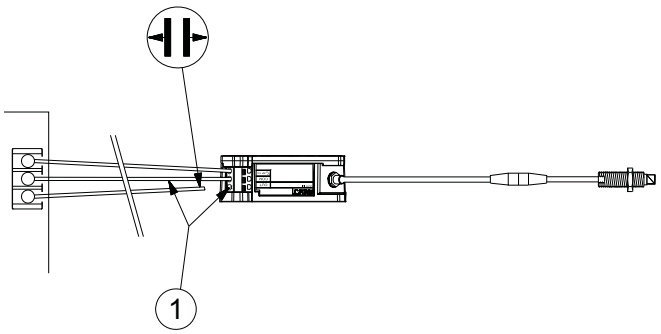
Possible causes:

- Incorrect power source voltage
- Short circuit in field wiring
- Short circuit at Proximitor Sensor terminal connection
- Faulty Proximitor Sensor

Does fault condition type 1 exist?

Yes: Use the procedure for fault type 1

No: Go to the next step



1. V_{SIG}

Figure 3-9: Fault Type 2 Measurement

Measure V_{SIG}: Is V_{SIG} = 0 Vdc?

No: Incorrect power source voltage or short in field wiring or short at Proximitor Sensor terminal connection.

Yes: Faulty Proximitor® Sensor.

3.5 Fault Type 3: -1 Vdc < V_{SIG} < 0 Vdc

Possible causes:

- Probe is incorrectly gapped (too close to target)

- Incorrect power source voltage
- Faulty Proximitor Sensor
- Probe is detecting other material than target (counter bore or machine case)
- Short or open circuit in a connector (dirty or wet) or loose connectors
- Short or open circuit in the probe
- Short or open circuit in extension cable

Does fault condition type 1 exist?

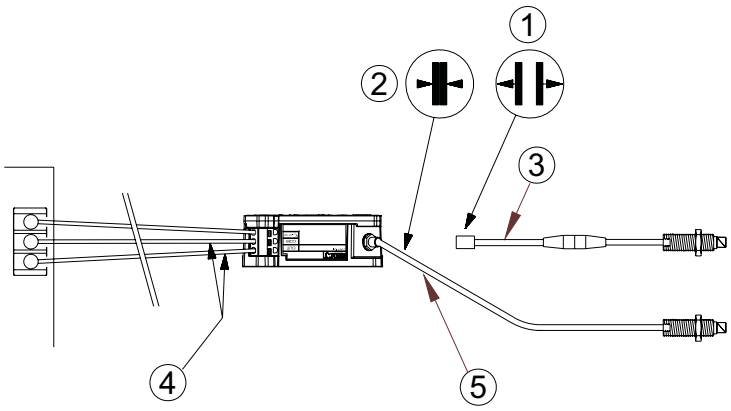
Yes: Use the procedure for fault type 1

No: Go to the next step

Is the probe gapped correctly? Are counter bore dimensions correct? (See Installing the Probe on page 5.)

No: Regap the probe or check counter bore. Retest system.

Yes Go to the next step.



1. Step 1
2. Step 2
3. Original probe extension cable
4. VSIG
5. Known good probe with correct length cable (open gap with probe held away from conductive material

Figure 3-10: Fault Type 3 Measurement 1

Measure V_{SIG}: Is $V_{SIG} < V_{XDCR} + 1$ Vdc?

No: Faulty Proximitor Sensor

Yes: Go to next step

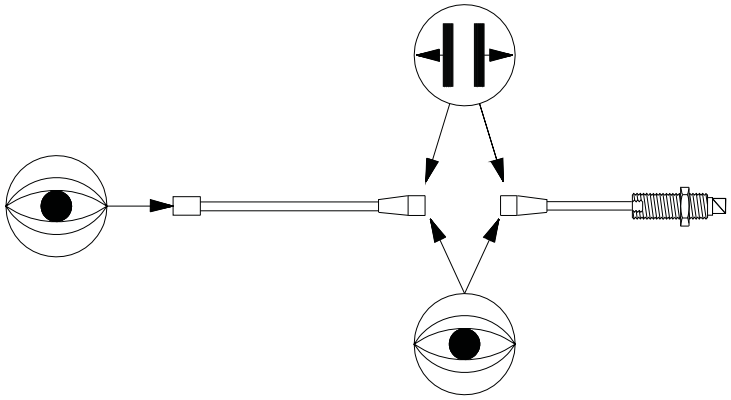
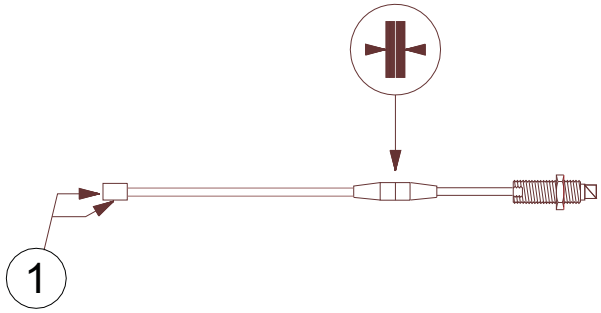


Figure 3-11: Fault Type 3 Measurement 2

Inspect for clean connection: Is the connection dirty, rusty, or a poor connection?

Yes: Clean the connector using isopropyl alcohol or electronic terminal cleaner, reassemble and retest the system.

No: Go to the next step.



1. R_{TOTAL}

Figure 3-12: Fault type 3 Measurement 3

Measure resistance R_{TOTAL}: Is R_{TOTAL} within specifications?

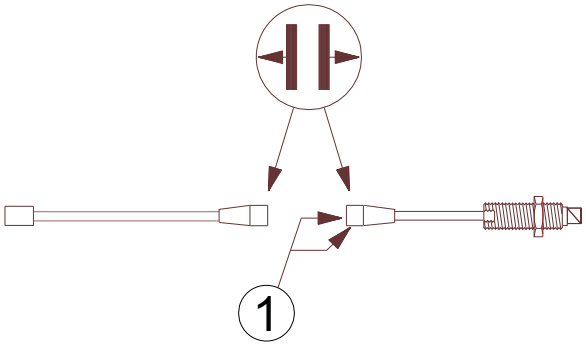
1 m system: Go to the next step.

5 m system: $8.75 \pm 0.70\ \Omega$

9 m System: $9.87 \pm 0.90\ \Omega$

Yes: Retest original system

No: Go to the next step



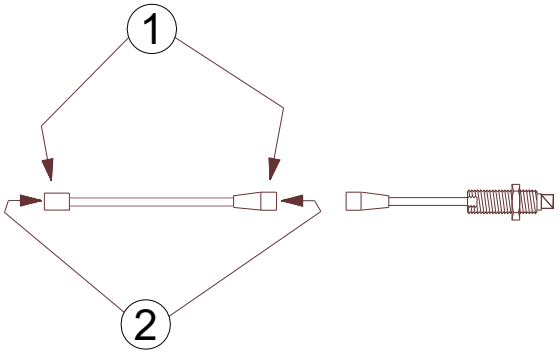
1. R_{PROBE}

Figure 3-13: Fault Type 3 Measurement 4

Measure resistance, R_{PROBE}: Is R_{PROBE} within specifications (see Table 4-1: Probe Nominal DC Resistance (R_{PROBE}) on page 31).

No: Faulty probe

Yes: Go to next step



1. R_{JACKET}
2. R_{CORE}

Figure 3-14: Fault Type 3 Measurement 5

Measure the resistance, R_{JACKET} and R_{CORE}: Is the resistance within specifications (see "Table 4-2: Extension Cable Nominal DC Resistance" on 32).

No: Faulty extension cable

Yes: Retest the original system

3.6 Fault Type 4: $V_{XDCR} < V_{SIG} < V_{XDCR} + 2.5$ Vdc

Possible causes:

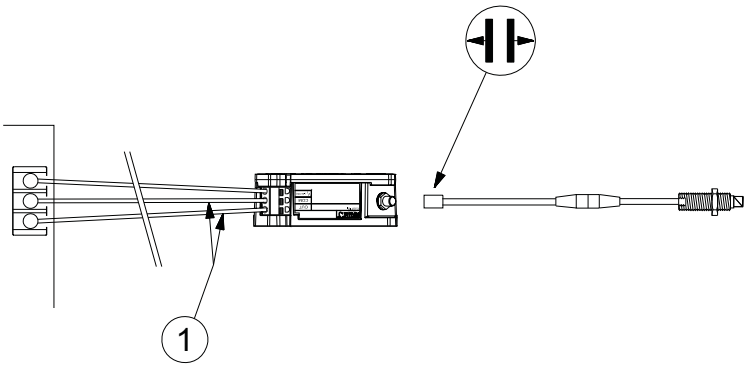
- Faulty Proximitor Sensor

- Probe is incorrectly gapped (too far from target)

Does fault condition type 1 exist?

Yes: Use the procedure for fault type 1

No: Go to the next step



1. V_{SIG}

Figure 3-15: Fault Type 4 Measurement

Measure V_{SIG}: Is $-1.2 < V_{SIG} < -0.3$ Vdc?

No: Faulty Proximitor sensor

Yes: Reconnect the system. Regap the probe. Retest the system.

3.7 Fault Type 5: $V_{SIG} = V_{XDCR}$

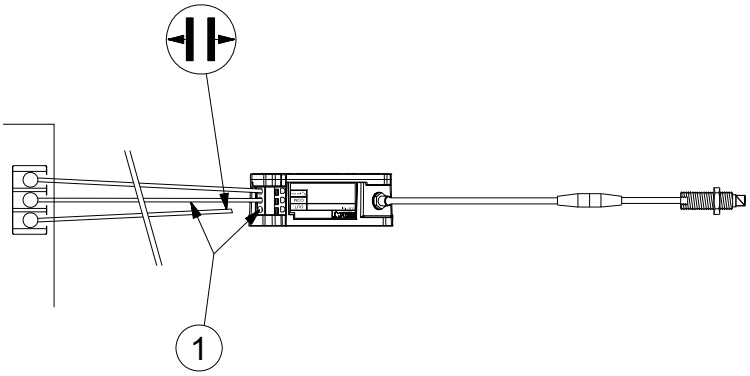
Possible causes:

- Incorrect power source voltage
- Faulty Proximitor Sensor
- Faulty field wiring (between Out and V_T)

Does fault condition type 1 exist?

Yes: Use the procedure for fault type 1

No: Go to the next step



1. V_{SIG}

Figure 3-16: Fault Type 5 Measurement

Measure V_{SIG}: Is $V_{SIG} = V_{XDCR}$?

Yes: Faulty Proximitor Sensor

No: Faulty field wiring (short between Out and V_T)

Bently Nevada LLC performs failure analysis on all returned transducers that are in warranty. We use the information gained during analysis of failed products to improve our current and future products. If you encounter a part that has failed, return the part with a brief description of the product application and symptoms observed to Bently Nevada headquarters in Minden, Nevada for analysis:

Bently Nevada LLC

Attn: Product Repair Department

1631 Bently Parkway South

Minden, Nevada 89423 USA

4. System Specifications

Unless otherwise noted, the following specifications are for a 3300 XL 8/5 mm Proximitor Sensor, extension cable and XL 8 mm or 3300 5 mm probe between +18 °C and +27 °C (+64 °F to +80 °F), with a -24 Vdc power supply, a 10 kΩ load, an AISI 4140 steel target, and a probe gapped at 1.27 mm (50 mils). Performance characteristics are applicable for systems that consist solely of 3300 XL 8 mm or 3300 5 mm components. The system accuracy and interchangeability specifications do not apply when using a transducer system calibrated to any target other than a Bently Nevada AISI 4140 steel target.

4.1 Electrical

Proximitor Sensor Input

Accepts one non-contacting 3300-series 5 mm, **or** 3300 XL 8 mm Proximity Probe and XL Extension Cable.

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

Table 4-1: Probe Nominal DC Resistance (R_{PROBE})

Probe Length (Meters)	**Resistance from the Center Conductor to the Outer Conductor** (R_{PROBE}) (ohms)
0.5	7.45 ± 0.50
1.0	7.59 ± 0.50
1.5	7.73 ± 0.50

Probe Length (Meters)	**Resistance from the Center Conductor to the Outer Conductor** (R_{PROBE}) (ohms)
2.0	7.88 ± 0.50
5.0	8.73 ± 0.70
9.0	9.87 ± 0.90

Table 4-2: Extension Cable Nominal DC Resistance

Length of Extension Cable (Meters)	**Resistance from Center Conductor to Center Conductor (R_{CORE}) (ohms)**	**Resistance from Outer Conductor to Outer Conductor (R_{JACKET}) (ohms)**
3.0	0.66 ± 0.10	0.20 ± 0.04
3.5	0.77 ± 0.12	0.23 ± 0.05
4.0	0.88 ± 0.13	0.26 ± 0.05
4.5	0.99 ± 0.15	0.30 ± 0.06
7.0	1.54 ± 0.23	0.46 ± 0.09
7.5	1.65 ± 0.25	0.49 ± 0.10
8.0	1.76 ± 0.26	0.53 ± 0.11
8.5	1.87 ± 0.28	0.56 ± 0.11

Extension cable capacitance

69.9 pF/m (21.3 pF/ft) typical

Field wiring

0.2 to 1.5 mm^2 (16 to 24 AWG). Recommend using three-conductor shielded triad cable. Maximum length of 305 metres (1,000 feet) between the 3300 XL Proximitor Sensor and the monitor. See the frequency and phase response graphs in Figure 6-11 through Figure 6-14 for signal roll off 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 to 2.3 mm (10 to 90 mils) (approximately –1 to –17 Vdc).

Recommended Gap Setting

1.27 mm (50 mils)

Incremental Scale Factor (ISF)

XL 8 mm standard 5- or 1-metre system

7.87 V/mm (200 mV/mil) ±5% including interchangeability error when measured in increments of 0.25 mm (10 mils) over the 80 mil linear range from 0 to +45 °C (+32 °F to +113 °F).

XL 8 mm standard 9-metre system

7.87 V/mm (200 mV/mil) ±6.5% including interchangeability error when measured in increments of 0.25 mm (10 mils) over the 80 mil linear range from 0 to +45 °C (+32 °F to +113 °F).

3300 5 mm standard 1-, 5- and 9-metre systems

7.87 V/mm (200 mV/mil) ±6.5% typical, including interchangeability error when measured in increments of 0.25 mm (10 mils) over the linear range.

Extended Temperature Range (ETR) 5 and 9 metre systems

7.87 V/mm (200 mV/mil) ±6.5% including interchangeability error when measured in increments of 0.25 mm (10 mils) over the 80 mil linear range from 0 to +45 °C (+32 °F to +113 °F).

Deviation from best fit straight line (DSL)

XL 8 mm standard 1 or 5metre system

Less than ±0.025mm (±1 mil) with components at 0 °C to +45 °C (+32 °F to +113 °F).

XL 8 mm standard 9metre system:

Less than ±0.038mm (±1.5 mil) with components at 0 °C to +45 °C (+32 °F to +113 °F).

3300 5 mm standard 1, 5 and 9metre systems

Less than ±0.038mm (±1.5 mil) with components at 18 °C to 27 °C (64 °F to 80 °F)

Extended Temperature Range 5 and 9metre systems

Less than ±0.038mm (±1.5 mil) with components at 0 °C to +45 °C (+32 °F to +113 °F).

XL 8 mm and 3300 5 mm standard 1- and 5-metre system performance over extended temperatures

Over a probe temperature range of –35 °C to +120 °C (-31 °F to +248 °F) with the Proximitor Sensor and extension cable between 0 °C to +45 °C (+32 °F to +113 °F), the ISF remains within ±10% of 7.87 V/mm (200 mV/mil) and the DSL remains within ±0.076 mm (±3 mils).

Over a Proximitor Sensor and extension cable temperature range of –35 °C to +65 °C (-31 °F to +149 °F) with the probe between 0 °C to +45 °C (+32 °F to +113 °F), the ISF remains

within ±10% of 7.87 V/mm (200 mV/mil) and the DSL remains within ±0.076 mm (±3 mils).

XL 8 mm and 3300 5 mm standard 9metre system performance over extended temperatures

Over a probe temperature range of –35 °C to +120 °C (-31 °F to +248 °F) with the Proximitor Sensor and extension cable between 0 °C to +45°C (+32 °F to +113 °F), the ISF remains within ±18% of 7.87 V/mm (200 mV/mil) and the DSL remains within ±0.152 mm (±6 mils).

Over a Proximitor Sensor and extension cable temperature range of –35 °C to +65 °C (-31 °F to +149 °F) with the probe between 0 °C to +45 °C (+32 °F to +113 °F), the ISF remains within ±18% of 7.87 V/mm (200 mV/mil) and the DSL remains within ±0.152 mm (±6 mils).

Extended Temperature Range system performance over extended temperatures

Over a probe and extension cable temperature range of –35 °C to + 260 °C (-31 °F to +500 °F) with the Proximitor Sensor between 0 °C to +45 °C (+32 °F to +113 °F), the ISF remains within ±18% of 7.87 V/mm (200 mV/mil) and the DSL remains within ±0.152 mm (±6 mils).

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

Measurements on shaft diameters smaller than 50 mm (2 in) usually require close spacing of radial vibration or axial position transducers with the potential for their electromagnetic emitted fields to interact with one another (cross-talk), resulting in erroneous readings. Take care 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. Radial vibration or position measurements on shaft diameters smaller than 76.2 mm (3 in) will generally change the scale factor.

Minimum

50.8 mm (2 in)

Recommended minimum

76.2 mm (3 in)

Effects of 60 Hz Magnetic Fields Up to 300 Gauss

See Table 4-3

Table 4-3: Output Voltages in mil pp/gauss

Gap	5-metre XL Proximitor Sensor	9-metre XL Proximitor Sensor	Probe	Ext. Cable
10 mil	0.0119	0.0247	0.0004	0.0004
50 mil	0.0131	0.0323	0.0014	0.0014
90 mil	0.0133	0.0348	0.0045	0.0045

Electrical Classification

Complies with the European CE mark.

Hazardous Area Approvals

NOTE
Multiple approvals for hazardous areas certified by Canadian Standards Association (CSA/NRTL/C) in North America and by Baseefa (2001) in Europe.

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.

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.

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 BAS99ATEX3100U,when installed per drawing 140979.

T5 @ Ta = -35 °C to +85 °C.

T4 @ Ta = -51 °C to +100 °C.

IEC Ex

3300 XL Proximitor Sensor, ia

IECEx BAS04.0055X

Ex ia IIC T4 / T5 (-51ºC ≤ Ta ≤ +100ºC / -35ºC ≤ Ta ≤ +85ºC)

Terminal Block Connections

Ui= -28V Ci = 0

Ii= 140mA Li =10µH

Pi= 0.84W

Coaxial Connection

Ui = -28V Ci= 5.7nF

Ii = 140mA Li = 0.85mH

Pi = 0.84W

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 following values in Table 4-4

Table 4-4: Proximitor Sensor 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

Installation of the XL Proximitor Sensor must minimize the risk of impact or friction with other metallic surfaces.

3300 XL Proximitor Sensor, nA

IECEx BAS04.0057X

AEx nA II T4 / T5 (-51ºC ≤ Ta ≤ +100ºC / -35ºC ≤ Ta ≤ +85ºC)

The terminals must be provided with a level of protection of at least IP54.

Ui = -28V

3300 XL 8mm and 3300 5 mm Eddy Current Probes, ia

IECEx BAS04.0056

AEx ia IIC Temperature Classification per Table 4-5.

Ui = -28V Ci = 1.5nF

Ii = 140mA Li = 200µH

Pi =0.84W

3300 XL 8mm and 3300 5mm Eddy Current Probes, nA

IECEx BAS04.0058X

Ex nA II Temperature Classification per Table 4-5.

Must be supplied from a voltage limited source.

EEx nA for Zone 2, Group IIC, EC certificate number BAS99ATEX3100U.

Table 4-5: Aex ia IIC Temperature Classification

Temperature Classification	Ambient Temperature (Probe Only)
T1	-51ºC to +232ºC
T2	-51ºC to +177ºC
T3	-51ºC to +120ºC
T4	-51ºC to +80ºC
T5	-51ºC to +40ºC

4.2 Mechanical

Probe Tip Material

Polyphenylene sulfide (PPS).

Probe Case Material

Forward Mount and Smooth Case Probes

AISI 304 stainless steel (SST)

Reverse Mount Probes

AISI 303 SST

Probe Cable Specifications

XL 8 mm standard cable

75 Ω triaxial, fluoroethylene propylene (FEP) insulated probe cable in the following total probe lengths: 0.5, 1, 1.5, 2, 5, or 9 metres.

3300 5 mm standard cable

75 Ω coaxial, fluoroethylene propylene (FEP) insulated probe cable in the following total probe lengths: 0.5, 1, 2, 5, or 9 metres.

Extended Temperature Range cable

75 Ω triaxial, perfluoroalkoxy (PFA) insulated probe cable in the following total probe lengths: 0.5, 1, 1.5, 2, 5, or 9 metres.

Extension Cable Material

75 Ω triaxial, fluoroethylene propylene (FEP) insulated.

Extended Temperature Range (ETR) Extension Cable Material

75 Ω triaxial, perfluoroalkoxy (PFA) insulated.

Proximitor Sensor Material

A380 aluminum

System Length

5 or 9 metres including extension cable, or 1 metre.

Standard Probe and Extension Cable Armor (optional)

Flexible AISI 302 or 304 SST with FEP outer jacket.

Extended Temperature Range Probe and Extension Cable Armor (optional)

Flexible AISI 302 or 304 SST with PFA outer jacket.

XL 8 mm and ETR Tensile Strength (maximum rated)

330 N (75 lbf) probe case to probe lead. 270 N (60 lbf) at probe lead to extension cable connectors.

3300 5 mm Tensile Strength (maximum rated)

220 N (50 lbf) probe case to probe lead. 220 N (50 lbf) probe lead to extension cable connectors.

Connector material

Gold-plated brass and gold-plated beryllium copper.

Table 4-6: Probe Case Torque Specifications

Probe case torque:	Maximum Rated	Recommended
Standard forward-mounted XL 8 mm probes (3/8-24, M10x1)	33.9 N•m (300 in•lbf)	11.2 N•m (100 in•lbf)
Standard forward-mounted 3300 probes (1/4-28, M8x1)	7.3 N•m (65 in•lbf)	5.1 N•m (45 in•lbf)
Standard forward-mount XL 8 mm probes - first three threads (3/8-24, M10x1)	22.6 N•m (200 in•lbf)	7.5 N•m (66 in•lbf)
Reverse mount probes	22.6 N•m (200 in•lbf)	7.5 N•m (66 in•lbf)

Connector-to-connector torque

See Table 4-7 for recommended torque.

Table 4-7: Recommended Connector-to-Connector Torque

Connector Type	Tightening Instructions
Two 3300 XL gold "click" type connectors	Finger tight
One non-XL stainless steel connector and one 3300 XL connector	Finger tight plus 1/8 turn using pliers

Maximum torque

0.565 N•m (5 in•lbf)

Minimum Bend Radius

25.4 mm (1.0 in)

Total System Mass (typical)

0.7 kg (1.5 lbm)

Probe

323 g (11.4 oz)

Extension Cable

34 g/m (0.4 oz/ft)

Armored Extension cable

103 g/m (1.5 oz/ft)

Proximitor Sensor

246 g (8.7 oz)

4.3 Environmental Limits

4.3.1 Probe Temperature Range

Operating and Storage Temperature

Standard probe

-51 °C to +177 °C (-60 °F to +351 °F)

Extended Temperature Range

Probe tip

-51 °C to +177 °C (-60 °F to +351 °F)

Probe cable and connector

-51 °C to +260 °C (-60 °F to +500 °F)

NOTE
Exposing the probe to temperatures below –34 °C (-30 °F) may cause premature failure of the pressure seal.

4.3.2 Extension Cable Temperature Range

Operating and Storage Temperature

Standard cable

-51 °C to +177 °C (-60 °F to +351 °F)

Extended Temperature Range cable

-51 °C to +260 °C (-60 °F to +500 °F)

4.3.3 Proximitor Sensor Temperature Range

Operating Temperature

-35 °C to +85 °C (-31 °F to +185 °F)

Storage Temperature

-51 °C to +100 °C (-60 °F to +212 °F)

Relative Humidity

Less than a 3% change in Average Scale Factor (ASF) when tested in 93% humidity in accordance with IEC standard 68-2-3 for up to 56 days.

Probe Pressure

3300 XL 8 mm and 3300 5 mm probes are designed to seal differential pressure between the probe tip and case. The probe sealing material consists of a Fluorocarbon O-ring. 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.

Application Advisory
It is the responsibility of the customer or user to ensure that all liquids and gases are contained and safely controlled should leakage occur from a proximity probe. In addition, solutions with high or low pH values may erode the tip assembly of the probe causing media leakage into surrounding areas. Bently Nevada®, LLC will not be held responsible for any damages resulting from leaking 3300 XL 8 mm or 3300 5 mm proximity probes. In addition, 3300 XL 8 mm or 3300 5 mm proximity probes will not be replaced under the service plan due to probe leakage.

4.4 Patents

Components or procedures described in one or more of the following patents apply to this product: 5,016,343; 5,126,664; 5,351,388; and 5,685,884.

5. System Ordering Information

5.1 3300 XL 8 mm Proximity Probes

3300 XL 8 mm Probe, 3/8-24 UNF thread, without armor[3]
330101-AXX-BXX-CXX-DXX-EXX

3300 XL 8 mm Probe, 3/8-24 UNF thread, with armor[3]
330102-AXX-BXX-CXX-DXX-EXX

A: Unthreaded Length Option

Order in increments of 0.1 in

Maximum unthreaded length: 8.8 in

Minimum unthreaded length: 0.0 in

Example: 0 4 = 0.4 in

NOTE
Unthreaded length must be at least 0.8 inches less than the case length.

.

B: Overall Case Length Option

Order in increments of 0.1 in

Maximum case length: 9.6 in

Minimum case length: 0.8 in

Example: 2 4 = 2.4 in

C: Total Length Option

0 5	0.5 metre (1.6 feet)
1 0	1.0 metre (3.3 feet)
1 5	1.5 metres (4.9 feet)
2 0	2.0 metres (6.6 feet)
5 0	5.0 metres (16.4 feet)[1]
9 0	9.0 metres (29.5 feet)

D: Connector and Cable-Type Option

0 1	Miniature coaxial ClickLoc™ connector with connector protector, standard cable
0 2	Miniature coaxial ClickLoc connector, standard cable
1 1	Miniature coaxial ClickLoc connector with connector protector, FluidLoc® cable

1 2 Miniature coaxial ClickLoc connector, FluidLoc cable

E: Agency Approval Option

0 0 Not required

0 5 Multiple Approvals

5.2 3300 XL 8 mm Proximity Probes, Metric

3300 XL 8 mm Probe, M10 x 1 thread, without armor[3]
330103-AXX-BXX-CXX-DXX-EXX

3300 XL 8 mm Probe, M10 x 1 thread, with armor[3]
330104-AXX-BXX-CXX-DXX-EXX

A: Unthreaded Length Option

Order in increments of 10 mm.

Maximum unthreaded length: 230 mm

Minimum unthreaded length: 0 mm

Example: 0 6 = 60 mm

NOTE
Unthreaded length must be at least 20 mm less than the case length.

B: Overall Case Length Option

Order in increments of 10 mm.

Maximum length: 250 mm

Minimum length: 20 mm

Example: 0 6 = 60 mm

C: Total Length Option

0 5 0.5 metre (1.6 feet)

1 0 1.0 metre (3.3 feet)

1 5 1.5 metres (4.9 feet)

2 0 2.0 metres (6.6 feet)

5 0 5.0 metres (16.4 feet) [1]

9 0 9.0 metres (29.5 feet)

D: Connector and Cable-Type Option

0 1 Miniature coaxial ClickLoc connector with connector protector, standard cable

0 2 Miniature coaxial ClickLoc connector, standard cable

1 1 Miniature coaxial ClickLoc connector with connector protector, FluidLoc cable

1 2 Miniature coaxial ClickLoc connector, FluidLoc cable

E: Agency Approval Option

0 0 Not required

0 5 Multiple Approvals

5.3 3300 XL 8 mm Reverse Mount Probes

3/8-24 UNF Threads[3]
330105-02-12-CXX-DXX-EXX

M10 x 1 Threads[3]
330106-05-30-CXX-DXX-EXX

C: Total Length Option

0 5 0.5 metre (1.6 feet)

1 0 1.0 metre (3.3 feet)

1 5 1.5 metre (4.9 feet)

2 0 2.0 metres (6.6 feet)

5 0 5.0 metres (16.4 feet) [1]

9 0 9.0 metres (29.5 feet)

D: Connector Option

0 2 Miniature ClickLoc coaxial connector

1 2 Miniature ClickLoc coaxial connector, FluidLoc cable

NOTE
The FluidLoc cable options –10 and –12 are not necessary on the vast majority of 330105 and 330106 installations due to the presence of the probe sleeve. Consider carefully the application before ordering the FluidLoc cable options

E: Agency Approval Option

0 0 Not required

0 5 Multiple Approvals

5.4 3300 XL 8 mm Proximity Probes, Smooth Case

3300 XL 8 mm Probe without armor[2]
330140-AXX-BXX-CXX-DXX

3300 XL 8 mm Probe with armor[2]
330141-AXX-BXX-CXX-DXX

A: Overall Case Length Option

Order in increments of 0.1 in

Maximum length: 9.6 in

Minimum length: 0.8 in

Example: 2 4 = 2.4 in

B: Total Length Option

0 5	0.5 metre (1.6 feet)
1 0	1.0 metre (3.3 feet)
1 5	1.5 metres (4.9 feet)
2 0	2.0 metres (6.6 feet)
5 0	5.0 metres (16.4 feet) [1]
9 0	9.0 metres (29.5 feet)

C: Connector and Cable-Type Option

0 1	Miniature coaxial ClickLoc connector with connector protector, standard cable
0 2	Miniature coaxial ClickLoc connector, standard cable
1 1	Miniature coaxial ClickLoc connector with connector protector, FluidLoc cable
1 2	Miniature coaxial ClickLoc connector, FluidLoc cable

D: Agency Approval Option

0 0	Not required
0 5	Multiple Approvals

5.5 3300 XL 8 mm Extended Temperature Range (ETR) Proximity Probes

3300 XL 8 mm ETR Probe, 3/8-24 UNF thread, without armor
330191-AXX-BXX-CXX-DXX

3300 XL 8 mm ETR Probe, 3/8-24 UNF thread, with armor
330192-AXX-BXX-CXX-DXX

A: Unthreaded Length Option

Order in increments of 0.1 in

Maximum unthreaded length: 8.8 in

Minimum unthreaded length: 0.0 in

Example: 1 5 = 1.5 in

NOTE
Unthreaded length must be at least 0.8 inches less than the case length.

B: Overall Case Length Option

Order in increments of 0.1 in

Maximum case length: 9.6 in

Minimum case length: 0.8 in

Example: 2 5 = 2.5 in

C: Total Length Option

0 5 0.5 metre (1.6 feet)

1 0 1.0 metre (3.3 feet)

1 5 1.5 metre (4.9 feet)

2 0 2.0 metres (6.6 feet)

5 0 5.0 metres (16.4 feet)[1]

9 0 9.0 metres (29.5 feet)

D: Agency Approval Option

0 0 Not required

0 5 Multiple Approvals

5.6 3300 XL 8 mm Extended Temperature Range (ETR) Proximity Probes, Metric

3300 XL 8 mm Probe, M10 x 1 thread, without armor
330193-AXX-BXX-CXX-DXX

3300 XL 8 mm Probe, M10 x 1 thread, with armor
330194-AXX-BXX-CXX-DXX

A: Unthreaded Length Option

Order in increments of 10 mm.

Maximum unthreaded length: 230 mm

Minimum unthreaded length: 0 mm

Example: 0 6 = 60 mm

NOTE
Unthreaded length must be at least 20 mm less than the case length.

B: Overall Case Length Option

Order in increments of 10 mm.

Maximum length: 250 mm

Minimum length: 20 mm

Example: 0 6 = 60 mm

C: Total Length Option

0 5 0.5 metre (1.6 feet)

1 0 1.0 metre (3.3 feet)

1 5 1.5 metres (4.9 feet)

2 0 2.0 metres (6.6 feet)

5 0 5.0 metres (16.4 feet) [1]

9 0 9.0 metres (29.5 feet)

D: Agency Approval Option

0 0 Not required

0 5 Multiple Approvals

5.7 3300 XL 8 mm Extended Temperature Range (ETR) Reverse Mount Probes

3/8-24 UNF Threads
330195-02-12-CXX-DXX

M10 x 1 Threads
330196-05-30-CXX-DXX

C: Total Length Option

0 5 0.5 metre (1.6 feet)

1 0 1.0 metre (3.3 feet)

1 5 1.5 metre (4.9 feet)

2 0 2.0 metres (6.6 feet)

5 0 5.0 metres (16.4 feet) [1]

9 0 9.0 metres (29.5 feet)

D: Agency Approval Option

0 0 Not required

0 5 Multiple Approvals

5.8 3300 XL 8 mm Extended Temperature Range (ETR) Proximity Probes, Smooth Case

3300 XL 8 mm Probe without armor[2]
330197-AXX-BXX-CXX

3300 XL 8 mm Probe with armor[2]
330198-AXX-BXX-CXX

A: Overall Case Length Option

Order in increments of 0.1 in

Maximum length: 9.6 in

Minimum length: 0.8 in

Example: 3 5 = 3.5 in

B: Total Length Option

0 5	0.5 metre (1.6 feet)
1 0	1.0 metre (3.3 feet)
1 5	1.5 metres (4.9 feet)
2 0	2.0 metres (6.6 feet)
5 0	5.0 metres (16.4 feet) [1]
9 0	9.0 metres (29.5 feet)

C: Agency Approval Option

0 0	Not required
0 5	Multiple Approvals

5.9 3300 5 mm Proximity Probes

3300 5 mm Probe, 1/4-28 UNF thread, without armor
330171-AXX-BXX-CXX-DXX-EXX

3300 5 mm Probe, 1/4-28 UNF thread, with armor
330172-AXX-BXX-CXX-DXX-EXX

A: Unthreaded Length Option

Order in increments of 0.1 in

Maximum unthreaded length: 8.8 in

Minimum unthreaded length: 0.0 in

Example: 0 4 = 0.4 in

NOTE
Unthreaded length must be at least 0.8 inches less than the case length.

B: Overall Case Length Option

Order in increments of 0.1 in

Maximum case length: 9.6 in

Minimum case length: 0.8 in

Example: 2 4 = 2.4 in

C: Total Length Option

0 5 0.5 metre (1.6 feet)

1 0 1.0 metre (3.3 feet)

2 0 2.0 metres (6.6 feet)

5 0 5.0 metres (16.4 feet)[1]

9 0 9.0 metres (29.5 feet)

D: Connector and Cable-Type Option

0 1 Miniature coaxial ClickLoc connector with connector protector, standard cable

0 2 Miniature coaxial ClickLoc connector, standard cable

E: Agency Approval Option

0 0 Not required

0 5 Multiple Approvals

5.10 3300 5 mm Proximity Probes, Metric

3300 5 mm Probe, M8 x 1 thread, without armor
330173-AXX-BXX-CXX-DXX-EXX

3300 5 mm Probe, M8 x 1 thread, with armor
330174-AXX-BXX-CXX-DXX-EXX

A: Unthreaded Length Option

Order in increments of 10 mm.

Length configuration:

Maximum unthreaded length: 230 mm

Minimum unthreaded length: 0 mm

Example: 0 6 = 60 mm

NOTE
Unthreaded length must be at least 20 mm less than the case length.

B: Overall Case Length Option

Order in increments of 10 mm.

Maximum length: 250 mm

Minimum length: 20 mm

Example: 0 6 = 60 mm

C: Total Length Option

0 5 0.5 metre (1.6 feet)

1 0 1.0 metre (3.3 feet)

2 0 2.0 metres (6.6 feet)

5 0 5.0 metres (16.4 feet) [1]

9 0 9.0 metres (29.5 feet)

D: Connector and Cable-Type Option

0 1 Miniature coaxial ClickLoc connector with connector protector, standard cable

0 2 Miniature coaxial ClickLoc connector, standard cable

E: Agency Approval Option

0 0 Not required

0 5 Multiple Approvals

5.11 3300 XL Proximitor Sensor

330180-AXX-BXX

A: Total Length and Mounting Option

1 0 1.0 metre (3.3 feet) system length, panel mount

1 1 1.0 metre (3.3 feet) system length, DIN mount

1 2 1.0 metre (3.3 feet) system length, no mounting hardware

5 0 5.0 metres (16.4 feet) system length, panel mount

5 1 5.0 metres (16.4 feet) system length, DIN mount

5 2 5.0 metres (16.4 feet) system length, no mounting hardware

9 0 9.0 metres (29.5 feet) system length, panel mount

9 1 9.0 metres (29.5 feet) system length, DIN mount

9 2 9.0 metres (29.5 feet) system length, no mounting hardware

B: Agency Approval Option

0 0 Not required

0 5 Multiple approvals

5.12 3300 XL Extension Cable

330130-AXXX-BXX-CXX

NOTE
Make sure that the extension cable length and the probe length, when added together, equal the Proximitor Sensor total length.

Option Descriptions

A: Cable Length Option

0 3 0 3.0 metres (9.8 feet)

0 3 5 3.5 metres (11.5 feet)

0 4 0 4.0 metres (13.1 feet)

0 4 5 4.5 metres (14.8 feet)

0 7 0 7.0 metres (22.9 feet)

0 7 5 7.5 metres (24.6 feet)

0 8 0 8.0 metres (26.2 feet)

0 8 5 8.5 metres (27.9 feet)

B: Connector Protector and Cable Option

0 0 Standard cable

0 1 Armored cable

0 2 Standard cable with connector protectors

0 3 Armored cable with connector protectors

1 0 FluidLoc cable

1 1 Armored FluidLoc cable

1 2 FluidLoc cable with connector protectors

1 3 Armored FluidLoc cable with connector protectors

C: Agency Approval Option

0 0 Not required

0 5 Multiple Approvals

5.13 3300 XL Extended Temperature Range (ETR) Extension Cable

330190-AXXX-BXX-CXX

NOTE
Make sure that the extension cable length and the probe length, when added together, equal the Proximitor Sensor total length.

A: Cable Length Option

- **0 3 0** 3.0 metres (9.8 feet)
- **0 3 5** 3.5 metres (11.5 feet)
- **0 4 0** 4.0 metres (13.1 feet)
- **0 4 5** 4.5 metres (14.8 feet)
- **0 7 0** 7.0 metres (22.9 feet)
- **0 7 5** 7.5 metres (24.6 feet)
- **0 8 0** 8.0 metres (26.2 feet)
- **0 8 5** 8.5 metres (27.9 feet)

B: Cable Option

- **0 0** Standard cable
- **0 1** Armored cable

C: Agency Approval Option

- **0 0** Not required
- **0 5** Multiple Approvals

5.14 Mounting Brackets

5.14.1 Aluminum Probe Clamp Bracket

The aluminum clamp bracket is an unthreaded mounting bracket designed for use with the smooth case probes (330140, 330141, 330197 and 330198). After gapping the probe, tighten the clamp bracket by tightening the screws. The mounting screws have pre-drilled holes for safety wire.

Order Number 137491-AXX

A: Mounting Screw Option

- **0 1** 10-24 UNC-2A mounting screws

0 2 M5 x 0.8-6g mounting screws

5.14.2 Aluminum probe threaded mounting bracket

The aluminum probe threaded mounting bracket is the standard mounting bracket for most 3300 and 3300 XL probe installations. The -01 and -02 options are supplied with two 10-24 UNC-2A mounting screws. The -03 and -04 options are supplied with two M5 x 0.8-6g mounting screws. The mounting screws have pre-drilled holes for safety wire.

Order Number 137492-AXX

A: Thread Size

0 1 3/8-24

0 2 1/4-28

0 3 M8 x 1

0 4 M10 x 1

5.14.3 Phenolic threaded probe mounting bracket

We recommend the phenolic threaded mounting bracket if your installation requires additional electric isolation from the mounting location (as in some generator and electrical motor bearing locations). The -01 and –02 options are supplied with two 10-24 UNC-2A mounting screws. The -03 and -04 options are supplied with two M5 x 0.8-6g mounting screws. The mounting screws have pre-drilled holes for safety wire.

Order Number 27474-AXX

A: Thread Size

0 1 3/8-24

0 2 1/4-28

0 3 M8 x 1

0 4 M10 x 1

5.15 Accessories

141078-01

Manual

175751

3300XL Multi-Purpose Stainless Steel Housing.
12”x12”x6”

176467

3300XL Multi-Purpose Stainless Steel Housing.
12”x8”x6”

02120015

Bulk field wire. 1.0 mm^2 (18 AWG), 3 conductor, twisted, shielded cable with drain wire. Specify length in feet.

138492-01

Replacement panel-mount mounting pad.

138493-01

Replacement DIN-mount mounting pad.

148722-01

3300 XL Test Plug. The 3300 XL Test Plug is contains three small test pins attached to three color-coded wires 1 metre in length, each terminated in a banana plug. The three-pin adapter plugs into the test pin holes on 3300 XL-style Proximitor Sensors. It is used to check the performance of the Proximitor Sensor from the test pin holes in the terminal strip without requiring the removal of the field wiring.

04310310

3300 XL Proximitor Sensor Panel-mount Screw. Package includes one 6-32 UNC thread forming mounting screw. (Supplied standard with 3300 XL Multi-Purpose housings when panel mount transducer option is ordered).

03200006

Silicone self-fusing tape. A 9.1 metre (10 yard) roll of silicone tape to protect connectors. It is easy to install and provides excellent electrical isolation and protection from the environment. It is not recommended for use inside the casing of the machine.

40113-02

Standard Connector Protector Kit. Connector Protector Kit for 3300 XL 8 mm probes and extension cables, including connector protectors and installation tools.

40113-03

5 mm/NSv Connector Protector Kit. Connector Protector Kit for 3300 5 mm probes, including connector protectors and installation tools.

136536-01

Connector Protector Adapter. Allows connector protector installation tools manufactured prior to 1998 to be used with 75 Ω ClickLoc connectors.

40180-02

Standard Connector Protectors. Package contains 10 pairs of connector protectors for 3300 XL 8 mm probes and 3300 XL extension cables.

40180-03

5 mm/NSv Connector Protectors. Package contains 10 pairs of connector protectors for 3300 5 mm probes.

03839410

Standard Connector Protector - Male. Male connector protectors are installed onto the 3300 XL extension cable and attach to the female connector protector on the probe, providing environmental protection of connectors.

03839420

Standard Connector Protector - Female. Female connector protectors are installed onto the 3300 XL probe lead and attach to the male connector protector on the 3300 XL extension cable, providing environmental protection of connectors. Also placed on the 3300 XL extension cable to slide over the connection to the Proximitor® Sensor and protect it from the environment.

03800001

5mm/NSv Connector Protector - Female. Placed onto 3300 5 mm probe leads; attaches to the male connector protector on the extension cable to provide environmental protection of connectors.

04301007

3/8-24 Probe Lock Nut with safety wire holes. Single probe lock nut with two holes drilled through the nut in order to secure the lock nut in place with safety wire.

04301008

M10 x 1 Probe Lock Nut with safety wire holes. Single probe lock nut with two holes drilled through the nut in order to secure the lock nut in place with safety wire.

330153-01

3300 XL Connector Kit. Used on 3300 XL 8 mm probes and 3300 XL extension cables. Contains one pair of male and female ClickLoc connectors, two color-coded sleeves, two pieces of slit FEP tubing, and one strip of silicone tape.

330153-04

3300 5 mm Connector Kit. Used on 3300 5 mm probes. Contains one male ClickLoc connector, one color-coded sleeve, one piece of slit FEP tubing, and one strip of silicone tape.

330153-09

3300 XL ETR Connector Kit. Used on ETR 3300 XL 8 mm probes and 3300 ETR XL extension cables. Contains one pair of male and female ClickLoc connectors, two color-coded sleeves, two pieces of high temperature slit FEP tubing, and one strip of silicone tape.

163356

Connector Crimp Tool Kit. Includes one set of multiconnector inserts and connector installation instructions. Compatible only with 330153 connector kits or with probes shipped in 2003 or later with ClickLoc connectors uninstalled. Supplied with carrying case.

Notes:

1. 5-metre probes are designed for use with the 5-metre Proximitor Sensor only.
2. Mounting clamps must be ordered separately for 330140, 330141, 330197, and 330198.
3. For a shorter delivery time, order commonly stocked probes. Currently, stocked probes consist of the following part numbers:

   330101-00-08-05-02-00, 330101-00-08-05-02-05, 330101-00-08-10-02-00, 330101-00-08-10-02-05, 330101-00-12-10-02-00, 330101-00-12-10-02-05, 330101-00-16-10-02-00, 330101-00-16-10-02-05, 330101-00-20-05-02-00, 330101-00-20-10-02-00, 330101-00-20-10-02-05, 330101-00-30-10-02-00, 330101-00-30-10-02-05, 330101-00-40-05-02-00, 330101-00-40-10-02-00, 330101-00-40-10-02-05, 330101-00-60-10-02-00, 330101-00-60-10-02-05, 330102-00-20-10-02-00, 330103-00-02-10-02-05, 330103-00-03-10-02-05, 330103-00-04-10-02-00, 330103-00-04-50-02-00, 330103-00-05-10-02-00, 330103-00-06-10-02-00, 330104-00-06-10-02-00, 330104-01-05-50-02-00, 330105-02-12-05-02-00, 330105-02-12-05-02-05, 330105-02-12-10-02-00, 330105-02-12-10-02-05, 330106-05-30-05-02-00, 330106-05-30-05-02-05, 330106-05-30-10-02-00 and 330106-05-30-10-02-05.

6. System Graphs and Dimensional Drawings

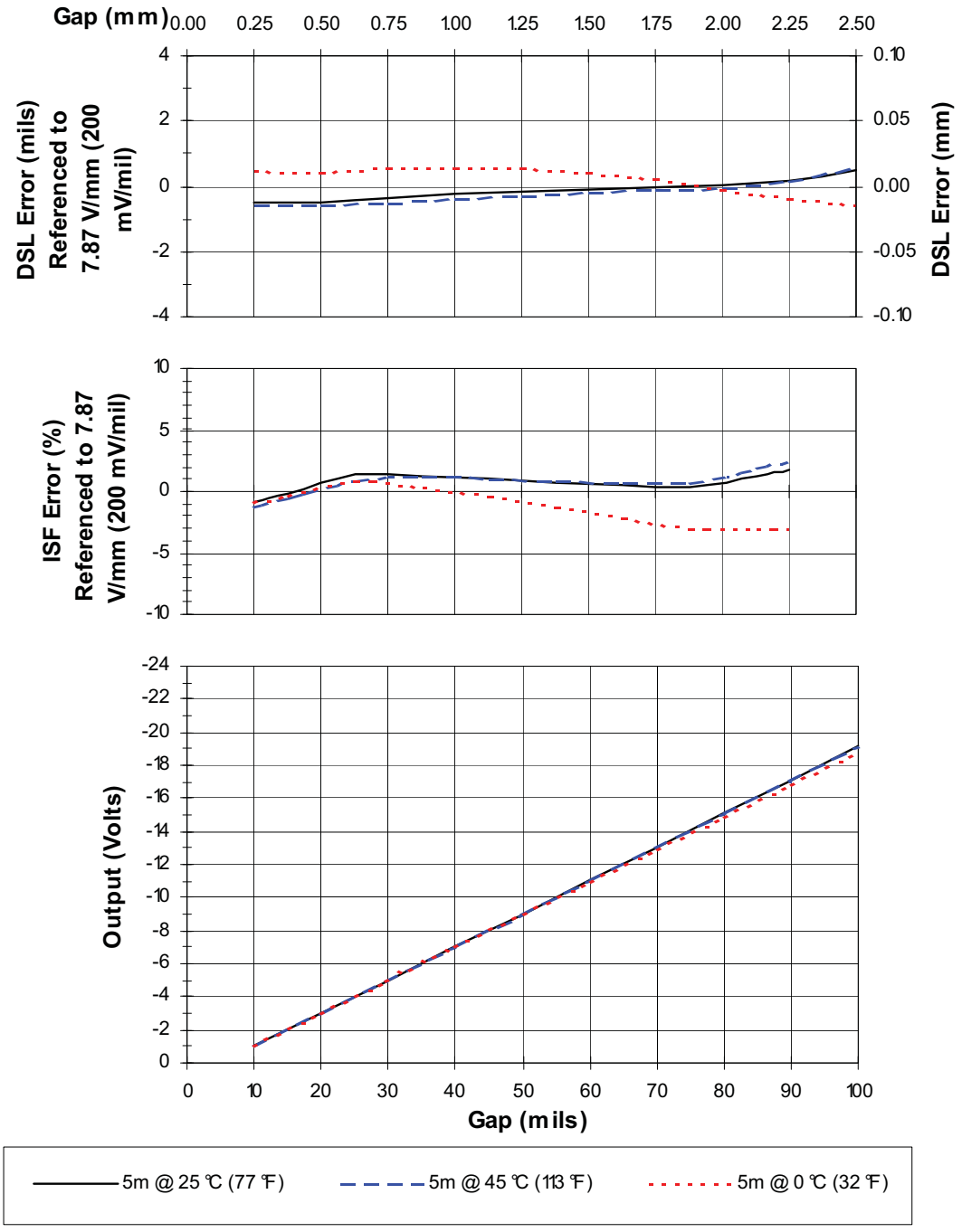


Figure 6-1: Typical 3300 XL 8mm 5m or 1m System over API 670 Testing Range

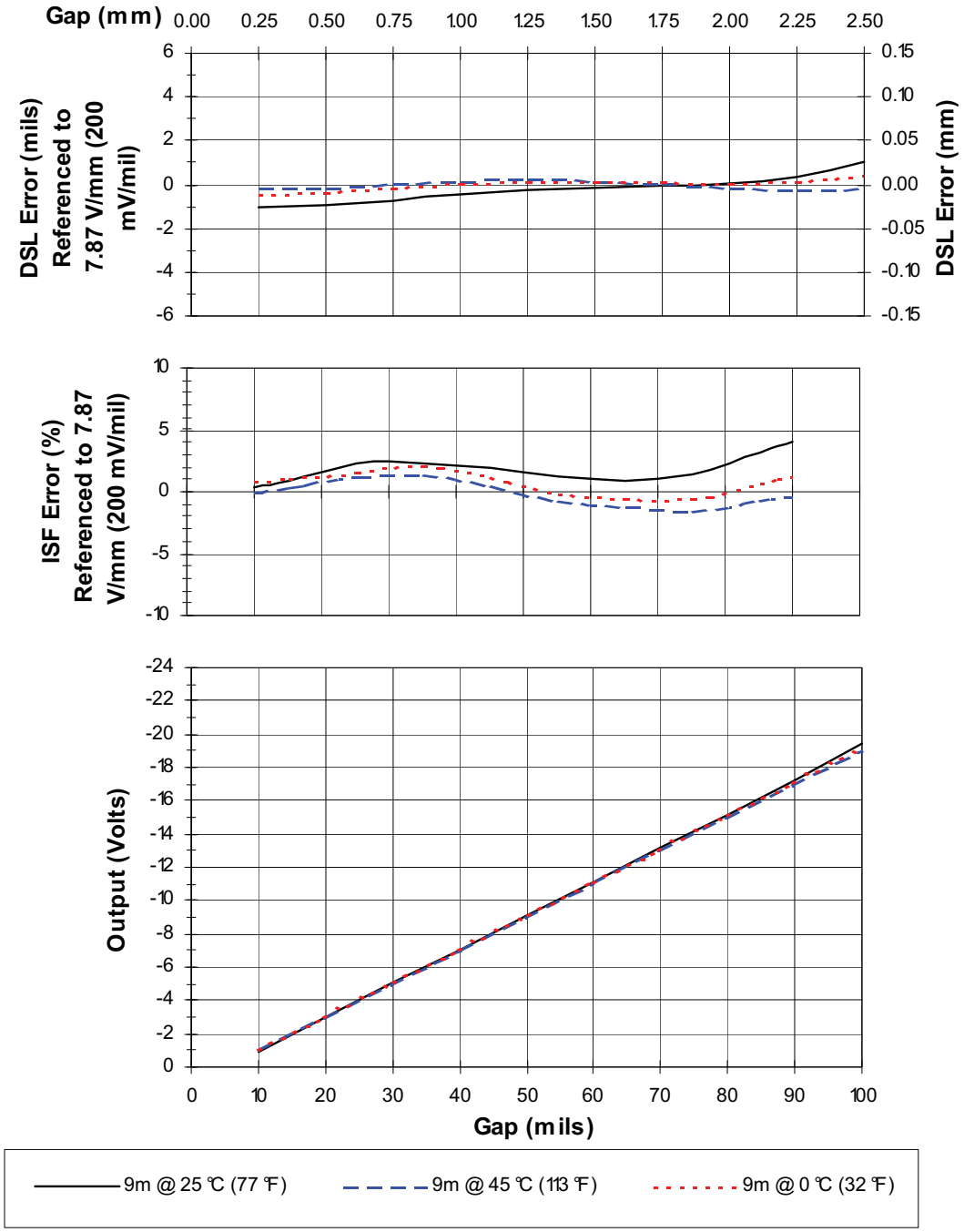


Figure 6-2: Typical 3300 XL 8mm 9m System over API 670 Testing Range

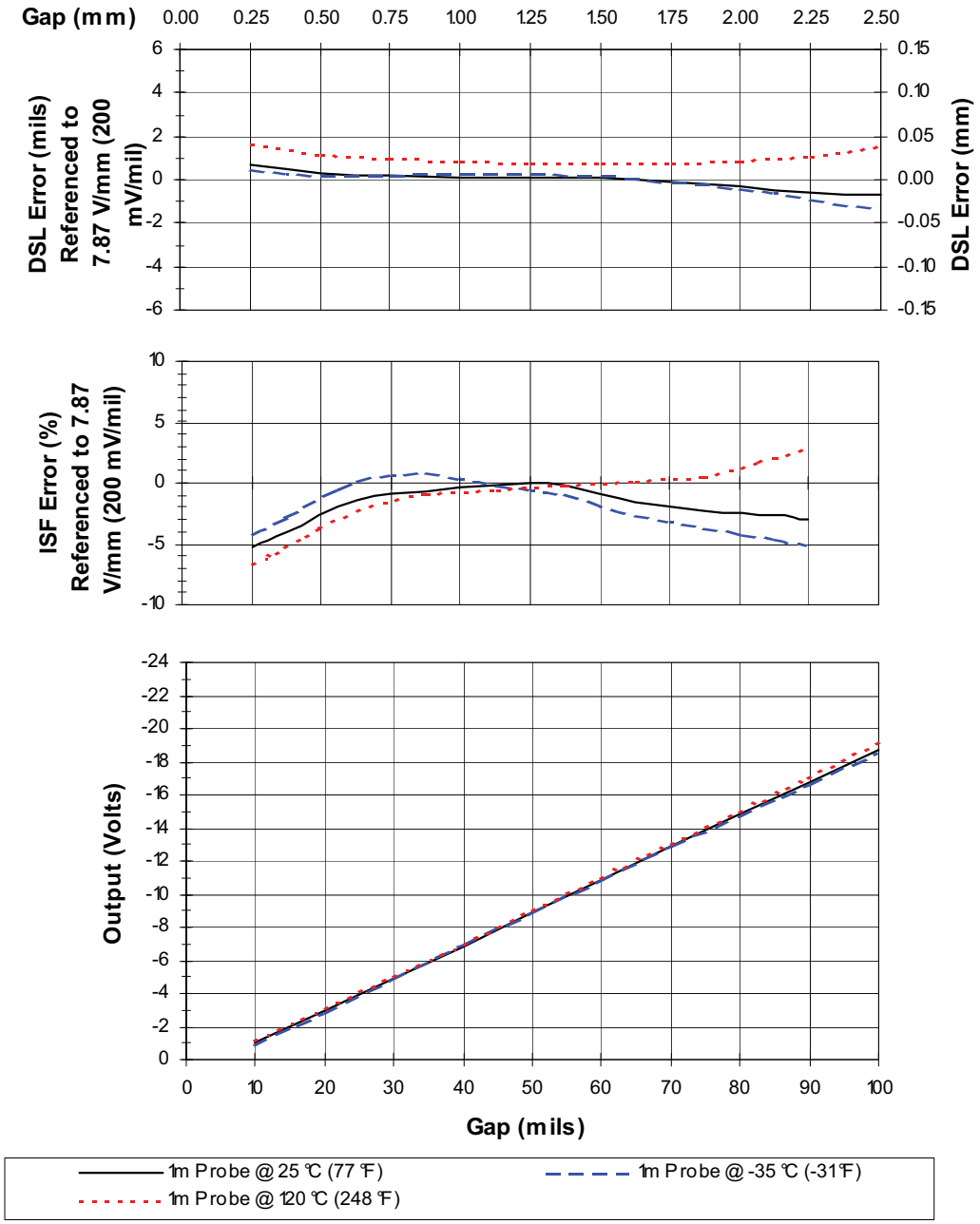


Figure 6-3: Typical 3300 XL 8mm Probe over API 670 Operating Range

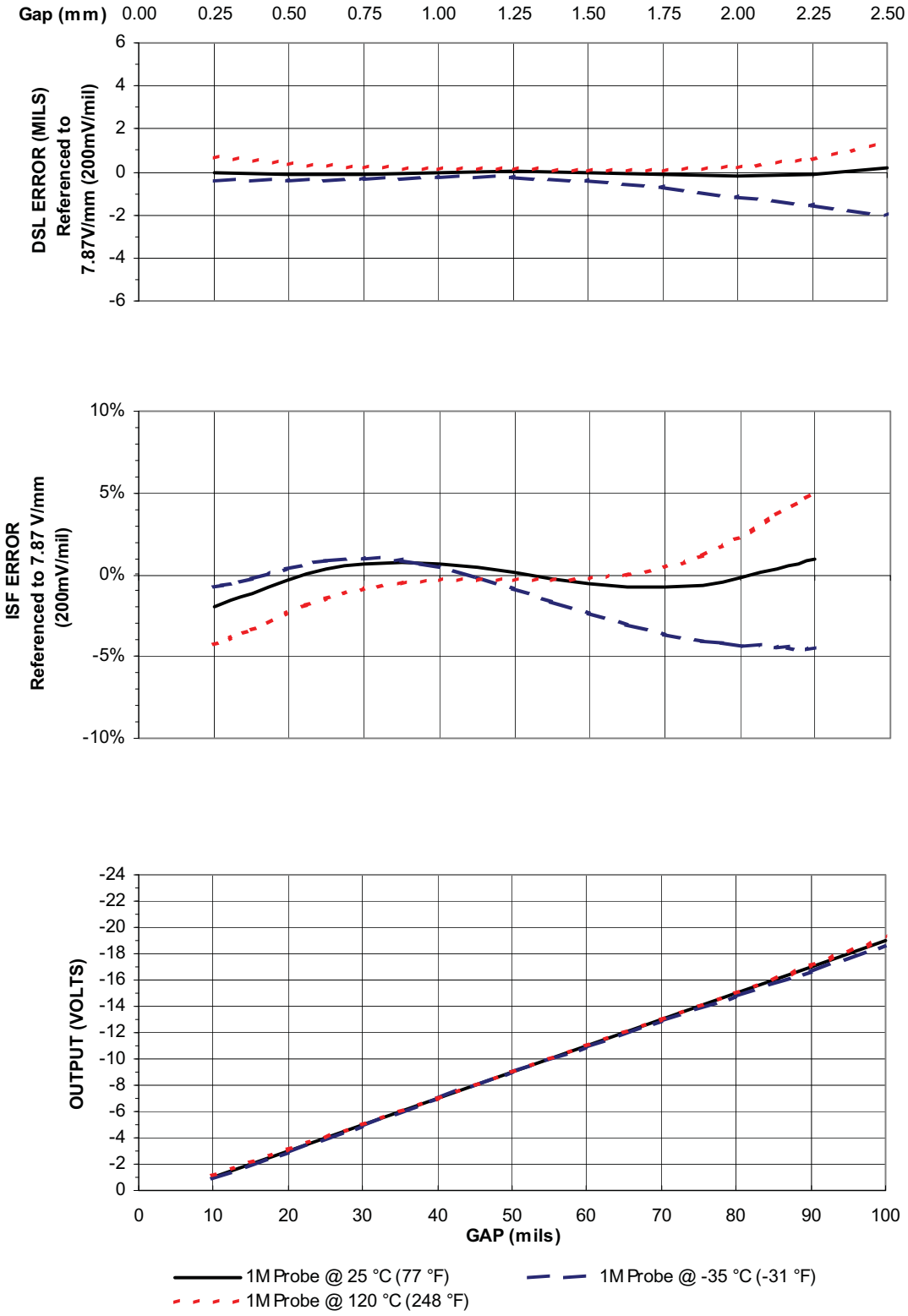


Figure 6-4: Typical 3300 5mm Probe over API 670 Operating Range

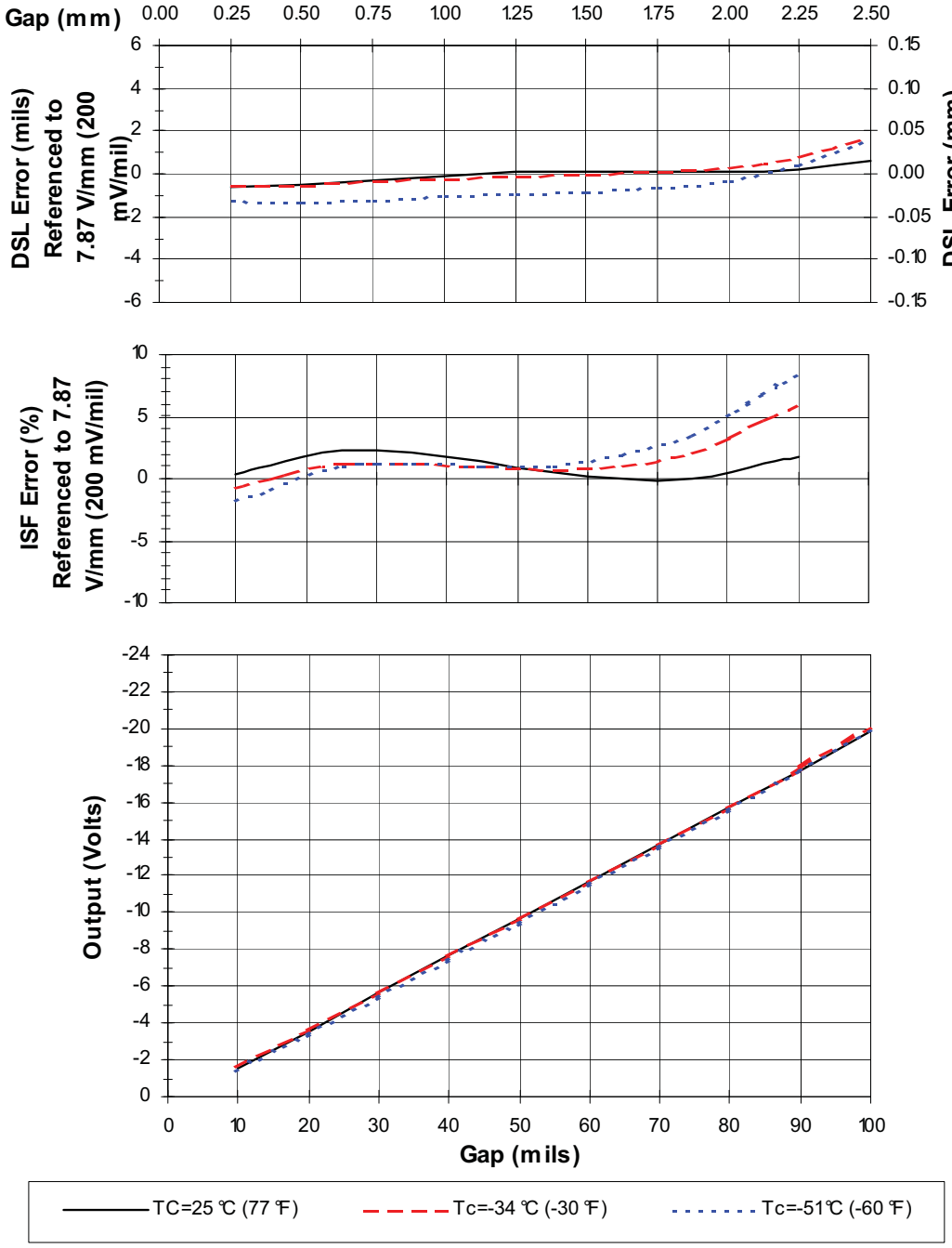


Figure 6-5: Typical 3300 XL 8mm 5m Proximitor Sensor with 4m Extension Cable @ Tc (Probe is at 25 °C)

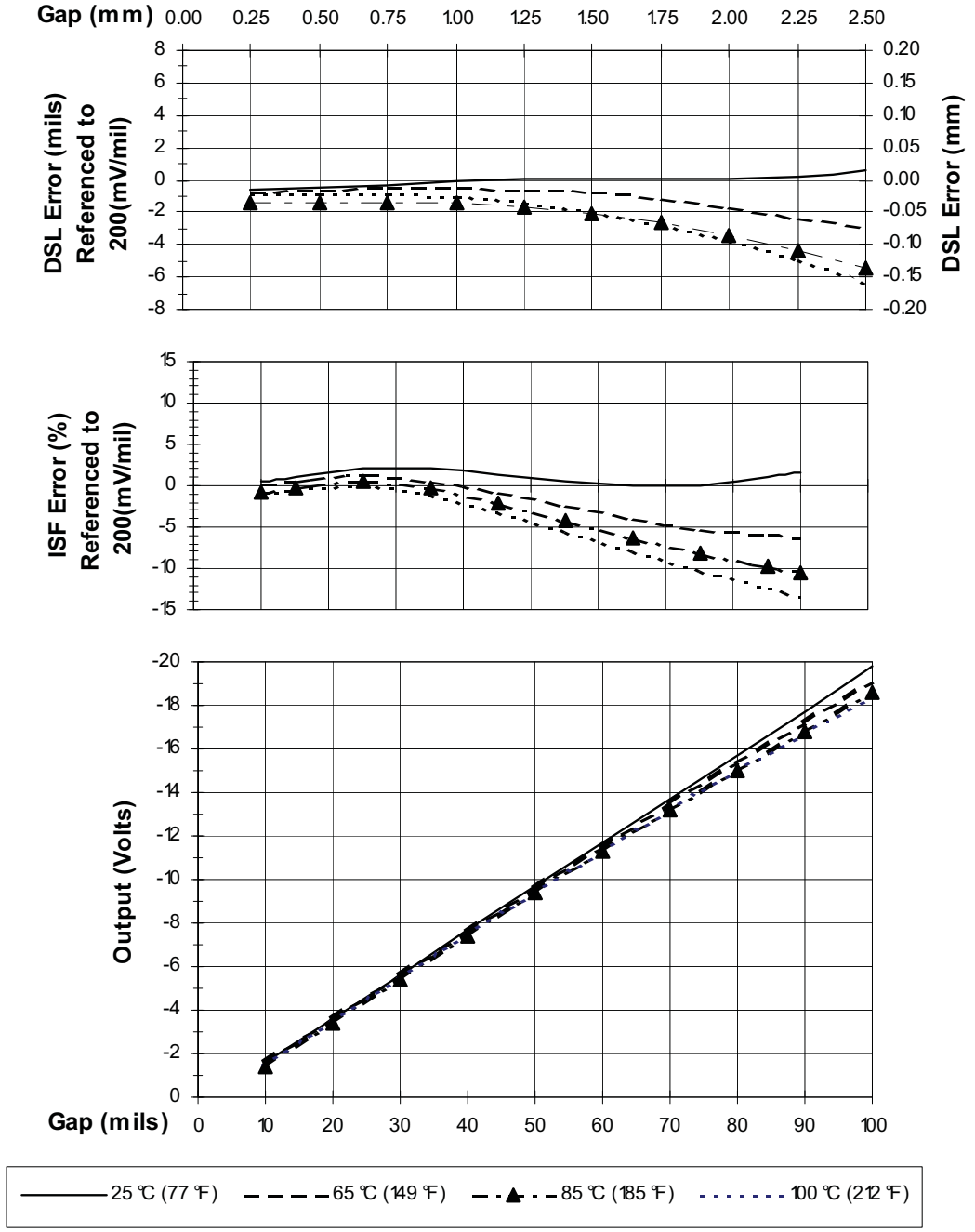


Figure 6-6: Typical 3300 XL 8mm 5m Proximitor Sensor with 4m Extension Cable @ Th (Probe is at 25°C)

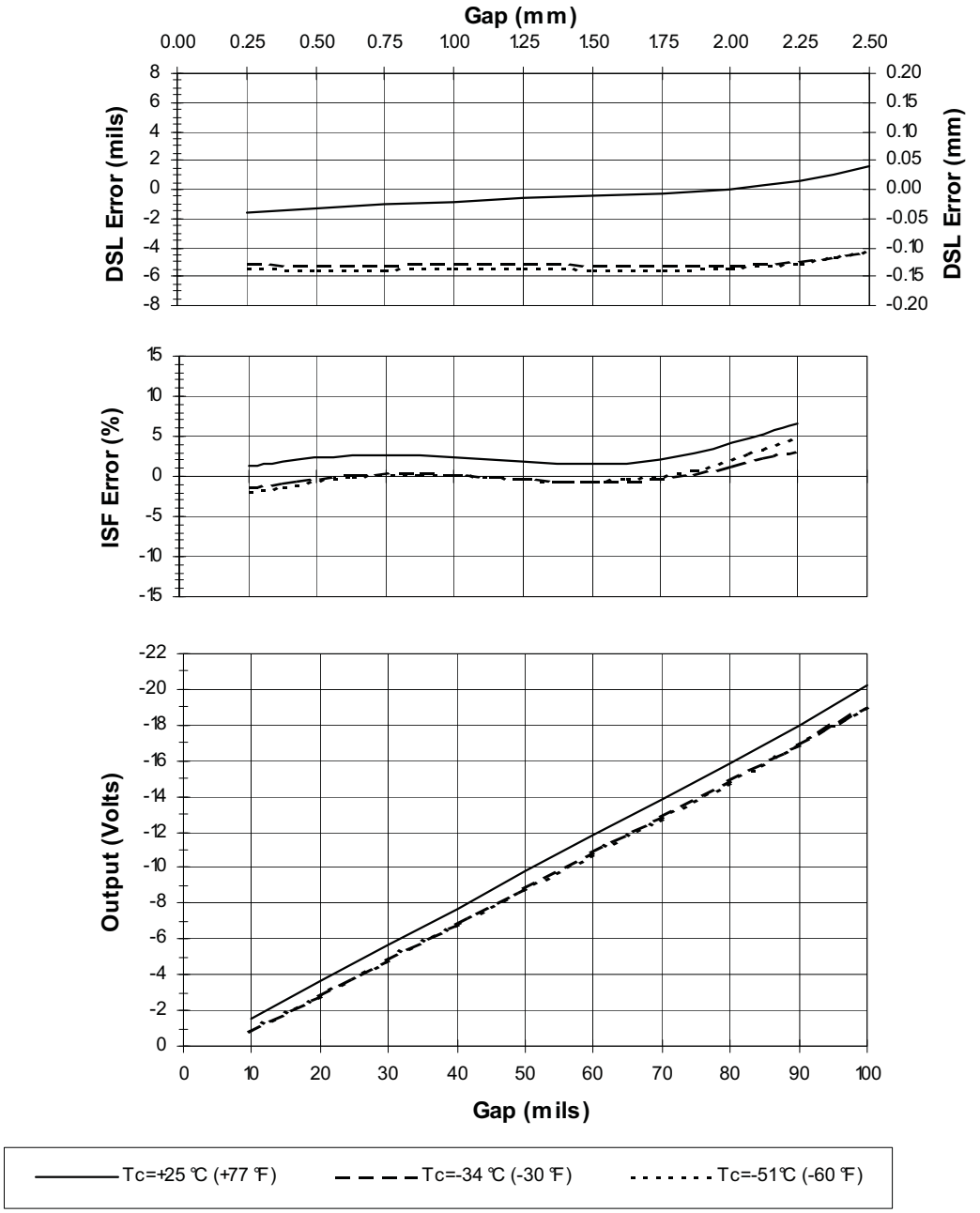


Figure 6-7: Typical 3300 XL 8mm 9m Proximitor Sensor with 8m Extension Cable @ Tc (Probe is at 25 °C)

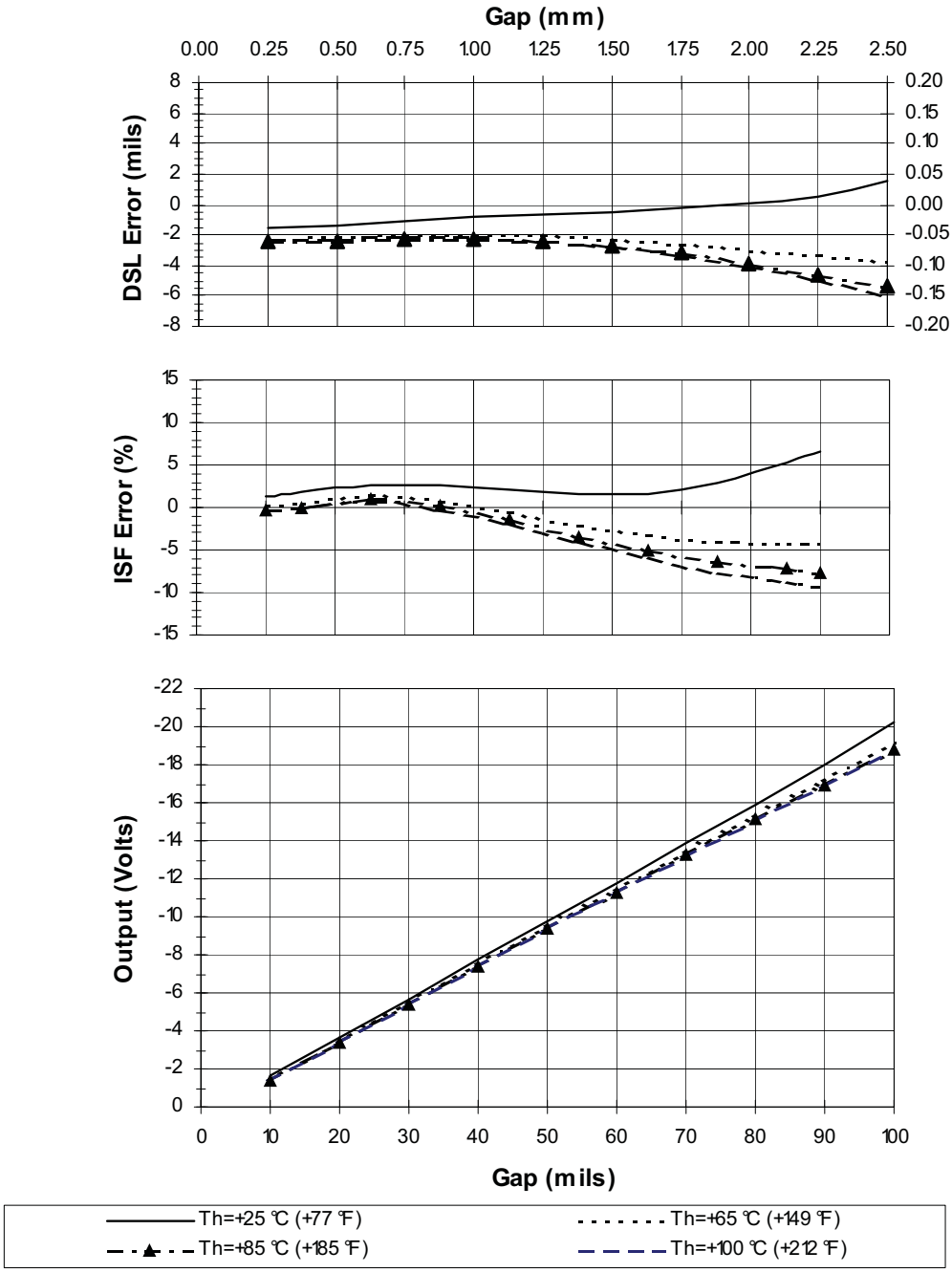


Figure 6-8: Typical 3300 XL 8mm 9m Proximitor Sensor with 8m Extension Cable @ Th (Probe is at 25 °C)

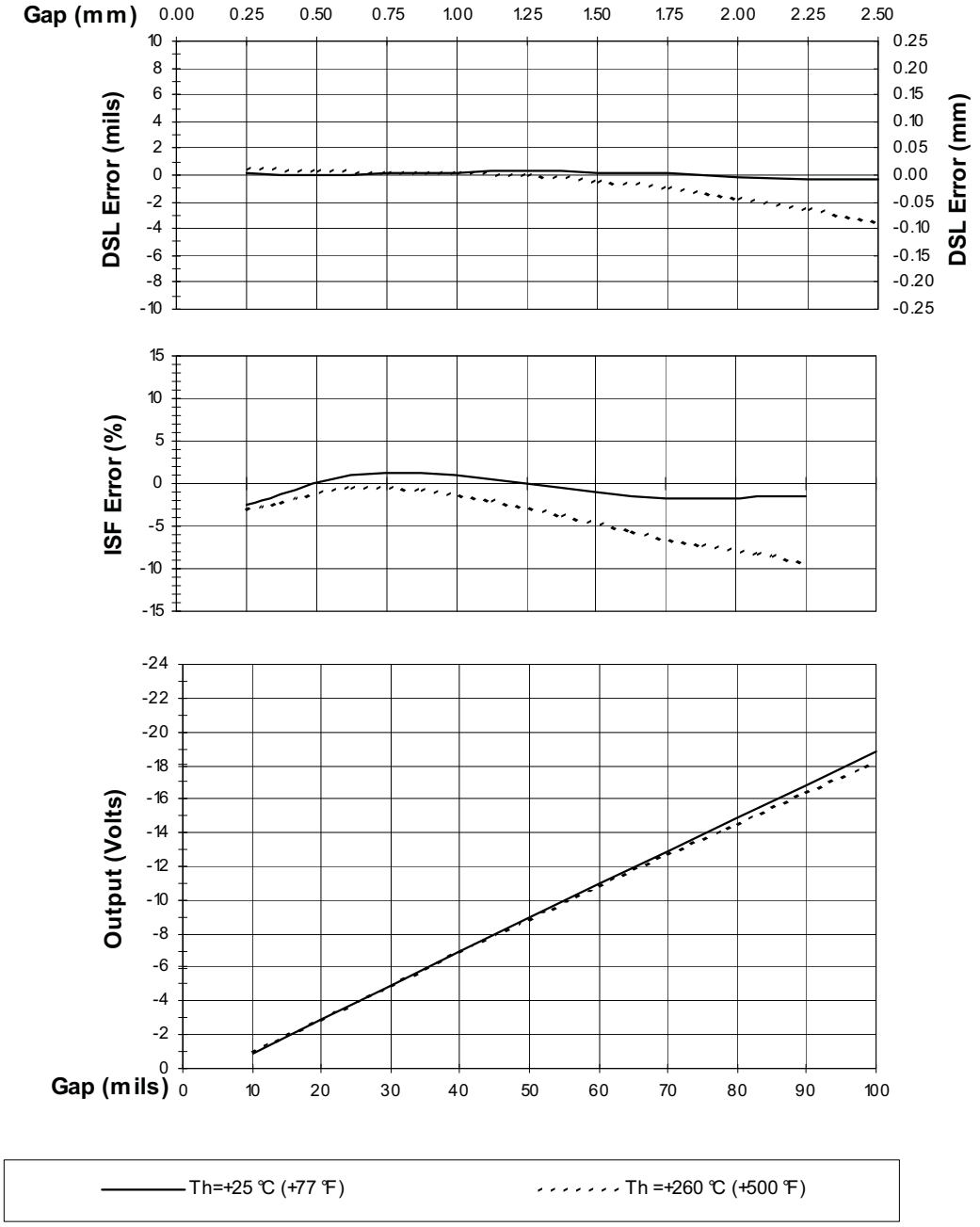


Figure 6-9: Typical 3300 XL Extended Temperature Range Probe and 4m Extended Temperature Range Extension Cable @ Th (Proximitor Sensor and probe tip with 1 foot of cable are at +25 °C)

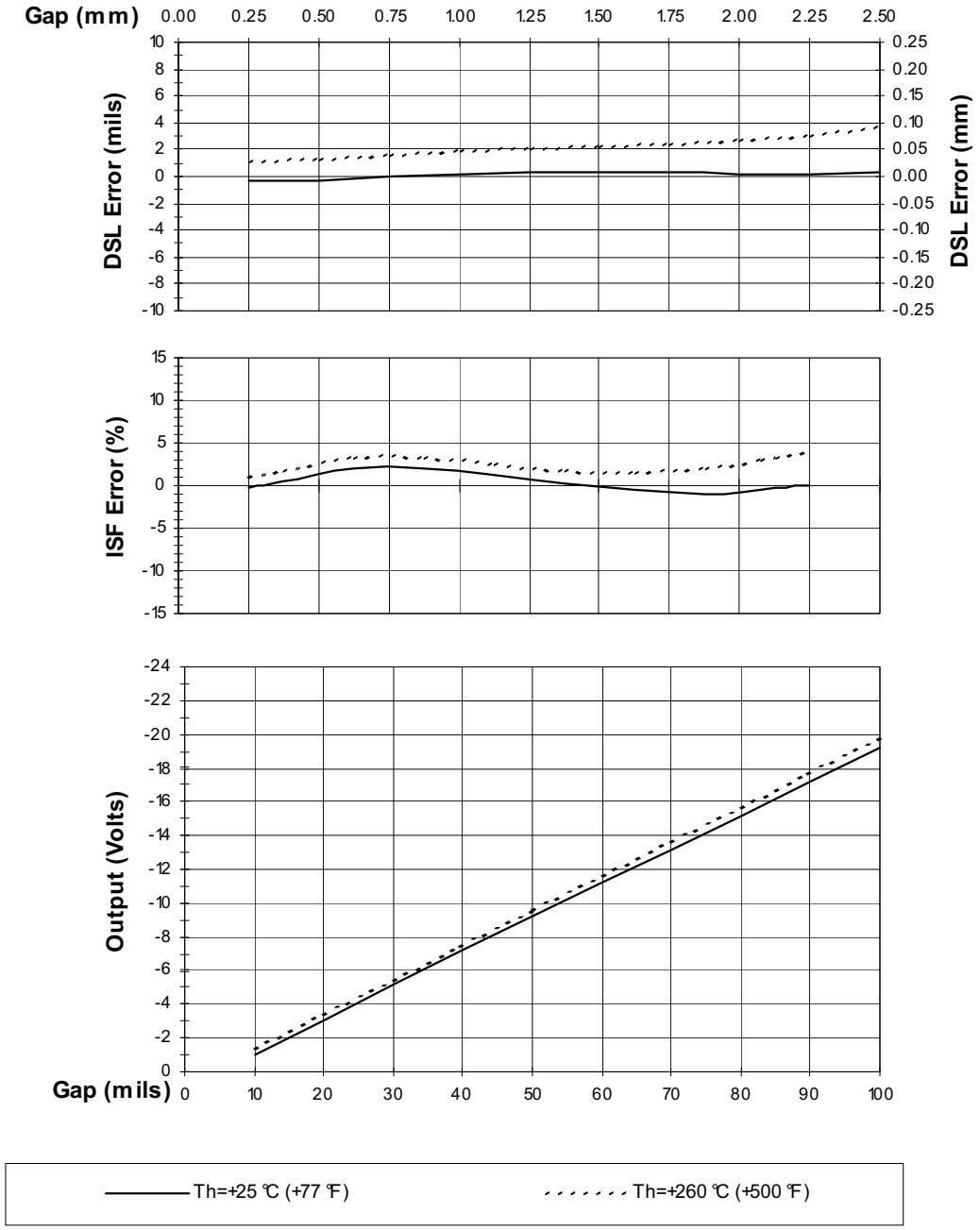


Figure 6-10: Typical 3300 XL Extended Temperature Range Probe and 8m Extended Temperature Range Extension Cable @ Th (Proximitor Sensor and probe tip with 1 foot of cable are at +25 °C)

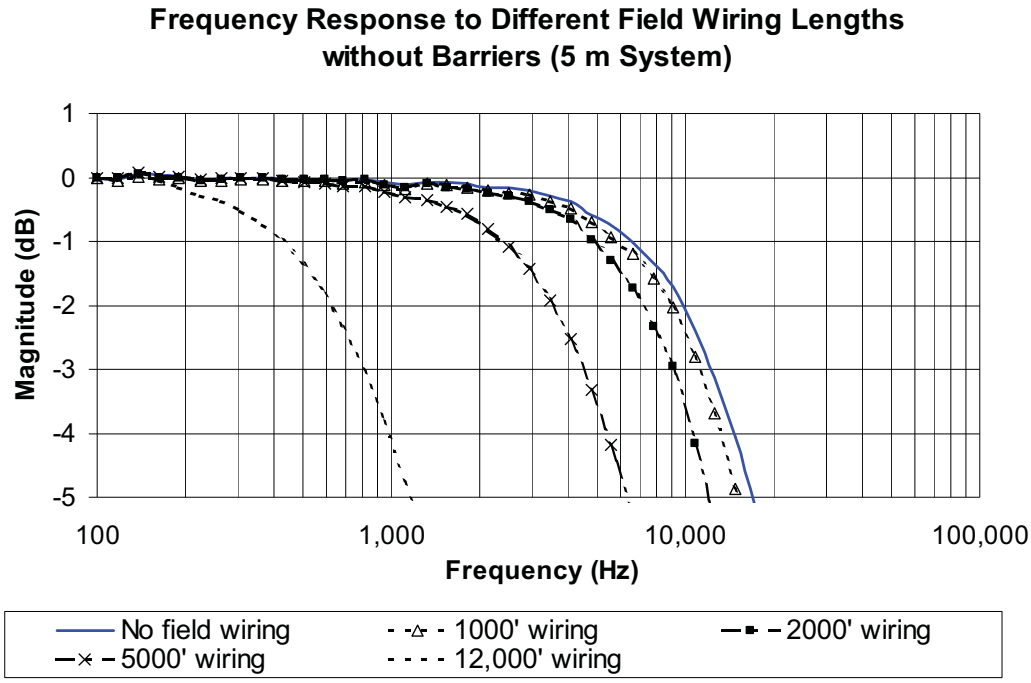


Figure 6-11: Frequency Response, typical 3300 XL 8mm 5m or 1m System with varying lengths of field wiring attached, no barriers

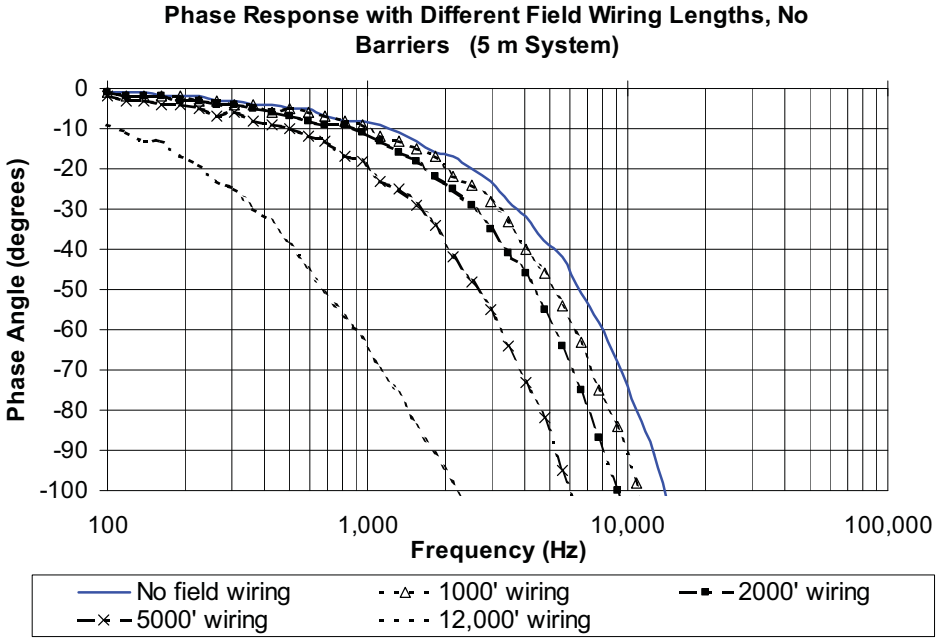


Figure 6-12: Phase Response, typical 3300 XL 8mm 5m or 1m System with varying lengths of field wiring attached, no barriers

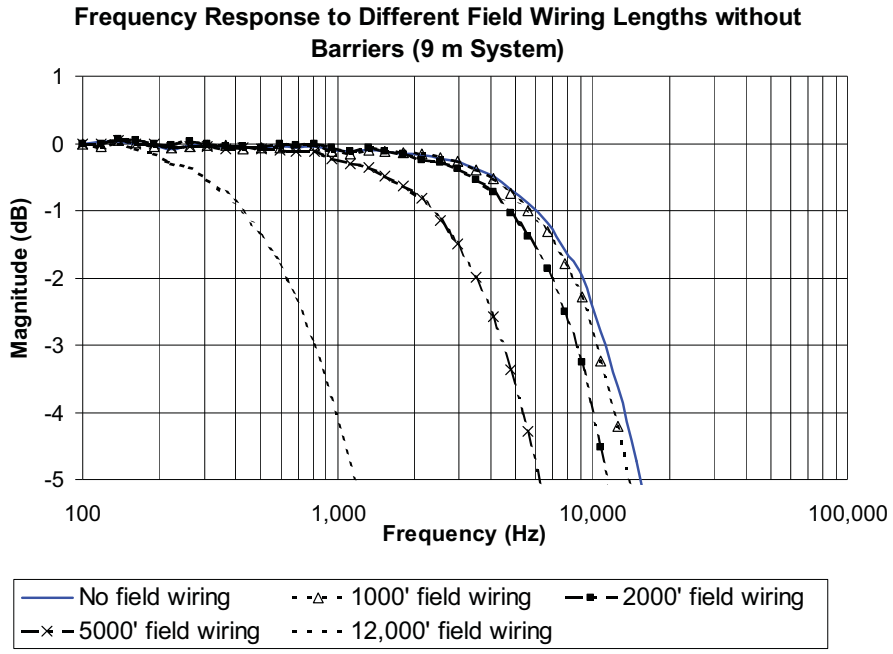


Figure 6-13 Frequency Response, typical 3300 XL 8mm 9m System with varying lengths of field wiring attached, no barriers

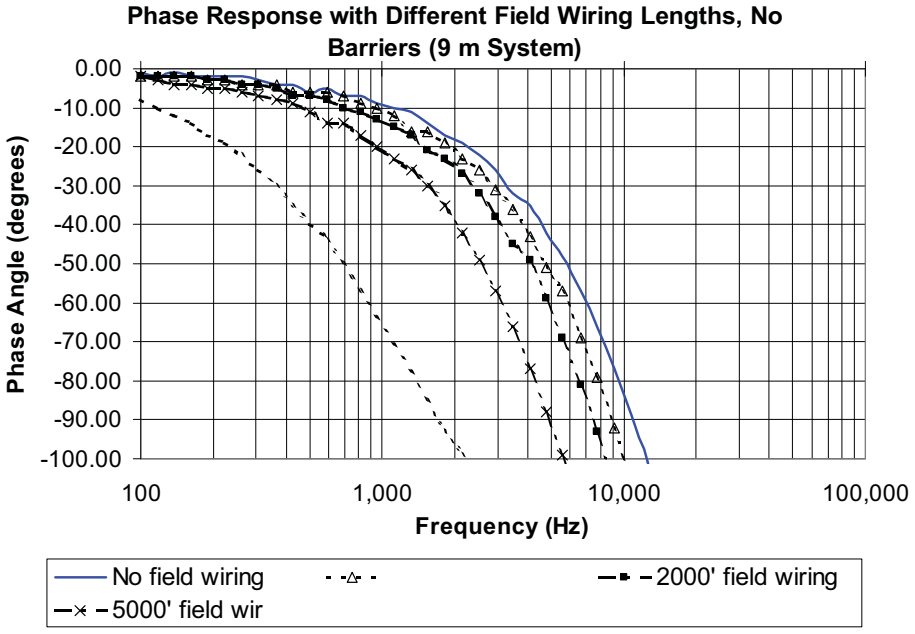
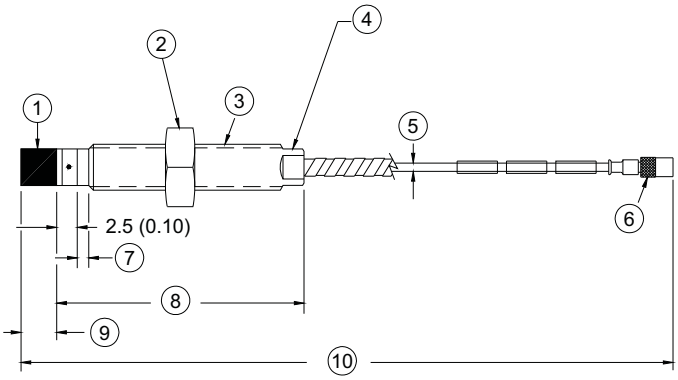


Figure 6-14: Phase Response, typical 3300 XL 8mm 9m System with varying lengths of field wiring attached, no barriers



1. 8.0 (0.31) diameter probe tip
2. 14.3 (9/16) for 3/8-24 threads[2]; 17.0 (0.67) for M10 threads[2]
3. Case thread
4. 8 (5/15) wrench flats, 4 each
5. 75Ω cable
   - 3.7 (0.15) maximum outside diameter
   - 3.9 (0.16) maximum diameter for FluidLoc cable
   - 7.6 (0.30) outside diameter for armor
   - 9.0 (0.35) maximum diameter for armor ferrule
6. Miniature male coaxial connector, 7.23 (0.285) maximum outside diameter "D"
7. Unthreaded length "A"
8. Case length "B"
9. 6.0 (0.236) maximum
10. Total length[3] "C", +30%, -0%

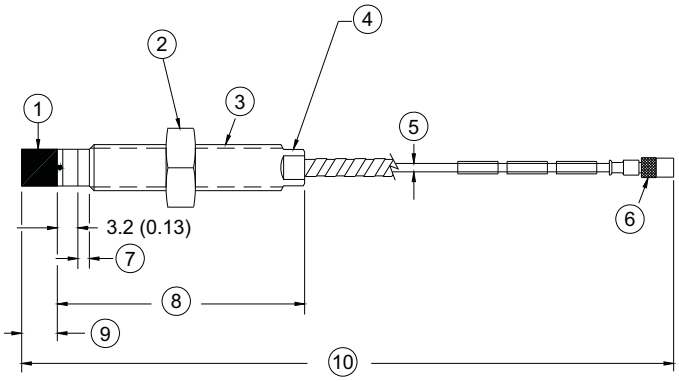
Figure 6-15: 3300 XL 8mm Proximity Probes, Standard Mount

330101 and 330191, 3/8-24 UNF-2A, without armor [7]

330102 and 330192, 3/8-24 UNF-2A, with armor [6]

330103 and 330193, M10X1 thread, without armor [7]

330104 and 330194, M10X1 thread, with armor [6]



1. 5.2 (0.21) diameter probe tip
2. 11.1 (7/16) for 3/8-24 threads[2]; 13.0 (0.51) for M10 threads[2]
3. Case thread
4. 5.6 (7.32) wrench flats for 1/4-28 threads, 7.0 (0,28) for M8 threads, 4 each
5. 75Ω cable
   2.8 (0.11) maximum outside diameter
   7.6 (0.30) outside diameter for armor
   9.0 (0.35) maximum diameter for armor ferrule
6. Miniature male coaxial connector, 7.23 (0.285) maximum outside diameter "D"
7. Unthreaded length "A"
8. Case length "B"
9. 6.0 (0.236) maximum
10. Total length[8] "C", +30%, -0%

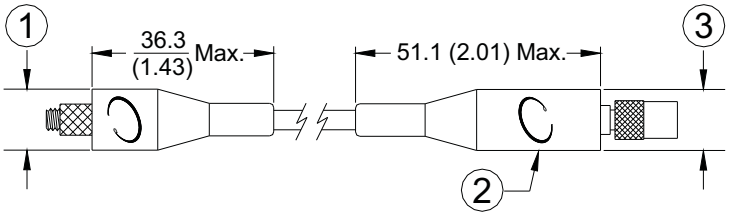
Figure 6-16: 3300 5mm Proximity Probes

330171, 1/4-28 UNF-2A, without armor [7]

330172 , 1/4-28 UNF-2A, with armor [6]

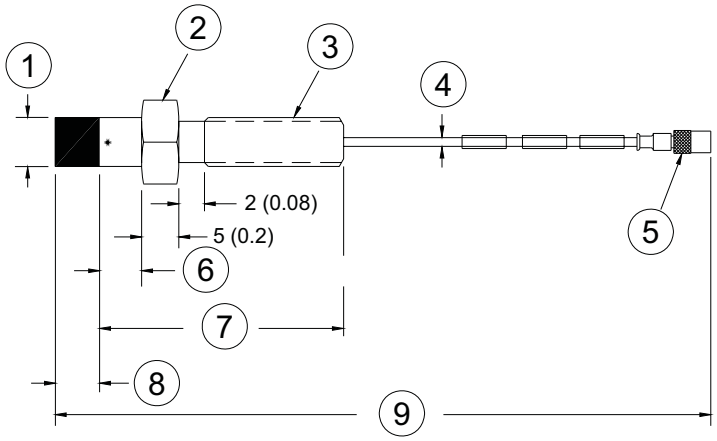
330173, M8X1 thread, without armor [7]

330174, M8X1 thread, with armor [6]



1. 12 (0.47) diameter maximum
2. Connector protector (fluorosilicone material)
3. 12 (0.47) diameter maximum

Figure 6-17: Installed Connector Protectors

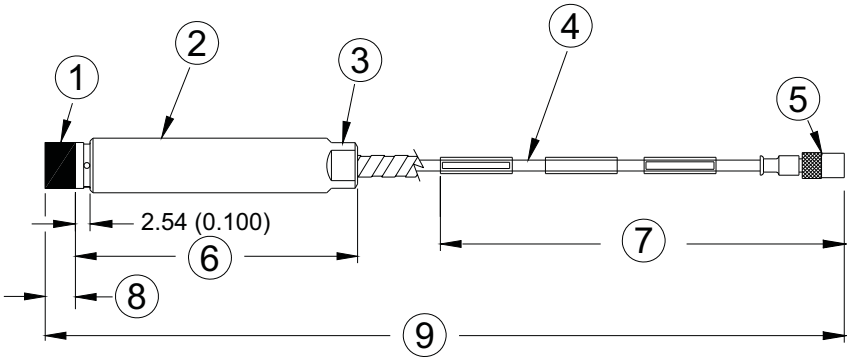


1. 8.0 (0.31) diameter probe tip
2. 7/16 or M10 hexagonal
3. Case thread
4. 75Ω cable, 3.7 (0.15) outside diameter
5. Miniature male coaxial connector, 7.23 (0.285) maximum outside diameter "D"
6. Unthreaded length "A"
7. Case length "B" 30 (1.2)
8. 6.0 (0.236) maximum
9. Total length[3] "C", +30%, -0%

Figure 6-18: 3300 XL 8mm Proximity Probes, Reverse Mount [4, 7]

330105 and 330195, 3/8-24 UNF-2A threads

330106 and 330196, M10X1 threads

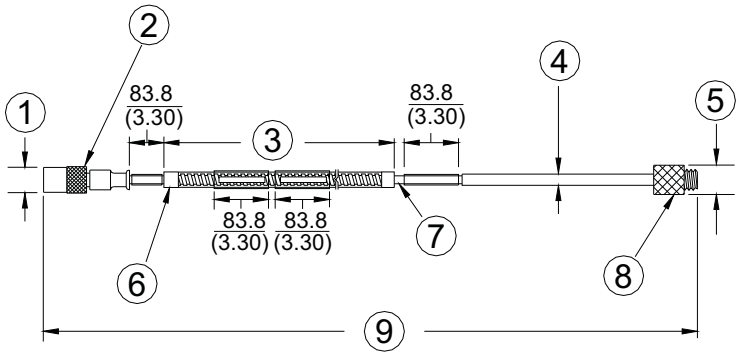


1. 8.0 (0.31) diameter probe tip
2. 9.6 (0.38) maximum diameter
3. 7.9 (0.31) wrench flats, 4 each
4. 75Ω cable, 3.68 (0.145) maximum diameter
5. 3.9 (0.16) maximum diameter for FluidLoc cable
6. 8.0 (0.315) outsided diameter for armor
7. 9.0 (0.35) maximim diameter for armor ferrule
8. Miniature male coaxial connector, 7.23 (0.285) maximum outside diameter
9. Case length "A"
10. 349.25 (13.720) maximum
11. 6.0 (0.236) maximum
12. Cable length[3]

Figure 6-19: 3300 XL 8mm Proximity Probes, Smooth Case

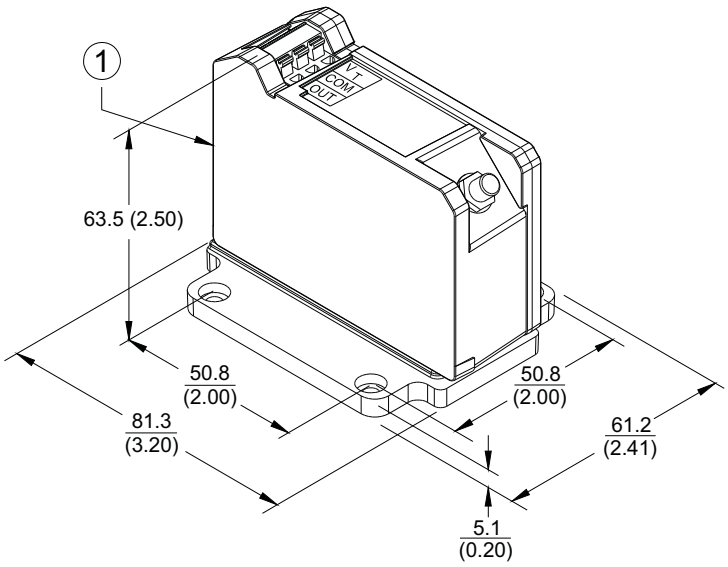
330140 and 330197, without armor [7]

330141 and 330198, with armor [6]



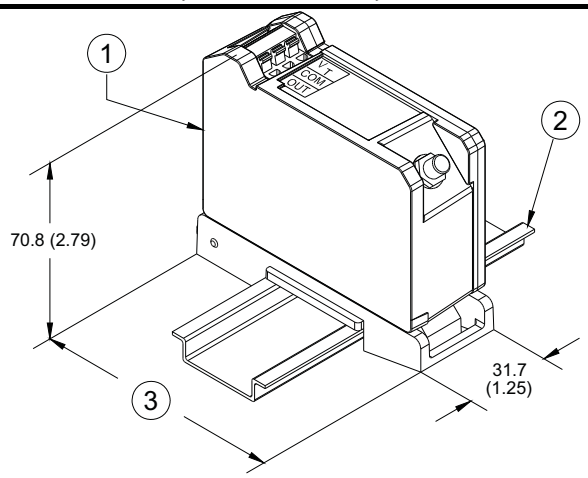
1. 7.2 (0.285) maximum diameter
2. Miniature male coaxial connector
3. FEP or PFA coated armor6, armor length 300 (11.8) less than cable length
4. 75Ω cable, 3.68 (0.145) maximum outside diameter
   (0.16) maximum diameter for FluidLoc cable
   (0.30) outside diameter for armor
   (0.35) maximum diameter for armor ferrule
5. 7.2 (0.285) maximum diameter
6. Stainless steel ferrules, 8.4 (0.33) diameter
7. FEP or PFA insulated triaxial cable
8. Miniature female coaxial connector
9. Cable length +20%, -0%

Figure 6-20: 330130, 3300 XL Extension Cable (FEP armor and insulation) 330190, 3300 XL ETR Extension Cable (PFA armor and insulation)



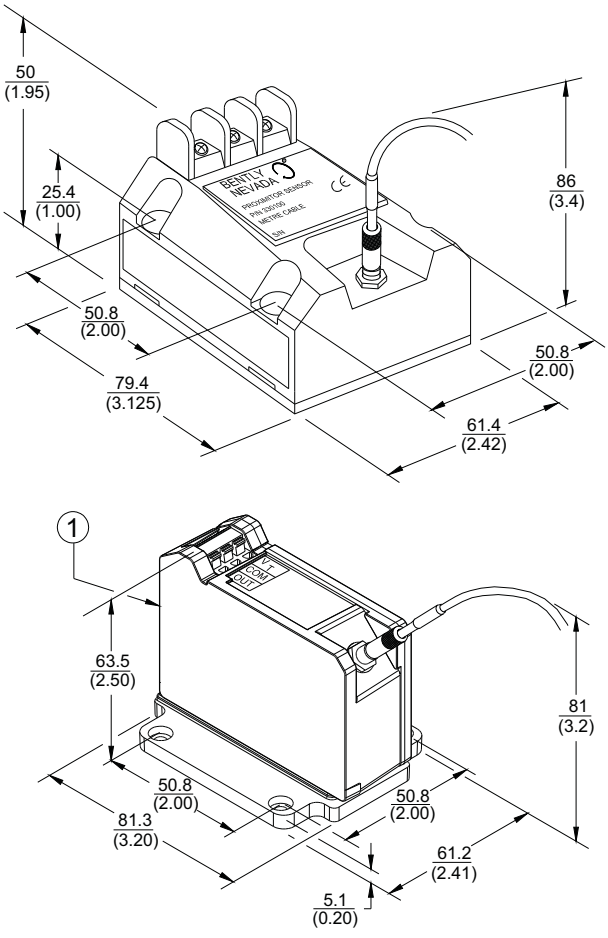
1. Mounting option “A”, options –50 or -90

Figure 6-21: Panel Mount 3300 XL Proximitor Sensor



1. Mounting option "A", options –51 or –91
2. 35mm DIN rail (not included)
3. 89.4 (3.52) [Additional 3.05 (0.120) require to remove DIN rail

Figure 6-22: DIN Mount 3300 XL Proximitor Sensor



1. Mounting option "A", options –50 or -90

Figure 6-23: Physical mounting characteristics showing interchangeability of 3300 and 3300 XL Proximitor Sensors when 4-hole mounting option is used[8]

Notes:

- All dimensions on figures are in millimetres (inches) unless otherwise noted.
- Standard mount 8 mm probes supplied with 17 mm or 9/16 inch lock nut.
- Probes ordered with 5 or 9 metre integral cables have a length tolerance of +20%, -0%.
- Reverse mount probes not available with armor or connector protector options.
- Letters inside quotation marks on figures refer to probe ordering options.
- Stainless steel armor is supplied with FEP outer jacket for standard probes, PFA outer jacket for ETR probes.
- FEP jacket is standard non-armored portion of the cable for standard probes, PFA jacket on non-armored portion for ETR probes.
- Use M3.5 or #6 screws for panel-mount Proximitor® Sensors (screws provided when purchasing Bently Nevada housings).

7. Micrometer Specifications and Ordering Information

7.1 Mechanical

Target Buttons

AISI 4140 Alloy Steel, 30.5 mm (1.20 in) diameter flat target. Contact your local sales office for details on special target materials.

Casing Material

3300 XL Precision Micrometer:

Fiberglass and Plastic.

3300 XL Shaft Micrometer

ABS Plastic.

Micrometer specifications:

Table 7-1: 3300 XL Precision Micrometer:

Part number	Resolution	Accuracy	Range
330185-01	0.000020 in	± 0.000015 in	0-1 in
330185-02	0.0005 mm	± 0.0004 mm	0-25 mm

Table 7-2: 3300 XL Shaft Micrometer

Part number	Resolution	Accuracy	Range
330186-01	0.001 in	±0.0001 in	0-1 in
300186-02	0.01 mm	±0.003 mm	0-25 mm

Size

3300 XL Precision Micrometer (case dimensions)

Height

226 mm (8.9 in)

Width

274 mm (10.8 in)

Length

356 mm (14.0 in)

3300 XL Shaft Micrometer (case dimensions)

Height

152 mm (6.0 in)

Width

246 mm (9.7 in)

Length

356 mm (14.0 in)

Total System Mass

3300 XL Precision Micrometer:

6.8 kg (15.0 lbm)

3300 XL Shaft Micrometer:

2.8 kg (6.2 lbm)

7.2 Ordering Information

7.2.1 3300 XL Precision Micrometer
330185-AXX

A: Scale Units

0 1	Micrometer in English units	(0-1 in)
0 2	Micrometer in metric units	(0-25 mm)

7.2.2 3300 XL Shaft Micrometer
330186- AXX
Option Descriptions

A: Scale Units

0 1	Micrometer in English units	(0-1 in)
0 2	Micrometer in metric units	(0-25 mm)

NOTE

The 3300 shaft micrometer and precision micrometer come with probe mounting adapters for 1/4 inch, 3/8 inch, 1/2 inch, 5/8 inch, M8, M10, M14 and M16 probe thread sizes.

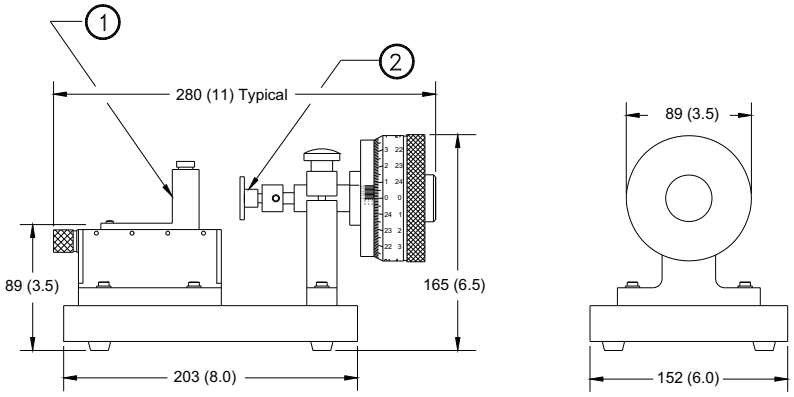
7.2.3 Accessories

Table 7-3: Accessory Part Numbers and Descriptions

Part Number	Description
138751-01	3300 XL Precision Micrometer Instruction Sheet
140273-01	3300 XL Shaft Micrometer Instruction Sheet
27505-01	Target button: A replacement 4140 target button that comes standard with the 3300 XL shaft micrometer. There can be a variation of up to 5% in the average scale factor (ASF) between each target button.
136534-01	High Precision target button: A replacement 4140 target button that comes standard with the 3300 XL precision micrometer. There can be a variation of up to 0.6% in the Average Scale Factor (ASF) between each target button.
02200218	Shaft Micrometer Strap: A replacement strap for the 3300 XL Shaft Micrometer.
49478-01	Probe mounting adapter, suitable for M5 threads.
49478-02	Probe mounting adapter, 1/4 inch threads.
49478-03	Probe mounting adapter, M8 threads.
49478-04	Probe mounting adapter, M10 threads.
49478-05	Probe mounting adapter, 3/8 inch threads.
49478-06	Probe mounting adapter, M11 threads.
49478-07	Probe mounting adapter, 1/2 inch threads.
49478-08	Probe mounting adapter, M14 threads.
49478-09	Probe mounting adapter, 5/8 inch threads.
49478-10	Probe mounting adapter, M16 threads.

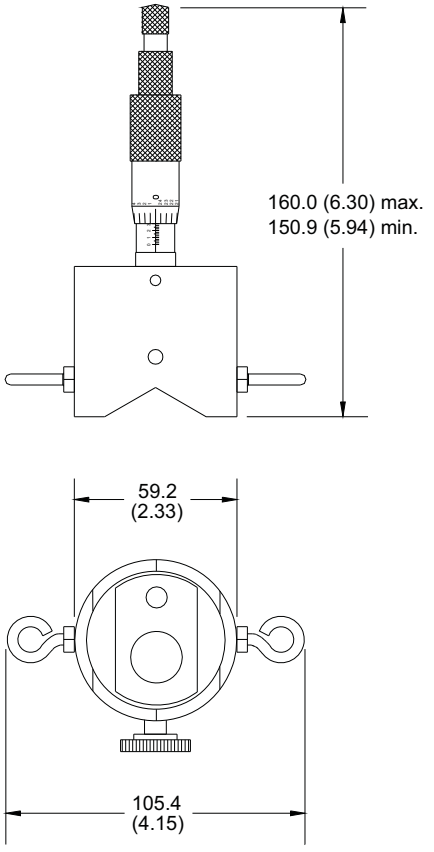
7.3 Dimensional Drawings

Note: Dimensions for figures are in millimetres (inches)



1. Collets to fit both metric and English 5mm, 8mm, and 14mm probes
2. Removable AISI 4140 target

Figure 7-1: 3300 XL Precision Micrometer



i.

Figure 7-2 - 3300 XL Shaft Micrometer

Certificate of Compliance

Certificate: 1109248 (LR 26744-222) **Master Contract:** 150368

Project: 2602032 **Date Issued:** February 15, 2013

Issued to: **Bently Nevada Inc**

1631 Bently Pky S
Minden, NV 89423
USA
Attention: Byron Hunt

The products listed below are eligible to bear the CSA Mark shown with adjacent indicators 'C' and 'US' for Canada and US or with adjacent indicator 'US' for US only or without either indicator for Canada only.

Eshwar Kashyap

Issued by: Eshwar Kashyap

PRODUCTS

CLASS 2258 04 - PROCESS CONTROL EQUIPMENT - Intrinsically Safe, Entity - For Hazardous Locations

Class I, Zone 0; Ex ia IIC T1…T5 Ga:

Class I, Groups A, B, C and D; Class II, Groups E, F and G; Class III:

• 3300XL & 7200 Series Proximitor Sensor, Models 330180-xx-xx, 330780-xx-xx, 330980-xx-xx, 330850-xx-xx, 330878-xx-xx, 144181-xx and 18745-xx-xx (suffixes denote cable length and certification body), housed in Certified proximitor housing, P/N 330181-xx-xx (suffixes denote transducer type, conduit fittings, gland plate thickness and terminal block), connected with, 190, 300, 3000, 3300 and 7200 Series probes. Intrinsically safe when connected to Certified barriers per installation Dwg 141092. Temperature Codes T5, Ta= -35°C to 85°C or T4, Ta= -51°C to 100°C for Proximitor Sensor, and T1, Ta= -51°C to 232°C; T2, Ta= -51°C to 177°C; T3, Ta= -51°C to 120°C; T4, Ta= -51°C to 80°C; T5, Ta= -51°C to 40°C for the probes.

Note: The 3300 XL & 7200 Series Proximitor Sensors maybe optionally supplied without the above referenced proximitor housing for Ex ia IIC or Class I, Groups A, B, C and D installation where its suitability as determined by the local Inspection Authority.

Certificate: 1109248 (LR 26744-222) **Master Contract:** 150368

Project: 2602032 **Date Issued:** February 15, 2013

CLASS 2258 84 - PROCESS CONTROL EQUIPMENT - Intrinsically Safe Entity - For Hazardous Locations - CERTIFIED TO U.S. STANDARDS

Class I, Groups A, B, C and D; Class II, Groups E, F and G; Class III:

• 3300 XL & 7200 Series Proximitor Sensor, Models 330180-xx-xx, 330780-xx-xx, 330980-xx-xx, 330850-xx-xx, 330878-xx-xx, 144181-xx and 18745-xx-xx (suffixes denote cable length and certification body), housed in Certified proximitor housing, P/N 330181-xx-xx (suffixes denote transducer type, conduit fittings, gland plate thickness and terminal block), connected with 190, 300, 3000, 3300 and 7200 Series probes. Intrinsically safe when connected to Certified barriers per installation Dwg 141092. Temperature Codes T5, Ta= -35°C to 85°C or T4, Ta= -51°C to 100°C for Proximitor Sensor, and T1, Ta= -51°C to 232°C; T2, Ta= -51°C to 177°C; T3, Ta= -51°C to 120°C; T4, Ta= -51°C to 80°C; T5, Ta= -51°C to 40°C for the probes.

Note: The 3300 XL & 7200 Series Proximitor Sensors maybe optionally supplied without the above referenced proximitor housing for Class I, Zone 0, Group IIC or Class I, Groups A, B, C and D installation where its suitability as determined by the local Inspection Authority.

CLASS 2258 03 - PROCESS CONTROL EQUIPMENT - Intrinsically Safe and Non-Incendive Systems - For Hazardous Locations

Class I, Zone 2; Ex nA IIC T1…T5 Gc:

Class I, Div. 2, Groups A, B, C and D:

• 3300XL & 7200 Series Proximitor Sensor, Models 330180-xx-xx, 330780-xx-xx, 330980-xx-xx, 330850-xx-xx, 330878-xx-xx, 144181-xx and 18745-xx-xx (suffixes denote cable length and certification body), housed in Certified proximitor housing, P/N 330181-xx-xx (suffixes denote transducer type, conduit fittings, gland plate thickness and terminal block), connected with, 190, 300, 3000, 3300 and 7200 Series probes. Non-Incendive circuit when connected per installation Dwg. 140979. Temperature Codes T5, Ta= -35°C to 85°C or T4, Ta= -51°C to 100°C for Proximitor Sensor, and T1, Ta= -51°C to 232°C; T2, Ta= -51°C to 177°C; T3, Ta= -51°C to 120°C; T4, Ta= -51°C to 80°C; T5, Ta= -51°C to 40°C for the probes.

CLASS 2258 83 - PROCESS CONTROL EQUIPMENT - Intrinsically Safe and Non-Incendive Systems - For Hazardous Locations - CERTIFIED TO U.S. STANDARDS

Class I, Div. 2, Groups A, B, C and D:

• 3300 XL & 7200 Series Proximitor Sensor, Models 330180-xx-xx, 330780-xx-xx, 330980-xx-xx, 330850-xx-xx, 330878-xx-xx, 144181-xx and 18745-xx-xx (suffixes denote cable length and certification body), housed in

Certificate: 1109248 (LR 26744-222) **Master Contract:** 150368

Project: 2602032 **Date Issued:** February 15, 2013

Certified proximitor housing, P/N 330181-xx-xx (suffixes denote transducer type, conduit fittings, gland plate thickness and terminal block), connected with 190, 300, 3000, 3300 and 7200 Series probes. Non-Incendive circuit when connected per installation Dwg 140979. Temperature Codes T5, Ta= -35°C to 85°C or T4, Ta= -51°C to 100°C for Proximitor Sensor, and T1, Ta= -51°C to 232°C; T2, Ta= -51°C to 177°C; T3, Ta= -51°C to 120°C; T4, Ta= -51°C to 80°C; T5, Ta= -51°C to 40°C for the probes.

APPLICABLE REQUIREMENTS

C22.2 No 0 - M1991	General Requirements - Canadian Electrical Code Part II.
CSA Std. C22.2 No 25-1966	Enclosures for Use in Class II, Groups E, F and G Hazardous Locations
C22.2 No 142 - M1987	Process Control Equipment.
C22.2 No 157 - M1992	Intrinsically Safe and Non-Incendive Equipment for Use in Hazardous Locations.
C22.2 No 213 - M1987	Non-Incendive Electrical Equipment for Use in Class I, Division 2 Hazardous Locations.
CAN/CSA-C22.2 No. 60079-0:11	Explosive Atmospheres - Part 0: Equipment - General requirements
CAN/CSA-C22.2 No. 60079-11:11	Explosive Atmospheres – Part 11: Equipment protection by intrinsic safety "i"
CAN/CSA-C22.2 No. 60079-15:12	Electrical apparatus for explosive gas atmospheres - Part 15: Construction, test and marking of type of protection “n” electrical apparatus
UL 913, 7Th Ed.	Intrinsically Safe Apparatus and Associated Apparatus for use in Class I, II, III, Division 1, Hazardous (Classified) Locations.
UL Std. No 916 - 4th Ed.	Energy Management Equipment
ANSI/ISA-12.12.01-2010	Non-incendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Divisions 1 and 2 Hazardous (Classified) Locations

Supplement to Certificate of Compliance

Certificate: 1109248 **Master Contract:** 150368

The products listed, including the latest revision described below, are eligible to be marked in accordance with the referenced Certificate.

Product Certification History

Project	Date	Description
2602032	Feb 15, 2013	Acceptance of test data from CSA custom test report 150368-2418692 for use of alternate labels.
2545092	Oct 4, 2012	Update to include the latest standards as well as several revised drawings.
2117662	Feb 5, 2009	Update to include Proximitor Sensor Model 144181-xx, added similar 3300 Series probes 137383 and 147038-01, and minor report and drawing revisions.
2068039	Sep 23, 2008	Update to add sensor probe 137383 & update revised drawings
1878232	Mar 29, 2007	Update to Report to Separately List Non-Incendive Circuits Under Class No. 2258 03/83
1834427	Jan 24, 2007	Update to Cover Alt. Encapsulant
1676429	Jun 10, 2005	Update to Report to Include P/N's
1673624	May 16, 2005	Update to Report to Cover Minor Drawings Revisions
1552612	May 11, 2004	Update to Report 1109248 to cover minor dwg revision- Haz Loc.
1479877	Sep 24, 2003	Report update to replace schematic dwgs with dwg. 165341.
1437644	May 6, 2003	Update to Report 150368 - 1109248 to Cover Alternative Probes per dwg 142491/L - for Installation in Hazardous Locations, Legacy File 26744

Certificate of Compliance

Certificate: 70123413 **Master Contract:** 150368 (026744_C_000)

Project: 70123413 **Date Issued:** 2017-03-02

Issued to: **Bently Nevada Inc**
1631 Bently Pky S
Minden, Nevada 89423
USA

Attention: Tonya Woods

The products listed below are eligible to bear the CSA Mark shown with adjacent indicators 'C' and 'US' for Canada and US or with adjacent indicator 'US' for US only or without either indicator for Canada only.

Issued by: *Behzad Nejad*
Behzad Nejad, P.Eng.

PRODUCTS
CLASS - C225804 - PROCESS CONTROL EQUIPMENT-Intrinsically Safe, Entity - For Hazardous Locations
CLASS - C225884 - PROCESS CONTROL EQUIPMENT - Intrinsically Safe, Entity-- For Hazardous Locations - Certified to US Standards

Ex ia IIC T5…T1 Ga
Class I, Zone 0, AEx ia IIC T5…T1 Ga
Class I, Division 1, Groups A, B, C and D; T5…T1
Class II, Groups E, F and G; Class III

- Proximity Probe/ Eddy Current Probe series 3000, 3300/3300XL, 7200:

Temperature Code
T1 @ Ta = -55°C to +232°C
T2 @ Ta = -55°C to +177°C
T3 @ Ta = -55°C to +120°C
T4 @ Ta = -55°C to +80°C
T5 @ Ta = -55°C to +40°C

Entity Parameters
Ui = -28V
Ii = 140mA
Pi = 0.91W
Ci = 1.5nF
Li = 610µH

"Intrinsically safe when connected per installation Dwg 141092"

Specific Conditions of Use:

i. The exposed plastic surface of the Probes with 50mm diameter, under certain extreme circumstances, may generate, an ignition-capable level of electrostatic charge. Therefore this version of the equipment shall not be installed in a location where the external conditions are conducive to the build-up of electrostatic charge on the plastic surface. In addition, the equipment shall only be cleaned with a damp cloth. This is particularly important if the equipment is installed in a Zone 0 location.
ii. The end user is to ensure appropriate earthing upon installation.

CLASS 2258 02 - PROCESS CONTROL EQUIPMENT - For Hazardous Locations
CLASS 2258 82 - PROCESS CONTROL EQUIPMENT - For Hazardous Locations - Certified to US Standards

Ex nA IIC T5…T1 Gc
Class I, Zone 2, AEx nA IIC T5…T1 Gc
Class I, Division 2, Groups A, B, C and D; T5…T1

- Proximity Probe/ Eddy Current Probe series 3000, 3300/3300XL, 7200:

- Temperature Code
T1 @ Ta = -55°C to +232°C
T2 @ Ta = -55°C to +177°C
T3 @ Ta = -55°C to +120°C
T4 @ Ta = -55°C to +80°C
T5 @ Ta = -55°C to +40°C

Rating
Ui = -28V
Ii = 140mA

"Non-Incendive circuit when connected per installation Dwg 140979"

Specific Conditions of Use:

i. This product is not resistant to light as required by clause 7.3 of IEC 60079-0:2011, therefore, it shall only be installed in a location where it is not exposed to direct sunlight or any other source of ultra-violet (UV) light.
ii. The connector shall not be disconnected while the circuit is live unless the area is known to be non-hazardous.
iii. The end user is to ensure appropriate earthing upon installation.

Certificate: 70123413 **Master Contract:** 150368

Project: 70123413 **Date Issued:** 2017-03-02

APPLICABLE REQUIREMENTS

C22.2 No. 0 - M91	General Requirements - Canadian Electrical Code Part II.
C22.2 No 142 - M1987	Process Control Equipment.
C22.2 No 213 - 16	Non-Incendive Electrical Equipment for Use in Class I, Division 2 Hazardous Locations.
CAN/CSA-C22.2 No. 60079-0:11	Explosive Atmospheres - Part 0: Equipment - General requirements
CAN/CSA-C22.2 No. 60079-11:14	Explosive Atmospheres – Part 11: Equipment protection by intrinsic safety "i"
CAN/CSA-C22.2 No. 60079-15:16	Electrical apparatus for explosive gas atmospheres - Part 15: Construction, test and marking of type of protection “n” electrical apparatus
UL 913, 7Th Ed.	Intrinsically Safe Apparatus and Associated Apparatus for use in Class I, II, III, Division 1, Hazardous (Classified) Locations.
UL Std. No 916 - 4th Ed.	Energy Management Equipment
ANSI/ISA-12.12.01-2015	Non-incendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Divisions 1 and 2 Hazardous (Classified) Locations
ANSI/UL 60079-0:13	Electrical Apparatus for Explosive Gas Atmospheres - Part 0: General Requirements
ANSI/UL 60079-11:13	Electrical apparatus for Explosive Gas Atmospheres - Part 11: Intrinsic Safety “i”
ANSI/UL 60079-15:12	Electrical apparatus for Explosive Gas Atmospheres - Part 15: Type of Protection “n”

MARKINGS

- CSA Monogram with C-US indicator;
- Submittor Identification;
- Certificate reference;
- Model Number;
- Serial Number, Date Code or Month and Year of Manufacture;
- Name or Mark of the certificate issuer, year and certificate number (CSA 17.70123413);
- Hazardous Location Designation;
- Electrical Ratings;
- Ambient temperature range;
- Reference to installation drawing 141092 & 140979.

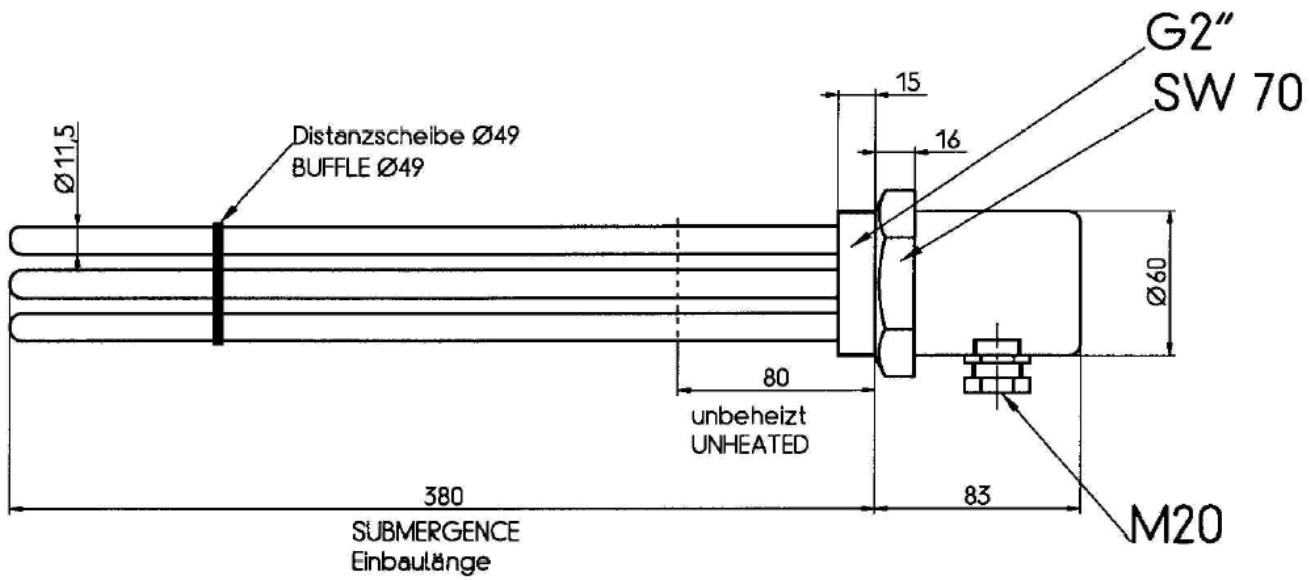
Supplement to Certificate of Compliance

Certificate: 70123413 **Master Contract:** 150368 (026744_C_000)

The products listed, including the latest revision described below, are eligible to be marked in accordance with the referenced Certificate.

Product Certification History

Project	Date	Description
70123413	2017-03-02	Full assessment for the Proximity Probe/ Eddy Current Probe series 3000, 3300/3300XL, 7200 for CSA-c-us for the markings: Class I, Zone 0, A/Ex ia IIC T5…T1 Ga, Class I, Division 1, Groups A, B, C, D, & Class II Division 1, Group E, F and G & Group III, Class I, Zone 2, A/Ex nA IIC T5…T1 Gc and Class I, Div 2 Group A, B, C, D.



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Manufacturer:	**Schniewindt GmbH**
Screw-in Heating Body Type:	ERCH III / 38
Voltage Range:	380 V AC – 660 V AC
Frequency:	50/60 Hz
Y-Connection	
Output Power:	1600 W
Surface Load:	2.5 W/cm²
Degree of Protection:	IP 54

Manufacturer:	**tmg – Temperaturmesstechnik Geraberg GmbH**
Plug connection:	Harting plug connector item-no.: 09360083001(stud element on the RTD) Crimp contacts silvered
Sensor:	2* or 3*Pt100, class B acc. to EN 60751
Circuit configuration:	2*Pt100 – 4-wire circuit / 3*Pt100 – 2-wire circuit
Protecting tube:	Diameter 9 * 1 mm (1.4571)
Protection class.:	IP 54 acc. to EN 60 529
Media:	Air, oil, water
Pressure strength:	16 bar

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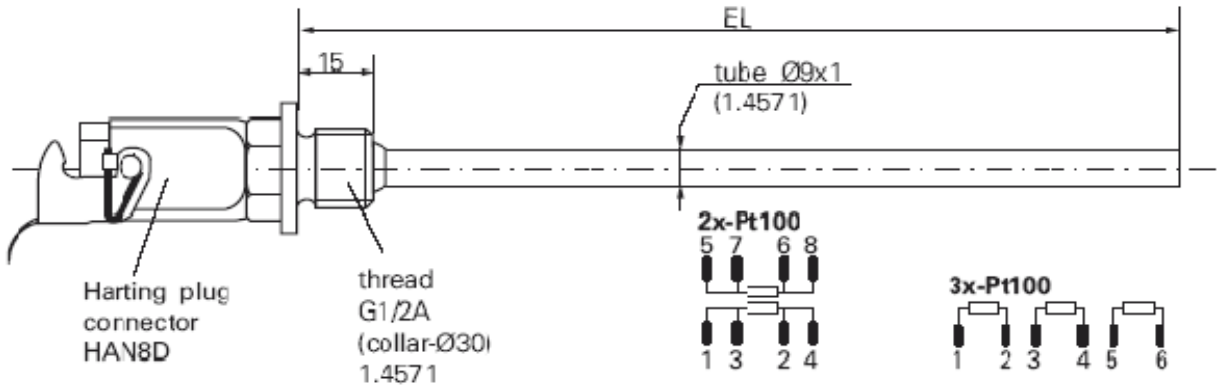


Fig. 1: Thermometer – drawing with dimensions

Manufacturer:	**tmg – Temperaturmesstechnik Geraberg GmbH**
Measuring Resistance:	PT100, BIFILAR – wound, 3.5 mm wide
Tolerance:	Class B ACC. DIN IEC 751
Insulation Class:	F
Connection Lead:	4 * 0.22 mm² (AWG 24)
Conductor Structure:	19 * 0.16 tinned
Wire Insulation:	Teflon (PTFE / FEP)
Sheath:	Teflon (FEP), grey
Colour Code:	BU, RD, GY, YE

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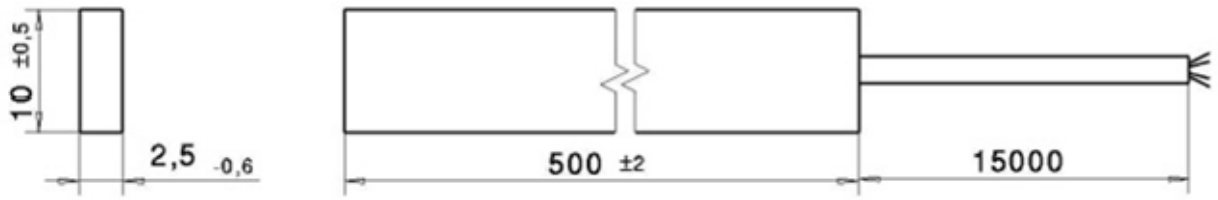
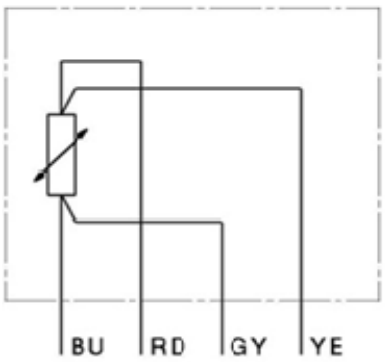


Fig. 1: Thermometer – drawing with dimensions

Fig. 2: Wiring diagram



Manufacturer:	**tmg – Temperaturmesstechnik Geraberg GmbH**
Sensor:	2 × or 3 × Pt100, class B acc. to EN 60751; measuring range 0…+120°C
Circuit configuration:	2 × Pt100 – 4-wire circuit / 3 × Pt100 – 2-wire circuit
Protecting tube:	Diameter 6mm; 1.4571
Process connection:	G 1/2A-outer thread (PVDF)
Plug connection:	Harting plug connector item-no.: 09360083001(stud element on the RTD), Crimp contacts silvered
	Limiting temperatures -40 … +125°C
Vibrostability:	>5g at 120Hz, 20h

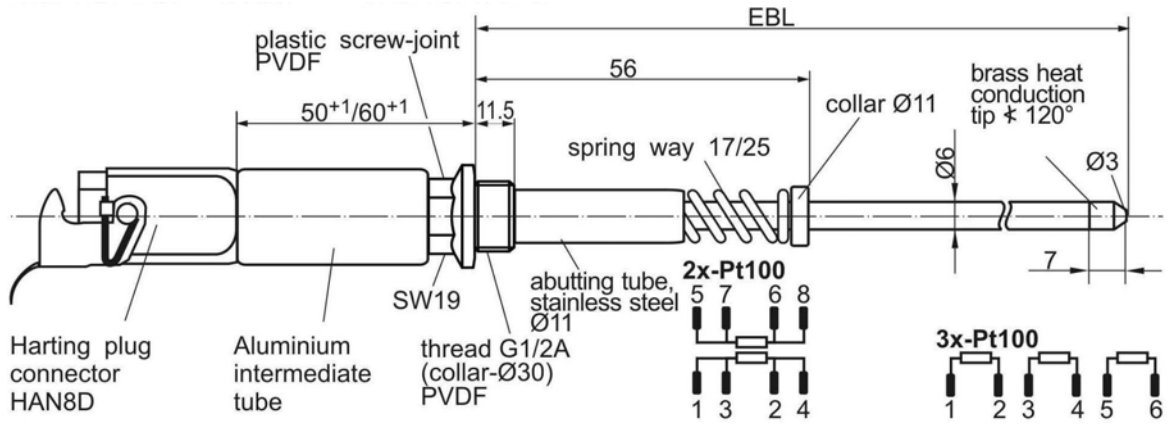
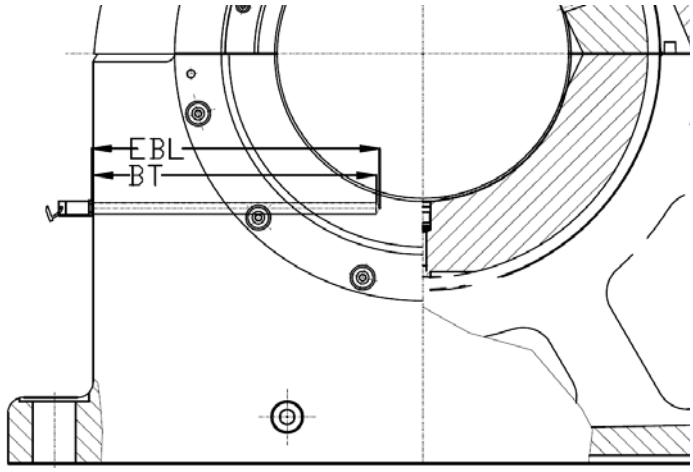


Fig. 1: Thermometer – drawing with dimensions

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EBL: Length of thermometer
given by manufacturer of thermometer
incl. 2 mm spike of borehole

BT: Depth of borehole done by manufacturer
of the bearing

Fig. 2: Bearing – drawing with dimension of borehole (BT)

Manufacturer: **SIEMENS**

Documentation title: **SITRANS LVL100 – Transistor (PNP)**
Operating Instructions

No. of pages: 32

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Vibrating Switches

SITRANS LVL100

- transistor (PNP)

Operating Instructions • 07/2013



SITRANS

SIEMENS

Safety Guidelines: Warning notices must be observed to ensure personal safety as well as that of others, and to protect the product and the connected equipment. These warning notices are accompanied by a clarification of the level of caution to be observed.

Qualified Personnel: This device/system may only be set up and operated in conjunction with this manual. Qualified personnel are only authorized to install and operate this equipment in accordance with established safety practices and standards.

Unit Repair and Excluded Liability:

- The user is responsible for all changes and repairs made to the device by the user or the user's agent.
- All new components are to be provided by Siemens Milltronics Process Instruments.
- Restrict repair to faulty components only.
- Do not reuse faulty components.

Warning: Cardboard shipping package provides limited humidity and moisture protection. This product can only function properly and safely if it is correctly transported, stored, installed, set up, operated, and maintained.
This product is intended for use in industrial areas. Operation of this equipment in a residential area may cause interference to several frequency based communications.

Note: Always use product in accordance with specifications.

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43191-EN-141016

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1 About this document

1.1 Function

This operating instructions manual provides all the information you need for mounting, connection and setup as well as important instructions for maintenance and fault rectification. Please read this information before putting the instrument into operation and keep this manual accessible in the immediate vicinity of the device.

1.2 Target group

This operating instructions manual is directed to trained specialist personnel. The contents of this manual should be made available to these personnel and put into practice by them.

1.3 Symbolism used



Information, tip, note
This symbol indicates helpful additional information.



Caution: If this warning is ignored, faults or malfunctions can result.

Warning: If this warning is ignored, injury to persons and/or serious damage to the instrument can result.

Danger: If this warning is ignored, serious injury to persons and/or destruction of the instrument can result.



Ex applications
This symbol indicates special instructions for Ex applications.

- **List**
  The dot set in front indicates a list with no implied sequence.

→ **Action**
This arrow indicates a single action.

1 **Sequence of actions**
Numbers set in front indicate successive steps in a procedure.



Battery disposal
This symbol indicates special information about the disposal of batteries and accumulators.

2 For your safety

2.1 Authorised personnel

All operations described in this operating instructions manual must be carried out only by trained specialist personnel authorised by the plant operator.

During work on and with the device the required personal protective equipment must always be worn.

2.2 Appropriate use

The SITRANS LVL100 is a sensor for point level detection.

You can find detailed information on the application range in chapter "*Product description*".

Operational reliability is ensured only if the instrument is properly used according to the specifications in the operating instructions manual as well as possible supplementary instructions.

For safety and warranty reasons, any invasive work on the device beyond that described in the operating instructions manual may be carried out only by personnel authorised by the manufacturer. Arbitrary conversions or modifications are explicitly forbidden.

2.3 Warning about incorrect use

Inappropriate or incorrect use of the instrument can give rise to application-specific hazards, e.g. vessel overfill or damage to system components through incorrect mounting or adjustment.

2.4 General safety instructions

This is a high-tech instrument requiring the strict observance of standard regulations and guidelines. The user must take note of the safety instructions in this operating instructions manual, the country-specific installation standards as well as all prevailing safety regulations and accident prevention rules.

The instrument must only be operated in a technically flawless and reliable condition. The operator is responsible for trouble-free operation of the instrument.

During the entire duration of use, the user is obliged to determine the compliance of the necessary occupational safety measures with the current valid rules and regulations and also take note of new regulations.

2.5 Safety label on the instrument

The safety approval markings and safety tips on the device must be observed.

2.6 CE conformity

The device fulfills the legal requirements of the applicable EC guidelines. By affixing the CE marking, we confirm successful testing of the product.

3 Product description

3.1 Configuration

Scope of delivery

The scope of delivery encompasses:

- SITRANS LVL100 point level switch
- Test magnet
- Documentation
  - this operating instructions manual
  - if necessary, certificates

Constituent parts

The SITRANS LVL100 consists of the components:

- Housing with electronics
- Process fitting with tuning fork



Fig. 1: SITRANS LVL100

Type plate

The nameplate contains the most important data for identification and use of the instrument:

- Article number
- Serial number
- Technical data
- Article numbers, documentation

3.2 Principle of operation

Application area

SITRANS LVL100 is a point level sensor with tuning fork for point level detection.

It is designed for industrial use in all areas of process technology and can be used in liquids.

Typical applications are overfill and dry run protection. With a tuning fork of only 38 mm length, SITRANS LVL100 can be also mounted e.g. in pipelines from DN 25. The small tuning fork allows use in vessels, tanks and pipes. Thanks to its simple and robust measuring system, SITRANS LVL100 is virtually unaffected by the chemical and physical properties of the liquid.

It functions even under difficult conditions such as turbulence, air bubbles, foam generation, buildup, strong external vibration or changing products.

Function monitoring
The electronics module of SITRANS LVL100 continuously monitors via frequency evaluation the following criteria:

- Strong corrosion or damage on the tuning fork
- Loss of vibration
- Line break to the piezo drive

If a malfunction is detected or in case of power failure, the electronics takes on a defined switching condition, i.e. the output is open (safe condition).

Functional principle

The tuning fork is piezoelectrically energised and vibrates at its mechanical resonance frequency of approx. 1100 Hz. When the tuning fork is submerged in the product, the frequency changes. This change is detected by the integrated electronics module and converted into a switching command.

Voltage supply

SITRANS LVL100 is a compact instrument, i.e. it can be operated without external evaluation system. The integrated electronics evaluates the level signal and outputs a switching signal. With this switching signal, a connected device can be operated directly (e.g. a warning system, a pump etc.).

The data for power supply are specified in chapter "*Technical data*".

3.3 Adjustment

The switching status of SITRANS LVL100 can be checked with closed housing (signal lamp). Products with a density > 0.7 g/cm^3 (0.025 lbs/in^3) can be detected.

3.4 Storage and transport

Packaging

Your instrument was protected by packaging during transport. Its capacity to handle normal loads during transport is assured by a test based on ISO 4180.

The packaging of standard instruments consists of environment-friendly, recyclable cardboard. For special versions, PE foam or PE foil is also used. Dispose of the packaging material via specialised recycling companies.

Transport

Transport must be carried out in due consideration of the notes on the transport packaging. Nonobservance of these instructions can cause damage to the device.

Transport inspection

The delivery must be checked for completeness and possible transit damage immediately at receipt. Ascertained transit damage or concealed defects must be appropriately dealt with.

Storage

Up to the time of installation, the packages must be left closed and stored according to the orientation and storage markings on the outside.

Unless otherwise indicated, the packages must be stored only under the following conditions:

- Not in the open
- Dry and dust free
- Not exposed to corrosive media
- Protected against solar radiation
- Avoiding mechanical shock and vibration

Storage and transport temperature

- Storage and transport temperature see chapter "*Supplement - Technical data - Ambient conditions*"
- Relative humidity 20 … 85 %

4 Mounting

4.1 General instructions

Suitability for the process conditions

Make sure that all parts of the instrument coming in direct contact with the process, especially the sensor element, process seal and process fitting, are suitable for the existing process conditions, such as process pressure, process temperature as well as the chemical properties of the medium.

You can find the specifications in chapter "*Technical data*" and on the nameplate.

Switching point

In general, SITRANS LVL100 can be installed in any position. The instrument only has to be mounted in such a way that the tuning fork is at the height of the desired switching point.

Keep in mind that the swichting point can vary dependent on the installation position.

The switching point refers to the medium water (1 g/cm^3/0.036 lbs/in^3). Please keep in mind that the switching point of the instrument shifts when the medium has a density differing from water.

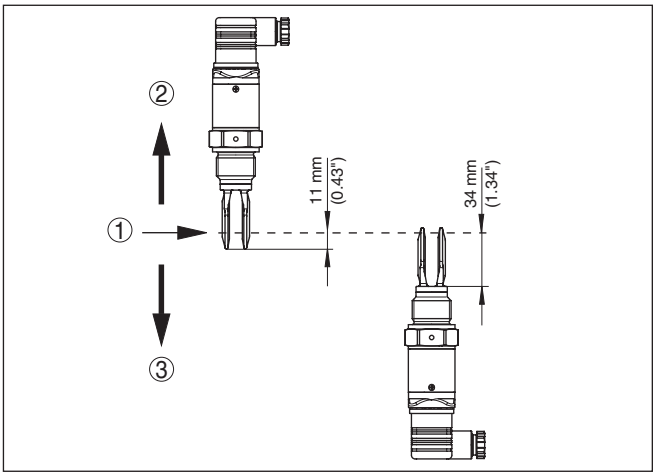


Fig. 2: Vertical mounting

1 Switching point in water
2 Switching point with lower density
3 Switching point with higher density

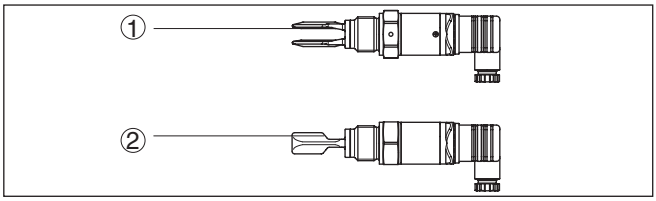


Fig. 3: Horizontal mounting

1 Switching point
2 Switching point (recommended mounting position, particularly for adhesive products)

Moisture

Use the recommended cables (see chapter "*Connecting to power supply*") and tighten the cable gland.

You can give your SITRANS LVL100 additional protection against moisture penetration by leading the connection cable downward in front of the cable entry. Rain and condensation water can thus drain off. This applies mainly to outdoor mounting as well as installation in areas where high humidity is expected (e.g. through cleaning processes) or on cooled or heated vessels.

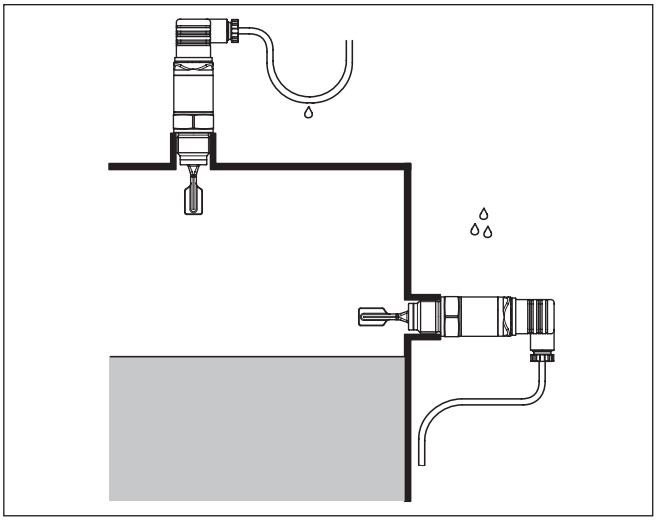


Fig. 4: Measures against moisture penetration

Transport

Do not hold SITRANS LVL100 on the tuning fork.

Pressure/Vacuum

The process fitting must be sealed if there is gauge or low pressure in the vessel. Before use, check if the seal material is resistant against the measured product and the process temperature.

The max. permissible pressure is specified in chapter "*Technical data*" or on the type label of the sensor.

Handling

The vibrating level switch is a measuring instrument and must be treated accordingly. Bending the vibrating element will destroy the instrument.

Warning:
The housing must not be used to screw the instrument in! Applying tightening force can damage internal parts of the housing.

Use the hexagon above the thread for screwing in.

4.2 Mounting instructions

Welded socket

For threaded versions of SITRANS LVL100 in combination with a mounting boss with O-ring in front and welding marking.

SITRANS LVL100 with thread sizes ¾" and 1" have a defined thread runout. This means that every SITRANS LVL100 is in the same position after being screwed in. Remove therefore the supplied flat seal from the thread of SITRANS LVL100. This flat seal is not required when using a welded socket with front-flush seal.

Before welding, unscrew SITRANS LVL100 and remove the rubber ring from the welded socket.

The welded socket is provided with a marking (notch). For horizontal mounting, weld the socket with the notch facing upward or downward; in pipelines (DN 25 to DN 50) aligned with the direction of flow.

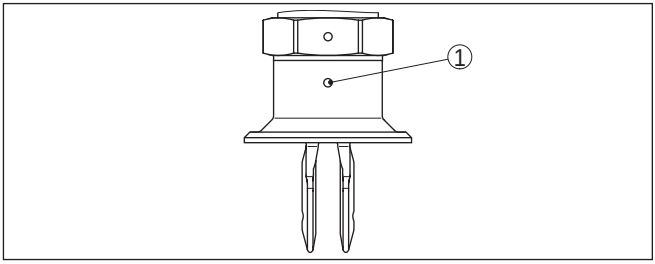


Fig. 5: Marking on the welded socket

1 Marking

Adhesive products

In case of horizontal mounting in adhesive and viscous products, the surfaces of the tuning fork should be vertical in order to reduce buildup on the tuning fork. The position of the tuning fork is indicated by a marking on the hexagon of SITRANS LVL100. With this, you can check the position of the tuning fork when screwing it in. When the hexagon touches the seal, the thread can still be turned by approx. half a turn. This is sufficient to reach the recommended installation position.

In adhesive and viscous products, the surfaces of the tuning fork should protrude into the vessel to avoid buildup. Therefore sockets for flanges and mountings bosses should not exceed a certain length.

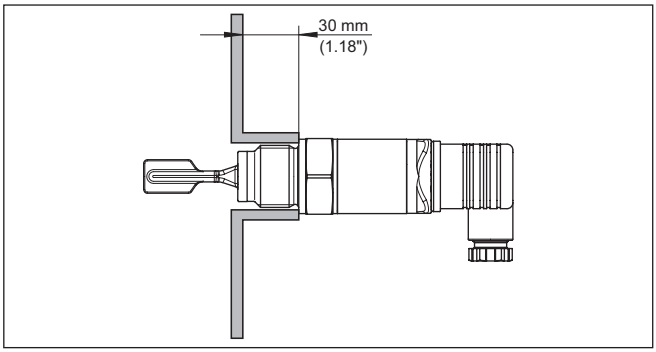


Fig. 6: Adhesive products

Inflowing medium

If SITRANS LVL100 is mounted in the filling stream, unwanted false measurement signals can be generated. For this reason, mount SITRANS LVL100 at a position in the vessel where no disturbances, e.g. from filling openings, agitators, etc., can occur.

Flows

To make sure the tuning fork of SITRANS LVL100 generates as little resistance as possible to product flow, mount the sensor so that the surfaces are parallel to the product movement.

5 Connecting to power supply

5.1 Preparing the connection

Note safety instructions

Always keep in mind the following safety instructions:

- Connect only in the complete absence of line voltage

Connection cable

The instrument is connected with standard two-wire cable without screen. If electromagnetic interference is expected which is above the test values of EN 61326 for industrial areas, screened cable should be used.

Use cable with round cross section. Depending on the plug connection, you have to select the outer diameter of the cable respectively so that the seal effect of the cable gland is ensured.

- Valve plug ISO 4400, ø 4.5 … 7 mm
- Valve plug ISO 4400 with IDC crimping technology, ø 5.5 … 8 mm

Cable glands

Use cable with a round wire cross section and tighten the cable gland.

When mounting outdoors, on cooled vessels or in moist areas in which cleaning is made with steam or high pressure, the sealing of the cable gland is very important.

5.2 Wiring plan

Housing overview

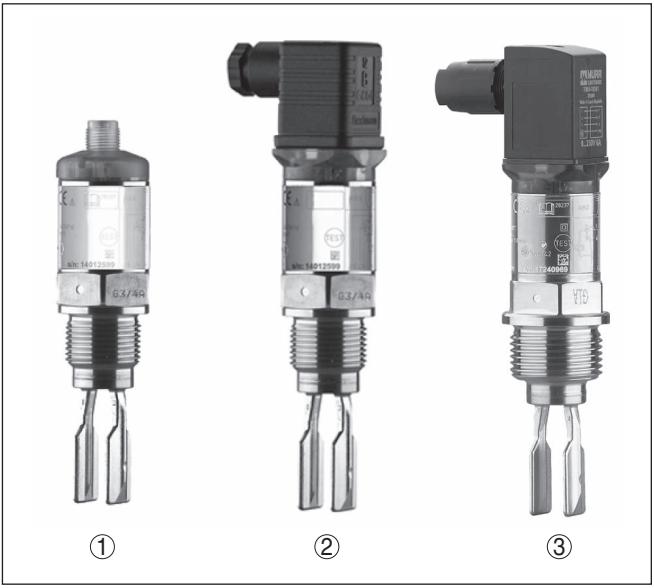


Fig. 7: Overview of the connection versions

1 M12 x 1 plug connection
2 Valve plug ISO 4400
3 Valve plug ISO 4400 with IDC method of termination

Plug versions

M12 x 1 plug connection
This plug connection requires a prefabricated cable with plug. Depending on the version, protection IP 66/IP 67 or IP 68 (0.2 bar).

Valve plug ISO 4400
For this plug version, standard cable with round wire cross-section can be used. Cable diameter 4.5 … 7 mm, protection IP 65.

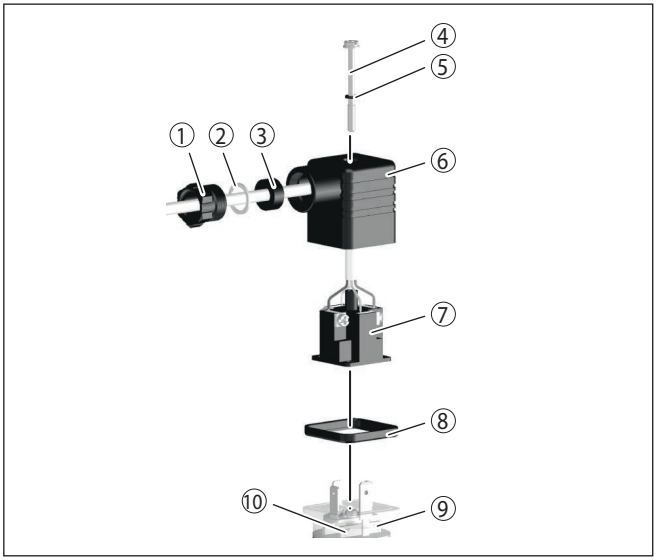


Fig. 8: Connection, valve plug ISO 4400

1 Pressure screw
2 Pressure disc
3 Seal ring
4 Fixing screw
5 Seal washer
6 Plug housing
7 Plug insert
8 Profile seal
9 Control lamp
10 SITRANS LVL100

Valve plug ISO 4400 with IDC method of termination
For this plug version you can use standard cable with round wire cross-section. The inner conductors do not have to be stripped. The plug connects the conductors automatically when screwing in. Cable diameter 5.5 … 8 mm, protection IP 67.

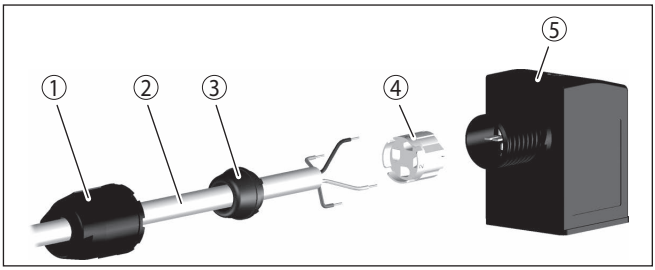


Fig. 9: Connection, valve plug ISO 4400 with IDC crimping technology

1 Compression nut
2 Cable
3 Seal ring
4 Terminal insert
5 Plug housing

Transistor output

For connection to binary inputs of a PLC.

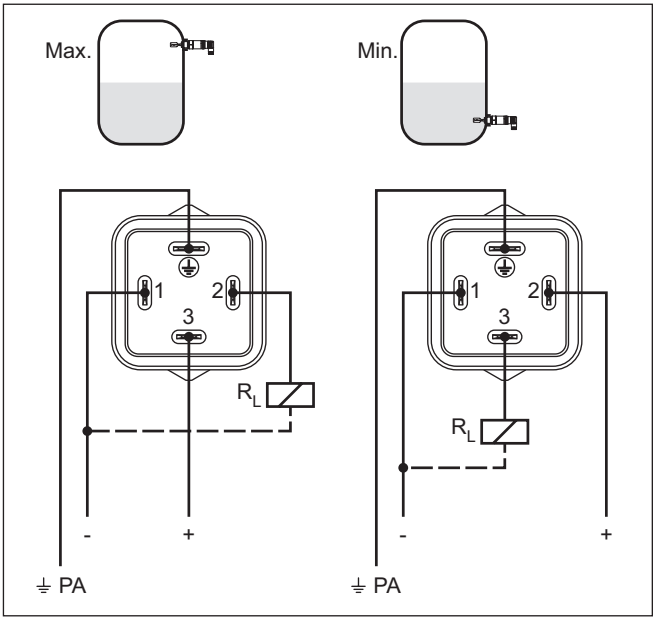


Fig. 10: Wiring plan, Transistor output with valve plug ISO 4400

PA Potential equalisation
R_L Load resistance (contactor, relay, etc.)

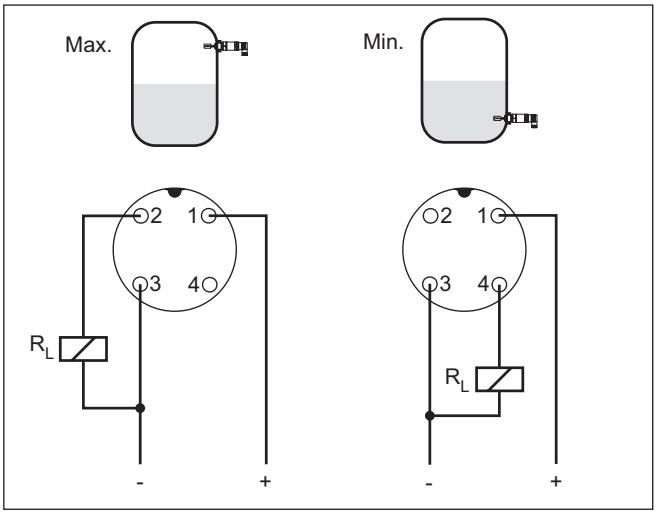


Fig. 11: Wiring plan (housing), transistor output with M12 x 1 plug connection

1 Brown
2 White
3 Blue
4 Black
R_L Load resistance (contactor, relay, etc.)

6 Setup

6.1 Indication of the switching status

The switching status of the electronics can be checked via the signal lamps (LEDs) integrated in the upper part of the housing.

The signal lamps have the following meaning:

- Green lights - voltage supply connected
- Yellow lights - vibrating element covered
- Red lights briefly - function test during instrument start (for 0.5 s)
- Red lights - shortcircuit or overload in the load circuit (sensor output high-impedance)
- Red flashes - Error on the vibrating element or the electronics (sensor output high impedance)

6.2 Simulation

The SITRANS LVL100 has an integrated function for simulation of the output signal which can be activated magnetically. Please proceed as follows:

→ Hold the test magnet (accessory) against the circle symbol with the label "TEST" on the instrument housing

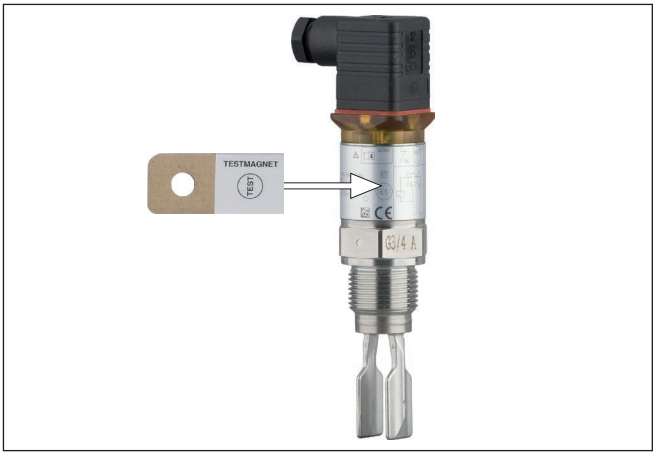


Fig. 12: Simulation of the output signal

The test magnet changes the current switching condition of the instrument. You can check the change on the signal lamp. Please note that all connected device are activated during the simulation.

If SITRANS LVL100 does not switch over after several tests with the test magnet, you have to check the plug connection and the connection cable and try it again. If there is no switching function, the electronics will be defective. In this case you have to exchange the electronics or return the instrument to our repair department.

Caution:
It is absolutely necessary that you remove the test magnet from the instrument housing after the simulation.

6.3 Function chart

The following chart provides an overview of the switching conditions depending on the set mode and the level.

	Level	Switching status	Control lamp Yellow - coverage	Control lamp Green - voltage indication	Control lamp Red - fault signal
Mode max.		closed	○	☼	○
Mode max.		open	☼	☼	○
Mode min.		closed	☼	☼	○
Mode min.		open	○	☼	○
Fault	any	open	any	☼	☼

7 Maintenance and fault rectification

7.1 Maintenance

If the instrument is used properly, no special maintenance is required in normal operation.

7.2 Rectify faults

Reaction when malfunctions occur

The operator of the system is responsible for taking suitable measures to rectify faults.

Failure reasons

SITRANS LVL100 offers maximum reliability. Nevertheless, faults can occur during operation. These may be caused by the following, e.g.:

- Sensor
- Process
- Voltage supply
- Signal processing

Fault rectification

The first measure to be taken is to check the output signal. In many cases, the causes can be determined this way and the faults rectified.

Checking the switching signal

Error	Cause	Rectification
Green signal lamp off	Voltage supply interrupted.	Check the voltage supply and the cable connection
	Electronics defective	Exchange the instrument or send it in for repair
Red signal lamp lights (switching output high-impedance)	Error with the electrical connection	Connect the instrument according to the wiring plan
	Shortcircuit or overload	Check the electrical connection
Red signal lamp flashes (switching output high-impedance)	Virbating frequency out of specification	Check the vibrating element on buildup and remove it
	Buildup on the vibrating element	Check the vibrating element and the sensor if there is buildup and remove it
	Vibrating element damaged	Check if the vibrating element is damage or extremely corroded

Reaction after fault rectification

Depending on the reason for the fault and the measures taken, the steps described in chapter "*Set up*" may have to be carried out again.

7.3 Instrument repair

If it is necessary to repair the instrument, please contact Siemens Milltronics Process Instruments Inc. You find the locations on our homepage "www.siemens.com/processautomation".

8 Dismounting

8.1 Dismounting steps



Warning:
Before dismounting, be aware of dangerous process conditions such as e.g. pressure in the vessel, high temperatures, corrosive or toxic products etc.

Take note of chapters "*Mounting*" and "*Connecting to power supply*" and carry out the listed steps in reverse order.

8.2 Disposal

The instrument consists of materials which can be recycled by specialised recycling companies. We use recyclable materials and have designed the parts to be easily separable.

WEEE directive 2002/96/EG
This instrument is not subject to the WEEE directive 2002/96/EG and the respective national laws. Pass the instrument directly on to a specialised recycling company and do not use the municipal collecting points. These may be used only for privately used products according to the WEEE directive.

Correct disposal avoids negative effects on humans and the environment and ensures recycling of useful raw materials.

Materials: see chapter "*Technical data*"

If you have no way to dispose of the old instrument properly, please contact us concerning return and disposal.

9 Supplement

9.1 Technical data

General data	
Material 316L corresponds to 1.4404 or 1.4435	
Materials, wetted parts	
– Tuning fork	316L
– Process seal	Klingersil C-4400
– Process fittings	316L
Materials, non-wetted parts	
– Housing	316L and plastic PEI
Weight approx.	250 g (9 oz)
Process fittings	
– Pipe thread, cylindrical (DIN 3852-A)	G½, G¾, G1
– American pipe thread, conical (ASME B1.20.1)	½ NPT, ¾ NPT, 1 NPT
– hygienic fittings	Clamp 1", Clamp 1½", Clamp 2", PN 16 DIN 32676, ISO 2852/316L, bolting DN 25 PN 40, bolting DN 40 PN 40, bolting DN 50 PN 25, SMS DN 38 PN 6
Max. torque - process fitting	
– Thread G½, ½ NPT	50 Nm (37 lbf ft)
– Thread G¾, ¾ NPT	75 Nm (55 lbf ft)
– Thread G1, 1 NPT	100 Nm (73 lbf ft)
Surface quality	
– Standard	R_a < 3.2 µm (1.26^{-4} in)
– Hygienic version	R_a < 0.8 µm (3.15^{-5} in)

Measuring accuracy	
Hysteresis	approx. 2 mm (0.08 in) with vertical installation
Switching delay	approx. 500 ms (on/off)
Measuring frequency	approx. 1100 Hz

Ambient conditions	
Ambient temperature on the housing	-40 … +70 °C (-40 … +158 °F)
Storage and transport temperature	-40 … +80 °C (-40 … +176 °F)

Process conditions	
Process pressure	-1 … 64 bar/-100 … 6400 kPa (-14.5 … 928 psig)
Process temperature - Standard	-40 … +100 °C (-40 … +212 °F)

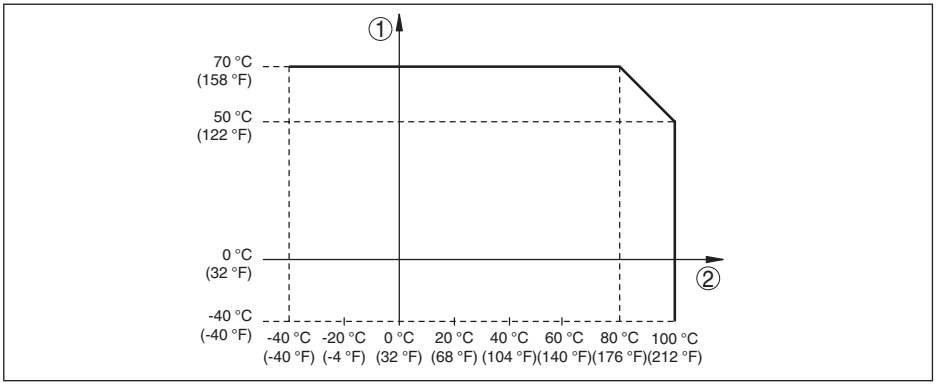


Fig. 31: Dependency ambient temperature to process temperature

1 Ambient temperature in °C (°F)
2 Process temperature in °C (°F)

Process temperature - High temperature version (option) -40 … +150 °C (-40 … +302 °F)

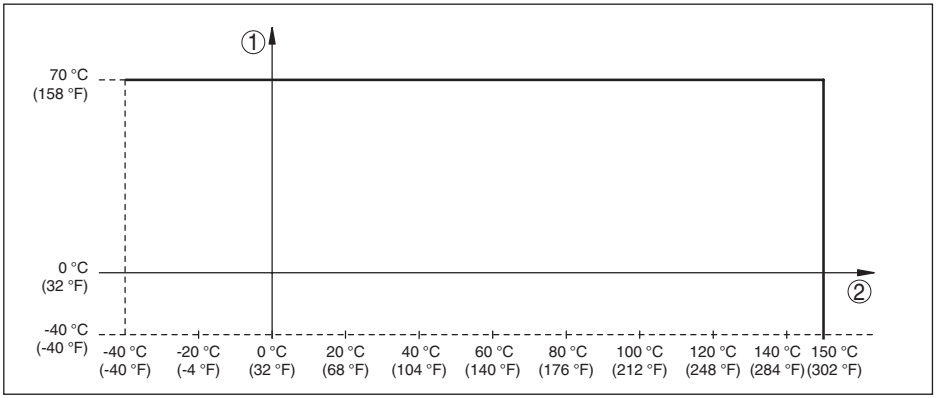


Fig. 32: Dependency ambient temperature to process temperature

1 Ambient temperature in °C (°F)
2 Process temperature in °C (°F)

Viscosity - dynamic	0.1 … 10000 mPa s
Flow velocity	max. 6 m/s (with a viscosity of 10000 mPa s)
Density	0.7 … 2.5 g/cm^3 (0.025 … 0.09 lbs/in^3)

Adjustment

Plug connections	Specification see "*Connecting to power supply*"
Signal lamps (LED)	
– Green	Voltage supply on
– Yellow	Vibrating element covered
– Red	Fault

Output variable	
Output	Transistor output PNP
Load current	max. 250 mA (output, permanently short-circuit proof)
Voltage loss	< 3 V
Switching voltage	< 34 V DC
Blocking current	< 10 µA
Mode	
– Min./Max.	Changeover by electronic connection
– Max.	Overflow protection
– Min.	Dry run protection
Voltage supply	
Operating voltage	9.6 … 35 V DC
Power consumption	max. 0.5 W
Electromechanical data	
Valve plug ISO 4400	
– Wire cross-section	1.5 mm^2 (0.06 in^2)
– Outer cable diameter	4.5 … 7 mm (0.18 … 0.28 in)
Valve plug ISO 4400 with IDC method of termination	
– Wire cross-section	for wire cross-section of 0.5 … 1 mm^2 (0.02 … 0.04 in^2)
– Single-wire diameter	> 0.1 mm (0.004 in)
– Wire diameter	1.6 … 2 mm^2 (0.06 … 0.08 in^2)
– Outer cable diameter	5.5 … 8 mm (0.22 … 0.31 in)
– Connection frequency	10 x (on the same cross-section)
Electrical protective measures	
Protection rating	
– Valve plug ISO 4400	IP 65
– Valve plug ISO 4400 with IDC method of termination	IP 67
– M12 x 1 plug connection	IP 66/IP 67 or IP 68 (0.2 bar)
Overvoltage category	III
Protection class	II

Approvals

Depending on the version, instruments with approvals can have different technical data. For these instruments, please note the corresponding approval documents. They are included in the scope of delivery.

9.2 Dimensions

SITRANS LVL100, standard version - thread

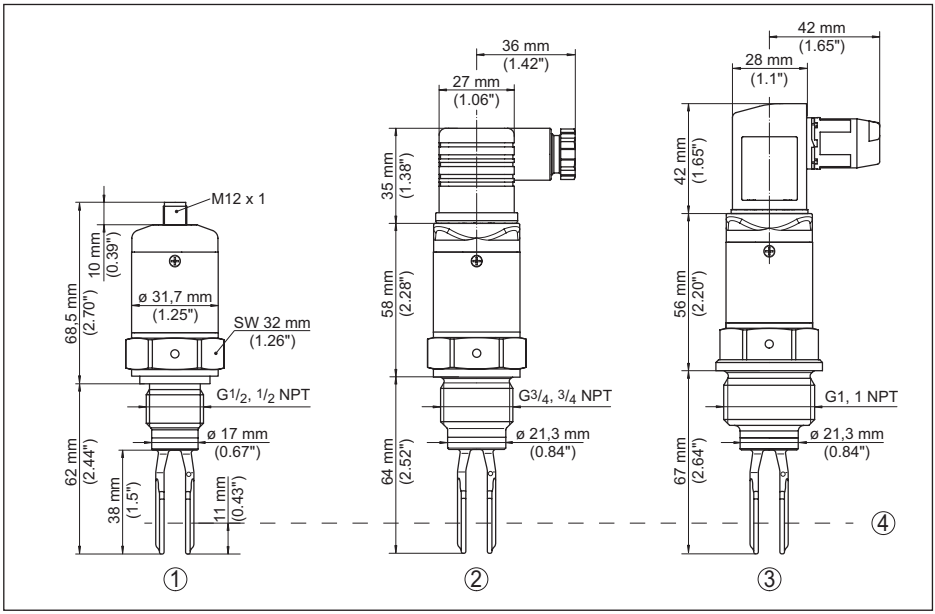


Fig. 33: SITRANS LVL100, standard version - thread

1 Thread G½ (DIN ISO 228/1), ½ NPT (M12 x 1)[1)]
2 Thread G¾ (DIN ISO 228/1), ¾ NPT (valve plug ISO 4400)
3 Thread G1 (DIN ISO 228/1), 1 NPT (valve plug ISO 4400 with DC method of termination)
4 Switching point

[1)] Keep in mind that the total length is extended by the plug connection.

SITRANS LVL100, standard version - thread G¾, G1, ¾ NPT, 1 NPT

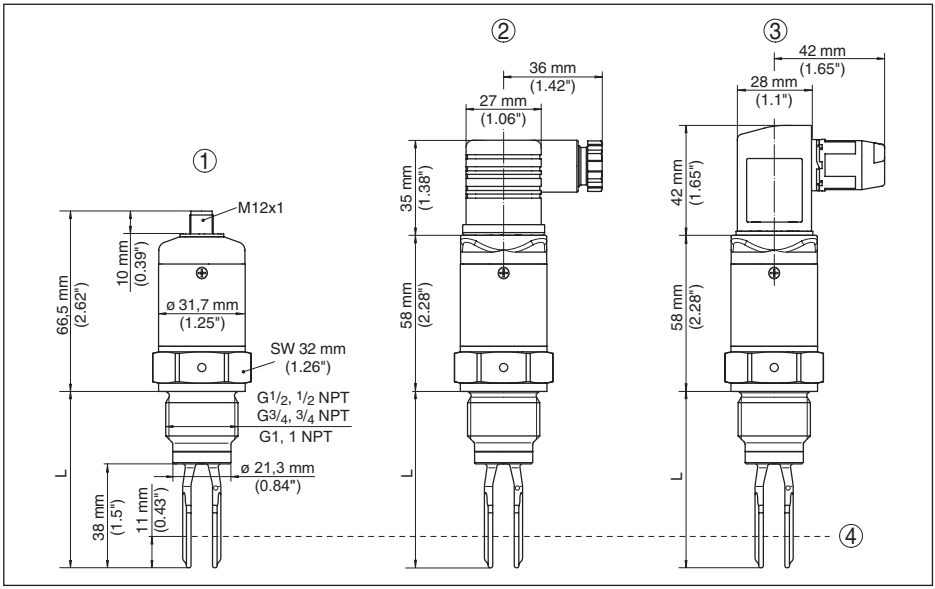


Fig. 34: SITRANS LVL100, standard version - thread G¾, G1, ¾ NPT, 1 NPT

1 Thread G¾, G1 (DIN ISO 228/1), ¾ NPT or 1 NPT (M12 x 1)[2)]
2 Thread G¾, G1 (DIN ISO 228/1), ¾ NPT or 1 NPT (valve plug ISO 4400)
3 Thread G¾, G1 (DIN ISO 228/1), ¾ NPT or 1 NPT (valve plug ISO 4400 with IDC crimping technology)
4 Switching point
L Length with G¾ (DIN ISO 228/1), ¾ NPT: 64 mm (2.5 in)
L Length with G1 (DIN ISO 228/1), 1 NPT: 67 mm (2.64 in)

[2)] Keep in mind that the total length is extended by the plug connection.

SITRANS LVL100, high temperature version

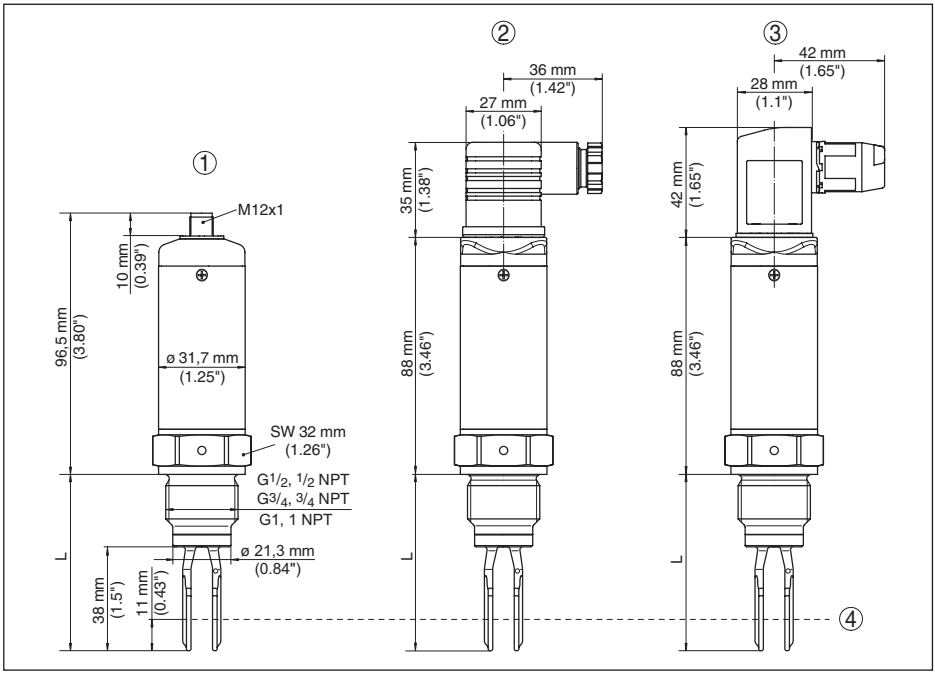


Fig. 35: SITRANS LVL100, high temperature version

1 *Thread G½, G¾, G1 (DIN ISO 228/1), ½ NPT, ¾ NPT or 1 NPT (M12 x 1)[3)]*
2 *Thread G½, G¾, G1 (DIN ISO 228/1), ½ NPT, ¾ NPT or 1 NPT (valve plug ISO 4400)*
3 *Thread G½, G¾, G1 (DIN ISO 228/1), ½ NPT, ¾ NPT or 1 NPT (valve plug ISO 4400 with IDC crimping technology)*
4 *Switching point*
L *Length with G½ (DIN ISO 228/1), ½ NPT: 62 mm (2.44 in)*
L *Length with G¾ (DIN ISO 228/1), ¾ NPT: 64 mm (2.5 in)*
L *Length with G1 (DIN ISO 228/1), 1 NPT: 67 mm (2.64 in)*

3) Keep in mind that the total length is extended by the plug connection.

SITRANS LVL100, hygienic versions

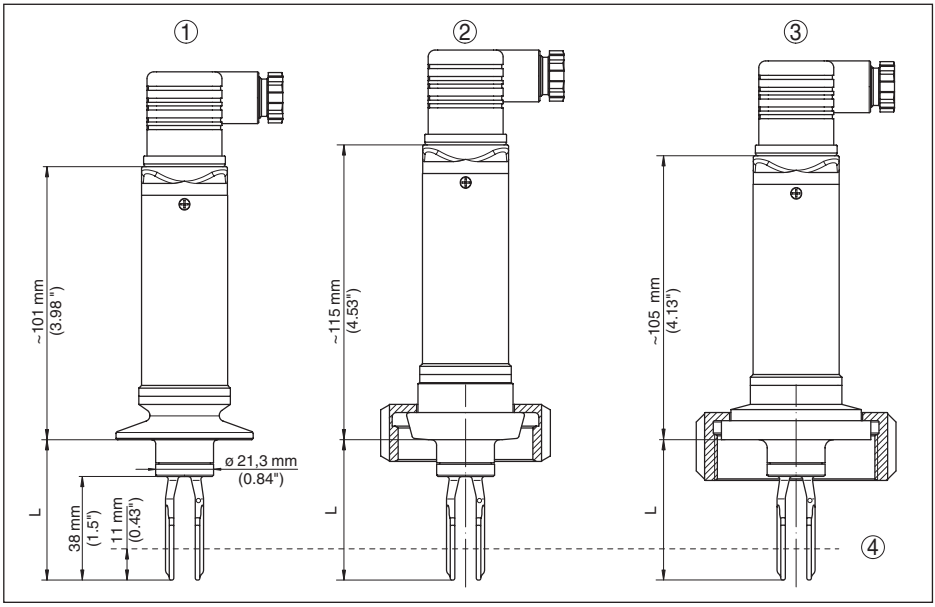


Fig. 36: SITRANS LVL100, hygienic versions

1 Clamp (valve plug ISO 4400)
2 Bolting (valve plug ISO 4400)
3 SMS 1145 (valve plug ISO 4400)
4 Switching point
L Length with Clamp: 53 mm (2.1 in)
L Length with bolting: 53 mm (2.1 in)
L Length with SMS 1145: 53 mm (2.1 in)

Notes

Notes

Notes

For more information

www.siemens.com/level

www.siemens.com/weighing

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Rev. 1.0

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Manufacturer: **Schunk Bahn- und Industrietechnik GmbH**

Documentation: **DOCUMENTATION**
Plug-in Brush Holder 06.00.0468.xx

Description
Assembly
Maintenance
Information

No. of pages: 12

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DOCUMENTATION

Plug-in Brush Holder Assembly
06.00.0468.xx

Description
Assembly
Maintenance
Information

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1.2 Structure 3

1.3 Types 4

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1 Description of the problem

If current flows through the bearings of an electrical machine, high current densities come about at the small contact points within each bearing and these bring about localized melting of the metal surfaces at these points. Small craters and groove patterns are the consequence. These increase the friction in the bearing and lead to the failure of the bearing through the relatively high degree of heating up in combination with the poorer lubrication. In general a shaft voltage of 500 mV is considered the highest level permissible for anti-friction bearings.

Shaft voltages can be caused by:

- Asymmetries in the magnetic circuit of rotating electrical machines
- Electrostatic charging of the shaft
- Capacitive coupling of voltages with static exciter systems

1.1 Task of the brush holder assembly

Fundamentally the brush holder in combination with appropriate carbon brushes serves as a bridge of low resistance for the transmission of current from fixed to rotating components. Here one differentiates between the following types of current transmission:

- Transmission of operating current
- Transmission of signal current
- Protective earthing of the rotating components

1.2 Structure

Two plug-in brush holders aligned at 90° relative to one another are used for the earthing of turbine shafts.

The Schunk plug-in brush holder assembly is characterized by the opportunity it permits for the brushes to be replaced while the generator system is in operation. To make this possible, the carbon brushes are seated in separate plug-in holders which can be locked and unlocked by simply pressing together the two grab handles.

1.3 Types

The Schunk plug-in holder assembly is available in different types. The variants differ in the length and position of their compression levers to respond towards dificult mounting situations and to assure easy maintenance.

This technical prescription is valid for the following plug-in holder types:

Type	Article-No.	Drawing-No.
angled lever clamp type A	10236289	06.00.0468.00
straight lever short clamp type A	10417001	06.00.0468.04
straight lever long clamp type A	10557274	06.00.0468.05
angled lever clamp type B	10573181	06.00.0468.06
straight lever short clamp type B	10578465	06.00.0468.07
straight lever long clamp type B	10578463	06.00.0468.08

1.4 Part List (Carbon Brushes)

The above listed holder types are to be quipped with the following brushes:

Material	Dokument	Materialkurztext	Menge	ME
10322358	02.40.0017.00	Set Erdungsbürsten 20x8x32 02.40.0017.00	0	ST
10022511	16.19.0148.00	Bürsten 101 161 115 002 S13/F19	1	ST
10022760	16.19.0148.01	Bürsten 101 161 115 001 F19/S13	1	ST
10214867	33.01.005	Minigrip-Beutel 120x170x0,09 33.01.005	1	ST

1.5 State as delivered

The plug-in brush holder assembly is supplied as one fully assembled unit as well as loose parts. In the state as delivered, the two legs are aligned at an angle of 180° to one another. Two dowel pins (item 6) are enclosed loose with the holder.

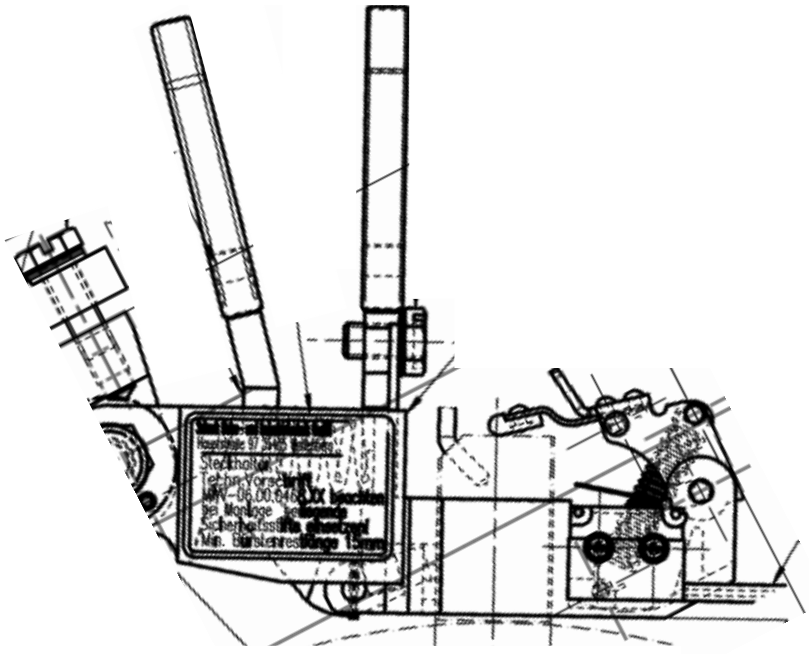
1.6 Micro switch

The micro switch is an optional accessory, which is not included in the standard design.

Together with an on-site monitoring system the micro switch indicates an upcoming carbon brush replacement. As the switch is normally closed, an open circuit will indicate that the brush has reached a usable rest length of approx. 3mm.
Please note that the micro switch may not be used for any current transmission operation except as specified below. Make sure the signal wire does not hinder or jam the carbon brush working area.

Specification	
Temperature range °C -40°C to +85°C/120°C	
Protection IP 6K7	
Cable length 3m	
Signal point 3mm before end of lever stop	
Functions normally-closed	
AC minimum: 12V / 10mA	maximum: 250V / 5A
DC minimum: 12V / 10mA	maximum: 30V / 5A

Micro switch position on holder:



2 Mounting

2.1 Securing of the brush holder assembly

(1) The distance of the securing pin (Ø=16 mm) from the surface of the shaft is to be determined in accordance with the following table:

Ø shaft / slip-ring [mm]	Distance centre of pin to shaft surface [mm]
600	57
500	58
400	60
360	60.5
300	61.5
250	63

(2) Care must be taken that the securing pin is parallel to the axis of the shaft and that it permits the brush holder to be secured firmly.
(3) The brush holder assembly is pushed on to the fixing bolt and secured so that it cannot rotate. Make sure that the clamping pieces don't tilt and all clamping screws are fastened equally with fastening torque 10Nm.
(4) After this the legs are aligned to the shaft. The distance between the lower side of the holder and the surface of the shaft may be 1 – 2 mm.
(5) The position of the legs is fixed with the aid of the hexagonal screws.
(6) After the angle between the legs has been set, the brush holder assembly is removed from the securing pin again so that the two dowel pins can be fitted. For this purpose there are holes in the two legs. These must be carried over to the central clamping piece (hole diameter = 3 mm).
(7) The dowel pins are pressed into the holes with the aid of a punch.
(8) Finally the brush holder assembly can be mounted on the securing pin again. (see step 3)

2.2 Mounting of the carbon brushes

The two plug-in holders are first removed from the brush holder assembly by pressing the grab handles together.

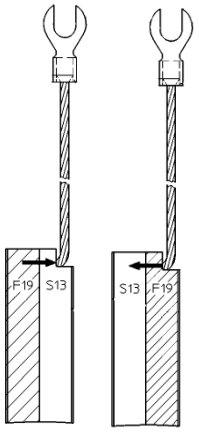
After the compression levers have been opened, the carbon brush is inserted in the guide provided for it and the power cable is screwed to the plug-in holder (hexagonal screw beneath the grab handle).

Important: This version is designed exclusively for one-direction running. For two-direction running, other solutions must be selected. Ensure that the orientation of the brushes is correct. The arrow marking on the carbon brush must point in the direction in which the shaft rotates.

Then the compression lever is closed and the plug-in holder with the brush is pressed on a flat surface in order to press the brush upwards in its guide.

When the grab handles are pressed together, the brush is located in position and the plug-in holder can be mounted again.

Here care must be taken that the locking mechanism of the plug-in holder engages properly.



The carbon brush used is a multi-layer carbon brush of silver and graphite with a "right-hand" and a "left-hand" form of execution. By reason of the mounting of the brushes in the plug-in holders and the securing of the power cable on the holder, the power cables are secured in the brush in different ways. In this way it is ensured that the graphite layer of the brush always points in the direction in which the shaft rotates while the silver-graphite layer points in the opposite direction.

3 Technical data

The technical data stated below refer exclusively to products from the scope of delivery of Messrs. Schunk with account being taken of the documentation relating to the particular product.

3.1 Brushes

Number of brushes:	2 (pieces) (see part list chapter 1.4)
Brush dimensions :	20 x 8 x 32 (mm)
Brush material:	layer material F19 / S13
Nominal brush pressure:	160-200 (cN/cm²)

3.2 Requirements to be satisfied by the counter face

Material of the counter face	steel (stainless)
Diameter of the shaft	250 – approx. 1500 [mm]
Initial meaned peak-to-valley height	Ra<1,6 / Rz < 7 [µm]
Concentricity properties	< 40 [µm]
circumferential speed	93 [m/s]



Important : Under no circumstances may oil or similar fluid lubricants be allowed to get into the region of the brushes or of the holder.

3.3 Current load

Max. steady current Ieff.	15 [A/cm²]
Max. short-term overload (<30s)	20 [A/cm²]
Max. voltage eff	30 [V]

3.4 Ambient conditions

Air humidity:	>3 to >15g/m³

4 General statements on operating and maintenance

4.1 Maintenance intervals

Under normal operating conditions and assuming that the brush holder has been properly mounted and that the peripheral speed of the counter surface is 20 – 70 m/s, an average brush wear of 1 – 4 mm / 1000 h is to be reckoned on.

I. The brush used (initial length 32 mm) is to be replaced at the latest when it has worn down to a length of 15 mm.



IMPORTANT: If the brushes are not replaced early enough the axle surface may be damaged seriously by the worn brushes.

II. If the system, in which the holder assembly is used, is maintained at different intervals, then the brush holder assembly is to be included in the maintenance measure for the system. Within every brush-replacement, the holder has to checked regarding the following criteria:

   a. Correct adjustment (distance between holder and slipring surface: 1-2mm)

   b. Easy movement of brushes in the holder

   c. Correct position of security pins

   d. Transition resistance measured accoring the attached drawing (refer to chapter 6). The usage of a conventional resistance measurement tool with 4-point measuring mode is recommendend to avoid measuring mistakes caused by cable lengths).

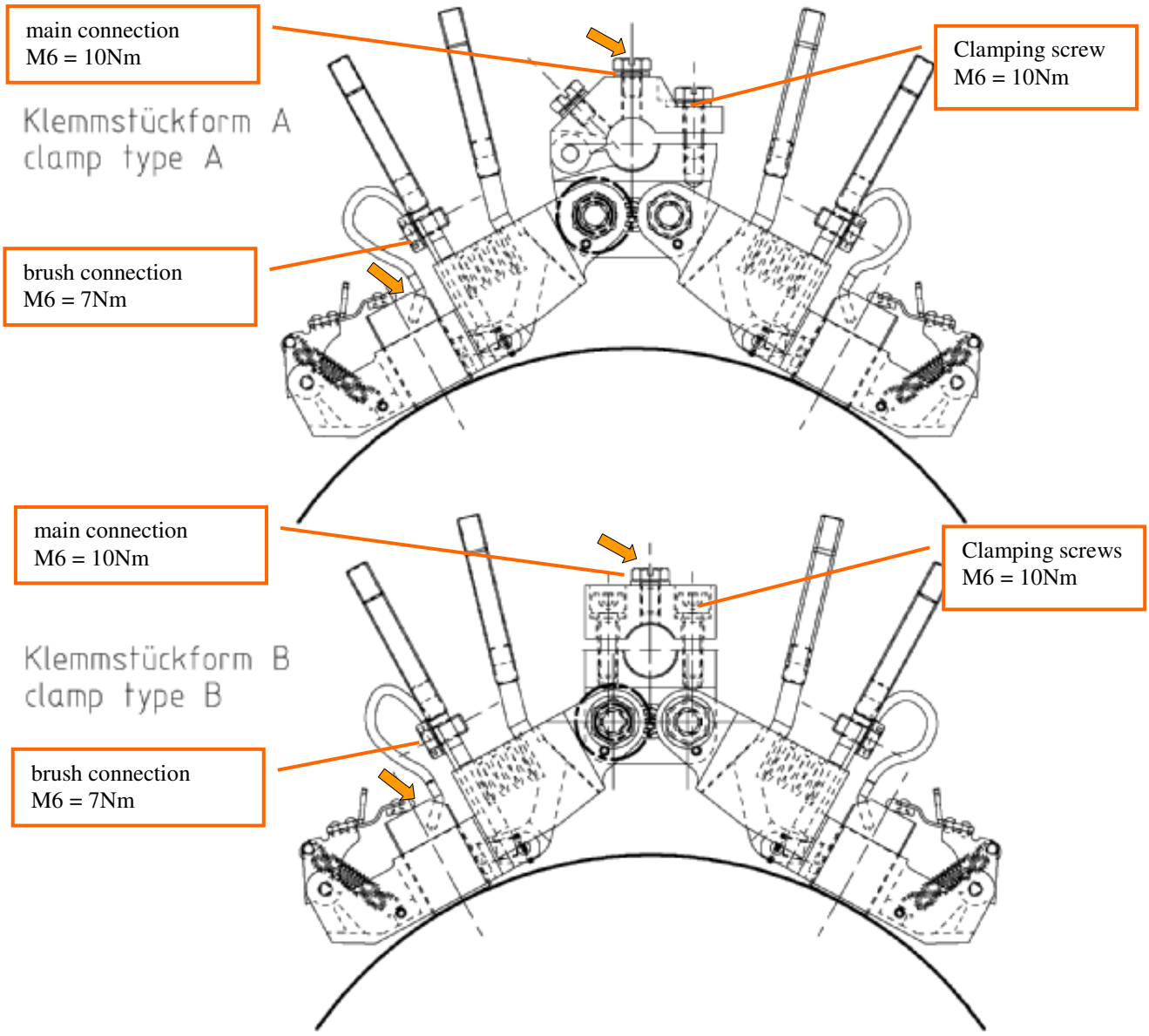
III. After a maximum of 10 years the brush-holder must be replaced

5 Normal operating

The situation of normal operating in the sense of directive 94/9 EC (ATEX) is given when all requirements of this documentation in respect of mounting, maintenance, operating and ambient conditions are maintained.

6 Symbolic view with measuring points

Arrows mark measuring points for resistance measurement according to proper maintenance.



Schunk Bahn- und Industrietechnik GmbH

Test certificate

for Plug-in Brush Holder Assembly as type 06.00.0468.XX

In case of any brush change of the plug-in brush holder a measurement of the contact resistance between the brushes and terminal screw must be done, according to Schunk technical regulation. It must be measured between the measuring points as marked on the drawing on both brushes with a calibrated digital voltmeter using conventional probes. The measurement results are filled in the space provided on the attached table in milliohms. There are used to demonstrate the proper brush change.

Anlage / Standort: _____

Betreiber:_____

Bürsten-wechsel	Datum	Messwert IST- [mOHm]	Messwert SOLL [mOhm]	Unterschrift
1.			<30	
2.			<30	
3.			<30	
4.			<30	
5.			<30	
6.			<30	
7.			<30	
8.			<30	
9.			<30	
10.			<30	

This document is NOT subject to revision service!

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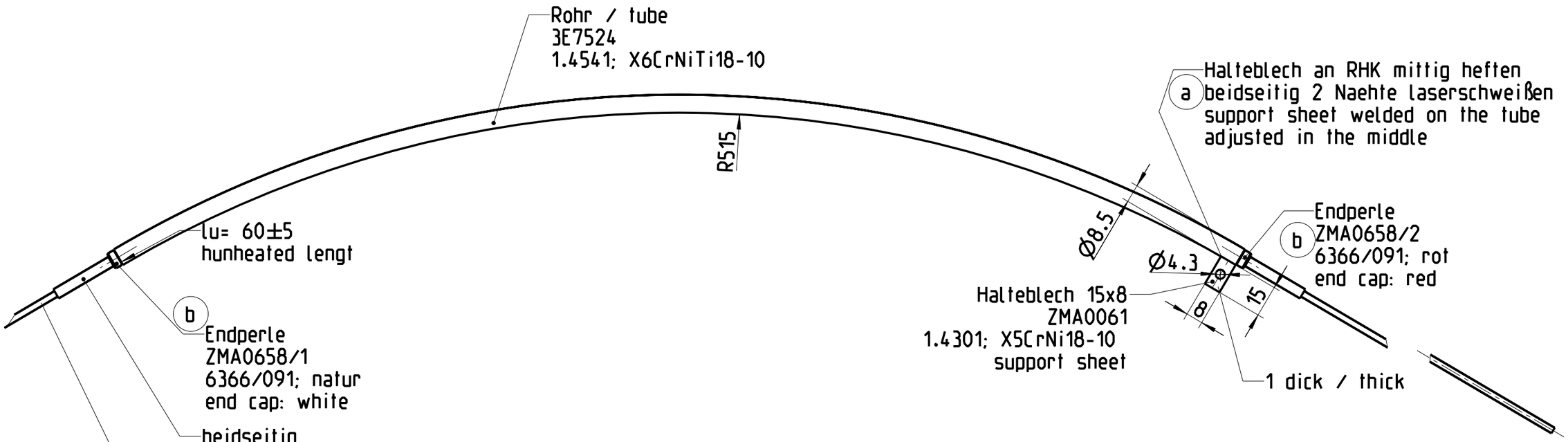
Manufacturer: **Döbeln Elektrowärme GmbH**

Documentation title: **Heating Element**
Drawing 3E7524

Voltage: 200 V

No. of Pages: 1 drawing

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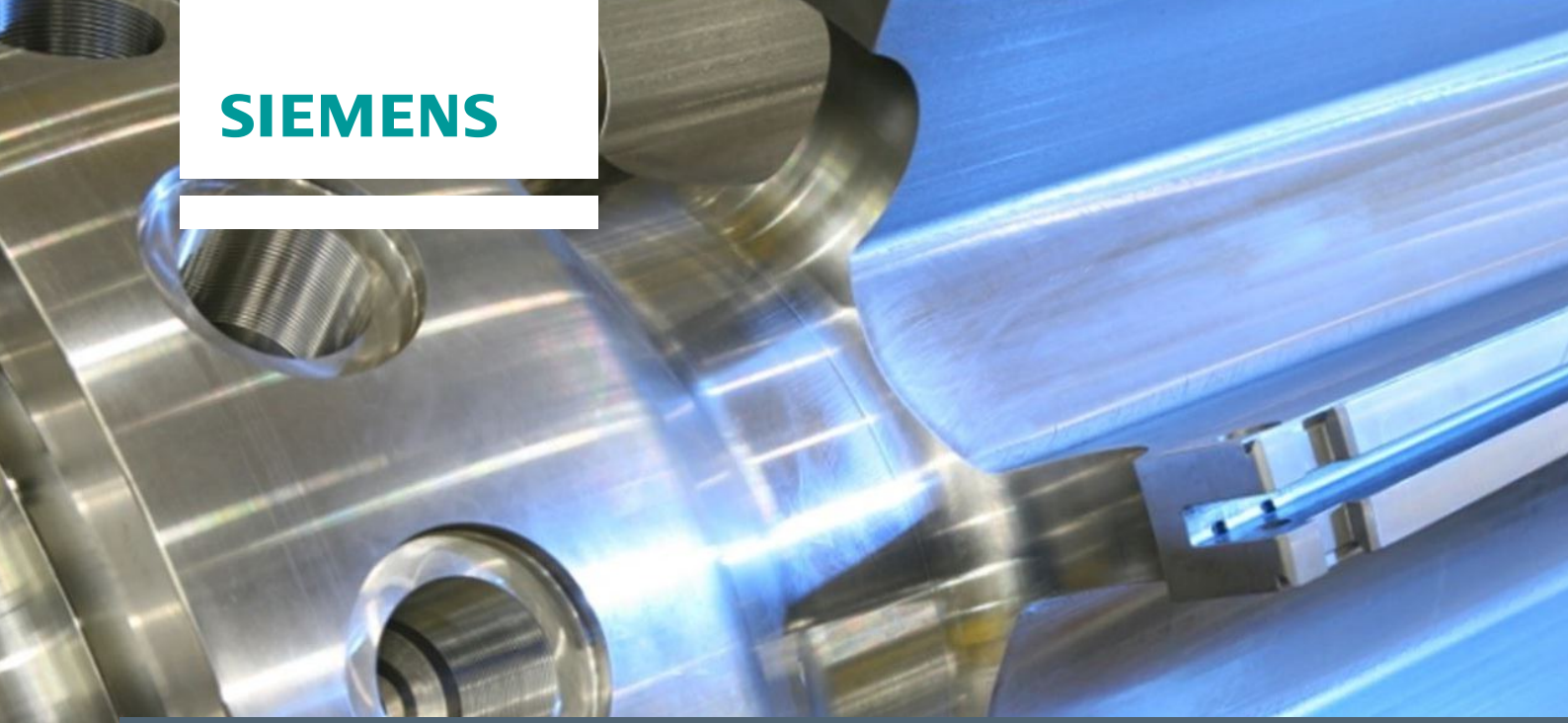


Spannung / Voltage: 200 V
Leistung / Power: 100 W +5/-10%
Hochspannungsfestigkeit: 1250 V/min
high voltage resistance: 1250V/min
R kalt / R cold: 374.2-436.6 Ohm
Isolationswiderstand bei Auslieferung:
isolating resistance by delivery: >2000MΩ
Isolationswiderstand nach 1/2 jaehrlicher Lagerung:
isolating resistance after 1/2 year storage: min. 100MΩ

Stempelung 70mm vom Rohrende, beidseitig möglich
Marking 70mm distance to the tube end posssible
Spannung Leistung DEW DEW-Nr. MMJJ
c Voltage, Power DEW DEW-No. MMYY

Drawing Number: DPPPG-70116871 Rev. A
Alt-ID: 3-122936

Dateiname des Modells: 3E7524					Dateityp: ASSEM	Dateiname der Zeichnung: 3E7524	
Kunde: Siemens Erfurt				Allgemeintol. DIN ISO 2768-v	Kanten DIN ISO 13715	Maßstab: 1:2 (A3)	Masse: 0.075 kg
						Werkstoff: Halbzeug:	
					Datum	Name	Benennung: Rundrohrheizkörper heating element
				Bear.	14.05.2005	Kießling	
				Gepr.	14.07.2005	Ruckert	
				Norm			
				Qual.	15.07.2005	Brassat	
c	26K15	06.02.15	Kie	Döbeln Elektrowärme GmbH www.dew-doebeln.com		Zeichnungsnummer: 3E7524	Bl. 1 / 1 Bl.
b	96K12	22.08.12	Kie				
a	64K12	32.05.12	Kie				
Zust.	Änderung	Datum	Name	(Urspr.)		(Ers. f.:)	(Ers. d.:)



SIEMENS

Description of the System/ Plant Section 2

Protection and Monitoring 2.4

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2.4.1 Generator Protection – General

2.4.2 Protective Devices and Supervisory Equipment

2.4.3 Auxiliary Wiring Diagrams

SIEMENS
ENERGY SECTOR
GN ERF (Erfurt plant)

AUXILIARY WIRING DIAGRAMS GENERATOR

PROJECT	VILNIUS Biomass
ORDER NUMBER	EG000367
PURCHASER	
FINAL CUSTOMER/USER	Vilniaus Kogeneracine Jegaine
DATE OF ISSUE	2017, Dec. 19

Revision A 2017, Dec. 19
Revision B 2018, Apr. 16
Revision C 2018, Nov. 15

NUMBER OF PAGES 79

INFORMATION ABOUT CHANGES

no.	sh. index	Date	Name	Description of changes
1	a	19.12.2017	Möbius	first release for customer
2	b	16.04.2018	Rabe	V20 added; MTB adapted; first workshop release
3	c	15.11.2018	Rabe	revision as built
4				
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	1	COVER SHEET	Revision C	15.11.2018	19.12.2017	Rabe
	2	INFORMATION ABOUT CHANGES	Revision C	15.11.2018	19.12.2017	Rabe
	3	TABLE OF CONTENTS	Revision C	15.11.2018	19.12.2017	Rabe
	4	TABLE OF CONTENTS	Revision C	15.11.2018	19.12.2017	Rabe
	5	TABLE OF CONTENTS	Revision C	15.11.2018	19.12.2017	Rabe
+INSTRUMENTLIST	6	GENERATOR INSTRUMENT LIST TEMPERATURE			19.12.2017	
+INSTRUMENTLIST	7	GENERATOR INSTRUMENT LIST LEAKAGE, VIBRATION, HEATERS, SSC			19.12.2017	
+LIST	8	CONSUMER LIST	Revision B	16.04.2018	19.12.2017	Rabe
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+CABLING	13	CABLING LEAKAGE WATER DETECTION LOCATION DIAGRAM			19.12.2017	
+CABLING	14	CABLING RELATIVE SHAFT VIBRATION LOCATION DIAGRAM	Revision C	15.11.2018	19.12.2017	Rabe
+CABLING	15	CABLING ABSOL. BEARING VIBRATION LOCATION DIAGRAM	Revision C	15.11.2018	19.12.2017	Rabe
+CABLING	16	CABLING ANTICONDENSATION HEATER LOCATION DIAGRAM	Revision B	16.04.2018	19.12.2017	Rabe
+CABLING	17	CABLING EXCITER LOCATION DIAGRAM			19.12.2017	
+V20MKA10GA010	18	JUNCTION BOX MEASURING MOUNTING PLATE	Revision B	16.04.2018	19.12.2017	Rabe
+V20MKA10GA010	19	JUNCTION BOX MEASURING STATOR WINDING TEMPERATURE	Revision B	16.04.2018	19.12.2017	Rabe
+V20MKA10GA010	20	JUNCTION BOX MEASURING STATOR WINDING TEMPERATURE	Revision B	16.04.2018	19.12.2017	Rabe
+V20MKA10GA010	21	JUNCTION BOX MEASURING BEARING TEMPERATURE			19.12.2017	
+V20MKA10GA010	22	JUNCTION BOX MEASURING COLD AIR TEMPERATURE			19.12.2017	
+V20MKA10GA010	23	JUNCTION BOX MEASURING WARM AIR TEMPERATURE			19.12.2017	
+V20MKA10GA010	24	JUNCTION BOX MEASURING LEAKAGE WATER DETECTION			19.12.2017	
+V20MKA10GA010	25	Klemmenplan : =+V20MKA10GA010-X1			19.12.2017	
+V20MKA10GA010	26	Klemmenplan : =+V20MKA10GA010-X1			19.12.2017	
+V20MKA10GA010	27	Klemmenplan : =+V20MKA10GA010-X2			19.12.2017	
+V20MKA10GA010	28	Klemmenplan : =+V20MKA10GA010-X3			19.12.2017	
+V20MKA10GA010	29	Klemmenplan : =+V20MKA10GA010-X3			19.12.2017	
+V20MKA10GA010	30	Klemmenplan : =+V20MKA10GA010-X5			19.12.2017	
+V20MKD10GA010	31	JUNCTION BOX VIBRATION MOUNTING PLATE TURBINE END			19.12.2017	
+V20MKD10GA010	32	JUNCTION BOX RELATIVE SHAFT VIBRATION DRIVE END			19.12.2017	
+V20MKD10GA010	33	JUNCTION BOX MEASURING ABSOLUTE BEARING VIBRATION TURBINE END	Revision B	16.04.2018	19.12.2017	Rabe

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+V20MKC20GA010	48	JUNCTION BOX ROTOR EARTH FAULT DETECTION		19.12.2017	
+V20MKC20GA010	49	Klemmenplan : =+V20MKC20GA010-X4		19.12.2017	
+V20MKC10GE010	50	JUNCTION BOX PERMANENT MAGNET GENERATOR MOUNTING PLATE		19.12.2017	
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+V20MKA10GE020	56	Klemmenplan : =+V20MKA10GE020-X0		19.12.2017	
+V20MKA10GE020	57	Klemmenplan : =+V20MKA10GE020-X7N		19.12.2017	
+V20MKA10GE020	58	Klemmenplan : =+V20MKA10GE020-X7N		19.12.2017	
+V20MKA10GE050	59	NEUTRAL SIDE CUBICLE ANTICONDENSATION HEATER	Revision B 16.04.2018	19.12.2017	Rabe
+V20MKA10GE050	60	Klemmenplan : =+V20MKA10GE050-X1		19.12.2017	
+V20MKA10GE010	61	LINE SIDE CUBICLE PARTIAL DISCHARGE MEASUREMENT	Revision B 16.04.2018	19.12.2017	Rabe
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+V20MKA10GE010	63	LINE SIDE CUBICLE VOLTAGE TRANSFORMER		19.12.2017	
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+V20MKA10GE010	72	Klemmenplan : =+V20MKA10GE010-X8		19.12.2017	
+V20MKA10GE010	73	Klemmenplan : =+V20MKA10GE010-X10		19.12.2017	
+V20MKA10GE010	74	Klemmenplan : =+V20MKA10GE010-X10		19.12.2017	
+V20MKA10GE040	75	LINE SIDE CUBICLE ANTICONDENSATION HEATER	Revision B 16.04.2018	19.12.2017	Rabe
+V20MKA10GE040	76	Klemmenplan : =+V20MKA10GE040-X1		19.12.2017	
+V20MKD10GA020	77	JUNCTION BOX ROTOR EARTHING MOUNTING PLATE		19.12.2017	
+V20MKD10GA020	78	JUNCTION BOX ROTOR EARTHING		19.12.2017	
+V20MKD10GA020	79	Klemmenplan : =+V20MKD10GA020-X0		19.12.2017	

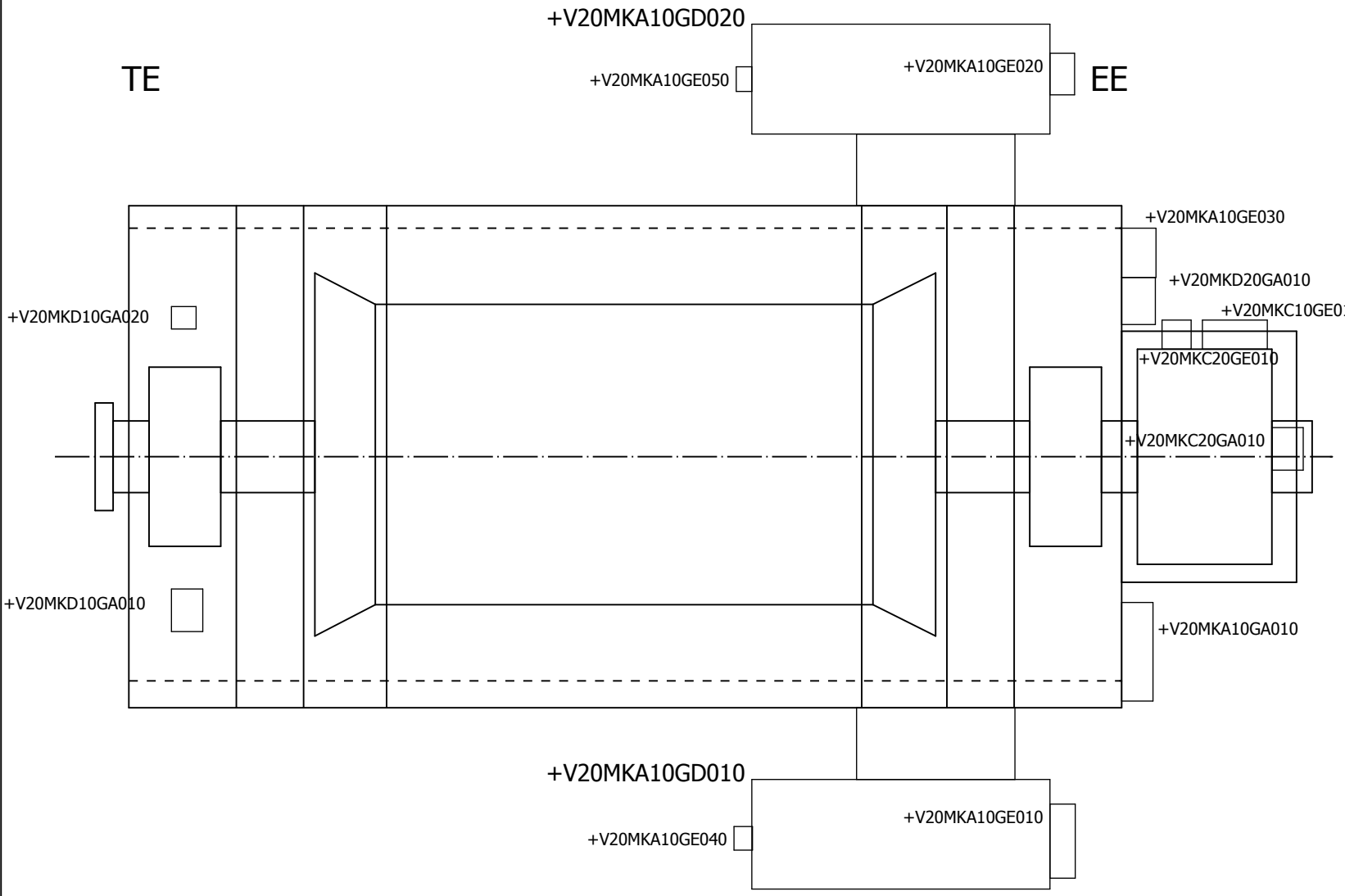
KKS	DESCRIPTION	TYPE	MANUFACTURER
=V20MKA10CT010-B1	STATOR SLOT THERMOMETER 1	4-123317	TMG
=V20MKA10CT020-B1	STATOR SLOT THERMOMETER 2	4-123317	TMG
=V20MKA10CT030-B1	STATOR SLOT THERMOMETER 3	4-123317	TMG
=V20MKA10CT011-B1	STATOR SLOT THERMOMETER 4	4-123317	TMG
=V20MKA10CT021-B1	STATOR SLOT THERMOMETER 5	4-123317	TMG
=V20MKA10CT031-B1	STATOR SLOT THERMOMETER 6	4-123317	TMG
=V20MKA10CT012-B1	STATOR SLOT THERMOMETER 7	4-123317	TMG
=V20MKA10CT022-B1	STATOR SLOT THERMOMETER 8	4-123317	TMG
=V20MKA10CT032-B1	STATOR SLOT THERMOMETER 9	4-123317	TMG
=V20MKA10CT013-B1	STATOR SLOT THERMOMETER 10 SPARE	4-123317	TMG
=V20MKA10CT023-B1	STATOR SLOT THERMOMETER 11 SPARE	4-123317	TMG
=V20MKA10CT033-B1	STATOR SLOT THERMOMETER 12 SPARE	4-123317	TMG
=V20MKD10CT010-B1	BEARING METAL THERMOM. TE	WQ 0232-PVDF	TMG
=V20MKD20CT010-B1	BEARING METAL THERMOM. EE	WQ 0232-PVDF	TMG
=V20MKA10CT050-B1	COLD AIR THERMOMETER TE	WQ 0233	TMG
=V20MKA10CT055-B1	COLD AIR THERMOMETER EE	WQ 0233	TMG
=V20MKA10CT060-B1	WARM AIR THERMOMETER	WQ 0233	TMG
=V20MKA10CT062-B1	WARM AIR TEMPERATURE EXCITER	WQ 0233	TMG

KKS	DESCRIPTION	TYPE	MANUFACTURER
=V20MKA10CL110-B1	LEAKAGE WATER SENSOR TE ALARM	SITRANS LVL100 (7ML5745-1BA42-1BA0)	SIEMENS
=V20MKA10CL111-B1	LEAKAGE WATER SENSOR TE TRIP	SITRANS LVL100 (7ML5745-1BA42-1BA0)	SIEMENS
=V20MKA10CL120-B1	LEAKAGE WATER SENSOR EE ALARM	SITRANS LVL100 (7ML5745-1BA42-1BA0)	SIEMENS
=V20MKA10CL121-B1	LEAKAGE WATER SENSOR EE TRIP	SITRANS LVL100 (7ML5745-1BA42-1BA0)	SIEMENS
=V20MKD10CY011-B1	REL. SHAFT VIBRATION SENSOR TE-X	330106-05-30-05-02-00	BENTLY NEVADA
=V20MKD10CY011-A1	PROXIMITOR 9m, 200mV/mil	330180-91-00	BENTLY NEVADA
=V20MKD10CY012-B1	REL. SHAFT VIBRATION SENSOR TE-Y	330106-05-30-05-02-00	BENTLY NEVADA
=V20MKD10CY012-A1	PROXIMITOR 9m, 200mV/mil	330180-91-00	BENTLY NEVADA
=V20MKD20CY011-B1	REL. SHAFT VIBRATION SENSOR EE-X	330106-05-30-05-02-00	BENTLY NEVADA
=V20MKD20CY011-A1	PROXIMITOR 9m, 200mV/mil	330180-91-00	BENTLY NEVADA
=V20MKD20CY012-B1	REL. SHAFT VIBRATION SENSOR EE-Y	330106-05-30-05-02-00	BENTLY NEVADA
=V20MKD20CY012-A1	PROXIMITOR 9m, 200mV/mil	330180-91-00	BENTLY NEVADA
=V20MKD10CY010-B1	ABSOL. BEARING VIBRATION SENSOR TE-A	330500-02-00	BENTLY NEVADA
=V20MKD10CY020-B1	ABSOL. BEARING VIBRATION SENSOR TE-B	330500-02-00	BENTLY NEVADA
=V20MKD10CY030-B1	ABSOL. BEARING VIBRATION SENSOR TE-C	330500-02-00	BENTLY NEVADA
=V20MKD20CY010-B1	ABSOL. BEARING VIBRATION SENSOR EE-A	330500-02-00	BENTLY NEVADA
=V20MKD20CY020-B1	ABSOL. BEARING VIBRATION SENSOR EE-B	330500-02-00	BENTLY NEVADA
=V20MKD20CY030-B1	ABSOL. BEARING VIBRATION SENSOR EE-C	330500-02-00	BENTLY NEVADA
=V20MKD10CY013-B1	KEYPHASOR	330106-05-30-05-02-00	BENTLY NEVADA
=V20MKD10CY013-A1	PROXIMITOR 9m, 200mV/mil	330180-91-00	BENTLY NEVADA
=V20MKA10AH110-E01	HEATER TE	ERCH III/38	Schniewindt
=V20MKA10AH110-E02	HEATER EE	ERCH III/38	Schniewindt

Consumer List

no.	KKS	Description	Rated Power	Rated Voltage	400V 50Hz	230V 50Hz	24V DC		Start	Operation	Standstill	Notes
1	=V20MKA10AH110-E01	GENERATOR HEATER TE	1600 W	400V 50Hz	1600 W				1600 W		1600 W	
2	=V20MKA10AH110-E02	GENERATOR HEATER EE	1600 W	400V 50Hz	1600 W				1600 W		1600 W	
3	=V20MKC10AH110-E01	EXCITER HEATER	100 W	200V 50Hz	100 W				100 W		100 W	
4	=V20MKC10AH110-E02	EXCITER HEATER	100 W	200V 50Hz	100 W				100 W		100 W	
5	=V20MKA10AH111-E101/E102	MTB NEUTRAL SIDE HEATER	300W	200V 50Hz		300 W			300 W	300 W	300 W	
6	=V20MKA10AH111-E103/E104	MTB LINE SIDE HEATER	300W	200V 50Hz		300 W			300 W	300 W	300 W	
7	=V20MKA10CL110-111	LEAKAGE WATER SENSOR TE	1 W	24V DC			1 W		1 W	1 W	1 W	
8	=V20MKA10CL120-121	LEAKAGE WATER SENSOR EE	1 W	24V DC			1 W		1 W	1 W	1 W	
9												
10												
11												
12												
13												
14												
15												
16												
17												
18												
19												
20												
21												
22												
23												
24												
25												
26												
27												
28												
29												
30	**TOTAL ELECTRICAL CONSUMPTION [W]**				**3400 W**	**600 W**	**2 W**		**4002 W**	**602 W**	**4002 W**	

TOP VIEW - SCHEMATICAL DRAWING



+V20MKA10GA010
JUNCTION BOX MEASURING

+V20MKD10GA010
JUNCTION BOX VIBRATION MEASUREMENT TE

+V20MKD20GA010
JUNCTION BOX VIBRATION MEASUREMENT EE

+V20MKA10GE030
JUNCTION BOX VOLTAGE

+V20MKC20GE010
JUNCTION BOX EXCITER FIELD; HEATER

+V20MKC20GA010
JUNCTION BOX ROTOR GROUND FAULT DETECTION

+V20MKC10GE010
JUNCTION BOX PERMANENT MAGNET GENERATOR

+V20MKD10GA020
JUNCTION BOX ROTOR EARTHING

+V20MKA10GD010
LINE SIDE CUBICLE

+V20MKA10GE010
LINE SIDE CUBICLE JUNCTION BOX

+V20MKA10GE040
LINE SIDE CUBICLE JUNCTION BOX HEATER

+V20MKA10GD020
NEUTRAL SIDE CUBICLE

+V20MKA10GE020
NEUTRAL SIDE CUBICLE JUNCTION BOX

+V20MKA10GE050
NEUTRAL SIDE CUBICLE JUNCTION BOX HEATER

b	16.04.2018	Rabe	Date	19.12.2017	VILNIUS Biomass	
			Drawn	Möbius		
			Appr.	Rabe		
REVISION	Date	Name	NORM		Replacement for	Replaced by

SIEMENS
ENERGY SECTOR

AUXILIARY JUNCTION BOXES
OVERVIEW
SCHEMATICAL DRAWING

=
+ CABLING

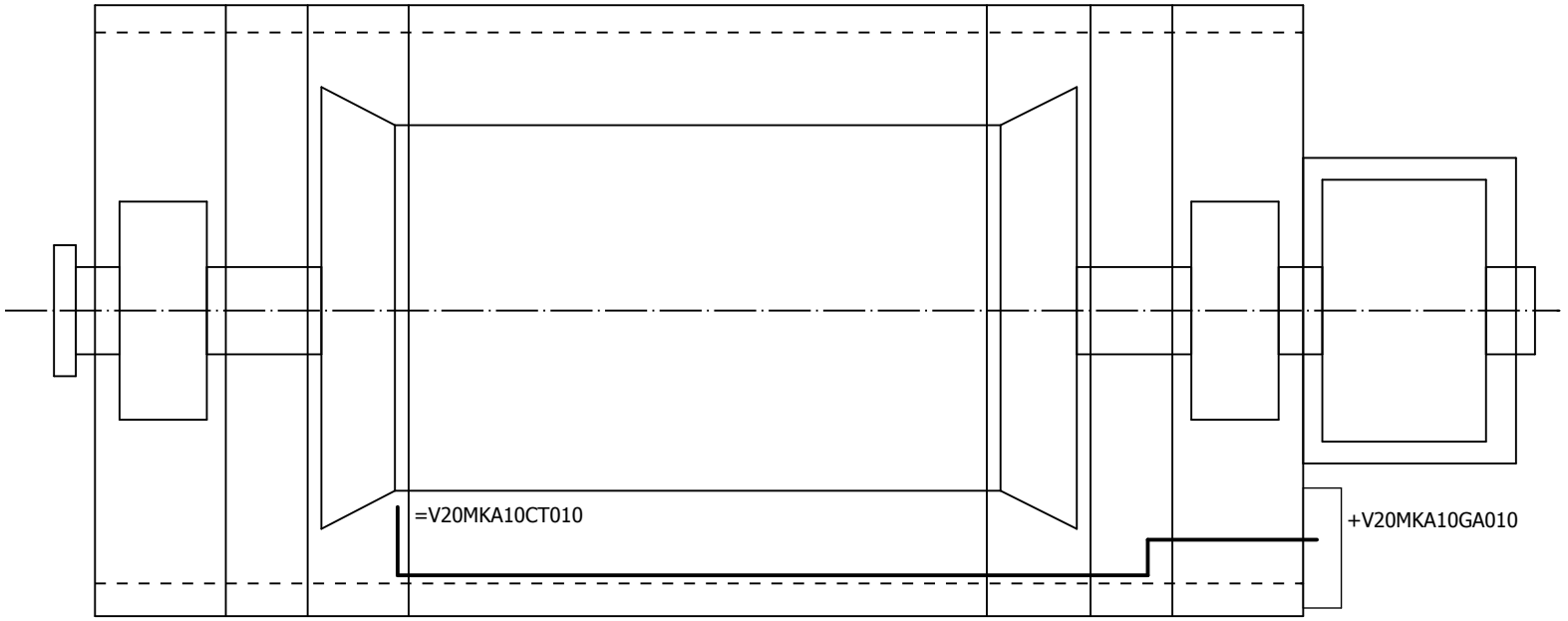
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TOP VIEW - SCHEMATICAL DRAWING

TE

EE



+V20MKA10GA010
JUNCTION BOX MEASURING

REMARKS FOR ASSEMBLY AT FACTORY

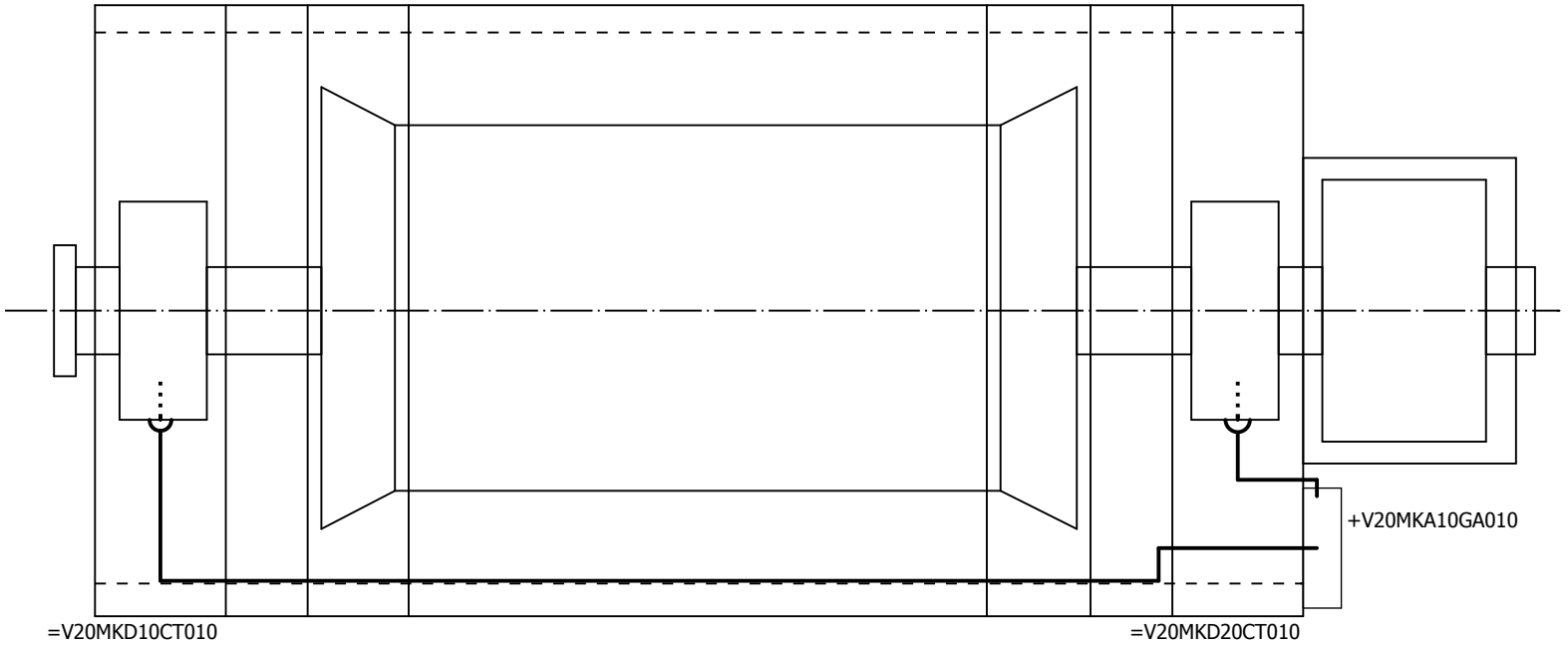
Check all devices after mounting

REMARKS FOR ASSEMBLY AT SITE

NONE

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			Drawn	Möbius					+ CABLING	
			Appr.	Rabe				EG000367	DPPPG-70152441	Page 10
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TOP VIEW - SCHEMATICAL DRAWING



REMARKS FOR ASSEMBLY AT FACTORY

Check all devices after mounting

RTD WITH PLUG CONNECTOR

+V20MKA10GA010
JUNCTION BOX MEASURING

REMARKS FOR ASSEMBLY AT SITE

NONE

			Date	19.12.2017	VILNIUS Biomass	
			Drawn	Möbius		
			Appr.	Rabe		
REVISION	Date	Name	NORM		Replacement for	Replaced by

SIEMENS
ENERGY SECTOR

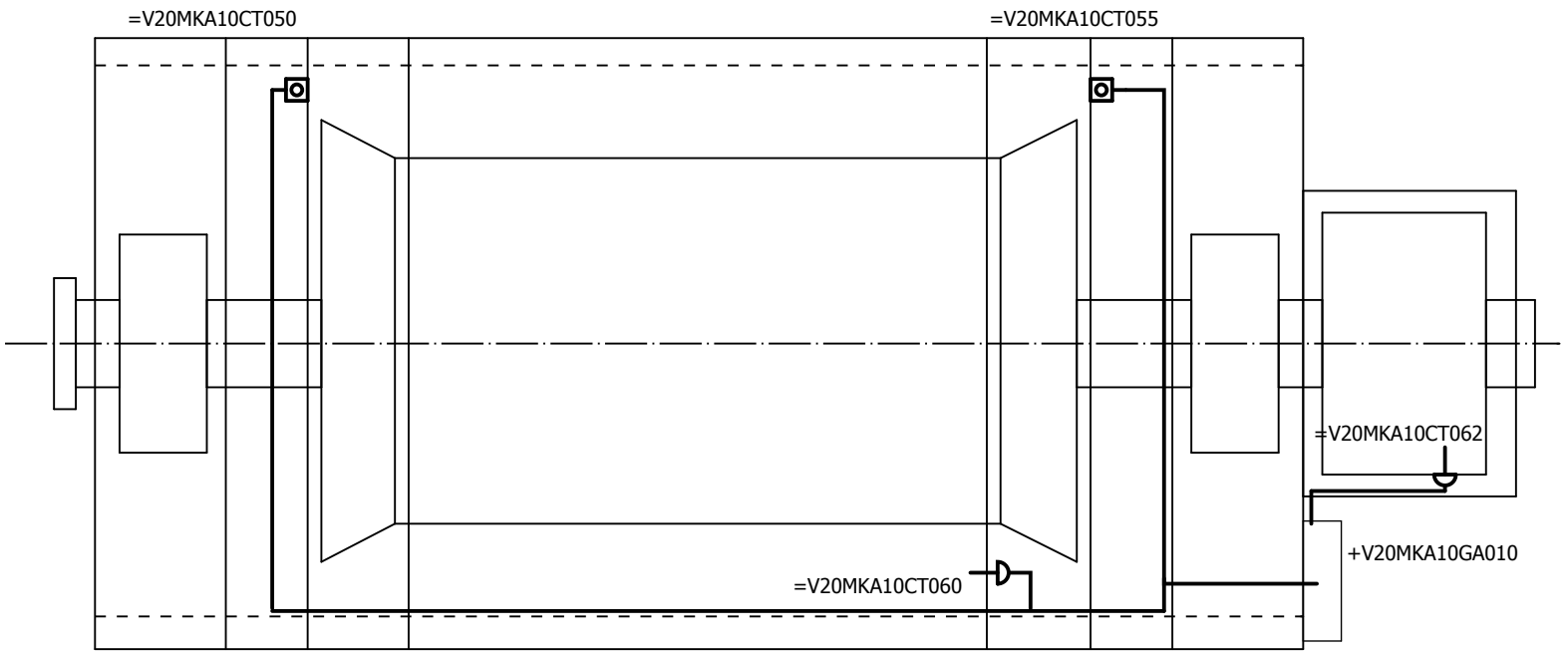
CABLING
BEARING THERMOMETER
LOCATION DIAGRAM

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=
+ CABLING

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TOP VIEW - SCHEMATICAL DRAWING



+V20MKA10GA010
JUNCTION BOX MEASURING

REMARKS FOR ASSEMBLY AT FACTORY

Check all devices after mounting

WITH ANGLE BRACKET

IN THREADED HOLE G 1/2"

REMARKS FOR ASSEMBLY AT SITE

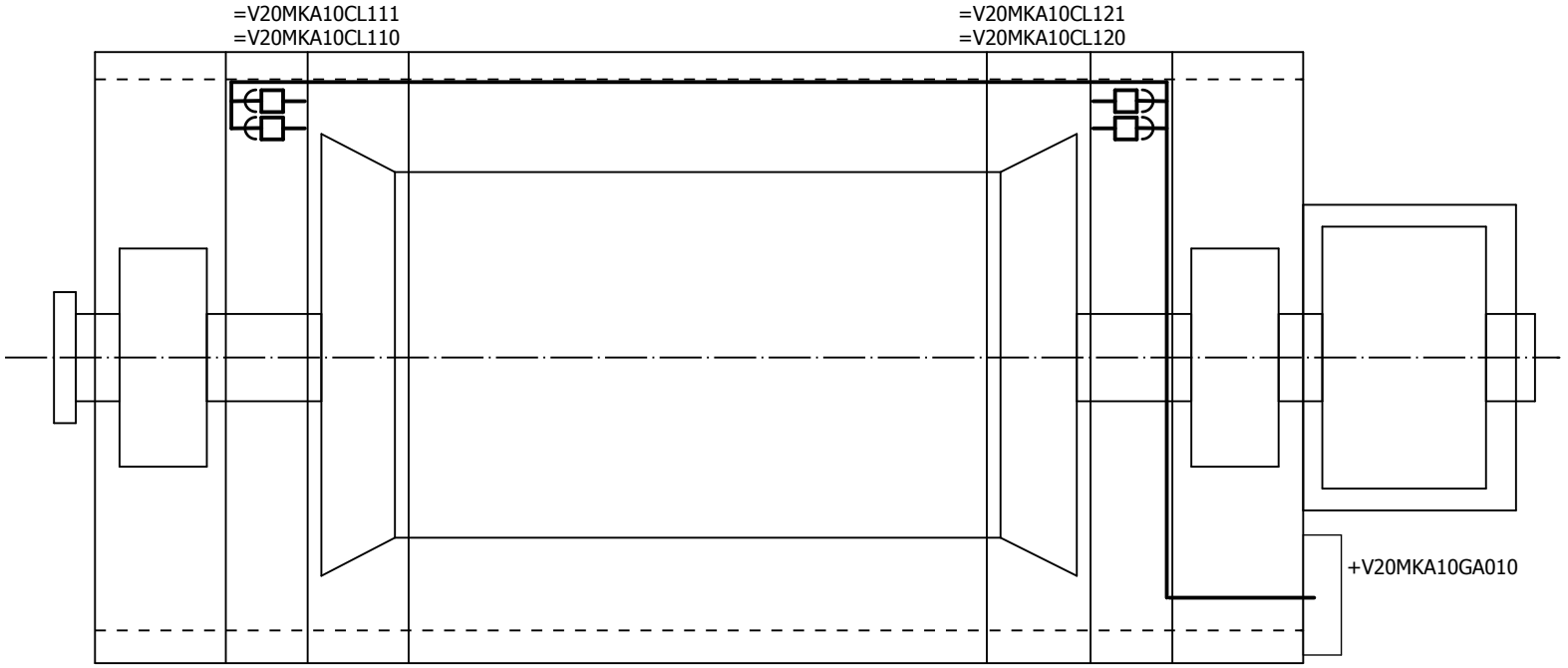
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			Drawn	Möbius				+ CABLING	
			Appr.	Rabe				EG000367	DPPPG-70152441
REVISION	Date	Name	NORM		Replacement for	Replaced by		Page	12
								Pg.	79

TOP VIEW - SCHEMATICAL DRAWING

TE

EE



REMARKS FOR ASSEMBLY AT FACTORY

Check all devices after mounting

Leakage water detector SITRANS LVL100
in leakage water collector of cooler

● HAN 3A PLUG

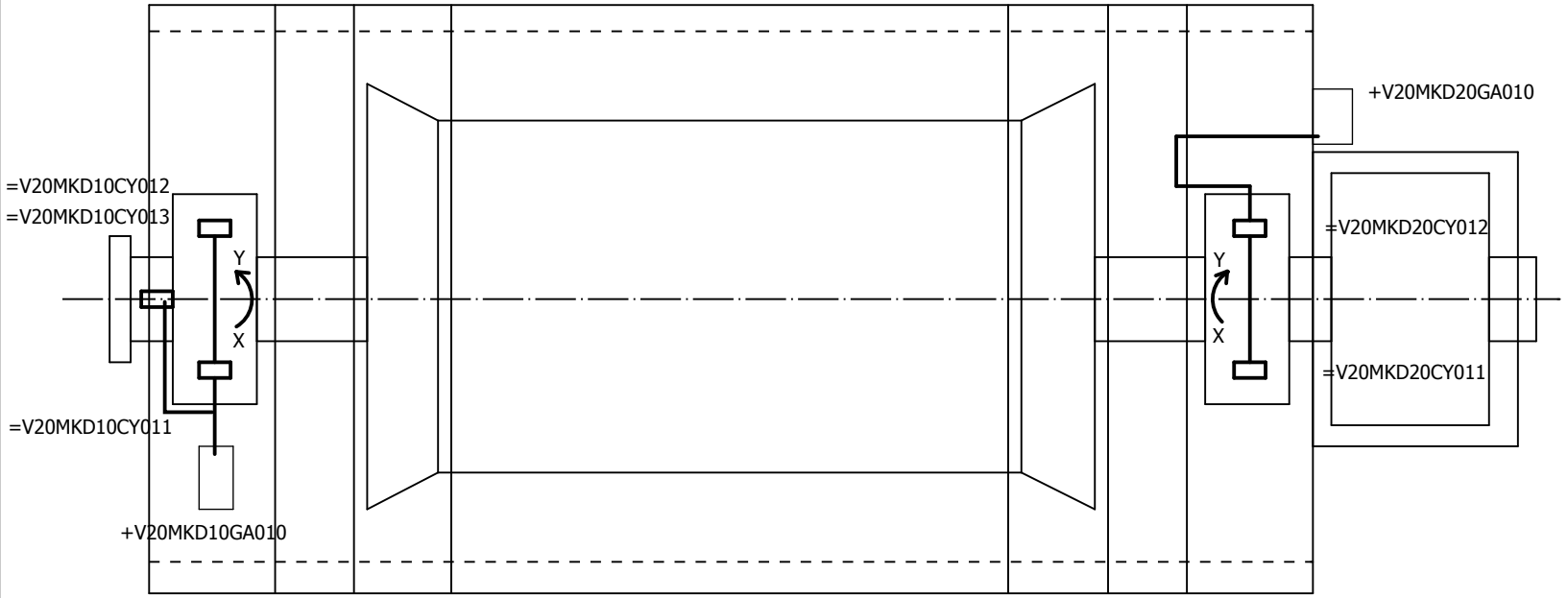
+V20MKA10GA010
JUNCTION BOX MEASURING

REMARKS FOR ASSEMBLY AT SITE

CONNECT PLUG CONNECTORS TO
LEAKAGE WATER ELECTRODES

			Date	19.12.2017	VILNIUS Biomass		SIEMENS ENERGY SECTOR	CABLING LEAKAGE WATER DETECTION LOCATION DIAGRAM	=	
			Drawn	Möbius					+ CABLING	
			Appr.	Rabe					EG000367	DPPPG-70152441
REVISION	Date	Name	NORM		Replacement for	Replaced by			Page	13
									Pg.	79

TOP VIEW - SCHEMATICAL DRAWING



REMARKS FOR ASSEMBLY AT FACTORY

Check all devices after mounting

PROBE HOUSING
PROXIMITORS ARRANGED IN JUNCTION BOX

+V20MKD10GA010
JUNCTION BOX VIBRATION MEASUREMENT TE

+V20MKD20GA010
JUNCTION BOX VIBRATION MEASUREMENT EE

REMARKS FOR ASSEMBLY AT SITE

NONE

c	15.11.2018	Rabe	Date	19.12.2017	VILNIUS Biomass	
			Drawn	Möbius		
			Appr.	Rabe		
REVISION	Date	Name	NORM		Replacement for	Replaced by

SIEMENS
ENERGY SECTOR

CABLING
RELATIVE SHAFT VIBRATION
LOCATION DIAGRAM

=
+ CABLING

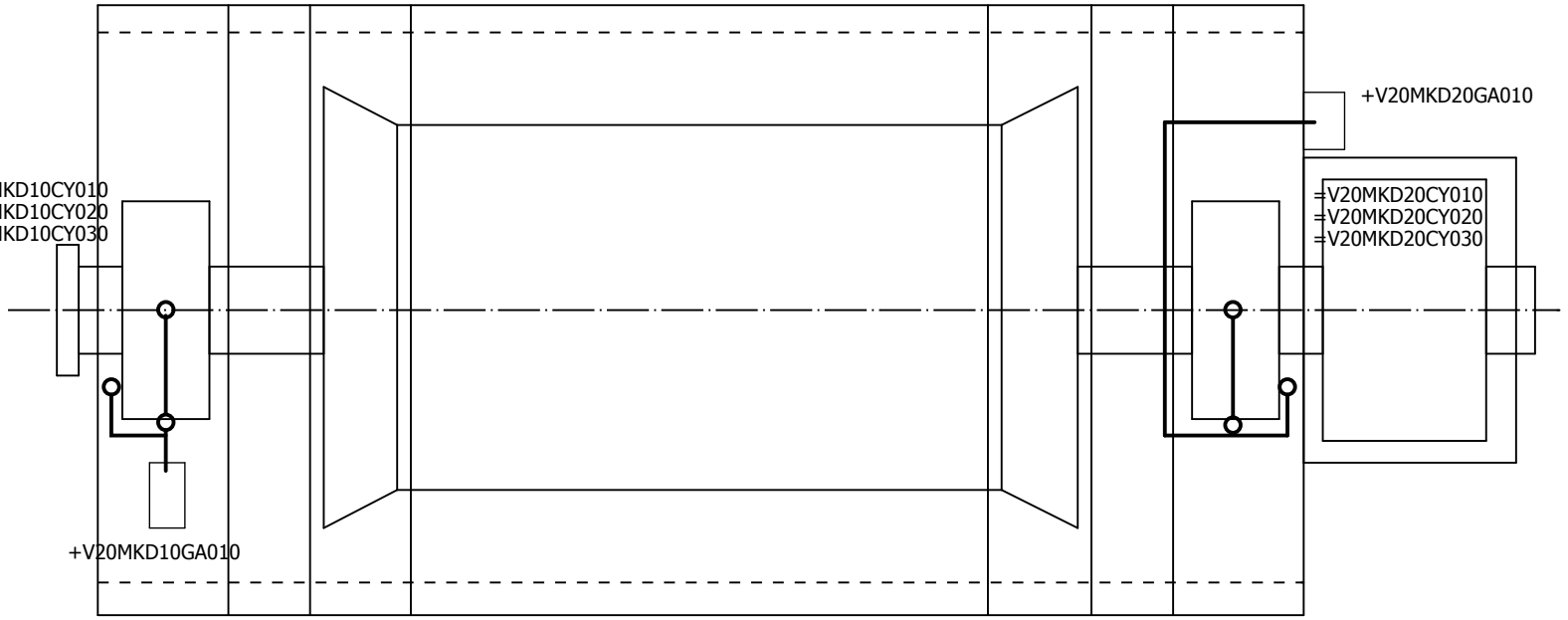
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TOP VIEW - SCHEMATICAL DRAWING

TE

EE



REMARKS FOR ASSEMBLY AT FACTORY

Check all devices after mounting

+V20MKD10GA010
JUNCTION BOX VIBRATION MEASUREMENT TE

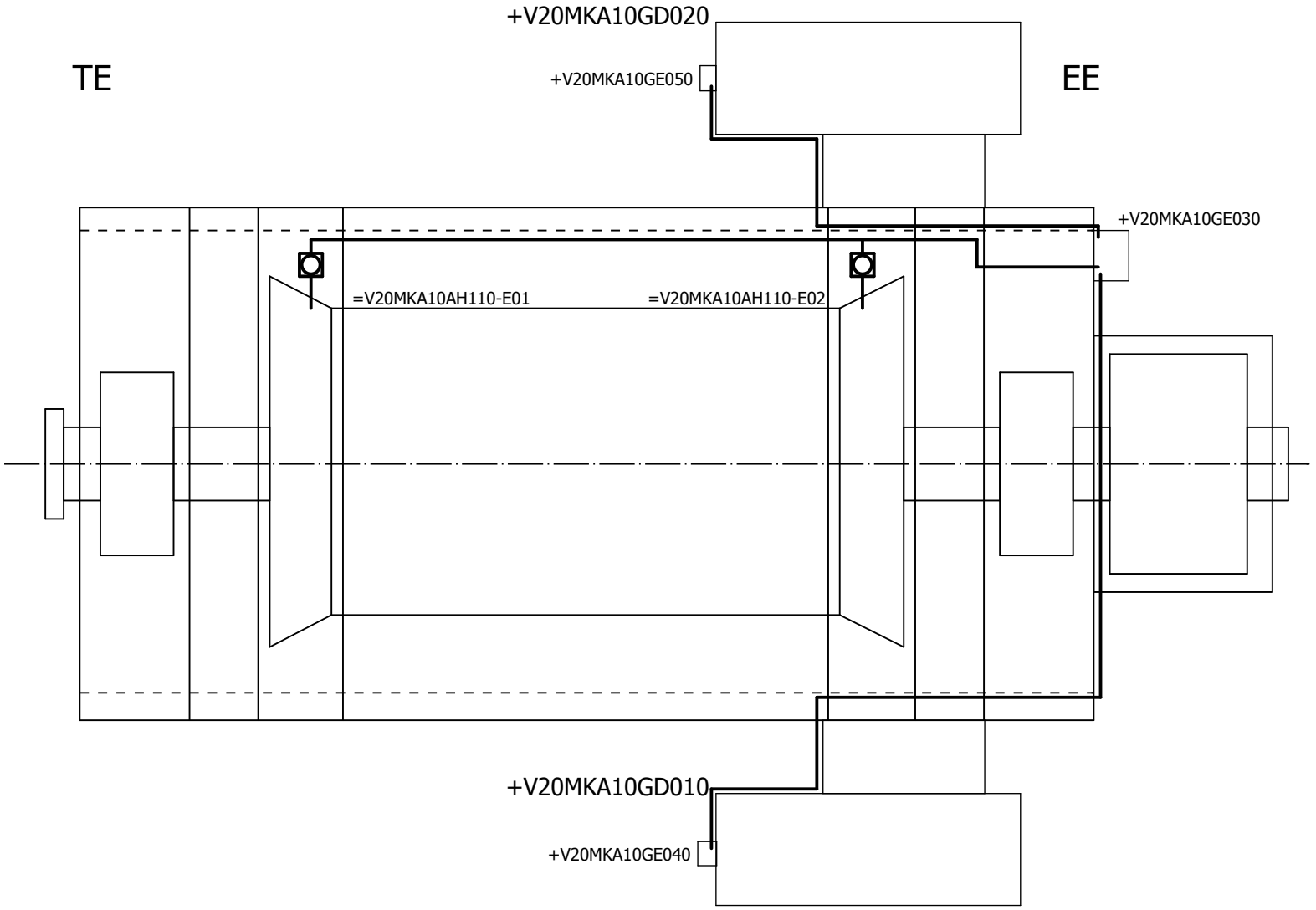
+V20MKD20GA010
JUNCTION BOX VIBRATION MEASUREMENT EE

REMARKS FOR ASSEMBLY AT SITE

NONE

c	15.11.2018	Rabe	Date	19.12.2017	VILNIUS Biomass	SIEMENS ENERGY SECTOR	CABLING ABSOL. BEARING VIBRATION LOCATION DIAGRAM	=	
			Drawn	Möbius				+ CABLING	
			Appr.	Rabe			EG000367	DPPPG-70152441	Page 15
REVISION	Date	Name	NORM		Replacement for	Replaced by			Pg. 79

TOP VIEW - SCHEMATICAL DRAWING



REMARKS FOR ASSEMBLY AT FACTORY

Check all devices after mounting

WITH ANGLE BRACKET

+V20MKA10GE030
JUNCTION BOX VOLTAGE

+V20MKA10GD010
LINE SIDE CUBICLE

+V20MKA10GE040
LINE SIDE CUBICLE JUNCTION BOX HEATER

+V20MKA10GD020
NEUTRAL SIDE CUBICLE

+V20MKA10GE050
NEUTRAL SIDE CUBICLE JUNCTION BOX HEATER

REMARKS FOR ASSEMBLY AT SITE

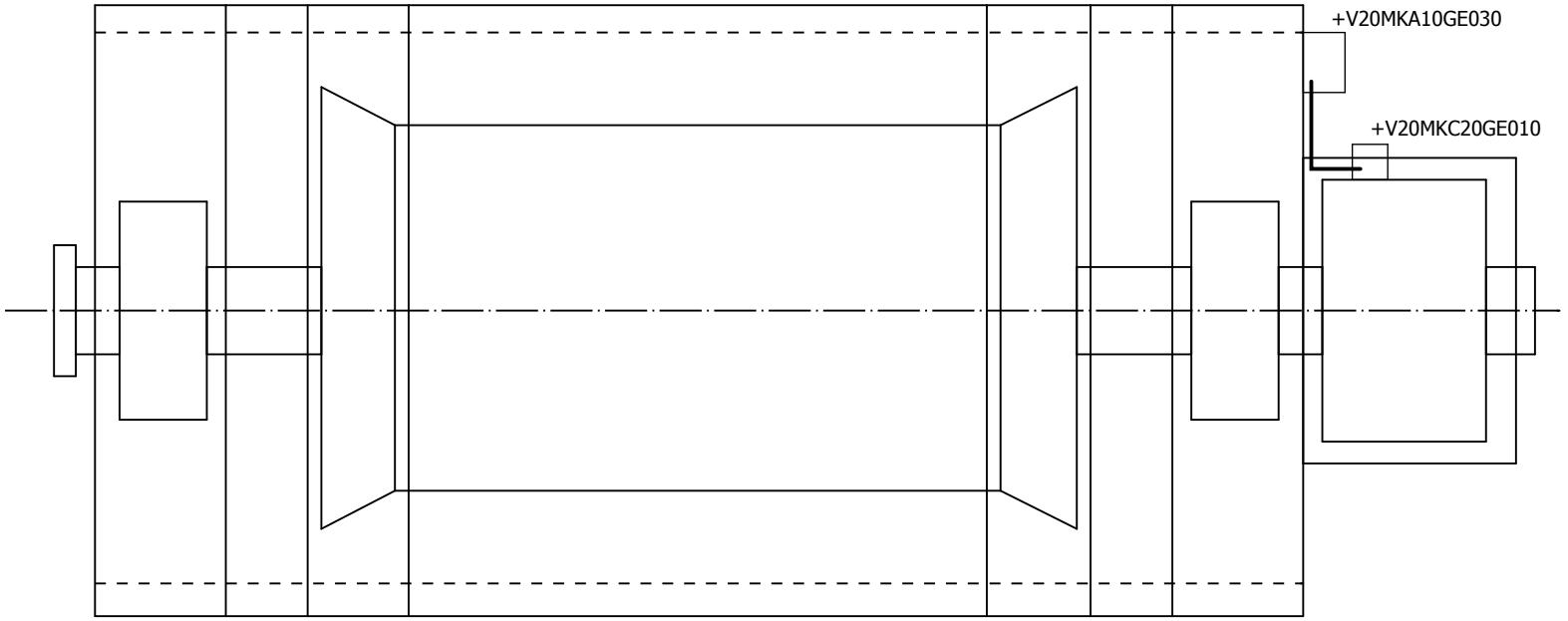
NONE

b	16.04.2018	Rabe	Date	19.12.2017	VILNIUS Biomass		SIEMENS ENERGY SECTOR	CABLING ANTICONDENSATION HEATER LOCATION DIAGRAM	=	
			Drawn	Möbius					+ CABLING	
			Appr.	Rabe					EG000367	DPPPG-70152441
REVISION	Date	Name	NORM		Replacement for	Replaced by			Page	16
									Pg.	79

TOP VIEW - SCHEMATICAL DRAWING

TE

EE



REMARKS FOR ASSEMBLY AT FACTORY

Check all devices after mounting

+V20MKA10GE030
JUNCTION BOX VOLTAGE

+V20MKC20GE010
JUNCTION BOX EXCITER FIELD; HEATER

REMARKS FOR ASSEMBLY AT SITE

NONE

			Date	19.12.2017	VILNIUS Biomass	SIEMENS ENERGY SECTOR	CABLING EXCITER LOCATION DIAGRAM	=	
			Drawn	Möbius				+ CABLING	
			Appr.	Rabe				EG000367 DPPPG-70152441	Page 17
REVISION	Date	Name	NORM		Replacement for	Replaced by			Pg. 79

MANUFACTURER HÄWA
STANDARD CASING
40/40/20
DEGREE OF PROTECTION
IP66

TAPPED HOLES IN REAR WALL
(SIEMENS)

FLANGE PLATE AT
BOTTOM
(CUSTOMER)

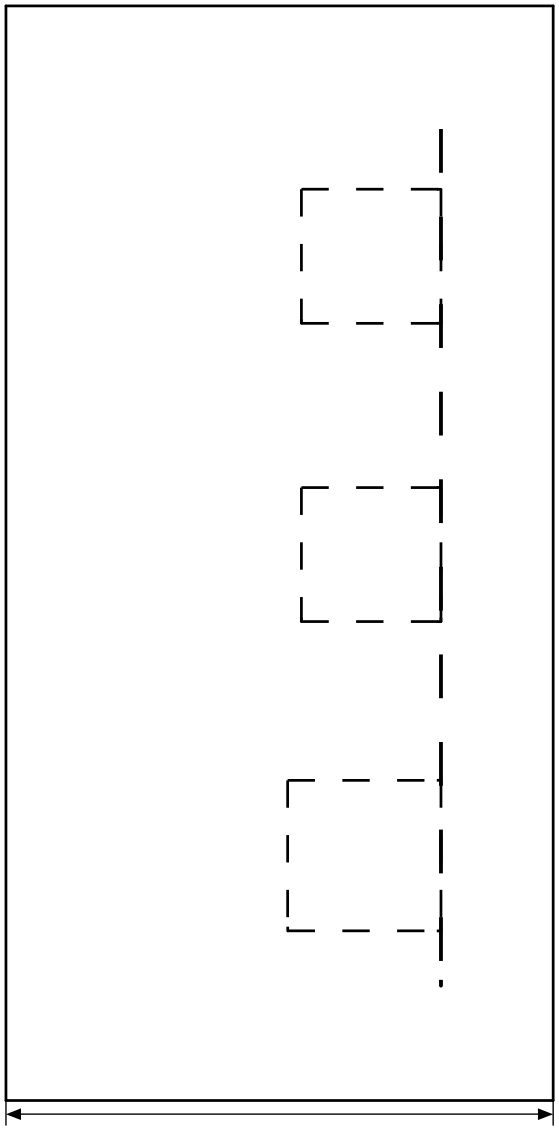
MOUNTING RAIL
TS 35 (EN60715)

ALL DIMENSIONS IN MM

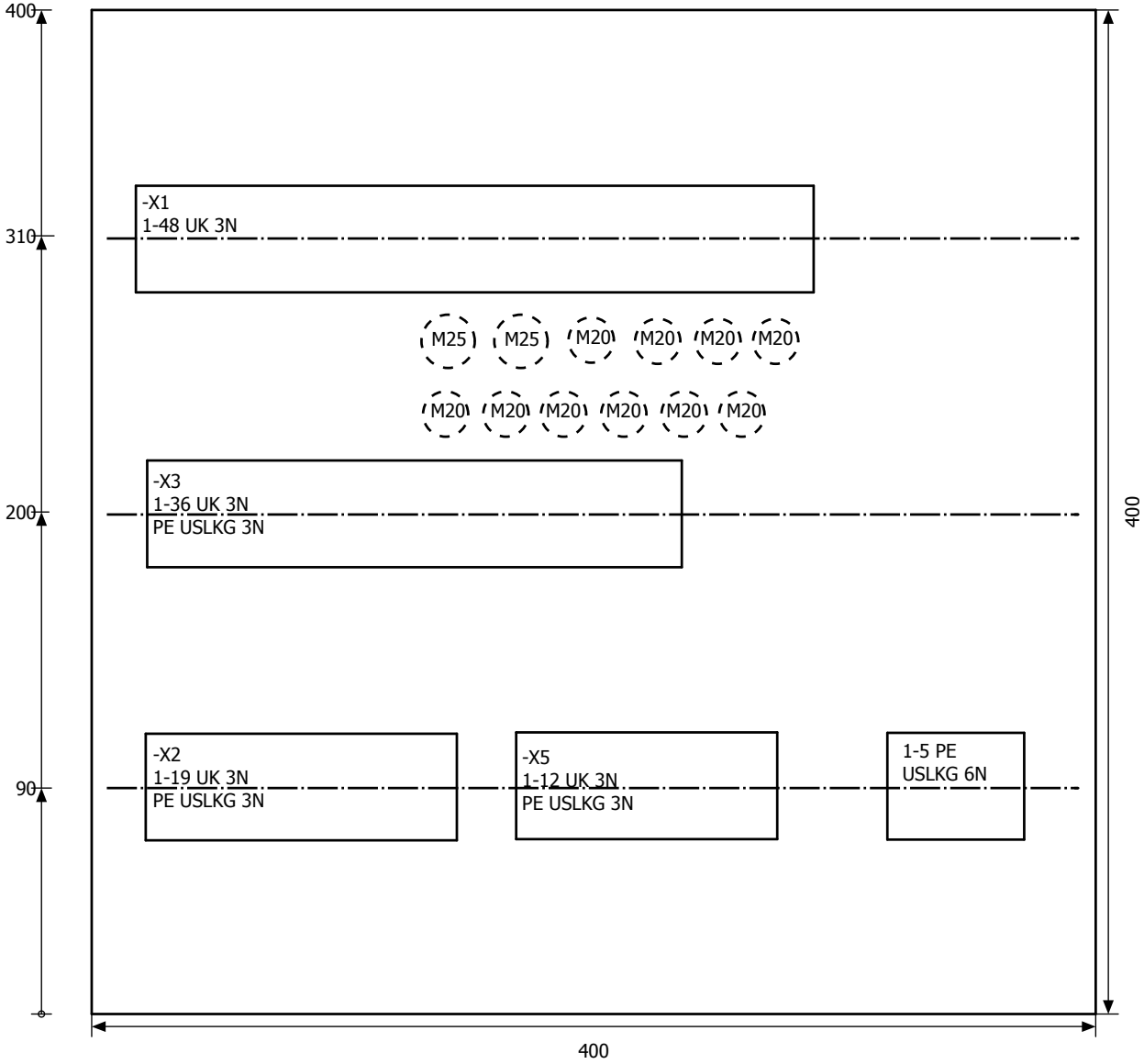
COLOUR: RAL 7035

SCALE 1:2(A3)

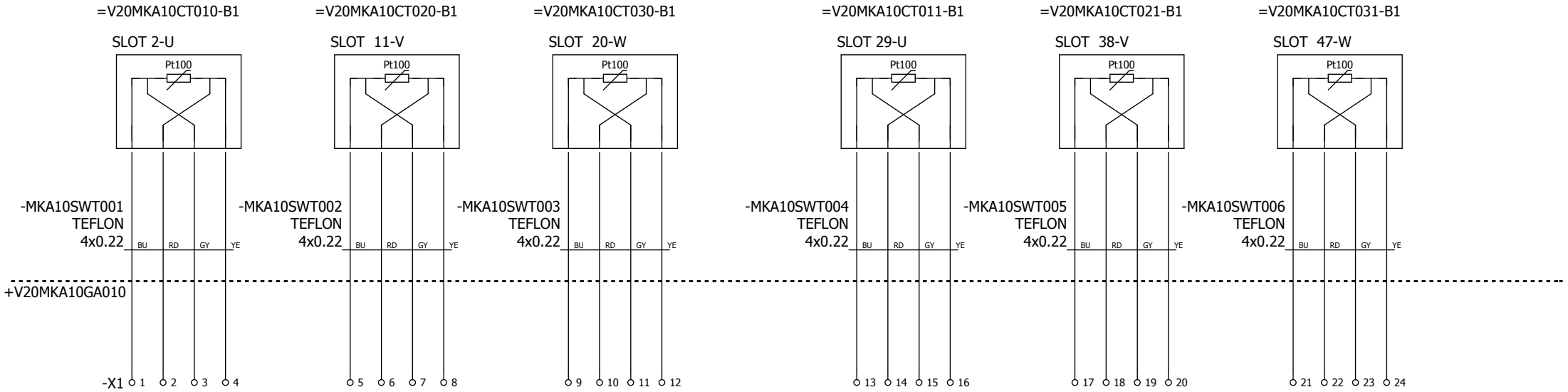
VIEW ON RIGHT HAND SIDE



FRONT VIEW WITHOUT COVER



b	16.04.2018	Rabe	Date	19.12.2017	VILNIUS Biomass		SIEMENS ENERGY SECTOR	JUNCTION BOX MEASURING MOUNTING PLATE	DPPPG-70160082	=
			Drawn	Möbius						+ V20MKA10GA010
			Appr.	Rabe					EG000367	DPPPG-70152441
REVISION	Date	Name	NORM		Replacement for	Replaced by				Page 18 / Pg. 79



b	16.04.2018	Rabe	Date	19.12.2017	VILNIUS Biomass	
			Drawn	Möbius		
			Appr.	Rabe		
REVISION	Date	Name	NORM		Replacement for	Replaced by

SIEMENS
ENERGY SECTOR

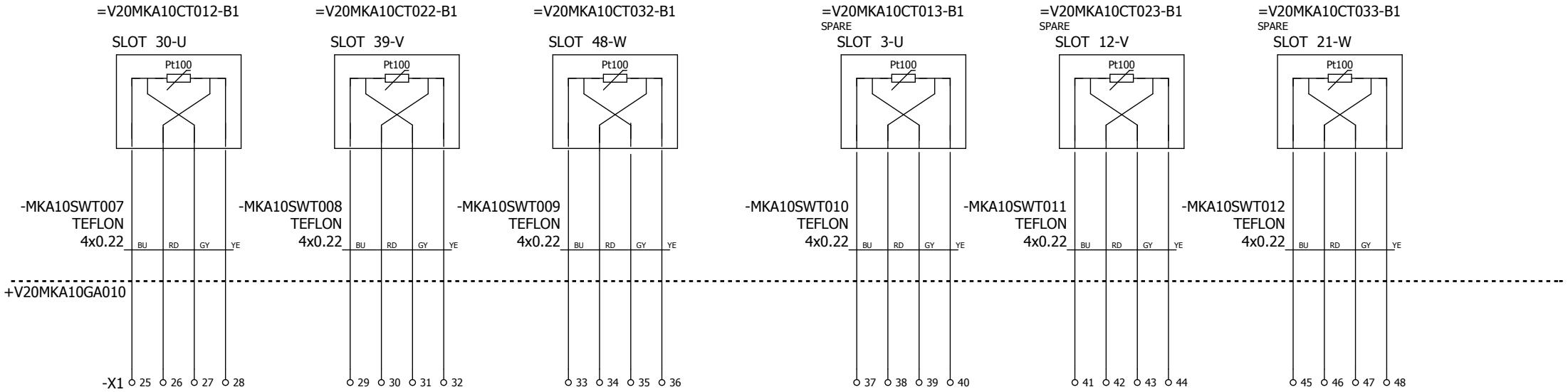
JUNCTION BOX MEASURING
STATOR WINDING TEMPERATURE

DPPPG-70160082

EG000367 DPPPG-70152441

= + V20MKA10GA010

Page 19
Pg. 79



b	16.04.2018	Rabe	Date	19.12.2017	VILNIUS Biomass	
			Drawn	Möbius		
			Appr.	Rabe		
REVISION	Date	Name	NORM		Replacement for	Replaced by

SIEMENS
ENERGY SECTOR

JUNCTION BOX MEASURING
STATOR WINDING TEMPERATURE

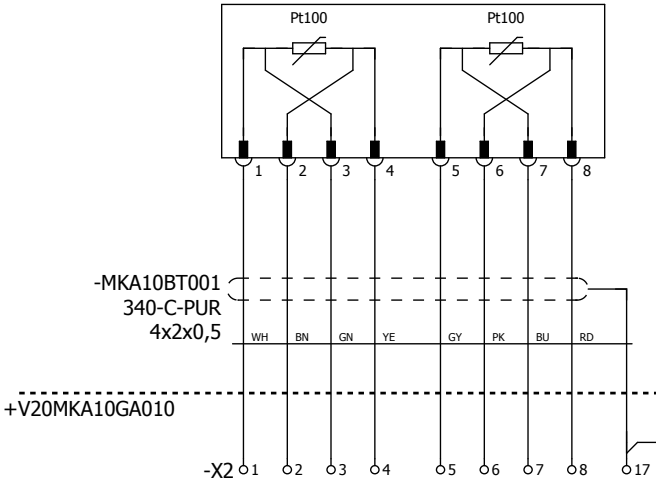
DPPPG-70160082

EG000367 | DPPPG-70152441

=
+ V20MKA10GA010

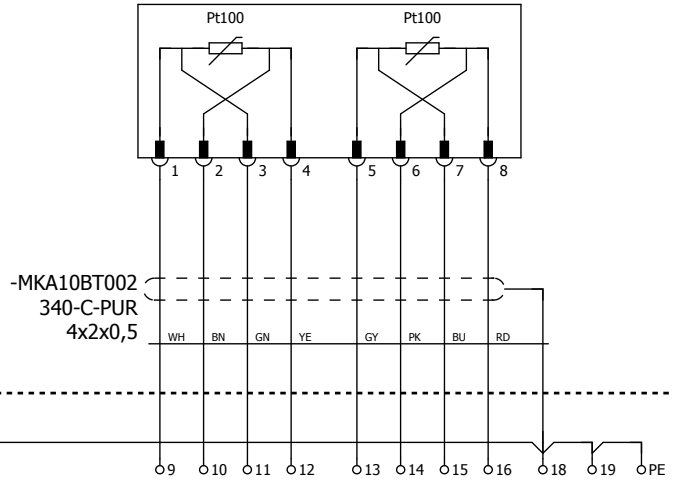
BEARING METAL TEMP. TE
DOUBLE ELEMENT

=V20MKD10CT010-B1



BEARING METAL TEMP. EE
DOUBLE ELEMENT

=V20MKD20CT010-B1



TE ... TURBINE END
EE ... EXCITER END

			Date	19.12.2017	VILNIUS Biomass	
			Drawn	Möbius		
			Appr.	Rabe		
REVISION	Date	Name	NORM		Replacement for	Replaced by

SIEMENS
ENERGY SECTOR

JUNCTION BOX MEASURING
BEARING TEMPERATURE

DPPPG-70160082

EG000367 | DPPPG-70152441

= + V20MKA10GA010

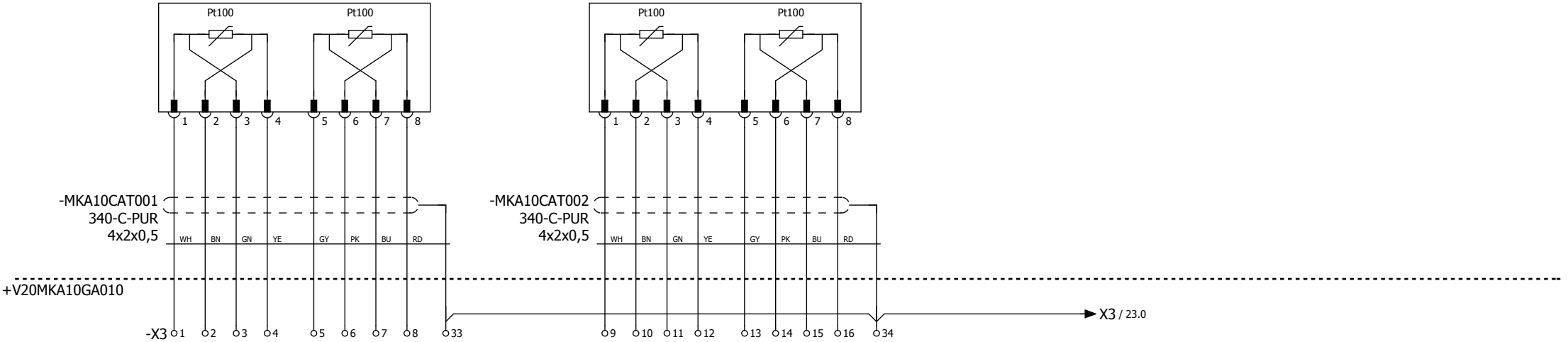
Page 21
Pg. 79

COLD AIR TEMP. TE
DOUBLE ELEMENT

=V20MKA10CT050-B1

COLD AIR TEMP. EE
DOUBLE ELEMENT

=V20MKA10CT055-B1



TE ... TURBINE END
EE ... EXCITER END

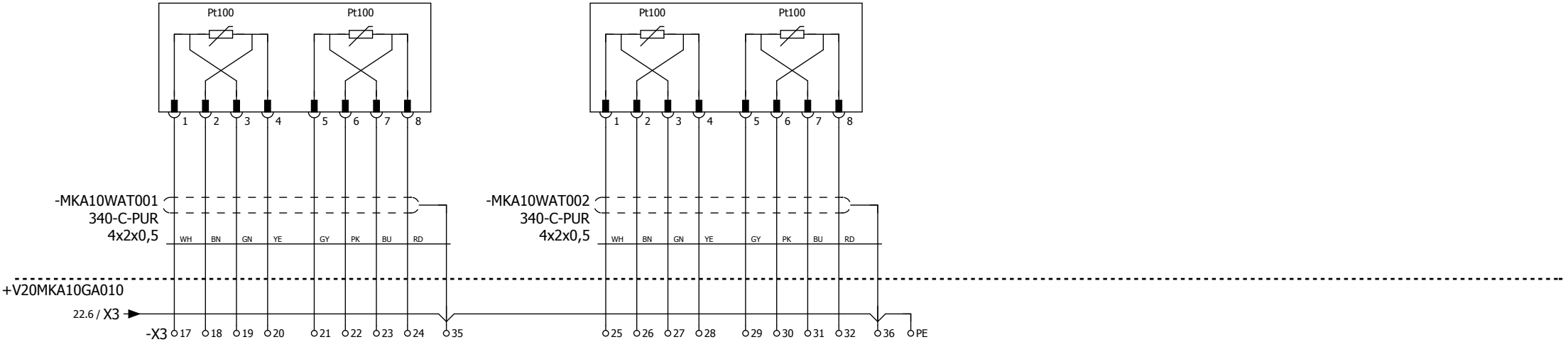
			Date	19.12.2017	VILNIUS Biomass	SIEMENS ENERGY SECTOR	JUNCTION BOX MEASURING COLD AIR TEMPERATURE	DPPPG-70160082	= + V20MKA10GA010
			Drawn	Möbius					
			Appr.	Rabe				EG000367 DPPPG-70152441	Page 22
REVISION	Date	Name	NORM		Replacement for	Replaced by			Pg. 79

WARM AIR TEMPERATURE
DOUBLE ELEMENT

=V20MKA10CT060-B1

WARM AIR TEMPERATURE EXCITER
DOUBLE ELEMENT

=V20MKA10CT062-B1

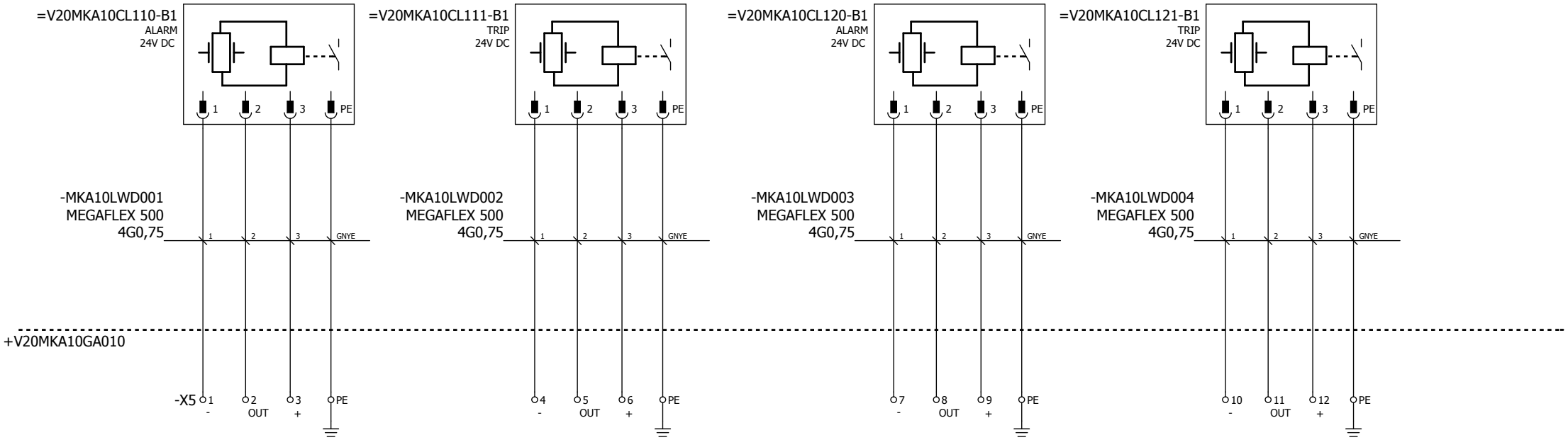


TE ... TURBINE END
EE ... EXCITER END

			Date	19.12.2017	VILNIUS Biomass	SIEMENS ENERGY SECTOR	JUNCTION BOX MEASURING WARM AIR TEMPERATURE	DPPPG-70160082	= + V20MKA10GA010
			Drawn	Möbius					
			Appr.	Rabe				EG000367 DPPPG-70152441	Page 23
REVISION	Date	Name	NORM		Replacement for	Replaced by			Pg. 79

LEAKAGE WATER SENSOR TE

LEAKAGE WATER SENSOR EE



TE ... TURBINE END
EE ... EXCITER END

			Date	19.12.2017	VILNIUS Biomass	
			Drawn	Möbius		
			Appr.	Rabe		
REVISION	Date	Name	NORM		Replacement for	Replaced by

SIEMENS
ENERGY SECTOR

JUNCTION BOX MEASURING
LEAKAGE WATER DETECTION

DPPPG-70160082 | =
EG000367 | DPPPG-70152441 | + V20MKA10GA010

Page 24
Pg. 79

Terminal diagram

item designation	Lev.	no. cable	type cable	Terminal strip =+V20MKA10GA010-X1 destination A	terminal	link	terminal number	destination B	terminal	Lev.	no. cable	type cable	MKA10SWT001	MKA10SWT002	MKA10SWT003	MKA10SWT004	MKA10SWT005	MKA10SWT006	MKA10SWT007	MKA10SWT008	page / track
													TEFLON	TEFLON	TEFLON	TEFLON	TEFLON	TEFLON	TEFLON	TEFLON	
SLOT 2-U							1	=V20MKA10CT010-B1					BU								19 0
=							2	=V20MKA10CT010-B1					RD								19 1
=							3	=V20MKA10CT010-B1					GY								19 1
=							4	=V20MKA10CT010-B1					YE								19 1
SLOT 11-V							5	=V20MKA10CT020-B1						BU							19 2
=							6	=V20MKA10CT020-B1						RD							19 2
=							7	=V20MKA10CT020-B1						GY							19 2
=							8	=V20MKA10CT020-B1						YE							19 2
SLOT 20-W							9	=V20MKA10CT030-B1							BU						19 3
=							10	=V20MKA10CT030-B1							RD						19 3
=							11	=V20MKA10CT030-B1							GY						19 4
=							12	=V20MKA10CT030-B1							YE						19 4
SLOT 29-U							13	=V20MKA10CT011-B1								BU					19 5
=							14	=V20MKA10CT011-B1								RD					19 5
=							15	=V20MKA10CT011-B1								GY					19 5
=							16	=V20MKA10CT011-B1								YE					19 6
SLOT 38-V							17	=V20MKA10CT021-B1									BU				19 6
=							18	=V20MKA10CT021-B1									RD				19 6
=							19	=V20MKA10CT021-B1									GY				19 7
=							20	=V20MKA10CT021-B1									YE				19 7
SLOT 47-W							21	=V20MKA10CT031-B1										BU			19 8
=							22	=V20MKA10CT031-B1										RD			19 8
=							23	=V20MKA10CT031-B1										GY			19 8
=							24	=V20MKA10CT031-B1										YE			19 8
SLOT 30-U							25	=V20MKA10CT012-B1											BU		20 0
=							26	=V20MKA10CT012-B1											RD		20 1
=							27	=V20MKA10CT012-B1											GY		20 1
=							28	=V20MKA10CT012-B1											YE		20 1
SLOT 39-V							29	=V20MKA10CT022-B1												BU	20 2
=							30	=V20MKA10CT022-B1												RD	20 2
=							31	=V20MKA10CT022-B1												GY	20 2
=							32	=V20MKA10CT022-B1												YE	20 2

SEPARATION PLATE
SEPARATION WITH TS-K

Terminal diagram

item designation	Lev.	no. cable	type cable	destination A	terminal	link	terminal number	destination B	terminal	Lev.	no. cable	MKA10SWT009	MKA10SWT010	MKA10SWT011	MKA10SWT012	page / track
				Terminal strip =+V20MKA10GA010-X1												
SLOT 48-W						⊙	33	=V20MKA10CT032-B1								20 3
=						⊙	34	=V20MKA10CT032-B1			RD					20 3
=						⊙	35	=V20MKA10CT032-B1			GY					20 4
=						⊙	36	=V20MKA10CT032-B1			YE					20 4
SLOT 3-U						⊙	37	=V20MKA10CT013-B1				BU				20 5
=						⊙	38	=V20MKA10CT013-B1				RD				20 5
=						⊙	39	=V20MKA10CT013-B1				GY				20 5
=						⊙	40	=V20MKA10CT013-B1				YE				20 6
SLOT 12-V						⊙	41	=V20MKA10CT023-B1					BU			20 6
=						⊙	42	=V20MKA10CT023-B1					RD			20 6
=						⊙	43	=V20MKA10CT023-B1					GY			20 7
=						⊙	44	=V20MKA10CT023-B1					YE			20 7
SLOT 21-W						⊙	45	=V20MKA10CT033-B1						BU		20 8
=						⊙	46	=V20MKA10CT033-B1						RD		20 8
=						⊙	47	=V20MKA10CT033-B1						GY		20 8
=						⊙	48	=V20MKA10CT033-B1						YE		20 8
						○										
						○										
						○										
						○										
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						○										

SEPARATION PLATE
SEPARATION WITH TS-K

			Date	19.12.2017	VILNIUS Biomass	SIEMENS ENERGY SECTOR	Klemmenplan : =+V20MKA10GA010-X1	DPPPG-70160082	= + V20MKA10GA010
			Drawn	Möbius					
			Appr.	Rabe				EG000367	DPPPG-70152441
REVISION	Date	Name	NORM		Replacement for	Replaced by			Page 26 Pg. 79

Terminal diagram

item designation	Lev.	no. cable	type cable	destination A	terminal	link	terminal number	destination B	terminal	Lev.	no. cable	MKA10BT001	MKA10BT002	page / track
				Terminal strip =+V20MKA10GA010-X2										
BEARING METAL TEMP. TE							1	=V20MKD10CT010-B1	1		WH			21 1
=							2	=V20MKD10CT010-B1	2		BN			21 1
=							3	=V20MKD10CT010-B1	3		GN			21 1
=							4	=V20MKD10CT010-B1	4		YE			21 1
=							5	=V20MKD10CT010-B1	5		GY			21 2
=							6	=V20MKD10CT010-B1	6		PK			21 2
=							7	=V20MKD10CT010-B1	7		BU			21 2
=							8	=V20MKD10CT010-B1	8		RD			21 2
BEARING METAL TEMP. EE							9	=V20MKD20CT010-B1	1			WH		21 4
=							10	=V20MKD20CT010-B1	2			BN		21 4
=							11	=V20MKD20CT010-B1	3			GN		21 5
=							12	=V20MKD20CT010-B1	4			YE		21 5
=							13	=V20MKD20CT010-B1	5			GY		21 5
=							14	=V20MKD20CT010-B1	6			PK		21 5
=							15	=V20MKD20CT010-B1	7			BU		21 6
=							16	=V20MKD20CT010-B1	8			RD		21 6
BEARING METAL TEMP. TE							17							21 2
BEARING METAL TEMP. EE							18							21 6
=							19							
=							PE							

SEPARATION PLATE
SEPARATION WITH TS-K

			Date	19.12.2017	VILNIUS Biomass	SIEMENS ENERGY SECTOR	Klemmenplan : =+V20MKA10GA010-X2	DPPPG-70160082	=	
			Drawn	Möbius					+ V20MKA10GA010	
			Appr.	Rabe						
REVISION	Date	Name	NORM		Replacement for	Replaced by		EG000367	DPPPG-70152441	Page 27 Pg. 79

Terminal diagram

item designation	Lev.	no. cable	type cable	Terminal strip =+V20MKA10GA010-X3 destination A	terminal	link	terminal number	destination B	terminal	Lev.	no. cable	type cable	MKA10CAT001	MKA10CAT002	MKA10WAT001	MKA10WAT002	page / track
COLD AIR TEMP. TE							1	=V20MKA10CT050-B1	1				WH				22 1
=							2	=V20MKA10CT050-B1	2				BN				22 1
=							3	=V20MKA10CT050-B1	3				GN				22 1
=							4	=V20MKA10CT050-B1	4				YE				22 1
=							5	=V20MKA10CT050-B1	5				GY				22 2
=							6	=V20MKA10CT050-B1	6				PK				22 2
=							7	=V20MKA10CT050-B1	7				BU				22 2
=							8	=V20MKA10CT050-B1	8				RD				22 2
COLD AIR TEMP. EE							9	=V20MKA10CT055-B1	1					WH			22 3
=							10	=V20MKA10CT055-B1	2					BN			22 4
=							11	=V20MKA10CT055-B1	3					GN			22 4
=							12	=V20MKA10CT055-B1	4					YE			22 4
=							13	=V20MKA10CT055-B1	5					GY			22 4
=							14	=V20MKA10CT055-B1	6					PK			22 4
=							15	=V20MKA10CT055-B1	7					BU			22 5
=							16	=V20MKA10CT055-B1	8					RD			22 5
WARM AIR TEMPERATURE							17	=V20MKA10CT060-B1	1						WH		23 1
=							18	=V20MKA10CT060-B1	2						BN		23 1
=							19	=V20MKA10CT060-B1	3						GN		23 1
=							20	=V20MKA10CT060-B1	4						YE		23 1
=							21	=V20MKA10CT060-B1	5						GY		23 2
=							22	=V20MKA10CT060-B1	6						PK		23 2
=							23	=V20MKA10CT060-B1	7						BU		23 2
=							24	=V20MKA10CT060-B1	8						RD		23 2
WARM AIR TEMPERATURE EXCITER							25	=V20MKA10CT062-B1	1							WH	23 3
=							26	=V20MKA10CT062-B1	2							BN	23 4
=							27	=V20MKA10CT062-B1	3							GN	23 4
=							28	=V20MKA10CT062-B1	4							YE	23 4
=							29	=V20MKA10CT062-B1	5							GY	23 4
=							30	=V20MKA10CT062-B1	6							PK	23 4
=							31	=V20MKA10CT062-B1	7							BU	23 5
=							32	=V20MKA10CT062-B1	8							RD	23 5

SEPARATION PLATE
SEPARATION WITH TS-K

Terminal diagram

Terminal strip =+V20MKA10GA010-X3

item designation	no. cable / type cable	destination A	terminal	link	terminal number	destination B	terminal	no. cable / type cable	MKA10CAT001 340-C-PUR	MKA10CAT002 340-C-PUR	MKA10WAT001 340-C-PUR	MKA10WAT002 340-C-PUR	page / track
COLD AIR TEMP. TE					33								22 2
COLD AIR TEMP. EE					34								22 5
WARM AIR TEMPERATURE					35								23 2
WARM AIR TEMPERATURE EXCITER					36								23 5
=					PE								

SEPARATION PLATE
SEPARATION WITH TS-K

Terminal diagram

item designation	Lev.	no. cable	type cable	destination A	terminal	link	terminal number	destination B	terminal	Lev.	no. cable	type cable	MKA10LWD001 MEGAFLEX 500	MKA10LWD003 MEGAFLEX 500	MKA10LWD002 MEGAFLEX 500	MKA10LWD004 MEGAFLEX 500	page / track
				Terminal strip =+V20MKA10GA010-X5													
LEAKAGE WATER SENSOR TE							1	=V20MKA10CL110-B1	1				1				24 1
=							2	=V20MKA10CL110-B1	2				2				24 1
=							3	=V20MKA10CL110-B1	3				3				24 1
=							4	=V20MKA10CL111-B1	1								24 3
=							5	=V20MKA10CL111-B1	2								24 3
=							6	=V20MKA10CL111-B1	3								24 3
LEAKAGE WATER SENSOR EE							7	=V20MKA10CL120-B1	1					1			24 5
=							8	=V20MKA10CL120-B1	2					2			24 5
=							9	=V20MKA10CL120-B1	3					3			24 6
=							10	=V20MKA10CL121-B1	1								24 7
=							11	=V20MKA10CL121-B1	2								24 8
=							12	=V20MKA10CL121-B1	3								24 8
LEAKAGE WATER SENSOR TE							PE	=V20MKA10CL110-B1	PE				GNYE				24 2
=							PE	=V20MKA10CL111-B1	PE						GNYE		24 4
LEAKAGE WATER SENSOR EE							PE	=V20MKA10CL120-B1	PE					GNYE			24 6
=							PE	=V20MKA10CL121-B1	PE							GNYE	24 8

SEPARATION PLATE
SEPARATION WITH TS-K

			Date	19.12.2017	VILNIUS Biomass		SIEMENS ENERGY SECTOR	Klemmenplan : =+V20MKA10GA010-X5	DPPPG-70160082	= + V20MKA10GA010	
			Drawn	Möbius							
			Appr.	Rabe					EG000367	DPPPG-70152441	Page 30 Pg. 79
REVISION	Date	Name	NORM		Replacement for	Replaced by					

MANUFACTURER HÄWA
STANDARD CASING K12-30/20
DEGREE OF PROTECTION IP65

TAPPED HOLES

MOUNTING RAIL TS 35 (EN60715)

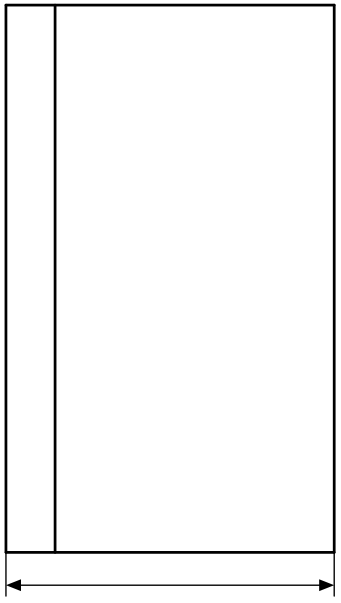
ALL DIMENSIONS IN MM

SCALE 1:2 (A3)

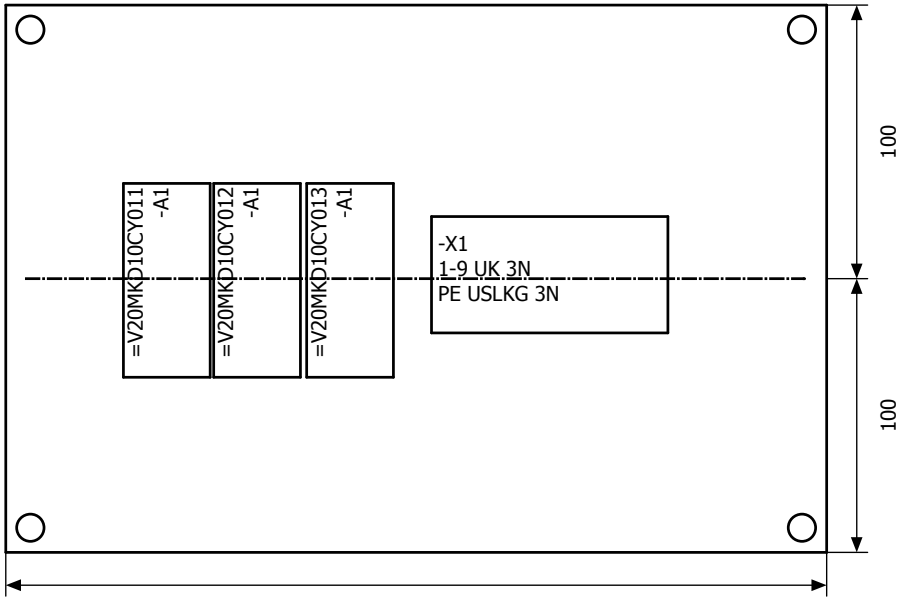
BOTTOM SIDE FOR CUSTOMER CONNECTION DRILLED AT SITE

COLOUR: RAL 7035

VIEW ON RIGHT HAND SIDE

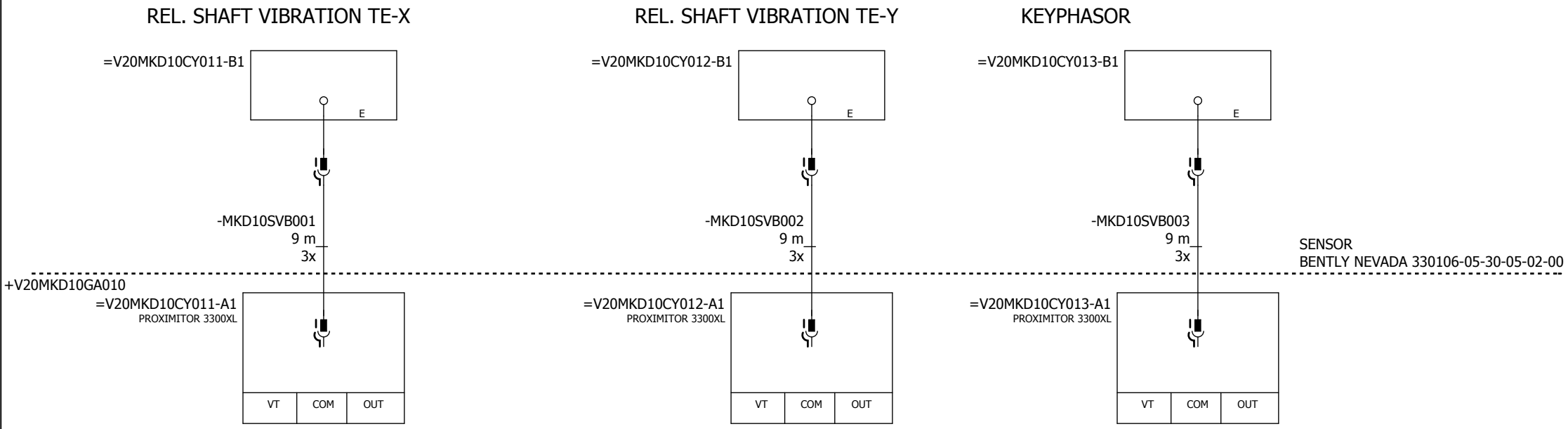


FRONT VIEW WITHOUT COVER



			Date	19.12.2017	VILNIUS Biomass	SIEMENS ENERGY SECTOR	JUNCTION BOX VIBRATION MOUNTING PLATE TURBINE END	DPPPG-70160083	= + V20MKD10GA010
			Drawn	Möbius					
			Appr.	Rabe				EG000367	DPPPG-70152441
REVISION	Date	Name	NORM		Replacement for / Replaced by				Page 31 / Pg. 79

BEARING TE



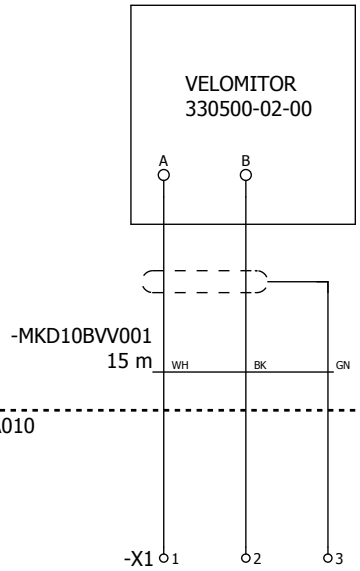
TE ... TURBINE END
EE ... EXCITER END

			Date	19.12.2017	VILNIUS Biomass	SIEMENS ENERGY SECTOR	JUNCTION BOX RELATIVE SHAFT VIBRATION DRIVE END	DPPPG-70160083	=
			Drawn	Möbius					+ V20MKD10GA010
			Appr.	Rabe				EG000367	DPPPG-70152441
REVISION	Date	Name	NORM		Replacement for	Replaced by			Page 32 / Pg. 79

BEARING TE

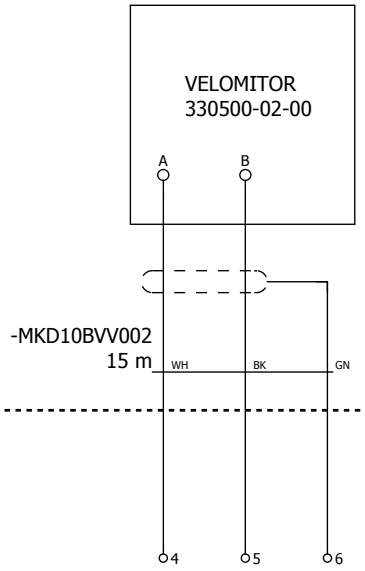
ABS. BEARING VIBRATION TE-A

=V20MKD10CY010-B1
VERTICAL



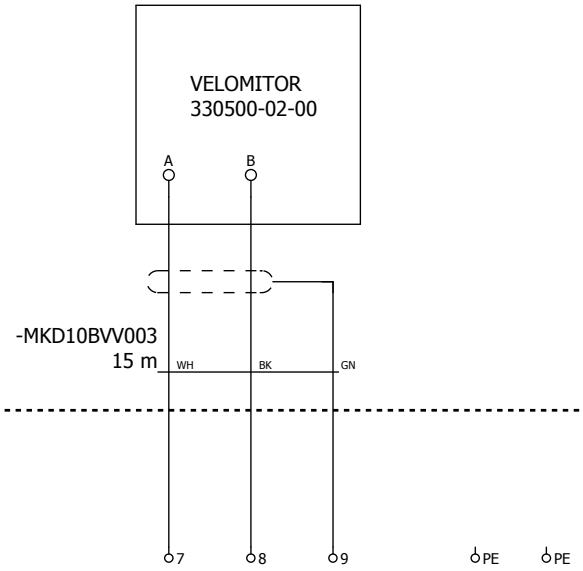
ABS. BEARING VIBRATION TE-B

=V20MKD10CY020-B1
HORIZONTAL



ABS. BEARING VIBRATION TE-C

=V20MKD10CY030-B1
AXIAL



TE ... TURBINE END
EE ... EXCITER END

b	16.04.2018	Rabe	Date	19.12.2017	VILNIUS Biomass	SIEMENS ENERGY SECTOR	JUNCTION BOX MEASURING ABSOLUTE BEARING VIBRATION TURBINE END	DPPPG-70160083	=	
			Drawn	Möbius					+ V20MKD10GA010	
			Appr.	Rabe				EG000367	DPPPG-70152441	Page 33
REVISION	Date	Name	NORM		Replacement for	Replaced by				Pg. 79

Terminal diagram

item designation	Lev.	no. cable	type cable	destination A	terminal	link	terminal number	destination B	terminal	Lev.	no. cable	MKD10BVV001	MKD10BVV002	MKD10BVV003	page / track
				Terminal strip =+V20MKD10GA010-X1											
ABS. BEARING VIBRATION TE-A						⊙	1	=V20MKD10CY010-B1	A			WH			33 1
=						⊙	2	=V20MKD10CY010-B1	B			BK			33 1
=						⊙	3					GN			33 1
ABS. BEARING VIBRATION TE-B						⊙	4	=V20MKD10CY020-B1	A				WH		33 3
=						⊙	5	=V20MKD10CY020-B1	B				BK		33 4
=						⊙	6						GN		33 4
ABS. BEARING VIBRATION TE-C						⊙	7	=V20MKD10CY030-B1	A					WH	33 6
=						⊙	8	=V20MKD10CY030-B1	B					BK	33 6
=						⊙	9							GN	33 7
=						⊙	PE								
=						⊙	PE								
						○									
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SEPARATION PLATE
SEPARATION WITH TS-K

			Date	19.12.2017	VILNIUS Biomass	SIEMENS ENERGY SECTOR	Klemmenplan : =+V20MKD10GA010-X1	DPPPG-70160083
			Drawn	Möbius				= + V20MKD10GA010
			Appr.	Rabe				
REVISION	Date	Name	NORM		Replacement for	Replaced by	EG000367	DPPPG-70152441

MANUFACTURER HÄWA
STANDARD CASING K12-30/20
DEGREE OF PROTECTION IP65

TAPPED HOLES

MOUNTING RAIL TS 35 (EN60715)

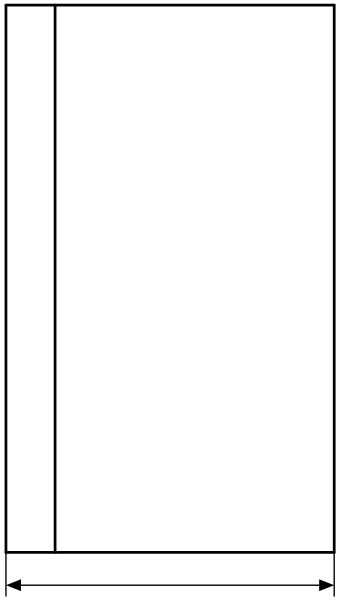
ALL DIMENSIONS IN MM

SCALE 1:2 (A3)

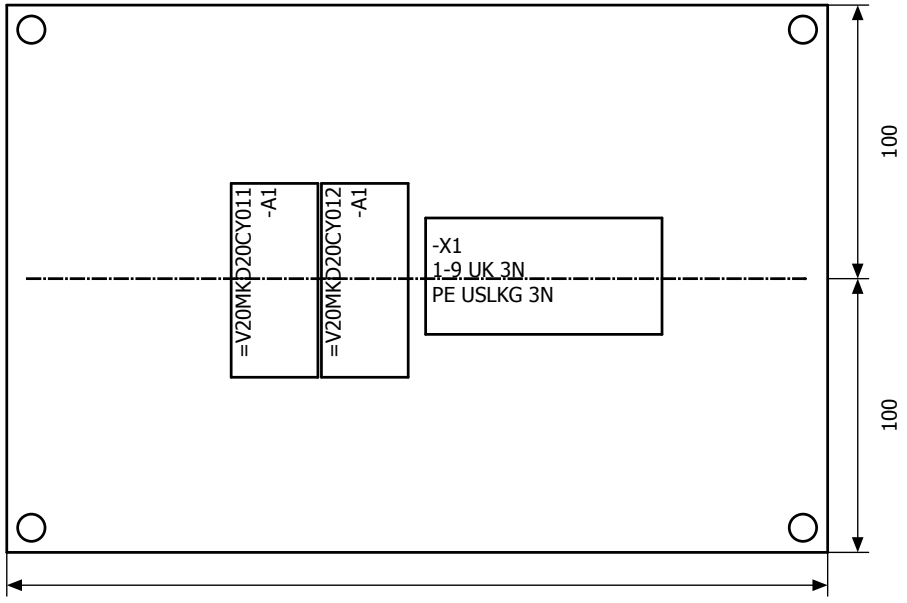
BOTTOM SIDE FOR CUSTOMER CONNECTION DRILLED AT SITE

COLOUR: RAL 7035

VIEW ON RIGHT HAND SIDE



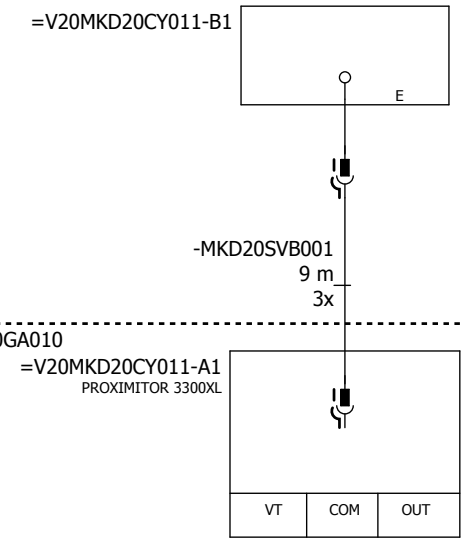
FRONT VIEW WITHOUT COVER



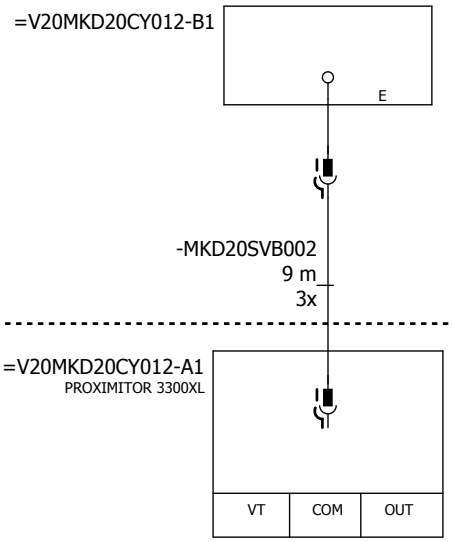
			Date	19.12.2017	VILNIUS Biomass	SIEMENS ENERGY SECTOR	JUNCTION BOX VIBRATION MOUNTING PLATE TURBINE END	=	
			Drawn	Möbius				+ V20MKD20GA010	
			Appr.	Rabe				EG000367 DPPPG-70152441	Page 35
REVISION	Date	Name	NORM		Replacement for	Replaced by			Pg. 79

BEARING EE

REL. SHAFT VIBRATION EE-X



REL. SHAFT VIBRATION EE-Y



SENSOR
BENTLY NEVADA 330106-05-30-05-02-00

PROXIMITOR 9m, 200µm pp
BENTLY NEVADA 330180-91-00

TE ... TURBINE END
EE ... EXCITER END

			Date	19.12.2017	VILNIUS Biomass	
			Drawn	Möbius		
			Appr.	Rabe		
REVISION	Date	Name	NORM		Replacement for	Replaced by

SIEMENS
ENERGY SECTOR

JUNCTION BOX VIBRATION
RELATIVE SHAFT VIBRATION
NON DRIVE END

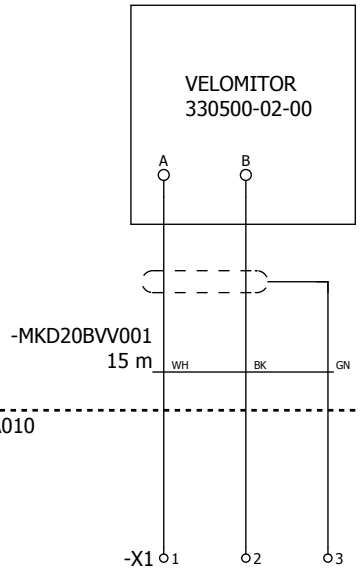
=
+ V20MKD20GA010

EG000367 | DPPPG-70152441

BEARING EE

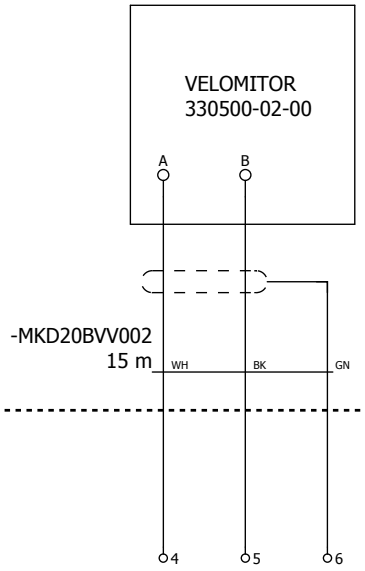
ABS. BEARING VIBRATION EE-A

=V20MKD20CY010-B1
VERTICAL



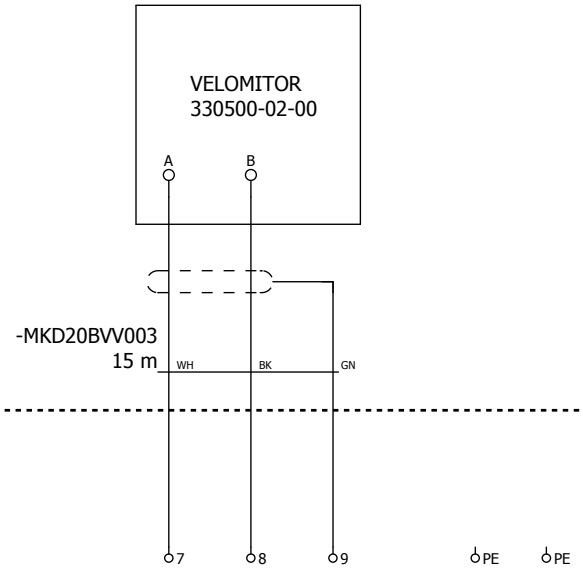
ABS. BEARING VIBRATION EE-B

=V20MKD20CY020-B1
HORIZONTAL



ABS. BEARING VIBRATION EE-C

=V20MKD20CY030-B1
AXIAL



+V20MKD20GA010

TE ... TURBINE END
EE ... EXCITER END

b	16.04.2018	Rabe	Date	19.12.2017	VILNIUS Biomass	
			Drawn	Möbius		
			Appr.	Rabe		
REVISION	Date	Name	NORM		Replacement for	Replaced by

SIEMENS
ENERGY SECTOR

JUNCTION BOX MEASURING
ABSOLUTE BEARING VIBRATION
EXCITER END

=
+ V20MKD20GA010

EG000367 | DPPPG-70152441

Page 37
Pg. 79

Terminal diagram

item designation	Lev.	no. cable	type cable	destination A	terminal	link	terminal number		destination B	terminal	Lev.	no. cable	MKD20BVV001	MKD20BVV002	MKD20BVV003	page / track
				Terminal strip =+V20MKD20GA010-X1												
ABS. BEARING VIBRATION EE-A						⊙	1		=V20MKD20CY010-B1	A			WH			37 1
=						⊙	2		=V20MKD20CY010-B1	B			BK			37 1
=						⊙	3						GN			37 1
ABS. BEARING VIBRATION EE-B						⊙	4		=V20MKD20CY020-B1	A				WH		37 3
=						⊙	5		=V20MKD20CY020-B1	B				BK		37 4
=						⊙	6							GN		37 4
ABS. BEARING VIBRATION EE-C						⊙	7		=V20MKD20CY030-B1	A					WH	37 6
=						⊙	8		=V20MKD20CY030-B1	B					BK	37 6
=						⊙	9								GN	37 7
=						⊙	PE									
=						⊙	PE									
						○										
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SEPARATION PLATE
SEPARATION WITH TS-K

			Date	19.12.2017	VILNIUS Biomass	SIEMENS ENERGY SECTOR	Klemmenplan : =+V20MKD20GA010-X1	=
			Drawn	Möbius				+ V20MKD20GA010
			Appr.	Rabe				
REVISION	Date	Name	NORM		Replacement for	Replaced by	EG000367	DPPPG-70152441

MANUFACTURER HÄWA
STANDARD CASING K12-30/20
DEGREE OF PROTECTION IP65

TAPPED HOLES

MOUNTING RAIL TS 35 (EN60715)

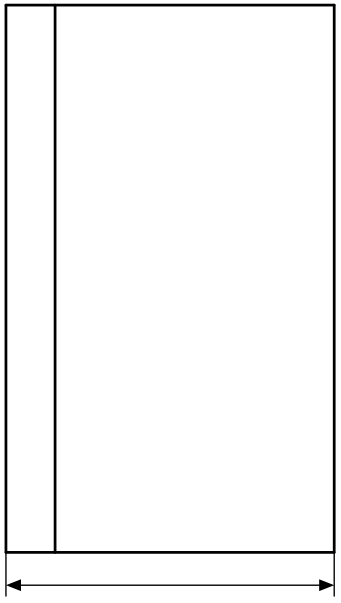
ALL DIMENSIONS IN MM

SCALE 1:2 (A3)

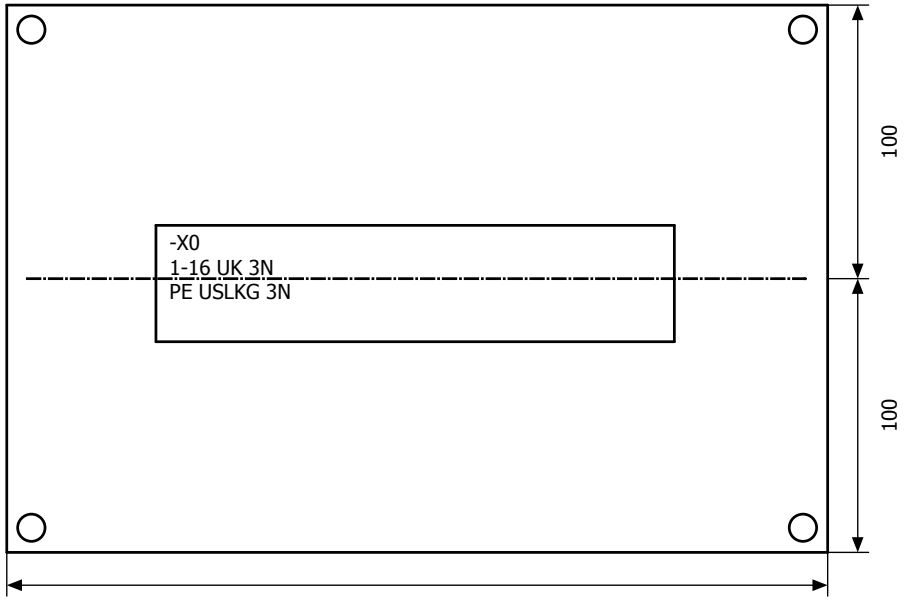
BOTTOM SIDE FOR CUSTOMER CONNECTION DRILLED AT SITE

COLOUR RAL 7035

VIEW ON RIGHT HAND SIDE



FRONT VIEW WITHOUT COVER



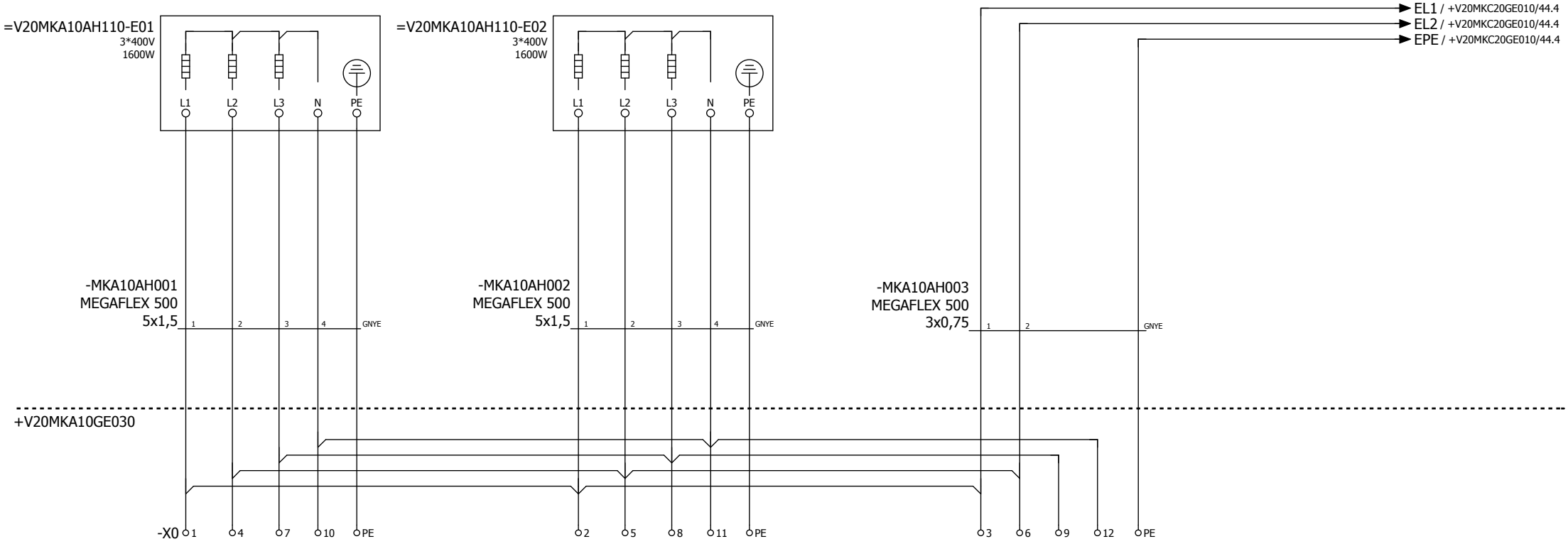
			Date	19.12.2017	VILNIUS Biomass		JUNCTION BOX VOLTAGE MOUNTING PLATE	DPPPG-70160084	=	
			Drawn	Möbius					+ V20MKA10GE030	
			Appr.	Rabe						
REVISION	Date	Name	NORM		Replacement for	Replaced by		EG000367	DPPPG-70152441	Page 39 / Pg. 79

SIEMENS
ENERGY SECTOR

GENERATOR HEATER TE

GENERATOR HEATER EE

TO EXCITER HEATER



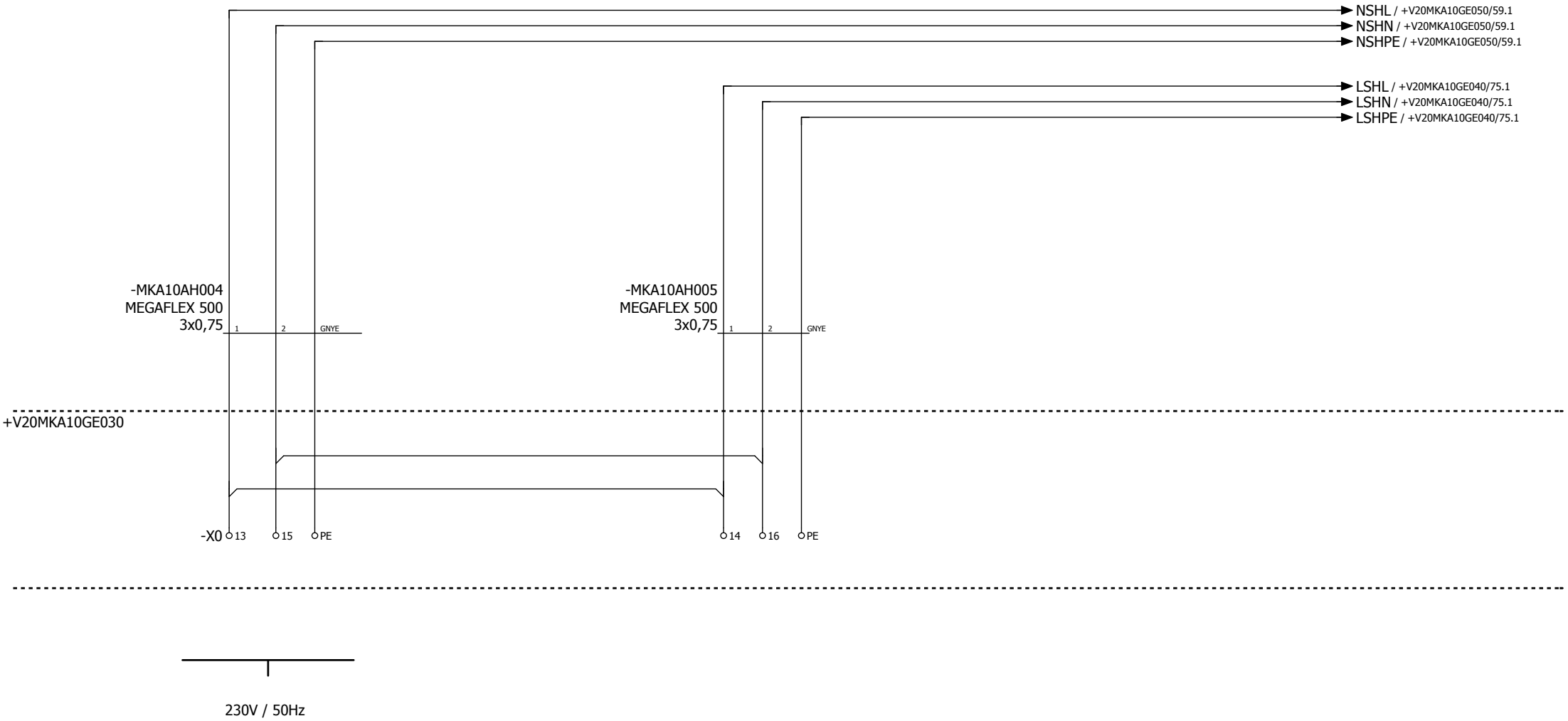
400V / 50Hz

TE ... TURBINE END
EE ... EXCITER END

			Date	19.12.2017	VILNIUS Biomass	SIEMENS ENERGY SECTOR	JUNCTION BOX VOLTAGE	DPPPG-70160084	=
			Drawn	Möbius					+ V20MKA10GE030
			Appr.	Rabe					
REVISION	Date	Name	NORM		Replacement for	Replaced by		EG000367 DPPPG-70152441	Page 40 / Pg. 79

TO NSC HEATER

TO LSC HEATER



230V / 50Hz

			Date	19.12.2017	VILNIUS Biomass	SIEMENS ENERGY SECTOR	JUNCTION BOX VOLTAGE	DPPPG-70160084	= + V20MKA10GE030
			Drawn	Möbius					
			Appr.	Rabe				EG000367 DPPPG-70152441	Page 41 Pg. 79
REVISION	Date	Name	NORM		Replacement for	Replaced by			

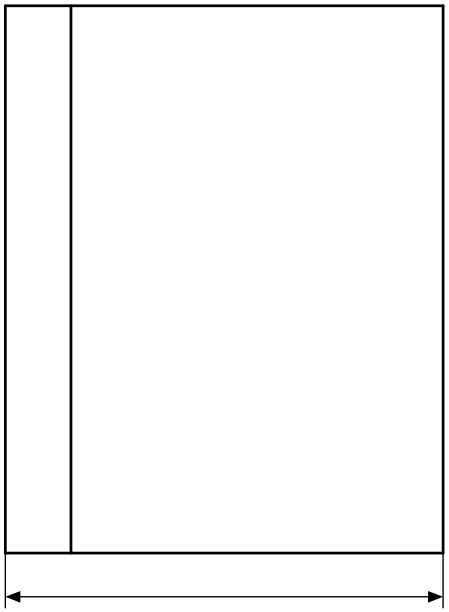
Terminal diagram

item designation	Lev.	no. cable	type cable	destination A	terminal	link	terminal number	destination B	terminal	Lev.	no. cable	type cable	MKA10AH001 MEGAFLEX 500	MKA10AH002 MEGAFLEX 500	MKA10AH003 MEGAFLEX 500	MKA10AH004 MEGAFLEX 500	MKA10AH005 MEGAFLEX 500	page / track
				Terminal strip =+V20MKA10GE030-X0														
GENERATOR HEATER TE							1	=V20MKA10AH110-E01	L1				1					40 1
GENERATOR HEATER EE							2	=V20MKA10AH110-E02	L1					1				40 3
TO EXCITER HEATER							3	+V20MKC20GE010-X41	1						1			44 4
GENERATOR HEATER TE							4	=V20MKA10AH110-E01	L2				2					40 1
GENERATOR HEATER EE							5	=V20MKA10AH110-E02	L2					2				40 3
TO EXCITER HEATER							6	+V20MKC20GE010-X41	3						2			44 6
GENERATOR HEATER TE							7	=V20MKA10AH110-E01	L3				3					40 1
GENERATOR HEATER EE							8	=V20MKA10AH110-E02	L3					3				40 4
TO EXCITER HEATER							9											
GENERATOR HEATER TE							10	=V20MKA10AH110-E01	N									40 2
GENERATOR HEATER EE							11	=V20MKA10AH110-E02	N									40 4
TO EXCITER HEATER							12											
TO NSC HEATER							13	+V20MKA10GE050-X1	1							1		59 4
TO LSC HEATER							14	+V20MKA10GE040-X1	1								1	75 4
TO NSC HEATER							15	+V20MKA10GE050-X1	3							2		59 5
TO LSC HEATER							16	+V20MKA10GE040-X1	3								2	75 5
GENERATOR HEATER TE							PE	=V20MKA10AH110-E01	PE				GNYE					40 2
GENERATOR HEATER EE							PE	=V20MKA10AH110-E02	PE					GNYE				40 4
TO EXCITER HEATER							PE	+V20MKC20GE010-X41	4						GNYE			44 7
TO NSC HEATER							PE	+V20MKA10GE050-X1	5							GNYE		59 6
TO LSC HEATER							PE	+V20MKA10GE040-X1	5								GNYE	75 6

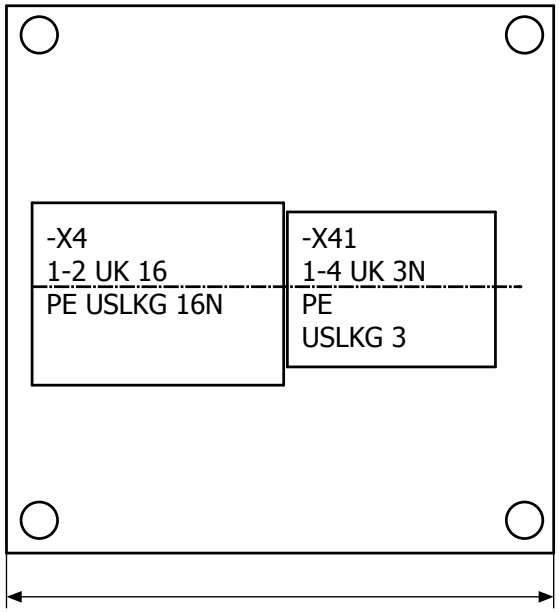
SEPARATION PLATE
SEPARATION WITH TS-K

			Date	19.12.2017	VILNIUS Biomass	SIEMENS ENERGY SECTOR	Klemmenplan : =+V20MKA10GE030-X0	DPPPG-70160084	=	
			Drawn	Möbius					+ V20MKA10GE030	
			Appr.	Rabe				EG000367	DPPPG-70152441	Page 42
REVISION	Date	Name	NORM		Replacement for	Replaced by				Pg. 79

VIEW ON RIGHT HAND SIDE



FRONT VIEW WITHOUT COVER



MANUFACTURER HÄWA
STANDARD CASING K12-15/15
DEGREE OF PROTECTION IP65

TAPPED HOLES

MOUNTING RAIL TS 35 (EN60715)

ALL DIMENSIONS IN MM

SCALE 1:2 (A3)

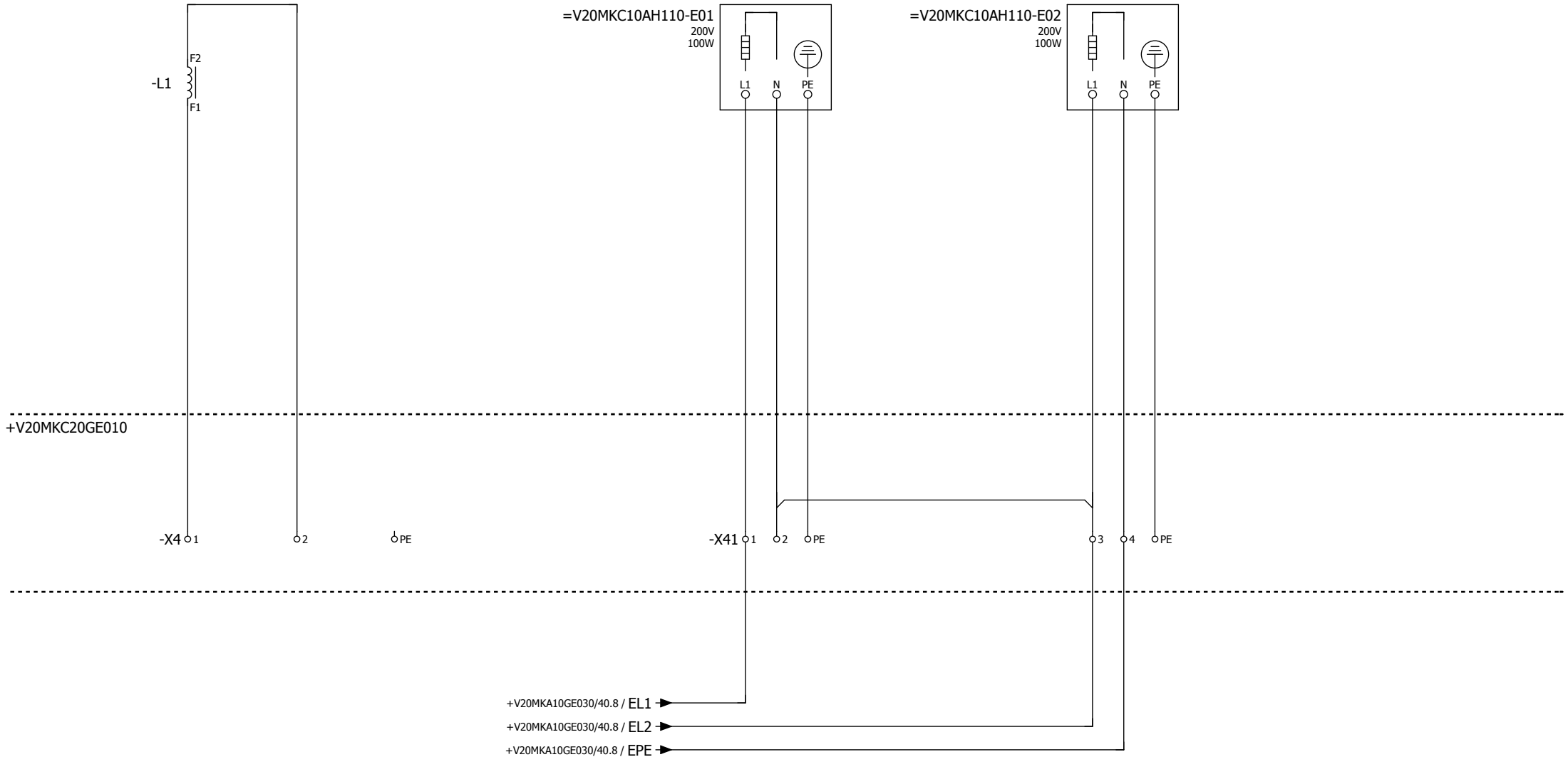
BOTTOM SIDE FOR CUSTOMER CONNECTION DRILLED AT SITE

COLOUR RAL 7035

			Date	19.12.2017	VILNIUS Biomass	SIEMENS ENERGY SECTOR	JUNCTION BOX EXCITER FIELD; HEATER MOUNTING PLATE	DPPPG-70160085	= + V20MKC20GE010
			Drawn	Möbius					
			Appr.	Rabe				EG000367	DPPPG-70152441
REVISION	Date	Name	NORM		Replacement for	Replaced by			Page 43 Pg. 79

FIELD WINDING

EXCITER 2x HEATER



			Date	19.12.2017	VILNIUS Biomass	SIEMENS ENERGY SECTOR	JUNCTION BOX EXCITER FIELD; HEATER	DPPPG-70160085	=
			Drawn	Möbius					+ V20MKC20GE010
			Appr.	Rabe				EG000367	DPPPG-70152441
REVISION	Date	Name	NORM		Replacement for	Replaced by			Page 44 / Pg. 79

Terminal diagram

Terminal strip
=+V20MKC20GE010-X4

item designation	Lev. / no. cable / type cable	destination A	terminal	link	terminal number	destination B	terminal	Lev. / no. cable / type cable	page / track
FIELD WINDING					1	-L1	F1		44 1
=					2	-L1	F2		44 1
=					PE				

SEPARATION PLATE
SEPARATION WITH TS-K

Terminal diagram

item designation	MEGAFLEX 500 type cable	MKA10AH003 no. cable	Lev.	Terminal strip =+V20MKC20GE010-X41 destination A	terminal	link	terminal number	destination B	terminal	type cable	Lev.	page / track
EXCITER 2x HEATER	1			+V20MKA10GE030-X0	3		1	=V20MKC10AH110-E01	L1			44 4
=							2	=V20MKC10AH110-E01	N			44 4
=	2			+V20MKA10GE030-X0	6		3	=V20MKC10AH110-E02	L1			44 6
=	GNYE			+V20MKA10GE030-X0	PE		4	=V20MKC10AH110-E02	N			44 7
=							PE	=V20MKC10AH110-E01	PE			44 5
=							PE	=V20MKC10AH110-E02	PE			44 7

SEPARATION PLATE
SEPARATION WITH TS-K

			Date	19.12.2017	VILNIUS Biomass	SIEMENS ENERGY SECTOR	Klemmenplan : =+V20MKC20GE010-X41	DPPPG-70160085
			Drawn	Möbius				= + V20MKC20GE010
			Appr.	Rabe				
REVISION	Date	Name	NORM		Replacement for	Replaced by	EG000367	DPPPG-70152441 Page 46 Pg. 79

MANUFACTURER HÄWA
STANDARD CASING K12-20/20
DEGREE OF PROTECTION IP65

TAPPED HOLES

MOUNTING RAIL TS 35 (EN60715)

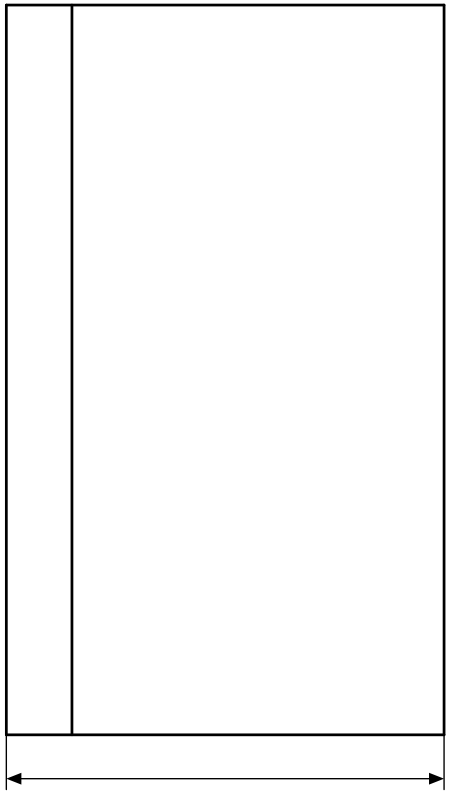
ALL DIMENSIONS IN MM

SCALE 1:2 (A3)

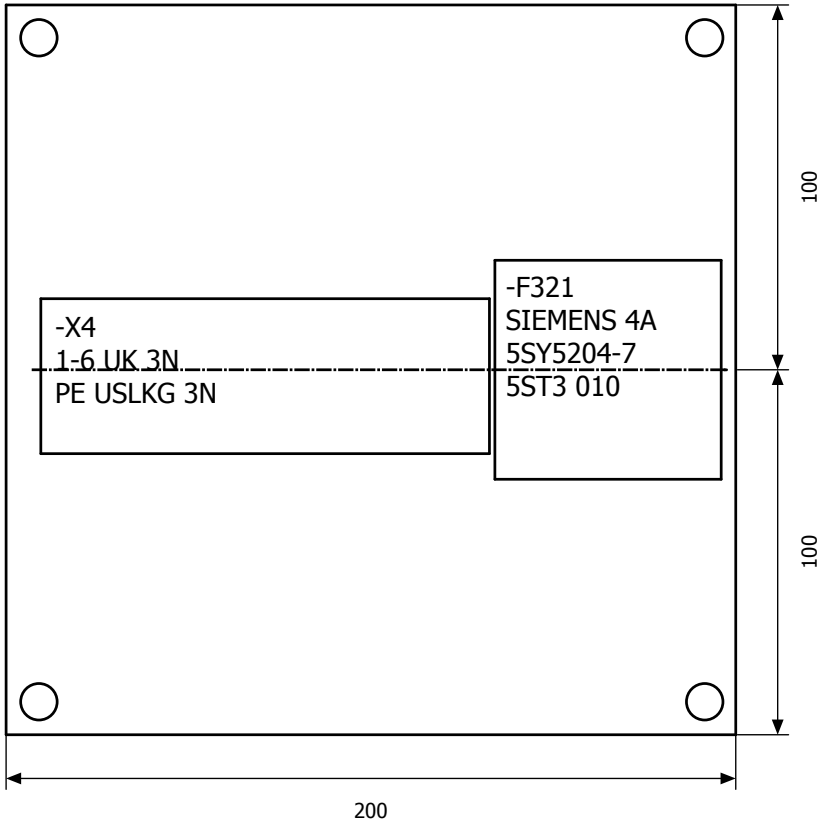
BOTTOM SIDE FOR CUSTOMER CONNECTION DRILLED AT SITE

COLOUR RAL 7035

VIEW ON RIGHT HAND SIDE

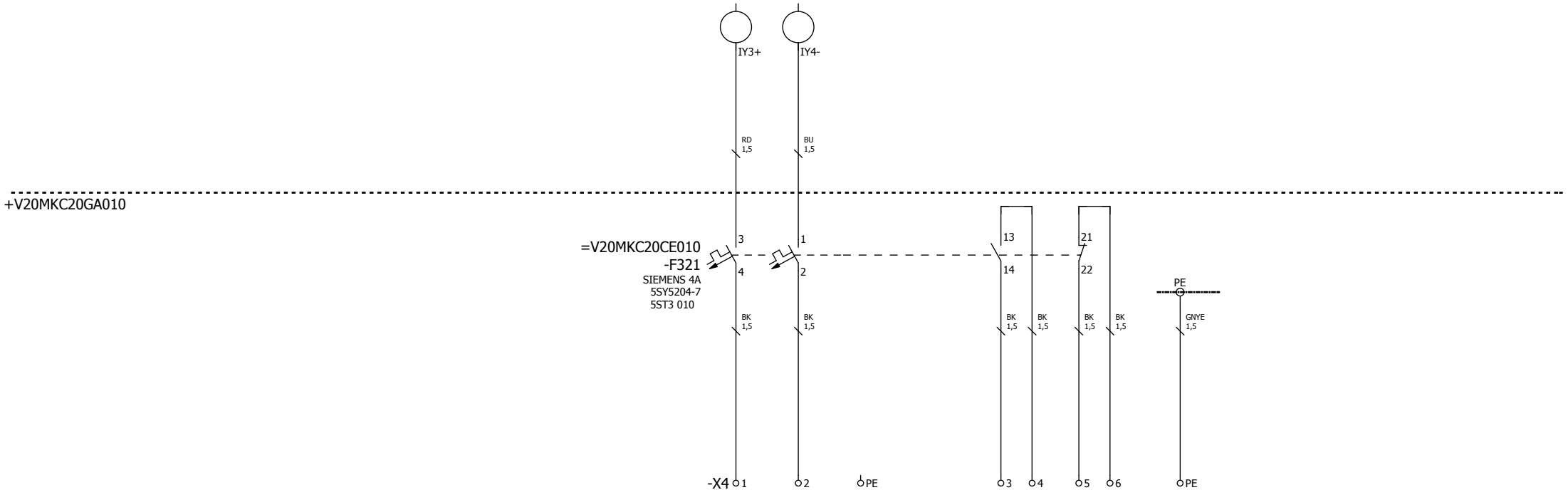


FRONT VIEW WITHOUT COVER



			Date	19.12.2017	VILNIUS Biomass	SIEMENS ENERGY SECTOR	JUNCTION BOX ROTOR EARTH FAULT DETECTION MOUNTING PLATE	DPPPG-70160086	= + V20MKC20GA010
			Drawn	Möbius					
			Appr.	Rabe				EG000367	DPPPG-70152441
REVISION	Date	Name	NORM		Replacement for	Replaced by			Page 47 Pg. 79

EXCITATION VOLT. MEASUREMENT



			Date	19.12.2017	VILNIUS Biomass		SIEMENS ENERGY SECTOR	JUNCTION BOX ROTOR EARTH FAULT DETECTION	DPPPG-70160086	= + V20MKC20GA010
			Drawn	Möbius						
			Appr.	Rabe					EG000367	DPPPG-70152441
REVISION	Date	Name	NORM		Replacement for	Replaced by				Page 48 Pg. 79

Terminal diagram

item designation	Lev.	no. cable	type cable	destination A	terminal	link	terminal number	destination B	terminal	Lev.	no. cable	type cable	1,5 mm²	page / track
				Terminal strip =+V20MKC20GA010-X4										
EXCITATION VOLT. MEASUREMENT							1	=V20MKC20CE010-F321	4				BK	48 4
=							2	=V20MKC20CE010-F321	2				BK	48 4
=							3		14				BK	48 6
=							4		13				BK	48 6
=							5		22				BK	48 6
=							6		21				BK	48 6
=							PE							
=							PE		PE				GNYE	48 7

SEPARATION PLATE
SEPARATION WITH TS-K

			Date	19.12.2017	VILNIUS Biomass	SIEMENS ENERGY SECTOR	Klemmenplan : =+V20MKC20GA010-X4	DPPPG-70160086
			Drawn	Möbius				= + V20MKC20GA010
			Appr.	Rabe				
REVISION	Date	Name	NORM		Replacement for	Replaced by	EG000367	DPPPG-70152441

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Pg. 79

MANUFACTURER HÄWA
STANDARD CASING K12-40/20
DEGREE OF PROTECTION IP65

TAPPED HOLES

MOUNTING RAIL TS 35 (EN60715)

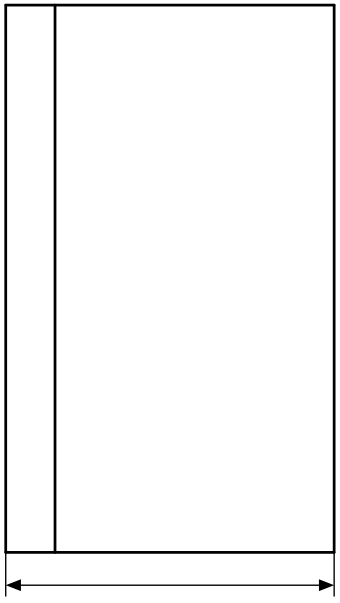
ALL DIMENSIONS IN MM

SCALE 1:2 (A3)

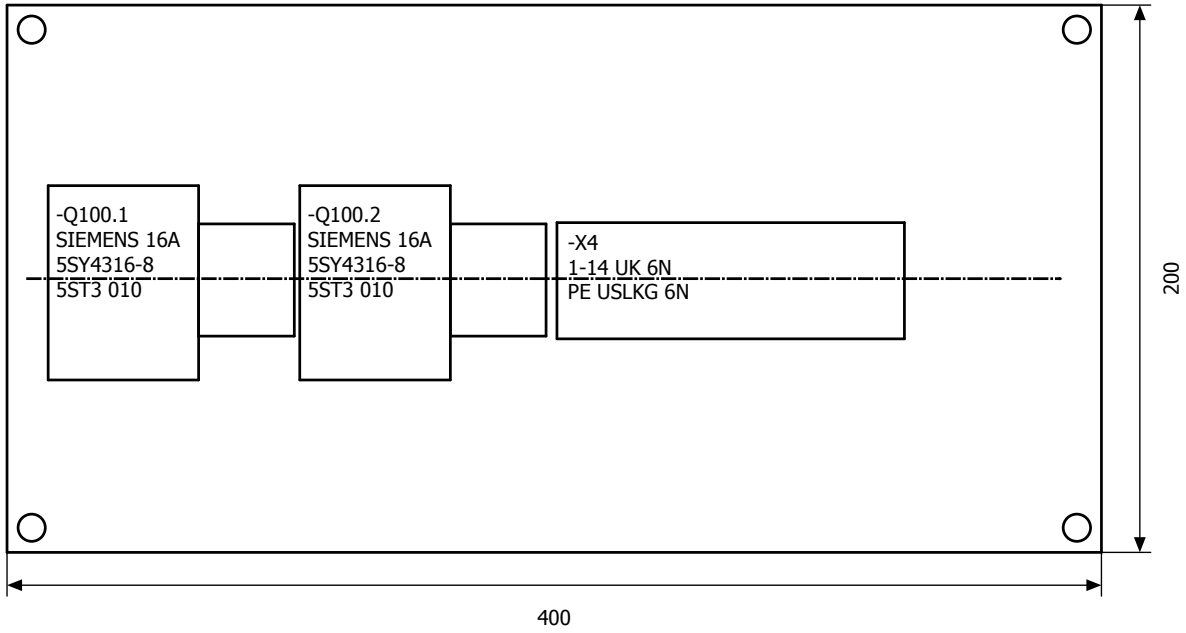
BOTTOM SIDE FOR CUSTOMER CONNECTION DRILLED AT SITE

COLOUR RAL 7035

VIEW ON RIGHT HAND SIDE

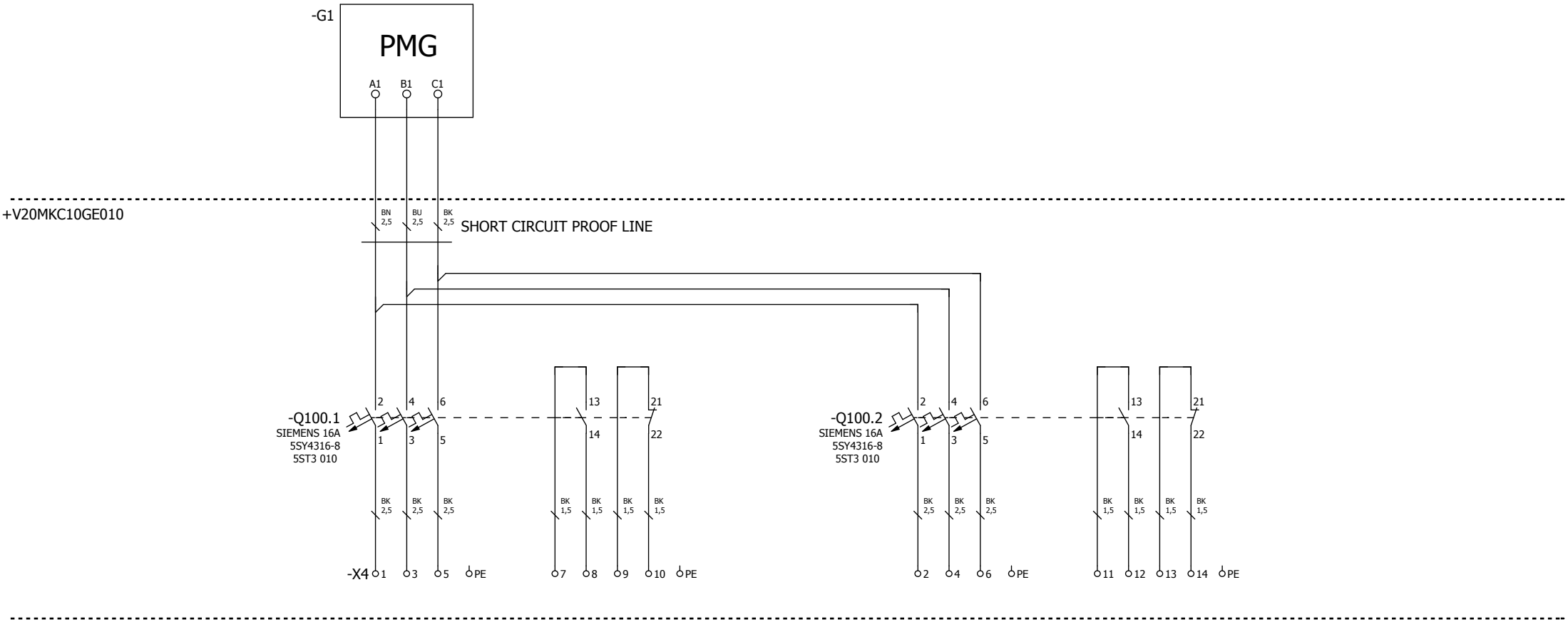


FRONT VIEW WITHOUT COVER



			Date	19.12.2017	VILNIUS Biomass	SIEMENS ENERGY SECTOR	JUNCTION BOX PERMANENT MAGNET GENERATOR MOUNTING PLATE	DPPPG-70160087	= + V20MKC10GE010
			Drawn	Möbius					
			Appr.	Rabe				EG000367	DPPPG-70152441
REVISION	Date	Name	NORM		Replacement for	Replaced by			Page 50 Pg. 79

PILOT EXCITER



			Date	19.12.2017	VILNIUS Biomass	
			Drawn	Möbius		
			Appr.	Rabe		
REVISION	Date	Name	NORM		Replacement for	Replaced by

SIEMENS
ENERGY SECTOR

JUNCTION BOX
PERMANENT MAGNET GENERATOR

DPPPG-70160087

EG000367 DPPPG-70152441

= + V20MKC10GE010

Terminal diagram

Terminal strip
=+V20MKC10GE010-X4

item designation	Lev. / no. cable / type cable	destination A	terminal	link	terminal number	destination B	terminal	Lev. / no. cable / type cable	1,5 mm²	2,5 mm²	page / track	
PILOT EXCITER					1	-Q100.1	1			BK	51	2
=					2	-Q100.2	1			BK	51	5
=					3	-Q100.1	3			BK	51	2
=					4	-Q100.2	3			BK	51	5
=					5	-Q100.1	5			BK	51	2
=					6	-Q100.2	5			BK	51	5
=					7	-Q100.1	13		BK		51	3
=					8	-Q100.1	14		BK		51	3
=					9	-Q100.1	21		BK		51	4
=					10	-Q100.1	22		BK		51	4
=					11	-Q100.2	13		BK		51	7
=					12	-Q100.2	14		BK		51	7
=					13	-Q100.2	21		BK		51	7
=					14	-Q100.2	22		BK		51	7
=					PE							
=					PE							
=					PE							
=					PE							
				○								
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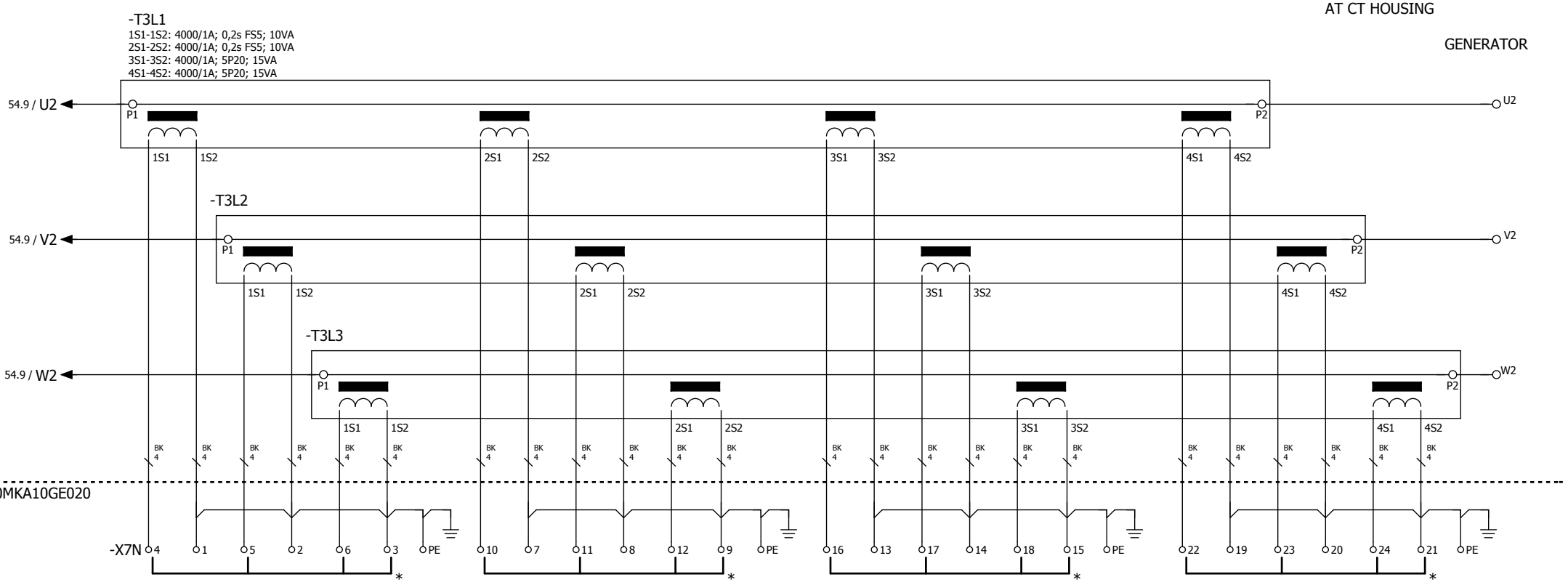
SEPARATION PLATE
SEPARATION WITH TS-K

MEDIUM VOLTAGE COMPARTMENT
NEUTRAL SIDE

+V20MKA10GD020

CT CORES ARE EARTHED
ON SECONDARY SIDE
BY EARTHING SCREWS
AT CT HOUSING

GENERATOR



MEASURING

MEASURING

GENERATOR PROTECTION
AND SYNCHRONIZATION CUBICLE

GENERATOR PROTECTION
AND SYNCHRONIZATION CUBICLE

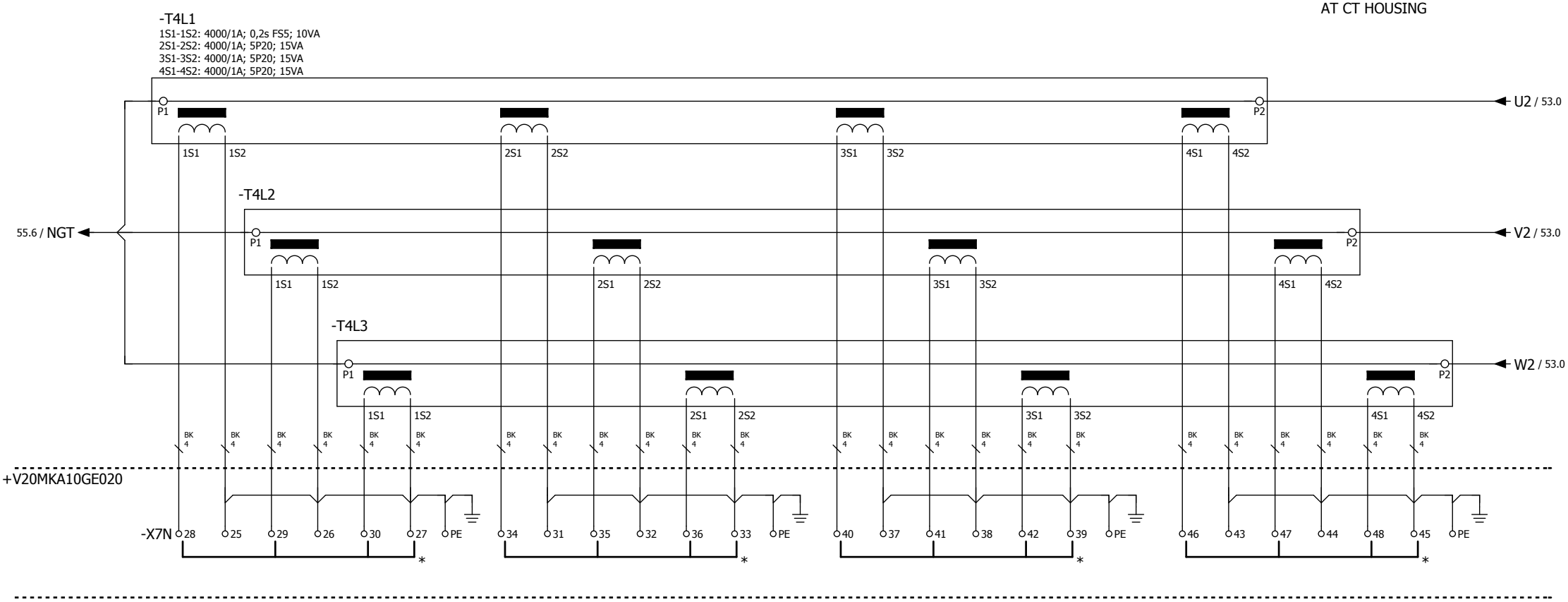
* REMOVE LINKS DURING ERECTION OR COMMISSIONING

b	16.04.2018	Rabe	Date	19.12.2017	VILNIUS Biomass	SIEMENS ENERGY SECTOR	NEUTRAL SIDE CUBICLE CURRENT TRANSFORMER	=	
			Drawn	Möbius				+ V20MKA10GE020	
			Appr.	Rabe				EG000367	DPPPG-70152441
REVISION	Date	Name	NORM		Replacement for	Replaced by		Page	53
								Pg.	79

MEDIUM VOLTAGE COMPARTMENT NEUTRAL SIDE

+V20MKA10GD020

CT CORES ARE EARTHED
ON SECONDARY SIDE
BY EARTHING SCREWS
AT CT HOUSING



MEASURING

GENERATOR PROTECTION
AND SYNCHRONIZATION CUBICLE

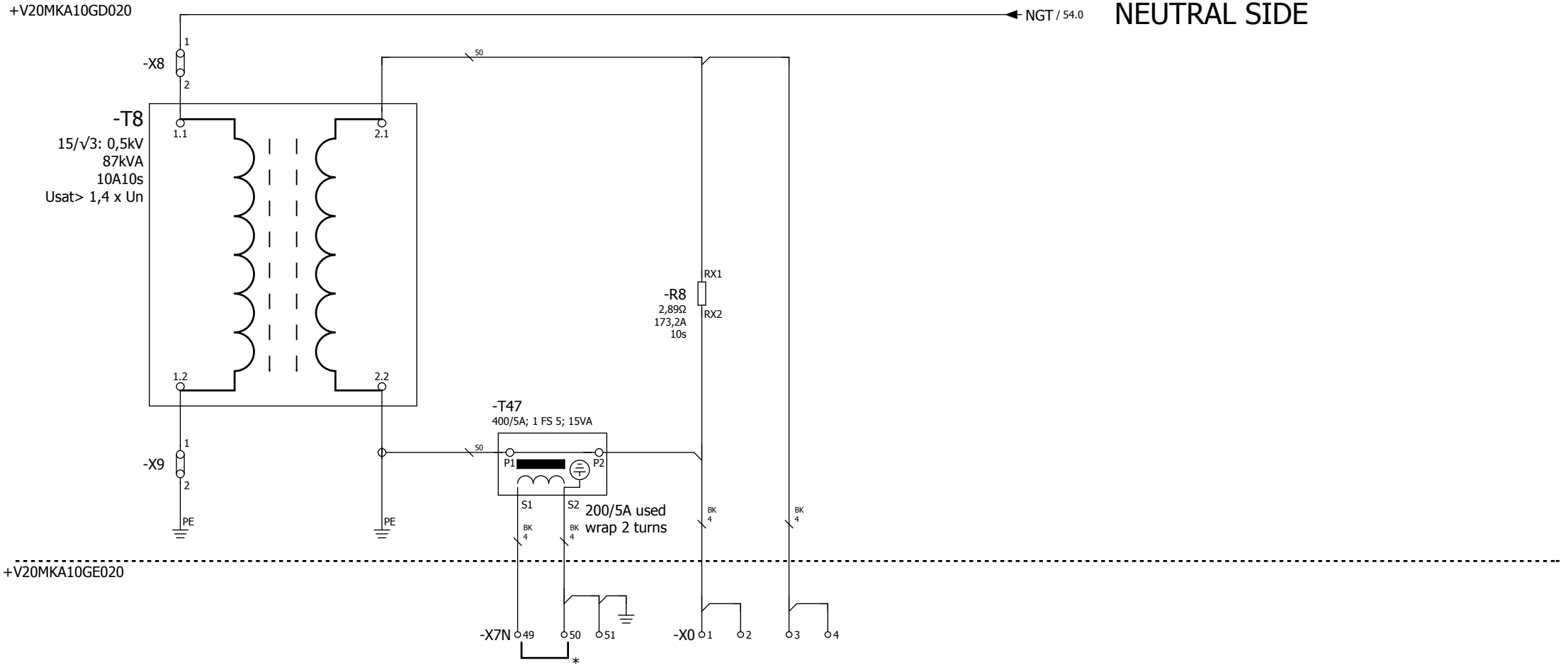
GENERATOR PROTECTION
AND SYNCHRONIZATION CUBICLE

GENERATOR PROTECTION
AND SYNCHRONIZATION CUBICLE

* REMOVE LINKS DURING ERECTION OR COMMISSIONING

b	16.04.2018	Rabe	Date	19.12.2017	VILNIUS Biomass	SIEMENS ENERGY SECTOR	NEUTRAL SIDE CUBICLE CURRENT TRANSFORMER	= + V20MKA10GE020
			Drawn	Möbius				
			Appr.	Rabe			EG000367	DPPPG-70152441
REVISION	Date	Name	NORM		Replacement for	Replaced by		Page 54 / Pg. 79

MEDIUM VOLTAGE COMPARTMENT
NEUTRAL SIDE



PROTECTION

* REMOVE LINKS DURING ERECTION OR COMMISSIONING

b	16.04.2018	Rabe	Date	19.12.2017	VILNIUS Biomass	
			Drawn	Möbius		
			Appr.	Rabe		
REVISION	Date	Name	NORM		Replacement for	Replaced by

SIEMENS
ENERGY SECTOR

NEUTRAL SIDE CUBICLE
GROUNDING TRANSFORMER

= + V20MKA10GE020

EG000367 | DPPPG-70152441

Terminal diagram

item designation	Lev.	no. cable	type cable	destination A	terminal	link	terminal number	destination B	terminal	Lev.	no. cable	type cable	4 mm²	page / track
								Terminal strip =+V20MKA10GE020-X0						
							1	+V20MKA10GD020-R8	RX2				BK;BK	55;55 4;3
							2							
							3	+V20MKA10GD020-R8	RX1				BK	55 4
							4							

SEPARATION PLATE
SEPARATION WITH TS-K

			Date	19.12.2017	VILNIUS Biomass	SIEMENS ENERGY SECTOR	Klemmenplan : =+V20MKA10GE020-X0	=
			Drawn	Möbius				+ V20MKA10GE020
			Appr.	Rabe			EG000367	DPPPG-70152441
REVISION	Date	Name	NORM		Replacement for	Replaced by		Page 56 / Pg. 79

Terminal diagram

Terminal strip
=+V20MKA10GE020-X7N

item designation	Lev.	no. cable	type cable	destination A	terminal	link	terminal number	destination B	terminal	Lev.	no. cable	type cable	4 mm²	page / track
							1	+V20MKA10GD020-T3L1	1S2				BK	53 1
							2	+V20MKA10GD020-T3L2	1S2				BK	53 2
							3	+V20MKA10GD020-T3L3	1S2				BK	53 2
							4	+V20MKA10GD020-T3L1	1S1				BK	53 1
							5	+V20MKA10GD020-T3L2	1S1				BK	53 1
							6	+V20MKA10GD020-T3L3	1S1				BK	53 2
							7	+V20MKA10GD020-T3L1	2S2				BK	53 3
							8	+V20MKA10GD020-T3L2	2S2				BK	53 4
							9	+V20MKA10GD020-T3L3	2S2				BK	53 4
							10	+V20MKA10GD020-T3L1	2S1				BK	53 3
							11	+V20MKA10GD020-T3L2	2S1				BK	53 3
							12	+V20MKA10GD020-T3L3	2S1				BK	53 4
							13	+V20MKA10GD020-T3L1	3S2				BK	53 5
							14	+V20MKA10GD020-T3L2	3S2				BK	53 6
							15	+V20MKA10GD020-T3L3	3S2				BK	53 6
							16	+V20MKA10GD020-T3L1	3S1				BK	53 5
							17	+V20MKA10GD020-T3L2	3S1				BK	53 5
							18	+V20MKA10GD020-T3L3	3S1				BK	53 6
							19	+V20MKA10GD020-T3L1	4S2				BK	53 7
							20	+V20MKA10GD020-T3L2	4S2				BK	53 8
							21	+V20MKA10GD020-T3L3	4S2				BK	53 8
							22	+V20MKA10GD020-T3L1	4S1				BK	53 7
							23	+V20MKA10GD020-T3L2	4S1				BK	53 8
							24	+V20MKA10GD020-T3L3	4S1				BK	53 8
							25	+V20MKA10GD020-T4L1	1S2				BK	54 1
							26	+V20MKA10GD020-T4L2	1S2				BK	54 2
							27	+V20MKA10GD020-T4L3	1S2				BK	54 2
							28	+V20MKA10GD020-T4L1	1S1				BK	54 1
							29	+V20MKA10GD020-T4L2	1S1				BK	54 1
							30	+V20MKA10GD020-T4L3	1S1				BK	54 2
							31	+V20MKA10GD020-T4L1	2S2				BK	54 3
							32	+V20MKA10GD020-T4L2	2S2				BK	54 4

SEPARATION PLATE
SEPARATION WITH TS-K

Terminal diagram

Terminal strip
=+V20MKA10GE020-X7N

item designation	Lev.	no. cable	type cable	destination A	terminal	link	terminal number	destination B	terminal	Lev.	no. cable	type cable	4 mm²	page / track
							33	+V20MKA10GD020-T4L3	2S2			BK		54 4
							34	+V20MKA10GD020-T4L1	2S1			BK		54 3
							35	+V20MKA10GD020-T4L2	2S1			BK		54 3
							36	+V20MKA10GD020-T4L3	2S1			BK		54 4
							37	+V20MKA10GD020-T4L1	3S2			BK		54 5
							38	+V20MKA10GD020-T4L2	3S2			BK		54 6
							39	+V20MKA10GD020-T4L3	3S2			BK		54 6
							40	+V20MKA10GD020-T4L1	3S1			BK		54 5
							41	+V20MKA10GD020-T4L2	3S1			BK		54 5
							42	+V20MKA10GD020-T4L3	3S1			BK		54 6
							43	+V20MKA10GD020-T4L1	4S2			BK		54 7
							44	+V20MKA10GD020-T4L2	4S2			BK		54 8
							45	+V20MKA10GD020-T4L3	4S2			BK		54 8
							46	+V20MKA10GD020-T4L1	4S1			BK		54 7
							47	+V20MKA10GD020-T4L2	4S1			BK		54 8
							48	+V20MKA10GD020-T4L3	4S1			BK		54 8
							49	+V20MKA10GD020-T47	S1			BK		55 3
							50	+V20MKA10GD020-T47	S2			BK		55 3
							51							55 3
							PE							53 3
							PE							53 5
							PE							53 7
							PE							53 9
							PE							54 3
							PE							54 5
							PE							54 7
							PE							54 9
							○							
							○							
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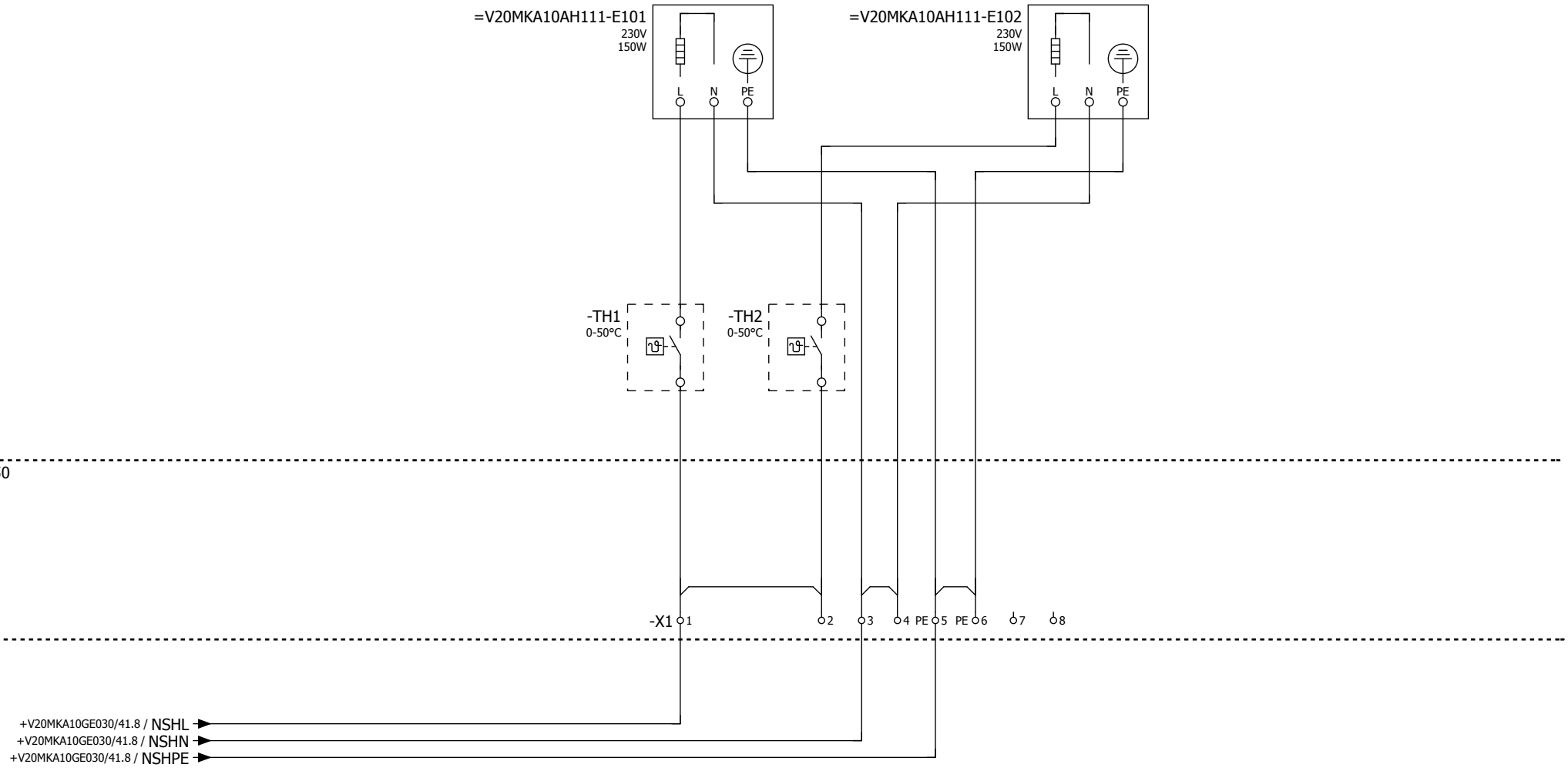
SEPARATION PLATE
SEPARATION WITH TS-K

			Date	19.12.2017	VILNIUS Biomass	SIEMENS ENERGY SECTOR	Klemmenplan : =+V20MKA10GE020-X7N	= + V20MKA10GE020
			Drawn	Möbius				
			Appr.	Rabe				
REVISION	Date	Name	NORM		Replacement for	Replaced by	EG000367	DPPPG-70152441 Page 58 Pg. 79

+V20MKA10GD020

MEDIUM VOLTAGE COMPARTMENT
NEUTRAL SIDE

NEUTRAL SIDE CUBICLE HEATER



b	16.04.2018	Rabe	Date	19.12.2017	VILNIUS Biomass	
			Drawn	Möbius		
			Appr.	Rabe		
REVISION	Date	Name	NORM		Replacement for	Replaced by

SIEMENS
ENERGY SECTOR

NEUTRAL SIDE CUBICLE ANTICONDENSATION HEATER

=
+ V20MKA10GE050

EG000367 | DPPPG-70152441 | Page 59 | Pg. 79

Terminal diagram

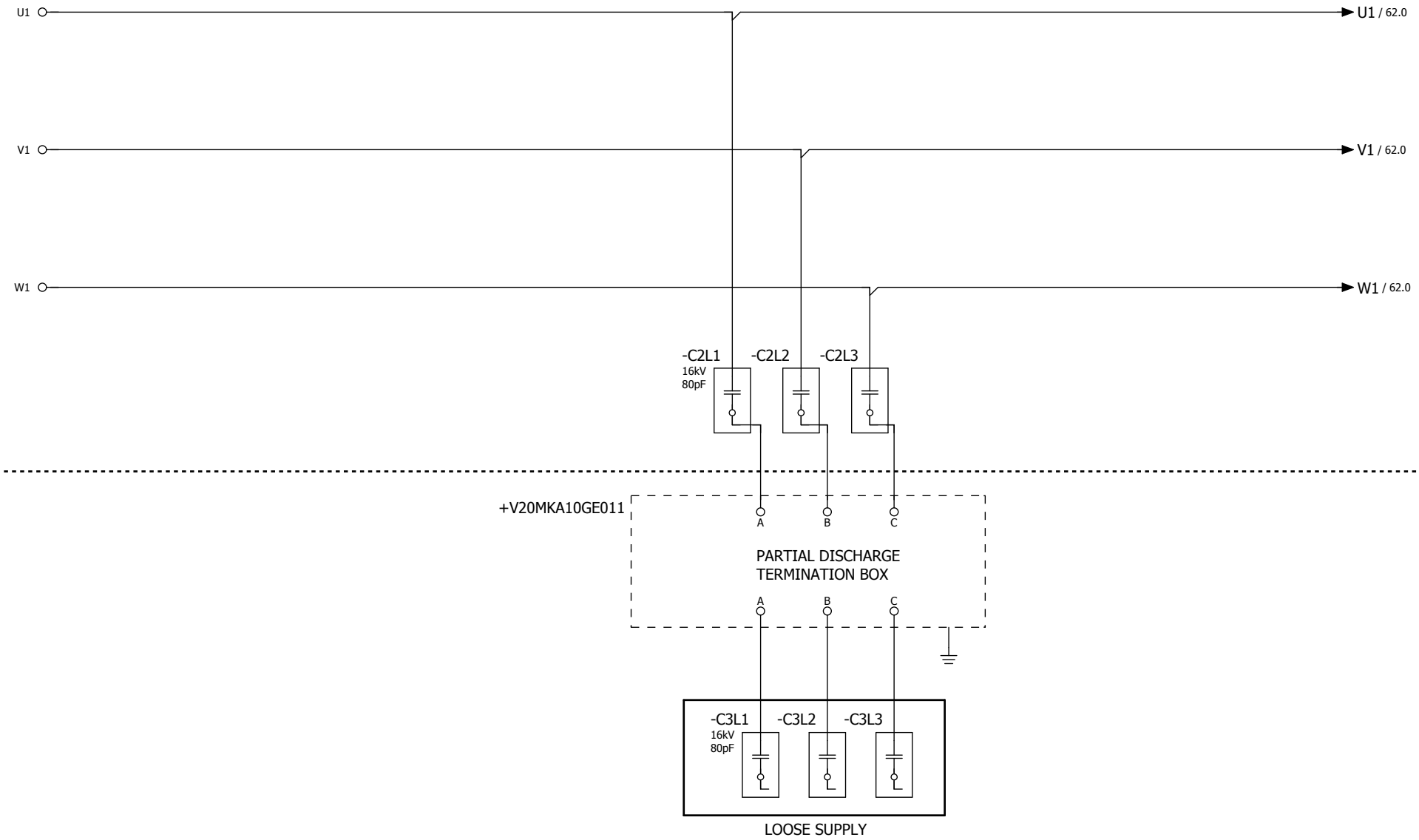
item designation	MEGAFLEX 500 type cable	MKA10AH004 no. cable	Lev.	Terminal strip =+V20MKA10GE050-X1 destination A	terminal	link	terminal number	destination B	terminal	Lev. type cable	no. cable	page / track
NEUTRAL SIDE CUBICLE HEATER		1		+V20MKA10GE030-X0	13		1	-TH1				59 4
=							2	-TH2				59 5
=		2		+V20MKA10GE030-X0	15		3	=V20MKA10AH111-E101	N			59 4
=							4	=V20MKA10AH111-E102	N			59 7
PE	GNYE			+V20MKA10GE030-X0	PE		5	=V20MKA10AH111-E101	PE			59 5
=							6	=V20MKA10AH111-E102	PE			59 7
NEUTRAL SIDE CUBICLE HEATER							7					
=							8					

SEPARATION PLATE
SEPARATION WITH TS-K

			Date	19.12.2017	VILNIUS Biomass	SIEMENS ENERGY SECTOR	Klemmenplan : =+V20MKA10GE050-X1	=
			Drawn	Möbius				+ V20MKA10GE050
			Appr.	Rabe			EG000367	DPPPG-70152441
REVISION	Date	Name	NORM		Replacement for	Replaced by		Page 60 Pg. 79

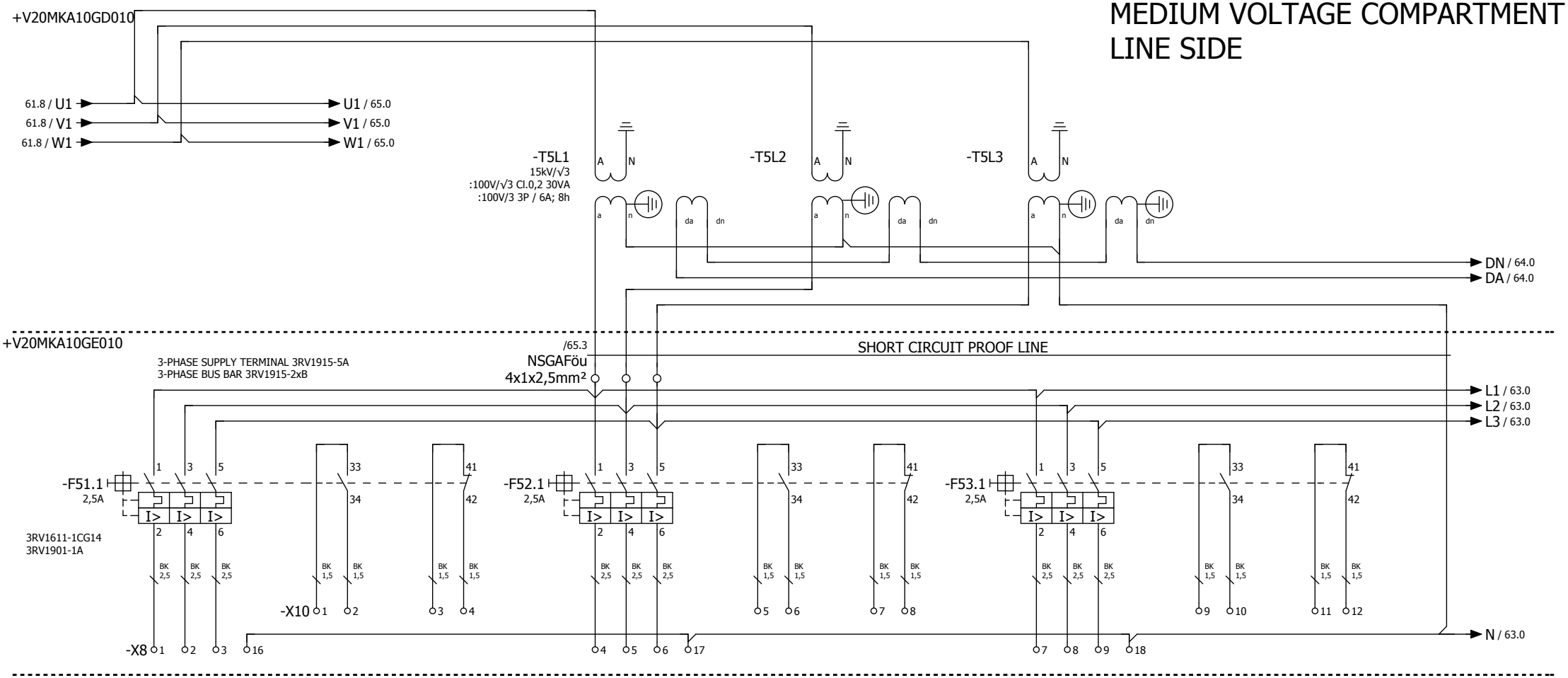
MEDIUM VOLTAGE COMPARTMENT
LINE SIDE CUBICLE

GENERATOR



b	16.04.2018	Rabe	Date	19.12.2017	VILNIUS Biomass	SIEMENS ENERGY SECTOR	LINE SIDE CUBICLE PARTIAL DISCHARGE MEASUREMENT		=	
			Drawn	Möbius					+ V20MKA10GE010	
			Appr.	Rabe				EG000367	DPPPG-70152441	Page 61
REVISION	Date	Name	NORM		Replacement for	Replaced by				Pg. 79

MEDIUM VOLTAGE COMPARTMENT
LINE SIDE



PROTECTION

VOLTAGE REGULATION

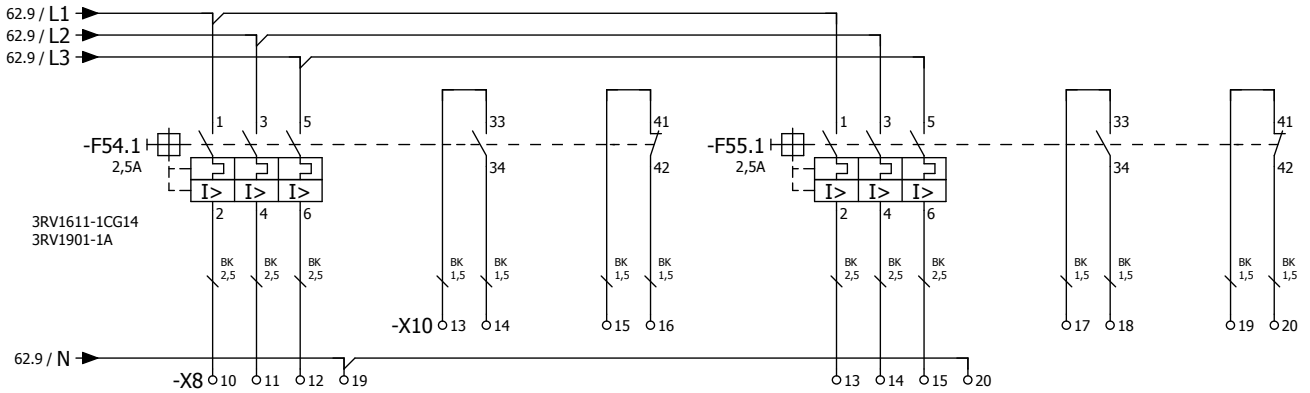
PROTECTION

			Date	19.12.2017	VILNIUS Biomass	SIEMENS ENERGY SECTOR	LINE SIDE CUBICLE VOLTAGE TRANSFORMER	=	
			Drawn	Möbius				+ V20MKA10GE010	
			Appr.	Rabe				EG000367 DPPPG-70152441	Page 62
REVISION	Date	Name	NORM		Replacement for	Replaced by			Pg. 79

+V20MKA10GD010

MEDIUM VOLTAGE COMPARTMENT
LINE SIDE

+V20MKA10GE010



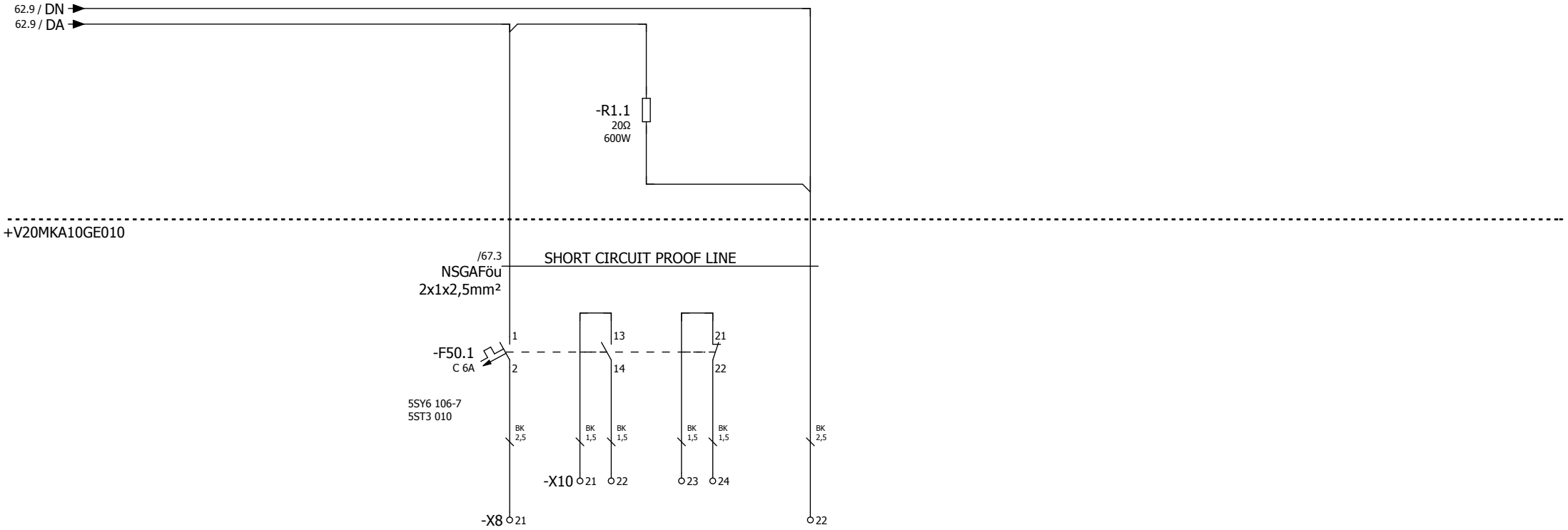
MEASUREMENT

SYNCHRONIZATION

			Date	19.12.2017	VILNIUS Biomass	SIEMENS ENERGY SECTOR	LINE SIDE CUBICLE VOLTAGE TRANSFORMER	=	
			Drawn	Möbius				+ V20MKA10GE010	
			Appr.	Rabe				EG000367 DPPPG-70152441	Page 63
REVISION	Date	Name	NORM		Replacement for	Replaced by			Pg. 79

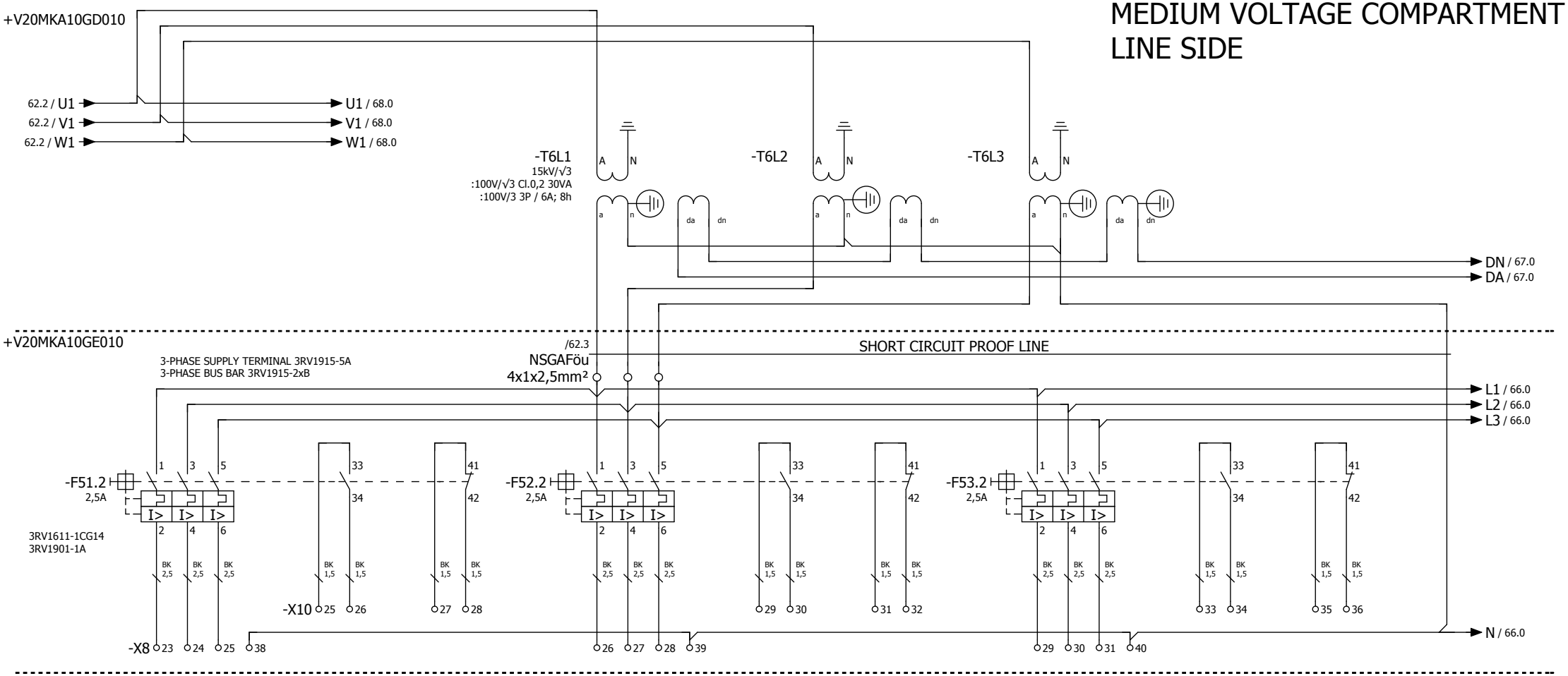
+V20MKA10GD010

MEDIUM VOLTAGE COMPARTMENT
LINE SIDE



			Date	19.12.2017	VILNIUS Biomass	SIEMENS ENERGY SECTOR	LINE SIDE CUBICLE VOLTAGE TRANSFORMER	=	
			Drawn	Möbius				+ V20MKA10GE010	
			Appr.	Rabe				EG000367 DPPPG-70152441	Page 64
REVISION	Date	Name	NORM		Replacement for	Replaced by			Pg. 79

MEDIUM VOLTAGE COMPARTMENT
LINE SIDE



PROTECTION

VOLTAGE REGULATION

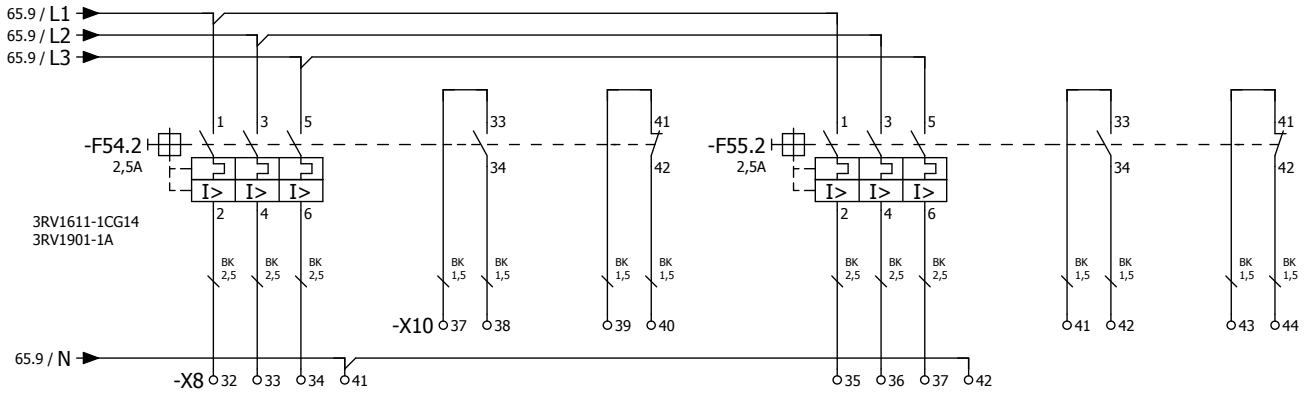
PROTECTION

			Date	19.12.2017	VILNIUS Biomass	SIEMENS ENERGY SECTOR	LINE SIDE CUBICLE VOLTAGE TRANSFORMER	=	
			Drawn	Möbius				+ V20MKA10GE010	
			Appr.	Rabe				EG000367	DPPPG-70152441
REVISION	Date	Name	NORM		Replacement for	Replaced by		Page	65
								Pg.	79

+V20MKA10GD010

MEDIUM VOLTAGE COMPARTMENT
LINE SIDE

+V20MKA10GE010



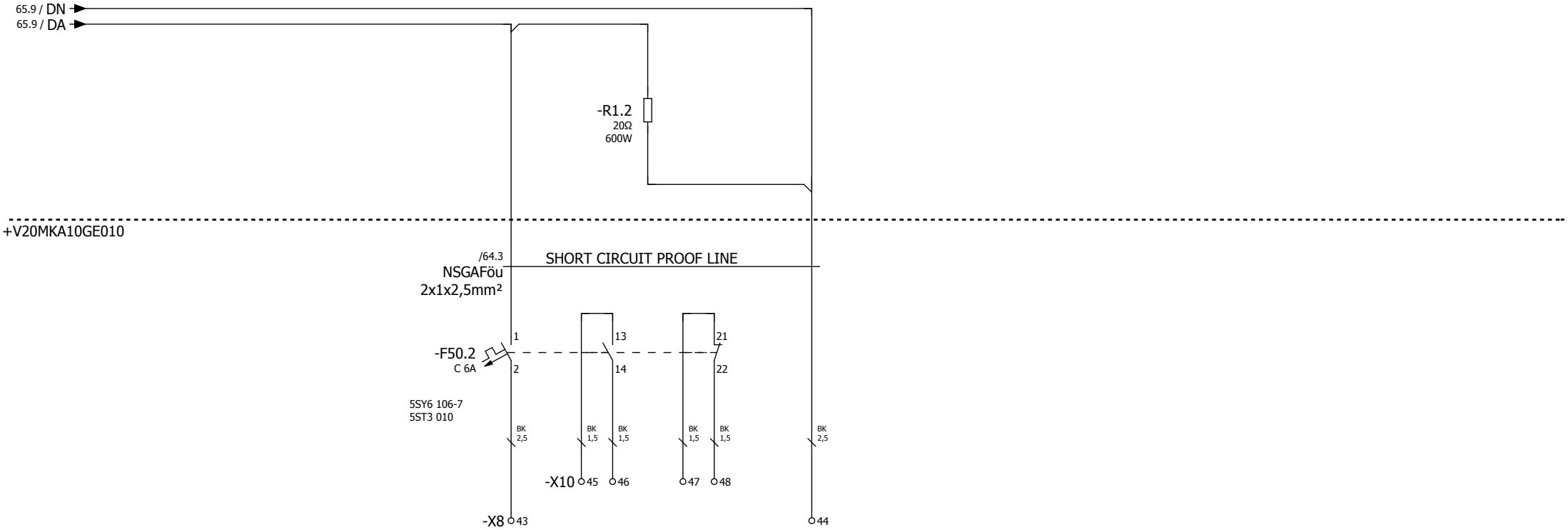
MEASUREMENT

SYNCHRONIZATION

			Date	19.12.2017	VILNIUS Biomass	SIEMENS ENERGY SECTOR	LINE SIDE CUBICLE VOLTAGE TRANSFORMER	=	
			Drawn	Möbius				+ V20MKA10GE010	
			Appr.	Rabe				EG000367 DPPPG-70152441	Page 66
REVISION	Date	Name	NORM		Replacement for	Replaced by			Pg. 79

+V20MKA10GD010

MEDIUM VOLTAGE COMPARTMENT
LINE SIDE

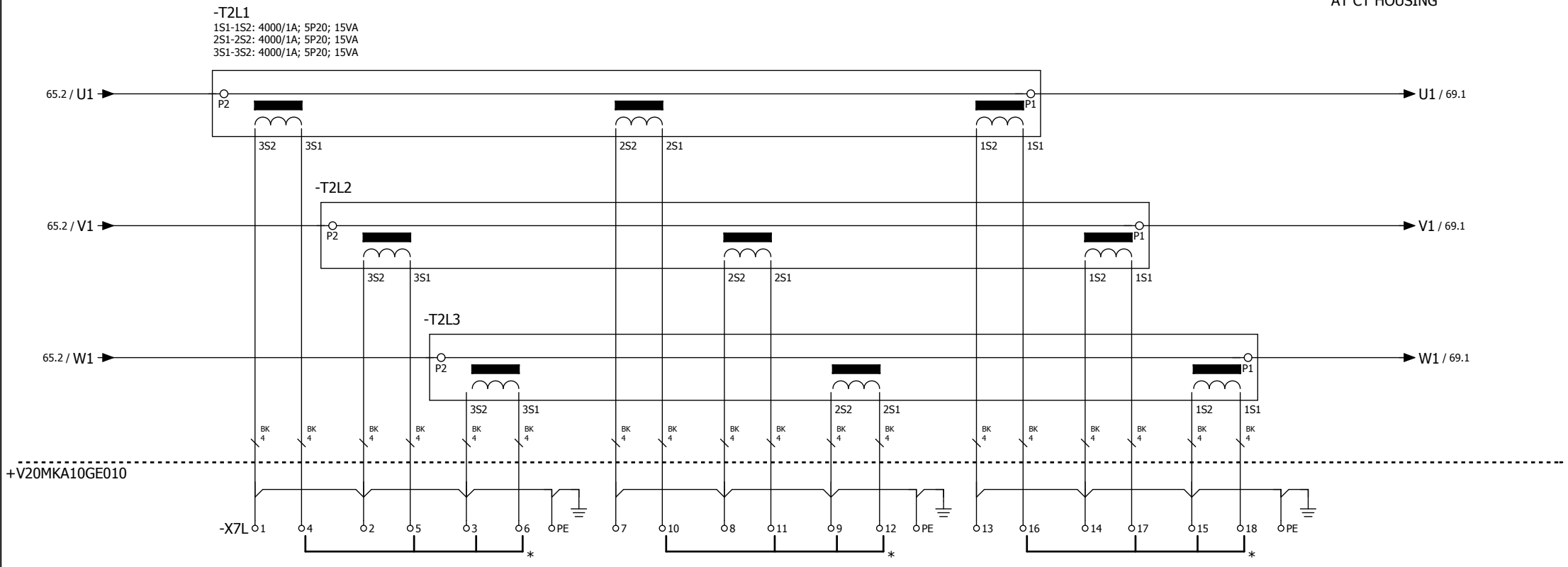


			Date	19.12.2017	VILNIUS Biomass	SIEMENS ENERGY SECTOR	LINE SIDE CUBICLE VOLTAGE TRANSFORMER	=	
			Drawn	Möbius				+ V20MKA10GE010	
			Appr.	Rabe				EG000367 DPPPG-70152441	Page 67
REVISION	Date	Name	NORM		Replacement for	Replaced by			Pg. 79

MEDIUM VOLTAGE COMPARTMENT
LINE SIDE

+V20MKA10GD010

CT CORES ARE EARTHED
ON SECONDARY SIDE
BY EARTHING SCREWS
AT CT HOUSING

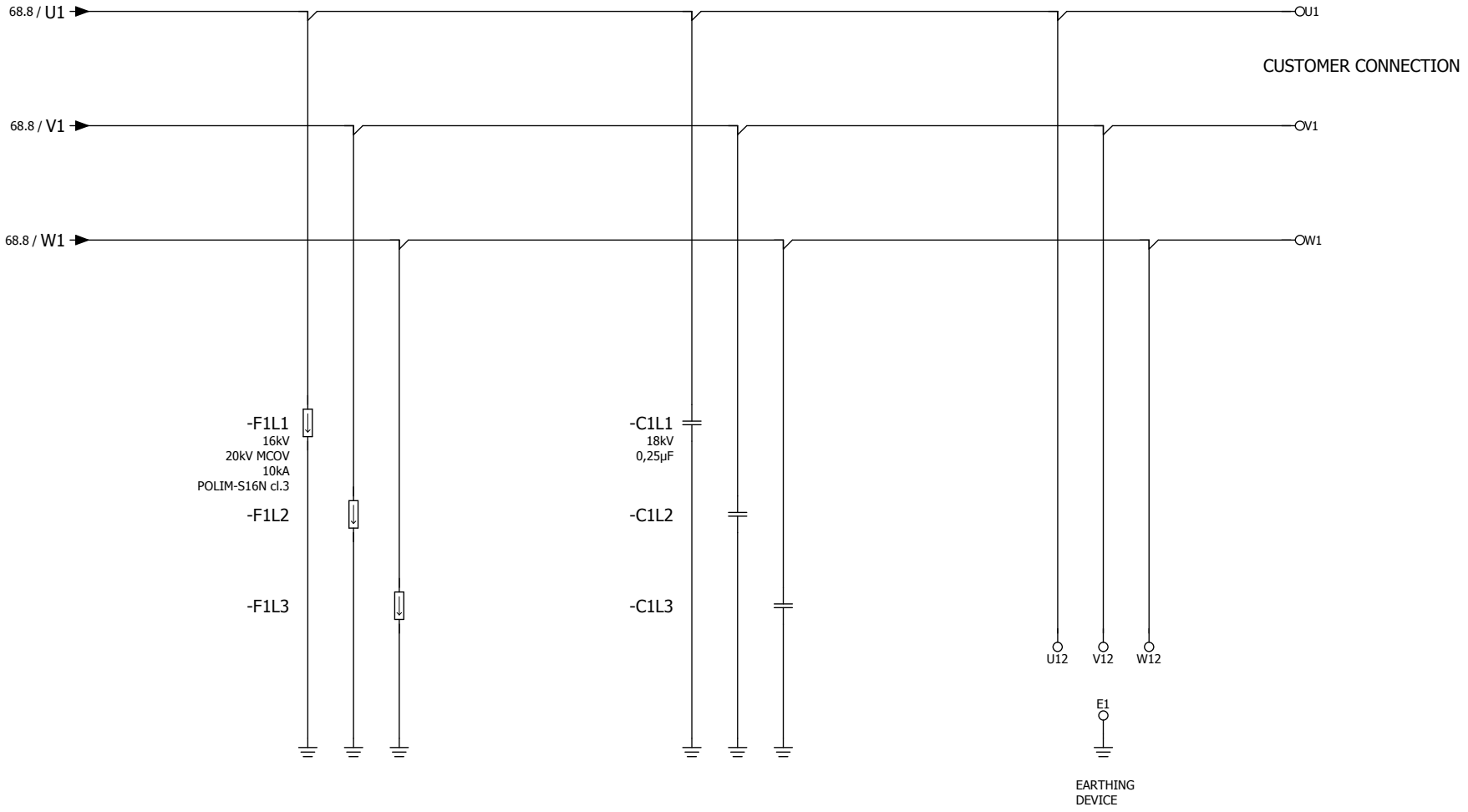


* REMOVE LINKS DURING ERECTION OR COMMISSIONING

b	16.04.2018	Rabe	Date	19.12.2017	VILNIUS Biomass	SIEMENS ENERGY SECTOR	LINE SIDE CUBICLE CURRENT TRANSFORMER	=	
			Drawn	Möbius				+ V20MKA10GE010	
			Appr.	Rabe				EG000367	DPPPG-70152441
REVISION	Date	Name	NORM		Replacement for	Replaced by		Page	68
								Pg.	79

+V20MKA10GD010

MEDIUM VOLTAGE COMPARTMENT
LINE SIDE



b	16.04.2018	Rabe	Date	19.12.2017	VILNIUS Biomass	SIEMENS ENERGY SECTOR	LINE SIDE CUBICLE SURGE ARRESTORS / CAPACITORS		=	
			Drawn	Möbius					+ V20MKA10GE010	
			Appr.	Rabe				EG000367	DPPPG-70152441	Page 69
REVISION	Date	Name	NORM		Replacement for	Replaced by				Pg. 79

Terminal diagram

item designation	Lev.	no. cable	type cable	destination A	terminal	link	terminal number	destination B	terminal	Lev.	no. cable	type cable	4 mm²	page / track
								Terminal strip =+V20MKA10GE010-X7L						
							1	+V20MKA10GD010-T2L1	3S2			BK		68 1
							2	+V20MKA10GD010-T2L2	3S2			BK		68 2
							3	+V20MKA10GD010-T2L3	3S2			BK		68 2
							4	+V20MKA10GD010-T2L1	3S1			BK		68 1
							5	+V20MKA10GD010-T2L2	3S1			BK		68 2
							6	+V20MKA10GD010-T2L3	3S1			BK		68 3
							7	+V20MKA10GD010-T2L1	2S2			BK		68 3
							8	+V20MKA10GD010-T2L2	2S2			BK		68 4
							9	+V20MKA10GD010-T2L3	2S2			BK		68 5
							10	+V20MKA10GD010-T2L1	2S1			BK		68 4
							11	+V20MKA10GD010-T2L2	2S1			BK		68 4
							12	+V20MKA10GD010-T2L3	2S1			BK		68 5
							13	+V20MKA10GD010-T2L1	1S2			BK		68 6
							14	+V20MKA10GD010-T2L2	1S2			BK		68 6
							15	+V20MKA10GD010-T2L3	1S2			BK		68 7
							16	+V20MKA10GD010-T2L1	1S1			BK		68 6
							17	+V20MKA10GD010-T2L2	1S1			BK		68 7
							18	+V20MKA10GD010-T2L3	1S1			BK		68 7
							PE							68 3
							PE							68 5
							PE							68 8

SEPARATION PLATE
SEPARATION WITH TS-K

			Date	19.12.2017	VILNIUS Biomass	SIEMENS ENERGY SECTOR	Klemmenplan : =+V20MKA10GE010-X7L	=	
			Drawn	Möbius				+ V20MKA10GE010	
			Appr.	Rabe					
REVISION	Date	Name	NORM		Replacement for	Replaced by	EG000367	DPPPG-70152441	Page 70 / Pg. 79

Terminal diagram

item designation	Lev.	no. cable	type cable	destination A	terminal	link	terminal number	destination B	terminal	Lev.	no. cable	W21	W25	2,5 mm²	page / track
				Terminal strip =+V20MKA10GE010-X8											
PROTECTION							1	-F51.1	2					BK	62 1
=							2	-F51.1	4					BK	62 1
=							3	-F51.1	6					BK	62 1
VOLTAGE REGULATION							4	-F52.1	2					BK	62 3
=							5	-F52.1	4					BK	62 3
=							6	-F52.1	6					BK	62 3
PROTECTION							7	-F53.1	2					BK	62 6
=							8	-F53.1	4					BK	62 6
=							9	-F53.1	6					BK	62 6
MEASUREMENT							10	-F54.1	2					BK	63 1
=							11	-F54.1	4					BK	63 1
=							12	-F54.1	6					BK	63 1
SYNCHRONIZATION							13	-F55.1	2					BK	63 3
=							14	-F55.1	4					BK	63 3
=							15	-F55.1	6					BK	63 3
PROTECTION							16								
VOLTAGE REGULATION							17								
PROTECTION							18	+V20MKA10GD010-T5L3							62;62 6;5
MEASUREMENT							19								
SYNCHRONIZATION							20								
							21	-F50.1	2					BK	64 3
							22	+V20MKA10GD010-T5L3				BK;BK			62;64 7;4
PROTECTION							23	-F51.2	2					BK	65 1
=							24	-F51.2	4					BK	65 1
=							25	-F51.2	6					BK	65 1
VOLTAGE REGULATION							26	-F52.2	2					BK	65 3
=							27	-F52.2	4					BK	65 3
=							28	-F52.2	6					BK	65 3
PROTECTION							29	-F53.2	2					BK	65 6
=							30	-F53.2	4					BK	65 6
=							31	-F53.2	6					BK	65 6
MEASUREMENT							32	-F54.2	2					BK	66 1

SEPARATION PLATE
SEPARATION WITH TS-K

			Date	19.12.2017	VILNIUS Biomass	SIEMENS ENERGY SECTOR	Klemmenplan : =+V20MKA10GE010-X8	=
			Drawn	Möbius				+ V20MKA10GE010
			Appr.	Rabe			EG000367	DPPPG-70152441
REVISION	Date	Name	NORM		Replacement for	Replaced by		Page 71 / Pg. 79

Terminal diagram

Terminal strip
=+V20MKA10GE010-X8

item designation	Lev. / no. cable / type cable	destination A	terminal	link	terminal number	destination B	terminal	Lev. / no. cable / type cable	W21 NSGAFöu	W25 NSGAFöu	2,5 mm²	page / track
MEASUREMENT					33	-F54.2	4				BK	66 1
=					34	-F54.2	6				BK	66 1
SYNCHRONIZATION					35	-F55.2	2				BK	66 3
=					36	-F55.2	4				BK	66 3
=					37	-F55.2	6				BK	66 3
PROTECTION					38							
VOLTAGE REGULATION					39							
PROTECTION					40	+V20MKA10GD010-T6L3						65;65 6;5
MEASUREMENT					41							
SYNCHRONIZATION					42							
					43	-F50.2	2				BK	67 3
					44	+V20MKA10GD010-T6L3				BK;BK		65;67 7;4

SEPARATION PLATE
SEPARATION WITH TS-K

Terminal diagram

item designation	Lev.	no. cable	type cable	destination A	terminal	link	terminal number	destination B	terminal	Lev.	no. cable	type cable	1,5 mm²	page / track
				Terminal strip =+V20MKA10GE010-X10										
PROTECTION							1	-F51.1	33				BK	62 2
=							2	-F51.1	34				BK	62 2
=							3	-F51.1	41				BK	62 2
=							4	-F51.1	42				BK	62 2
VOLTAGE REGULATION							5	-F52.1	33				BK	62 5
=							6	-F52.1	34				BK	62 5
=							7	-F52.1	41				BK	62 5
=							8	-F52.1	42				BK	62 5
PROTECTION							9	-F53.1	33				BK	62 7
=							10	-F53.1	34				BK	62 7
=							11	-F53.1	41				BK	62 8
=							12	-F53.1	42				BK	62 8
MEASUREMENT							13	-F54.1	33				BK	63 2
=							14	-F54.1	34				BK	63 2
=							15	-F54.1	41				BK	63 2
=							16	-F54.1	42				BK	63 2
SYNCHRONIZATION							17	-F55.1	33				BK	63 5
=							18	-F55.1	34				BK	63 5
=							19	-F55.1	41				BK	63 5
=							20	-F55.1	42				BK	63 5
							21	-F50.1	13				BK	64 3
							22	-F50.1	14				BK	64 3
							23	-F50.1	21				BK	64 4
							24	-F50.1	22				BK	64 4
PROTECTION							25	-F51.2	33				BK	65 2
=							26	-F51.2	34				BK	65 2
=							27	-F51.2	41				BK	65 2
=							28	-F51.2	42				BK	65 2
VOLTAGE REGULATION							29	-F52.2	33				BK	65 5
=							30	-F52.2	34				BK	65 5
=							31	-F52.2	41				BK	65 5
=							32	-F52.2	42				BK	65 5

SEPARATION PLATE
SEPARATION WITH TS-K

Terminal diagram

item designation	Lev.	no. cable	type cable	destination A	terminal	link	terminal number	destination B	terminal	Lev.	no. cable	type cable	1,5 mm²	page / track
				Terminal strip =+V20MKA10GE010-X10										
PROTECTION							33	-F53.2	33				BK	65 7
=							34	-F53.2	34				BK	65 7
=							35	-F53.2	41				BK	65 8
=							36	-F53.2	42				BK	65 8
MEASUREMENT							37	-F54.2	33				BK	66 2
=							38	-F54.2	34				BK	66 2
=							39	-F54.2	41				BK	66 2
=							40	-F54.2	42				BK	66 2
SYNCHRONIZATION							41	-F55.2	33				BK	66 5
=							42	-F55.2	34				BK	66 5
=							43	-F55.2	41				BK	66 5
=							44	-F55.2	42				BK	66 5
							45	-F50.2	13				BK	67 3
							46	-F50.2	14				BK	67 3
							47	-F50.2	21				BK	67 4
							48	-F50.2	22				BK	67 4

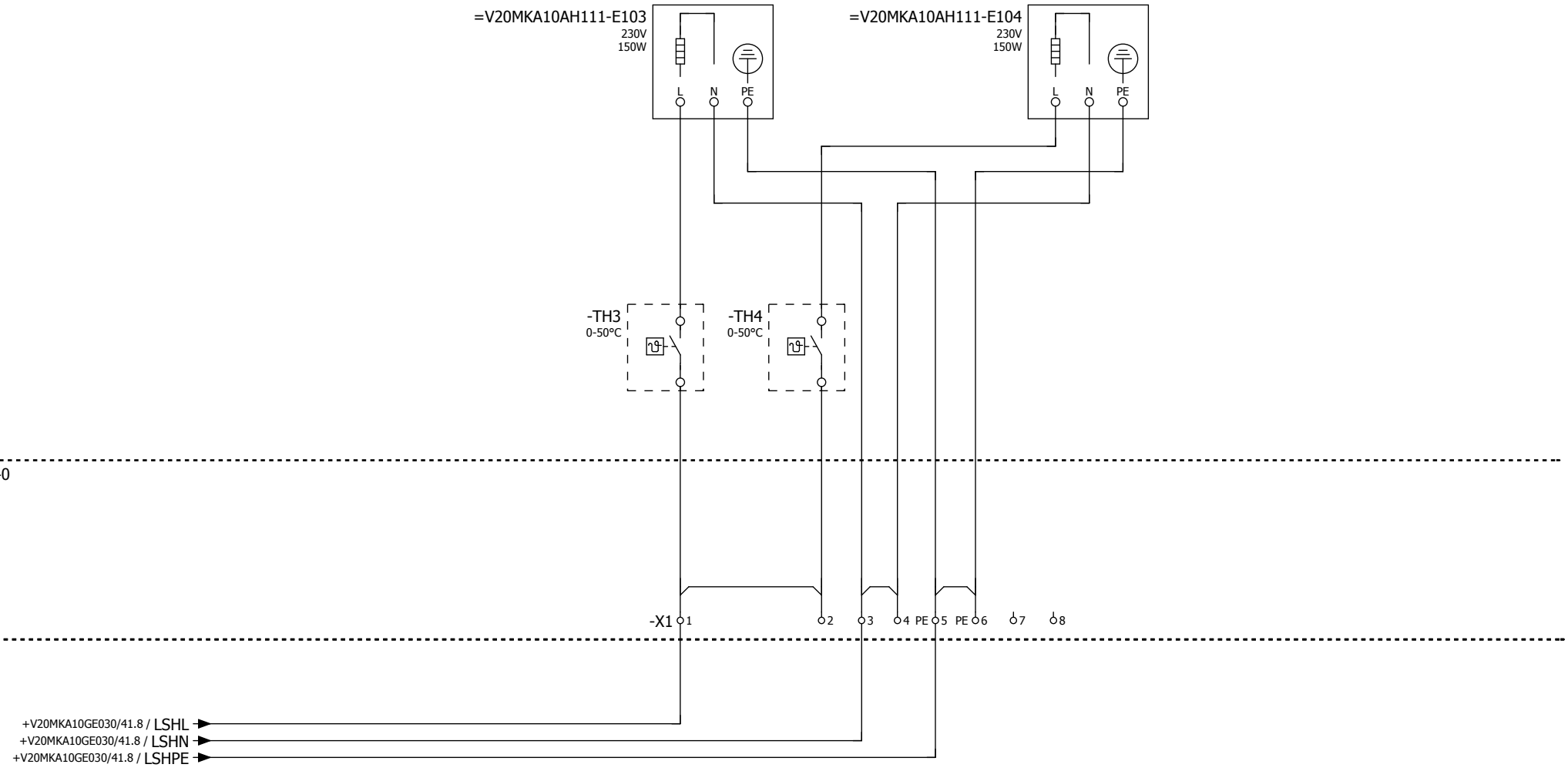
SEPARATION PLATE
SEPARATION WITH TS-K

			Date	19.12.2017	VILNIUS Biomass	SIEMENS ENERGY SECTOR	Klemmenplan : =+V20MKA10GE010-X10	=
			Drawn	Möbius				+ V20MKA10GE010
			Appr.	Rabe			EG000367	DPPPG-70152441
REVISION	Date	Name	NORM		Replacement for	Replaced by		Page 74 / Pg. 79

+V20MKA10GD010

MEDIUM VOLTAGE COMPARTMENT
LINE SIDE

LINE SIDE CUBICLE HEATER



b	16.04.2018	Rabe	Date	19.12.2017	VILNIUS Biomass		SIEMENS ENERGY SECTOR	LINE SIDE CUBICLE ANTICONDENSATION HEATER	=	
			Drawn	Möbius					+ V20MKA10GE040	
			Appr.	Rabe					EG000367	DPPPG-70152441
REVISION	Date	Name	NORM		Replacement for	Replaced by			Page	75
									Pg.	79

Terminal diagram

item designation	MEGAFLEX 500 type cable	MKA10AH005 no. cable	Lev.	Terminal strip =+V20MKA10GE040-X1 destination A	terminal	link	terminal number	destination B	terminal	type cable	Lev.	page / track
LINE SIDE CUBICLE HEATER	1			+V20MKA10GE030-X0	14		1	-TH3				75 4
=							2	-TH4				75 5
=	2			+V20MKA10GE030-X0	16		3	=V20MKA10AH111-E103	N			75 4
=							4	=V20MKA10AH111-E104	N			75 7
PE	GNYE			+V20MKA10GE030-X0	PE		5	=V20MKA10AH111-E103	PE			75 5
=							6	=V20MKA10AH111-E104	PE			75 7
LINE SIDE CUBICLE HEATER							7					
=							8					

SEPARATION PLATE
SEPARATION WITH TS-K

			Date	19.12.2017	VILNIUS Biomass	SIEMENS ENERGY SECTOR	Klemmenplan : =+V20MKA10GE040-X1	=
			Drawn	Möbius				+ V20MKA10GE040
			Appr.	Rabe			EG000367	DPPPG-70152441
REVISION	Date	Name	NORM		Replacement for	Replaced by		Page 76 / Pg. 79

MANUFACTURER HÄWA
STANDARD CASING K08-15/15
DEGREE OF PROTECTION IP66
TAPPED HOLES

MOUNTING RAIL TS 35 (EN60715)

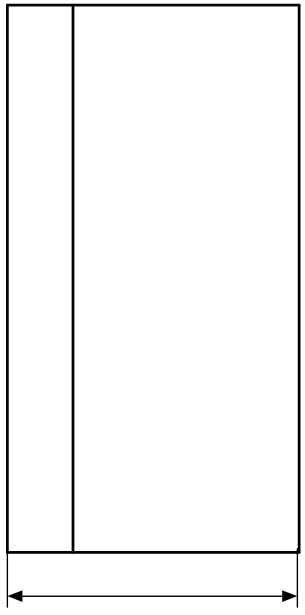
ALL DIMENSIONS IN MM

SCALE 1:2 (A3)

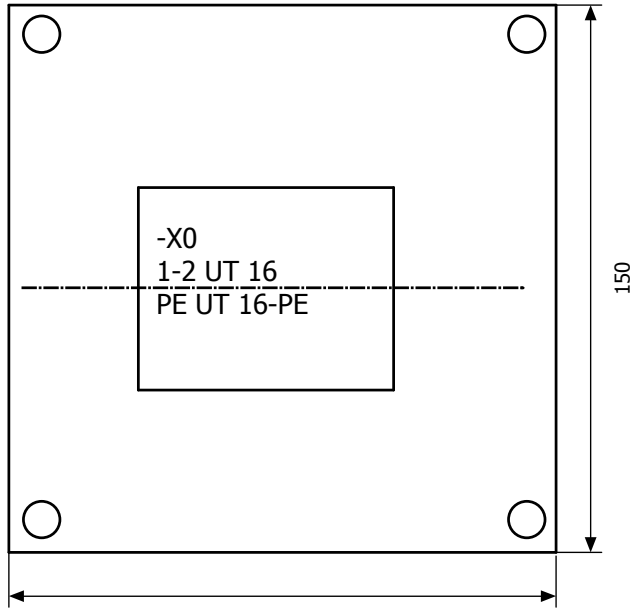
BOTTOM SIDE FOR CUSTOMER CONNECTION DRILLED AT SITE

COLOUR: RAL 7035

VIEW ON RIGHT HAND SIDE



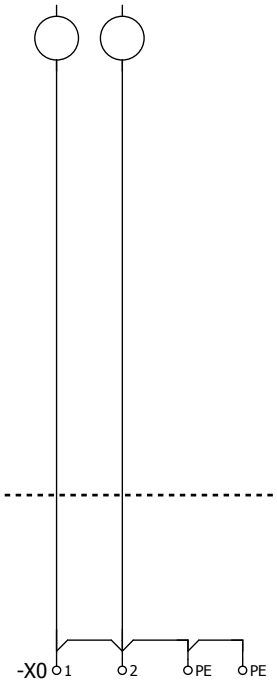
FRONT VIEW WITHOUT COVER



			Date	19.12.2017	VILNIUS Biomass		JUNCTION BOX ROTOR EARTHING MOUNTING PLATE	=	
			Drawn	Möbius				+ V20MKD10GA020	
			Appr.	Rabe				EG000367 DPPPG-70152441	Page 77
REVISION	Date	Name	NORM		Replacement for	Replaced by			Pg. 79

SIEMENS ENERGY SECTOR

ROTOR EARTHING BRUSHES
TE



+V20MKD10GA020

TE ... TURBINE END
EE ... EXCITER END

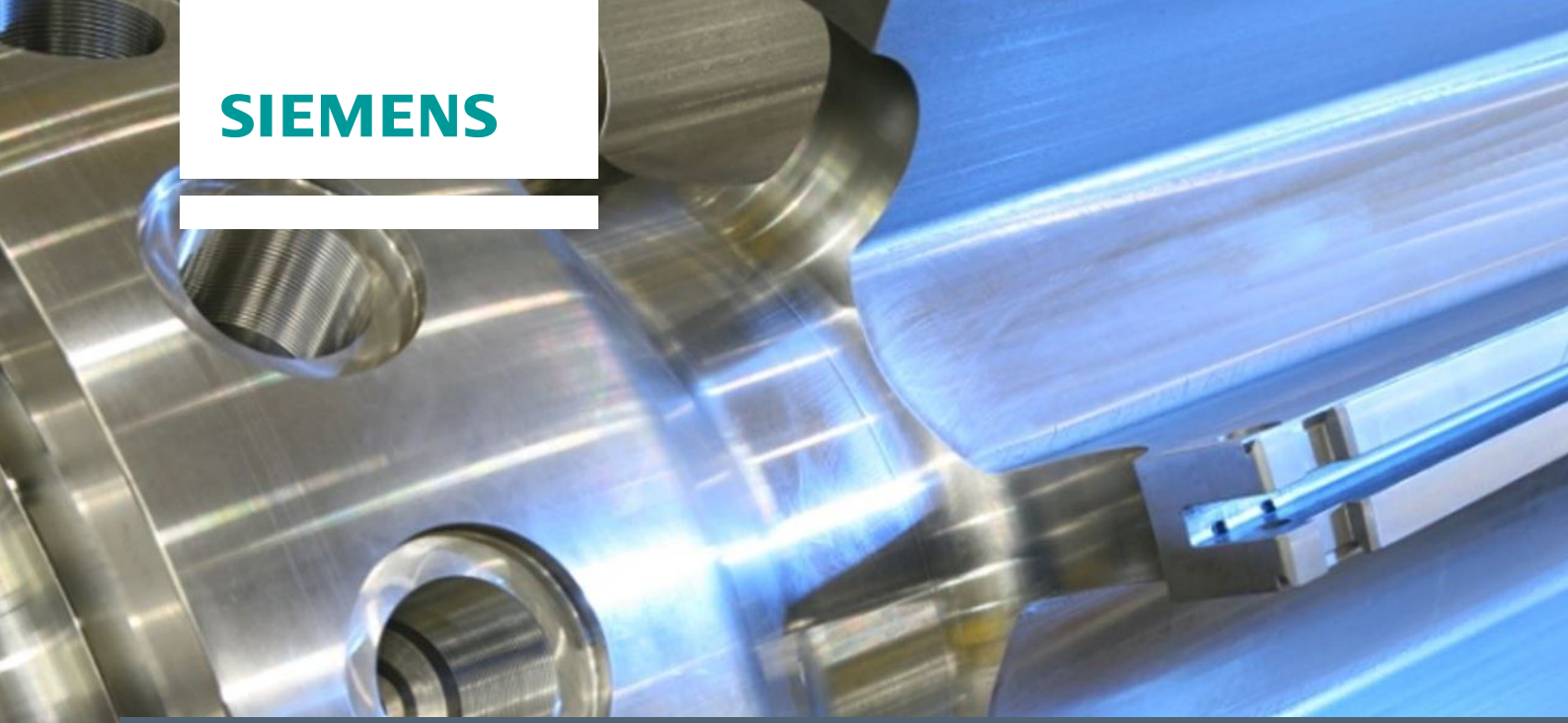
			Date	19.12.2017	VILNIUS Biomass	SIEMENS ENERGY SECTOR	JUNCTION BOX ROTOR EARTHING	=
			Drawn	Möbius				+ V20MKD10GA020
			Appr.	Rabe			EG000367	DPPPG-70152441 Page 78
REVISION	Date	Name	NORM		Replacement for	Replaced by		Pg. 79

Terminal diagram

Terminal strip
=+V20MKD10GA020-X0

item designation	destination A	terminal	link	terminal number	destination B	terminal	page / track
				1	-V1		78 2
				2	-V2		78 3
				PE			
				PE			

SEPARATION PLATE
SEPARATION WITH TS-K



SIEMENS

Turbogenerator | Operating and Maintenance Manual

Description of the System/ Plant Section 2

Drawings 2.5

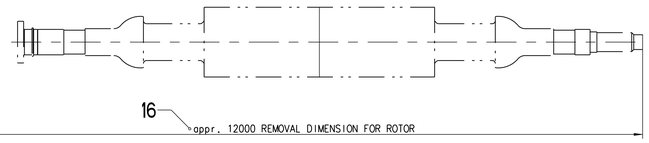
Contents

- Generator Dimensional Drawing
- Generator Dimensional Drawing Text
- Axial and Radial Rotor Clearances
- Generator Labels – General Drawing
- Generator Labels – Exciter
- Generator Labels – Cooler Cover
- Connection Diagram of Stator Winding
- Cooler – Drawing
- Generator Bearing TE and EE – Drawing and Parts List
- Bearing Oil Inlets
- Brushless Exciter – Dimensional Drawing
- Brushless Exciter – Dimensional Drawing Text
- Brushless Exciter – Exciter Complete
- PMG – Dimensional Drawing
- Neutral Point Cubicle– Drawings
- Line Side Cubicle– Drawings

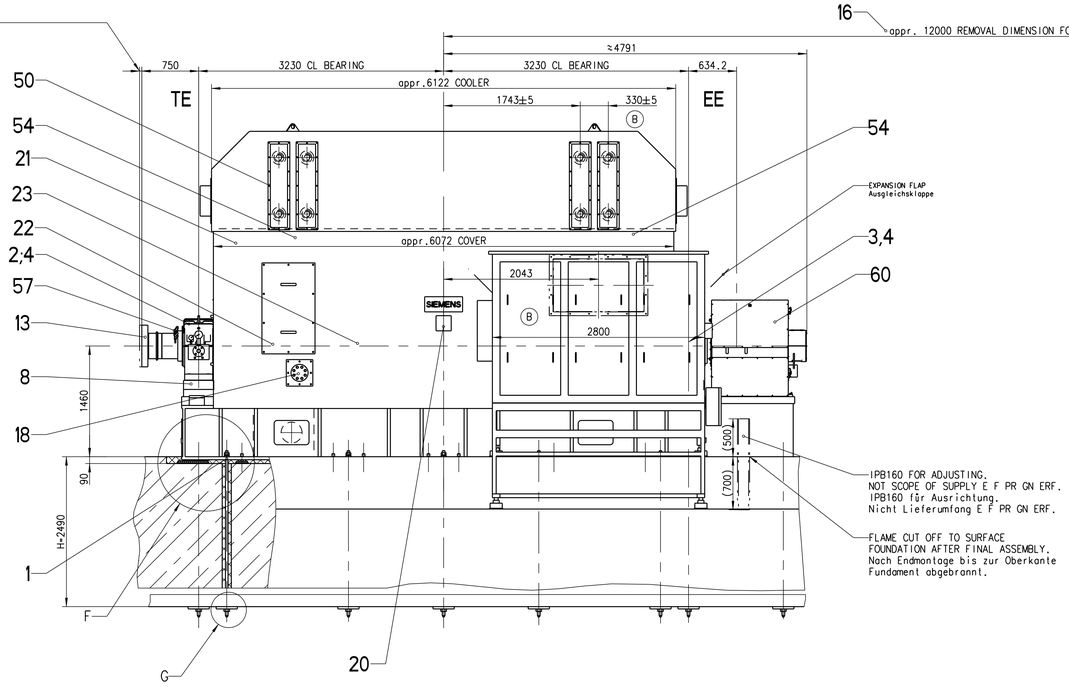
TO BALANCE THE HEAT-LENGHTENING OF THE TURBINES- AND GENERATORSHAFTS IN THE RATED OPERATING CONDITION, THE GENERATOR SHAFT IS PUT WITH THE INSTALLATION OUTSIDE THE MAGNETIC MIDDLE OF THE GENERATOR!

Zum Ausgleich der Wärmedehnung der Turbinen- und Generatorwelle im Nennlastbetrieb, wird die Generatorwelle bei der Generatormontage aus der magnetischen Mitte des Generators gestellt!

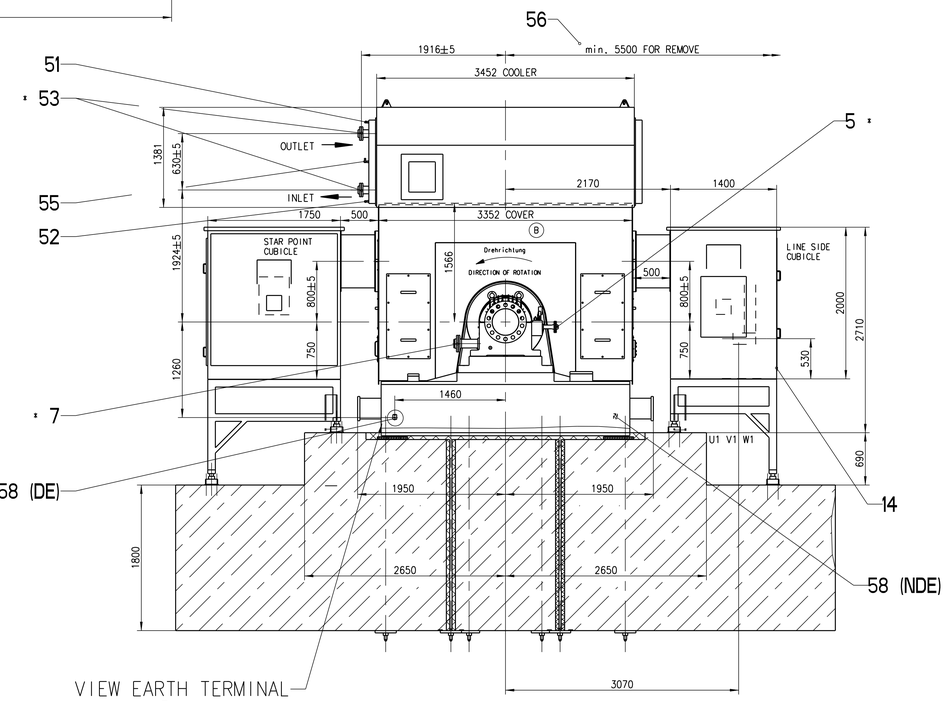
SEE DESIGN GROUP 0440!
SIEHE Baugruppe 0440!



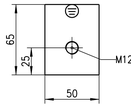
16 appr. 12000 REMOVAL DIMENSION FOR ROTOR

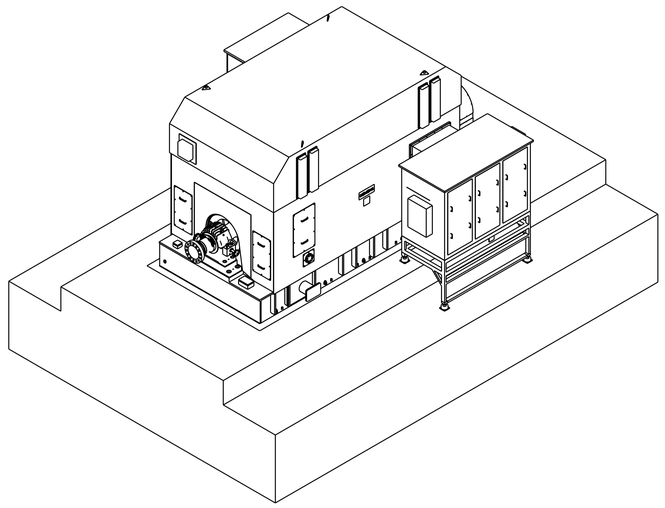


VIEW ONTO TE Ⓑ
SICHT VON TS

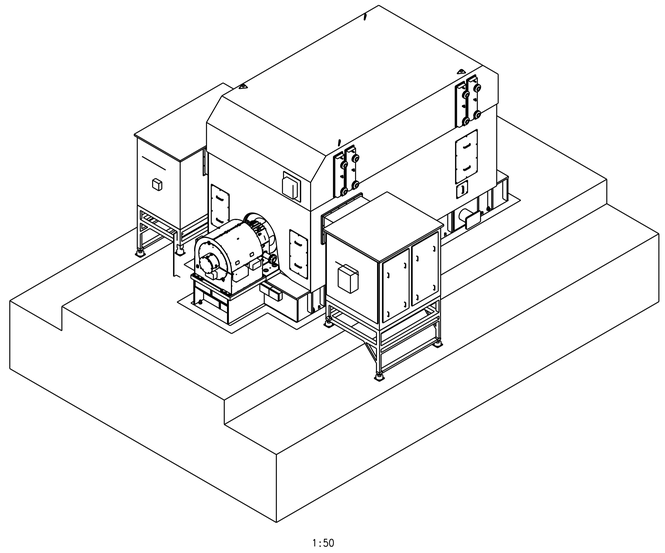


VIEW EARTH TERMINAL
Erdungsanschluss
1 FOR EACH SIDE (TE AND EE)
1 je Seite (TS und ES)





1:50



1:50

THE LINE TERMINALS ARE DESIGNATED U1,V1,W1
WITH THE CORRESPONDING NEUTRAL TERMINALS
DESIGNATED U2,V2,W2
THE VOLTAGE REACHES ITS POSITIVE MAXIMUM VALUE
IN THE ORDER U1,V1,W1

Die Ausleitungsschienen sind bezeichnet mit U1, V1, W1
die entsprechenden Sternpunktschienen mit U2, V2, W2
Die Spannung erreicht ihr positives Maximum
in der Reihenfolge U1, V1, W1

* - OIL AND WATER CONNECTION FLANGE
ASSEMBLY FREE OF FORCES AND MOMENTS!
* - Oel und Wasseranschluesse
kraefte- und momentenfrei anschlieszen!

NOTE FOR ITEMS SEE OUTLINE DRAWING TEXT
DRW-NO. DPPPG-70149179
Erlaeuterungen der Positionen siehe Maszbildtext
Zeichnungsnr. DPPPG-70149179

CODE WORD:	VILNIUS Biomass
ORDER NUMBER:	EG000367

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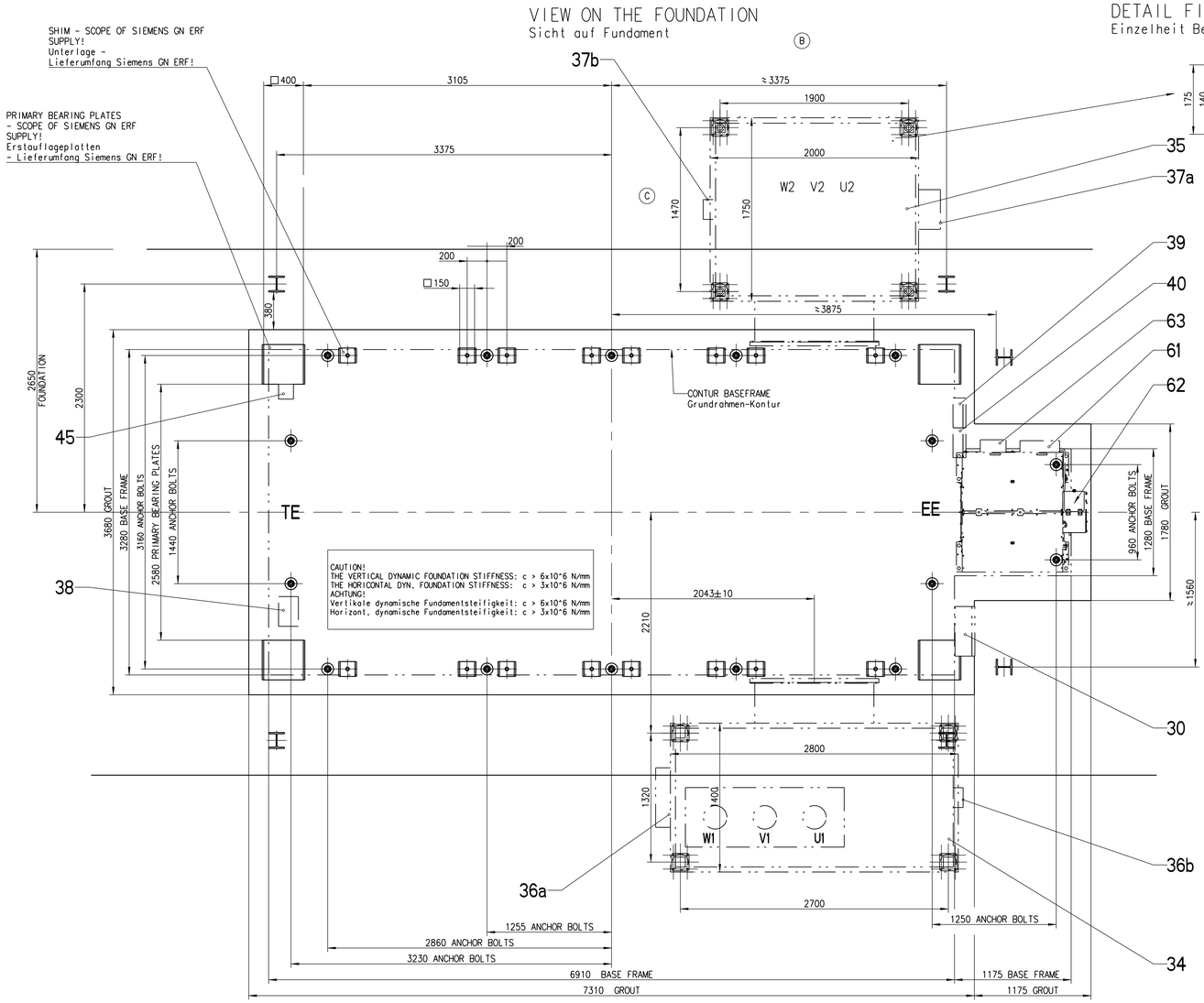
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CHECKED:	2017-10-25 BAUER		
RELEASED:	2018-09-05 MUELLER	OUTLINE DRAWING	
CONFIDENTIAL		LANG. - DRAWING NO. / VALUE: DPPPG-70149178	
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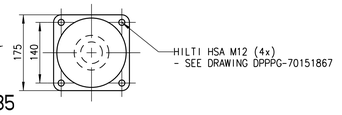
DO NOT SCALE, WORK TO DIMENSIONS SHOWN

Pro/ENGINEER A0

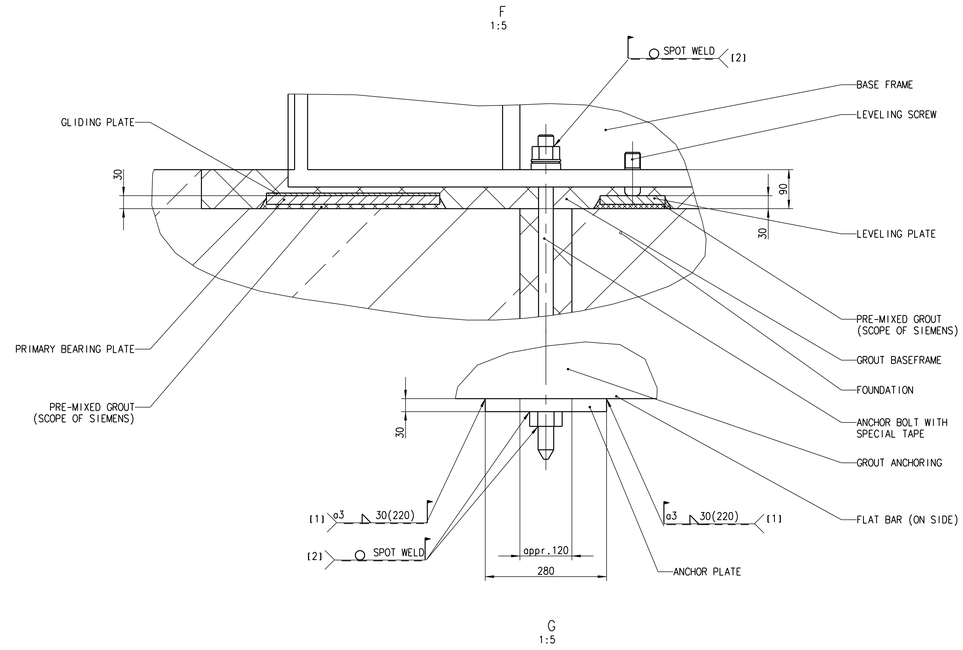
VIEW ON THE FOUNDATION
Sicht auf Fundament

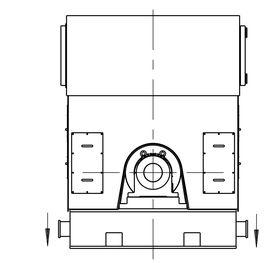


DETAIL FIXING CUBICLES
Einzelheit Befestigung Haubtklemmenkästen



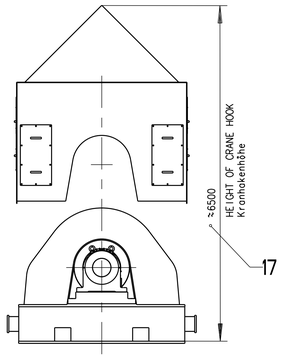
DETAIL ANCHORING
Detail Verankerung





Kurzschlusskraefte unter Beruecksichtigung der Gewichte
SHORT CIRCUIT FORCES UNDER CONSIDERATION OF WEIGHTS

Fundamentlast = Generatorgewicht ± Kurzschlusskraft
FOUNDATION LOAD = GENERATOR WEIGHT ± SHORT CIRCUIT LOAD



NOTE FOR ITEMS SEE OUTLINE DRAWING TEXT
DRW-NO. DPPPG-70149179
Erlaeuterungen der Positionen siehe Maszbildtext
Zeichnungsnr. DPPPG-70149179

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ORDER NUMBER:	EG000367

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Siemens AG

WEIGHT:	SCALE: 1:1	SPEC.:KUN351.00	
ORIGINATED:	2017-10-25 PARBS	TITLE: GENERATOR MASSBILD	
CHECKED:	2017-10-25 BAUER		
RELEASED:	2018-09-05 MUELLER	OUTLINE DRAWING	
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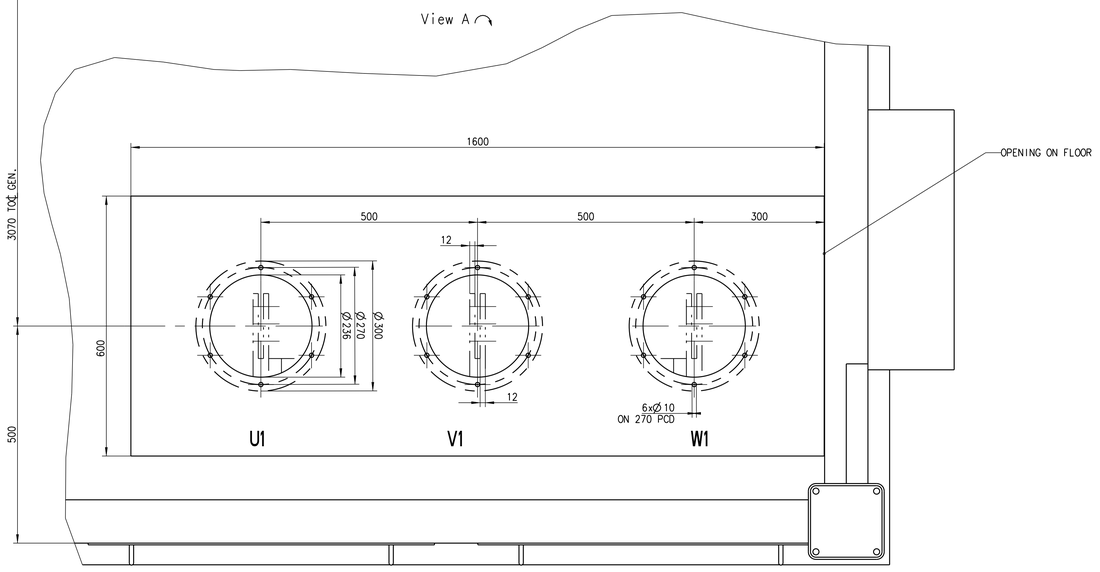
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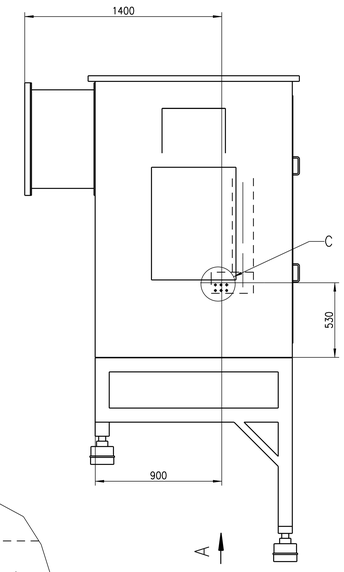
Pro/ENGINEER A0

VIEW ON THE CONNECTION BARS

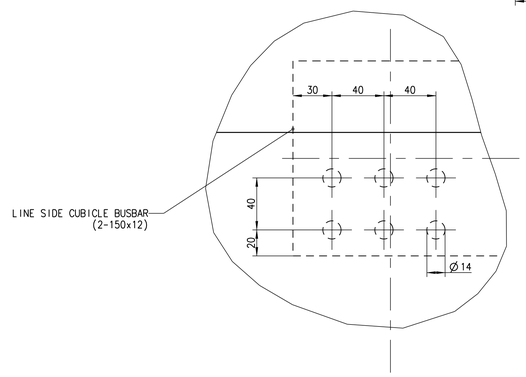
Sicht auf die Anschlussschienen
FOR MORE DETAILS SEE DRAWING DPPPG-70151868
für mehr Detail siehe Zeichnung DPPPG-70151868

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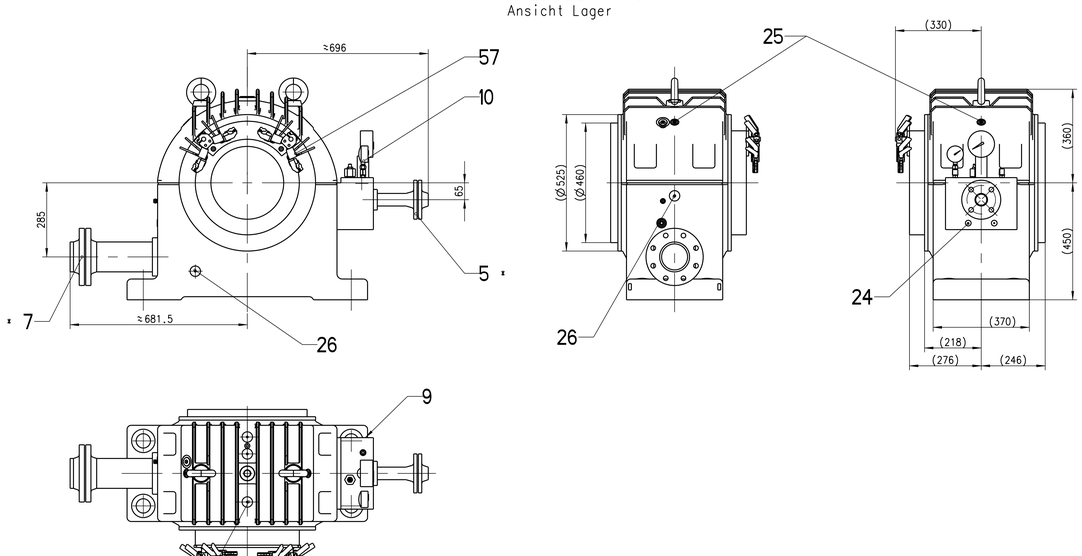


Detail C
3:5



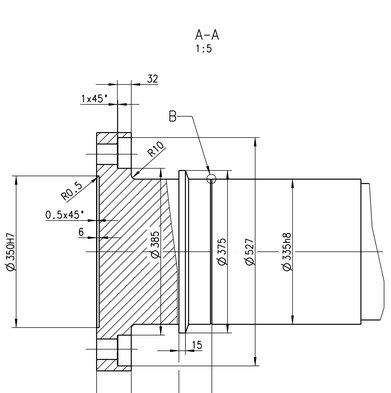
VIEW BEARING

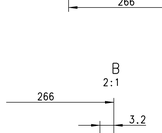
Ansicht Lager

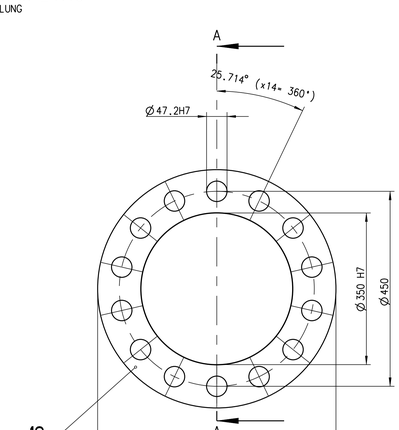


DETAIL COUPLING

EINZELHEIT KUPPLUNG







NOTE FOR ITEMS SEE OUTLINE DRAWING TEXT
DRW-NO. DPPPG-70149179
Erlaeuterungen der Positionen siehe Maszbildtext
Zeichnungsnr. DPPPG-70149179

CODE WORD:	VILNIUS Biomass
ORDER NUMBER:	EG000367

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Maßbildtext *OUTLINE DRAWING TEXT*	**VILNIUS Biomass**
Zeichnungsnummer/*DRAWING NUMBER*: **DPPPG-70149179**	RK.-Nr./W.-NO.: **EG000367**

Index	Datum *Date*	bearbeitet *constr.*	geprüft *checked*	Änderungsbeschreibung *Description of Revision*
A	2018-01-09	Müller	Petzoldt	First issue
B	2018-02-14	Müller	Petzoldt	COOLER DATA
C	2018-09-05	Müller	Petzoldt	IT 53: COOLER FLANGE, WEIGHTS PRELIM. DELETED

Maßbild **DPPPG-70149878**
OUTLINE DRAWING

ECCN: EAR99	AL: N	ECL: N	US-Content: N

SIEMENS	Form	Z.- Sys.	Zeichnungs-Nummer / DRAWING NUMBER	Index	Blatt / SHEET 1
	44	70	**DPPPG-70149879**	C	Von / OF 16

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MF

Spr. Kz.

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Generator Typ: SGen5-100A-2P (TLRI 92/30)

Nenndaten	***RATINGS***			
Leistung S_N	*POWER*	93,176	MVA	
cos φ	*P.F.*	0,85		
Drehzahl	*SPEED*	3000	min^{-1}	
Drehrichtung, bei Sicht von Turbine auf Gen.	*DIRECTION OF ROTATION, VIEW FROM TURBINE TO GEN.*	gegen Uhrzeigersinn/ counter clockwise		
Spannung	*VOLTAGE*	15,0 +5/-5 %	KV	
Strom	*CURRENT*	3586	A	
Frequenz	*FREQUENCY*	50	Hz	
Thermische Zeitkonstante Ständer	*THERMAL TIME CONSTANT STATOR*	18,48	Min	
Thermische Zeitkonstante Läufer	*THERMAL TIME CONSTANT ROTOR*	7,54	Min	
Kapazität Ständerwicklung pro Phase gegen Erde	*CAPACITY STATOR WINDING AGAINST EARTH PER PHASE*	0,359	µF	
Kapazität Läuferwicklung gegen Erde	*CAPACITY ROTOR WINDING AGAINST EARTH*	0,231	µF	
Kühlluftmenge	*RATE OF COOLING AIR*	26	m^3/s	
Kühllufttemperatur	*COOLING AIR TEMPERATURE*	50	°C	
Abzuführende Verluste	*HEAT LOSS*	1051	kW	
Schalldruckpegel (ISO 3744)	*SOUND PRESSURE LEVEL (ISO 3744)*	90	dB(A)	
max. Umgebungstemperatur	*MAX. AMBIENT TEMPERATURE*	50	°C	
Bauform	***TYPE OF CONSTRUCTION***			
Bauform (DIN IEC 34 T.7)	*TYPE OF CONSTRUCTION*	IM 7215		
Schutzart (DIN IEC 34 T.5)	*DEGREE OF PROTECTION*	IP 54		
Kühlart (DIN IEC 34 T.6)	*METHODS OF COOLING*	IC 8 A 1 W 7		
Farbe	*COLOR*	RAL 7030 C3 high	EN ISO 12944	
Verladebedingung	***SHIPMENT INDICATION***			
Umgebungstemperatur	*AMBIENT TEMPERATURE*	not less than -20°C		

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Nenndaten	*RATINGS*	Wert *VALUE*	Einheiten *DIM.*	REV.

Gewicht	***WEIGHTS***			C
Induktor komplett	*ROTOR COMPLETE*	24800	kg	
Ständer-Aktivteil komplett	*STATOR ACTIV PART COMPLETE*	69000	kg	
Grundrahmen, Zubehör	*BASE FRAME, ACCESSORIES*	27000	kg	
RG-Stator / Bürstenapparat	*STATOR EXCITER / BRUSH ASSEMBLY*	1000	kg	
Lager; Zwischenrahmen	*BEARING/INTERMEDIATE FRAME*	2900	kg	
Abdeckhaube	*SHROUDING COVER*	7000	kg	
Kühler, Kühlerhaube	*COOLING ELEMENTS, COVER*	6000	kg	
Verankerung / Zubehör	*ANCHORING / ACCESSORIES*	4000	kg	
Gesamtgewicht	*TOTAL WEIGHT*	141700	kg	
Gewicht für Komplettversand	*WEIGHT DESPATCH COMPLETE*	131700	kg	
Min. Krantragfähigk. (Läufermont.)	*MIN. LOAD CAPACITY (ROTOR INSTALLATION)*	30000	kg	
Ausleitungs-, Sternpunktkasten - separat aufgestellt	*LINE SIDE-, NEUTRAL SIDE CUBICLE - BUILT SEPARATELY*	4000	kg	
Erregung	***EXCITATION***			
Erregermaschine	*EXCITER MACHINE*	ELR 62/19-30/8-2S		
Hilfserreger	*PMG*	ATE DC 190/90/6		
Mechanische Daten	***MECHANICAL DATA***			
Trägheitsmoment ($m*r^2$) (Läufer komplett)	*MOMENT OF INERTIA ($M*R^2$) (ROTOR COMPLETE)*	2375	kgm^2	
Losbrechmoment mit Druckölentlastung	*BREAK AWAY TORQUE WITH PRESSURE OIL*	ca.115	Nm	
Losbrechmoment ohne Druckölentlastung	*BREAK AWAY TORQUE WITHOUT PRESSURE OIL*	ca.9,6	kNm	
Lagerverluste je Lager	*BEARING LOSSES PER BEARING*	32	kW	
Zulässige Überdrehzahl im Störfall	*PERMISSIBLE OVERSPEED FOR FAULT CONDITIOM*	+21	%	

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POS.	Bezeichnung	*DESIGNATION*	Wert/ *VALUE*	Einheit/ *DIM.*	REV.
	Verankerung	***ANCHORING***			
1	Ankerbolzen mit Zubehör liefert Siemens GN ERF, ebenso die Montagevorschrift.	*ANCHOR BOLTS, ACCESSORIES AND ASSEMBLY PROCEDURE SUPPLIED BY SIEMENS GN ERF.*	16 x M36; DIN 797;		
	Lagerangaben	***BEARING DETAILS***			
2	TS Lager, Größe: (Auflagefläche); Umlaufschmierung.	*TE BEARING, SIZE: (BEARING AREA); CLOSED CIRCUIT LUBRICATION.*	∅ 315 * 218,5		
3	ES Lager, Größe: (Auflagefläche); Umlaufschmierung.	*EE BEARING, SIZE: (BEARING AREA); CLOSED CIRCUIT LUBRICATION.*	∅ 315 * 218,5		
4	Lagerisolierung TS und ES durch isolierte Lagerschalen. Die Isolierung des TS-Lagers ist überbrückt. Überbrückung liefert Siemens GN ERF. Die Isolation des ES-Lagers darf nicht überbrückt werden.	*BEARING INSULATION AT TE AND EE BY INSULATED SHELL. THE INSULATION OF THE TE BEARING IS BY-PASSED (SIEMENS GN ERF - SCOPE OF SUPPLY). INSULATION OF EE-BEARING SHOULD NOT BE LINKED.*			
5	Ölzufluß mit Flansch, Edelstahl	*OIL INLET WITH FLANGE, SS- STEEL*	DN40 DINEN 1092-1		
7	Ölabfluß mit Flansch, Edelstahl	*OIL OUTLET WITH FLANGE, SS- STEEL*	DN100 DINEN 1092-1		
8	Zwischenrahmen unter den Lagerböcken.	*INTERMEDIATE FRAME UNDER THE BEARINGS.*			
9	Anschluß für Druckölentlastung:	*OIL PRESSURE JACKING CONNECTION:*	G 1/2"		
	Anhebedruck:	*LIFTING PRESSURE:*	118*	barg	
	Haltedruck:	*HOLDING PRESSURE:*	77*	barg	
	Erforderliche Ölmenge je Lager (bei max. 49°C Öltemperatur).	*REQUIRED OIL VOLUME PER BEARING (49°C MAX. OIL TEMPERATURE).*	3	l/min *litres/min*	
	Min. zulässige Turndrehzahl:	*MINIMUM TURNING SPEED:*	<1 or >56	min^{-1} *R.P.M.*	
	Übergangsdrehzahl nach DIN31652-1	*TRANSITION SPEED ACC. TO* DIN31652-1	240	min^{-1} *R.P.M.*	

* Die angegebenen Drücke/Ölmengen sind Richtwerte und müssen ggf. bei der Inbetriebnahme korrigiert werden.

* THE STATED PESSURE/OIL VOLUME VALUES ARE CALCULATED VALUES AND MAY HAVE TO BE CORRECTED DURING INITIAL START-UP.

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POS.	Bezeichnung	*DESIGNATION*	Wert/ *VALUE*	Einheit/ *DIM.*	REV.
10	Je Lager sind eine Öldrossel und ein Manometer installiert (Siemens P25).	*ONE THROTTLE AND ONE MANOMETER ARE INSTALLED FOR EACH BEARING (SIEMENS P25- SCOPE OF SUPPLY).*	Ja / YES		
	Ölinhalt beider Lager insgesamt:	*TOTAL OIL VOLUME OF THE TWO BEARINGS:*	60	l *litres*	
	Erforderliche Ölmenge für beide Lager insgesamt mind.:	*REQUIRED OIL VOLUME FOR BOTH BEARINGS AT LEAST:*	120	l/min *litres/min*	
	(Lager werden ohne Ölfüllung geliefert).	*(THE BEARINGS ARE SUPPLIED WITHOUT OIL).*			
	Maximale Öleintrittstemperatur:	*MAXIMUM OIL INLET TEMPERATURE:*	49	°C	
	Minimaler Öldruck am Ölzulauf:	*MINIMUM OIL PRESSURE AT OIL INLET:*	1,3	bar	
	Maximaler Öldruck am Ölzulauf:	*MAXIMUM OIL PRESSURE AT OIL INLET:*	2,0	bar	
	Reinheitsklasse nach ISO 4406	*PURITY KLASS ACC. TO ISO 4406*	Kl. 18 / 16 / 13		
	<u>Empfohlene Öleigenschaften:</u> Nichtschäumendes Mineralöl: Flammpunkt:	*<u>RECOMMENDED PROPERTIES:</u>* *NON-FOAMING MINERAL OIL:* *FLASH POINT:*	 ISO VG46 185	 °C	
	Ölabflußrohre mit Gefälle verlegen von mindestens:	*OIL DRAIN PIPES INSTALLED WITH A SLOPE OF AT LEAST :*	5	°	
	Achtung! Innerhalb der Lagergehäuse entsteht durch die Rotation der Welle Ölnebel. Der Ölnebel ist durch geeignete Maßnahmen des Anlagenbetreibers aus dem Lagergehäuse abzusaugen. Der empfohlene Unterdruck im Lagergehäuse beträgt 100 Pa.	***ATTENTION !*** *WITHIN THE BEARING HOUSING OIL MIST RESULTS FROM THE ROTATION OF THE ROTOR. THE OIL MIST IS TO BE SUCKED OFF FROM THE BEARING HOUSING BY SUITABLE MEASURES OF THE PLANT OPERATOR. THE RECOMMENDED NEGATIVE PRESSURE IN THE BEARING HOUSING AMOUNTS TO 100 PA.*			
	Maximales axiales Lagerspiel:	*MAX. AXIAL BEARING CLEARANCE:*	± 30	mm	

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	Allgemeine Daten	***GENERAL DATA***			
13	Generatorflansch	*GENERATOR FLANGE*			
14	Klemmenanschluß – Die Bezeichnung der Phasenklemmen erfolgt durch U1, V1, W1; die der entsprechenden Sternpunktklemmen durch U2, V2, W2. Die Klemmenspannung erreicht ihr positives Maximum in der Reihenfolge U1, V1, W1.	*TERMINAL CONNECTION – THE LINE TERMINALS ARE DESIGNATED U1, V1, W1; THE CORRESPONDING NEUTRAL TERMINALS DESIGNATED U2, V2, W2.* *THE VOLTAGE REACHES ITS POSITIVE MAXIMUM VALUE AT THE TERMINALS IN THE ORDER OF U1, V1, W1.*			
	Der Läufer ist zum Entkuppeln axial verschiebbar:	*FOR DE-COUPLING THE ROTOR CAN BE MOVED AXIALLY:*	20	mm	
16	Maß für das Ausfahren des Läufers. Ausbauvorr. (Rutschblech, Gleitbock, Gleitschuhe) liefert GNERF.	*DIMENSION FOR OBLIQUE REMOVAL OF THE ROTOR. ASSEMBLY DEVICE (SLIDING PLATE; SLIDING PEDESTAL; SLIDE SHOES) SUPPLIED BY GNERF.*			
17	Erforderliche Kranhakenhöhe zum Abheben der Haube.	*HEIGHT OF THE CRANE HOOK WHEN LIFTING THE COVER*			
18	Anschluss für Trockner	*CONNECTING FOR DRIER*		DN100	
20	Leistungsschild	*NAME PLATE*			
21	Abdeckhaube/ vor dem Abheben ist das Erdungskabel zu lösen.	*COVER/ BEFORE LIFTING THE COVER RELEASE THE GROUND CABLE.*			
22	Kaltluftthermometer	*COLD AIR THERMOMETER*	1 (TS / TE) 1 (ES / EE)	2*Pt100 2*Pt100	
23	Warmluftthermometer	*WARM AIR THERMOMETER*	1	2*Pt100	
24	Lagerthermometer	*BEARING THERMOMETER*	1 (TS / TE) 1 (ES / EE)	2*Pt100 2*Pt100	
25	Relative Schwingungsmessung (Welle) 2 Gewindebohrungen ¾“-14NPT um 90° versetzt im Lagerdeckel TS u. ES.	*RELATIVE SHAFT VIBRATION MEASUREMENT 2 BORES WITH SCREW ¾“-14NPT DISPLACED BY 90° ON THE BEARING COVER TE AND EE.*	*BENTLY NEVADA SERIES 3300 2 SENSORS PER BEARING*		
26	Absolute Schwingungsmessung (Lagerbock) 3 Gewindebohrungen M8x1 (X – Y – Z)	*ABSOLUTE VIBRATION MEASUREMENT (BEARING HOUSING) 3 BORES WITH SCREW M8X1* (X – Y – Z)	*BENTLY NEVADA SERIES 330400 3 SENSORS PER BEARING*		

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	Klemmenkästen	***TERMINAL BOXES***			
30	Klemmenkasten	*TERMINAL BOX*	**V20MKA10GA010**		
	Klemmenanschluß für Warmluftüberwachung	*TERMINAL STRIP CONNECTION FOR WARM AIR MONITORING*	1	2*Pt100	
	Klemmenanschluß für Warmluftüberwachung ERR	*TERMINAL STRIP CONNECTION FOR WARM AIR MONITORING EXCITER*	1	2*Pt100	
	Klemmenanschluß für Kaltluftüberwachung	*TERMINAL STRIP CONNECTION FOR COLD AIR MONITORING*	1 (TS / TE) 1 (ES / EE)	2*Pt100 2*Pt100	
	Klemmenanschluß für Widerstandsthermometer in der Ständerwicklung	*TERMINAL STRIP CONNECTION FOR RESISTANCE THERMOMETERS IN THE STATOR WINDING*	9 + 3 (SPARE)	1*Pt100	
	Klemmenanschluß für je ein Lagerthermometer	*TERMINAL STRIP CONNECTION FOR EACH ONE BEARING THERMOMETER*	1 (TS / TE) 1 (ES / EE)	2*Pt100 2*Pt100	
	Klemmenanschluß für Leckwassersensoren	*TERMINAL STRIP CONNECTION FOR LEAKAGE WATER SENSOR*	2 (TS / TE) 2 (ES / EE)	SIEMENS SITRANS	
34	Ausleitungskasten	*HIGH-VOLTAGE TERMINAL BOX*	**V20MKA10GD010**		
35	Sternpunktkasten	*NEUTRAL POINT TERMINAL BOX*	**V20MKA10GD020**		
36a	Hilfsklemmenkasten Ausleitungskasten	*AUXILIARY TERMINAL BOX HIGH-VOLTAGE TERMINAL BOX*	**V20MKA10GE010**		
36b	Ausleitungskasten Heizung	*HIGH-VOLTAGE CUBICLE JUNCTION BOX HEATER*	**V20MKA10GE011**		
	Anschluss für Heizung	CONNECTION FOR HEATER	230 50 2 x 150	V / AC Hz W	
37a	Hilfsklemmenkasten Sternpunktkasten	*AUXILIARY TERMINAL BOX NEUTRAL POINT TERMINAL BOX*	**V20MKA10GE020**		
37b	Sternpunktkasten Heizung	*NEUTRAL POINT CUBICLE JUNCTION BOX HEATER*	**V20MKA10GE021**		
	Anschluss für Heizung	*CONNECTION FOR HEATER*	230 50 2 x 150	V / AC Hz W	
38	Klemmenkasten (TS)	*TERMINAL BOX (TE)*	**V20MKD10GA010**		
	Relative Schwingungsmessung	*RELATIVE SHAFT VIBRATION MEASUREMENT*	*PER 2 SENSORS*	*BENTLY NEVADA*	
	Absolute Schwingungsmessung	*ABSOLUTE VIBRATION MEASUREMENT*	*PER 3 SENSORS*	*BENTLY NEVADA*	
	Keyphasor	*KEYPASOR*			
39	Klemmenkasten (ES)	*TERMINAL BOX (EE)*	**V20MKD20GA010**		
	Relative Schwingungsmessung	*RELATIVE SHAFT VIBRATION MEASUREMENT*	*PER 2 SENSORS*	*BENTLY NEVADA*	
	Absolute Schwingungsmessung	*ABSOLUTE VIBRATION MEASUREMENT*	*PER 3 SENSORS*	*BENTLY NEVADA*	

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40	Klemmenkasten	*TERMINAL BOX*	**V20MKA10GE030**		
	Klemmenanschluß für Stillstandheizung:	*TERMINAL BOX FOR ANTICONDENSATION HEATING:*	400 / 3 50 2 * 1,6	V /PHASE Hz kW	
45	Klemmenkasten	*TERMINAL BOX*	**V20MKD10GA020**		
	Klemmenanschluß für Erdungsbürste	*TERMINAL BOX FOR GROUND BRUSH*			

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	Kühler	***COOLER***	4 x 25 %		
50	Kühler Anzahl der Elemente:	*COOLER* *NUMBER OF ELEMENTS:*	4		
	Anzahl der Elemente in Betrieb	*NUMBER OF ELEMENTS IN WORKS*	4		
	zulässige Generatorleistung bei Ausfall eines Kühler-elementes (Klasse B):	ADMISS. GENERATOR OUTPUT BY FAILURE OF ONE COOLER ELEMENT (CLASS B)	67	**%**	
	Druckabfall wasserseitig:	*PRESSURE DROP WATER-SIDE*	< 1	bar	
	Minimal zulässige Wassereintrittstemperatur	*MIN. ALLOWABLE WATER INLET TEMPERATURE*	15	°C	
	Maximal zulässige Wassereintrittstemperatur	*MAXIMAL ALLOWABLE WATER INLET TEMPERATURE*	45		
	Wasseraustrittstemperatur:	*WATER OUTLET TEMPERATURE*	57.6		**B**
	Erforderliche Wassermenge:	*REQUIRED WATER FLOW*	73	m³/h	**B**
	Kühlwassergeschwindigkeit: (Flansche)	*WATER VELOCITY (FLANGES)*	1,9	m/s	**B**
	Auslegungsdruck:	*DESIGN PRESSURE*	25	barg	
	Prüfdruck:	*TESTING PRESSURE*	37,5	barg	
	Verschmutzungsfaktor	*FOULING FACTOR*	n.a.	m^2*K / W	
	Kühlwasser Frostschutz	*COOLING WATER ANTI-FREEZE*	-	%	
	Kühlerwerkstoffe:	*COOLER MATERIALS:*			
	Rohre:	*PIPES*	90/10 CuNi		**B**
	Rippen:	*FINS*	Al		**B**
	Rohrböden:	*TUBE PLATES*	C- Steel+ Epoxy		**B**
	Wasserkammern:	*WATERBOXES*	C- Steel+ Epoxy		**B**
	Wasseranalyse	*WATER ANALYSIS*	----		
51	Kühlerentlüftung	*COOLER VENTS*	(4xHahn+G1/2“) *(4xCock+G1/2“)*		
52	Kühlerentleerung	*COOLER DRAIN*	(4xHahn+G1/2“) *(4xCock+G1/2“)*		
53	Kühlwasseranschlußflansche (mit Gegenflansche)	*COOLING WATER CONNECTION FLANGES (WITH COUNTER FLANGES)*	DN 50 DIN EN 1092 PN 40	Carbon Steel	**B** **C**
54	Leckwassersensoren, je 4 auf TS und ES	*LEAKAGE WATER SENSORS, PER 4 ON TE AND EE*			
55	Sicherheitsventil	*SAFETY VALVE*	25	barg	
56	Maß für Kühlerausbau	*REMOVAL DIMENSION FOR COOLER*			

	Erdung	***GROUNDING***			
57	Erdungsbürste	*GROUND BRUSH*			
58	Erdungsklemmen	*EARTH TERMINALS*			

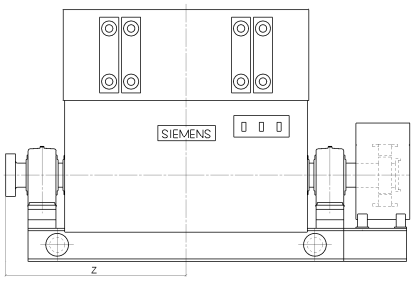
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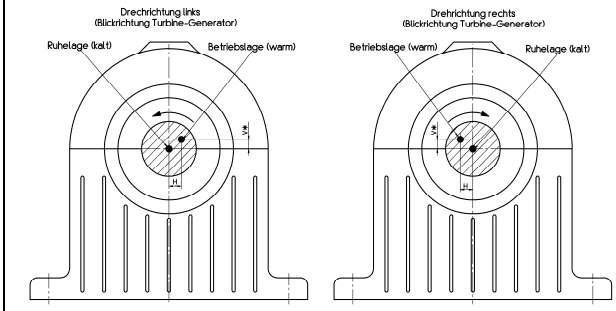
POS.	Bezeichnung	*DESIGNATION*	Wert/ *VALUE*	Einheit/ *DIM.*	REV.
	Erregereinrichtung	***EXCITATION EQUIPMENT***			
60	Haupterregermaschine (V20MKC10GE010)	*MAIN EXCITER*	ELR 62/19-30/8-2S		
	Hilfserregermaschine	*PMG*	ATE DC 190/90/6		
	Schutzart	*DEGREE OF PROTECTION*	IP 54		
	Werte	*VALUES*	Siehe Erreger- und Reglerangaben!/ See excitation data sheet!		
61	Klemmenkasten	*TERMINAL BOX*	**V20MKC10GE010**		
	PMG	*PMG*			
62	Klemmenkasten	*TERMINAL BOX*	**V20MKC10GA010**		
	Erdschlußmeßeinrichtung Meßbürsten permanent	*GROUND FAULT INDICATOR MEAS. BRUSHES PERMANENT*			
63	Klemmenkasten	*TERMINAL BOX*	**V20MKC10GE010**		
	Klemmenanschluß für Stillstandheizung:	*TERMINAL BOX FOR ANTICONDENSATION HEATING:*	200 1 50 2 x 100	V PH Hz W	**B**
	Anschlußklemmen Feldwicklung	*TERMINALS FOR THE FIELD WINDING*			

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Wellenverlagerung / *SHAFT DISPLACEMENT*

Drehrichtung: rechts (Sicht auf TS)
*DIRECTION OF ROTATION: C**CW** (VIEW ON TE)*





V* = Umgebungstemperatur: 20 / 50 °C - alle Werte theoretisch!

AMBIENT TEMPERATURE ***- ALL DATA ARE ONLY THEORETICAL!***

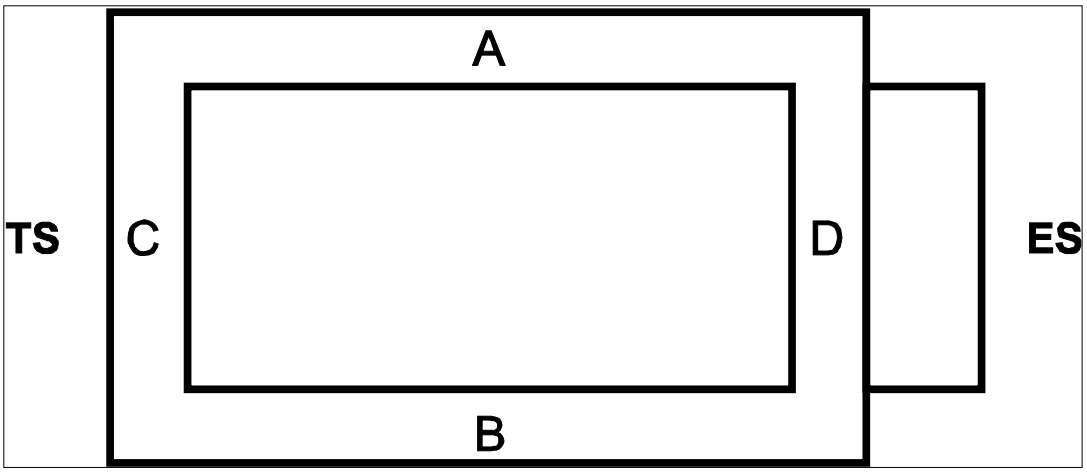
	ES		TS	
	H	V*	H	V*
Hydrodynamischer Betriebszustand *HYDRODYNAMIC OPERATION CONDITION*	0,187	0,083/0,083	0,187	0,083/0,083
Thermisches Wachsen Läufer *THERMAL EXPANSION ROTOR*		0,091/ 0,034		0,091/ 0,034
Thermisches Wachsen Lager *THERMAL EXPANSION BEARING*		0,164/ 0,062		0,164/ 0,062
Thermisches Wachsen Zwischenrahmen *THERMAL EXPANSION BAFFLE FRAME*		0,101/ 0,023		0,101/ 0,023
Gesamthöhenwachstum *TOTAL DISPLACEMENT*		0,439/ 0,202		0,439/ 0,202

Für die Berechnung der Wellenverlagerung wird davon ausgegangen, dass die Welle im kalten Zustand in der Unterseite der Lagerschale liegt.
FOR THE CALCULATION OF THE TOTAL SHAFT DISPLACMENT IT IS ASSUMED THAT IN THE COLD CONDITION THE SHAFTS LIE IN THE BOTTOM OF THE BEARINGS.

Axialdehnung Δ Z:	*AXIAL DISPLACEMENT Δ Z: (prelimin.)*	2,8	mm
Achtung! Maß ist ohne Getriebedehnung. Zum Ausgleich der Wärmedehnung der Getriebe- u. Generatorwellen im Nennlastbetrieb ist die Generatorwelle bei der Montage um diesen Betrag zuzüglich Getriebeschub außerhalb der magnetischen Mitte des Generators in Richtung Getriebe zu stellen.	***ATTENTION!*** *DIMENSION WITHOUT GEAR EXPANSION.* *TO THE OFFSET OF THE THERMAL EXPANSION OF THE GEAR- AND GENERATOR- SHAFTS IN THE RATED OPERATING CONDITION, THE GENERATOR SHAFT IS TO PUT WITH INSTALLATION ABOUT THIS AMOUNT ADDITIONAL GEAR SHAFT EXPANSION OUTSIDE THE MAGNETIC CENTRE INTO GEAR BOX DIRECTION.*		

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Fundamentbelastung / *FOUNDATION LOADING*



Durch das Gewicht ausgeübte Kräfte im Punkt:	*FORCE EXERTED BY THE WEIGHT IN POINTS:*	A: B: C: D: Summe:	**506,3** **506,3** **188,8** **188,8** **1390,2**	**kN** **kN** **kN** **kN** **kN**
Maximale Kraft errechnet aus dem maximalen Stoßmoment (2-poliger Klemmenkurzschluß)	*MAXIMUM FORCE CALCULATED FROM THE MAX. SUDDEN TORQUE (2 PHASE SHORT CIRCUIT)*	F_{dyn} =	**± 594,0**	**kN**
Die Kräfte treten unabhängig von der Drehrichtung wechselseitig auf (in A und B).	*THE FORCES OCCUR ALTERNATELY INDEPENDENT OF THE DIRECTION OF ROTATION (ON A & B).*			
Gesamt-Fundamentlast in A und B:	*TOTAL-FOUNDATION LOAD ON A AND B:*	**A/B:**	**506,3 ± 594,0**	**kN**
Berechnung und Ausführung des Fundamentes wird von der Bauabteilung ausgeführt.	*THE CALCULATION AND CONSTRUCTION OF THE FOUNDATION IS PROVIDED BY CIVIL ENGINEERING COMPANY.*			

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Betriebs- und Einstellwerte Generatorüberwachung /
OPERATING AND *SETTING VALUES – GENERATOR MONITORING*

Kriterium PARAMETER		Ausgangsleistung *POWER OUTPUT* / KKS *TAG NUMBER*	S_N=93,176 MVA Betrieb OPERATING >62,7	Betrieb OPERATING ≤62,7 *COOLER EMER-GENCY OPERA-TION* ****	Einstellwert *SETTING VALUE* Meldung ALARM HIGH >62,7	Meldung ALARM HIGH ≤62,7 *COOLER EMER-GENCY OPERA-TION* ****	Turbine Schutzausl TURBINE TRIP >62,7	Turbine Schutzausl TURBINE TRIP ≤62,7 *COOLER EMER-GENCY OPERA-TION* ****	Einheit UNIT
PHASE/SLOT	*U*	V20MKA10CT010	116	102	121		126		°C
	V	V20MKA10CT020							
Nuttemperatur	W	V20MKA10CT030							
Ständer	U	V20MKA10CT011							
STATOR SLOT	V	V20MKA10CT021							
TEMPERATURE	W	V20MKA10CT031							
Pt100	U	V20MKA10CT012							
	V	V20MKA10CT022							
	W	V20MKA10CT032							
Siemens SPARE	U	V20MKA10CT013							
Siemens SPARE	V	V20MKA10CT023							
Siemens SPARE	W	V20MKA10CT035							
Warmlufttemperatur WARM AIR TEMPER. Doppel – Pt100 DOUBLE – PT100		V20MKA10CT060	92	90					°C
Kaltlufttemperatur Doppel - Pt100	TS TE	V20MKA10CT050	50	60	55	65	60	70	°C
COLD AIR TEMPERATURE DOUBLE – PT100	ES EE	V20MKA10CT055							
Lagertemperatur	TS TE	V20MKD10CT010	92*		97*		102*		°C
BEARING TEMPERATURE	ES EE	V20MKD20CT010							
Leckwasserüber-wachung	TS	V20MKA10CL110			X				
	TE	V20MKA10CL111					X*****		
LEAKAGE WATER DETECTION	ES	V20MKA10CL120			X				
	EE	V20MKA10CL121					X*****		
Relative Wellen-schwingung **	TS	V20MKD10CY011	90		165		240		µm
	TE	V20MKD10CY012							
RELATIVE SHAFT VIBRATION **	ES	V20MKD20CY011							
	EE	V20MKD20CY012							
Absolute Lagerbock schwingung ***	TS	V20MKD10CY010	3,8		7,5		11,8		mm/s
	TE	V20MKD10CY020							
		V20MKD10CY030							
ABSOLUTE BEARING VBRATION ***	ES	V20MKD20CY010							
	EE	V20MKD20CY020							
		V20MKD20CY030							

SIEMENS	Form	Z.- Sys.	Zeichnungs-Nummer / DRAWING NUMBER	Index	Blatt SHEET 14
	44	70	**DPPPG-70149879**	C	Von OF 16

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MF

Spr. Kz.

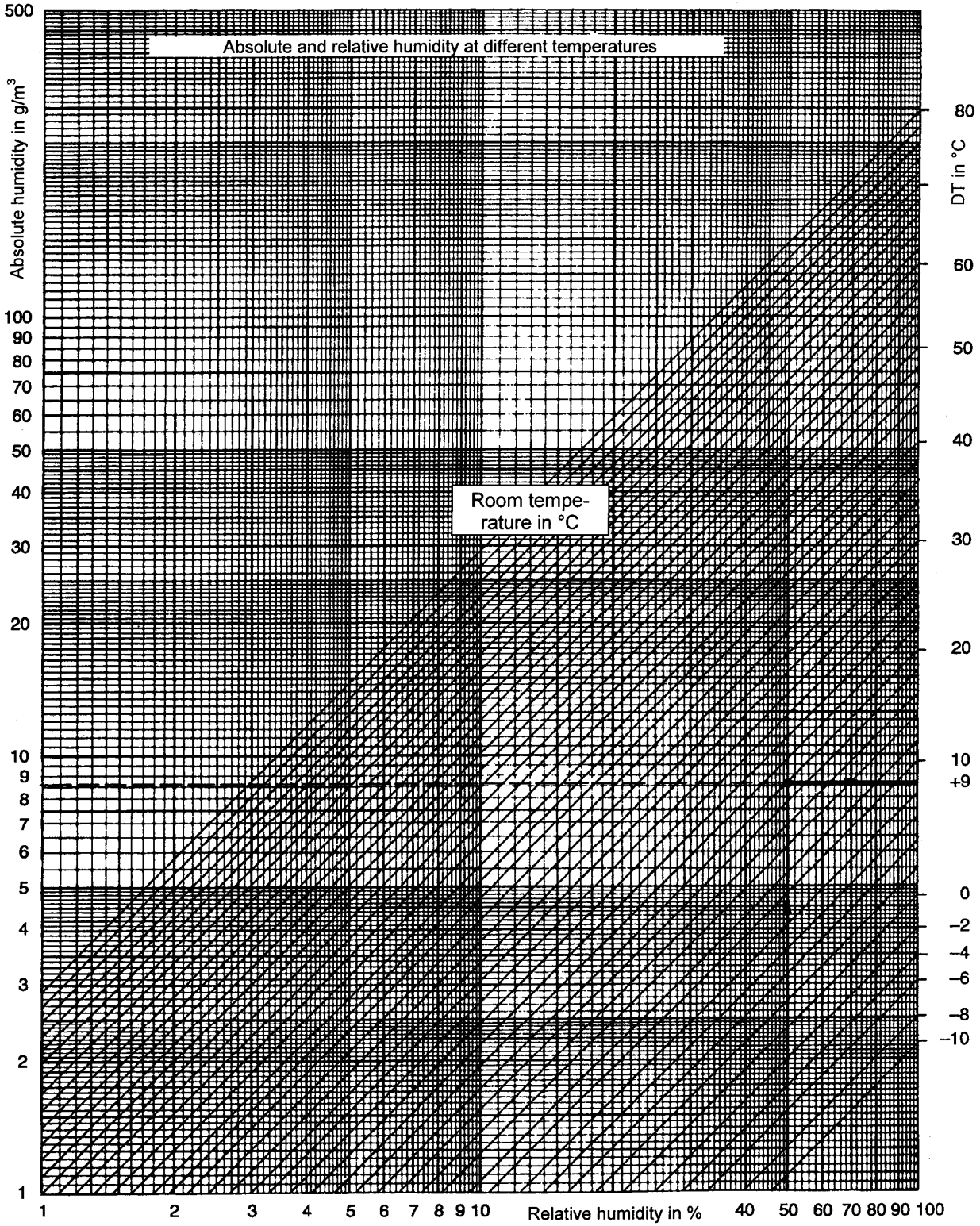
Die Betriebs- und Einstellwerte beziehen sich auf Maximalleistung des Generators bei entsprechender Kaltlufttemperatur.
THE OPERATING AND SETTING VALUES REFER TO MAXIMUM OUTPUT AT CORRESPONDING COOLING AIR TEMPERATURE.

* Die angegebenen Temperaturen sind Rechenwerte und werden nach der Inbetriebnahme korrigiert.
* *THE STATED TEMPERATURES ARE CALCULATED VALUES AND WILL BE CORRECTED AFTER INITIAL START-UP.*

** s_{p-p} nach ISO 7919-3 / ACCORDING TO ISO 7919–3
*** v_{eff} nach ISO 10816-3 / ACCORDING TO ISO 10816–3

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Bestimmung der Taupunkttemperatur / *Determination of Dewpoint Temperature*



Beispiel: Relative Luftfeuchte der Umgebungsluft = 50 % und Raumtemperatur = +20 °C ergeben eine Taupunkttemperatur (TP) = +9 °C. Dies entspricht einer absoluten Luftfeuchte von 8,6 g/m^3.

Example: Relative humidity of ambient air = 50 % and room temperature = +20 °C result in a dew-point temperature (DT) of +9°C, corresponding to an absolute humidity of 8,6 g/m^3.

SIEMENS	Form	Z.- Sys.	Zeichnungs-Nummer / DRAWING NUMBER	Index	Blatt / SHEET 16
	44	70	**DPPPG-70149879**	C	Von / OF 16

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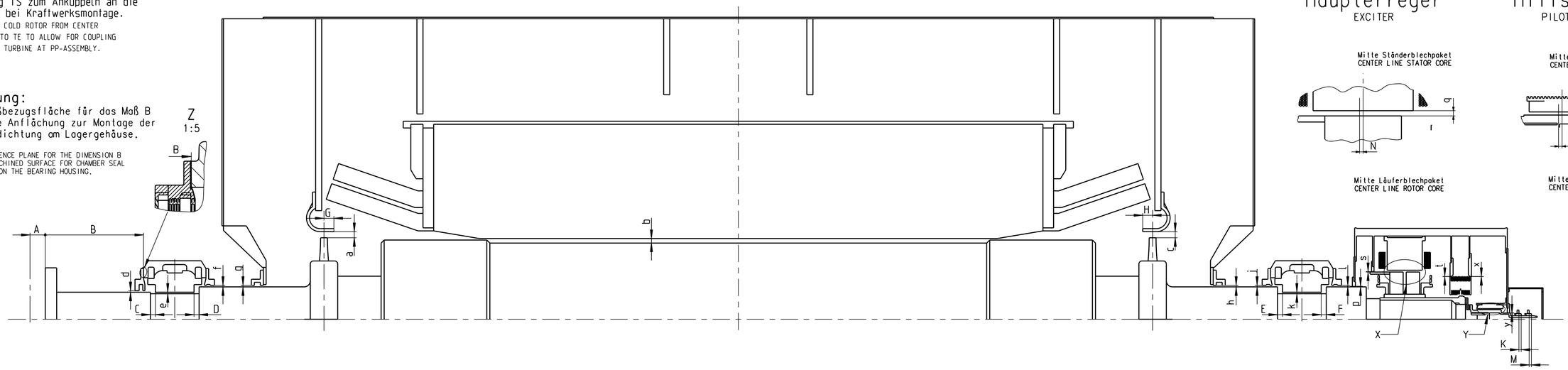
MF

Spr. Kz.

Verschiebung des kalten Läufers aus der Mittellage heraus in Richtung TS zum Ankuppeln an die Turbine bei Kraftwerksmontage.
OFFSET OF COLD ROTOR FROM CENTER POSITION TO TE TO ALLOW FOR COUPLING WITH THE TURBINE AT PP-ASSEMBLY.

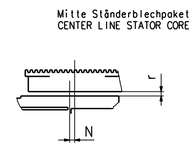
Achtung:
Die Maßbezugsfläche für das Maß B ist die Anflächung zur Montage der Kammerdichtung am Lagergehäuse.
NOTE:
THE REFERENCE PLANE FOR THE DIMENSION B IS THE MACHINED SURFACE FOR CHAMBER SEAL MOUNTING ON THE BEARING HOUSING.

Z
1:5



X
Haupterreger
EXCITER

Y
Hilfserreger
PILOT EXCITER

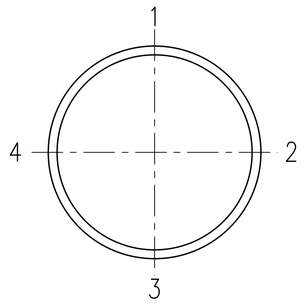


ACHTUNG!

Zunächst Mitte des Läufers zum Blechpaket ausrichten, dann Lagerbock und Konsole an Läufer ausrichten.
Luftführungsring nach Maß G und H einstellen.
Maß "A" dient zur Kompensation der Wärmedehnung des Läufers.
Der Axialschub der Turbine muss zusätzlich berücksichtigt werden, das heißt, Maß "A" muss um den Turbinenschub im stationären Zustand vergrößert werden.
Wenn Maß "B", gemessen von der Stirnseite der Kupplung eingestellt ist, steht Läufermitte auf Mitte Blechpaket.
Maß "B" bezogen auf kalten Zustand.
Die Wärmedehnung des Läufers wird berücksichtigt, indem der Abstand Kupplung - TS Lagerdichtfläche auf die Summe von "A" und "B" eingestellt wird.

NOTE!
FIRST ALIGN ELECTRICAL CENTER OF ROTOR TO STATOR CORE, THEN ADJUST BEARING PEDESTAL AND CONSOLE TO ROTOR.
ADJUST AIR BAFFLE RING TO DIMENSION G AND H.
DIM. "A" IS INTENDED FOR COMPENSATION OF THERMAL EXPANSION OF THE ROTOR.
THE AXIAL THRUST OF THE TURBINE HAS TO BE CONSIDERED ADDITIONALLY, THAT MEANS DIM. "A" HAS TO BE INCREASED BY THE STATIONARY TURBINE THRUST.
IF DIM. "B" AS MEASURED FROM THE FRONT SIDE OF COUPLING, ROTOR CENTRE LINE IS ON CORE CENTRE LINE.
DIM. "B" WITH RESPECT TO COLD CONDITION.
THE THERMAL EXPANSION OF THE ROTOR IS CONSIDERED IF THE DISTANCE FROM COUPLING TO SEALING AREA OF TE BEARING IS EQUAL TO THE SUM OF "A" AND "B".

Von TS gesehen
SEEN FROM TE



Axialspiele
AXIAL CLEARANCES

Maß DIM.	Sollmaß SPEC. DIM.	zul. Toleranz ALLOW. TOLERANCE +	−
A	2,9		
B	560		
C	35,0	1	1
D	35,0	1	1
E	35,0	1	1
F	35,0	1	1
G	65	5	5
H	65	5	5
K	25,5	1	1
M	25,5	1	1
N	2,8	1	1

Maß DIM.	Sollmaß SPEC. DIM.	zul. Toleranz ALLOW. TOLERANCE +	−
a	2,3	0,5	0,5
b	46	2,3	2,3
c	2,3	0,5	0,5
p	0,5	0,2	0,2
q	8	0,5	0,5
r	2,5	0,3	0,3
s	8	2	2
t	1	0,2	0,2
x	1	0,2	0,2
y	0,5	0,2	0,2

Maß DIM. \ Messpunkt MEAS. POINT	1 max.	1 min.	2 max.	2 min.	3 max.	3 min.	4 max.	4 min.
d	0,27	0,13	0,14	0,06	0,00	0,00	0,14	0,06
e	0,41	0,35	0,54	0,46	0,00	0,00	0,54	0,46
f	0,27	0,13	0,14	0,06	0,00	0,00	0,14	0,06
g	0,65	0,35	0,35	0,20	0,05	0,05	0,35	0,20
h	0,65	0,35	0,35	0,20	0,05	0,05	0,35	0,20
j	0,27	0,13	0,14	0,06	0,00	0,00	0,14	0,06
k	0,41	0,35	0,54	0,46	0,00	0,00	0,54	0,46
l	0,27	0,13	0,14	0,06	0,00	0,00	0,14	0,06

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ORIGINATED: 2018-07-24 HELBIG	TITLE: AXIALE U. RADIALE LAUFERSPIELE AXIAL AND RADIAL ROTOR CLEARANCES		
CHECKED: 2018-07-24 SIEGEL			
RELEASED: 2018-07-24 HELBIG			
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Z001K4FB - 2018-11-14 - DWG/DPPPG-70166125/000/A
DO NOT SCALE. WORK TO DIMENSIONS SHOWN
Pro/ENGINEER A1

1 Durchgangsbohrungen nach Pos. 10 angerissen und gebohrt,mit Pos. 150 gesichert
LAYOUT AND DRILL HOLES RESPECTED TO IT. 10, LOCKED WITH IT. 150

2 Neben Kabelverschraubung PG7 angebracht
ATTACHED CLOSE TO CABLE GLAND PG7

3 Auf Wand Luftfuehrungsring Grundrahmen ueber Thermometern Hoehe Maschinen- HA angebracht
MOUNTED ON AIR BAFFLE RING - BASEFRAME, UPPON THERMOMETERS, AT LEVEL MAIN- AXIS

4 Auf Montageoeffnung TS und ES angebracht
MOUNTED AT SERVICE OPENINGS ON TE & EE

5 Pos. 110 neben Erdungsanschluessen Kuehler beidseitig angebracht
IT. 110 ATTACHED CLOSE TO GROUNDING CONNECTIONS

6 Pos. 80, 90, 190, 170 auf Stirnwand ES angebracht
IT. 80,90,190,170 ATTACHED ON FRONT WALL

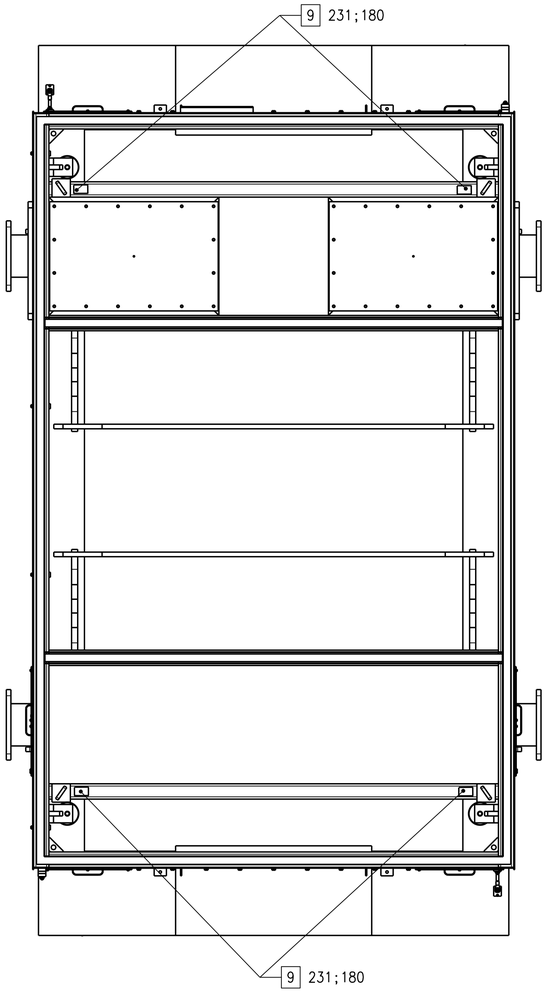
7 Pos. 120 auf Abdeckblech (fuer Oeffnungen der Kuehlanlage) Abdeckhaube angebracht
IT. 120 ATTACHED ON COVER PLATES (FOR COOLING OPENINGS) OF COVER

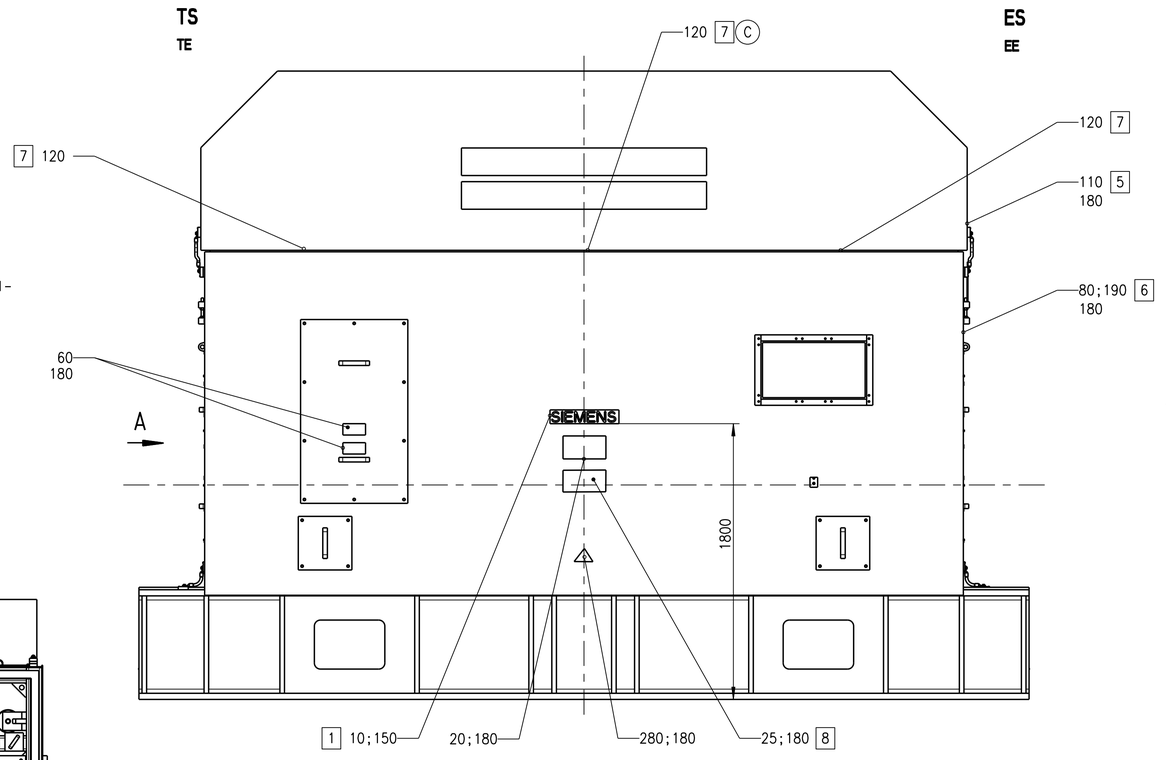
8 Falls Pos.25 in Stueckliste "GENERATOR SCHILDER" vorhanden, unterhalb Pos.20 anbringen
IF IT.25 PRESENT IN "GENERATOR LABELS" PART LIST, ATTACHED BELOW IT.20

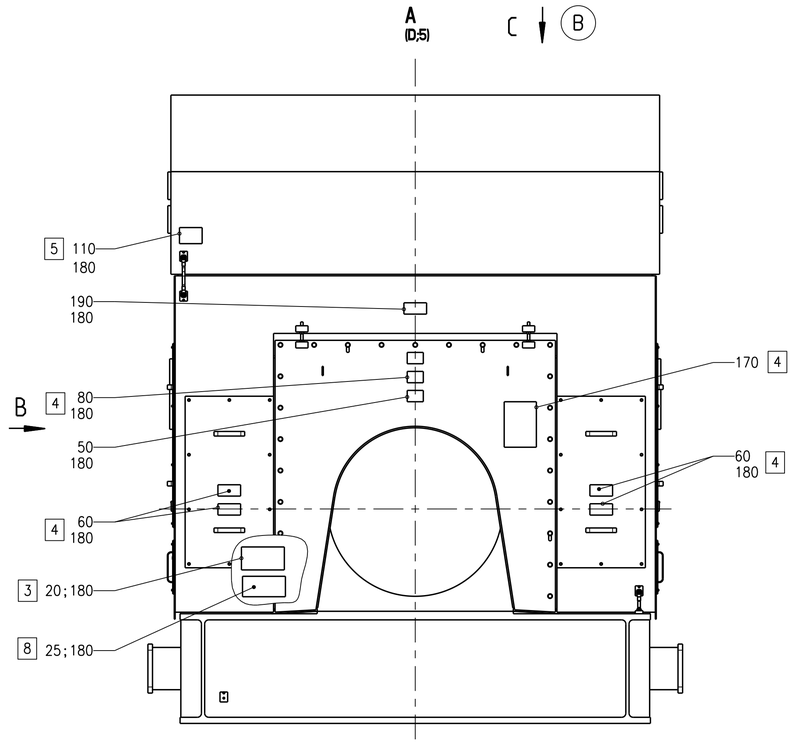
9 Neben Anhebeoesen angebracht.
ATTACHED CLOSE TO LIFTING POINT.

C
(A;15)

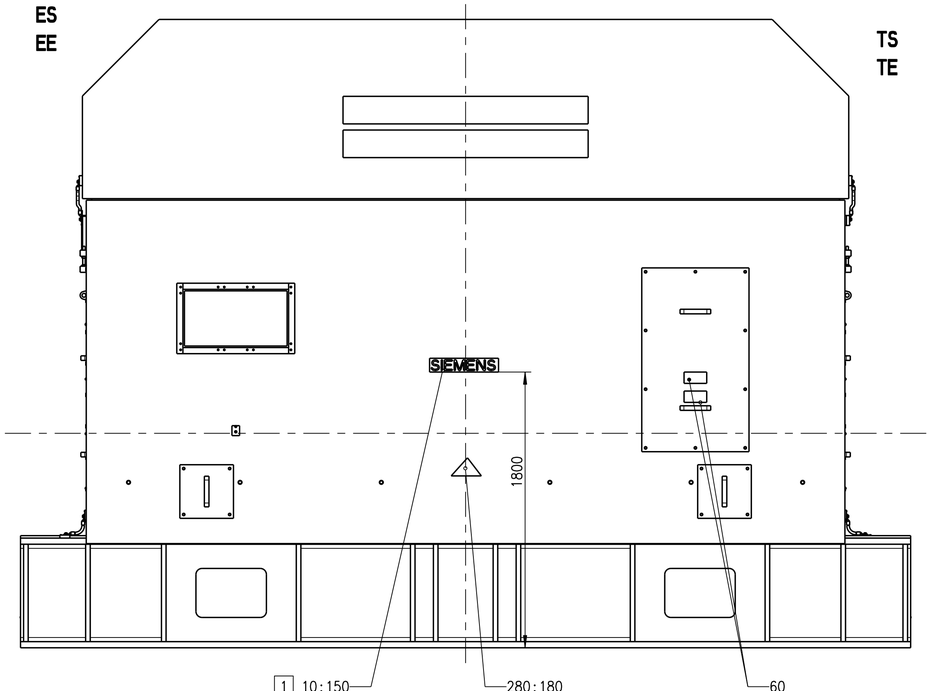
B Ansicht ohne Kuehlerhaube
VIEW WITHOUT COOLER COVER

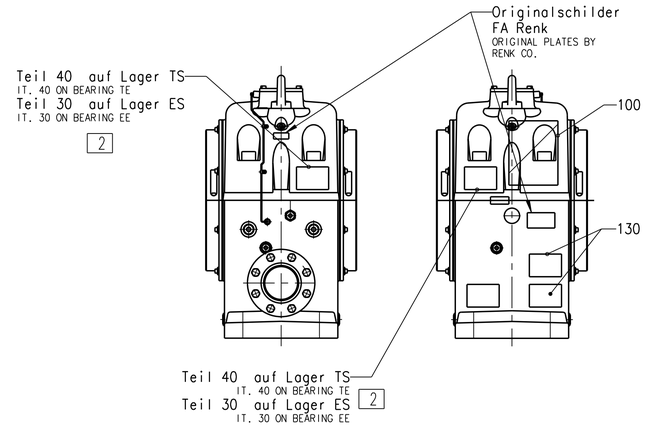






Beschriftung Lager
DESIGNATION BEARING





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ORIGINATED: 2016-08-12 WIEGAND	TITLE: PLATES		
CHECKED: 2016-08-12 PARBS			
RELEASED: 2016-08-12 WIEGAND	SCHILDER		
CONFIDENTIAL	LANG. - DRAWING NO. / VALUE: DPPPG-70124658	REV.: C	SHEET: 1/1
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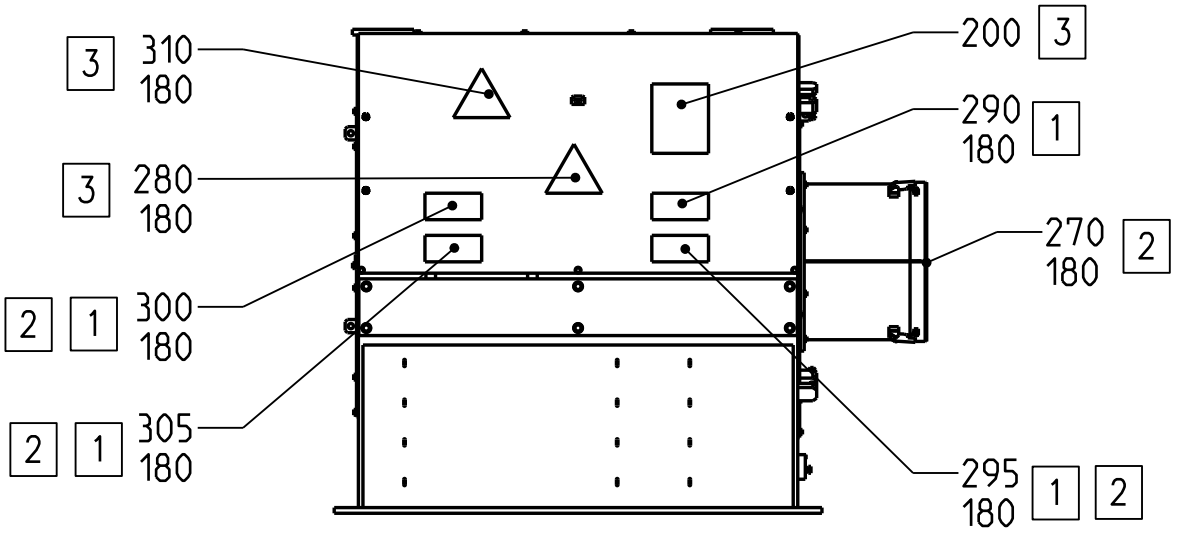
DO NOT SCALE; WORK TO DIMENSIONS SHOWN

1 Schilder oberhalb der zugehoerigen Klemmenkaesten auf Erregermaschine anbringen.
MOUNT SIGNS ABOVE THE ASSOCIATED TERMINAL BOXES ATTACHED TO EXCITER.

2 Falls Pos.270, 295, 300, 305 in Stueckliste "GENERATOR SCHILDER" vorhanden
IF IT.270 ,295, 300 ,305 PRESENT IN "GENERATOR LABELS" BOM

B

3 Auf beiden Seiten befestigt.
ATTACHED ON BOTH SIDES



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Siemens AG

WEIGHT:	SCALE: 1:1	SPEC.:KUN351.00	

ORIGINATED:	2016-04-13 WIEGAND	TITLE: BESCHRIFTUNG ERREGER
CHECKED:	2016-04-13 PRADEL	
RELEASED:	2016-04-13 WIEGAND	DESTRIPTION ECXITER

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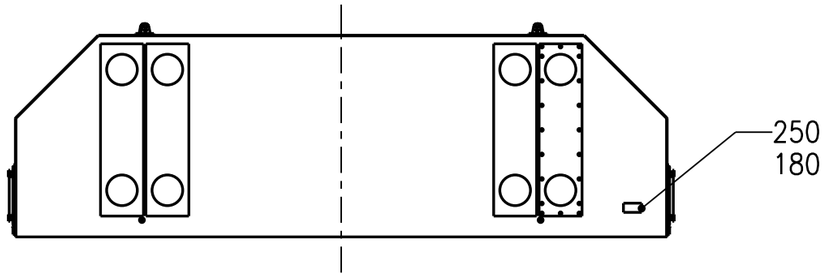
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DPPPG-70116685
26-70116685

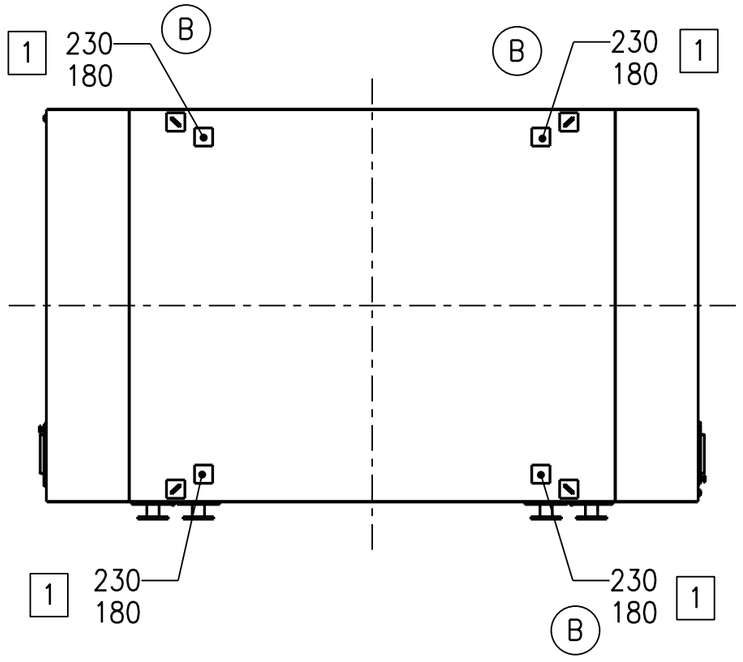
REV.:	SHEET:
B	1/1

Pro/ENGINEER A4

Z001K4FB - 2018-11-14 - DWG/DPPPG-70116685/000/B
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1 Neben Anhebeoesen angebracht.
ATTACHED CLOSE TO LIFTING-POINT.





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WEIGHT:	SCALE: 1:50	SPEC.:KUN351.00	
ORIGINATED: 2013-04-05 LEIPOLD	TITLE: SCHILDER KUEHLERHAUBE		
CHECKED: 2013-04-05 TUERKIS			
RELEASED: 2013-04-05 LEIPOLD	PLATES COOLER COVER		
CONFIDENTIAL	LANG. - DRAWING NO. / VALUE: DPPPG-70033284		
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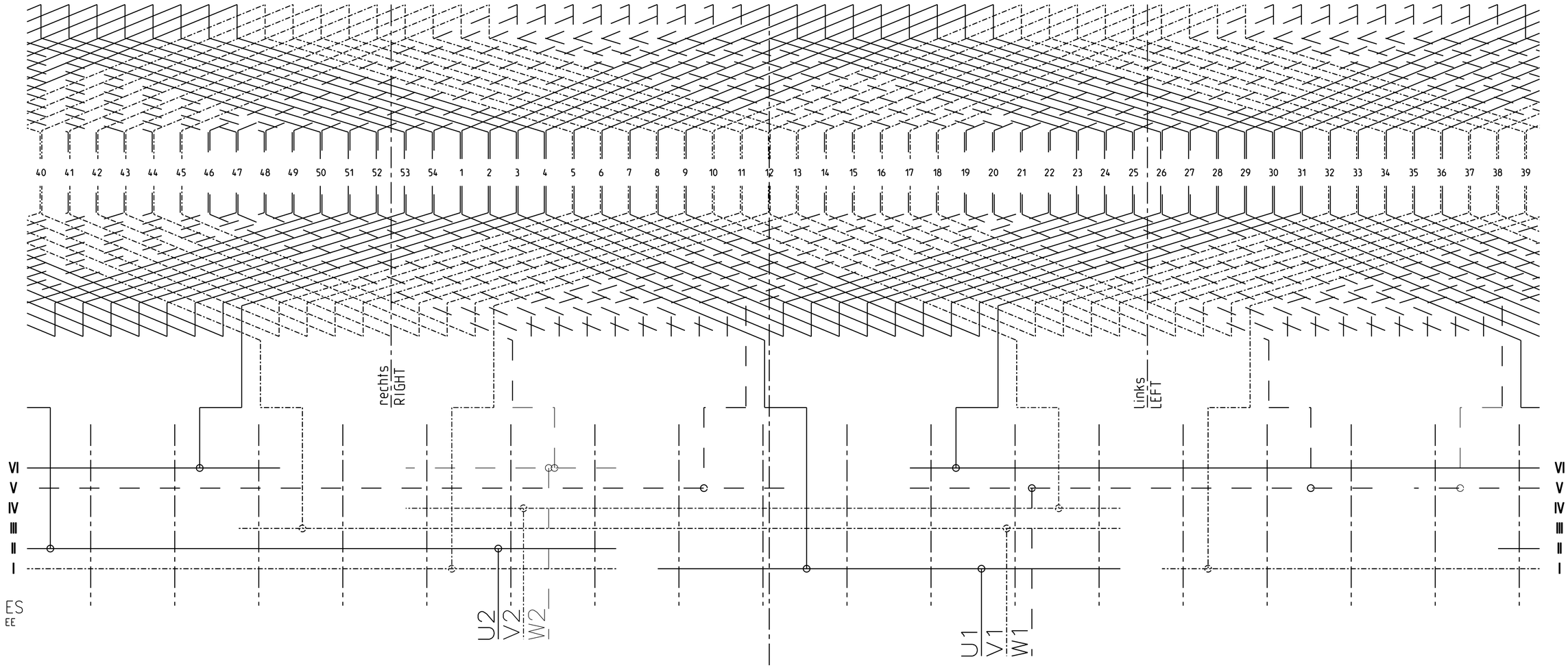
Pro/ENGINEER A3

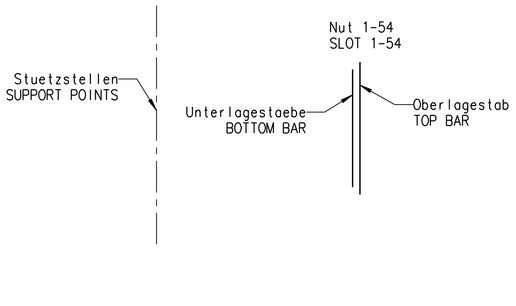
Z001K4FB - 2018-11-14 - DWG/DPPPG-70033284/000/B

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TS
TE

Drehrichtung
DIRECTION OF ROTATION





2-Schicht-Schleifenwicklung

Linkslauf von TS-Seite
3 Straenge 2 Pole 54 Nuten
Sehnung 22/27 Nutschritte
9 Nuten pro Pol und Strang
Schaltung Y

2-LAYER-LAP-WINDING
DIRECTION OF ROTATION SEEN FROM TE: COUNTER CLOCKWISE
3 PHASES 2 POLES 54 SLOTS
CHORD 22/27 SLOT PITCHES
9 SLOTS PER POLE AND PHASE
CONNECTION Y

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WEIGHT:	SCALE: 1:1	SPEC.:KUN351.00	
ORIGINATED: 2018-05-03 KOLBE	TITLE: WINDING DIAGRAM		
CHECKED: 2018-05-03 SUPERKA	WICKLUNGSBILD		
RELEASED: 2018-05-03 KOLBE	LANG. - DRAWING NO. / VALUE: DPPPG-70161068		
	22-70161068	REV.: A	SHEET: 1/1

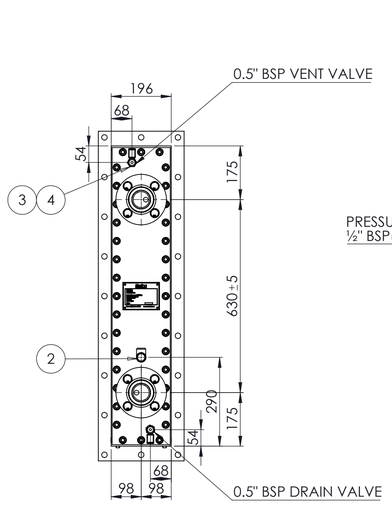
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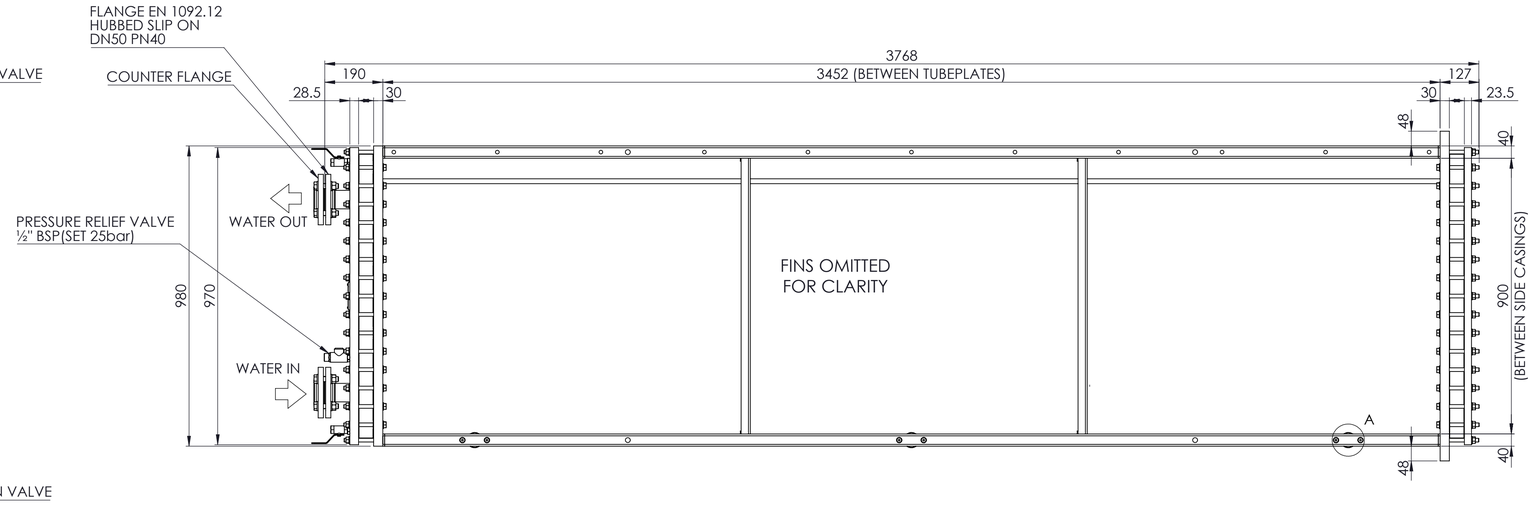
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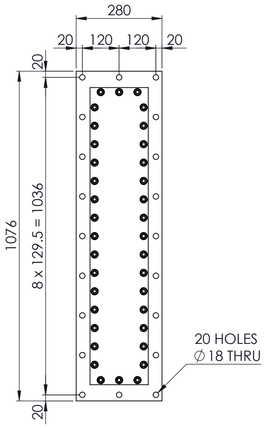
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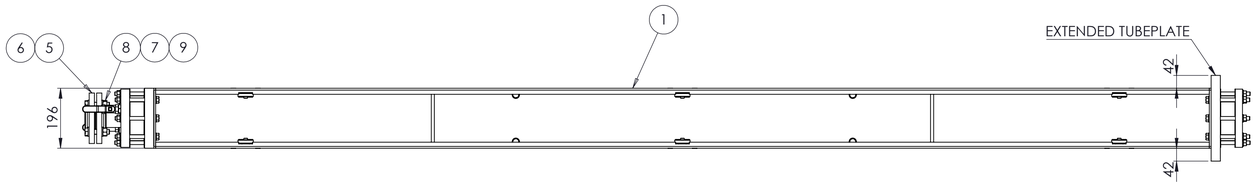
Pro/ENGINEER A1

REVISION							
REV.	REASON FOR CHANGE	ECN	DRAWN	DATE	CHK'D	DATE	APP'D	DATE
B	ELEMENTS WERE BOLTED TOGETHER	5833	JJW	21-02-18	AP	21-02-18	AP	21-02-18











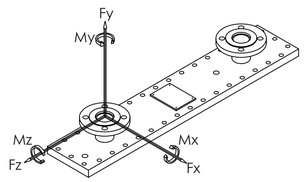
DETAIL A
SCALE 1 : 5

NOTES:

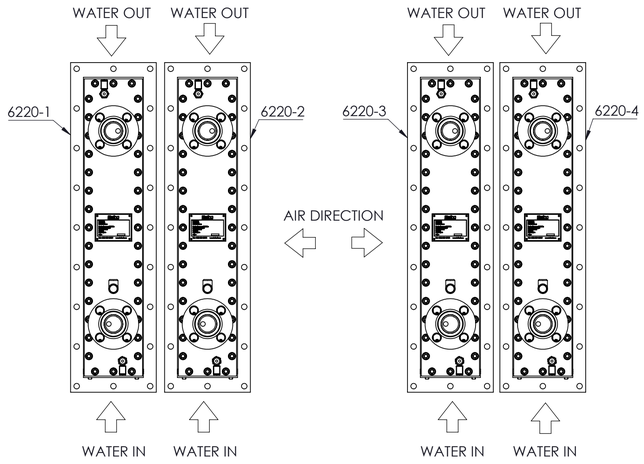
1) SEE SIEMENS DESIGN AND DATA SHEET: DPPPG-70152425 REV A
2) NO PIPE WORK LOADS TO BE CARRIED OUT BY THE COOLER CONNECTIONS - AS TABLE BELOW
3) MASS PER ELEMENT - 425 KG
4) MASS PER PAIR OF ELEMENTS - 852KG
5) APPROX. VOLUME PER ELEMENT - 47 LITRES
6) DESIGN TEMPERATURE 94 °C
7) DESIGN PRESSURE 25 bar g
8) TEST PRESSURE 37.5 bar g
9) NAMPLATES - ENGLISH

MATERIALS & FINISH
TUBES: COPPER NICKEL 90/10
FINS: ALUMINIUM, NATURAL
SIDE CASINGS AND INTERMEDIATES: GALVANISED STEEL SHEET BS EN10346, GALVANISED
FASTENERS: CARBON STEEL GRADE 8.8 DELTA-TONE

TUBEPLATES, HEADERS AND GRIDS: CARBON STEEL BSEN10025 S275 JR
WATERSIDE: EPOXY PAINT 525µm RA
AIRSIDE: TO SIEMENS SPECIFICATION TLV13-047 REV B 3.3.1 (INDOOR)
60µm INTERCURE 200, 60µm INTERTHAN 990
TOTAL 120 µm RA. COLOUR RAL7030



ALLOWABLE PIPEWORK LOADS								
DN	MAX FORCE				MAX MOMENT			
	Fx	Fy	Fz	Fres	Mx	My	Mz	Mres
50	1024	1335	1024	1970	149	243	149	322
NOTE: TABLE FOR REFERENCE ONLY SEE DPPPG-70152425 Rev A								



VIEW OF ELEMENTS INSTALLED ARRANGEMENT

EG000367	VILNIUS BIOMASS	DPPPG-70152426

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ITEM NO.	Number	STT Ref	DESCRIPTION	MATERIAL	QTY.
1	51345-04		ELEMENT GA [SINGLE TUBE]		1
2	K22512	K21106	PRESSURE RELIEF VALVE BIS-TS50P25B-½ in BSPP(SET 25bar)	STAINLESS STEEL 316/316L	1
3	K11130	K11130	0.5 ONE PIECE BALL VALVE TYPE 820	STAINLESS STEEL EN 10222-5 / 1.4401	2
4	P004328	086-021	0.5 INCH BSP HEX NIPPLE	STAINLESS STEEL 316/316L	2
SPARE PARTS LIST (PER ELEMENT)					
5	K22493	K22493	FLANGE EN 1092. 12 HUBBED SLIP ON DN50 PN40	CARBON STEEL EN10025 S235 JR	2
6	067-008	067-008	FLANGE GASKET BS EN 1514-1 FULL FACE DN50 PN40	NOVUS 30 (SUPRA)	2
7	098-017		SCREW HEXAGON HEAD M16 x 70	CARBON STEEL GRADE 8 GALVANISED	8
8	115-030	115-030	NUT HEXAGON FULL BS 3692 M16	CARBON STEEL GRADE 8 GALVANISED	8
9	122-040	122-040	WASHER PLAIN [FORM C] BS 4320 M16	CARBON STEEL GRADE 8 GALVANISED	16
10		51345-23	HEADER GASKET (CONNECTION)	KLINGER C-4106	2
11		51345-22	HEADER GASKET (RETURN)	KLINGER C-4106	2
SPARE PARTS LIST (PER FOUR ELEMENTS)					
12	293-007	293-007	CLEANING BRUSH AND ROD SET 0.625in 4M MAX		1

TITLE
CUSTOMER ELEMENT GA [SINGLE TUBE]

UNLESS OTHERWISE STATED ALL SYMBOLS ETC. TO BS.8888 BS.1553 BS.1646 BS.3939 ANSI/AWS A2.4
ALL DIMENSIONS IN MILLIMETRES (mm) MACHINE WHERE MARKED ✓
IF IN DOUBT ASK DO NOT SCALE
TOLERANCES TO BE AS SPECIFIED BELOW UNLESS OTHERWISE STATED

MACHINING		FABRICATION PLATE AND STRUCTURAL WORK					
BREAK ALL SHARP CORNERS AND EDGES 0.40mm MAX	UP TO 100mm ± 0.25mm 100-300mm ± 0.4 mm 300-1000mm ± 0.8 mm	SIZES	UP TO 300mm ± 1mm	300-1000mm ± 1.5mm	1000-2000mm ± 2mm	2000-4000mm ± 3mm	4000-8000mm ± 4mm	8000-12000mm ± 5mm
ANGLES ± 1°		LINEAR						
		⊥ ▱ ○	2	3	4	6	8	10

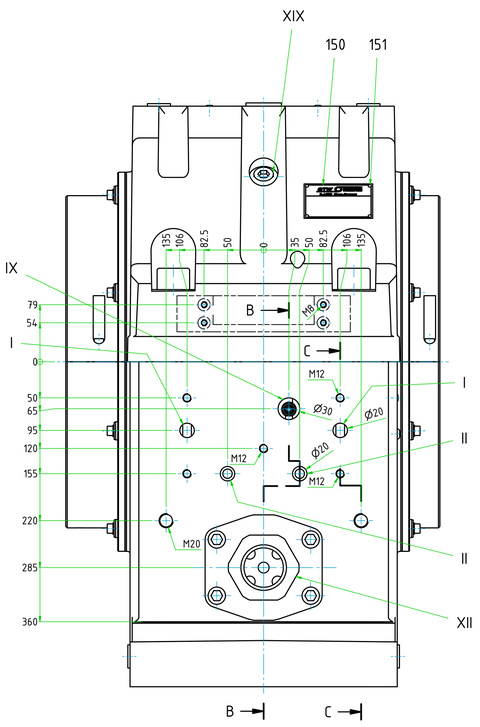
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MATERIAL
STT REF. No.
FINISH:- SEE JPS
WEIGHT Kg 852

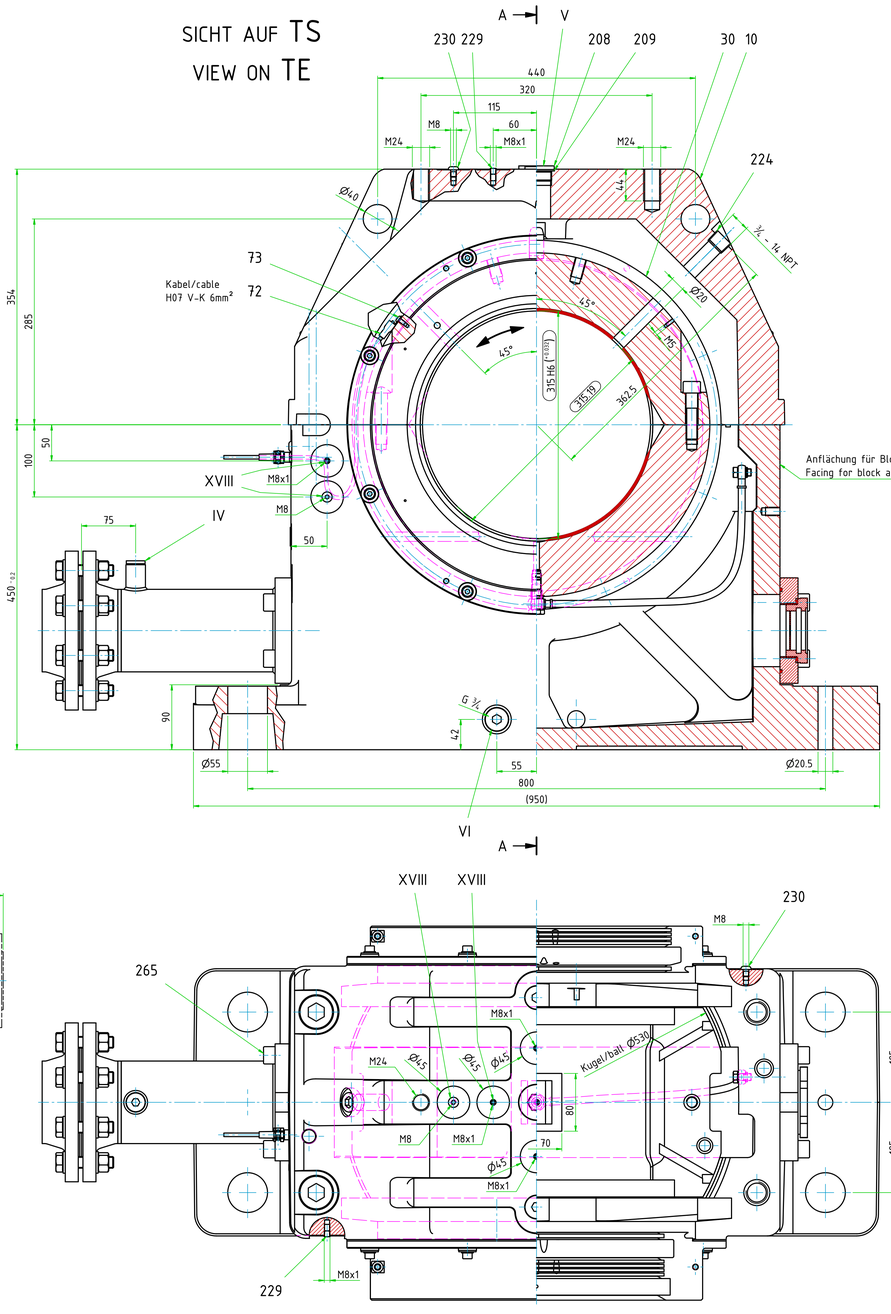
Sterling thermal technology
BRUNEL ROAD . RABANS LANE
AYLESBURY . BUCKS . ENGLAND . HP19 8TD
Tel +44(0)1296-487171 Fax +44(0)1296-436805
EMAIL: MAIL@STERLINGTT.COM
WWW.STERLINGTT.COM

JOB No. 06220-1P/4P
SCALE 1:20
SHT SIZE A1
DRAWING No. 51345-02
SHT OF SHTS. 1 OF 1
REV. B

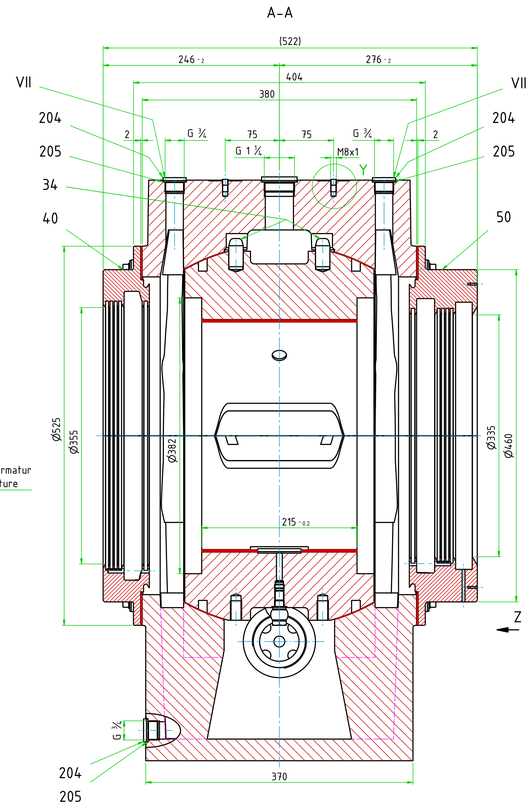
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VIEW ON TE



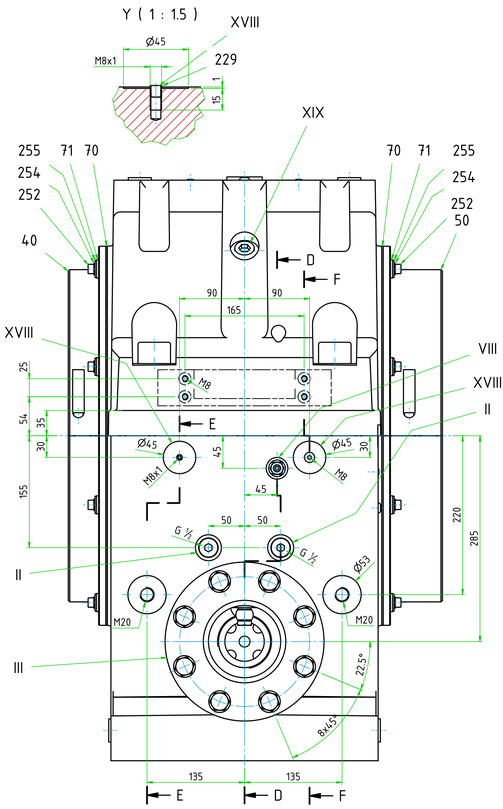
B–B



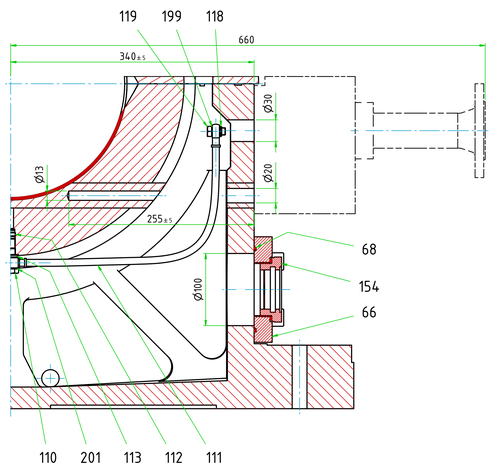
A–A



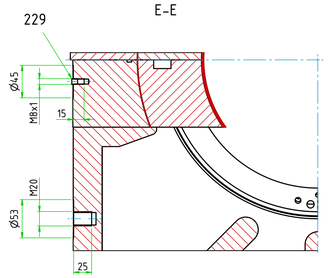
Y (1 : 1.5)



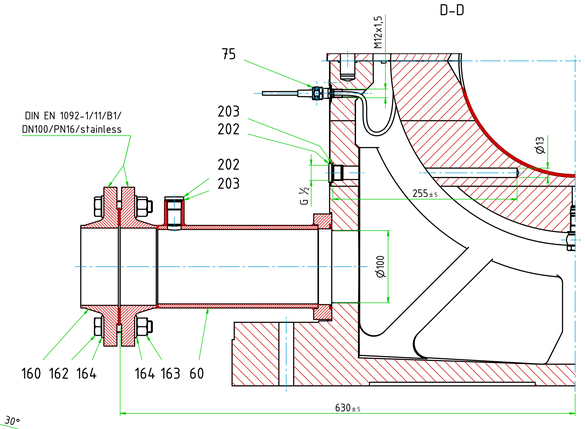
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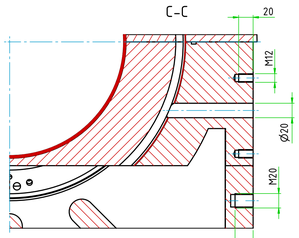
E–E

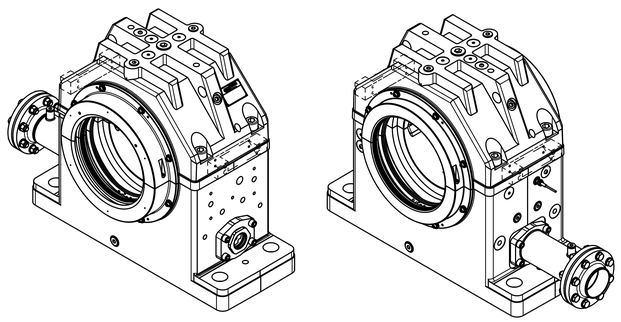


D–D

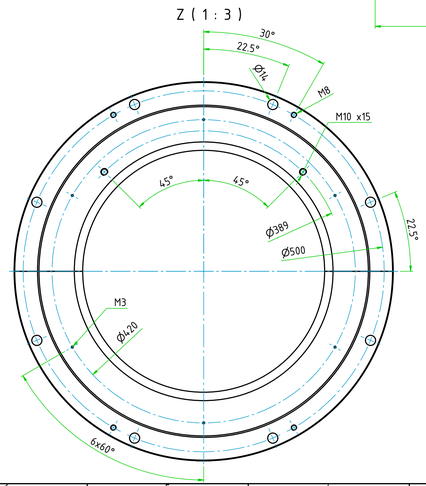


C–C

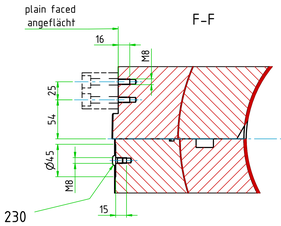




Z (1 : 3)



F–F



I	Ölzulauf bei Ölumlaufanlage radial	Circulation oil inlet radial
II	Temperaturmessung Lagerschale radial	Bearing metal temperature measurement radial
III	Ölablauf bei Ölumlaufanlage	Circulation pump oil outlet
IV	Anschluss für Ölsumpfthermometer	Connection for oil sump temperature measurement
V	Überprüfung Ölförderung des Schmierrings	Inspection of oil ring lubrication performance
VI	Ölablass	Oil drain
VII	Öleinfüllung bzw. Be- und Entlüftungsfilter	Oil filling or aeration filter
VIII	Erdungskabeldurchführung	Earthing cable lead - through
IX	Anschluss für Hydrostatik	Connection for hydrostatics
XII	Ölstandsanzeige	Oil level indicator
XVIII	Anschluss für Schwingungsmessung (Gehäuse)	Connection for vibration sensor (housing)
XIX	Anschluss für Schwingungsmessung (Welle)	Connection for vibration sensor (shaft)

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Energy Sector

Zeichnungs-Nr. / DRAWING NUMBER:
Auftrags-Nr. / ORDER NUMBER:
DPPPG - 7015 8485

INDEX: A
ISO 128

ECCN: EAR99 | AL: N | ECL: N | U.S.-Content: N

GENERAL TOLERANCES DIN ISO 2768 - mH

A0

SCALE: 1 : 100
WEIGHT: 761,7 kg

TITLE:
Gleitlager WPXYQ 28-315 TS
Slide bearing WPXYQ 28-315 TE

Assembly Siemens Erfurt - Hy+EK insulated

	DATE	NAME
Drawn BY	20.04.2018	SAN
CHECKED BY	23.04.2018	CBE

GTW Gesellschaft für Turbomaschinen Wolfhalden GmbH

DRAWING NUMBER: 452031
REVISION: 00
1 OF 2 SHEETS

INDEX	DESCRIPTION OF CHANGE	DATE	NAME	ORIGIN

STATUS: Freigegeben

POS	QTY	BENENNUNG	DESCRIPTION	DWG NO	REV	DIMENSIONS	MATERIAL	MASS
265	8	Zylinderschraube	Socket screw	DIN EN ISO 4762	00	M16x45	8.8 zinced	0,1 kg
255	16	Unterlegscheibe	Washer	DIN 9021	00	8,4	100 HV zinced	0 kg
254	16	Unterlegscheibe	Washer	DIN 125	00	A 8,4	140 HV zinced	0 kg
252	16	Zylinderschraube	Socket screw	DIN EN ISO 4762	00	M8x30	8.8 zinced	0 kg
230	4	Rundkopfschraube	Fillister Socked Head Screw	ISO 7380	00	M8x10	10.9 zinced	0 kg
229	6	Verschlußschraube	Plug	DIN 906	00	M8x1	St zinced	0 kg
224	2	Verschlußstopfen	Plug	ANSI B1.20	00	3/4" NPT	St zinced	0,1 kg
209	1	Dichtring	Gasket	DIN 7603	00	A42x49x2	Cu	0 kg
208	1	Verschlußschraube	Plug	DIN 908	00	G1¼A	St zinced	0,2 kg
205	4	Dichtring	Gasket	DIN 7603	00	A27x32x2	Cu	0 kg
204	4	Verschlußschraube	Plug	DIN 908	00	G¾A	St zinced	0,1 kg
203	3	Dichtring	Gasket	DIN 7603	00	A21x26x1,5	Cu	0 kg
202	3	Verschlußschraube	Plug	DIN 908	00	G½A	St zinced	0 kg
201	1	Dichtring	Gasket	DIN 7603	00	A14x18x1,5	Cu	0 kg
199	1	Dichtring	Gasket	DIN 7603	00	A10x13x1	Cu	0 kg
164	16	Unterlegscheibe	Washer	DIN 125	00	A 17	A2-70	0 kg
163	8	Sechskantmutter	Hexagon nut	DIN EN ISO 4032	00	M16	A2-70	0 kg
162	8	Sechskantschraube	Hexagon head screw	DIN EN 24017	00	M16x70	A2-70	0,1 kg
161	1	Flachdichtung PN16	Gasket	DIN 2690	00	DN100	KLINGERsil C-4400	0 kg
160	1	Vorschweißflansch	Welding neck flange	DIN EN 1092-1	00	11/B1/DN100x3,6/PN16	1.4404/1.4571	4,6 kg
159	1	Curil T- Dichtmasse	Sealing compound	000131	00	Tube 75ml		0 kg
154	1	Ölstandsauge	Oil level gauge	000213	00	G 2 1/2	CuZn40Pb2	0,7 kg
151	4	Kerbnagel	Grooved drive stud	DIN EN ISO 8746	00	2,5x8 - A	1.4404	0 kg
150	1	Typenschild GTW	Name plate	000540	00	95x67x0,5	1.4404	0 kg
119	1	Hohlschraube	Banjo bolt	001763	00	DIN 7643-3 / M10x1	St zinced	0 kg
118	1	Dichtkantenring	Edge sealing ring	001770	00	DKAZ M10	St zinced	0 kg
113	1	Dichtkantenring	Edge sealing ring	000221	00	DKAZ ¼	St zinced	0 kg
112	1	Rückschlagventil RC1	Non-return valve	000026	00	G 1/4	St	0 kg
111	1	Hydraulikschlauch	Hydraulic hose	R7 DN6	00	450mm	Polyflex	0,1 kg
110	1	Hohlschraube	Banjo bolt	000281	00	DIN 7643	St zinced	0 kg
75	1	Kabelverschraubung	Cable connection	001314	00	M12x1.5	Brass nickel plated	0 kg
73	1	Rundkopfschraube	Fillister Socked Head Screw	ISO 7380	00	M5x10	10.9 zinced	0 kg
72	1	Erdungskabel	Erthing Cable	000146	00	2 m		0 kg
71	16	Isolierhülse M8	Insulating bush	300192	00		Grivory GV4H	0 kg
70	2	Isolierscheibe, geteilt	Insulating disc	300193	02	ø525xø434x2	novapress 850	0,2 kg
68	2	O-Ring	O-ring	DIN 3771	00	110,72x3,53	NBR 90	0 kg
66	1	HAVIT SAE-Flansch AFC 4"	HAVIT SAE-Flange AFC 4"	303495	00		S235	3 kg
60	1	Ölablaufrohr DN100	Oil outlet pipe	303915	03	EN 1092-1/11/DN100/PN16	1.4404	10,1 kg
50.1	2	Zylinderschraube	Socket screw	DIN EN ISO 4762	00	M8x40	8.8 zinced	0 kg
50	1	Kammerdichtung W28-335 S	Rigid seal	302979	06		G-AlZn10Si8Mg	17,5 kg
40.1	2	Zylinderschraube	Socket screw	DIN EN ISO 4762	00	M8x40	8.8 zinced	0 kg
40	1	Kammerdichtung W28-355	Rigid seal	300292	07	(IP44)	G-AlZn10Si8Mg	10,2 kg
34	2	Zylinderstift	Pin	300231	00	ø20m6x45	PA66-GF30	0 kg
30.3	2	Zylinderschraube	Socket screw	DIN EN ISO 4762	00	M16x65	8.8	0,1 kg
30.2	2	Zylinderstift	Pin	DIN EN ISO 8733	00	ø16m6x40	St	0,1 kg
30	1	Lagerschale W-YQ 28-315	Bearing shell	303914	03		C10/C15 / GTW 89	206,6 kg
10.3	4	Zylinderschraube	Socket screw	DIN EN ISO 4762	00	M30x150	8.8 zinced	1,1 kg
10.2	2	Zylinderstift	Pin	DIN EN ISO 8733	00	ø20m6x50	St	0,1 kg
10.1	1	Isolierung	Insulation		00		Halar® ECTFE	0,2 kg
10	1	Lagergehäuse WP 28 isoliert	Pedestal housing	306196	00		EN-GJL-300	504,3 kg

Siemens AG
Energy Sector

Zeichnungs-Nr. / DRAWING NUMBER:
Auftrags-Nr. / ORDER NUMBER:
DPPPG - 7015 8485

INDEX: A

ISO 128

ECCN: EAR99 | AL: N | ECL: N | U.S.-Content: N

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GENERAL TOLERANCES
DIN ISO 2768 - mH

A2

SCALE: 1 : 100

WEIGHT: 761,7 kg

TITLE:
Gleitlager WPXYQ 28-315 TS
Slide bearing WPXYQ 28-315 TE

Assembly Siemens Erfurt - Hy+EK insulated

	DATE	NAME
DRAWN BY:	20.04.2018	SAN
CHECKED BY:	23.04.2018	CBE

GTW Gleitlagertechnik Weißbacher GmbH

DRAWING NUMBER: 452031

REVISION: 00

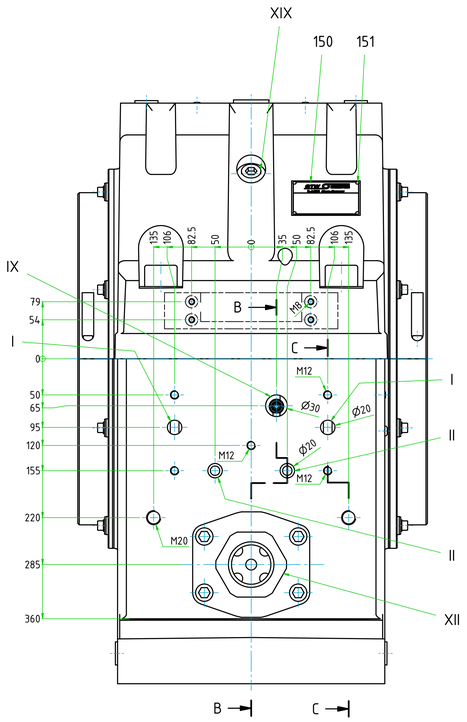
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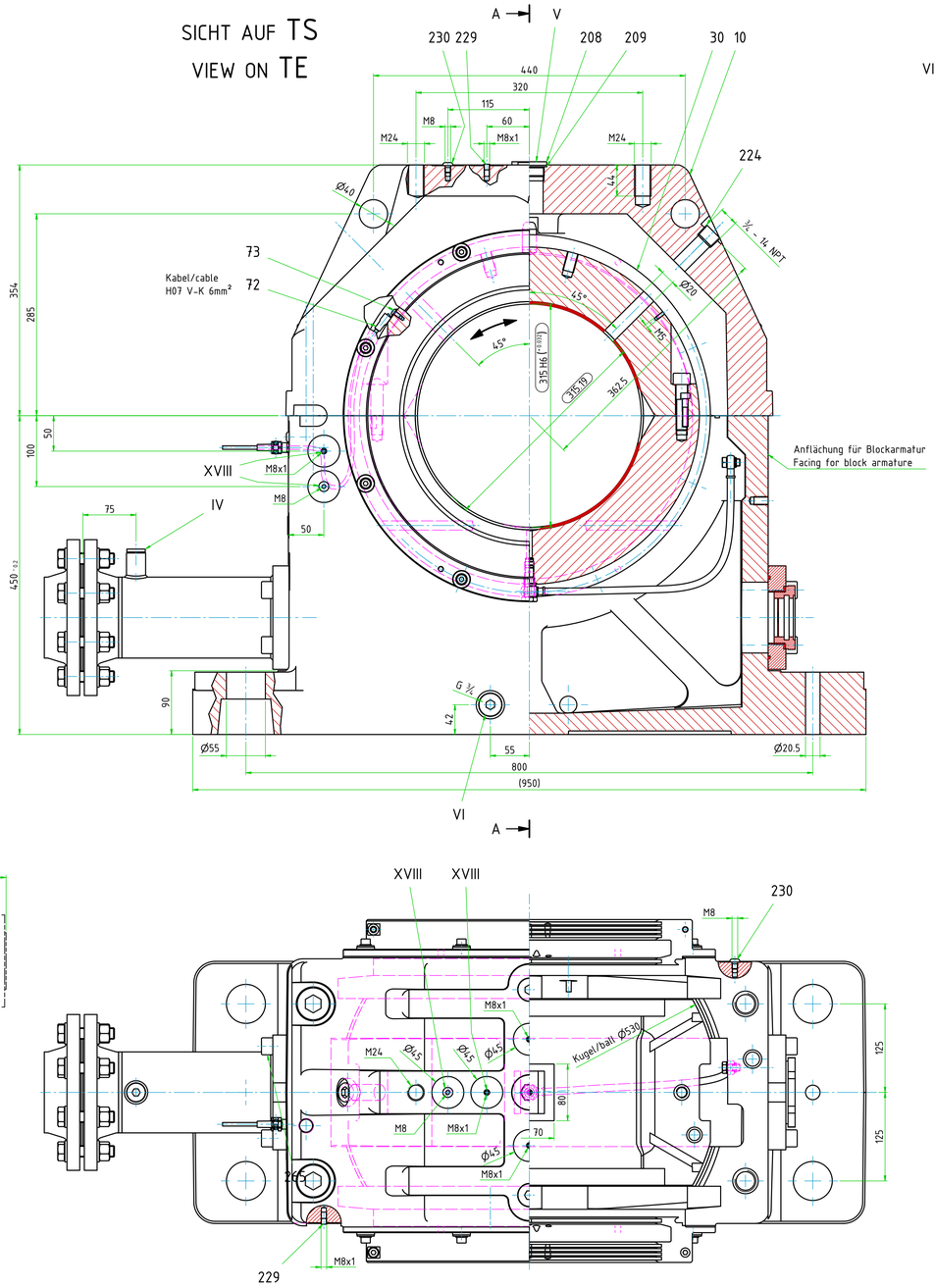
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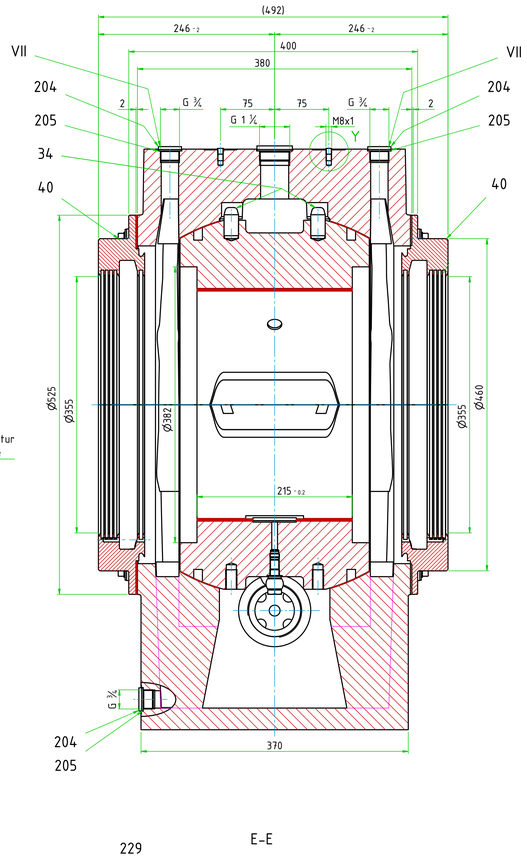
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VIEW ON TE



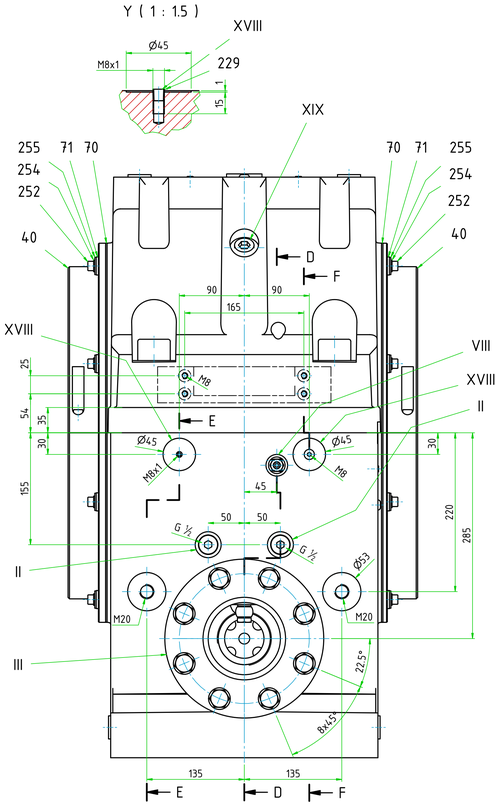
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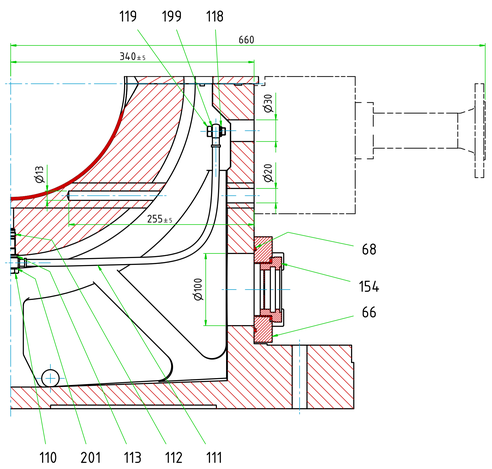
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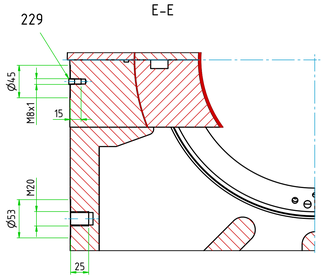
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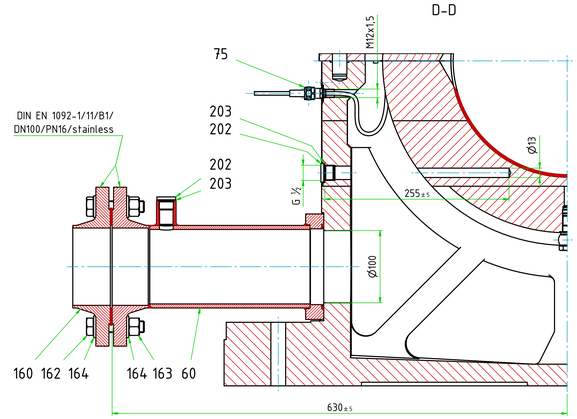
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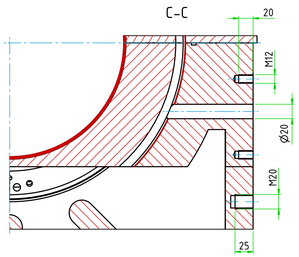
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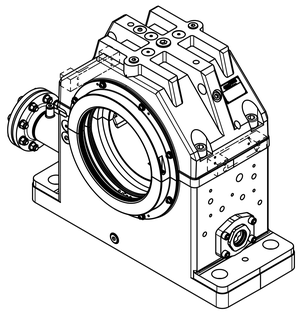


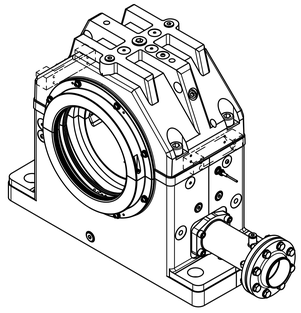
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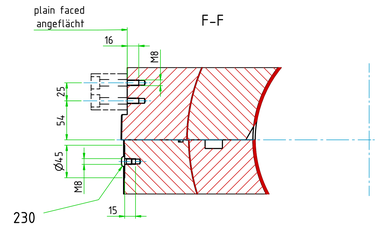
C-C







F-F



I	Ölzulauf bei Ölumlaufanlage radial	Circulation oil inlet radial
II	Temperaturmessung Lagerschale radial	Bearing metal temperature measurement radial
III	Ölablauf bei Ölumlaufanlage	Circulation pump oil outlet
IV	Anschluss für Ölsumpfthermometer	Connection for oil sump temperature measurement
V	Überprüfung Ölförderung des Schmierrings	Inspection of oil ring lubrication performance
VI	Ölablass	Oil drain
VII	Öleinfüllung bzw. Be- und Entlüftungsfilter	Oil filling or aeration filter
VIII	Erdungskabeldurchführung	Earthing cable lead - through
IX	Anschluss für Hydrostatik	Connection for hydrostatics
XII	Ölstandsanzeige	Oil level indicator
XVIII	Anschluss für Schwingungsmessung (Gehäuse)	Connection for vibration sensor (housing)
XIX	Anschluss für Schwingungsmessung (Welle)	Connection for vibration sensor (shaft)

Siemens AG
Energy Sector

Zeichnungs-Nr. / DRAWING NUMBER:
Auftrags-Nr. / ORDER NUMBER:
DPPPG - 7015 3217

INDEX: A
ISO 128

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GENERAL TOLERANCES DIN ISO 2768 - mH

A0

SCALE: 1 : 3
WEIGHT: 754.3 kg

TITLE:
Gleitlager WPXYQ 28-315 ES
Slide bearing WPXYQ 28-315 EE
Assembly Siemens Erfurt - Hy+EK insulated

	DATE	NAME
Drawn BY	12.01.2018	SMü
CHECKED BY	12.01.2018	GZO

GTW Gleitlagertechnik Weißwasser GmbH

DRAWING NUMBER: 452004
DIVISION: 00
1 OF 2 SHEETS

INDEX	DESCRIPTION OF CHANGE	DATE	NAME	ORIGIN

STATUS: Freigegeben

POS	QTY	BENENNUNG	DESCRIPTION	DWG NO	REV	DIMENSIONS	MATERIAL	MASS
265	8	Zylinderschraube	Socket screw	DIN EN ISO 4762	00	M16x45	8.8 zinced	0,1 kg
255	16	Unterlegscheibe	Washer	DIN 9021	00	8,4	100 HV zinced	0 kg
254	16	Unterlegscheibe	Washer	DIN 125	00	A 8,4	140 HV zinced	0 kg
252	16	Zylinderschraube	Socket screw	DIN EN ISO 4762	00	M8x30	8.8 zinced	0 kg
230	4	Rundkopfschraube	Fillister Socked Head Screw	ISO 7380	00	M8x10	10.9 zinced	0 kg
229	6	Verschlußschraube	Plug	DIN 906	00	M8x1	St zinced	0 kg
224	2	Verschlußstopfen	Plug	ANSI B1.20	00	3/4" NPT	St zinced	0,1 kg
209	1	Dichtring	Gasket	DIN 7603	00	A42x49x2	Cu	0 kg
208	1	Verschlußschraube	Plug	DIN 908	00	G1¼A	St zinced	0,2 kg
205	4	Dichtring	Gasket	DIN 7603	00	A27x32x2	Cu	0 kg
204	4	Verschlußschraube	Plug	DIN 908	00	G¾A	St zinced	0,1 kg
203	3	Dichtring	Gasket	DIN 7603	00	A21x26x1,5	Cu	0 kg
202	3	Verschlußschraube	Plug	DIN 908	00	G½A	St zinced	0 kg
201	1	Dichtring	Gasket	DIN 7603	00	A14x18x1,5	Cu	0 kg
199	1	Dichtring	Gasket	DIN 7603	00	A10x13x1	Cu	0 kg
164	16	Unterlegscheibe	Washer	DIN 125	00	A 17	A2-70	0 kg
163	8	Sechskantmutter	Hexagon nut	DIN EN ISO 4032	00	M16	A2-70	0 kg
162	8	Sechskantschraube	Hexagon head screw	DIN EN 24017		M16x70	A2-70	0,1 kg
161	1	Flachdichtung PN16	Gasket	DIN 2690	00	DN100	KLINGERsil C-4400	0 kg
160	1	Vorschweißflansch	Welding neck flange	DIN EN 1092-1	00	11/B1/DN100x3,6/PN16	1.4404/1.4571	4,6 kg
159	1	Curil T- Dichtmasse	Sealing compound	000131	00	Tube 75ml		0 kg
154	1	Ölstandsauge	Oil level gauge	000213	00	G 2 1/2	CuZn40Pb2	0,7 kg
151	4	Kerbnagel	Grooved drive stud	DIN EN ISO 8746	00	2,5x8 - A	1.4404	0 kg
150	1	Typenschild GTW	Name plate	000540	00	95x67x0,5	1.4404	0 kg
119	1	Hohlschraube	Banjo bolt	001763	00	DIN 7643-3 / M10x1	St zinced	0 kg
118	1	Dichtkantenring	Edge sealing ring	001770	00	DKAZ M10	St zinced	0 kg
113	1	Dichtkantenring	Edge sealing ring	000221	00	DKAZ ¼	St zinced	0 kg
112	1	Rückschlagventil RC1	Non-return valve	000026	00	G 1/4	St	0 kg
111	1	Hydraulikschlauch	Hydraulic hose	R7 DN6	00	450mm	Polyflex	0,1 kg
110	1	Hohlschraube	Banjo bolt	000281	00	DIN 7643	St zinced	0 kg
75	1	Kabelverschraubung	Cable connection	001314	00	M12x1.5	Brass nickel plated	0 kg
73	1	Rundkopfschraube	Fillister Socked Head Screw	ISO 7380	00	M5x10	10.9 zinced	0 kg
72	1	Erdungskabel	Erthing Cable	000146	00	2 m		0 kg
71	16	Isolierhülse M8	Insulating bush	300192	00		Grivory GV4H	0 kg
70	2	Isolierscheibe, geteilt	Insulating disc	300193	02	ø525xø434x2	novapress 850	0,2 kg
68	2	O-Ring	O-ring	DIN 3771	00	110,72x3,53	NBR 90	0 kg
66	1	HAVIT SAE-Flansch AFC 4"	HAVIT SAE-Flange AFC 4"	303495	00		S235	3 kg
60	1	Ölablaufrohr DN100	Oil outlet pipe	303915	03	EN 1092-1/11/DN100/PN16	1.4404	10,1 kg
40.1	2	Zylinderschraube	Socket screw	DIN EN ISO 4762	00	M8x40	8.8 zinced	0 kg
40	2	Kammerdichtung W28-355	Rigid seal	300292	07	(IP44)	G-AlZn10Si8Mg	10,2 kg
34	2	Zylinderstift	Pin	300231	00	ø20m6x45	PA66-GF30	0 kg
30.3	2	Zylinderschraube	Socket screw	DIN EN ISO 4762	00	M16x65	8.8	0,1 kg
30.2	2	Zylinderstift	Pin	DIN EN ISO 8733	00	ø16m6x40	St	0,1 kg
30	1	Lagerschale W-YQ 28-315	Bearing shell	303914	03		C10/C15 / GTW 89	206,6 kg
10.3	4	Zylinderschraube	Socket screw	DIN EN ISO 4762	00	M30x150	8.8 zinced	1,1 kg
10.2	2	Zylinderstift	Pin	DIN EN ISO 8733	00	ø20m6x50	St	0,1 kg
10.1	1	Isolierung	Insulation		00		Halar® ECTFE	0,2 kg
10	1	Lagergehäuse WP 28 isoliert	Pedestal housing	306196	00		EN-GJL-300	504,3 kg

Siemens AG
Energy Sector

Zeichnungs-Nr. / DRAWING NUMBER:
Auftrags-Nr. / ORDER NUMBER:
DPPPG - 7015 3217

INDEX A

ISO 128

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GENERAL TOLERANCES DIN ISO 2768 - mH

A2

SCALE: 1 : 3

WEIGHT: 754,3 kg

TITLE:
Gleitlager WPXYQ 28-315 ES
Slide bearing WPXYQ 28-315 EE
Assembly Siemens Erfurt - Hy+EK insulated

	DATE	NAME
DRAWN BY:	12.01.2018	SWi
CHECKED BY:	12.01.2018	GZO

GTW Gleitlagertechnik Weißbacher GmbH

DRAWING NUMBER: 452004

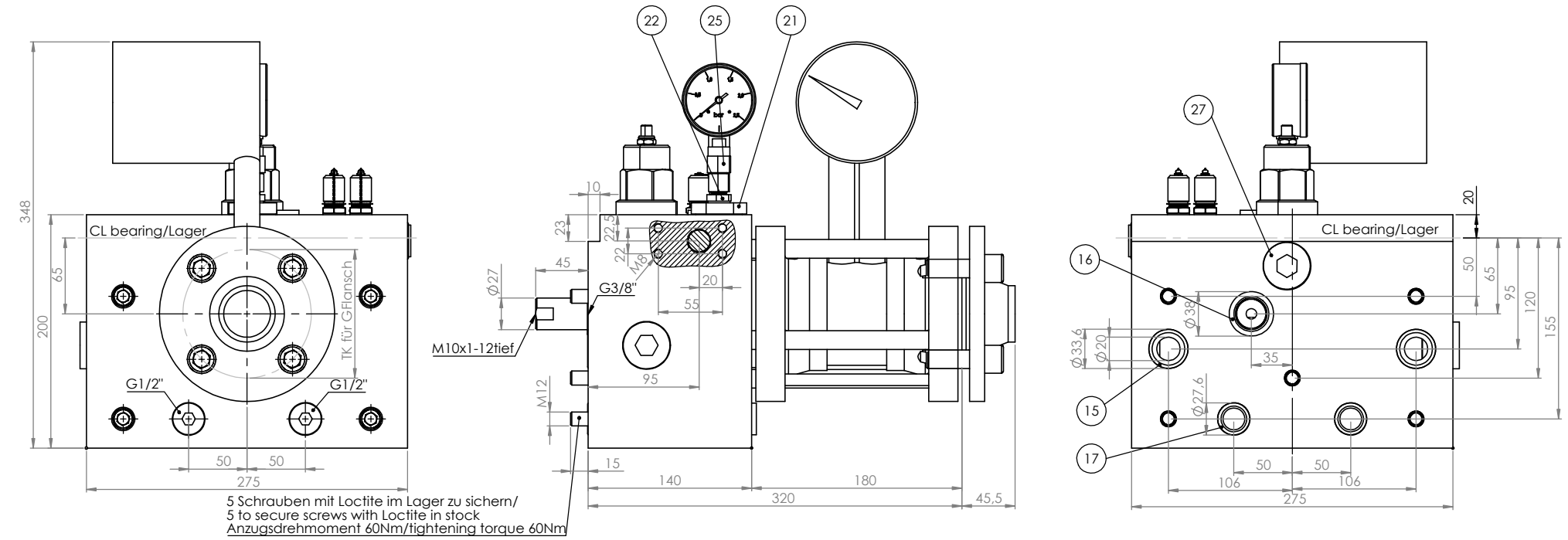
REVISION 00

2 OF 2 SHEETS

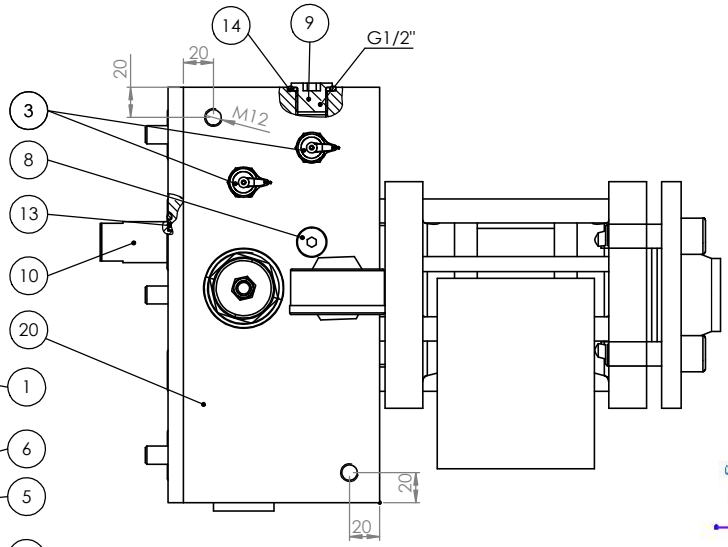
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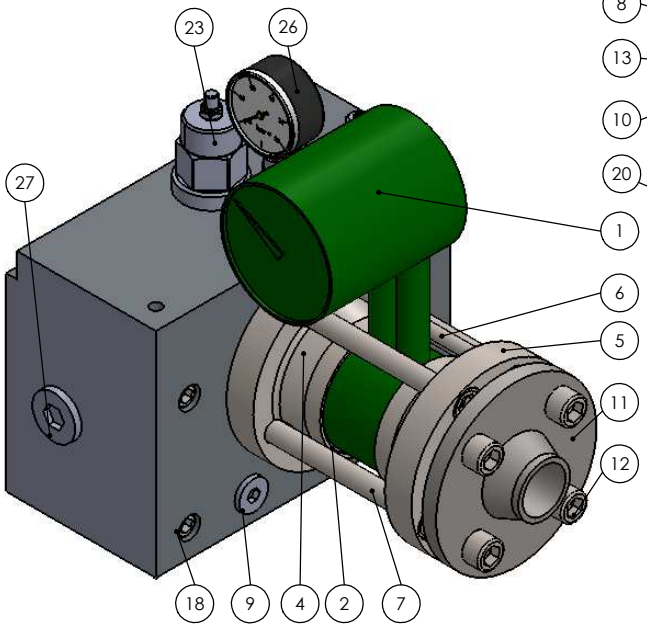
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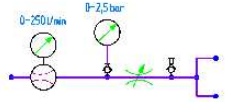
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5 Schrauben mit Loctite im Lager zu sichern/
5 to secure screws with Loctite in stock
Anzugsdrehmoment 60Nm/tightening torque 60Nm







ECCN: EAR99	AL: N	ECL: N	U.S.-CONTENT: N

POS-NR.	MENGE	BENENNUNG
27	2	Verschraubung/screw connection VS-R 1-WD
26	1	Manometer 0-2,5 bar, Einheit bar/psi Gauge 0-2,5 bar, unit bar / psi
25	1	Verschraubung/screw connection EMASD 8LR
23	1	Drosselventil/Throttle valve
22	1	Verschraubung/screw connection GES 8 LR-WD
21	1	Verschraubung/screw connection RED-R1-WD R1-4
20	1	567303_Block NG28 Al
18	5	Schraube/bolt DIN 912 M12 x 140 zn 8.8
17	2	O-Ring 24x2,0 NBR 70 Shore
16	1	O-Ring 32x3,0 NBR 90 Shore
15	2	O-Ring 30x2,0 NBR 70 Shore
14	1	O-Ring 26x3,0 NBR 90 Shore
13	1	O-Ring 22x2,0 NBR 90 Shore
12	4	Schraube/bolt DIN 912 M16 x 50
11	1	Vorschweißflansch/flange DIN40 PN16/ANSI 1 1/2" 150 lbs
10	1	Hydrostatik Anschlussbuchse für NG28/hydrostatic connection socket for NG28
9	3	Verschlussschraube/locking screw VS-R 1/2"-WD
8	1	Verschlussschraube/locking screw VS-R 1/4"-WD
7	4	Schraube/bolt DIN 912 M16 x 190
6	2	Schraube/bolt DIN 912 M10 x 160
5	1	Anschlussflansch/flange NG28
4	1	Flansch am Block/flange NG28
3	2	Schraubkupplung/threaded G1/4"
2	4	Dichtungen/seal
1	1	Durchflussmessgerät/flow meter 1.4571Messbereich/measuring: range 16-100l/min Einheit /unit: Liter/Gallon Anzeige/display: bis 100l/min

F889396	DN40	Stahl
F889398	ANSI 1 1/2"	Stahl
567304-01	DN40	VA
F889394	ANSI 1 1/2"	VA

Letzte Speicherung durch, am.
risch, 21.03.2017 09:10:36

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Allgemeintoleranzen ISO 2768-m
Schweißteiltoleranzen ISO 13920-AF
Kanten ohne Angabe 0,2x45° gefast

	Datum/Date	Name/Name
Gezeichnet	14.03.2017	H. Risch
Geprüft		
Freigabe In		
Freigabe Ex		

Nr/No.	Änderung/Revision	Datum/Date	Name

Fluidtechnik
hydraulik-pneumatik
Friedensstraße 14 · 71687 Geeigenmöd · Tel. 07433-31710
www.fluidtechnik.de

Maßstab, Format/scale: A2
Gewicht/Weight: [kg] 32.72
Werkstoff/Material:
Auftrags-Nr/Order-No:

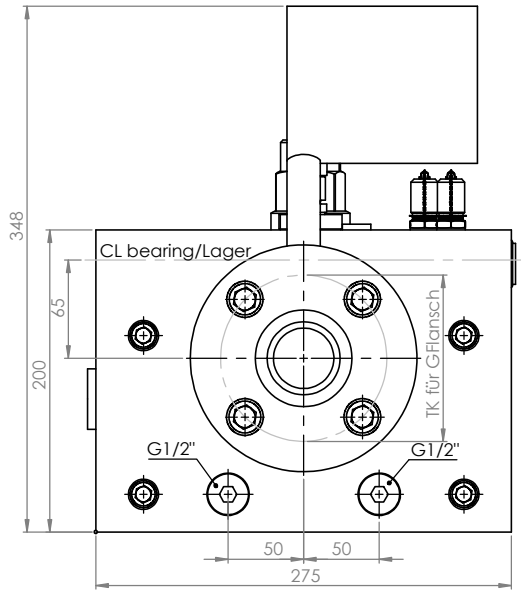
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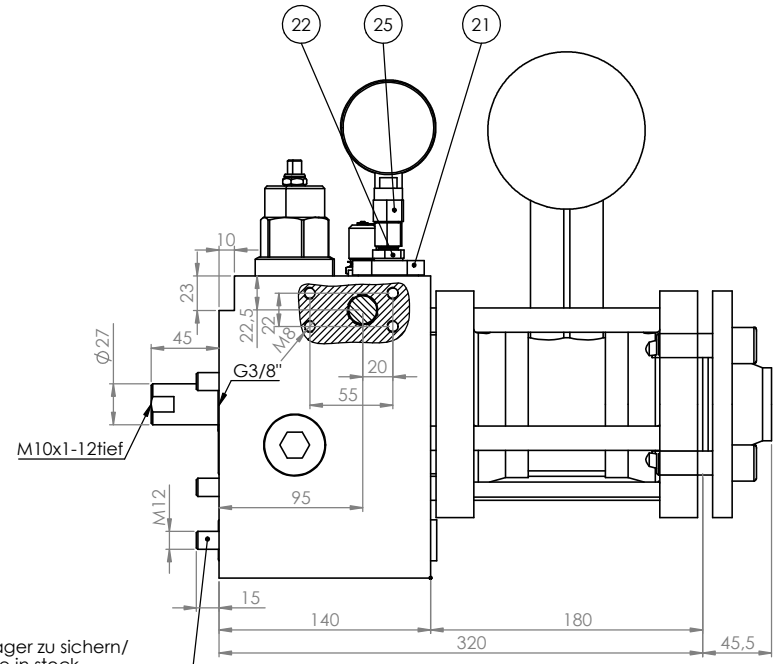
Ölzulauf NG28 re-li
oilinlet size 28 ri-le

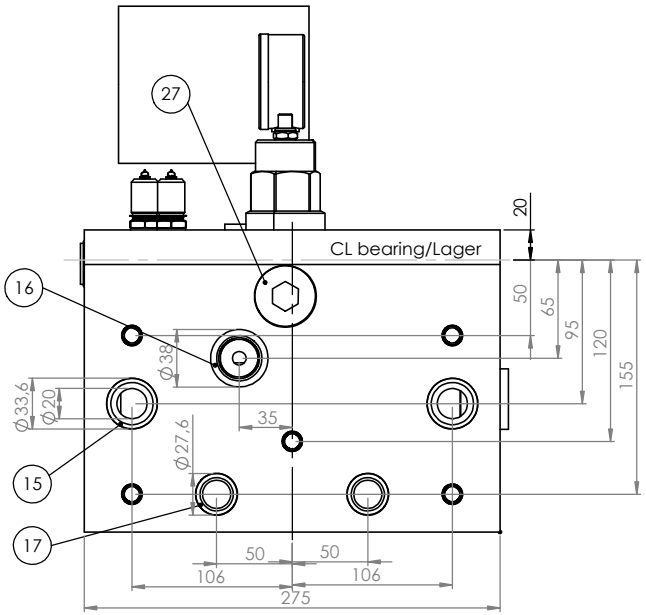
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Siemens: DPPPG-70133342-001

Blatt/sheet: 1/1

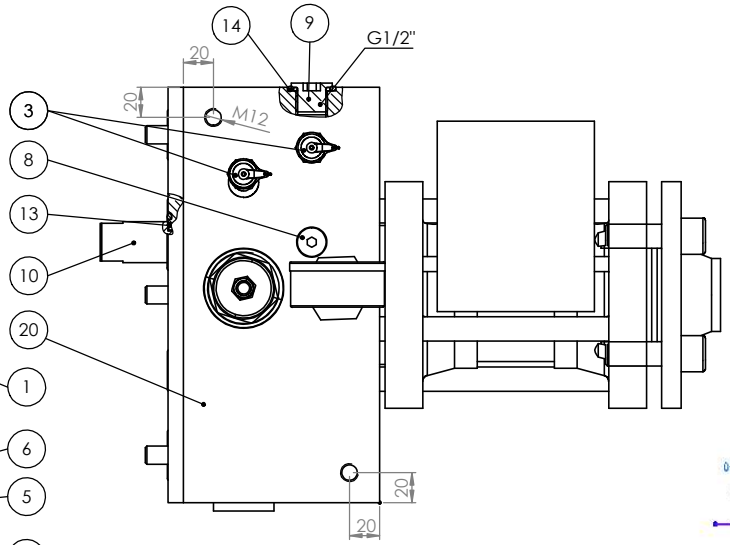
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Ers. durch:

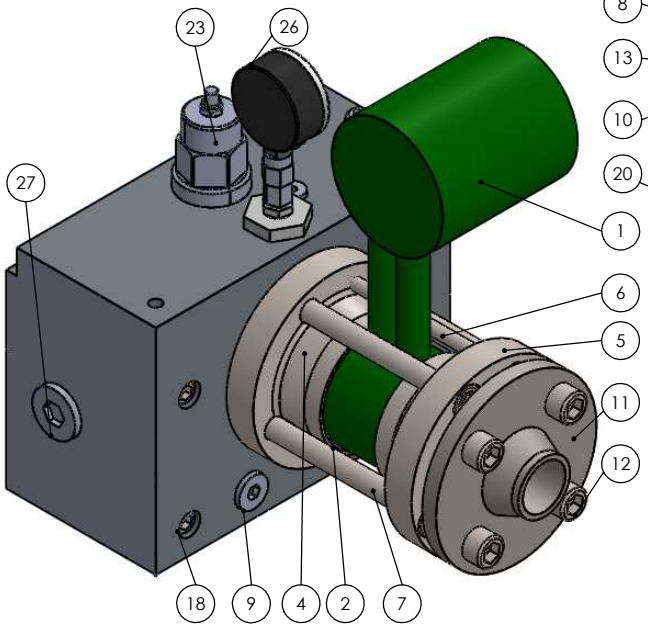


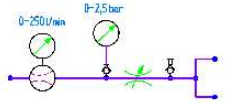




5 Schrauben mit Loctite im Lager zu sichern/
5 to secure screws with Loctite in stock
Anzugsdrehmoment 60Nm/tightening torque 60Nm







ECCN: EAR99	AL: N	ECL: N	U.S.-CONTENT: N

POS-NR.	MENGE	BENENNUNG
27	2	Verschraubung/screw connection VS-R 1-WD
26	1	Manometer 0-2,5 bar, Einheit bar/psi Gauge 0-2,5 bar, unit bar / psi
25	1	Verschraubung/screw connection EMASD 8LR
23	1	Drosselventil/Throttle valve
22	1	Verschraubung/screw connection GES 8 LR-WD
21	1	Verschraubung/screw connection RED-R1-WD R1-4
20	1	567303_Block NG28 Al
18	5	Schraube/bolt DIN 912 M12 x 140 zn 8.8
17	2	O-Ring 24x2,0 NBR 70 Shore
16	1	O-Ring 32x3,0 NBR 90 Shore
15	2	O-Ring 30x2,0 NBR 70 Shore
14	1	O-Ring 26x3,0 NBR 90 Shore
13	1	O-Ring 22x2,0 NBR 90 Shore
12	4	Schraube/bolt DIN 912 M16 x 50
11	1	Vorschweißflansch/flange DIN40 PN16/ANSI 1 1/2" 150 lbs
10	1	Hydrostatik Anschlussbuchse für NG28/hydrostatic connection socket for NG28
9	3	Verschlussschraube/locking screw VS-R 1/2"-WD
8	1	Verschlussschraube/locking screw VS-R 1/4"-WD
7	4	Schraube/bolt DIN 912 M16 x 190
6	2	Schraube/bolt DIN 912 M10 x 160
5	1	Anschlussflansch/flange NG28
4	1	Flansch am Block/flange NG28
3	2	Schraubkupplung/threaded G1/4"
2	4	Dichtungen/seal
1	1	Durchflussmessgerät/flow meter 1.4571Messbereich/measuring: range 16-100l/min Einheit /unit: Liter/Gallon Anzeige/display: bis 100l/min

F889397	DN40	Stahl
F889399	ANSI 1 1/2"	Stahl
567847-01	DN40	VA
F889395	ANSI 1 1/2"	VA

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Allgemeintoleranzen ISO 2768-m
Schweißteiltoleranzen ISO 13920-AF
Kanten ohne Angabe 0,2x45° gefast

Letzte Speicherung durch, am:
risch, 22.03.2017 11:42:43

Maßstab, Format/scale:	A2	Gewicht/Weight: [kg]	32.72
Werkstoff/Material:		Auftrags-Nr/Order-No:	

	Datum/Date	Name/Name
Gezeichnet	14.03.2017	H. Risch
Geprüft		
Freigabe In		
Freigabe Ex		

Benennung/Title:

Ölzulauf NG28 li-re
oilinlet size 28 le-ri

Fluidtechnik
hydraulik-pneumatik
Friedensstraße 14 99867 Georgenthal Tel. 036253-31710
www.fluidtechnik.de

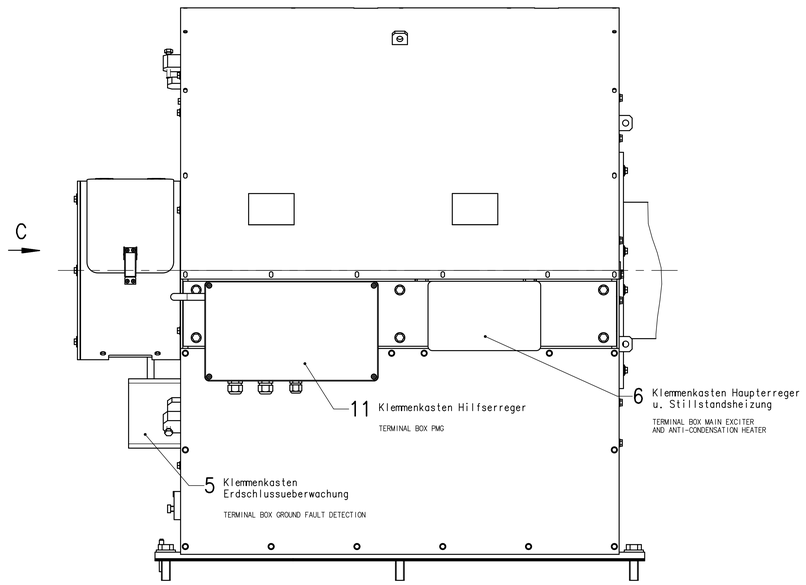
Zeichnungs-Nr/Drawing No:
FTG: 567847-01
Siemens: DPPPG-70133342-002

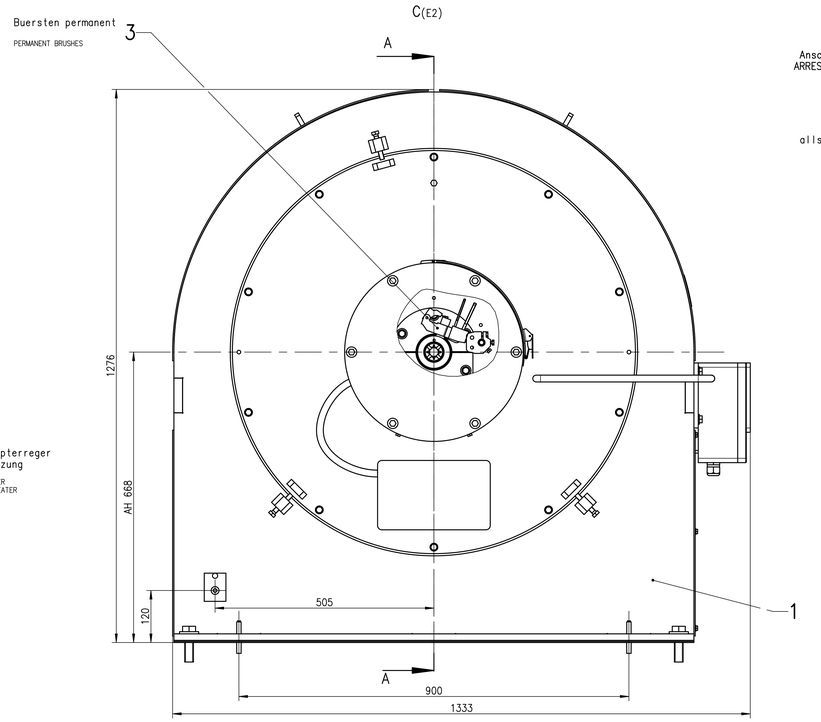
Blatt/sheet: 1/1

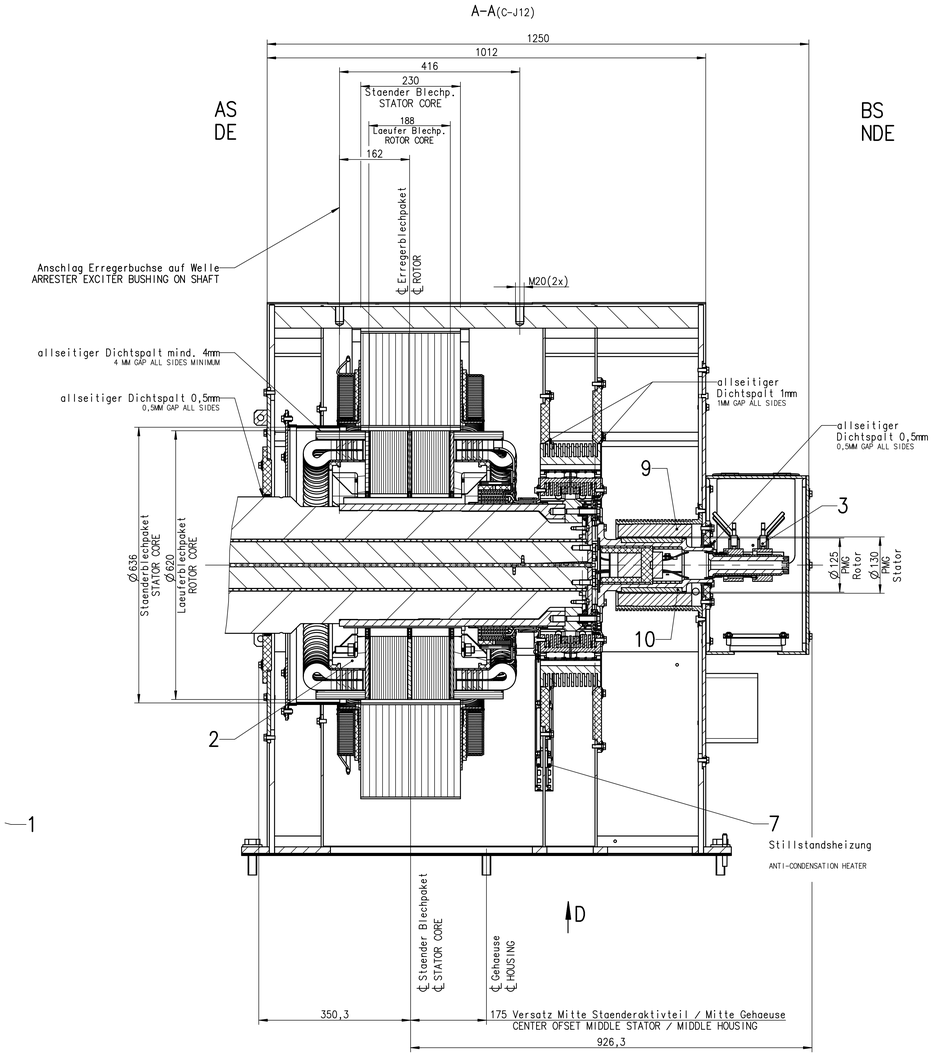
Nr/No.	Änderung/Revision	Datum/Date	Name

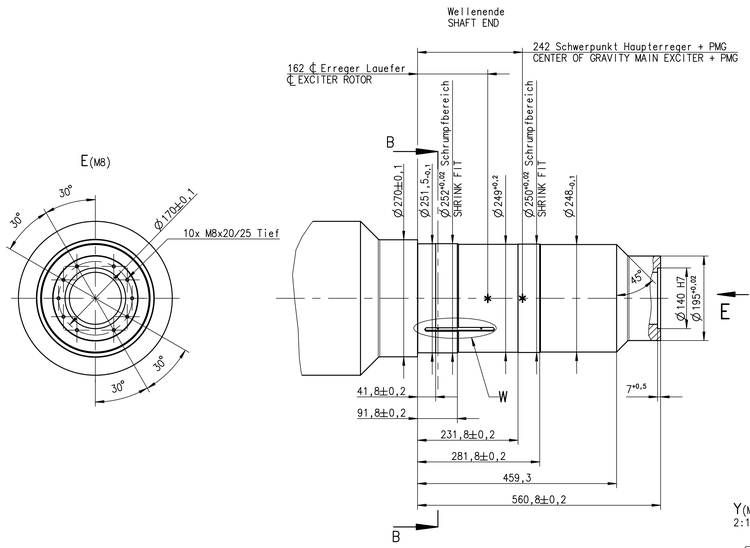
Ers. für: | Ers. durch:

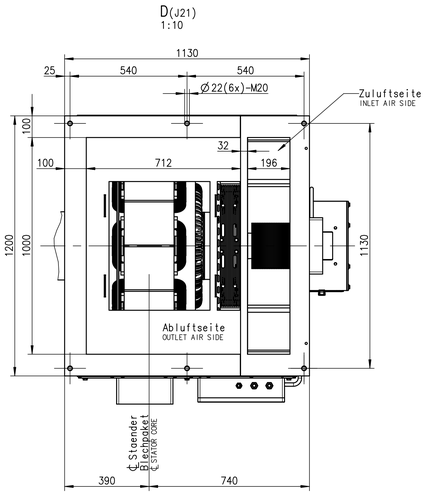
Baugruppe / ASSEMBLY	Gewicht/WEIGHT
Staender/STATOR	1660 kg
Laeufer/ROTOR	580 kg
Staender HiErr/STATOR PMG	19 kg
Laeufer HiErr/ROTOR PMG	16,5 kg

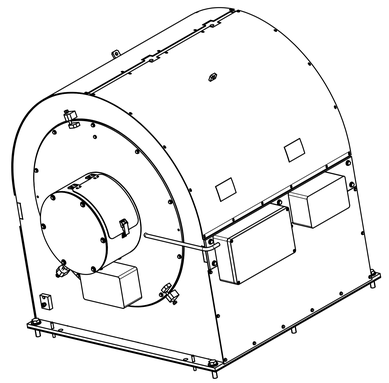


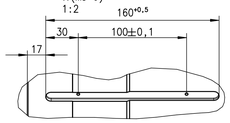


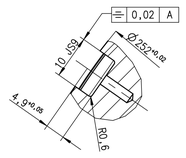


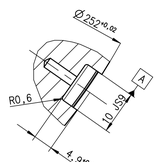












Wellensitze vor der Montage des Laeufers mit Fett Alltemp Q NB50 einstreichen.
COAT SHAFT FIT WITH GREASE ALLTEMP Q NB50 BEFORE ASSEMBLY ROTOR

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Technology Classification:

ECCN: EAR99 AL: N US-Content: NO

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Siemens AG
Energy Sector

WEIGHT:	2240 KG	SCALE: 1:5; 1:10	SPEC.:KUN351.00
ORIGINATED:	2014-05-14 KRAUSS	TITLE:	MASZBILD ERREGERMASCHINE AH668
CHECKED:	2014-05-14 BARTH		OUTLINE DRAWING EM
RELEASED:	2014-05-14 KRAUSS	LANG. - DRAWING NO. / VALUE:	DPPPG-70067248
			26-EXC0100-70067248
			ELR 62/19-30(36)/8-2S
		REV.:	A
		SHEET:	1/1

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Z01K4FB - 2018-11-15 - DWG\DPPPG-70067248\000\A

Pro/ENGINEER A0

Maßbildtext ***DIMENSIONAL DRAWING TEXT***	**Vilnius Biomass**
Zeichnungsnummer/*DRAWING NUMBER*: **DPPPG-70162509**	RK.-Nr./W.-NO.: **EG000367**

Index	**Datum** ***Date***	**bearbeitet** ***constr.***	**geprüft** ***checked***	**Änderungsbeschreibung** ***Description of Revision***
a	2018-05-29	Liebergeld	Schmitt	Erstausgabe / first release

Maßbild **DPPPG-70067248**
DIMENSIONAL DRAWING

Inhaltsverzeichnis	***TABLE OF CONTENTS***	**Seite/ Page**
Haupterregermaschine	***MAIN EXCITER***	
Nenndaten	*TECHNICAL DATA*	2
Bauform	*TYPE OF CONSTRUCTION*	2
Gewichte	*WEIGHTS*	2
Allgemeine Daten	*GENERAL DATA*	2
Hilfserregermaschine	***PILOT EXCITER***	3
Nenndaten	*TECHNICAL DATA*	3
Gewichte	*WEIGHTS*	3
Allgemeine Daten	*GENERAL DATA*	3

ECCN: EAR99	AL: N	ECL: N	US-Content: N

SIEMENS	Form	Z.-Sys.	Zeichnungs-Nummer / DRAWING NUMBER	Index	Blatt / SHEET 1
			DPPPG-70162509		
ERF EN1	44		26-EXC0110-70162509	**a**	Von / OF 3

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Spr. Kz.

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POS.	Nenndaten	*RATINGS*	Wert S1 *VALUE*	Wert S2 (10s) *VALUE*	Einheit *DIM.*	REV.

Erregermaschine Typ: ELR 62/19-30/8-2S

	Nenndaten	***RATINGS***				
	Leistung	*POWER*	186,4	745,5	kW	
	Drehzahl	*SPEED*		3000	min^{-1}	
	Drehrichtung, bei Sicht von Turbine auf Gen.	*DIRECTION OF ROTATION, VIEW FROM TURBINE TO GEN.*	Gegenuhrzeigersinn /Counterclockwise			
	Spannung	*VOLTAGE*	213	426	V	
	Strom	*CURRENT*	875	1750	A	
	Fremderregung	*SEPARATE*	60 11,8	122 23,7	V A	
	Bauform	***TYPE OF CONSTRUCTION***				
	Bauform (DIN IEC 34 T.7)	*TYPE OF CONSTRUCTION*	IM 5410			
	Schutzart (DIN IEC 34 T.5)	*DEGREE OF PROTECTION*	IP 54			
	Gewichte	***WEIGHTS***				
1	HEM Ständer	*STATOR*	1660		kg	
2	HEM Rotor	*ROTOR*	580		kg	
	Allgemeine Daten	***GENERAL DATA***				
	Läuferträgheitsmoment	*ROTOR MOMENT OF INTERIA*	31,4		kgm^2	
3	Messbürsten permanent	*MEASURING BRUSHES PERMANENT*	Ja / YES			
5	Klemmenkasten Erdschlußüberwachung	*TERMINAL BOX GROUND FAULT DETECTION*	+V20MKC20GA010			
6	Klemmenkasten Feldwicklung u. Heizkörper	*TERMINAL BOX FIELD WINDING ANTICONDENSATION HEATER*	+V20MKC20GE010			
7	Stillstandsheizung	*ANTICONDENSATION HEATER*	200 (AC) 2x100		V W	

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ECCN: EAR99	AL: N	ECL: N	US-Content: N

SIEMENS	Form	Z.-Sys.	Zeichnungs-Nummer / DRAWING NUMBER	Index	Blatt / SHEET
ERF EN1	44		DPPPG-70162509 26-EXC0110-70162509	a	2 Von / OF 3

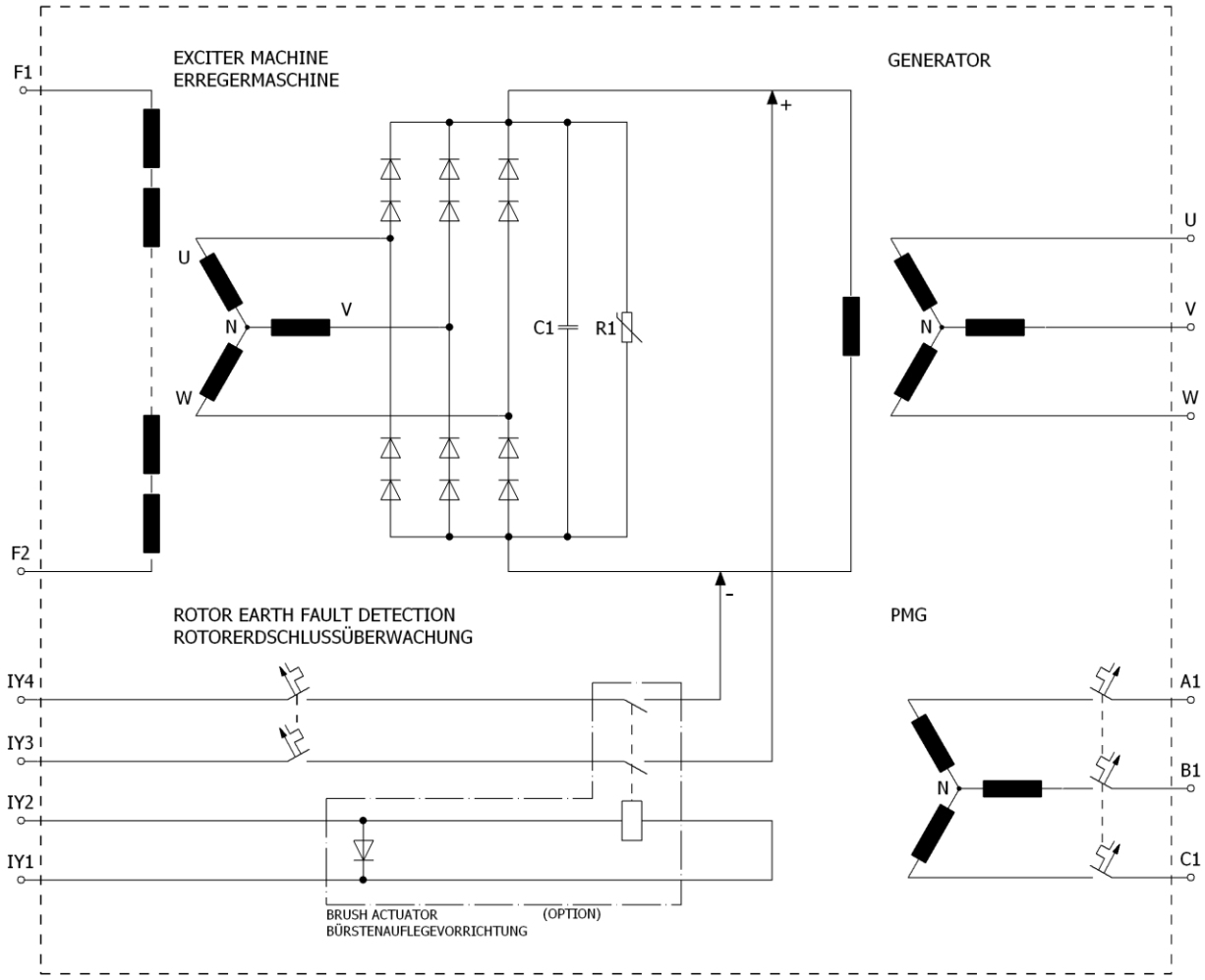
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POS.	Nenndaten	*RATINGS*	Wert S1 *VALUE*	Wert S2 (10s) *VALUE*	Einheit *DIM.*	REV.

	Hilfserreger	***PMG***	**ATE DC 190/90/6**			
	Nenndaten	***RATINGS***				
	Leistung	*POWER*	9,9	12,7	kVA	
	Spannung	*VOLTAGE*	248	244	V	
	Strom	*CURRENT*	23,0	30,0	A	
	cos phi		0,99			
	Gewichte	***WEIGHTS***				
9	HiE Ständer	*PMG STATOR*	19		kg	
10	HiE Rotor	*PMG ROTOR*	16,5		kg	
	Allgemeine Daten	***GENERAL DATA***				
11	Klemmenkasten mit 2. Einspeisung	*TERMINAL BOX*	+V20MKC10GE010			



ECCN: EAR99	AL: N	ECL: N	US-Content: N

SIEMENS	Form	Z.-Sys.	Zeichnungs-Nummer / DRAWING NUMBER	Index	Blatt / SHEET 3
ERF EN1	44		**DPPPG-70162509**	**a**	Von / OF 3
			26-EXC0110-70162509		

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Erregermaschine mit T. 60-80 auf dem Grundrahmen ausrichten und mit T.170/180 sichern. Gehaeuse auf BS-Seite zum Grundrahmen 2x aufbohren und mit T.240-260 verstiften.

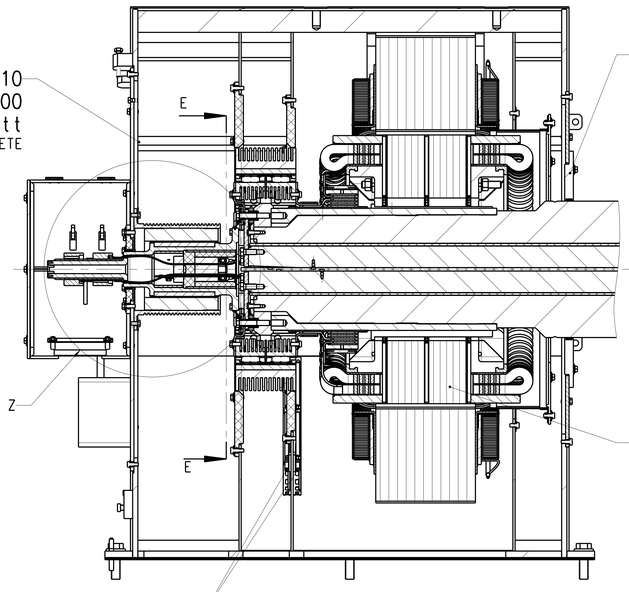
ALIGN EXCITER MACHINE WITH IT.60-80 AT BASE FRAME AND SECURE WITH IT.170/180. DRILL OUT 2 BORE HOLES AT BS_SIDE OF EXCITER TO BASE FRAME AND PIN WITH IT.240-260

T.120, 130, 140, 270 und 310 nur in Stueckliste
IT.120, 130, 140, 270 AND 310 ONLY IN BILL OF MATERIAL

BS
NDE

A-A(K-R,13)

AS
DE



10
EXC2000
Staender komplett
STATOR COMPLETE

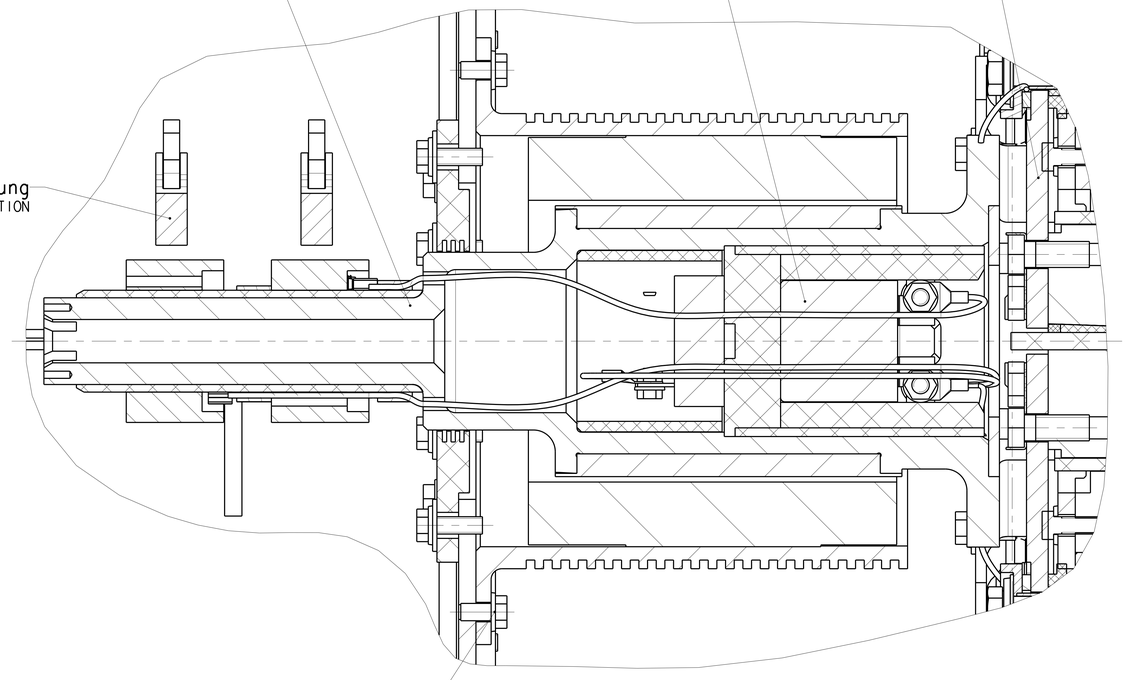
Dichtring Gehaeuseschild
SEAL RING HOUSING END SHIELD

Spaltmasze fuer Dichtringe nach EXC0100 Maszbild
GAP FOR SEAL RINGS ACC. TO EXC0100 DIMENSIONAL DRAWING

20
EXC3000
Laeufer komplett
ROTOR COMPLETE

Stillstandsheizung
ANTICONDENSATION HEATER

Z (D,6)
1:1



Hilfserreger Laeufer
PMG ROTOR

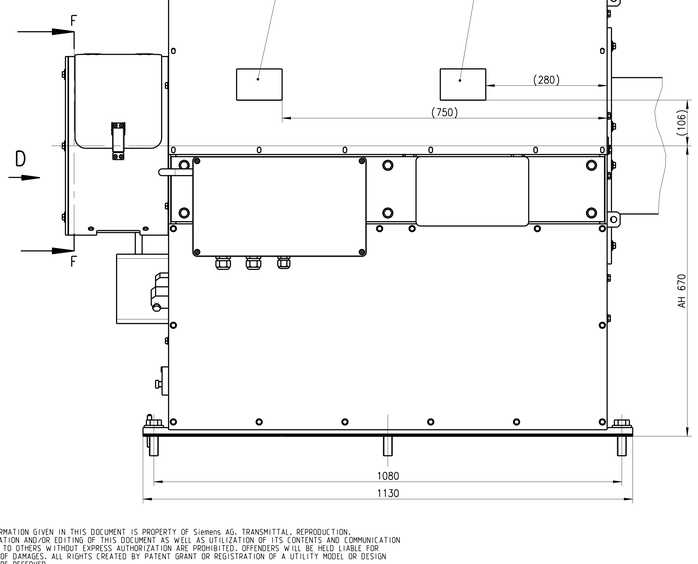
RG-Beschaltungsblock
RR-NETWORK ASSEMBLY

Gleichstromleitung
DC LEAD

Erdschlussueberwachung
GROUND FAULT DETECTION

220,230 (6x)

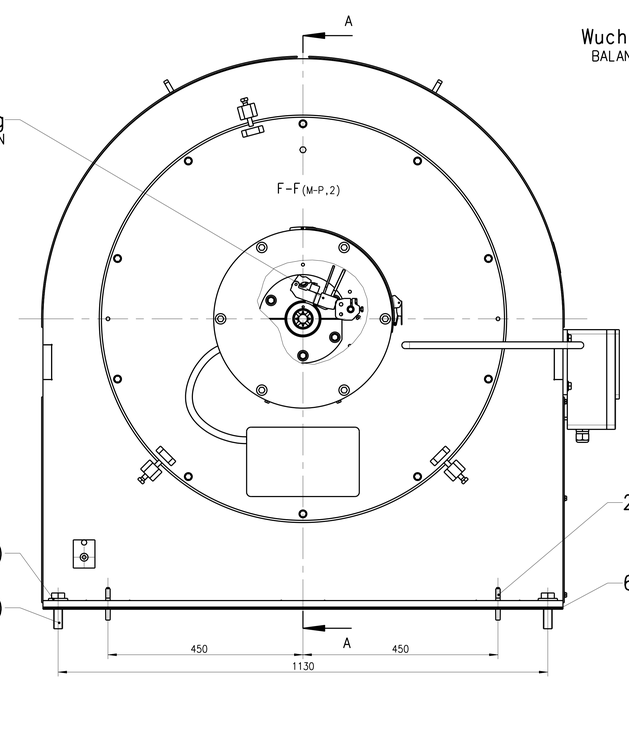
E-E(C-F,6)
2:5



Leistungsschild Hilfserreger
RATING PLATE PMG

100
Leistungsschild Haupterreger
RATING PLATE MAIN EXCITER

D(N,2)



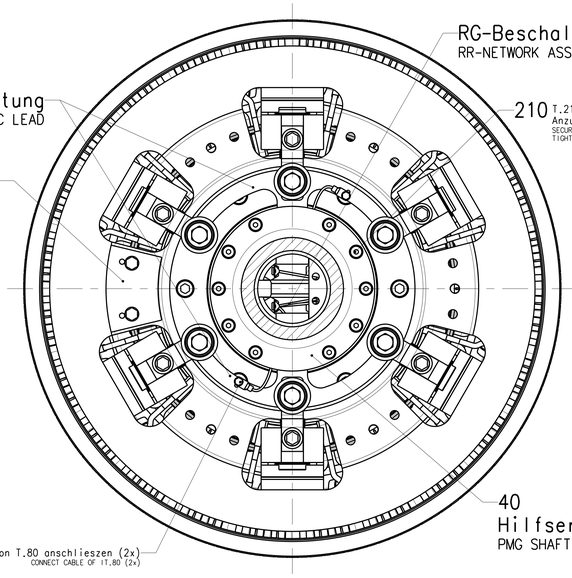
Erdschlussueberwachung
GROUND FAULT DETECTION

180 (6x)

170 (6x)

240,250,260 (2x)

60/70/80



RG-Beschaltungsblock
RR-NETWORK ASSEMBLY

Gleichstromleitung
DC LEAD

Wuchtgewichte
BALANCING WEIGHTS

210 T.210 mit Loctite T.190 gesichert
Anzugsmoment: 34 Nm
SECURE IT.210 WITH IT.190 LOCTITE
TIGHTENING TORQUE: 34 NM

40
Hilfserreger Laeufer
PMG SHAFT

Kabel von T.80 anschlieszen (2x)
CONNECT CABLE OF IT.80 (2x)

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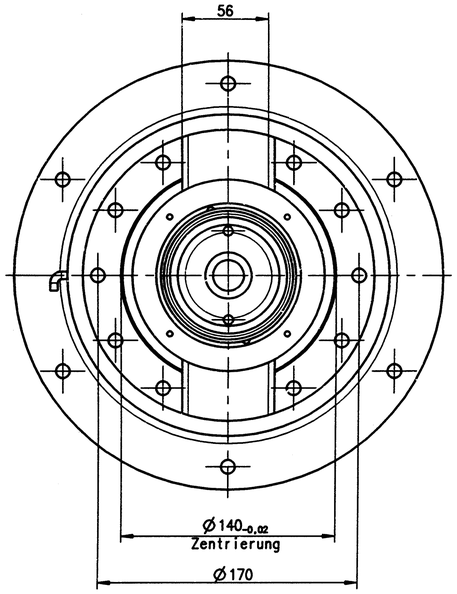
Siemens AG Energy Sector			
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ORIGINATED: 2014-08-04 KRAUSS	TITLE: ERREGERMASCHINE KOMPLETT ELR 62/19-30(36)/8-2S		
CHECKED: 2014-08-04 BARTH	EXCITER MACHINE COMPLETE		
RELEASED: 2014-08-04 KRAUSS	LANG. - DRAWING NO. / VALUE: DPPPG-70067255		
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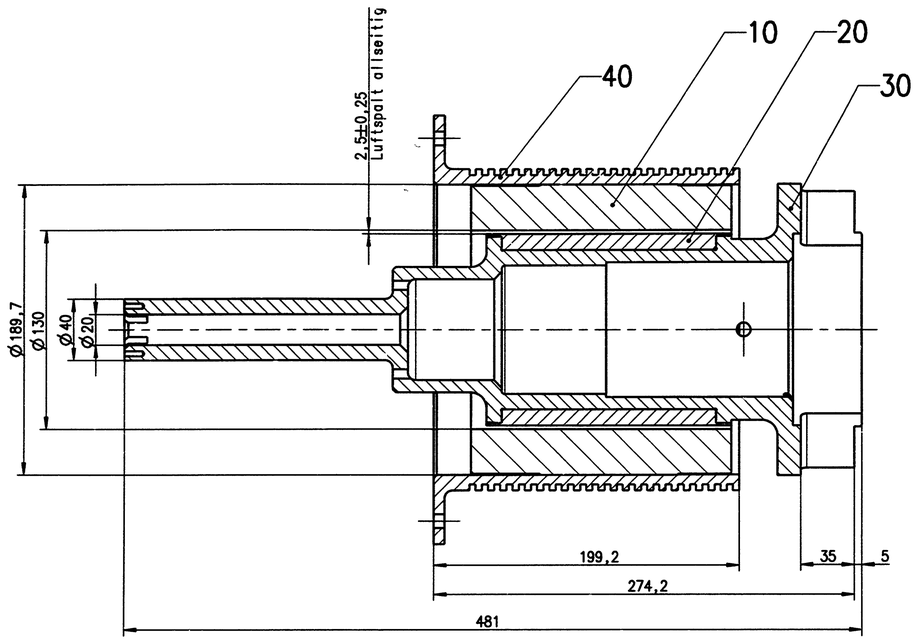
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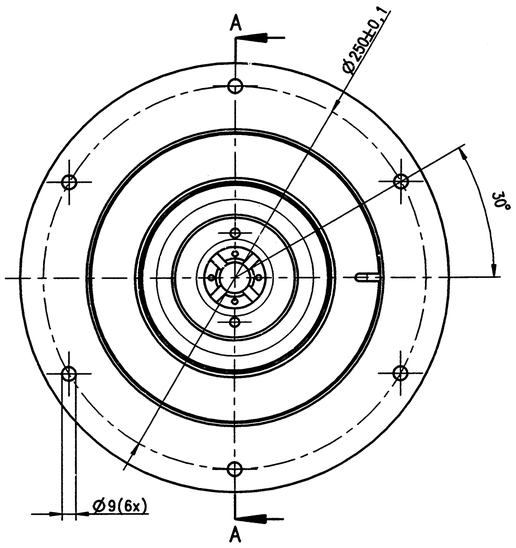
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Schnitt A-A
SECTION A-A







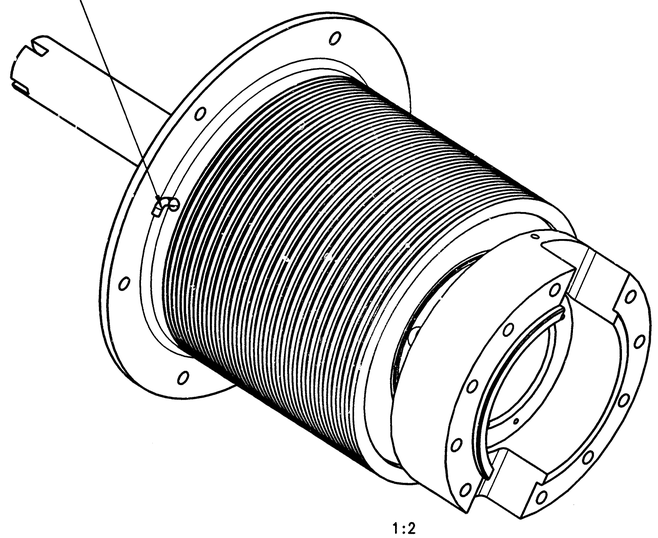
Technische Daten

Nenndrehzahl: 3000/3600 U/min
Schleuderdrehzahl: 4350 U/min für 2min
Kühllufttemperatur: max. 60°C

Werte für 3000 U/min:
Leerlaufspannung: <275 V (bezogen auf magnetische Mitte zwischen Läufer und Ständer)
Abweichung der verketteten Spannung: max ±5%
Frequenz: 150Hz
Leerlauf
S1: 160 V; 23,5 A; 7,3 kVA; cosphi 0,9
S2 10 Sekunden: 250 V; 37,5 A; 18,1 kVA; cosphi 0,9

Werte für 3600 U/min:
Leerlaufspannung: <275 V (bezogen auf magnetische Mitte zwischen Läufer und Ständer)
Abweichung der verketteten Spannung: max ±5%
Frequenz: 180Hz
Leerlauf
S1: 160 V; 23,5A; 7,3 kVA; cosphi 0,9
S2 10 Sekunden: 250 V; 37,5 A; 18,1 kVA; cosphi 0,9

(b) Ausleitung Hilfserreger-
Kabellaenge: 1000 mm
CURRENT LEAD AUXILIARY EXCITER
CABLE LENGTH: 1000 mm



1:2

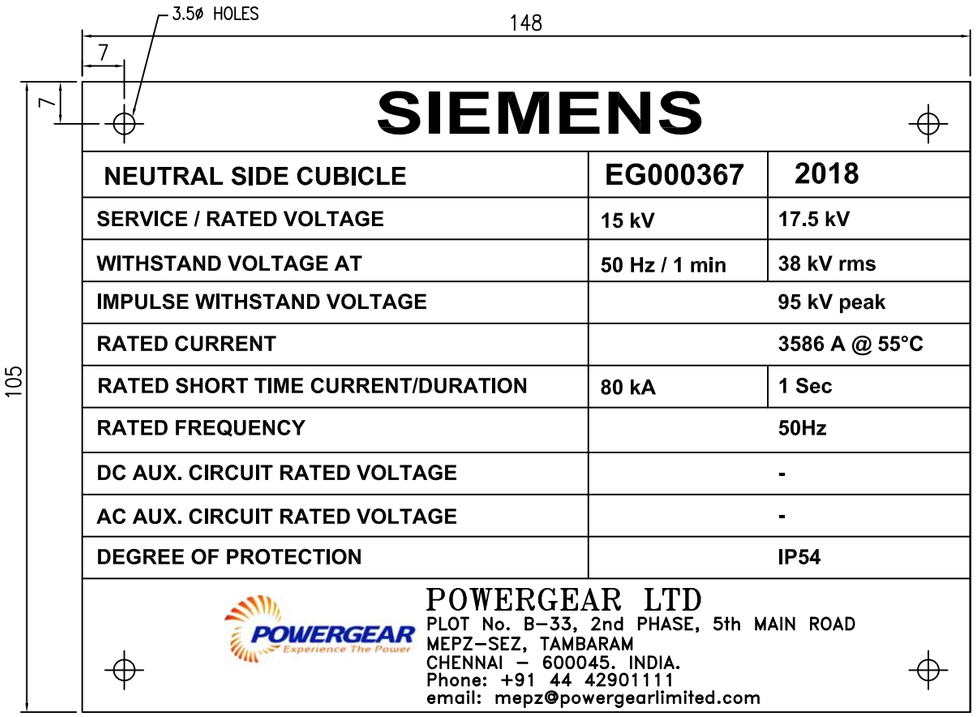
Pos. 50 und 60 (ohne Zeichnung)
lose dazu geliefert

REV.	DATE	CHANGE DESCRIPTION
B	2008-09-16	KABELAUSLEITUNG GEAENDERT
A		Erstausgabe

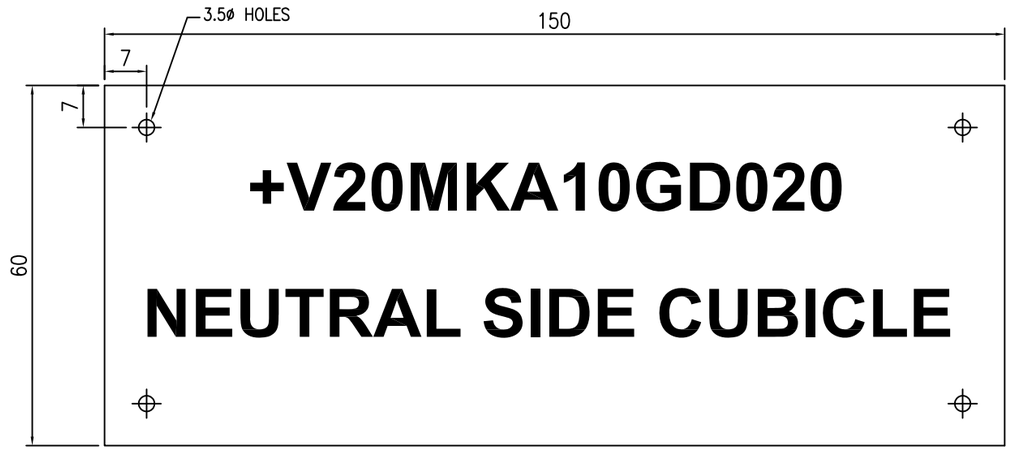
SIEMENS AG
POWER GENERATION

WEIGHT: KG	SCALE: 1:2	SPEC.: KUN351.00
DRAWN: 2008-03-02 RATHMANN	TITLE	
CHECKED: 2008-03-02 SCHMITT	MASZBILD HILFSERREGERMASCH.	
RELEASED: 2008-03-02 RATHMANN	OUTLINE PMG	
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RATING PLATE DETAILS



NAME PLATE DETAILS

NOTES :

MATERIAL : 2 th. STAINLESS STEEL

QUANTITY : 1 No. EACH

ALL DIMENSIONS ARE IN mm

REV. NO.	DESCRIPTION	DATE	APPD	REV.	DESCRIPTION	DATE	APPD.
				D	REVISION LEVEL UPDATED	17.07.18	J.R
				C	REVISION LEVEL UPDATED	04.04.18	J.R
				B	REVISION LEVEL UPDATED	21.03.18	J.R
E	REVISION LEVEL UPDATED	24.08.18	J.R	A	REVISION LEVEL UPDATED	03.03.18	J.R

ECCN : EAR99	AL : N	ECL : N	U.S – CONTENT : N
PROJECT VILNIUS BIOMASS			
CUSTOMER SIEMENS AG			
W .O. NO MP0650	TITLE NEUTRAL SIDE CUBICLE (RATING PLATE, NAME PLATE)		
SIZE A3	SCALE 1 : 30	POWERGEAR Experience The Power MEPZ, Tambaram, CHENNAI–600045 INDIA	

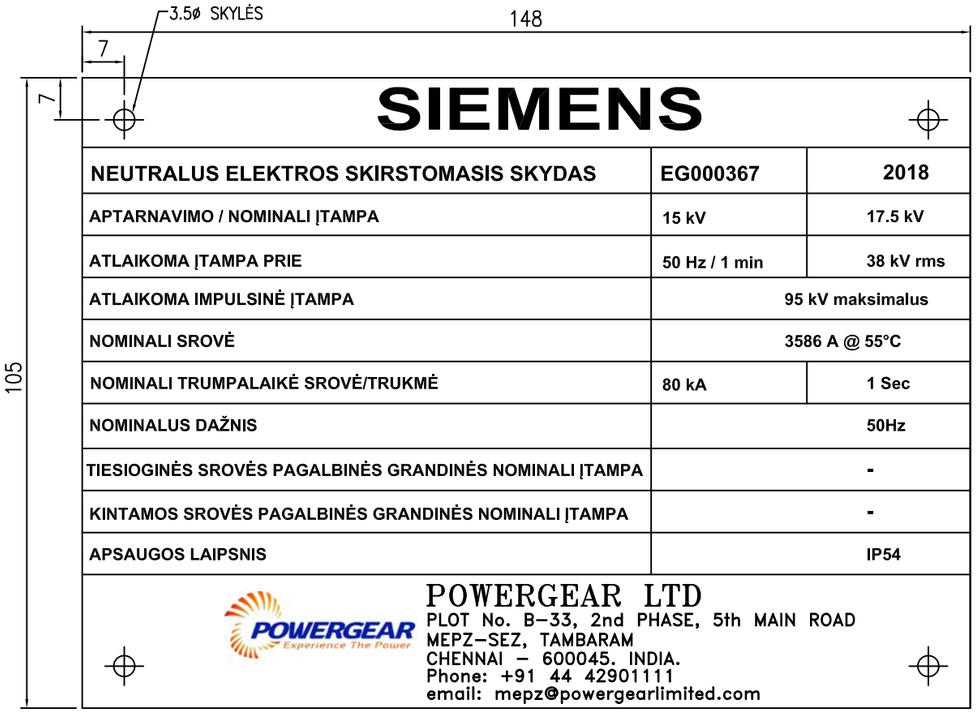
	SIGN	DATE
DRN.	A.ANTONY	30.01.2018
CHD.	J.RAMASWAMY	30.01.2018
APPD.	J.RAMASWAMY	30.01.2018

DRG. NO. DPPPG-70151867

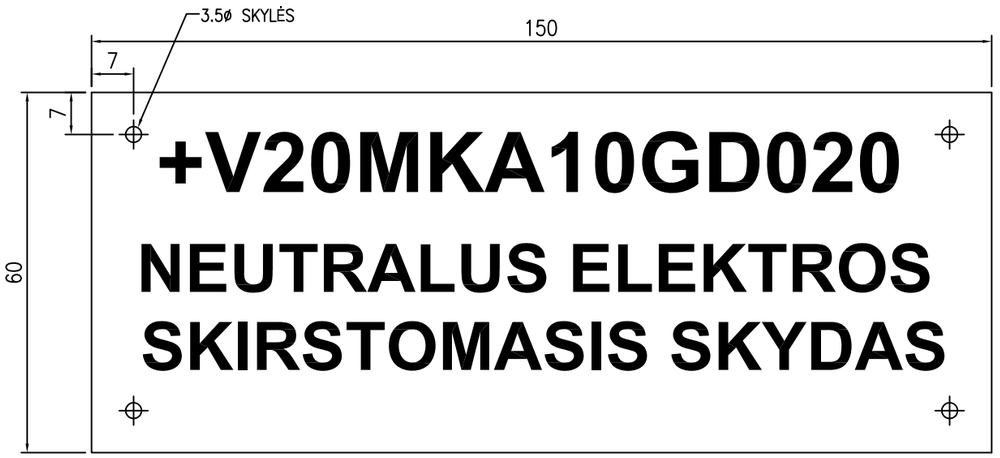
SHEET 1 OF 11 | REV E

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FILE NAME :



ĮVERTINIMO PLOKŠTELĖS DUOMENYS



PAVADINIMO PLOKŠTELĖS DUOMENYS

PASTABOS :

MEDŽIAGA : 2 storio NERŪDYJANTIS PLIENAS
KIEKIS : PO 1 KIEKVIENO NUMERIO

ALL DIMENSIONS ARE IN mm

REV. NO.	DESCRIPTION	DATE	APPD	REV.	DESCRIPTION	DATE	APPD.
				D	LITHUANIAN LANGUAGE RATING PLATE ADDED	17.07.18	J.R
				C	REVISION LEVEL UPDATED	04.04.18	J.R
				B	REVISION LEVEL UPDATED	21.03.18	J.R
E	REVISION LEVEL UPDATED	24.08.18	J.R	A	REVISION LEVEL UPDATED	03.03.18	J.R

ECCN : EAR99	AL : N	ECL : N	U.S – CONTENT : N
PROJECT VILNIUS BIOMASS			
CUSTOMER SIEMENS AG			
W .O. NO MP0650	TITLE NEUTRALUS ELEKTROS SKIRSTOMASIS SKYDAS (VERTINIMO PLOKŠTELĖ, PAVADINIMO PLOKŠTELĖ)		
SCALE 1 : 30	POWERGEAR Experience The Power MEPZ, Tambaram, CHENNAI–600045 INDIA		
SIZE A3			

	SIGN	DATE
DRN.	A.ANTONY	30.01.2018
CHD.	J.RAMASWAMY	30.01.2018
APPD.	J.RAMASWAMY	30.01.2018

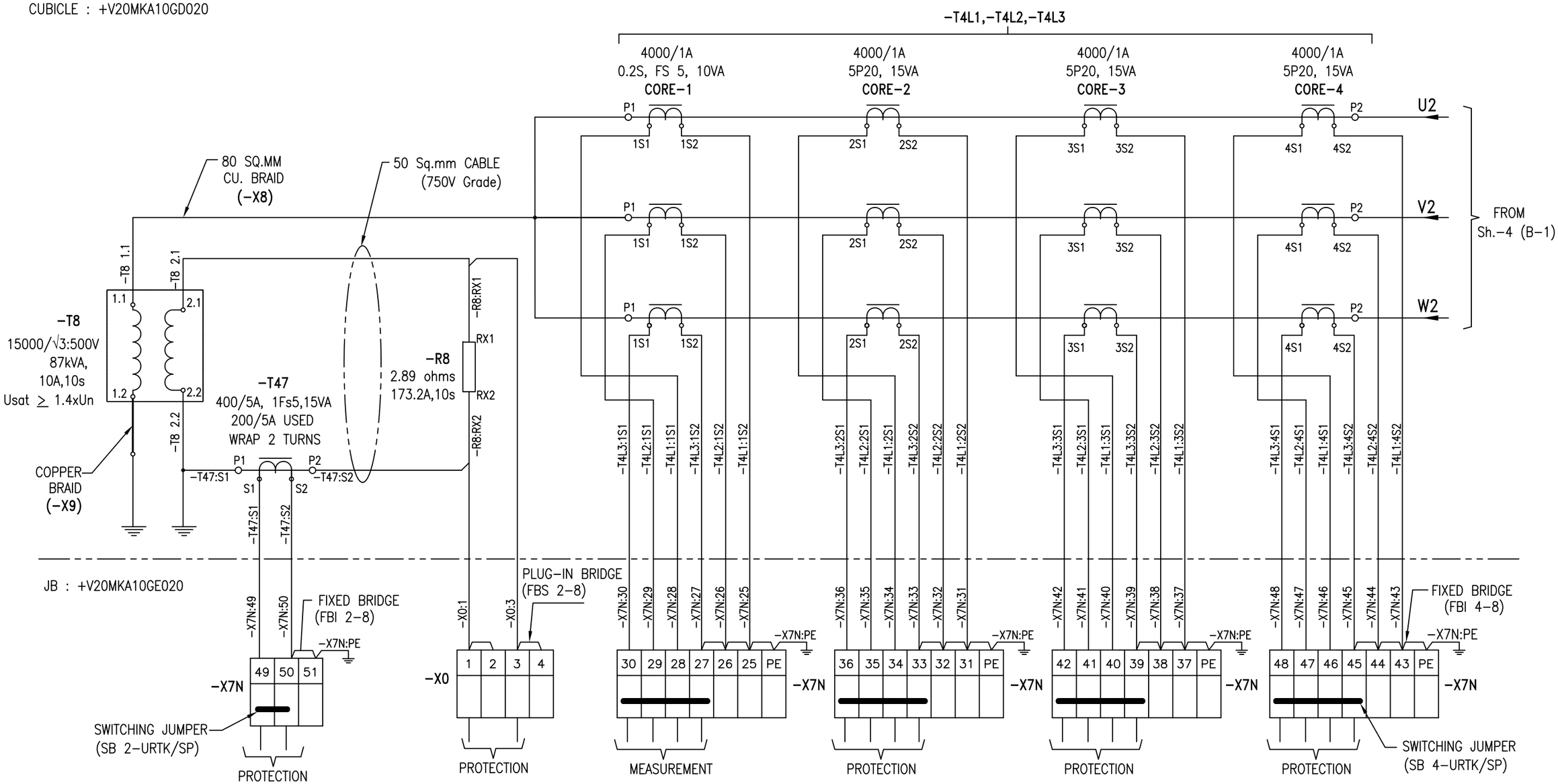
DRG. NO. DPPPG–70151867

SHEET 2 OF 11 | REV E

FILE NAME :

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CUBICLE : +V20MKA10GD020



REFERENCE DRAWING:

AUXILIARY WIRING DIAGRAMS GENERATOR : DPPPG – 70152441

NOTE: REFER SHEET 7 FOR BILL OF MATERIALS.
REFER SHEET 7 FOR NOTES ON WIRING.

ALL DIMENSIONS ARE IN mm

REV. NO.	DESCRIPTION	DATE	APPD	REV.	DESCRIPTION	DATE	APPD.
				D	REVISION LEVEL UPDATED	17.07.18	J.R
				C	REVISION LEVEL UPDATED	04.04.18	J.R
				B	CT CLASS & BURDEN UPDATED AS PER SIEMENS COMMENTS DTD. 16.03.18	21.03.18	J.R
E	KKS NUMBER +V20 UPDATED AS PER COMMENTS DTD 13.08.18	24.08.18	J.R	A	CT -T4 ADDED AS PER SIEMENS COMMENTS DTD. 01.03.18	03.03.18	J.R

PROJECT	VILNIUS BIOMASS
CUSTOMER	SIEMENS AG
W .O. NO	MP0650
TITLE	NEUTRAL SIDE CUBICLE (SCHEMATIC OF CT)
SCALE	-
SIZE	A3

POWERGEAR Experience The Power
MEPZ, Tambaram, CHENNAI–600045 INDIA

	SIGN	DATE
DRN.	A.ANTONY	29.01.2018
CHD.	J.RAMASWAMY	29.01.2018
APPD.	J.RAMASWAMY	29.01.2018

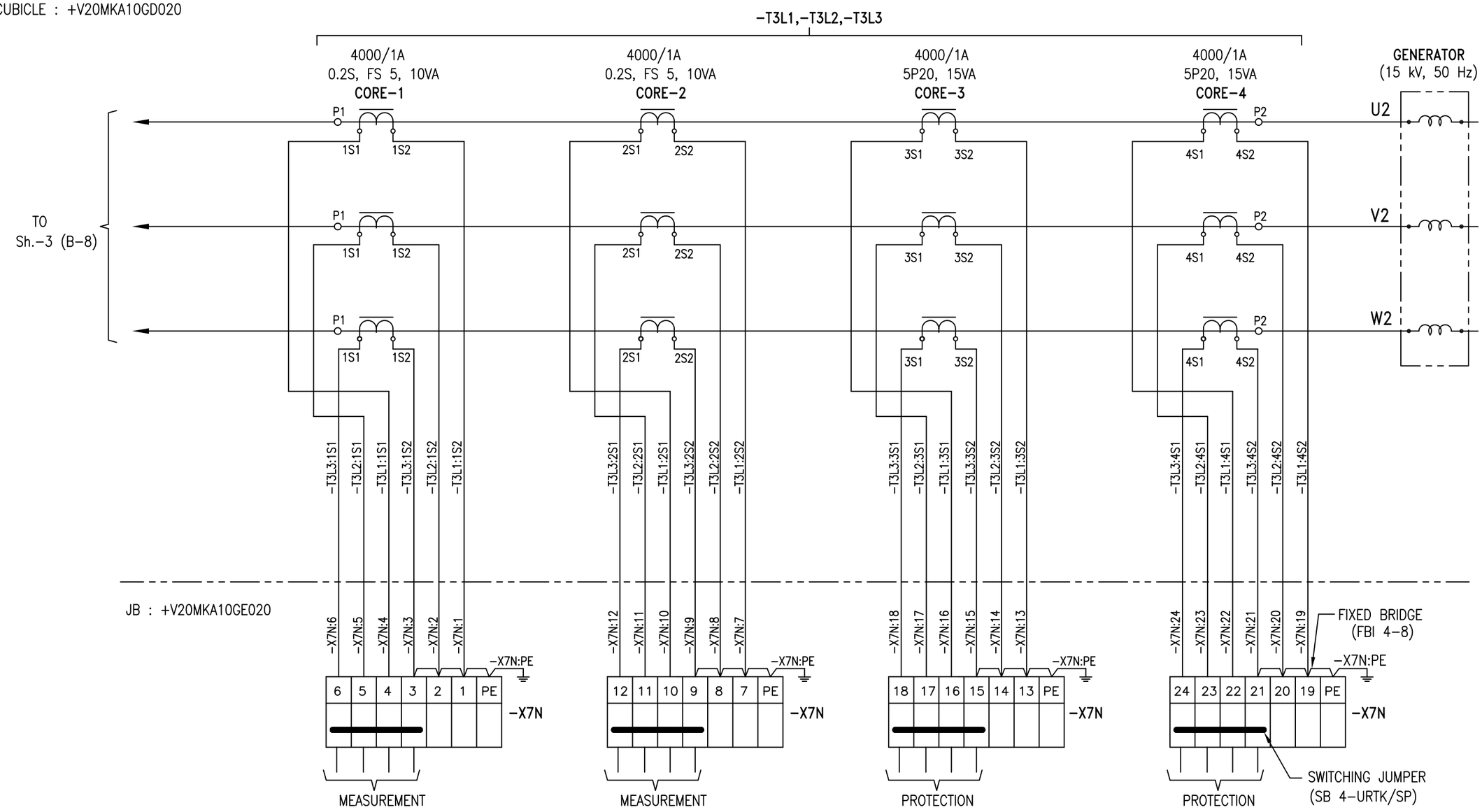
DRG. NO. DPPPG–70151867

SHEET 3 OF 11 | REV E

FILE NAME :

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CUBICLE : +V20MKA10GD020



ALL DIMENSIONS ARE IN mm

REV. NO.	DESCRIPTION	DATE	APPD	REV.	DESCRIPTION	DATE	APPD.
				D	REVISION LEVEL UPDATED	17.07.18	J.R
				C	REVISION LEVEL UPDATED	04.04.18	J.R
				B	CT CLASS & BURDEN UPDATED AS PER SIEMENS COMMENTS DTD. 16.03.18	21.03.18	J.R
E	REVISION LEVEL UPDATED	24.08.18	J.R	A	UPDATED AS PER SIEMENS COMMENTS DTD. 01.03.18	03.03.18	J.R

PROJECT VILNIUS BIOMASS

CUSTOMER SIEMENS AG

W .O. NO MP0650

TITLE NEUTRAL SIDE CUBICLE (SCHEMATIC OF CT)

SCALE -

SIZE A3

POWERGEAR Experience The Power

MEPZ, Tambaram, CHENNAI-600045 INDIA

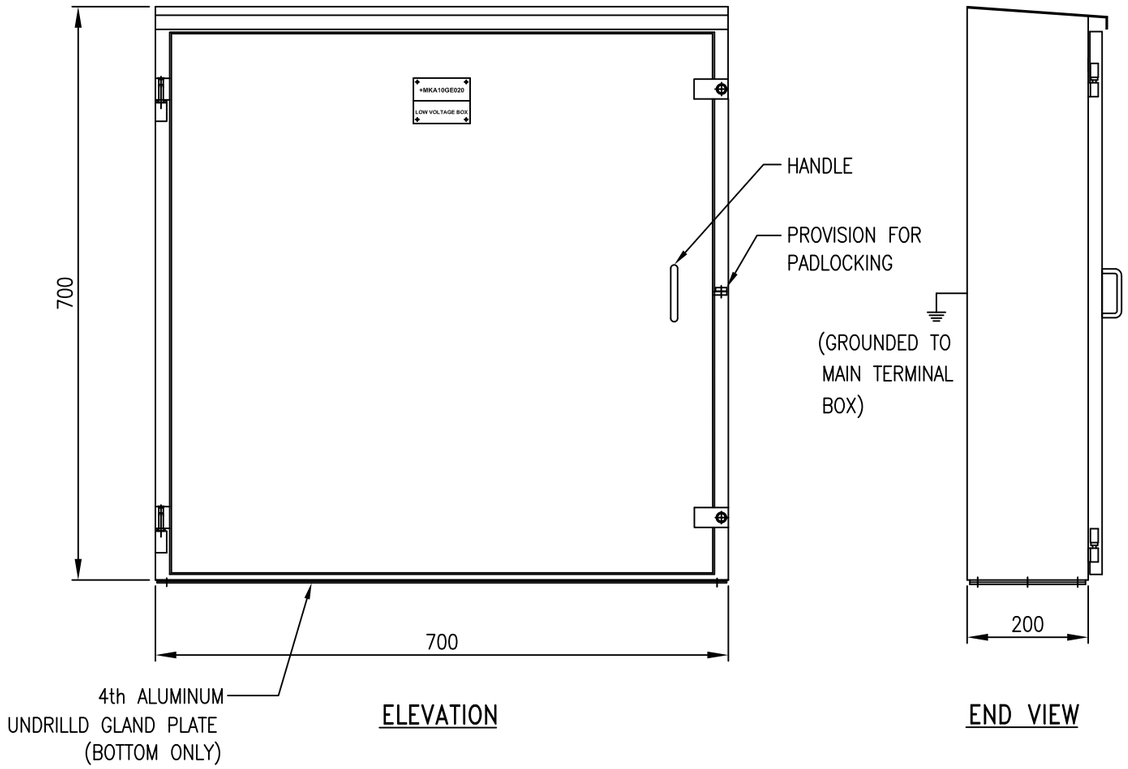
	SIGN	DATE
DRN.	A.ANTONY	29.01.2018
CHD.	J.RAMASWAMY	29.01.2018
APPD.	J.RAMASWAMY	29.01.2018

DRG. NO. DPPPG-70151867

SHEET 4 OF 11 REV E

FILE NAME :

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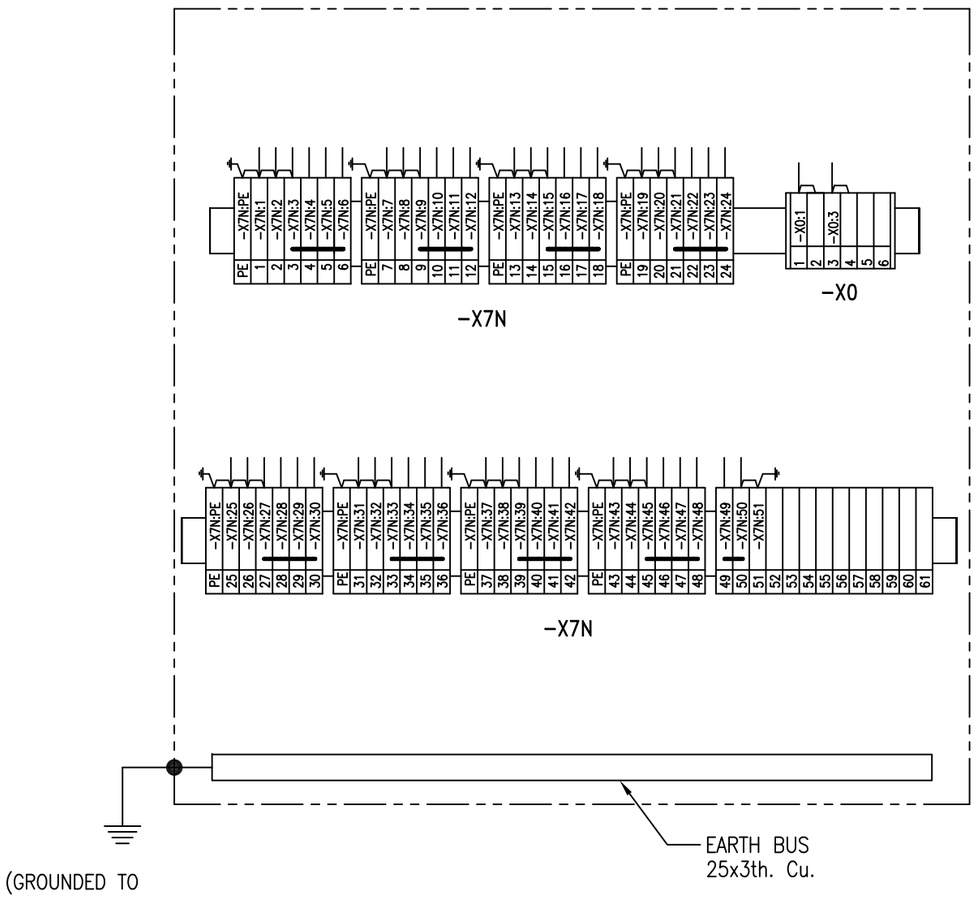


ELEVATION

END VIEW

GENERAL ARRANGEMENT OF JUNCTION BOX

MATERIAL : 2 Thk. STAINLESS STEEL

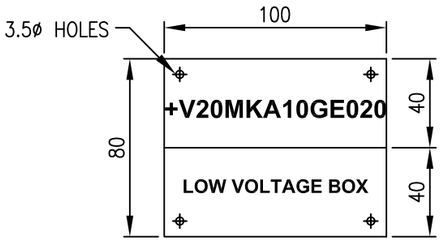


-X7N

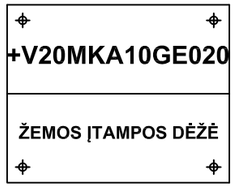
-X0

-X7N

TERMINAL BLOCK ARRANGEMENT INSIDE JUNCTION BOX



NAME PLATE DETAILS
(ENGLISH LANGUAGE)



NAME PLATE DETAILS
(LITHUANIAN LANGUAGE)

ALL DIMENSIONS ARE IN mm

REV. NO.	DESCRIPTION	DATE	APPD	REV.	DESCRIPTION	DATE	APPD.
				D	LITHUANIAN LANGUAGE NAME PLATE ADDED	17.07.18	J.R
				C	REVISION LEVEL UPDATED	04.04.18	J.R
				B	REVISION LEVEL UDPATED	21.03.18	J.R
E	KKS NUMBER +V20 UPDATED AS PER COMMENTS DTD 13.08.18 & JB TERMINAL BLOCK ARRANGEMENT UPDATED AS MADE	24.08.18	J.R	A	TERMINAL BLOCK ARRANGEMENT UPDATED	03.03.18	J.R

PROJECT	VILNIUS BIOMASS
CUSTOMER	SIEMENS AG
W .O. NO	MP0650
TITLE	NEUTRAL SIDE CUBICLE (JUNCTION BOX DETAILS)
SCALE	-
SIZE	A3

POWERGEAR Experience The Power
MEPZ, Tambaram, CHENNAI–600045 INDIA

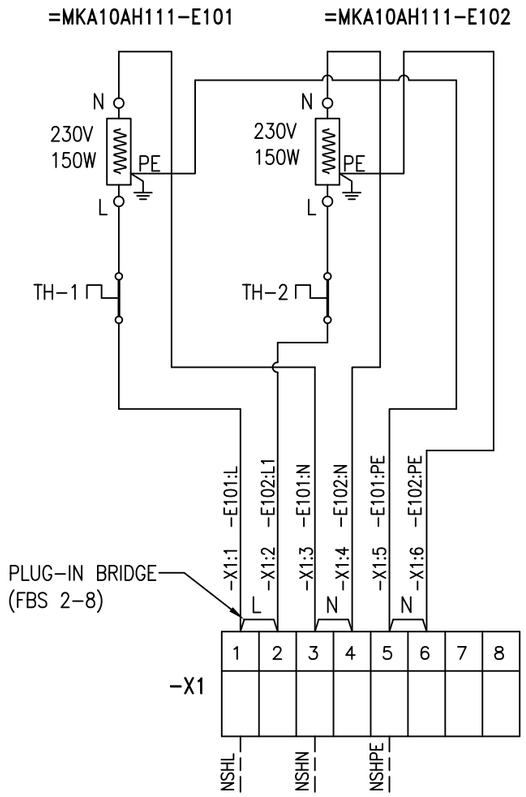
	SIGN	DATE
DRN.	A.ANTONY	29.01.2018
CHD.	J.RAMASWAMY	29.01.2018
APPD.	J.RAMASWAMY	29.01.2018

DRG. NO. DPPPG–70151867

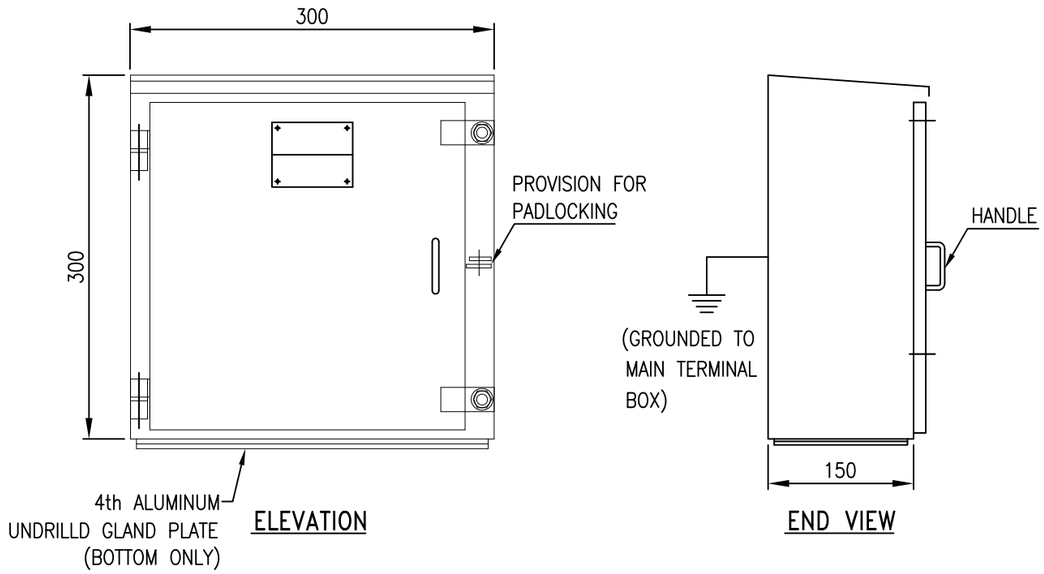
SHEET 5 OF 11 | REV E

FILE NAME :

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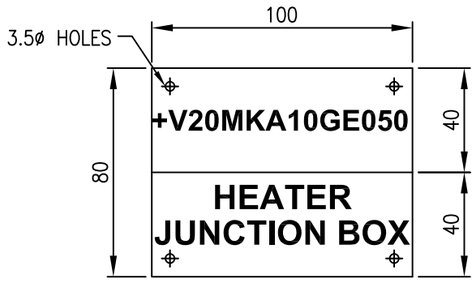


SPACE HEATER CIRCUIT

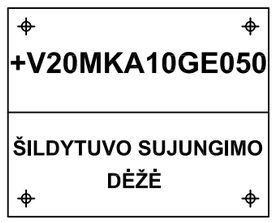


GENERAL ARRANGEMENT OF HEATER BOX

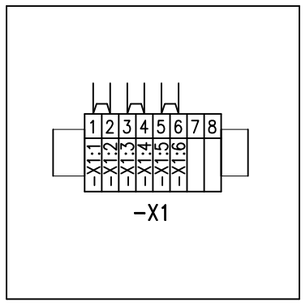
MATERIAL : 2 Thk. STAINLESS STEEL



NAME PLATE DETAILS
(ENGLISH LANGUAGE)



NAME PLATE DETAILS
(LITHUANIAN LANGUAGE)



TERMINAL DETAILS INSIDE HEATER BOX

ALL DIMENSIONS ARE IN mm

REV. NO.	DESCRIPTION	DATE	APPD	REV.	DESCRIPTION	DATE	APPD.
				D	LITHUANIAN LANGUAGE NAME PLATE ADDED	17.07.18	J.R
				C	REVISION LEVEL UPDATED	04.04.18	J.R
				B	THERMOSTAT ADDED AS PER SIEMENS COMMENTS DTD. 21.03.18	21.03.18	J.R
E	KKS NUMBER +V20 UPDATED AS PER COMMENTS DTD 13.08.18	17.07.18	J.R	A	REVISION LEVEL UPDATED	03.03.18	J.R

			SIGN	DATE
PROJECT	VILNIUS BIOMASS	DRN.	A.ANTONY	29.01.2018
CUSTOMER	SIEMENS AG	CHD.	J.RAMASWAMY	29.01.2018
W .O. NO	MP0650	APPD.	J.RAMASWAMY	29.01.2018
TITLE	NEUTRAL SIDE CUBICLE (SCHEMATIC OF SPACE HEATER)	DRG. NO.	DPPPG-70151867	
SCALE	-	SHEET	6 OF 11	REV E
SIZE	A3			

POWERGEAR Experience The Power
MEPZ, Tambaram, CHENNAI-600045 INDIA

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FILE NAME :

CURRENT TRANSFORMER (–T3L1,–T3L2,–T3L3,,–T4L1,–T4L2,–T4L3)

TYPE : DRY TYPE, CAST RESIN
RATED VOLTAGE : 15 kV
RATED FREQUENCY : 50 HZ.
INSULATION LEVEL(WHEN MOUNTED) : 17.5 kV /38 kV rms (1 Min.)/98 kV peak.
INSULATION CLASS : B(130 Deg.C)
SHORT TIME RATING : 80 kA rms–1sec.
APPLICABLE STANDARD : IEC 60044–1 / IEC 61869–2

CURRENT TRANSFORMER (–T47)

TYPE : CAST RESIN
RATED FREQUENCY : 50 HZ.
INSULATION LEVEL : 0.72 kV /3 kV rms (1 Min.)
INSULATION CLASS : B
APPLICABLE STANDARD : IEC 60044–1 / IEC 61869–2

NEUTRAL GROUNDING TRANSFORMER (–T8)

TYPE : DRY TYPE, CAST RESIN
RATIO : 15000/√3 – 500V
RATED FREQUENCY : 50 Hz
INSULATION LEVEL : 17.5 kV /38 kV rms (1 Min.)/95 kV peak
RATED POWER : 87 kVA FOR 10 SEC
SATURATION VOLTAGE : ≥1.4 x Un
APPLICABLE STANDARD : IEC 60076–11

NEUTRAL GROUNDING RESISTOR (–R8)

TYPE : SS WIRE GRID
RESISTANCE VALUE : 2.89 ohms
CURRENT RATING : 173.2 A FOR 10 SEC.
APPLICABLE STANDARD : IEEE–32

BILL OF MATERIALS

SL.No.	LEGEND	DESCRIPTION		QUANTITY (Nos.)	MAKE	TYPE	CATALOQUE REF.
1	–T3L1,–T3L2,–T3L3	CURRENT TRANSFROMER RATIO : 4000/1/1/1/1A	CORE–1 : CLASS – 0.2S,FS 5,10VA	3	PRAYOG, INDIA	CAST RESIN	CT–2452/R
			CORE–2 : CLASS – 0.2S,FS 5,10VA				
			CORE–3 : CLASS – 5P 20,15VA				
			CORE–4 : CLASS – 5P 20,15VA				
2	–T4L1,–T4L2,–T4L3	CURRENT TRANSFROMER RATIO : 4000/1/1/1/1A	CORE–1 : CLASS – 0.2S,FS 5,10VA	3	PRAYOG, INDIA	CAST RESIN	CT–2452/R
			CORE–2 : CLASS – 5P20,15VA				
			CORE–3 : CLASS – 5P20,15VA				
			CORE–4 : CLASS – 5P20,15VA				
3	–T47	CURRENT TRANSFROMER RATIO : 400/5A	CLASS – 1Fs5, 15VA	1	PRAYOG, INDIA	CAST RESIN	LTCT–2118
4	–T8	NEUTRAL GROUNDING TRANSFORMER		1	PRAYOG, INDIA	CAST RESIN	NGT–2474
5	–R8	NEUTRAL GROUNDING RESISTOR		1	KWK, INDIA		100910
6	–X7N	TERMINALS IN +V20MKA10GE020		51+10	PHOENIX,GERMANY	DISCONNECTING TYPE	URTK/SP
	–X0			4+2	PHOENIX,GERMANY	STUD TYPE	UT6
7	–	CT SWITCHING JUMPER		8	PHOENIX,GERMANY	4 WAY	SB 4–URTK/SP
8	–	CT SWITCHING JUMPER		1	PHOENIX,GERMANY	2 WAY	SB 2–URTK/SP
9	–	SHORTING BRIDGE		8	PHOENIX,GERMANY	4 WAY	FBI 4–8
10	–	SHORTING BRIDGE		1	PHOENIX,GERMANY	2 WAY	FBI 2–8
11	–	PLUG–IN BRIDGE		5	PHOENIX,GERMANY	2 WAY	FBS 2–8
12	–E101, –E102	SPACE HEATERS 230V AC, 150W		2	KWK, INDIA	BOX TYPE	
13	–X1	TERMINALS IN HEATER BOX (+V20MKA10GE050)		6+2	PHOENIX,GERMANY	STUD TYPE	UT6
14	TH–3 & TH–4	THERMOSTAT (0–50°C SETTING RANGE)		2	JUMO, GERMANY	CAPILLARY TYPE	

NOTES

1. WIRING WILL BE DONE AS GIVEN BELOW :

CT CIRCUIT – 4 Sq.mm TINNED COPPER, 750V GRADE, 90°C HEAT RESISTANCE CABLE – BLACK COLOUR FOR PHASE & SHORTING
GREEN/YELLOW COLOUR FOR GROUND

NGR CIRCUIT – 4 Sq mm TINNED COPPER, 750V GRADE, 90°C HEAT RESISTANT CABLE – BLACK COLOUR
– 4 Sq. mm TINNED COPPER, 750V GRADE, 90°C HEAT RESISTANCE CABLE – GREEN/YELLOW COLOUR FOR GROUND

HEATER CIRCUIT – 2.5 Sq mm TINNED COPPER, 750V GRADE, 90°C HEAT RESISTANT CABLE – BLACK COLOUR FOR LINE
– BLUE COLOUR FOR NEUTRAL

2. ALL THE ABOVE CABLES ARE "CE" MARKED

ALL DIMENSIONS ARE IN mm

REV. NO.	DESCRIPTION	DATE	APPD	REV.	DESCRIPTION	DATE	APPD.
				D	REVISION LEVEL UPDATED	17.07.18	J.R
				C	REVISION LEVEL UPDATED	04.04.18	J.R
				B	BILL OF MATERIAL UPDATED AS PER SIEMENS COMMENTS DTD. 16.03.18 & 21.03.18	21.03.18	J.R
D	BILL OF MATERIAL UPDATED AS MADE	24.08.18	J.R	A	–T4 CT ADDED AS PER SIEMENS COMMENTS DATED 01.02.18	03.03.18	J.R

PROJECT VILNIUS BIOMASS
CUSTOMER SIEMENS AG
W .O. NO MP0650
TITLE NEUTRAL SIDE CUBICLE (TECHNICAL SPECIFICATION & BOM)
SCALE –
SIZE A3
POWERGEAR Experience The Power
MEPZ, Tambaram, CHENNAI–600045 INDIA

	SIGN	DATE
DRN.	A.ANTONY	29.01.2018
CHD.	J.RAMASWAMY	29.01.2018
APPD.	J.RAMASWAMY	29.01.2018

DRG. NO. DPPPG–70151867
SHEET 7 OF 11 REV E

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FILE NAME :

TECHNICAL PARTICULARS

SERVICE VOLTAGE	: 15 kV
HIGHEST VOLTAGE	: 17.5 kV
RATED CURRENT	: 3586 A @ 55° C
RATED FREQUENCY	: 50 Hz.
SHORT TIME CURRENT RATING	: 80 kA rms for 1 Sec. (200 kA Peak)
BASIC INSULATION LEVEL	: 17.5 KV / 38 KV rms (1 Min.)/95 KV peak.
TEMPERATURE RISE OVER AN AMBIENT OF 55°C	
– BUSBAR	: 50°C
– ENCLOSURE	: 15°C
DEGREE OF PROTECTION	: IP 54

BILL OF MATERIALS FOR FIELD ASSEMBLY

ITEM	DESCRIPTION	MATERIAL	QUANTITY	IDENTIFICATION
1	RETAINER PLATE – 50x6x1300	MS PAINTED	4 NO's	SHEET 11
2	RETAINER PLATE – 50x6x690	MS PAINTED	4 NO's	SHEET 11
3	M10 x 45 LONG + 1PW	SS A270	16 NO's	SHEET 11
4	COPPER BRAID FLEXIBLE–50x25x380mm LONG	COPPER	12 NO's	SHEET 11
5	M12x90 BOLT+NUT+2PW+1SW	SS A270	12 NO's	SHEET 11
6	M12x100 BOLT+NUT+2PW+1SW	SS A270	12 NO's	SHEET 11
7	ANCHOR BOLT – M12X140/50 HST, HILTI MAKE	STEEL (5.6 GR.)	16 NO's	SHEET 9
8	ANTI–VIBRATION MOUNT	–	4 NO's	SHEET 9
9	PACKING SHIM – 100x100mm THICKNESS : 15+6+6+3+2 (Per Mount)	GALVD.	4 NO's EACH	SHEET 9
10	M16 NUT + 1PW + 1SW	SS A270	4 NO's	SHEET 9
11	M12x50LONG+NUT+2PW+1SW	SS A270	20 NO's	SHEET 9
12	RUBBER BELLOW	EPDM	1 NO	SHEET 11
13	M10X45N+2PW	SS A270	16 NO's	SHEET 11
14	SUPPORT STRUCTURE	MS	1 NO	SHEET 9

NOTES :

1. REFERENCE DRAWING
   - a. GENERATOR MASSBILD – OUTLINE DRAWING : DPPPG–70149178 Rev.A
   - b. AUXILIARY WIRING DIAGRAMS GENERATOR : DPPPG – 70152441
   - c. BUSHING / TERMINAL BOARD : 2–460377 Rev.A
   - d. BUSBAR : 3–403720 Rev.B
   - e. WELDING FLANGE : 2–457773 Rev.A
   - f. BUSHING ASSEMBLY : 1–2570–451105 Rev.A
   - g. INQUIRY DATA SHEET : DPPPG–70151865
2. CONSTRUCTION
   - CUBICLE : 4mm THICK ALUMINUM
   - JUNCTION BOX : 2mm THICK STAINLESS STEEL
   - BUSBAR (MAIN) : COPPER(2 RUNS OF 150 x12)
   - SUPPORTING STRUCTURE : MILD STEEL EXTRUSION
3. ALL THE DIMENSIONS ARE MARKED IN ENGLISH SYSTEM. [mm]
4. MINIMUM CLERANCES – PHASE TO PHASE & – PHASE TO GROUND : 160 mm
5. PAINT FINISH
   - ENCLOSURE – INSIDE AND OUTSIDE : RAL 7030
   - BUSBAR : BLACK PAINTED
   - SUPPORT STRUCTURE : RAL 7030
6. ALL BUSBAR JOINT CONTACT SURFACES ARE BARE COPPER (GEN. FLEXIBLE END SILVER PLATED)
7. HARDWARE, GASKETS TO CONNECT NEUTRAL POINT CUBICLE ENCLOSURE WITH GENERATOR WILL BE SUPPLIED BY POWERGEAR
8. HARDWARE, FLEXIBLES TO CONNECT NEUTRAL POINT CUBICLE BUSBAR WITH GENERATOR LEADS WILL BE SUPPLIED BY POWERGEAR
9. DANGER PLATES ARE PROVIDED ON ALL ACCESS DOORS
10. WEIGHT : CUBICLE – 1000 kgs
    : STRUCTURE – 150 kgs

ALL DIMENSIONS ARE IN mm

REV. NO.	DESCRIPTION	DATE	APPD	REV.	DESCRIPTION	DATE	APPD.
				D	REVISION LEVEL UPDATED	17.07.18	J.R
				C	REVISION LEVEL UPDATED	04.04.18	J.R
				B	REVISION LEVEL UPDATED	21.03.18	J.R
E	REVISION LEVEL UPDATED	24.08.18	J.R	A	REVISION LEVEL UPDATED	03.03.18	J.R

PROJECT	VILNIUS BIOMASS		
CUSTOMER	SIEMENS AG		
W .O. NO	MP0650	TITLE	NEUTRAL SIDE CUBICLE (NOTES ON GENERAL ARRANGEMENT & FIELD ASSY BOM)
SCALE			
SIZE	A3	1 : 30	

POWERGEAR Experience The Power
MEPZ, Tambaram, CHENNAI–600045 INDIA

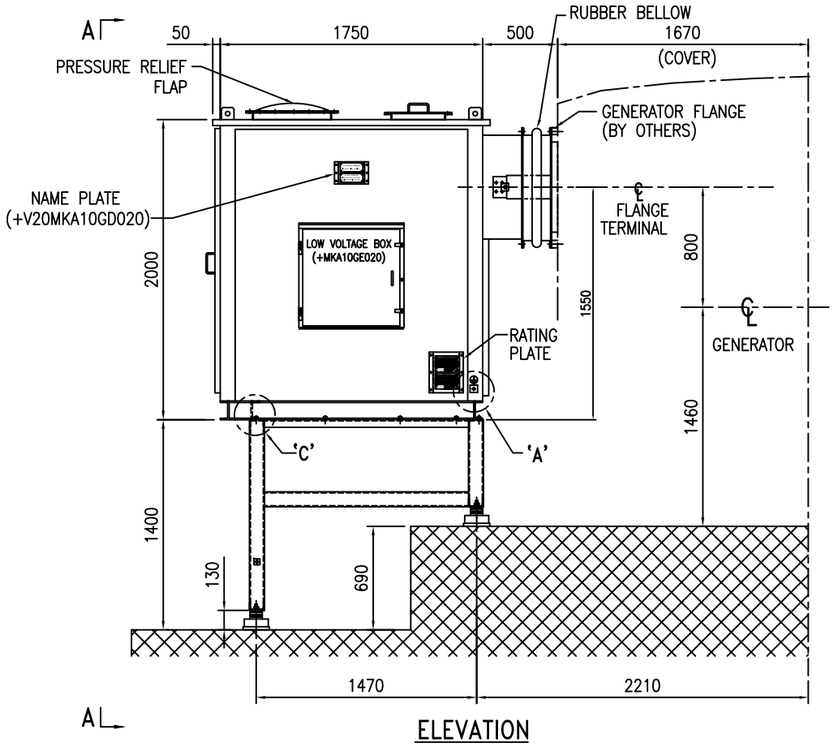
	SIGN	DATE
DRN.	A.ANTONY	29.01.2018
CHD.	J.RAMASWAMY	29.01.2018
APPD.	J.RAMASWAMY	29.01.2018

DRG. NO. DPPPG–70151867

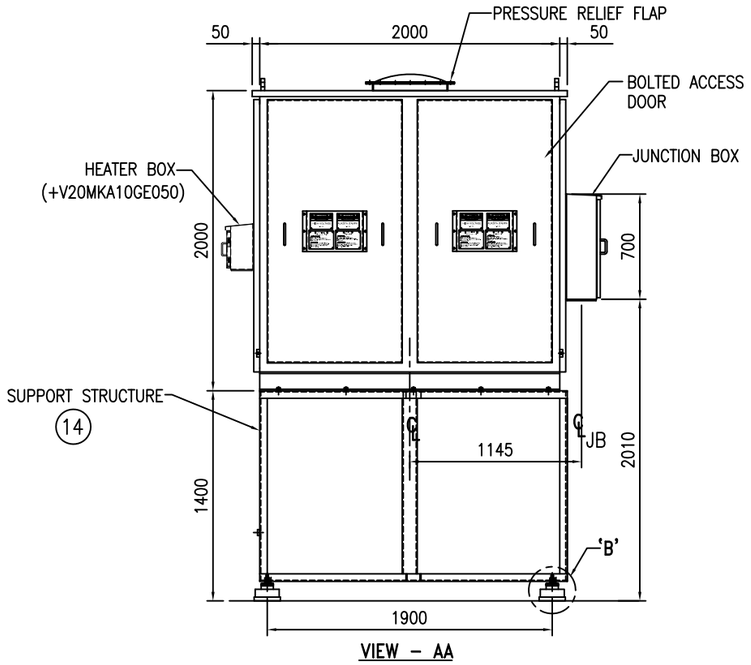
SHEET 8 OF 11 | REV E

FILE NAME :

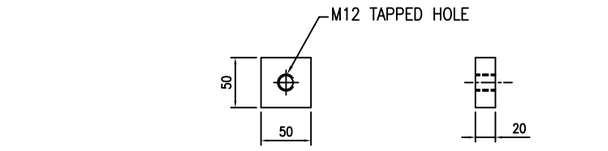
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ELEVATION



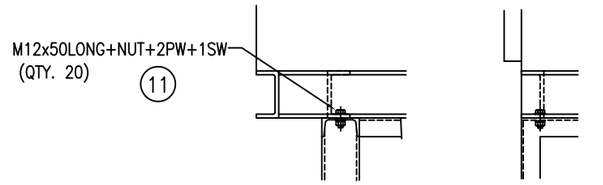
VIEW – AA



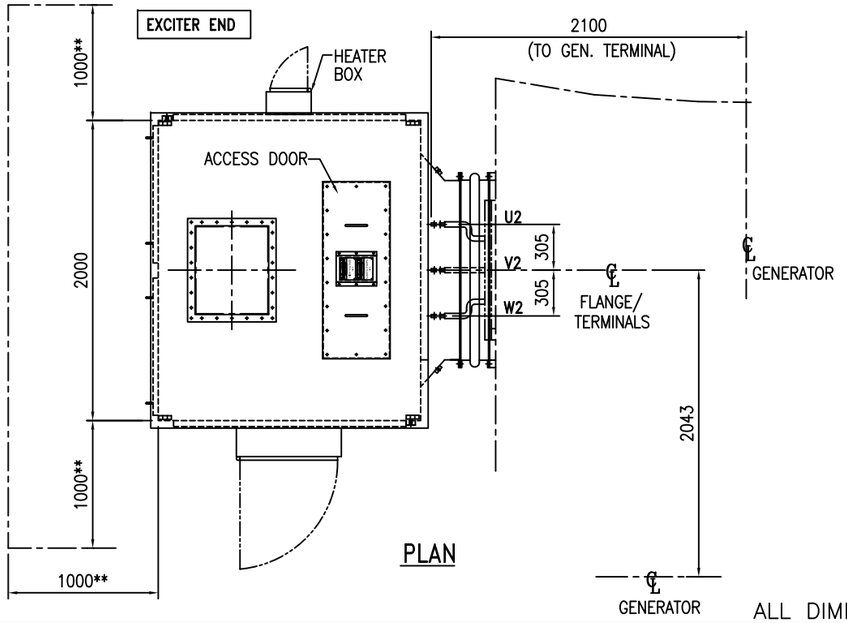
MATERIAL : 20 Th. ALUMINIUM

EARTH PAD DETAILS (PE)

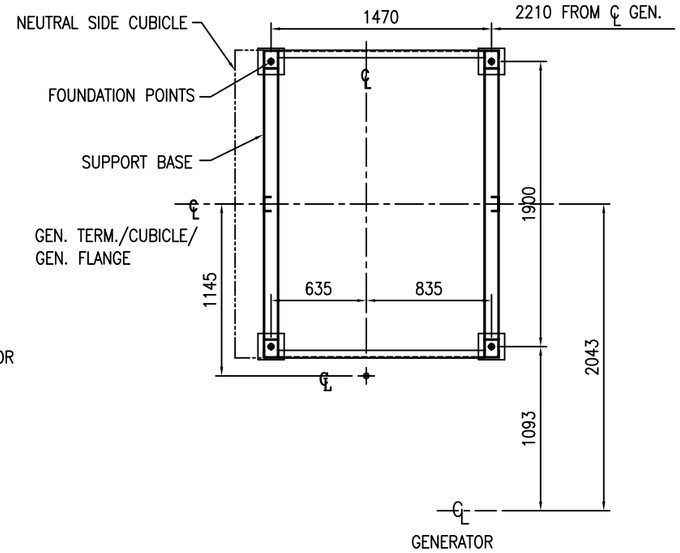
(ON DIAGONALLY OPPOSITE SIDES)



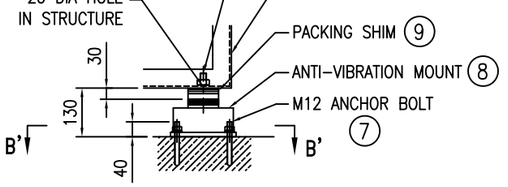
(CONNECTION BETWEEN CUBICLE AND STRUCTURE)

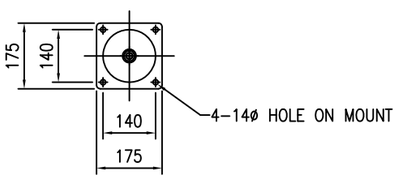


PLAN



FOUNDATION PLAN





NOTE:

* * MINIMUM CLEARANCE REQUIRED FOR MAINTENANCE

ALL DIMENSIONS ARE IN mm

REV. NO.	DESCRIPTION	DATE	APPD	REV.	DESCRIPTION	DATE	APPD.
				D	REVISION LEVEL UPDATED	17.07.18	J.R
				C	UPDATED PER SIEMENS COMMENTS DTD. 28.03.18	04.04.18	J.R
				B	REVISION LEVEL UPDATED	21.03.18	J.R
E	REVISION LEVEL UPDATED	24.08.18	J.R	A	CUBICLE SIZE UPDATED	03.03.18	J.R

PROJECT	VILNIUS BIOMASS		
CUSTOMER	SIEMENS AG		
W .O. NO	MP0650	TITLE	NEUTRAL SIDE CUBICLE (OUTLINE)
SIZE	A3	SCALE	1 : 30
			MEPZ, Tambaram, CHENNAI–600045 INDIA

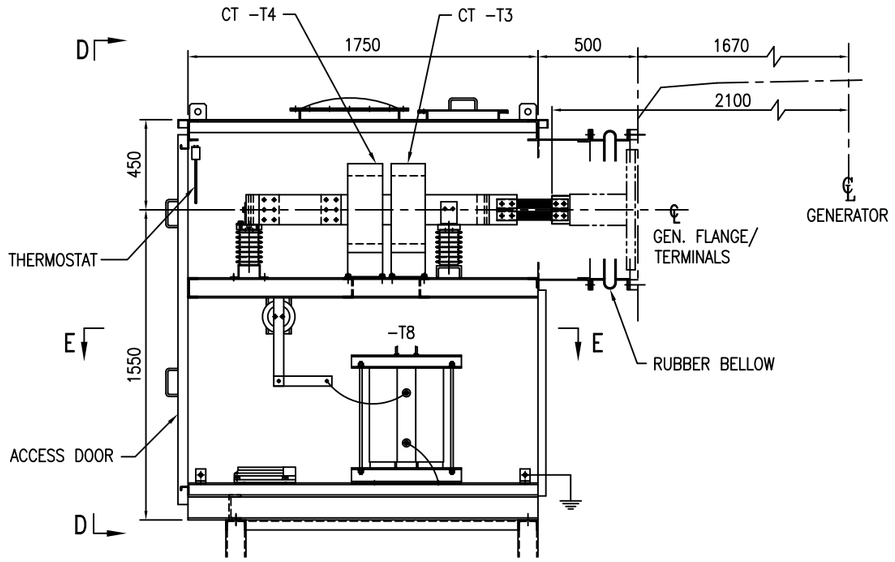
	SIGN	DATE
DRN.	A.ANTONY	29.01.2018
CHD.	J.RAMASWAMY	29.01.2018
APPD.	J.RAMASWAMY	29.01.2018

DRG. NO. DPPPG–70151867

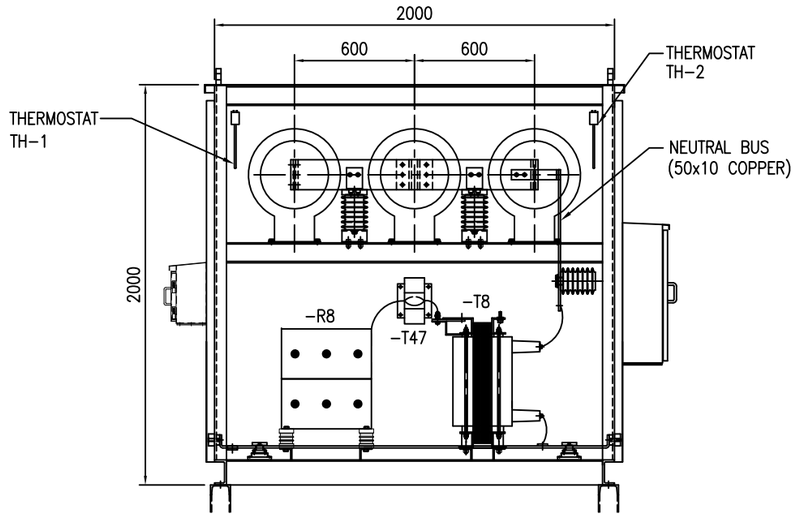
SHEET 9 OF 11 | REV E

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FILE NAME :

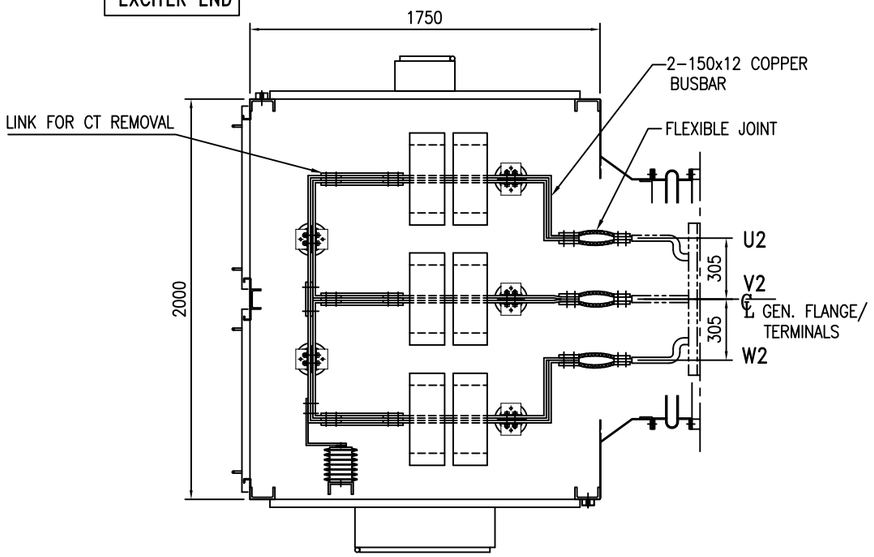


ELEVATION
(INTERNAL DETAILS)

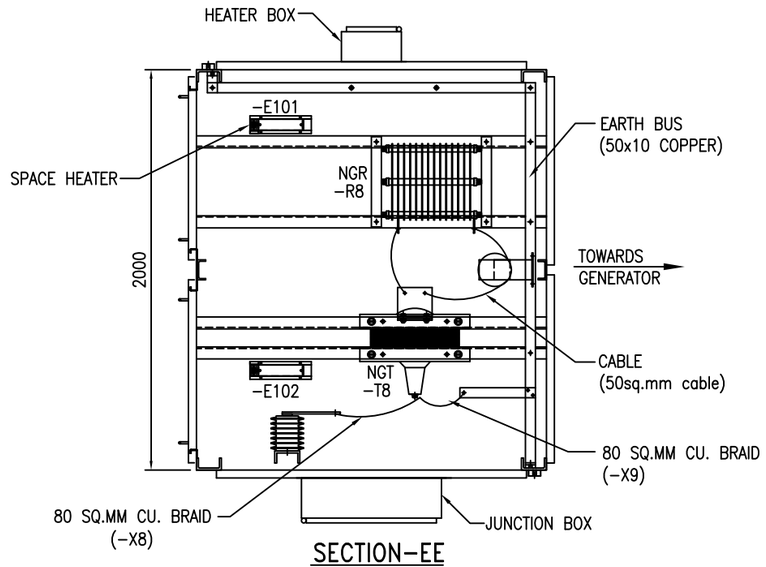


VIEW-DD
(DOOR REMOVED)

EXCITER END



PLAN



SECTION-EE

ALL DIMENSIONS ARE IN mm

REV. NO.	DESCRIPTION	DATE	APPD	REV.	DESCRIPTION	DATE	APPD.
				D	REVISION LEVEL UPDATED	17.07.18	J.R
				C	UPDATED IN LINE WITH SHEET-9	04.04.18	J.R
				B	THERMOSTAT ADDED AS PER SIEMENS COMMENTS DTD. 21.03.18	21.03.18	J.R
E	UPDATED AS MADE	24.08.18	J.R	A	INTERNAL ARRANGEMENT AND CUBICLE SIZE UPDATED	03.03.18	J.R

PROJECT	VILNIUS BIOMASS
CUSTOMER	SIEMENS AG
W .O. NO	MP0650
TITLE	NEUTRAL SIDE CUBICLE (INTERNAL ARRANGEMENT)
SCALE	1 : 30
SIZE	A3
	MEPZ, Tambaram, CHENNAI-600045 INDIA

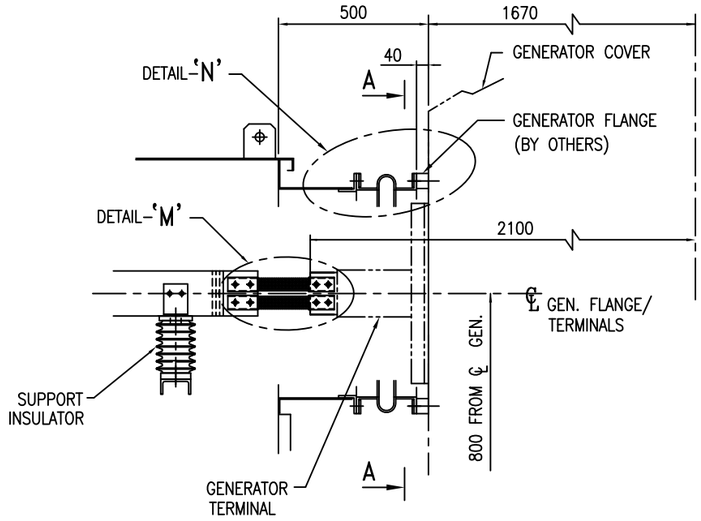
	SIGN	DATE
DRN.	A.ANTONY	29.01.2018
CHD.	J.RAMASWAMY	29.01.2018
APPD.	J.RAMASWAMY	29.01.2018

DRG. NO. DPPPG-70151867

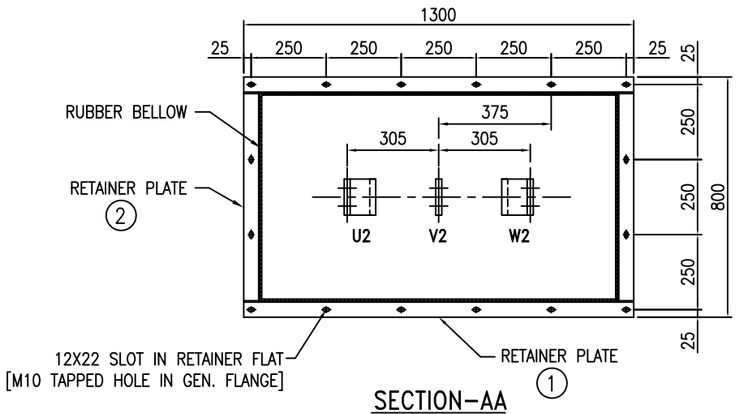
SHEET 10 OF 11 | REV E

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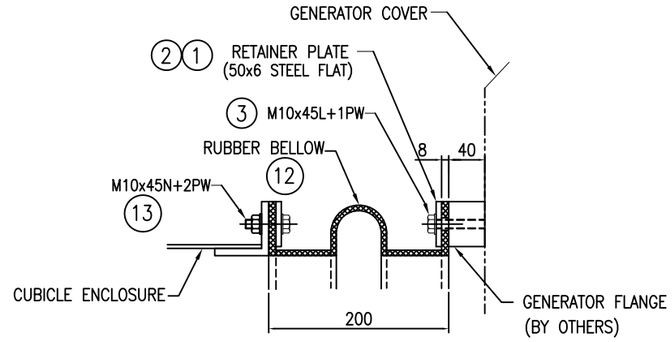
FILE NAME :



GENERATOR INTERFACE DETAILS

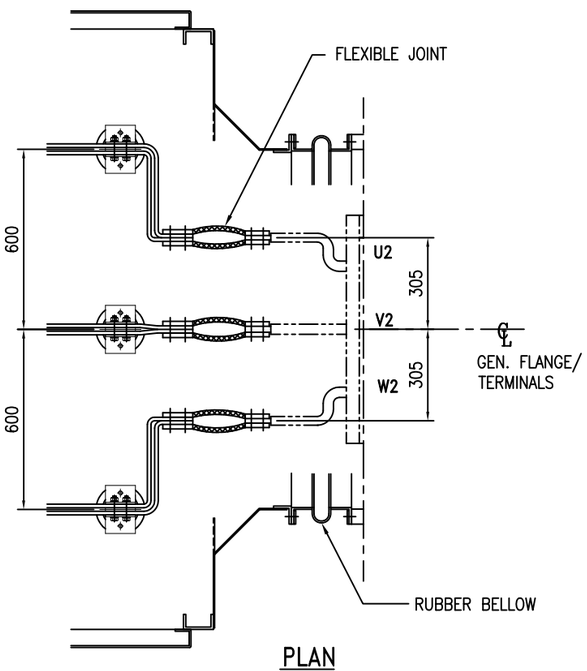


SECTION-AA

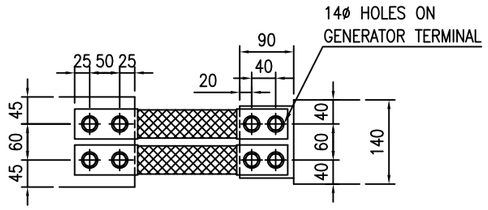


DETAIL-N

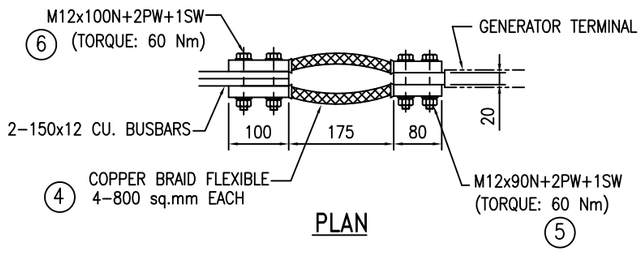
ENCLOSURE CONNECTION WITH GENERATOR



PLAN



DETAIL-M



PLAN

BUSBAR CONNECTION WITH GENERATOR LEAD

ALL DIMENSIONS ARE IN mm

REV. NO.	DESCRIPTION	DATE	APPD	REV.	DESCRIPTION	DATE	APPD.
				D	REVISION LEVEL UPDATED	17.07.18	J.R
				C	REVISION LEVEL UPDATED	04.04.18	J.R
				B	REVISION LEVEL UPDATED	21.03.18	J.R
E	REVISION LEVEL UPDATED	24.08.18	J.R	A	REVISION LEVEL UPDATED	03.03.18	J.R

PROJECT	VILNIUS BIOMASS		
CUSTOMER	SIEMENS AG		
W .O. NO	MP0650	TITLE	NEUTRAL SIDE CUBICLE (TERMINATION AT GENERATOR)
SIZE	A3	SCALE	1 : 30

POWERGEAR Experience The Power
MEPZ, Tambaram, CHENNAI-600045 INDIA

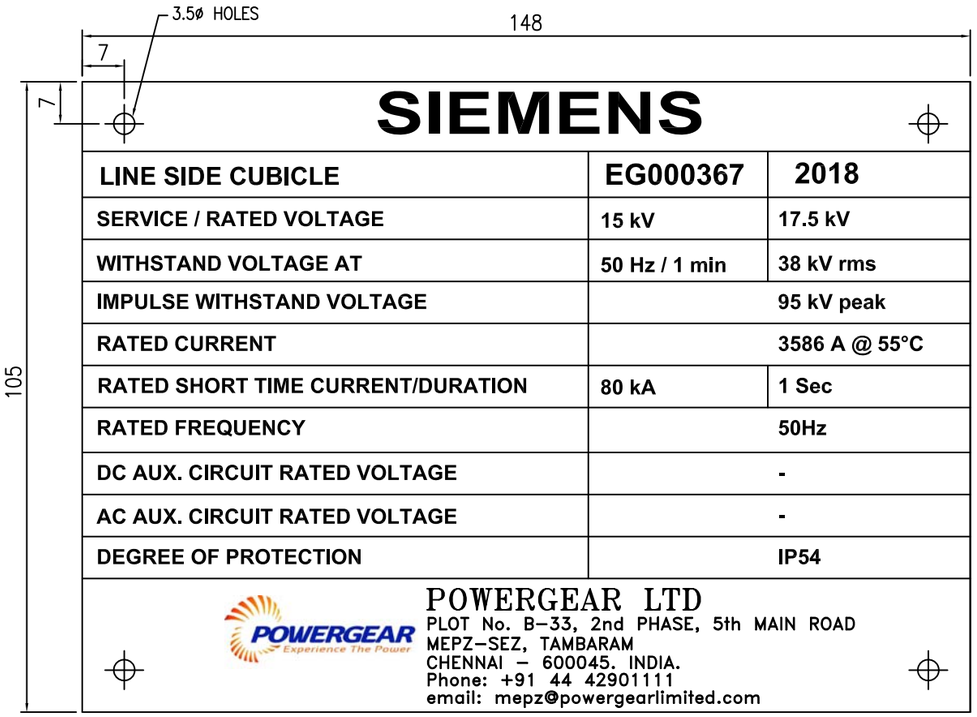
	SIGN	DATE
DRN.	A.ANTONY	29.01.2018
CHD.	J.RAMASWAMY	29.01.2018
APPD.	J.RAMASWAMY	29.01.2018

DRG. NO. DPPPG-70151867

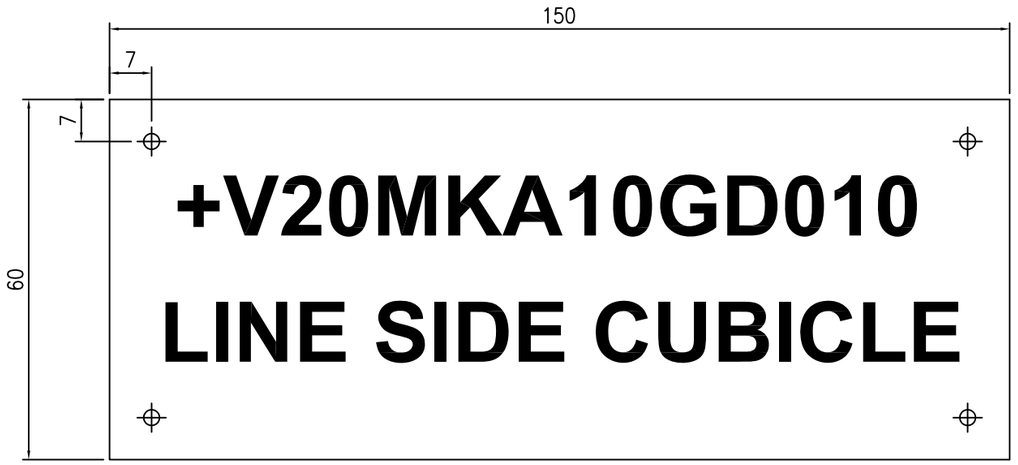
SHEET 11 OF 11 | REV E

FILE NAME :

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RATING PLATE DETAILS



NAME PLATE DETAILS

NOTES :

MATERIAL : 2 th. STAINLESS STEEL

QUANTITY : 1 No. EACH

ALL DIMENSIONS ARE IN mm

REV. NO.	DESCRIPTION	DATE	APPD	REV.	DESCRIPTION	DATE	APPD.
				D	REVISION LEVEL UPDATED	24.08.18	J.R
				C	REVISION LEVEL UPDATED	17.07.18	J.R
				B	REVISION LEVEL UPDATED	21.03.18	J.R
E	REVISION LEVEL UPDATED	07.11.18	J.R	A	REVISION LEVEL UPDATED	03.03.18	J.R

ECCN : EAR99	AL : N	ECL : N	U.S – CONTENT : N
PROJECT VILNIUS BIOMASS			
CUSTOMER SIEMENS AG			
W .O. NO MP0650	TITLE LINE SIDE CUBICLE (RATING PLATE, NAME PLATE)		
SIZE A3	SCALE 1 : 30	POWERGEAR Experience The Power MEPZ, Tambaram, CHENNAI–600045 INDIA	

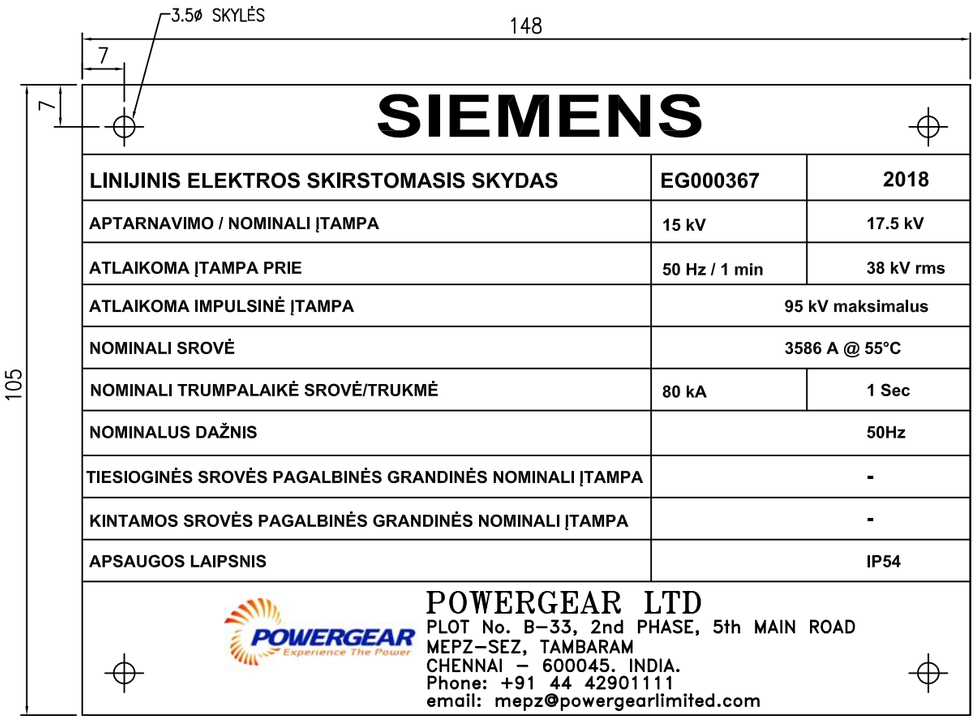
	SIGN	DATE
DRN.	A.ANTONY	29.01.2018
CHD.	J.RAMASWAMY	29.01.2018
APPD.	J.RAMASWAMY	29.01.2018

DRG. NO. DPPPG–70151868

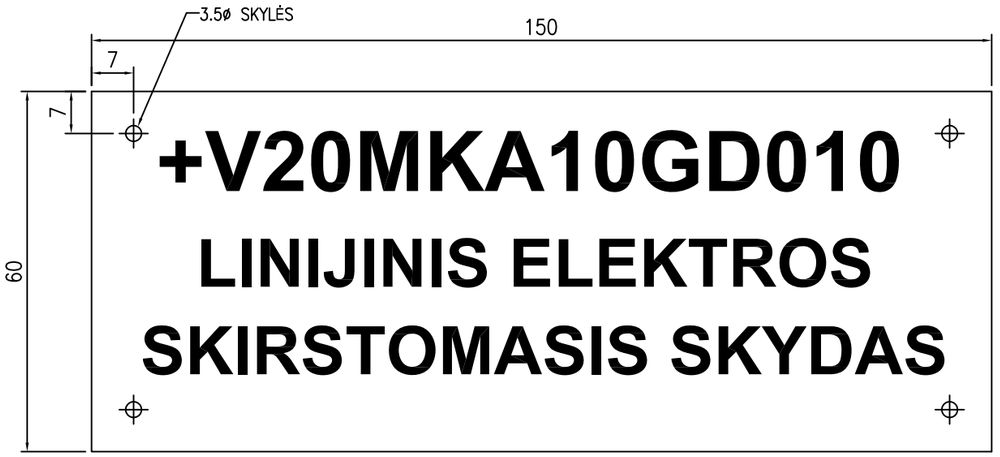
SHEET 1 OF 16 | REV E

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FILE NAME :



ĮVERTINIMO PLOKŠTELĖS DUOMENYS



PAVADINIMO PLOKŠTELĖS DUOMENYS

PASTABOS :

MEDŽIAGA : 2 storio NERŪDYJANTIS PLIENAS
KIEKIS : PO 1 KIEKVIENO NUMERIO

ALL DIMENSIONS ARE IN mm

REV. NO.	DESCRIPTION	DATE	APPD	REV.	DESCRIPTION	DATE	APPD.
				D	REVISION LEVEL UPDATED	24.07.18	J.R
				C	LITHUANIAN LANGUAGE UPDATED	17.07.18	J.R
				B	REVISION LEVEL UPDATED	21.03.18	J.R
E	REVISION LEVEL UPDATED	07.11.18	J.R	A	REVISION LEVEL UPDATED	03.03.18	J.R

ECCN : EAR99	AL : N	ECL : N	U.S – CONTENT : N
PROJECT VILNIUS BIOMASS			
CUSTOMER SIEMENS AG			
W .O. NO MP0650	TITLE LINIJINIS ELEKTROS SKIRSTOMASIS SKYDAS (VERTINIMO PLOKŠTELĖ, PAVADINIMO PLOKŠTELĖ)		
SIZE A3	SCALE 1 : 30	POWERGEAR Experience The Power MEPZ, Tambaram, CHENNAI–600045 INDIA	DRG. NO. DPPPG–70151868

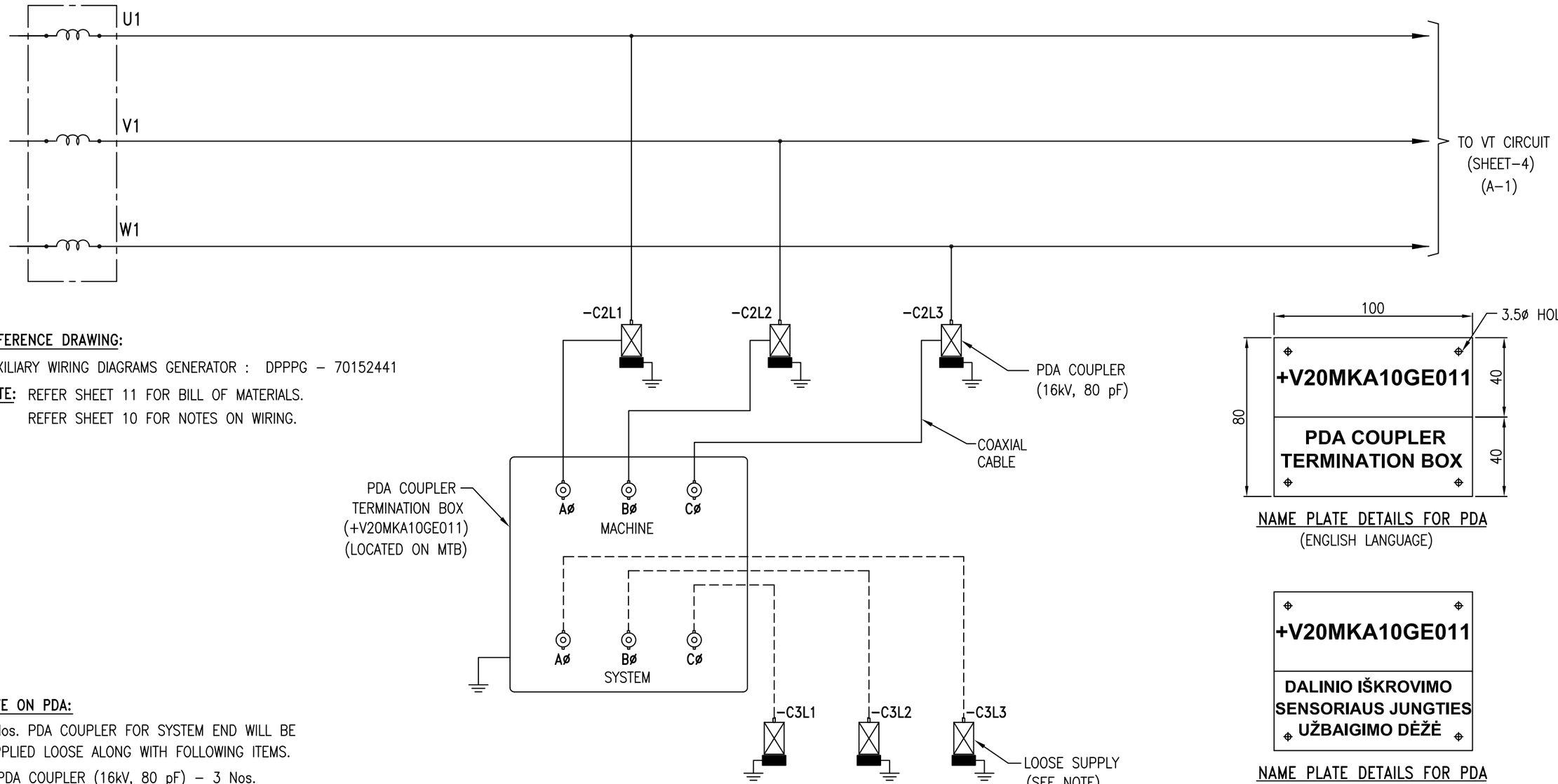
	SIGN	DATE
DRN.	A.ANTONY	29.01.2018
CHD.	J.RAMASWAMY	29.01.2018
APPD.	J.RAMASWAMY	29.01.2018

SHEET 2 OF 16 | REV E

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FILE NAME :

CUBICLE : +V20MKA10GD010



REFERENCE DRAWING:

AUXILIARY WIRING DIAGRAMS GENERATOR : DPPPG – 70152441

NOTE: REFER SHEET 11 FOR BILL OF MATERIALS.
REFER SHEET 10 FOR NOTES ON WIRING.

NOTE ON PDA:

3 Nos. PDA COUPLER FOR SYSTEM END WILL BE SUPPLIED LOOSE ALONG WITH FOLLOWING ITEMS.

1. PDA COUPLER (16kV, 80 pF) – 3 Nos.
2. BNC CONNECTOR – 6 Nos.
3. COAXIAL CABLE – 30 Mtr. (10 Mtr./COUPLER)
4. WIRING BETWEEN SYSTEM END PDA AND PDA TERMINATION BOX WILL BE DONE AT SITE BY SIEMENS.

NAME PLATE DETAILS FOR PDA
(ENGLISH LANGUAGE)

NAME PLATE DETAILS FOR PDA
(LITHUANIAN LANGUAGE)

ALL DIMENSIONS ARE IN mm

REV. NO.	DESCRIPTION	DATE	APPD	REV.	DESCRIPTION	DATE	APPD.
				D	KKS NUMBER +V20 UPDATED AS PER COMMENTS DTD 13.08.18	24.08.18	J.R
				C	PDA NAME PLATE ADDED	17.07.18	J.R
				B	REVISION LEVEL UPDATED	21.03.18	J.R
E	REVISION LEVEL UPDATED	07.11.18	J.R	A	REVISION LEVEL UPDATED	03.03.18	J.R

PROJECT	VILNIUS BIOMASS		
CUSTOMER	SIEMENS AG		
W .O. NO	MP0650	TITLE	LINE SIDE CUBICLE (SCHEMATIC OF PDA COUPLER)
SIZE	A3	SCALE	–
			MEPZ, Tambaram, CHENNAI–600045 INDIA

	SIGN	DATE
DRN.	A.ANTONY	29.01.2018
CHD.	J.RAMASWAMY	29.01.2018
APPD.	J.RAMASWAMY	29.01.2018

DRG. NO. DPPPG–70151868

SHEET 3 OF 16 | REV E

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FILE NAME :

CUBICLE : +V20MKA10GD010

CONTINUED FROM Sh.-3 (B-8)

U1
V1
W1

TO Sh.-6 (A-1)

-T5L1,-T5L2,-T5L3
PRIMARY
15000/√3 V

A N A N A N

SECONDARY-1
100V/√3
CL 0.2;30VA

a n a n a n

-T5L1:1a
-T5L2:3a
-T5L3:5a
-T5:1n

NFGAFOU
2.5Sq.mm

da dn da dn da dn

SECONDARY-2
100V/3
CL 3P; 6A, 8h

-T5L1:da
-T5:dn

NFGAFOU
2.5Sq.mm

TO VT CIRCUIT (SHEET-5) (A-1)

JB : +V20MKA10GE010

MCB BUSBAR

	-F51.1 2.5A	-F52.1 2.5A	-F53.1 2.5A	-F54.1 2.5A	-F55.1 2.5A
	-F51.1:1	-F52.1:1	-F53.1:1	-F54.1:1	-F55.1:1
	-F51.1:3	-F52.1:3	-F53.1:3	-F54.1:3	-F55.1:3
	-F51.1:5	-F52.1:5	-F53.1:5	-F54.1:5	-F55.1:5
	-F51.1:2	-F52.1:2	-F53.1:2	-F54.1:2	-F55.1:2
	-F51.1:4	-F52.1:4	-F53.1:4	-F54.1:4	-F55.1:4
	-F51.1:6	-F52.1:6	-F53.1:6	-F54.1:6	-F55.1:6
	-F51.1:33	-F52.1:33	-F53.1:33	-F54.1:33	-F55.1:33
	-F51.1:34	-F52.1:34	-F53.1:34	-F54.1:34	-F55.1:34
	-F51.1:41	-F52.1:41	-F53.1:41	-F54.1:41	-F55.1:41
	-F51.1:42	-F52.1:42	-F53.1:42	-F54.1:42	-F55.1:42
	-X8:1	-X8:4	-X8:7	-X8:10	-X8:13
	-X8:2	-X8:5	-X8:8	-X8:11	-X8:14
	-X8:3	-X8:6	-X8:9	-X8:12	-X8:15
	-X8:16	-X8:17	-X8:18	-X8:19	-X8:20
	-X10:1	-X10:5	-X10:9	-X10:13	-X10:17
	-X10:2	-X10:6	-X10:10	-X10:14	-X10:18
	-X10:3	-X10:7	-X10:11	-X10:15	-X10:19
	-X10:4	-X10:8	-X10:12	-X10:16	-X10:20
-X8	1 2 3 16	4 5 6 17	7 8 9 18	10 11 12 19	13 14 15 20
-X10	1 2 3 4	5 6 7 8	9 10 11 12	13 14 15 16	17 18 19 20
	PROTECTION	VOLTAGE	PROTECTION	MEASUREMENT	SYNCHRONIZATION
	INDICATION	INDICATION	INDICATION	INDICATION	INDICATION

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ALL DIMENSIONS ARE IN mm

REV. NO.	DESCRIPTION	DATE	APPD	REV.	DESCRIPTION	DATE	APPD.
				D	KKS NUMBER +V20 UPDATED AS PER COMMENTS DTD 13.08.18	24.08.18	J.R
				C	REVISION LEVEL UPDATED	17.07.18	J.R
				B	REVISION LEVEL UPDATED	21.03.18	J.R
E	REVISION LEVEL UPDATED	07.11.18	J.R	A	REVISION LEVEL UPDATED	03.03.18	J.R

PROJECT VILNIUS BIOMASS

CUSTOMER SIEMENS AG

W .O. NO: MP0650

TITLE: LINE SIDE CUBICLE (SCHEMATIC OF VT)

SIZE: A3

SCALE: -

POWERGEAR Experience The Power

MEPZ, Tambaram, CHENNAI-600045 INDIA

	SIGN	DATE
DRN.	A.ANTONY	29.01.2018
CHD.	J.RAMASWAMY	29.01.2018
APPD.	J.RAMASWAMY	29.01.2018

DRG. NO. DPPPG-70151868

SHEET 4 OF 16 | REV E

FILE NAME :

CUBICLE : +V20MKA10GD010

CONTINUED FROM Sh.-4 (C-8)

DN

DA

-R1.1

1 2

20 Ohms
600 W

-R1.1:1

-R1.1:2

JB : +V20MKA10GE010

-F50.1:1

1

-F50.1
6A

2

13 21

14 22

-F50.1:2

-F50.1:13

-F50.1:14

-F50.1:21

-F50.1:22

-X8:21

-X8:22

-X10:21

-X10:22

-X10:23

-X10:24

-X8 21 22

-X10 21 22 23 24

PROTECTION

INDICATION

ALL DIMENSIONS ARE IN mm

REV. NO.	DESCRIPTION	DATE	APPD	REV.	DESCRIPTION	DATE	APPD.
				D	REVISION LEVEL UPDATED	24.08.18	J.R
				C	REVISION LEVEL UPDATED	17.07.18	J.R
				B	REVISION LEVEL UPDATED	21.03.18	J.R
E	REVISION LEVEL UPDATED	07.11.18	J.R	A	REVISION LEVEL UPDATED	03.03.18	J.R

PROJECT VILNIUS BIOMASS

CUSTOMER SIEMENS AG

W .O. NO MP0650

TITLE LINE SIDE CUBICLE (SCHEMATIC OF VT)

SCALE -

SIZE A3

POWERGEAR Experience The Power

MEPZ, Tambaram, CHENNAI-600045 INDIA

	SIGN	DATE
DRN.	A.ANTONY	29.01.2018
CHD.	J.RAMASWAMY	29.01.2018
APPD.	J.RAMASWAMY	29.01.2018

DRG. NO. DPPPG-70151868

SHEET 5 OF 16 REV E

FILE NAME :

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CONTINUED FROM Sh.-4 (A-7)

CUBICLE : +V20MKA10GD010

U1
V1
W1

TO Sh.-8 (B-1)

-T6L1,-T6L2,-T6L3

PRIMARY
15000/√3 V

A N A N A N

SECONDARY-1
100V/√3
CL 0.2;30VA

a n a n a n

-T6L1:1a
-T6L2:3a
-T6L3:5a
-T6:1n

NFGAFOU
2.5Sq.mm

da dn da dn da dn

SECONDARY-2
100V/3
CL 3P; 6A, 8h

-T6L1:da
-T6:dn

NFGAFOU
2.5Sq.mm

TO VT CIRCUIT
(SHEET-7)
(A-1)

JB : +V20MKA10GE010

MCB BUSBAR

	-F51.2 2.5A	-F52.2 2.5A	-F53.2 2.5A	-F54.2 2.5A	-F55.2 2.5A
	-F51.2:1	-F52.2:1	-F53.2:1	-F54.2:1	-F55.2:1
	-F51.2:3	-F52.2:3	-F53.2:3	-F54.2:3	-F55.2:3
	-F51.2:5	-F52.2:5	-F53.2:5	-F54.2:5	-F55.2:5
	-F51.2:2	-F52.2:2	-F53.2:2	-F54.2:2	-F55.2:2
	-F51.2:4	-F52.2:4	-F53.2:4	-F54.2:4	-F55.2:4
	-F51.2:6	-F52.2:6	-F53.2:6	-F54.2:6	-F55.2:6
	-F51.2:33	-F52.2:33	-F53.2:33	-F54.2:33	-F55.2:33
	-F51.2:34	-F52.2:34	-F53.2:34	-F54.2:34	-F55.2:34
	-F51.2:41	-F52.2:41	-F53.2:41	-F54.2:41	-F55.2:41
	-F51.2:42	-F52.2:42	-F53.2:42	-F54.2:42	-F55.2:42
	-X8:23	-X8:26	-X8:29	-X8:32	-X8:35
	-X8:24	-X8:27	-X8:30	-X8:33	-X8:36
	-X8:25	-X8:28	-X8:31	-X8:34	-X8:37
	-X10:25	-X10:29	-X10:33	-X10:37	-X10:41
	-X10:26	-X10:30	-X10:34	-X10:38	-X10:42
	-X10:27	-X10:31	-X10:35	-X10:39	-X10:43
	-X10:28	-X10:32	-X10:36	-X10:40	-X10:44
	-X8:38	-X8:39	-X8:40	-X8:41	-X8:42
-X8	23 24 25 38	26 27 28 39	29 30 31 40	32 33 34 41	35 36 37 42
-X10	25 26 27 28	29 30 31 32	33 34 35 36	37 38 39 40	41 42 43 44
	PROTECTION	INDICATION	VOLTAGE	INDICATION	PROTECTION	INDICATION	MEASUREMENT	INDICATION	SYNCHRONIZATION	INDICATION

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ALL DIMENSIONS ARE IN mm

REV. NO.	DESCRIPTION	DATE	APPD	REV.	DESCRIPTION	DATE	APPD.
				D	KKS NUMBER +V20 UPDATED AS PER COMMENTS DTD 13.08.18	24.08.18	J.R
				C	REVISION LEVEL UPDATED	17.07.18	J.R
				B	REVISION LEVEL UPDATED	21.03.18	J.R
E	REVISION LEVEL UPDATED	07.11.18	J.R	A	REVISION LEVEL UPDATED	03.03.18	J.R

PROJECT VILNIUS BIOMASS

CUSTOMER SIEMENS AG

W .O. NO: MP0650

TITLE: LINE SIDE CUBICLE (SCHEMATIC OF VT)

SIZE: A3

SCALE: -

POWERGEAR Experience The Power

MEPZ, Tambaram, CHENNAI-600045 INDIA

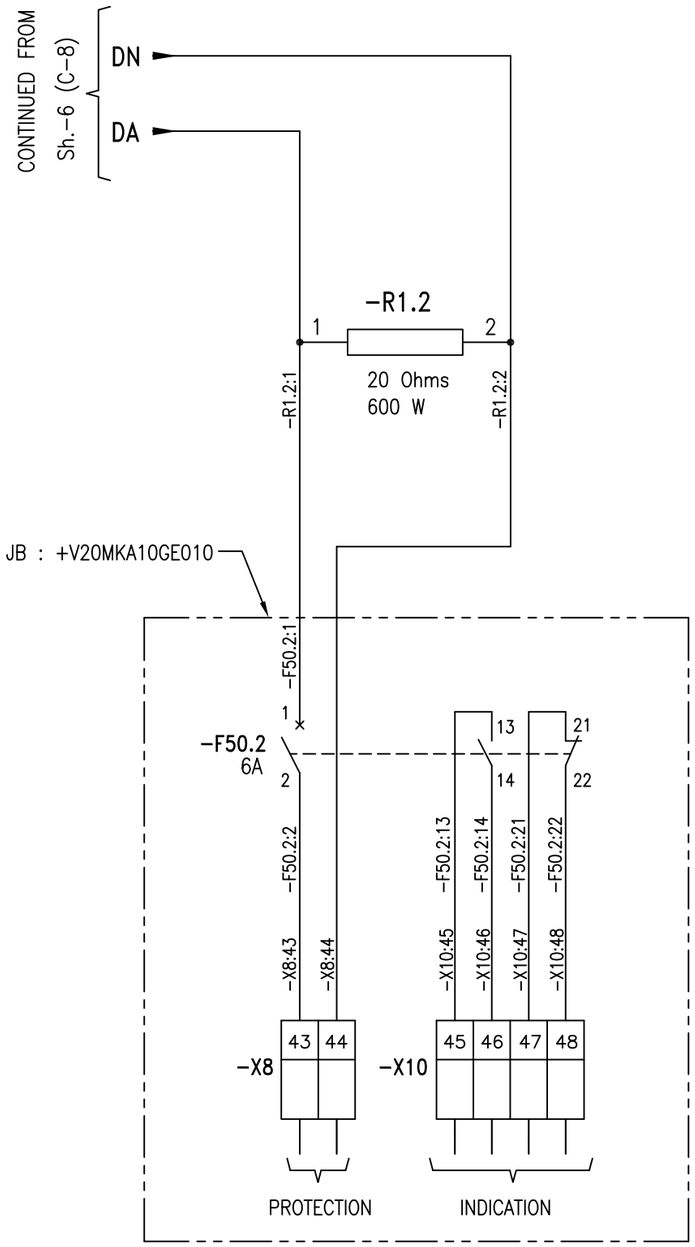
	SIGN	DATE
DRN.	A.ANTONY	29.01.2018
CHD.	J.RAMASWAMY	29.01.2018
APPD.	J.RAMASWAMY	29.01.2018

DRG. NO. DPPPG-70151868

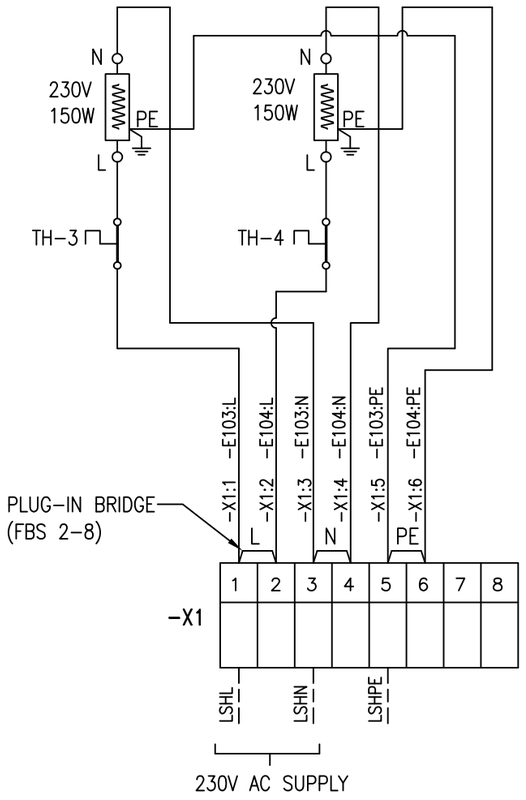
SHEET 6 OF 16 | REV E

FILE NAME :

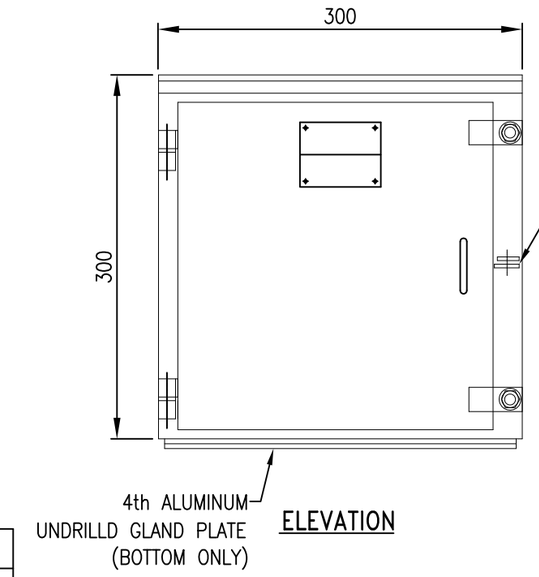
CUBICLE : +V20MKA10GD010



=MKA10AH111-E103 =MKA10AH111-E104

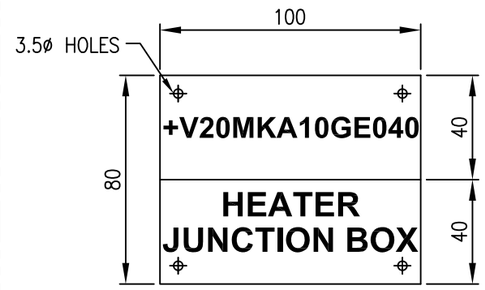


SPACE HEATER CIRCUIT

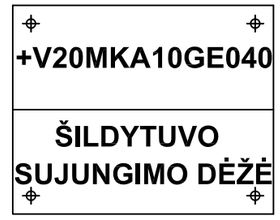


GENERAL ARRANGEMENT OF HEATER BOX

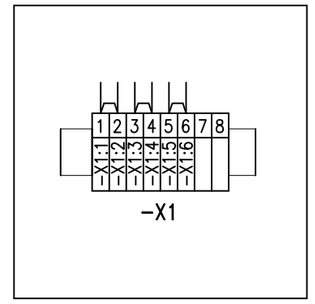
MATERIAL : 2 Thk. STAINLESS STEEL



NAME PLATE DETAILS
(ENGLISH LANGUAGE)



NAME PLATE DETAILS
(LITHUANIAN LANGUAGE)



TERMINAL DETAILS INSIDE HEATER BOX

ALL DIMENSIONS ARE IN mm

REV. NO.	DESCRIPTION	DATE	APPD	REV.	DESCRIPTION	DATE	APPD.
				D	KKS NUMBER +V20 UPDATED AS PER COMMENTS DTD 13.08.18	24.08.18	J.R
				C	LITHUANIAN LANGUAGE HEATER BOX NAME PLATE ADDED	17.07.18	J.R
				B	THERMOSTAT ADDED AS PER SIEMENS COMMENTS DTD. 21.03.18	21.03.18	J.R
E	REVISION LEVEL UPDATED	07.11.18	J.R	A	REVISION LEVEL UPDATED	03.03.18	J.R

		SIGN	DATE
DRN.	A.ANTONY		29.01.2018
CHD.	J.RAMASWAMY		29.01.2018
APPD.	J.RAMASWAMY		29.01.2018

PROJECT VILNIUS BIOMASS

CUSTOMER SIEMENS AG

W .O. NO MP0650

TITLE LINE SIDE CUBICLE (SCHEMATIC OF VT & SPACE HEATER)

SCALE -

SIZE A3

POWERGEAR Experience The Power

MEPZ, Tambaram, CHENNAI-600045 INDIA

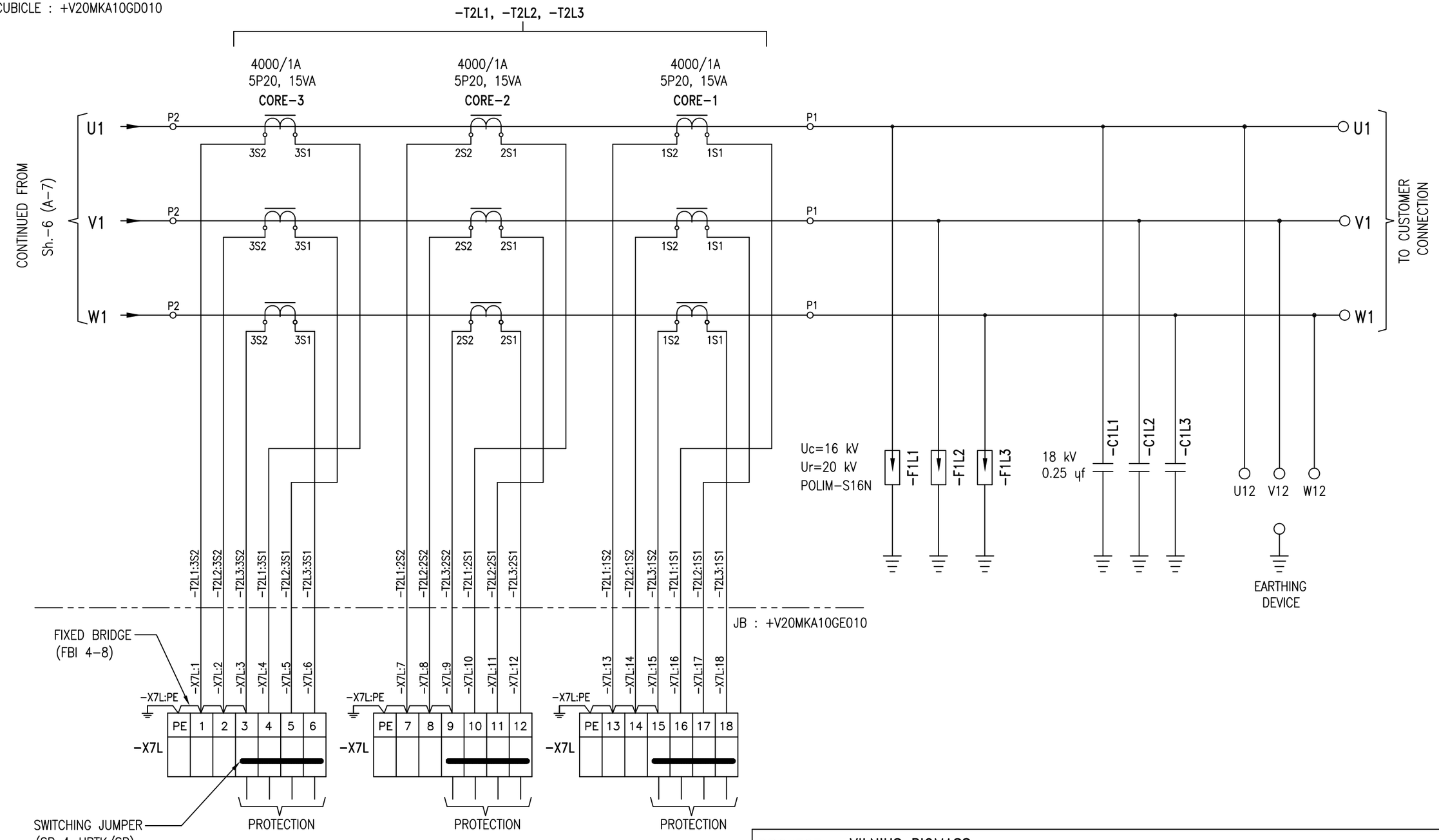
DRG. NO. DPPPG-70151868

SHEET 7 OF 16 REV E

FILE NAME :

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CUBICLE : +V20MKA10GD010



ALL DIMENSIONS ARE IN mm

REV. NO.	DESCRIPTION	DATE	APPD	REV.	DESCRIPTION	DATE	APPD.
				D	KKS NUMBER +V20 UPDATED AS PER COMMENTS DTD 13.08.18	24.08.18	J.R
				C	REVISION LEVEL UPDATED	17.07.18	J.R
				B	REVISED AS PER SIEMENS COMMENTS DTD. 16.03.18	21.03.18	J.R
E	REVISION LEVEL UPDATED	07.11.18	J.R	A	REVISION LEVEL UPDATED	03.03.18	J.R

PROJECT VILNIUS BIOMASS

CUSTOMER SIEMENS AG

W .O. NO MP0650

TITLE LINE SIDE CUBICLE (SCHEMATIC OF CT)

SCALE -

SIZE A3

POWERGEAR Experience The Power

MEPZ, Tambaram, CHENNAI-600045 INDIA

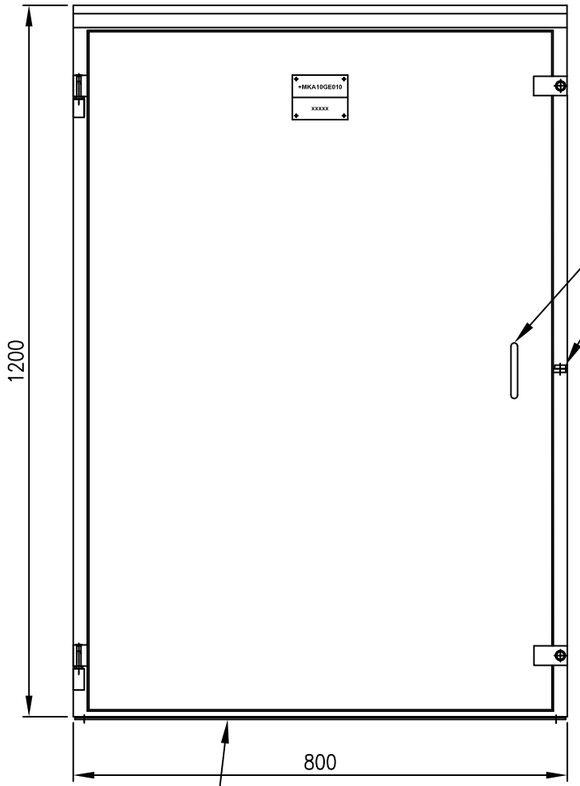
	SIGN	DATE
DRN.	A.ANTONY	29.01.2018
CHD.	J.RAMASWAMY	29.01.2018
APPD.	J.RAMASWAMY	29.01.2018

DRG. NO. DPPPG-70151868

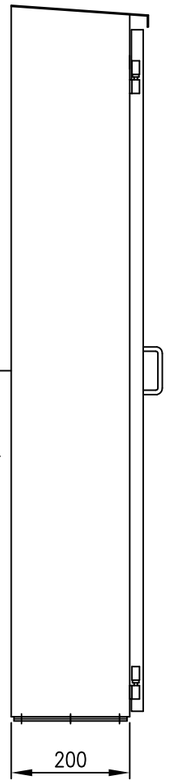
SHEET 8 OF 16 REV E

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FILE NAME :



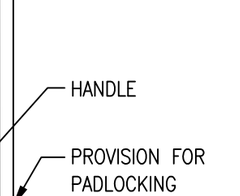
ELEVATION



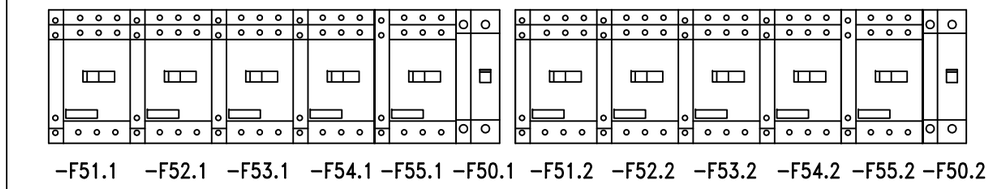
END VIEW

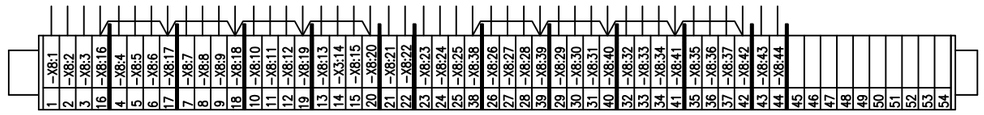
GENERAL ARRANGEMENT OF JUNCTION BOX

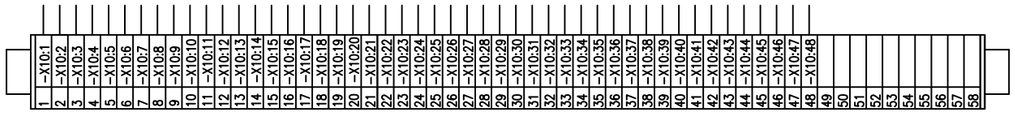
NAME PLATE DETAILS
(ENGLISH LANGUAGE)

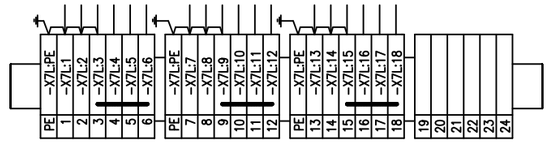


NAME PLATE DETAILS
(LITHUANIAN LANGUAGE)









(GROUNDED TO
CUBICLE)

TERMINAL BLOCK ARRANGEMENT INSIDE JUNCTION BOX

EARTH BUS
25x3th. Cu.

ALL DIMENSIONS ARE IN mm

REV. NO.	DESCRIPTION	DATE	APPD	REV.	DESCRIPTION	DATE	APPD.
				D	KKS NUMBER +V20 UPDATED AS PER COMMENTS DTD 13.08.18	24.08.18	J.R
				C	LITHUANIAN LANGUAGE JB NAME PLATE ADDED	17.07.18	J.R
				B	REVISION LEVEL UPDATED	21.03.18	J.R
E	REVISION LEVEL UPDATED	07.11.18	J.R	A	REVISION LEVEL UPDATED	03.03.18	J.R

			SIGN	DATE
PROJECT	VILNIUS BIOMASS	DRN.	A.ANTONY	29.01.2018
CUSTOMER	SIEMENS AG	CHD.	J.RAMASWAMY	29.01.2018
W .O. NO	MP0650	APPD.	J.RAMASWAMY	29.01.2018
TITLE	LINE SIDE CUBICLE (JUNCTION BOX DETAILS)	DRG. NO.	DPPPG-70151868	
SCALE	-	SHEET	9 OF 16	REV E
SIZE	A3			

POWERGEAR Experience The Power
MEPZ, Tambaram, CHENNAI-600045 INDIA

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FILE NAME :

CURRENT TRANSFORMER (–T2L1,–T2L2,–T2L3)

TYPE	: DRY TYPE, CAST RESIN
RATED VOLTAGE	: 15 kV
RATED FREQUENCY	: 50 HZ.
INSULATION LEVEL(WHEN MOUNTED)	: 17.5 kV /38 kV rms (1 Min.)/95 kV peak.
INSULATION CLASS	: B (130° C)
SHORT TIME RATING	: 80 KA–1sec
APPLICABLE STANDARD	: IEC 60044–1 / IEC 61869–2

VOLTAGE TRANSFORMER (–T5L1,–T5L2,–T5L3,–T6L1,–T6L2–T6L3)

TYPE	: DRY TYPE, CAST RESIN
RATED FREQUENCY	: 50 HZ.
INSULATION LEVEL	: 17.5 kV/38 kV rms (1 Min.)/95 kV peak
INSULATION CLASS	: B (130° C)
OVER VOLTAGE FACTOR	: 1.2 cont. / 1.9 For 8 Hours
APPLICABLE STANDARD	: IEC 60044–1 / IEC 61869–3

SURGE CAPACITORS (–C1L1,–C1L2,–C1L3)

RATED VOLTAGE	: 18 KV
CAPACITOR RATING	: 0.25 Micro F. ± 10 %
RATED FREQUENCY	: 50 Hz
INSULATION LEVEL FOR CAPACITOR BUSHING	: 17.5 kV/38 kV rms (1 Min.)/95 kV peak
APPLICABLE STANDARD	: IEC 60871

LIGHTNING ARRESTORS (–F1L1,–F1L2,–F1L3)

TYPE	: STATION–GAPLESS, METAL OXIDE, POLYMER
RATED VOLTAGE (Ur)	: 20 kV
MCOV RATING (Uc)	: 16 kV
NOMINAL DISCHARGE CURRENT	: 10 kA
REF. STANDARD	: IEC 60099/ANSI/IEEE C62.11

NOTES

1. WIRING WILL BE DONE AS GIVEN BELOW :

CT CIRCUIT	– 4 Sq.mm TINNED COPPER, 750V GRADE, 90°C HEAT RESISTANCE CABLE	– BLACK COLOUR FOR PHASE & SHORTING GREEN/YELLOW COLOUR FOR GROUND
VT CIRCUIT	– 2.5 Sq.mm TINNED COPPER, 1800V GRADE, NSGAFOU CABLE UPTO MCB	– BLACK COLOUR FOR PHASE
	– 2.5 Sq.mm TINNED COPPER, 750V GRADE, 90°C HEAT RESISTANCE CABLE (AFTER MCB)	– BLACK COLOUR FOR PHASE
	_ 4 Sq. mm TINNED COPPER, 750V GRADE, 90°C HEAT RESISTANCE CABLE	– GREEN/YELLOW COLOUR FOR GROUND
HEATER CIRCUIT	– 2.5 Sq.mm TINNED COPPER, 750V GRADE, 90°C HEAT RESISTANCE CABLE	– BLACK COLOUR FOR LINE – LIGHT BLUE COLOUR FOR NEUTRAL

2. ALL THE ABOVE CABLES ARE "CE" MARKED

ALL DIMENSIONS ARE IN mm

REV. NO.	DESCRIPTION	DATE	APPD	REV.	DESCRIPTION	DATE	APPD.
				D	KKS NUMBER +V20 UPDATED AS PER COMMENTS DTD 13.08.18	24.08.18	J.R
				C	REVISION LEVEL UPDATED	17.07.18	J.R
				B	REVISION LEVEL UPDATED	21.03.18	J.R
E	REVISION LEVEL UPDATED	07.11.18	J.R	A	REVISION LEVEL UPDATED	03.03.18	J.R

PROJECT	VILNIUS BIOMASS		
CUSTOMER	SIEMENS AG		
W .O. NO	MP0650	TITLE	LINE SIDE CUBICLE (TECHNICAL SPECIFICATION)
SCALE	–		POWERGEAR Experience The Power MEPZ, Tambaram, CHENNAI–600045 INDIA
SIZE	A3		

	SIGN	DATE
DRN.	A.ANTONY	29.01.2018
CHD.	J.RAMASWAMY	29.01.2018
APPD.	J.RAMASWAMY	29.01.2018

DRG. NO. DPPPG–70151868

SHEET 10 OF 16 | REV E

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FILE NAME :

BILL OF MATERIALS

SL.No.	LEGENDA	DESCRIPTION		QUANTITY (Nos.)	MAKE	TYPE	CATALOQUE REF.
1	–T2L1,–T2L2,–T2L3	CURRENT TRANSFROMER (SEE DETAILS IN Sh.8) RATIO : 4000/1/1/1A	CORE–1 : CLASS – 5P20,15VA CORE–2 : CLASS – 5P20,15VA CORE–3 : CLASS – 5P20,15VA	3	PRAYOG, INDIA	CAST RESIN	CT–2452/R
2	–T5L1,–T5L2,–T5L3 –T6L1,–T6L2,–T6L3	VOLTAGE TRANSFORMER (SEE DETAILS IN Sh.10) 15000/√3V:100/√3:100/3	WINDING –1 : CL. 0.2, 30VA WINDING –2 : CL. 3P, 6A, 8h	6	PRAYOG, INDIA	CAST RESIN	VT–2473
3	–R1.1, –R1.2	OPEN DELTA VT RESISTOR 20 Ohms, 600 W		2	KWK, INDIA	WIRE WOUND	
4	–C1L1,–C1L2,–C1L3	SURGE CAPACITOR (SEE DETAILS IN Sh.10)		3	ABB, INDIA		YC1H419450–031
5	–F1L1,–F1L2,–F1L3	LIGHTNING ARRESTOR (SEE DETAILS IN Sh.10)		3	ABB	POLIM–S	POLIM–S16N
6	–C2L1,–C2L2–C2L3	PDA COUPLER – 16kV, 80 pF		3+3	IRIS	EMC	
7		PDA COUPLER CABLE TERMINATION BOX – FIBRE GLASS POLYESTER (+V20MKA10GE011)		1	IRIS	EMC	
8	–X7L	TERMINALS IN (+V20MKA10GE010)		21+6	PHOENIX,GERMANY	DISCONNECTING TYPE	URTK/SP
	–X8,–X10			92+20	PHOENIX,GERMANY	STUD TYPE	UT6
9	–	CT SWITCHING JUMPER		3	PHOENIX,GERMANY	4 WAY	SB 4–URTK/SP
10	–	SHORTING BRIDGE		3	PHOENIX,GERMANY	4 WAY	FBI 4–8
11	–F51.1,–F52.1,–F53.1,–F54.1,–F55.1 –F51.2,–F52.2,–F53.2,–F54.2,–F55.2	MINIATURE CIRCUIT BREAKER, 3POLE, 2.5A WITH 1NO+1NC CONTACTS		10	SEIMENS		3RV1611–1CG14 3RV2901–1A
12	–F50.1, –F50.2	MINIATURE CIRCUIT BREAKER, 1POLE, 6A WITH 1NO+1NC CONTACTS		2	SIEMENS		5SL–61067RC 5ST3 010
13	–	MCB BUSBAR – 5 WAY		2	SIEMENS		3RV1915–2DB
14	–	MCB TERMINAL		2	SIEMENS		3RV1915–5A
15	–U12,–V12,–W12	EARTHING DEVICE		1 SET	CATU		
16	–E103, –E104	SPACE HEATERS 230V AC, 150W		2	KWK, INDIA	BOX TYPE	
17	–X1	TERMINALS IN HEATER BOX (+V20MKA10GE040)		8	PHOENIX,GERMANY	STUD TYPE	UT6
18	–	PLUG–IN BRIDGE		3	PHOENIX,GERMANY	2 WAY	FBS 2–8
19	TH–3 & TH–4	THERMOSTAT (0–50°C SETTING RANGE)		2	JUMO, GERMANY	CAPILLARY TYPE	

ALL DIMENSIONS ARE IN mm

REV. NO.	DESCRIPTION	DATE	APPD	REV.	DESCRIPTION	DATE	APPD.
				D	BILL OF MATERIAL UPDATED AS MADE	24.08.18	J.R
				C	REVISION LEVEL UPDATED	17.07.18	J.R
				B	REVISED AS PER SIEMENS COMMENTS DTD. 16.03.18 & 21.03.18	21.03.18	J.R
E	REVISION LEVEL UPDATED	07.11.18	J.R	A	REVISION LEVEL UPDATED	03.03.18	J.R

PROJECT VILNIUS BIOMASS

CUSTOMER SIEMENS AG

W .O. NO: MP0650

TITLE: LINE SIDE CUBICLE (TECHNICAL SPECIFICATION)

SCALE: –

SIZE: A3

POWERGEAR Experience The Power

MEPZ, Tambaram, CHENNAI–600045 INDIA

	SIGN	DATE
DRN.	A.ANTONY	29.01.2018
CHD.	J.RAMASWAMY	29.01.2018
APPD.	J.RAMASWAMY	29.01.2018

DRG. NO. DPPPG–70151868

SHEET 11 OF 16 REV E

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FILE NAME :

TECHNICAL PARTICULARS

SERVICE VOLTAGE	: 15 kV
HIGHEST VOLTAGE	: 17.5 kV
RATED CURRENT	: 3586 A @ 55° C
RATED FREQUENCY	: 50 Hz.
SHORT TIME CURRENT RATING	: 80 kA rms for 1 Sec. (200 kA Peak)
BASIC INSULATION LEVEL	: 17.5 kV / 38 kV rms (1 Min.)/95 kV peak.
TEMPERATURE RISE OVER AN AMBIENT OF 55°C	
– BUSBAR	: 50°C
– ENCLOSURE	: 15°C
DEGREE OF PROTECTION	: IP 54

NOTES :

1. REFERENCE DRAWING
   - a. GENERATOR MASSBILD – OUTLINE DRAWING : DPPPG–70149178 Rev.A
   - b. AUXILIARY WIRING DIAGRAMS GENERATOR : DPPPG – 70152441
   - c. BUSHING / TERMINAL BOARD : 2–460377 Rev.A
   - d. BUSBAR : 3–403720 Rev.B
   - e. WELDING FLANGE : 2–457773 Rev.A
   - f. BUSHING ASSEMBLY : 1–2570–451105 Rev.A
   - g. INQUIRY DATA SHEET : DPPPG/70151865
   - h. BELLOW UNIT 164/94 : 6.37.04.012.611–620.02
   - i. BUS BAR CONNECTION UNIT SIS 17,5–4000A E–A1 : 38.265261.00
2. CONSTRUCTION
   - CUBICLE : 4mm THICK ALUMINUM
   - JUNCTION BOX : 2mm THICK STAINLESS STEEL
   - BUSBAR (MAIN) : 2 – 150 x 12 COPPER
   - EARTH BUSBAR : 1 – 50 x 10 COPPER (TINNED)
   - SUPPORTING STRUCTURE : MILD STEEL EXTRUSION
3. ALL THE DIMENSIONS ARE MARKED IN METRIC SYSTEM. [mm]
4. MINIMUM CLERANCES – PHASE TO PHASE & – PHASE TO GROUND : 160 mm
5. PAINT FINISH
   - ENCLOSURE – INSIDE AND OUTSIDE : RAL 7030
   - BUSBAR : BLACK MATT
   - SUPPORT STRUCTURE : RAL 7030
6. ALL BUSBAR JOINT CONTACT SURFACES ARE BARE COPPER (GEN. FLEXIBLE END SILVER PLATED)
7. HARDWARE, GASKETS TO CONNECT LINE SIDE CUBICLE ENCLOSURE WITH GENERATOR WILL BE SUPPLIED BY POWERGEAR
8. HARDWARE, FLEXIBLES TO CONNECT LINE SIDE CUBICLE BUSBAR WITH GENERATOR LEADS WILL BE SUPPLIED BY POWERGEAR
9. HARDWARE, GASKET, INSULATED BUSBAR, RUBBER BELLOW & FLEXIBLE TO CONNECT IPB END WITH BUSDUCT BY SIEMENS
10. IPB DUCT MUST BE ELECTRICALY ISOLATED FROM CUBICLE
11. DANGER PLATES ARE PROVIDED ON ALL ACCESS DOORS
12. WEIGHT : CUBICLE – 1500 kgs
    : STRUCTURE – 150 kgs

ALL DIMENSIONS ARE IN mm

REV. NO.	DESCRIPTION	DATE	APPD	REV.	DESCRIPTION	DATE	APPD.
				D	REVISION LEVEL UPDATED	24.08.18	J.R
				C	REVISION LEVEL UPDATED	17.07.18	J.R
				B	NOTE 9 UPDATED AS PER SIEMENS COMMENTS DTD. 12.03.18	21.03.18	J.R
E	REVISION LEVEL UPDATED	07.11.18	J.R	A	REVISION LEVEL UPDATED	03.03.18	J.R

BILL OF MATERIALS FOR FIELD ASSEMBLY

ITEM	DESCRIPTION	MATERIAL	QUANTITY	IDENTIFICATION
1	RETAINER PLATE – 50x6x1300	MS PAINTED	4 NO's	SHEET 16
2	RETAINER PLATE – 50x6x690	MS PAINTED	4 NO's	SHEET 16
3	M10 x 45 LONG + 1PW	SS A270	16 NO's	SHEET 16
4	COPPER BRAID FLEXIBLE–50x25x380mm LONG	COPPER	12 NO's	SHEET 16
5	M12x90 BOLT+NUT+2PW+1SW	SS A270	12 NO's	SHEET 16
6	M12x100 BOLT+NUT+2PW+1SW	SS A270	12 NO's	SHEET 16
7	ANCHOR BOLT – M12X140/50 HST, HILTI MAKE	STEEL (5.6 GR.)	24 NO's	SHEET 13
8	ANTI–VIBRATION MOUNT	–	6 NO's	SHEET 13
9	PACKING SHIM – 100x100mm THICKNESS : 15+6+6+3+2 (Per Mount)	GALVD.	6 NO's EACH	SHEET 13
10	M16 NUT + 1PW + 1SW	SS A270	6 NO's	SHEET 13
11	M12x50LONG+NUT+2PW+1SW	SS A270	20 NO's	SHEET 13
12	EARTHING SYSTEM WITH KIT	–	1 NO's	SHEET 15
13	RUBBER BELLOW	EPDM	1 NO's	SHEET 16
14	M10X45N+2PW	SS A270	16 NO's	SHEET 16
15	SUPPORT STRUCTURE	MS	1 NO's	SHEET 13
16	EPOXY MICA CAPACITOR (16kV, 80 pF)	–	3 NO's	LOOSE SUPPLY
17	BNC CONNECTOR	–	6 NO's	LOOSE SUPPLY
18	COAXIAL CABLE	–	30 Mtr.	LOOSE SUPPLY
19	PDA NAME PLATE (–C3L1, –C3L2, –C3L3)	SS	3 No's	LOOSE SUPPLY
20	EMC METAL CLAMP (FOR PDA)	SS	6 No's (3 Set)	LOOSE SUPPLY
21	EMC BOOT (FOR PDA)	–	3 No's	LOOSE SUPPLY
22	15kV JUMPER CABLE WITH ANGLE LUG(FOR PDA)	–	3 No's	LOOSE SUPPLY
23	GROUND WIRE CONNECTION (FOR PDA)	–	10 ft	LOOSE SUPPLY
24	HI – VOLTAGE LUG WITH HEAT SHINK + GROUND WIRE LUG (FOR PDA)	–	3 No's	LOOSE SUPPLY
25	SHORTING BUSBAR – 1 (150–12Th.)	COPPER	2 NO's	SHEET 16
26	SHORTING BUSBAR – 2 (150–12Th.)	COPPER	4 NO's	SHEET 16
27	M12x60 BOLT+NUT+2PW+1SW	SS A270	24 NO's	SHEET 16
28	12 Th. COPPER BUSBAR (WITH TINNED PLATED)	COPPER	3 NO's	SHEET 14

PROJECT VILNIUS BIOMASS

CUSTOMER SIEMENS AG

W .O. NO MP0650

TITLE LINE SIDE CUBICLE (NOTES ON GENERAL ARRANGEMENT & FIELD ASSEMBLY)

SCALE 1 : 30

SIZE A3

POWERGEAR Experience The Power

MEPZ, Tambaram, CHENNAI–600045 INDIA

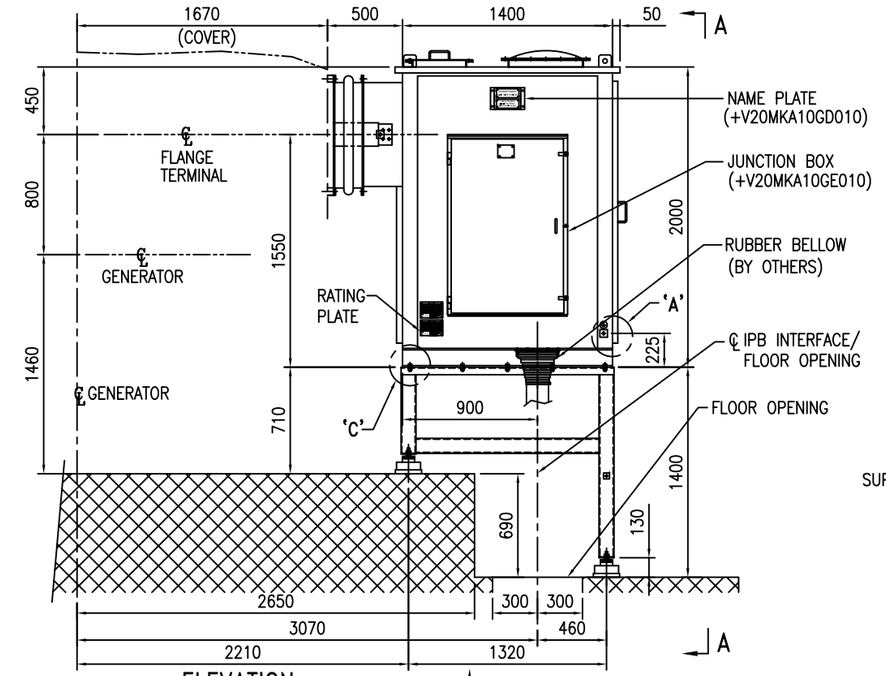
	SIGN	DATE
DRN.	A.ANTONY	29.01.2018
CHD.	J.RAMASWAMY	29.01.2018
APPD.	J.RAMASWAMY	29.01.2018

DRG. NO. DPPPG–70151868

SHEET 12 OF 16 REV E

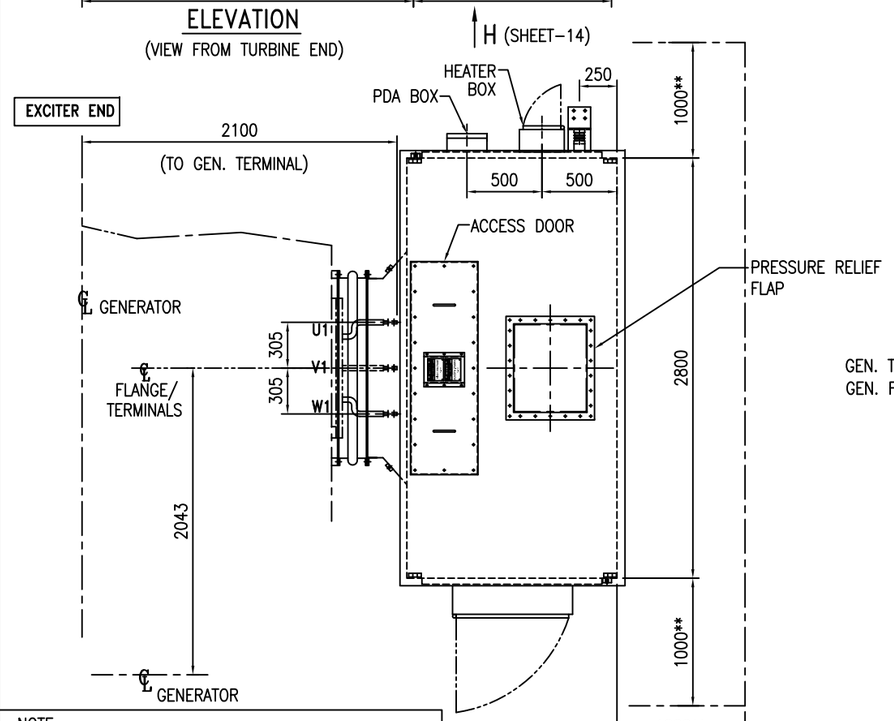
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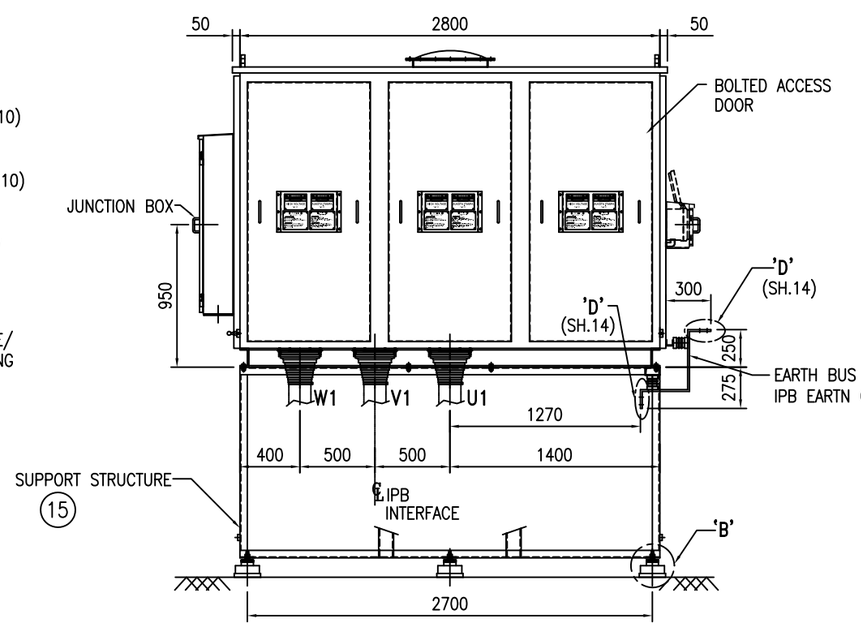
ELEVATION

(VIEW FROM TURBINE END)

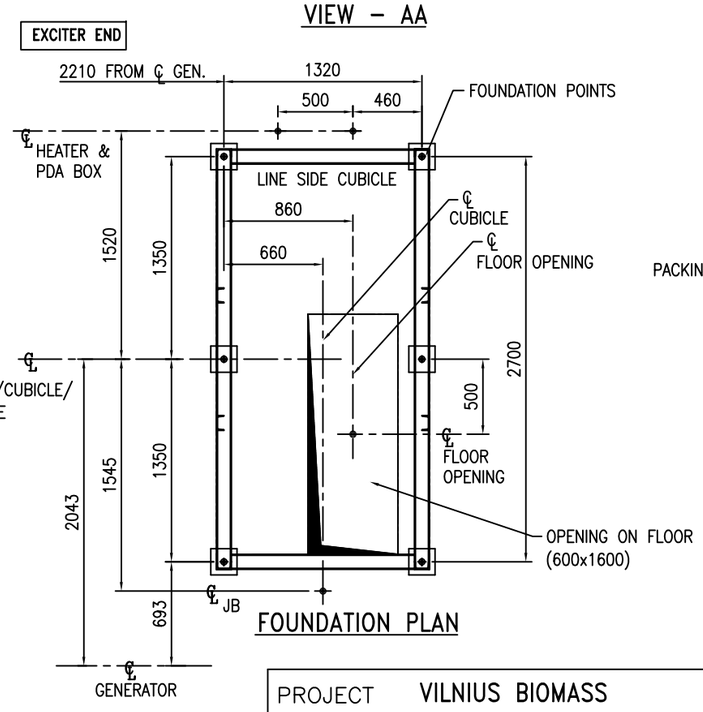


PLAN

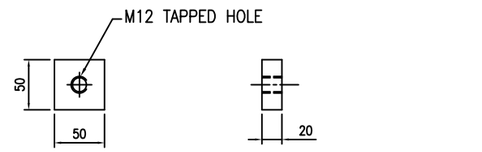
NOTE:
* * MINIMUM CLEARANCE REQUIRED FOR MAINTENANCE



VIEW – AA



FOUNDATION PLAN



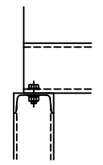
DETAIL–A

END VIEW

MATERIAL : 20 Th. ALUMINIUM

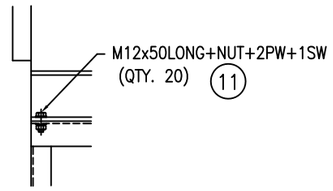
EARTH PAD DETAILS
(PE)

(ON DIAGONALLY OPPOSITE SIDES)

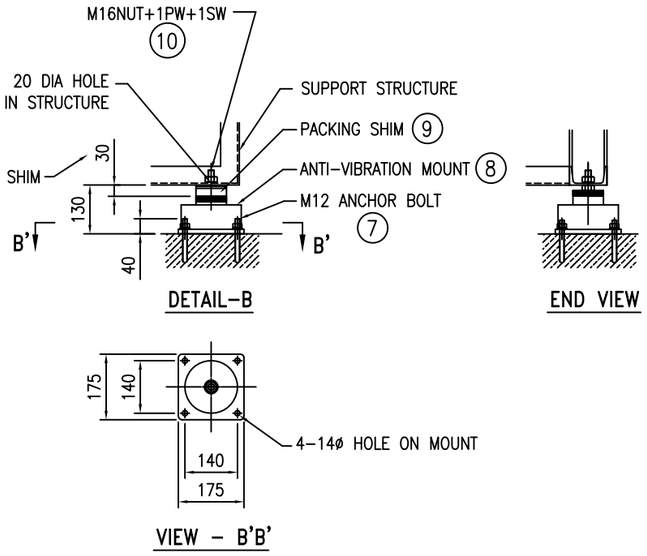


DETAIL–C

(CONNECTION BETWEEN
CUBICLE AND STRUCTURE)



END VIEW



DETAIL–B

END VIEW

VIEW – B'B'

ALL DIMENSIONS ARE IN mm

REV. NO.	DESCRIPTION	DATE	APPD	REV.	DESCRIPTION	DATE	APPD.
				D	REVISION LEVEL UPDATED	24.08.18	J.R
				C	REVISION LEVEL UPDATED	17.07.18	J.R
				B	REVISED AS PER SIEMENS COMMENTS DTD. 12.03.18	21.03.18	J.R
E	UPDATED AS PER SIEMENS COMMENTS DTD.07.11.18	07.11.18	J.R	A	REVISED AS PER SIEMENS COMMENTS DTD. 01.03.18	03.03.18	J.R

	SIGN	DATE
DRN.	A.ANTONY	29.01.2018
CHD.	J.RAMASWAMY	29.01.2018
APPD.	J.RAMASWAMY	29.01.2018

PROJECT VILNIUS BIOMASS

CUSTOMER SIEMENS AG

W .O. NO MP0650

TITLE LINE SIDE CUBICLE (OUT LINE)

SCALE 1 : 40

SIZE A3

POWERGEAR Experience The Power

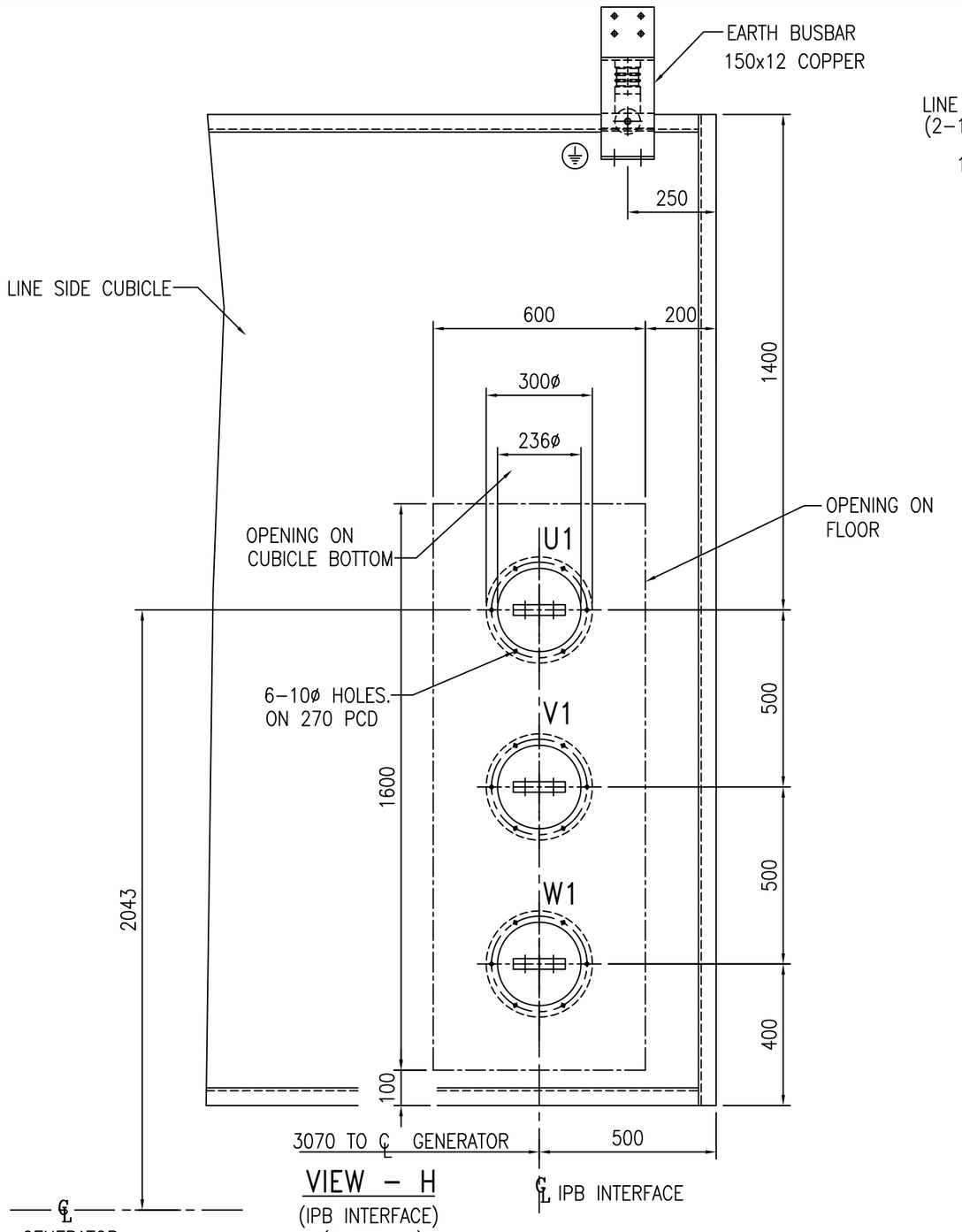
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DRG. NO. DPPPG–70151868

SHEET 13 OF 16 REV E

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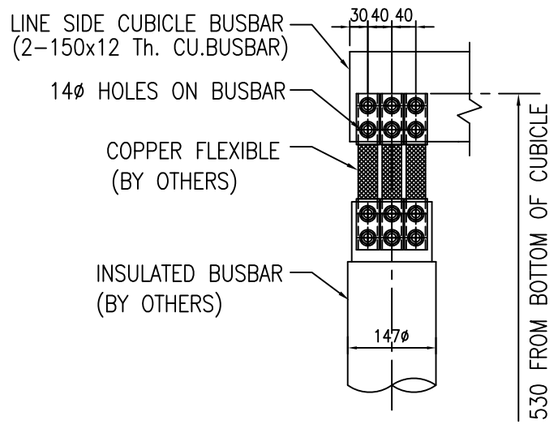
FILE NAME :



VIEW – H

(IPB INTERFACE)

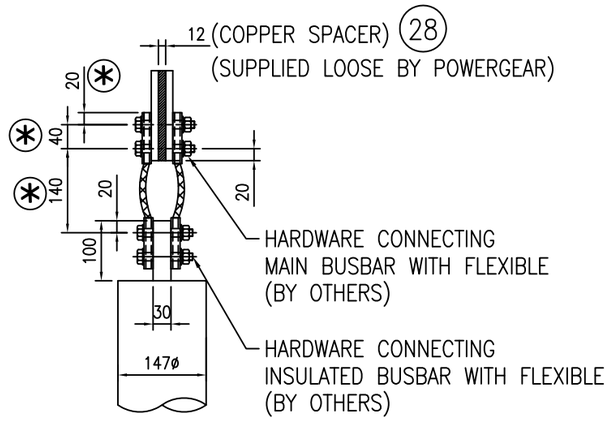
(SHEET–13)



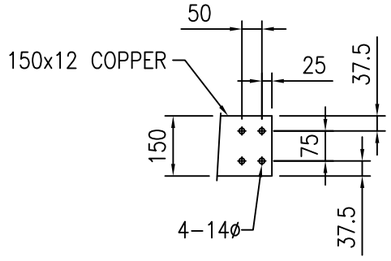
DETAIL–G

(SH. 15)

FLEXIBLE CONNECTION WITH
IPB END INSULATED BUSBAR



END VIEW



DETAIL–D

(IPB EARTH BUS DETAILS)

ALL DIMENSIONS ARE IN mm

REV. NO.	DESCRIPTION	DATE	APPD	REV.	DESCRIPTION	DATE	APPD.
				D	UPDATED AS PER SIEMENS COMMENTS DTD.06.09.18	06.09.18	J.R
				C	REVISION LEVEL UPDATED	17.07.18	J.R
				B	REVISED AS PER SIEMENS COMMENTS DTD. 12.03.18	21.03.18	J.R
E	REVISION LEVEL UPDATED	07.11.18	J.R	A	REVISION LEVEL UPDATED	03.03.18	J.R

PROJECT	VILNIUS BIOMASS		
CUSTOMER	SIEMENS AG		
W .O. NO	MP0650	TITLE	LINE SIDE CUBICLE (IPB INTERFACE INFORMATION)
SCALE	1 : 40		
SIZE	A3		

POWERGEAR Experience The Power

MEPZ, Tambaram, CHENNAI–600045 INDIA

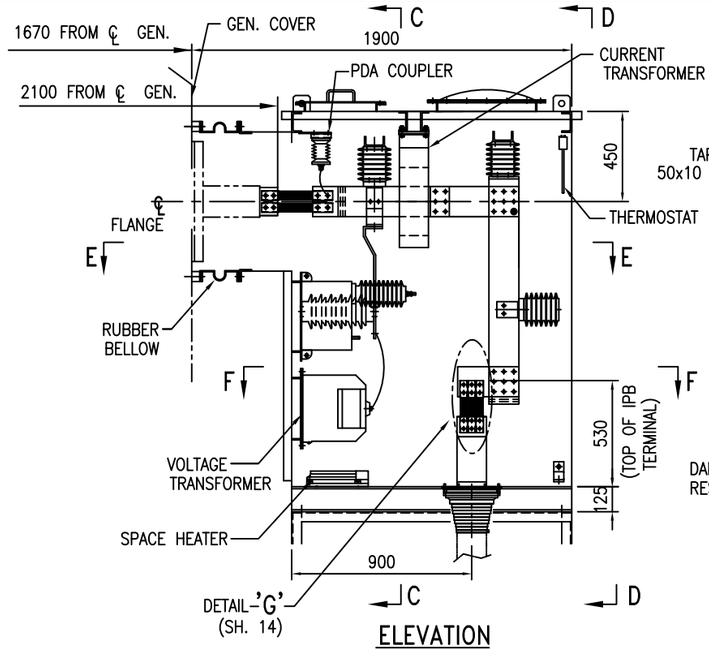
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DRN.	A.ANTONY	29.01.2018
CHD.	J.RAMASWAMY	29.01.2018
APPD.	J.RAMASWAMY	29.01.2018

DRG. NO. DPPPG–70151868

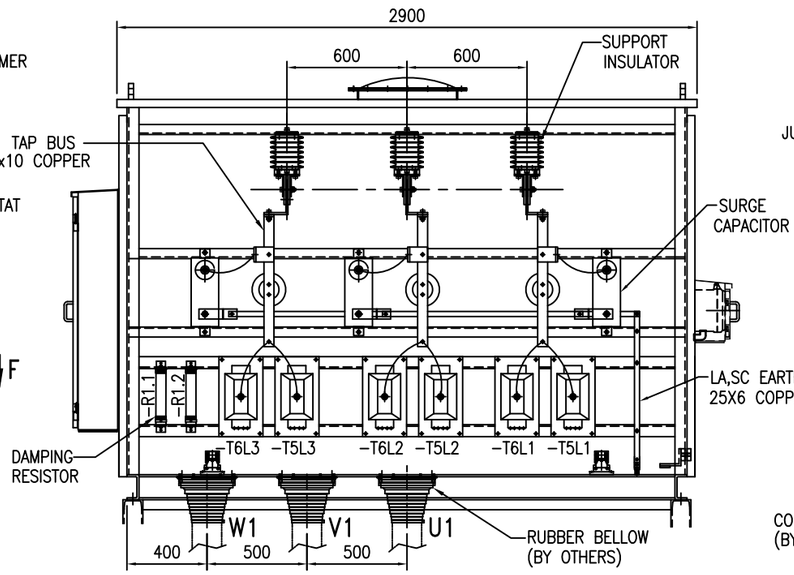
SHEET 14 OF 16 | REV E

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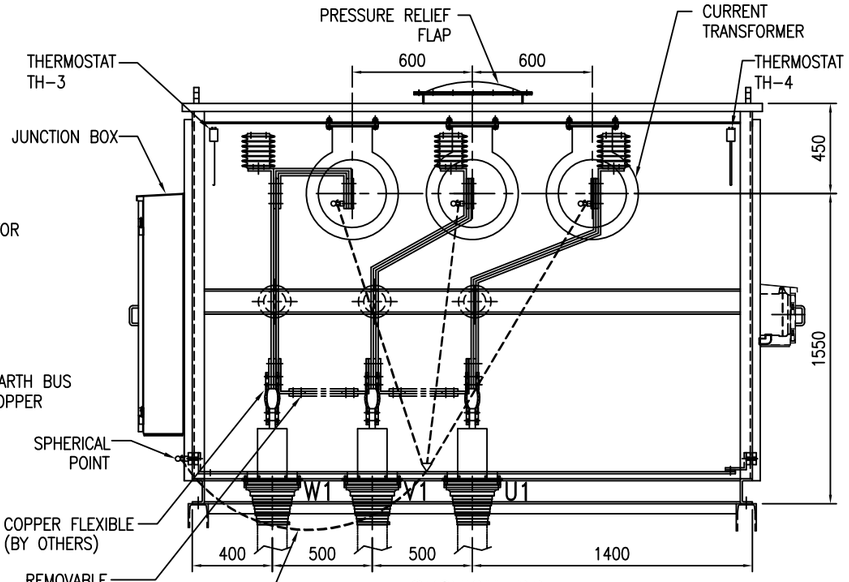
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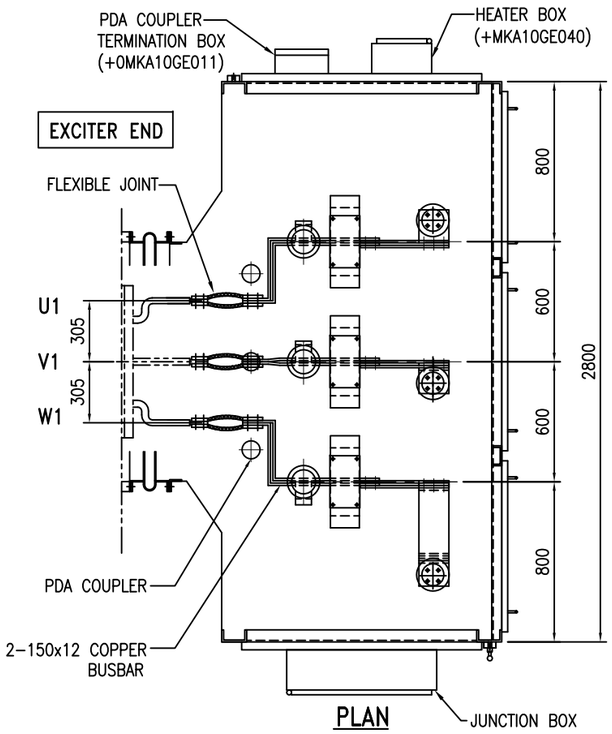
ELEVATION
(INTERNAL DETAILS)



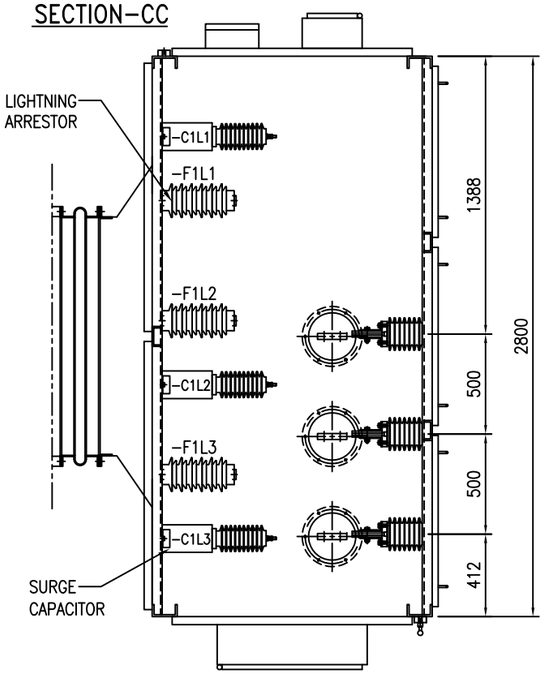
SECTION-CC



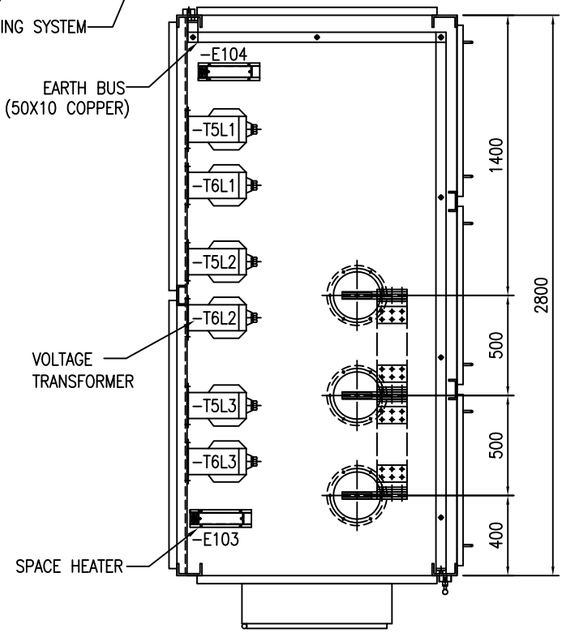
SECTION-DD



PLAN



SECTION-EE
(SHOWING THE LA & SC ONLY)



SECTION-FF

ALL DIMENSIONS ARE IN mm

REV. NO.	DESCRIPTION	DATE	APPD	REV.	DESCRIPTION	DATE	APPD.
				D	UPDATED AS MADE	24.08.18	J.R
				C	REVISION LEVEL UPDATED	17.07.18	J.R
				B	REVISED AS PER SIEMENS COMMENTS DTD. 12.03.18 & 21.03.18	21.03.18	J.R
E	UPDATED AS PER SIEMENS COMMENTS DTD. 07.11.18	07.11.18	J.R	A	REVISION LEVEL UPDATED	03.03.18	J.R

PROJECT	VILNIUS BIOMASS		
CUSTOMER	SIEMENS AG		
W .O. NO	MP0650	TITLE	LINE SIDE CUBICLE (INTERNAL ARRANGEMENT)
SIZE	A3	SCALE	1 : 30
			MEPZ, Tambaram, CHENNAI-600045 INDIA

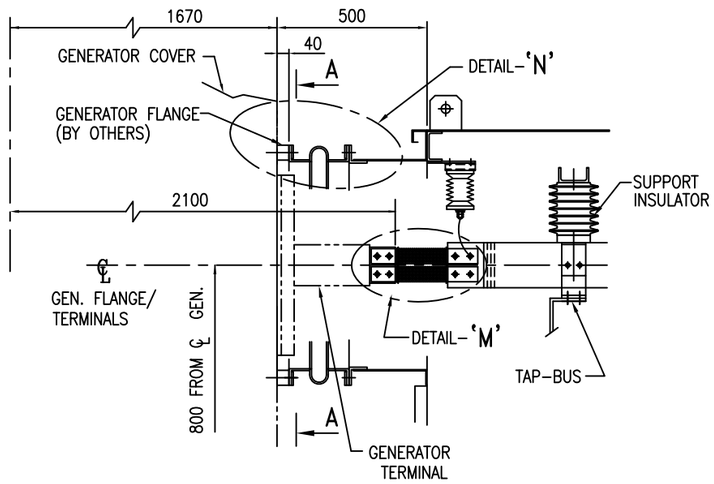
	SIGN	DATE
DRN.	A.ANTONY	29.01.2018
CHD.	J.RAMASWAMY	29.01.2018
APPD.	J.RAMASWAMY	29.01.2018

DRG. NO. DPPPG-70151868

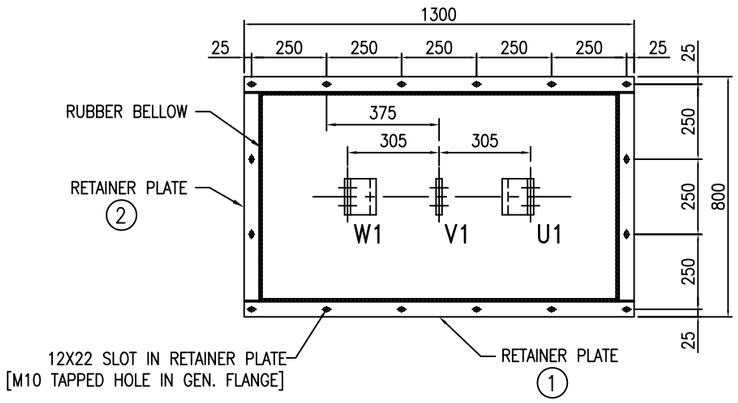
SHEET 15 OF 16 | REV E

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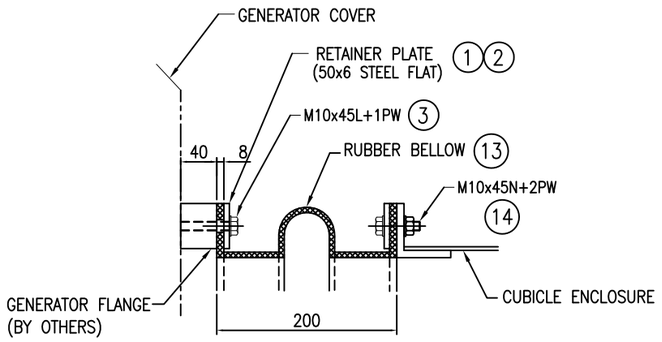
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GENERATOR INTERFACE DETAILS

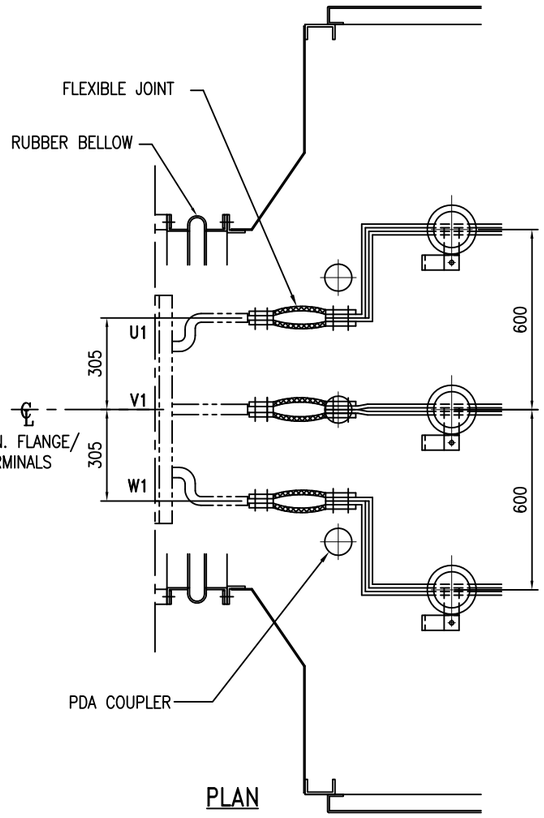


SECTION–AA

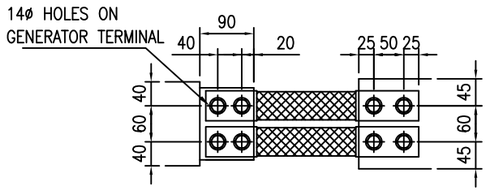


DETAIL–N

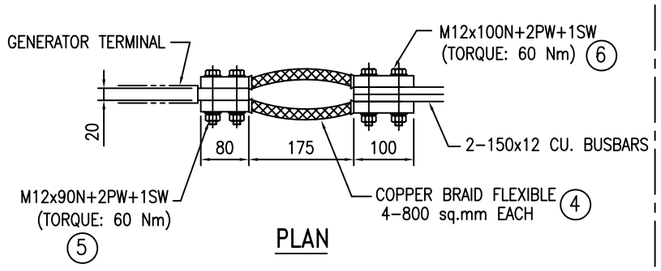
ENCLOSURE CONNECTION WITH GENERATOR



PLAN

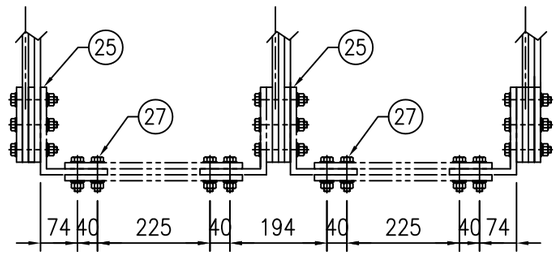


DETAIL–M

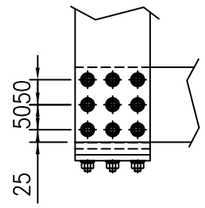


PLAN

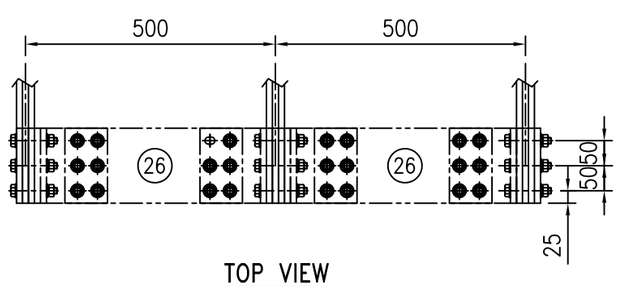
BUSBAR CONNECTION WITH GENERATOR LEAD



DETAIL – K



END VIEW



TOP VIEW

LINE SIDE SHORTING BUSBAR CONNECTING DETAILS

(REMOVABLE TYPE – SUPPLIED LOOSE)
(FOR TESTING PURPOSE ONLY)
(150x12Th. COPPER)

ALL DIMENSIONS ARE IN mm

REV. NO.	DESCRIPTION	DATE	APPD	REV.	DESCRIPTION	DATE	APPD.
				D	REVISION LEVEL UPDATED	24.08.18	J.R
				C	REVISION LEVEL UPDATED	17.07.18	J.R
				B	SHORTING BUSBAR CONNECTION DETAIL UPDATED	21.03.18	J.R
E	REVISION LEVEL UPDATED	07.11.18	J.R	A	REVISION LEVEL UPDATED	03.03.18	J.R

PROJECT VILNIUS BIOMASS

CUSTOMER SIEMENS AG

W .O. NO: MP0650

TITLE: LINE SIDE CUBICLE (TERMINATION AT GENERATOR)

SCALE: 1 : 40

SIZE: A3

POWERGEAR Experience The Power

MEPZ, Tambaram, CHENNAI–600045 INDIA

	SIGN	DATE
DRN.	A.ANTONY	29.01.2018
CHD.	J.RAMASWAMY	29.01.2018
APPD.	J.RAMASWAMY	29.01.2018

DRG. NO. DPPPG–70151868

SHEET 16 OF 16 | REV E

FILE NAME :

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SIEMENS

Operation of the System/ Plant Section 3

Contents

3.1 Running Routine

3.2 Start-Up

3.3 On-Load Running

3.4 Shutdown

3.5 Standstill



SIEMENS

Turbogenerator | Operating and Maintenance Manual

Operation of the System/ Plant Section 3

Running Routine 3.1

Contents

- Operating and Setting Values – General
- Running Routine – General
- Operation Log – Generator Supervision

Strict observance of the operating and setting values is a prerequisite for reliable operation of the turbogenerator.

NOTE:

These values are documented in the Dimensional Drawing Text of the generator.

The dimensional drawing text provides an overview of sensors installed in the generator and of the operation, alarm and protection values if applicable.

All operating and setting values refer to rated output of generator and maximum cooling air (DAC) respectively cooling water (TEWAC) temperatures under steady-state conditions.

The operating and setting values initially specified in this manual are based on experience under due consideration of the specific site conditions, such as static head in case of pressure measuring points or thermal characteristics in case of temperature measuring points. These calculated values are intended as guiding values for making the preliminary settings during initial commissioning of the unit.

These settings require certain corrections to account for the actual conditions. The final settings obtained after startup and initial load operation are to be entered in the ***Operation Value*** column, and the corrected table should be promptly submitted to Siemens for revision.

Revised pages will then be sent to the holder of the instruction manual as updates the request to discard all pages that have been replaced by those of a later date.

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1 Operating Log

During initial startup and during normal operation, the turbogenerator, auxiliaries and all instruments and controls should be monitored to assure continuous reliable operation.

The observations and readings should be recorded. A typical operating log is contained in these operating instructions. This table will, of course, have to be adapted to the particular conditions of the plant. The important requirement is that all checks and readings be made at certain predetermined intervals and preferably at the same load point.

Any special conditions regarding the operation of the turbogenerator should be noted separately. Such notes may be useful in determining the cause of any subsequent trouble and speeding up corrections.

2 Normal and Special Operating Conditions

The generator should be continuously monitored from startup to shutdown.

During initial startup, all checks should be made at frequent intervals. Hourly readings may be taken after completion of the initial trial period.

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Project: M.-No.: Notes:

Operation values	Tag Number	Unit	Date / Measurement			
Active power		MW				
Reactive power		Mvar				
Stator current		kA				
Stator voltage		kV				
Field current		A				
Field voltage		V				
Speed		s^{-1}				
Stator slot temperature — Slot		°C				
		°C				
		°C				
		°C				
		°C				
		°C				
		°C				
		°C				
Cold-air temperature TE		°C				
Cold-air temperature EE		°C				
Warm-air temperature		°C				
Bearing temperature TE		°C				
Bearing temperature EE		°C				
Shaft vibration TE		µm				
S_{max} (VDI2059) * TE		µm				
S_{PP} (ISO7919) * EE		µm				
EE		µm				
Bearing oil temperature — Inlet TE		°C				
Bearing oil temperature — Inlet EE		°C				
Bearing oil temperature — Outlet TE		°C				
Bearing oil temperature — Outlet EE		°C				
Bearing oil pressure TE		bar				
Bearing oil pressure EE		bar				
Total oil flow TE		l/min				
Total oil flow EE		l/min				
Cooling water volume flow		m^3/h				
Cooling water temperature Inlet		°C				
Cooling water temperature Outlet		°C				
Leakage water monitoring TE						
Leakage water monitoring EE						

* Cancel whichever is not applicable

Data should be recorded during steady-state conditions after constant operation for several hours.

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Operation of the System/ Plant Section 3

Start-Up 3.2

Contents

- Turning Gear Operation and Run-up of Generator
- Generator Start-up Diagram
- Permissible Synchronizing Criteria

1 General

The generator should be operated on the turning gear and run up in accordance with the turbine startup diagrams.



⚠ WARNING

Rotor damage

Parts of the rotor may break due to fatigue and cause serious injuries.

Generator is designed for 10000 start/stop cycles. Exceeding this limit may lead to serious rotor damage.

Contact the local Siemens service at an early stage for measures to extend the lifetime.

2 Turning Gear Operation

Prior to running the generator on turning gear, the shaft lift oil pump (if existing) and the bearing oil system must be placed into operation.

The oil flow to the bearings should be checked prior to turning gear operation to ensure an adequate flow. In addition, drains should be inspected for proper operation.

3 Run-up

During runup to rated speed, the bearing oil inlet temperature should be in accordance with the turbine manual.

During run-up the critical speed ranges should be passed through quickly and at a uniform rate.

Smooth running depends on several factors. Even minor temperature differences of 1 to 2 K between opposite sides of the rotor may result in rotor distortion which could lead to inadmissible vibrations due to unbalance.

During run-up the bearing and oil temperatures should be read and logged at short intervals.

To prevent these thermal unbalances during runup the turbine-generator should be run on turning gear. If the generator is run up following prolonged turning gear operation, no restriction regarding the rate of runup need be observed other than those required for the turbine.

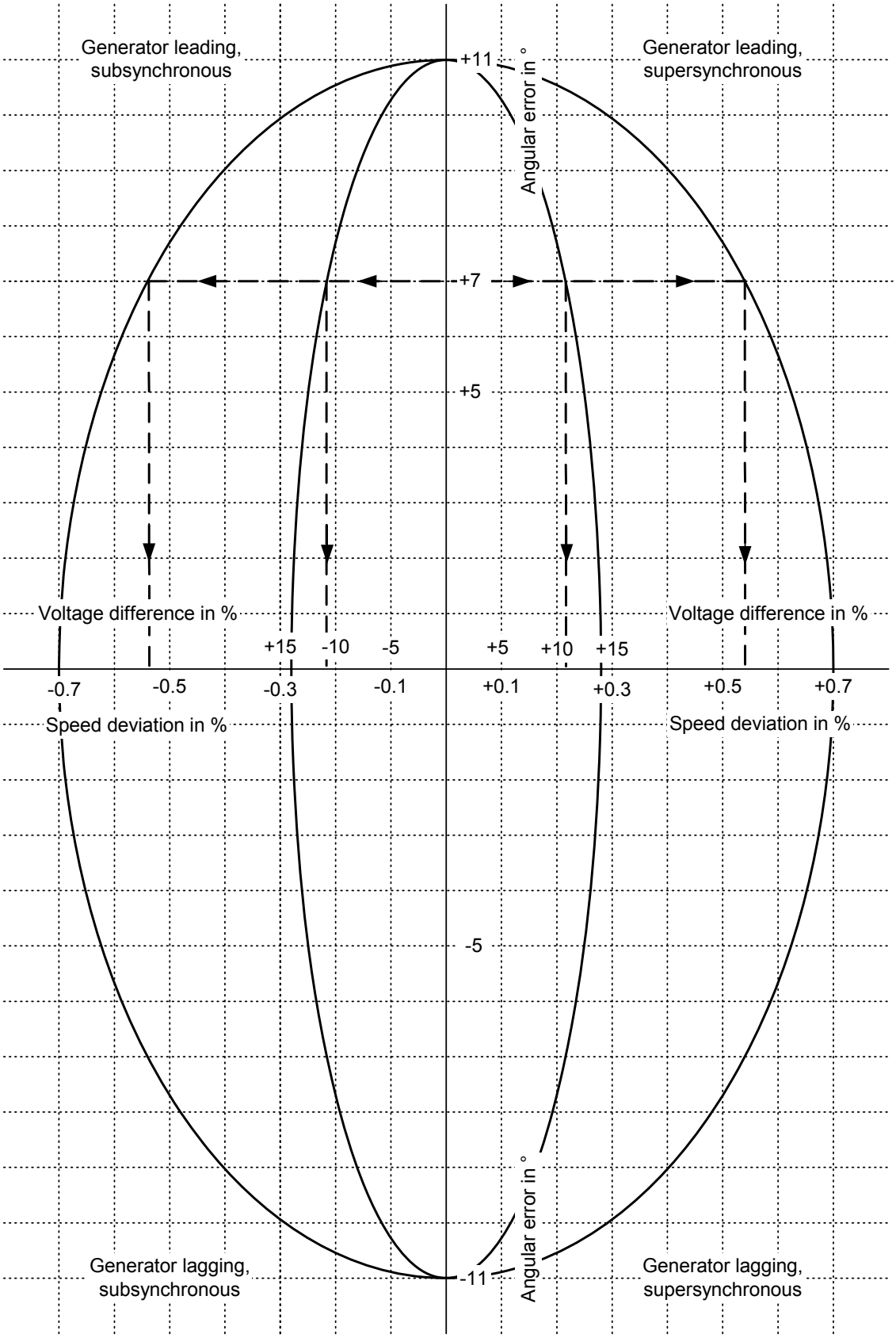
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	Actual condition
1 Command: Start up generator	$\vartheta_{\text{cold air}} \geq$ -20 °C trip limit “cooling air temperature HH” may be deactivated **2)**
Bearing oil supply system	in operation
Jacking oil supply	in operation **1)**
Cooling system	in operation
Bearing oil inlet temperature/pressure	see Dimensional Drawing Text
Anticondensation heating system / dryer	in operation
Measuring devices and supervisory equipment	in operation
Automatic voltage regulator	ready for operation
Generator protection	no error
2 Command: Run up generator	
Anticondensation heating system / dryer	out of operation for n > 50 rpm
Speed	n ≈ 90% rated speed
Jacking oil supply	out of operation **1)**
Vibrations	within the limits, see Dimensional Drawing Text
Bearing metal temperatures	within the limits, see Dimensional Drawing Text
Field circuit breaker	closed
Set point for rated voltage	set
Speed	n = rated speed
3 Synchronizing, parallelling and loading	$\vartheta_{\text{cold air}} \geq$ 0 °C trip limit “cooling air temperature HH” must be activated **2)**
Synchronizing	
Parallelling	
Loading	to required load, however, only within the region of the capability curve

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1) The specific switching-on speed is shown in the Dimensional Drawing Text (chapter “Technical Data”).

2) Relevant to gas turbines only!



Example: Angular error +7° { Permissible speed deviation ± 0.54% max.
Permissible voltage difference ± 10,7% max.

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Turbogenerator | Operating and Maintenance Manual

Operation of the System/ Plant Section 3

On-Load Running 3.3

Contents

- Permissible Load Limits of Generator
- Permissible Loading at Rated P.F. during Voltage and Frequency Deviations

1 Load Limits

The generator can be excited, synchronized and connected to the system after rated speed has been reached. To do this, the excitation system must be taken into operation. For details, see separate description.

After the generator has been connected to the system, the active power should be set by means of the turbine speed changer and the reactive power through the excitation system.

For the permissible loading, always refer to the capability curve. The following conditions are assumed to exist:

- Generator is operated at rated frequency
- Generator is operated at rated voltage
- Generator phase sequence corresponds to phase sequence of system

This diagram shows different limiting curves for operation which indicate the active and reactive power at a given power factor. The design point, representing the rated data of the generator, has been specially marked in this diagram. Any desired load setting is possible within the limits indicated as long as the load is not increased beyond the limit specified for the respective cold air temperature.

2 Rate of Loading

During operation, any desired load variation is permissible within the region of the capability curve. The permissible rate of loading depends on the condition of the winding insulation.

Generators provided with a *Micalastic*® stator winding insulation and a rotor winding of silver-alloyed copper with glass laminate insulation can be suddenly loaded and unloaded. The actual rate of loading should, however, be matched to the limits permissible for the turbine.

3 Unbalanced Load

The continuously permissible unbalanced load as specified must not be exceeded under any operating condition. Unbalanced load is defined as the ratio of negative sequence current to rated current, with the rated current not being exceeded in any of the three phases.

The rated current is the permissible stator operation current for the selected cold air temperature.

4 Load Restrictions

During service, operating conditions may arise at the generator which require the generator to be operated at reduced load in order to avoid damage to the unit.

5 Deviation of Voltage and Frequency

Loading of the generator with deviations from the rated generator voltage and/or frequency is only permissible up to the limits shown in attached diagram.

NOTE:

The operating temperatures can rise if the machine operating point deviates from the rated voltage and frequency values. The class B temperature limits can then be exceeded (the machine is used according to class F). This reduces the machine's service life.

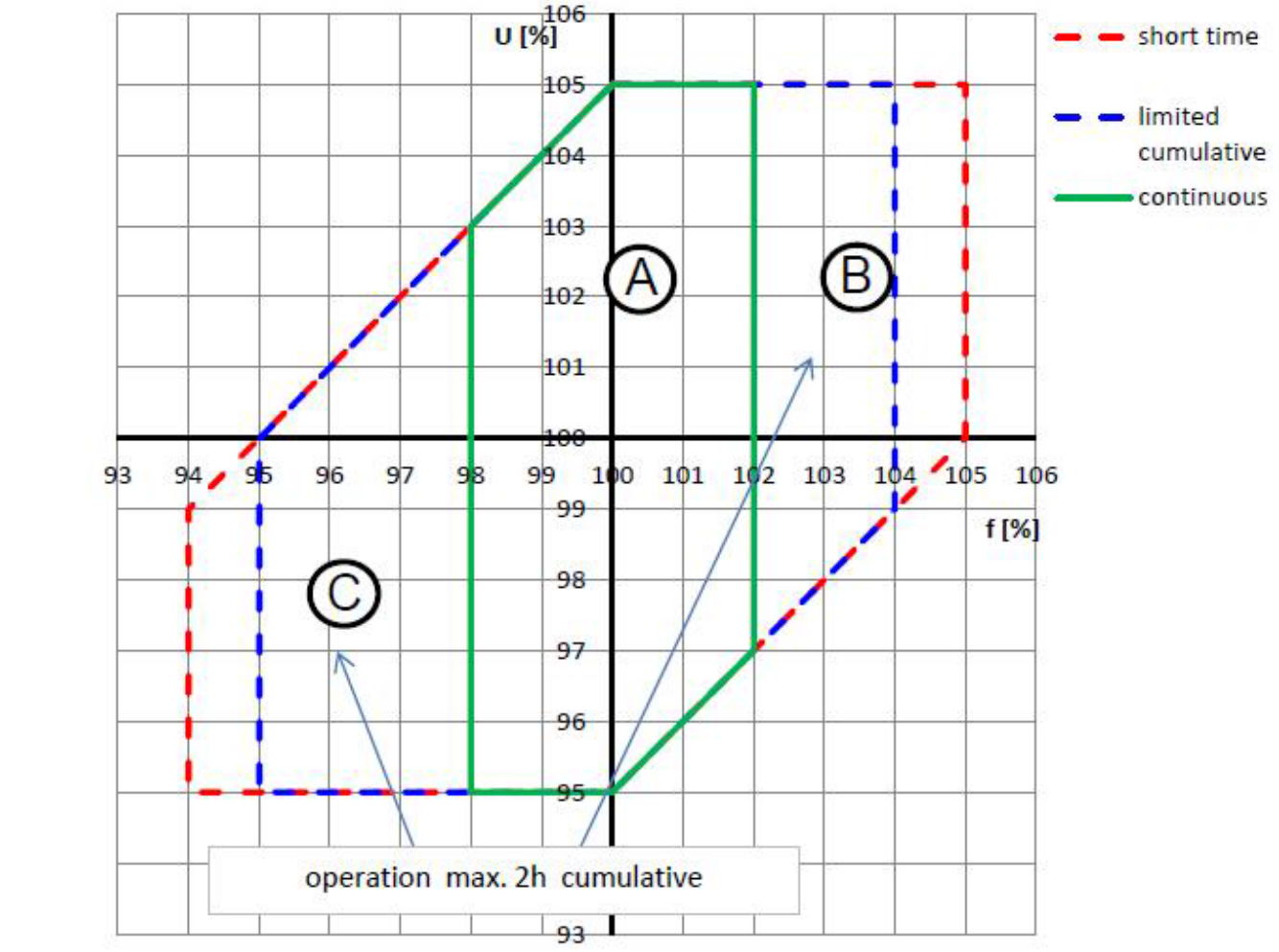
The duration, extent and frequency of deviations from the rated values should therefore be restricted during operation of the machine.

6 Operation at low temperature

(Open Air Cooled machines only)

Open Air Cooled machines are also operated at ambient temperatures below 0°C. A generator cold air temperature below 0°C is not allowed. Therefore, an air-recirculation system is integrated in OAC-machines. The temperature control must generate a disturbance signal, when the generator cold air is below 0°C for more than 5 minutes.

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Frequency protection

Zone	Time	Event	Comment
98% < f < 102%	continuous		
95% < f < 98%	continuous	warning; 2nd warning after 10 min	after 2 h cumulative → service inspection [1]
94% < f < 95%	50 s	alarm/trip after 50 s [2]	after 2 h cumulative → service inspection [1]
f < 94%	10 s	alarm/trip after 10 s	grid disconnection after 1 s
102% < f < 104%	continuous	warning; 2nd warning after 10 min	after 2 h cumulative → service inspection [1]
104% < f < 105%	30 s	alarm/trip after 30 s [2]	after 2 h cumulative → service inspection [1]
f > 105%	10 s	alarm/trip after 10 s [2]	

[1] Minor inspection without bearing inspection
[2] 10 s before trip release the turboset should be disconnected from grid



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Turbogenerator | Operating and Maintenance Manual

Operation of the System/ Plant Section 3

Shutdown 3.4

Contents

- Shutdown of Generator
- Generator Shutdown Diagram

1 General Information

If a hydraulic shaft lifting device is available, it must be brought into operation at the latest when the generator runs down to the speed stated in the Dimensional Drawing Text.

2 Turning Gear Operation

In order to avoid difficulties caused by thermal asymmetries during the next start up and consequent warping of the rotor, when the generator is run down, the turning gear must be brought into operation at the speed (turning speed) stated in the Turbine Manual (this usually happens automatically) and it must remain in operation without interruption until the rotor has cooled to a temperature near room temperature.

3 Generator Drying

It must be ensured that the anti-condensation heaters and/or air-driers come into operation after the excitation has been switched off.

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Generator Shutdown Diagram

Command: Unload generator	Actual condition
Generator load	$S < 0{,}05\ S_N$
Generator main circuit breaker	tripped
Speed	n ≈ 90% rated speed
Jacking oil supply	in operation[1)]
Excitation field circuit breaker	open
Turning Operation	see turbine manual
Anticondensation heating system / Dryer	in operation for n < 50 rpm
Speed	$n = 0\ s^{-1}$, at room temperature
Cooling system	out of operation trip limit “cooling air temperature HH” may be deactivated [2)]
Bearing oil supply system /Jacking oil supply	out of operation
Shutdown procedures	completed

1) The specific switching-on speed is shown in the Dimensional Drawing Text (Chapter: “Technical Data”).

2) Relevant to gas turbines only!

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Turbogenerator | Operating and Maintenance Manual

Operation of the System/ Plant Section 3

Standstill 3.5

Contents

- Supervision of Generator during Standstill
- Determination of Dew Point Temperature
- Preventive Measures to Avoid Moisture Condensation
- Measures for Preservation
- Insulation Resistance Measurements on Stator Winding
- Drying the Windings
- Electrical Tests on Stator Winding with Vacuum Impregnated MICALASTIC® High-Voltage Insulation
- Insulation Resistance Measurements on Rotor and Exciter Windings

During a standstill, the space heaters installed in the stator end shields should be switched on and maintained in this condition until the generator is started up again. The space heaters prevent the formation of moisture condensate in the generator interior (alternatively the generator is equipped with an air dryer).

Even after having been taken out of service, a generator cannot be left fully unattended.

During a shutdown not exceeding 10 days:

The unit should be checked once a day.

During a shutdown for a longer period up to six months:

The gaps between the rotor shaft journals and the stator end shields should be sealed with cotton cord and acid-free Vaseline applied to the rotor shaft journals.

When recommissioning the generator, be sure to carefully wipe off the Vaseline from the shaft journals to prevent it from coming into contact with the turbine oil.

During a shutdown for a period exceeding two months:

Preservation measures will have to be taken. The scope of the preservation work required depends on the duration of the shutdown, on the overall conditions in the vicinity of the unit and on the extent to which checks and inspections are possible during such periods.

It will be necessary to request the services of specially trained Siemens personnel for the execution of such preservation measures. If it is intended to shut down the generator for a longer period, the competent Siemens Office should be informed, when requesting the services of the erection personnel, how long the unit is to be shut down, on the conditions prevailing in the vicinity of the unit during the outage and whether customer's personnel will be available for any required checks. The necessary preparations for the preservation will then be made in all details by the competent Siemens Office.

The services of Siemens erection personnel should again be requested if a preserved unit is to be recommissioned. The preservation measures will then be abolished by the Siemens personnel. For recommissioning, the same procedure should be followed as during initial startup.

In case of rust formation on the stator and/or rotor the rust shall be removed as far as possible by only using a sponge (e.g. Scotch-Brite™) and Rivolta SLX or ethanol as solvent. Do not use any other solvent!

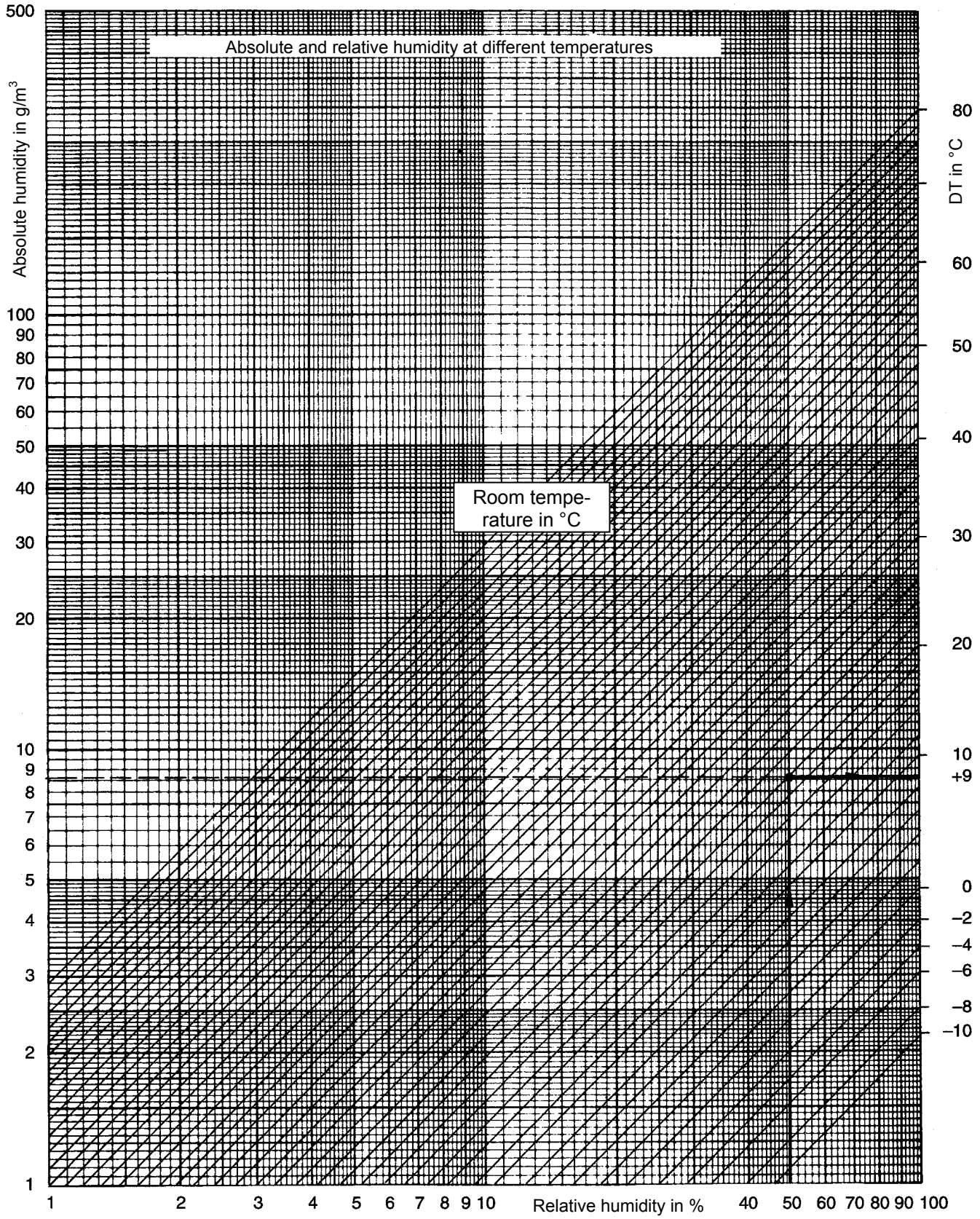


NOTE:

Rust which cannot be removed can stay on the particular generator component; generator function will not be restricted due to it.

Use space heaters or air dryers during future standstills to avoid further rust formation.

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Example: Relative humidity of ambient air = 50% and room temperature = +20°C result in a dew-point temperature (DT) of +9°C, corresponding to an absolute humidity of 8.6 g/m³.

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Phase	Keyword		Precautionary Measures and Checks
Transport	**Packing:**	**1**	Dry rotor retaining rings by blowing dry air into rotor end windings from portable air dryers (e.g. Munters dryer) shortly before packing. Multiple dry packing in sheetings with desiccant added.
	Accompanying documents:	**2**	Reference to special packing and request for restoration after opening due to customs or in-transit damage.
	Damage to packing:	**3**	Restore proper condition of dry packing immediately. For details, see description accompanying the cargo.
	Receiving:	**4**	Check effectiveness of dry packing and desiccant. Record condition in checklist. Request for repeat checks according to checklist during subsequent storage.
Storage	**Condition:**	**5**	Maintain dry packing until immediately before assembly.
	Check:	**6**	Monthly functional check of dry packing and desiccant according checklist.
	Storage area:	**7**	Indoor storage in dry building; outdoor storage in seaworthy packing, under shelter, protected against precipitation/ground moisture.
Installa-tion	**Outdoor installation:**	**8**	Transport to jobsite in dry packing. Acclimatization in dry packing to avoid condensation after unpacking.
		9	Installation under shelter. Removal of dry packing from retaining rings (1st layer) as late as possible.
	Open gene-rator, rotor installed:	**10**	With danger of condensation (outdoor installations and open power house), blow dry air from portable air dryers into rotor end windings.
Ready for operation (standstill or turning gear operation)	**Generator closed:**	**11**	**Air cooled generators:** Gear operation: Pass small cooling water flow through the air cooler to ensure that the cooler is the coldest component in the generator (condensation hazard!). Standstill: Continuous operation with installed space heater or air dryer.
	Exciter unit in enclosure:	**12**	**Exciter units:** Drying process with stationary or mobile air dryer.
Scheduled mainten. without rotor removal	**Outdoor installation:**	**13**	**Generator closed:** Measures as under ***Ready for operation***.
		14	**Generator open:** Shelters must prevent precipitation from entering the generator; the retaining rings areas must be covered and kept dry by supplying dry air.
Scheduled mainten. with rotor removal	**Indoor installation:**	**15**	If rotor is set down in dry power house with even temperature, it is sufficient if the entire rotor is covered against dirt and wetness. If danger of condensation, the rotor area between the bearing journals must be provided with dry packing.
	Outdoor installation:	**16**	Set down rotor under shelter and provide rotor areas between bearing journals with dry packing.

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Preservation measures will have to be taken when a generator is to be shut down for a period exceeding two months.

The scope of the preservation work required depends on the duration of the shutdown, on the overall conditions in the vicinity of the unit and on the extent to which checks and maintenance are possible during such period.

The preservation measures recommended in the following are sufficient under normal conditions. High relative humidity in combination with severe temperature changes involves the risk that the temperature of certain surfaces in the generator may drop below the dew point, resulting in the possible formation of a moisture film due to condensation on these generator components.

1 Generator Interior

The air dryer should be switched on to protect the stator and rotor windings against moisture by maintaining the generator interior in a dry condition.

Prior to recommissioning the generator, the insulation resistances of the stator and rotor windings should be measured and the windings dried, if required.

2 Bearings

No preservation measures are required on the bearings of the turbogenerator.

However, the bearing oil system should be placed into operation once a week and the entire system adequately flushed with water-free oil. After activation of the oil system, the rotor should be operated on the turning gear for approximately three to four hours.

3 Coolers

All coolers should be drained on their cooling water sides and dried in a suitable manner. During the shutdown, the drains and vents should be kept open.



NOTICE

Never leave water-filled coolers standing idle for several weeks.

For cooler drying, hot air or dry ambient air may be used which should be admitted by means of blowers via the cooling water inlet/outlet flanges. A fan-forced heater with a rating of 1 to 2 kW has proved satisfactory for this purpose.

4 Exciter

The exciter should be protected against moisture by maintaining the space below the enclosure at a moderate temperature by suitable means. This may be achieved by mobile air blower.

The carbon brushes should be lifted off and the shaft covered with oiled paper.

5 Bright Components

All accessible bright components, e.g. exposed shaft portions, should be protected with a suitable corrosion inhibiting oil or grease, e.g. ***Tectyl***.

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During manufacture and transport the insulation of the stator winding may have been exposed to moisture which would reduce the insulation resistance of the windings. The insulation resistance should therefore be measured prior to initial startup, after prolonged shutdowns and after work on the windings. If required, the generator should be dried until a sufficient insulation resistance is obtained.

1 Required Insulation Resistance of Stator Winding

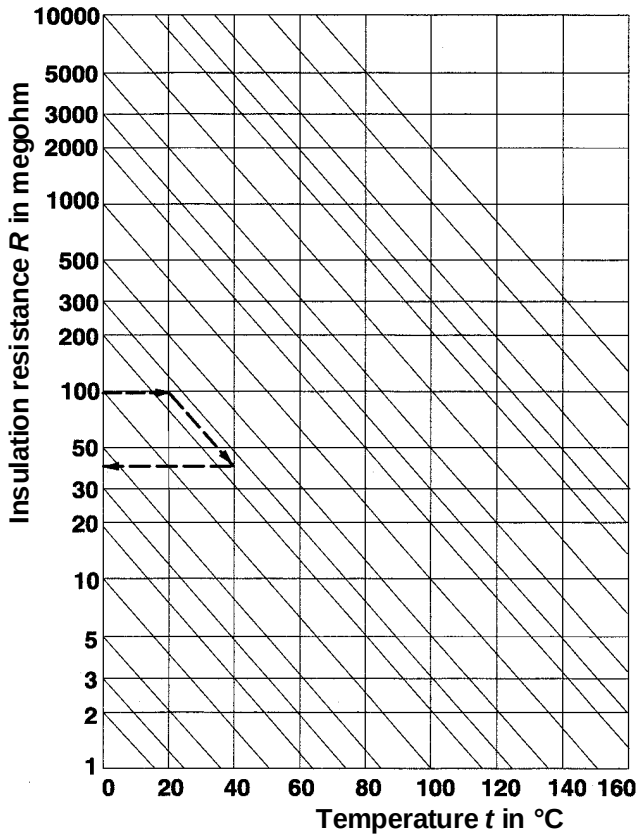


Fig. 1: Diagram for correction of insulation resistance measured to a temperature of 40 °C

The insulation resistance measured is dependent on the temperature. To permit a proper assessment, a correction to an agreed reference temperature (formerly 75 °C,167 °F) must be made.

An insulation resistance of 1 megohm per each kilovolt of rated voltage at 75 °C (167 °F) is normally attainable without any difficulties.

New international standards specify an insulation resistance of not less than 1 megohm per each kilovolt of rated generator voltage at 40 °C (104 °F).

A correction of the insulation resistance measured at the winding temperature prevailing during the measurement to the above reference temperature can be made using the diagram in fig. 1.

If the insulation resistance measured is lower than the specified minimum value, the neutral connections must be separated and the insulation resistances of the individual winding phases measured. During the test, the other two phases which are not involved should be grounded. If the insulation resistances of the individual phases are likewise lower than the required limit value, drying of the windings will be indispensable. Great differences in the insulation resistance values are indicative of local contaminations, e.g. insulators in bus duct or terminal-bushings. If practicable, additional connections should be separated.

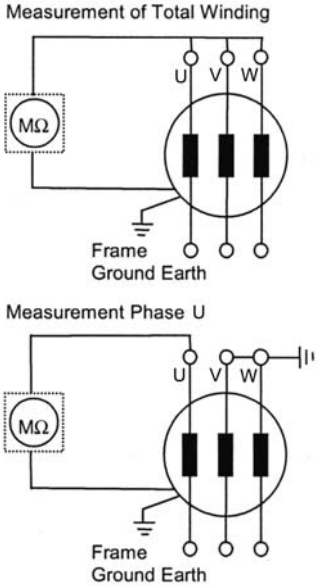
If this measure does not result in an improvement, it is recommended to obtain the services of a specialist from the manufacturer's works.

2 Measurement of Insulation Resistance

Prior to each measurement, the generator must be de-excited and any static charges removed by grounding the windings. The windings should also be grounded after each measurement for the duration of the recharging period.

The insulation resistance of the stator is measured between the winding copper and the stator core.

The measurement should be made with a megger giving a scale reading of not less than 1000 megohm. The megger voltage should be not less than 1000 V, but may amount to up to 5000 V. The insulation resistance should be reached after one minute.



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1 General

Any reduction of the insulation resistance during transport, erection or a prolonged shutdown is mostly caused by the formation of a moisture film on the surface of the insulation. To prevent any damage to the insulation, the insulation resistance of the stator and rotor windings should be checked prior to running the unit at rated voltage. In the event of an insufficient insulation resistance being detected, a drying procedure is to be performed until a sufficient insulation resistance has been obtained.

2 Dry-Out Using a Space Heater

If the space heater is in operation, the temperature in the generator interior is maintained at a value slightly above ambient temperature. This prevents the formation of a moisture film on the surface of the stator and rotor windings, in case the temperature falls short of the dew point.

3 Dry-Out by Direct Current

If the generator dry-out cannot be performed by means of the space heaters, the following procedure should be employed:

For the direct-current dry-out, suitable d.c. sources, such as welding converters, should be available. When it is intended to employ several welding converters for drying, care should be taken that the converters have approximately the same characteristics. A direct-current dry-out of the stator can be performed already before the rotor is inserted. However, if the rotor is in the frame, it should be turned during the drying procedure. It will have to be ensured for interconnection of the three phases that the magnetic fields set up in the stator winding balance each other. When no suitable measures are taken in this respect, the turning gear may be destroyed owing to the large forces effective between stator and rotor. The connection of the stator winding for balancing the magnetic fields is shown in the illustrations.

Sources supplying a current amounting to about 1/4 to 1/3 of the rated generator current suffice for drying the stator winding with direct current. The voltage required is very low and may be approximately 5 to 15 V. A winding temperature of 75 °C (167 °F) should not be exceeded. As in normal operation, the winding temperature is measured through the resistance temperature detectors embedded in the slots. A sufficient exchange of the air within the generator housing should be ensured during the drying period. This can be effected by opening all connections and inspection holes. It is advisable to accelerate the exchange of the generator air by means of blowers or with clean compressed-air. The steady-state winding temperature of 75 °C (167 °F) should be reached not earlier than after six hours. The stator should thus be heated slowly by gradually raising the d.c. current and continuous supervision of the slot temperatures.

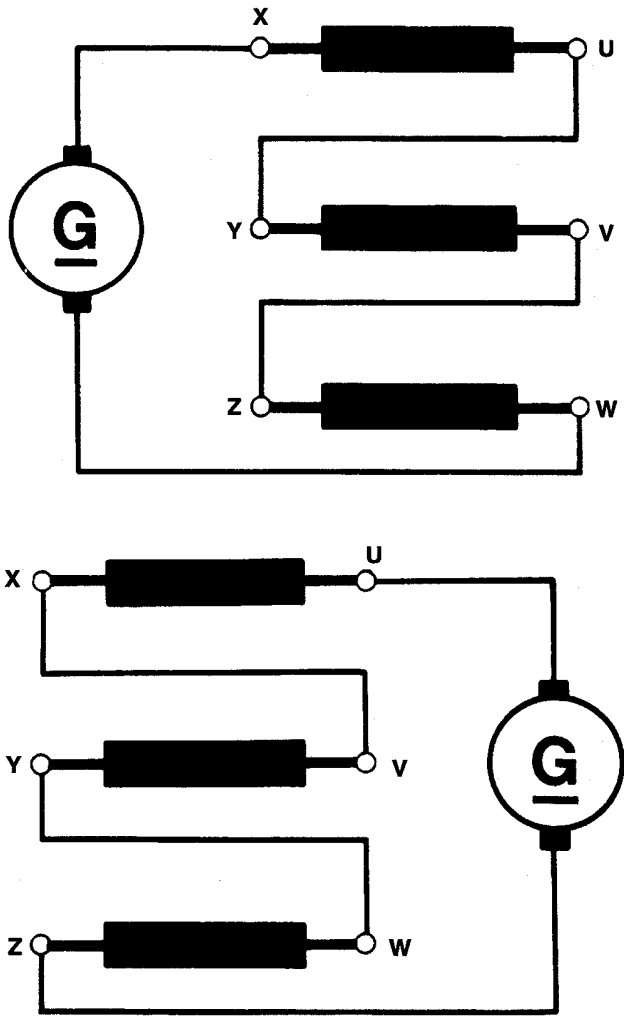


Fig. 1: Stator winding connections for dry-out by direct current

Also refer to the following information:

[1] 4.5-2300 Insulation Resistance Measurements on Stator Winding

[2] 4.5-3300 or 3301 Insulation Resistance Measurements on Rotor (and Exciter) Winding(s)

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1 The Insulation System of the Stator Winding

The insulation system serves to insulate the generator stator bars, which are subjected to a high-voltage potential of up to 30 kV, from each other and from the grounded stator iron parts for reliable protection against the additional thermal and mechanical stresses arising during operation.

The *Micalastic*® insulation consists of mica tapes applied continuously from end to end on the bars, including the end winding portions. Vacuum impregnation with epoxy resin provides an insulation system which is resistant to mechanical, thermal and electric stresses and also impervious to moisture. Drying the insulation prior to start-up of the generator will thus only be required to remove any moisture film on the surface.

2 Purpose and Kind of Electrical Tests

During the manufacturing process until delivery of the generator, a comprehensive quality verification program is performed by subjecting the insulation to electrical tests. Unless the insulated parts in the generator are stressed due to abnormal conditions during transport or during the installation and assembly at the power plant, no electrical testing would be required prior to placing a new generator into operation. For safety considerations, the insulation resistance should, however, be checked by means of a megger prior to each start-up.

It is a known fact that even the best insulation system is subject to aging during service, especially as a result of operational disturbances, such as voltage surges due to sudden short-circuits. etc.

During overhauls, the degradation of the insulation and any damage due to accidental disturbances should therefore be ascertained by a visual inspection and by means of suitable electrical tests to give assurance of trouble-free operation for further years.

There are several methods of electrical testing:

- Insulation resistance measurement (megger)
- Recharging and leakage current measurement for exact determination of insulation resistance
- Dissipation factor measurement
- Partial discharge measurements
- High-potential proof tests: AC voltage, DC voltage, 0.1-Hz voltage

3 Insulation Resistance Measurement

Insulation resistance measurement is one of the simplest tests to determine the integrity of the insulation. It is made with an instrument commonly known as megger and supplying a variable DC voltage between 100 V and 5000 V. The instrument is calibrated for direct reading of the insulation resistance in megohms. The DC voltage for measurement is generated by a hand-operated or motor-operated generator or by electronic means. This voltage should be applied for not less than one minute prior to reading the insulation resistance value to allow for the decay of the absorption current component with time due to a polarization of the dielectric in the electric field. This process, which follows an exponential function, is reflected at the instrument by a pointer deflection which is initially fast and then gradually slows down. The results of this reading indicate only the presence or absence of a winding short to ground and that the insulation resistance is at a level above the accepted minimum limit. This test is performed prior to each start-up of the unit and prior to each high-potential test on a winding.

4 Recharging and Leakage Current Measurement

To determine the true insulation resistance of an insulation, somewhat larger and more complicated equipment is required, permitting also a determination of the polarization index. For this test, a stabilized DC power source and a micro ammeter are required, enabling the current to be measured as a function of the test period under otherwise constant conditions and allowing the influence of temperature, moisture and dirt to be determined and considered.

The insulation of *Micalastic*®-insulated generators is not subject to moisture absorption. Recharging and leakage current behavior and the insulation resistance, respectively, may merely be affected by dirt or moisture on the surface of the end windings.

This test is just as easy to perform as the megger reading.

5 Dissipation Factor Measurement

The winding insulation system is primarily a capacitive setup, with the winding copper constituting one electrode and the grounded frame the other electrode. Such circuits are accessible for bridge methods of resistance measurement to determine the dielectric constant and the dielectric loss factor. Dielectric loss is defined as the ratio of active power to reactive power. In connection with insulation testing, the

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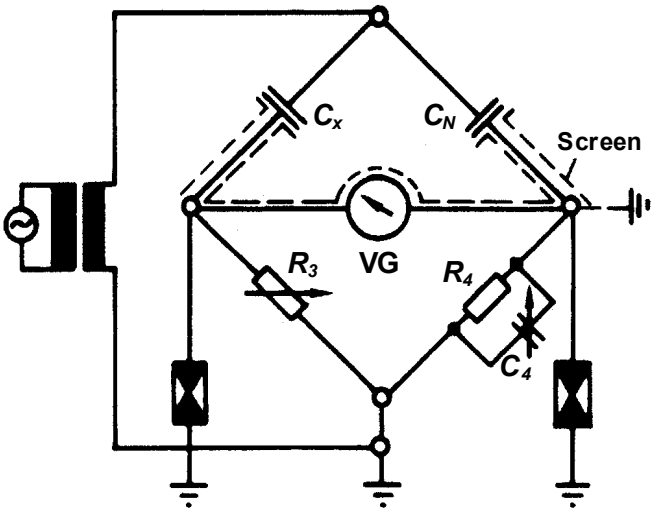


Fig. 1: Schering bridge

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dielectric loss indicates the amount of electrical energy converted into heat in the insulation.

The dissipation factor and capacitance of a solid insulating material are not dependent on the test voltage applied as long as there is no change in the conduction mechanism. A change in the conduction mechanism of insulating materials occurs due to loss of bond between layers of insulation, with voids being formed in minute cracks. As the voltage is increased above a certain level (partial discharge start voltage) during the dissipation factor measurement, partial discharges will occur which increase with rising voltage and result in a dissipation factor tip-up.

Micalastic® insulation is impregnated with epoxy resin under vacuum to be essentially void-free. In new condition, this insulation thus exhibits a dissipation factor tip-up of less than 0.001 for each measuring interval of 20% of rated voltage.

Prolonged exposure to thermal and mechanical stresses and last but not least the effect of partial discharges may result in new separations and thus in additional discharges. Measurement of the dissipation factor as a function of the test voltage can therefore provide information on the aging of an insulation by a relatively simple method.

Measuring the dissipation factor on individual winding components, such as bars, is mostly performed by means of a guarded electrode to eliminate the effect of leakage currents across the coil end. Such a guarded electrode system cannot be provided for complete windings which are mostly equipped with an end corona protection. This effect must therefore be taken into consideration when evaluating the variation of the dissipation factor with voltage.

The dielectric constant and the dissipation factor are measured with a **Schering bridge** (see fig. 1). At balance, zero current flows through the bridge branch. The capacitance of the winding is then:

$$C_x = \frac{R_4 \cdot C_N}{R_3}$$

and the dissipation factor:

$$\tan \delta = R_4 \cdot \omega \cdot C_4$$

To perform dissipation factor measurements on generator windings, disturbing error capacitances can be eliminated with a universal capacitance/dissipation factor bridge using ancillary equipment for the initial balancing adjustment. This scheme offers an effective method for measurements on windings in a directly grounded stator.

6 Partial Discharge Measurements

The dissipation factor measurement described in the preceding section covers the sum of the losses occurring in the insulation voids due to partial discharges. Since partial discharge is a radio-frequency phenomenon, this opens up the possibility of using radio-frequency methods for detection (see fig. 2).

Partial discharge measurements provide useful information for the detection of localized defects in winding components, such as the phase connector insulation system. This method is also used for quality assurance during manufacturing.

In the case of generator windings, the partial discharge method has so far been applied to detect high-energy discharges, as caused, for instance, by a break in the internal corona shielding system. The measurement is performed in a manner similar to the dissipation factor measurement by recording the maximum apparent discharge magnitude as a function of the voltage for each phase up to 120 % of rated voltage. To do this, a coupling capacitor C_K is connected in parallel to the phase capacitance C_X. The partial discharge is then detected in the ground connection of the coupling capacitor with a suitable partial discharge detector via a four terminal coupling network AKV.

As with the dissipation factor measurement, the test voltage is applied via a regulating transformer, a high-voltage transformer and a reactor to compensate for the winding and coupling capacitances.

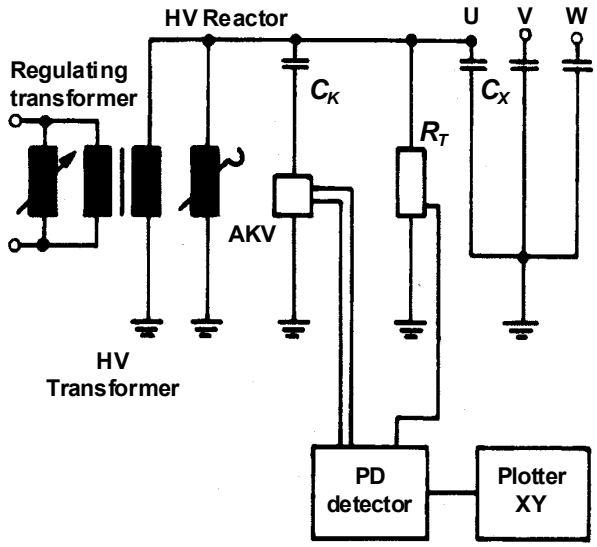


Fig. 2: Partial discharge measurement

Such a test setup is sensitive to external noise which cannot be avoided at the power station or in the test field. If no additional measures for rejection of the external noise are taken, background noise levels from 100 pC to more than 1000 pC are to be expected.

7 High-Potential Proof Tests

All tests described in the preceding sections are performed with relatively low voltages. Using suitable standards for comparison, they provide information on the contamination, surface moisture condition and also on the aging of the insulation. They are indicative of the dielectric strength of the insulation with a certain probability only.

A high-voltage test is an indispensable last criterion for determining with assurance whether or not the insulation on a winding is suitable for continued operation with sufficient reliability. The application of a high test voltage is especially recommended in all cases where it is to be expected that the insulation may have a suffered and localized damage as a result of extremely high mechanical stresses due to a sudden short-circuit or extremely high electric stresses due to transients. A high-potential proof test is also applied in the case of serious aging as identified by a dissipation factor measurement and if localized weak points in the insulation cannot be ruled out.

Any breakdown occurring during a proof test indicates that the winding is approaching the end of its serviceability. After removal of bars on which a breakdown has occurred, the areas of the insulation most severely affected by degradation can be assessed, permitting scheduling of a suitable date for rewinding. If no breakdown occurs during the proof test or following the removal of already failed bars, this means that after completion of the test even the weakest area of the insulation still has a certain *life expectancy* which will be longer at the field intensity arising during normal operation than at the test stress level. This enhances the probability of troublefree operation at least for a certain service period following the test and avoids the risk of a breakdown occurring during operation together with the consequential damage resulting from the high currents arising.

7.1 AC Voltage Test

This test is normally performed with a power-frequency AC voltage of 1.5 times rated voltage. The use of a 50-Hz or 60-Hz AC voltage offers the advantage that the field distribution will be the same as during normal operation, especially at the transition between the straight slot section and the end winding, resulting in a proportional stressing of the winding components. As generator sizes increase, the capacitance of the winding to ground increases accordingly and thus also the transformer rating required for the test. To test one phase of a large turbogenerator, a test set of 400 kVA or more will fairly often be required. For this reason, resonance test circuits are frequently used, permitting a compensation of the high leading reactive power. An exact control of the preset test voltage is accomplished through a high-voltage instrument transformer.

7.2 DC Voltage Test

When utilizing a high DC voltage for proof testing, the field distribution will differ from that described in the preceding section especially at the end windings. As a result of this, DC testing subjects the end turn insulation to considerably higher stresses than AC testing. This drawback arises especially on so-called *discontinuous* insulation systems where different insulations are used for the end windings and the straight slot portions, resulting in a joint at the transition from the slot to the end winding. The continuous *Micalastic*® insulation does not involve this drawback.

The equipment involved in performing a DC high-potential test is considerably smaller and easier to transport than the AC test equipment. If DC testing is used for this reason, it is necessary to use a multiplication factor to obtain nearly equivalent searching ability as an AC test. It is recommended that 1.7 times the AC RMS test voltage be used.

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7.3 0,1-Hz Voltage Test

An AC high-potential test requires a large and heavy testing transformer which is capable of providing also the reactive power of the winding capacitance, whereas for DC over-voltage testing smaller and lighter test equipment is mostly sufficient. To make use of the lower weight, while retaining the advantage of a field distribution corresponding to that obtained with a power-frequency test equipment, tests are also performed at a reduced frequency of 0.1 Hz. Tests conducted at Swedish and American laboratories have shown that the 0.1-Hz test voltage to be applied must be higher than the 50-Hz or 60-Hz test voltage to obtain equivalent test conditions as an AC test. For such tests, a multiplication factor of 1.25 has been specified.

Laboratory tests on new and aged insulation systems have rendered greatly differing values of the multiplication factor to be used both for DC testing and 0.1-Hz testing to obtain equivalent results as a test at power-frequency alternating voltage. These multiplication factors are mostly considerably higher for new insulation systems than for aged insulations.

From this, it may be concluded that the stress mechanism during both DC testing and 0.1-Hz testing differs from that obtained by the use of an alternating voltage. Accordingly, the multiplication factor should be selected under due consideration of the aging of the winding insulation. However, since the high-potential test serves to establish the life of the insulation, it appears more appropriate to use a power-frequency alternating voltage for the high-potential test if it is practicable to obtain and transport the heavy test equipment.

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During manufacture and transport, the insulation of the rotor winding may have been exposed to moisture which would reduce the insulation resistance of the winding. The insulation resistance should therefore be measured prior to initial startup, after prolonged shutdowns and after work on the winding. If required, the generator should be dried until a sufficient insulation resistance is obtained.

1 Required Insulation Resistance of Rotor Winding

The insulation resistance should amount to ≥1 megohm at 40 °C (104 °F).

At winding temperatures other than 40 °C, a correction can be made using the curve shown in Fig. 1.

2 Measurement of Insulation Resistance

Prior to each measurement, the generator must be deexcited and any static charges removed by grounding the winding.

The insulation resistance should be measured between one slipring being in contact to the rotor winding and the slipring being in contact to the generator shaft, using a megger with a maximum voltage of 250 V. This voltage will present no danger to any of the devices in the excitation circuit. The duration of the test should be at least two minutes.

The measuring brush for ground monitoring should not be in contact with the slipring when measuring.

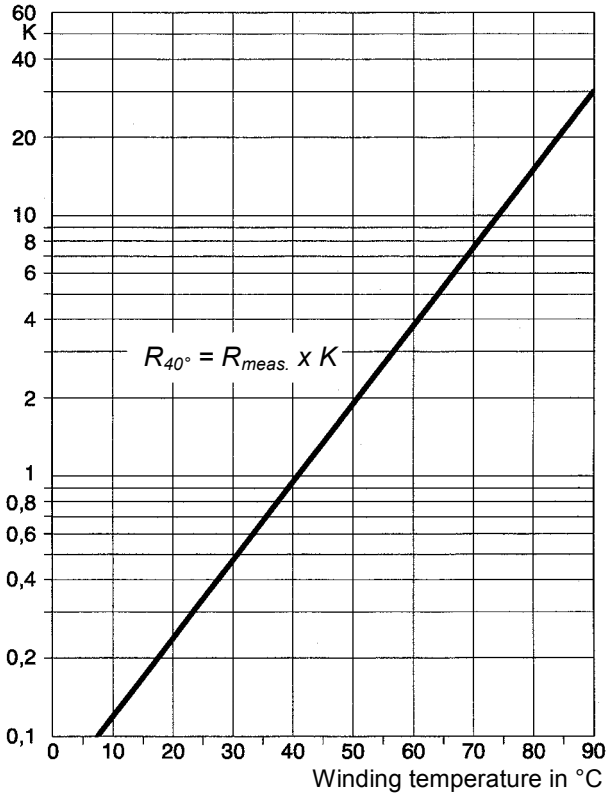
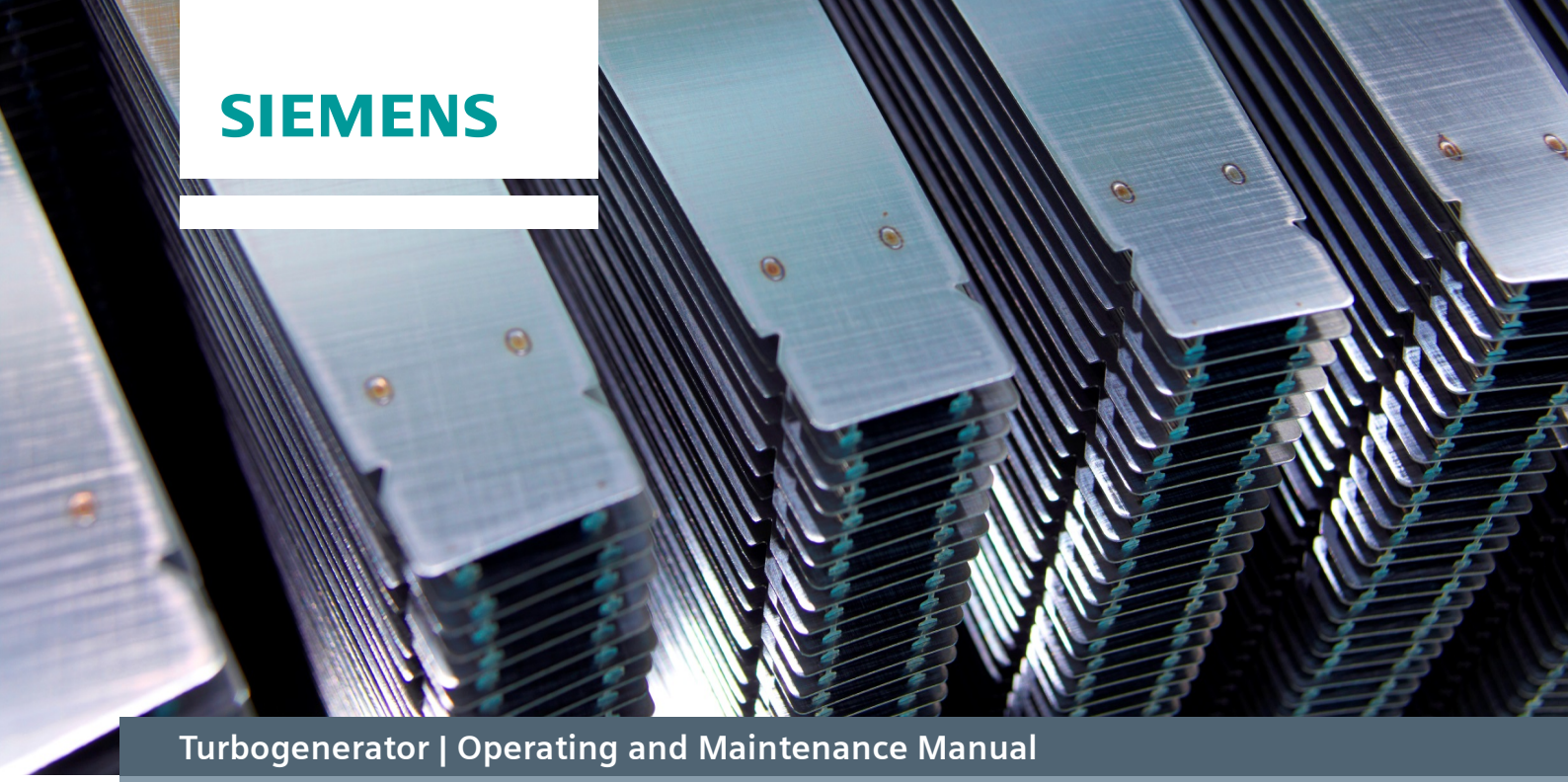


Fig. 1: Correction curve for insulation resistance measured (R_{meas}) to a temperature of 40 °C

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SIEMENS

Maintenance of the System/ Plant Section 4

Contents

4.1 Storage and Commissioning Preparation

4.2 Maintenance

4.3 Inspection

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4.5 Spare Parts



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Maintenance of the System/ Plant Section 4

Storage and Commissioning Preparation 4.1

Contents

- Receipt and Storage
- Generator Packing Checklist
- Generator Packing Checklist – Humidity Check during Long Time Storage
- Packing, Transport and Storage of Generator Rotors
- Preventive Measures for Transport and Storage of Generator Rotors
- Checking Desiccant in Packing of Generator Rotors
- Insulation Resistance Measurements on Rotor and Exciter Windings – Test Report
- Preparation of Machinery Parts
- Flushing the Oil Piping
- Treatment of Bolted Contact Surfaces
- Preparations for Start-up

1 Packing

The goods to be dispatched are packed in packing cases in the manufacturing works according to the conditions and climatic influences encountered in transport and in the country of destination.

1.1 Symbols

The package is marked with additional symbols for transport and storage and instructions for proper handling. These symbols are to observe absolute.

1.2 Desiccant in sealed packages

A desiccant is used to take up the moisture in the interior of the package. The amount used depends on the volume of the sealed package, duration of transport and the climate. Due to the corrosion hazard, the desiccant bags must not come into direct contact with metal surfaces. Appropriate openings and instructions are provided for regeneration and replacement of the desiccant.

NOTICE

Desiccant must not come into contact with metal.

1.3 Checking of desiccant

The moisture content may be read off from the indicators suspended inside the sealed package. Indicators are often provided with color charts. When unaffected by dampness, all the humidity indicators are colored blue (see fig. 1).

Open the appropriate marked flap immediately after arrival and check the indicator.

- Indicator blue: Desiccant still fully effective
- Indicator pink: Contents moist, desiccant no longer effective

NOTE:

The color charts contain further information.

Small cases do not have a flap; open lid to read indicator. **Storage goods must be checked monthly!**



Fig. 1: Humidity indicator

1.4 Measures to be taken in the event of moisture

If assembly is to take place within about one week, open case, check plastic sheeting for leaks and patch with adhesive tape; if necessary, protect against rain.

If assembly is possible within about one week or if there is water in the sheeting, unpack contents and place in a dry, well-ventilated room; heat room with electric heaters if necessary and ventilate well.

If neither of those measures is possible, open plastic sheeting carefully at a suitable point, insert fresh or regenerated desiccant, carefully re-close sheeting with clear adhesive tape or, if possible, heat-seal.

Desiccant can be regenerated. To do this, take desiccant from bag and spread in a thin layer on a pan, dry at between 120°C and 130°C for several hours, stirring continuously (desiccant becomes useless through calcination). Regeneration is completed when the weight of the desiccant remains constant.

For more checks of indicators the regeneration of moisture indicators is necessarily, too.

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1.5 Inspection at receipt

Immediately after receipt of the goods, the packing should be examined all round for any signs of damage. The external condition of the packing does not immediately reveal the condition of the contents. If necessary, remove the case lid or a few slats so that the contents may be seen. **Do not damage plastic sheeting in the case of sealed packages!**



NOTICE

Before unpacking equipment that is damaged or suspected to be damaged, make arrangements for appropriate storage in a dry place.

Immediate examination is important to determine the extent of damage, cause of damage and the person, if any, responsible for the damage. In line with rail, ship and road forwarding practice (that is particularly in Europe), notify the carrier concerned immediately (within prescribed time limits) and invite him to draw up a joint damage report. This is essential as evidence in claims for damages or for lodging claims with the insurance company.

If damage is discovered upon arrival overseas, it is essential to notify without delay the competent insurance agents (e.g. average adjusters of Hamburg and Bremen underwriters, the agents of Lloyds, or the local Insurance company) to enable them to inspect and certify the damage. If a thorough examination of the contents of the case cannot be made immediately (poor storage facilities), recourse at a much later date to the carrier or other persons responsible for the damage 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 (max. 90 days).



NOTE:

It is always advisable to photograph serious damage.

Inform order department at the Siemens Plant of any damage in a damage report.

1.6 Transport

After receipt of the shipment, carry out transport on or to the site with circumspection and care. The means of transport must be suitable as regards their construction and load carrying capacity.



NOTICE

Pay attention to inscriptions on the packages for details of weight, mode of lifting and transport.

When loading and unloading heavy parts, particularly if they have to be moved with winches jacks, crowbars, etc. the truck should be braced from below by props or jacks to prevent its loading surface from caving in or canting (truck suspension 1) Truck brakes must be on. Heavy parts should be secured against movement or displacement during transport, steel ropes should he cushioned with wooden blocks to prevent them from rubbing against the cases.



⚠ WARNING

Note loading capacity of set-down surfaces.

When using hoists take note of their carrying capacity and hoist attachment points on the packing or parts. Transport heavy parts using cranes If possible, or place in horizontal position on suitable trucks, rollers or guide ways, etc.

2 Storage

2.1 Outdoor storage

All components can be stored within their transportation boxes as long as humidity indicators show no indication. If these boxes are damaged all parts shall be unpacked and packed again with new desiccant inside the box.

Upon receipt of unit and components, visually inspect them for damages, moisture or other foreign contamination. Fill in the Generator Packing Checklist. Any indication of this must be reported to the supplier for corrective action.

Protect the cases against ground clamp by placing them on boards. Select the storage area to offer maximum protection against damp (flooding), dirt, vermin such as rats, mice, termites, etc. and tampering.

Avoid stacking heavy goods one on top of the other.

Record the humidity indicators of all boxes every 4 weeks. Fill in the ”Generator Packing Checklist – Humidity Check During Long Time Storage”. Depending on indication boxes can be stored, desiccant must be replaced or packing must be renewed.

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If there is any indication of the humidity indicator at the main generator box the generator must be dried out by special procedure.

At field conditions the use of a dehumidifier is proved. This dehumidifier can be attached to the internal packing tarp, to a tarp arrangement around the unpacked generator or to the generator enclosure that is assembled on top of the generator. The de-humidifier shall run the entire storage time. Megger stator winding once a month and record results so that any trending may be detected. Visually inspect the interior of the generator every three months.

If the unit suffers any unusual moisture damage for any reason, submit a Field Action Request (FAR) to *Engineering.*

2.2 Indoor storage

The storeroom should be well ventilated and dry if possible, and spacious enough to allow stable and clearly arranged storage. Pay attention to the load-bearing capacity of the flooring.

2.3 Rust on Rotor and Stator Surface

In case of rust formation the rust shall be removed as far as possible by only using a sponge (e.g. Scotch-Brite™) and Rivolta SLX or ethanol as solvent. Do not use any other solvent!

NOTE:

Rust which cannot be removed can stay on the particular generator component; generator function will not be restricted due to it.

Use space heaters or air dryers during future standstills to avoid further rust formation.

2.4 Removal from storage

Do not remove parts from store until immediately before assembly. If possible, transport components complete with packing to inspection/assembly site and place ready for use in proper sequence. Secure heavy components against slipping or canting.

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This checklist shall be completed by the responsible Siemens or other representatives at site for each generator.

NOTE:

This generator checklist is required for every shipping item arriving at site!

STEP	PROCEDURE	CHECK IF STATUS = "O.K."	INITIAL/DATE CHECKED
	Receipt of Generator Components and Generator		
A.	Verify that the following components are stored in a clean and dry area. Generator packing is not suitable for long-term storage.		
	1. Generator itself		
	2. Generator coolers		
	3. Enclosure		
	4. Oil Piping		
	5. Automatic Voltage Regulator		
	6. Jacking Oil Supply Unit		
	7. Anchoring and other loose shipped parts		
	8. Main lead assembly containing current transformers		
	9. Neutral lead assembly containing current transformers		
B.	Visually inspect all components of the generator and collector/exciter for evidence of damage, moisture and corrosion. Photo documentation should be retained documenting condition of the components whether damaged or not. Inspections should document any water ingestion, loose hardware, foreign objects, rust or any damage to any components. Replace all protective coverings and all bolting hardware after verification.		
	1. A crawl through should take place on the generator and every opened packing verifying as received conditions.		
	2. The exciter machine or collector and collector rings should be inspected to verify them as received condition.		
	3. The rotor should be inspected externally to verify it as received condition.		

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This checklist shall be completed by the responsible Siemens or other representatives at site for each generator.

NOTE:

This checklist is required for every stored shipping box and needs to be filled out during long time storage every 4 weeks!

STEP	PROCEDURE	CHECK IF STATUS = "O.K."	INITIAL/DATE CHECKED
	Order-No.:		
	Checking of Generator Components and Generator		
A.	Verify that the boxes of the following components are stored in a clean and dry area. The packing boxes are subject of control respective moisture, damaging and destruction. Additional care shall be taken for checking the fixing of tarpaulins on the box roofs.		
	1. Generator itself		
	2. TEWAC or Air Filter unit		
	3. Enclosure		
	4. Oil Piping		
	5. Automatic Voltage Regulator		
	6. Jacking Oil Supply Unit		
	7. Anchoring and other loose shipped parts		
	8. Main lead assembly containing current transformers		
	9. Neutral lead assembly containing current transformers		
B.	Visually inspect all humidity indicators of each box. Photo documentation should be retained documenting condition of the components whether damaged or not if indicators respond. Inspections should document any water ingestion, loose hardware, foreign objects, rust or any damage to any components. Taken photos shall show labels adjacent to the indicators readable. Replace all protective coverings and all bolting hardware after verification.		

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Preliminary Note

Generator rotors are components which are sensitive to moisture. For this reason, they must be protected against corrosion and mechanical damage during transport and storage.

The packing precautions and the organizational measures for protection during transport and storage are described below and summarized in document [1] (see end of this document). This description contains all details required for restoring the standard packing provided by Siemens AG for delivery of the rotor. If a rotor is to be returned to the manufacturer's works for overhaul or in the case of a prolonged outage of the generator involving a separate storage of the rotor, the requirements specified in the following must be met for protection of the rotor.

Any deviations from the standard packing due to special circumstances shall be subject to the approval of Siemens AG.

1 Basic Make-up of Packing

The packing precautions and organizational measures during transport and storage are intended for reliably preventing the effects of moisture on the rotor and especially on the rotor retaining rings which may be endangered by the effects of moisture and for protection against mechanical damage during transport and transhipment procedures.

For protection against the effects of moisture, the rotor retaining rings and the rotor body are packed in sealed plastic sheeting covers, adding materials for moisture absorption. This sealed packing is protected with a second plastic sheeting cover. In the case of sea transport, a third plastic sheeting cover is provided for the rotor retaining rings and the rotor body. This cover forms a second additional barrier against the diffusion of moisture into the innermost plastic sheeting cover.

The metallically bright shaft ends (shaft journals and couplings) are protected with a hard wax coating.

The rotor is then placed on a skid with closed bottom and secured in position for protection against mechanical damage. For land transport not exceeding one month, this unit is protected against external influences by a wooden enclosure resting on the bottom frame of the skid. This enclosure must be removed prior to each transhipment to hitch the rotor with a lath grid in place at the middle of the rotor body.

In the case of land transport exceeding one month and with sea transport, the enclosure forms an integral part of the skid. The hitch should then be taken directly at the skid. The complete cargo is covered with tarpaulins for protection from the elements.

Rotors with water-cooled winding are protected against corrosion by filling the water passages with pure nitrogen after drying to a gauge pressure of 0.5 – 1 bar (7 – 14 psig) via a cover at the exciter end. The pressure can be read on a permanently installed pressure gauge.

2 Definitions

2.1 Land Transport

The packing provided for this mode of shipment affords sufficient protection for land transport under moderate climatic conditions and for a scheduled transit period of not more than one month. This provides a reliable protection for short-distance transport (from Erfurt to destinations in the German Republic or in neighbouring countries).

This type of packing also ensures adequate protection during subsequent storage in a covered hall, e.g. power house. Following the receiving inspection, the insulation resistance of the rotor winding and the condition of the desiccant should be checked at inter-

vals of one month and the desiccant reactivated, if necessary.

2.2 Sea Transport

The packing provided for this mode of shipment affords protection during shipment by sea, during unavoidable outdoor storage and for transport periods and under conditions exceeding those under Item 2.1.

The additional packing, as compared to land transport, consists of a third plastic sheeting cover and a closed, seaworthy outer packing. The desiccant included in the plastic sheeting covers is sufficient for the scheduled transport period, but for not more than six months.

The inspections required during storage are the same as specified for land transport under Item 2.1.

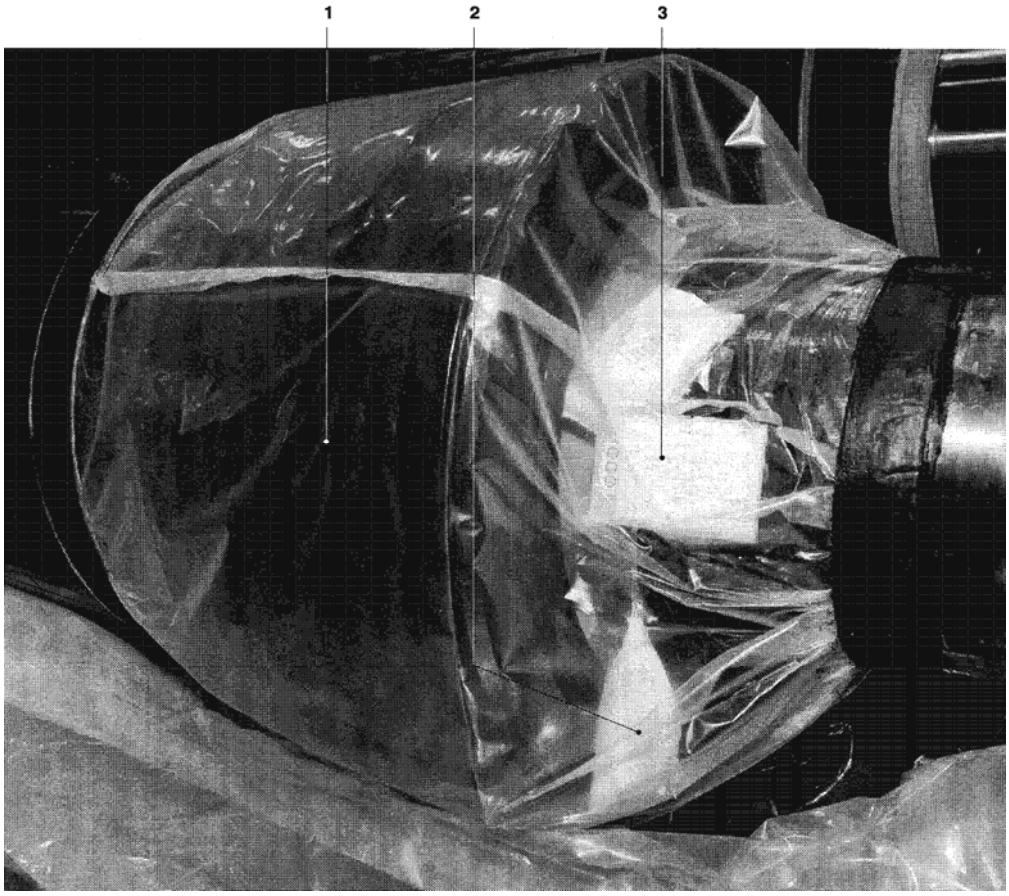


Fig. 1: Sealed Packing of Rotor Retaining Ring

1 Moisture-proof plastic sheeting
2 Desiccant pouch
3 Moisture indicator

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3 Summary of Rotor Packing Requirements

The summary in document [1] contains information on the makeup of the packing and on the procedures required to maintain the packing in sealed condition. A detailed description is given in the following section.

4 Sealed Packing

To obtain a reliable and long-lasting corrosion protection, both suitable production appliances and materials and appropriate methods of packing are required.

The basic prerequisites are:

- **Dry Condition of Rotor Prior to Packing**

The rotor must be dried if it is expected to be in a wet condition due to operational faults. To do this, the rotor and especially the rotor retaining rings and end winding portions should be dried with dry air by means of an air dryer (e.g. Munters dryer).

- **Water-Cooled Rotor Winding**

Drying the cooling water circuit of the rotor winding should be performed with a vacuum pump, heating the winding with direct current to approximately 60 – 70 °C (140 – 158 °F). Drying can be terminated when a pressure of less than 5 torr has been maintained on

the hot rotor for a period of five hours. Following this, the rotor winding should be filled with pure nitrogen to a gauge pressure of 0.5 bar (7 psig) via the end cover at the exciter end.

The equipment and power sources required for vacuum drying should be obtained by the owner in due time. The mechanical data for the procurement of the equipment are available from Siemens AG on request.

- **Weather-Protected Packing Area**

Packing and unpacking are only permissible in a weather-protected area, preferably in a hall.

- ***No Delays in Packing Procedure***

Care must be taken to ensure that after its removal the rotor will not suffer any moisture condensation or accidental wetting. Packing the rotor should therefore be performed immediately after withdrawal of the rotor and any required drying procedure in order to minimize any uncontrolled phases.

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4.1 Appliances and Packing Material

In addition to the standard tools, such as scissors, knife etc., special appliances are required for obtaining a packing affording corrosion protection:

- Heat-impulse fixture for heat-sealing of polythene plastic sheeting, consisting of: heat-impulse generator and heat-sealing tongs for a minimum seam length of 200 mm (7.8 in.).
- Heated plate to melt wax-coated sheeting for bonding (e.g. electric iron).
- Blower with low delivery rating for checking the plastic sheeting covers for tightness and for extracting the test air (e.g. vacuum cleaner).
- Air dryer for any required drying of rotor end windings prior to packing (e.g. Munters dryer).
- The following packing materials are used, which are available from Siemens AG on request:
- Polythene sheeting, 0.2 mm (0.008 in.) thick, endless, preferred width 6000 mm (236.2 in.)
- Rubber board with canvas reinforcement, 3 mm (0.12 in.) thick, minimum width 1000 mm (39.4 in.)
- Wax-coated linen binding with 1 mm (0.04 in.) wax coating, 100 mm (3.94 in.) wide (e.g. Denso binding)
- Hard wax for application by brush (e.g. Tectyl 506)
- Cold degreasing agent
- Wax-coated aluminium foil
- Adhesive for plastic sheeting
- Adhesive tape for plastic sheeting
- Foam material which does not absorb water, 5 – 10 mm thick (e.g. polyurethane)
- Silica gel in linen pouches as desiccant
- Moisture indicators for functional checking of desiccant with German end English inscriptions (color indicators for 30 %, 40 % and 50 % relative humidity)
- Hemp rope, 2 mm (0.08 in.) thick, for attaching desiccant pouches
- Fabric tape, 20 mm (0.8 in.), endless
- Steel band, 1 mm (0.04 in.) thick, 30 mm (1.2 in.) wide, with turnbuckle and tensioning device
- Lath grid for taking a hitch at the rotor body, consisting of hardwood laths, 50x80x3000 mm (1.97x3.15x118 in.), nailed to 5 mm (0.2 in.) thick fabric mat.

4.2 Protection of Metallically Bright Shaft Ends

The metallically bright shaft ends should be cleaned and degreased and protected with a hard wax coating (e.g. Tectyl 506) of sufficient thickness (dark-brown). In addition, the areas of support in the skid should be wrapped with two layers of wax-coated bindings (e.g. Denso binding) and a 3 mm thick canvas-reinforced rubber mat. All other areas contacting the skid should also be covered with 3 mm (0.12 in.) thick rubber board.

4.3 Making Plastic Sheeting Covers

The polythene sheeting covers are made directly on the components to be protected. To protect the plastic sheeting cover from damage, any contact with sharp edges must be avoided. Edges should be padded with layers of rubber board or foam rubber. The use of excelsior, corrugated cardboard, felt or other hygroscopic materials is not permissible. Care should be taken to ensure that the plastic sheeting cover remains intact during the subsequent packing procedures. Even pinpricks and minute tears in the plastic sheeting will render tight sealing ineffective. Within the range of rotor support in the skid and of other contact points (upper shipping saddles), the polythene sheeting should be inserted between two rubber boards of sufficient size for protection against damage. In the retaining ring area, each plastic sheeting cover is provided with a 500 mm dia. opening for connection of a plastic sheeting hose having the same diameter and a length of approximately 1 m.

After checking the cover for tight sealing, the desiccant is added via this hose, which is then closed by heat-sealing.

To maintain the sealed range in a dry condition, desiccant (see Item 4.4) is added to each plastic sheeting cover.

After heat-sealing and tight wrapping with wax-coated bonding, each plastic sheeting cover should be checked for tight sealing. To do this, one corner of the plastic-sheeting hose should be cut for insertion of a vacuum cleaner hose (discharge end) and tightly sealed with a binding. If the cover remains inflated during the following two hours, the cover is properly sealed. Following this check, the air should be drawn off.

First Plastic Sheeting Cover

As a first step, the entire rotor body should be wrapped with wax-coated aluminium foil with 50 – 70 mm (2 – 2.8 in.) overlap, with the wax coating facing the rotor body. Seams and overlapping portions should be sealed airtight by melting the wax coating with an electric iron.

To protect the aluminum foil from being damaged by the handling ropes, a canvas-reinforced rubber mat, 3 mm thick and approximately 2500 – 3600 mm (98 – 142 in.) wide (dependent on overall length of rotor) should be placed around the center of gravity of the rotor. This rubber mat consists of individual sections, each having a length corresponding to the rotor body diameter +100 mm (3.94 in) and arranged with an overlap of not less than 100 mm. All overlap seams should be sealed with wax-coated canvas bindings. Axial overlap seams should be additionally secured with steel bands. The overlap seam at the top on the circumference is to be secured in axial direction by a wooden lath, 80x40 mm (3.15x1.57 in.), which is also held in place with steel bands.

Finally, a lath grid (hardwood laths attached to fabric mat or fabric tape) should be placed in position for hitching. The grid should cover not less than the lower half two-thirds of the rotor body circumference and be adequately secured with steel bands. The wooden laths must be on the outside and arranged so that the rubber mat is approximately 150 mm (6 in.) wider at each end of the rotor. The range between the wax-protected shaft portion and the end of the rotor body should then be wrapped with polythene sheeting which is to be sealed tightly with wax-coated canvas bindings at the rotor body and free shaft portion.

Experience has shown that in the case of larger rotor body diameters (>1300 mm, 51.2 in.), the aluminium foil cannot be wrapped around the rotor with sufficient tightness and may thus be omitted. In such cases, the above mentioned polythene sheeting should extend beyond the rubber mat at the middle of the rotor body and should be wrapped tightly with wax-coated canvas bindings at these points.

The precautionary measures specified under Items 4.2 to 4.3. – *First Plastic Sheeting Cover* provide for the minimum packing requirements and are sufficient for land transport not exceeding 20 hours. In the case of rotors provided with aluminium foil within the range of the rotor body, sealing of the rubber mat at the middle of the rotor body will not be required for short-distance transport.

Second Plastic Sheeting Cover

In addition to the first plastic sheeting cover described above, a second polythene sheeting cover of the same type should be provided between the shaft ends and the rubber mat at the middle of the rotor body. To separate the two plastic sheeting covers, a 5-10 mm (0.2 – 0.4 in.) thick layer of foam material should be placed over the top half circumference of the rotor retaining rings and rotor body.

Two plastic sheeting covers are required for land transport and storage as defined under Item 2.1.

Third Plastic Sheeting Cover

For sea transport and outdoor storage as defined under Item 2.2, an additional diffusion barrier should be provided. This third polythene sheeting cover protects the entire range of the rotor between the shaft journals at either end. It is placed over the plastic sheeting covers according to Items *First Plastic Sheeting Cover* and *Second Plastic Sheeting Cover* and is to be made in the same manner.

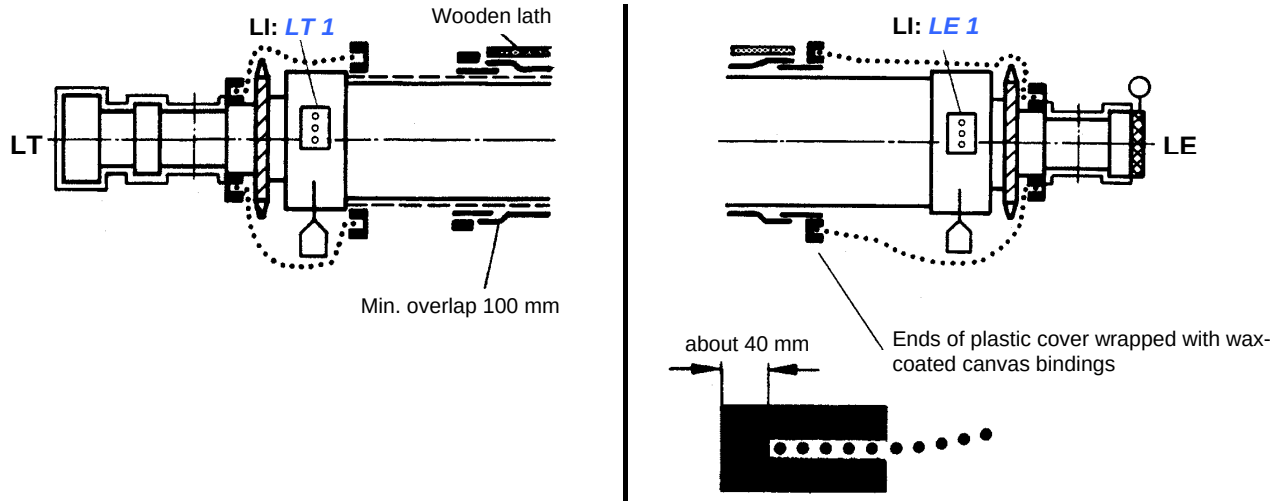
The plastic sheeting is placed over the rotor before the rotor is supported on the skid. Within the range of rotor support, the plastic sheeting is inserted between two rubber mats of 3 mm thickness each. After the rotor has been supported on the skid, its upper half portion (rotor body and retaining rings) should be covered with a 5 – 10mm (0.2 – 0.4 in.) thick layer of foam material outside the lath grid area, and then the plastic sheeting cover should be heat-sealed.

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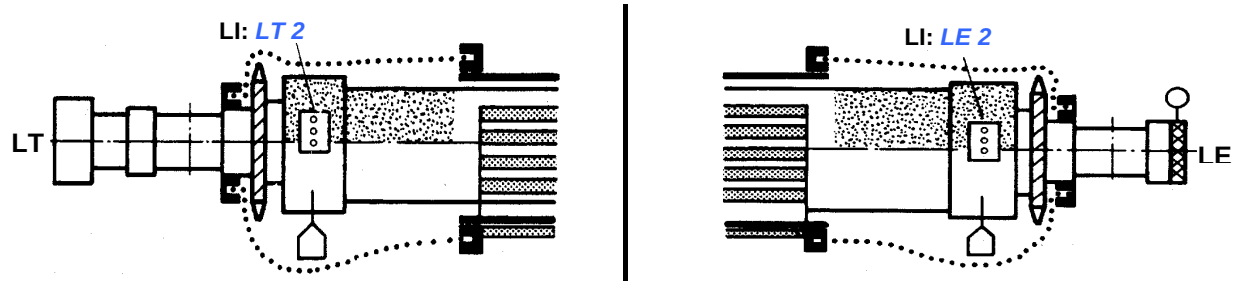
Rotor body diameter < 1300 mm

Rotor body diameter > 1300 mm

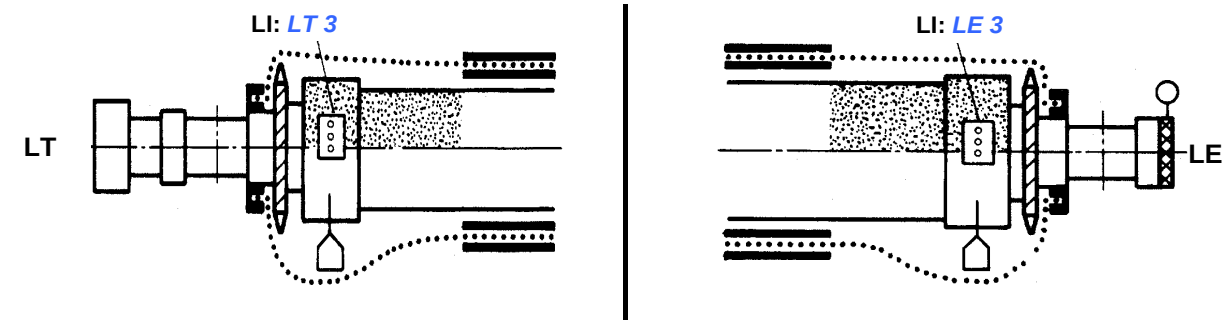
First plastic sheeting cover



Second plastic sheeting cover
(first cover not shown, except for rubber mat)



Third plastic sheeting cover
(first and second covers not shown)



Hard wax coating
Polythene sheeting
Wax-coated aluminium foil
Rubber mat
Wax-coated canvas binding
Lath grid or wooden lath
Polyurethane foam mat

IL Location identification

Moisture indicator with location identification

Desiccant pouch

Cover with potential measuring points for insulation resistance measurements and, if applicable, pressure gauge for nitrogen pressure in water-cooled rotor winding

Fig. 2: Sealed packing

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4.4 Desiccant

Type and Application

The desiccant consists of silica gel in dust-free and air-permeable pouches. It should be inserted into each plastic sheeting cover via the plastic sheeting hoses at the two retaining rings. The desiccant must be placed so that it can be replaced when this becomes. necessary and that it does not come into contact with steel or winding components (danger of corrosion). If necessary, cover contact area with polythene or rubber sheeting.



Fig. 3: Moisture Indicator



50% relative humidity
All circles pink:
Danger of corrosion!



40% relative humidity
Two circles pink:
Replace desiccant!



30% relative humidity
One circle pink:
Warning!

Fig. 4: Indicated ranges of relative humidity
(exact location identification to be entered in handwriting)

All pouches must be tied together with a hemp rope, and, when used, they must be in an active, i.e. absolutely dry condition.

Desiccant Quantities

The desiccant quantities (also see end of this document, [1]) are proportioned to accommodate highly adverse climatic conditions. The maximum quantity is sufficient for a transport period not exceeding six months.

Checking and Reactivation

The moisture absorption capacity of the desiccant must be checked after arrival at site, after interruptions in transit involving a storage period of more than one month and during normal storage at the site (see Item 7.2). To do this, use the moisture indicators (fig. 3) inserted in the plastic sheeting covers at a distance of not less than 5 cm (2 in.) the sheeting.

The moisture indicators are marked with their respective location identifications as illustrated in fig. 2 and show the relative humidity inside the cover in three ranges: > 30 %, > 40 % and > 50 % (fig. 4). With the packing in dry condition, all circles are blue. A change in colour to pink in the respective circle indicates the relative humidity in percent. As soon as the 40 % indicator changes to the pink colour, the desiccant must be removed and replaced or reactivated by drying.

Make sure that sufficient replacement desiccant or the necessary drying facility for reactivation is available. After opening, the plastic sheeting cover should be provisionally resealed, but must not be left in this condition for more than 20 hours.

For reactivation, the pouches should be dried in a drying oven at a temperature of 110 °C (230 °F) for 12 hours. If a drying oven is not available, the desiccant should be removed from the pouch spread out in a thin layer on a metal plate and dried at 110–130 °C (230–266 °F) for several hours until the weight of the desiccant remains constant. The desiccant should then be filled back into the pouches which are to be closed and reinserted into the plastic sheeting covers as quickly as possible. Care should be taken to ensure that the pouches do not come into contact with metal parts. The opening in the plastic sheeting cover should then be resealed with a heat-sealing unit.

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5 Skid and Outer Protection

Siemens AG generator rotors are delivered in box type shipping containers, consisting of a skid and an enclosure. Fig. 5 and 6 depict typical examples. It is recommended to keep this shipping container for future needs, unless an adjustable universal skid is used for land transport which is available from Siemens AG if requested in due time. The information given in the following relates to the remounting of the rotor in sealed packing on the skid and to the provision of the outer protection.

5.1 Land Transport (Less Than One Month)

For land transport, the rotor should be supported on a skid similar to fig. 5. The points of support should be padded with rubber mats for protection of the plastic sheeting covers. At the shaft ends, the rotor should be attached to the skid by means of upper saddles and secured in axial direction.

For loading operations, the hitch should be taken either at the middle of the rotor body (lath grid) or at the rotor ends.

During transit, the rotor should be protected against external influences by a wooden enclosure resting on the bottom frame of the skid. Both long sides of this protective enclosure should be clearly stencil-marked with the following note:

NOTE

Remove protective enclosure for rotor transhipment.

The complete cargo should be covered with a lashed tarpaulin.

5.2 Land Transport or Sea Transport of Longer Duration

For land transport exceeding one month and for sea transport, the rotor should be packed in a closed, self-supporting container. The setup for two-pole rotors corresponds to fig. 5.

The container bottom should have openings with perforated-plate covers for ventilation and to prevent the accumulation of water. In addition, inspection openings with covers should be provided on the long sides for access to the desiccant pouches via the plastic sheeting hoses. An inspection opening at the exciter end should provide access to the contact pins on the EE end cover of the rotor for measurement of the insulation resistance of the rotor winding.

Prior to closing the container, the rotor should be covered with 3 mm (0.12 in.) thick pressboard panels and polythene sheeting, taking care to avoid the formation of troughs in which water might accumulate.



Fig. 5 Skid for prolonged land or sea transport of rotors <100 Mg (outer enclosure not yet provided)

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Fig. 6 Shipping container for sea transport of rotors > 100 Mg

The container lid should be covered with tar board sanded on one side and folding down over the edges not less than 200 mm (7.87 in.).

The total weight and the dimensions of the cargo should be marked on the container. In addition the hitching range should be colour-marked. The complete cargo should be covered with a tarpaulin for protection against the elements.

6 Protection of Packing During Transit

6.1 Organizational Measures

Proper packing of the rotor will prevent both the ingress and the condensation of moisture during transit, unless the sealed packing is damaged by improper loading procedures or customs inspections. This should be avoided by suitable precautions, enabling a quick restoration of the dry condition of any damaged sealed packing. These measures include:

On the cargo:

- Instructions for correct handling.
- Reference to ***Sealed Packing*** on shipping container.
- Indication of desiccant quantity inserted into each individual plastic sheeting cover behind inspection hole cover.
- Attaching this instruction 2.5-0030.

In the accompanying documents:

- Reference to ***Sealed Packing***.
- Reference to arrangements for customs clearance at place of installation.
- Request for immediate drying in case of transport damage with moisture penetration.
- Check list relating to condition of desiccant [2].
- Check list relating to insulation resistance of rotor winding [3].

6.2 Loading

If a flatcar is used for transport, the cargo should be loaded so that it can slide on the car, i.e. the skid must not be secured in position and must be free to move in both directions of running. Provision should be made for a sliding distance of approximately 1.5 m (59 in.) at either end.

Planks, approximately 50 mm (2 in.) thick, should be nailed to the long sides adjacent to the battens.

If a deep well wagon is used for transport, the skid-mounted rotor should be secured in position at both ends of the loading bridge. The bridge trough should be sealed with boards for protection against stones.

During shunting operations, the car must never be allowed to pass over a hump. A corresponding note should be included in the waybill and affixed to the car in a well visible location.

6.3 Receiving Inspection

After arrival of the rotor, the consignee should examine the packing for external damage. The condition of the desiccant can be ascertained at the moisture indicators. In addition, the insulation resistance of the rotor winding should be checked. In the case of a

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water-cooled rotor winding, the pressure of the nitrogen blanket should also be checked. The date of the receiving inspection should be entered in the respective section on the inspection hole covers. The results of the receiving inspection should be recorded in the check lists [2], [3], copies of which should be forwarded to the consignor.

If the packing is found in damaged condition, it should be resealed as soon as possible. The same requirement applies if the seals were opened by the customs authorities.

If the moisture absorption capacity of the desiccant is no longer sufficient (40 % indicator is pink), the desiccant should be removed from the plastic sheeting cover, with the shipping container protected from the environment, and reactivated (see Item 4.4.3). If the rotor is unpacked immediately after delivery, it may become necessary to bring it to ambient temperature level for protection against moisture condensation. If the rotor temperature is equal to or higher than the room temperature, there will be no need for raising the temperature of the rotor to the level of the ambient temperature. The rotor temperature can be measured at the accessible rotor ends using a temperature measuring instrument. If the rotor temperature is lower than the ambient temperature, steps must be taken to ensure that the rotor temperature will be 5 K (safety margin) higher than the dew point temperature of the ambient air [4].

In the case of outdoor units, the rotor assembly phase should be timed so that the unpacked rotor will not be exposed to extreme changes in temperature as this will involve the risk of moisture condensation.

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7 Storage

The precautionary measures during storage provide for maintaining the dry condition of the rotor in the sealed packing without any interruptions until commencement of the assembly.

To this end, certain minimum requirements must be observed, which are dependent on the condition of the storage area. In addition, the condition of the packing and of the desiccant contained in the packing must be checked at regular intervals. To obtain additional verification, the insulation resistance of the rotor winding should be measured.

As long as the nitrogen pressure is still slightly above atmospheric, it will normally not be necessary to recharge a water-cooled rotor winding with nitrogen. If the nitrogen pressure has dropped to zero, the winding should be filled with pure nitrogen to a gauge pressure of 0.5 bar (7 psig) from the nitrogen bottle permanently installed in the shipping container.

7.1 Storage Area

Sufficiently ventilated and dry storage rooms for stable support of the parts in a fully accessible location are favourable preconditions for storage. If outdoor storage cannot be avoided, a heavy-duty outer packing of the seaworthy type must be provided. The outdoor storage facility must be set up in such a way that the stored item is protected against rainfall and moisture from the ground.

This would include placing a waterproof shelter over the shipping container which affords sufficient ventilation. In addition, the stored item should be blocked up on the solid ground for protection against moisture. Enough space must be left between the boxes to permit inspections and checks.

7.2 Checks During Storage Period

Following the receiving inspection, surveillance of the equipment should be conducted by repeat checks at intervals of four weeks. The checks required are the same as specified for the receiving inspection under Item 6.3. The dates of the repeat checks should be recorded on the outer packing below the date of the receiving inspection and in the check lists [2], [3].

7.3 Removal From Storage

If the storage area and the place of installation are not located in the same room (power house or workshop), the rotor temperature may be below the dew point level on transfer of the rotor from a cool storage area to a warm power house. To protect the rotor from moisture condensation, it should be left in its sealed packing for several days and allowed to assume the ambient temperature prior to removing the packing for immediate assembly.

Also refer to the following information:

[1] 4.5-0031	Preventive Measures for Transport and Storage of Generator Rotors (Summary)
[2] 4.5-0032	Checking Desiccant in Packing of Components
[3] 4.5-0033	Insulation Resistance Measurements on Rotor and Exciter Windings during Storage (Test Report)
[4] 4.5-0019	Determination of Dew point Temperature

Purpose / Phase	Components	Prev. Measure	Protective Materials and Setup	
			Land Transport Short Distance, Transport Period Less Than One Month	**Sea Transport** Shipment by Sea or Transport Period More Than One Month
A **Corrosion protection of shaft ends**	**Shaft journals Couplings**	**(1)**	Hard wax coating (e.g. Tectyl 506) of sufficient thickness (dark-brown color). Additionally protect areas of support in skid with two layers of wax-coated bindings and one layer of 3 mm (0.12 in.) canvas-reinforced rubber mat.	
B **Corrosion protection of rotor winding**	**Water-cooled rotor winding**	**(2)**	Fill dried rotor winding with pure nitrogen to a gauge pressure of 0.3 – 0.5 bar (4.35 – 7.25 psig) through cover at exciter end.	
C **First packing of rotor retaining rings and rotor body in plastic sheeting cover** **(sufficient for short-distance transport up to 20 hours and immediate installation)**	**Rotor body**	**(3)**	Place wax-coated aluminium foil over entire range of rotor body (only for rotor body diameters <300 mm (<11.8 in.), due to difficult handling).	
		(4)	Place 3 mm (0.12 in.) canvas-reinforced rubber mat, 2500 – 3600 mm (98 – 141 in.) wide (dependent on length of rotor) around center of gravity; seal overlap seams with wax-coated bindings and steel bands; secure axial overlap seam with wooden lath.	
		(5)	Place lath grid on fabric mat, about 300 mm (11.8 in.) narrower than **(4)**, around two-thirds of rotor circumference and secure at top.	
	Retaining rings Fans (waterboxes)	**(6)**	Place 0.2 mm (0.08 in.) polythene sheeting between shaft ends **(1)** and body ends **(3)** and rubber mat **(4)**, respectively; seal joints with wax-coated bindings at both ends; heat-seal seams.	
		(7)	Check plastic sheeting cover for tight sealing by inflation with air and recheck after two hours.	
		(8)	Add desiccant per m^2 (1 m^2 = 1.2 sq.yd.) of sheeting surface: shipping time up to 1 month: 500 g (1.1 lb.); up to 3 months: 1000 g (2.2 lb.); up to 6 months: 1500 g (3.3 lb.). Plus 280 g (0.62 lb.) for each kg of wood and 35 g (1.23 oz.) for each kg of foam material within plastic cover. Moisture indicators for relative humidity >30 %, >40 %, >50 %.	
D **Protection of first packing C by second plastic sheeting cover**	**Rotor body and retaining rings**	**(9)**	Place 0.2 mm (0.008 in.) polythene sheeting between shaft ends **(1)** and rubber mat **(4)** over a 5 – 10 mm (0.2 – 0.4 in.) foam mat around top half circumference of rotor retaining rings and rotor body.	
		(10)	Check heat-sealed and tightly wrapped plastic cover **(9)** for tight sealing as under **(7)**.	
		(11)	Add desiccant and moisture indicators as under **(8)**.	
E **Protection of packings C and D by third plastic sheeting cover**	**Rotor body and retaining rings**	**(12)**	Not required for land transport.	Place 0.2 mm (0.008 in.) polythene sheeting over a foam mat and cover entire rotor between shaft ends as under **(9)**. With four-pole rotors, foam mat is split within range of lath grid; insert plastic sheeting between 3 mm (0.008 in.) rubber boards. Check for tight sealing as under **(7)**. Add desiccant as under **(8)**.
F **Transit protection**	**Tightly sealed rotor**	**(13)**	Tightly sealed rotor **(1)** to **(11)** on skid with closed bottom under enclosure and tarpaulin.	Tightly sealed rotor **(1)** to **(12)** in closed self-supporting shipping container under tarpaulin.

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Purpose / Phase	Components	Prev. Measure	Protective Materials and Setup	
			Land Transport Short Distance, Transport Period Less Than One Month	**Sea Transport** Shipment by Sea or Transport Period More Than One Month
G **Loading**	**Complete cargo**	**(14)**	Hitch point on rotor at lath grid in center of gravity after removal of enclosure.	Hitch point on shipping container; in the case of four-pole rotors on steel sleeve at mid-length of skid.
H **Receiving of Cargo**	**Complete packing and rotor winding**	**(15)**	Check outer packing and relative humidity inside plastic sheeting at moisture indicators. Replace desiccant when relative humidity is higher than 40 %. Return check list with details on condition of packing and insulation resistance of rotor winding to consignor.	
		(16)	Prior to unpacking the rotor in a weather-protected location, a cold rotor must have ambient or dew-point temperature plus 5 K safety margin to prevent moisture condensation.	
J **Storage**	**Storage area**	**(17)**	With packing for land transport, only in a hall kept at a moderate temperature. For outdoor storage, seaworthy packing plus additional precautions are required: storage on well tamped and suitable reinforced ground and set on blocks for protection against moisture, case under protective roof.	
	Complete packing and rotor winding	**(18)**	During storage (including interruptions in transit), check outer packing for damage and tight sealing, insulation resistance of rotor winding and, if applicable, nitrogen blanket at intervals of four weeks.	
K **Removal from storage**	**Rotor**	**(19)**	Maintain tight sealing of packing as long as possible until rotor is installed. Protection against condensation hazard by preventive measure (16).	

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Desiccant Checking Requirements

The absorbent capacity of the desiccant must be checked after shipment has been completed and at intervals of one month during any subsequent storage period. The results should be recorded in the table below. The control interval must be reduced to one week as soon as the 40% indicator reacts by changing to a pink colour. The protective coating must be renewed immediately the 50% indicator reacts by changing to a pink colour.

Job name: **Sl. No.:** **Type:**

Shipping or storage phase	Date	Name	Company	Condition of component	Condition of outer packing	Location identification of moisture indicator	Moisture indicator blue or pink?			Weight of desiccant in packing in kg (1 kg = 2.2 lb.)	Replacement or reactivation of desiccant
							Bottom circle (30 %)	Center circle (40 %)	Top circle (50 %)		
Prior to shipment						TE 1					
						TE 2					
						TE 3					
						EE 1					
						EE 2					
						EE 3					
						TE 1					
						TE 2					
						TE 3					
						EE 1					
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						EE 3					

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The insulation resistance should be checked after shipment has been completed and at intervals of one month during any subsequent storage period. The results should be recorded in the table below.

Job name: **Sl. No.:** **Type:** **Component:**

Shipping or storage phase			Prior to shipment									
Date												
Name												
Company												
Storage area												
Temperature in storage area in °C												
Rel. humidity of ambient air in storage area in %												
Rotor temperature in °C												
Moisture indicator in packing blue or pink?	TE1	50						-				
		40										
		30										
	EE1	50										
		40										
		30										
Pressure of nitrogen blanket in bar												
Applied voltage in V												
Insulation resistance in megohm	15 s											
	30 s											
	45 s											
	1 min											
	2 min											
	3 min											
	4 min											
	5 min											
	6 min											
	7 min											
	8 min											
	9 min											
	10 min											

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Notes

1. The insulation resistance should be measured with an insulation measuring device with max. 500 V measuring voltage with start-up and due to possible impurities max. 250 V with later revisions.
2. Prior to each measurement, any static charges should be removed by grounding the windings as a precautionary measure (10 minutes).
3. The connection to the rotor winding should be made at a specially identified bolt on the EE end cover.
4. The connection to the rotor body should be made at a second bolt on the EE end cover.
5. After each measurement, any static charges should be removed by short-circuiting the winding through the rotor body (not less than 20 minutes).

1 General

The machinery parts to be assembled are delivered ready for mounting, unless certain portions must be protected during transport against corrosion or damage.

In case of orders for delivery to ***European*** countries, all sensitive portions of the machinery parts, e.g. journals, are provided with a protective coating and protected against damage.

In case of orders for delivery to ***overseas*** countries, all machined surfaces are provided with a protective coating. In addition, complete assemblies are sealed in plastic sheeting.

2 Removal of Protective Coating

The protective coating applied at the manufacturer's work should be carefully removed prior to installation. The surfaces to be cleaned should be washed with petroleum or a similar agent. When using trichloroethylene, the cleaned surfaces should be carefully dried and afterwards a thin oil film should be applied. Non-observance of this requirement implies the danger of corrosion.

Particularly thick layers of protective coating should be softened by applying one of the above-mentioned cleaning agents and then be removed by means of a hardwood board (approx. 10 cm x 10 cm x 1 cm, 3.94 in. x 3.94 in. x 0.4 in.).



NOTICE

Never use scrapers, finishing trowels or sheet metal strips for removing the protective coating from highly sensitive machinery parts (journals, etc.).

Cleaning of internal and external threads should be done by chasing, using suitable taps or cutting dies. The dimensions of the external and internal threads may be taken from the respective drawings. Use dry compressed air to blow out the rethreaded tapped holes.

Where no taps are available, cleaning of the tapped holes may also be carried out with the aid of the original screws. At first, the screws should be cleaned by means of solvent and a brush. The cleaned screws should then be dipped into a solvent and immediately afterwards be screwed into the holes for thread cleaning.

If required, this procedure should be repeated several times until the threads are free from protective coating.

3 Remedying of Minor Damage

Damaged machinery parts should be reconditioned as dictated by the extent of the damage and the operational requirements unless the nature of the damage does not warrant such remedying.

Seriously damaged parts should be returned to the manufacturer's works together with a damage or failure report.

The machinery parts and the fixing and locating elements should be checked for burrs and compression marks, and such imperfections should be removed by means of a smooth-cut file. Fine-finished surfaces should only be polished by means of an oilstone.



NOTICE

Burrs and compression marks on bearing metal surfaces should only be removed by means of a spoon scraper or flat scraper.

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1 General

The prerequisite for fault-free operation of the oil circuits is proper and complete assembly of all the components provided according to the drawing specifications of the machine component manufacturer involved with the oil system, and thorough cleansing of the entire oil system after it has been completed.

The objective of these activities is to remove contaminants that have penetrated into the pipework during installation. The assembly and cleansing of the oil systems of generators and their drive systems require specific knowledge and great care. The currently valid work, fire and environmental protection regulations must be complied with when handling oil and oil-wetted components, and when flushing with oil.

Ensure that fire-fighting equipment is available and in good working order before flushing with oil. The areas surrounding the generator and its prime mover, and the escape and rescue routes must be kept clear. These tasks may only be performed by competent, trained installation technicians.

After the installation of the lubricating and lifting oil pipe systems has been completed, the circuits are subjected to a cleaning process, which is usually done with the operating medium at operating temperature. All tanks, oil coolers, pipes, hoses, fittings and other system components should be included in the cleaning process.

Appropriate filters should be mounted upstream of the bearing connections and in the return line upstream of the sump. The filters must be dimensioned so that they do not significantly affect the desired high speed of the oil through the circuit. The filter elements should be exchangeable so that the filter stages can be matched to the progress of the cleansing. Appropriate auxiliary connectors, suitable fittings etc. are to be used to mount the filters in the oil circuits. Bypasses with suitable cross-sections can be used to maintain the flushing process during the filter cleaning period.

If switchable bypasses are not available during filter cleaning, switch off the oil pumps, and secure them against being unintentionally switched on again.

It is not permissible to close shut-off elements in the oil return system while pumping. Any flexible pipes and connecting elements used must be suitable for the operating pressures and temperatures.

Measures must be taken to prevent oil from leaking or spraying out during the flushing process. All flanges and seals in the oil circuit must be checked before the pumps are switched on. The lower parts of the outer bearing housing multi-lip sealing rings should be mounted in order to prevent oil spraying out.

The maximum possible quantity of flushing oil can be set for each bearing with the corresponding bearing oil choke in the circuit.

2 Preparation of the Bearing Compartments

The bearings and bearing compartments of the generator are supplied in a clean condition and ready for operation. Cleansing, in the form of flushing with oil, is not necessary. Lines are therefore laid to bypass the bearing connections before starting to flush with oil. However, if it becomes necessary to clean the bearings and bearing compartments for unexpected reasons, then they are to be included in the oil circuit at the original connection points.

Any dirt deposits must be cleared out of the bearing compartments after the flushing process has finished. This must be done carefully with lint-free cloths (cotton waste must never be used). Any cleanser used must not be allowed to mix with the oil. There must not be any residues remaining in the bearing housing. The bearings and bearing compartments must be given a thorough visual inspection after cleaning.

3 Preparatory Work

If a bypass cannot be mounted, ensure that the upper half-shells of the bearings are dismounted and that temporary oil drain pipes are fitted to the inlet openings of the lower half-shells. The installation must be made so that the flushing oil cannot flow between the shaft and the lower half-shell of a bearing.

The connecting hoses within the bearing housing are mounted but not attached to the bearing shells, so that they are integrated into the flushing process.

4 Flushing Oil

The oil used for flushing must be provided by the user and oil supplier as laid down in the generator manufacturer's oil specification. In this connection, it may also be necessary to consult the turbine manufacturer.

The following methods are possible:

Use of the same oil grade for both flushing and operation. On completion of the flushing procedure, oil samples should be taken and analyzed to decide whether the flushing oil charge can be used as operating oil after treatment by the oil supplier.

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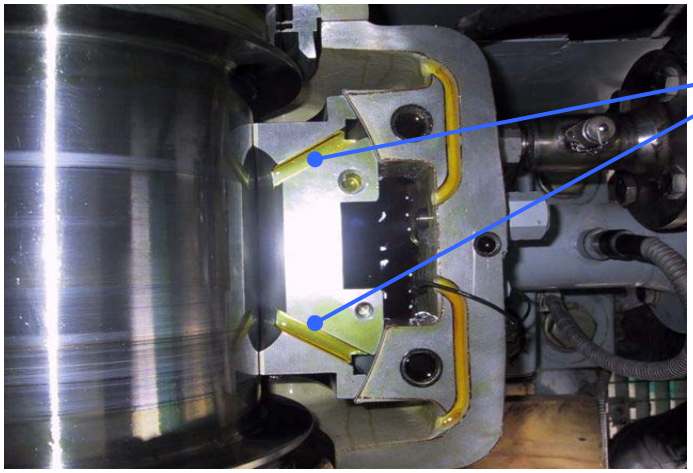


Fig. 1: Oil inlet holes in lower half-shell

These four holes are to be sealed by suitable means, e.g. profile rubber so that flushing oil cannot penetrate between the shaft and the lower half-shell of the bearing.

These holes are found on both sides of the bearing.

Use of an oil grade intended for use as flushing oil only. Its properties, particularly its viscosity, are matched to the specific intended purpose. This oil charge is completely drained on completion of the flushing procedure and replaced by fresh operating oil. The properties of the operating oil and the flushing oil must be compatible.

5 Flushing Procedure

During the flushing process, the oil should flow as fast as possible through the oil circuit pipes and temperatures up to a maximum of 80°C are to be maintained.

The flushing process can take place simultaneously along the entire generator-turbine axis through all bearing oil pipes and all pressure oil pipes of the hydraulic shaft lifting device. If the speed of the oil flow drops too far over the entire generator-turbine axis, shut-off elements can be fitted so that parallel branches can be flushed locally one after the other.

The oil temperature is not raised during the first hours. Heavier particles are entrained as a result of the higher oil density and the higher oil speed achieved with the coarser filters. After finer filters have been fitted, the oil temperature is raised to a maximum of 80°C.

The oil pipes must be continually tapped during the flushing process to dislodge dirt particles from the inside walls of the pipes.

The drive pumps should be repeatedly switched on and off to generate flow surges.

During the flushing, the screens upstream of the bearings and in the return line must be checked and cleaned as and when necessary. The filters must be cleaned regularly and replaced by finer elements according to the quantities of dirt found and its grain sizes. The flushing process must not be ended until no further dirt has been found in the finest filters and screens for a considerable period of time.

Remove and clean all filters and screens after completion of the relevant flushing process. Filters and screens removed for the flushing process must be refitted or replaced by those in the original generator-turbine axis equipment. All by-passes, restrictor plates and blind disks, and additionally fitted filters must be removed. The hoses of the shaft lifting devices are to be connected to the bearings and checked for leaks.

Finally, all bearings, bearing covers, multi-lip sealing rings and flanges must be fitted ready for operation.

All concluding work on the oil system and bearings must be performed with care, and with the use of appropriate measures to prevent renewed contamination.

After completion of all work on the oil system, the outsides of the pipes, flanges and connectors are cleaned and then subjected to a system pressure and leak test.

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1 General

The tinned contact surfaces and the bright copper surfaces of the contact faces should be treated with contact grease primarily to fill up the gaps remaining after bolting.

In addition, the contact grease improves the electrical conductivity of the contact surfaces, it is chemically inert and water-repellent, it does not dry up, it cleans oxidized contact surfaces and protects them against corrosion.

Contact grease has a grease-like, pasty consistency.

2 Application

Degrease tinned contact surfaces by means of a cloth wetted with solvent. **In the case of the terminal bushings make sure that the insulators *never* come into contact with the solvent.**

Copper surfaces without tin coating should be cleaned and degreased by means of solvent after emery-polishing.

After this preparatory treatment, apply the contact grease to the contact surfaces with clean fingers in such a quantity that a little excess grease is pressed out all around on bolting of the contact faces.

If greased surfaces are soiled prior to making the bolted connection, these should be cleaned and greased anew.

Excess contact grease should be wiped off with a clean rag.

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It is prerequisite for startup of the turbogenerator that continuous contacts be maintained between all plant sections directly or indirectly involved in the starting procedure

Checking the Transmitters

Prior to startup, all connections should be rechecked. This applies to piping as well as to cabling. When checking the cabling, special attention should be paid to testing the metering and signal cables. All alarm systems should be checked by changing the setting of the contacts. Where changes in the contact setting cannot be made, the alarm system shoud be checked for proper functioning by short-circuiting the terminals at the relevant signal transmitters.

All temperature measuring points should also be checked. This applies to the local as well as the remote reading thermometers. Unless temperature rises where brought about by other preparatory work at the measuring points, temperatures of approximately ambient or room temperature should be indicated. When doubts exist regarding the electrical temperature measurements, *calibration* and *line compensation* should be repeated.

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Maintenance of the System/ Plant Section 4

Maintenance 4.2

Contents

- Maintenance – Introduction
- Maintenance – Overview of Works and Intervals
- Maintenance – Important Operating Characteristics
- Maintenance – Carbon Brushes for Shaft Grounding
- Maintenance – Bearings
- Maintenance – Rotor Ground Fault Sensor System with Measuring Brushes Permanently in Contact
- Maintenance – Leakage Air Filter in the Cooler Cover

The turbogenerator and their auxiliaries require continuous maintenance and supervision to assure reliable operation and serviceability of the complete plant.

Some maintenance work can be performed during operation, but some activities can only be carried out when the machine is at a standstill.

The maintenance work required on the generator described herein is specified in the following section.

Follow the safety instructions for maintenance in the General information chapter, and the safety instructions in the supplier documentation.

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Work required	Maintenance intervals					
	Daily	Weekly	Monthly	Every 3 months	Every 6 months	Annually
Grounding Brushes						
Check the shaft grounding carbon brushes		x[1]				
Bearings						
Supervision of function of lubrication devices	x					
Supervision of bearing insulation					x	
Removing of oil mist condensate		x				
Rotor Ground Fault Sensor System						
Check pickup brushes		x[2]				
Check surface of slip-ring for measuring circuit					x[3]	
Cooler						
Check leakage air filter in the cooler cover for contamination, clean or replace the filter mats if necessary					x[4]	

[1] The maintenance interval starts with weekly inspections; this interval can later be adjusted according to the specific experience gained in the power plant.

[2] The maintenance interval starts with weekly inspections; this interval can later be adjusted according to the specific experience gained in the power plant.

[3] Preferably with rotor stationary.

[4] At the first shut down after commissioning, or after 6 months at the latest. The maintenance interval must be specified on the basis of the inspection after commissioning, according to the environmental conditions.

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Work required
Monitoring the stator winding temperature
Monitoring the cooling air temperatures
Monitoring the vibration level
Monitoring the rotor temperature
Monitoring the bearing temperature
Monitoring of the lubrication oil temperature, flow rate and pressure
Monitoring the exciter values
Monitoring the leak water level*

* if existing

1 Main operating characteristics

The monitoring of the generator is described in the Protection and Monitoring chapter.

Reference is made to the most important operating characteristics once again in the following. These must remain within defined limit values in order to ensure trouble-free plant operation. The characteristics must be recorded in the operating log. Long term trends have to be identified so that corrective measures can be taken during planned shutdowns, before the generator protection has to intervene in operation, and the risk of unplanned shutdowns arises.

2 Stator winding temperature

The temperature monitoring in and around the turbogenerator must ensure that the temperatures remain within their limit values. Attention must be paid to every unusual temperature change. The rated operating values must be restored as quickly as possible.

If there exists the danger of overheating, a corresponding load reduction should be made.

The temperatures between the top and bottom bars of the stator windings are measured with resistance temperatur detectors (RTD‘s).

The RTD‘s are distributed uniformly over the three phases. The RTD‘s should indicate approximately identical values for indentical currents in all three phases. If different temperatures are indicated with identical currents in the three phases, a check should be performed to determine if the slot RTD‘s are correctly calibrated and/or compensated.

Differences in the temperature indication up to 5 K may be due to tolerances in the RTD‘s, the compensating resistors and tolerances caused by differences in the contact at the measuring point selector switch. Other small temperature differences may be due to different mounting conditions at the RTD‘s.

3 Cooling-Air Temperatures

The temperatures of the cooling air in the machine are monitored at the drive and non-drive end cooling air inlets and in the hot air outlet of the generator.

The temperature transmitters installed in the cooling air inlet ducts indicate the temperature of the air used to cool the generator.

The temperature transmitters installed in the hot air outlet duct indicate the temperature of the heated air leaving the generator after cooling generator components.

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4 Smooth running of the rotor

The smooth running of the generator rotor must be monitored. Attention must be paid to any changes, and their causes must be found. In most cases, the turbogenerator must be shut down if there is a major change in the smooth running in order to be able to carry out the necessary investigations.

NOTICE

Before starting to align or dismount the rotor, all brushes contacting the rotor must be removed from their holders. Do not replace the brushes until all work has been completed.

5 Rotor temperature

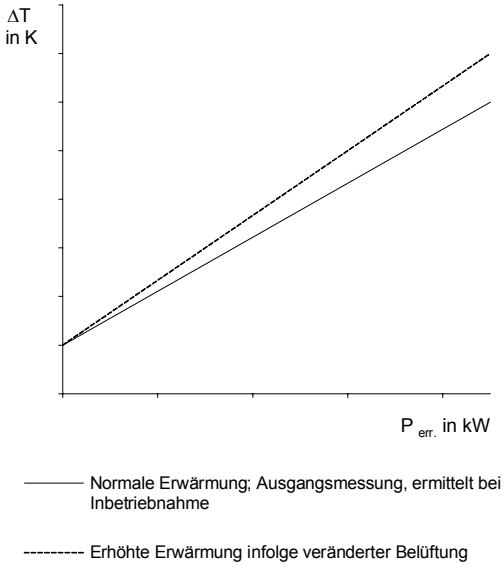
The increase in temperature of the rotor must be monitored. The increase in temperature of rotors with a slip ring must be determined up to the upper load range according to the following formula and diagram.

The measurements must be made with the highest precision by specialists during the commissioning (initial measurement), and repeated after certain periods of operation, but as a minimum before each inspection. Whether the rotor needs to be dismounted and the cooling ducts checked during the next inspection depends on the impairment of the cooling found.

Contamination of the cooling ducts in the rotor of open-circuit, air-cooled generators cannot be ruled out, despite the in-built filters. The air filters must be maintained very thoroughly at regular intervals. The rotor temperature rises more strongly if the cooling ducts become contaminated.

$$\Delta T = \frac{U_f}{I_f} \cdot \frac{255}{R_{20}} - (235 + T)$$

ΔT = Rotor temperature rise
U_f = Field voltage
I_f = Field current
T = Cold air temperature in the generator
R_{20} = Rotor resistance
255; 235 = Constant



Normal temperature rise; output measurement when commissioning
Increased temperature rise due to modified ventilation

Fig. 1: Rotor temperature rise

6 Bearing temperature

NOTICE

Danger due to bearing failure from excessively high temperature.

The causes of an increased bearing temperature must be determined and evaluated, see also document 4.3-9450.

The temperatures of the generator bearings are measured by thermosensors and displayed in the control room. The temperature measurement and registration, if necessary, takes place in conjunction with the turbine monitoring.

7 Lubrication oil temperature, flow rate and pressure

The temperature of the lubrication oil is determined by the setting of the volume of cooling water and the temperature of the cooling air for the bearing oil cooler. The temperature of the lubrication oil for all the bearings in the turboset is set on the cooler. The temperature measurement and registration, if necessary, takes place in conjunction with the turbine monitoring.

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Both the flow volume of the lubrication oil and the lubrication oil pressure must be checked at regular intervals. The setpoint values are stated in the text of the generator dimensional drawing. The bearings only function according to specifications if both values roughly correspond to the values in the text of the dimensional drawing.

8 Excitation system

The exciter values required for the particular load must be checked continually, and entered in the operating logs. All unusual events must also be entered in the operating logs as comments.

9 Leak water level

In some places, level indicators are installed to monitor the amount of liquid in the generator.

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Work required	Maintenance schedule					
	Daily	Weekly	Monthly	Every 3 months	Every 6 months	Annually
Check the shaft grounding carbon brushes		x[1]				

1) The maintenance interval starts with weekly inspections; this interval can later be adjusted according to the specific experience gained in the power plant.

1 General notes

During operation, the useful length of each individual carbon brush can be determined by a visual inspection. The carbon brushes must be changed when the length remaining falls below 16 mm. The wearmark on the carbon brushes signals this condition (see Fig. 1).

Carbon brushes must preferably be changed while the machine is stationary. If this is not possible, then they can be changed during operation, but all described safety precautions must be observed.

The work must be done with great care by qualified personnel. Close-fitting working clothes must be worn in order to avoid the risk of clothing coming into contact with rotating parts. Protective goggles must be worn. We recommend wearing thin, well-fitting protective gloves. These gloves must not restrict the mobility of the fingers and must enable small parts to be handled safely and surely.

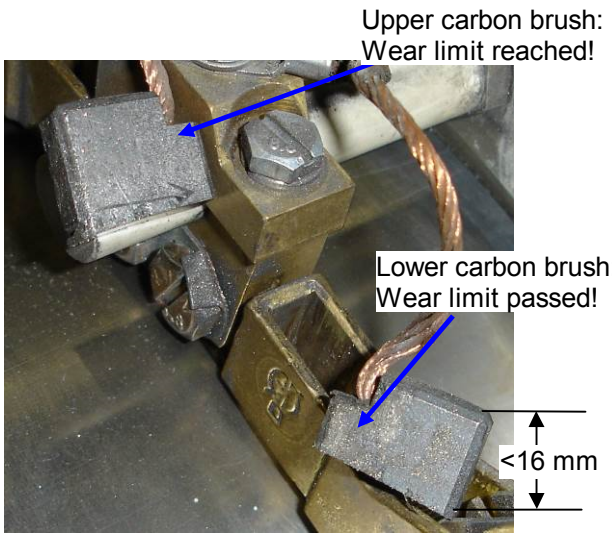
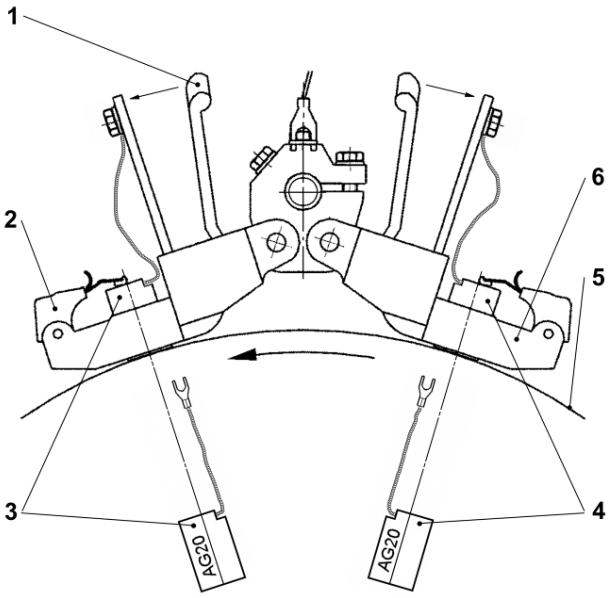


Fig. 1: Worn-out carbon brushes

Always ensure that the brushes are changed one after the other. Never remove more than one brush at any one time.

The new 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 (see Fig. 2).



1 Grip lever (movable)
2 Finger plate
3 Grounding brush (design A)
4 Grounding brush (design B)
5 Rotor surface
6 Plug-in brush holder

Fig. 2: Plug-in brush holder with grounding brushes

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2 Replacing carbon brushes



⚠ WARNING

Rotating machine parts.



There is a risk of injury when changing the carbon brushes.



- ***Do not touch the rotating shaft.***
- ***Do not touch the rotating coupling.***
- ***Do not place anything on the shaft or nearby parts of the machine (bearing).***



- ***Ensure that you have a secure footing (do not stand on rotating components).***
- ***Pay attention to sufficient lighting (e.g. helmet lamp).***



- ***Wear work clothing, safety glass and protective gloves.***

2.1 Demounting plug-in brush holder

It must be ensured that always only one plug-in brush holder will be demounted.

1. Open maintenance flap.
2. Press the moveable grip lever and pull out from the holder.

   Remove the plug-in brush holder together with the brush. The carbon brush remains in the holder.

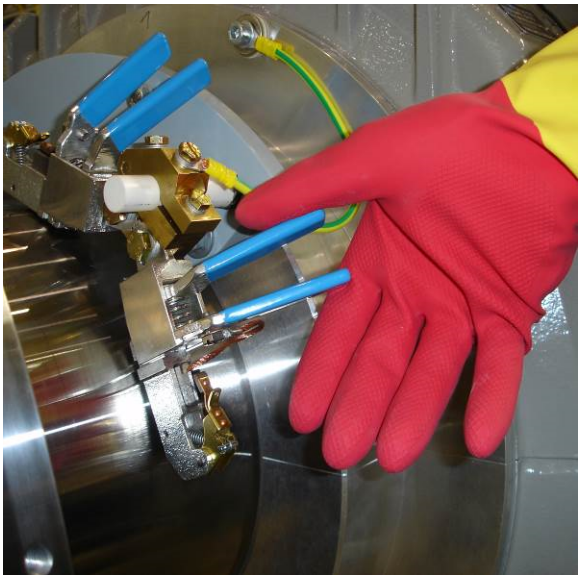


Fig. 3: Disassembly brush holder (1)

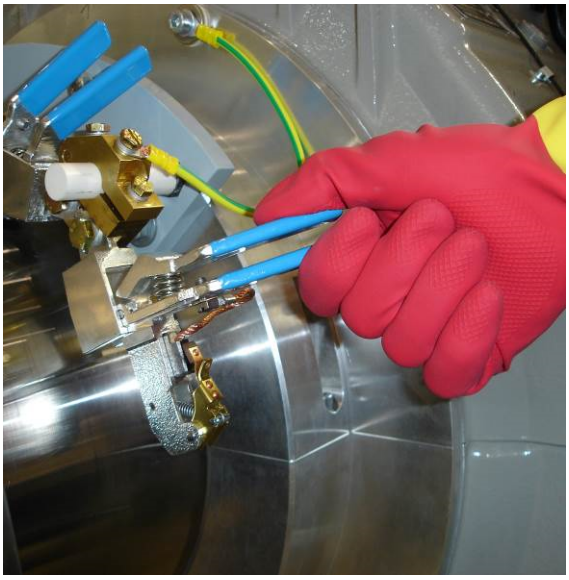


Fig. 4: Disassembly brush holder (2)

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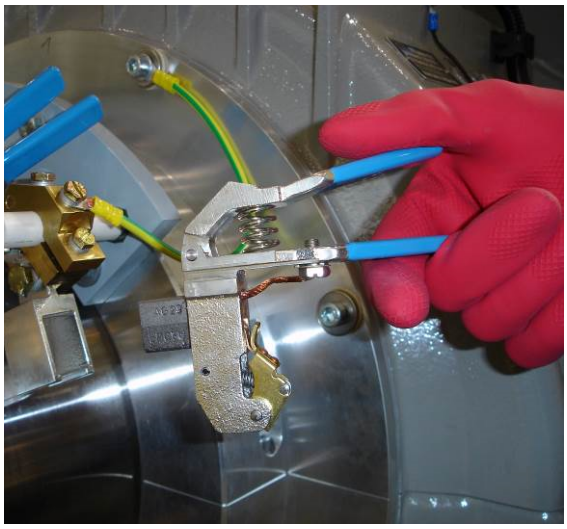


Fig. 5: Disassembly brush holder (3)

3. Open the grip lever of the brush holder and allow the carbon brush to slide out

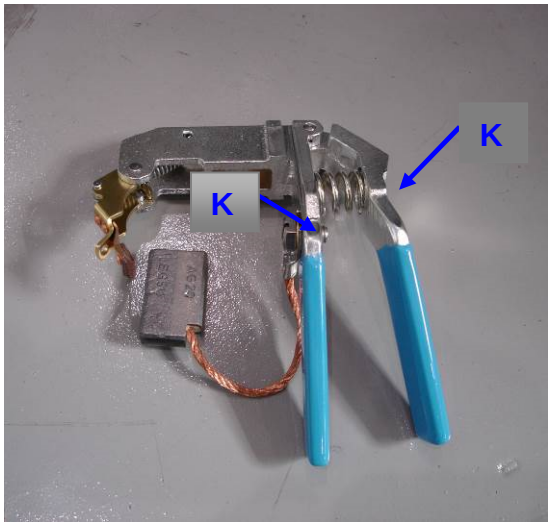


Fig. 6: Disassembly brush holder (4)

4. Loosen the cable lug
5. Swing back the finger plate and remove the worn brush.
6. Clean the contact surfaces (K) on the grip lever

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2.2 Assembly plug-in brush holder

Reassemble in the reverse order. Make sure that design A and design B are each fitted on the correct side (see Fig. 2).



Fig. 7: Assembly brush holder (1)

1. Insert carbon brush in the guide
2. Clamp cable lug (M 6, 6 to 8 Nm)
3. Pressing the grip levers together and insert plug-in brush holder. Pay attention that the contact surfaces on the grip lever are correctly fitted in the holder

   Pressing the grip levers together, clamps the carbon brush in place and it cannot fall out.
4. Open the grip of the plug-in brush holder.
5. Mount the finger plate on the carbon brush.

   The carbon brush is brought into its final position against the pressure of the spring.

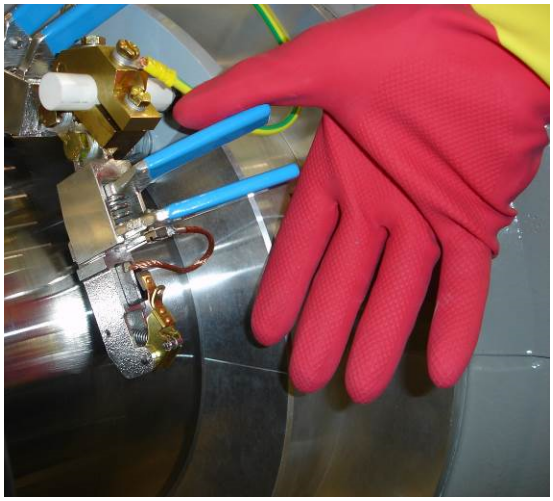


Fig. 8: Disassembly brush holder (2)

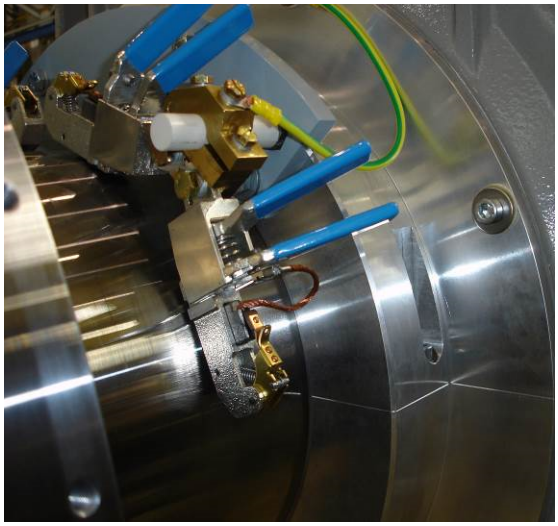
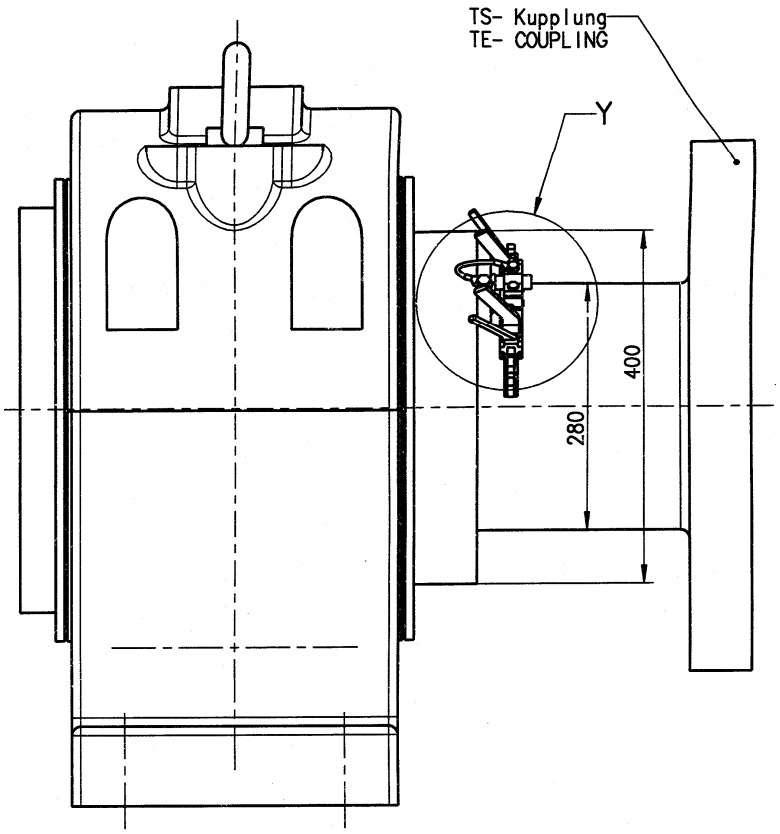


Fig. 9: Disassembly brush holder (3)

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2.3 Possible sources of error



Ensure that the mounting direction of grip levers (Y)!

Grip levers point toward the bearing pedestal.

Fig. 10: Correct mounting direction of grip levers

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Work required	Maintenance schedule					
	Daily	Weekly	Monthly	Every 3 months	Every 6 months	Annually
Supervision of function of lubrication devices	x					
Supervision of bearing insulation					x	
Removing of oil mist condensate		x				

1 General notes

During normal operation, no service or maintenance work is required on the generator plain bearing. Smooth running and the bearing and lubrication oil temperatures are part of the turbine monitoring.

All lubrication units and instruments provided for monitoring must be continually observed during operation. Perform a bearing inspection when running noises change.

NOTE:

***You will find more detailed information about maintenance work on the bearings in the supplier documentation (see chapter* Components and Purchased Parts).**

2 Start-up and run-up

If a hydraulic shaft jacking device is available, check the rotor lift before startung the generator. The rotor lift must be set to between 0.08 and 0.12 mm. The increase must be checked simultaneously by means of dial gauge at both bearings. The shaft should turn easily with active hydrostatics and must not jam in the top of the wiper bearing seal. Oil film pressures of 40 to 80 bar are reached at higher speeds and at the rated speed. The oil film pressures must be recorded in the operating log. If the oil film pressures fall over the course of time, the affected bearing shells must be checked.

3 Supervision of bearing insulation

The measurement of the shaft voltage of the generator rotor can be used as an indirect indicator to check the bearing insulation during operation.

4 Removing of oil mist condensate

The oil mist exhaust is to be adjusted to a negative pressure of at least 100 Pa.



⚠ WARNING

Risk of injury from contact with cleansers.



Wear protective gloves and goggles.

Avoid contact with the skin or eyes.

Follow the instruction manual for the cleanser used.

If oil mist condensate runs out of the bearing, the oil mist and/or smaller oil leakages at the appropriate bearing house openings are to be removed with suitable means.



NOTICE

Only use cleansers that do not attack the bearing metal, for example

- VALVOLINE 150 or

- Solvents and alkaline cleansers (pH 6 to 9, short application time).



NOTICE

Never use fraying cloths or cotton waste.

If fibres are allowed to remain in the bearing, they lead to excessive heating.

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Work required	Maintenance schedule					
	Daily	Weekly	Monthly	Every 3 months	Every 6 months	Annually
Check measuring brushes		x[1)]				
Check surface of slip-ring for measuring circuit					x[2)]	

1) The maintenance interval starts with weekly inspections; this interval can later be adjusted according to the specific experience gained in the power plant.
2) Preferably with rotor stationary

The measuring brushes must be replaced when they have worn down to about 30% of their original length. The wearmark on the brushes indicates the critical length.



⚠ WARNING

The brush holders are electrically live! Rotating parts in the immediate vicinity!

Failure to comply with the warning notices can lead to serious physical injuries and in addition considerable material damage.

Be very careful when removing and inserting the holders into the brush holders.

Wear insulating gloves to reduce the risk of accidents.

The brushes may only be replaced by qualified personnel. All safety measures must be taken in compliance with the regulations.

1 Removing the Brush Holders

Before starting work, electrically disconnect both current paths from the monitoring device by opening the associated automatic circuit breakers (located in the auxiliary terminal box on the exciter machine). The automatic circuit breakers must not be closed again until all the work has been completed.

In order to remove a plug-in brush holder, pull its grip lever. The carbon brush is then clamped in its guide by a clamping pin and the holder is released from its press fit in the brush holder socket.

Replace the carbon brushes always outside the slip rings so that there is no danger caused by them working during operation.

2 Changing the Worn-out Carbon Brushes

1. Remove the cover
2. Pull the plug-in brush holder, keep the grip lever pulled
3. Carefully remove the plug-in brush holder from the machine
4. Use a finger to hold the brush against the compression spring in the guide
5. Release the grip lever, allow the brush to slide out
6. Unclamp the cable lug

3 Inserting New 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.

1. Insert the brush into the guide
2. Reclamp the cable lug
3. Slide the brush into the guide, holding it against the compression spring with a finger
4. Tighten grip lever
5. Insert the plug-in brush holder
6. Replace the cover plate

4 Checking the Slip-rings

Heavily soiled slip rings must be cleaned with the machine at a standstill. They are best cleaned with clean dusting brushes and dry linen cloths. Depending upon the type of soiling, it may be helpful to use a cleaning fluid (*Rivolta*® or similar). If necessary, resurface the slip-rings by polishing.

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Work Required	Maintenance intervals					
	Daily	Weekly	Monthly	Every 3 months	Every 6 months	Annually
Check leakage air filter in the cooler cover for contamination, clean or replace the filter mats if necessary					x[1)]	

1) At the first shut down after commissioning, or after 6 months at the latest. The maintenance interval must be specified on the basis of the inspection after commissioning, according to the environmental conditions.

1 General

NOTE:

Only trained personnel may check and change the filter mats.

The maintenance of the leakage air filters must be documented during the warranty period.

If possible, check and change the filter mats with the generator at a standstill. In order to avoid interrupting operations, the work can also be done very carefully while the generator is in operation. In this case, each time a cover is opened it must be shut again as quickly as possible.

NOTICE

Blocked filters can lead to dirt being deposited in the machine!

The leakage air filter mats must be checked regularly for contamination and cleaned or changed if required.

The filters must be checked without fail if work creating dust is performed near the machine.

The leakage air filter in the cooler cover becomes contaminated as a result of the continuous air exchange in the generator cooling system.

Each leakage air filter consists of two stages:

- Stage 1: a pre-filter to absorb larger particles.
- Stage 2: a fine filter to absorb very small particles.

The filter must be checked at the first operational shut down after commissioning, or after 6 months at the latest in the case of uninterrupted operation. The maintenance intervals then have to be specified according to the degree of contamination.

The maintenance interval should be shortened if, after a certain operating time, a change in the environmental conditions leads to a higher rate of filter contamination. The maintenance intervals can also be lengthened if the inspections do not show any discernable contamination of the filters.

2 Cleaning or changing the air filter

The filter mats can be changed without having to open the doors leading to the cooler hood as the protective filter covers are located outside and can be screwed off.

NOTE:

Two fine filter mats and two pre-filter mats have to be placed per door.

1. After removing the filter protection cover take the both pre-filter mats and the both fine filter mats out of the filter frame. Check the filter mats for contamination.
2. Replace the filter mat in case of heavy contamination. In case of minor contamination, mostly a blowing-out of the filter mat with dry compressed air is sufficient.
3. Fit the cleaned or new filter mats in right sequence (fine filter inside to the generator, pre-filter outside) in the frame and fix the filter protection cover.

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Turbogenerator | Operating and Maintenance Manual

Maintenance of the System/ Plant Section 4

Inspection 4.3

Contents

- Inspection – General Information
- Inspection – Inspection Preparation with Generator in Operation
- Inspection – Stator
- Inspection – Rotor
- Inspection – Cooler
- Inspection – Bearings
- Inspection – Exciter System
- Inspection – Generator Supervisory Equipment
- Inspection – Commissioning
- Checking the Insulation for Protection from Shaft Currents
- Measures to Prevent Corrosion during Inspections
- Check List for Works during Generator Inspection
- Rotor Removal and Installation Using a Crane

1 Preventive Maintenance

Reliable operation of the generator will be ensured only if inspections and overhauls are carried out at regular intervals so that any faults can be detected and corrected before they result in costly failures. Following each inspection, the next inspection should be scheduled.

Provided that commercial tools can be used and that no special skills are required for the dismantling and erection work, the inspections can be supported by skilled power station personnel. The services of trained Siemens service personnel are required for all work which requires special tools as well as specific knowledge of assembly.

Establish a checklist of inspections to be performed and plan tooling and manpower requirements. Siemens offers the appropriate support for the entire process, including the supply of tools and personnel, as well as support for efficient inspection and maintenance planning. For more detailed information, please contact your local Siemens representative or your contact person at Siemens itself.

All findings should be documented for subsequent examinations.

Strategic spare parts already stored for unplanned repairs should be checked at regular intervals. Components packed in plastic sheeting mostly contain a desiccant which must be replaced or reactivated from time to time. Furthermore stock should be checked prior inspection works and refilled if necessary.

Apart from its scope, the timing of an inspection is important. To account for the deterioration and stresses due to different modes of operation, the number of operating hours, the number of starts and the turning times are used as criteria in determining the intervals between the inspections.

Siemens recommendations are a guide to support power plant owners and operators to schedule inspections; however they should also take into account their own experience.

2 Types of Inspection

Depending on the scope, date and duration of the inspections, a differentiation is made between

- Minor Inspection (MiI) (or Short Inspection)
- Medium Inspection (MeI)
  (or Intermediate Inspection)
- Major Inspection (MaI) (or Main Inspection)

Type	Features
MiI	Checks and measures required based on observations during operation and checks **with minor partial disassembly** (opening the manhole cover only) but **without rotor removal**
MeI	Checks and measures required based on observations during operation and checks **with partial disassembly** but **without rotor removal**
MaI	Checks and measures required based on observations during operation and checks **with extended disassembly** and **optionally with rotor removal, but only if really required**

Tab. 1: Types of Inspection, Features

The **Minor Inspection (MiI)** can be routinely scheduled or performed when a shutdown occurs. It serves to detect changes at an early stage which have not yet been detected by the monitoring system as well as to verify its results. The generator remains nearly full assembled during a MiI, only the manholes are opened.

The scheduling of **Medium Inspections (MeI)** is generally determined by other power station components. The downtime can be used not only for an extensive inspection but also for small improvements and minor repairs.

During **Major Inspection (MaI)** comprehensive inspections, repairs and renewal of parts, even to a larger extent, are made. The auxiliary plant units have to be integrated. The rotor removal is optionally, but it is required in case of supposed earth fault, vibration deviations or excitation current deviations.

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3 Equivalent Operating Hours and Inspection Scheduling

The scheduling of the inspections mainly depends on the number of operating hours, the number of starts and the turning gear operation times.

The total number of equivalent operating hours since the initial commissioning, the last Major Inspection or other incidents important for the inspection schedule corresponds to:

$$T_{equiv} = T_1 + K_2 \bullet T_2 + n \bullet T_3$$

while:

T_{equiv} - Equivalent operating hours

T_1 - Operating hours since the initial commissioning or the last Major Inspection

K_2 - Weighting factor for turning gear operation

T_2 - Turning gear operation in hours since the initial commissioning or the last Major Inspection

n - Number of starts since the initial commissioning or the last Major Inspection

T_3 - Weight time in hours per start.

In some cases, the turning gear operation time T_2 is not exactly known. In this case, an estimated numerical value may be used which takes into account the mode of operation and corresponds to the minimum of two values.

The following equation is a recommendation for calculating the annual turning gear operation time. A turning gear operation time of 50 hours is assumed for each shutdown procedure, but not more than the difference between 8500 hours per year and the annual operating hours.

$$T_2 = \min \{ n \bullet 50; \quad 8500 \bullet t_{cal} - T_1 \}$$

while:

t_{cal} - Calendar time in years since the initial commissioning, since the last Major Inspection or since every other incident used to calculate T_{equiv}.

The maximum number of operating hours per year is assumed to be the maximum possible operating hours. A calendar year has 365 days = 8760 hours. However, supposed that every plant has standstills the average maximum annual operating time is less than the calendar time.
As shown in Figure 1, the evaluation factor for turning gear operation (K_2) depends on the nominal apparent power of the generator (S).

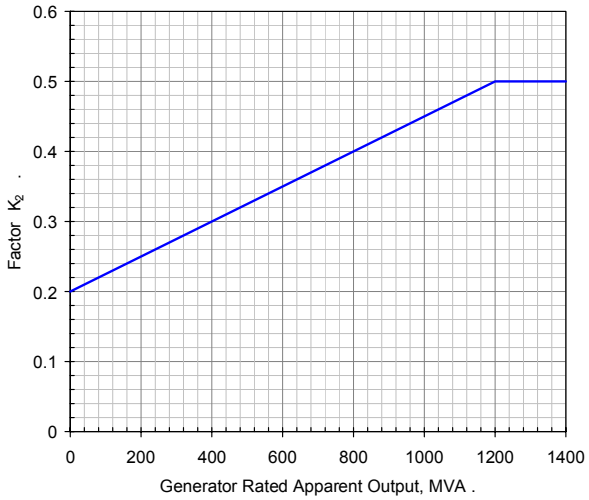


Fig. 1: Weighting factor for turning gear operation K_2

The numerical value of (K_2) for a specific nominal apparent power of the generator (S) in MVA corresponds to:

$$K_2 = S / 4000 + 0.2$$

with a maximum value of $K_2 = 0.5$

As shown in Figure 2, the equivalent evaluation time (T_3) depends on the nominal apparent power of the generator (S).

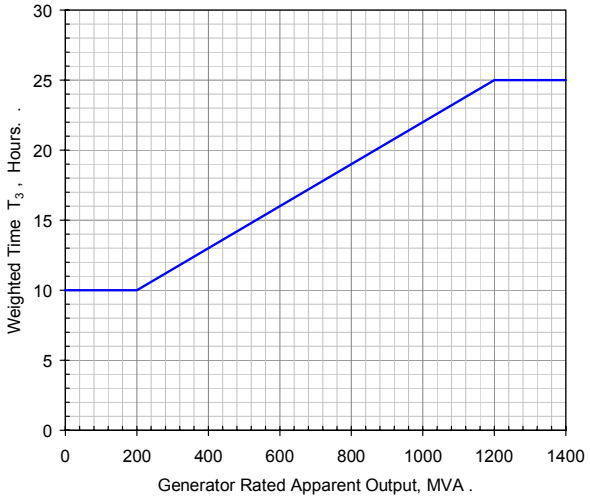


Fig. 2: Weighted time in hours per start T_3

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The numerical value of $\mathbf{T_3}$ for a specific nominal apparent power of the generator (S) in MVA corresponds to:

T_3 = 0.015h x S/MVA + 7h
with a minimum value of 10 h and a maximum value of 25 h

4 Additional Factors and Recommendations for Scheduling Inspection Intervals

The recommendations given in the following apply to normal operation without major incidents. Abnormal disturbances, such as close-in system faults, faulty synchronizing, asynchronous running and inadmissibly high unbalanced load, may lead to the requirement of shortening the respective inspection interval or perform an immediate check.

When scheduling inspections, also consider the following factors:

- Ambient conditions (moisture, salty air ect.)
- Mode of operation (frequent large and rapid load changes; frequent start-ups and shut-downs)
- Wear and deterioration of components
- Deterioration of running behaviour
- Number of load shedding with overspeed
- Earth faults or interturn faults in generator field circuit
- Water leaks due to cooler or enclosure defect
- Change in coolant flow rates
- Fouling of air filters and/or stator air passages
- Deterioration of shaft insulation
- Cleanliness of the lubricating oil

With proper performance of the generator and provided that the inspection findings obtained by the preceding inspections (s) have been favourable, the intervals between inspections may be lengthened within the limits defined in next paragraph.

5 Recommendation for Inspection Intervals

Major Inspections are recommended to be performed after every equivalent operating time of

80000 h (EOH) < $T_{equiv\,r}$ < 106000 h (EOH)

It is recommended that one or more Minor and Medium Inspections are performed between Major Inspections.

The resulting generator inspection interval schedule shall be designed to fit into turbine shut downs.

Irrespective of the above-mentioned recommendations, the following total time (operating time + turning gear operation time + shutdown time) between two inspections on account of adverse long-term influences should not exceed:

	Total time between two inspections
MiI	3 years
MeI	6 years
MaI	12 years

Tab. 2: Maximum Total Time between Inspection Intervals

6 Example Calculations of Equivalent Operating Hours and Intervals between Major Inspections

Exemplary calculations of equivalent operating hours using the above-mentioned methods and equations are given below. These calculations use various nominal outputs for the generator, various turning gear operation times and different numbers of starts. All these parameters are taken into account in the correct selection or calculation of the evaluation factor K2 for turning gear operation and the equivalent evaluation time T3 in hours per start.
In this way, the number of equivalent operating hours is calculated adequately for five typical modes of operation, which reflect the various combinations of the regular annual operating time, the turning gear operation time and the number of starts. Selected combinations are shown in Table 3, and they are to a great extent identical with real practical operation.

The number of equivalent operating hours is calculated for a calendar year ($\mathbf{t_{cal}}$ = 1 year). It is assumed that the actual, exact value for the turning gear operation time is unknown. Therefore an estimated equivalent is calculated using the method described above and the number of starts **n** (Table 3).

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Operating Mode	Load Ranges	Annual Operation Time in h	Annual No. of Starts	Annual turning gear operation time in h
A	Base load	7000	10	500
B	Lower medium load	5000	50	2500
C	Upper medium load	3000	150	5500
D	Peak load	2000	250	6500
E	Operation in industrial power station	7000	10	500

Tab. 3: Typical Operating Modes

The five modes of operation in Table 3 are used in Table 4 for different generator nominal outputs.

Generator rated power **S** = 600 MVA				
Operating type	$T_2 \cdot K_2$ in h	$n \cdot T_3$ in h	T_{equiv} per year in h	Intervals for Major Inspections in years
A + E	175	160	7335	11
B	875	800	6675	12
C	1925	2400	7325	11
D	2275	4000	8275	10

Generator rated powers **S** = 300 MVA				
Operating type	$T_2 \cdot K_2$ in h	$n \cdot T_3$ in h	T_{equiv} per year in h	Intervals for Major Inspections in years
A + E	175	160	7335	11
B	688	575	6262	12*
C	1513	1725	6237	12*
D	1788	2875	6662	12

Generator rated powers **S** = 100 MVA				
Operating type	$T_2 \cdot K_2$ in h	$n \cdot T_3$ in h	T_{equiv} per year in h	Intervals for Major Inspections in years
A + E	113	100	7213	11
B	563	500	6063	12*
C	1238	1500	5738	12*
D	1463	2500	5963	12*

Tab. 4: Example calculations of equivalent operating hours T_{equiv} of the generators for one year and intervals between Major Inspections.

* The calendar time which has passed since the last Major Inspection / the first commissioning must not exceed 12 years.

The currently recommended scope of the inspections is described on the following pages. Please contact Siemens for up to date and complete engineering service recommendations.

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Work required	Minor inspection	Medium inspection	Major inspection
Vibration measurement at various load stages on the entire shafting	x	x	x
Record operating data of the generator and the auxiliary systems	x	x	x
Shaft voltage measurement to assess the bearing insulation	x	x	x

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Work required	Minor inspection	Medium inspection	Major inspection
Electrical measurements			
Measure insulation resistances of stator winding	x	x	x
Measure insulation resistances of temperature sensor	x	x	x
Measure winding resistances			x
Measure resistances of temperature sensors			x
Perform high pot (high-voltage) test[1)]			x
Perform tan δ and partial discharge measurement[2)]			x
Perform stator core interlamination verification test (such as EL-CID measurement)			x
Visual inspections			
Inspection of the end winding spacers	x	x	x
Inspection of the circuit ring and circuit ring supports	x	x	x
Inspection of the pressure plates and their locking elements	x	x	x
Inspection of the stator core bore for pressure marks in the core tooth area			x
Inspection of the end winding support and its bracing	x	x	x
Inspection of the end winding insulation	x	x	x
Inspection of the outer corona protection (OCP) insulation in the step iron region	x	x	x
Inspection of the winding surface sealing	x	x	x
Inspection of the winding end leads	x	x	x
Inspection of the RTD connections	x	x	x
Check stator vent slots			x
Inspection of the sealing between laminated core and air guide walls, between air guide walls and housing, between bushing support and housing and between laminated core and housing and renew if necessary		x	x
Check tightness of foundation bolting		x	x

1) Test to be conducted depending on available measurement equipment wether as AC test (prefered) or as DC test.

2) Tests to be performed if AC equipment is available on site. Test results only comparable if the same equipment is used with identical boundary conditions using the same procedure.

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1 General Information



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2 Insulation Resistance Measurement

After each shutdown, prior to carrying out the inspection, the insulation resistances should be measured according to documents [1] and [2] (see end of document).

3 Stator Winding

Depending on the scope of the inspection, the windings in the slot section of the core and in the end winding areas should be inspected for proper seating. Means to check if winding does not move and all distances are kept as specified. After opening the generator, the interior should always be inspected for contamination of any kind. If contamination is detected, its cause should be determined and corrected in order to preclude any new contamination. The generator interior should be cleaned thoroughly.

The exposed OCP of the end windings should be visually inspected for signs of erosion. The areas of inspection are located at the exit edge of both ends of the core, in the step iron regions. A boroscope should be used for this inspection. Any findings should be reported to Siemens Engineering for evaluation and further recommendation.

4 Terminal Bushings and Phase Connectors

The terminal bushings should be inspected to establish their condition. It should be checked that the flexible links are still in good condition and are properly attached. Checking of proper attachment of the flexible links covers both the connections to the terminal bushings and the connections to the phase connectors. The terminal bushings should also be checked for proper connection to the bus bars arranged external to the generator.

5 Replacement of Flexible Links

Flexible links that are no longer in good condition must be replaced without delay. The following requirements must be observed during replacement of flexible links:

- Grounding of the phase connector ends and the generator terminal bushings must be performed before work is started.
- Cleanliness (absence of foreign matter) of the end-winding region must be assured at all times. The precautionary measures given in the next section must be strictly observed.
- The new flexible links must be of the same type and length as the flexible links to be replaced. Fitting of flexible links of differing types or lengths should only take place when expressly instructed by Siemens generator engineering.
- Replacement flexible links are to be checked first for proper condition (surface finish, absence of deformation).
- Flexible links are to be installed in accordance with the assembly procedures documented in the installation manual.
- Vibration behavior of replacement flexible links is to be checked with the aid of a stroboscope at 50 or 60 Hz and 100 or 120 Hz after restart. Any significant differences in vibration behavior relative to unreplaced flexible links should be reported to the Siemens AG.

6 Flanged Joints and Metering Connections

All stator flanges should be checked for proper attachment. The stator should be checked for tight anchoring to the foundation. All metering connections should be checked for proper mounting and condition so far as practicable. Prior to restart, the insulation resistance of the stator winding should be measured. If necessary, appropriate measures should then be taken to increase insulation values.



NOTICE

Even minimal-size metallic particles left inside after work on the generator can lead to large-scale damage during generator operation.

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In order to prevent such damage to the generator and the stator winding, the following precautionary measures must be taken.

1. Only persons assigned to such work may enter the interior of the generator.
2. Persons assigned to such work must be in the possession of clear work and safety procedures and have been informed of special features of the work scope involved and of the associated potential dangers.
3. All persons entering the interior of the generator must wear clean overshoes.
4. Before entering the generator interior, all persons must empty their pockets and remove all metallic objects worn (such as watches, chains, earrings etc.).
5. Tools required for work inside the generator may only be transported within boxes, and must be returned to these boxes after use.
6. After completion of work inside the generator, the completeness of tool kits should be verified against tool lists and the results of this check logged.
7. All winding areas on which work is to be performed must be covered carefully before work is started.
8. All parts to be installed or removed should be listed, with details of where to find them after work is finished.
9. Should a part be dropped despite all the above precautionary measures, it is imperative that it be located and removed. Site management should be informed in the case of any problems in this context.
10. Generator openings should be closed off with the original covers for the duration of any work breaks.
11. The use of the attached check list (4.5-2001) for works at the generator is strictly required.

Also refer to the following information (if included):

[1] 4.5-2300 Insulation Resistance Measurements on Stator Winding
[2] 4.5-2310 or 2311 Drying the Windings

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Work required	Minor inspection	Medium inspection	Major inspection
Electrical measurements			
Measure insulation resistance	x	x	x
Measure winding resistance		x	x
Visual inspections			
Inspection of the slot wedges			x
Inspection of the retaining rings		x	x
Inspection of the bearing journals	x	x	x
Inspection of the sealing surfaces (rotor bushing area)	x	x	x
Inspection of the coupling face for pressure marks			x[1)]
Inspection of the fans	x	x	x
Removal, cleaning and non-destructively testing of all the fan blades, checking the threads			x
Inspection of the balancing weights	x	x	x
Inspection of the end windings via borescopic inspection	x		
Borescopic inspection of end windings, including, in particular, the contacts between axial direct-current supply line and A coil		x	x
Inspection of the air gap accessible to inspection between rotor and stator windings		x	x
Borescopic inspection of accessible corner brazes and the corner brazed joint at the pole transition conductor at the transition from pole 1 to pole 2		x	x
Inspection of the radial cooling air vent paths			x

1) Only if rotor removal is required due to operation incidents such as high vibration levels, rotor earth fault indication

1 General Information



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2 Rotor Wedges and Retaining Rings

The rotor should be subjected to a simple visual examination. The wedges and retaining rings should be inspected for proper condition as far as accessible.

3 Shaft Journals

The shaft journals should be checked for any damages, e.g. grooves, arching or heat discoloration. In the event of any irregularities being detected, the reconditioning should be carried out according to the instructions given by our erection engineers.

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4 Cleaning the Rotor

As far as accessible the rotor should be cleaned thoroughly, even if the visual inspection did not reveal any contamination. Cleaning the rotor should be done very carefully so as not to impair any of the numerous insulated parts. Therefore it is recommended to order skilled trained Siemens personnel regarding qualification. Regarding tooling Siemens can support with special vacuum cleaners as well as with recommendations for solvents and chemical cleaners not affecting any of the different rotor materials.

5 Fan blades



⚠ WARNING

Risk of injury from the effects of arcs and flying debris.

Fan blades must be handled with great care! Damaged or incorrectly mounted fan blades can work loose and cause a short circuit in the stator end winding. Flying debris could break through the enclosure.

- ***The fan blades may only be removed and refitted by trained assembly personnel. This must be done very carefully.***
- ***If the vibration values increase, the vibration protection monitor must bring down the system to standstill immediately.***

The fan blades must be removed and tested non-destructively. The fan has to be turned to do this. Check that the threads are in faultless condition.

Siemens Service must be informed promptly if the tests find defects. They will initiate the necessary actions.

6 Coupling

The coupling flange at the rotor should be checked both at the guide flange and the fitting bolt holes. The coupling bolts should be checked for proper condition.

7 Insulation Resistance Measurements

Prior to recommissioning, the insulation resistance of the rotor winding should be measured (see below, document [1]) and, if necessary, improved by drying the windings (see document [2]).



NOTICE

Disconnect telemetry system (if present) before measuring insulation resistance.

Also refer to the following information:

[1] 4.5-3300 or 3301 Insulation Resistance Measurements on Rotor (and Exciter) Windings (Chapter *Operation*, Section "Standstill")

[2] 4.5-2310 or 2311 Drying the Windings (Chapter *Operation*, Section "Standstill")

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Work required	Minor inspection	Medium inspection	Major inspection
Check the cooling water inlets and outlets	x	x	x
Check the vent and drain tubes	x	x	x
Check the temperature measuring device	x	x	x
Remove cooler element, clean on the water and air sides, renew seals			x
Leakage test		x	x
Inspect via borescope the returning chambers of the coolers; check the coating condition	x	x	x
Replace gaskets of the returning chambers of the disassembled cooler elements			x

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1 General

Depending on the extent of the inspection, the air cooler sections should be cleaned thoroughly both on the air and water sides. During a less extensive inspection, the tubes should be cleaned on the water-side only. For this purpose, no withdrawal of the cooler sections will be necessary.

The cooler cleaning interval depends on the cooling water condition and is indicated when a substantial reduction of the heat removal capacity is observed at the cooler sections. A repetition of the tube cleaning every two months may be necessary when the cooling water is heavily contaminated. It may be possible, however, that the interval between one cleaning and the next may amount to several years. It is recommended to perform the first cleaning operation two months after initial commissioning. The date at which the next cleaning will be required can be determined at that time. The intervals for cleaning can, however, be definitely fixed only after several years of operation.

The coolers should be withdrawn from their wells when more extensive inspection work is required. After withdrawal, the coolers should be thoroughly inspected on the air side. On detection of any contamination, the air side should be cleaned by means of dry and clean compressed air. The coolers should then be installed in the generator housing, using new gaskets for reassembly.

Depending on machine size and total cooling air flow the leakage air flow can amount to 0.5 m^3/s. Control the leakage air filter sequentially.

2 Mechanical Cleaning on Water Side

For this purpose, no withdrawal of the cooler sections will be necessary.

Close water inlet valves at the individual cooler sections and then open vent and drain valves.

Detach return water channels after all water has been drained from the cooler sections.

The tubes are cleaned by special brushes, which are moved up and down in the individual tubes of the tube bundle. After all tubes are brushed, a new flat gasket should be fitted and the return water channel bolted tightly to the tube sheet of the cooler section. This should be followed by reopening the inlet and outlet valves, whereby the tube bundle is flushed with cooling water.

3 Chemical Cleaning

Brushing of the tubes normally suffices for cleaning. Any scale deposits which cannot be removed by brushing should be dissolved with a chemical solution.

The following globally available cleaning agents are recommended:

Water Side:

Cleaning agent	**Manufacturer**
P3-288	Henkel KGaA, Düsseldorf
SAF-ACID	Drew Ameroid GmbH, Hamburg
Vecom BA-S	Vecom GmbH, Hamburg

Air Side:

Cleaning agent	Manufacturer
P3 Grato 90	Henkel KGaA, Düsseldorf
Ameroid ACC9	Drew Ameroid GmbH, Hamburg
Vecom B-85	Vecom GmbH, Hamburg

Equipment Required:

Pump
Vessel
Piping
Shutoff fittings
Cleaning agents

Close water inlet valves and then open vent and drain valves. Drain water from cooler sections. Close drain valves and water outlet valves. Connect circulating pump to cleaning circuit via water inlet and outlet pipes. Fill system. Close vent valves and circulate cleaning agent through the circuit. After cleaning, thoroughly flush circuit with water.

Remove cleaning equipment. Place water circuit in service again. It is advisable, in the event of sufficient experience not being available, to have such chemical cleaning work performed by specialist firms.



⚠ WARNING

Toxic materials.

When performing chemical cleaning work be sure to observe the applicable instructions for the handling of chemicals.

4 Hydraulic Cleaning

Close water inlet valves at the individual cooler sections and then open vent and drain valves. Detach return water channel after the water has been completely drained from the cooler. Keep health and safety guidelines for hydraulic cleaning with high pressure steam.

High-Pressure Water Spray Cleaning

Connect high-pressure water spray cleaning unit and push spray nozzle into each individual tube.

Steam Cleaning

Connect steam lance to a steam generator or operating steam supply. Insert steam lance into each individual tube.

After cleaning, remove cleaning equipment. Refit return water channels, using only new gaskets and place water circuit in service again.

Cleaning Cooler on Air Side

To do this, the cooler sections must be removed according to the respective instruction and set down on a support.

To remove minor contaminations, clean the fins and tubes with dry compressed air.

In case of more severe fouling, high-pressure water spray cleaning may be used. Recommended pressure: 120 bar with 3 mm dia. spray nozzle. Distance between spray nozzle and tube bundle should be approximately 2 meters.

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Work Required	Minor inspection	Medium inspection	Major inspection
Perform bearing pedestal insulation measurement	x	x	x
Check bearing surfaces and babbitt bonding by ultrasonic and dye penetration testing			x
Check bearing clearances	x	x	x
Check seat of bearing shell in bearing shell support	x	x	x
Check and renew rigid labyrinth seals if necessary	x	x	x
Check bearing thermometer	x	x	x
Check hydraulic shaft jacking (if existing)	x	x	x
Replace the HP hoses for shaft jacking device (if existing)		x	x

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1 General information



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The insulation resistance of insulated bearings should be measured prior to each inspection. If the insulation resistance is found to be bad, a particularly thorough inspection must be made to see whether any form of electrical corrosion (electrochemical erosion) can be found.

The bearings should then be dismantled and cleaned thoroughly. Bearing sleeves and shaft journals should be checked for proper condition. All parts of the bearings must be examined for signs of wear.

The inspection procedure described above should be performed at all sleeve bearings of the turbine generator.



NOTE:

***You will find more detailed information about inspection work on bearings in the supplier's documentation in chapter* Components and Purchased Parts.**

2 Check the state of wear of all parts of the bearings.

The state of wear of all parts of the bearings must be determined by a visual inspection. Especially the assessment of the bearing surfaces of the bearing shells requires a great deal of experience. In case of doubt, always insert new bearing parts.

The insulating coatings on the spherical surfaces in the upper and lower parts of the housing must be inspected. Contact Siemens without delay if they are found to be damaged.

Work required	Minor inspection	Medium inspection	Major inspection
Electrical measurements			
Check insulation resistance of the windings	x	x	x
Check blocking characteristics of the diodes		x	x
Check RC circuit blocks/overvoltage protection		x	x
Check winding resistance of rotor and stator windings	x	x	x
Visual inspections			
Check condition and function of rotary rectifier wheels, check stator and rotor winding	x	x	x



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Work required	Minor inspection	Medium inspection	Major inspection
Check condition and performance of temperature gauges and alarms	x	x	x
Check condition and performance of grounding brushes	x	x	x
Visually inspect earthing cables (baseframe-enclosure, enclosure-cooler)	x	x	x
Check leakage water supervisory equipment	x	x	x
Check performance of anticondensation heater*	x	x	x

* If existing

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Work required	Minor inspection	Medium inspection	Major inspection
Control of shaft lifting (hydrostatic) of bearing before start-up	x	x	x
Control of oil lubrication flow of bearing before start-up	x	x	x
Visual inspection of bearings for any oil leakages	x	x	x
Vibration measurement at various load stages on the entire shafting	x	x	x
Shaft voltage measurement	x	x	x

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1 General

During operation of a generator, voltages are set up along the rotor due to magnetic unbalances. This shaft voltage would cause a destructive current to flow through the bearings and other components if the rotor were not insulated from ground at least at the exciter end. For reasons of interchangeability; all stator components coming into contact with the generator rotor are insulated.

2 Checking the Bearing Insulation During Installation

2.1 Bearings

Prior to inserting the rotor and supporting it on the bearings, the insulation resistance of the assembled bearings should be measured separately by means of a 100 V megger applied between the bearing and the base plate. The values measured should be recorded.

The bearing shells are insulated inside the bearing housings. The shaft seals are insulated mounted. The bearing shell potentials are lead out of the bearing housings by wires.

With satisfactory insulation, a value in excess of 0.5 megohms is to be expected. If an insulation resistance value below 0.5 megohms is measured, the insulating parts should be checked for moisture, contamination or metallic contacts. The measurement should be repeated immediately after the rotor has been supported on the bearings.



NOTICE

During this measurement both rotor bearings must be insulated, and the generator rotor must not come into contact with the turbine shaft through measuring devices or similar parts, to prevent the generator rotor from being grounded.

Since, with the rotor inserted, all individual resistances measured previously are now in parallel in the measuring circuit, the total resistance will be slightly lower than the lowest individual resistance value measured before.

2.2 Final Checking

After the generator rotor has been insulated from the bearings, a final insulation check should be performed. The total insulation resistance must not be less than 0.5 megohms. Due to contact with the shaft, the measuring circuit covers in parallel:

TE/EE bearings with pipework

3 Checking the Bearing Insulation of the Assembled Unit

Checking the bearing insulation during operation may be done by way of the shaft voltage prevailing with the generator running in an excited condition. For this purpose, the potential of the insulated bearings is accessible external to the generator. With the generator running, the components coming into contact with the shaft are separated from the shaft by an oil film, which has insulating properties. Consequently, a non-defined resistance value is set up at the potential measuring points of the bearings which is dictated by the magnitude of the resistances of the oil film and insulating parts. The following method permits the insulation to be checked without disassembly of components being required.

Useful results are, however, to be accepted only if the turbine end of the generator rotor and the turbine shaft are grounded properly during the measurements. Grounding must be maintained to discharge to ground any static charges occurring continuously during operation due to steam and oil film friction.

3.1 Checking the Insulation with the Generator in an Excited Condition

Due to the rotor grounding arrangement at the turbine end, the shaft voltage should be measured at the exciter end. Since the result depends, however, on the function of the rotor grounding system (carbon brush sliding on shaft), the shaft voltage should first be measured according to fig. 1 with the generator running and excited. Normally, this will be an ac voltage of a few volts on which a small dc component is superimposed. Measurement should be performed by means of a voltmeter in the ac range. The voltage should be picked off the shaft for example through a sliding contact with an insulated handle, which is connected to the meter by a cable (all not scope of supply!).

The shaft voltage measured in this way should then be compared with the voltage measured according to fig. 2. If the two readings are not identical, the rotor grounding system should be rectified first before taking any further readings to check the insulation for shaft currents.

If the shaft voltage can be accurately measured according to fig. 2, the measuring brush on the shaft

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should first be connected to the potential measuring terminal on the insulated bearing at the exciter end by means of a cable. The oil film is thus bridged, and the component assumes the shaft potential. With satisfactory insulation, the instrument will continue to indicate a shaft voltage of the original magnitude. Insufficient insulation resistance will result in a current flow through the insulation that can be read on the ammeter. The bridging of the oil film results in a reduction of the original shaft voltage or in its complete collapse.

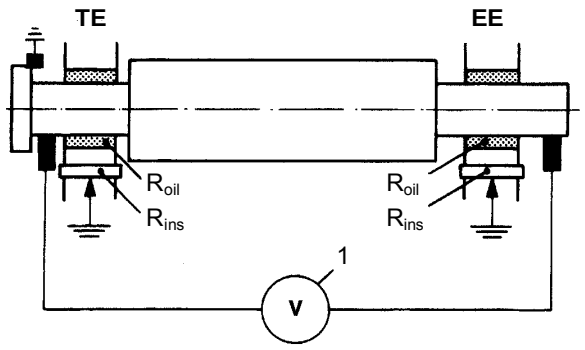
The resulting current can be measured for a brief moment by means of an ammeter connected into the circuit between the measuring brush and the potential measuring terminal (fig. 3).

3.2 Checking the Insulation With the Generator in Non-Excited Condition

A bridge instrument must be used to locate insulation defects with the generator running and in non-excited condition. To measure the resistance of the insulated component with respect to the shaft and ground, the bridge instrument should be connected between this component and ground. The resistances (***R_{oil}*** and ***R_{ins}*** in series) of the parts in contact with the shaft are then connected in parallel with the measuring voltage.

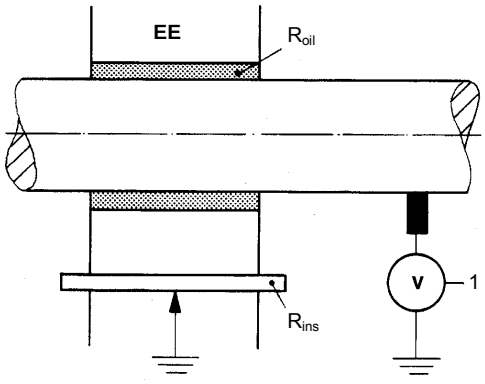
This measurement is not practicable with the generator at standstill, since a stable oil film providing for full insulation can only be formed above a speed of approximately 3.33 to 6.66 s^{-1}.

In case of a low insulation resistance, it must be assumed that the insulation is defective, requiring detailed checking of the insulating parts. Such an insulation test requires great experience in the interpretation of the results and should be performed only by a Siemens specialist.



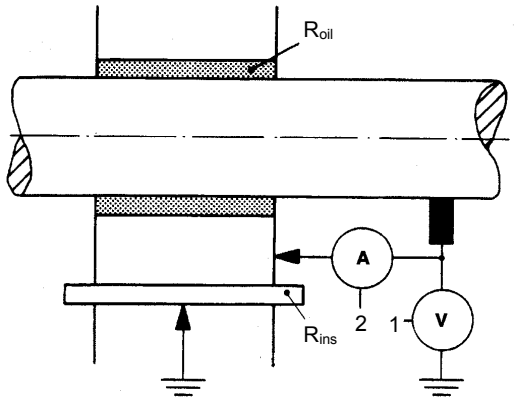
1 Voltmeter (ac range)

Fig. 1 Measurement of shaft voltage with the generator in excited condition



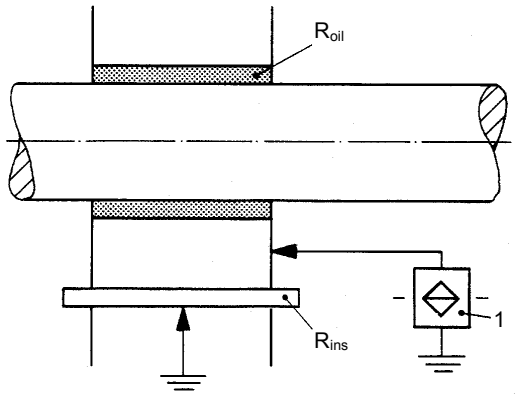
1 Voltmeter (ac range)

Fig. 2 Measurement of shaft voltage at exciter end with the generator in excited condition



1 Voltmeter (ac range)
2 Ammeter

Fig. 3 Measurement of shaft current with the generator in excited condition



1 Bridge instrument

Fig. 4 Measurement of insulation resistance with the generator in non-excited condition

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During an inspection, the individual components of the generator are exposed to the ambient conditions which may result in hazards to these components. It is therefore strongly recommended to take suitable measures for preventing any exposure to moisture, especially rain, snow, liquids of any kind and condensation. Covering the components will not afford sufficient protection.

To avoid the above-mentioned hazards, the assembly work during an inspection should be accomplished under protection from weather conditions. The generator should only be opened if an uninterrupted execution of the work will be ensured and provided that the necessary protective measures can be taken. After opening of the unit and withdrawal of the rotor, the stator openings should be promptly reclosed. The stator should be dried by means of a portable air dryer or fan-forced heater and kept above ambient temperature level. The air dryer or fan-forced heater should be arranged so that the air will circulate through the stator interior in a closed circuit for ventilation of the entire internal space.

The rotor should be protected in such a manner that especially the retaining ring area can be kept dry and above ambient temperature level. The air dryer or fan-forced heater should be arranged so that the air will circulate in a closed circuit.

The cooling water should be drained from the coolers. The coolers should be cleaned, dried and maintained in dry condition by suitable measures.

Normally, a condensation hazard can be recognized with the help of a dewpoint measuring device. In case of doubt, however, it is recommended to dry the components on a continuous basis in order to achieve a markedly low dew-point temperature on these components, i.e. to maintain their temperature above ambient temperature level.

For further information see chapter *Standstill*.

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	Description of works to be carried out	To be checked by	Date	Name/Signature
1	Issuing of work permit for works on generator			
2	Area around generator to be barred off (work passes to be issued to individual workers) and supervisor to be nominated for the period the generator is open. Closing during breaks and process interruptions to be assured.			
3	Cleanness check of area around generator			
4	Instruction of workers regarding working inside and around the generator			
5	Listing of all tools used for repairwork inside of generator. Tools to be marked			
6	Checking of inside of generator immediately after manholes are opened (first man inside generator)			
7	All opening of generator, pipework and bearings to be temporarily covered			
8	Listing of all material removed from the generator parts to be collected in separate boxes			
9	Checking of complete generator inside prior to closing of manholes (last man inside generator)			
10	Check of whereabout of tools used inside of generator			
11	Checking the material removed from generator			
12	Release of generator for start-up			
13	Return of work permit			

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SIEMENS

Rotor Removal and Installation Using Crane

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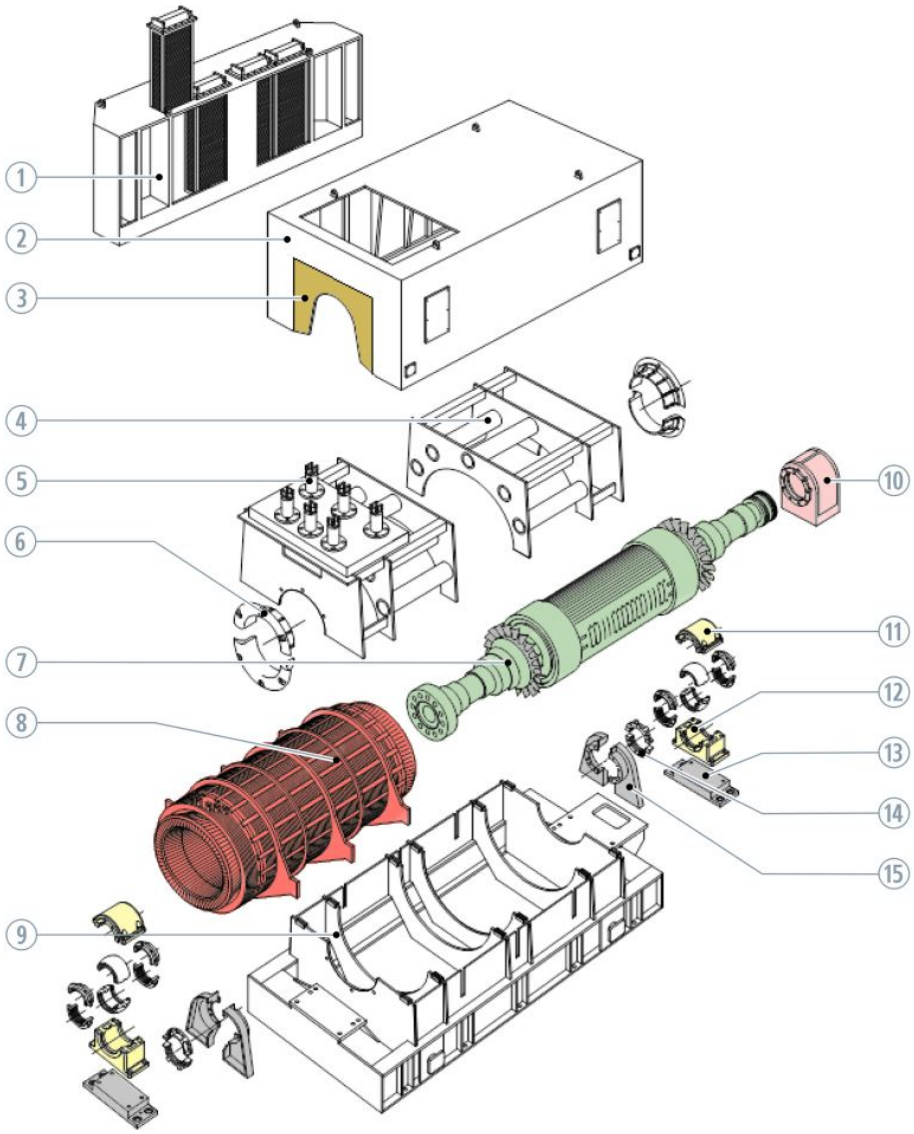
3 Rotor Installation 19

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1 Preliminary Remarks

This description explains how to remove the rotor from a two-pole generator. Depending on the actual design, certain details might be different from those included in this description. Because of this, it is necessary to contact the manufacturer in order to obtain further information. The generator views in figs. 1 and 2 show an example of a generator with laterally arranged cooling units, exciter machine and outbound lines on top.

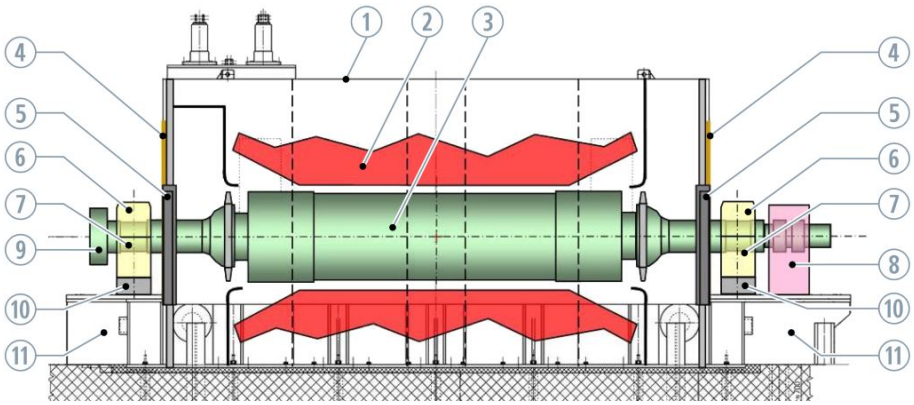
Fig. 1: Two-pole generator, exploded view



1 Cooler
2 Cover
3 End wall segment
4 Upper air guide
5 Outbound lines
6 Air baffle ring
7 Rotor
8 Inner stator with core
9 Base frame
10 Exciter set
11 Bearing pedestal, cover
12 Bearing pedestal, base
13 Intermediate frame
14 Labyrinth ring
15 Shaft bushing

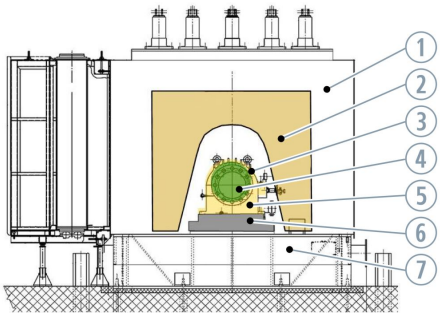
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Fig. 2: Two-pole generator, longitudinal section



1 Cover
2 Stator
3 Rotor
4 End wall segment
5 Shaft bushing
6 Bearing pedestal, cover
7 Bearing pedestal, base
8 Exciter set
9 Turbine coupling
10 Intermediate frame
11 Base frame

Fig. 3: View on TE



1 Cover
2 End wall segment
3 Bearing pedestal, cover
4 Rotor
5 Bearing pedestal, base
6 Intermediate frame
7 Base frame

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Safety precautions

- **Only skilled personnel are authorized to perform any disassembly or assembly work on the generator.** The accident prevention regulations applicable on the construction site must be complied with.
- The valid safety regulations must be observed when working on platforms.
- Lifting equipment and hitching gear must be of a size and strength adequate for the required loads. Round slings must be used as hitching gears.
- Suitable measures must be used to secure the rotor against unintended movements during every step, as well as after the rotor is in its resting position after having been removed.
- Removed parts must be safely stored outside marked walkways. They must be stored in such a way that it is impossible for the parts to unintentionally change position or topple over.
- Do not store any tools or component parts in the area of base frame and generator windings.
- Suitable aids or materials (e.g., foil) must be used to protect uncovered openings from soiling and to prevent foreign particles from entering them.

- Openings must be adequately marked and blocked in line with operator protection requirements.

Equipment required

The following items are included in the standard scope of supply from Siemens (see *Special Tools*):

- 1 Sliding plate
- 2 Sliding shoes
- 1 Sliding pedestal
- 2 Set-down troughs
- 2 Rubber plates
- 1 Adapter plate (optionally)
- Sliding grease

The generator operator has to provide:

- Gantry crane and hitching gears (sling equipment for jacking the rotor)
- Chain or rope hoists
- Securing devices
- Foil
- Wire reels
- Water level
- Height-leveling supports

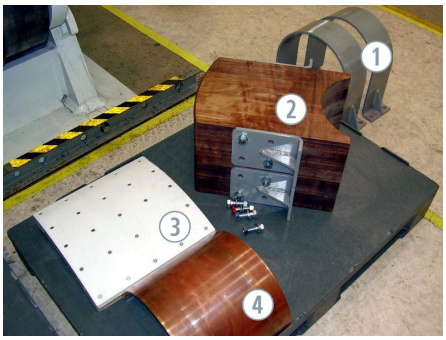
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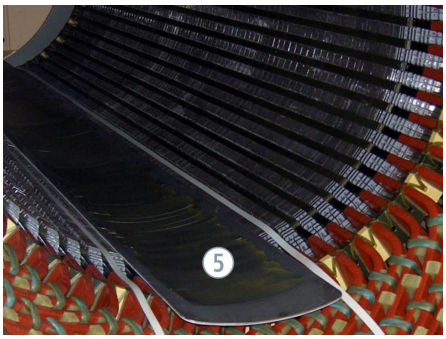
The standard scope of supply for the generator may not include all the tools and equipment mentioned in this description. The agreed scope of supply must be checked. If necessary, various parts, tools, and equipment may have to be ordered separately.

Special tools

Fig. 4 shows a section of the special tools used for removing rotors. The brackets (1) that can be seen in the background are mounted on the base of the sliding pedestal (2) with hexagonal bolts (also see Fig. 14, page 12). The sliding pedestal is placed near or next to the bearing area (dependent on the clamp diameter on the on the sliding pedestal) facing the center of the generator. The copper shim is inserted in between, in order to protect the bearing area.

Fig. 4: Some of the special tools for removing the rotor





1 Sliding pedestal, U-brackets
2 Sliding pedestal, base
3 Sliding shoe
4 Sliding pedestal, copper shim
5 Sliding plate

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2 Rotor Removal

Overview

The rotor removal process is divided into the following steps:

1. Preparatory work, especially the disassembly of peripheral devices
2. Disengaging the rotor on the turbine end
3. Inserting the sliding plate
4. Removing the intermediate frame on the turbine end
5. Removing the TE bearing cover and the top bearing shell
6. Removing the lower bearing pedestal section and the lower bearing shell on the turbine end
7. Assembling the sliding pedestal on the turbine end
8. Preparations on exciter end for pulling out the rotor
9. Travelling out the rotor
10. Placing the exciter end of the rotor on a set-down trough and suitable underlays
11. Suspending the rotor horizontally
12. Putting down the rotor onto both set-down troughs in the final position

2.1 Preparatory Work

Preparation

The **transportation safety devices and safety tools** delivered with the generator must be prepared when starting work.

Depending on the actual generator design, the **cooling elements** and the **sound-absorbing hood** may have to be removed as part of the dismantling procedure. Loosen all cable couplers before lifting off the sound-absorbing hood without fail.



NOTICE

- During all crane work, make sure that the hitching gears are not placed on the rotor retaining rings, on the bearing points, or in the area of the sealing surfaces.

Work steps

The remaining work steps must be carried out in the following order:

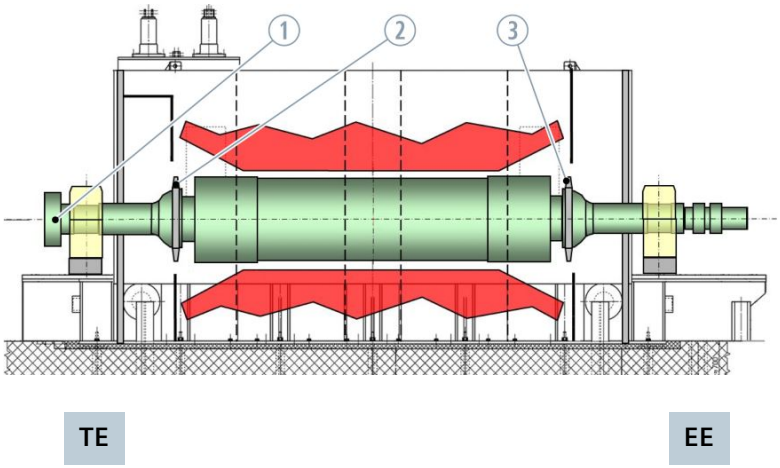
1. Align the **rotor coupling** vertically (transport position marking 0 or 12 on the coupling must face upwards).
2. Remove the **exciter** or the **static excitation device** (slip ring housing, connecting cables, plug-in brush holder, and brush yoke).
3. Remove the TE and EE **front wall segments**.
4. Remove the **labyrinth rings** and the upper TE and EE **shaft bushings.**
5. Remove all **bearing pedestal connections** (oil flanges, cables, shaft vibration pickups, etc.).
6. Mark and remove the TE and EE **air baffle rings.**
7. Remove all **tightness rings**, **vibration detectors** and **temperature sensors** at the TE or EE bearing pedestals.

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NOTICE

- If any oil leaks from the bearings during the work being carried out, use adequate means to capture it.
- After opening, the bearings must be immediately protected from mechanical damage with suitable measures (e.g., covering).

Fig. 5: After preparatory works have finished



1 TE coupling half
2 TE fan blades
3 EE fan blades

2.2 Disengaging the Rotor on the Turbine End

The rotor must be disengaged on the turbine end.

Coupling

Jack apart the TE coupling half from the coupling recess with the help of the original clamping bolts. While jacking apart the half couplings, observe the maximum axial clearance values as specified in the dimensional drawing on *Axial and radial rotor clearances*.

NOTICE

- Only jack apart until the coupling overhang is located at a maximum distance of 10 mm outside the coupling face. A bigger distance between the half couplings will impede rotor later lifting in the area of cap / toothed end packets.

Fan blades

It might be necessary to remove the fan blades on both rotor ends as preparation for the following step. The fan blades must be removed if the fan's diameter is greater than the inner diameter of the rotor retaining ring or if there is a danger that the fan blades will interfere with the housing.

NOTICE

- The fan blade ends should be bandaged using soft protective material to protect the threads before they are placed down.

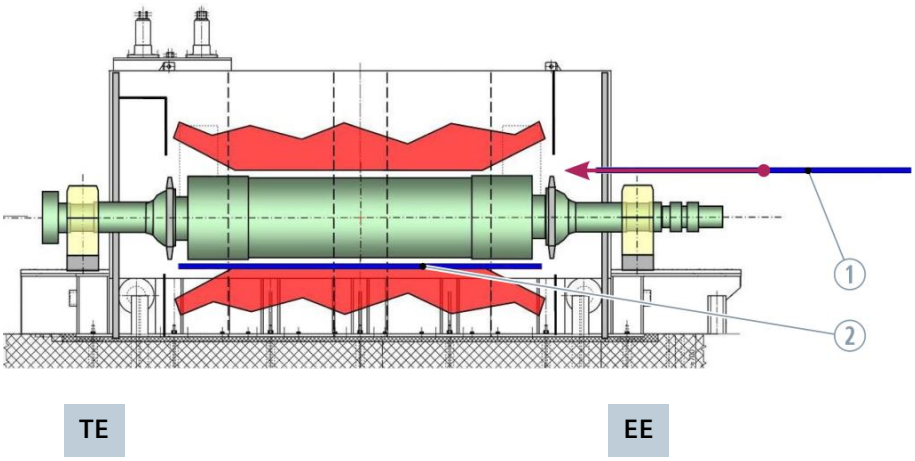
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2.3 Inserting the Sliding Plate

Work steps

1. Clean the sliding plate, apply a thin film of sliding grease to the inner side, and wrap it in sheeting.
2. Slide in the plate, covered in foil, through the generator gap between the rotor and stator, above the EE bearing (Fig. 6).
3. Place the plate centrally underneath the rotor by guiding it manually on both sides. The sliding plate's required final position is shown in Fig. 4, right side, and in Fig. 6.
4. After this, the foil between the rotor and the sliding plate must be removed.

Fig. 6: Inserting the sliding plate



1 Sliding plate, inserting position
2 Sliding plate, final position

NOTICE

Risk of damaging the rotor and stator.

▶ Insert the sliding plate very carefully.

2.4 Removing the Intermediate Frame on Turbine End

Work steps

1. Release the TE bearing's intermediate frame from the base frame. To do this, remove the bearing pedestal bolts and alignment pins from the base frame.
2. Attach the hitching gear to the rotor shaft near the bearing (not to the suspension eyelets!).
3. Lift the bearing a few millimeters with the intermediate frame and shaft still attached to it (Fig. 7, I).

⚠ WARNING

Danger of injury from heavy loads falling.

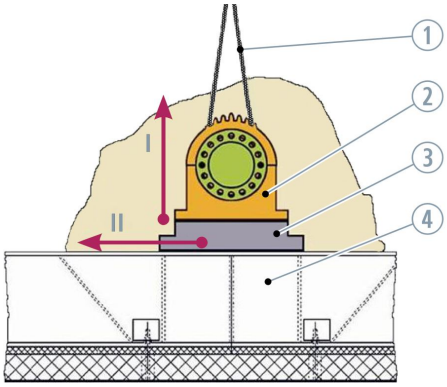
▶ The rotor must NOT be suspended from the suspension eyelets on the bearing cover. These are only for lifting up the bearing pedestal or bearing.

4. Place thin rolls (welding wires) underneath the intermediate frame. These rolls are used as aids for transportation. Alternatively, a lubricated sliding pad may be used.

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5. Once these aids have been positioned, lower the bearing together with the intermediate frame.
6. Release now the intermediate frame from the bottom part of the TE bearing pedestal. Remove the screws and dowel pins.
7. Lift the rotor with the crane until the intermediate frame can move freely.
8. Pull out the intermediate frame from the side and store it safely (Fig. 7, II).

Fig. 7: Removing the intermediate frame – view on TE

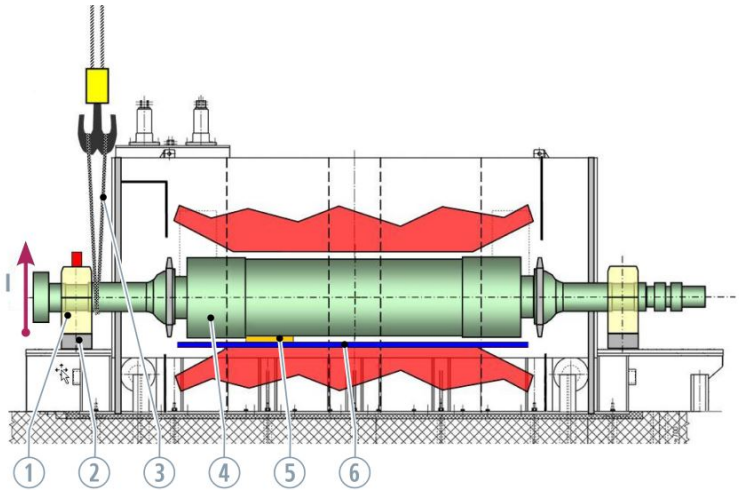


1 Hitching gear attached to the rotor
2 Bearing pedestal
3 Intermediate frame in installation position
4 Base frame

I Lifting the rotor and bearing pedestal
II Pulling out the intermediate frame

9. Insert the sliding shoe between the centrally aligned sliding plate and the rotor, flush with the edge of the retaining ring (Fig. 8).

Fig. 8: Removing the TE intermediate frame



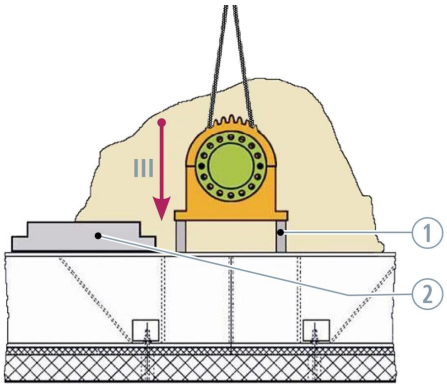
1 Bearing pedestal
2 TE intermediate frame
3 Hitching gear attached to the rotor
4 Rotor retaining ring
5 Sliding shoe
6 Sliding plate

I Lifting the rotor and bearing pedestal to pull out the intermediate frame

10. Once the sliding shoe has been positioned, lower the rotor until it is bearing on the sliding shoe.
11. Finally, the TE bearing is supported with the help of height-adjustable elements (Fig. 9).

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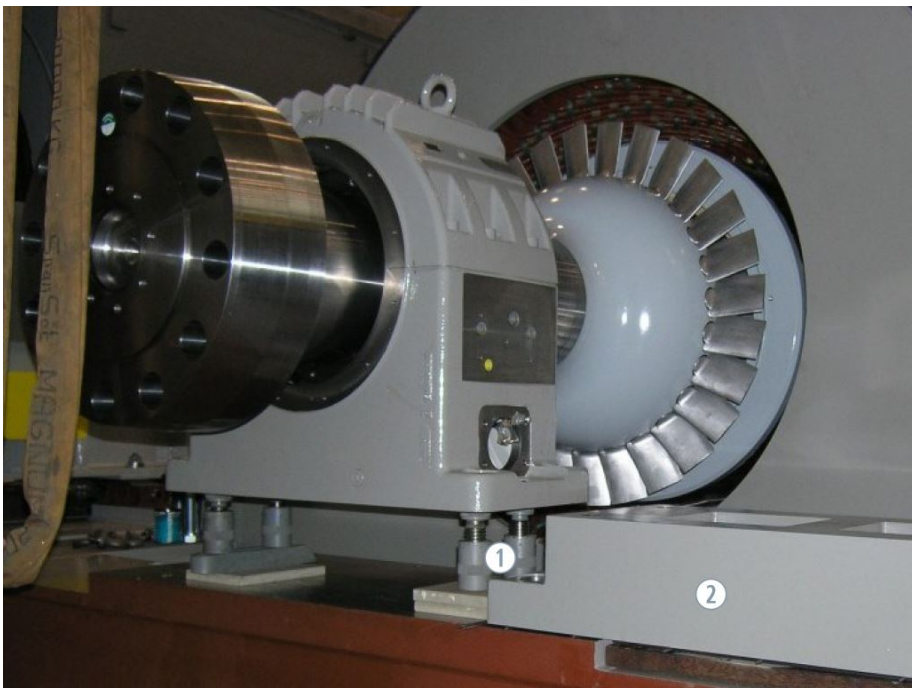
Fig. 9: View on TE, Lowering the rotor



1 Supports adjustable in height
2 Intermediate frame in parking position

III Lowering the rotor until it is resting on the sliding pad and bearing is resting on bearing supports

Fig. 10: Turbine end with bearing resting on bearing supports



1 Supports adjustable in height
2 Intermediate frame in parking position

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2.5 Removing the TE Bearing Cover and the Top Bearing Shell

Work steps

1. Disassemble completely the TE bearing cover's threaded connection.
2. Attach the hitching gear to the bearing cover's eyelets and carefully lift off the bearing cover (Fig. 11, I).
3. Place the bearing cover in its resting position with the crane or, alternatively, a hydraulic jack. Put it down safely on a suitable soft support pad (wood, rubber, or similar). Remove the slinging ropes.

NOTICE

- If a hydraulic jack is used instead of a crane, the jack must be placed underneath the coupling or between the bearing pedestal and the coupling. Insert suitable material for shaft protection between shaft and jack (e.g., copper or aluminum sheets).

4. Unscrew the bearing shell's screw couplings. After this, remove at first the measuring cable for the bearing insulation monitoring system and then the top bearing shell (Fig. 11, II).
5. Pack up the bearing shell and store it safely.

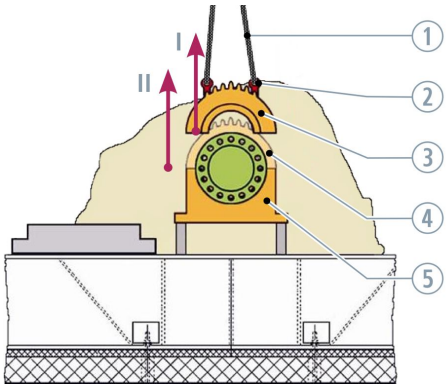


Fig. 11: Removing the TE bearing cover and the top bearing shell – View on TE

1 Hitching gear attached to bearing suspension eyelets
2 Bearing suspension eyelets
3 Bearing pedestal, cover
4 Top bearing shell
5 Bearing pedestal, base, with lower bearing shell

I Removing the bearing cover
II Removing the top bearing shell

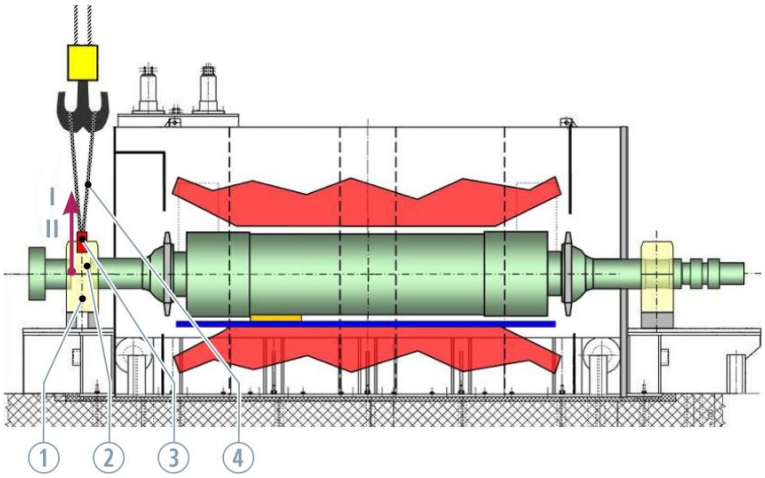


Fig. 12: Removing the TE bearing cover and the top bearing shell

1 Bearing pedestal, base
2 Bearing pedestal, cover
3 Bearing suspension eyelets
4 Hitching gear attached to bearing suspension eyelets

I Removing the bearing cover
II Removing the top bearing shell

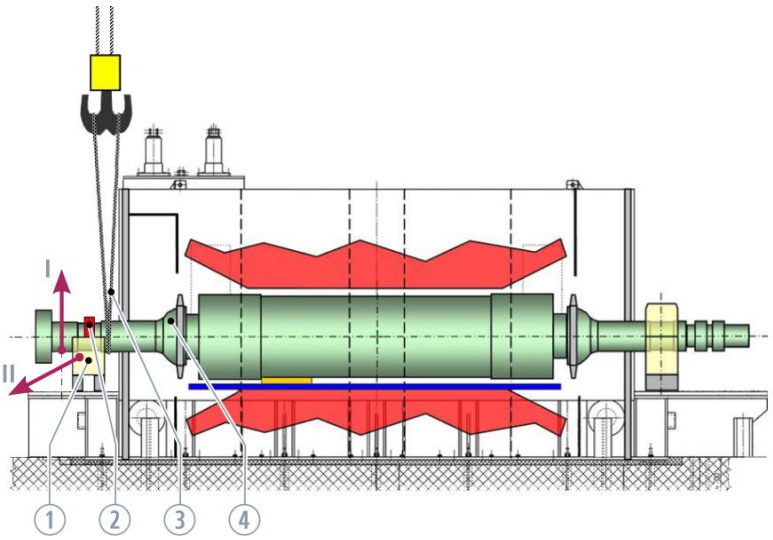
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2.6 Removing the TE Lower Bearing Pedestal Section and the Lower Bearing Shell

Work steps

1. Attach the hitching gears in the immediate vicinity of the bearing pedestal. If there is sufficient space, attach the gears on the side facing the fan hub (Fig. 13).

Fig. 13: Removing the TE lower bearing pedestal section and the lower bearing shell



1 Bearing pedestal, base
2 Eye bolts fixed on the bearing pedestal base
3 Hitching gear attached to rotor
4 Fan hub

I Lifting the TE rotor shaft
II Removing the TE lower bearing pedestal section and the lower bearing shell

2. Remove the high-pressure hose and the oil line for the jacking oil (if any) that are located underneath the bearing shell. Remove the grounding cable.

3. Lift the shaft on the turbine end by 0.1 to 0.3 mm.

4. Once the shaft is lifted, swivel out the lower bearing shell.

5. After this, attach two eye bolts to the bottom of the TE bearing pedestal, diagonally opposite to each other.

6. Lower the rotor until it rests on the sliding shoe.

7. Attach the hitching gears to the eyelets. After this, remove the height-adjustable supports.

8. Lower the bearing pedestal base section, remove it sideways and store it safely.

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2.7 Assembling the Sliding Pedestal on the Turbine End

Work steps

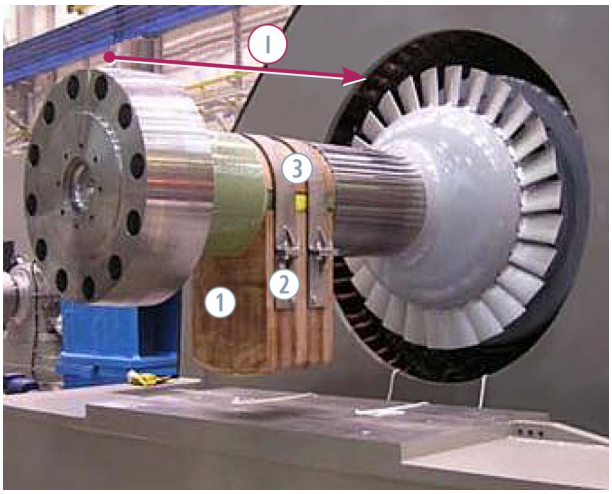
1. Assemble the **sliding pedestal** on the TE bearing point (Fig. 14) (or next to it).

NOTICE

- In order to ensure that the bearing is protected, the assembly process must be carried out only while using the copper shims included in the scope of supply.
- It is necessary to assemble the sliding pedestal perpendicularly to the rotor axis. Use a water level to check the horizontal alignment.

2. Lower the rotor until it rests on the sliding shoe.
3. Remove the hitching gears and crane on turbine end.

Fig. 14: Sliding pedestal assembled on turbine end bearing point



1 Sliding pedestal
2 U-brackets
3 Copper shims

I Removal direction

2.8 Preparations on Exciter End for Pulling out the Rotor

Equipment required

- Bearing transportation securing device
- Rope hoist or chain hoist
- Adapter plate (optionally)

Normally, the rotor will be travelled out by pulling it from the exciter end. Alternatively, if there is not sufficient space for pulling, the rotor can be moved in direction to exciter end applying hydraulic jacks or equivalent tools on the turbine end.

The following steps describe the preparations on exciter end for the pulling procedure.

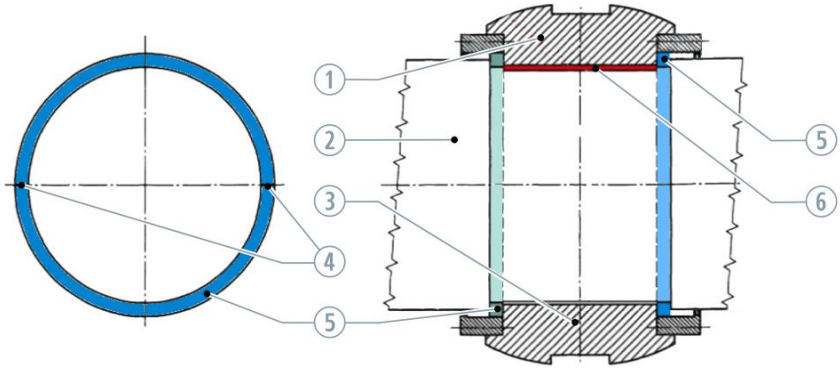
To pull out the rotor, a rope sling is attached either **to the EE bearing pedestal** or, alternatively, **to an adapter plate**.

Work steps

1. If the rope sling will be attached to the EE bearing pedestal, lock at first the bearing using the **transportation securing device** (Fig. 15).
   If the rope sling will be attached to an adapter plate, mount this at first to the rotor exciter end (Fig. 16).

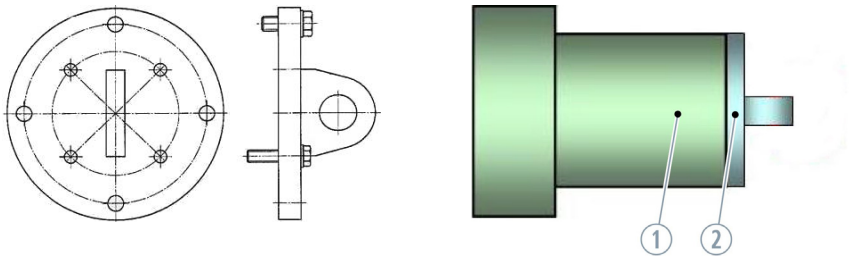
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Fig. 15: Bearing transportation securing



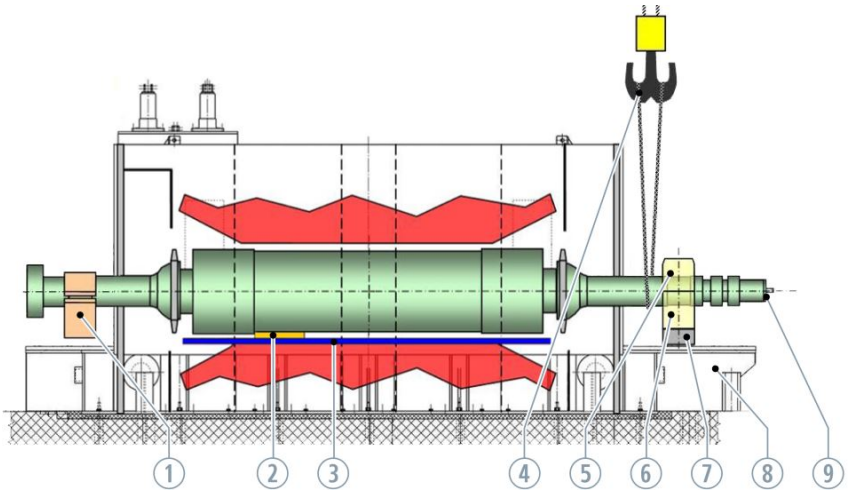
1 Top bearing shell
2 Rotor
3 Lower bearing shell
4 Separating joint
5 Axial retaining ring(divided)
6 Anti-rotation locks (shim between the shaft and the upper bearing shell in both bearings)

Fig. 16: Adapter plate, schematic diagram and mounted on exciter end



1 Rotor exciter end
2 Adapter plate with eyelet

Fig. 17: Rotor resting on the sliding shoe, with exciter end suspended from the crane and adapter plate mounted



1 Sliding pedestal on TE
2 Sliding shoe
3 Sliding plate
4 Gantry crane with hitching gears attached to EE
5 EE bearing pedestal, cover
6 EE bearing pedestal, base
7 EE intermediate frame
8 Base frame
9 Adapter plate

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2. Attach now the rope sling to the EE bearing pedestal (Fig. 18) or to the adapter plate (Fig. 19).

NOTICE

- No attachment points other than the points specified for attaching the axial pull mechanism must be used. In particular, no forces must be exerted on the slip rings while removing the rotor. This also applies to the fan blades if they have been left on the rotor due to there being enough space available.

3. As the pull mechanism use **a rope hoist or a chain hoist**, which is attached to an appropriate and sufficiently stable anchor point.
4. Before starting to pull out the rotor, remove the bolts and pins which fix the EE intermediate frame onto the base frame.
5. Attach the crane to the rotor's exciter end, next to the bearing point, using suitable hitching gears (round slings). If the space available allows, attach the hitching gear between bearing and fan.
6. The rotor must be carefully lifted until the EE bearing is no longer bearing a load.

2.9 Travelling out the Rotor

Requirements for moving the rotor

Preparing steps that have already been carried out:

- ✓ The EE bearing was fixed using the transportation securing device, in order to transmit the axial tensile force onto the rotor.
- ✓ The EE intermediate frame was loosened from the base frame.
- ✓ The rotor was lifted until the EE bearing was no longer bearing a load.
- ✓ On the turbine end, the rotor is still bearing against the sliding shoe.
- ✓ The rope hoist (or chain hoist) is connected to the bearing (EE bearing pedestal or adapter plate) and a fixed point by a rope sling (or chain).

Pulling force

The force required to pull out the rotor is equal to the frictional force that must be overcome.

- The frictional force can be approximated with $F_R = \mu \times F_N$.
- Normal force $F_N = F_G = m \times g$
- **m:** shaft mass, can be gathered from the dimensional drawing text
- **g:** gravitational acceleration (g = 9.81 m/s2)
- **μ:** coefficient of static friction for steel–teflon + sliding grease (μ ≈ 0.1)

If this value for μ is used for the calculation, the result obtained is approximately the **maximum force** that the attachment point of the chain or wire rope used to pull out the rotor must hold. A suitable anchor point must be selected according to this information. Since the sliding plate is lubricated, the coefficient of friction will decrease significantly as soon as the rotor is moving.

NOTICE

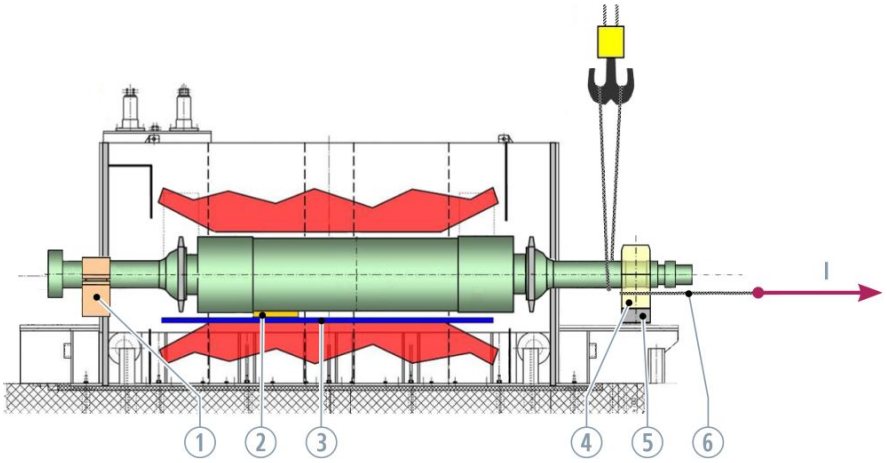
- It is absolutely necessary to ensure that the applied tensile forces act solely in an axial direction. Avoid any oblique or a skew pulling. Do not use the crane to carry out any axial pulling movements!
- The rotor and stator components must not come into contact with each other while the rotor is being removed.

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Work steps

1. Start to pull out the rotor from the stator by exerting an axial pull while continuously guiding the crane (figs. 18 and 19).

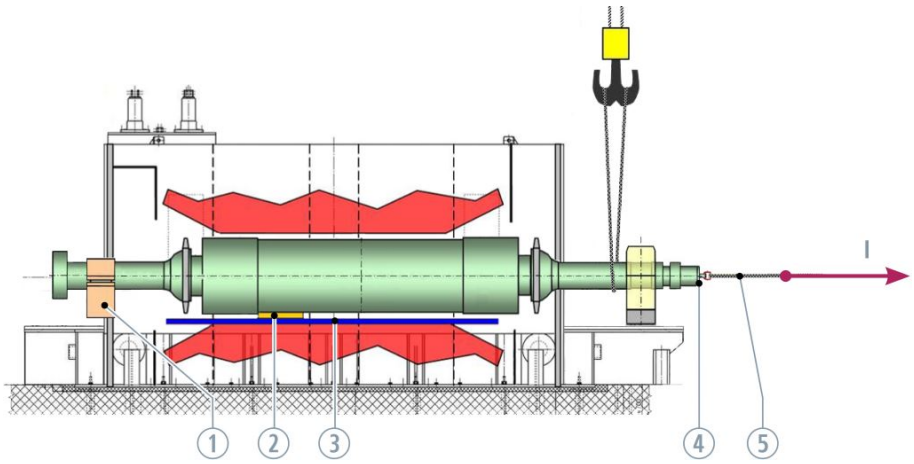
Fig. 18: Alternative 1 – Rope is attached to the bearing-pedestal base



1 Sliding pedestal
2 Sliding shoe
3 Sliding plate
4 EE bearing pedestal, base
5 EE intermediate frame
6 Rope hoist
I Pulling direction

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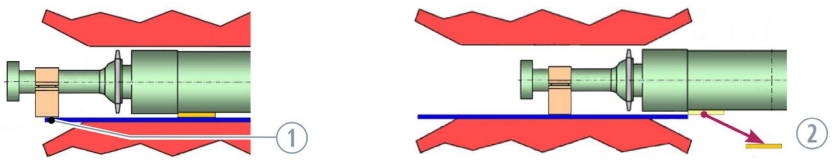
Fig. 19: Alternative 2 – Rope is attached to the adapter plate



1 Sliding pedestal
2 Sliding shoe
3 Sliding plate
4 Adapter plate
5 Rope hoist
I Pulling direction

2. Continue to pull out the rotor until the sliding pedestal comes into contact with the sliding plate (Fig. 20, 1).

Fig. 20: Other stages in the rotor removal process



1 Sliding pedestal comes into contact with the sliding plate
2 Removing the sliding shoe

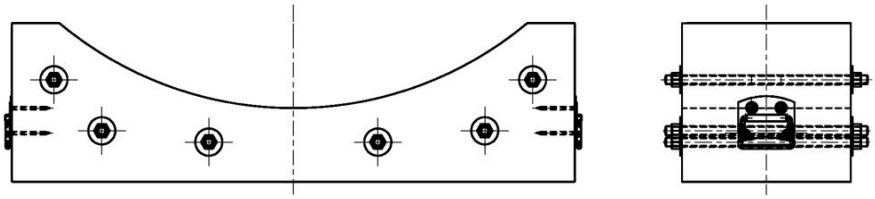
3. When continuing the process, the sliding shoe will reach the leading edge of the sliding plate on the exciter end. Remove the sliding shoe (Fig. 20, 2).

2.10 Placing the Rotor Exciter End on the Set-down Trough

Work steps

1. Continue to move out the rotor until its attachment position (geometrical center of the rotor) is located outside the stator and the attachment area is freely accessible (see Fig. 22).
2. Place a **set-down trough** (Fig. 21) near the EE retaining ring, centrally under the rotor body (not under the retaining ring). The height difference in relation to the hall floor must be compensated for with stable **pad elements** (height-levelling supports). The support trough and pad elements must be placed in such a way that the required hitching-gear rope spread for the following crane work can be achieved.

Fig. 21: Set-down trough, schematic diagram



3. As soon as the position described above has been reached, place the rotor body down on the trough (Fig. 22). Put the rotor down in such a way that a safe resting position is maintained that completely prevents any subsequent sliding or settling movements from occurring after the crane is removed.

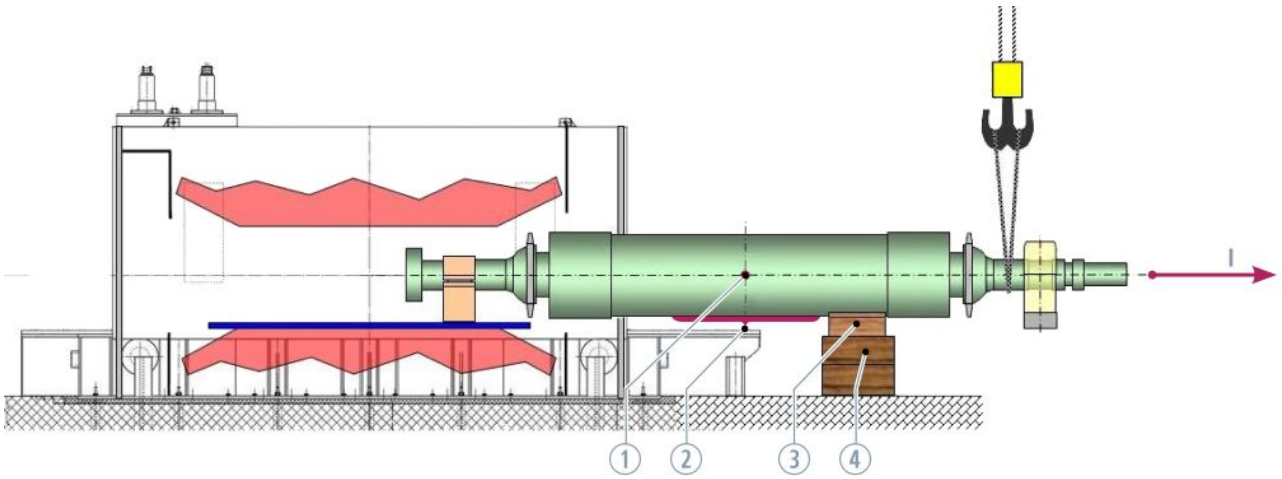


Fig. 22: Placing the rotor exciter end on the set-down trough

1 Geometrical center of the rotor
2 Attachment area
3 Set-down trough
4 Pad elements
I Pulling direction

4. Remove the aids used for axially pulling the rotor.

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2.11 Suspending the Rotor Horizontally

NOTICE

If the rotor is not suspended horizontally, this reduces the clearance in the air gap required when the rotor is pulled out. This creates a risk of the rotor contacting the stator.

Due to the large mass of the rotor, this contact will most probably result in heavy damage.

- Suspend the rotor horizontally and balance it with great care.
- Position the crane exactly vertically above the center of the rotor.

Any sudden braking or accelerating movements by the crane can cause uncontrollable rotor movements, which in turn can lead to damage to the stator and/or rotor.

- It is absolutely essential to ensure that the rotor is pulled out as evenly as possible.

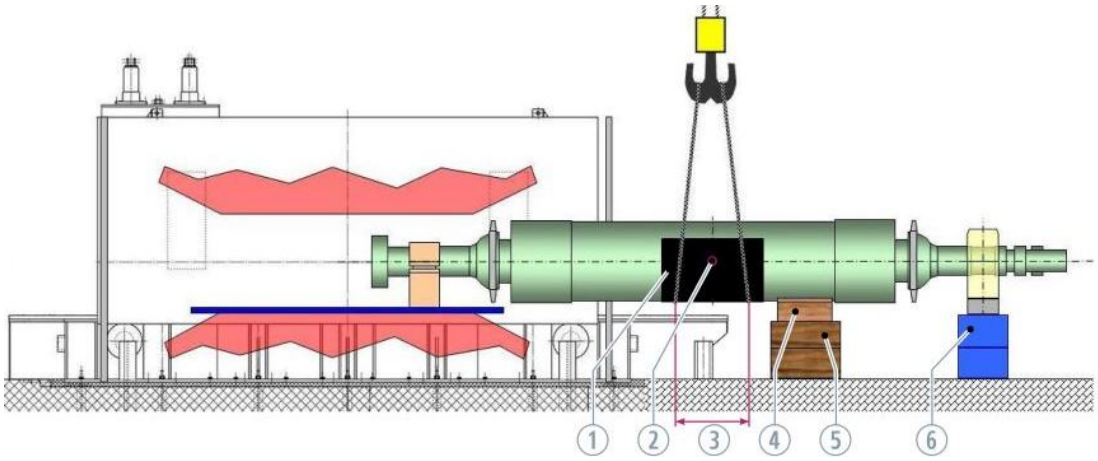
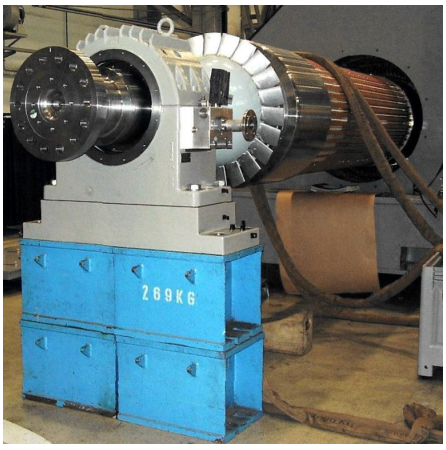


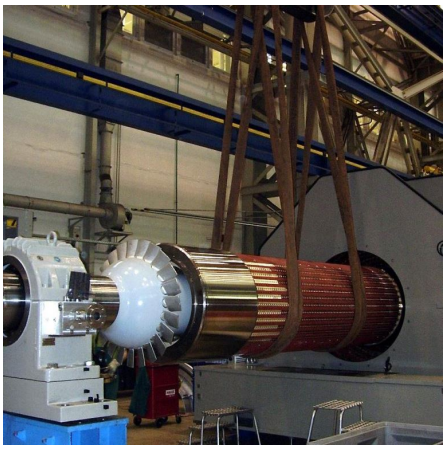
Fig. 23: Rotor suspended horizontally

1 Rubber pad
2 Geometrical center of the rotor
3 Rope spreading min. 600 mm
4 Set-down trough
5 Pad elements
6 Alternative support elements

Fig. 24: Suspending the rotor, detailed views



Supporting the EE bearing pedestal by alternative support elements



Sufficient rope spreading

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Work steps

1. Support the EE bearing pedestal by alternative support elements.
2. Place the hitching gears for the crane approximately in the geometrical center of the rotor. The attachment points must be separated by a minimum of 600 mm.
   Sling the rotor in such a way that it is hanging in a horizontal position after being lifted (please observe the bearing weight). Use a water level in order to ensure that a perfectly horizontal position is achieved.
   Monitor the rotor's position by observing, from both bearing points, how the rotor lifts off during the crane lifting operation.
3. Lift both ends off their supports at the same time.
4. In order to be able to perform necessary corrections, put the rotor down again in the same position. The correction is made by moving the slings by a few centimeters. Repeat this procedure until the rotor is in a perfectly horizontal position.
5. As long as the rotor is still in the proximity of the stator, carefully guide the rotor ends by hand. This way, small displacements can be corrected.
6. Remove set-down trough, pad elements and alternative supports.

2.12 Putting down the Rotor onto the Final Position

Work steps

1. Remove the rotor completely.
2. Once removed, put the rotor safely down on the two set-down troughs or in a shipping crate.

NOTICE

- Do not support the rotor on the retaining rings, the slip rings or the fan blades (if these were left on the rotor). These components must neither be used for support nor securing purposes.

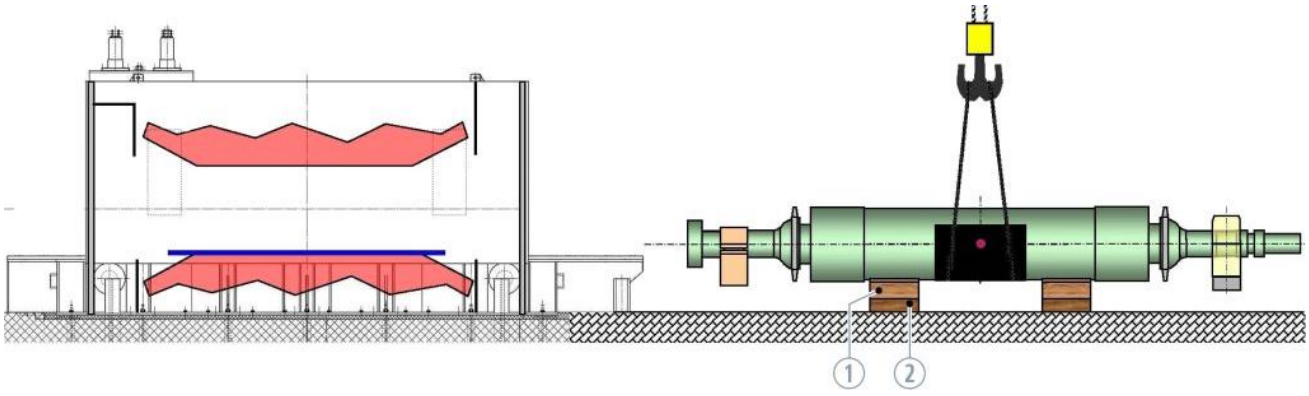


Fig. 25: Rotor put onto its final position

1 Set-down trough
2 Pad elements

3. Once all work is done, inspect visually all gaps and openings.
   Moreover, ensure once again that all removed parts are safely stored.
4. If it becomes necessary to disassemble the EE bearing, the procedure to be followed is the same as that for disassembling the bearing on the turbine side.

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3 Rotor Installation

Preparation

Before the rotor installation make sure that

- ✓ all installation equipment (see page 4) is prepared,
- ✓ the rotor has been placed on two set-down troughs,
- ✓ the sliding pedestal is mounted on the rotor's turbine end,
- ✓ the sliding plate, greased on the inner side, is placed inside the stator core.

Work steps

In order to install the rotor, follow the steps described in chapter 2 for rotor removal in changed order:

1. Assemble adapter plate on turbine end (optionally).
2. Suspend rotor horizontally (hitching gears in central position).
3. Insert rotor turbine end with sliding pedestal into stator core, put down sliding pedestal on greased sliding plate and place rotor exciter end on set-down trough and support elements.
4. Attach rope sling to sliding pedestal or adapter plate, the other end to a rope hoist.
5. Displace hitching gears from rotor center to exciter end, remove set-down trough and support elements.
6. Pull in rotor into the stator applying the rope hoist. While doing this, place sliding shoe between rotor and sliding plate, behind TE rotor cap.
7. When rotor has reached final position, displace hitching gears from exciter end to turbine end.
8. Remove sliding pedestal.
9. Assemble lower bearing pedestal section and lower bearing shell on turbine end.
10. Assemble TE bearing cover and top bearing shell.
11. Assemble TE intermediate frame.
12. Remove sliding shoe pulling it from exciter end with small ropes attached beforehand. If necessary, lift rotor.
13. Remove sliding plate, remove adapter plate.
14. Engage rotor on turbine end.
15. Align rotor coupling vertically, then do finishing work as described in chapter 2.1 *Preparatory Work* (page 5), but in reverse order.

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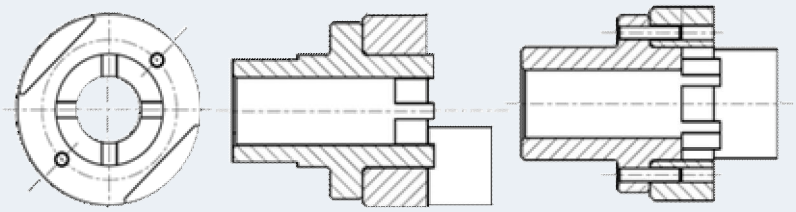
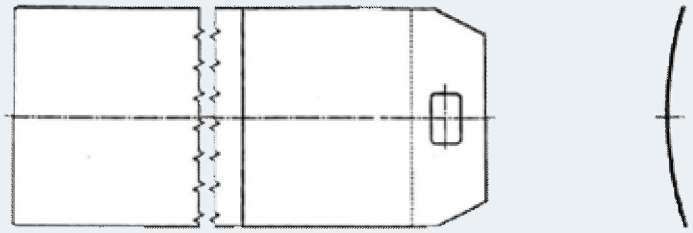
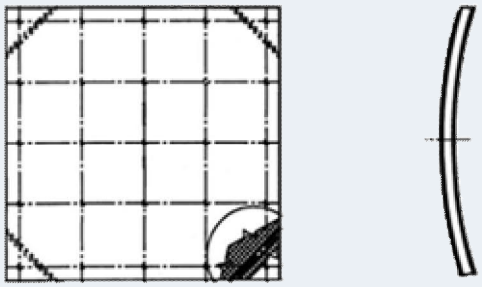
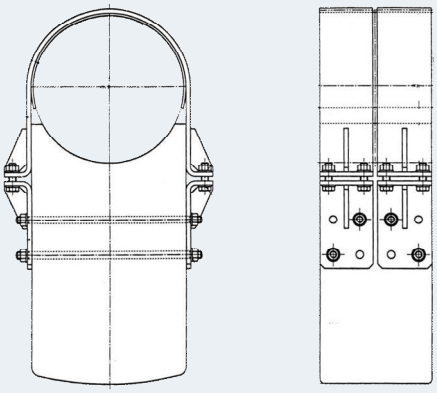
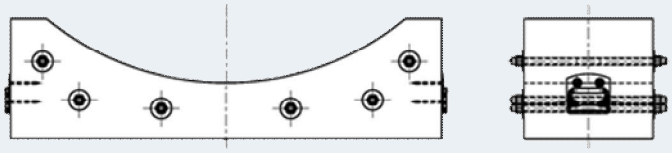
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Maintenance of the System/ Plant Section 4

Special Tools 4.4

Contents

- List of Provided Special Tools
- Air Baffle Ring Mounting and Dismounting – Application of the Special Wrench

Special tool	Manufacturer's internal no.	Qty.
Air baffle ring dismounting and mounting		
Special wrench consisting of 2 wrenches and 2 parallel pins 	P0015622800	1 pce
Rotor removal and installation		
Sliding plate 	P0058654300	1 pce
Sliding shoe 	P0058654400	2 pcs
Sliding pedestal 	P0058659700	1 pce
Set-down trough 	P0016184300	2 pcs

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Special tool	Manufacturer's internal no.	Qty.
Rubber plate 8×400×1600	PE234174	2 pcs
Grease Bechem Berutox MB II-H 	PE112415	1 kg
Cooler inspection[1]		
Cooler cleaning brush 	P0017462100	1 pce

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[1] For cooler inspection see document 4.5-1040.

The delivered special wrench is required for mounting, dismounting, and axial adjusting of the air baffle ring.

It consists of 2 wrenches (items 6 and 8) and 2 parallel pins (item 7). It is required for axial adjusting by turning the screw collars (item 3).

For mounting or dismounting of the air baffle ring only 1 wrench (item 8) is required to tighten or loosen the hexagon nuts (item 2).

Before axial adjusting or dismounting of the air baffle ring the cotter pins have to be removed. After axial adjusting or mounting of the air baffle ring **new** cotter pins have to be inserted. One set of new cotter pins is included.

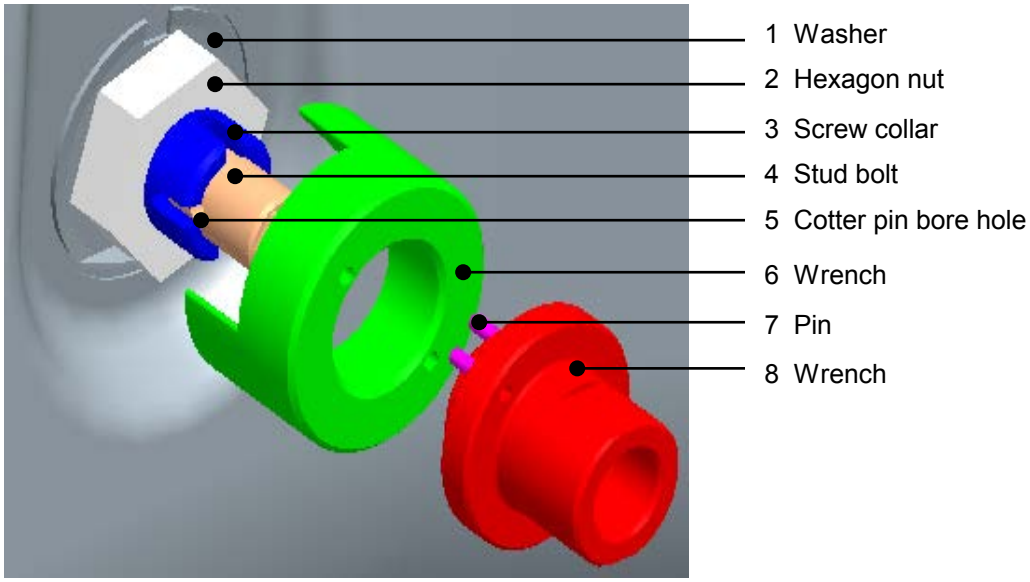


Fig. 1: Special wrench

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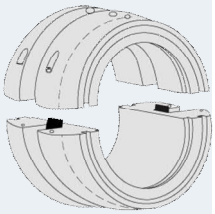
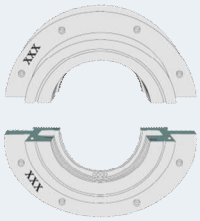
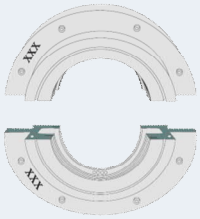
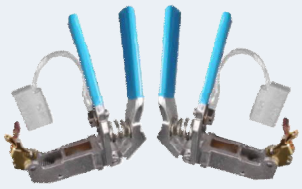
Turbogenerator | Operating and Maintenance Manual

Maintenance of the System/ Plant Section 4

Spare Parts 4.5

Contents

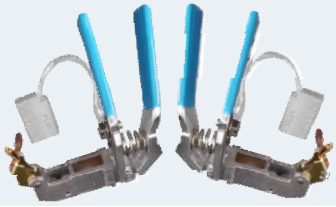
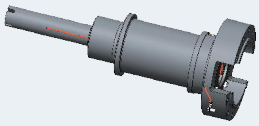
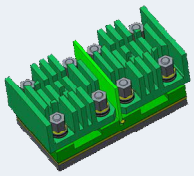
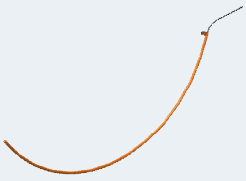
- List of Recommended Spare Parts

Parts identification number	Designation	Installed quantity	Recommended quantity for 2 years	Unit
Generator bearings				
P0017029400	Bearing shell 	2	2	pcs
P0017030300	Chamber seal W28-375, IP 44; width 52 	2	2	pcs
P0035287300	Chamber seal W28-335 IP 55; width 82 	1	1	pcs
PE104083	Jointing compound Hylomar M 	1	1	pcs
Rotor grounding system				
PE113413	Plug-in brush holder assembly 06.00.0468.00 	2	4	pcs
P0002947100	Two-layer contact brush, design A* EMT 513-005, 20×8×32 mm 	2	20*	pcs
P0002946000	Two-layer contact brush, design B* EMT 513-005, 20×8×32 mm 	2	20*	pcs
	* Brushes design A and B should be ordered in same quantities.			

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Parts identification number	Designation	Installed quantity	Recommended quantity for 2 years	Unit
Anti-condensation heating				
PE111723	CSN Threaded heating body ERCH III/38, 1.6 kW, 3×400V 	2	1	pcs
Generator monitoring				
PE119889	Resistance thermometer type WQ 0233 2×PT100 installation length 250 mm, HAN 8D 	4	2	pcs
P0016971000	Resistance thermometer type WQ 0232-PVDFö 2×PT100 installation length = 415 mm HAN 8D 	2	2	pcs
P0008726800	Leakage water monitoring 7ML5745-1BA42-1BA0 	4	1	pcs
PE114624	Probe for shaft vibration 330106-05-30-05-02-00 	5	1	pcs
PE116328	Proximitor for shaft vibration 330180-91-00 	5	1	pcs
PE117452	Velomitor for bearing vibration 330500-02-00 	6	1	pcs

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Parts identification number	Designation	Installed quantity	Recommended quantity for 2 years	Unit
Cooler				
P0017560800	Filter mat M5 314×314×25 	4*	8*	pcs
P0017561100	Filter mat F7 314×314×4 	4*	8*	pcs
	* Filter mats M5 and F7 are used in double quantities, see maintenance description 4.4-4321.			
Rotor ground fault detection (exciter)				
PE113413	Plug-in brush holder assembly 06.00.0468.00 	1	1	pcs
Brushless exciter				
PE441687	RC Network assembly 	1	1	pcs
PE441683	RR Diode module 	6	3	pcs
PE122936	Tubular heating element 200 V 	2	1	pcs

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Parts identification number	Designation	Installed quantity	Recommended quantity for 2 years	Unit
Air baffle ring seal and mounting material				
P0055365300	Stud bolt	12	12	pcs
P0055365200	Threaded sleeve	12	12	pcs
P0008700400	Hexagon nut	12	12	pcs
PE106935	Washer 31 ST A2B DIN432	12	12	pcs
PE103035	Cotter pin	24	24	pcs
P00599921	Rubber seal 25/ 50	10	10	m

NOTE:
For the use of spare parts not bought at Siemens AG there is no guarantee for damages or defects resulting from this.

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Fault Alarms Relating to System/ Plant Section 5

Contents

- Fault Tracing – General
- Fault Tracing – Stator and Generator Supervisory Equipment
- Fault Tracing – Rotor
- Fault Tracing – Bearings
- Fault Tracing – Coolers

The details given herein on faults, their possible causes and the corrective measures cannot be considered complete in every respect, since all possible troubles cannot be covered in advance.

In most cases, the operator will have to decide on the measures to be taken. The individual measures required depend on the mode of operation.

Unless corrective measures can be taken in accordance with the following instructions, the turbogenerator should be shut down.

If required, the services of the manufacturer should be requested. In most cases, however, sufficient details will be found in the turbogenerator manual.

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Fault **Possible Causes**	**Remedy**
Differences in slot temperatures between top bar and bottom bar of stator winding	
• Malfunction of measuring equipment (esp. slot thermometers)	The embedded RTD`s should be checked when different slot temperatures are indicated while stator currents are of equal magnitude in the three phases. Such check should only be made with the generator at rest and in non-excited condition. The check should include resistance measurements as well as testing of the detector leads, the measuring point selector switches and the indicators. Care should be taken during resistance measurements of the embedded RTD`s to ensure that they are not heated as this will falsify the results. In many cases, a fault can be cleared by recalibration of the RTD`s.
High warm air temperature and/or High cold air temperature	
• A high-temperature rise can be caused by overload.	The load has to be reduced immediately to the permissible value.
• Insufficient cooler capacity	The cooling water system has to be checked. Furthermore, a cooler cleaning during a generator standstill can remedy things.
• Insufficient cooling-water volumetric flow or higher cooling-water temperature	A rise of the cooling-water temperature will require a higher cooling-water volumetric flow for removal of the loss heat. The cooling water volumetric flow should be increased. In addition, the cooler should be vented via the vent valves. If the cold-air temperature downstream of the cooler cannot be reduced to the permissible operating value, the generator load should be reduced.
• Loss of cooling-water flow	Restore cooling-water flow immediately. If this should not be possible, the generator should be unloaded and shut down.
Unbalanced load	
• Unequal phase loading of the system connected to generator	If the generator is operated with unbalanced load due to particular system conditions, care must be taken that the continuously permissible unbalanced load is not exceeded. The unbalanced load is defined as the ratio of negative sequence current to rated current. The permissible rated stator current should not be exceeded in any stator phase. When the unbalanced load is higher than the continuously permissible unbalanced load, steps should be taken for bringing about a uniform system load. The generator should be shut down if it is impossible to distribute the system load more uniformly over the three phases.
Power supplied fluctuates	
• Excitation system incorrectly adjusted	The excitation system adjustments have to be checked and re-adjusted.
Generator remains dead	
• Open circuit in field circuit	All switchgears and supply circuits have to be checked for breaks.
• Speed too low	The prime mover speed has to be increased accordingly.
• Excitation system defective	The function of the excitation system has to be checked.

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Fault **Possible Causes**	**Remedy**
Rated voltage not obtained when generator loaded	
• Overload	The loading has to be reduced immediately to the permissible value.
• Interturn short-circuit in field winding	A high temperature rise and even discoloured varnish can indicate an Interturn short-circuits. It is advisable to put the SIEMENS service personal in charge of removing it.
Generator draws inductive reactive power	
• Open circuit in field circuit	All switchgears and supply circuits have to be checked for breaks.
• Excitation system defective	The function of the excitation system has to be checked.
• Interturn short-circuit in field winding	A high temperature rise and even discoloured varnish can indicate interturns short-circuit. It is advisable to put the SIEMENS service personal in charge of removing it.
Unequal stator currents	
• Unbalanced load • Poor contact conditions • Interturn short-circuit in stator winding	Check whether unequal stator currents are due to unbalanced load. If it has been established that the unequal stator currents are not caused by unbalanced load, the unit must be shut down. After the unit has been shut down, first check the terminal bushings at the bus bars resp. cables for proper connection and reliable contact making. If no defect is detected and if the unequal currents are not due to poor condition of the contacts in the bus duct, the brazed soldered connections of the stator winding should be examined. It is also advisable to check the stator winding for Interturn short-circuits. In case of an interturn short-circuit the SIEMENS service personal should be put in charge of removing it.
Unequal phase voltages	
• One supply phase disconnected	All switchgears and supply circuits have to be checked for breaks.
• Stator winding incorrectly connected	In case of an incorrectly connected stator winding, the connection has to be corrected.
• Interturn or phase short-circuit in stator winding	A high temperature rise and even discoloured varnish can indicate an interturn or phase short-circuits. It is advisable to put the SIEMENS service personal in charge of removing it.

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Fault **Possible Causes**	**Remedy**
Sudden deterioration of rotor running condition	
• Interturn short-circuit in field winding • Rotor unbalanced • Rotor out of true. Shaft distorted; unequal air gap over poles • Misalignment • Unbalance/shocks from prime mover (turbine) • Uneven running caused by gearing • Resonance with foundation • Changes in foundation	Check whether the deteriorated running condition originated due to the turbine or whether the rotor bearings are damaged. A deterioration of the running condition may be caused by a change in the balancing condition or by a rotor winding short. Unload and shut down turbine generator as soon as feasible if cause cannot be located and corrected for severe condition. Since it is very difficult in most cases to find a definite cause, it is advisable to obtain the help of the SIEMENS service personal.

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Fault **Possible Causes**	**Remedy**
Temperatures of generator bearings too high	
Temperature variations at the generator bearings may be due to different causes. The turbogenerator can be kept in operation as long as the permissible bearing temperature is not exceeded. When a variation is noted, the operating temperatures should be carefully monitored to ensure the limit temperature is not exceeded. If the bearing temperature exceeds the permissible value, the turbogenerator should be shut down.	
• Cold oil temperature too high • Bearing oil pressure too low	If a deviation occurs, first the cold oil temperature (oil temperature after cooler) and the bearing oil pressure should be checked and corrected if necessary.
• Oil contaminated or aged	The bearing housing has to be cleaned. Possibly the oil has to be renewed.
• Low oil level	The oil level has to be checked. Oil has to be filled up if necessary.
• Oil viscosity too high	If the oil viscosity is too high, the oil has to be changed (thinner oil).
• Forced lubrication fails; oil or cooling water failure	The oil supply system has to be inspected.
• Residual oil pressure of bearings with oil jacking drops during operation with jacking oil pump inoperative	The jacking oil piping and the nonreturn valve have to be checked. It has to be checked, if the concerning bearing shell is skewed.
• Excessive axial thrust resp. radial load	The magnetic centre and the alignment have to be checked. In case of deviations, the bearings and/or the machine have to be realigned.
• Inadequate radial clearance	The concerning bearing shell has to be adapted by scraping or remachining (only carried out by experienced fitters)
• Damage to bearing lining. Defective bond between lining and supporting block of bearing shell	Change of the bearing.
• Oil pockets too small; transitation to bearing surface not smooth enough	The oil pockets have to be refinished accordingly (only carried out by experienced fitters).
• Bearing currents	The bearing insulation has to be checked and - if necessary - cleaned or replaced to remove possible creepage paths.
Jacking oil pressure drops	
• Bearing oil inlet temperature has changed • Leakage in the shaft lift oil system • Nonreturn valve leaky	Oil pressure depends in part on the bearing oil inlet temperature. Check first to determine whether the pressure drop was caused by an oil temperature variation. If not, the shaft lift oil system should be checked for leakages. The fault may be due to a leak at the nonreturn valve in the lift oil pipe. Replace or repair the nonreturn valve at the next shutdown or inspection.

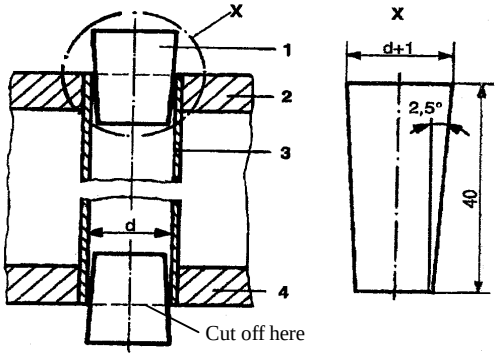
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Fault **Possible Causes**	**Remedy**
Oil blackens prematurely or contains abraded matter	
• Low oil level	The oil level has to be checked. Oil has to be filled up if necessary.
• Oil viscosity too low	If the oil viscosity is too low, the oil has to be changed (thicker oil).
• Residual oil pressure of bearings with oil jacking drops during operation with jacking oil pump inoperative	The jacking oil piping and the nonreturn valve have to be checked. It has to be checked, if the concerning bearing shell is skewed.
• Excessive radial clearance	Change of the bearing.
• Damage to bearing lining. Defective bond between lining and supporting block of bearing shell	Change of the bearing.
• Bearing currents	The bearing insulation has to be checked and - if necessary - cleaned or replaced to remove possible creepage paths.
Bearing loses oil; oil drawn into machine	
• Oil viscosity too low	If the oil viscosity is too low, the oil has to be changed (thicker oil).
• Oil viscosity too high due to low oil temperature (esp. during start-up)	Bearing or oil have to be heated during or prior to start-up.
• Oil foams	The bearing vent has to be checked for perfect function. After enquiry with the supplier, different oil can be used. Possibly an anti-foam additive should be used.
• Oil pressure of forced lubrication system too high (> 0.5 bar)	The oil pressure has to be reduced, if necessary with an additional pressure reducing valve.
• Forced-lubricated bearing flooded	The correct adjustment of bearing oil rate and bearing oil level has to be checked. There must not be any obstructions in the oil discharge.
• Sealing rings defective. Gap between shaft and sealing ring too large	The sealing rings can serve its purpose only restrictedly and therefore should be replaced.
• Sealing-air supply incorrectly adjusted (SGen5/6-100A-2P-series only)	Tubing, valves and seals have to be inspected. The original pressure has to be readjusted.
• Leak in bearing part joint	The bearing part joint should be replaced.
• Oil mist exhaust does not function	In the bearing housing there must be a negative pressure of approx. 100 Pa with operation. Check the pressure in the bearing housing and guarantee the functioning of the oil mist exhaust.

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Fault **Possible Causes**	**Remedy**
Bearings operated in possible wear area during shutdown	
• Breakdown of the hydrostatic pump	After an event of fault, when the bearings had to be operated in possible wear area, an inspection would be advisable. Alternatively, the generator can be started and checked for variations of the bearing temperature and vibration values. Regular oil analysis can show how much wear material is removed in the oil. If the values did not change, the inspection of the bearings can be delayed until the next regular inspection.

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Fault **Possible Causes**	**Remedy**
Liquid in Generator	
· This fault is due to a leaking or defective cooler tube.	Identify the defective cooler section. Reduce the load (see also document 4.3-8170 Permissible Load Limits of Generator) and take this cooler out of operation. Empty the collected liquid in the drain pan by drain screws of the level detector container. Then drain the cooling water from the cooler section. Detach the return water channel and the inlet/outlet water channel. Tightly seal lower tubesheet. Then fill cooler tubes with water. Re-install return water channel and supply compressed air to water in coolers tubes via the vent. After some time water from the defective tube will have been drained. Isolate the compressed-air supply and re-install the return water channel. The defective tube can be identified now since cooling water is drained from this tube, while all other tubes remain filled with water up to upper edge. Mark defective tube and drain water from the cooler section. Plug the defective tube at both ends. As a material for the plugs we recommend hardwood, rubber or plastic. Metal plugs should not be used. Insert plugs by light hammer blows. Cut off protruding part of plugs. Note that not more than 3% of the pipes of a cooling element should be plugged. Re-install inlet/outlet water channel and return water channel. 1 Plug 2 Upper tube sheet 3 Cooler tube 4 Lower tube sheet  **Fig. 1: Plugging a Defective Cooler Tube**
High Cold-Air Temperature	
· The cause will be usually a fouled cooler.	A rise of the cooling water temperature will require a higher cooling water flow for removal of the loss heat. The cooling water flow should be increased. If this measure is not successful, the cooler may be contaminated and should be cleaned on its water side. Reduce the generator load and clean the cooler. If the results of cleaning on water side are not acceptable the cleaning of the cooler on its air side is required. To do this, shut down generator and remove cooler. Prior to performing such work, the vents on cooler gaskets should be checked. When a disturbed heat removal capacity of the coolers is detected during operation, pay attention to proper venting of the coolers.

Also refer to the specific instructions on installation, maintenance and operation for cooler and cooler cover.

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