Self-regulating alternators

ECO47-49 MV-HV

Installation, Use and Maintenance Manual

Translation of the original instructions

Document code: MAOMAPPA022-GB

Revision: 0

Date: 03/17/2020

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1 General Information

This instruction manual is an integral part of the Self-regulating alternators ECO47-49 MV-HV, successively also defined as "machine" or "product" and must always be available for consultation by users.

1.1 Responsibility of the user

- The product to which this documentation refers is envisioned for use by personnel instructed in its use. Such instruction must impart sufficient knowledge of the machine and the installation, maintenance and manoeuvre operations required during use to ensure operation in conditions of complete safety.
- All personnel trained to operate with the machine must read this manual carefully in all its parts and thoroughly understand its content.
- It is very important that personnel be informed of the importance of safety, the use of Personal Protective Equipment and the general safety rules required to ensure the protection of personnel, the machine, and the surrounding environment.
- Only the correct use of the machine in accordance with the instructions provided can ensure long-term, efficacious operation in complete safety for the operators and the machine itself.
-

1.2 Warranty

The following conditions invalidate the terms of Warranty provided by Mecc Alte S.p.a.:

- Inappropriate use, or in other words, the use of the machine other than as described in Point *2.1 Intended Use*.
- Use by unauthorised or untrained personnel.
- Partial or total failure to comply with these instructions.
- Defective electric power supply.
- Inadequate maintenance, incorrect maintenance, or maintenance performed by untrained personnel.
- Pollution from outside the machine.
- Unauthorised modifications or repairs.
- Use of unauthorised spare parts.
- Unforeseeable circumstances such as earthquakes, flood or fire (whenever not directly caused by the machine).

1.3 After-sales assistance

After commissioning of the Self-regulating alternators, the Mecc Alte S.p.a. after-sales assistance can be contacted for questions regarding the following:

- Problems during operation
- The supply of spare parts
- Inspections and repair operations

1.3.1 Information required to obtain after-sales assistance

Whenever Mecc Alte S.p.a. after-sales assistance is required, the following data must be provided regarding the Self-regulating alternators (see also *1.5 Machine identification details*):

- Type and model of the alternator.
- Description of the problem and parts involved.

1.4 Addressees of the manual

This Installation, Use and Maintenance manual has been prepared for all authorised users qualified for the operations and maintenance of the machine.

All such users must carefully read and comprehend the contents of this manual. Such content must be respected during all operations with the machine.

This manual specifies which users must perform certain types of operation. Refer to paragraph *2.3.1 Users and their roles* for the definition of the types of user and their tasks.

The following points must also be considered:

- This manual is an integral part of the machine to which it refers and must be preserved for the latter's entire working life.
- In case of transfer or sale of the machine, this manual and all its related or enclosed documentation must be delivered together with the machine.

1.5 Machine identification details

These instructions refer to the following Self-regulating alternators models:

Name:	Self-regulating alternators
Models:	ECO47-49 MV-HV

An identification plate listing its main characteristics has been applied to the machine. See also *1.5.1 Description of the product code*.

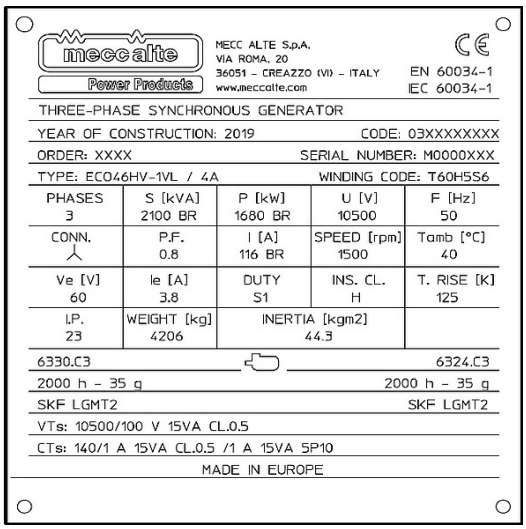

Figure 1- Data plate example

Phases	Number of phases	I [A]	Rated current
S [kVA]	Apparent power	SPEED [rpm]	Rated speed
P [kW]	Active power	Ie [A]	Excitation current
U [V]	Nominal voltage	DUTY	Duty cycle
F [Hz]	Frequency	INS. CL.	Class of isolation
Ue [V]	Excitation voltage	T RISE [K]	Temperature rise
CONN.	Type of connection, Star or Delta	IP	Class of protection
P.F.	Power factor	WEIGHT [kg]	Weight
INERTIA [kgm^2]	Moment of inertia		

Table 1 - Generator plate data

The lubrication intervals of the bearings , type of lubricant and if measurement transformers are present are indicated on the lower part of the plate.

1.5.1 Description of the product code

Every alternator is identified by a unique code made up as described below.

Code example: ECO47HV-1L/4A T60H5S6

Description:

ECO47	Type of alternator	ECO47 ECO49	
HV	Voltage range	HV: > 7.2 kV MV: >= 1 kV LV: < 1kV	
1L	Alternator model. Identifies the work power in class H	**ECO47** 1M 2M 1L	**ECO49** L VL XL
4	Number of poles		
A	Current version of the machine		
T60H5S6	Winding code	See *Table 3 - Winding code*	

Table 2 - Description of the product code

N°. phases	Terminals	Voltage	Frequency	Connections	Winding pitch
T = Three-phase S = Single phase M = Multiphase D = DC	0 = 12 6 = 6 4 = 4 2 = 2	40 = 400 V 41 = 415 V 38 = 380 V 69 = 690 V 01 = 10 ÷ 20 V 02 = 20 ÷ 30 V 3M = 3,000 V 4M = 3.3 ÷ 3.5 kV 6M = 6,000 V 7M = 6.3 ÷ 6.6 V 0H = 10 ÷ 11kV 1H = 11.5 ÷ 12 kV 2H = 11.4 kV	5 = 50 Hz 6 = 60 Hz 4 = 400 Hz S = Special V = Variable	S = Series star P = Parallel star D = Delta A = Parallel delta Z = Zig zag B = Special	3 = 2/3 6 = 5/6

Table 3 - Winding code

1.6 CE certificate

The machines to which reference is made in this manual are compliant with the Directives in force. The original CE certificate is included in the attached documentation supplied on delivery. Also see the *1.8 Structure of documentation* chapter.

1.7 Manufacturer's identification details

Below find the information of the manufacturer:

Mecc Alte S.p.a. with sole shareholder

Registered office: Via Roma, 20 - 36051 Creazzo (VI)

Tel. +39-0444-1831295 - Fax +39-0444-1831306

www.meccalte.com - e-mail: info@meccalte.it

Tax identification code and VAT code n. 01267440244

1.8 Structure of documentation

1.8.1 Composition of the documentation

The machine documentation is comprised of:

- This document, known as Installation, Use and Maintenance manual:

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- The set of enclosed documents listed in *10.1 Diagrams and drawings* and *10.2 Components documentation*.

Contact Mecc Alte S.p.a. if in doubt regarding the structure and use of such documentation.

1.8.2 Content of the manual

This manual and its enclosed documentation enclosed provide information on the following aspects.

General information and safety information are contained in the following chapters:

1 General Information

2 Safety

Description of the machine and the operation of its composite parts, transport and installation methods, and methods of use:

3 Description and features

4 Transport and installation

5 Operation

Maintenance and troubleshooting for machine operation and spare parts:

6 Maintenance

7 Troubleshooting

8 Spare parts

Instructions necessary for the interruption of the service, the disposal of the machine and its storage:

9 Decommissioning, Dismantling and Disposal

Lists of enclosed documentation, such as diagrams, drawings and documentation for the components installed:

10 Enclosed documentation

1.9 Symbols and conventions used in this manual

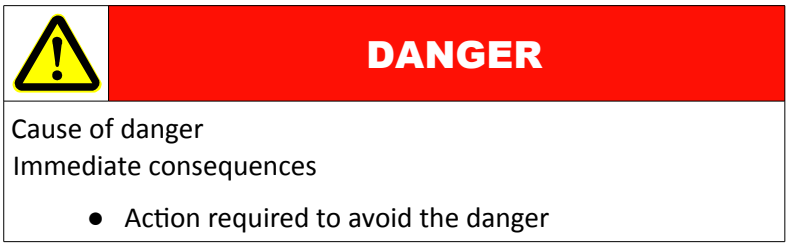
Several conventions are used in this manual to provide the necessary information. The conventions used are explained below.

1.9.1 Definition of warning levels

Notices containing warnings and explanations are used to warn users of potential dangers or draw attention to particularly dangerous or risky operations.

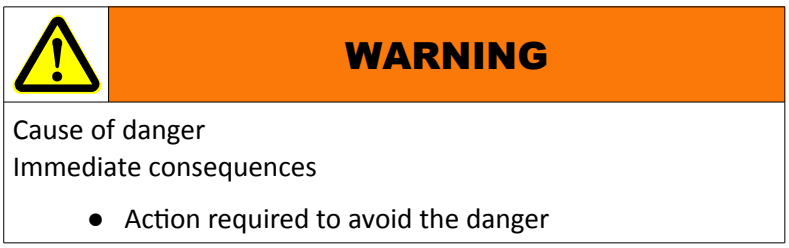
Danger

A notice of this type identifies a situation of immediate danger, which if not avoided, will produce immediate consequences such as serious injury or even death to personnel.



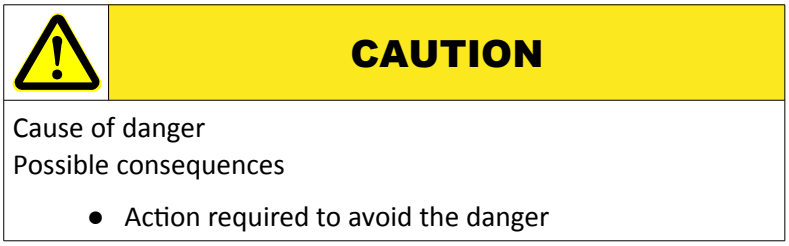
Warning

A notice of this type identifies a situation of potential danger, which if not avoided, could produce immediate consequences such as serious injury or even death to personnel.



Caution with danger symbol

Notices of this type identify a situation of potential danger, which if not avoided, could produce consequences such as injury or damage to property.



Notice

Notices of this type identify a situation of potential danger, which if not avoided, could produce damage to property.

NOTICE
Cause of danger Possible consequences • Action required to avoid the danger

Note

NOTE

This notice provides useful information regarding the safe and efficacious use of the machine.

1.9.2 Conventions used in the text

Texts preceded by one of the following symbols:

➔ Text preceded by this symbol indicates an action to be taken.

✔ Text preceded by this symbol describes the requisites that must be met before an action can be taken.

➢ Text preceded by this symbol describes the result achieved after one or more actions have been taken.

✗ Text preceded by this symbol indicates a particular condition that may occur. This is followed by a description of how to proceed whenever such condition occurs.

Every operation to be performed in a certain order is indicated by the corresponding order number:

1- first operation

2- second operation

3- third operation

A generic list of components is indicated as follows:

- Component on list
- Component on list
- Component on list

2 Safety

2.1 Intended Use

The Self-regulating alternators ECO47-49 MV-HV are brushless synchronous alternators used for the production of continuous electric energy or in the case of an emergency.

The use for purposes other than those indicated or to obtain production values higher than the limits prescribed will be considered “inappropriate use”.

2.2 Importance of the manual

This manual provides information and technical data regarding the Self-regulating alternators ECO47-49 MV-HV.

The manual enables users and technicians to intervene with accuracy and maximum safety in all routine maintenance operations.

This manual is an integral part of the supply of which this machine is a part and must therefore be carefully kept in easy reach for consultation whenever required in any moment for the operation and maintenance of the machine.

2.3 Responsibility of the user

- The end user of the machine is responsible for setting up all protections necessary, such as isolating devices, protection against direct and indirect contact, protections against over-currents and over voltages, emergency stop devices, at the place of installation of the machine.
- The plant in which the machine is installed must be compliant with regulations in force in the country of installation.
- Prior to commissioning the machine, the user must have first carefully read this manual and the necessary enclosures and have acquired detailed knowledge of its technical specifications and controls.
- All maintenance operations and control must be performed solely by technical personnel trained for the purpose.
- If in doubt or you have problems understanding this manual or any of its parts, we recommend contacting Mecc Alte S.p.a.
- Contact Mecc Alte S.p.a. exclusively for any type of technical assistance required.

2.3.1 Users and their roles

In order to ensure the maximum safety, only personnel with certain requisites can work on the Self-regulating alternators ECO47-49 MV-HV.

All personnel assigned to operations on the machine are referred to as Users.

Users are divided into different classes on the basis of the different tasks to be performed and the different abilities required.

Operator at the lifting devices

The operator at the lifting devices is an educated and skilled person, assigned to lifting manoeuvres and moving loads using lifting devices and means.

This user is the only person authorised for loading, unloading and moving operations using means such as cranes, hoists, overhead cranes, lifting trucks or others, including devices necessary such as ropes, chains and straps for lifting.

Machine operator

The machine operator is a person designated by the company that has purchased the alternator.

The machine operator must be provided with technical instruction, be professionally trained in his specific sector, such as an electrician, mechanic or fitter and also be instructed in the use of this machine.

Service technician

The Service technician is a person designated by the company that has purchased the alternator or by the company that manages the plant in which the alternator operates.

The Service technician must be provided with technical instruction, be professionally trained in his specific sector, such as an electrician, mechanic or fitter and also be instructed in the maintenance operations to be performed on the machine.

After-sales Service technician

The Mecc Alte S.p.a. After-sales Service Technician is an appropriately trained and authorised person who responds directly to Mecc Alte S.p.a. and is capable of performing maintenance and repair operations on the machine.

2.4 Safety rules

The Self-regulating alternators ECO47-49 MV-HV have been manufactured in compliance with current Safety Standards. In spite of this, during operation several regulations must be complied with, in order to ensure safe operation for the users, the surrounding environment and the machine itself. Read the following safety rules carefully before proceeding with any operation on the machine.

- Use the machine only if it is in perfect working order, making sure all the instructions provided in this manual are respected and never exceeding the operating limits prescribed therein.
- Keep this manual in an accessible place for the operator at all times, for quick consultation when doubts may arise regarding operation.
- Avoid any action or type of behaviour that may compromise the operation of the machine or pose a risk to personnel or property.
- Every user must be provided with the PPE necessary, according to the operations to perform.
- In case of malfunction, stop the machine in any of the ways foreseen and have the cause of malfunction eliminated only by specialised personnel trained for the purpose.
- Whenever doubts arise in regard to operation, do not intervene directly but contact the manufacturer Mecc Alte S.p.a.
- In addition to the product documentation enclosed with the machine, also respect the standards and regulations in force governing accident prevention and safety in the workplace.

2.5 Residual risks

The Self-regulating alternators have been manufactured in compliance with current safety criteria. In spite of this, residual risks linked to their operation remain that may cause injury to personnel or damage to property in particular cases.

DANGER

Moving mechanical parts.
Risk of crushing, dragging or entrapment.

- Remain at a safe distance from all moving generator parts.

CAUTION

Parts of the alternator at high temperature.
Burns hazard during contact with very hot surfaces.

- Wear protective gloves before coming into contact with the overheated machine parts.

NOTICE

Presence of magnetic fields in proximity of the alternator during operation.
Possibility of damage to magnetic medium or equipment sensitive to magnetic fields.

- Do not introduce equipment or objects that are sensitive to magnetic fields in the vicinity of the alternator.

The general safety and accident-prevention regulations must be respected and the Personal Protection Equipment provided must be worn at all times.

3 Description and features

3.1 Description of the Self-regulating alternators ECO47-49 MV-HV

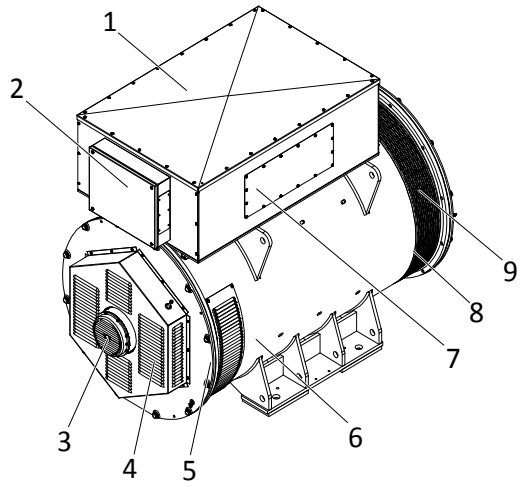


Figure 2- Alternators ECO47

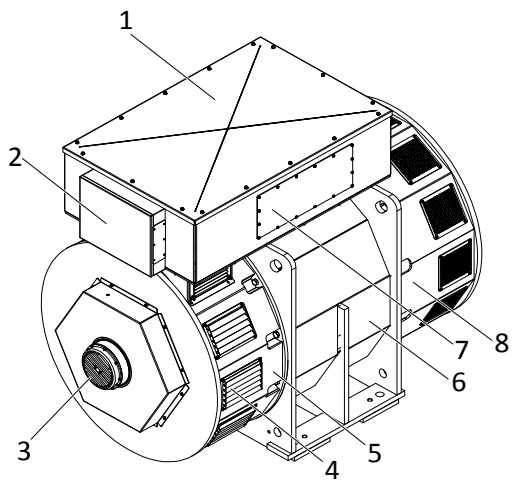


Figure 3- Alternators ECO49

1- Terminal boxes
2- Aux. box
3- PMG (permanent magnet alternator)
4- Alternator cooling air inlet
5- NDE shield
6- Casing
7- Cables passage aperture in non-magnetic material.
8- DE shield
9- Protection grid

The Self-regulating alternators ECO47-49 MV-HV are brushless synchronous alternators used for the production of continuous electric energy or in the case of an emergency.

They have a rotating inducer with damping cage and stationary armature with skewed slots. The windings are short pitch in order to reduce the harmonic content.

The alternators are manufactured in compliance with the directives in force and relative amendments. The electromagnetic compatibility tests have been performed in the conditions prescribed by the regulations.

Executions in agreement with other specifications can be performed on customer request.

The mechanical construction gives good access to the connections and allows easy inspection of the various components.

The shaft is in C45 steel with lock-set fan. The protection rating is IP23.

Isolations are performed in class H with impregnation in epoxy resin and vacuum-treated high-voltage parts, such as the stators (special treatments are available on request).

3.1.1 DER2 voltage regulator

The DER2 is a voltage regulator for synchronous alternators, set-up for operation and calibration in stand-alone mode. The regulator functions along with a monitoring unit, which allows programming and display of all DER2 functional parameters via the USB port mounted on the board.

Refer also to the DER 2 Regulator documentation, see *10 Enclosed documentation*.

3.1.2 Temperature probes

Two PT100 temperature probes are mounted on every phase of the alternator winding. To set the alarm and stop temperatures, refer to *4.4.5 Setting the alarm and stop temperature*.

3.2 Components available on request

3.2.1 Heat exchangers

The alternator can be combined with a heat exchanger, which has the purpose of cooling the stator and rotor windings.

Refer to the documentation of the heat exchanger manufacturer (see *10 Enclosed documentation*).

3.2.2 Measurement and protection sensors

The standard supply of the generators envisions a voltage transformer (TV) and a current transformer (TA). Other sensors can be supplied on customer request.

The current transformers supply a current on the secondary that is proportional to the current circulating in the primary. They have 15 VA performance, class 0.5 FS10 for the measurement sensors or 5P10 for the protection sensors (or differential protection). They can be single or double secondary winding.

The voltage transformers supply a voltage on the secondary that is proportional to the voltage in the primary. They have 15 VA performance, class 0.5 FS10 for the measurement sensors, or 3 P for the protection sensors. They can be single or double secondary winding.

3.2.3 Anti-condensation heaters

The anti-condensation heaters are installed in the alternator stator case. They prevent the formation of condensate inside the alternator when the machine is at a standstill.

3.2.4 Additional temperature probes

A temperature probe can be mounted on each bearing on the alternator. To set the alarm and stop temperatures, refer to *4.4.5 Setting the alarm and stop temperature*.

3.3 Technical features

Below find the technical features of the Self-regulating alternators. Refer also to the alternator Test Report, see *10 Enclosed documentation.*

3.3.1 Alternator electric data

Refer to the data plate fixed to the machine (see Figure 1-)

3.3.2 Alignment with the motor

Alignment tolerances of the alternator with the prime engine.

Alternators coupling single support

Alternator	SAE	L (mm)
ECO47	18	15.7
	21	0
ECO49	18	15.7
	21	0

Table 4 - Alignment - Individual support

Alternators coupling dual support

Refer also to Figure 11- and Figure 12- on page 34.

RPM	Radial tolerance (mm)	Angular tolerance (mm/100 mm)
1,500	0.06	0.05
1,800	0.05	0.05

Table 5 - Alignment - Dual support

3.3.3 Noise in dB (A)

Alternator	50 Hz		60 Hz	
	1 m	7 m	1 m	7 m
ECO47	103	91	107	95
ECO49	105	93	109	97

Table 6 - Noise

3.3.4 Volume of air required (m^3/min)

Alternator	50 Hz	60 Hz
ECO47 4A	300	360
ECO49 4A	250	300

Table 7 - Volume of air required

3.3.5 Installation altitude

The performance of the alternator is affected by the installation altitude and the temperature. Refer to the following table.

	Environment temperature °C					
Altitude m	**22**	**40**	**45**	**50**	**55**	**60**
<= 1,000	1.07	1	0.96	0.93	0.91	0.89
> 1,000 <= 1,500	1.01	0.96	0.92	0.89	0.87	0.84
> 1,500 <= 2,000	0.96	0.91	0.87	0.84	0.83	0.79
> 2,000 <= 3,000	0.9	0.85	0.81	0.78	0.76	0.73

Table 8 - Derating coefficient

3.3.6 Resistance of the windings

ECO47

Type	Voltages	Pitch	Alternator		PMG	Exciter	
			PHASE-PHASE stator [mΩ] ±5%	Rotor [Ω] ±5%	50Hz / 60Hz [Ω] ±5%	Stator [Ω] ±5%	PHASE-PHASE rotor [mΩ] ±5%
ECO47MV 1M4 A	3	2/3	19,3	1,23	1.5 / 1.3	12.9	43
ECO47MV 2M4 A	3	2/3	15,8	1,34	1.5 / 1.3	12.9	43
ECO47MV 1L4 A	3	2/3	12,4	1,46	1.5 / 1.3	12.9	43
ECO47MV 1M4 A	3	5/6	16,1	1,23	1.5 / 1.3	12.9	43
ECO47MV 2M4 A	3	5/6	12,6	1,34	1.5 / 1.3	12.9	43
ECO47MV 1L4 A	3	5/6	13,4	1,46	1.5 / 1.3	12.9	43
ECO47MV 1M4 A	3.3 / 3.5	2/3	24,3	1,23	1.5 / 1.3	12.9	43
ECO47MV 2M4 A	3.3 / 3.5	2/3	20,6	1,34	1.5 / 1.3	12.9	43
ECO47MV 1L4 A	3.3 / 3.5	2/3	16,9	1,46	1.5 / 1.3	12.9	43
ECO47MV 1M4 A	3.3 / 3.5	5/6	20,9	1,23	1.5 / 1.3	12.9	43
ECO47MV 2M4 A	3.3 / 3.5	5/6	17,1	1,34	1.5 / 1.3	12.9	43
ECO47MV 1L4 A	3.3 / 3.5	5/6	13,4	1,46	1.5 / 1.3	12.9	43
ECO47MV 1M4 A	6	2/3	74,7	1,23	1.5 / 1.3	12.9	43
ECO47MV 2M4 A	6	2/3	63,2	1,34	1.5 / 1.3	12.9	43
ECO47MV 1L4 A	6	2/3	45,9	1,46	1.5 / 1.3	12.9	43
ECO47MV 1M4 A	6	5/6	64,3	1,23	1.5 / 1.3	12.9	43
ECO47MV 2M4 A	6	5/6	57,1	1,34	1.5 / 1.3	12.9	43
ECO47MV 1L4 A	6	5/6	40,6	1,46	1.5 / 1.3	12.9	43
ECO47MV 1M4 A	6.3 / 6.6	2/3	93,5	1,23	1.5 / 1.3	12.9	43
ECO47MV 2M4 A	6.3 / 6.6	2/3	80	1,34	1.5 / 1.3	12.9	43
ECO47MV 1L4 A	6.3 / 6.6	2/3	67,8	1,46	1.5 / 1.3	12.9	43
ECO47MV 1M4 A	6.3 / 6.6	5/6	81,3	1,23	1.5 / 1.3	12.9	43
ECO47MV 2M4 A	6.3 / 6.6	5/6	68,5	1,34	1.5 / 1.3	12.9	43
ECO47MV 1L4 A	6.3 / 6.6	5/6	49,5	1,46	1.5 / 1.3	12.9	43
ECO47HV 1M4 A	11.4	2/3	256,3	1,23	1.5 / 1.3	12.9	43
ECO47HV 2M4 A	11.4	2/3	225,8	1,34	1.5 / 1.3	12.9	43
ECO47HV 1L4 A	11.4	2/3	156,7	1,46	1.5 / 1.3	12.9	43
ECO47HV 1M4 A	11.4	5/6	229,2	1,23	1.5 / 1.3	12.9	43
ECO47HV 2M4 A	11.4	5/6	158,9	1,34	1.5 / 1.3	12.9	43
ECO47HV 1L4 A	11.4	5/6	137,1	1,46	1.5 / 1.3	12.9	43
ECO47HV 1M4 A	10/10.5/11	2/3	329,6	1,23	1.5 / 1.3	12.9	43

Type	Voltages	Pitch	Alternator		PMG	Exciter	
			PHASE-PHASE stator [mΩ] ±5%	Rotor [Ω] ±5%	50Hz / 60Hz [Ω] ±5%	Stator [Ω] ±5%	PHASE-PHASE rotor [mΩ] ±5%
ECO47HV 2M4 A	10/10.5/11	2/3	274,1	1,34	1.5 / 1.3	12.9	43
ECO47HV 1L4 A	10/10.5/11	2/3	242,2	1,46	1.5 / 1.3	12.9	43
ECO47HV 1M4 A	10/10.5/11	5/6	334,9	1,23	1.5 / 1.3	12.9	43
ECO47HV 2M4 A	10/10.5/11	5/6	244,5	1,34	1.5 / 1.3	12.9	43
ECO47HV 1L4 A	10/10.5/11	5/6	209,3	1,46	1.5 / 1.3	12.9	43
ECO47HV 1M4 A	11.5/12	2/3	393,8	1,23	1.5 / 1.3	12.9	43
ECO47HV 2M4 A	11.5/12	2/3	352,9	1,34	1.5 / 1.3	12.9	43
ECO47HV 1L4 A	11.5/12	2/3	293,9	1,46	1.5 / 1.3	12.9	43
ECO47HV 1M4 A	11.5/12	5/6	358,8	1,23	1.5 / 1.3	12.9	43
ECO47HV 2M4 A	11.5/12	5/6	296,7	1,34	1.5 / 1.3	12.9	43
ECO47HV 1L4 A	11.5/12	5/6	260,9	1,46	1.5 / 1.3	12.9	43

Table 9 - Resistance of the windings at room temperature 20 °C - Alternators ECO47

ECO49

Type	Voltages	Pitch	Alternator		PMG	Exciter	
			PHASE-PHASE stator [mΩ] ±5%	Rotor [Ω] ±5%	50Hz / 60Hz [Ω] ±5%	Stator [Ω] ±5%	PHASE-PHASE rotor [mΩ] ±5%
ECO49MV L4 A	3	2/3	7,4	1.69	1.34 / 1.12	11.4	95.0
ECO49MV VL4 A	3	2/3	7,8	1.83	1.34 / 1.12	11.4	95.0
ECO49MV XL4 A	3	2/3	5,6	1.98	1.34 / 1.12	11.4	95.0
ECO49MV L4 A	3	5/6	8,1	1.69	1.34 / 1.12	11.4	95.0
ECO49MV VL4 A	3	5/6	8,4	1.83	1.34 / 1.12	11.4	95.0
ECO49MV XL4 A	3	5/6	5,9	1.98	1.34 / 1.12	11.4	95.0
ECO49MV L4 A	3.3 / 3.5	2/3	9,6	1.69	1.34 / 1.12	11.4	95.0
ECO49MV VL4 A	3.3 / 3.5	2/3	7,8	1.83	1.34 / 1.12	11.4	95.0
ECO49MV XL4 A	3.3 / 3.5	2/3	8,3	1.98	1.34 / 1.12	11.4	95.0
ECO49MV L4 A	3.3 / 3.5	5/6	10,5	1.69	1.34 / 1.12	11.4	95.0
ECO49MV VL4 A	3.3 / 3.5	5/6	8,4	1.83	1.34 / 1.12	11.4	95.0
ECO49MV XL4 A	3.3 / 3.5	5/6	8,9	1.98	1.34 / 1.12	11.4	95.0
ECO49MV L4 A	6	2/3	35,7	1.69	1.34 / 1.12	11.4	95.0
ECO49MV VL4 A	6	2/3	31,3	1.83	1.34 / 1.12	11.4	95.0
ECO49MV XL4 A	6	2/3	27,4	1.98	1.34 / 1.12	11.4	95.0
ECO49MV L4 A	6	5/6	52,1	1.69	1.34 / 1.12	11.4	95.0

Type	Voltages	Pitch	Alternator		PMG	Exciter	
			PHASE-PHASE stator [mΩ] ±5%	Rotor [Ω] ±5%	50Hz / 60Hz [Ω] ±5%	Stator [Ω] ±5%	PHASE-PHASE rotor [mΩ] ±5%
ECO49MV VL4 A	6	5/6	27,8	1.83	1.34 / 1.12	11.4	95.0
ECO49MV XL4 A	6	5/6	39,1	1.98	1.34 / 1.12	11.4	95.0
ECO49MV L4 A	6.3 / 6.6	2/3	38,5	1.69	1.34 / 1.12	11.4	95.0
ECO49MV VL4 A	6.3 / 6.6	2/3	37,9	1.83	1.34 / 1.12	11.4	95.0
ECO49MV XL4 A	6.3 / 6.6	2/3	27,4	1.98	1.34 / 1.12	11.4	95.0
ECO49MV L4 A	6.3 / 6.6	5/6	38,9	1.69	1.34 / 1.12	11.4	95.0
ECO49MV VL4 A	6.3 / 6.6	5/6	27,8	1.83	1.34 / 1.12	11.4	95.0
ECO49MV XL4 A	6.3 / 6.6	5/6	23,9	1.98	1.34 / 1.12	11.4	95.0
ECO49HV L4 A	11.4	2/3	109,9	1.69	1.34 / 1.12	11.4	95.0
ECO49HV VL4 A	11.4	2/3	93,9	1.83	1.34 / 1.12	11.4	95.0
ECO49HV XL4 A	11.4	2/3	79,1	1.98	1.34 / 1.12	11.4	95.0
ECO49HV L4 A	11.4	5/6	96,1	1.69	1.34 / 1.12	11.4	95.0
ECO49HV VL4 A	11.4	5/6	101,6	1.83	1.34 / 1.12	11.4	95.0
ECO49HV XL4 A	11.4	5/6	85,1	1.98	1.34 / 1.12	11.4	95.0
ECO49HV L4 A	10/10.5/11	2/3	109,9	1.69	1.34 / 1.12	11.4	95.0
ECO49HV VL4 A	10/10.5/11	2/3	93,9	1.83	1.34 / 1.12	11.4	95.0
ECO49HV XL4 A	10/10.5/11	2/3	79,1	1.98	1.34 / 1.12	11.4	95.0
ECO49HV L4 A	10/10.5/11	5/6	119,5	1.69	1.34 / 1.12	11.4	95.0
ECO49HV VL4 A	10/10.5/11	5/6	146,7	1.83	1.34 / 1.12	11.4	95.0
ECO49HV XL4 A	10/10.5/11	5/6	126,5	1.98	1.34 / 1.12	11.4	95.0
ECO49HV L4 A	11.5/12	2/3	164,9	1.69	1.34 / 1.12	11.4	95.0
ECO49HV VL4 A	11.5/12	2/3	116,9	1.83	1.34 / 1.12	11.4	95.0
ECO49HV XL4 A	11.5/12	2/3	100,1	1.98	1.34 / 1.12	11.4	95.0
ECO49HV L4 A	11.5/12	5/6	179,3	1.69	1.34 / 1.12	11.4	95.0
ECO49HV VL4 A	11.5/12	5/6	126,5	1.83	1.34 / 1.12	11.4	95.0
ECO49HV XL4 A	11.5/12	5/6	107,8	1.98	1.34 / 1.12	11.4	95.0

Table 10 - Resistance of the windings at room temperature 20°C - Alternators ECO49

3.3.7 Clearance and weights

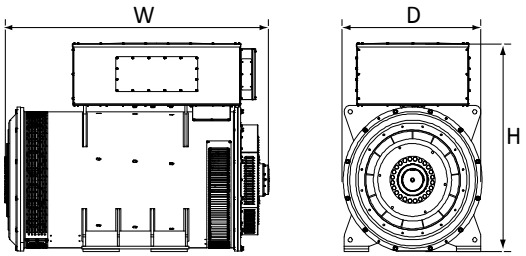


Figure 4- ECO47 - 1 bearing

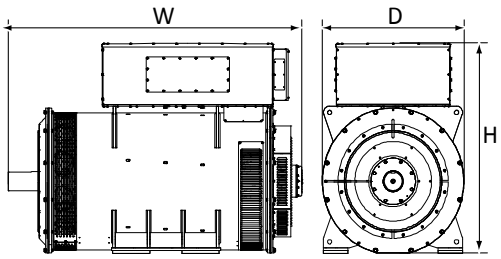


Figure 5- ECO47 - 2 bearings

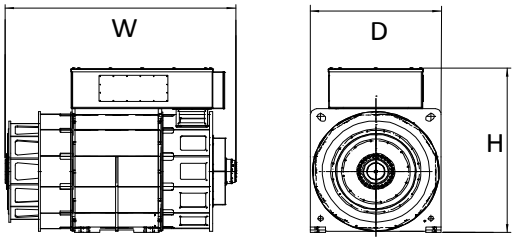


Figure 6- ECO49 - 1 bearing

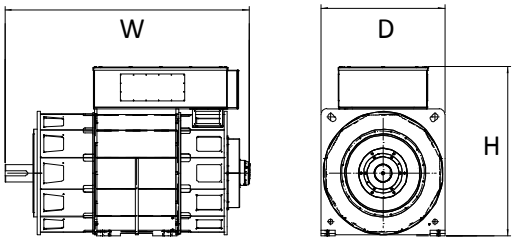


Figure 7- ECO49 - 2 bearings

ECO47					ECO49				
mm	**W**	**H**	**D**	**Weight kg**	**mm**	**W**	**H**	**D**	**Weight kg**
1M	2,374 *2,174*	1,634 *1,634*	1,140 *1,140*	6,400	L	2,355 *2,625*	1,704 *1,704*	1,280 *1,280*	9,100
2M	2,374 *2,174*	1,634 *1,634*	1,140 *1,140*	7,000	VL	2,455 *2,725*	1,704 *1,704*	1,280 *1,280*	9,450
1L	2,487 *2,287*	1,634 *1,634*	1,140 *1,140*	7,700	XL	2,565 *2,835*	1,704 *1,704*	1,280 *1,280*	9,700

Table 11 - Clearance and weights

1 bearing

2 bearings

4 Transport and installation

4.1 Transport

Barring other agreements between Mecc Alte S.p.a. and the customer, the transport of the components necessary for the machine and all other complementary equipment required for operation is the responsibility of Mecc Alte S.p.a.

Transport must be performed using suitable means and in compliance with the regulations in force.

4.1.1 Packaging

The alternators are transported in the following way:

1- Using a wooden pallet (Figure 8-)

The generators are fixed to the pallet using screws (2) and fastened to the loading deck of the means of transport by ropes or straps fixed to the 4 points (1) indicated.

NOTE

Do not fix cords or straps to the painted surface of the alternator. Use the holes envisioned (1) in order not to use the external finish.

2- By means of a pallet covered with a wooden crate in the case of shipping by sea (Figure 9-).

In the single support alternators, the rotor is fixed using relevant support equipment.

NOTICE

The rotor can slip during handling if not withheld by the support equipment.
Possible damage to the rotor.

- Do not remove the rotor support equipment before handling.

4.1.2 Lifting and handling

Responsibility: Operator at the lifting devices

Prerequisites: The following must be available:

- Suitable lifting equipment such as a crane, hoist, lifting truck or trans-pallet.
- Cables, chains, clevis, eyebolts as required

DANGER

Beware of suspended loads.
Risk of death due to crushing by falling loads following release or breakage of lifting ropes or hooks.

- Never stand or transit beneath suspended loads.
- Always check to make sure that the lifting ropes, eyebolts and all the other lifting equipment is in perfect working order.
- It is mandatory to ensure that the devices to be used are suitable to support the loads to be lifted.

➔ Lift the alternators using the relevant lifting points (1).

➔ Handle as shown in Figure 8- and Figure 9- .

The lifting truck forks must be inserted in the points indicated by the arrows.

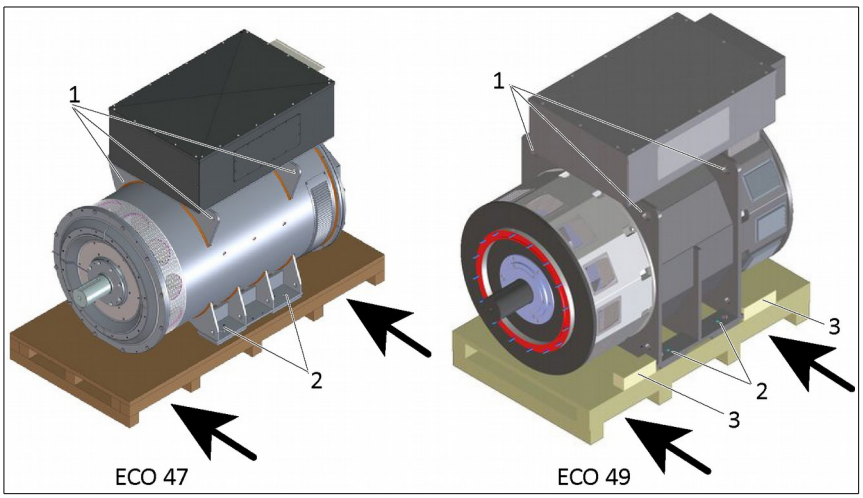


Figure 8- Transport on pallet

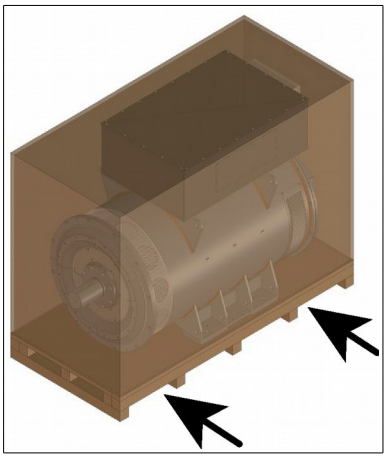


Figure 9- Transport on pallet covered with crate

NOTE

Lifting devices such as ropes or straps can damage the alternators terminal board box if the fixing angle is too acute.
Make sure that the lifting devices do not touch the terminal board box during operations.

NOTICE

Once coupled, the alternator cannot be lifted with the prime motor.
Possibility of damage to the alternator and the prime engine coupled.

- Do not use the eyebolts provided to lift the coupled alternator.
- Lift the assembly using the specific means envisioned.

4.1.3 Storage

Store the alternators in a closed, cool, dry place without vibrations.

NOTE

After long periods of storage or in the presence of traces of humidity, check the status of isolation (see 4.1.4 Measuring the insulation resistance).

In the case of storage longer than three months, refer to *9.3 Storage*

4.1.4 Measuring the insulation resistance

If the alternator has been inactive for a period exceeding two months, the insulation resistance of the alternator main stator to earth must be measured. The measurement must be made in compliance with the IEEE 43-2000 Standard.

Take the measurement as indicated in *6.3 Measuring the insulation resistance.*

4.2 Checking the supply

At the moment of delivery of the machine components and everything else agreed, the customer must make sure that everything specified in the contractual terms has been effectively delivered and is perfectly integral.

Mecc Alte S.p.a. will not accept any subsequent claims in regard.

4.3 Characteristics of the installation site

The Self-regulating alternators ECO47-49 MV-HV must be installed in an environment that has the following features:

- Closed environment protected from atmospheric agents;
- Temperature between 5 °C and 40 °C;
- Installation altitude (see also *3.3.5 Installation altitude*): < 1,000 m;
- The support surface must be well levelled.

Respect also the following conditions.

- Install the alternator leaving sufficient space to perform maintenance;
- Make sure that the cooling air inlets and vents are always free (check the volumes of air required in *3.3.4 Volume of air required (m3/min)*);
- The inlet side must not be near heat sources. In all cases, unless specifically agreed, the temperature of the cooling air must be that of the environment and however not over 40 °C. The alternator can work at higher temperatures with appropriate derating (*3.3.5 Installation altitude*).

4.4 Installation

Responsibility: Service technician

Prerequisites: All components necessary are available and ready for installation; the equipment necessary for installation

- Make sure that the base onto which the alternator is fixed is stable and able to support the weight.
- Before installation, check that the data indicated on the alternator plate are suitable for the features of the mains electricity of the service envisioned.
- Measure the insulation resistance of the windings before starting commissioning.
- Make sure that any mechanical blocks present on the alternator for transport, such as blocking clamps or other, have been removed.

4.4.1 Direction of rotation of the alternator

The alternator rotor must turn clockwise, looking at the alternator from the coupling side. Refer to the following figures.

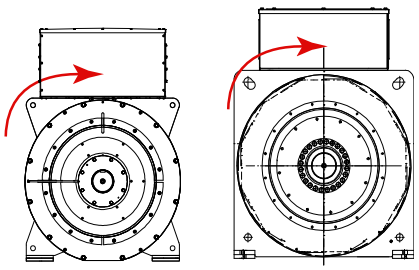


Figure 10- Direction of rotation of the alternators

4.4.2 Coupling the alternator with the prime engine

The Mecc Alte Power Products rotors and alternators comply with the ISO 1940-1 Standard. Any excessive vibrations are to be blamed therefore on the drive engine or incorrect motor-alternator coupling and could lead to damage or breakage of the bearings.

The fitter is responsible for following the regulation regarding assessment and measurement of vibrations on the final machine, in compliance with ISO 8528-9.

The alternators can be coupled with the prime engine as indicated below.

NOTE

Make sure the rotor does not slip. Keep the alternator in the horizontal position.

Coupling with joint - Dual support alternators

- Make sure that the support base where the alternator and the prime engine are installed is able to support the weight and not deform.
- In engine-alternator coupling, respect the assembly tolerances indicated in *3.3.2 Alignment with the motor*.

NOTICE

Possible damage to the shafts or bearing due to misalignment.

- Respect the radial and angular tolerances between the shafts given in *3.3.2 Alignment with the motor*.

➔ Remove the flange protection paint;

✗ If the alternator has been stored for 18 months or more:

➔ Replace the grease in the bearings before commissioning (see *6.4.2 Replacing grease in the bearings*).

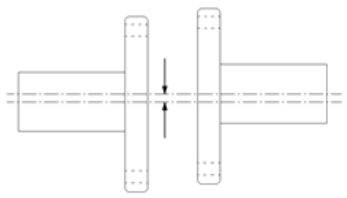


Figure 11- Radial tolerance

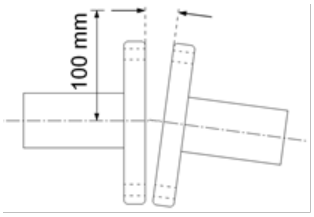


Figure 12- Angular tolerance

Refer to *Table 5 - Alignment - Dual support* on page 23.

Coupling via SAE flange- Single support alternators

This coupling must be performed by the customer and must be made in compliance with the safety regulations in force via an appropriately dimensioned joint. Also comply with the following.

- The alternator with single support requires a solid flat base in a way to perform correct alignment.
- Bending on the alternator coupling flange can cause strong vibrations and, in the worst case, even mechanical breakage. Check the correctness of the L Quota given in *Table 12 - Shaft projection*.

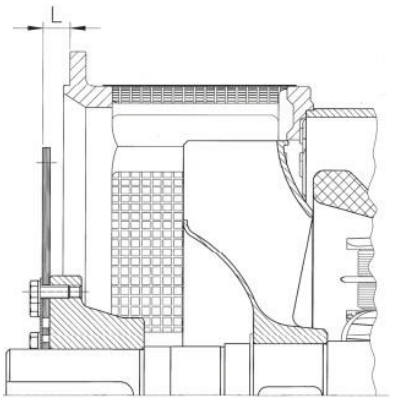


Figure 13- Configuration for coupling with rotor

Type	SAE	L
ECO47 ECO49	18	15.7
	21	0

Table 12 - Shaft projection

Compensation for thermal dilation

Regarding alignment of the cold machine, the alternator and the engine can have different thermal dilation coefficients, which when hot can cause different dimensional changes between these parts. The operating temperatures have a significant effect on the alignment tolerances and must be taken into consideration.

Due to this, during operation the alternator shaft may be in a different position with respect to the condition when cold. Alignment compensation may therefore be necessary and depends on the operating temperature, the type of coupling, the distance between the two machines, etc...

The two types of important thermal dilation to be taken into consideration are the vertical and axial types.

Vertical thermal dilation

This thermal dilation can make the radial tolerance vary and can be calculated using the following formula:

$$\Delta H = \alpha \, \Delta T \, H$$

where:

ΔH = Variation of the height

α = Thermal dilation coefficient (use the value $\alpha = 10 \times 10\text{-}6$ K-1)

ΔT = Difference between the alignment temperature and the operating temperature

H = Axis height

To calculate the variation of radial tolerance, the thermal dilation coefficient of the alternator must be related to that of the engine.

Axial thermal dilation

The axial thermal dilation value can decrease the axial tolerance between two shafts. It is a very important value, since when all the system is at temperature, a very narrow tolerance when cold can lead to an axial force that can burden the bearings, damaging them or breaking them.

It can be calculated using the following formula:

$$\Delta L = \alpha \, \Delta T \, L$$

where:

ΔL = Variation of shaft length

α = Thermal dilation coefficient (use the value $\alpha = 10 \times 10\text{-}6$ K-1)

ΔT = Difference between the alignment temperature and the operating temperature

L = Length of the shaft, calculated between the bearing and the coupling discs with the engine (see Figure 14-)

The variation of axial tolerance must be calculated by confronting the axial thermal dilation of the alternator and that of the engine.

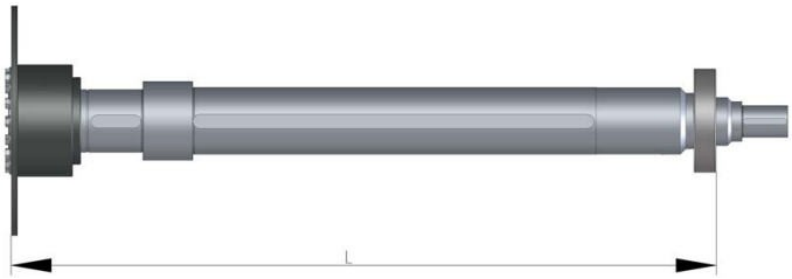


Figure 14- L Quota

4.4.3 Fixing the alternator to the base

	CAUTION
Inaccurate fixing cause operating problems. Possibility of damage to the alternator or the prime engine due to vibrations and movement of the alternator. ● Make sure that the alternator is correctly fixed to the surface. ● Make sure that the alternator and prime engine mounting surface can sustain the weight.	

➔ Fix the alternator to the base using the screws with the dimension indicated:

- ECO47: 4 x M30 (class 8.8)
- ECO49: 4 x M36 (class 8.8)

Respect the correct coupling torque, see *4.5.4 Coupling torques.*

4.4.4 Electric connection

DANGER

Presence of dangerous electric voltage.
Risk of death following electric shocks caused by contact with uncovered electric cables or live parts.

- Remove the voltage before proceeding with the job.
- Always use suitable Individual protection Equipment.

DANGER

Presence of voltage generated by the movement of the alternator engine.
Risk of death caused by electric shocks.

- Block the alternator rotor before making the electric connection.

General indications

- For entry into the terminal box use cable glands and cable ties that comply with the regulations in force in the country of destination. Only use the cables passage aperture in the envisioned non-magnetic material.
- Connect the alternator to earth using a wire with suitable section, using one of the two appropriate terminals present inside the terminal board box or outside the machine (see *Alternator connection to earth* on page 43).
- The power cables for connection to the user must be wired and supported suitably so that they do not cause mechanical stress on the alternator terminal board.
- Refer also to the wiring diagram provided with the alternator, see *10 Enclosed documentation.*
- Consider the coupling torques envisioned, stated in *4.5.4 Coupling torques*.

Terminals box connection

Connect the alternator to the utility, making reference to Figure 15- and Figure 16- .

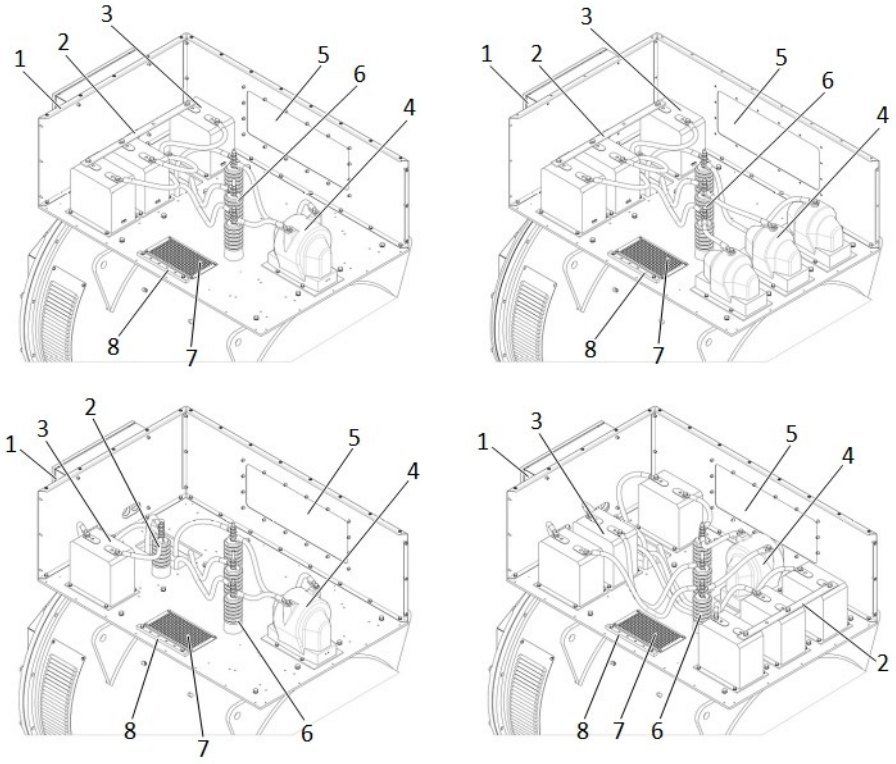


Figure 15- ECO47 terminals box

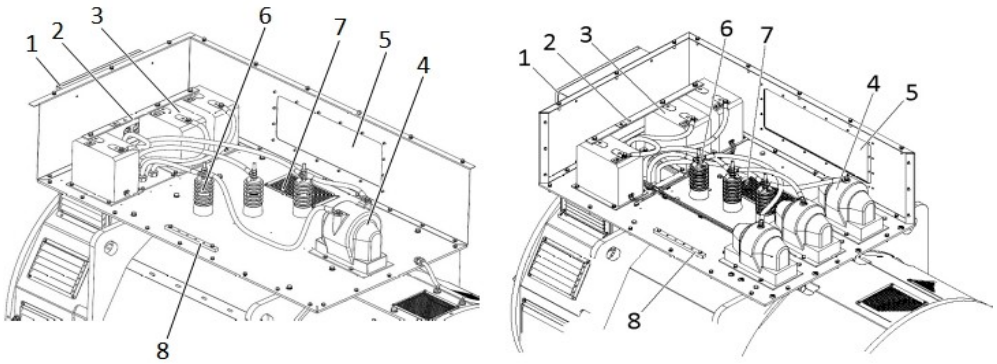


Figure 16- ECO49 terminals box

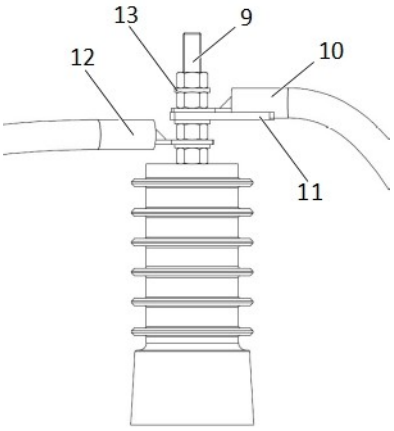


Figure 17- Phases connection terminal

1- Aux. box
2- Valve centre connection
3- Current sensor (TA)
4- Voltage sensor (TV)
5- Cables passage opening
6- Phases connection terminals (U-V-W from left to right in Figure 15- and Figure 16-)
7- Anti-explosion diaphragm
8- Earth connection
9- Brass threaded bar M12 x 110
10- Connection to the voltage sensor
11- Vetronite support
12- Power terminal
13- Isolator

Auxiliaries box connection

Make the connections in the auxiliaries box in compliance with the *Auxiliaries box wiring diagram*, see *10.1 Diagrams and drawings*.

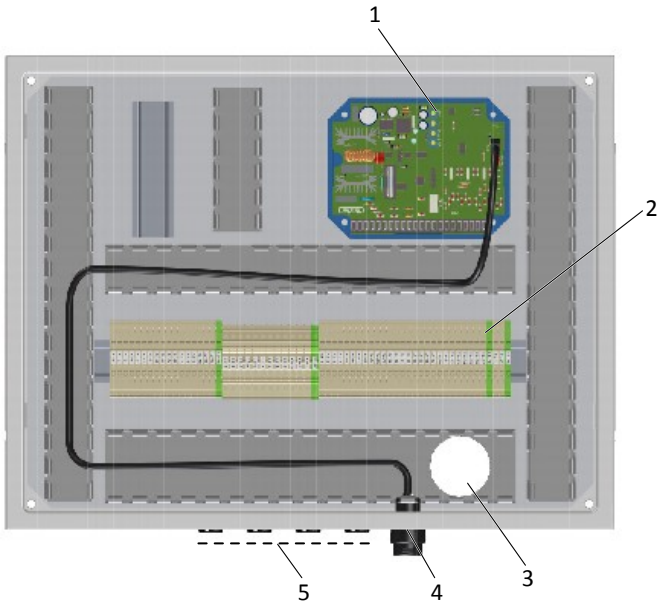


Figure 18- Generators auxiliaries box ECO47 and ECO49

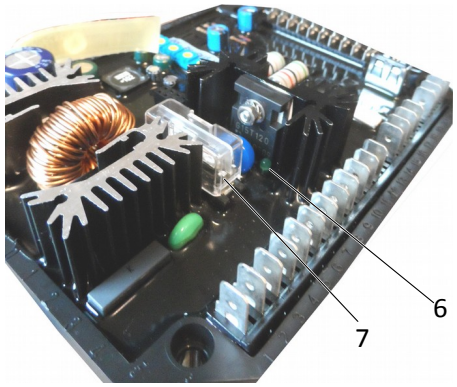


Figure 19- DER 2 voltage regulator

1- DER2 voltage regulator
2- Terminal board
3- Cables passage hole to the terminals box
4- USB connection
5- Sensors cables passage
6- Alarm signal LED
7- Protection fuse 5A, 250 V

4.4.5 Setting the alarm and stop temperature

The probes mounted on the alternator detect the temperature of the winding phases and the bearings (see also *3.1 Description of the Self-regulating alternators ECO47-49 MV-HV*).

Refer to the following tables for the correct temperature setting values.

Isolation class of the windings	Maximum continuous temperature °C	Alarm temperature °C	Stop temperature °C
Class B	130	120	140
Class F	155	145	165
Class H	180	170	190

Table 13 - Alarm and stop temperature for the windings

Bearings	Alarm temperature °C	Stop temperature °C
Drive End (DE)	Environment T + maximum 45 °C	Environment T + maximum 50 °C
Non Drive End (NDE)	Environment T + maximum 40 °C	Environment T + maximum 45 °C

Table 14 - Alarm and stop temperature for the bearings

4.4.6 Alternator connection to earth

Connect the alternator to earth in the points indicated. The earth plate to which the alternator is connected must be compliant to that envisioned by the laws in force.

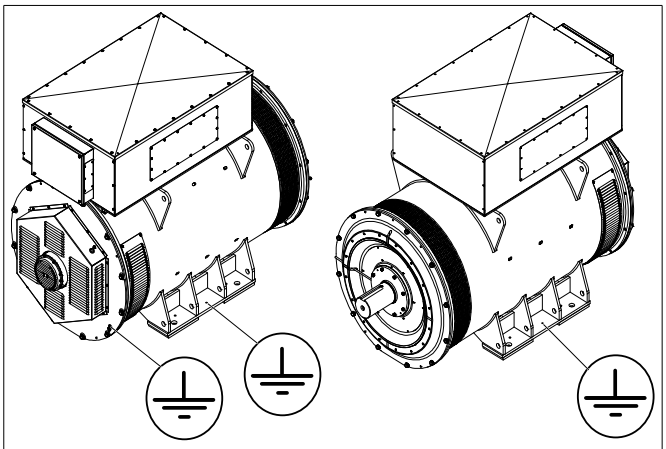


Figure 20- Alternators ECO47

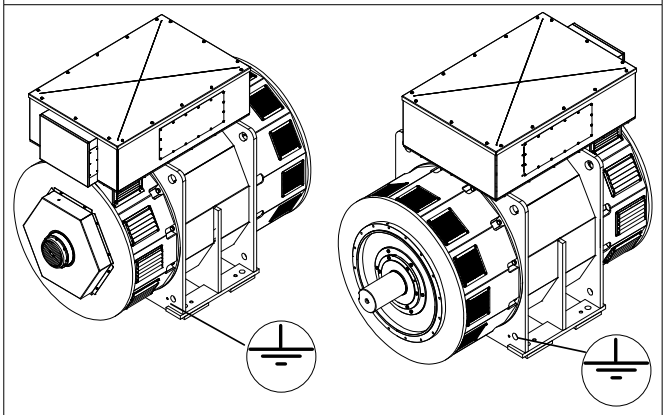


Figure 21- Alternators ECO49

4.5 Checks after installation

Responsibility: Service technician

Prerequisites: Installation of the alternator is concluded

➔ Perform commissioning at low speed

➔ Check for the presence of abnormal noise or vibrations that may indicate mechanical coupling problems

NOTICE

Possible damage to the shafts or bearing due to misalignment.

- Stop the alternator in the case of excessive noise or vibrations and check alignment.

NOTE

The fitter is responsible for respecting the regulation regarding the measurement and assessment of mechanical vibrations.

➔ Check the temperature of the windings.

4.5.1 DER2 digital voltage regulator

Refer also to the DER2 voltage regulator user manual, see *10.2 Components documentation*.

In static conditions, the DER2 voltage regulator guarantees voltage value accuracy of ± 1% with any power factor and with a speed change between -5% and 20%.

The regulator can be connected to a PC via a USB connection accessible on the auxiliaries box (see *Figure 18- Generators auxiliaries box ECO47 and ECO49*).

The regulator has low speed protection against overloading.

The low speed protection intervenes instantly and causes the alternator voltage to lower when the frequency drops below 4% (± 1%) of the nominal value.

The overload protection circuit compares the partialized exciter voltage. If the value pre-established for this voltage is exceed for more than 20 seconds (value to which a load current value corresponds equal to a 1,1 times the alternator plate current), the regulator intervenes by lowering the alternator voltage with consequent limitation of the current within safety values.

The delay is appropriately introduced to allow the engines peak, which normally start-up in 5 ÷ 10 seconds. This intervention threshold is adjustable by operating on the voltage regulator "AMP" potentiometer.

Causes that trigger intervention of protection devices.

Low speed protection instantaneous intervention	Speed reduced by 4 ± 1 % with respect to plate data
Overload protection delayed intervention	Overload of 10% with respect to plate data.
	Power factor (cosϕ) lower than plate data.
	Environment temperature above 50°C
Intervention of both protections	Combination of factor 1 with factors 2, 3, 4

On intervention of the protections, the voltage supplied by the operator drops to a value that depends on the size of the problem. The voltage goes back automatically to its nominal value after the problem.

Inputs and outputs technical data

CONNECTOR CN1				
Terminal*	**Name**	**Function**	**Specifications**	**Notes**
1	Exc-	Energisation	Continuous reg. 4 A dc maximum Transient reg.: 12 A dc peak	
2	Aux/Exc+			
3	Aux/Exc+	Power supply	40 ÷ 270 Vac, Frequency: 12 ÷ 72 Hz **	*
4	UFG	Sensing scale 2	Scale 2: 150÷300 Vac	U channel
5	UFG			
6	UHG	Sensing scale 1	Scale 1: 75÷150 Vac	
7	UHG			
8	UHB	Bridge scale 1		Short circuit for voltages 75 ÷ 150 Vac
9	UFB			
10	UFB		Board common reference	Delta centre of YY or Y connections in common with the board power supply *
11	UFB			
12	UFB			
13	-		Not present	
14	VFG	Sensing	Scale 1: 75 ÷ 150 Vac	Channel V to be connected in parallel with channel U in case of single-phase reference.
15	VHG	Sensing scale 1		
16	VHB		Scale 2: 150 ÷ 300 Vac	
17	VFB	Scale 2		
18	-		Not present	
19	WFG	Sensing	Scale 1: 75 ÷ 150 Vac	Channel W, not used (with short-circuited inputs) in case of single-phase reference.
20	WHG	Sensing scale 1		
21	WHB		Scale 2: 150 ÷ 300 Vac	
22	WFB	Scale 2		

* They are connected together on the terminals board: 2 - 3, 4 - 5, 6 - 7, 9 - 10, 11 - 12.

** Minimum power supply voltage: 40 Vac at 15 Hz, 100 V at 50 Hz, 115 V at 60 Hz.

CONNECTOR CN3				
Terminal	**Name**	**Function**	**Specifications**	**Notes**
23	Common	Active protections output	Type: non-isolated open collector output Current: 100 mA Voltage: 30 V Maximum length: 30 m * Type: non-isolated input Maximum length: 3 m	Programmable both the alarm that activates it and the delay time
24	A.P.O.			
25	Common	Bridge 50/60 Hz		Low speed protection threshold selection **
26	50/60 Hz			
27	0 EXT	Live input bridge 0-2.5 Vdc	Type: non-isolated input Maximum length: 3 m	Short circuit for input 0-2.5 Vdc or potentiometer
28	JP1			
29	0 EXT	Remote control of the voltage with ± 10 Vdc	Type: non-isolated input Maximum length: 30 m *	Adjustment ± 10% ***
30	PEST	Remote control with Pext or with 0-2.5 Vdc	Input: 0-2.5 Vdc or potentiometer 100 K	Absorption: 0-1 mA (sink)
31	JP2	Pext Bridge	Type: non-isolated input Maximum length: 3 m	Short circuit for input 0-2.5 Vdc or potentiometer
32	± 10V	Remote control with Pext or with ± 10 Vdc	Input: ± 10 Vdc	Absorption: ± 1 mA (source)

* With external EMI filter (3 m without EMI filter)

** 50•(100%-αHz%) or 60•(100%-αHz%) where αHz% is the relative position of the trimmer Hz or the percentage value of parameter P[21]

*** Values not to be exceeded, the effective range depends on the parameter P[16].

The regulators mounted on the alternators are calibrated during the final inspection. In the case of regulators supplied separately (e.g. spare parts) or whenever cabling or calibration variations are requested, the regulator must be calibrated accurately.

The main settings can be carried out directly on the regulator via 4 trimmers (VOLT - STAB - Hz - AMP), the jumper 50/60, JP1, JP2 and the Pext input. More detailed settings of measurements can be made exclusively via software using the USB connection.

Remote control of voltage

The Pext inputs (terminal 30) and ±10 V (terminal 32) allow analogue remote control of the output voltage via direct voltage or a potentiometer, with programmable range of variation with respect to the value set via trimmer (default) or via parameter P[19].

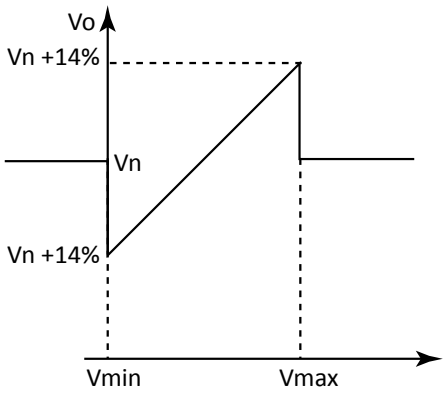


Figure 22- Without saturation of the output voltage

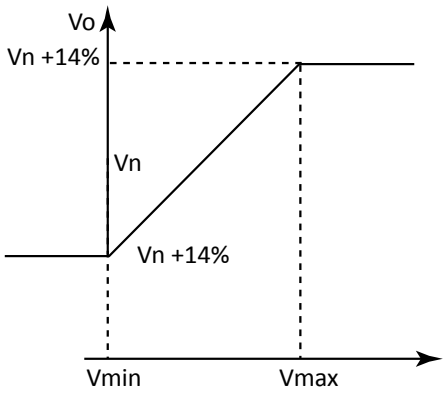


Figure 23- With saturation of the output voltage

Whenever direct voltage is to be used, it will have effect if within 0 Vdc/2,5 Vdc or -10 Vdc/+10 Vdc, , if connected respectively between terminals 30 and 29, or 32 and 29 and on the basis of the presence or not of jumpers JP1 and JP2.

For values that exceed these limits (or in case of disconnection) there are two options:

- Do not consider the value and, with regulation, go back to the voltage value set via trimmer (if enabled) or via parameter P[19] (Figure 22-);
- Maintain the minimum (or maximum) voltage value that can be reached (Figure 23-).

The second option can be set via the RAM Voltage CTRL option in the Configuration menu corresponding to bit B7 of the configuration word P[10].

NOTE

The direct voltage source must be able to absorb at least 2 mA.
On regulation, it is good practice not to exceed ± 10% of the alternator voltage nominal value.

50/60 signal

A jumper positioned at the input 50/60 (connector CN1 clamps 12 and 13) sets the switch-over of the low speed protection threshold from 50·(100%-αHz%) to 60·(100%-αHz%), where αHz% represents the relative position of the trimmer Hz.

APO contact

Acronym of Active Protection Output: (connector CN1 terminals 14 and 15) on-isolated transistor open collector 30V-100 mA, normally closed by default. The transistor is normally open and closes in the case of an active alarm. It opens with a delay programmable via software from 1 to 15 seconds, when, one or more result active among the alarms, selectable separately via software.

VOLT Trimmer

Allows regulation from approx. 70 V to approx. 140 V whenever terminals 4 and 5 are used for sensing, or from approx. 140 V to approx. 280 V whenever terminals 6 and 7 are used.

STAB Trimmer

Regulate the dynamic response (droop) of the alternator in transient conditions.

AMP Trimmer

Adjusts the intervention threshold of the exciter over-current protection. To calibrate the overload protection, follow the procedure given below:

- ➔ Rotate the Trimmer AMP completely clockwise.
- ➔ Apply an overload at cosϕ = 0.8 or cosϕ = 0 to the alternator, respectively equal to 125% or 110% of the nominal load.
- ➔ After two minutes, turn the trimmer AMP slowly anti-clockwise until a drop in the alternator voltage value is obtained and alarm 5 is activated (visible via a change in flashing of the LED).
- ➔ Calibrate the trimmer AMP until the output voltage value is taken to 97% of the nominal value; alarm 5 is still active.
- ➔ Remove the load.
- ➢ After a few seconds the alarm 5 disappears and the voltage of the alternator rises to the nominal value.

Hz Trimmer

Allows calibration of the intervention threshold of the low speed protection of up to -20% with respect to the nominal speed value set by the jumper 50/60 (at 50 Hz the threshold can be calibrated from 40 Hz to 50 Hz, at 60 Hz the threshold can be calibrated from 48 Hz to 60 Hz).

The intervention of the protection makes the alternator voltage decrease. Perform calibration as follows:

➔ Rotate the Trimmer HZ completely anti-clockwise.

✗ If the machine must operate at 60 Hz:

➔ Make sure that the bridge is introduced between terminals 25 and 26

➔ Take the alternator to a speed equal to 96% of nominal speed

➔ Rotate the trimmer Hz slowly. Rotate it clockwise to lower the voltage and make sure that the LED starts to flash quickly

➢ By increasing the speed, the alternator voltage must normalise and the alarm must disappear.

➔ Take the speed back to nominal value

NOTE

Continuing to regulate the voltage, if the frequency assumes a value less than 20 Hz, the regulator switches off. The alternator must be stopped completely in order to restore the regulator.

For management of the alarms, refer to the regulator user manual, see *10.2 Components documentation*.

4.5.2 Calibration of the stability of the DER 2 voltage regulator

Responsibility: Service technician

Prerequisites: The alternator has been installed correctly and is ready to operate

The alternators are part of a system that can be categorised, e.g. motor + alternator. The alternator can also have instability in rotation and voltage due to operating irregularities of the motor to which it is connected.

There is a potentiometer dedicated to the adjustment of stability (STAB potentiometer), because the voltage adjustment systems of the alternator and of motor speed can come into conflict, causing fluctuations of speed and voltage.

It is important to highlight the Mecc Alte Power Products alternators are tested using an electric motor not a thermal motor. Therefore, the STAB adjustment is set correctly for the alternator driven by electric motor.

General instructions to follow if problems of instability arise.

1- Use the DxR Terminal software to connect a PC to the voltage regulator through the USB port;

2- Control the setting of the STAB potentiometer and make sure that it corresponds to a value of approx. 31295;

3- If there is no correspondence, set the potentiometer to obtain a value of approx. 31295;

4- Due to persistent instability, set the potentiometer at half the travel possible:

5- Turn the potentiometer by one notch anti-clockwise and repeat the test;

6- If differences are not noticed or if the differences are minimal, turn another notch anti-clockwise. Continue with this procedure until the problem is solved;

7- If the instability of the voltage increases by turning the potentiometer anti-clockwise, set the potentiometer according to that envisioned in point 3. Turn the potentiometer by one notch clockwise and repeat the test;

8- If there are no variations or if the variations are minimal, turn an additional notch clockwise and repeat the test;

9- Continue with this procedure until the problem is solved;

10- If, after these passages, the problem is still not resolved, it may be necessary to operate on the stability (gain) of the motor speed adjustment system. If this still doesn't solve the problem, try and change the software stability parameters of the voltage regulator. Refer also to the DER 2 regulator manual and the manual of the DXR Terminal software.

4.5.3 Checking the alternator output voltage

Responsibility: Service technician

Prerequisites: The alternator has been correctly installed and is at a standstill

Refer to the auxiliaries wiring diagram, see *10.1.1 List of diagrams and drawings*.

➔ Check the voltage ratio of the voltage sensor in the terminal box according to that stated on the plate affixed to the sensor;

➔ Identify the terminals that refer to the secondaries of the voltage sensors in the auxiliaries box;

➔ Rotate the alternator.

DANGER

Hazardous voltage inside the alternator terminals box.
Electric shock and electrocution hazard.

- Do not touch components contained in the auxiliaries box.
- Wear suitable protective gloves.

DANGER

Generator operating, rotating parts in movement.
Risk of crushing, dragging or entrapment.

- Remain at a safe distance from all moving alternator parts.

➔ Measure the voltage at the terminals of the auxiliaries box connected to the voltage sensor;

✔ If a voltage of 100 V or 110 V is detected at the terminals, according to that detected by the plate present on the sensor, the machine operates correctly.

✗ If the voltage detected is not correct:

➔ Refer to *7.1 Problems of an electrical nature*.

4.5.4 Coupling torques

Respect the coupling torques listed for the screws indicated.

Alternator ECO47 B3B14	Thread	Material	Coupling torque [Nm] ±7%
Balancing template on rotor	Convex cylindrical head with hexagon socket M8x20	8.8	22
Protection net IP23	Hex head M5x25	4.8	3
DE Bearing cover	Hex head M6x100	8.8	9
DE Shield on stator	Hex Head M16x60	8.8	180
NDE Shield on stator	Hex Head M16x60	8.8	180
NDE Bearing cover	Hex head M6x85	8.8	9
Rear lid mass	M16x30	8.8	180
Exciter stator on NDE shield	Hexagon socket head cap screw M8x140	8.8	22
Exciter rotor on rotor ECO47	Hexagon socket head cap screw M8x40	8.8	22
Diodes bridge on rotor ECO47	Hex head M5x20	4.8	3
Diodes bridge connection	Hex head M5x25	Brass	3
PMG rotor at rotor ECO47	M14		120
PMG cover plate stator	Hexagon socket head cap screw M6x80	8.8	9
PMG protection	Hex head M6x20	4.8	5
PMG shield	Hex head M6x16	8.8	12
Terminal board support brackets	Hex head M8x30	8.8	22
Terminal board plate on brackets	Hex head M12x30	8.8	75
Terminal board cover ECO47	Hex head M6x16	8.8	12
Machine cover	TEF M6x12	4.8	5
Cable on tie-rod M12	NUT M12	Brass	40

Table 15 - Alternators coupling torque ECO47 B3B14

Alternator ECO47 MD35	Thread	Material	Coupling torque [Nm] ±7%
Flexible discs	Hex head M16x40	8.8	200
Balancing template on rotor	Convex cylindrical head with hexagon socket M8x20	8.8	22
Protection net IP23	Hex head M5x25	4.8	3
DE Shield on stator	Hex head M14x70	8.8	120
NDE Shield on stator	Hex head M14x70	8.8	120
NDE Bearing lid	Hex head M6x85	8.8	9
Rear lid mass	M16x30	8.8	180
Exciter stator on NDE shield	Hexagon socket head cap screw M8x140	8.8	22
Exciter rotor on rotor ECO47	Hexagon socket head cap screw M8x40	8.8	22
Diodes bridge on rotor ECO467	Hex head M5x20	4.8	3
Diodes bridge connection	Hex head M5x25	Brass	3
PMG rotor at rotor ECO47	M14		120
PMG cover plate stator	Hexagon socket head cap screw M6x80	8.8	9
PMG Protection	Hex head M6x20	4.8	5
PMG Shield	Hex head M6x16	8.8	12
Terminal board support brackets	Hex head M8x30	8.8	22
Terminal board plate on brackets	Hex head M12x30	8.8	75
Terminal board cover ECO47	Hex head M6x16	8.8	12
Machine cover	TEF M6x12	4.8	5
Cable on tie-rod M12	NUT M12	Brass	40

Table 16 - Alternators coupling torque ECO47 MD35

Alternator ECO49 B3B14	Thread	Material	Coupling torque [Nm] ±7%
Fan on hub	Hexagon socket head cap screw M16x60	8.8	185
Balancing template on rotor	Convex cylindrical head with hexagon socket M12x35	8.8	75
Exciter key on rotor shaft	Hex head M8x40	8.8	22
Diodes port template on exciter	NUT M8	cl.8	22
Diodes bridge on template	Hexagon socket head cap screw M5x25	8.8	4.5
Diodes bridge connection	M6	4.8	3
DE Bearing cover	Hex head M12x110	8.8	75
DE Bearing seat	Hex head M12x90	8.8	75
Machine cover	TEF M6x12	4.8	5
DE Shield on stator	Hex head M20x65	8.8	360
Exciter on NDE shield	Hex head M12x90	8.8	75
NDE Shield on stator	Hex head M20x65	8.8	360
NDE Bearing seat	Hex head M12x90	8.8	75
NDE Bearing cover	Hex head M12x140	8.8	75
PMG cover plate on shield NDE	Hex head M8x25	8.8	22
PMG rotor at rotor ECO49	M14		120
PMG cover plate stator	Hexagon socket head cap screw M6x80	4.8	9
PMG protection	Hex head M6x30	4.8	9
Terminal board plate on ECO49	Hex head M12x30	8.8	75
Terminal board cover ECO49	Hex head M8x35	8.8	22
Cable on tie-rod M12	NUT M12	Brass	40

Table 17 - Alternators coupling torque ECO49 B3B14

Alternator ECO49 MD35	Thread	Material	Coupling torque [Nm] ±7%
Flexible discs	Hex head M20x60	8.8	400
Fan on hub	Hexagon socket head cap screw M16x60	8.8	185
Balancing template on rotor	Convex cylindrical head with hexagon socket M12x35	8.8	75
Exciter key on rotor shaft	Hex head M8x40	8.8	22
Diodes port template on exciter	NUT M8	cl.8	22
Diodes bridge on template	Hexagon socket head cap screw M5x25	8.8	4.5
Diodes bridge connection	M6	4.8	3
Machine cover	TEF M6x12	4.8	5
DE Shield on stator	Hex head M20x65	8.8	360
Exciter on NDE shield	Hex head M12x90	8.8	75
NDE Shield on stator	Hex head M20x65	8.8	360
NDE Bearing seat	Hex head M12x90	8.8	75
NDE Bearing cover	Hex head M12x140	8.8	75
PMG cover plate on shield NDE	Hex head M8x25	8.8	22
PMG rotor at rotor ECO49	M14		120
PMG cover plate stator	Hexagon socket head cap screw M6x80	4.8	9
PMG protection	Hex head M6x30	4.8	9
Terminal board plate on ECO49	Hex head M12x30	8.8	75
Terminal board cover ECO49	Hex head M8x35	8.8	22
Cable on tie-rod M12	NUT M12	Brass	40

Table 18 - Alternators coupling torque ECO49 MD35

5 Operation

5.1 Commissioning of the alternator

Responsibility: Machine operator

Prerequisites: The installation has been completed correctly and the alternator is ready to function

NOTE

The cooling air intake and discharge apertures must always be free. For the volumes of cooling air necessary, see 3.3.4 Volume of air required (m3/min).

The inlet side must not be near heat sources. In all cases, the temperature of the cooling air must be that of the environment and however not over 40 °C. The alternator can work at higher temperatures with appropriate derating.

NOTE

If the alternator has been inactive for a period exceeding two months, the insulation resistance must be measured, see 6.3 Measuring the insulation resistance. If the resistance value measured is less than 400 MΩ the winder must be reconditioned.

The alternator is started along with the engine to which it is connected.

5.2 Stopping the alternator

The alternator is stopped along with the engine to which it is connected.

	**CAUTION**
Possibility of formation of condensate inside the alternator. • Make sure that the anti-condensation heaters remain on during the period of inactivity of the alternator.	

Open master switch of the utilities connected before stopping the prime motor.

The alternator voltage regulator has protection in the event of low speed. The low speed protection intervenes instantly and causes the alternator voltage to lower when the frequency drops below 4% (± 1%) of the nominal value.

6 Maintenance

The maintenance operations that the user can perform are described in this chapter. Other operations mentioned but, without description of execution, are the responsibility of the Mecc Alte S.p.a. after-sales service.

Any operation on electrical parts, even not live, must be performed by specialised personnel with knowledge of the regulations and safety standards regarding work on electric components.

If in doubt regarding any questions regarding maintenance, contact Mecc Alte S.p.a.

DANGER

Moving mechanical machine parts!
Risk of dragging or entrapment.

- Stop the machine before proceeding to any maintenance operations.

DANGER

Live machine parts!
Risk of death following electric shocks caused by contact with live parts.

- Disconnect the voltage to the plant before working on parts that are usually live.
- Make sure no one can connect the voltage to the plant by blocking the master switch using a padlock.

CAUTION

Components on the alternator at high temperature.
Burns hazard due to contact with very hot surfaces.

- Wear Personal Protective Equipment (PPE).
- Wait for the alternator to cool down before any intervention.

CAUTION

Do not allow unauthorised personnel to perform maintenance interventions.
Possible injury to personnel or damage to the machine.

- For the maintenance interventions not described in this manual, request the intervention of the machine manufacturer.
- Whenever signs of decreased performance are noted, promptly contact Mecc Alte S.p.a. Service.

NOTICE

Risk of damage to the machine caused by the use of non-original spare parts.
Always use spare parts and consumables in compliance with the information provided by the component's manufacturer.

NOTE

During machine downtime exceeding one month, the anti-condensate heaters must be on in order to prevent the formation of condensate in the windings.

6.1 Maintenance intervals

These intervals must be respected in order to keep the machine in the safe and efficient working order required for complete warranty coverage.

All maintenance operations must be performed by a person (type of user) trained in the tasks required as indicated in *2.3 Responsibility of the user*.

Table 19 - Maintenance intervals for the alternator

Interval	Subject of the intervention	Type of intervention
ECO47: every 2,000 operating hours or once a year ECO49: every 2,000 operating hours or once a year	NDE and DE supports	Lubrication (see *6.4 Maintenance of the supports*)
Every six months	Generator shaft	Manual rotation of 1/4 rev. *6.5.1*
Every six months	Air filters	Check and clean if necessary *6.5.2*
Every 8,000 operating hours or once a year	Auxiliary circuits connection cables (probes, anti-condensation heaters if present)	● Check general conditions ● Appropriate fixing of the clamps ● Check for the presence of any oxidation and clean, if necessary
After machine standstill over 2 months or once a year	Windings	Check insulation resistance (see *6.3 Measuring the insulation resistance*).
Every 2,500 operating hours	Windings	● Check conditions of the windings *6.2.1, 6.2.2* ● Cleaning the windings *6.2.4* ● Resistance/continuity test *6.2.5*
Every 8,000 operating hours or once a year	Stator and rotor connection cables	Check correct fixing and general conditions
After machine standstill over 2 weeks or once a year	Anti-condensation heaters (if present)	● Check the operation and resistance value, cleaning and any replacement ● Check the insulation resistance of the heaters
According to that defined by the manufacturer	Heat exchanger (if present)	Refer to the documentation of the heat exchanger manufacturer
In the case of a fault	Rectifier bridge	Replacement (see 6.5.5)

6.2 Maintenance of the stator and rotor windings

The duration of the electric machine is affected by the duration of the windings insulation.

The insulation ages because it is subjected to electrical, mechanical and heat phenomena. This process can be slowed down with appropriate maintenance interventions.

6.2.1 Check conditions of the windings

Responsibility: Service technician or machine operator

Frequency: Every 2,500 hours

Prerequisites: The alternator is at a standstill and has cooled down

- ➔ Disconnect the voltage regulator, voltage sensors and any other device connected to the alternator windings;
- ➔ Measure the isolating resistance to earth (see *6.3 Measuring the insulation resistance*). The value measured must not exceed 400 MΩ;
- ✗ If the value measured is less than 400 MΩ:
- ➔ Dry the windings (see *6.2.2 Drying the windings*).

6.2.2 Drying the windings

Responsibility: Service technician

Prerequisites: The alternator is at a standstill

Frequency: If machine standstill should last more than one month

If condensate should form, the windings must be dried in one of the ways indicated below.

Using an industrial welder

- ➔ Disconnect the machine from the plant
- ➔ Disconnect the voltage transformers (TV)
- ➔ Power two phases of the alternator with a direct current source like an industrial welder, with a current equal to 25/30% of the machine nominal current
- ➔ Check the temperature of the windings using the temperature sensors PT100. Do not exceed the temperature of 100°C

Using a jet of hot air

- ➔ Direct a jet of hot air at 50-60°C through the alternator air vents.

With batteries or a direct current power supply unit (24 V, 5 A)

CAUTION

Damage to the voltage regulator if there is no connection between regulator and exciter.

- Remove the connection between PMG (permanent magnets alternator that powers the voltage regulator) and the voltage regulator.
- The connection must be removed upstream from the voltage regulator by disconnecting the cables from the terminal board.

➔ Short circuit the stator windings

➔ Rotate the alternator

➔ Energise the alternator by powering the exciter (see the *Auxiliaries box wiring diagram*) with one 24 V battery or two 12 V batteries in series or use a direct current power supply unit

➔ Keep the alternator rotating for two hours.

6.2.3 Correct operating temperature

The windings are kept at a correct temperature via accurate cleaning during the maintenance interventions and correct temperature control via the Pt100 temperature probe.

Noteworthy differences between the temperatures detected by the probes can be indicative of malfunctioning of the windings.

6.2.4 Cleaning the windings

Responsibility: Service technician

Prerequisites: The alternator is at a standstill

Frequency: Every 20,000 hours or more frequently in the case of dusty environments

NOTE

Contact Mecc Alte S.p.a. for thorough washing in case of windings in a very bad state.

- ➔ Disassemble the alternator (see *6.6 Disassembly of the alternators*)
- ➔ Clean the windings alternator using specific high-evaporation solvents for electric windings
- ➔ Perform the following controls after the cleaning operations:
  - Check for the presence of traces of carbonisation;
  - Check the integrity of the windings insulation;
  - Measure the isolation resistance.

6.2.5 Resistance/continuity test

Responsibility: Service technician

Prerequisites: The alternator and the prime engine are at a standstill; the alternator is disconnected from the energy sources

Perform the test on the rotor windings and the windings of the main stator of the exciter. For the resistance values, refer to *3.3.6 Resistance of the windings*.

Main stator

- ➔ Use a multimeter to measure the resistance/continuity of the phases;

Main rotor

- ➔ Use a multimeter to measure the resistance/continuity of the main rotor winding;

Exciter stator

- ➔ Use a multimeter to measure the resistance/continuity of the exciter stator winding between the positive wire (yellow) and the negative wire (blue).

Exciter rotor

- ➔ Use a multimeter to measure the resistance/continuity of the exciter rotor winding between phase and phase.

6.3 Measuring the insulation resistance

Responsibility: Service technician

Prerequisites: Respect the following conditions:

- The alternator must be at a standstill
- The following must be disconnected:
  - Voltage transformers and current transformers
  - Valve centre
  - Power cables.

Also see *6.6 Disassembly of the alternators*.

Frequency: Once a year or if the machine is at a standstill for more than two weeks

Reference regulation: IEEE STD 43-2000

DANGER

Live windings during and after measurements.
Electric shock hazard.

- Do not touch the windings or connection terminals.
- Use isolated gloves and footwear during the operations.
- After the measurements, connect the windings to earth for a few minutes.

DANGER

During winding measurements they charge electrically.
Electric shock hazard due to contact with the windings or with connection terminals.

- Do not touch the windings.
- Use isolated gloves and footwear during the operations.
- After the measurements, connect the windings to earth for a few minutes.

NOTE

Remove the connection to adjustment devices, before performing the test.

Main stator

The insulation resistance measurement between the windings and earth must be made with the relevant measuring device, powered with direct current and output voltage as near as possible to the machine's nominal voltage.

Proceed as follows to measure the insulation resistance.

- ➔ Remove the electric connection between the adjustment devices or other devices;
- ➔ Take the measurement between the winding and the mass (Figure 24-), if valve centre not available;

or

- ➔ Make the measurement between a phase and earth, with the remaining two phases and auxiliaries connected to earth (Figure 25-) if valve centre is available.

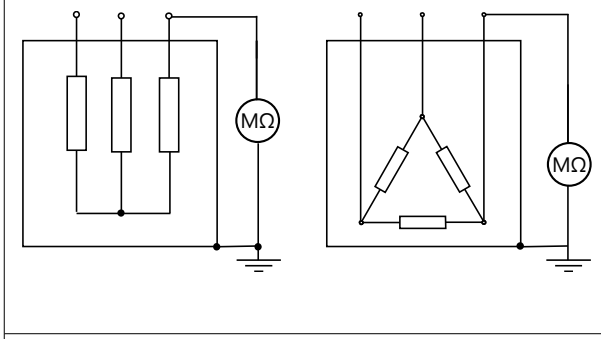


Figure 24- Measurement between winding and earth

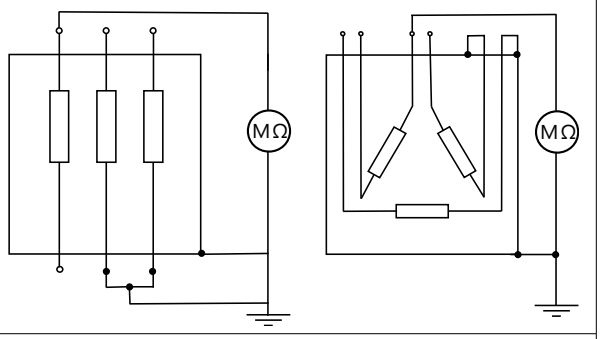


Figure 25- Measurement between every phase and earth

Rotor winding

The insulation resistance measurement between the winding and earth must be made with the relevant measuring device, powered with direct current and output voltage of 500 V.

The insulation resistance must be measured between the positive terminal or the negative terminal of the rotor winding on the rectifier bridge and the earth of the rotor. See Figure 26- and Figure 27- . The minimum isolation value must be 5 MΩ.

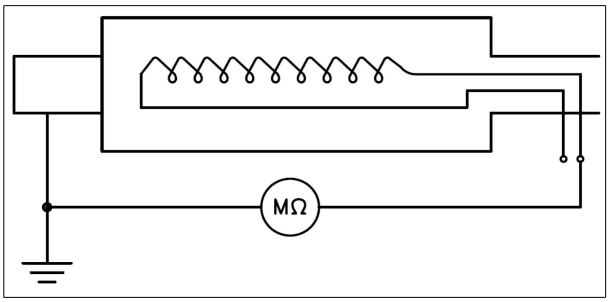


Figure 26- Measuring the isolation resistance on the rotor winding

+ and - terminals of the rectifier bridge

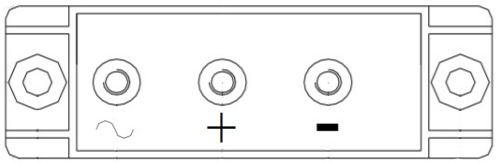


Figure 27- Rectifier bridge

Exciter stator winding

- ➔ Measure the insulation resistance between phase and earth using an insulation tester (megger);
- ✔ The minimum isolation value must be 5 MΩ;
- ✗ If the resistance is lower than 5 MΩ:
- ➔ Clean the stator and, if necessary, paint it again with grey tropicalising paint EG43;
- ➔ Dry it at 50-60 °C.

If the value remains low even after these operations, the stator must be re-wound or replaced.

Exciter rotor winding

➔ Measure the insulation resistance between phase and earth using an insulation tester (megger)

✔ The minimum isolation value must be 5 MΩ

✗ If the resistance is lower than 5 MΩ

➔ Clean the rotor and impregnate it, if necessary

➔ Dry the rotor at 50-60 °C.

If the value remains low even after these operations, the rotor must be re-wound or replaced.

PMG winding

➔ Measure the insulation resistance between phase and earth using an insulation tester (megger)

✔ The minimum isolation value must be 5 MΩ

✗ If the resistance is lower than 5 MΩ:

➔ Clean the rotor and impregnate it, if necessary

➔ Dry the rotor at 50-60 °C.

6.3.1 Conversion of the values relative to the insulation resistance

The value of the insulation resistance must refer to a temperature of 20°C. It is therefore necessary to convert the data measured to the corresponding value at 20°C, with the aid of a coefficient, by applying the following formula:

$R_{iS\ 20°C} = k * R$

where:

$R_{iS\ 20°C}$ is the resistance value equal to 20 °C

R is the resistance value measured

k is the correction coefficient

T windings in °C	15	20	25	30	35	40
Coefficient k	0.69	1	1.42	2	2.82	4

Table 20 - Temperatures and corrective coefficients

Example:

R = 50 MΩ, with winding at the temperature of 30 °C;

$R_{iS\ 20°C}$ = 2 * 50 = 100 MΩ

The following table indicated the quality of the level of insulation on the basis of the resistance measured.

Value of the insulation resistance (MΩ at 20 °C)	Quality of the level of insulation
< 50	Dangerous
from 50 to 400	Level of insulation not safe
from 400 to 1,000	Good
> 1,000	Very good

Table 21 - Level of insulation on the basis of the resistance measured

Notes

- Insulation resistance values that are too low can indicate the presence of humidity or dirt in the winding, contact Mecc Alte S.p.a. to schedule the intervention of a technician.
- The insulation resistance decreases with the increase in temperature.
- The insulation resistance value measured during inspection of the alternator is generally higher than that detected on site.
- An appropriate insulation resistance value is an essential requirement for safety. Do not start the alternator if resistance values are lower than the minimum acceptable.

6.4 Maintenance of the supports

6.4.1 Lubricating the bearings

Responsibility: Service technician

Prerequisites: The alternator is at a standstill

	**CAUTION**
Lubricant grease can pollute the environment. Possibility of pollution of the land due to the dispersion of grease. ● Always dispose of grease according to the regulations in force or take it to a company specialised in the disposal of special waste.	

The NDE and DE supports (Non Drive END and Drive END) of the alternator must be lubricated as indicated in *Table 22 - Intervals of supports lubrication and type of grease*.

Proceed with greasing the NDE bearing as indicated below.

➔ Identify the connection point for the greaser on the side of the alternator of interest;

➔ Introduce the amount of grease indicated by means of a greaser;

➔ Clean any grease escaping.

Generator	Support	Support type	Interval of lubrication	Type of grease	Quantity
ECO47	NDE	626	2,000 h	SKF LGMT 2	50 g
	DE	6232	2,000 h	SKF LGMT 2	100 g
ECO49	NDE	6236-M-C3	2,000 h	SKF LGMT 2	50 g
	DE	6236-M-C3	2,000 h	SKF LGMT 2	50 g

Table 22 - Intervals of supports lubrication and type of grease

6.4.2 Replacing grease in the bearings

Responsibility: Service technician

Prerequisites: The alternator is at a standstill

Replacing the grease in the bearings involves the removal of old grease and topping up with new grease. Proceed as indicated below. The numbers indicated refer to the disassembly and assembly operations of the alternators of chapters *6.6 Disassembly of the alternators* and *6.7 Assembling of the alternators*.

NOTE

Do not mix different greases to prevent problems with bearings. Makes sure that the grease available is the type indicated by the manufacturer.

Alternators ECO47 (see *6.6.1 Disassembly of the Alternators ECO47*)

- ➔ Perform the removal operations up to point 45 on page 85
- ➔ Use a solvent to remove the grease present.
- ➔ Lubricate the bearing as indicated in point 9 and 35 on *6.7.1 Assembling Alternators ECO47 and 35.*
- ➔ Re-mount the alternator following the indications from point 4.

Alternators ECO49 (see *6.6.2 Disassembly of the Alternators ECO49*)

- ➔ Perform the removal operations up to point 35 on *6.6.2 Disassembly of the Alternators ECO49*
- ➔ Use a solvent to remove the grease present.
- ➔ Lubricate the bearing as indicated in point 8 on *6.7.2 Assembly of the Alternators ECO49.*
- ➔ Re-mount the alternator following the indications from point 9.

6.4.3 Replacing the bearings

Responsibility: Service technician or Mecc Alte S.p.a. After-sales service technician

Prerequisites: The alternator is at a standstill and uncoupled from the prime engine

Replace the bearings as indicated below. The numbers indicated refer to the disassembly and assembly operations of the alternators of chapters *6.6 Disassembly of the alternators* and *6.7 Assembling of the alternators*.

Alternators ECO47 (see*6.6.1 Disassembly of the Alternators ECO47*)

- ➔ Perform the removal operations up to point 45 on page 85.
- ➔ Replace the grease in the bearing, see *6.4.2 Replacing grease in the bearings.*
- ➔ Mount a new bearing.
- ➔ Re-mount the alternator.

Alternators ECO49 (see *6.6.2 Disassembly of the Alternators ECO49*)

- ➔ Perform the removal operations up to point 35 on *6.6.2 Disassembly of the Alternators ECO49*.
- ➔ Replace the grease in the bearing, see *6.4.2 Replacing grease in the bearings.*
- ➔ Mount a new bearing.
- ➔ Re-mount the alternator.

6.5 Other maintenance operations

6.5.1 Manual rotation of 1/4 rev.

Responsibility: Service technician or machine operator

Frequency: If machine standstill should last more than six months

Prerequisites: The alternator is at a standstill.

If the machine is at a standstill for a period of time exceeding six months, permanent deformations of the rotating parts may occur.

- ➔ Manually rotate the alternator shaft by 1/4 rev.

6.5.2 Check and clean the air filters

Responsibility: Service technician

Frequency: Every six months

Prerequisites: The alternator is at a standstill

If the alternator is fitted with air filters, their status of cleanliness must be checked.

- ➔ Remove the filter.
- ➔ Use a jet of compressed air to clean the filter.
- ➔ Re-mount the filter.
- ➔ Replace the filter if it is still clogged.

6.5.3 Visual inspection

Responsibility: Service technician or machine operator

Frequency: Every 2,500 hours

Prerequisites: The alternator is at a standstill and has cooled down

- ➔ Check for the presence of dents, rust or other visible anomalies;
- ➔ Check the conditions of the power connection cables and the regulator cables;
- ➔ Check the correct tightness of all couplings.

6.5.4 Check the alternator operates correctly

Responsibility: Service technician or machine operator

Frequency: Every 2,500 hours

The alternator must operate without abnormal vibrations or noise. If particular noises or an increase in vibrations occur, check the following.

- Alignment of the alternator with the engine;
- The presence of stress in the three-phase engine and the vibration-damping supports;
- The balance of the rotor;
- The status of the alternator bearings.

6.5.5 Checking and replacing the diodes bridge

Responsibility: Service technician

Frequency: In the case of a fault

Prerequisites: The alternator is at a standstill and has cooled down

The diodes bridge is made up from 3 blocks with 2 diodes (see la *Figure 27- Rectifier bridge*).

- ➔ Remove the PMG lid;
- ➔ Remove the PMG;;
- ➔ Access the rectifier bridge (see *Figure 28-*);
- ➔ Check each diode in both directions using a multimeter set for verification of the diodes. If necessary, replace the diodes bridge. Check the spare parts code in *8 Spare parts.*

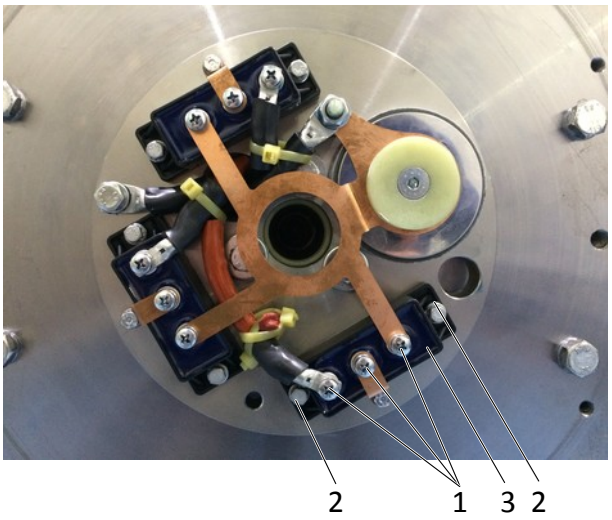


Figure 28- Rotating rectifier

- ➔ Remove the clamping screws (1);
- ➔ Remove the 2 clamping screws (2) of the rectifier block;
- ➔ Remove the rectifier block (3);
- ➔ Install a new rectifier block (3);
- ➔ Re-mount the clamping screws (2) of the rectifier block;
- ➔ Fix the connections to the terminals again;
- ➔ Re-mount the protective grids from the alternator cooling air inlet vents.

6.5.6 Checking the DER 2 regulator operation

Responsibility: Service technician

Prerequisites: The alternator is operating

Malfunctioning of the DER 2 voltage regulator can cause the failure of alternator functioning or its irregular functioning.

Perform the following checks if in doubt regarding operation of the regulator. Refer also to the regulator manual and the manual of the DXR Terminal software (see *10.2 Components documentation*).

DANGER

Moving mechanical machine parts!
Risk of dragging or entrapment.

- Do not approach moving machine parts during operations.

DANGER

Hazardous voltage inside the alternator auxiliaries box.
Electric shock and electrocution hazard.

- Do not touch components contained in the auxiliaries box.
- Wear suitable protective gloves.

- Visually check the regulator, checking the presence of damage;
- Verify the status of the signalling LED present (6 in Figure 19-);
- Connect a PC through the USB port present in the regulator and through the DXR Terminal, check the presence of alarms;
- Check the integrity of the fuse inside the regulator (see *6.5.8 Replacing the DER 2 voltage regulator fuse*).

If the problems detected are not solved, contact the Mecc Alte S.p.a. after-sales service. Replace the regulator if necessary.

6.5.7 DER 2 voltage regulator replacement

Responsibility: Service technician

Prerequisites: The alternator is at a standstill and disconnected from the electric power supply

NOTE

The DER 2 voltage regulator must be set by Mecc Alte S.p.a. before assembly. The calibration data must be communicated when a new regulator is ordered.

Replace the DER 2 regulator, as described below. Refer to *Terminals box connection* on page 39 and *Auxiliaries box connection* on page 41.

- ➔ Remove the lid of the auxiliaries box;
- ➔ Remove the electric connection to the regulator;
- ➔ Remove the four regulator clamping screws and remove the regulator;
- ➔ Mount a new regulator and fix it with the four screws;
- ➔ Restore the electric connections;
- ➔ Re-mount the lid of the auxiliaries box.

6.5.8 Replacing the DER 2 voltage regulator fuse

Responsibility: Service technician

Prerequisites: The alternator is at a standstill and disconnected from the electric power supply

Replace the fuse of the DER 2 regulator, as described below. Refer to *Figure 19- DER 2 voltage regulator*.

- ➔ Remove the lid of the auxiliaries box;
- ➔ Identify the fuse in the regulator and replace it;
- ➔ Re-mount the lid of the auxiliaries box.

6.5.9 Removing the disc holder hub

Responsibility: Service technician or machine operator

Prerequisites: The alternator has been uncoupled from the prime engine

⚠	**CAUTION**
Risk of hub falling. Possibility of injury to operator or damage to the hub. ● Support the hub with suitable lifting equipment during the final extraction phase.	

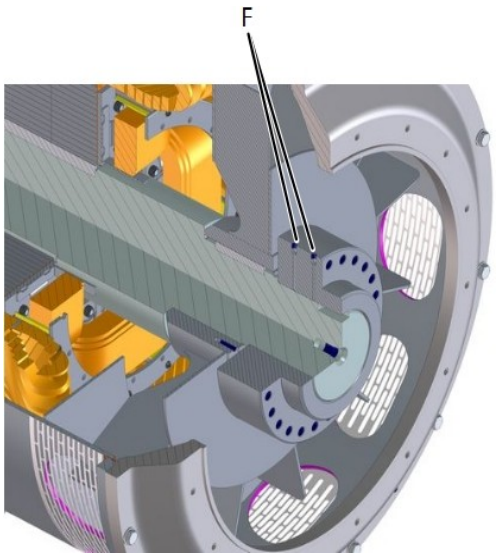
Alternators ECO47

1- Remove the coupling discs as described in *Removing the SAE 21 discs - Single support alternators.* and *Removing the SAE 18 discs - Single support alternators.* on page 82

There are two different methods for extracting the hub.

✔ Envision the use of an additional flange of suitable size.

➔ Fix the flange to the hub with at least 6 x M20 Cl. 8.8 screws.

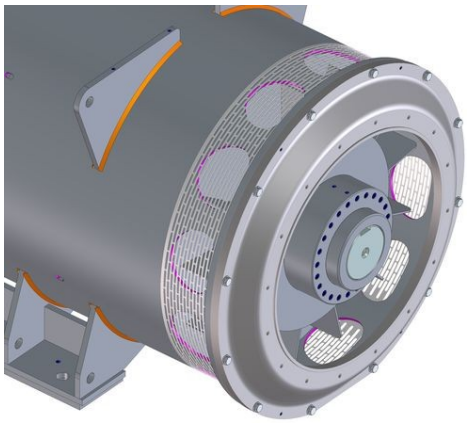


Introducing pressurised oil

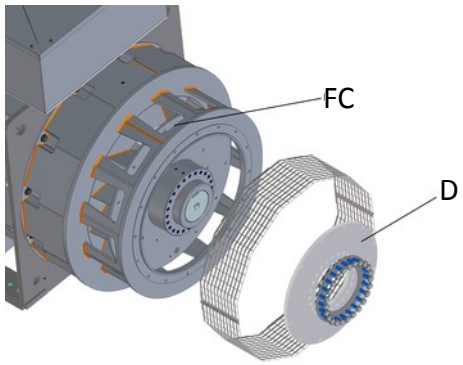
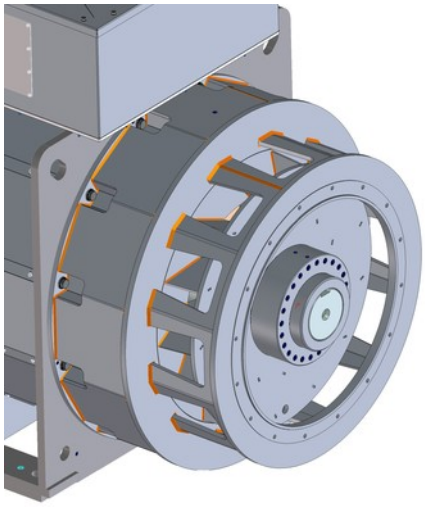
1- Use a soft belt, as a loop, to fasten the hub to be removed, in a way to prevent it falling once extracted;

2- Pump oil into the holes (F) indicated, until oil starts to escape from the contact area between shaft and hub;

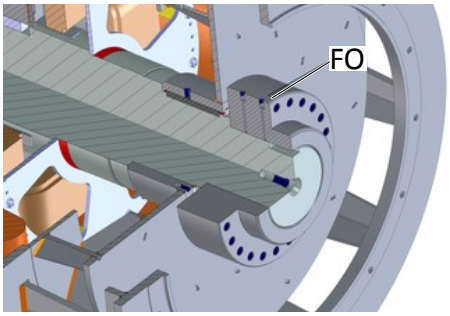
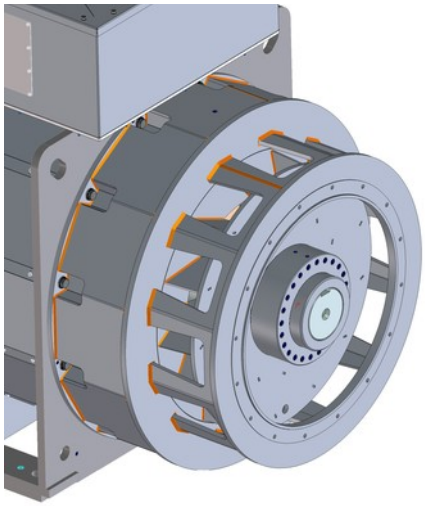
3- Operate on the additional flange with and extractor to remove the shaft

	**Heating and extraction** 1- Position a three arm extractor and attach it to the additional flange; 2- Heat the hub uniformly using two torches; 3- Pressurise the extractor until the hub is removed completely from the shaft;

ECO49 alternators

	1- Remove the protection net on the SAE shield; 2- Support the rotor using a threaded bar M16 in the hub of the fan through the hole FC; 3- Loosen the 24 x M20x60 hex head screws, which fix the flywheel discs (D) to the hub; 4- Remove the flywheel discs from their seat on the hub.
	5- Envision the use of an additional flange, with suitable dimensions, and fix it to the shield DE to be extracted with at least 6 x M20 class 8.8 screws. M20 screws maximum coupling torque=> 100Nm ±7%.

There are two different methods for extracting the hub.

	**Introducing pressurised oil** 1- Use a soft belt, as a loop, to fasten the hub to be removed, in a way to prevent it falling once extracted; 2- Pump oil into the hole (FO) indicated, until oil starts to escape from the contact area between shaft and hub; 3- Extract the hub from the rotor shaft ECO49 MD35 with a three arm extractor.
	**Heating and extraction** 1- Position a three arm extractor and attach it to the additional flange; 2- Heat the hub uniformly using two torches; 3- Pressurise the extractor until the hub is removed completely from the shaft of the rotor ECO49 MD35.

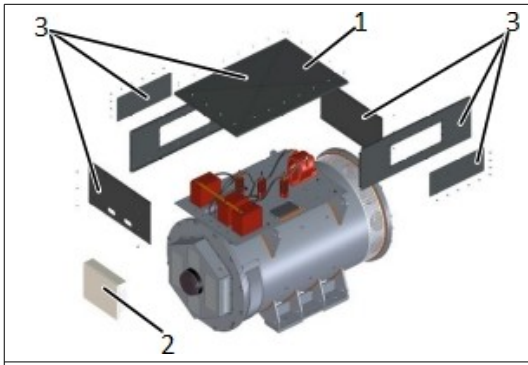
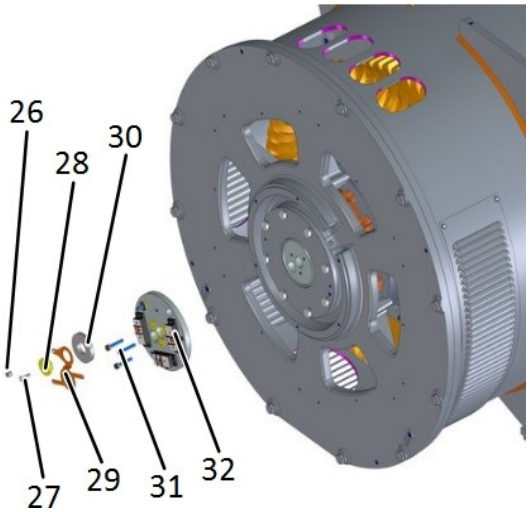
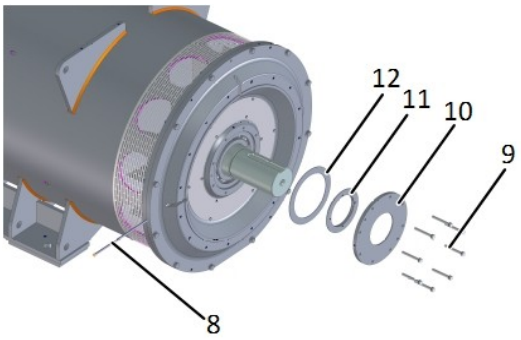
6.6 Disassembly of the alternators

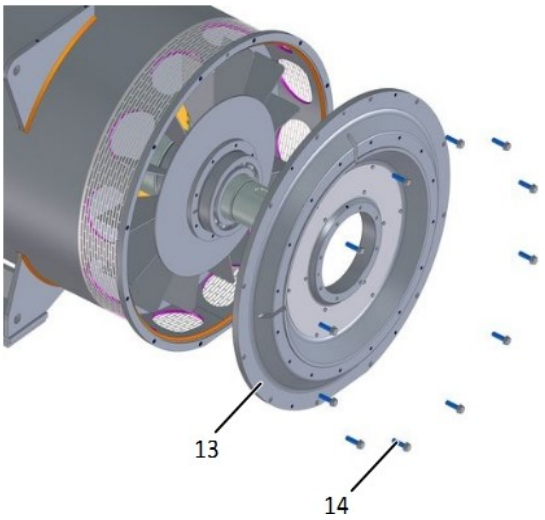
The alternator must be removed for some maintenance operations. Below find the descriptions of the disassembly operations to which reference must be made inside the manual.

6.6.1 Disassembly of the Alternators ECO47

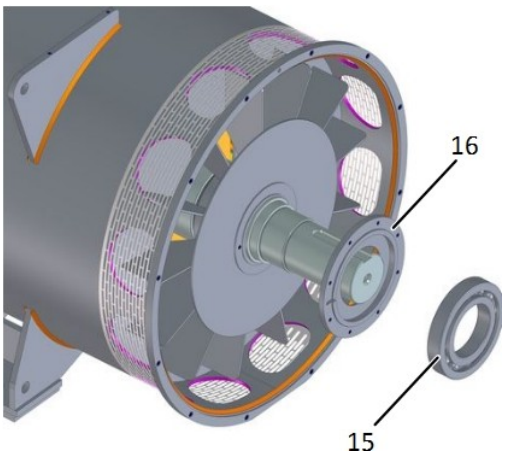
Disassemble the alternators as described successively.

The description of the operations is distinguished by single support alternator models (MD35) and dual support models (B3B14) and the common operations for the two alternator models are indicated.

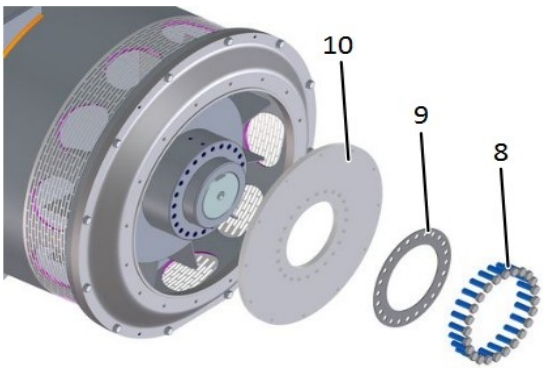
<table>
<tr>
<td> 
</td>
<td>1- Remove the lid (1) of the terminal box.
2- Cut the auxiliaries cables straps and disconnect them.
3- Disconnect all auxiliary cables from the terminal box and extract them.
4- Remove the auxiliaries box (2).
5- Remove all panels (3) of the terminal box.</td>
</tr>
<tr>
<td> 
</td>
<td>6- Disconnect all of the power cables from the isolators and the current and voltage sensors (4).
7- Remove the M6 (5) hex head clamping screws of the connection collar of the terminal box to the stator casing.
8- Remove the M12 (6) hex head clamping screws from the base plate of the terminal box.
9- Remove the base plate (7).</td>
</tr>
<tr>
<td> 
</td>
<td>Removing the shield - Dual support alternators.
10- Unscrew and remove the greasing pipe (8).
11- Unscrew the M12 (9) hex head screws and remove the external lid of the bearing (10).
12- Remove the slinger shield (11) and the grease threshold ring (12).</td>
</tr>
</table>



13- Use eyebolts to fasten the DE shield (13) connected to the rotor to suitable lifting equipment (weight approx. 2500 kg).
14- Loosen and remove the M16 screws (14).
15- Using the eyebolts on the DE shield (13), rest the rotor delicately on the stator.
16- Extract the DE shield (13).

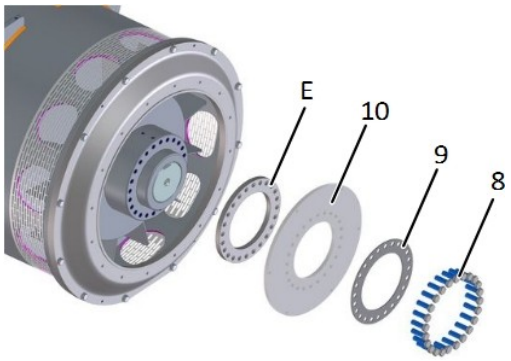


17- Use and extractor to extract the DE bearing (15) Do not operate on the bearing but on the internal lid (16).



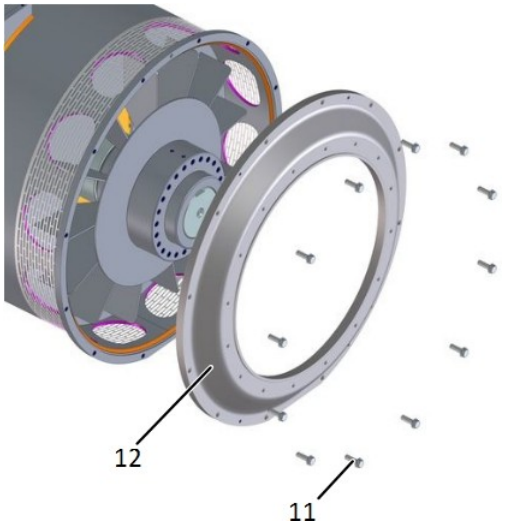
Removing the SAE 21 discs - Single support alternators.

18- Loosen and remove the M20x60 screws (8).
19- Remove the joint press disc (9).
20- Remove the coupling discs (10).

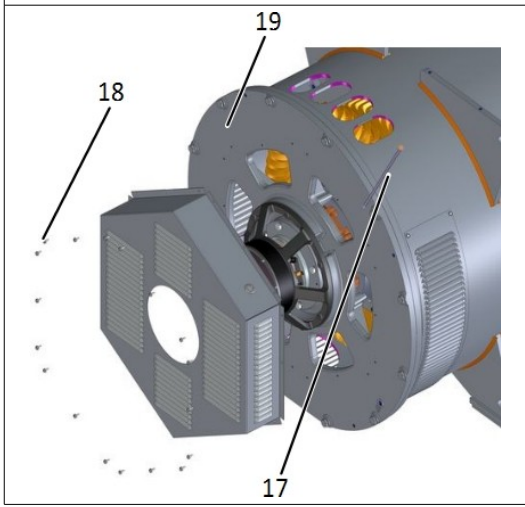


Removing the SAE 18 discs - Single support alternators.

21- Loosen and remove the M20x60 screws (8).
22- Remove the joint press disc (9).
23- Remove the coupling discs (10) and the spacer ring (E).

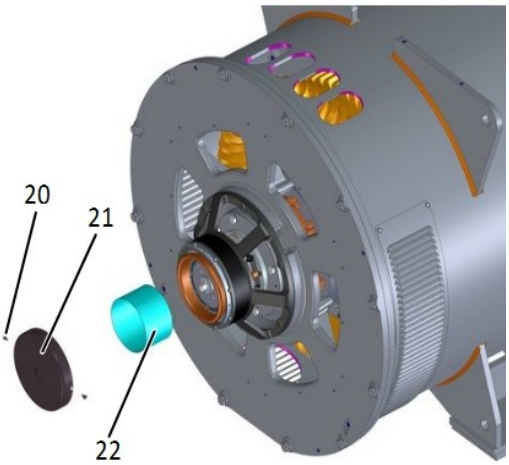
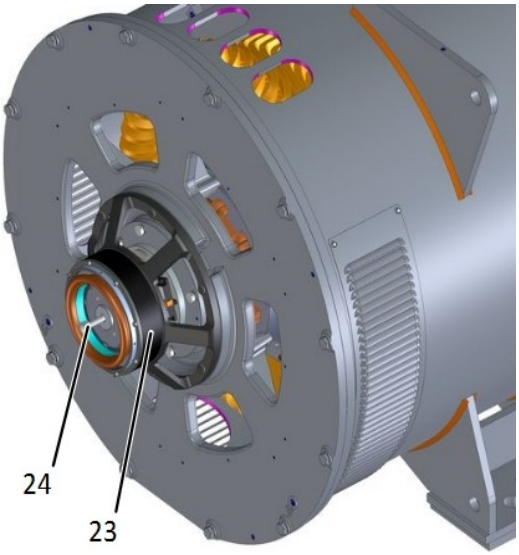
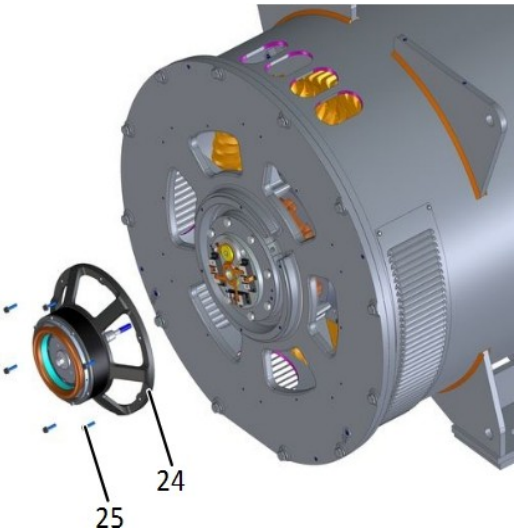


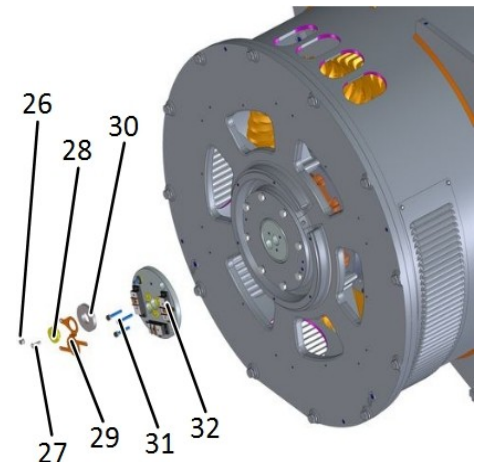
24- Use eyebolts to fasten the DE shield (12) to suitable lifting equipment (weight approx. 160 kg).
25- Unscrew the M16x55 screws (11) to remove the DE shield.



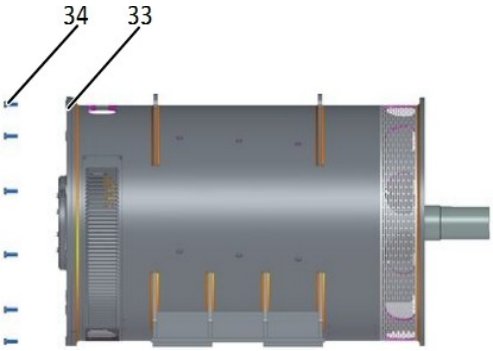
Removing the NDE protection

26- Unscrew and remove the greasing pipe (17).
27- Loosen and remove the M6 hex head screws (18) of the rear protection (19).
28- Remove the rear protection (19).

	29- Loosen the M5 TEIC screws (20) and remove the protection cap (21). 30- Insert a paper spacer (22) with thickness of 0.2-0.3 mm between stator and PMG rotor.
	31- Loosen the central tie-rod M14 (23) and, without removing it completely, use it as a lever on the PMG in order to uncouple it from the shaft. 32- 24- Use a soft belt to attach the PMG (24) (weight approx. 30 kg) to suitable lifting equipment.
	33- Loosen the M8 hex head screws (25). 34- Remove the PMG unit (24).



35- Loosen and remove the M8 nut (26).
36- Unscrew and remove the M8 (27) Hexagon socket countersunk flat head cap screws and the varistor support bushing (28).
37- Loosen the M5 screws of the rectifiers, remove the rectifier poles connection bridge (29) and the varistor (30).
38- Loosen the M8 (31) hex head screws and remove diodes bridge (32).

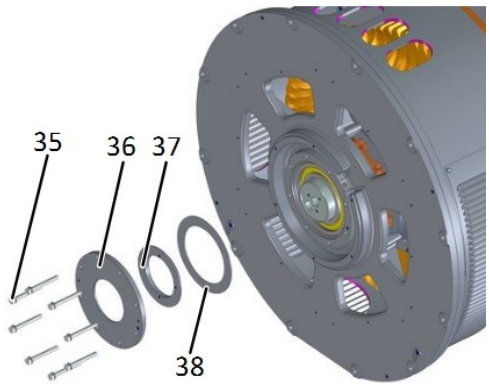


Removing the NDE shield

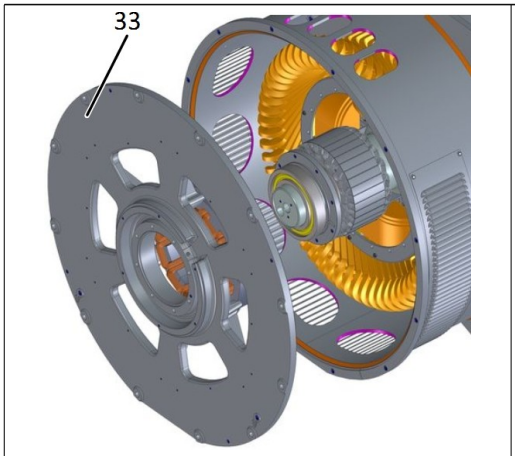
NOTE

Remove the NDE shield only if it is necessary to extract the rotor from the machine.

39- Fasten the NDE shield (33) to suitable lifting equipment using eyebolts (shield-rotor overall weight approx. 2600 kg).
40- Loosen and remove the M16 clamping screws (34).
41- Use M12 screws in the relevant threaded holes of the NDE shield to move the shield approx. 10 mm from the stator, keeping the NDE shield and the stator lifted, and place the rotor delicately on the stator.



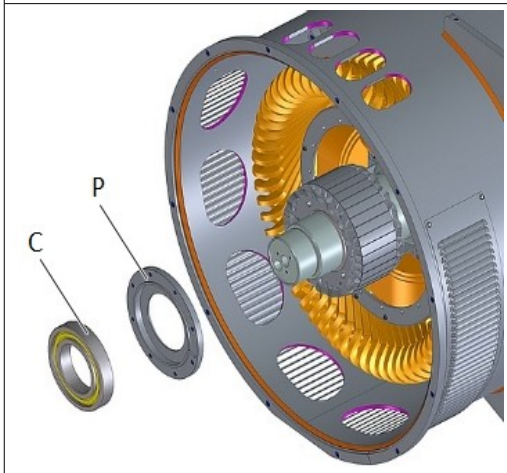
42- Unscrew and remove the M12 (35) hex head screws and remove the external lid of the bearing (36).
43- Remove the slinger shield (37) and the grease threshold ring (38).



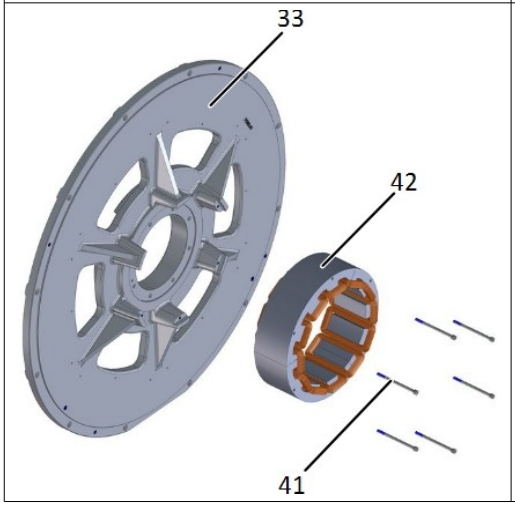
44- Remove the NDE shield (33) from the bearing while maintaining it lifted via eyebolts (weight approx. 150 kg).

NOTE

If necessary, use an extractor to push between shaft and shield.

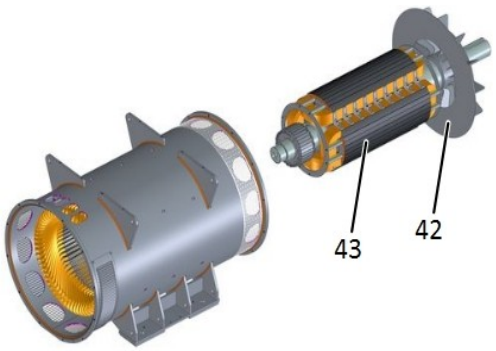


45- Extract the bearing (C):
- Use an extractor with 3 arms.
- Pull on the internal lid (P) instead of directly on the bearing.



46- The exciter stator (42) will remain attached to the NDE shield (33).

47- Unscrew the M12 screws (41) to remove the shield.



48- Support the rotor (43) on both sides and extract it from the machine.

49- As soon as possible, support the rotor by passing soft belts around the rotor pack and paying attention not to apply force to the fan (42).

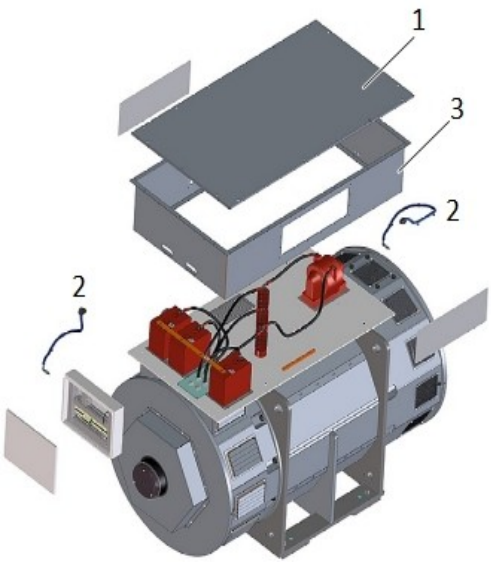
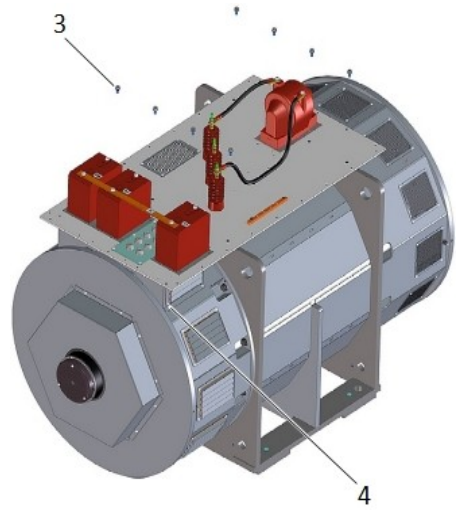
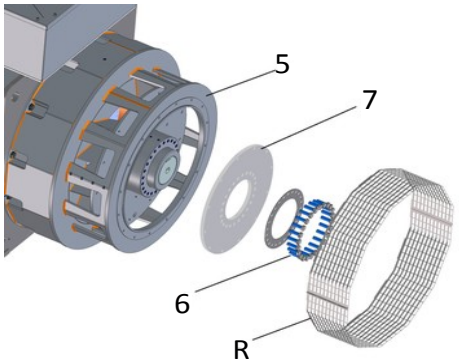
NOTE

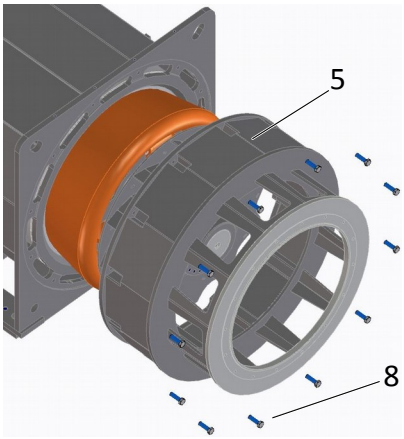
Attention not to rub the rotor on the stator.

6.6.2 Disassembly of the Alternators ECO49

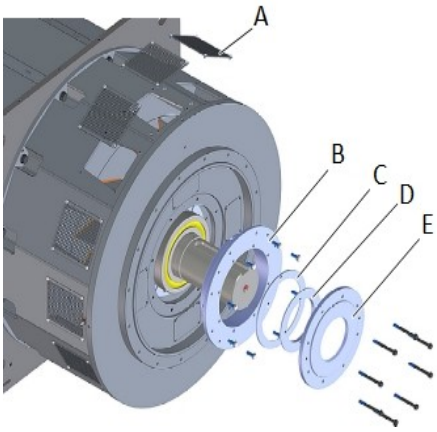
Disassemble the alternators as described successively.

The description of the operations is distinguished by single support alternator models (MD35) and dual support models (B3B14) and the common operations for both alternator models are indicated.

<table>
<tr>
<td> 
</td>
<td>Both alternator models
1- Remove the lid (1) of the terminal box.
2- Cut the auxiliary cables straps side the terminal box.
3- Disconnect all auxiliary terminal board cables and extract them from the terminal box.
4- Disconnect the set-ups and the vibration sensors (2).
5- Remove all of the lateral panels (3) from the terminal box.</td>
</tr>
<tr>
<td> 
</td>
<td>6- Disconnect all of the power cables from the isolators and the current and voltage sensors.
7- Remove the M12 x 30 hex head clamping screws from the base plate (3) of the terminal box.
8- Remove the M6 x 12 hex head clamping screws of the connection collar (4) of the terminal box to the shield on the non drive end.
9- Remove the base plate.</td>
</tr>
<tr>
<td> 
</td>
<td>Single support alternators
10- Remove the IP23 protection net (R) from the drive end shield (5).
11- Loosen the 24 x M20 x 60 hex head screws (6) and remove the coupling SAE discs (7).</td>
</tr>
</table>

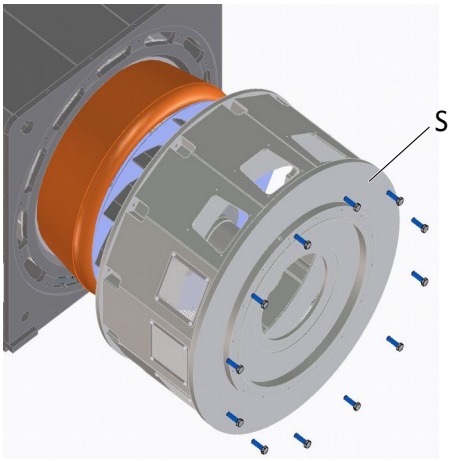


12- Use soft belts to fasten the DE shield (5) to suitable lifting equipment.
13- Loosen the 12 x M20 x 65 hex head screws (8) and extract the shield (weight approx. 340 kg).

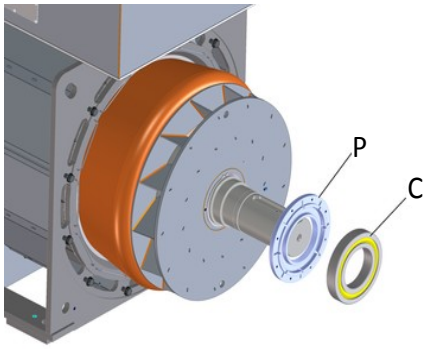
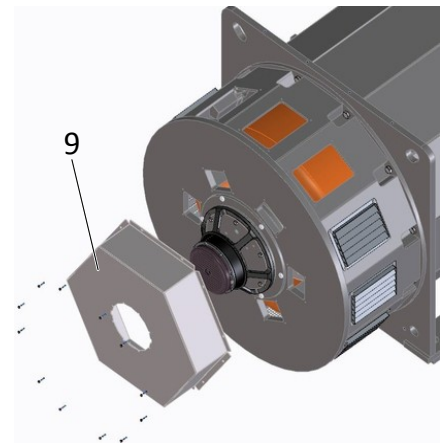
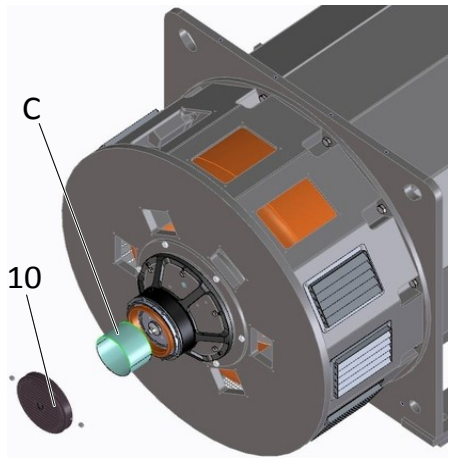


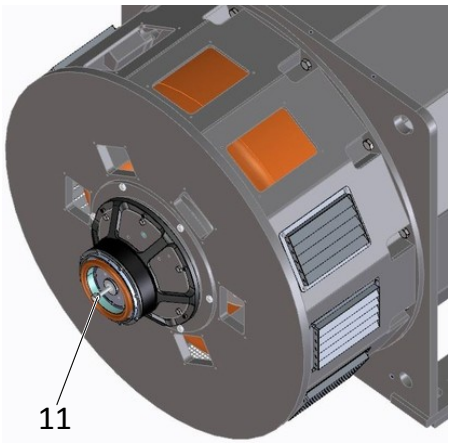
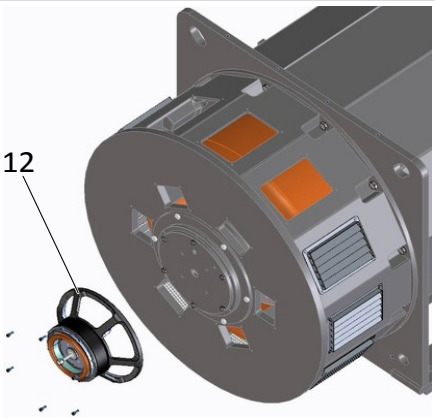
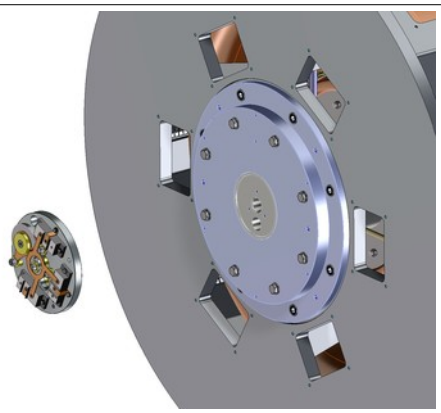
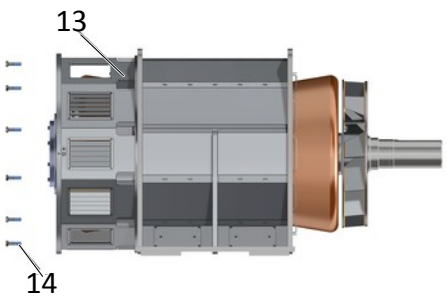
Dual support alternators

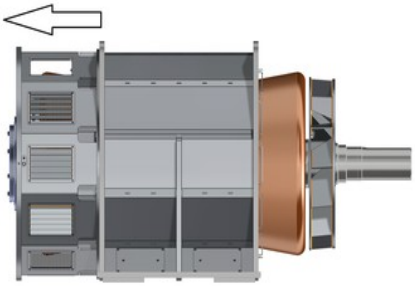
1- Loosen the M12x110 hex head clamping screws and remove the bearing lid (E) on the coupling side shield.
2- Remove the oiler ring (D) and the grease threshold ring (C).
3- Loosen the M6x12 screws and remove the three upper protection covers (A).
4- Attach the hole present on the central ring of the fan using a soft belt and keep the rotor lifted (2000 kg).
5- Loosen the M12x40 hex head clamping screws.
6- Fasten the bearing seat using an eye-bolt and a lifting device (B) and complete the extraction (weight approx. 35 kg).



7- Delicately place the rotor on the stator and remove the soft belt from the fan.
8- Use soft belts to fasten the coupling side NDE shield (S) to suitable lifting equipment.
9- Loosen the 12 x M20x65 hex head screws and extract the shield (weight approx. 340 kg).

	10- Extract the bearing (C): ● Use an extractor with 3 arms. ● Pull on the internal lid (P) instead of directly on the bearing.
	**Both alternator models** 11- Remove the greaser pipe. 12- Remove the 12 x M6x30 hex head screws. 13- Remove the rear guard .(9) (weight approx. 20 kg).
	14- Remove the protection cap (10) of the PMG via the 2 x M5 x 10 lateral convex hex socket head screws. 15- Insert a paper spacer (C) with thickness of 0.2-0.3 mm between stator and PMG rotor.

	16- Loosen the central tie-rod M14 (11) without removing it completely. 17- Use the tie-rod to lever on the PMG device to uncouple it from the shaft. 18- Use a soft belt to attach the PMG to suitable lifting equipment.
	19- Remove the 6 x M8 x 20 screws. 20- Use a lever to remove the PMG device (12).
	21- Disconnect all rotating rectifier cables. 22- Remove the rotating rectifier.
	23- Use soft belts to fasten the NDE shield (13) (weight approx. 2500 kg) and the end of the LA shaft (weight approx. 2000 kg) to suitable lifting equipment. 24- Remove the 12 x M20 x 65 screws (14).



25- Use M12 sews in the threaded holes to move the NDE shield approx. 10 mm from the stator.
26- Keep the DE rotor lifted.
27- Place the rotor on the stator.

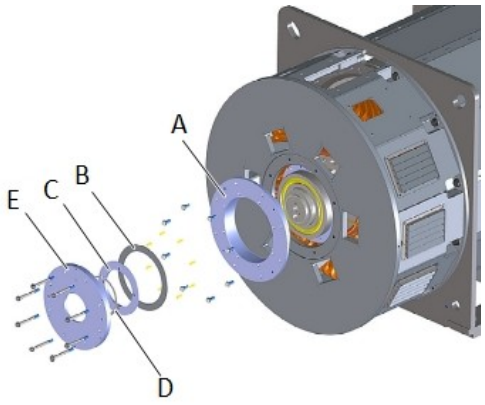
NOTE

Remove the DE shield only if it is necessary to extract the rotor from the machine.

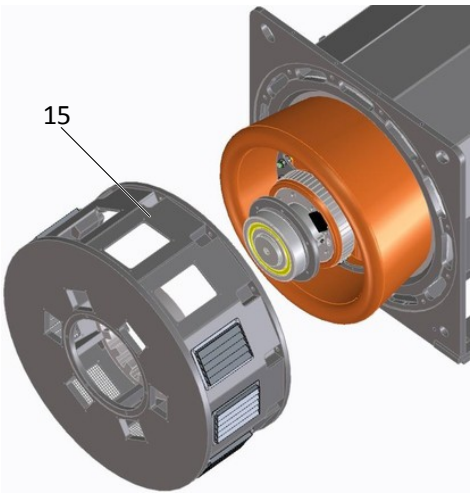
28- Pass a belt through the intermediate ring of the fan (weight approx. 2000 kg) to lift the rotor.

NOTE

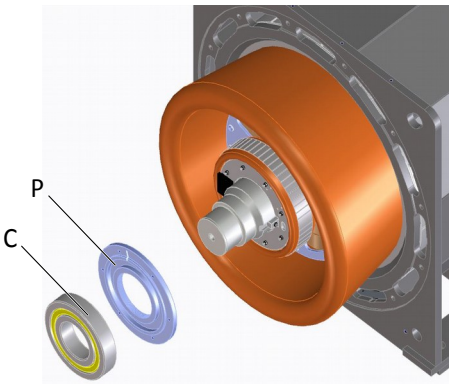
Attention not to rub the rotor on the stator.



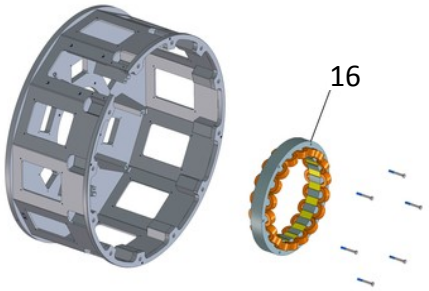
29- Remove the 8 x M12x140 hex head screws and extract the bearing lid (D). Use the relative holes for M8 extraction (weight approx. 23 kg).
30- Remove the oiler ring (C) and the grease threshold ring (B).
31- Remove the 6 x M12x40 hex head screws in order to extract the bearing seat (A).
32- Use an eyebolt to fasten the bearing seat (A) (weight approx. 46 kg) to suitable lifting equipment and complete extraction.



33- Use soft belts to keep the NDE shield lifted (15) from the bearing (weight approx. 360 kg).
34- If necessary, use an extractor to push between shaft and shield.



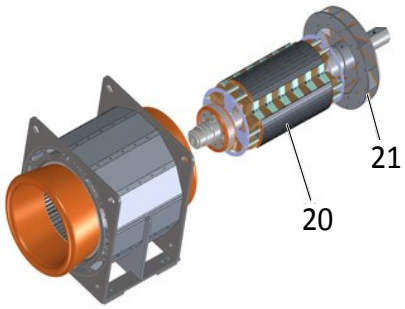
35- Extract the bearing (C):
- Use an extractor with 3 arms.
- Pull on the internal lid (P) instead of directly on the bearing.



Both alternator models

36- The exciter stator (16) will remain attached to the NDE shield.

37- Unscrew the 6 x M12 x 90 hex head screws to remove the shield.



38- Support the machine rotor (20) from both sides.

39- Extract the rotor.

40- As soon as possible, pass soft belts around the rotor pack to support it.

NOTE

Do not use the fan to support the rotor.

NOTE

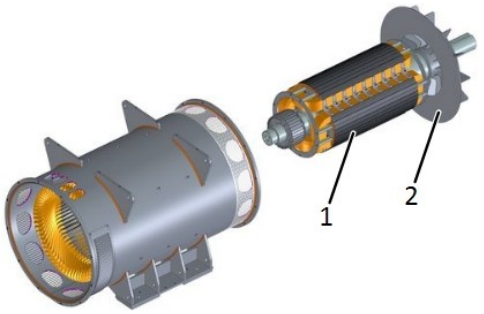
Attention not to rub the rotor on the stator.

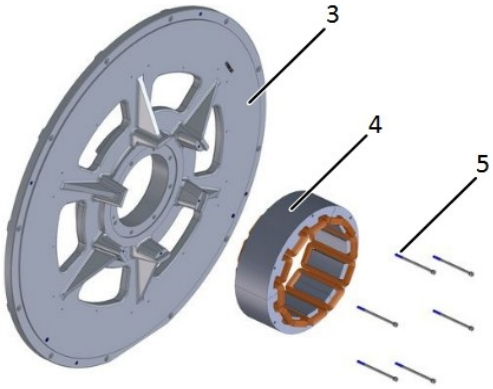
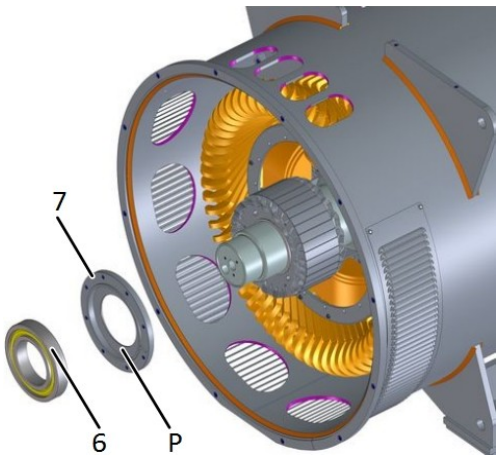
41- Put the rotor in a safe place.

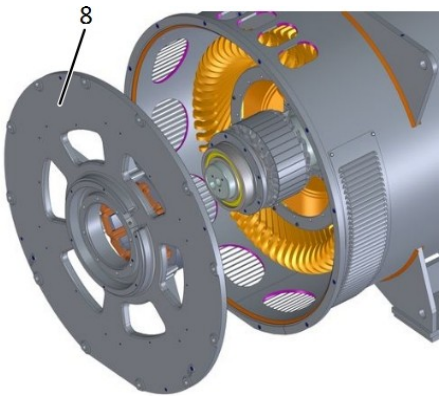
6.7 Assembling of the alternators

6.7.1 Assembling Alternators ECO47

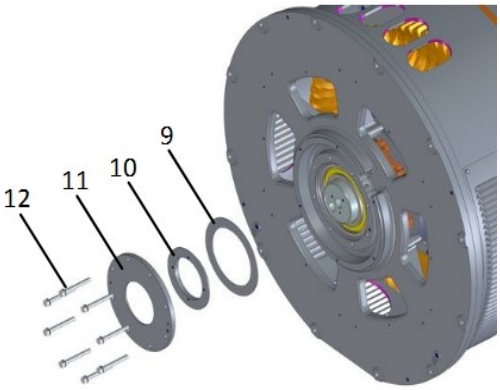
Re-mount the alternators as described successively. The description of the operations is distinguished by single support alternator models (MD35) and dual support models (B3B14) and the common operations for both alternator models are indicated.

<table>
<tr>
<td> 
</td>
<td>NOTE
Do not apply force onto the fan(2)during operations.

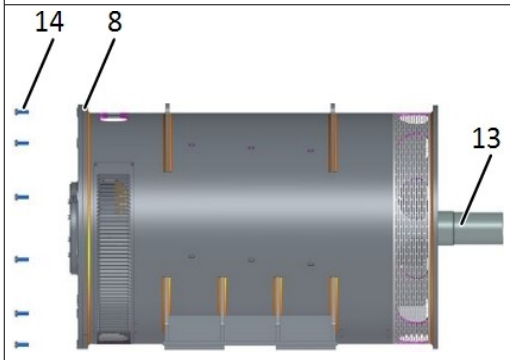
1- Support the rotor on both sides using soft belts (1).
2- Insert the rotor into the casing.
3- Position the rotor by aligning the rotor pack with the stator pack.</td>
</tr>
<tr>
<td> 
</td>
<td>4- Mount the exciter stator (4) on the NDE shield (3) using the M12 hex head screws (5).</td>
</tr>
<tr>
<td> 
</td>
<td>5- Insert the bearing internal lid (6).
6- Fill the hollow (P) present on the bearing lid with grease.
7- Pre-heat the bearing (7) to 110 °C and introduce it.
8- Prepare an M12 tie-rod in one of the threaded holes of the bearing lid (6) to facilitate alignment with the external lid.
9- Fill approx. 50% of the free volume with grease to lubricate the bearing (7).</td>
</tr>
</table>



10- Use eyebolts to keep the NDE shield lifted (8) (weight approx. 150 kg).
11- Re-mount the shield, by inserting the bearing into the seat completely.



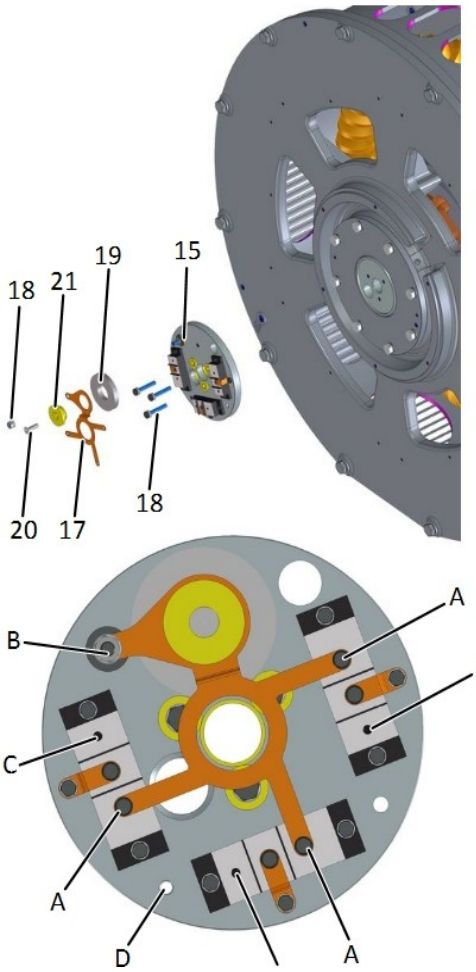
12- Insert the grease threshold ring (9).
13- Insert the slinger ring (10).
14- Insert the bearing external lid (11) and fix it to the internal lid using M12x100 hex head screws (12).



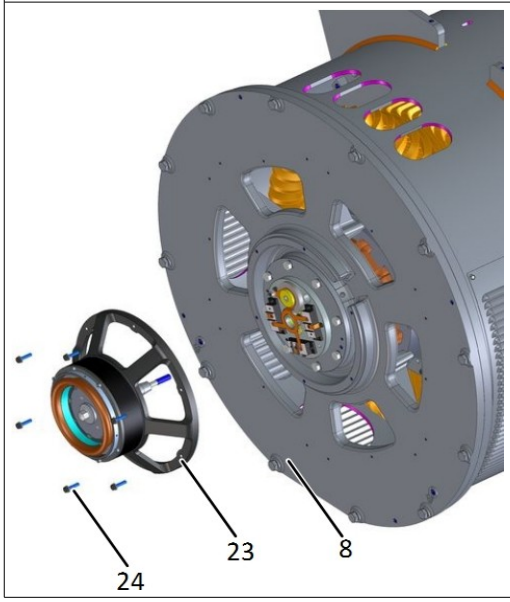
15- Fasten the NDE shield (8) and the DE (13) of the shaft to suitable lifting equipment (overall weight 2600 kg).
16- 14- Lift the NDE shield (8) and the rotor slightly to fix the shield to the stator using the M16X60 screws (14).

NOTE

Attention not to rub the rotor on the stator.



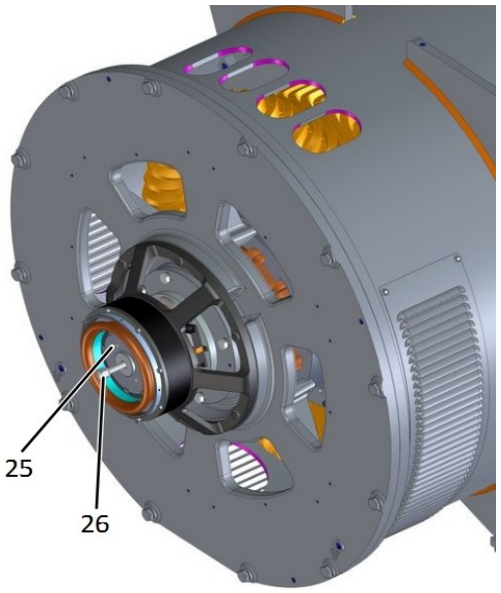
17- Fix the unit (15) with the M8x50 screws (16).
18- Connect the exciter rotor cables to the 3 rectifiers (C).
19- Connect the positive pole [+] of the rotor winder to the base of the unit (D).
20- Fix the copper connection clamp (17) using the rectifier screws (A).
21- Connect the negative pole [-] of the winder to the point (B) and fix it using the M8 nut (18).
22- Position the varistor (19) under the copper connection clamp (17) and fix it using the Hexagon socket countersunk flat head cap screw M8x30 (20) and the vetronite bushing (21).



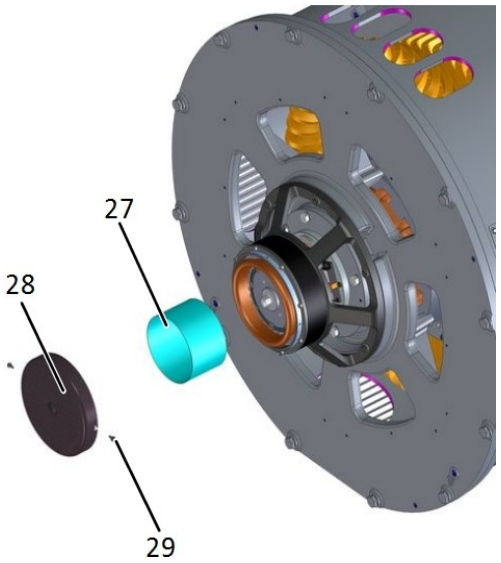
23- Couple the PMG support (23) to the NDE shield (8) and fix it using the M8x35 screws (24).

NOTE

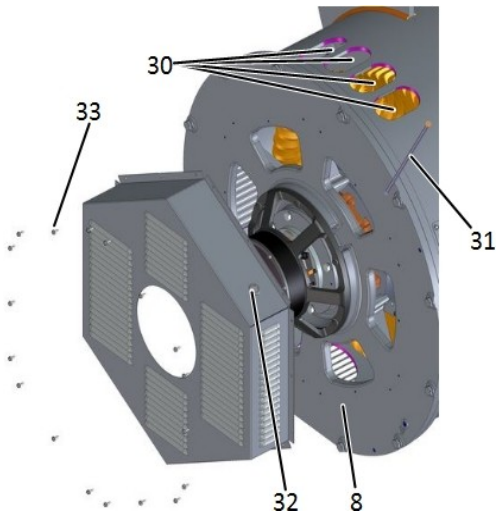
Position the PMG so that the cable faces upwards.



24- Fix the PMG rotor (25) to the shaft, via the central tie-rod M14 (26).



25- Remove the paper spacer (27) present in the PMG gap.
26- Mount the PMG protection cap (28) and fix it with the M5x12 (29) lateral screws.

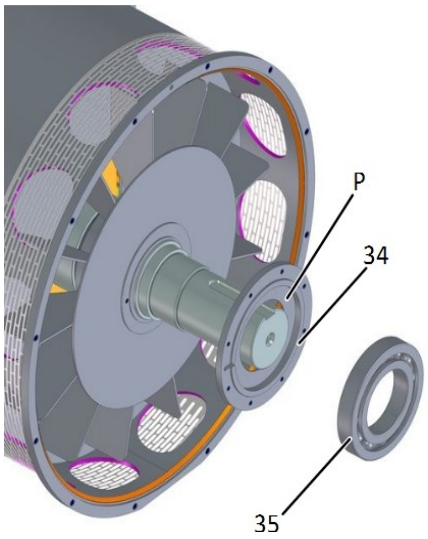


27- Pass all the power and auxiliary cables through the holes in the stator casing (30).

NOTE

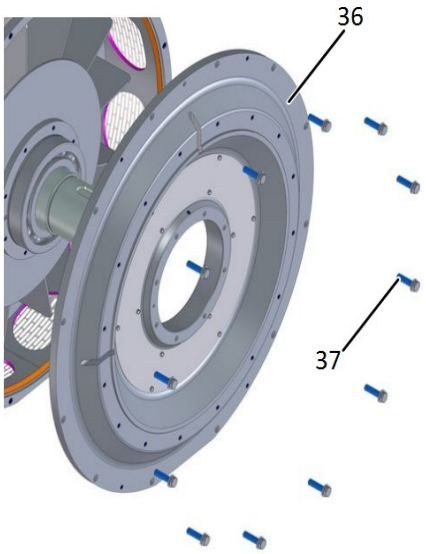
Fix the cables using straps to prevent movement.

28- Mount the greasing pipe with the respective elbow joint (31), keeping it inclined by about 60° with respect to the horizontal axis.
29- Pass the greasing pipe (31) through the hole in the NDE protection template (32).
30- Fix the NDE protection template (32) to the shield (8) using the M6x16 screws (33).



Assembly of the shield - Dual support alternators

31- Insert the bearing internal lid (34).
32- Fill the hollow (P) present on the bearing lid with grease.
33- Pre-heat the bearing (35) to 110 °C and introduce it.
34- Prepare an M12 tie-rod in one of the threaded holes of the bearing lid (36) to facilitate alignment with the external lid.
35- Fill approx. 50% of the free volume with grease to lubricate the bearing (35).

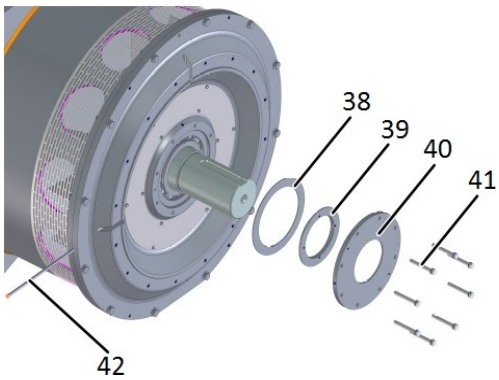


36- Use eyebolts to keep the DE shield lifted (36) (weight approx. 180 kg) and insert the bearing into the seat completely.

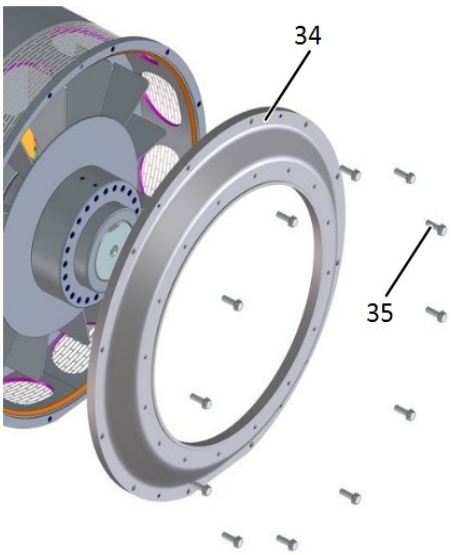
NOTE

During insertion, use the previously-fixed tie-rod to control the direction of the bearing internal lid.

37- Fasten the DE shield to suitable lifting equipment (shield+rotor overall weight 2600 kg).
38- Lift the DE shield assembly to the rotor and fix it using the M16x60 screws (37).



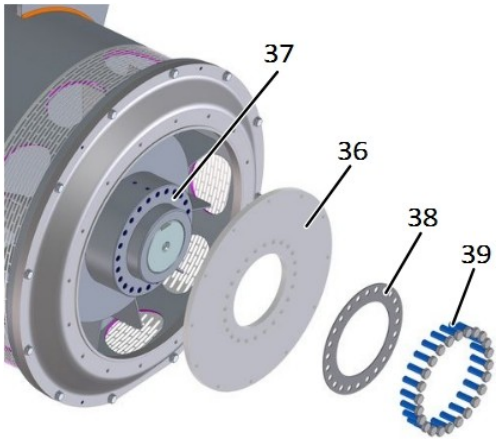
39- Insert the grease threshold ring (38).
40- Insert the slinger ring (39).
41- Mount the bearing external lid (40) directing the greaser hole horizontally, aligned with the DE shield hollow.
42- Fix the bearing external lid with the M12x100 screws (41).
43- Insert the greaser (42) in a horizontal position through the hollow of the DE shield.



Assembly of the shield - Dual Single support alternators.

44- Use eyebolts to fasten the DE shield (34) to suitable lifting equipment (weight approx. 160 kg).

45- Place the DE shield at the stator casing and fix it using the M16x55 screws (35).

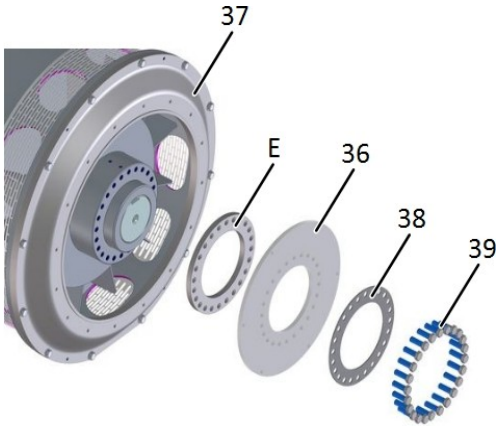


Assembly of the SAE 21 discs - Single support alternators.

46- Introduce the coupling discs (36) onto the hub (37).

47- Introduce the joint press disc (38).

48- Fix with the M20x60 screws (39).

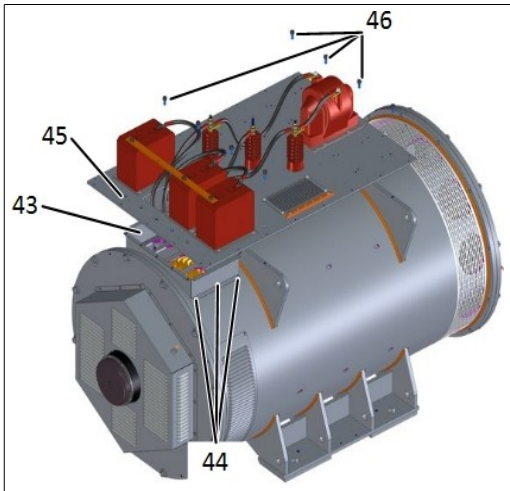


Assembly of the SAE 18 discs - Single support alternators.

49- Introduce the spacer ring (E) and the coupling discs (36) onto the hub (37), aligning the holes for the screws.

50- Introduce the joint press disc (38).

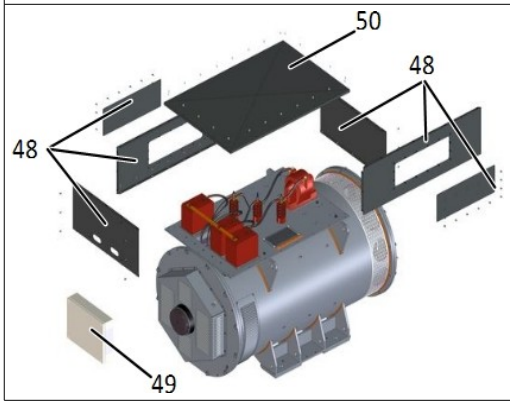
51- Fix with the screws M20x60 (39).



52- Fix the cables protection guard (43) to the casing with the M6x16 screws (44).
53- Mount the base plate (45) of the terminal board box and fix it using theM12x35 screws (46).
54- Fix the collar to the base plate with the M6x20 screws.

NOTE

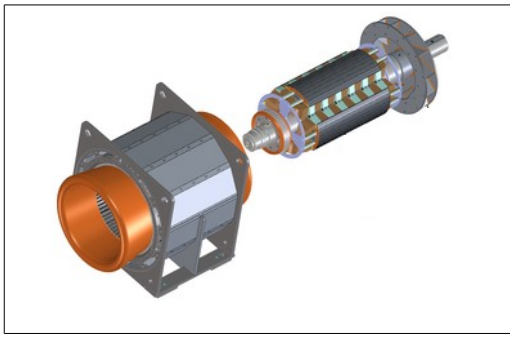
All the electric cables must pass through the window present on the terminal board base plate.



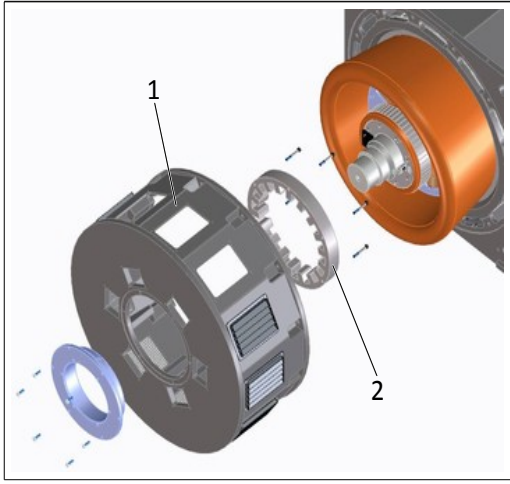
55- Connect the power cables.
56- Mount the lateral panels (48) of the terminal box.
57- Mount the auxiliaries box (49).
58- Insert the terminals of the auxiliary cables into the auxiliary box and connect them to the terminal board according to the wiring diagram.
59- Use straps to fix the auxiliaries cables inside the main box.
60- Mount the terminal box lid (50).

6.7.2 Assembly of the Alternators ECO49

Re-mount the alternators as described successively. The description of the operations is distinguished by single support alternator models (MD35) and dual support models (B3B14) and the common operations for both alternator models are indicated.

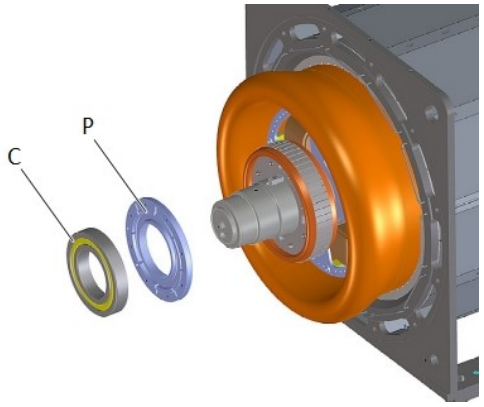


1- Support the rotor on both sides using soft belts and insert it.
2- Position the rotor in a way that it projects towards the NDE by 10-20 mm.



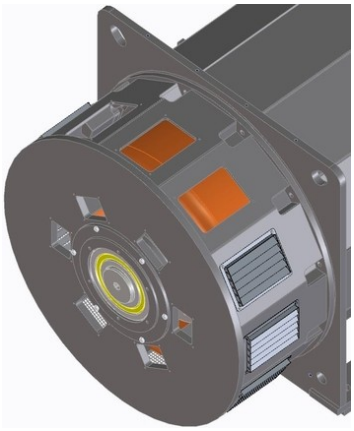
3- Mount the exciter stator (2) on the NDE shield (1) using the 6 x M12 x 90 hex head screws.

4- Mount the bearing support with the 6 x M12 x 40 hex head screws.

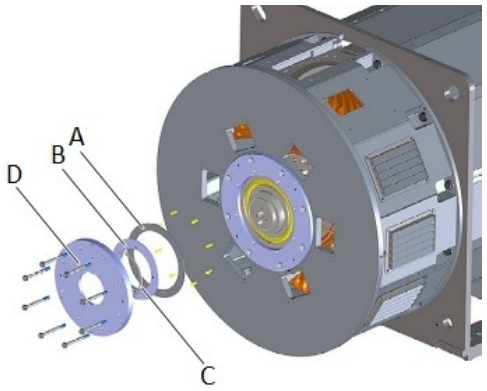


5- Fill the hollow present on the internal lid (P) of the bearing with grease.
6- Insert the components indicated in this order:
- the internal lid of the bearing (P).
- the bearing (C) appropriately pre-heated to 110 °C.

7- Prepare an M12 tie-rod in one of the threaded holes to facilitate the successive alignment of the external lid.
8- Fill approx. 50% of the free volume with grease to lubricate the bearing.

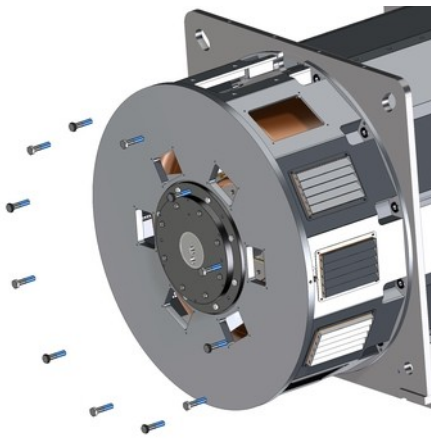


9- Use soft belts to lift the NDE shield (weight approx. 360 kg) in a way that the bearing enters the seat.
10- During insertion, pay attention to the direction of the internal lid, using the previously-inserted tie-rod.



11- Insert the components indicated in this order:
- the bearing pre-load spring;
- the grease threshold ring (A);
- the oiler disc (B);
- the safety ring (C).

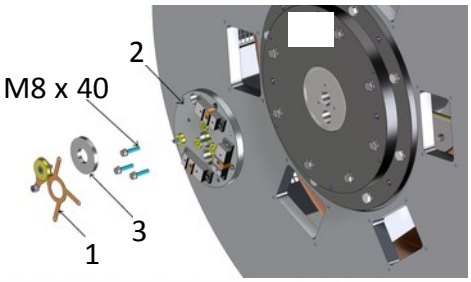
12- Mount the lid (D) so that the greasing hole faces upwards.
13- Fix the lid using the 8 x M12 x 140 hex head screws.

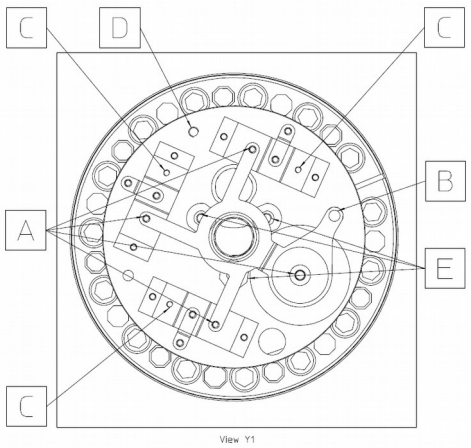


14- Fasten the NDE shield (weight approx. 2500 kg) and the end of the DE shaft (weight approx. 2000 kg) to suitable lifting devices.
15- Lift the NDE casing and rotor slightly by approx. 5 mm in a way to couple the casing with the stator using the 12 x M20 x 65 hex head screws.

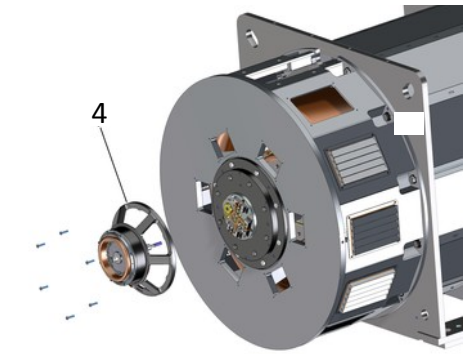
NOTE

Attention not to rub the rotor on the stator.



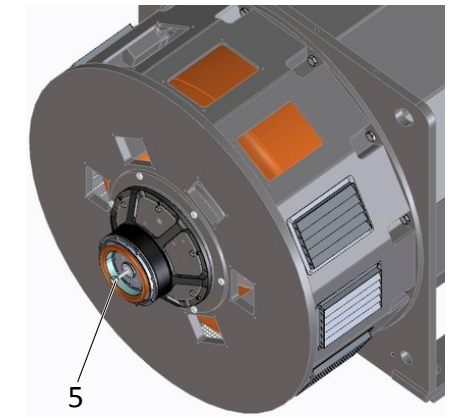


16- Mount the rectifier bridge:
- Fix the unit (2) with the 3 x M8 x 40 screws.
- Connect the three cables of the exciter rotor from the bridges (C), along with the connection (+) of the rotor winding (D).
- Fix the copper connection (1) and the cable (B), rotor winding negative.
- Fix the varistor (3).
- Fix the 4 x M8 screws (A).

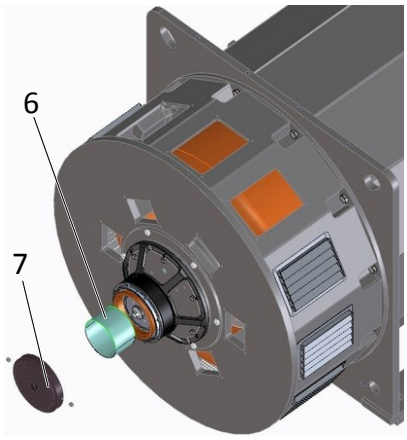
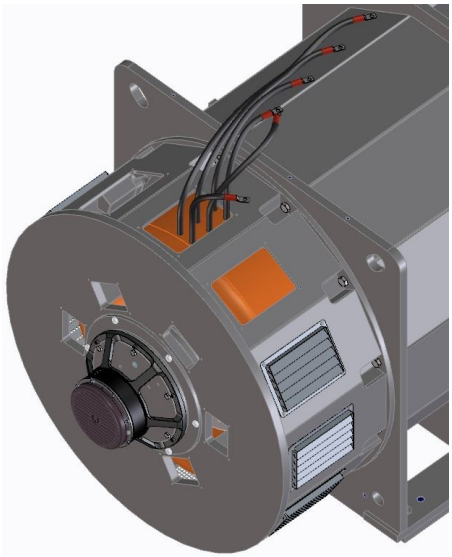
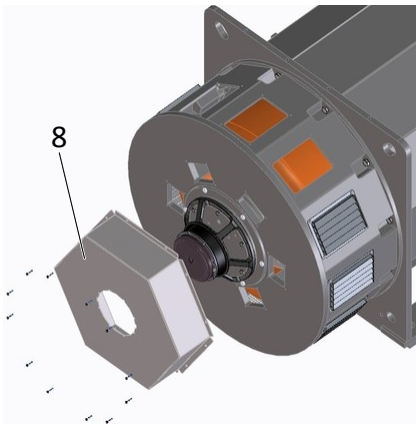


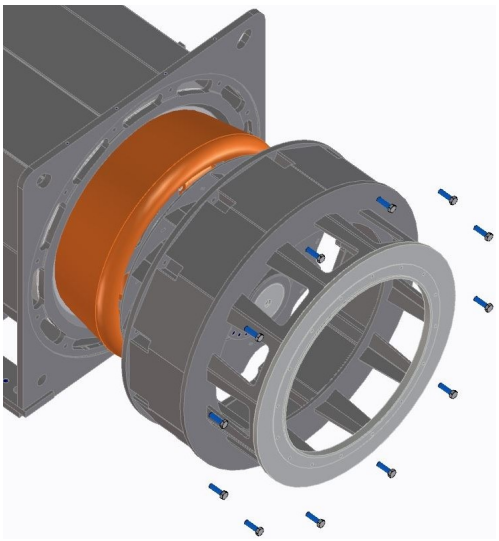
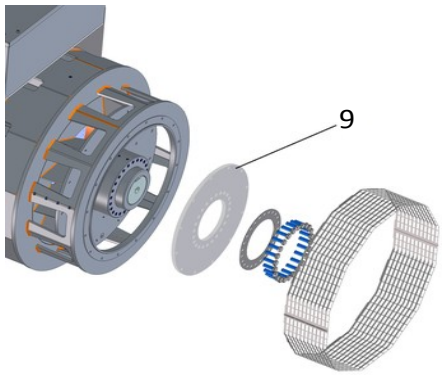
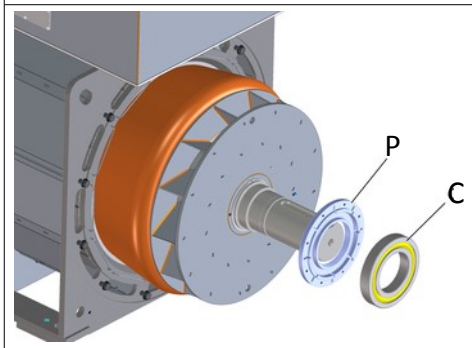
17- Mount the PMG (4).
- Couple the PMG to the support and fix it using the 6 x M8 x 20 screws.
- Couple the complete PMG to the alternator.

Make sure the cable faces upwards.



18- Fix the PMG rotor to the rotor, via the central tie-rod M14 (5).

	19- Remove the paper spacer (6) present in the PMG gap. 20- Mount the protection cap (7) of the PMG and fix it with the 2 x M5 x 10 convex hex socket head screws.
	21- Pass all power and auxiliary connections through the upper window of the shield NDE. 22- Fix all electric cables with the straps so that they cannot move.
	23- Re-mount the rear guard (8) (weight approx. 20 kg) and fix it with the 12 x M6 x 30 hex head screws. 24- Insert the greaser pipe.

<table>
<tr><td>  </td><td>Single support alternators
25- Lift the DE shield (weight approx. 340 kg) using a suitable lifting device.
26- Couple the stator case and fix it using the 12 x M20 x 65 screws.</td></tr>
<tr><td> 
</td><td>27- Mount the coupling discs SAE (9), fixing them with the 24 x M20 x 60 screws.
28- Position the IP23 protection net on the DE casing.</td></tr>
<tr><td> 
</td><td>Dual support alternators
29- Mount the DE shield (A) to the bearing support (B), approx. weight 35 kg, with the 8 x M12 x 40 hex head screws.</td></tr>
<tr><td> 
</td><td>30- Fill the hollow present on the internal lid (P) of the bearing with grease.
31- Insert the components indicated in this order:
● the internal lid of the bearing (P);
● the appropriately pre-heated bearing (C) .
32- Prepare an M12 tie-rod in one of the threaded holes to facilitate the successive alignment of the external lid.
33- Fill approx. 50% of the free volume with grease to lubricate the bearing.</td></tr>
</table>

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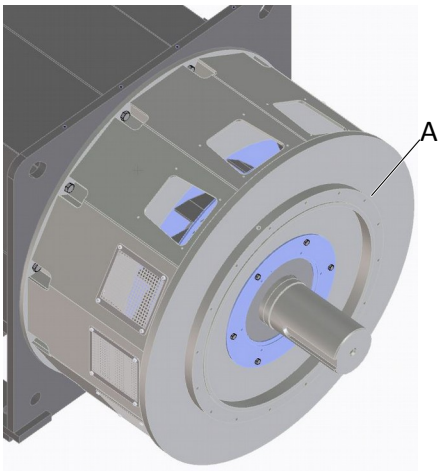
<td> 
</td>
<td>34- Use soft belts to lift the DE shield (A) (weight approx. 340 kg).
35- Mount the shield so that the bearing enters the seat.
36- During insertion, pay attention to the direction of the internal lid, using the previously-inserted tie-rod.
37- Use suitable lifting equipment for the DE shield (A) (weight approx. 2500 kg) to suitable lifting devices.
38- Lift the DE shield and the rotor by about 5 mm and couple the stator casing via the 12 x M20x65 hex head screws.</td>
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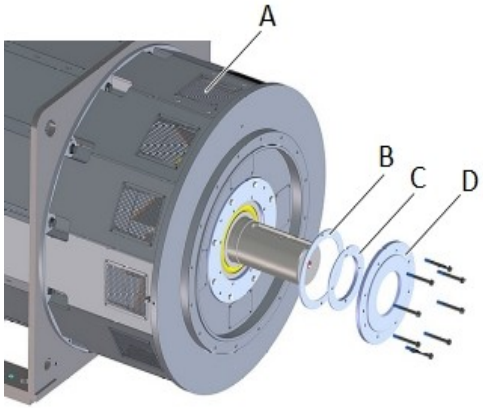
<td> 
</td>
<td>39- Insert the components indicated in this order:
● the grease threshold ring (B);
● the oiler disc (C);
40- Mount the lid (D) with the greasing hole facing upwards.
41- Fix the lid using the 8 x M12x120 hex head screws.
42- Fix the three upper protection lids (A) using the M6x12 screws.</td>
</tr>
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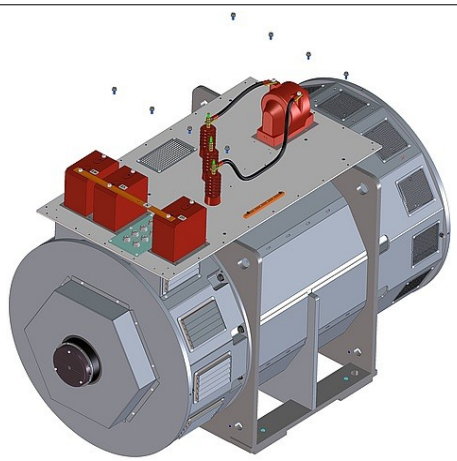
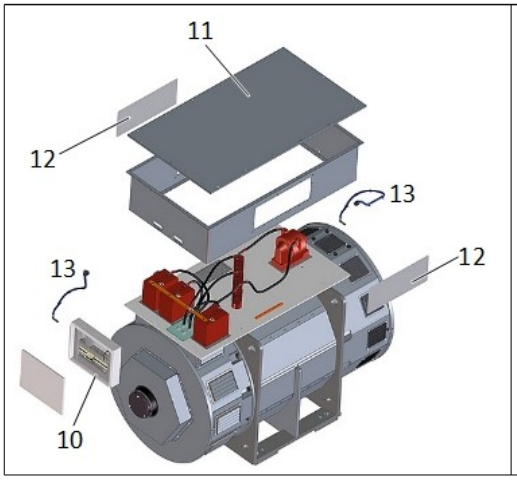
<td>  </td>
<td>Both alternator models
43- Mount the terminal board base plate.
44- Fix the base plate to the stator casing with the M12 x 30 hex head screws.
45- Fix the connection collar with the M6 x 12 hex head screws.
46- All electric cables must pass through the window present on the terminal board base plate.</td>
</tr>
</table>



47- Connect the power cables.
48- Mount the auxiliaries cables straps.
49- Mount the lateral panels (12) of the terminal box and auxiliaries box (10).
50- Connect the set-ups for the vibration sensors to the terminal box (13).
51- Insert the auxiliaries box and the terminals and connect them to the terminal board according to the wiring diagram.
52- Use straps to fix the auxiliaries cables inside the main box.
53- Mount the terminal box lid (11).

6.8 General cleaning

Responsibility: Service technician or machine operator

Frequency: As required at regular intervals

Prerequisites: The alternator is at a standstill and has cooled down

NOTICE

- Do not use water on parts of the alternator.
- Do not use jets of compressed air directly on the windings or inside the terminal board box.

General cleaning concerns the external parts of the alternator and the installation area.

➔ Clean the alternator and the surrounding area.

➔ Check the status of integrity of the alternator parts.

➔ Check the correct tightness of the screws and bolts.

7 Troubleshooting

Below find a series of malfunctioning symptoms of the alternator and possible causes. If the indications provided do not solve the problem, contact the Mecc Alte S.p.a. after-sales service.

The references present in this manual which are useful for solving the problem are shown in this table in brackets.

7.1 Problems of an electrical nature

Symptom	Probable cause	Possible cause
The alternator is not energised	a- Connections interrupted b- Rotating diodes fault c- Driver circuits faulty d- DER 2 voltage regulator faulty e- Voltage regulator fuse intervention	a- Check and restore the connections (4.4.4) b- Check the diodes and replace them if necessary (6.5.5) c- Check the continuity of the driver circuit d- Check and replace the regulator, if necessary (6.5.6) e- Replace the voltage regulator fuse (6.5.8)
On-load voltage below nominal	a- Speed less than nominal b- Voltage regulator calibrated incorrectly or faulty c- Over-excitation limitation device intervention	a- Check the number of revs. b- Reset the nominal voltage value, modifying the parameters of the regulator or replace it (4.5.1) c- Replace the voltage regulator (6.5.6)
Voltage too high or unstable	Voltage regulator faulty	Replace the voltage regulator (6.5.6)
Temperature of the windings too high	a- Excessive network unbalance b- Winding fault c- Defect in the measuring system	a- Check that the network balance meets requirements b- Check the windings c- Check the sensors

NOTE

Also refer to the alarms signalled by the voltage regulator if the alternator should malfunction. See the DER 2 regulator manual and of the DXR Terminal software in 10.2 Component documentation. Malfunctioning of the alternator may be caused by the voltage regulator. See *6.5.6 Checking the DER 2 regulator operation*

7.2 Problems of a mechanical nature

Symptom	Probable cause	Possible cause
The alternator vibrates and is noisy	a- Incorrect fixing to the base b- Excessive network unbalance	a- Check the fixing screws and tighten if necessary b- Check that the network balance meets requirements
● Excessive supports temperature ● Noisy supports ● Excessive vibrations at the support	a- Problems with lubrication (insufficient or excessive) b- Faulty support c- Machine misalignment d- External loads not envisioned	a- Check that the lubricant corresponds to that indicated by the manufacturer and that the quantity is correct b- Check the status of the support and replace it, if necessary c- Check the alignment d- Check the coupling area

For additional information regarding supports malfunctioning, see also *10.2 Components documentation.*

8 Spare parts

8.1 List of recommended spare parts

Below find the list of recommended spare parts for the alternators. Contact the Mecc Alte S.p.a. After-sales service, if necessary. Refer also to the assembly drawing of the alternator, see *10.1 Diagrams and drawings*.

ECO47 B3B14

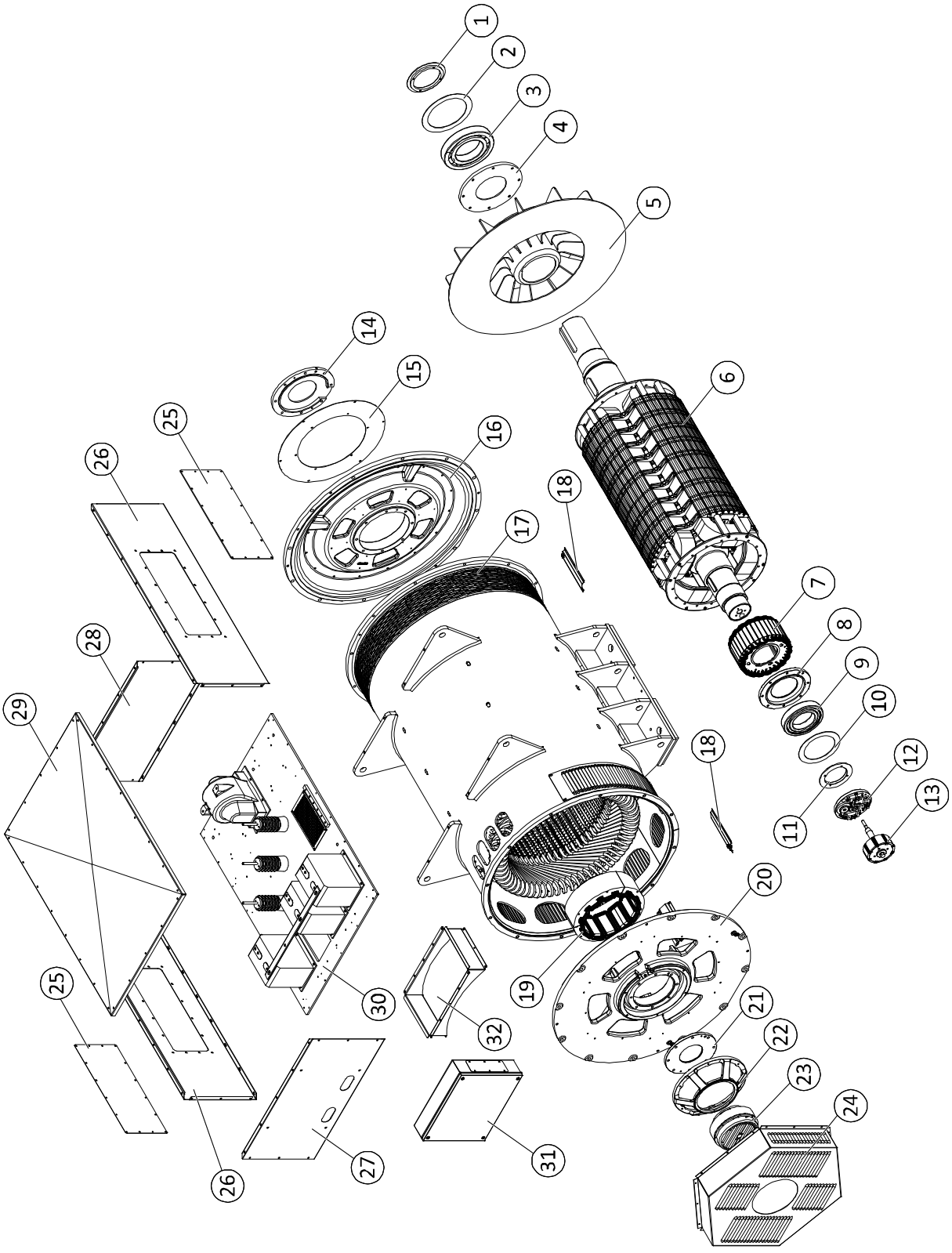

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Table 23 - Spare parts ECO47 B3B14

POS.	Name	Code
1	FRONT GREASE SLINGER RING ECO47A	6801011208
2	FRONT GREASE THRESHOLD RING ECO47A	9810018014
3	BALL BEARING 6232 C3	9810027048
4	FRONT BEARING INTERNAL CLOSURE RING ECO47A	6801011209
5	FAN ECO47A WORKED	6801005030
6	MAIN ROTOR B3B14	
7	EXCITER ROTOR ECO47A	6102521188
8	REAR BEARING INTERNAL CLOSURE RING ECO47A	6801011212
9	BALL BEARING 6226 C3	9810027049
10	REAR GREASE THRESHOLD RING ECO47A	9810018015
11	REAR GREASE SLINGER RING ECO47A	6801011213
12	ROTATING RECTIFIER	
13	PMG ROTOR	
14	FRONT BEARING INTERNAL CLOSURE RING ECO47A	6801011210
15	FRONT LID CLOSURE B3B14 ECO47	9810018036
16	FRONT SHIELD ECO47A B3B14 CAST IRON	9801102001
17	WORKED STATOR	
18	ANTI-CONDENSATE HEATER RSPU150230LPM	9810051006
19	EXCITER STATOR	4500486560
20	REAR LID ECO47A CAST IRON	6801001074
21	REAR BEARING EXTERNAL CLOSURE RING ECO47A	6801011211
22	PMG COVER PLATE	6110625054
23	PMG STATOR	
24	REAR PANEL IP23 ECO47A	9810049215
25	CABLES OUTPUT PANEL ECO47A	9810018011
26	BI-LATERAL PANEL ECO47A	9810018010
27	REAR PANEL IP23 ECO47A	9810018012
28	FRONT PANEL ECO47A	9810018013
29	TERMINAL BOARD BOX CAP ECO47A	9810018009
30	TERMINAL BOX	
31	AUXILIARY COMPONENTS BOX	
32	CABLES OUTPUT GUARD ECO47A	9810049214

ECO47 MD35

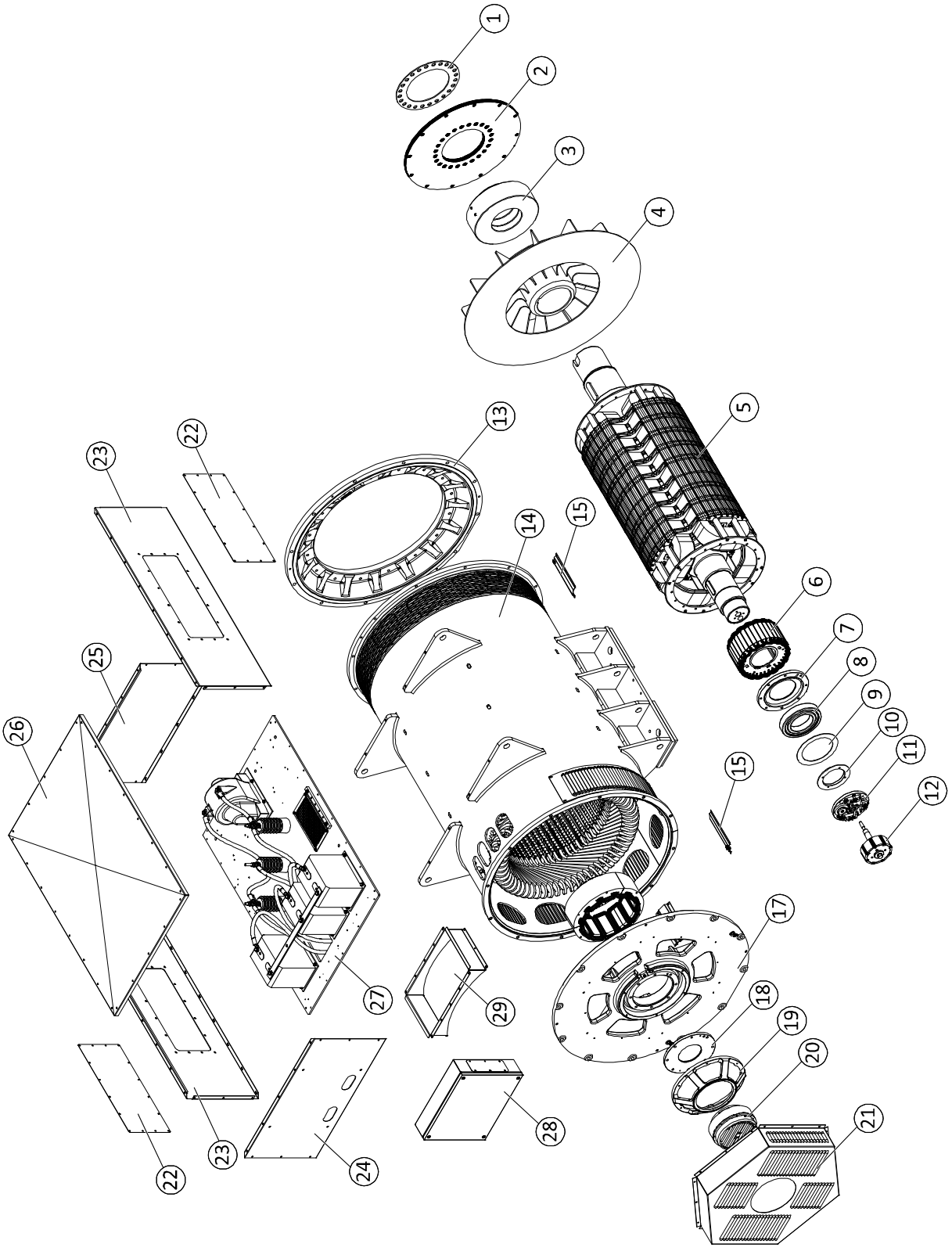
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Table 24 - Spare parts ECO47 MD35

POS.	Name	Code
1	JOINT PRESSING DISC MD35	-
2	SAE DISCS UNIT	-
3	SAE JOINT HUB	-
4	FAN ECO47A WORKED	6801005030
5	MAIN ROTOR MD35	-
6	EXCITER ROTOR ECO47A	6102521188
7	REAR BEARING INTERNAL CLOSURE RING ECO47A	6801011212
8	BALL BEARING 6226 C3	9810027049
9	REAR GREASE THRESHOLD RING ECO47A	9810018015
10	REAR GREASE SLINGER RING ECO47A	6801011213
11	ROTATING RECTIFIER	-
12	PMG ROTOR	-
13	FRONT SHIELD ECO47A MD35 CAST IRON	9801102003
14	WORKED STATOR	-
15	ANTI-CONDENSATE HEATER RSPU150230LPM	9810051006
16	EXCITER STATOR	4500486560
17	REAR LID ECO47A CAST IRON	6801001074
18	REAR BEARING EXTERNAL CLOSURE RING ECO47A	6801011211
19	PMG COVER PLATE	6110625054
20	PMG STATOR	-
21	REAR PANEL IP23 ECO47A	9810049215
22	CABLES OUTPUT PANEL ECO47A	9810018011
23	BI-LATERAL PANEL ECO47A	9810018010
24	REAR PANEL IP23 ECO47A	9810018012
25	FRONT PANEL ECO47A	9810018013
26	TERMINAL BOARD BOX CAP ECO47A	9810018009
27	TERMINAL BOX	-
28	AUXILIARY COMPONENTS BOX	-
29	CABLES OUTPUT GUARD ECO47A	9810049214

ECO49 B3B14

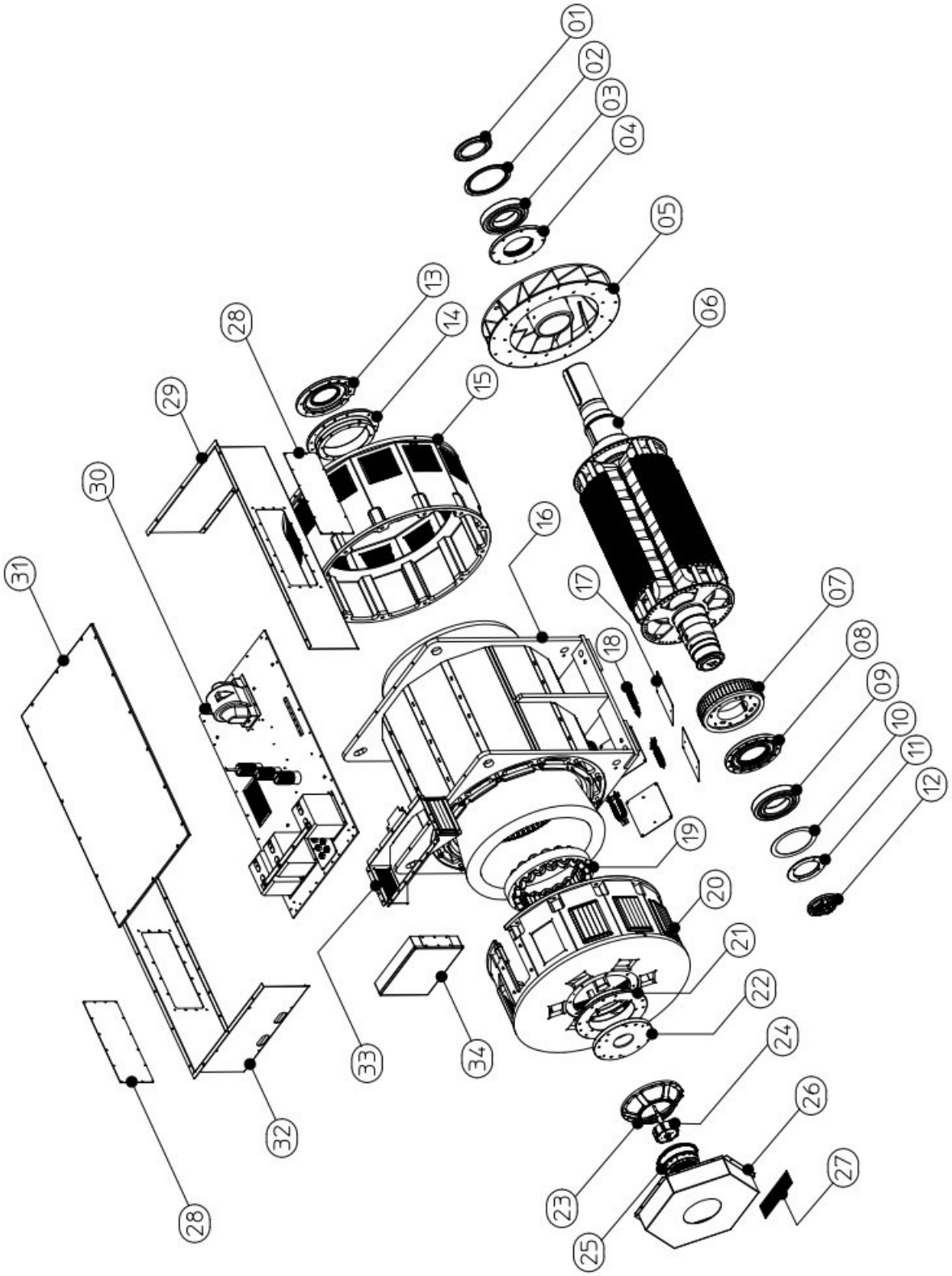
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Table 25 - Spare parts ECO49 B3B14

POS.	Name	Code
01	NDE oiler ring	MAPPA4534
02	Grease threshold ring	MAPPA4535
03	DE Radial bearing (SKF6236-C3)	9810027010
04	DE Rear cover	MAPPA4536
05	Fan ECO49	MAPPA4543
06	Connected rotor and shaft	-
07	Connected exciter rotor H=70 mm	MAPPA2374
08	NDE Rear cover	MAPPA4539
09	NDE Radial bearing (SKF6236-C3)	9810027010
10	NDE Grease threshold ring	MAPPA4541
11	NDE slinger ring	MAPPA4534
12	Rotating rectifier ECO49	-
13	DE front cover	MAPPA4538
14	DE Bearing seat ring	MAPPA4537
15	DE Shield	MAPPA4575
16	Connected stator	-
17	Heater cover	MAPPA4473
18	150 W Anti-condensate heater	9810005003
19	Exciter connected stator	MAPPA2377
20	NDE Shield	MAPPA4555
21	NDE bearing seat ring	MAPPA4537
22	NDE bearing cover front ring	MAPPA4540
23	PMG cover plate	0390400937 KIT PMG3-60/4 ECO49
24	Rotor pack PMG3-60/4	
25	Stator pack PMG3-60/4	
26	PMG covering	MAPPA4533
27	PMG ventilation template	MAPPA3381
28	Cables output template	MAPPA2397
29	Terminals box connection	MAPPA4610
30	ECO47/ECO49 1TA-1TV terminal box	MAPPA4602
31	Terminals lid ECO49	MAPPA4605
32	Terminals box connection	MAPPA4610
33	Terminal box interface sheet steel	MAPPA4574
34	Auxiliaries box ECO47/ECO49	B0849
	Digital regulator DER2/A	4505005536
	Three-phase rectifier bridge MTS 180.16 SS8 FIX5	9810005003

ECO49 MD35

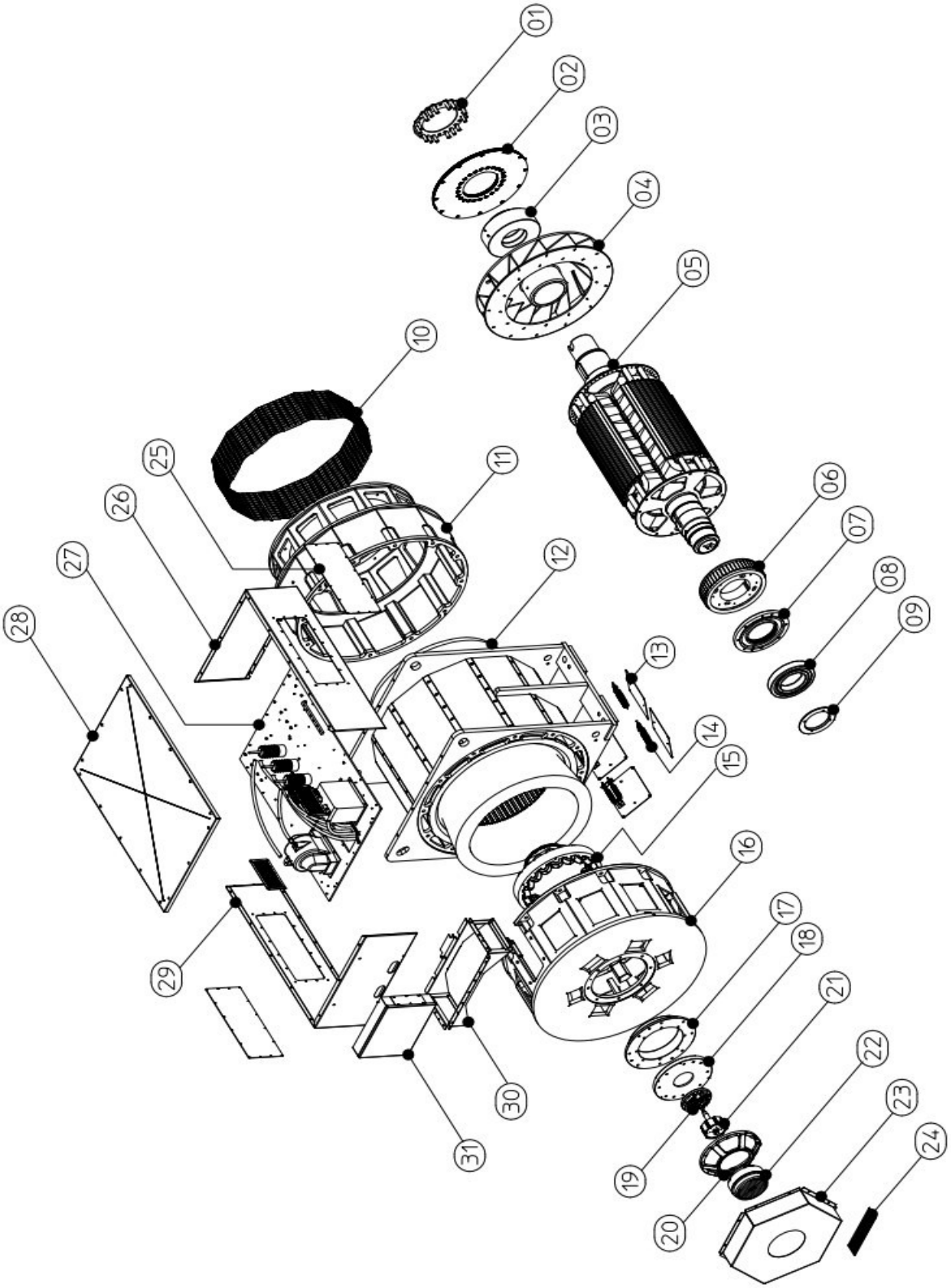
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Table 26 - Spare parts ECO49 MD35

POS.	Name	Code
01	SAE discs press template	MAPPA2392
02	Flywheel discs 21	MAPPA2298
03	Hub joint ECO49 MD35	MAPPA4669
04	Fan ECO49	MAPPA4543
05	Connected rotor and shaft	-
06	Connected exciter rotor H=70 mm	MAPPA2374
07	NDE Rear cover	MAPPA4539
08	NDE radial bearing (SKF6236 M C3)	9810027010
09	Slinger ring	MAPPA4534
10	Fan protection net ECO46 MD35	MAPPA4781
11	DE shield SAE00 MD35	MAPPA4815
12	Connected stator	-
13	Heater cover	MAPPA4473
14	150 W Anti-condensate heater	9810051003
15	Exciter connected stator	MAPPA2377
16	NDE Shield	MAPPA4555
17	NDE Bearing seat ring	MAPPA4537
18	Bearing cover front lid NDE	MAPPA4540
19	Rotating rectifier ECO49	-
20	PMG cover plate	-
21	Rotor pack PMG3-60/4	0390400937
22	Stator pack PMG3-60/4	KIT PMG3-60/4 ECO49
23	PMG Covering	MAPPA4533
24	PMG ventilation template	MAPPA3381
25	Cables output template	MAPPA2397
26	Terminals box connection	MAPPA4610
27	ECO47/ECO49 1TA-1TV terminal box	MAPPA4602
28	Terminals lid ECO49	MAPPA4605
29	Terminals box connection	MAPPA4610
30	Terminals connection sheet steel	MAPPA4574
31	Auxiliaries box ECO47/ECO49	B0849
	Digital regulator DER2/A	4505005536
	Three-phase rectifier bridge MTS 180.16 SS8 FIX5	9810005003

9 Decommissioning, Dismantling and Disposal

9.1 Decommissioning and removal

9.1.1 Stopping machine operation

Responsibility: Service technician or Mecc Alte S.p.a. After-sales service technician

Prerequisites: The machine is at a standstill and isolated electrically from the mains

- ➔ Isolate the machine from the electric power supply sources;
- ➔ Remove the mechanical connection of the alternator to the prime engine;
- ➔ Remove the alternator from its seat.

9.2 Disassembly

9.2.1 Disassembly of the machine

Responsibility: Service technician or Mecc Alte S.p.a. After-sales service technician

Prerequisites: The machine is at a standstill and isolated electrically from the mains

Refer also to *6.6 Disassembly of the alternators*.

CAUTION

Lubricant liquids and other process fluids harmful for the environment are contained in the machine and its piping.
Possibility of pollution of the surrounding environment with toxic substances.

- Recover all harmful lubricant liquids and other process fluids and have them eliminated by a specialised company.

➔ Dismantle the machine.

✗ If the machine must be used subsequently:

➔ Carry out the actions necessary for storage, as described in 9.3 *Storage*.

✗ If the machine is to be eliminated definitively:

➔ Perform all the actions necessary for disposal as described in *9.4 Disposal*.

➔ Dispose of all fluids and other materials or substances potentially harmful for the environment as specified by the regulations in force.

9.3 Storage

NOTICE

Possible damage to the alternator is the insulation resistance of the windings does not lie within the values envisioned.
Possible consequences

- Check the value of the insulation resistance before commissioning.

9.3.1 Short-term storage

Short-term storage means a period not exceeding three months. The following measures must be complied with during this period.

1- The temperature of the parts must always be such as to prevent the condensation of humidity in the structures.

2- Switch on the anti-condensate heaters (if present) and regularly make sure they function correctly.

3- Provide appropriate protection to prevent the entry of insects and parasites.

4- Storage can be with or without the packaging used for transport.

5- Whenever parts must be kept in their original packaging, suitable aeration slots should be cut into the same.

6- Whenever parts must be stored without packaging, it is indispensable to provide covering that permits aeration while ensuring protection against infiltration by insects and parasites.

9.3.2 Electric and electronic components

It is preferable to position the electric and electronic components in a place with the following features:

- constant temperature in the range of 10°C - 40°C
- relative air humidity below 75%
- good ventilation
- no corrosive gases
- no vibrations
- no dusts

9.3.3 Long term storage

Long term storage means a period exceeding three months. The following measures must be complied with during this period.

1- The temperature of the parts must always be such as to prevent the condensation of humidity in the structures.

2- Check the conditions of the anti-corrosion paint applied to metal parts. All signs of corrosion must be removed as soon as possible and a new anti-corrosion treatment must be applied.

3- Provide appropriate protection to prevent the entry of insects and parasites.

4- The alternator shaft must be made to rotate manually.

- Storage can be with or without the packaging used for transport.
- Whenever parts must be kept in their original packaging, suitable aeration slots should be cut into the same.
- Whenever parts must be stored without packaging, it is indispensable to provide covering that permits aeration while ensuring protection against infiltration by insects and parasites.

Storage for more than 18 months

In the case of storage longer than 18 months, the bearings grease must be replaced before re-starting the alternator. See *6.4.2 Replacing grease in the bearings*.

9.4 Disposal

9.4.1 Disposal of the machine

Responsibility: Operator/user

Prerequisites: The procedure described in *9.2.1 Disassembly of the machine* has been concluded

CAUTION

Lubricant liquids, process fluids or machine components are harmful for the environment.
Possibility of pollution of the surrounding environment with toxic substances or materials.

- Recover the lubricant liquids, other process fluids and materials and have them disposed of by a specialised company.

For the correct disposal of the machine, we recommend contacting a specialised company or Mecc Alte S.p.a.

10 Enclosed documentation

This chapter lists the component documents and documentation enclosed to this manual.

See also *1.8 Structure of documentation*.

10.1 Diagrams and drawings

The following diagrams and drawings are enclosed with this manual.

10.1.1 List of diagrams and drawings

Document title	Document code	File
CE Declaration	-	
Auxiliaries box wiring diagram		
Measurement transformer data sheet		

10.2 Components documentation

The table below lists the documents that refer to the components installed on the ECO47-49 MV-HV Self-regulating alternators.

10.2.1 List of component documentation

Component	Type	File
Exchanger		
Thrust bearing support		
Guide bearing		
Manual of the DER 2 voltage regulator		
Manual of the DXR Terminal software of the voltage regulator		

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Power Products