User and maintenance manual

RL6

33501921401NE_3

1. Preface

1.1. General recommendations

Thank you for selecting a lighting column from our company.

This manual has been written for your attention, to help you operate and maintain your lighting column correctly.
The information contained in this manual is taken from technical data available at the time of print. In line with our policy of continually improving the quality of our products, this information may be amended without warning.
Read the safety instructions attentively in order to prevent any accident, incident or damage. These instructions must be adhered to constantly.

You are likely to encounter several warning symbols in this manual.

 Danger	This symbol indicates an immediate danger to human health and life in case of exposure. Not following this instruction may seriously affect the health of people or prove fatal.

 Warning	This symbol draws attention to the potential risks to human health and life in case of exposure. Not following this instruction may seriously affect the health of people or prove fatal.

 Important	This symbol indicates a dangerous situation if the warning is not heeded. Failure to follow the corresponding instruction could result in minor injury of personnel or damage to any other object in case of exposure.

To get the best possible efficiency and obtain the longest possible service life for the lighting column, maintenance operations must be performed as per the intervals indicated in the preventive maintenance tables herein. If the lighting column is used in dusty or unfavourable conditions, certain intervals will need to be reduced.

Ensure that all adjustments and repairs are carried out by personnel who have received appropriate training. The dealers possess this qualification, and can answer all of your questions. They can also supply you with spare parts and other services.

The left and right-hand sides are seen from the rear of the lighting column.

The design of our lighting columns means that damaged or worn parts can be replaced by new parts or reconditioned with a minimum down time.
For any parts replacement, contact our company's nearest dealer, as they have the necessary equipment and have suitably trained and informed personnel to carry out maintenance on, or replace components of lighting columns, or even completely rebuild them.

1.2. Pictograms and their meanings

Safety notices are clearly mounted on the equipment to draw the operator's or maintenance technician's attention to the potential dangers and explain the action to be taken in the interest of safety. These notices are reproduced in this publication for ease of identification by the operator. Replace any notice that is missing or illegible.

The aim of the pictograms is as follows:

- To draw the attention of the operator or maintenance technician to the potential dangers.
- To explain how to act in the interest of personal safety and to avoid damaging the equipment.

The safety pictograms present on the equipment are explained below.

 Warning: danger	 Important, Electrical risk	 Important, risk of explosion
 Important, toxic materials	 Important, rotating or moving parts	 Important, pressurised fluids
 Important, high temperature	 Important, corrosive product	

Figure 1: Warning pictograms

 Entry prohibited to unauthorised persons	 Jet washing prohibited

Figure 2: Pictograms indicating prohibited activities

 Reading the manual for the equipment is compulsory	 Wearing suitable protective clothing is compulsory	 Wearing suitable protective goggles and ear defenders is compulsory
 Lifting point required	 Forklift required for lifting	 Battery charge must be checked
 Periodic maintenance compulsory		

Figure 3: Pictograms indicating compulsory operations

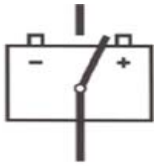
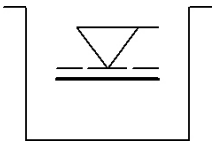
	Earth		Battery isolating switch		External fuel connections
	Diesel fuel		Drain the fuel		Inspection flap
	Fill the coolant		Drain the coolant		Mains supply connection prohibited before filling with water
	Fill the oil		Drain the oil		
	Retention container high level		Drain the retention container		

Figure 4: Information pictograms

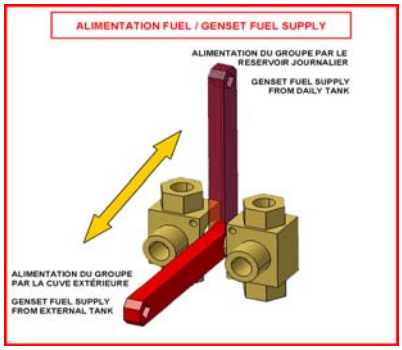
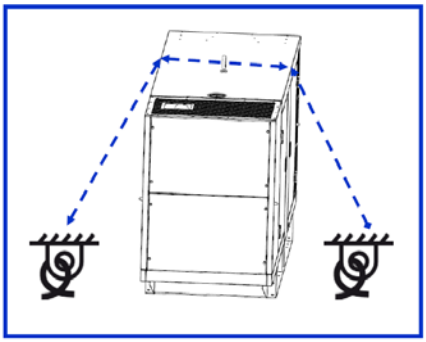
 Flammable product, Do not smoke or create sparks or flames	 Reading the manual for the equipment is compulsory
 Fuel supply - Selection valve -	 Securing straps routing point

Figure 5: Specific pictograms

 Wearing suitable protective clothing and goggles is compulsory	 Rinse any splashes of acid on the skin or in the eyes using clean water. Consult a doctor immediately. Wash contaminated clothing with water.

Figure 6: Pictograms relating to battery operations

1.3. Instructions and safety regulations

THESE SAFETY GUIDELINES ARE IMPORTANT

If you do not understand or have any questions about any point in this manual, contact your dealer who will explain it to you or give you a demonstration. A list of risks and precautionary measures to take follows. You should also refer to any local and national regulations that apply in accordance with your own jurisdiction.

KEEP THIS MANUAL

This manual contains important instructions which must be followed when installing or carrying out maintenance on a generating set or batteries.

1.3.1 General advice

Use

- ✓ The operating and safety instructions must be made known to operating personnel. They will be regularly updated.
- ✓ Read and understand the manuals provided with the generating set, pump unit or lighting column properly. The manufacturer's instructions must remain at the disposal of technicians, if possible in situ.
- ✓ The facility must be operated under the direct or indirect supervision of a person appointed by the operator, who is familiar with the operation of the facility, and the dangers and drawbacks of the products used or stored in the facility.
- ✓ Do not wear loose clothing, or get close to machines in operation. Note that the fans are not clearly visible when the engine is running.
- ✓ Warn personnel present to keep their distance during operation.
- ✓ Do not run the generating set, pump unit or lighting column without refitting the protective covers and closing all the access doors.
- ✓ Never let a child touch the generating set, pump unit or lighting column, even when shut down.
- ✓ Avoid operating the generating set, pump unit or lighting tower in the presence of animals (disturbance, scares, etc.).
- ✓ Engage the parking brake when the generating set or lighting tower on its trailer is installed on the operating site. When chocking the trailer on a slope; ensure that there is nobody in the path of the trailer.
- ✓ Never start the engine without an air filter or exhaust.
- ✓ Engine with turbocharger: never start the engine without fitting the air filter. The compressor wheel rotating inside the turbocharger may cause serious bodily injury. Foreign objects in the inlet pipe may cause mechanical damage.
- ✓ Engine with air preheating (starting components): never use a starting spray or any other similar starter assistance product. Upon contact with the starting component, an explosion may occur in the inlet tube, causing bodily injury.
- ✓ Do not touch the lighting column lights when they are switched on.

Maintenance

- ✓ Follow the maintenance table and its instructions.
- ✓ Always use tools in good condition which are suited to the work to be done. Ensure you have understood the instructions before beginning any operation.
- ✓ Goggles should be worn when carrying out maintenance operations and watches, bracelets etc. should be removed.
- ✓ Fit only original parts.
- ✓ Disconnect the battery and the pneumatic starter (if fitted) before undertaking any repairs, to prevent the engine from starting accidentally. Fit a panel over the controls to prevent any attempt to start.
- ✓ Only use the correct crankshaft turning techniques for turning the crankshaft manually. Do not try to turn the crankshaft by pulling it or levering the fan. This method may cause serious bodily or material damage, or damage the vanes of the fan, reducing the service life of the fan.
- ✓ Clean off any trace of oil, fuel or coolant using a clean cloth.
- ✓ Do not use a soapy solution containing either chlorine or ammonia, as these two chemicals prevent bubble formation.
- ✓ Never use petrol or other inflammable substances to clean the parts. Use only approved cleaning solvents.
- ✓ Do not use a high pressure cleaner for cleaning the engine and equipment. The radiator, hoses, electrical components, etc. may be damaged.
- ✓ Avoid accidental contact with parts at high temperatures (exhaust manifold, exhaust).
- ✓ Before any maintenance operation on a lighting column light, cut the electrical power supply and wait for the bulbs to cool down.

Consumables

- ✓ Observe regulations in force concerning use of fuel before using your generating set, pump unit or lighting tower.
- ✓ Under no circumstances use seawater or any other corrosive or electrolytic product in the cooling circuit.

Environment

- ✓ The operator must take the necessary measures to comply with the aesthetics of the site of use. The whole site must be maintained in a good state of cleanliness.
- ✓ The premises must be kept clean, and be regularly cleaned so as to avoid accumulation of dangerous materials or pollutants and dust, which could ignite or cause an explosion. The cleaning equipment must be suited to the risks posed by the products and dust.
- ✓ The presence of dangerous or combustible materials inside premises housing combustion devices shall be limited to the operating requirements.
- ✓ Facilities must be operated under the constant supervision of a qualified person, who must regularly check that the safety devices are operating correctly and ensure that the combustion devices have the correct fuel supply.
- ✓ Apart from the combustion devices, it is prohibited to use fire in any form. This restriction must be clearly displayed.
- ✓ Spreading of waste water, sludge and waste is prohibited.
- ✓ The fuels to be used must correspond to those featured in the declaration file and the specifications recommended by the combustion device manufacturer.
- ✓ The fuel is considered to remain in the same physical state as when it is introduced into the combustion chamber.
- ✓ Burning of waste in the open air is prohibited.
- ✓ Always protect your hands when checking for leaks. Pressurised liquids may penetrate body tissue and cause serious damage. Risk of blood contamination.
- ✓ Drain and dispose of engine oil in a specially provided container (fuel distributors can collect your used oil).
- ✓ Except by special agreement, once closed, the gas supply main unit must only be re-opened by the gas distributor. However, the user may access it under certain conditions. Check these for each site.

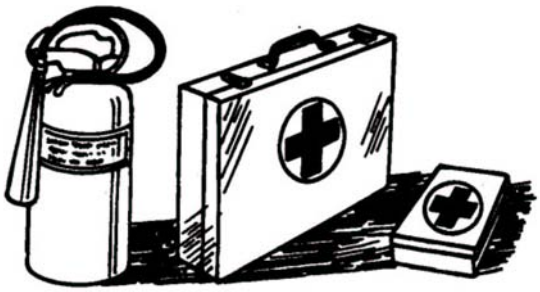
1.3.2 Risks related to exhaust gases and fuels

	The carbon monoxide present in exhaust gases may cause death if the concentration levels in the air breathed are too high. Always use generating sets, pump units or lighting towers in a well-ventilated place where gases cannot accumulate. In case of indoor use: ✓ Be sure to evacuate exhaust gases outdoors. ✓ Provide appropriate ventilation so that personnel present are not affected.
Danger	

- ✓ Observe the local regulations in force for generating sets, pump units or lighting towers, as well as local regulations for use of fuel (petrol, diesel fuel and gas) before using your generating set, pump unit or lighting tower.
- ✓ Fuel filling should be carried out when the engine is off (except for generating sets with an automatic filling system).
- ✓ Engine exhaust gases are toxic: do not run the generating set, pump unit or lighting column in unventilated premises. If installed in a ventilated room, additional requirements for fire and explosion protection must be observed.
- ✓ A leaking burnt gas exhaust may increase the sound level of the generating set, pump unit or lighting column. To check on its efficiency, regularly examine the burnt gas exhaust.
- ✓ Pipes must be replaced as soon as their condition demands it.

1.3.3 Risks related to toxic products

<table>
<tr><td>  </td><td rowspan="2">The corrosion inhibitor contains alkali.
Do not swallow it.
This substance should not come into contact with the eyes. In the event of contact with the eyes, rinse immediately with plenty of water for at least 15 minutes.
Avoid prolonged or repeated contact with the skin. In the event of contact with the skin, wash thoroughly with water and soap. CONSULT A DOCTOR IMMEDIATELY. KEEP THE PRODUCT OUT OF THE REACH OF CHILDREN.

The anti-rust product is toxic and dangerous if absorbed. Avoid all contact with the skin and eyes. Read the instructions on the packaging.</td><td rowspan="2">Glycol is a toxic product and dangerous if absorbed. Avoid all contact with the skin and eyes. Read the instructions on the packaging.
  </td></tr>
<tr><td>Warning</td></tr>
</table>

- ✓ Caution: fuels and oils are dangerous to inhale. Ensure proper ventilation, and use a protective mask.
- ✓ Never expose the equipment to liquid splashes or rainfall, and do not place it on wet ground.
- ✓ The battery electrolyte is harmful to skin and especially eyes. If splashes get into eyes, rinse immediately with running water and/or a 10% diluted boric acid solution.
- ✓ Wear protective eyewear and strong base resistant gloves for handling the electrolyte.

1.3.4 Risk of fire, burns and explosion

<table>
<tr><td>  </td><td rowspan="2">The engine should not be operated in environments containing explosive products. As not all of the electrical and mechanical components are shielded, there is a risk of sparks forming.</td></tr>
<tr><td>Danger</td></tr>
</table>




- ✓ Make sure not to create sparks or flames, and not to smoke near the batteries, as the electrolyte gases are highly flammable (especially if the battery is charging). Their acid also poses a risk to the skin, and in particular to the eyes.
- ✓ Never cover the generating set, pump unit or lighting tower with any material during operation or just after shutdown (wait for the engine to cool).
- ✓ Do not touch hot parts such as the exhaust pipe, or put combustible materials on it.
- ✓ Keep all flammable or explosive materials (e.g. petrol, oil, cloth, etc.) out of the way when the set is running.
- ✓ Proper ventilation is required for your generating set, pump unit or lighting column to work properly. Without this ventilation, the engine would very quickly rise to an excessively high temperature, causing accidents or damage to the equipment and to surrounding property.
- ✓ Do not remove the radiator cap if the engine is hot and the coolant is pressurised, due to risks of burns.
- ✓ Depressurise the air, oil and cooling circuits before removing or disconnecting all the fittings, pipes or connected components. Watch out for the possible presence of pressure when disconnecting a device from a pressurised system. Do not try to find pressure leaks by hand. Oil at high pressure can cause bodily damage.
- ✓ Some preservative oils are flammable. Also, some are dangerous to inhale. Ensure proper ventilation. Use a protective mask.
- ✓ Hot oil causes burns. Avoid contact with hot oil. Check that the system is no longer pressurised before carrying out any procedures. Never start or run the engine with the oil filler cap off (oil may splash out).
- ✓ Never coat the generating set, pump unit or lighting column with a thin layer of oil to protect it from rust.
- ✓ Never top up the oil or coolant if the generating set, pump unit or lighting column is running, or if the engine is hot.
- ✓ A generating set can only operate when stationary, and cannot be installed on a vehicle or other mobile equipment, without a prior study taking into account the various specific features of using the generating set.

1.3.5 Risks related to electrical networks

- ✓ The electrical equipment supplied with the generating set complies with standard NF C15.100 (France), or with the standards of the countries in question.
- ✓ The earth connection must be installed in accordance with the standards in force in each country in question, and with the neutral system sold.
- ✓ Read the manufacturer's identification plate carefully. The values for voltage, power, current and frequency are shown. Check that these values match the supply use.
- ✓ Never accidentally touch stripped cables or loose connections.
- ✓ Never handle a generating set with wet hands or feet.
- ✓ Maintain electrical wires and connections in good condition. Using equipment in poor condition can lead to electrocution and damage to equipment.

- ✓ Always disconnect the power to the equipment or facility (generating set voltage, battery voltage and network voltage) before any operation.
- ✓ The electrical connections must be made in accordance with current standards and regulations in the country of use.
- ✓ Do not use faulty, poorly insulated or provisionally connected wires.
- ✓ Never reverse the positive and negative terminals on batteries when connecting them. This could cause severe damage to the electrical equipment. Follow the wiring diagram supplied by the manufacturer.
- ✓ The generating set should not be connected to any other power sources, such as the mains supply network. In specific cases where there is to be a connection to existing electrical networks, this must only be installed by a qualified electrician, who should take the operating differences of the equipment into account, according to whether the mains supply network or generating set is being used.
- ✓ Protection against electric shocks is ensured by an assembly of specific equipment. If this needs to be replaced, it should be by components with identical nominal values and specifications.
- ✓ If the protective plates (blanking covers) need to be removed to route cables, the protector (blanking cover) must be refitted when the operations are finished.
- ✓ Due to high mechanical stresses, use only strong flexible wiring with rubber sheathing, compliant with IEC 245-4, or equivalent wiring.

1.3.6 Dangers presented by electric currents (first aid)

First aid

In the event of an electric shock, shut off the power immediately and activate the emergency stop on the generating set or lighting column. If the voltage has not yet been cut off, move the victim out of contact with the live conductor as quickly as possible. Avoid direct contact both with the live conductor and the victim's body. Use a dry plank of wood, dry clothes or other non-conductive materials to move the victim away. The live wire may be cut with an axe. Take great care to avoid the electric arc that will be generated by this.

Begin emergency procedures

Resuscitation

If breathing has stopped, begin artificial respiration at once in the same place the accident took place unless the victim or operator's life could be endangered by this.
In the event of cardiac arrest, carry out cardiac massage.

1.3.7 Risks related to moving the set

To unload the generating sets, pump units or lighting columns from their transport support brackets under optimum safety and efficiency conditions, you must ensure that the following points are observed:

- ✓ The lifting machinery or equipment is suited to the work required, in good condition and with sufficient lifting capacity.
- ✓ The slings are positioned in the rings provided for this operation, the forklift arms are resting fully underneath all of the base frame cross-beams, or the lifting bars are inserted in the apertures provided for this purpose in the base to lift the entire generating set (according to models).
- ✓ For completely safe working conditions and to prevent damage to the components fitted on the upper edge of the set, pump unit or lighting column, the generating set, pump unit or lighting column must be lifted up with an adjustable boom. All the chains and cables must be parallel with each other, and as perpendicular as possible with the upper edge of the generating set, pump unit or lighting column.
- ✓ If other equipment fitted on the generating set, pump unit or lighting column alters its centre of gravity, special lifting devices may be necessary to maintain correct balance and completely safe working conditions.
- ✓ The ground must be able to withstand the load of the generating set, pump unit or lighting column and its lifting machinery without stress (otherwise, put down beams of sufficient strength in a stable configuration).
- ✓ Position the generating set, pump unit or lighting column as close as possible to its place of use or transport, in a clear space with free access.
- ✓ Never perform work on a generating set, pump unit or lighting tower just hanging from a lifting device.

1.4. Identification of generating set and lighting column

Lighting columns are identified by two identification plates:

- ✓ generating set identification plate mounted on the set base frame (ref. 1)
- ✓ lighting column identification plate mounted on the trailer (ref. 2)

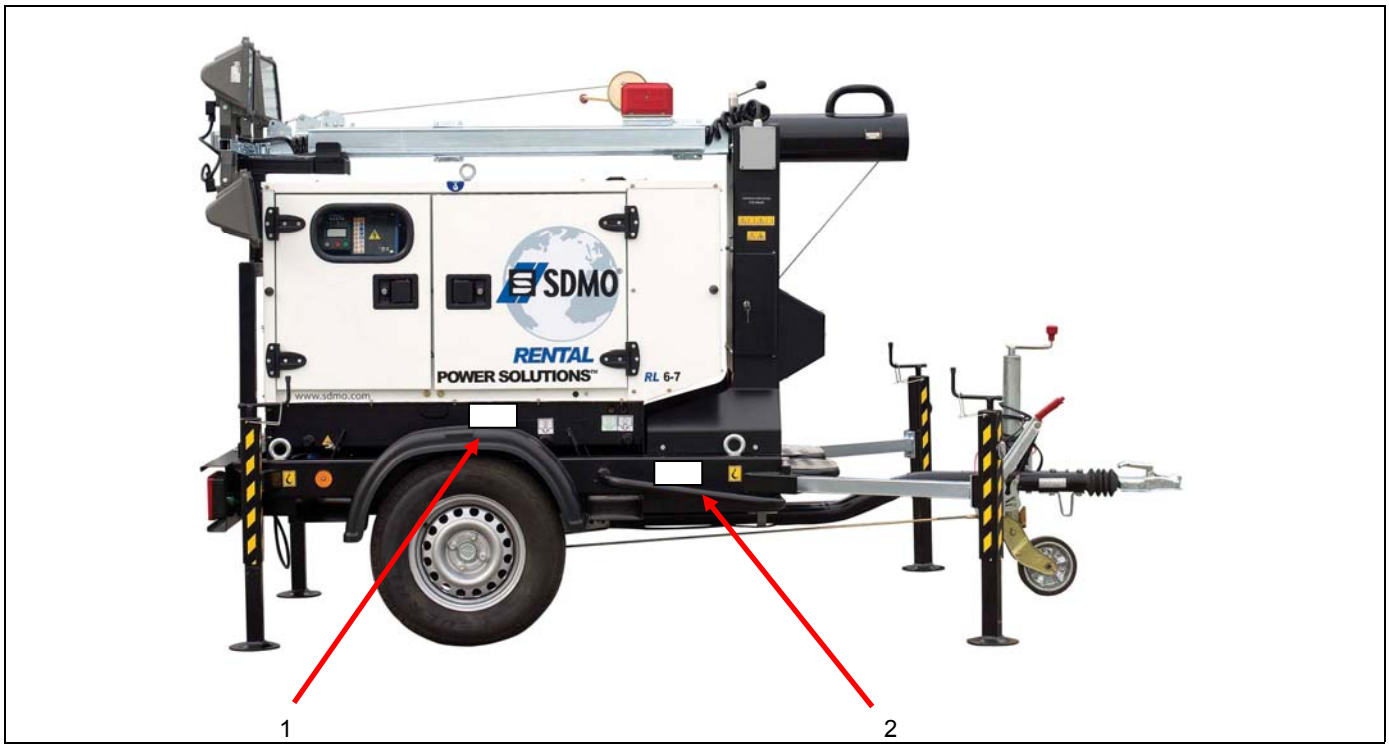


Figure 1.1 – Location of identification plates

2. General description

2.1. Description

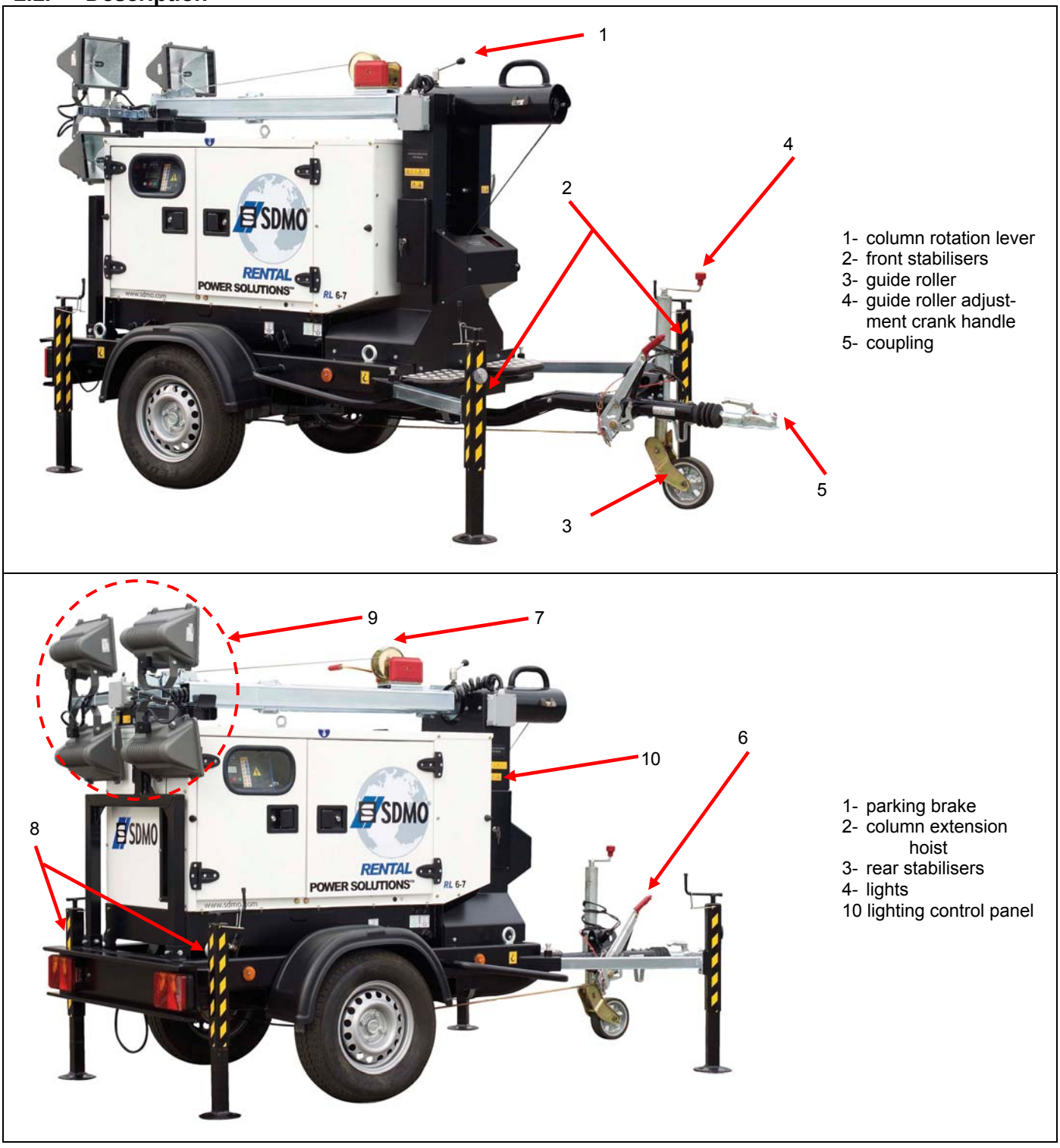


Figure 2.1 – Description of lighting column

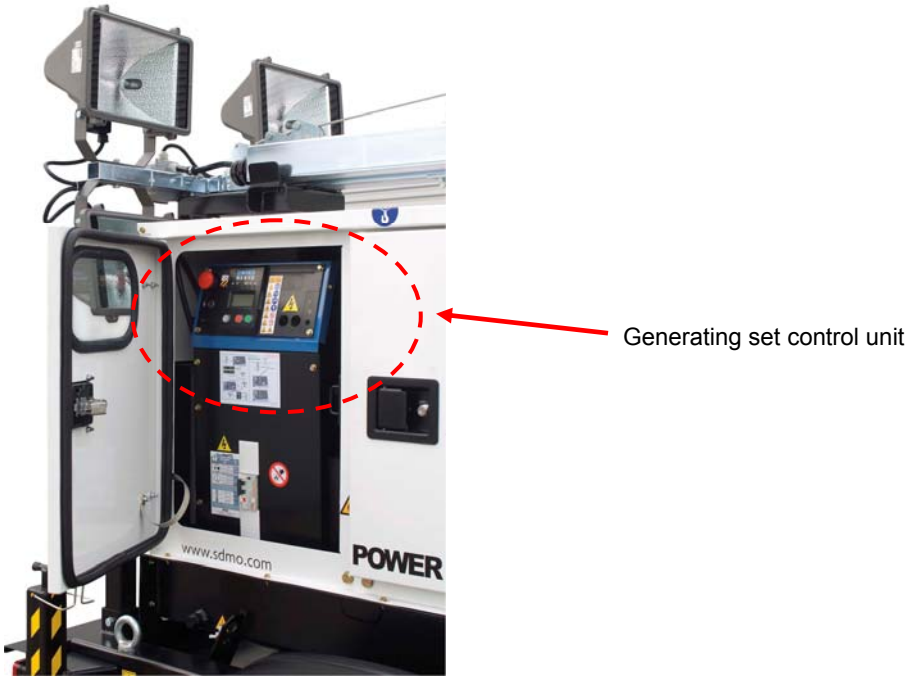


Figure 2.2 – arrangement of control unit and panel

2.2. Specifications

Lighting column

Structure	4 sections
Type	Telescopic
Maximum height	7 M
Raising	Manual
Light wiring	H07RN-F
Cable breaking load	1100 kg
Maximum wind stability	110 km/h
IP grade of connections	IP 55
Orientation	350° swivelling

Lights

Bulb	Halogen
Power	4 x 1000 W
Composition	Watertight and swivelling. Equipped with tempered glass and a silicone seal. Stainless steel exterior fastenings
IP protection grade	IP 55
Mounting socket	Attacco R7s – R7s mountings
Dimensions (Length x H x Depth in mm)	355 x 270 x 150

Hoist for tilting the column (from horizontal to vertical and vice-versa)

Model and code	501 – 244.894
Brake	Equipped with an automatic pressure brake with non-return device, enabling easy and uniform raising and lowering of the telescopic column.
Maximum load	500 kg
Direction of hauling	Time
Direction of release	Anti-clockwise

Hoist for raising the telescopic column

Model and code	351 – 244.893
Maximum load	300 kg
Column extension direction	Time
Column lowering direction	Anti-clockwise

Trailer equipped with column and generating set

Brakes	Drum
Tyres	175R13V
Tightening torque of wheel mounting bolts	90 Nm (67 lbs/ft)
Inflation pressure	4.15 bar (65 PSI)
Maximum dimensions for moving (Length x Width. x H in mm), column retracted	3178 x 1400 x 1820
Maximum dimensions (Length x Width x H in mm), mast folded out	3178 x 1400 x 7000
Weight of column in working order	940 kg
Recommended maximum speed	80 km/h

GENERATING SET SPECIFICATIONS

Generating set powers (without using the lighting column (1))

Voltage	ESP power (2) kW / kVA	PRP power (3) kW / kVA	Emergency amperage
240 SINGLE	6/6	5/5	25
230 SINGLE	6/6	5/5	26
220 SINGLE	6/6	5/5	27

(1) Auxiliary power available with lighting column in use: 1500 W
(2) **PRP**: Main power available continuously under variable load for an unlimited number of hours annually, in accordance with ISO 8528-1, an overload of 10 % one hour every 12 hours is available in accordance with ISO 3046-1
(3) **ESP**: Stand-by power available for emergency use under variable load, in accordance with ISO 8528-1, no overload available under this service

Physical specifications

Enclosure type	M 125
Sound level dB(A)@1 m	69
Sound level dB(A)@7 m	59
Acoustic power in Lwa	85

Engine data	
Manufacturer / model	MITSUBISHI L3E.SD , 4-stroke, Aspirated
Cylinder configuration	3 L
Cubic capacity	0.95 L
Rotation speed	1500 Rpm
Max emergency power at nominal speed	7.37 kW [10 BHP]
Adjustment type	Mechanical

Lubrication	
Oil capacity with filter	4.1 L
Min. Oil pressure	0.5 bar [7.2 psi]
Nominal oil pressure	4 bar [58.0 psi]
Oil consumption (100 % load)	0.006 L/h
Oil sump capacity	3.6 L [1.0 gall]
Type of lubricant	SAE 10W-30

Fuel	
100 % main power	2.3 L/h [0.6 gall/hr]
75 % main power	1.7 L/h [0.4 gall/hr]
50 % main power	1.3 L/h [0.3 gall/hr]
Fuel type	Diesel
Fuel tank capacity	50 L

Cooling	
Engine capacity with radiator	3.7 L [1.0 gall]
Fan power	0.2 kW
Refrigerant type	Gencool
Thermostat	76.5-90°C

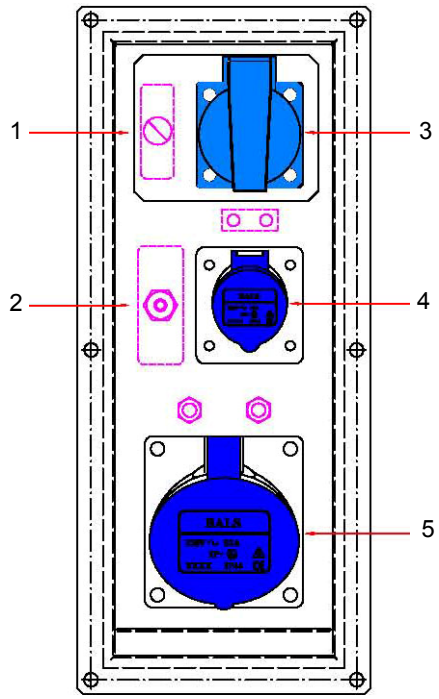
Emissions	
HC	30 mg/Nm3
CO	250 mg/Nm3
Nox	960 mg/Nm3
PM	120 mg/Nm3

Alternator data	
Type	MECC ALTE ECP3-2S
Number of phases	3
Power factor (cos Phi)	0.8
Number of poles	4
Voltage regulator	DSR
Short-circuit current	AC
Number of bearing(s)	1
Coupling	Direct

Control unit(s)	
NEXYS 	<u>Standard specifications</u>: Frequency meter, Voltmeter, Ammeter <u>Alarms and faults</u>: Oil pressure, Coolant temperature, Fail to start, Overspeed, Alternator min/max, Fuel level low, Emergency shutdown <u>Engine parameters</u>: Working hours counter, Engine speed, Battery voltage, Fuel Level, Air Preheating

Fittings

Termination boxes and socket control panels



1 10A CIRCUIT BREAKER (16A – UK)
2 16A CIRCUIT BREAKER
3 230V-10A SOCKET (110V-16A – UK)
4 230V-16A SOCKET (lighting column electrical connection)
5 230V-32A SOCKET

3. Installation - Moving

3.1. Choice of location

- ✓ A space will be reserved for installing the lighting column. This must be flat and firm enough for the column not to sink in.
- ✓ Position the column on a flat surface, making sure the slope does not exceed 10°.
- ✓ Access to the column will need to be free at all times, for safety and maintenance reasons.
- ✓ The column ventilation must under no circumstances be disrupted by miscellaneous objects put down nearby. This would cause abnormal heating, and power loss.
- ✓ Burnt gas will be freely discharged to prevent any resuction into the air filter or coolant system.

	Exhaust gases contain carbon monoxide, a highly toxic substance. This substance can cause death if it is present in excessive concentrations in the air inhaled. For this reason, always use your column in a well-ventilated location, where the gases cannot accumulate.
Danger	

- ✓ Good ventilation is required for your column to run properly. Without this, the motor would very quickly run at too high a temperature, which could lead to accidents or damage to the equipment and to surrounding items. However, if it is necessary to operate it inside a building, appropriate ventilation must be provided, so that people and animals are not affected. It is imperative that exhaust gases are discharged outside.

3.2. Unloading

3.2.1 Safety during unloading

To unload the lighting column from its transport support bracket under optimum safety and efficiency conditions, make sure that the following points are observed:

- ✓ Lifting machinery or equipment appropriate for the work required.
- ✓ Position of slings in the rings provided for this operation, or lifting arms positioned in the fork-lift pockets intended for this purpose
- ✓ Ground that can withstand the load of the column and its lifting machinery without stress (otherwise, put down beams of sufficient strength in a stable configuration).
- ✓ Position the column as close as possible to its place of use or transport, in a clear space with free access.

Example of equipment to be used:

- ✓ Crane, slings, lifting beam, safety hook, shackles.
- ✓ Forklift truck.

3.2.2 Instructions for unloading

3.2.2.1. Slings

- ✓ Fasten the lifting machine slings to the rings on the lighting column provided for this procedure. Tension the slings slightly.
- ✓ Ensure that the slings are correctly fastened and that the equipment is secure
- ✓ Gently raise the lighting column.
- ✓ Guide the lighting column towards the selected position, stabilising it.
- ✓ Carefully set down the equipment while continuing to position it.
- ✓ Release the tension on and then unfasten the slings.

3.2.2.2. Fork lift truck

- ✓ Position the forklift arms under the base frame in the pockets provided for this purpose.
- ✓ Lift the equipment, handling it gently.
- ✓ Put down the lighting column on its unloading point.

3.3. Moving

3.3.1 Coupling /uncoupling the trailer

Before hitching up the trailer, check the hitching ring on the towing vehicle; this must be perfectly compatible with the trailer ring.

Warning	Any attempt to tow a trailer with a non-compliant device (bar, cables, lashing, etc.) runs the risk of serious accidents. Also check: - that there are no incipient ruptures or significant wear on the hitching system. - that the locking system is working properly.

Coupling

❶ Drive the towing vehicle or trailer (after releasing the parking brake) until it reaches the coupling position.

❷ Open the coupling head. To do so, pull the coupling handle (figure 3.1) in the direction of the arrow.
The coupling mechanism can remain open as long as the coupling head is not resting on the hitching joint.

❸ Fit the open coupling head on the hitching joint by gently lowering the guide roller (jockey). The coupling head clicks into place automatically, then the coupling handle should be lowered. The coupling head is properly connected to the hitching joint when the green section on the safety indicator is visible (figure 3.1).
The coupling mechanism will then be engaged, and the coupling handle cannot adopt a lower position (when manoeuvred by hand).

❹ Fasten this cable to the attachment point on the hitching plate (figure 3.2).

❺ Connect the electrical cable plug controlling the lamps, indicators, etc. to the socket on the towing vehicle.

❻ Lift the guide roller fully until it is completely retracted and lock it into position ensuring that it does not impede the brake rod or the release cable. The wheel retracts when the mechanism touches the base of the main part of the wheel (see photos).

Normal position

Retraction position

Danger	The equipment must never be placed in the retraction position if the trailer is not attached to a vehicle as, in this case (whether or not there is any load), the wheel will retract.

❼ Ensure that the parking brake is completely disengaged by pushing its handle down fully. If necessary, remove the wheel chocks and store them.

Warning	If the coupling head is not correctly attached to the hitching joint, the trailer will separate from the towing vehicle. The release cable engages the parking brake (acting as an emergency brake) should the trailer detach from the towing vehicle. For the braking system to fulfil its role effectively, it is essential to observe the following advice: 1) The release cable MUST NOT be wound around the guide roller, as this would prevent the emergency brake from working 2) The release cable MUST run as straight as possible, without being impeded at any point. 3) The release cable must be long enough to allow turning, and it must not be stressed or impeded in use, as this would trigger the parking brake while the vehicle is being towed.

Figure 3.1 – Coupling head

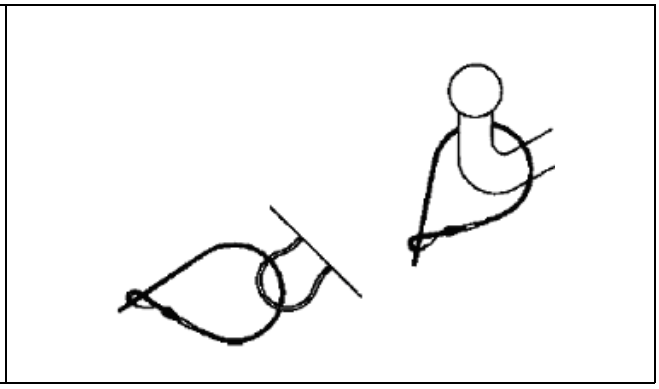


Figure 3.2 – Release cable

Uncoupling

❶ Immobilise the trailer by placing chocks under the wheels, after engaging the parking brake fully.
❷ Open the coupling handle and lift the coupling head, by lowering the guide roller. The retraction mechanism should lock automatically before the wheel touches the ground.
❸ When you are sure that the mechanism is locked and that the wheel is bearing the load, you can uncouple the trailer from the vehicle.
❹ Disconnect the electrical cable plug controlling the lamps, indicators, etc. from the socket on the towing vehicle.
❺ Remove the release cable from the hitching plate.

NB: wear indicator

The coupling head has a wear indicator (figure 3.3) that tells you whether the wear limit of the towing vehicle's hitching joint or of the towed vehicle's coupling has been reached.

To use this indicator, couple the trailer and drive the towing vehicle around 500 m, so that the coupling head is positioned. When you have done this, check the wear as indicated below.

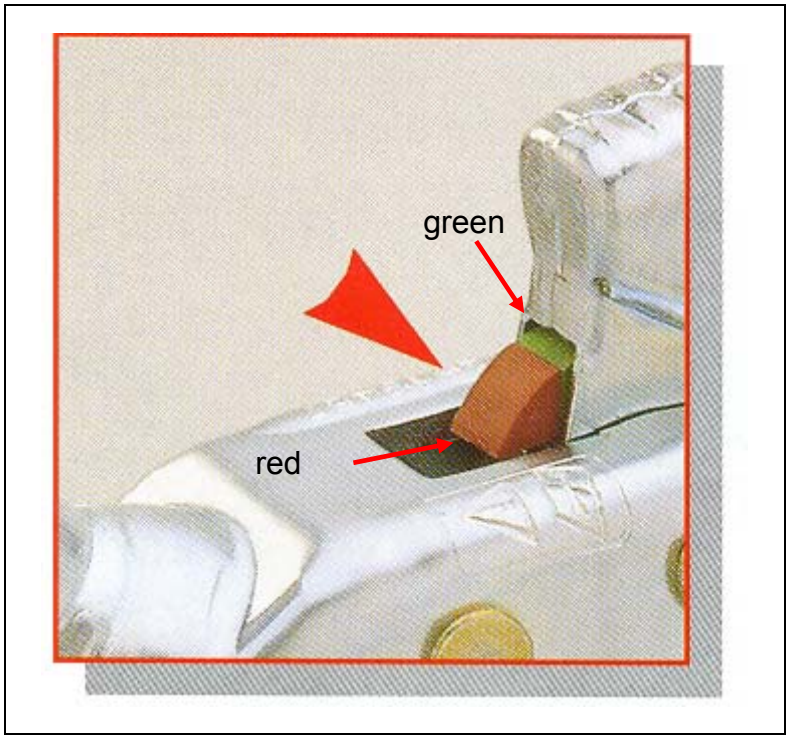


Figure 3.3 – Wear indicator

If the green section of the indicator can be seen on the coupling (secured), the coupling head is in good condition, or the hitching joint wear is less than the prescribed limit. If the green section of the indicator is completely masked, and only the red section is visible, it can be assumed either that the hitching joint has reached the wear limit (diameter of 49.61 mm), or that the coupling head and hitching joint both have signs of wear, or finally that the hitching joint is in good condition (diameter 50 mm), but that the coupling head is worn.

Important:

In these conditions, the coupling head may come free from the hitching joint, and the trailer detach from the towing vehicle. Therefore, the coupling head and hitching joint must be checked before they are reused. Any defective part must be replaced.

3.3.2 Check before towing

Before towing, check the following:

- ✓ Tightness of the wheels
- ✓ Locking of the hitching hook
- ✓ Tyre pressure
- ✓ Operation of the signal lights
- ✓ Closure of the set enclosure doors
- ✓ Parking brake released
- ✓ Guide rollers and front and rear stabilisers raised and locked
- ✓ Fitting of the release cable.

3.3.3 Operation

The driving speed must be suited to the condition of the road and the handling of the trailer. Driving at high speed causes heating of the tyres; so it is important to stop from time to time and check them. Excessive heating may cause a puncture, and therefore a serious accident.

 Warning	Particular attention must be paid to the tightness of wheels on new vehicles, or after removing wheels. In the first few miles' driving, heating of the brake hubs and drums will actually reduce the wheel tightness. So it is vital to check the tightnesses after 20 kilometres, at most 100 km, until no further loosening is observed. The tightness check must nonetheless be carried out whenever you have towed the trailer.

3.4. Electricity

3.4.1 People protection

The generating set must be earthed. To do this, use a minimum 25 mm^2 stripped copper wire and a 16 mm^2 for insulated cable, connected to the generating set earth socket and a galvanised steel earthing rod fully embedded vertically into the ground.

This rod must have a minimum length as indicated in the table below.
For a default voltage of 25 V and default current of 30mA.

Nature of ground	Length of rod in metres	
Rich arable land, moist compact ballast	1	
Lean arable land, Lean arable land, Gravel, coarse ballast	1	
Bare stony soils, dry sand, impermeable rock	3.6	To obtain an equivalent length, you can use more than one earthing rod connected in parallel and set apart by at least their length. Example: 4 interconnected 1 metre rods separated by 1 metre.

3.5. Special arrangements

The lighting columns are not equipped with protection devices against surges originating from atmospheric discharges or due to manoeuvring, so it is prohibited to use the lighting column in a storm.
The company disclaims all liability for any accidents caused by these phenomena.

4. Preparation before starting the generating set supplied with the lighting column

Warning	The checks specified in this section are for ensuring proper start-up of the generating set supplied with the lighting column. Specific skills are required to carry out these operations. They must only be entrusted to personnel with the necessary skills. **Failure to follow these instructions in any way could lead to incidents or very serious accidents.**

4.1. Installation checks

- **make sure that the general recommendations figuring in the installation's "Instructions and safety regulations" section are observed.**
- **carry out level checks (oil, coolant, diesel, battery).**
- **ensure that the generating set earth socket is earthed.**
- **ensure that the electrical connections are correctly fitted (see paragraph 2.2, socket ref. 4).**

5. Starting the lighting column

5.1. Implementation for installation

Before any operation, ensure that the lighting column is switched off.
The electrical connection between the lighting column's lights and control panel uses a 9G2.5 mm² spiral cable inserted into a cylinder, enabling it to slide readily in operation.
If the lighting column is used under critical meteorological conditions, at excessively low or high temperatures, monitor the spiral cable, making sure that it is sliding properly inside the cylinder, since this cable will be subject to temporary structural distortion.
❶ Position the lights, tilting them manually and loosening the tightening nuts (fig. 5.1, ref. 1) on the light support bracket.
❷ Turn the lights according to the type of lighting desired, by loosening the light support bracket nut (fig. 5.1, ref. 2).

NB: the lights can only be inclined once the column has been vertically raised slightly.

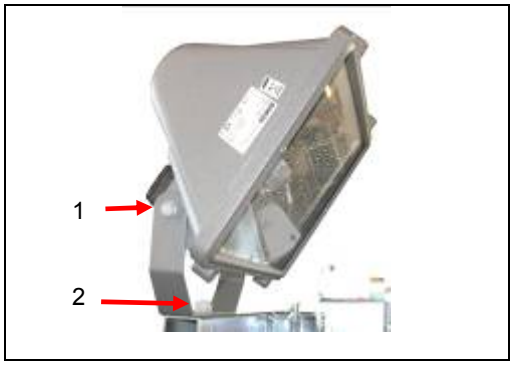


Figure 5.1 – Adjusting the lights

❸ Remove the 2 front stabilisers, withdrawing the studs from their housing (fig. 5.2, ref. 1) and carry out the removal manually, so that the studs prevent the tube from popping out, (check that the studs are properly inserted in their respective tube locking housings) and then lower all the stabilisers (front and rear) by turning the crank handles (figures 5.2 and 5.3).

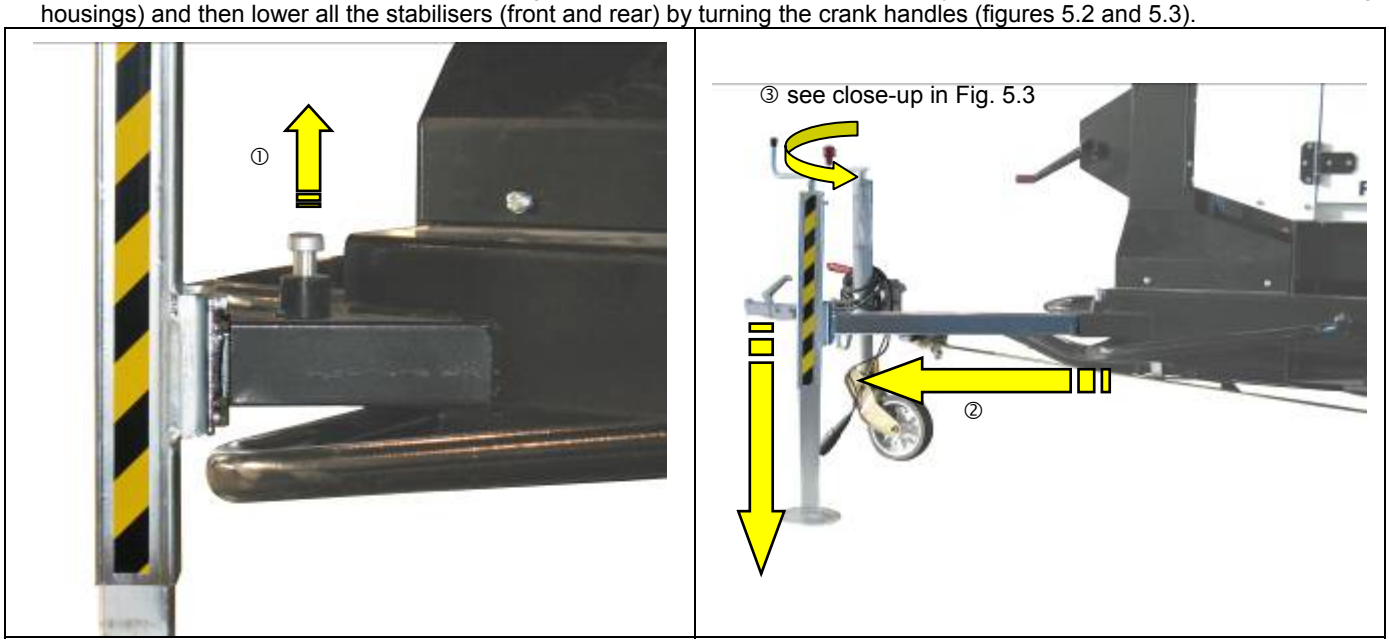


Figure 5.2 – Removing the stabilisers

Figure 5.3 – Close-up view of a crank handle

Refer to the spirit levels to ensure the column is correctly positioned and stabilised.

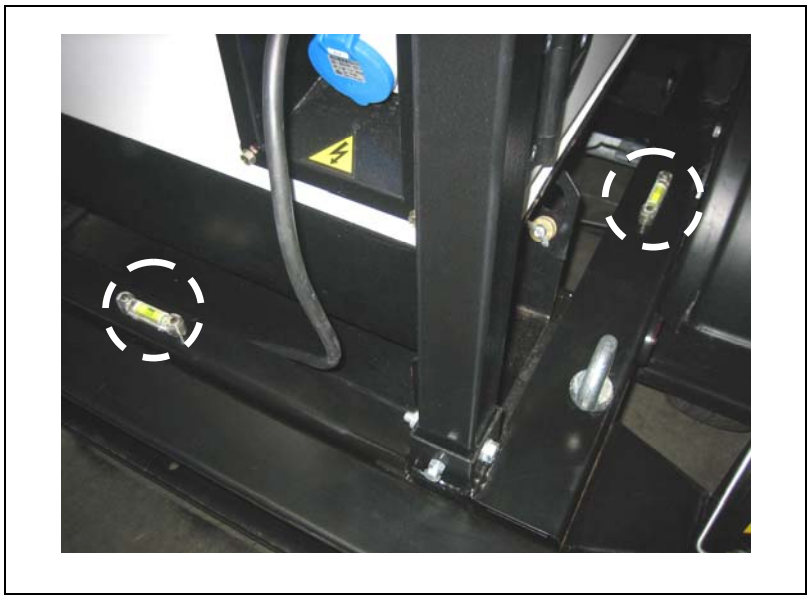


Figure 5.4 – Spirit levels

Important	It is impossible to raise the lighting column unless all the stabilisers have been correctly removed. Prior to first using the lighting column, you are recommended to be familiar with the operation of all the installation's controls

❹ Unlock the column safety lever (figure 5.5) and then perform the first raising phase, from horizontal to vertical position, by turning the hoist crank handle with automatic brake (figure 5.6).

Important	For raising, the hoist crank handle must only be turned clockwise. Any error in rotation could cause damage to personnel/property in the vicinity of the column.

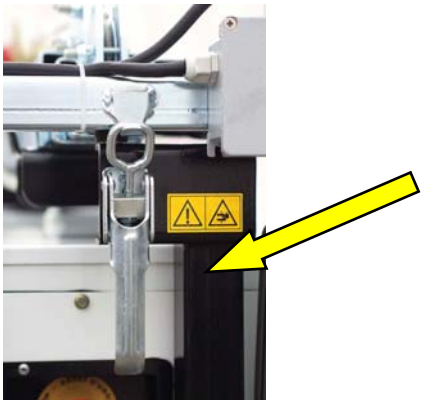


Figure 5.5 – Safety lever

Figure 5.6 – Vertical positioning of column

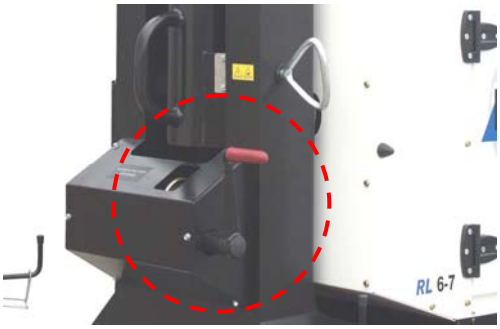


Figure 5.7 – Close-up view of hoist

❺ After reaching the desired vertical position, the lower stud ensures that the telescopic column is securely locked (fig. 5.8, ref. 1).

❻ Performing the second raising phase. Raise the column to the desired height using the hoist with automatic brake (fig. 5.8, ref. 2).

Important	For raising, the hoist crank handle must only be turned clockwise. Any error in rotation could cause damage to personnel/property in the vicinity of the column.

Important	The lighting column extended to its maximum height is designed to withstand a wind of around 110 m/h. If used in areas prone to strong gusts of wind, remain alert to these and lower the telescopic column in due time.

Important	It is formally prohibited to lift the stabilisers when the lighting column is in the vertical position.

❼ The column can be oriented according to requirements. It can swivel through 330°, by unscrewing the pivot (fig. 5.8, ref. 3).

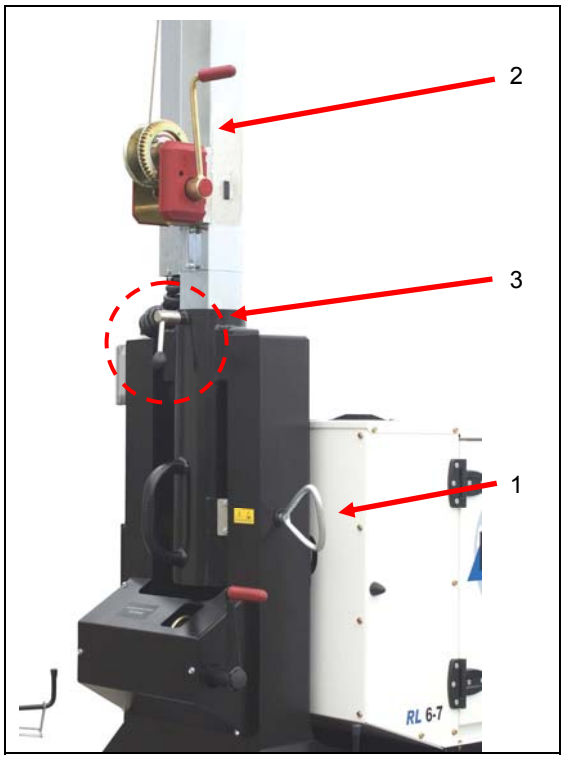


Figure 5.8 – Locking and raising the mast

5.2. Care after use

Important	It is formally prohibited to lift the stabilisers when the lighting column is in the vertical position.

❶ Switch off the lights (see paragraph 6.4).
❷ If the telescopic column has been oriented, return it to its initial position, and then lock the column rotation using the corresponding pivot (Fig. 5.9, ref. 1).
❸ Turn the hoist crank handle with automatic brake anti-clockwise, until telescopic sections no. 2, 3 and 4 fit back into the first section (Fig. 5.9, ref. 2).

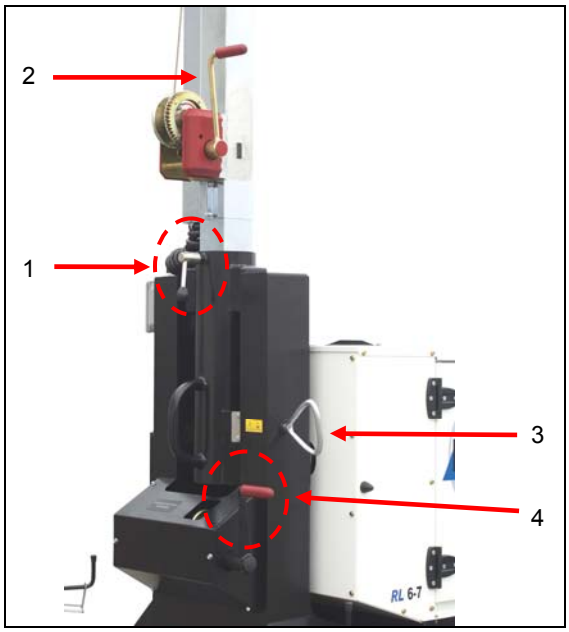


Figure 5.9 – Lowering the column

❹ Pull the lower safety stud (Fig. 5.9. ref. 3) to unlock it, and at the same time lower the telescopic column using the hoist crank handle with automatic brake (Fig. 5.9. ref. 4), and then release the safety pivot and continue lowering the column.
NB: before returning the column to the horizontal position, check that the lights are not inclined.
❺ Lock the column safety lever (Figure. 5.5).
❻ Lift up the front and rear stabilisers using the crank handle and bring the stabilisers to their rest position.
❼ Shut down the generating set.

6. Using the lighting column

6.1. Presentation of the generating set control unit

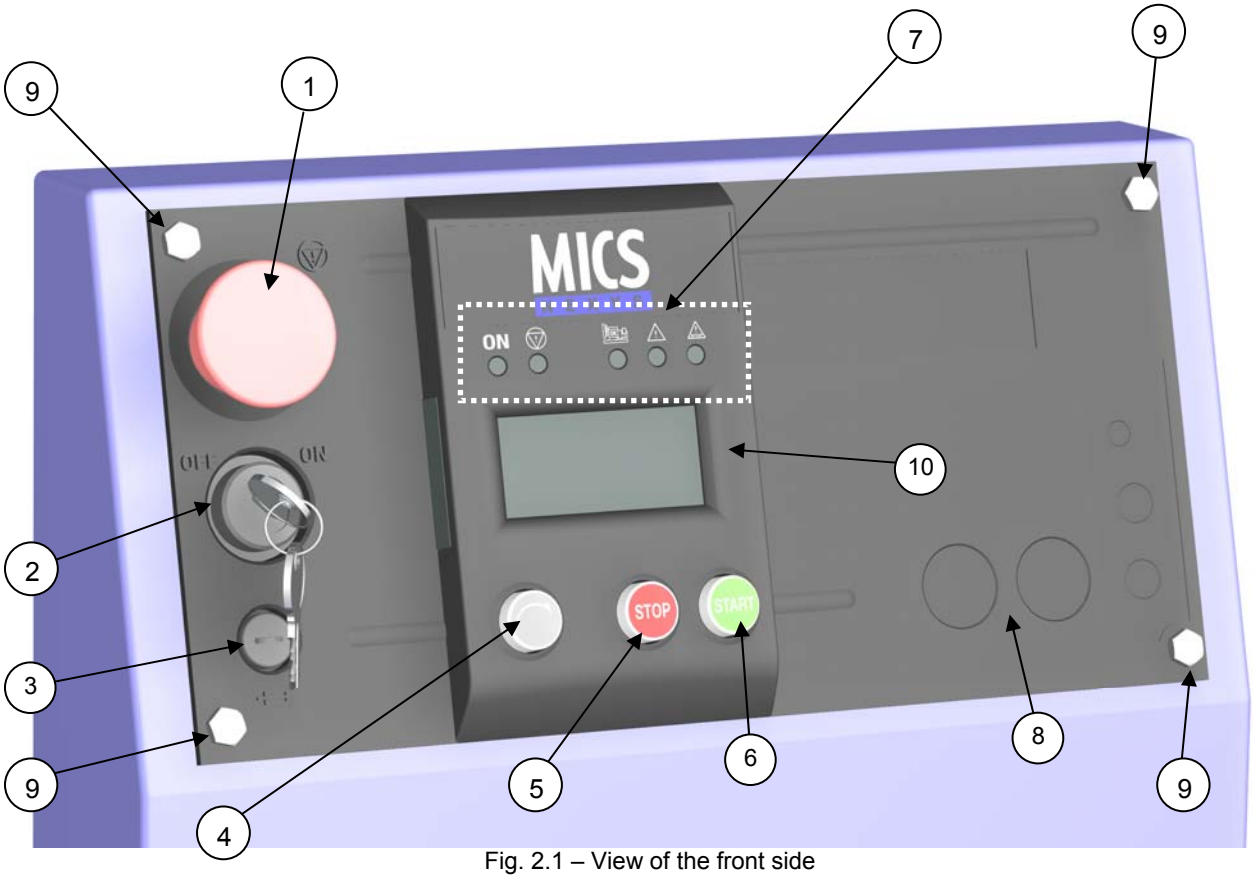


Fig. 2.1 – View of the front side

① Emergency stop button for switching off the generating set in the event of a fault which could endanger personnel or damage equipment
② Key switch for starting up/shutting down the module and RESET function
③ Electronic card protection fuse
④ Screen-scroll button, press successively to access the various screens which are available
⑤ STOP button, press to switch off the generating set
⑥ START button, press to switch on the generating set
⑦ Normal operation LEDs and alarm and fault warning LEDs
⑧ Slot reserved for panel fascia options
⑨ Mounting bolt.
⑩ LCD for displaying alarms and faults, operating states, electrical and mechanical quantities

Fig. 2.2 – Description of the LEDs

A lit LED indicates:
① Module being supplied (green, lights up and remains lit)
② Emergency stop activated (control panel or external emergency stop) (red, lights up and remains lit)
③ Visualisation of starting phase and speed/voltage stabilisation (flashing) and generating set operating OK or set ready to generate (green, lights up and remains lit)
④ General alarm (orange, flashing)
⑤ General fault (red, flashing)

6.1.1 Introduction to pictograms

The pictograms are as follows:

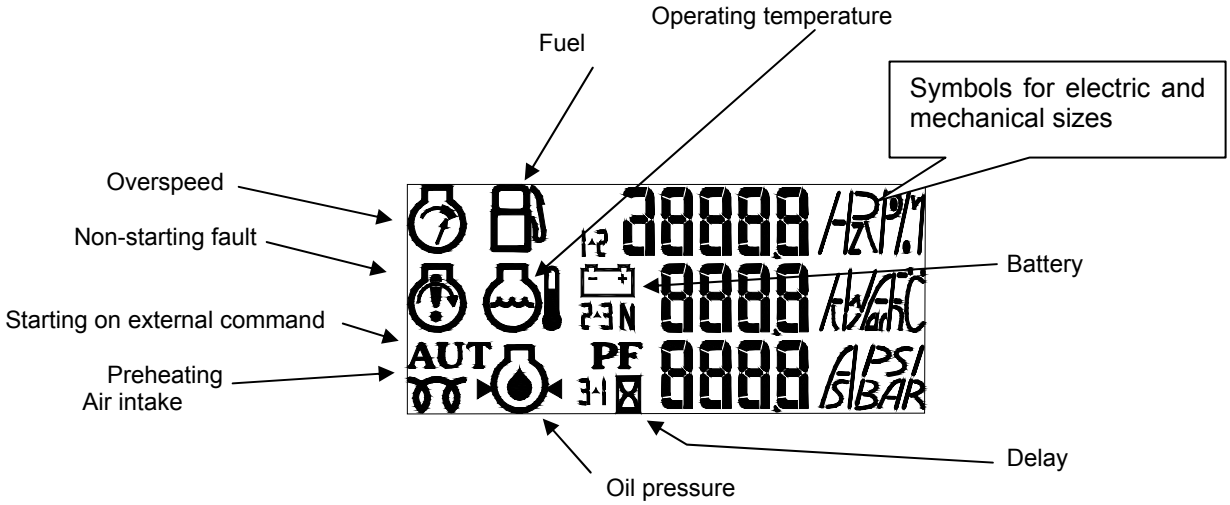


Fig. 2.3 – View of pictograms

- The "fuel level" pictogram is used to display the fault, the alarm and the fuel level.
- The "operating temperature" and "oil pressure" pictograms are used to display the fault and analog value
- The "overspeed" and "non-starting fault" pictograms are used to display the fault.
- The "battery" pictogram is used to display the "alternator charge" fault and to indicate the battery voltage.

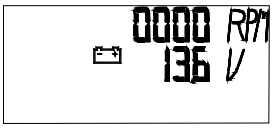
6.2. Manual starting

Danger	Check that the generating set circuit breaker has triggered.

❶ connect the generating set battery.

❷ turn the key switch to the ON position (without forcing it)

- ✓ All of the LEDs light up for 2 seconds, to confirm that they are operating correctly.
- ✓ If the LEDs do not light up, check the protection fuse and replace it if necessary.
- ✓ All the items on the screen are displayed for 2 seconds.
- ✓ Only the "ON" LED remains lit to indicate that the module is powered up.
- ✓ The following screen appears.

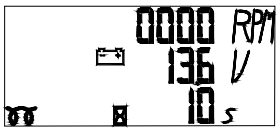


The first line displays the motor speed in RPM.
The second line displays the battery voltage in volts (V).

- ✓ Check the battery voltage (min. 12 V)

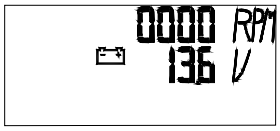
❸ Press (once briefly) the green "START" button.

- ✓ If the motor is equipped with an air preheating system, there is a 10-second delay before the motor starts (preheating activation period).
- ✓ The following screen appears



The third line displays the air preheating time remaining (with pictograms representing a resistor and an hourglass).

- ✓ If the motor is not fitted with an air preheating system or once the preheating delay has elapsed, the engine starts up (start of a cycle comprising 3 attempts to start up the engine).
- ✓ The following screen appears.



Warning	The number of successive and automatic starting attempts is limited to 3.

Note: the LED 

flashes as soon as the START button is pressed and continues to flash until the frequency stabilises if a "measurements" card has not been inserted and until the frequency and voltage stabilise if a "measurements" card has been inserted.

Following stabilisation, the LED light comes on continuously. 

6.3. Generating set checks

- ✓ Carry out the mechanical checks (oil pressure, water temperature, absence of noise etc.)
- ✓ Carry out the electrical checks (voltage and frequency)
- ✓ Carry out the safety checks (emergency stop, oil pressure, water temperature etc.)

6.4. Switching the lights on and off

After closing the circuit breaker in the bottom of the console, you can switch the lights on and off using the 4 switches on the front panel (figure 6.4).

Figure 6.4 – Light control switches

6.5. Shutting down the generating set

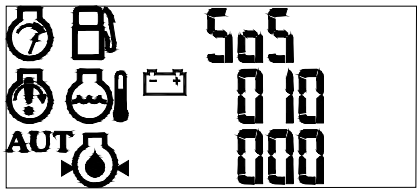
❶ trigger the circuit breaker located at the base of the centre console
❷ Let the motor run under no load for 1 to 2 minutes to allow it to cool.
❸ press the "STOP" button to stop the generating set.
❹ switch off the MICS Nexys module by switching the key to "OFF" (without forcing it).

7. Faults - alarms, failures and solutions

7.1. Generating set

7.1.1 Alarms and faults

The appearance of a fault or an alarm causes the following screen to be displayed (one or more pictograms or a fault code along with the SOS message are displayed).



The user can access the following screens by pressing the key 

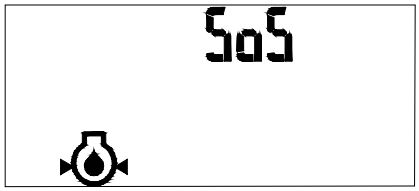
The fault or alarm screen will disappear once the fault or alarm has been removed.
Only one fault is displayed on this screen (the fault which caused the generating set to stop).
If one or more faults have appeared after the first fault, they can only be displayed after the first fault has been reset (press "Reset" as many times as the number of faults present).
Note: an alarm can appear at the same time as a fault.

7.1.2 Faults and alarms - Details

List of faults which will cause the generating set to stop and generate a pictogram

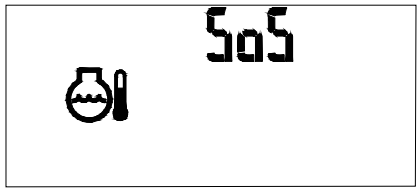
Associated pictogram

Oil pressure fault: Indicates that the oil pressure is incorrect



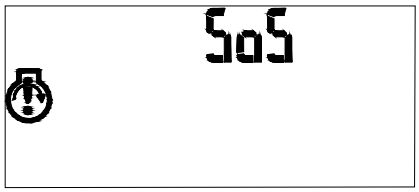
Associated pictogram

Engine temperature fault: Indicates that the engine temperature is too high.



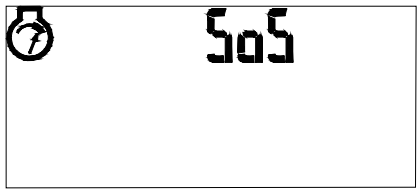
Associated pictogram

Non-starting fault: Indicates that there have been three consecutive unsuccessful starting attempts.



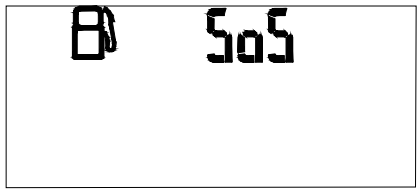
Associated pictogram

Overspeed fault: Indicates an excessive generating set running speed.



Associated pictogram

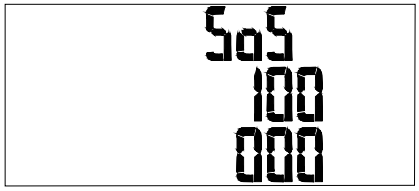
Low fuel level fault: Indicates the need to top up the fuel.



List of faults which will cause the generating set to stop and generate a fault code

Low coolant level fault: indicates that the level of coolant is low in the radiator (linked to a two second time delay).
Or
Overload or short-circuit fault (optional): with the circuit breaker SD contact closing (overload or short-circuit), the generating set switches off immediately also causing the main circuit breaker to be triggered.

Associated message

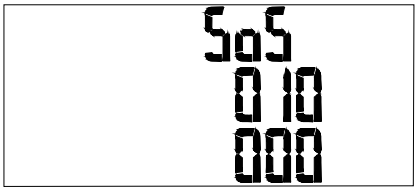


Additional fault linked to message opposite: is displayed in the following two cases:

- Differential fault (1)
- insulation fault (2)

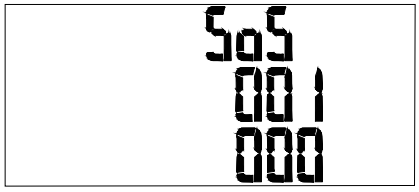
(1) Differential fault (optional): with a differential fault causing the activation of the differential relay, the generating set stops immediately also causing the main circuit breaker to be tripped.
(2) Insulation fault (optional): with an insulation fault causing the activation of the control unit performing insulation, the generating set stops immediately.

Associated message



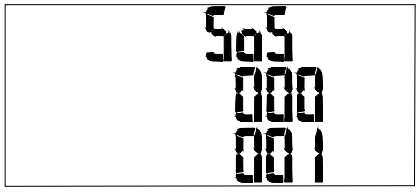
Underspeed fault: indicates an incorrect rotation speed (below 1000 rpm).

Associated message

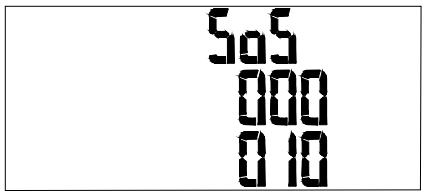


Emergency stop or external emergency stop fault

Associated message



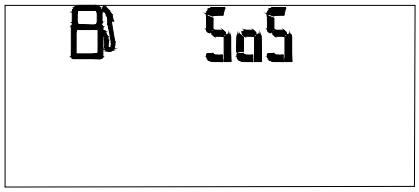
"STOP" fault activated if the "STOP" button is pressed whilst the "AUT" LED is flashing to indicate that the generating set is operating in automatic mode.



List of alarms associated with a pictogram

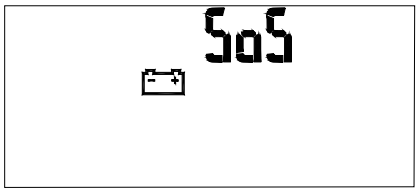
Low fuel level alarm: Indicates the need to fill up with fuel.

Associated pictogram



"Alternator charging fault" alarm indicates a problem affecting the alternator charging rate.

Associated pictogram



7.2. Lighting column

The hoist does not raise the column	Probable causes	Remedial action
	Cable incorrectly wound	Wind the cable correctly
	Incorrect crank handle direction of rotation	Turn the crank handle the right way (clockwise)
	Brake worn	Check the brake, and replace the worn parts
	Brake clutch penetrated with oil and/or grease	Clean or replace the clutch
The brake does not release, or lowering problems	Probable causes	Remedial action
	Clutch mechanism or crank handle locked	Unlock it by tapping the handle anti-clockwise.
The automatic brake stops working (load is not maintained)	Probable causes	Remedial action
	Incorrect tightening with the hexagonal screw	Have the brake checked or replaced
The generating set differential circuit breaker is triggered when the lights are switched on	Probable causes	Remedial action
	Insulation fault when lighting column in use.	Check the electrical installation.
	The generating set cannot distribute the current required to supply the lighting column lights	Check the power supplied by the generating set
One or more bulbs do not come on	Probable causes	Remedial action
	Bulbs defective or blown	Before replacing the bulb, it is advisable to perform a test by fitting the bulb that is supposed to be blown in a light whose bulb was working

7.3. Trailer

Table 1: axle

Fault	Cause	Remedial action
Mediocre braking	Linings worn or damaged. Brake rings slightly offset. Brakes incorrectly installed.	Replace the liningsThe effect will disappear after a few brake applications. Adjust the brakes and ensure that the system is lubricated.
Problems reversing.	Braking system too tight. Automatic reverse mechanism lever too tight.	Adjust the brakes. Lubricate and release the reverse lever.
Brakes overheating	Incorrect setting. Braking system not free enough. Coupling lever stuck. Damage or corrosion of braking system	Adjust the brakes. Ensure that the parking brake lever has been released and that the system is completely free running. Lubricate and release the reversing lever. Check the system and replace or repair the parts as necessary.
Parking brake not efficient enough	System incorrectly set. Brake rings slightly offset.	Adjust the brakes accordingly and, if necessary, lubricate. The effect will disappear after a few brake applications.
Awkward driving or irregular braking	Mediocre brake setting. Defective shock absorber. Defective axle shock absorbers.	Adjust the brakes. Check and repair the shock absorber if need be. Replace the shock absorber.

Table 2: coupling heads

Fault	Cause	Remedial action
The coupling does not engage on the ball joint	The ball joint diameter is too big. The ball joint is damaged or deformed. The coupling head is dirty or defective.	Use a ball joint with the recommended diameter. Fit a new ball joint. Clean and lubricate the coupling, replacing it if necessary.
Problems uncoupling	Ball joint damaged or deformed. Coupling damaged or deformed. Coupling head pressurised by shock absorber.	Fit a new ball joint. If necessary, replace it. Draw it forwards a few centimetres to release the pressure.
Coupling play too high	Coupling damaged or deformed. Ball joint too small.	If necessary, replace it. Fit a new ball joint.

Table 3: coupling devices

Fault	Cause	Remedial action
Mediocre braking	Coupling pivot bolt too tight. Coupling pivot bolt corroded. Housing damaged.	Lubricate the coupling pivot bolt and replace the damaged parts.
Brakes overheating during towing	Parking brake lever not properly released. Braking system not correctly set. Release cable incorrectly fastened.	Release the parking brake. Adjust the brakes. Check the cable mounting.
Parking brake not efficient enough	Gas shock absorber defective. Spring ram incorrectly set	Replace the gas shock absorber. Adjust the spring ram
The brakes are engaged upon deceleration or driving downhill	Coupling shock absorber defective.	Replace the coupling shock absorber.

8. Maintenance schedule

8.1. Engine

Operation \ Interval	50 hrs	First 50 service hours for a new or over-hauled engine	100 hrs	250 hrs	500 hrs	1000 hrs	1500 hrs	3000 hrs	Every 2 years
Air cleaner - Check	●								
Check the engine oil and coolant levels	●								
Solenoid fuel pump filter - Inspect and clean		●	●						
Engine oil and Oil filter - Replace		●		●					
Bolts and nuts on the engine - Retighten		●				●			
Belt and belt tension - Inspect and Adjust				●					
Radiator fins - Check and Clean				●					
Fuel filter element (switching cock type) - Replace					●				
Solenoid fuel pump filter - Replace					●				
Valve clearance - Inspect					●				
Checking glow plug					●				
Specific gravity of battery electrolyte - Check					●				
Starter - Inspect						●			
Alternator - Inspect						●			
Nozzle tip - Clean							●		
Fuel injection nozzle - Check and maintenance								●	
Coolant - Change									●

8.2. Alternator

After 20 hours' operation, check the tightness of all the mounting screws, the general condition of the machine and the installation's various electrical connections.

8.3. Column

Operation \ Frequency	Every 3 months	every 6 months	Every year
Greasing the pulleys			●
Greasing the telescopic column	● (1)	●	
Greasing the hoists			●
Checking the steel cables		●	

(1) in case of frequent use

8.4. Trailer

Operation \ Frequency	After the first 500 km	1,500 km	10,000 km or every year	every year	As required
Check the brake transmission setting	●	●			
Wash the base frame				●	
Check the wheel brake linings			●		
Lubricate the screw threads and the guide roller pivot bolt					●
Lubricate or grease the mobile parts of the coupling device			●		

9. Maintenance

9.1. Pre-Start Inspection

- **Inspecting the engine compartment**

- Make sure there is no combustible material near the engine or battery. Also, check to make sure that the engine and battery are clean. If combustible materials or dust are found near the engine or battery, remove them.
- Check the electrical wiring for such components as the starter and alternator for looseness.
- Check the entire engine for fuel leakage, engine oil or coolant. If leakages are found, repair.
- Make sure the following valves, plugs and cocks are open or closed (tightened) properly:
  - ✓ Fuel feed valve : Open ;
  - ✓ Coolant drain cock (plug) : Closed (Tightened) ;
  - ✓ Oil drain valve : Closed.

- **Checking the engine oil level**

⚠ Important	- **Do not** top up the oil if the oil level is not **below** the low level marker. - **Do not** exceed the hatched area The oil level is correct if it is within the hatched area.

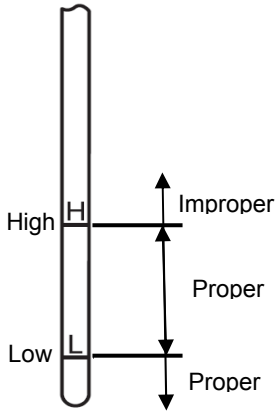
❶ Pull out the oil level gauge and wipe it clean using a waste cloth.

❷ Insert the oil level gauge fully into the oil level gauge guide, then pull out the gauge again.

❸ The proper oil level is between the high and low marks on the oil level gauge. If the oil level is low, add engine oil.

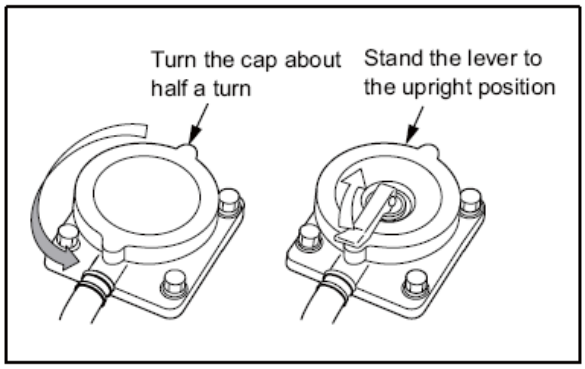
❹ Install the oil filler cap after refilling.

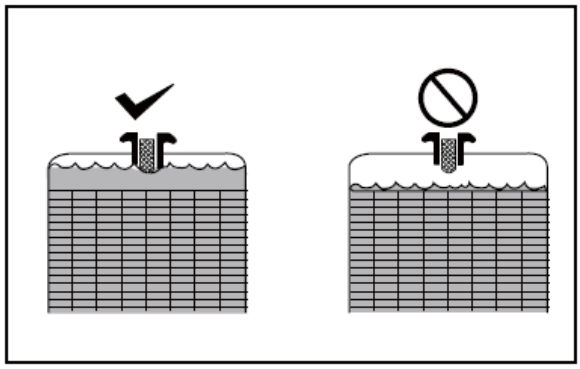
❺ Check the oil pan and other area for oil leakage.



- **Checking the coolant level**

⚠ Warning	Remove the radiator filler cap only after the engine has cooled to room temperature. Place a waste cloth over the cap, and loosen the cap about a half-turn or stand the lever to the upright position to release internal pressure. Never open the radiator filler cap while the engine is hot, otherwise the steam or hot coolant spurts out and you may be scald with it.





❶ Open the radiator filler cap and check the coolant level.

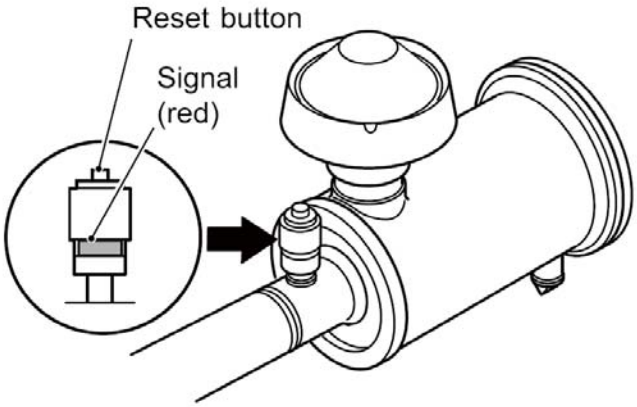
❷ If the coolant level is low, add coolant to the specified level.

❸ Check for leaks in the cooling circuit.

- **Checking the air filter**

Important	A clogged filter element limits the engine's air intake and a reduced air supply to the engine.

The air cleaner indicator alarms with its red signal when air cleaner elements become clogged, the difference in pressure between front air cleaner and rear air cleaner, and reaches the specified value. The signal indicates only, and does not generate an alarm. Therefore, the periodic visually inspection is needed.
Press the reset button on the top of air cleaner indicator and restore the signal after cleaned the air cleaner indicator or replaced with a new one.



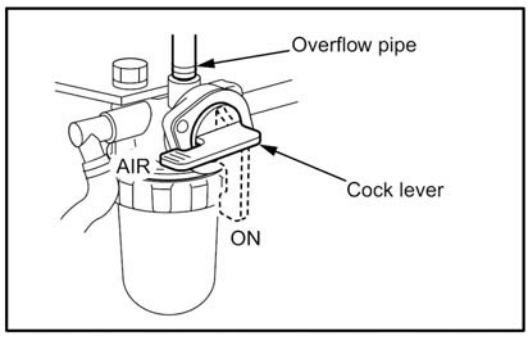
- **Checking the fuel filters**

Danger	**When handling fuel, make sure there are no open flames or other fire hazards near the engine. Wipe off any spilled fuel completely.Spilled fuel can ignite and cause a fire.**

✓ **First filter type : switching coke type**

Bleed air :

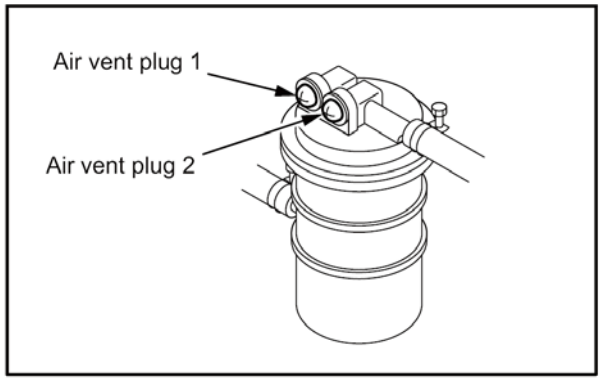
❶ Turn the fuel filter cock to "AIR" position.
❷ Feed fuel using the solenoid fuel pump.
❸ Return the cock to "ON" position when the fuel flow from overflow pipe becomes free of bubbles.
❹ Stop feeding fuel.



✓ **Second filter type : cartridge type**

Bleed air :

❶ Loosen air vent plug 1 of fuel filter.
❷ Feed fuel using the solenoid fuel pump.
❸ When the fuel from the air vent plug 1 becomes free of bubbles, stop priming and tighten the air vent plug 1 to the specified torque.
❹ Loosen air vent plug 2 of fuel filter.
❺ When the fuel from the air vent plug 2 becomes free of bubbles, stop priming and tighten an air vent plug 2 to the specified torque.
❻ Stop feeding fuel.



9.2. Engine and alternator

The maintenance procedures for the engine and alternator fitted on the generating set are described in appendices B and C.

9.3. Column

9.3.1 Cleaning

Regular cleaning of the machine is recommended in order to prevent any deposits of dirt that could compromise its efficiency. The frequency of this operation depends on its place of use.

9.3.2 Greasing the pulleys

To lubricate the pulleys (figure 9.1), use the grease recommended for low temperature and very high speed applications. It is recommended to use SKF LGLT 2 grease, a top quality lithium soap product with a 100 % synthetic base oil. If using another lubricant, this must still be characterised by a base oil viscosity of 18 mm²/s at 40°C and 4.5 mm²/s at 100°C.

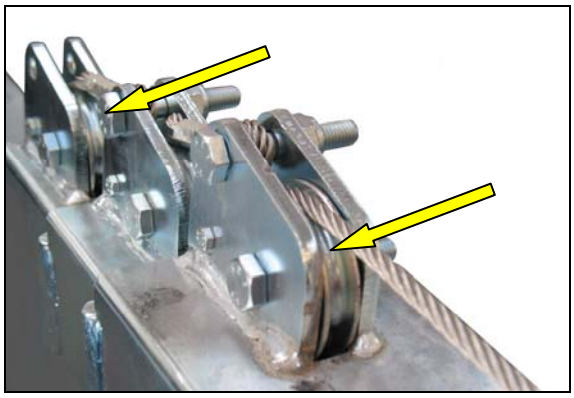


Figure 9.1 – Pulley greasing

9.3.3 Greasing the telescopic column

To grease the telescopic columns, use a WD40 type lubricant spray, to be applied to the metal parts to facilitate the sliding of the various sections during the column raising and lowering operations. In case of frequent use, carry out this operation every three months.

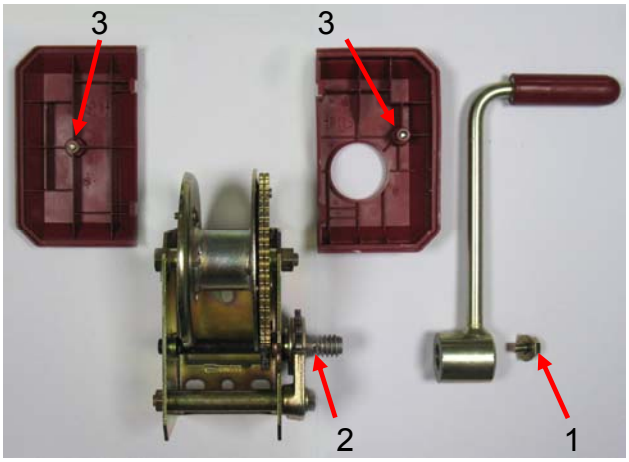
9.3.4 Greasing the hoists

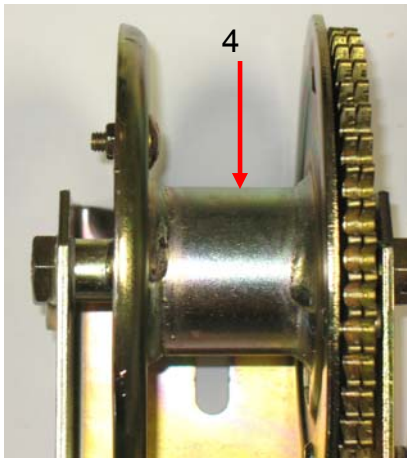
The hoists are greased in the manufacturing phase by the manufacturer, but it is still recommended to grease certain parts.

Important	**These operations must only be carried out with the column in the rest position.**

❶ Remove the control shaft handle (fig. 9.2, ref. 2) by unscrewing the hexagonal nut (fig. 9.2, ref. 1).
❷ Remove the protective covers after removing the screws (fig. 9.2, ref. 3).
❸ Grease the drum hub (fig. 9.2, ref. 4), the control shaft ring (fig. 9.2, ref. 5), the toothed gear (fig. 9.2, ref. 6) and the crank handle thread (fig. 9.2, ref. 7).
❹ After completing all the greasing operations, refit all the parts in the reverse order of removal.
NB: The tightening torque to be applied for the control shaft handle mounting screw is 15 Nm.

Important	**Never oil or grease the brake mechanism.**





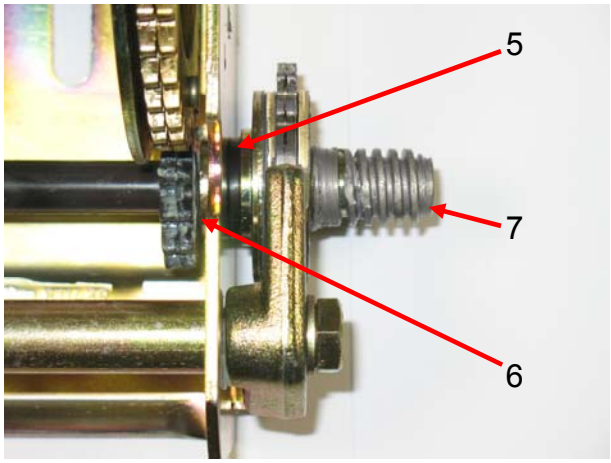


Figure 9.2 – Hoist greasing

9.3.5 Checking the steel cables

The steel cables consist of 133 wires, and enable the telescopic column to be raised and lowered. Regularly check their condition and that they are running perfectly inside the pulleys. Also check the tightness of the screws supporting the steel cables. At least 2 loops of the steel cable must remain wound on the drum hoist when the column is being lowered. If this is not the case or if the steel cable has signs of wear, do not use the lighting column, and contact the manufacturer directly.

9.3.6 Replacing the light bulbs and glasses

To replace the light bulb or glass, follow the procedure below:
❶ Open the light by unscrewing the screw on the frame and removing the clamps
❷ Replace the bulb or glass
❸ Bond the new glass to the light frame, by applying a small layer of silicone to the 4 corners
❹ Secure the light by refitting the screw

The bulb used must meet the following specifications:
Bulb type: halogen
Mounting: R7s
Nominal power: 1000 W
Bulb voltage: 230V – 50 Hz

Important	**You must not touch halogen bulbs with your fingers, since the grease deposits left on them would carbonise the first time the light comes on due to the very high temperature, blackening the glass and possibly even breaking it**

9.4. Trailer

9.4.1 General information

The rubberised AL-KO suspension does not require any maintenance, and was designed and developed to adapt to any road conditions. Three rubber parts are housed in a hexagonal axle tube. They provide the suspension, and by their nature have shock absorbing properties.
The axle bearings require no maintenance (they are greased for life and sealed) or adjustment.

9.4.2 Checking the brake linings

Check the brake lining wear using the wear indicators (fig. 9.3 – ref. 1). If necessary, adjust the linings.

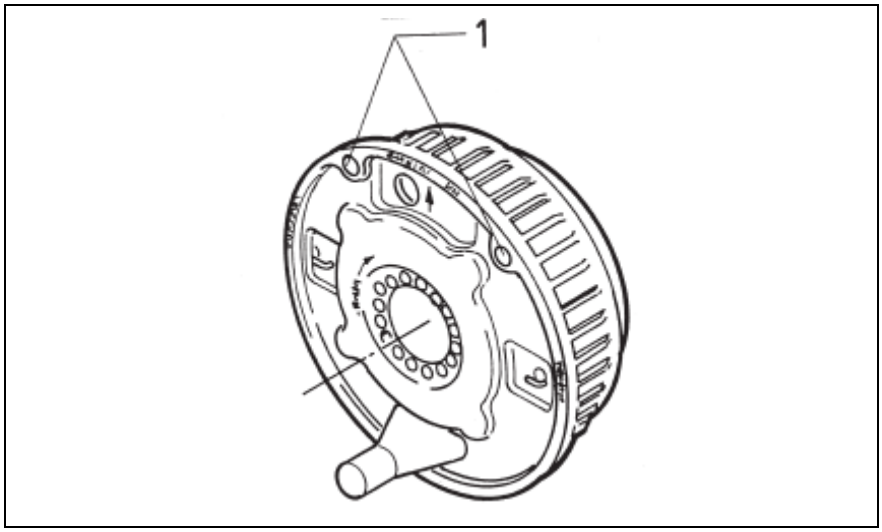


Figure 9.3 – brake lining wear indicators

9.4.3 Adjusting the braking system

1. Ensure that the towing pivot bolt and coupling head are fully to the front.
2. Release the parking brake completely. It is not possible to adjust the braking system properly unless the parking brake is completely released.
3. Lift up one side of the trailer using a jack.
4. Remove the interior plastic cone fitted on the support plate, so as to clear access to the cross piece adjuster. (figures 9.4 and 9.6).
5. While turning the wheel forwards (never backwards), adjust the cross piece using a suitable screwdriver by turning it in the direction of the arrow embossed on the support plate, until the wheel rotation hits a resistance point. (figure 9.6).
6. Loosen the cross piece adjuster until the wheel turns freely forward. (figure 9.6).
7. Check the adjustment at the end of the brake cable, where it attaches to the butt joint (abutment) welded in the centre of the axle. If the interior cable is released, it must have a protruding length of between 5 and 8 mm (figure 9.5).
8. Do the same for the other wheel.
9. Ensure that the balancing bar (compensator) is equally distributed (figures 9.4 and 9.5). Excessive movement of this bar indicates a possible adjustment fault (if necessary, repeat operation 7).
10. Ensure that the brake rod support plate (at fixed distance from the ground) uniformly supports the rod. The brake rod must be straight, without any curving or deformation, whatever the set-up adopted.
11. Eliminate the brake rod play by adjusting the screw ball joint, on the rear of the balancing bar, while ensuring that the coupling lever is in contact with the end of the towing pivot bolt.

Note: over-adjustment of the screw ball joint (fig. 9.5 – ref. 2) may shift the brake cable, which could reduce the play in the brake rings. If the coupling lever cannot come into contact, it may be due to incorrect setting of the two lock nuts on the front of the spring ram. Loosen the lock-nuts and then adjust the brake rod as indicated above (figures 9.4 and 9.5).

12. You can check that the linkage is correctly set by engaging the parking brake lever so that the second or third tooth brakes the wheels slightly.
13. Excessively tight brakes or linkage setting will make any reversing manoeuvre difficult due to immobilisation of the wheels
14. When parked, the parking brake lever must be in the vertical position (90°). This will compress the ram spring, thereby storing enough energy for the brake to be automatically tightened if the trailer moves. If you have difficulty with this manoeuvre, you can push the trailer backwards with one hand while correcting the parking brake lever with the other. This manoeuvre must not be attempted if the rear of the trailer is facing down a slope. In this case, wheel chocks will be used to supplement the parking brake
15. Finally, if the wheels have been removed, retighten all the M12 bolts, using a torque wrench set to 90 Nm (67 lbs/ft); tighten in the order top, bottom, left and right, **rather than** in a clockwise or anti-clockwise direction (this only applies to steel wheel rims). Remember that over-tightening is as dangerous as under-tightening, since it may cause deformation of the wheel rim. Avoid using an electric tool.

 Warning	The tightening torque of the wheel mounting bolts must be checked 20 km after tightening. The wheel bolts must **never** be lubricated.

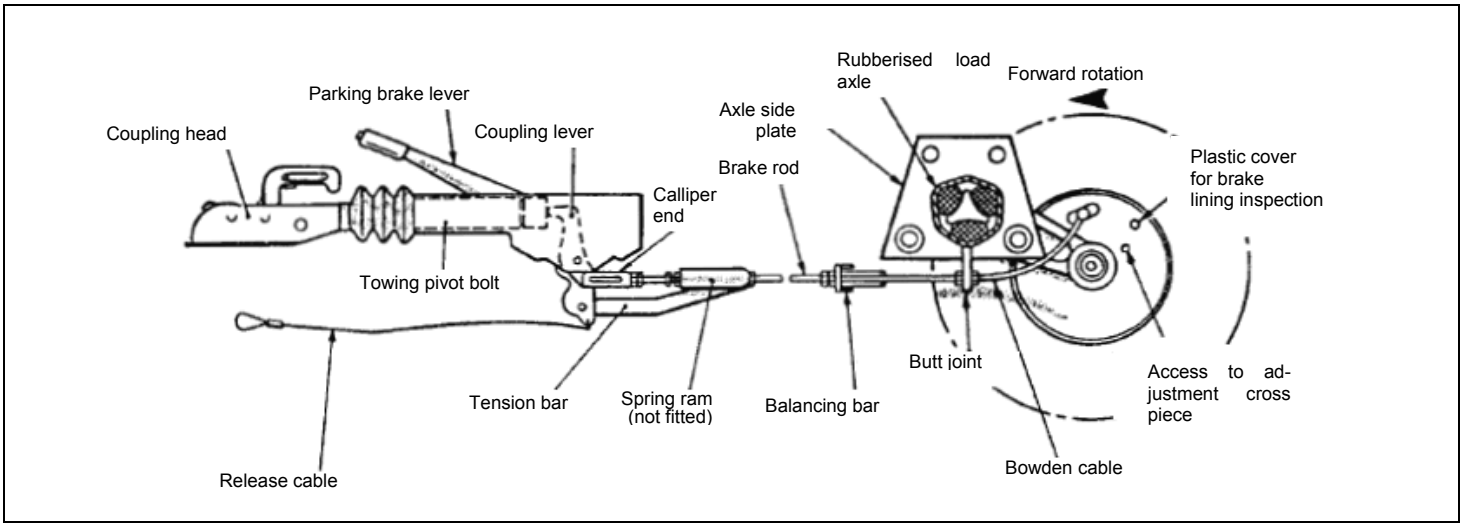


Figure 9.4 – Braking system diagram

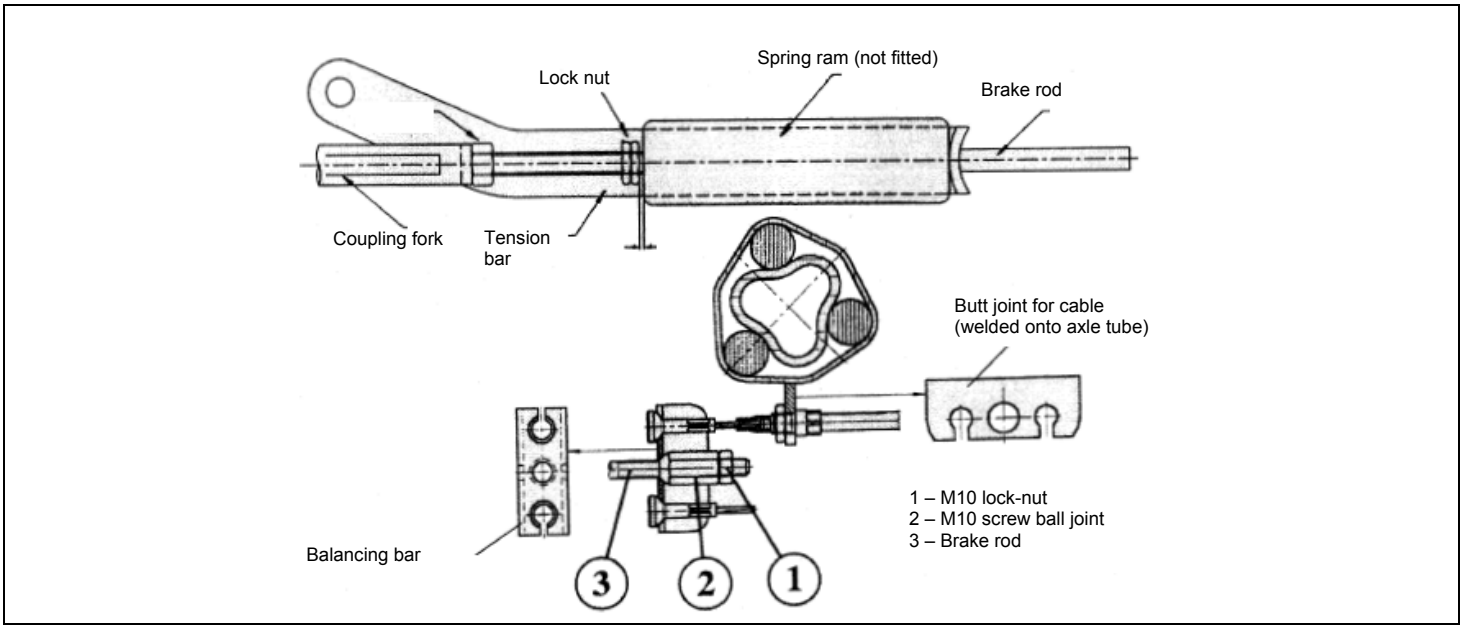


Figure 9.5 – Diagram of braking system / close-up

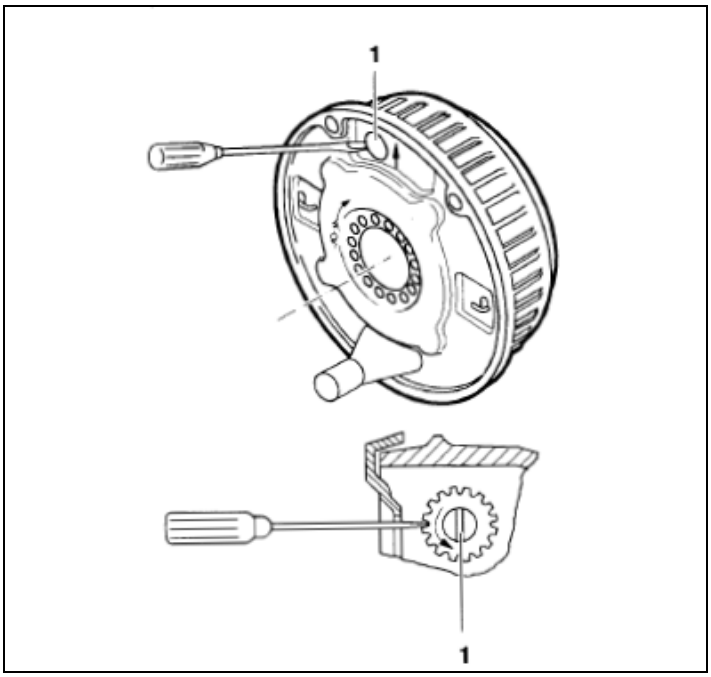


Figure 9.6 – Adjustment cross piece

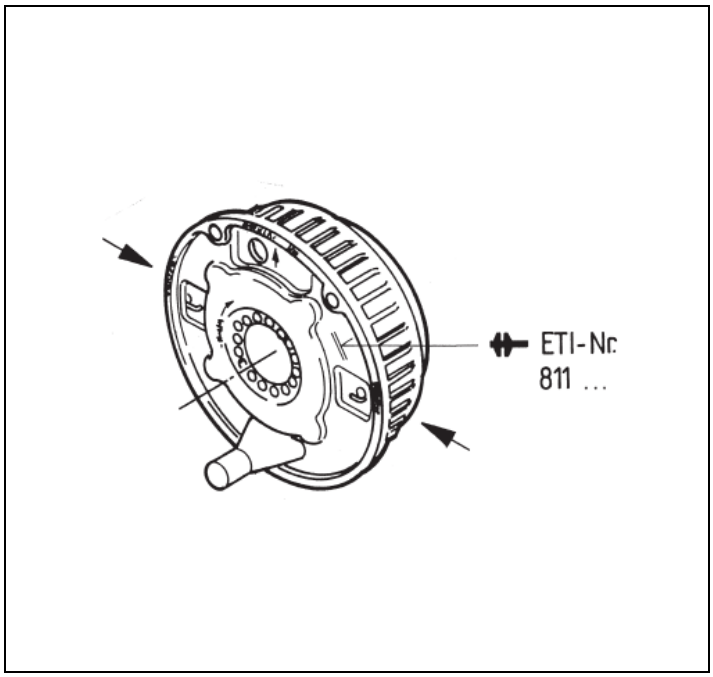


Figure 9.7 – Identification number

Note: The flanged hub nut under the dust cover, used for keeping the brake drum in place, is a single-use nut (not to be re-used). After being removed, it must be replaced by a new flanged nut (tightening torque 290 ± 10 Nm (214 ± 7.5 lbs/ft)). Before fitting the new nut, be sure to gently coat the stub axle threads with a special mineral grease available from AL-KO. After fitting the nut, the excess grease is eliminated with a cloth soaked in white spirit.
Under no circumstances **must any manipulation be made** on the hexagonal head bolt under the black plastic cover. Any manipulation of this nut will cause immediate tyre wear and damage the braking system, resulting in **all the warranties being voided**. If the condition of this rear nut is inadvertently altered, the entire axle should be returned to
AL-KO for the toe-in and camber angle to be reset.
You must not attempt to remove the bearing. In the event of damage to the bearing or drum, the whole thing will be replaced, since the spare part includes the entire drum with its bearing and its retaining ring. No grease is used for the hub, except for the mineral grease on the stub axle. No grease must be applied inside the dust cover. This is not a grease cap with which all the previous hubs were fitted.

To determine the spare part required for an axle, you must indicate the axle type and the part identification number. (ETI no.), which is engraved on the wheel brake or on the manufacturer plate (figure 9.7).

9.4.4 Lubricating / greasing the coupling device

Lubricate or grease the mobile parts of the coupling device, as illustrated (figure 9.8).
Lubricant recommended. General purpose grease compliant with DIN 51825 KTA 3KA.

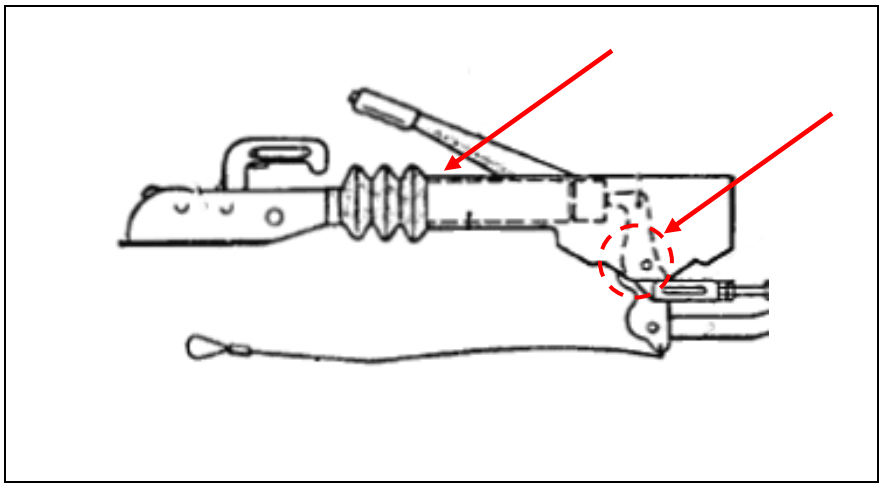


Figure 9.8 - Lubrication / greasing points

9.5. Battery maintenance

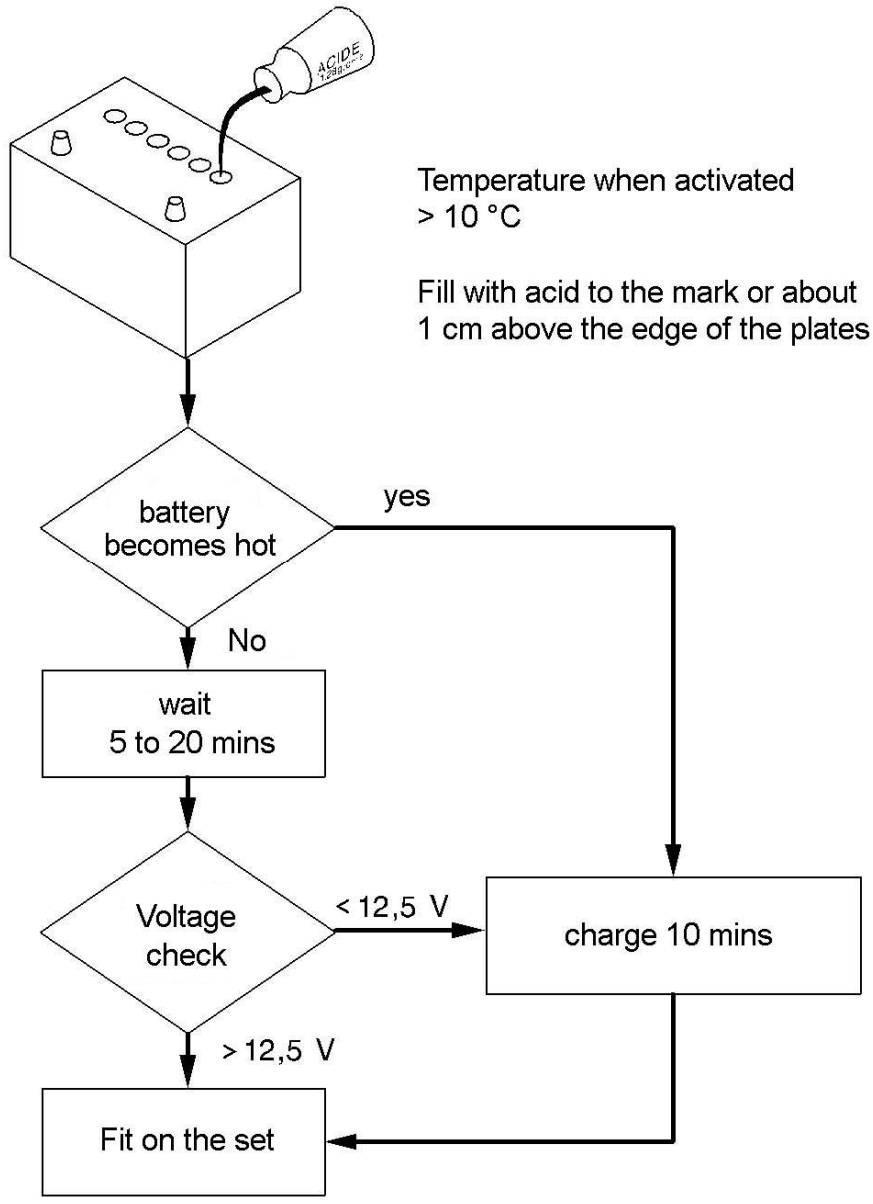
⚠	Fit the battery so that it is properly ventilated. Maintenance should only be carried out by a qualified person. If replacing batteries, only use the same type as those to be replaced. Do not throw the old battery in the fire. Only use insulated tools (the operator should not be wearing a watch, bracelet or any metal object) Never use sulphuric acid or acid water to top up the electrolyte level. Batteries release oxygen and hydrogen gas, which are flammable Never use flames or generate sparks near the battery since this might cause an explosion. Discharge any static electricity on your body before handling the batteries by first touching an earthed metal surface. Do not use the battery when the fluid is below the minimum required level. Using a battery with a low electrolyte level could result in an explosion. Do not short circuit the battery terminals with a tool or other metal object. When disconnecting battery cables, remove the cable from the negative (-) terminal first. When reconnecting the battery, connect the positive cable (+) first. Charge the battery in a well-ventilated area, with all filler hole plugs removed. Make sure that the cable clamps are correctly secured to the battery terminals. A loose cable clamp can cause sparks that could result in an explosion. Before servicing electrical components or performing electric welding, set the battery switch to [OFF] or disconnect the battery negative cable (-) to cut off the electrical current.
Danger	Electrolyte contains dilute sulphuric acid. Incorrect handling of the battery could lead to a loss of sight and burns. Wear safety goggles and rubber gloves when working on the battery stopping-up the electrolyte, recharging the battery, etc.) If electrolyte comes into contact with your skin or clothes, wash it off immediately with plenty of water. Then wash thoroughly with soap. If electrolyte comes into contact with your eyes, rinse immediately with plenty of water and see a doctor as soon as possible. Should you accidentally swallow electrolyte, gargle with plenty of water, then drink lots of water. Consult a doctor immediately. Electrolyte spillages should be rinsed using a neutralising agent. A common method is to use a solution of 500g of bicarbonate of soda diluted in 4 litres of water. The bicarbonate of soda solution should be added until it is clear the reaction has finished (foaming). The remaining liquid should be rinsed off with water and left to dry.

9.5.1 Storage and transport

- ✓ Batteries ready for use must be stored in a cool and dry place (frost-free) protected from the sun (self-discharge).
- ✓ Batteries must be transported and stored vertically (risk of acid spillage)
- ✓ Leave the terminal cover on the positive terminal

9.5.2 Battery setting into service

- ✓ Batteries filled with acid have a density of 1.28 g/ml and are charged.
- ✓ In the case of dry batteries, fill each battery cell with acid up to the maximum level mark or to 15 mm above the plates. Let the battery rest for 20 minutes.
- ✓ Before fitting the battery, stop the engine and any power consumer, clean the terminals and give them a light coating of grease. When connecting, connect the positive terminal (+) first, and then the negative terminal (-).



9.5.3 Check

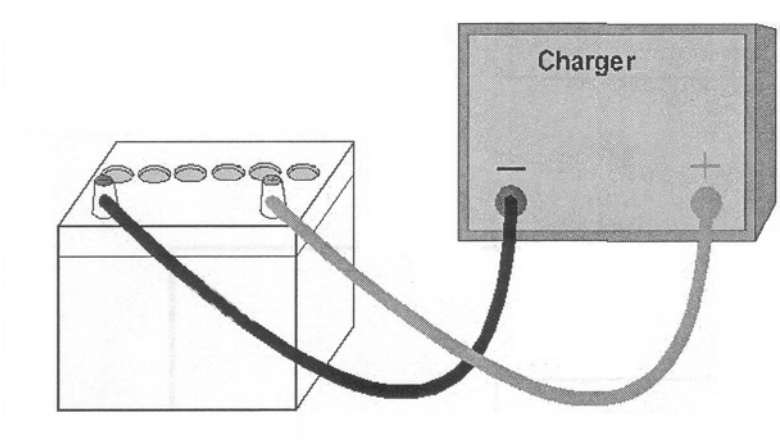
Acid density	Charge status	Voltage when idle	
1.27	100%	Above 12.60 V	
1.25	80%	12.54 V	
1.20	60%	12.36 V	**From 50 % recharge**
1.19	40%	12.18 V	**Risk of sulphation**
1.13	20%	Under 11.88 V	**Unusable**

9.5.4 Load preconization

- ✓ Very discharged or sulphated batteries (formation of whitish lead sulphate deposit on the plates which becomes hard and insoluble in acid; this deposit reduces the active surface of the plates and increases their internal resistance) can no longer regenerate or charge in a set.

Warning	A discharged battery should be recharged immediately otherwise it will suffer irreparable damage.

Battery charge



When several batteries are connected together, the following points should be checked:

- ✓ Are the batteries connected in series ?
- ✓ Is the voltage chosen exact? 1 x 12 V battery, 3 x 36V batteries
- ✓ Adjust the charge current to the lowest battery.
- ✓ The power difference between the batteries must be as low as possible.

Example of charge:

- ✓ Battery 12V 60 Ah = charging current 6 A
- ✓ Charge status: 50% (acid density 1.21/voltage when idle 12.30V)
- ✓ Battery lacks 30 Ah, recharging required
- ✓ Charge factor: 1.2
- ✓ Ah x 1.2 = 36 Ah to be recharged
- ✓ Charging current: 6A around 6 hours charging required.

Recharging is complete when the battery voltage and the acid density stop increasing.

→ The charging current must always be $1/10^{th}$ of the nominal capacity of the battery

The power of the charger must be suitable for the battery to be charged and the charging time available.
You need to use an automatic charger able to provide a sufficient voltage and charging current, as well as a compensation voltage to handle spontaneous battery discharge.

9.5.5 Faults and remedies

Fault observed	Probable origin	Measures or observations
The acid heats up when a new battery is filled	- Incorrect composition - Incorrect storage - Prolonged storage in a damp place	- Cool - Charge - Check the acid density
The acid escapes through the filler holes	- Battery overflow during filling	- Reduce the battery fluid level
Acid level too low	- Battery tray not leaktight - Significant gas formation caused by too high a charging voltage	- Replace the battery - Check the charger and repair if necessary.
Acid level too low Incorrect operation from start-up	- Insufficient charge - Short circuit in the current circuit - Consumption fault	- Recharge - Check the electrical installation
Acid density too high	- The battery has been filled with acid instead of water	- Reduce the acid level and fill with distilled water. Repeat the operation if need be.
Starting problems Starting test incorrect	- Battery empty - Battery used up or faulty - Capacity too low - Battery sulphated	- Recharge the battery - Fit a new battery
Battery terminals melted	- Incorrect electrical connection - Incorrect battery wiring	- Tighten the ends of the battery cables, or replace them if necessary
One or two cells release a lot of gas at high charge	- Cell(s) faulty	- Fit a new battery
The battery discharges very quickly	- Charge status too low - Short circuit in the current circuit - High self-discharge (for example: through electrolyte contamination) - Sulphation (storage of discharged battery)	- Check the charge - Replace the battery
Short service life	- Incorrect battery part no. - Too many repeated deep discharges - Battery stored too long without charge	- Define the correct battery part no. for the recommended use - Think about charging the battery using a regulator
High water consumption	- Overload - Charging voltage too high	- Check the charger (voltage regulator)
The battery explodes	- Spark after battery charging - Short circuit - Connection or disconnection during charging - Internal fault (for example: interruption) and low electrolyte level	- Replace the battery (beware of fire and sparks) - Ensure there is sufficient ventilation

10. Appendix

10.1. Appendix A - Wiring diagram of lighting installation

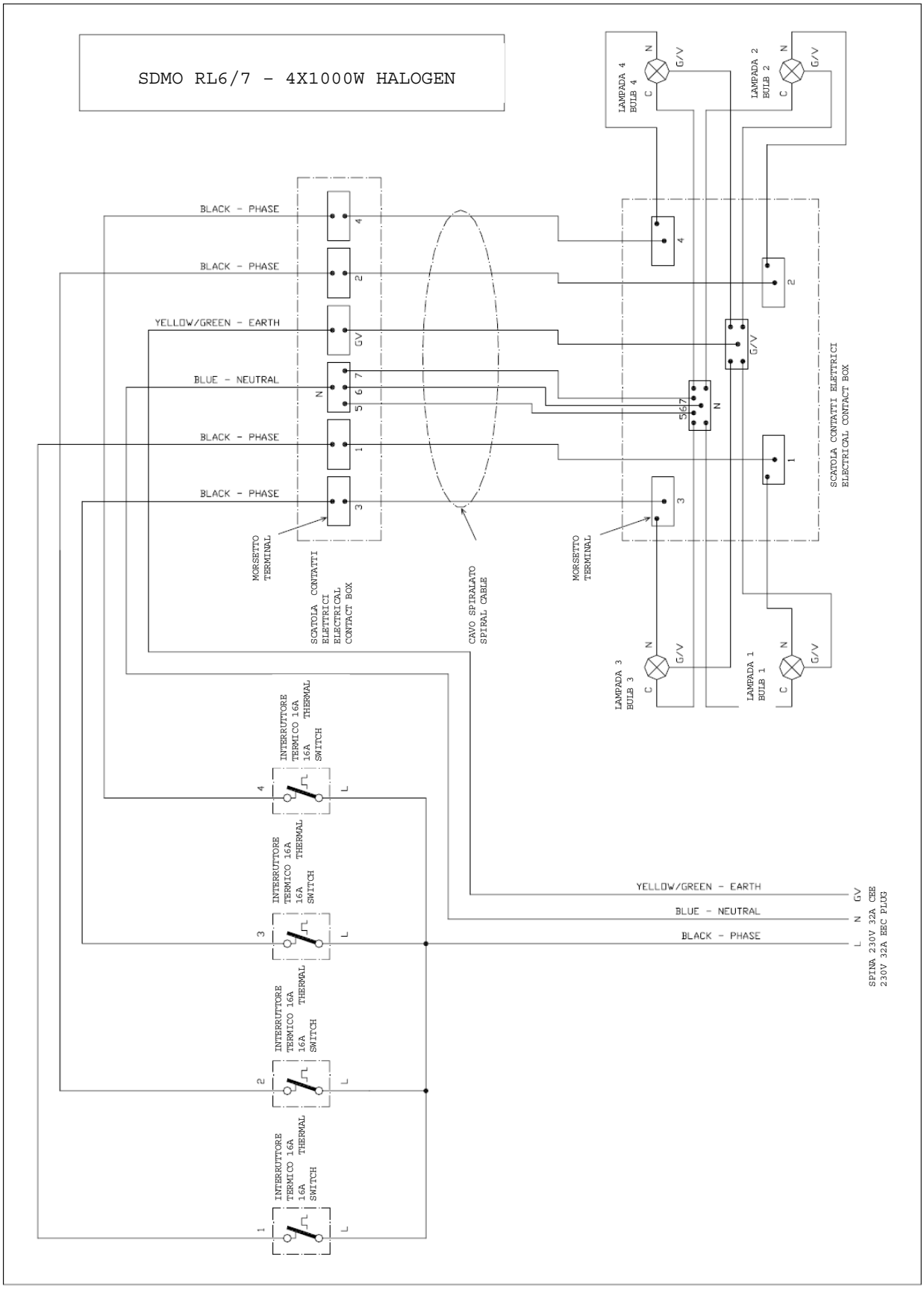


Figure 10.1: wiring diagram of lighting installation

10.2. Appendix B – Engine user and maintenance manual

User guide and maintenance manual

MITSUBISHI

Engine

L-SERIES

99610-15140
01/07/2009

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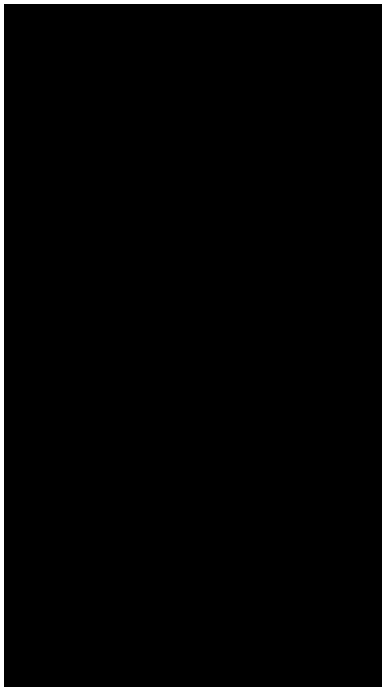
OPERATION & MAINTENANCE MANUAL



MITSUBISHI DIESEL ENGINES

L-SERIES

The operator and supervisor are requested to read this Operation and Maintenance Manual carefully before operating the engine or conducting inspection and maintenance.
Never operate the engine or conduct maintenance work without completely understanding this manual.

MITSUBISHI HEAVY INDUSTRIES, LTD.

July 2009
Pub. No. 99610-15140

INTRODUCTION

This operation and maintenance manual contains detailed operation, inspection and maintenance information for engines from Mitsubishi Heavy Industries, Ltd.

Please read this manual thoroughly before proceeding with operation, inspection, and maintenance work for correct use and servicing.

Failure to follow directions in this manual may result in serious accidents.

Limited warranty

Mitsubishi Heavy Industries, Ltd. will repair or replace parts returned to us when we judges that the parts are defective in material and/or workmanship after conducting inspection.
Mitsubishi Heavy Industries, Ltd.'s warranty is limited to the compensation work of repair or replacement of parts.
The warranty coverage is effective for the original purchaser only. Those to whom ownership is later transferred are not provided with the warranty.

- **Mitsubishi Heavy Industries, Ltd.'s makes no warranties, either expressed or implied, except as provided in this manual, including, but not limited to, warranties as to marketability, merchantability, fitness for a particular purpose or use, or against infringement of any patent.**
- **Mitsubishi Heavy Industries, Ltd. will not be liable for any damages or consequential damages, including, but not limited to, damages or other costs resulting from any abuse, misuse, misapplication of the engine and devices supplied from us.**
- **Mitsubishi Heavy Industries, Ltd. will not be liable for any damages or personal injuries resulting from any modification, without our written permission, of the engine and devices supplied from us.**
- **Mitsubishi Heavy Industries, Ltd. will not be liable for any damages or production losses caused by the use of fuel, engine oil and/or long life coolant (LLC) that we are not recommended.**
- **The owner of the engine is responsible for the performance of the required maintenance listed in this operation manual.**
  Mitsubishi Heavy Industries, Ltd. may deny the warranty coverage if the engine or part has failed due to inadequate or improper maintenance.

Emission warranty

IMPORTANT

The following warranty applies to the engines that are approved of the emission regulation of the U.S. Environmental Protection Agency.

Warranty coverage

Mitsubishi Heavy Industries, Ltd. warrants to the first owner and each subsequent purchaser of a new non-road diesel engine that the emission control system of your engine:

- is designed, built and equipped so as to conform at the time of sales with all applicable regulation of the U.S. Environmental Protection Agency.If the vehicle in which the engine is installed is registered in the state of California, a separate California emission regulation also applies.
- is free from the defects in material and workmanship which will cause the engine to fail to meet these regulations within the warranty period.

Then its warranty period is

The emission warranty period is shown below.

However, if your engine warranty period is longer than the emission warranty period, the emission warranty period extends to same as the engine warranty period.

Below warranty period shall begin on the date the engine is delivered to the first owner.

If your engine is certified as	And its maximum power is	And its rated speed is	Then its warranty period is
Variable speed or constant speed	kW < 19	Any speed	1,500 hours or 2 years, whichever comes first.
Constant speed	19 ≤ kW < 37	3800 min^{-1} or more	1,500 hours or 2 years, whichever comes first.
Constant speed	19 ≤ kW < 37	Less than 3000 min^{-1}	3000 hours or 5 years, whichever comes first.
Variable speed	19 ≤ kW < 37	Any speed	3000 hours or 5 years, whichever comes first.
Variable speed or constant speed	kW ≥ 37	Any speed	3000 hours or 5 years, whichever comes first.

Warranted parts

Mitsubishi Heavy Industries, Ltd. warrants the parts which will increase the emission of pollutants when they become defective.

The followings are examples.

- Inlet/Exhaust manifold
- Crankcase ventilation system
- Fuel system
- Fuel injection nozzle

LIMITED WARRANTY

Refer to "LIMITED WARRANYT".

California emission control warranty statement your warranty rights and obligations

IMPORTANT

The following warranty applies to the engines that are approved of the emission regulation of the California Air Resources Board (CARB).

The **California Air Resources Board (CARB)** is pleased to explain the **emission control system warranty** on you 2008 or later engine.In California, new heavy-duty off-road engines must be designed, built, and equipped to meet the State's stringent anti-smog standards.Mitsubishi Heavy Industries, Ltd. must warrant the emission control system on your engine for the periods of time listed below provided there has been no abuse, neglect or improper maintenance of your engine.

Your emission control system may include parts such as the fuel-injection system and the air induction system. Also included may be hoses, belts, connectors and other emission-related assemblies.

Where a warrantable condition exists, Mitsubishi Heavy Industries, Ltd. will repair your heavy-duty off-road engine at no cost to you including diagnosis, parts, and labor.

MANUFACTURER'S WARRANTY COVERAGE:

The **2008** and later heavy-duty off-road engines are warranted for the Warranty Period. If any emission-related part on your engine is defective, the part will be repaired or replaced by Mitsubishi Heavy Industries, Ltd.

OWNER'S WARRANTY RESPONSIBILITIES:

- As the heavy-duty off-road engine owner, you are responsible for the performance of the **required maintenance listed in your owner's manual**.Mitsubishi Heavy Industries, Ltd. recommends that you retain all receipts covering maintenance on your heavy-duty off-road engine, but Mitsubishi Heavy Industries, Ltd. cannot deny warranty solely for the lack of receipts or for your failure to ensure the performance of all scheduled maintenance.
- As the heavy-duty off-road engine owner, you should however be aware that Mitsubishi Heavy Industries, Ltd. may deny you warranty coverage if your heavy-dutyoff-road engine or a part has failed due to abuse, neglect, improper maintenance or unapproved modifications.
- Your engine is designed to operate on diesel fuel only. Use of any other fuel may result in your engine no longer operating in compliance with California's emissions requirements.
- You are responsible for initiating the warranty process. The Air Rexources Board suggests that you present your heavy-duty off-road engine to a Mitsubishi Heavy Industries, Ltd. dealer or distributor dealer as soon as problem exists. The warranty repairs should be completed by the dealer or distributor as expeditiously as possible.

If you have any questions regarding your warranty rights and responsibilities, you should contact Mitsubishi Engine North America at **1-630-268-0750**.

Warranty coverage

(a) The warranty period shall begin on the date the engine or equipment is delivered to an ultimate purchaser.

(b) Mitsubishi Heavy Industries, Ltd. warrants to the ultimate purchaser and each subsequent purchaser of the engine registered in the state of California that the engine is:

(1) Designed, built and equipped so as to conform with all applicable regulations adopted by the Air Resources Board.

(2) Free from defects in materials and workmanship which cause the failure of a warranted part to be identical in all material respects to the parts as described in Mitsubishi Heavy Industries, Ltd.'s application for certification for a period of 5 years or 3,000 hours of operation, whichever occurs first. In the absence of a device to measure hours of use, the engine shall be warranted for a period of 5 years. For all engines rated less than 19kW, and for constant-speed engines rated under 37 kW with rated speeds higher than or equal to 3,000 min^{-1}, the period of 2 years or 1,500 hours of operation, whichever occurs first, shall apply. In the absence of a device to measure hours of use, the engine shall be warranted for a period of 2 years.

(c) The warranty on emission-related parts shall be interpreted as follows:

(1) Any warranted part which is not scheduled for replacement as required maintenance in the written instructions required by Subsection (e) shall be warranted for the warranty period defined in Subsection (b) (2). If any such part fails during the period of warranty coverage, it shall be repaired or replaced by Mitsubishi Heavy Industries, Ltd. according to Subsection (4) below. Any such part repaired or replaced under the warranty shall be warranted for the remaining warranty period.

(2) Any warranted part which is scheduled only for regular inspection in the written instructions required by Subsection (e) shall be warranted for the warranty period defined in Subsection (b) (2). A statement in such written instructions to the effect of "repair or replace as necessary" shall not reduce the period of warranty coverage. Any such part repaired or replaced under the warranty shall be warranted for the remaining warranty period.

(3) Any warranted part which is scheduled for replacement as required maintenance in the written instructions required in Subsection (e) shall be warranted for the period of time prior to the first scheduled replacement point for that part. If the part fails prior to the first scheduled replacement, the part shall be repaired or replaced by Mitsubishi Heavy Industries, Ltd. according to Subsection (4) below. Any such part repaired or replaced under warranty shall be warranted for the remainder of the period prior to the first scheduled replacement point for the part.

(4) Repair or replacement of any warranted part under the warranty provisions shall be performed at no charge to the owner at a warranty station.

(5) Notwithstanding the provisions of Subsection (4) above, warranty services or repairs shall be provided at all Mitsubishi Heavy Industries, Ltd. distribution centers that are franchised to service the subject engines.

(6) The owner shall not be charged for diagnostic labor that leads to the determination that a warranted part is in fact defective, provided that such diagnostic work is performed at a warranty station.

(7) Mitsubishi Heavy Industries, Ltd. shall be liable for damages to other engine components proximately caused by failure under warranty of any warranted part.

(8) Throughout the engine's warranty period defined in Subsection (b) (2), Mitsubishi Heavy Industries, Ltd. shall maintain a supply of warranted parts sufficient to meet the expected demand for such parts.

(9) Any replacement part may be used in the performance of any maintenance or repairs and must be provided without charge to the owner. Such use shall not reduce the warranty obligations of Mitsubishi Heavy Industries, Ltd..

(10) Add-on or modified parts that are not exempted by the Air Resources Board may not be used. The use of any non-exempted add-on or modified p arts shall be grounds for disallowing a warranty claim. Mitsubishi Heavy Industries, Ltd. shall not be liable to warrant failures of warranted parts caused by the use of a non-exempted add-on or modified part.

(11) The Air Resources Board may request and, in such case, Mitsubishi Heavy Industries, Ltd. shall provide, any documents which describe that Mitsubishi Heavy Industries, Ltd.'s warranty procedures or policies.

(d) Warranted parts list.

(1) Fuel metering system
- (A) Fuel injection system.
- (B) Air/fuel ratio feedback and control system.
- (C) Cold start enrichment system.

(2) Air induction system
- (A) Controlled hot air intake system.
- (B) Intake manifold.
- (C) Heat riser valve and assembly.
- (D) Turbocharger/supercharger systems.
- (E) Charged air cooling systems.

(3) Exhaust gas recirculation (EGR) system
- (A) EGR valve body, and carburetor spacer if applicable.
- (B) EGR rate feedback and control system.

(4) Air injection system
- (A) Air pump or pulse valve.
- (B) Valves affecting distribution of flow.
- (C) Distribution manifold.

(5) Catalyst or thermal reactor system
- (A) Catalytic converter.
- (B) Thermal reactor.
- (C) Exhaust manifold.

(6) Particulate controls
- (A) Traps, filters, precipitators, and any other devices used to capture particulate emissions.
- (B) Regenerators, oxidizers, fuel additive devices, and any other devic e used to regenerate or aid in the regeneration of the particulate control device.
- (C) Control device enclosures and manifolding.
- (D) Smoke puff limiters.

(7) Advances oxides of nitrogen (NOx) controls
- (A) NOx absorbers.
- (B) Lean NOx catalysts.
- (C) Selective catalyst reduction.
- (D) Reductant (urea/fuel) containers/dispensing systems.

(8) Positive crankcase ventilation (PCV) system
- (A) PCV valve.
- (B) Oil filler cap.

(9) Miscellaneous items used in above systems

(A) Vacuum, temperature, and time sensitive valves and switches.

(B) Electronic control units, sensors, solenoids, and wiring harnesses.

(C) Hoses, belts, connectors, assemblies, clamps, fittings, tubing, sealing gaskets or devices, and mounting hardware.

(D) Pulleys, belts and idlers.

(E) Emission control information labels.

(F) Any other part with the primary purpose of reducingemissions or that can increase emission during failure without significantly degrading engine performance.

(e) Mitsubishi Heavy Industries, Ltd. shall furnish with each new engine written instructions for the maintenance and use of the engine by the owner.

LIMITED WARRANTY:

Refer to "LIMITED WARRANTY".

Important information

- To avoid the potential hazard, accident prevention activities must be planned methodically and conducted continually by considering all aspect of engine operation, maintenance and inspection.All related personnel, including managers and supervisors, should actively participate, recognize their roles and organize themselves and their work to ensure a safe environment.
- The foremost safety objective is to prevent accidents which may result in injury or death, or equipment damage.
- Always observe laws or regulations of the local or federal/national government.
- Mitsubishi Heavy Industries, Ltd. cannot foresee all potential dangers of the engine, potential danger resulting from human error and other causes, or danger caused by a specific environment in which the engine is used. Since there are many actions that cannot be performed or must not be performed, it is impossible to indicate every caution in this manual or on warning labels. As such, it is extremely important to follow directions in this manual and also to take general safety measures when operating, maintaining and inspecting the engine.
- When the engine is used by individuals whose native language is not English, the customer is requested to provide thorough safety guidance to the operators.Also add safety, caution and operating signs that describe the original warning label statements in the native language of the operators.
- The engine must be operated, maintained and inspected only by qualified persons who have thorough knowledge of engines and their dangers and who also have received risk avoidance training.
- To prevent an accident, do not attempt to carry out any operation other than those described in this manual, and do not use the engine for any unapproved purpose.
- When the ownership of the engine is transferred, be sure to provide this manual with the engine to the new owner. Also inform Mitsubishi Heavy Industries, Ltd. of the name and address of the new owner of the engine.
- This manual is copyrighted and all rights are reserved.No part of this manual, including illustrations and technical references, may be photocopied, translated, or reproduced in any electronic medium or machine readable form without prior written consent from Mitsubishi Heavy Industries, Ltd.
- The contents in this manual are subject to change at any time without notice for improvement of the engine.
- Pictures or illustrations of the product in this manual may differ from those of product you have. Please note that, depending on specifications, items described in this manual may differ from those on your engine in shape, or may not be installed on your engine.
- Please contact a dealer of Mitsubishi Heavy Industries, Ltd. if you need more information or if you have any questions.
- If you lost or damaged this manual, obtain a new copy at a dealer of Mitsubishi Heavy Industries, Ltd. as soon as possible.
- Mitsubishi Heavy Industries, Ltd. recommends the engine owner to install an hour meter on the engine due to monitor correct running intervals and to perform the maintenance at the appropriate timing.

Warning indication

The following means are used to call the attention of the operators and maintenance personnel to potential dangers of the engine.

- Warning statements in the manual
- Warning labels affixed on the engine

Warning statements

The warning statements in this manual describe potential danger in operating, inspecting or maintaining the engine, using the following 5 classifications to indicate the degree of potential hazard.

Failure to follow these directions could lead to serious accidents which could result in personal injury, or death in the worst case.

Understand the directions well, and handle engines with following directions.

DANGER	Indicates an immediately hazardous situation which, if not avoided, will result in death or serious injury.
WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
CAUTION	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.
CAUTION	Indicates a potentially hazardous situation which, if not avoided, may result in property damage.
Note :	Indicates important information or information which is useful for engine operation.

Units of measurement

Measurements are based on the International System of Units (SI), and they are converted to the metric system units in this manual using the following conversion rates.

- Pressure :1 MPa = 10.197 kgf/cm^2
- Torque :1 N·m = 0.10197 kgf·m
- Force :1 N = 0.10197 kgf
- Horsepower :1 kW = 1.341 HP = 1.3596 PS
- Meter of mercury :1 kPa = 0.75 cmHg
- Meter of water :1 kPa = 10.197 cmH_2O(cmAq)
- Engine speed :1 min^{-1} = 1 rpm
- Kinetic viscosity:1 mm^2/s = 1 cSt

Abbreviations, standards and others

- API = American Petroleum Institute
- ASTM = American Society for Testing and Materials
- ISO = International Organization for Standardization
- JIS = Japanese Industrial Standards
- LLC = Long Life Coolant
- MIL = Military Specifications and Standards
- MSDS = Material Safety Data Sheet
- SAE = Society of Automotive Engineers

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Chapter 1 BASIC SAFETY PRECAUTIONS

Fire and explosions

⚠ WARNING

Keep flames away

Do not use flames near the engine (in the engine room). Fuel vapor or other gas can catch fire and produce dangerous situations.
Wipe off spilled fuel, oil and LLC immediately and thoroughly. Spilled fuel, oil and LLC may ignite and cause a fire.
Store fuel and engine oil in a well-ventilated area. Make sure that the caps of fuel and engine oil containers are tightly closed.

Keep engine surrounding area tidy and clean

Do not leave combustible or explosive materials, such as fuel, engine oil and LLC, near the engine. Such substances can cause fire or explosion.
Remove dust, dirt and other foreign materials accumulated on the engine and surrounding parts thoroughly. Such materials can cause fire or the engine to overheat. In particular, clean the top surface of the battery thoroughly. Dust can cause a short-circuit.

Care for fuel, oil and exhaust gas leakage

If any fuel, oil or exhaust gas leakage is found, immediately take corrective measures to stop it.
Such leakages, if left uncorrected, can cause fuel or engine oil to reach hot engine surfaces or hot exhaust gas to contact flammable materials, possibly leading to personal injury and/or damage to equipment.

Use explosion-proof lighting apparatus

When inspecting fuel, engine oil, coolant, battery electrolyte, etc., use a flameproof light. An ordinary lighting apparatus may ignite gas and cause it to explode.

Prevent electrical wires from short-circuiting

Avoid inspecting or servicing the electrical system with the ground cable connected to the battery. Otherwise, a fire could result from short-circuiting. Be sure to disconnect the battery cable from the negative (-) terminal before beginning with the work procedure.
Short-circuits, possibly resulting in fire, may be caused by a loose terminal or damaged cable/wire. Inspect the terminals, cables and wires, and repair or replace the faulty parts before beginning with the service procedure.

Keep fire extinguishers and a first-aid kit handy

Keep fire extinguishers handy, and become familiar with their usage.
Keep a first-aid kit at the designated place where it is easily accessible by anyone at any time.
Establish response procedures to follow in the event of fire or accident. Provide an emergency evacuation route and contact points and means of communication in case of emergency.

Stay clear of all rotating and moving parts

⚠ WARNING

Install protective covers around rotating parts

Make sure the protective covers of the engine are correctly installed.
Repair any damaged or loose covers.
Never remove the covers such as damper cover, camshaft cover, or rocker cover that enclose the revolving parts during operation.
When the engine is coupled to driven equipment, be sure to provide protective covers over the parts such as the connecting belts and couplings that are exposed.
Never remove protective covers.

Check work area for safety

Before starting the engine, make sure no one is near the engine and tools are not left on or near the engine.
Verbally notify persons within the immediate area when starting the engine.
When the starter device is posted with a sign that prohibits startup operation, do not operate the engine.

Stay clear of moving parts while engine is running

Do not approach rotating or sliding parts of the engine while the engine is running. Keep objects likely to be caught by rotating parts away from such parts.
If any part of the clothing or outfitting is caught by a rotating part, serious bodily injuries could result.

Lockout and tagout

Be sure to lockout and tagout before starting inspection and maintenance.
Lockout and tagout are effective methods of cutting off machines and equipment from energy sources.
To accomplish the lockout/tagout, remove the starter switch key, set the battery switch to "OFF" position and attach a "Do Not Run" or similar caution tag to the starter switch.
The starter switch key must be kept by the person who performs inspection and maintenance during the work.

Keep engine stopped during servicing

Be sure to stop the engine before proceeding to inspection and service procedure. Never attempt to make adjustments on the engine parts while the engine is running.
Rotating parts such as belt can entangle your body and cause serious injuries.

Always restore engine turning tools after use

Be sure to remove all turning tools used during maintenance and inspection work. Remember also that the turning gear must be returned to the operating condition before starting the engine.
Starting the engine with the turning tools inserted or with the turning gear in engagement can lead to not only engine damage but also personal injuries.

Changing the engine speed setting is prohibited

Never change engine speed setting. Tampering with the setting can cause the engine and its coupled machine to operate at excessive speeds and result in accidents.

Be careful of exhaust fume poisoning

WARNING

Operate engine in a well-ventilated area

If the engine is installed in an enclosed area, and the exhaust gas is ducted outside, ensure that there is no exhaust gas leakage from duct joints.

When using the engine as portable generator set, do not run it in doors such as a warehouse or tunnel, or in an poorly-ventilated area near the shielding. When running it indoors by necessity, discharge the exhaust gas to outside and thoroughly ventilate the room.

Make sure the exhaust gas is not discharged directly to surrounding buildings, plants or living passersby.

Exhaust gas from the engine contains carbon monoxide and other harmful substances. Operating the engine in an poorly-ventilated area can produce gas poisoning.

Be careful of falling down

WARNING

Lift engine carefully

To lift the engine, use slings capable of supporting the weight of the engine.

Attach the wire rope to the hangers provided on the engine using a correct sling.

During lifting process, keep the engine in a well-balanced position by taking the center of gravity of the engine into consideration.

Keep the angle formed by slings attached to hangers within 60°. If the angle exceeds this limit, excessive load could be imposed on the hangers and this could damage the hangers and result in a serious accident.

If the wire rope contacts the engine directly, place a cloth or other soft padding to avoid damage to the engine and wire rope.

Do not climb onto the engine

Do not climb onto the engine, nor step on any engine parts located on the lateral sides.

To work on parts located on the upper section of engine, use a ladder, stool, etc., that was firmly secured.

Climbing on the engine may not only damage engine parts but also cause falling down from the engine and result in personal injuries.

Always prepare stable scaffold

When working on the upper part of the engine and other hard-to-reach places, use a stable work platform.

Standing on a decrepit stool or parts box may result in personal injury.

Do not place any unnecessary objects on a work platform.

Protect ears from noise

⚠ CAUTION

Wear ear plugs

Always wear ear plugs when entering the machine room (engine room). Combustion sound and mechanical noise generated by the engine can cause hearing problems.

Be careful of burns

⚠ CAUTION

Do not touch the engine during or immediately after operation

To avoid burns, do not touch the engine during or immediately after operation.

A hot engine can cause burns.

To conduct maintenance and inspection work, wait until the engine has cooled sufficiently by checking the temperature gauge.

Do not open the radiator filler cap when the engine is hot

Never open the radiator filler cap while the engine is running or immediately after the engine is stopped.

When opening the cap, stop the engine and allow the coolant temperature to lower sufficiently.

When opening the radiator filler cap, open slowly to discharge the pressure inside the tank. Also to avoid a risk of getting scalded by steam, wear thick rubber gloves or wrap a cloth around the cap.

When closing the cap, be sure to tighten securely.

The coolant is hot while engine is running and immediately after the engine stops. If the cap is opened when the coolant is at operating temperature, steam and hot coolant may blow out and result in burns.

Do not touch high pressure injection fuel

If fuel leaks or sprays out from the high pressure injection pipe, do not touch the fuel.

Fuel in the fuel injection pipes is under high pressure and if the fuel contact your skin, it goes into deep tissues and may result gangrene.

Refill coolant only after the coolant temperature dropped

When refilling of coolant, perform it after coolant temperature drops, not immediately after the engine is stopped. Otherwise you are scalded with hot coolant.

Be careful when handling fuel, engine oil or LLC

⚠ CAUTION

Use only specified fuel, engine oil and LLC

Use fuel, oil and LLC specified in this manual, and handle them carefully.

Use of any other fuel, oil or LLC, or improper handling may cause various engine problems and malfunctions.

Obtain the MSDS issued by the fuel, oil and LLC suppliers, and follow the directions in the MSDSs for proper handling.

Handle LLC carefully

When handling LLC, always wear rubber gloves and a protective face mask. If LLC or cooling water containing LLC comes into contact with your skin or eyes, or if it is swallowed, you would suffer from inflammation, irritation or poisoning.

Should LLC be accidentally swallowed, induce vomiting immediately and seek medical attention. Should LLC enter your eyes, flush them immediately with plenty of water and seek medical attention. If LLC splashes onto your skin or clothing, wash it away immediately with plenty of water.

Keep flames away from LLC. The LLC can catch flames, causing a fire. Coolant (containing LLC) drained from the engine is toxic. Never dispose of coolant into regular sewage. Abide by the applicable law and regulations when discarding drained coolant.

Proper disposal of waste oil, LLC and coolant

Do not discharge waste engine oil, LLC and coolant into sewerage, river, lake or other similar places. Such a way of disposal is strictly prohibited by laws and regulations.

Dispose of waste oil, LLC and coolant and other environmentally hazardous waste in accordance with the applicable law and regulations.

When abnormality occurs

⚠ CAUTION

Do not add coolant immediately after a sudden stop due to overheating

If the engine stops suddenly or if you have no choice but stop the engine suddenly due to overheating, do not add coolant immediately.

Adding water while the engine is hot can damage parts such as cylinder heads due to a sudden drop of temperature. Add coolant gradually after the engine has completely cooled.

Avoid immediate restart after abnormal stop

If the engine stops abnormally, do not restart the engine immediately. If the engine stops with an alarm, check and remedy the cause of the problem before restarting. Sustained use of the engine without any remedy could result in serious engine problems.

Avoid continuous engine operation at low oil pressure

If an abnormal engine oil pressure drop is indicated, stop the engine immediately, and inspect the lubrication system to locate the cause. Continuous engine operation with low oil pressure could cause bearings and other parts to seize.

If belt breaks, stop engine immediately

If the belt breaks, stop the engine immediately. Continuous engine operation with the broken belt could cause the engine to overheat and thereby the coolant to boil into steam, which may gush out from the reserve tank or radiator, and you may be scalded with it.

Service battery

⚠ CAUTION

Handle the battery correctly

- Never use flames or allow sparks to generate near the battery. The battery releases flammable hydrogen gas and oxygen gas. Any flames or sparks in the vicinity could cause an explosion.
- Do not use the battery when the battery electrolyte level of which is below "LOWER LEVEL" line. Sustained use of the battery could result in an explosion.
- Do not short the battery terminals with a tool or other metal object.
- When removing battery, always remove the plug from the negative (-) terminal first. When connecting battery, always connect the plug to the positive (+) terminal first.
- Remove all plugs, then charge the battery in a well-ventilated area.
- Make sure the cable clamps are securely installed on the battery terminals. A loose cable clamp can cause sparks that may result in an explosion.
- Before servicing electrical components or conducting electric welding, set the battery switch to the "Open/OFF" position or remove the plug from the negative (-) terminal to cut off the electrical current.
- Battery electrolyte contains dilute sulfuric acid. Careless handling of the battery can cause the loss of sight and/or skin burns. Also, do not consume the battery electrolyte.
- Wear protective goggles and rubber gloves when working with the battery (when adding water, charging, etc.)
- If battery electrolyte is spilled onto the skin or clothing, immediately wash it away with lots of water. Use soap to thoroughly clean.
- The battery electrolyte can cause the loss of sight if splashing into the eyes. If it gets into the eyes, immediately flush it away with plenty of clean water, and seek immediate medical attention.
- If the battery electrolyte is accidentally consumed, gargle with plenty of water, then drink lots of water, and seek immediate medical attention.

Other cautions

⚠ CAUTION

Never modify engine

Unauthorized modification of the engine will void our warranty.

Modification of the engine may not only cause engine damage but also produce personal injuries.

If there is a need to modify the engine, contact a dealer of Mitsubishi Heavy Industries, Ltd.

Observe safety rules at work site

Observe the safety rules established at your workplace when operating and maintaining the engine.

Do not operate the engine if you are feeling ill, inform your supervisor of your condition. Operation of the engine with reduced awareness may cause improper operation that could result in accidents.

When working in a team for two or more people, use specified hand signals to communicate among workers.

Work clothing and protective gear

Wear a hardhat, face shield, safety shoes, dust mask, gloves and other protective gear as needed. When handling compressed air, wear safety goggles, a hardhat, gloves and other necessary protective gear.

Works without wearing proper protective gear could result in serious injuries.

Never break seals

To ensure proper engine operation, the fuel control linkage is sealed to prevent accidental change of the injection volume and rotation speed settings. Operating the engine without these seals in place can cause problems described below, and also invalidates the warranty.

- Rapid wear of sliding and rotating parts
- Engine damage such as seizing of engine parts
- Considerably increased consumption of fuel and lubricating oil
- Degradation of engine performance due to improper balance between fuel injection volume and governor operation or overrunning of the engine which could result in a serious accident

Perform all specified pre-operation inspections and periodic inspections

Conduct the pre-operation inspections and periodic inspections as described in this manual.

Failure to conduct the specified inspections may cause various engine problems, damage to parts, and serious accidents.

Break-in the engine

To break-in new engines or overhauled engines, operate the engine at a speed lower than the rated speed in a light load condition during the first 50 hours of operation.

Operating new engines or overhauled engines in a severe condition during the break-in period shortens the service life of the engine.

Warm up the engine before use

After starting the engine, run the engine at low idling speeds for 5 to 10 minutes for warm up. Start the work after this operation is completed. Warm up operation circulates the lubricant through the engine. Therefore, individual engine parts are well lubricated before they are subjected to heavy loads.

Warm up operation circulates lubricants in the engine and contributes to a longer service life and economical operation.

Do not conduct warm up operation for prolonged period of time. Prolonged warm up operation causes carbon build-up in the cylinders that leads to incomplete combustion.

Never operate the engine in an overloaded condition

If the engine shows an overloaded condition such as black exhaust smoke, reduce the load immediately to operate the engine at an appropriate output and load.

Overloading causes not only high fuel consumption but also excessive carbon deposits inside the engine. Carbon deposits cause various problems and will shorten the service life of the engine.

Conduct cooling operation before stopping the engine

Before stopping the engine, let it idle in low gear for 5 to 6 minutes to cool down.
Stopping the engine immediately after high-load operation will cause engine parts to heat up and shorten the service life of the engine.
During cooling operation, check the engine for abnormalities.

Protection of the engine against water entry

Do not allow rainwater, etc. to enter the engine through the air inlet or exhaust openings.
Do not wash the engine while it is operating. Cleaning fluid (water) can be sucked into the engine.
Starting the engine with water inside the combustion chambers can cause the water hammer action which may result in internal engine damage and serious accidents.

Conduct proper maintenance of air cleaner

The major cause of abnormal wear on engine parts is dust from intake air. Worn parts produce many problems such as an increase of oil consumption, decrease of output, and starting difficulties. For effective removal of dust from intake air, maintain the engine with air cleaner according to the following instructions.

- Never service the air cleaner while the engine is running. Operating the engine without the air cleaner can suck particles of foreign matter into the engine and could result in serious accidents.
- Remove theair cleaner slowly to prevent dust accumulated on the element from falling off. After removing the air cleaner, immediately cover the air inlet with plastic sheet or similar means to prevent dust from entering the engine.

Use of tools optimum for each work

Always keep in mind to select most appropriate tools for the work to be performed and use them correctly. If tools are damaged, replace them with new tools.

Avoidance of prolonged time of starter operation

Do not use the starter for more than 10 seconds at a time. If the engine does not start, wait for at least 1 minute before cranking again.
Continuous operation of the starter will drain the battery power and cause the starter to seize.

Do not turn off the battery switch during operation

Do not turn off the battery switch during operation.
If the battery switch is turned OFF when the engine is running, not only various meters will stop working but also the alternator may have its diode and transistor deteriorated.

Cautionary instructions for transporting the engine

When transporting the engine on a truck, consider the engine weight, width and height to ensure safety.
Abide by road traffic law, road vehicles act, vehicle restriction ordinance and other pertinent laws.

Engine external diagrams

The external diagram is for the standard type of the engine. The installed equipment and shapes differ according to the engine type.

L2E left view

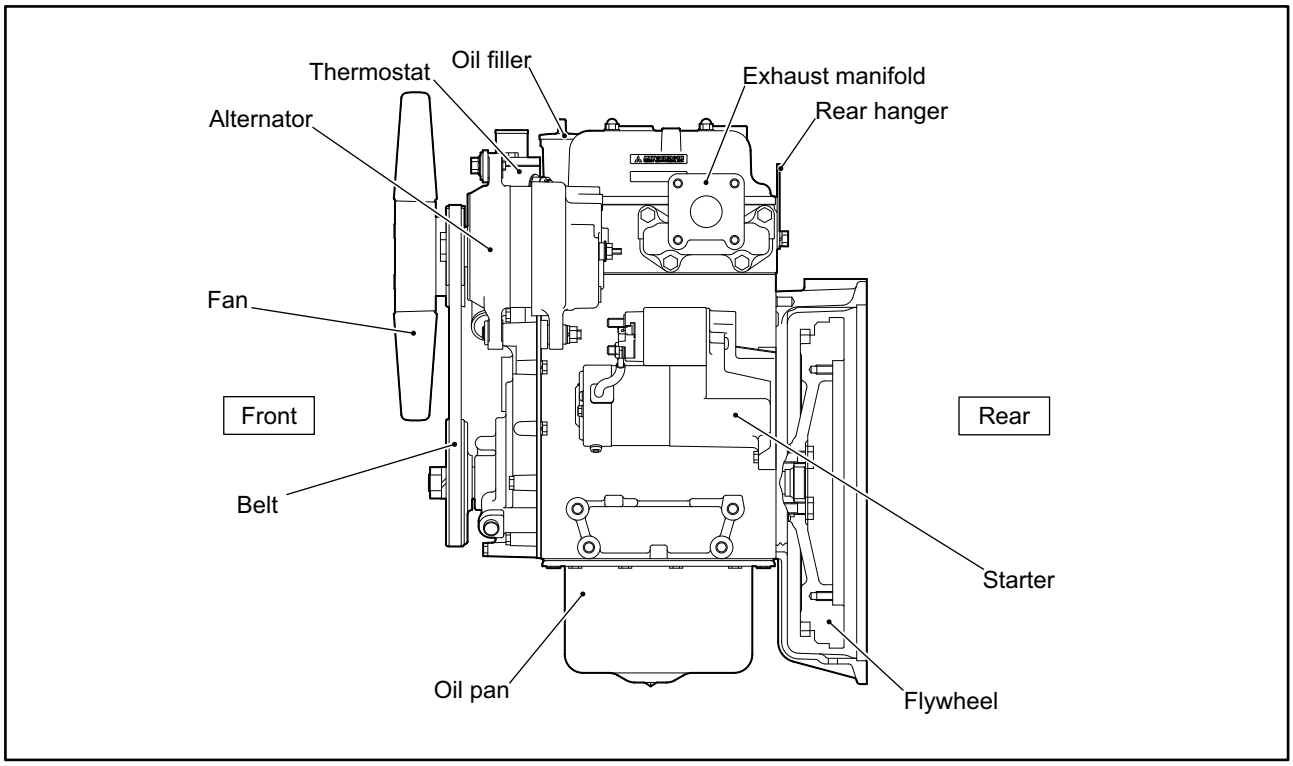


Fig. 2-1 Engine left view

L2E right view

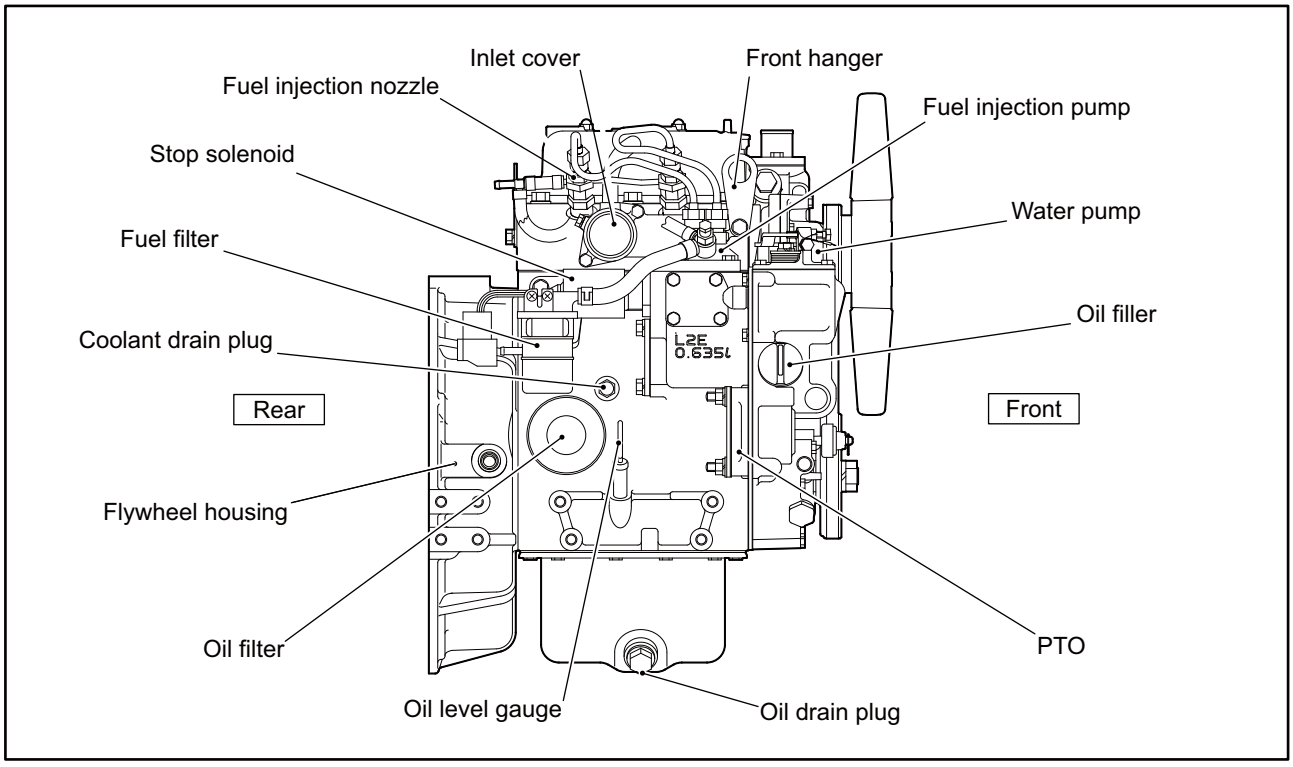


Fig. 2-2 Engine right view

L3E left view

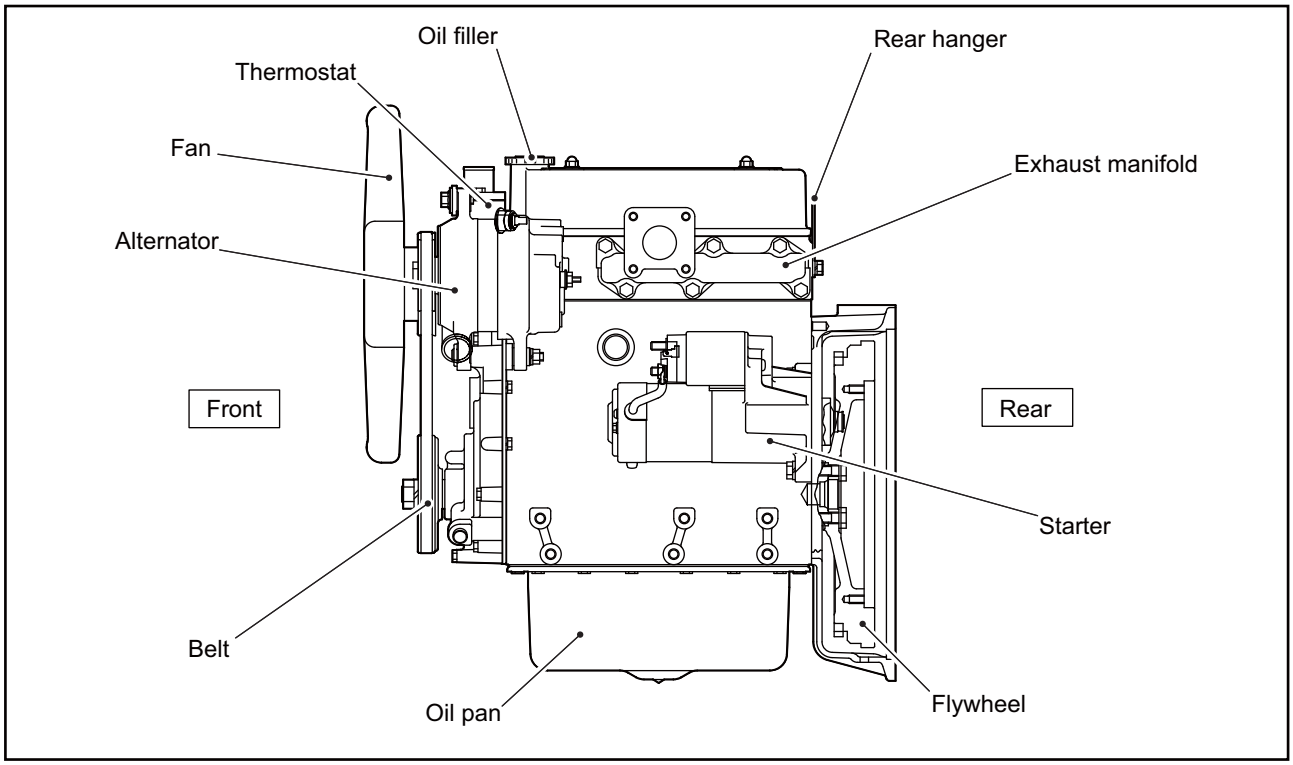


Fig. 2-3 Engine left view

L3E right view

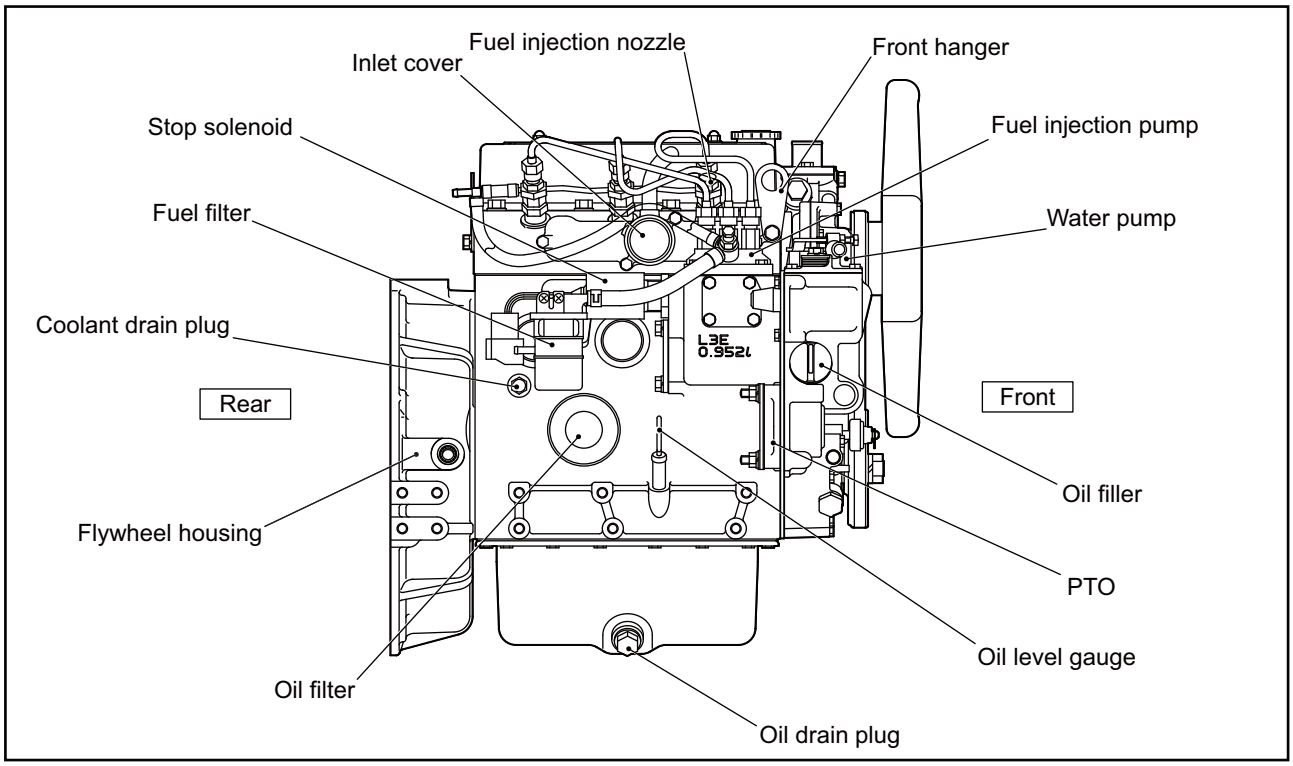


Fig. 2-4 Engine right view

Equipment and instrument

The installed equipment and shapes differ on the engine type.

Starter switch

The starter switch is used to start the engine.

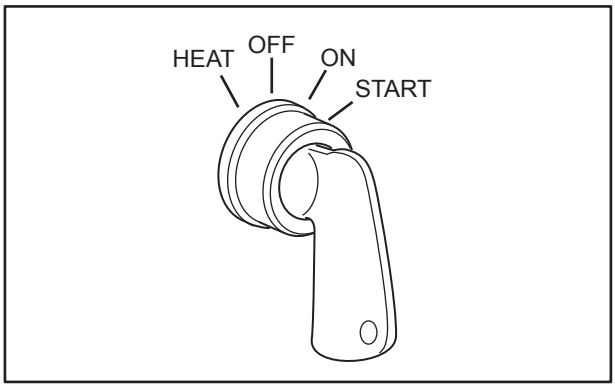


Fig. 2-5 Starter switch

HEAT

When the key is turned to this position, the glow plugs become hot and allow easy startup of a cold engine.

OFF

When the key is turned to this position, power supply to the electric circuits is cut off, and the key can be removed and inserted at this position. To sotp engine, turn the key to this position.

ON

When the key is at this position, power is supplied to the electric circuits. After the engine starts, the key is set to this position.

START

When the key is turned to this position, the starter cranks the engine and the engine starts. When the key is released, ti automatically returns to the "ON" position.

Preheat indicator

The preheat indicator shows the condition of the glow plugs.

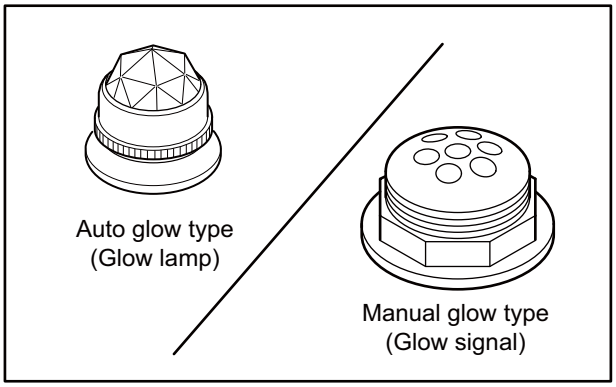


Fig. 2-6 Preheat indicator

Automatic glow type

The preheat lamp is on during the set periods of the glow timer, and off when the preheating is completed.

Manual glow type

The glow signal turns red to indicate the preheating condition as the glow plug is heated.

Water temperature meter and thermo unit

The engine coolant temperature detected by the thermo unit is displayed by the water temperature meter.
When the water temperature meter shows 95°C [203°F], idle the engine in low gear until the temperature becomes normal. After the temperature becomes normal, perform cooling operation for 5 or 6 minutes and then inspect the cooling system.

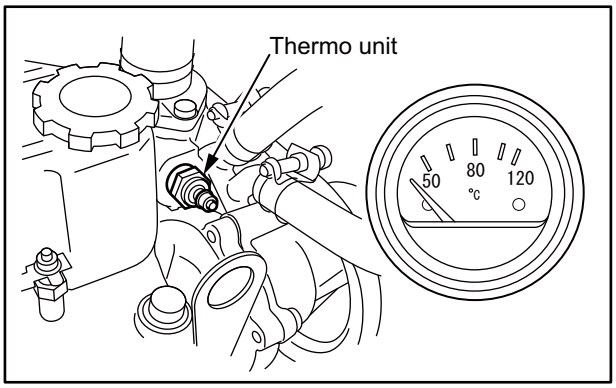


Fig. 2-7 Water temperature meter and thermo unit

Ammeter

It indicates the battery charging condition while the engine is running.
When the battery is charged, the pointer swings to the positive (+) side. When the battery is discharged, the pointer swings negative (-) side.

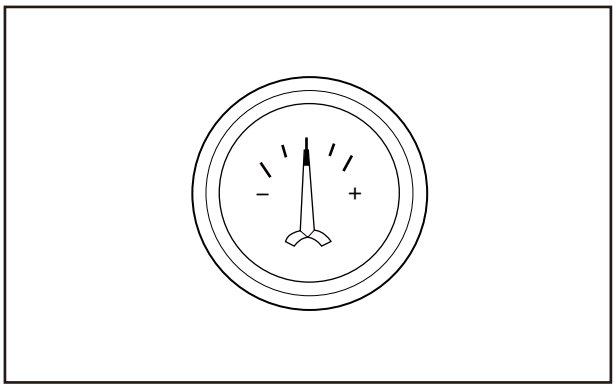


Fig. 2-8 Ammeter

Hour meter

It indicates the operating time of the engine.
When performing the periodic inspection and maintenance, check the time interval with this meter.

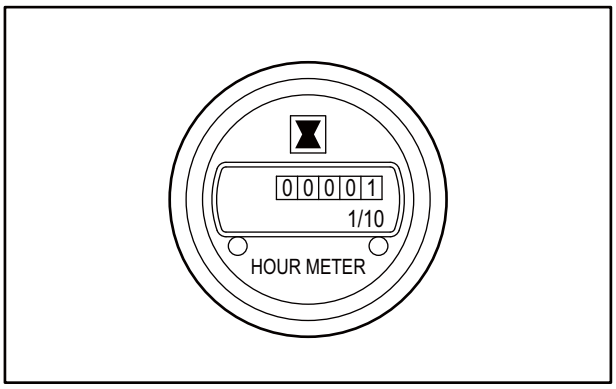


Fig. 2-9 Hour meter

Stop solenoid

The stop solenoid operates for normal shutdown of engine operation.

The stop solenoid moves the rack of fuel injection pump to cut the fuel, and consequently stops the engine.

Two types of stop solenoids are available.

RUN OFF (ETS: Energized To Stop) type

Not energized while the engine is running. Energized by a stop signal to stop the engine.

RUN ON (ETR: Energized To Run) type

Energized while the engine is running, and de-energized to stop the engine.

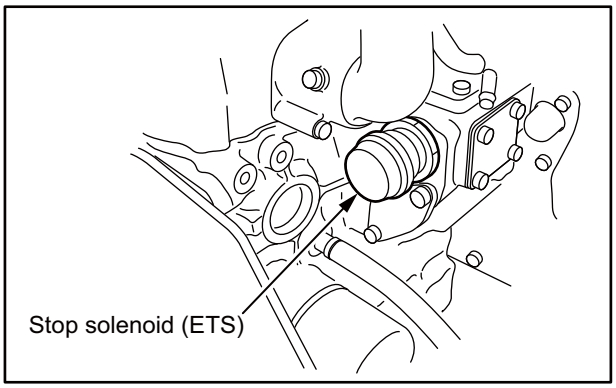


Fig. 2-10 Stop solenoid

Engine protection devices

The engine protection device is a device to prevent the engine from the accident by generating the alarm when abnormality occurs. Stop the engine if the protection device is activated, investigate the cause of abnormality and restore it. When the cause of abnormality is unknown, contact a dealer of Mitsubishi Heavy Industries, Ltd. The installed protection devices, type (set value) or shapes varies according to the specifications.

Oil pressure switch

The oil pressure switch activates the alarm system or stops the engine suddenly when the engine oil pressure becomes abnormally low.

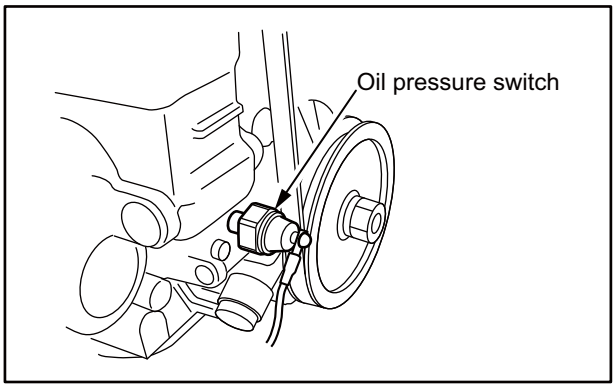


Fig. 2-11 Oil pressure switch

Thermo switch

The oil pressure switch generates an alarm when the engine coolant temperature becomes high and reaches the specified temperature.

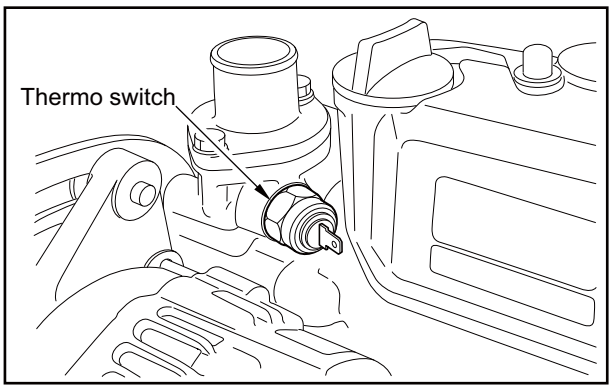


Fig. 2-12 Thermo switch

Air cleaner indicator

The air cleaner indicator alarms with its red signal when air cleaner elements become clogged, the difference in pressure between front air cleaner and rear air cleaner, and reaches the specified value. The signal indicates only, and does not generate an alarm, Therefore, the periodic visually inspection is needed. Press the reset button on the top of air cleaner indicator and restore the signal after cleaned the air cleaner indicator or replaced with a new one.

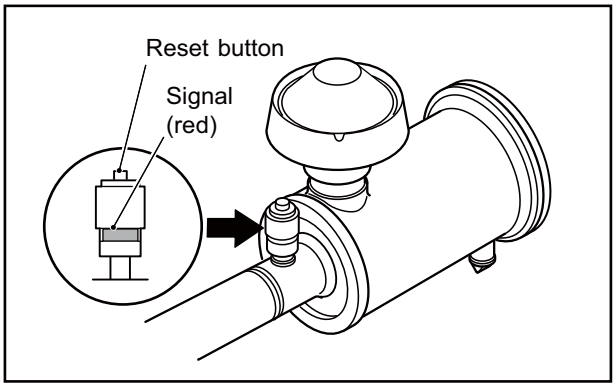


Fig. 2-13 Air cleaner indicator

Chapter 3 OPERATION

Preparations for operation

⚠ CAUTION

Should an engine abnormality be observed during operation, stop the engine and correct the problem, or contact a dealer of Mitsubishi Heavy Industries, Ltd.

Always conduct the following inspection before starting the engine.

Engine external - Inspect

⚠ CAUTION

Be sure to keep combustible materials away from the engine, especially from the hot engine parts such as exhaust manifolds, or the battery. Check for fuel and oil leakage. Clean the top surface of the battery. A fire can be caused by combustible materials placed near hot engine parts. If any abnormality is found, be sure to repair it or contact a dealer of Mitsubishi Heavy Industries, Ltd.

Inspect the engine exterior as described below.

1. Make sure there is no combustible material near the engine or battery. Also, check to make sure that the engine and battery are clean. If combustible materials or dust are found near the engine or battery, remove them.
2. Check the electrical wiring for such components as the starter and alternator for looseness.
3. Check the entire engine for fuel leakage, engine oil or coolant. If leakages are found, repair or contact a dealer of Mitsubishi Heavy Industries, Ltd.
4. Make sure the following valves, plugs and cocks are open or closed (tightened) properly:
   - ♦Fuel feed valve: Open
   - ♦Coolant drain cock (plug): Closed (Tightened)
   - ♦Oil drain valve: Closed

Battery electrolyte level - Inspect

⚠ CAUTION

If battery electrolyte is spilled on your skin or clothes, flush immediately with plenty of water. If battery electrolyte get into your eyes, flush them immediately with plenty of water and then get medical attention.

Do not use open flames or other fire hazards near the battery. When handling the battery, be careful of sparks generated by accidental shorting. For other cautions in handling the battery, refer to "Service battery" (1-6).

Battery electrolyte evaporates during use and the electrolyte level gradually decreases. Proper electrolyte surface level is between the "LOWER LEVEL" and "UPPER LEVEL" lines.

For the battery without level lines, proper electrolyte surface level is about 10 to 15 mm [0.394 to 0.591 in.] above the top of the plates.

If the electrolyte level is low, remove the caps and add distilled water to the proper level.

Note: When adding distilled water, pour in carefully.

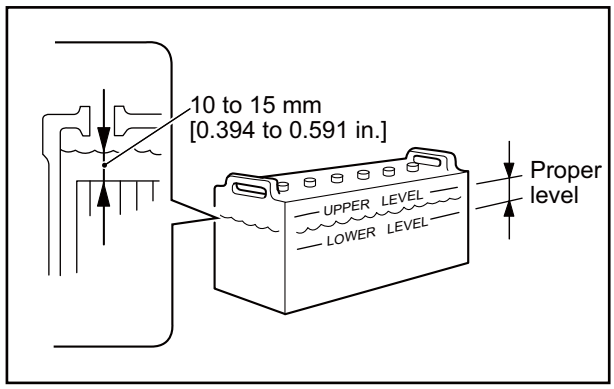


Fig. 3-1 Battery electrolyte level - Inspect

Fuel tank oil level - Check

WARNING

When working around fuel, make sure there are no open flames, heaters or other fire hazards.

Wipe off any spilled fuel completely.Spilled fuel can ignite and cause a fire.

CAUTION

Do not remove the strainer when filling the fuel tank.

For fuel to be used, refer to "FUEL" (4-1).

Make sure the fuel tank is full.

If the fuel level is low, refill the tank to the "FULL" level line.

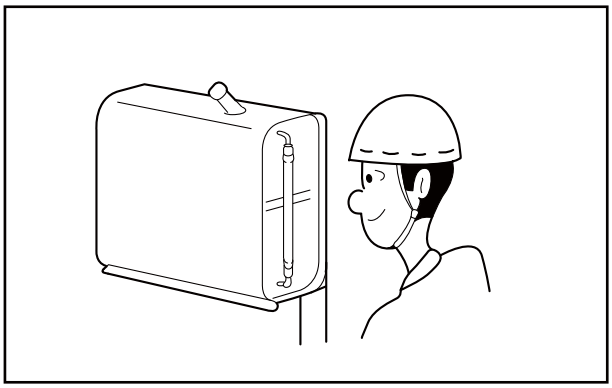


Fig. 3-2 Fuel tank oil level - Check

Engine oil level - Check

CAUTION

For engine oil to be used, refer to "ENGINE OIL" (5-1).

1. Pull out the oil level gauge and wipe it clean using a waste cloth.
2. Insert the oil level gauge fully into the oil level gauge guide, then pull out the gauge again.
3. The proper oil level is between the high and low marks on the oil level gauge. If the oil level is low, add engine oil of the specified type.
4. Install the oil filler cap after refilling.
5. Check the oil pan and other area for oil leakage.

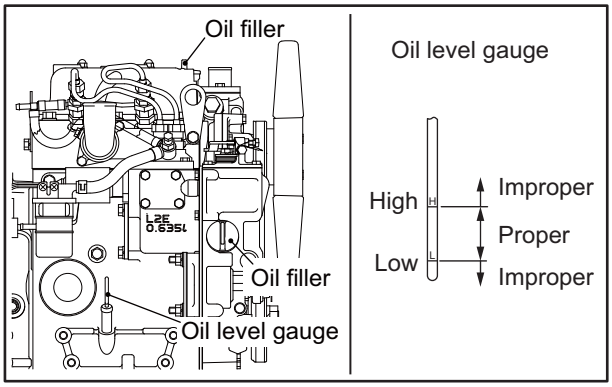


Fig. 3-3 Oil filler and Oil level gauge

Coolant level - Check

⚠ WARNING

Remove the radiator filler cap only after the engine has cooled to room temperature. Place a waste cloth over the cap, and loosen the cap about a half-turn or stand the lever to the upright position to release internal pressure. Never open the radiator filler cap while the engine is hot, otherwise the steam or hot coolant spurts out and you may be scald with it.

1. Open the radiator filler cap and check the coolant level.
2. If the coolant level is low, add coolant to the specified level.

CAUTION

Always use the coolant with the same LLC concentration.

Note: Determine the quantities of LLC based on the coolant capacity and the LLC concentration chart.
For the coolant, refer to "COOLANT" (6-1). For the coolant capacity, refer to "MAIN SPECIFICATIONS" (12-1).

3. If a reserve tank is equipped, fill the reserve tank with coolant up to the "FULL" level line.

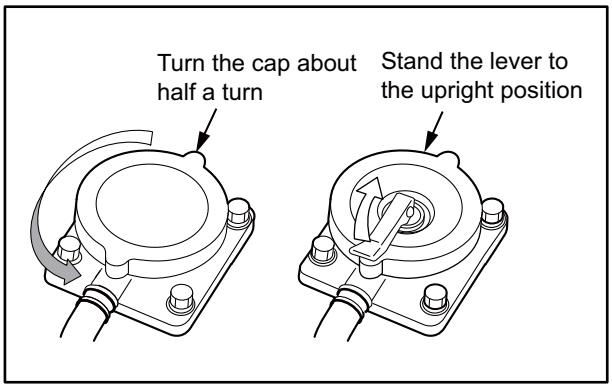


Fig. 3-4 Radiator filler cap

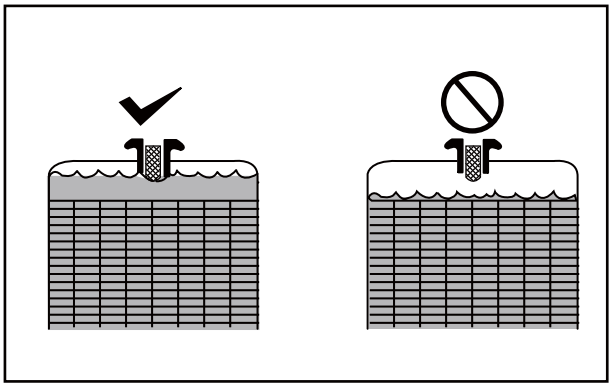


Fig. 3-5 Radiator coolant level

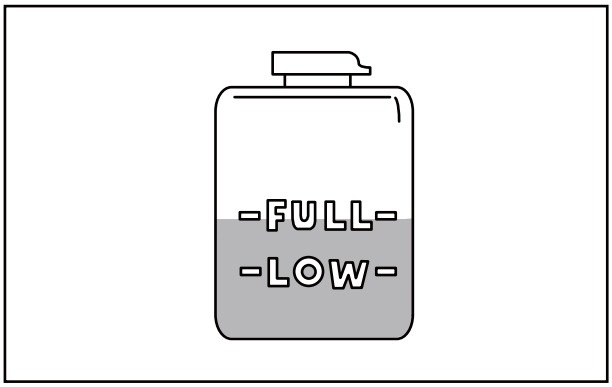


Fig. 3-6 Reserve tank coolant level

Starting

The starting method changes based on the application and specifications.Start the engine according to the specified procedure.

⚠ WARNING

Before starting the engine, check to make sure no one is near the engine and that tools are not left on or near the engine.In a loud voice, notify people in the area when starting the engine.

CAUTION

Do not apply a load to the engine at starting. (Disengage the clutch if installed.)

Continuous operation of the starter will drain the battery power and cause the starter to seize. Do not use the starter for more than 10 seconds at a time. When the engine does not start, wait for more than 1 minute before cranking again.

When preheating, do not heat over 30 seconds at a time (For manual glow plug). Otherwise the battery capacity reduce in a short time or decrease glow plug life.

Automatic glow plug

1. Turn the starter key to "ON" position. Confirm the oil pressure lamp, water temperature lamp, battery charge lamp and preheat lamps turn on at the time. The preheat lamp lighting duration is as follows:

Note: When the engine is cold, move the speed control lever to "FULL" position and turn the starter switch key to "ON" position.

Table 3-1 Preheat duration (automatic grow plug)

Specifications	Water temperature	Preheat duration
Quick type (bimaterial)	Low water temperature (5°C [41°F] or below)	Approx. 3 seconds
	High water temperature (5°C [41°F] or above)	Approx. 1 seconds
Standard type	Any time	Approx. 6 or 10 seconds

2. After the preheat lamp goes off, turn the starter key to "START" position and start up the engine. The preheat lamp turns on at "START" position as well.
3. Release your hand from the key when the engine starts up. The key returns to "ON" (operating) position automatically.

Manual glow plug

1. Turn the starter key to "HEAT" position. The preheat duration is as follows;

Table 3-2 Preheat duration (manual grow plug)

Ambient temperature	Preheat duration
+5°C [41°F] or higher	Approx. 10 seconds
-5°C [23°F] or higher, less than +5°C [41°F]	Approx. 15 seconds
less than -5°C [41°F]	Approx. 20 seconds

2. After the preheat lamp glows, turn the starter key to "START" position and start up the engine.
3. Release your hand from the key when the engine starts up. The key returns to "ON" (operating) position automatically.

Warm up operation

⚠ WARNING

Do not approach rotating parts during operation. Entanglement by rotating parts can cause serious injury.

After the engine starts, operate the engine in a no load condition at low idling speed for 5 to 10 minutes to warm up the engine.

Checking engine oil pressure

During warm up operation, check if the oil pressure is in the range of standard value (0.15 MPa {1.5 kgf/cm^2} [21 psi] or more).

Also, make sure the oil pressure gauge is operating properly.

Note: The oil pressure gauge may indicate a higher level than normal level immediately after the engine starts, due to the low oil temperature. The pressure gradually lowers to the normal level as the oil temperature rises.

External inspection during warm up

Visually check the external view of the engine for fuel, engine oil and coolant leakage, or exhaust gas leakage from joints.

Operation

Cautions when operating

⚠ WARNING

Do not approach rotating parts during operation. Entanglement by rotating parts can cause serious injury.

⚠ CAUTION

Do not touch any hot part of the engine such as exhaust pipes during operation or immediately after shut down. A hot engine can cause burns.

CAUTION

Always provide adequate ventilation in the engine room. If air supply to the engine room is not sufficient, the room temperature rises and can affect engine output and performance.

For the first 50 hours, operate the engine under a light load for break-in operation. Operating the engine under heavy load or severe conditions during the break-in period can shorten the service life of the engine.

Do not turn the battery switch to "OFF" position when the engine is running. Turning off the battery switch during operation not only stops the instrument operations but also may deteriorate the alternator diode and regulator.

Never turn the key to the "START" position during operation. The starter may be damaged.

When operating the engine with a 30 % of rated load or lower, limit each operation to an hour. Prolonged warm up operation causes carbon build-up in the cylinders that leads to incomplete combustion. Operate the engine with a 30 % of rated load or more for over 5 minutes after continuous operation for an hour to prevent causing carbon build-up.

Inspection during operation

Carefully check the exterior of engine such as piping joints for leaks.

Check for abnormal engine noises or vibrations such as knocking.

Check the color of exhaust gas from the exhaust muffler.

Check the instruments and gauges for proper operation and make sure they indicates normal values.

Table 3-3 Standard values at rated speed

Item	Standard
Engine oil pressure	0.29 to 0.49 MPa {3 to 5 kgf/cm^2} [43 to 71 psi]
Coolant temperature	70 to 90°C [158 to 194°F]

Note: (a) When the oil pressure drops below 0.15 MPa {1.5 kgf/cm^2} [21 psi] in normal operation, or below 0.05 MPa {0.5 kgf/cm^2} [7 psi] at low idling, stop the engine immediately.
Be sure to locate the cause of problem and correct it before restarting the engine.

(b) When the thermo switch is activated in normal run, idle the engine in low gear immediately until the engine temperature becomes normal. Then, perform cooling operation for 5 or 6 minutes before stopping the engine.Be sure to locate the cause of problem and correct it before restarting the engine.

Stopping

⚠ CAUTION

Stopping the engine abruptly while engine parts are hot due to high-speed operation can be a cause for heat up of the engine parts and shorten the engine life. Before stopping the engine, idle the engine in low gear immediately until the engine temperature becomes normal except in an emergency. Then, perform cooling operation for 5 or 6 minutes before stopping the engine and inspect the whole engine.
Never accelerate the engine immediately before shutting it down.
Do not restart the engine immediately after abnormal shut down. When the engine stops with alarms, be sure to locate the cause of the problem and correct the problem before restarting the engine. After restarting the operation, inspect the whole engine for any abnormalities again. If the engine has an abnormality, repair it immediately.

Engine stopping method may differ depending on the specifications.
Follow the instructions according to the specifications of the equipment.

Inspection after stopping

Inspect the engine for fuel, oil or coolant leakage. If any leakage is found, repair the leakage or contact a dealer of Mitsubishi Heavy Industries, Ltd.

Recommended fuel

WARNING

Use a fuel specified in this manual only. Do not refill the fuel tank more than the specified level, as it may result in a fire.

Use a diesel fuel equivalent for "JIS K 2204 diasel fuel".

It is necessary to use a fuel that has a pour point suitable for the ambient temperature.

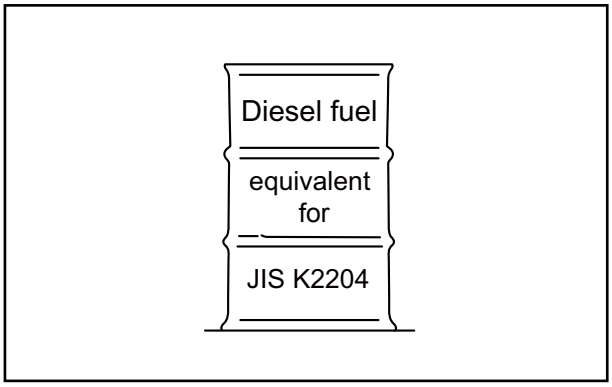


Fig. 4-1 Recommended fuel

Handling fuel

When using fuel stored in a storage tank, leave it to sit for more than 24 hours so that dust and water can settle at the bottom. Then, use the upper clean fuel.

Fill up the fuel tank or service tank after each operation.

This prevents water from mixing with fuel in the tank and also gives time for dust and water to separate and settle at the bottom of the tank.

Before refilling, clean the areas around the caps thoroughly and remove the caps from the drum and tank. Also clean your hands and the hose before refueling. When using a hand-operated pump, be careful not to pump water or sediment accumulated at the bottom of the storage tank.

Be sure to use a strainer when filling fuel tank. For a complete filtration, it is recommended to use a clean lint-free cloth together with the strainer.

Table 4-1 Recommended limit and use limit of fuel property

Properties		Recommended limits	Use limits	Test method
Flash point		50°C [122°F] or higher	45°C [113°F]	JIS K 2265:2007 ISO 3769 ISO 2719
Distillation	Initial boiling point	170°C [338°F] or higher		JIS K 2254:1998 ISO 3405
	90 % distillate temperature	330 to 380°C [626 to 716°F]		
Pour point (PP)		6°C [42.8°F] or lower than ambient temperature		JIS K 2269:1987 ISO 3016
Cloud point (CP)		Below ambient temperature		JIS K 2269:1987 ISO 3015
Cold filter plugging point (CFPP)		3 °C [37.4 °F] or lower than ambient temperature		JIS K 2288:2000 IP 309/96
Carbon residue (10 % bottom oil)		0.1 weight % or lower	0.4 weight % or lower	JIS K 2270:2000 ISO 6615 ISO 10370
Cetane number		45 or higher	40 or higher	JIS K 2280:1996 ISO 5165
Cetane index (new type)		45 or higher	40 or higher	JIS K 2280:1996 ISO/DIS 4264
Kinematic viscosity		2.0 mm^2/s [0.0031 in^2/s] or more at 30 °C [86 °F] 8.0 mm^2/s [0.0124 in^2/s] or more at 30 °C [86 °F]		JIS K 2283:2000 ISO 3104
Sulfur content		0.2 weight % or lower (Except in cases the value is specified by the emission control.)		JIS K 2541:2003 (The content should be as low as the diesel fuel.) ISO 4260 ISO 8754
Water content and sediment		0.1 volume % or lower		JIS K 2275:1996 ISO 3733
Ash content		0.01 % by mass or less	0.03 weight % or lower	JIS K 2272:1998 ISO 6245
Copper corrosion (3 hrs at 50 °C [122 °F])		Color change = Copper plate No.3 or less		JIS K 2513:2000 ISO 2160
Density at 15 °C [59 °F]		0.83 to 0.87 g/cm^3 [49.9424 to 54.3123 lb/ft^3]	0.80 to 0.87 g/cm^3 [49.9424 to 54.3123 lb/ft^3]	JIS K 2249:1995 ISO 3675
Caulking	24 hrs at 250 °C [482 °F]	75 % carbonization or less	80 % carbonization or less	Fed 791B
	24 hrs at 230 °C [446 °F]	55 % carbonization or less	-	
	48 hrs at 180 °C [356 °F]	Tar-free	-	
Aromatics substances (by HPLC)		35 % by volume or less (total of aromatic components)		JIS K 2536:2003 ISO 3837
Polycyclic aromatic content		8 % by volume or less		JIS K 2536:2003 IP 391
Asphaltene		0.1 weight % or lower		-

Table 4-1 Recommended limit and use limit of fuel property

Properties	Recommended limits	Use limits	Test method
Foreign materials (foreign materials at engine fuel inlet)	5.0 mg/liter or less		JIS B 9931:2000 ISO 4405
Lubricity: MWSD (Measured mean Wear Scar Diameter) by HFRR wear test at 60 °C [140 °F] fuel temperature	460 µm [0.02 in.] or less (calculated wear scar diameter at WS 1.4 kPa {0.0143 kgf/cm^2} [0.2031 psi])		ISO 12156-1
BDF: Biodiesel fuel (FAME: Fatty Acid Methyl Ester)	BDF quality shall meet JIS K 2390, EN14214, or ASTM D6751 BDF blending of 5 % by volume or less is approved (Except in cases the value is specified by the emission control.)		JIS K 2390:2008 (FAME for mixture) ASTM D 6751 EN 14214

Note: When using fuel less than use limits, white smoke, worsening start up or unstable rotation may occur.

Chapter 5 ENGINE OIL

Recommended engine oil

CAUTION

Use only the engine oils recommended in this manual. Never use other oils.
The use of inappropriate or inferior oils will result in sticking of piston rings, seizure between piston and cylinder, or premature wear of bearings and moving parts, and significantly shortens the service life of the engine.

Many oil standards, which are established through special engine tests, are available to determine the quality of oil depending on the engines to which they will be applied and on operating conditions. Among those standards, API (American Petroleum Institute) service classifications are mostly used to classify engine oils. SAE specifies the viscosity only, while the API service classification indicates the quality level of engine oil.
For engine lubrication oil, please use API service classification CF.

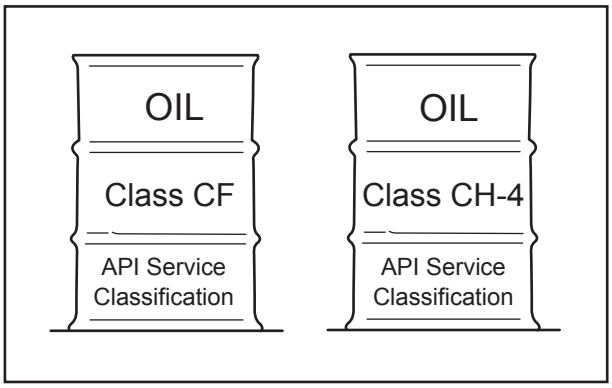


Fig. 5-1 Recommended engine oil

Selection of oil viscosity

Use the following chart to select the appropriate oil viscosity according to the ambient temperature.
Excessively high oil viscosity causes power loss and an abnormal rise of oil temperature, while excessively low oil viscosity accelerates wear due to inadequate lubrication, and also causes a decrease in engine output due to leakage of combustion gas.

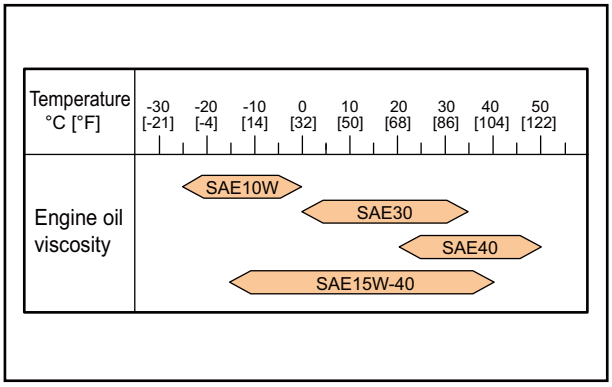


Fig. 5-2 Selection of oil viscosity

Handling engine oil

WARNING

Before filling the engine with engine oil, stop the engine and make sure there are no open flames and other fire hazards near the engine. Leaked or spilled oil on hot surfaces or electrical components can cause a fire. Wipe off any spilled oil immediately and thoroughly. After filling, securely close the filler cap.

CAUTION

Never mix different brands of engine oil. Mixing different brands of engine oil may cause a chemical reaction of additives in the engine oil that could degrade the engine oil quality.

When handling oil in greater than the legally specified quantities, be sure to have the work performed by a service station in compliance with the law. When removing oil from the engine or oil can, use an oil pump. Do not suck oil with the mouth to siphon it.
Be sure to close the cap on the oil can after use.
Keep oil in a well-ventilated area and out of direct sunlight.
Be sure to obtain the MSDS of the engine oil used and follow the instructions of the MSDS.

Engine oil performance requirements

Engine oil requires the following performances.

- Excellent dispersion performance (the ability of oil to disperse sludge in the oil) at high temperature that prevents engine oil deterioration due to sludge accumulation and soot contamination.
- Excellent acid-neutralizing performance that prevents oxidative degradation due to fuel sulfur content.
- Excellent high temperature oxidation stability that endures continuous operation under prolonged high-load.
- Sufficient viscosity concentration to maintain the cold start performance, and lubrication performance at high temperature.
- Good rust and corrosion resistance to water.
- Good foam resistance to prevent the lubricating quality from lowering due to oxidation.

Engine oil deterioration mechanisms

- Engine oil deteriorates due to natural deterioration and due to the contamination. The natural deterioration of oil has two primary causes; one is the degradation caused by oxidation reaction or thermo decomposition of base oil and additives, and the other is the degradation in the performance due to consumption of additives during use.
- Contaminants such as fuel and combustion products (soot, water vapor or oxidation products) that intrude into oil have critical influence on oil quality. Soot adheres to the oil film of cylinder wall, and is scraped off the cylinder wall by the piston ring. Such soot increases the rate of insoluble substances in the engine oil and can cause the wear of piston rings and cylinder walls.
- Abrasion powder in the engine oil also accelerates deterioration as it can catalyze oxidation reaction. Dust and dirt entered from outside deteriorate the engine oil as well. Contamination and deterioration process accelerates with operation time.
- Deterioration products and contaminants in the engine oil, if it is a small amount, are harmless as they can be dispersed in oil. However, if it is a large amount, they become harmful. Since such products and contaminants flow out of the oil pan and start to accumulate inside the piston and in the oil system, they eventually lead to serious problems such as piston ring sticking and bearing scuffing.
- Sulfur content in fuel is burned and transformed into sulfurous acid gas and sulfuric gas that cause corrosive wear of cylinders and piston rings. A detergent additive in the engine oil neutralizes them into harmless substances. As the detergent additive is consumed in its role of neutralizing, the engine oil total base value decreases. A decrease in the total base value indicates a corresponding decrease in soot dispersion ability. As a result, deposits on the pistons increase.
- Due to oxygen in the air, oil temperature rise under high-load continuous operation causes oxidation degradation. As oxidation degradation accelerates, oxidative products are polymerized. The polymerized oxidative products cause the oil viscosity to increase, which leads to the generation of sludge and varnish. As a result, problems such as lubrication failure and piston ring sticking occur. Also acid substances generated by oxidation can cause problems like main bearing corrosion.

Definition of properties of engine oil

Viscosity

Viscosity is a basic physical property of engine oil and is considered as the most important aspect when evaluating oil.

Contamination of oil by blow-by gas and deterioration of oil by its natural aging in crease the viscosity and degrade the performance of viscosity, which will cause the deposition of sludge inside the engine and oil filter clogging. Contamination of oil by fuel and sheared molecules of viscosity index improver in oil decrease the viscosity and degrade the performance of viscosity, which will cause insufficient lubrication and friction/wear of engine parts.

Total base number

Total base number (TBN) shows the ability to neutralize acids such as organic acid due to engine oil oxidation, or sulfurous or sulfuric acid due to the sulfur content of fuel.

Because TBN indicates the amount of dispersant detergent in oil, it can be used to estimate consumption of basic dispersant detergent. The ability to disperse sludge declines as dispersant detergent is used up.

Total acid number

The total acid number in oil increases as the organic acid is being derived by the engine oil oxidation, or sulfurous acid or sulfuric acid derived by the combustion of sulfur content of fuel, or the oil becomes contaminated with imperfect combustion products.

An increase in the total acid number will result in corrosion or wear of the inner parts of the engine (such as cylinder liners or metal) due to sulfur content, and piston ring seizure due to sludge.

Water content

Water in oil promotes corrosion/wear, and decreases lubricity in sliding parts.

Flash point

The flash point is lowered by contamination with fuels. Flash point is measured to check the dilution of fuel. The dilution of fuel reduces oil film, and causes insufficient lubrication that will cause friction or wear of engine parts.

Insoluble

Insoluble includes acid products of engine oil, imperfect combustion products, sludge or soot, metal abrasive particles and dust. Insoluble is an indication of degradation/contamination of oil.

Dispersant detergent, which is an additive in engine oil, absorbs sludge particles, and disperses them as fine particles in oil. Total insoluble density and remaining dispersibility can be obtained by measuring insoluble and coagulated insoluble (using chemical specialities to stop action of disperse detergent and to collect the sludge dispersed in oil) by which piston ring seizure or premature wear can be prevented before it occurs.

Service Limits of engine oil

Engine oil degrades through the use and by lapse of time.

To determine the timing of engine oil replacement, analyze the used oil, and understand the condition of oil deterioration and oil defacement. It is also required to compare the oil analysis results and the engine analysis results including inside contamination and wear condition of engine, and to consider the engine operating condition.

The engine oil affects the engine oil quality to use, the engine operating condition and the quality of fuel.Analyze the used oil, and understand the condition of oil deterioration and oil defacement. To determine the timing of engine oil replacement, the stabiration of engine is required.

Refer to the following table for the determination of engine oil performance degradation. If any of the following deviate the limit, replace the engine oil with new oil.

Table 5-1 Engine oil properties

Properties		Standard	Test method
Viscosity	mm^2/s [in^2/s] @100°C [212 °F]	+30% or less -15% or more of new oil	JIS K 2283:2007 ISO 3107 ISO 2909
Total base number	mgKOH/g	2.0 or more with hydrochloric acid (HCL) method 1/2 of new oil or more with perchloric acid (PCA) method	JIS K 2501:2003 ISO 3771
Total acid number	mgKOH/g	Up to +3.0 of new oil	JIS K 2501:2003 ISO 3771
Water content	Vol %	0.2 or less	JIS K 2275:1996 ISO 9029
Flash point (open cup)	°C [°F]	180 [356] or higher	JIS K 2265:2007 ISO 3769 ISO 2719
Pentane insoluble	Wt %	0.5 or less	ASTM D 893
Pentane insoluble coagulated	Wt %	3.0 or less	ASTM D 893

Chapter 6 COOLANT

Note: In this operation manual, the word "coolant" represents the liquid combined water and LLC.

Recommended water for coolant

Use soft water for the engine cooling system. The water quality must meet the requirements in the Table below. Basically, the water quality should be within the recommended value, however, up to the limit is acceptable.

Table 6-1 Water quality standards

Item	Chemical symbol	Unit	Recommend value	Limit	Main adverse effect
pH (25 °C [77 °F])	-	-	6.5 to 8.0	6.5 to 8.5	Corrosion and rust, scale formation
Electrical conductivity (25 °C [77 °F])	-	mS/m	< 25	< 40	Corrosion and rust, scale formation
Total hardness	$CaCO_3$	ppm	< 95	< 100	Scale formation
M alkalinity	$CaCO_3$	ppm	< 70	< 150	Scale formation
Chlorine ion	Cl^-	ppm	< 100	< 100	Corrosion and rust
Sulfuric acid ion	SO_4^{2-}	ppm	< 50	< 100	Corrosion and rust
Total iron	Fe	ppm	< 1.0	< 1.0	Scale formation
Silica	SiO_2	ppm	< 30	< 50	Scale formation
Residue from evaporation	-	ppm	< 250	< 400	Scale formation

Note: Figures in parentheses are the standard value. In addition to the items specified above, turbidity is specified to be below 15 mg/liter.

Long life coolant (LLC)

⚠ CAUTION

Should coolant or LLC be accidentally consumed, induce vomiting immediately and seek medical attention. If LLC should enter eyes, flush immediately with plenty of water and seek medical attention.

Be sure to use Mitsubishi Heavy Industries, Ltd. genuine long life coolant (LLC) "GLASSY long life coolant (Ethylene glycol type)" or "PG GLASSY long life coolant (Non-amine type)" as coolant. When using other brand LLCs by necessity, be sure to use the LLC that meets the specification in Mitsubishi Heavy Industries, Ltd. Mitsubishi heavy industries, Ltd. disclaim the warranty claim concerning malfunctions caused by the use of LLC that does not meet the following specification.

Genuine LLC

Mitsubishi Heavy Industries, Ltd. recommends the use of our genuine long life coolant "GLASSY long life coolant (Ethylene glycol type)", and Eco-friendly product "PG GLASSY long life coolant (Non-amine type)", which are most appropriate coolant for diesel engine from Mitsubishi Heavy Industries, Ltd.

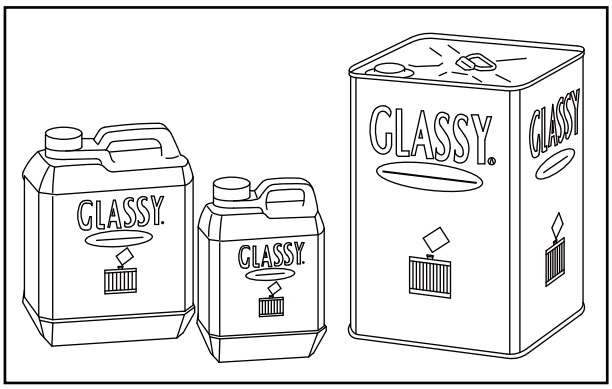


Fig. 6-1 GLASSY - LLC

Other brand LLCs

CAUTION

Never mix Mitsubishi Heavy Industries, Ltd. genuine LLC with other brand LLCs. Mixing with other brand LLCs degrades the performance of Mitsubishi Heavy Industries, Ltd. genuine LLC.

When using LLC other than Mitsubishi Heavy Industries, Ltd. genuine long life coolant (LLC) "GLASSY long life coolant (Ethylene glycol type)" or "PG GLASSY long life coolant (Non-amine type)", be sure to use the LLC which meets specification in Mitsubishi Heavy Industries, Ltd.

The quality and performance of commercially available LLCs as well as their component variations are the responsibility of LLC suppliers.

Before purchasing commercial LLC, be sure to discuss the suitability of LLC with the LLC supplier.

Use only all-season LLC (non-amine type). Do not use antifreeze alone instead of LLC.

Standard for other brand LLC

When using other brand LLCs by necessity, be sure to use the LLC that meets following specification. Mitsubishi heavy industries, Ltd. disclaim the warranty claim concerning malfunctions caused by the use of LLC that does not meet the following specification.

General demands of LLC

- LLC shall be a homogeneous liquid.
- Engine cooling system shall not receive troubles such as corrosions and precipitation products etc. by LLC when the LLC is diluted to 30 to 60 % density.
- LLC shall be mixed with other LLC that satisfies this specification, and shall not separate elements each other, and shall not decrease the performance each other.
- LLC shall not allow the container to be corroded, and shall not has precipitation products etc. even if LLC is left in the container for 6 months.
- LLC shall not has extraction products etc. even if LLC is kept in -20 to -25°C [-4 to -13°F]
- The validity term of the quality that provides with this specification is 2 years after it delivers with the indoor normal temperature keeping.

LLC specification

LLC shall examine according to JIS K2234 section 7 (examination methods), and satisfy this specification. General matters and the sample to the examination is shown in JIS K2234.

Table 6-2 LLC specification

Property				Standard
External				Not precipitation
Density				Minimum 1.112 g/cm^3 [69.4199 lb/ft^3] (20/20 °C) [68/68 °F] (Stock solution)
Water content				Maximum 5.0 weight % (Stock solution)
Frozen temperature		30 vol %		Maximum -14.5 °C [6 °F]
		50 vol %		Maximum -34.0 °C [-29 °F]
Boiling temperature				Minimum 155 °C [311 °F] (Stock solution)
pH				7.0 to 11.0 (30 vol %)
Bubbling character (ASTM D 3306-01)		30 vol %		Maximum 4.0 ml
		33 1/3 vol %		Maximum 150 ml, Disappearance of bubble within 5 sec.
Hard water adaptability				Maximum 1.0 (50 vol %)
Metallic causticity (88±2°C [190±36°F], 336±2 Hr, 30 vol % (E.G), 50 vol % (P.G))	Test piece	Mass change	Aluminum	±0.30 mg/cm^2
			Cast iron	±0.15 mg/cm^2
			Steel	±0.15 mg/cm^2
			Brass	±0.15 mg/cm^2
			Solder	±0.30 mg/cm^2
			Copper	±0.15 mg/cm^2
		External of test piece after the examination		Not corrosion on surface excluding between test piece and spacer. Discoloration is OK.
	Bubbling while examination			Not bubbling overflow
	Properties of liquid after the examination	pH		6.5 to 11.0
		pH change		±1.0
		Precipitation		Maximum 0.5 vol %
		External of liquid		Not remarkable discoloration, separation and gel.
Circulation metallic causticity (98±2°C [208±36°F], 1000 Hr, 30 vol % (E.G), 50 vol % (P.G))	Test piece	Mass change	Aluminum, Cast iron, Steel, Brass, Solder, Copper	±0.30 mg/cm^2
		External of test piece after the examination		Not corrosion on surface excluding between test piece and spacer. Discoloration is OK.
	Properties of liquid after the examination	pH		7.0 to 9.0
		pH change		±1.0
		Pre-alkalinity change		±15 %
		Precipitation		1.0 vol %
		External of liquid		Not remarkable discoloration, separation and gel.
		Density of ion	Fe, Cu, Al, Zn, Pb, NH_4^+	Maximum 10 ppm

Table 6-2 LLC specification

Property				Standard
Circulation metallic causticity (88±3°C [190±37°F], 1000±2 Hr, 30 vol % (E.G))	Test piece	Mass change	Aluminum	±0.60 mg/cm^2
			Cast iron	±0.30 mg/cm^2
			Steel	±0.30 mg/cm^2
			Brass	±0.30 mg/cm^2
			Solder	±0.60 mg/cm^2
			Copper	±0.30 mg/cm^2
		External of test piece after the examination		Not corrosion on surface excluding between test piece and spacer. Discoloration is OK.
	Properties of liquid after the examination	pH		6.5 to 11.0
		pH change		Maximum ±1.0
		External of liquid		Not remarkable discoloration, separation and gel.
	Condition of parts	Pump seal		Not trouble while the examination
		Inside of pump case and blade		Not remarkable corrosion
Rubber adaptability (30 vol %, 115°C [239°F], 360 Hr)	Silicon	Tensile strength change		-60 to 0 %
		Elongation change		-40 to +20 %
		Volume change		0 to +40 %
		Hardness change		-20 to +10 %
	Acrylonitrile butadiene rubber	Tensile strength change		0 to +10 %
		Elongation change		-15 to +15 %
		Volume change		0 to +40 %
		Hardness change		-10 to 0 %
	Ethylene propylene diene monomer	Tensile strength change		0 to +10 %
		Elongation change		-30 to 0 %
		Volume change		0 to +10 %
		Hardness change		-10 to 0 %
Storage stability vol % (30 vol %, room temperature, 6 Hr)				Maximum 0.3

Maintenance of LLC

⚠ CAUTION

Should coolant or LLC be accidentally consumed, induce vomiting immediately and seek medical attention. If LLC should enter eyes, flush immediately with plenty of water and seek medical attention.
LLC is toxic. Never dispose of coolant containing LLC drained from engine into regular sewage. For disposal of used coolant, consult LLC distributor.

Replacement intervals of LLC

CAUTION

Be sure to renew LLC at the intervals specified in the maintenance schedule of this manual.
Failure to renew LLC may cause malfunctions due to performance degradation of preventing rust and cavitation.

The coolant mixed with LLC which Mitsubishi Heavy Industries, Ltd. recommended expires in 2 years. Be sure to change coolant at least once every 2 years.

LLC concentration

Keep the LLC concentration of 30 % (GLASSY) and 40 % (PG GLASSY) on any temperature conditions. LLC of less than 30 % concentration does not provide sufficient corrosion protection. If the LLC concentration is lower than 10 %, it may accelerate corrosion.
When adding coolant, do not add plain water. Always use coolant with the same LLC concentration.

Table 6-3 Recommended LLC concentration

Item	Type	External	Lowest ambient temperature			
			-10 °C [14 °F] or above	-20 °C [-4 °F] or above	-30 °C [-22 °F] or above	-45 °C [-40 °F] or above
LLC concentration (%)	GLASSY	Green	30	40	50	60
	PG GLASSY	Red	40	55	70	-

Note: (a) If the outside air temperature is -30 °C or less, use "GLASSY".
(b) The concentration above is based on Mitsubishi Heavy Industries, Ltd. genuine LLC "GLASSY long life coolant (Ethylene glycol type)" or "PG GLASSY long life coolant (Non-amine type)".
For determining the accurate LLC concentration, refer to the instructions for the LLC used.

Importance of LLC

Today's trend is toward smaller and lighter engines offering greater output, lower fuel consumption and lower exhaust emission levels.
Conditions to which engine coolant is subjected, therefore, are becoming severer due to longer operating hours, higher coolant temperature and higher coolant circulating speed.
Many different materials such as steel, aluminum, copper, solder and rubber are used in the cooling system, and they are also subjected to the severe conditions described above. Those materials have different ionization characteristics, and this difference accelerates corrosion through the medium of engine coolant. To prevent such a problem, the use of LLC that contained the additive to prevent rust is very important.

Characteristics of LLC additive and important notes

LLC contains several chemicals in such proportions as to produce chemical reactions that suppress corrosion (ionization) of engine parts in contact with the coolant. LLC loses its effectiveness by hours of use as well as lapse of time.
Moreover, if the chemicals in LLC are not maintained, certain chemicals in the LLC become rapidly used up and result in dissolution of metals instead of protecting metals from corrosion. Consequently, other corrosion preventing chemicals react with dissolving metals and accelerate corrosion. This condition generates more severe corrosion than when plain soft water is used. This is a typical problem caused by the use of inappropriate LLC.

Examples of abnormalities caused by LLC (amine type)

Pitting of iron parts

Amines are generally effective in suppressing the rusting of ferrous metals, but they are said to cause problems for copper parts.
Dissolved copper (copper corrosion) in the cooling system deposits on iron parts and the copper deposits cause corrosion and then pitting on iron parts that have a high ionization characteristics due to galvanic or local-cell action.

Corrosion of aluminum parts

Silicate is highly effective in protecting aluminum against rusting. However, it is unstable in a solution in which the pH is 9 or lower, and can turn to gel and precipitate in the solution. For this reason, the pH is usually specified to be about 10 to ensure a high alkaline level.
This means, after silicate is used up, the high alkalinity causes chemical attacks on aluminum. To prevent this problem, proper maintenance of the coolant is required. For case example, rapid wear of mechanical seals in the water pump due to secondary effects of silicate gel formed. Corrosion of aluminum parts after silicate is consumed.

Pitting and clogging of the radiator

When LLC deteriorates or when its concentration in the coolant is too low, the anti-corrosion performance of LLC lowers and results in the corrosion of metals.Brass and solder tend to corrode faster than other metals, and corrosion of these metals is said to cause water leakage and clogs. Example: Holes and clogs in radiator

Chapter 7 MAINTENANCE SCHEDULE

How to use the maintenance schedule

Periodic inspection not only extends the service life of the engine but also serves to ensure safe operation. Be sure to conduct inspections and maintenance according to the maintenance schedule.

The maintenance schedule shows the standard service intervals. If you notice any abnormalities such as abnormal noise, black exhaust smoke, white exhaust smoke, extremely high temperature of exhaust gas, abnormal vibration, and fuel, oil or exhaust gas leakage, make sure to conduct the inspection and maintenance work, regardless of recommended service intervals in the "Maintenance schedule."

Note: Appropriate service intervals vary depending on the usage and operating conditions as well as consumption of fuel, oil and coolant. Check the operating record of the engine to determine the most appropriate service intervals. (Feel free to consult a dealer of Mitsubishi Heavy Industries, Ltd. regarding service intervals.)

Service the items at multiples of the original requirement. For example, at 1000 service hours, also service those items listed under every 250 service hours and every 50 service hours.

Items marked with * in the maintenance schedule require special tools or large equipment. For the servicing of those items, contact a dealer of Mitsubishi Heavy Industries, Ltd.

Maintenace schedule

Table 7-1 Maintenace schedule

Interval and Service item		Page
Every 50 service hours	Fuel tank - Drain water (If water sedimenter is installed, drain water every 500 service hours or 1 year.)	8-2
	Air cleaner - Check	8-14
First 50 service hours for a new or overhauled engine	Solenoid fuel pump filter - Inspect and clean	8-2
	Engine oil and Oil filter - Replace	8-7
	Bolts and nuts on the engine - Retighten	*
Every 100 service hours	Solenoid fuel pump filter - Inspect and clean	8-2
Every 250 service hours	Engine oil and Oil filter - Replace	8-7
	Belt and belt tension - Inspect and Adjust	8-1
	Radiator fins - Check and Clean	8-13
Every 400 service hours	Fuel filter (cartridge type) - Replace	8-5
Every 500 service hours	Fuel filter element (switching cock type) - Replace	8-6
	Solenoid fuel pump filter - Replace	8-6
	Valve clearance - Inspect	*
	Cleaning the fuel tank (Every 500 service hours or Every 1 years)	*
	Checking glow plug	*
Every 1000 service hours	Starter - Inspect	8-17
	Alternator - Inspect	8-17
	Bolts and nuts on the engine - Retighten	*
Every 1500 service hours	Nozzle tip - Clean	*
Every 3000 service hours	Fuel injection nozzle - Check and maintenance	*
Every 2 years	Coolant - Change	8-10
As required	Air cleaner element - Clean, Check and Replace	8-15
	Fuel system - Bleed air	8-3
	Water sedimenter - Drain water	8-5
	Specific gravity of battery electrolyte - Check	8-16

Chapter 8 PERIODIC INSPECTION AND MAINTENANCE PROCEDURES

Basic engine

Belt and belt tension - Inspect and Adjust

CAUTION

If defects such as cuts or surface separations are found during inspection, replace the belt.
Keep oil and grease away from the belt. They may cause the belt to slip and shorten the service life.
Excessive belt tension can cause rapid wear of the alternator bearing and shorten the service life of the belt.
Adjust the belt tension accurately by following the procedures below.

Belt - Inspect

1. Inspect the belt visually for separation or damage. If any abnormality is found, replace the belt with a new one.
2. Inspect belt tension (deflection).
   Push the belt downward at the midway between pulleys. If the deflection is 12 mm [0.47 in.], the tension is correct.
   Belt pushing force: Approx. 98 N {10 kgf} [22 lbf]
   If the deflection of belt is not within the standard, adjust the belt tension.

Belt tension (Alternator side) - Adjust

1. Remove the belt cover.
2. Loosen all retaining bolts of the alternator and adjusting plate.
3. Move the alternator to adjust the belt tension.
4. After adjusting the belt tension, tighten all retaining bolts of the alternator and adjusting plate.
5. Install the belt cover.

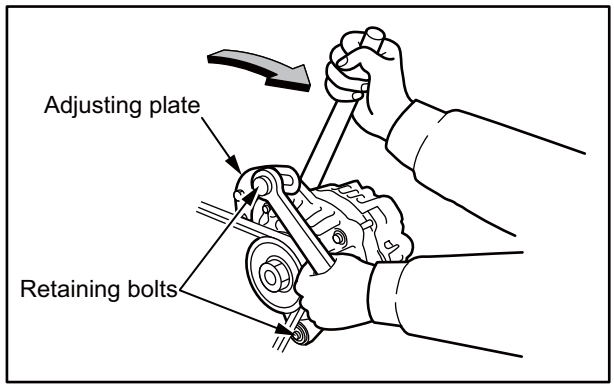


Fig. 8-1 Belt and belt tension - Inspect and Adjust

Fuel system

Fuel tank - Drain water

⚠ WARNING

When working around fuel, make sure there are no open flames, heaters or other fire hazards. Wipe off any spilled fuel completely. Spilled fuel can ignite and cause a fire.

CAUTION

Do not remove the strainer when filling the fuel. For fuel to be used, refer to "FUEL" (4-1).
Bleeding water procedure described below is a commonly used procedure. Some application may be equipped with different fuel tank.

If fuel gets mixed with particles of foreign materials such as dust, dirt, or water, it can cause not only decrease of output but also malfunctions of the fuel system. To avoid such a problem, drain fuel tank as described below.

1. Place a fuel tray (capacity of 2 L [0.5 U.S. gal.] or more) under the drain cock of fuel tank.
2. Open the drain cock of fuel tank and drain fuel at least 1 to 2 L [0.3 to 0.5 U.S. gal.].
3. Make sure that water and particles of foreign materials discharged with fuel. Close the drain cock.

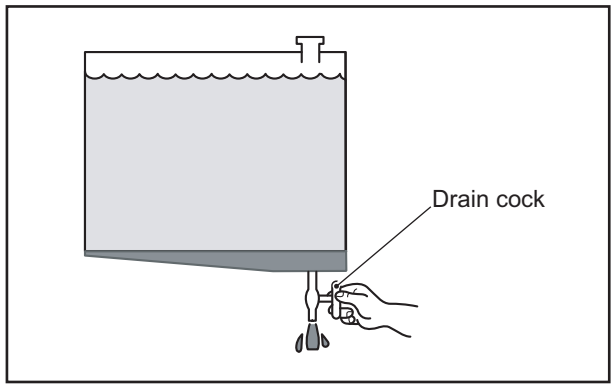


Fig. 8-2 Fuel tank - Drain water

Solenoid fuel pump filter - Inspect and clean

⚠ WARNING

When handling fuel, make sure there are no open flames or other fire hazards near the engine. Wipe off any spilled fuel completely. Spilled fuel can ignite and cause a fire.

1. Clean around the solenoid fuel pump.
2. Check the starter key is at the "OFF" position.
3. Place a fuel tray under the solenoid fuel pump.
4. Close the valve to stop fuel flow.
5. Remove the lower solenoid fuel pump cover.
6. Soak the gaskets, filter, magnet and cover in fuel to clean.
7. Inspect if there is any damaged part, and if so, change it for a new one.
8. Put all the parts back together in a reverse way.
9. Open the main valve of the fuel tank.
10. Turn the starter switch to the "ON" position.
11. Make sure that solenoid fuel pump clicks and fuel starts to flow.
12. Check the solenoid fuel pump for fuel leakage. If leakage is found, reassemble again.
13. Bleed air from the fuel system.
    Refer to "Fuel system - Bleed air" (8-3).

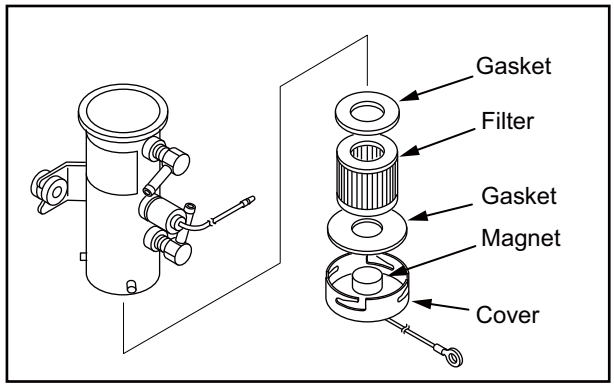


Fig. 8-3 Solenoid fuel pump filter - Inspect and clean

Fuel system - Bleed air

⚠ WARNING

When handling fuel, make sure there are no open flames or other fire hazards near the engine.
Wipe off any spilled fuel completely.Spilled fuel can ignite and cause a fire.

When cleaning or replaceing the parts of fuel system, perform air bleeding from each parts.
Note: Air in the fuel injection pipe and nozzle is discharged automatically by clanking of engine.

Fuel filter element (switching cock type) - Bleed air

1. Turn the fuel filter cock to "AIR" position.
2. Feed fuel using the solenoid fuel pump.
3. Return the cock to "ON" position when the fuel flow from overflow pipe becomes free of bubbles.
4. Stop feeding fuel.

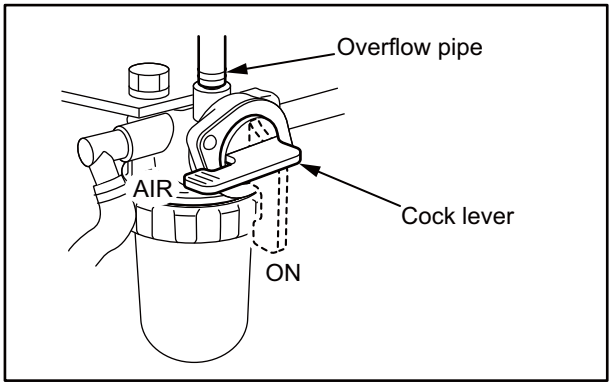


Fig. 8-4 Fuel filter element (switching cock type) - Bleed air

Fuel filters (cartridge type) - Bleed air

1. Loosen air vent plug 1 of fuel filter.
2. Feed fuel using the solenoid fuel pump.
3. When the fuel from the air vent plug 1 becomes free of bubbles, stop priming and tighten the air vent plug 1 to the specified torque.
4. Loosen air vent plug 2 of fuel filter.
5. When the fuel from the air vent plug 2 becomes free of bubbles, stop priming and tighten an air vent plug 2 to the specified torque.
6. Stop feeding fuel.

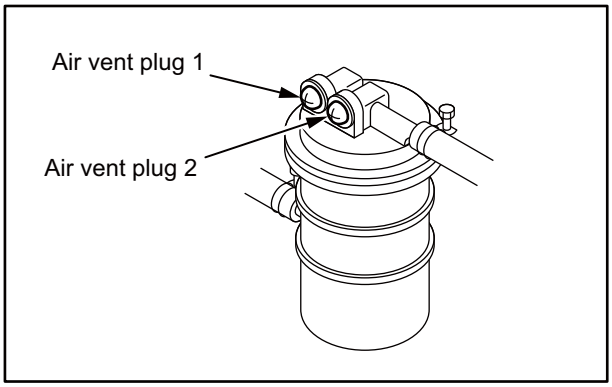


Fig. 8-5 Fuel filters (cartridge type) - Bleed air

Water sedimenter - Bleed air

1. Loosen the fuel inlet port air vent plug of water sedimenter.
2. Feed fuel using the solenoid fuel pump.
3. When the fuel from the fuel inlet air vent plug becomes free of bubbles, stop priming and tighten the plug to the specified torque.
4. Loosen the fuel outlet air vent plug.
5. When the fuel from the fuel outlet air vent plug becomes free of air bubbles, stop priming and tighten the plug to the specified torque.
6. Stop feeding fuel.

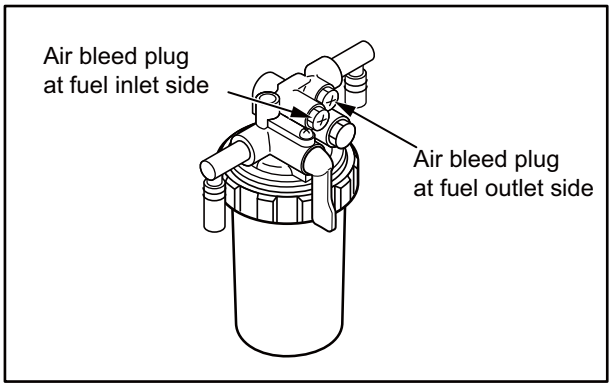


Fig. 8-6 Water sedimenter - Bleed air

Water sedimenter - Drain water

⚠ WARNING

When handling fuel, make sure there are no open flames or other fire hazards near the engine.
Wipe off any spilled fuel completely. Spilled fuel can ignite and cause a fire.

1. Clean around the water sedimenter.
2. Place a fuel tray under the water sedimenter.
3. Turn the cock to "C" (close) position, stop the flow of fuel.
4. Remove ring nut and cup.
5. Drain water in the cup and soak the element in fuel to clean.
6. Install filter element and cup with careful attention to O-ring and then fix with ring nut.
7. Bleed air of water sedimenter.
   (Refer to "Water sedimenter - Bleed air" (8-4))
8. Turn the cock to "O" (open) position, start the engine and let it idle for several minutes.
9. Check the water sedimenter for fuel leakage. If leakage is found, loosen ring nut and check O-ring for damage.

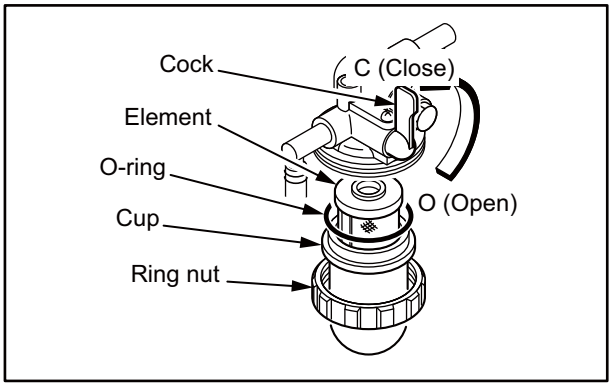


Fig. 8-7 Water sedimenter - Drain water

Fuel filter (cartridge type) - Replace

⚠ WARNING

When handling fuel, make sure there are no open flames or other fire hazards near the engine.
Wipe off any spilled fuel completely. Spilled fuel can ignite and cause a fire.

1. Clean the area around the fuel filters.
2. Place a fuel tray under the fuel filter.
3. Put a stopper on fuel pipe and stop fuel flow.
4. Change the fule filter for a new one.
5. Bleed air from the fuel filter.
   Refer to "Fuel system - Bleed air" (8-3).
6. Start the engine and let it idle for several minutes.
7. Check the fuel filter for fuel leakage. If fuel leakage is found, retighten the fixing clamp of the fuel pipe.

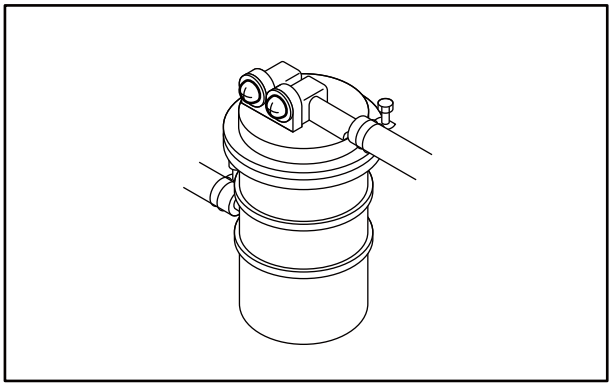


Fig. 8-8 Fuel filter (cartridge type) - Replace

Fuel filter element (switching cock type) - Replace

WARNING

When handling fuel, make sure there are no open flames or other fire hazards near the engine.Wipe off any spilled fuel completely. Spilled fuel can ignite and cause a fire.

1. Clean the area around the fuel filters.
2. Place a fuel tray under the fuel filter.
3. Turn the cock to "C" (close) position, stop fuel flow.
4. Remove ring nut and cup, chang the filter elemet for a new one and then fix the ring nut.
5. Bleed air from the fuel filter.
   Refer to "Fuel system - Bleed air" (8-3).
6. Turn the cock to "ON" position, start the engine and let it idle for several minutes.
7. Check the fuel filter for fuel leakage. If leakage is found, loosen ring nut and check O-ring for damage.

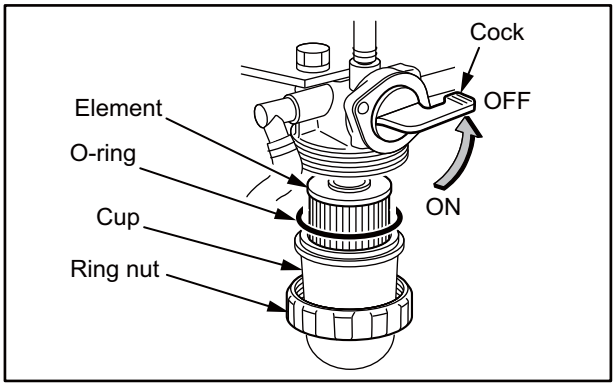


Fig. 8-9 Fuel filter element (switching cock type) - Replace

Solenoid fuel pump filter - Replace

WARNING

When handling fuel, make sure there are no open flames or other fire hazards near the engine.
Wipe off any spilled fuel completely. Spilled fuel can ignite and cause a fire.

1. Clean around the solenoid fuel pump.
2. Check the starter key is at the "OFF" position.
3. Place a fuel tray under the solenoid fuel pump.
4. Close the valve to stop fuel flow.
5. Remove the lower solenoid fuel pump cover.
6. Change the element for a new one.
7. Inspect if there is any damaged part, and if so, change it for a new one.
8. Put all the parts back together in a reverse way.
9. Open the main valve of the fuel tank.
10. Turn the starter switch to the "ON" position.
11. Make sure that solenoid fuel pump clicks and fuel starts to flow.
12. Check the solenoid fuel pump for fuel leakage. If leakage is found, reassemble again.
13. Bleed air from the fuel system.
    Refer to "Fuel system - Bleed air" (8-3).

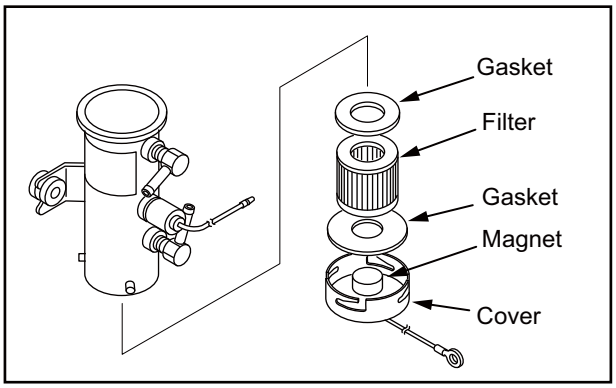


Fig. 8-10 Solenoid fuel pump filter - Replace

Lubricating system

Engine oil and Oil filter - Replace

⚠ CAUTION

When draining oil or changing the oil filter, wear gloves. Hot engine oil and parts may cause burns.

CAUTION

Do not dump waste oil. It is forbidden by law. For disposal of waste oil, consult a dealer of Mitsubishi Heavy Industries, Ltd.

Change engine oil and the oil filter at the same time.

Also checking and analyzing the oil properties is recommended when changing the engine oil.

Do not reuse the oil filter element, as it is a paper type.When replacing filters, always replace gasket with new ones.

Engine oil - Drain

After the engine has stopped, drain engine oil from the engine oil drain port.

Note: Draining by suction should be avoided.

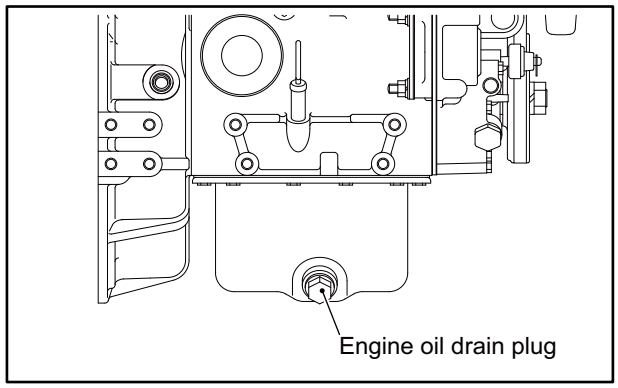


Fig. 8-11 Engine oil drain plug

Engine oil - Refill

1. Make sure that the oil drain plug is tightened.
2. Remove the oil filler cap.
3. Fill the engine oil pan with specified engine oil to the specified level.

Note: For engine oil, refer to "ENGINE OIL" (5-1). For engine oil capacity, refer to "MAIN SPECIFICATIONS" (12-1).

4. Check the oil level in the oil pan as follows:
5. Pull out the oil level gauge, and wipe it with a waste cloth.
6. Insert the oil level gauge fully into the oil level gauge guide, then pull out the gauge again.
7. The proper oil level is between the high and low marks on the oil level gauge. If the oil level is low, add engine oil of the specified type.
8. Check the oil pan and other area for oil leakage. Repair any oil leakage found.
9. Run the engine with starter for approx. 10 seconds while pulling the stop lever and feed engine oil to all parts of engine. Stop the operation for 1 minute, then, repeat the operation two or three times. Circulate engine oil to all parts of the engine.

Note: Prepare for the Cooling system.

10. Check the oil level with the oil level gauge again, and add oil to the specified level.

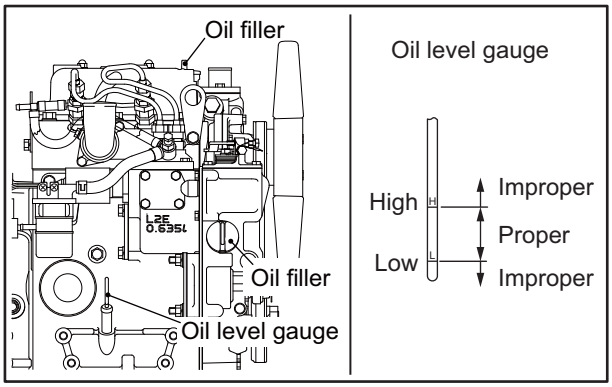


Fig. 8-12 Engine oil - Refill

Oil filter - Change

⚠ WARNING

Do not use a dented filter cartridge.
Filter damage or fule leakage may occur while engine is running and it can cause fire hazard.

CAUTION

To avoid damage to the filter, do not use a filter wrench when installing. Tighten the filter by hand.

1. Clean around the oil filters.
2. Place a drip pan under the oil filter.
3. Using a filter wrench, remove the oil filter.

Note: Check the element of the oil filter that has been removed. If metal particles are found, consult a dealer of Mitsubishi Heavy Industries, Ltd.

4. Thoroughly wipe off oil on the mounting surface of oil filter with a waste cloth.
5. Check the new oil filter for proper seating of gasket.
6. Apply clean engine oil to gasket.
7. Install the oil filter. When the filter gasket contacts the mounting surface of filter, tighten the filter with specified torque.

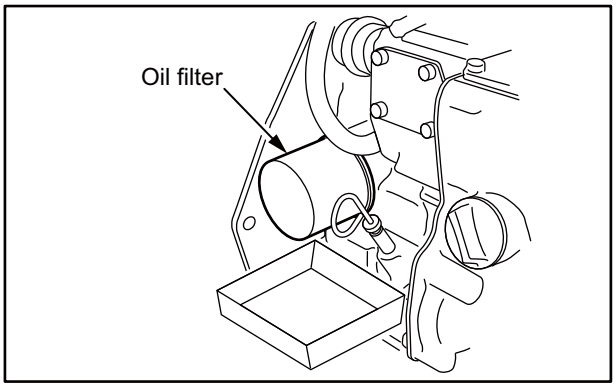


Fig. 8-13 Oil filter - Change

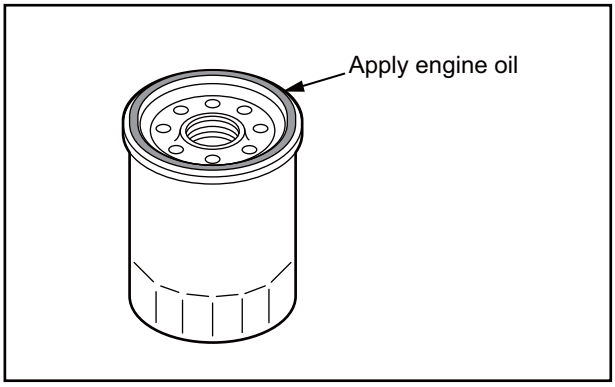


Fig. 8-14 Oil filter

Cooling system

Coolant - Change

⚠ WARNING

Remove the radiator filler cap only after the engine has cooled to room temperature. Place a waste cloth over the cap, and loosen the cap about a half-turn or stand the lever to the upright position to release internal pressure. Never open the radiator filler cap while the engine is hot, otherwise the steam or hot coolant spurts out and you may be scald with it.
Coolant (containing LLC) drained from the engine is toxic. Never dispose of coolant into regular sewage. For disposal of used coolant, consult a dealer of Mitsubishi Heavy Industries, Ltd. or a industrial waste disposer.

CAUTION

The service life of LLC is 2 years. Be sure to change coolant at least once every 2 years.

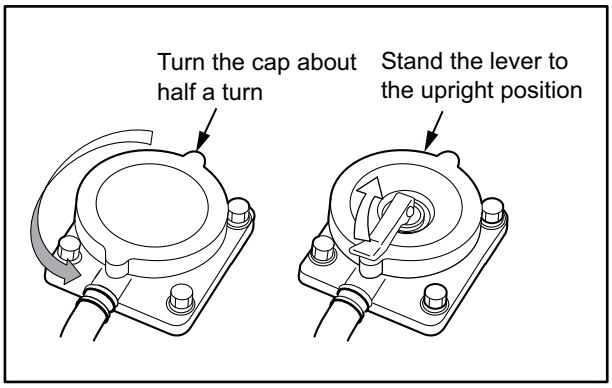


Fig. 8-15 Radiator filler cap

Coolant - Drain

1. When draining coolant immediately after engine operation, idle the engine in low gear for 5 to 6 minutes until the coolant temperature drops to 70 to 80 °C [158 to 176 °F].
2. Open the radiator filler cap.
3. Place coolant receiving can under the drain cocks and plugs, and open the coolant drain cocks and plugs to drain the coolant.

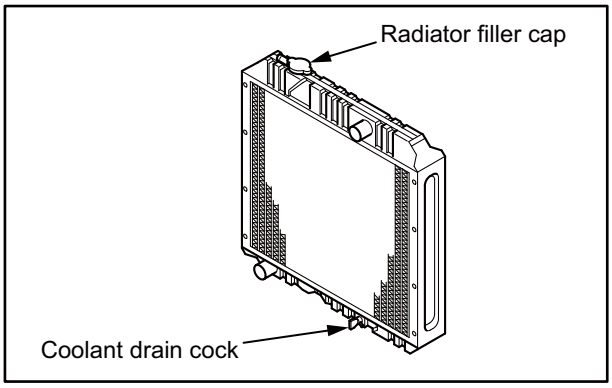


Fig. 8-16 Coolant drain cock (radiator)

Cooling system - Clean

CAUTION

Clean the cooling system when operating the engine first time, or restarting the engine after storage with coolant drained.

1. Close coolant drain cocks and plugs.
2. Pour in a cleaning solution (a solution that is non-corrosive to rubber and metals) in the cooling system, and operate the engine at 800 to 900 min^{-1} for about 15 minutes, then drain the cleaning solution.
3. Close coolant drain cocks and plugs.
4. Pour in fresh water, and operate the engine at 800 to 900 min^{-1} for about 10 minutes.
   Repeat rinsing until the draining water becomes clear and clean.

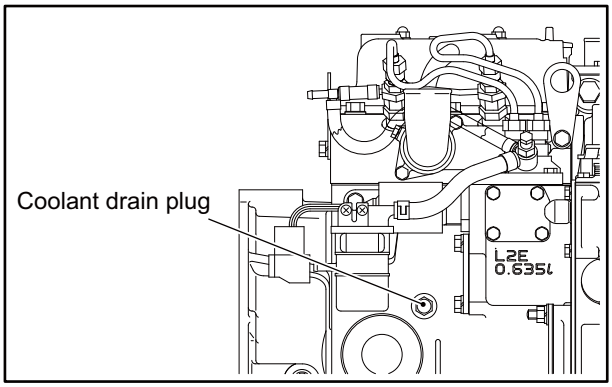


Fig. 8-17 Coolant drain plug (engine)

Coolant - Refill

1. Tighten the coolant drain cocks and plugs.
2. Remove the radiator filler cap, and pour in undiluted LLC.

Note: Determine the amounts of LLC and water to be added by using the LLC concentration chart. For the coolant, refer to "COOLANT" (6-1). For the coolant capacity, refer to "MAIN SPECIFICATIONS" (12-1).

3. Pour in water (soft water with minimal impurities, such as tap water) slowly to "FULL" level line.
4. Check the radiator and other parts for coolant leakage. If any coolant leakage is found, repair it.
5. When coolant reaches "FULL" level line, close the radiator filler cap securely.
6. Run the engine with starter for approx. 10 seconds while pulling the stop lever.
   Stop the operation for 1 minute, then, repeat the operation two or three times to bleed the cooling system.
7. Check the coolant level in the radiator.
   If the engine is equipped with a reserve tank, fill the reserve tank with coolant to "FULL" level line as well.

CAUTION

Always use the coolant with the same LLC concentration.

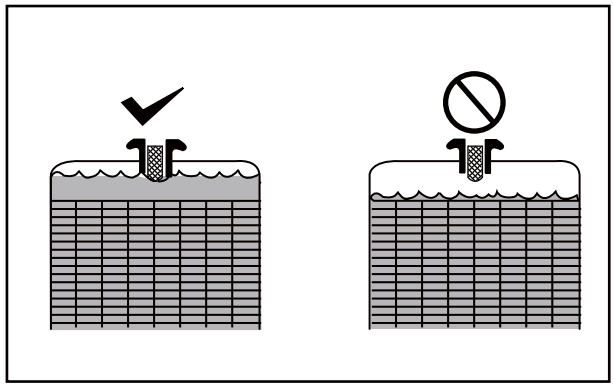


Fig. 8-18 Radiator coolant level

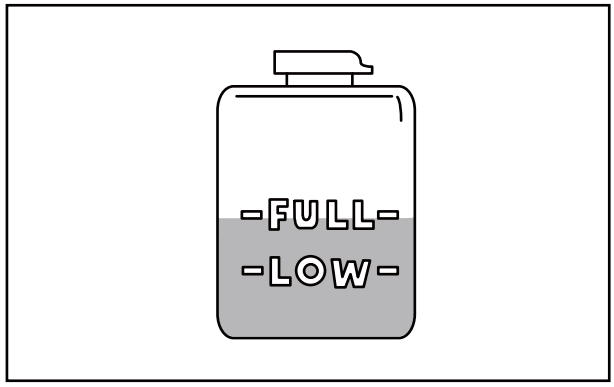


Fig. 8-19 Reserve tank

Radiator fins - Check and Clean

⚠ CAUTION

When handling compressed air, wear safety goggles, a hardhat, gloves and other necessary protective gear. Works without wearing proper protective gear could result in serious injuries.

Check the radiator fins for holes and cracks.
To clean the radiator fins, blow compressed air from the opposite direction of the normal air flow.

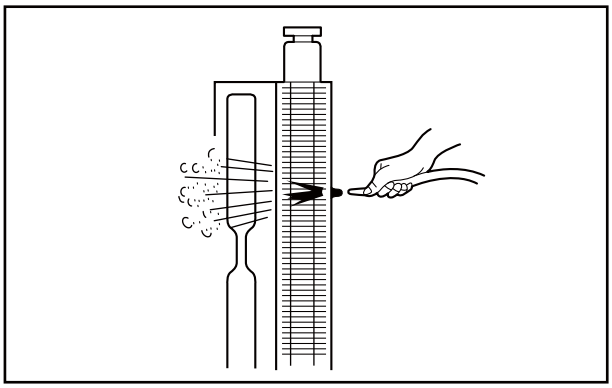


Fig. 8-20 Radiator fins - Clean

Inlet and exhaust systems

Air cleaner - Check

CAUTION

Checking procedure described below is a commonly used procedure. Some application may be equipped with different air cleaner.

1. Check the air cleaner indicator for the element clog.
2. If the element is clogged, the red signal mark is visible.
3. Immediately clean or replace the air cleaner element when the signal turns red.

Note: For cleaning of the air cleaner element, refer to "Air cleaner element - Clean, Check and Replace" (8-15).

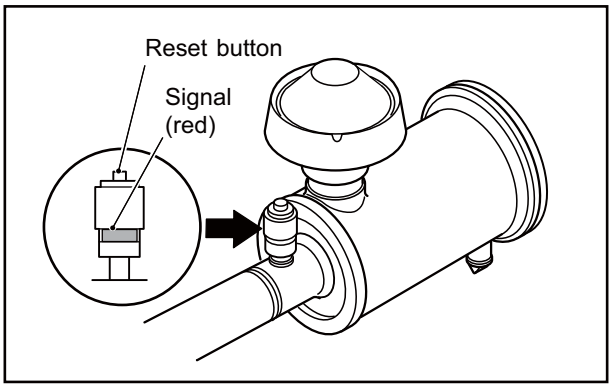


Fig. 8-21 Air cleaner - Check

Air cleaner element - Clean, Check and Replace

⚠ CAUTION

When handling compressed air, wear safety goggles, a dust mask, a hardhat, gloves and other necessary protective gear. Works without wearing proper protective gear could result in serious injuries.
Never service the air cleaner while the engine is running. Servicing the air cleaner while the engine is running can cause particles of foreign material to enter the engine and result in rapid wear of parts, leading to a shorter service life of the engine.Never knock or hit the element.

CAUTION

Cleaning, inspecting and replacing procedure described below is a commonly used procedure. Some application may be equipped with different air cleaner.

1. Remove the air cleaner cap and wing bolt.
2. Remove the air cleaner element from the body.
3. Blow compressed air (0.69 MPa {7 kgf/cm^2} [100 psi] or lower) onto the inside surface of the element to remove foreign materials.
4. To remove dust stuck on the air cleaner element, blow dry compressed air onto the outside surface from a distance.
   Blow compressed air on the inside surface toward the outside along the pleats. Then, blow compressed air on the outside and inside surface again.
5. After cleaning, hold the air cleaner element near a light bulb to illuminate the inside, to check for defects such as cuts, pinholes or local wear.
6. If any defect is found, replace the air cleaner element with a new one.
7. Reassemble the air cleaner element as it is.

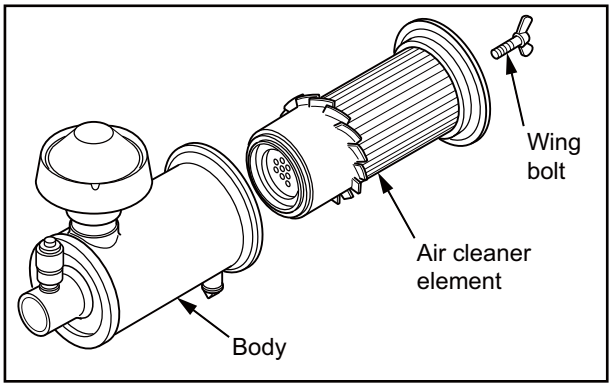


Fig. 8-22 Air cleaner element - Remove

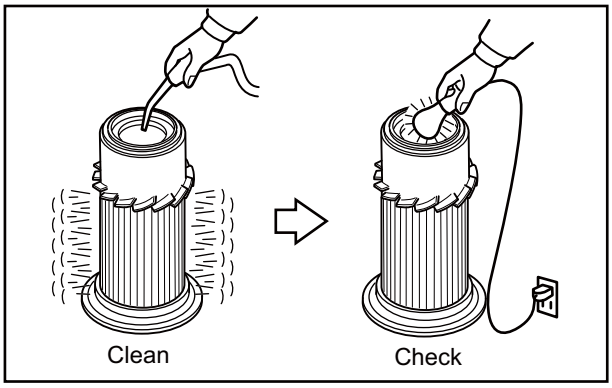


Fig. 8-23 Air cleaner element - Clean and Check

CAUTION

If defects such as cuts, pinholes or local wear are found in the element, or if the air cleaner indicator shows a red sign soon after the cleaned element is installed, change it for new one.

After cleaning or replacing the air cleaner element, press the reset button to reset the indicator.

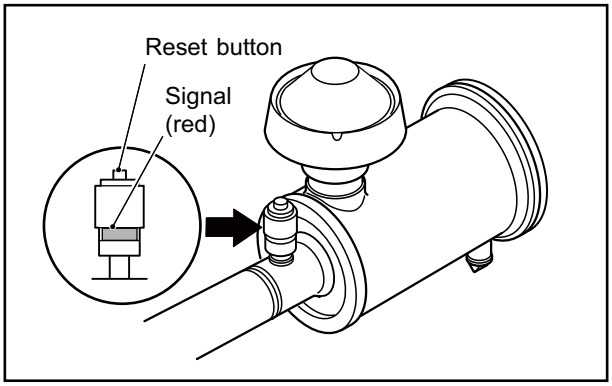


Fig. 8-24 Air cleaner - Check

Electrical system

Battery - Inspect

⚠ CAUTION

If battery electrolyte is spilled on your skin, flush immediately with plenty of water. If battery electrolyte enters the eyes, flush them immediately with lots of fresh water and seek medical attention at once.

Do not use open flames or other fire hazards near the battery. When handling the battery, be careful of sparks generated by accidental shorting.

Battery electrolyte level - Inspect

Battery electrolyte evaporates during use and the f electrolyte level gradually decreases. The proper electrolyte surface level is between the "LOWER LEVEL" and "UPPER LEVEL" lines.

For the battery without level lines, the proper electrolyte surface level is about 10 to 15 mm [0.394 to 0.591 in.] above the top of the plates.

If the electrolyte level is low, remove the caps and add distilled water to the proper level.

Note: When adding distilled water, pour in carefully.

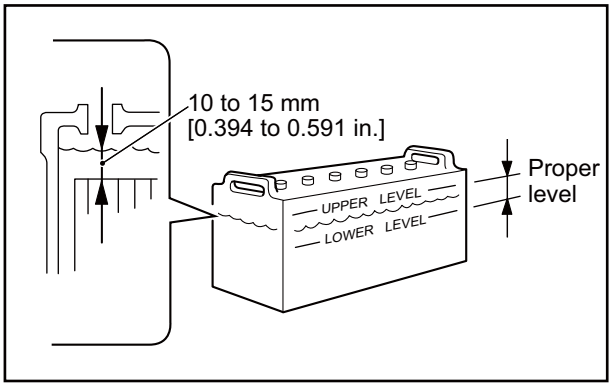


Fig. 8-25 Battery electrolyte level - Inspect

Specific gravity of battery electrolyte - Check

If the specific gravity measured at 20 °C [68 °F] is lower than 1.22, then charge the electrolyte.

Table 8-1 Specific gravity of electrolyte

Specific gravity at 20 °C [68 °F]	Condition	Remedy
From 1.26 to 1.28	Fully charged	-
From 1.22 to 1.26	Charged	Charge
Less than 1.22	Discharged	Charge

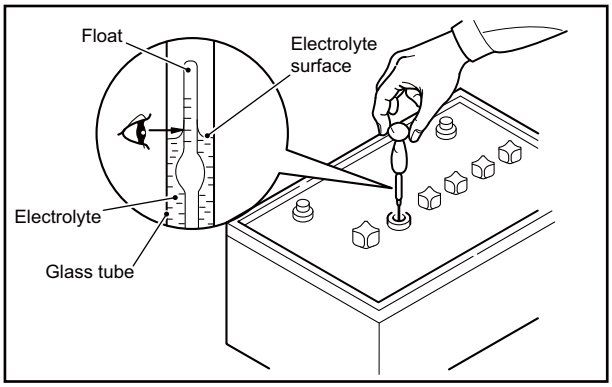


Fig. 8-26 Specific gravity of battery electrolyte - Check

Starter - Inspect

Visually check the starter for damage.

If the starter is dusty, blow dirt using compressed air.

Note: If the starter is defective, consult a dealer of Mitsubishi Heavy Industries, Ltd.

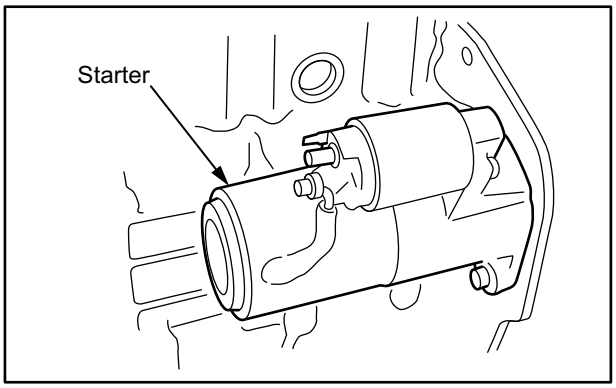


Fig. 8-27 Starter - Inspect

Alternator - Inspect

Visually check the alternator for damage.

If the alternator is dusty, blow foreign material using compressed air.

Remove the belt and check that the movement is smooth when rotating the pulley by hand.

Note: If the alternator is defective, consult a dealer of Mitsubishi Heavy Industries, Ltd.

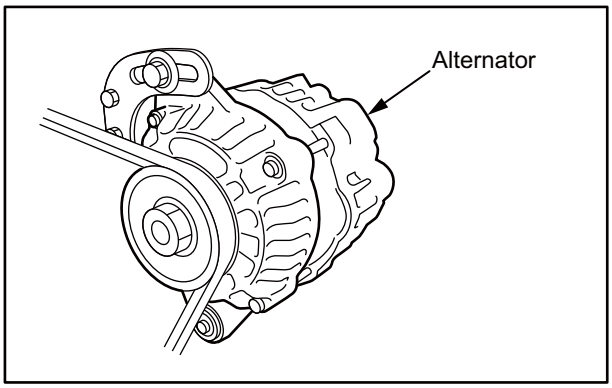


Fig. 8-28 Alternator - Inspect

Chapter 9 LONG-TERM STORAGE

Long-term storage

The following describes how to store the engine in a non-operable condition for 3 months or more and in an operable condition for 3 months or more.

If the engine has been left unattended for 3 months or more, the internal engine parts can rust, and that may cause damage to the engine.

When storing the engine for an extended period of time, be sure to follow the directions below.

Storing the engine in a non-operable condition for 3 months or more

Preparation for storage

1. Drain the engine oil in-use, pour new oil.
2. Prepare a fuel mixture containing 50 % rust-preventive oil (NP-9), and fill the fuel tank with it.
3. Operate under non-load minimum engine speed for 5 to 10 minutes.
4. Immediately before stopping the engine, spray volatile corrosion inhibitor (VCI) through the inlet port to prevent rust on the air intake system.
5. With the engine stopped, drain the fuel mixture from the fuel tank.
6. Apply rust-preventive oil (NP-3) liberally on the exposed sections of the machining.
7. Seal the air inlet, exhaust outlet, breather and other openings with an adhesive cloth tape.
8. Cover the entire engine.

Note: (a) Store the engine in a well-ventilated indoor area.

(b) It is not necessary to drain coolant since it contains LLC. (Add LLC to increase the concentration to between 30 to 60 %.)

(c) Post a sign at an easily noticeable place to warn that the rust-preventive oil in the engine must be replaced with engine oil, and the fuel tank must be filled with fuel before operating the engine for the first time after storage.

(d) New engine oil can substitute for rust-preventive oil (NP-10-2) of lubrication system.

Recommended rust-preventive oil and corrosion inhibitor

Table 9-1 Recommended rust-preventive oil and corrosion inhibitor

JIS No.		Recommended product	Application
K 2246	NP-3	Nippon Oil Corporation Anti Rust P-1600	Prevention of rust on exposed machine surfaces
	NP-9	Nippon Oil Corporation Anti Rust P-2400	Prevention of rust in fuel system
	NP-10-2	Nippon Oil Corporation Anti Rust P-230	Prevention of rust in lubricating system
Z 1519	-	Ryoukou Kagaku VCI Diana ND volatile corrosion inhibitor	Prevention of rust in air intake system

Maintenance during storage

Charge the battery once a month. First, check the battery electrolyte for proper level and then charge the battery.

Using the engine after storage

1. Remove the cover from the engine.
2. Connect a fully charged battery.
3. Remove the covers from the starters and alternator.
4. Adjust the tension of belt.

Note: Inspect and adjust V-belt tension. Refer to "Belt and belt tension - Inspect and Adjust" (8-1).

5. Remove sealing tapes from the openings of the engine.
6. Connect pipes.

Note: For engine oil, refer to "ENGINE OIL" (5-1).

7. Fill the fuel tank with fuel, and bleed the fuel system.

Note: For bleeding fuel system, refer to "Fuel system - Bleed air" (8-3).

8. Inspect the entire engine.
9. Remove the rocker covers, and lubricate the valve mechanisms.
10. Run the engine with starter for approx. 10 seconds while pulling the stop lever. Stop the operation for approx. 1 minute, then, repeat the operation two or three times.
11. Make sure the engine oil pressure rises.
12. Conduct a warm up operation for a sufficient duration.

Note: For starting the engine, refer to "Starting" (3-4).

13. Apply load and increase the engine speed to the rated speed.

Storing the engine in an operable condition for 3 months or more

When the engine is not operated during storage of 3 months or more, internal engine parts can rust and lose oil film. As a result, the engine can seize when it is started after storage. To prevent such a risk, the engine must be operated periodically during storage.

Operating the engine for maintenance

Operate the engine for maintenance at least once a month as described below.

1. Run the engine with starter for approx. 10 seconds while pulling the stop lever. Stop the operation for approx. 1 minute, then, repeat the operation two or three times.
2. Make sure the engine oil pressure rises.
3. Operate the engine about 5 to 10 minutes under no load as the maintenance operation.

Note: For starting the engine, refer to "Starting" (3-4).

Lifting the engine

⚠ WARNING

To lift the engine, use wire ropes, shackles and slings capable of supporting the weight of the engine.
Attach the wire rope to the hangers provided on the engine using a correct sling.
Keep the engine balanced during lifting by considering the engine's center of gravity.
Keep the angle formed by slings attached to hangers within 60°. If the angle exceeds this limit, excessive load could be imposed on the hangers and this could damage the hangers and result in a serious accident.
Attach wire ropes to the hangers after removing the pipe cover and the insulator near the hangers. To prevent wire ropes from contacting the engine, use a cloth or other soft padding.

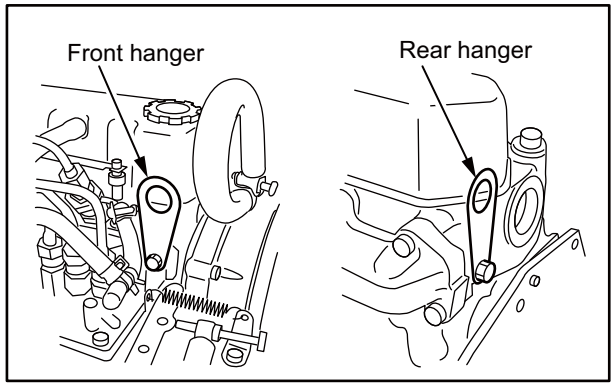
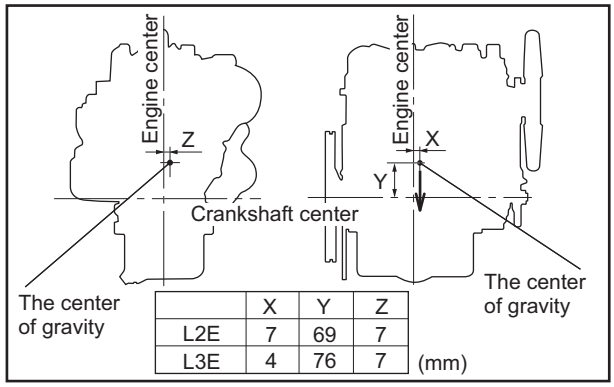


Fig. 10-1 Hangers



	X	Y	Z
L2E	7	69	7
L3E	4	76	7

(mm)

Fig. 10-2 Engine's center of gravity (standard specification)

Chapter 11 TROUBLESHOOTING

General precautions

Contact a dealer of Mitsubishi Heavy Industries, Ltd. for repair service

Repairing a malfunctioning engine may require special equipment or involve potentially dangerous work, except for relatively simple procedures such as the change and addition of fuel, engine oil and coolant. In the event of the engine failure, contact a dealer of Mitsubishi Heavy Industries, Ltd.

Considerations before work

Before troubleshooting, consider possible causes of the problem and try to find out if the same problem has occurred in the past.

Check the parts that may be causing the problem in the most efficient order.

When disassembling a component, pay close attention to the disassembly sequence so that you can reassemble the component in reverse order of disassembly.

Cautions against contamination

Dust and foreign materials are the most common cause of rapid wear of parts.

When disassembling a component, take measures to prevent dust and foreign materials from entering the component being disassembled.

Cautions regarding parts handling

Handle parts carefully.

When replacing parts, use only genuine parts by referring to the parts catalogue.

Work safety

Be sure to use wrenches of the correct size. Using a wrench of the wrong size not only damages nuts but can also cause the personal injury.

Use correct tools and perform work with utmost caution.

Be sure to accurately estimate the weight of the part being dismounted. If the removed part is much heavier than you have estimated, it may fall down during lifting and can result in the damage to the parts or personal injury.

Troubleshooting

The starter does not crank or cranks slowly, resulting in start failure

Table 11-1 The starter does not crank or cranks slowly, resulting in start failure

Cause		Remedies
Electrical system	Faulty wire connection	♦Check the DC fuse. ♦Check wiring connection between battery, starter and starter switch.
	Insufficiently charged battery	♦Check alternator. (Refer to P8-17) ♦Check and adjust belt. (Refer to P8-1)
	Faulty battery	♦Check specific gravity of battery electrolyte. (Refer to P8-16) ♦Charge battery. ♦Change battery.
	Faulty starter or starter relay	♦Consult a dealer of Mitsubishi Heavy Industries, Ltd.
Lubricating system	Oil viscosity too high	♦Use appropriate engine oil. (Refer to P5-1)
	Excessive oil	♦Check amount of engine oil and lubrication system. (Refer to P3-2)
Engine mechanical	Rapid wear of sliding parts, or locked	♦Consult a dealer of Mitsubishi Heavy Industries, Ltd.

The starter cranks, but the engine does not start

Table 11-2 The starter cranks, but the engine does not start

Cause		Remedies
Fuel system	Run out of fuel, blocked pipe	♦Inspect fuel tank, supply fuel, bleed air. (Refer to P8-2) ♦Check fuel pipes, valves.
	Improper fuel property	♦Use appropriate fuel. (Refer to P4-1) ♦Remove dust, water impurities. (Refer to P8-2)
	Fuel leakage in fuel pipes and injection pipes.	♦Check faults and retighten fuel pipes and injection pipes. ♦Consult a dealer of Mitsubishi Heavy Industries, Ltd.
	Clogged fuel filter	♦Inspect and replace fuel filter. (Refer to P8-5) or (Refer to P8-6) ♦Gauze filter - Clean
	Faulty fuel feed pump	♦Consult a dealer of Mitsubishi Heavy Industries, Ltd.
	Faulty fuel injection pump	♦Check the rack movement. ♦Consult a dealer of Mitsubishi Heavy Industries, Ltd.
	Faulty fuel injection nozzle	♦Consult a dealer of Mitsubishi Heavy Industries, Ltd.
Air intake system	Insufficient amount of air	♦Clean, inspect and replace air cleaner element. (Refer to P8-14)
Control system	Faulty governor	♦Fuel control link - Check ♦Consult a dealer of Mitsubishi Heavy Industries, Ltd.
Basic engine	Low compression pressure	♦Consult a dealer of Mitsubishi Heavy Industries, Ltd.

Output decrease

Table 11-3 Output decrease

Cause		Remedies
Fuel system	Improper fuel property	♦Use appropriate fuel. (Refer to P4-1)
	Clogged fuel filter	♦Inspect and replace fuel filter. (Refer to P8-5) or (Refer to P8-6) ♦Gauze filter - Clean
	Faulty fuel feed pump	♦Consult a dealer of Mitsubishi Heavy Industries, Ltd.
	Faulty fuel injection pump	♦Consult a dealer of Mitsubishi Heavy Industries, Ltd.
	Faulty fuel injection nozzle	♦Consult a dealer of Mitsubishi Heavy Industries, Ltd.
	Faulty fuel injection timing	♦Consult a dealer of Mitsubishi Heavy Industries, Ltd.
	Improper amount of injected fuel	♦Check fuel injection pump rack stroke. ♦Consult a dealer of Mitsubishi Heavy Industries, Ltd.
Cooling system	Overheat, overcooled	♦Check fan and radiator. ♦Check control system. ♦Consult a dealer of Mitsubishi Heavy Industries, Ltd.
Inlet and exhaust systems	Insufficient amount of air	♦Clean, inspect and replace air cleaner element. (Refer to P8-15) ♦Check intake air pressure and leakage of intake air. ♦Check intake air temperature and ventilation device. ♦Consult a dealer of Mitsubishi Heavy Industries, Ltd.
	Increase resistance of exhaust air.	♦Check exhaust pipes and silencer. ♦Consult a dealer of Mitsubishi Heavy Industries, Ltd.
Basic engine	Low compression pressure	♦Consult a dealer of Mitsubishi Heavy Industries, Ltd.
	Faulty valve timing	♦Consult a dealer of Mitsubishi Heavy Industries, Ltd.
	Rapid wear of sliding parts	♦Consult a dealer of Mitsubishi Heavy Industries, Ltd.
Control system	Faulty governor control	♦Consult a dealer of Mitsubishi Heavy Industries, Ltd.

Exhaust smoke is white or blue

Table 11-4 Exhaust smoke is white or blue

Cause		Remedies
Fuel system	Improper fuel property	⬧Check cetane index, and use appropriate fuel. (Refer to P4-1)
	Faulty fuel injection timing	⬧Consult a dealer of Mitsubishi Heavy Industries, Ltd.
	Faulty fuel injection nozzle	⬧Consult a dealer of Mitsubishi Heavy Industries, Ltd.
	Uneven fuel injection	⬧Check ignition noise, exhaust smoke temperature. ⬧Consult a dealer of Mitsubishi Heavy Industries, Ltd.
	Incorrect fuel injection timing	⬧Consult a dealer of Mitsubishi Heavy Industries, Ltd.
Lubricating system	Combustion of engine oil	⬧Check amount of engine oil and lubrication system. (Refer to P3-2) ⬧Consult a dealer of Mitsubishi Heavy Industries, Ltd.
Cooling system	Overcooled	⬧Check radiator. (Refer to P8-13) ⬧Check control system. ⬧Thermostat - Inspect ⬧Consult a dealer of Mitsubishi Heavy Industries, Ltd.
Basic engine	Faulty valve timing	⬧Consult a dealer of Mitsubishi Heavy Industries, Ltd.
	Low compression pressure	⬧Consult a dealer of Mitsubishi Heavy Industries, Ltd.

Exhaust smoke is black or charcoal

Table 11-5 Exhaust smoke is black or charcoal

Cause		Remedies
Fuel system	Improper fuel property	⬧Use appropriate fuel. (Refer to P4-1)
	Faulty fuel feed pump	⬧Consult a dealer of Mitsubishi Heavy Industries, Ltd.
	Faulty fuel injection pump	⬧Consult a dealer of Mitsubishi Heavy Industries, Ltd.
	Faulty fuel injection nozzle	⬧Consult a dealer of Mitsubishi Heavy Industries, Ltd.
	Faulty fuel injection timing	⬧Consult a dealer of Mitsubishi Heavy Industries, Ltd.
	Uneven fuel injection	⬧Check exhaust smoke temperature. ⬧Consult a dealer of Mitsubishi Heavy Industries, Ltd.
Inlet and exhaust systems	Insufficient amount of air	⬧Clean, inspect and replace air cleaner element. (Refer to P8-15) ⬧Check intake air pressure and leakage of intake air. ⬧Check intake air temperature and ventilation device. ⬧Consult a dealer of Mitsubishi Heavy Industries, Ltd.
	Increase resistance of exhaust air.	⬧Check exhaust pipes and silencer. ⬧Consult a dealer of Mitsubishi Heavy Industries, Ltd.
Basic engine	Low compression pressure	⬧Consult a dealer of Mitsubishi Heavy Industries, Ltd.
	Faulty valve timing	⬧Consult a dealer of Mitsubishi Heavy Industries, Ltd.
	Rapid wear of sliding parts	⬧Consult a dealer of Mitsubishi Heavy Industries, Ltd.
Control system	Increase in load	⬧Check control system. ⬧Consult a dealer of Mitsubishi Heavy Industries, Ltd.

Fuel consumption is high

Table 11-6 Fuel consumption is high

Cause		Remedies
Fuel system	Faulty fuel injection nozzle	⬧Consult a dealer of Mitsubishi Heavy Industries, Ltd.
	Faulty fuel injection timing	⬧Consult a dealer of Mitsubishi Heavy Industries, Ltd.
	Improper fuel property	⬧Use appropriate fuel. (Refer to P4-1)
	Fuel leakage in fuel pipes and injection pipes.	⬧Check faults and retighten fuel pipes and injection pipes. ⬧Consult a dealer of Mitsubishi Heavy Industries, Ltd.
Cooling system	Overcooled	⬧Check radiator. (Refer to P8-13) ⬧Check control system. ⬧Thermostat - Inspect ⬧Consult a dealer of Mitsubishi Heavy Industries, Ltd.
Inlet and exhaust systems	Insufficient amount of air	⬧Clean, inspect and replace air cleaner element. (Refer to P8-15) ⬧Check intake air pressure and leakage of intake air. ⬧Check intake air temperature and ventilation device. ⬧Consult a dealer of Mitsubishi Heavy Industries, Ltd.
	Increase resistance of exhaust air.	⬧Check exhaust pipes and silencer. ⬧Consult a dealer of Mitsubishi Heavy Industries, Ltd.
Basic engine	Low compression pressure	⬧Consult a dealer of Mitsubishi Heavy Industries, Ltd.
	Faulty valve timing	⬧Consult a dealer of Mitsubishi Heavy Industries, Ltd.
	Rapid wear of sliding parts	⬧Consult a dealer of Mitsubishi Heavy Industries, Ltd.

Engine oil consumption is high

Table 11-7 Engine oil consumption is high

Cause		Remedies
Fuel system	Faulty fuel injection timing	♦Consult a dealer of Mitsubishi Heavy Industries, Ltd.
Lubricating system	Oil leakage to the outside of engine	♦Check oil leakage. ♦Consult a dealer of Mitsubishi Heavy Industries, Ltd.
	Engine oil viscosity too low	♦Use appropriate oil viscosity. (Refer to P5-3)
	Engine oil temperature is high.	♦Check amount of engine oil and lubrication system. (Refer to P3-2) ♦Consult a dealer of Mitsubishi Heavy Industries, Ltd.
Cooling system	Overheating	♦Check radiator. (Refer to P8-13) ♦Check control system. ♦Thermostat - Inspect ♦Consult a dealer of Mitsubishi Heavy Industries, Ltd.
Inlet and exhaust systems	Spread oil to intake part	♦Consult a dealer of Mitsubishi Heavy Industries, Ltd.
	Wear of valve operating system	♦Consult a dealer of Mitsubishi Heavy Industries, Ltd.
Basic engine	Wear of sliding parts	♦Consult a dealer of Mitsubishi Heavy Industries, Ltd.
Control system	Increase in load	♦Check control system. ♦Consult a dealer of Mitsubishi Heavy Industries, Ltd.

Overheating

Table 11-8 Overheating

Cause		Remedies
Cooling system	Low coolant level	•Check coolant leakage. •Check coolant level. (Refer to P3-3)
	Faulty water pump operation	•Consult a dealer of Mitsubishi Heavy Industries, Ltd.
	Faulty thermostat operation	•Consult a dealer of Mitsubishi Heavy Industries, Ltd.
	Faulty radiator operation	•Check and clean radiator and radiator filler cap. (Refer to P8-13)
Control system	Increase in load	•Check fuel injection pump rack stroke. •Check control system. •Consult a dealer of Mitsubishi Heavy Industries, Ltd.
Basic engine	Rapid wear of sliding parts	•Consult a dealer of Mitsubishi Heavy Industries, Ltd.

Low engine oil pressure

Table 11-9 Low engine oil pressure

Cause		Remedies
Lubricating system	Insufficient amount of engine oil	•Check amount of engine oil and lubrication system. (Refer to P3-2)
	Faulty engine oil property (viscosity)	•Analyze oil property. Use appropriate engine oil. (Refer to P5-1)
	Oil temperature too high	•Check coolant system. •Consult a dealer of Mitsubishi Heavy Industries, Ltd.
	Oil filter clogged	•Inspect and replace oil filter. (Refer to P8-7)
	Faulty oil pump operation	•Consult a dealer of Mitsubishi Heavy Industries, Ltd.
	Faulty relief valve operation	•Consult a dealer of Mitsubishi Heavy Industries, Ltd.
Control system	Faulty pressure unit operation	•Check control system and wire. •Consult a dealer of Mitsubishi Heavy Industries, Ltd.
Basic engine	Increase in load	•Check control system. •Consult a dealer of Mitsubishi Heavy Industries, Ltd.
	Rapid wear of sliding parts	•Consult a dealer of Mitsubishi Heavy Industries, Ltd.
	Increase clearance of sliding part.	•Consult a dealer of Mitsubishi Heavy Industries, Ltd.

When fuel has run out

When fuel runs out while engine is running and the engine has stopped, restart the engine as described below.

1. Return the starter switch to the "OFF" position.
2. Add fuel to the fuel tank.
   For filling fuel tank, refer to "Fuel tank oil level - Check" (3-2).
3. Bleed air from the fuel system.
   For bleeding fuel system, refer to "Fuel system - Bleed air" (8-3).
4. Restart the engine.
   For starting the engine, refer to "Starting" (3-4).

Chapter 12 MAIN SPECIFICATIONS

Main specifications

Table 12-1 Main specifications

Item		Specifications	
Engine model		L2E	L3E
Type		Vertical water cooled, 4 stroke cycle diesel engine	
No. of cylinders - arrangement		2 cylinder in-line	3 cylinder in-line
Cylinder bore × stroke		φ76 × 70 mm [2.99 x 2.76 in.]	φ76 × 70 mm [2.99 x 2.76 in.]
Displacement		0.635 L [0.2 U.S. gal.]	0.952 L [0.3 U.S. gal.]
Conbustion type		Swirl chamber	
Compression ratio		23 : 1	
Firing order		1 - 2	1 - 3 - 2
Direction of rotation		Counterclockwise as viewed from flywheel side	
Dimensions (L x W x H)		417 × 418 × 500 mm [16.42 x 16.46 x 19.69 in.]	505 × 418 × 500 mm [19.88 x 16.34 x 19.69 in.]
Dry weight		Approx. 61 kg [134 lb.]	Approx. 75 kg [134 lb.]
Fuel		Diesel fuel (equivalent for JIS K 2204)	
Fuel injection pump		PER type	
Fuel filter		Cartridge or cock type paper-element	
Fuel injection nozzle		Throttle type	
Initial fuel injection pressure		13.73 MPa {140 kgf/cm^2} [1991 psi]	
Lubrication method		Forced circulation (pressure feed by oil pump)	
Lubrication oil		Class CF or CH-4 oil (API service classification)	
Engine oil capacity	Standard Oil pan	Whole engine: Approx. 2.5 L [0.7 U.S. gal.], Oil pan Max/Min: Approx. 2.0 L [0.5 U.S. gal.]/Approx. 1.3 L [0.3 U.S. gal.]	Whole engine: Approx. 3.6 L [1.0 U.S. gal.], Oil pan Max/Min: Approx. 3.1 L [0.8 U.S. gal.]/Approx. 1.8 L [0.5 U.S. gal.]
	Deep type oil pan	-	Whole engine: Approx. 4.7 L [1.2 U.S. gal.], Oil pan Max/Min: Approx. 4.2 L [1.1 U.S. gal.]/Approx. 3.0 L [0.8 U.S. gal.]
Oil filter		Cartridge type paper-element	
Cooling method		Forced water cooling by centrifugal pump	
Coolant capacity		Approx. 1.2 L [0.3 U.S. gal.] (basic engine only)	Approx. 1.8 L [0.5 U.S. gal.] (basic engine only)
Starting system		Electric motor starting	
Starter		DC 12 V - 1.2 kW	DC 12 V - 1.7 kW
Alternator		DC 12 V - 40 A	

Note: (a) The specifications above are subject to change without prior notice.

(b) The specifications above are described for the standard model. The special model specifications may differ from these of standard model.

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10.3. Appendix C – Alternator user and maintenance manual

Manuel d’utilisation et d’entretien
User guide and maintenance manual
Manual de uso y mantenimiento
Betriebs- und Wartungsanleitung
Manuale d’uso e di manutenzione

MECC ALTE

Alternateur
Alternator
Alternador
Generator
Alternatori

ECP3

Rév. 01
01/04/2011

33522918601_1_1

mecc alte

Member of CISQ Federation
RINA
ISO 9001:2008
Sistema Qualità Certificato

I

ALTERNATORI AUTOREGOLATI SERIE ECP3

ISTRUZIONI PER L'USO E LA MANUTENZIONE

GB

SELF- REGULATING ALTERNATORS SERIES ECP3

OPERATING AND MAINTENANCE INSTRUCTIONS

F

ALTERNATEURS AUTO - REGULES SERIE ECP3

MANUEL D'INSTRUCTION ET DE MAINTENANCE

D

SELBSTREGELNDER GENERATOR SERIE ECP3

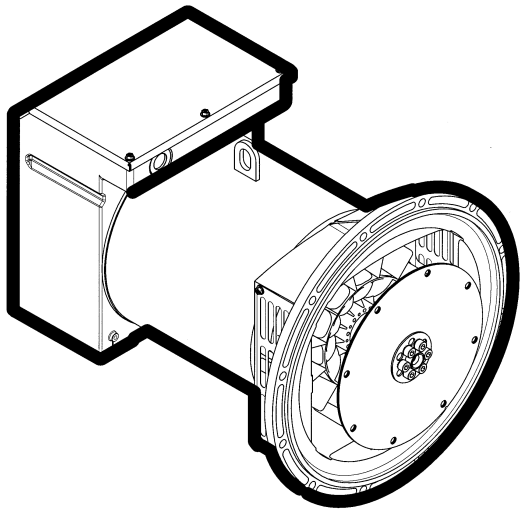
BETRIEBS-UND WARTUNGSANLEITUNG

ES

ALTERNADORES AUTOREGULADOS SERIE ECP3

INSTRUCCIONES PARA USO Y MANTENIMIENTO

ECP3

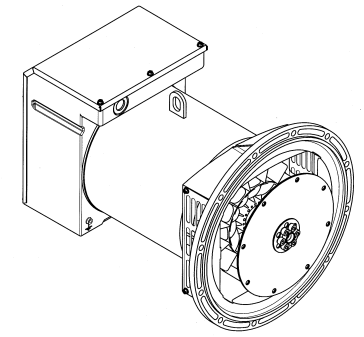


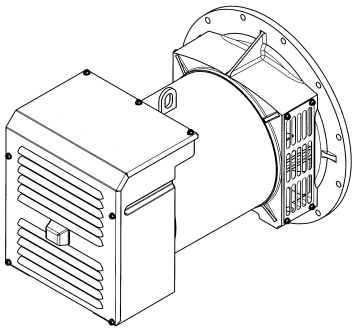
CE

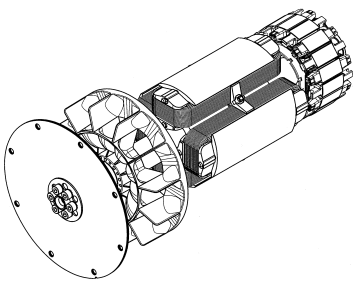
c UL us
INSULATION SYSTEM

DESCRIZIONE MACCHINA

I generatori della serie ECP3 sono autoregolati, brushless a 2 e 4 poli.
Hanno induttore rotante provvisto di gabbia di smorzamento (generatori a 2 poli) e indotto fisso a cave inclinate.
Gli avvolgimenti sono a passo raccorciato per ridurre il contenuto armonico.
I generatori sono costruiti in conformità alle direttive 2006/42, 2006/95, 2004/108 e relative modifiche, alle norme CEI 2-3, EN 60034-1, IEC 34-1, VDE 0530, BS4999 - 5000.
Le prove per la verifica della compatibilita' elettromagnetica sono state eseguite nelle condizioni prescritte dalle norme, con il neutro collegato a terra. Esecuzioni in accordo ad altre specifiche possono essere eseguite su richiesta del cliente.
La struttura meccanica, sempre molto robusta, consente un facile accesso ai collegamenti e permette di eseguire le verifiche nelle diverse parti altrettanto facilmente.
La carcassa e' realizzata in acciaio, gli scudi in alluminio pressofuso, l'albero in acciaio C45 con ventola calettata.
Il grado di protezione e' IP23 (a richiesta e' possibile realizzare un grado di protezione superiore).
Gli isolamenti sono eseguiti in classe H, le impregnazioni con resine epossidiche per le parti rotanti e trattamenti sottovuoto per le parti di piu' elevata tensione, quali gli statori (a richiesta trattamenti speciali). Nel campo dei radio disturbi, la produzione di serie soddisfa la norma EN61000-6-3, EN61000-6-1.







MACHINE DESCRIPTION

ECP3 2 and 4 pole alternators are brushless, self regulating and incorporate a rotating inductor with damper cage (2 pole generators) and a fixed stator with skewed slots. The stator windings have a shortened pitch to reduce the harmonic content of the output waveform.
The alternators are made in compliance with the 2006/42, 2006/95, 2004/108 directives and their amendments, and the CEI 2-3, EN60034-1, IEC34-1, VDE0530, BS 4999-5000 regulations.
Tests to verify the electromagnetic compability have been carried out in the foreseen conditions by the standards with the neutral connected to the earth.
On customer's request alternators can be manufactured according to different specifications.
The robust mechanical construction gives good access to the generator output connections, and allows the user to inspect the various components with ease. The casing is made of steel, the shields of cast iron, and the shaft of C45 steel and it has a keyed fan.
The mechanical protection level meets standard IP23 (upon request higher levels of protection can be supplied).
Insulation materials meet class H requirements, and all rotating components are epossy resins impregnated, higher voltage parts, such as the stators, are vacuum-treated (special treatments are available on request).Radio interference suppression meets the requirements of EN61000-6-3, EN61000-6-1 regulations.

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CENTRES D'ASSISTANCE	SERVICE-CENTER	CENTROS DE ASISTENCIA

DESCRIPTION DE LA MACHINE

Les alternateurs de série ECP3 sont auto-régulés, sans bague ni balai à 2 et 4 pôles.
Ils sont à inducteurs tournants avec cage d'amortissement (série 2 pôles) et stator à encoches inclinées.
Les bobinages sont à pas raccourcis afin de réduire le taux d'harmoniques.
Les alternateurs sont construits en conformité aux directives CEE 2006/42, 2006/95, 2004/108 et leurs modifications, aux normes CEI 2-3, EN 60034-1, IEC 34-1, VDE 0530, BS4999-5000.
Les exécutions en accord avec d'autres spécifications peuvent être suivies sur demande du client.
La structure mécanique, toujours trés robuste, permet un accés facile aux raccordements et permet les vérifications des autres parties trés facilement.
La carcasse est en acier, les flasques en fonte, l'arbre est en acier C45 avec ventilateur claveté.
Le grade de protection est IP23 (sur demande, il est possible de réaliser un grade de protection supérieur).
Les isolements sont de la classe H, les imprégnations en vernis epoxy pour les parties tournantes et les parties plus élevées en tension comme les stators sont imprégnées sous vide et pression (sur demande, nous pouvons exécuter des traitements spéciaux). Dans le domaine des anti-parasitages, la production de série satisfait la norme EN61000-6-3, EN61000-6-1.

MASCHINEN BESCHREIBUNG

Die 2 und 4 poligen Generatoren der Serie ECP3 sind selbstregelnd und brushless.
Sie besitzen eine mit einem Dämpfungskäfig ausgestattete, rotierende Drossel und einen fest eingebauten Anker mit schrägen Nuten. Die Wicklungen sind im Schritt Verkurzt, um den harmonischen Gehalt zu reduzieren. Die Generatoren sind in Ubereinstimmung mit den Bestimmungen 2006/42, sowie mit 2006/95 und 2004/108 und deren entsprechenden Änderung, und den Normen CEI 2-3, EN 60034-1, IEC 34-1, VDE 0530, BS4999-5000. Ausführungen, die anderen als den angegebenen Spezifikationen entsprechen sollen, können auf Kundenanfrage hergestellt werden.
Die mechanische, sehr widerstandsfähige, robuste Struktur ermöglicht leichten Zugang zu den Verbindungen und Anschlüssen und erlaubt eine ebenso leichte Kontrolle der verschiedenen Teile. Das Gehäuse besteht aus Stahl, die (Schutz) schilde aus Gußeisen, die Welle aus C45-Stahl mit aufgezogenem Lüfterrad. Die Schutzklasse ist IP23 (auf Anfrage kann auch eine hohere Schutzklasse realisiert werden). Die Isolierungen entsprechen der Klasse H, die Imprägnierungen erfolgen mit Epoxidharzen für die drehbaren Teile, bzw, durch Vakuumverfahren für die Teile, die erhöhter Spannung ausgesetzt sind, wie z.B. Ständer (auf Anfrage auch Sonderverfahren möglich). Bezüglich der Funkstörungen, entspricht die Produktionsserie der EN61000-6-3, EN61000-6-1. Normen.

DESCRIPCION MAQUINA

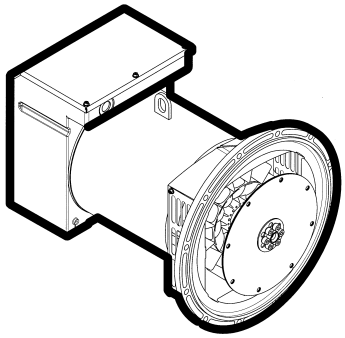
Los generadores serie ECP3 son autoregulados, brushless a 2 y 4 polos.
Possen inductor rotante con jaula de atenuación e inducido fijo con canaletas inclinadas.
Los bobinados son a paso recortado para reducir el contenido armónico.
Los generadores están construidos en conformidad a las directivas 2006/42, 2006/95, 2004/108 y sus modÍficas, normas CEI 2-3, EN 60034-1, IEC 34-1, VDE 0530, BS4999-5000.
Construcciones de acuerdo con otras especÍficas podrán ser realizadas bajo pedido del cliente.
La estructura mecánica, siempre de gran consistencia, permite un fácil acceso a los conexionados, como asÍ también un control de las diferentes partes de la misma.
La carcasa está construida en acero, las tapas en fundición, el eje en acero C45 con ventilador acoplado.
El grado de protección es IP23 (a pedido es posible realizar un grado de protecciÓn superior).
Los aislantes son en clase H, las partes rotantes son impregnadas con resinas epoxÍdicas con tratamiento en vacÍo para las partes que trabajan a mayor tensión, como son los estatores (a pedido tratamientos especiales). En el campo de la radio-interferencia, la produccion de serie satisface las normas EN61000-6-3, EN61000-6-1.

PREMESSA

I generatori della serie ECP3, rispondono alle direttive CEE 2006/42, 2009/95, 2004/108 e loro modifiche; pertanto non presentano pericolo per l'operatore, se installati, usati, manutenuti secondo le istruzioni fornite dalla Mecc Alte e a condizione che i dispositivi di sicurezza siano tenuti in perfetta efficienza.

Per questa ragione occorre attenersi scrupolosamente alle istruzioni indicate in questo manuale.

E' vietata qualsiasi riproduzione di questo manuale.



INTRODUCTION

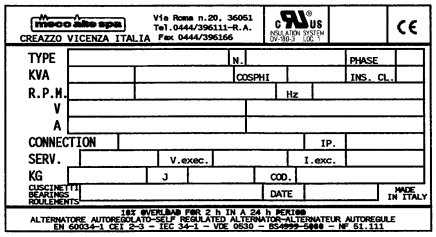
The ECP3 alternators comply with the EEC directives 2006/42, 2009/95, 2004/108 and their amendments; therefore they pose no danger to the operator if they are installed, used and maintained according to the instructions given by Mecc Alte and provided the safety devices are kept in perfect working conditions.

Therefore a strict observance of these instructions is required.

Any reproduction of this manual is forbidden.

IDENTIFICAZIONE MACCHINA

Per qualsiasi comunicazione con la Mecc Alte o con i centri di assistenza autorizzati, citare sempre il tipo e il codice del generatore.

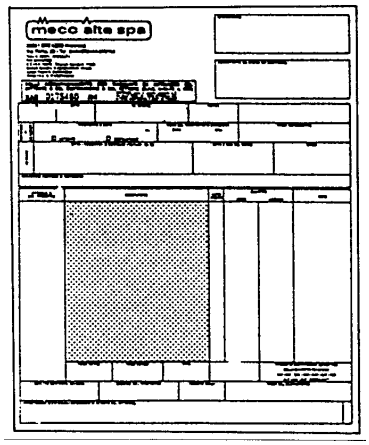


MACHINE IDENTIFICATION

Always indicate the generator type and code when contacting Mecc Alte or the authorized after-sales service centres.

VERIFICA ALLA CONSEGNA

Alla consegna del generatore controllare con la bolla di accompagnamento che non ci siano danni o parti mancanti; nel caso informare immediatamente lo spedizionere, l'assicurazione, il rivenditore o la Mecc Alte.



INSPECTION ON DELIVERY

When the alternator is delivered, check that unit conforms with the delivery note and ensure that there are no damaged or defective parts; should there be any, please inform the forwarding agent, the insurance company, the seller or Mecc Alte immediately.

PRESCRIZIONI DI SICUREZZA

Prima di qualsiasi intervento di pulizia, lubrificazione o manutenzione il motore primario a cui e' collegato il generatore non deve essere in funzione, ma fermo e isolato dalle sue fonti di energia.

Per fermare il generatore occorre seguire scrupolosamente la procedura di arresto del sistema di trascinamento; il generatore non e' previsto di Stop/Emergenza, ma si arresta istantaneamente in relazione al sistema di arresto predisposto dall'installatore.

SAFETY REQUIREMENTS

Before any cleaning, lubrication or maintenance operation, ensure that the generator is stationary and disconnected from the power supply.

When stopping the generator, ensure the compliance with the procedures for stopping the prime mover.
The generator, in fact, has no Emergency Stop, but is controlled by the device arranged by the installer.

INTRODUCTION

Les alternateurs de la série ECP3 répondent aux directives CEE 2006/42, 2009/95, 2004/108 et leurs modifications. Toutefois, ils ne présentent aucun danger pour l'utilisateur si l'installation, l'utilisation, les manutentions suivent les instructions fournies par Mecc Alte et à condition que les dispositifs de protection soient tenus en parfait état de marche.

Pour cette raison, il faut se conformer scrupuleusement aux instructions indiquées dans ce manuel.

Il est interdit de reproduire quoique ce soit de ce manuel.

VORWORT

Die Generatoren entsprechen den ECP3 estimmugen 2006/42, 2009/95, 2004/108 und deren entsprechenden Änderungen; aus diesem Grunde stellen sie keinerlei Gefahr für den Bediener dar, sofern sie in Übereinstimmung mit den von Mecc Alte vorgeschriebenen Anweisungen installiert, verwendet und gewartet werden und unter der Bedingung, daß die Schutzvorrichtungen stets in einem voll funktionstüchtigen Zustand gehalten werden.

Aus den oben genannten Grunden ist es erforderlich, sich streng an die in diesem Handbuch angegebenen Anweisungen zu halten.

Jegliche Form der Verbreitung und Reproduktion dieses Handbuchs ist verboten.

ACLARACION

Los generadores de la serie ECP3, responden a las directivas CEE 2006/42, 2009/95, 2004/108 y a sus respectivas modificaciones, por lo tanto no se presentan peligros para el operador, si instalados, usados y mantenidos según las instrucciones dadas por la MECC ALTE y con la condición que los dispositivos de seguridad sean mantenidos en una condición de perfecta eficiencia.

Por esta razón es necesario adecuarse a la perfección a las instrucciónes indicadas en este manual.

Se prohibe la reproducción total o parcial de este manual.

IDENTIFICATION DE LA MACHINE

Pour toute demande auprès de Mecc Alte ou auprès des centres agrées autorisés, citer toujours le type et le code de l'alternateur.

MASCHINEN IDENTIFIKATION

Für Mitteilungen an Mecc Alte oder an die autorisierten Service-Zentralen, ist der Generatorentyp und der Code anzugeben.

IDENTIFICACION MAQUINA

Para cualquier tipo de comunicación con la Mecc Alte o con los centros de reparación autorizados, indicar siempre el tipo y el código del generador.

VERIFICATION A LA LIVRAISON

A la livraison de l'alternateur, contrôler avec le bon de livraison qu'il n'y a aucun dommage ou pièces manquantes; si tel est le cas, informer immédiatement l'expéditeur, l'assureur, le revendeur ou Mecc Alte.

ÜBERPRÜFUNG BEI LIEFERUNG

Bei Lieferung des Generators ist anhand des Lieferscheins dieser auf Schäden, bzw. auf fehlende Teile hin zu überprüfen; in diesem Falle sind der Spediteur, die Versicherung, der Wiederverkäufer oder Mecc Alte umgehend darüber zu informieren.

CONTROL A LA ENTREGA

A la entraga del generador, controlar junto con la factura que no existan defectos o piezas faltantes; en caso contrario informar inmediatamente la empresa de transportes, la compañia de seguros, el revendedor o la Mecc Alte.

PRESCRIPTIONS DE SECURITE

Avant une quelconque intervention de nettoyage, lubrification ou manutention, le moteur avec lequel est accouplé l'alternateur ne doit pas être en fonctionnement mais isolé de ses sources d'énergie.

Pour coupé un alternateur, il faut suivre scrupuleusement la procédure d'arrêt du système d'entraînement, l'alternateur n'est pas pourvu d'arrêt d'urgence, mais il s'arrête instantanément en fonction du système d'arrêt prévu par l'installateur.

SICHERHEITS VORSCHRIFTEN

Vor jedem Eingriff für Reinigung, Schmierung oder Wartung, muß der Hauptmotor, an den der Generator angeschlossen ist, außer Betrieb gesetzt werden; er muß stillstehen und von seinen Energiequellen isoliert werden.

Um dem Generator zu stoppen, ist es erforderlich genauestens das Abstell-verfahren für das Zugsystem einzuhalten; der Generator ist nicht mit einem Sicherheits-abschalter ("NOTAUS") versehen, sondern er stoppt unmittelbar in Abhängigkeit von dem Abschaltsystem, das vom Hersteller vorgesehen ist.

PRECAUCIONES DE SEGURIDAD

Antes de cualquier tipo de operación de limpieza, lubrificación o mantenimiento, el motor primario al cual está acoplado el generador no debe estar en funcionamiento, el mismo deberá estar inmóvil y aislado de sus fuentes de energía.

Para detener el generador es necesario seguir escrupolosamente los procedimientos de detención del sistema de arrastre; el generador no posee un Stop/Emergencia, pués el mismo se detiene instantaneamente en función del sistema de stop preparado por el instalador.

PRESCRIZIONI DI SICUREZZA

Durante la consultazione del presente manuale d'uso e manutenzione troverete alcuni simboli; questi hanno un preciso significato.

SIMBOLOGIA CONVENZIONALE E SUA DEFINIZIONE

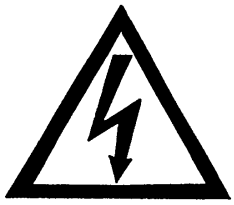
IMPORTANTE
Segnala al personale interessato che l'operazione descritta presenta un rischio che può avere come conseguenza un danno alla macchina, se non effettuata nel rispetto delle normative di sicurezza.

ACCORTEZZA
Segnala al personale interessato che l'operazione descritta presenta un rischio che può avere come conseguenza un danno alla macchina e/o lesioni al personale stesso, se non effettuata nel rispetto delle normative di sicurezza.

AVVERTIMENTO
Segnala al personale interessato che l'operazione descritta presenta un rischio che può avere come conseguenza lesioni gravi o morte, se non effettuata nel rispetto delle normative di sicurezza.

PERICOLO
Segnala al personale interessato che l'operazione descritta presenta un rischio immediato che ha come conseguenza lesioni gravi o morte, se non effettuata nel rispetto delle normative di sicurezza.

IMPORTANTE
IMPORTANT
WICHTIG



SAFETY REQUIREMENTS

Symbols having specific meanings have been used throughout this instruction and maintenance manual.

CONVENTIONAL SYMBOLS AND SYMBOL DESCRIPTION

IMPORTANT
This symbol warns the personnel concerned that the described operation may cause damages to the machine if it is not carried out according to the safety standards.

CAUTION
This symbol warns the personnel concerned that the described operation may cause damages to the machine and/or injures to the personnel if it is not carried out according to the safety standards.

WARNING
This symbol warns the personnel concerned that the described operation may cause serious injuries or death to the personnel if it is not carried out according to the safety standards.

DANGER
This symbol warns the personnel concerned that the described operation may immediately cause serious injuries or death to the personnel if it is not carried out according to the safety standards.

PRESCRIPTIONS DE SECURITE

Pendant la consultation du présent manuel d'instruction et de mantenance, vous trouverez quelques symboles; ces ont une précis signification.

SIMBOLIQUE CONVENTIONNEL ET DEFINITION

IMPORTANT
Signe au personnel interessé que l'operation décrite presente, une risque qu'il peut avoir comme conséquence une domage au la machine, si n'effectué pas dans le respect des normes de securité.

ADRESSE
Signe au personnel interessé que l'operation décrite presente, une risque qu'il peut avoir comme conséquence une domage au la machine et/ou lésiones graves au personnel même, si n'effectué pas dans le respect des normes de securité.

AVVERTISSEMENT
Signe au personnel intéressé que l'exécution décrite présente une risque qu'il peut avoir comme consèquence une domage ou lésiones graves ou mort, si n'effectué pas dans le respect des normes de securité.

DANGER
Signe au personnel intéressé que l'exécution décrite présente une risque immédiat qu'il a comme consèquence une domage ou lésiones graves ou mort, si n'effectué pas dans le respect des normes de securité.

SICHERHEITS VORSCRIFTEN

Beim Nachschlagen in diesem Handbuch zur Bedienung und Wartung sind hier und da einige Symbole zu finden; diese haben eine bestimmte Bedeutung.

ALLGEMEIN ÜBLICHE SYMBOLIK UND IHRE DEFINITION

WICHTIG
Signalisieren Sie dem zuständigen Personal, daß die beschriebene Arbeit ein Risiko darstellt, welches Schäden an der Maschine zur Folge haben kann; falls die Arbeit nicht unter voller Beachtung der Sicherheitsvorschriften erfolgt.

HINWEIS
Signalisieren Sie dem zuständigen Personal, daß die beschriebene Arbeit ein Risiko darstellt, welches Schäden an der Maschine und/oder Verletzungen des Personales selbst zur Folge haben kann; falls die Arbeit nicht unter voller Beachtung der Sicherheitsvorschriften erfolgt.

WARNHINWEIS
Dieses Symbol warnt das Personal, daß die hier beschriebene Operation eine eventuelle Gefahr darstellt, die ernste Verletzungen oder den Tod als Konsequenz zur Folge haben kann, wenn auszuführende Arbeit nicht nach den vorgeschriebenen Sicherheitsnormen durchgeführt wird.

GEFAHR
Dieses Symbol warnt das Personal, daß die hier beschriebene Operation eine sofortige Gefahr darstellt, die ernste Verletzungen oder den Tod als Konsequenz zur Folge haben kann, wenn auszuführende Arbeit nicht nach den vorgeschriebenen Sicherheitsnormen durchgeführt wird.

PRECAUCIONES DE SEGURIDAD

Durante la consultaciòn de el presente manual uso y manutention, aquìy allì hallerà algunes simbolos; Esos ont une preciso significado.

SIMBOLOGIA CONVENCIONAL Y SUAS DEFINICION

IMPORTANTE
Signa a el personal interesado que el operation descrita presenta, une riesgo que puede hacer como consecuencia une daño a la maquina, se no efectuada en el respecto de les normatives de securidad.

AGUDEZA
Signa a el personal interesado que el operation descrita presenta, une riesgo que puede hacer como consecuencia une daño a la maquina y/ou lésiones a el persoanl mismo, se no efectuada en el respecto de les normatives de securidad.

ADVERTIMIENTO
Señales a los personales interesado que la operación descrita introduce un riesgo que él pueda tener como lesiones o muertos serios de la consecuencia, si no está realizado en el respecto de lles normatives de securidad.

PELIGRO
Señales a los personales interesado que la operación descrita introduce un riesgo inmediato que tenga como lesiones o muertos seriosn de la consecuencia, si no está realizado en el respecto de les normatives de securidad.

PRESCRIZIONI DI SICUREZZA

ADDETTO ALLA MOVIMENTAZIONE
Identifica il tipo di operatore a cui è riservato l'intervento trattato.
Questa qualifica presuppone una piena conoscenza e comprensione delle informazioni contenute nel manuale d'uso del costruttore oltre che competenze specifiche dei mezzi di sollevamento, dei metodi e delle caratteristiche d'imbragatura e della movimentazione in sicurezza.

MANUTENTORE MECCANICO
Identifica il tipo di operatore a cui è riservato l'intervento trattato.
Questa qualifica presuppone una piena conoscenza e comprensione delle informazioni contenute nel manuale d'uso del costruttore oltre che competenza specifica per effettuare gli interventi di installazione, regolazione, manutenzione, pulizia e/o riparazione.

MANUTENTORE ELETTRICO
Identifica il tipo di operatore a cui è riservato l'intervento trattato.
Questa qualifica presuppone una piena conoscenza e comprensione delle informa-zioni contenute nel manuale d'uso del costruttore oltre che competenza specifica per gli interventi di natura elettrica di collegamento, regolazione, manutenzione e/o riparazione.
E' in grado di operare in presenza di tensione all'interno di armadi e quadri elettrici.

Nel caso di interventi straordinari e su autorizzazione scritta del servizio assistenza rivolgersi ai centri autorizzati Mecc Alte.

SAFETY REQUIREMENTS

HANDLER
This symbol identifies the type of operator in charge of the operation described.
This qualification requires a complete knowledge and understanding of the information contained in the manufacturer's instruction manual as well as specific skills about the hoisting means, slinging methods and features and safe handling procedures.

MECHANICAL SERVICE MAN
This symbol identifies the type of operator in charge of the operation described.
This qualification requires a complete knowledge and understanding of the information contained in the manufacturer's instruction manual as well as specific skills necessary to perform installation, adjustment, maintenance, cleaning and/or repair operations.

ELECTRICAL SERVICE MAN
This symbol identifies the type of operator in charge of the operation described.
This qualification requires a complete knowledge and understanding of the information contained in the manufacturer's instruction manual as well as specific skills necessary to perform electrical operations such as connections, adjustment, maintenance and/or repair.
The electrical service man must be able to work even in case electrical cabinets and panels are live.

In case of exceptional operations and upon written request of servicing operations please apply to Mecc Alte authorized centers.

PRESCRIPTIONS DE SECURITE	SICHERHEITS VORSCRIFTEN	PRECAUCIONES DE SEGURIDAD
PRÉPOSÉ AU LA MOUVEMENTATION Identifié le type de operateur dont il est reservé l'intervention traité. Cette qualification suppose une pleine connaisance et compréhension des renseignement contenu dans le manuel d'instruction du constructeur plus loin que compétences spécifiques de moyens du soulévement, des méthodes et des caractéristiques d'éligage et du mouvementation en sécurité.	**TRANSPORTBEAUFTRAGTER** Identifiziert den Personentyp, der mit dem Transport bzw. der Bewegung der Maschine beauftragt ist. Diese Qualifikation setzt eine volle Kenntnis und Verständnis der im Bedienungshandbuch des Herstellers enthaltenen Informationen voraus, zusätzlich zu den spezifischen Kompetenzen, was die Transport- und Anhebemittel, die Eigenschaften der Transportschlingen und der sicheren Bewegung betrifft.	**APLICADO A LA MOVIMENTATION** Identifica el tipo de operador la cual es reservado el intervenciòn tartado. Esta calificaciòn presupone una llena conocimiento y comprensiòn des informa-ciònes contenidos en el manual para uso de el constructor de la parte de allà que competencia especificaciòn des medios de leventamiento, des métodos y des caracterìsticas de barrachera y de movimentaciòn en securidad.
PRÉPOSÉ MÉCANIQUE Identifié le type de operateur dont il est reservé l'intervention traité. Cette qualification suppose une pleine connaisance et compréhension des renseignement contenu dans le manuel d'instruction du constructeur plus loin que compétences spécifiques pour effectuer les interventiones d'installation, regulation, manutention, nettoyage et/ou réparation.	**WARTUNGSFACHMANN MECHANIK** Identifiziert den Personentyp, der mit der mechanischen Wartung beauftragt ist. Diese Qualifikation setzt eine volle Kenntnis und Verständnis der im Bedienungshandbuch des Herstellers enthaltenen Informationen voraus, zusätzlich zu den spezifischen Kompetenzen, was die Aufstellungs-, Einstellungs-, Wartungs-, Reinigungs- und/oder Reparaturarbeiten betrifft.	**MANUTENDOR MECANICO** Identifica el tipo de operador la cual es reservado el intervenciòn tartado. Esta calificaciòn presupone una llena conocimiento y comprensiòn des informaciònes contenidos en el manual para uso de el constructor de la parte de allà que competencia especificaciòn por efectuar los intervenciònes de instalaciòn, regulaciòn, manutenciòn, limpieza y/ou reparaciòn.
PRÉPOSÉ ÉLECTRIQUE Identifié le type de operateur dont il est reservé l'intervention traité. Cette qualification suppose une pleine connaisance et compréhension des renseignement contenu dans le manuel d'instruction du constructeur plus loin que compétences spécifiquede nature électrique de liaison, regulation, manutention, et/ou réparation. **Il est en degré de agir en présence de ension à l'interieur des armoires et tableaux électriques.**	**WARTUNGSFACHMANN ELEKTRIK** Identifiziert den Personentyp, der mit der elektrischen Wartung beauftragt ist. Diese Qualifikation setzt eine volle Kenntnis und Verständnis der im Bedienungshandbuch des Herstellers enthal-tenen Informationen voraus, zusätzlich zu den spezifischen Kompetenzen, was die Eingriffe elektrischer Natur betrifft, wie: Anschlüsse, Einstellung, Wartung und/oder Reparaturen. **Er ist in der Lage, auch Arbeiten im Inneren von Schaltschränken und –tafeln auszuführen, wenn diese unter Spannung stehen.**	**MANUTENDOR ELÉCTRICO** Identifica el tipo de operador la cual es reservado el intervenciòn tartado. Esta calificaciòn presupone una llena conocimiento y comprensiòn des informaciònes contenidos en el manual para uso de el constructor de la parte de allà que competencia especificaciòn por efectuar los intervenciònes de natura electrica de coligamiento, regulaciòn, manutenciòn, y/ou reparaciòn. **Es en grado de trabajar en presencia de tension a los interno des armarios y cuadros electricos.**
En cas des interventiones extraordinaires et sur autorisation écrite du service et assistance s'addreser aux centres autorisés Mecc Alte.	Im Fall von außergewöhnlichen Eingriffen und auf schriftliche Bestätigung des techn. Services sich an die autorisierten Kundendienstzentren von Mecc Alte wenden.	En caso de intervenciçnes extraordinarios y su autorizaciòn escritura du servicio assistencia revolverse a los centros autorizado Mecc Alte.

PRESCRIZIONI DI SICUREZZA

Al momento dell'installazione le norme prevedono che il generatore sia collegato a terra.
Per questa ragione assicurarsi che l'impianto di messa a terra sia efficiente ed in conformita' con le direttive del paese dove il generatore sara' installato.

ATTENZIONE
L'INSTALLATORE FINALE E' RESPONSABILE DELLA PREDISPOSIZIONE DI TUTTE LE PROTEZIONI (DISPOSITIVI DI SEZIONAMENTO, PROTEZIONI CONTRO I CONTATTI DIRETTI E INDIRETTI, PROTEZIONI CONTRO SOVRACORRENTI E SOVRATENSIONI, ARRESTO DI EMERGENZA ECC.) NECESSARIE PER RENDERE CONFORME IL MACCHINARIO E L'IMPIANTO UTILIZZATORE, ALLE VIGENTI NORME DI SICUREZZA INTERNAZIONALI/ EUROPEE.

Per la movimentazione dei generatori disimballati usare sempre ed esclusivamente gli appositi golfari.
Utilizzare funi di portata adeguata senza sollevare il generatore troppo dal pavimento (max 30 cm.)

Alla fine del periodo di vita della macchina, rivolgersi alle agenzie di smaltimento materiali ferrosi e non disperderne parti nell'ambiente.

Gli addetti all'installazione, conduzione e manutenzione del generatore devono essere tecnici adeguatamente qualificati e che conoscano le caratteristiche dei generatori.

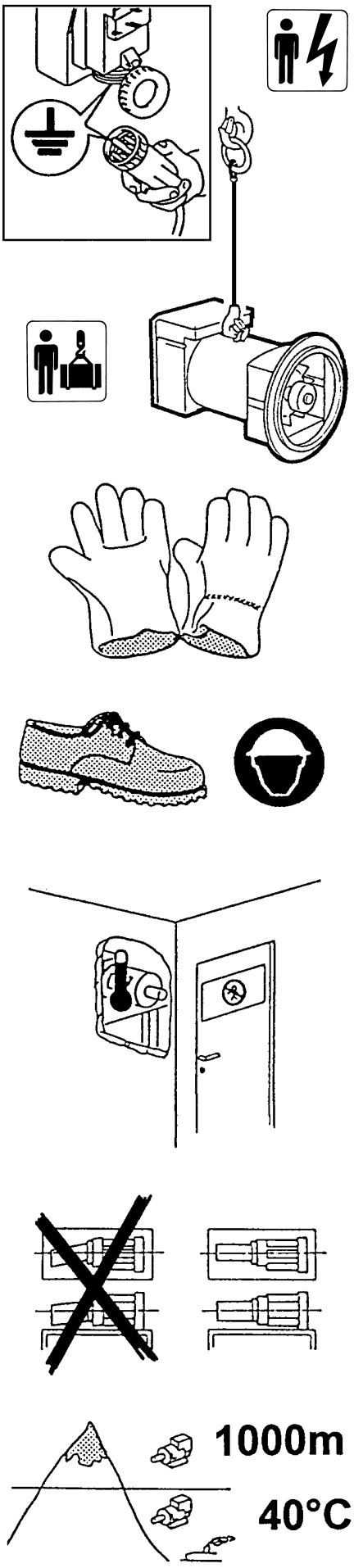
Le persone addette alla movimentazione devono sempre indossare guanti da lavoro e scarpe antinfortunistiche.
Qualora il generatore o l'intero impianto debba essere sollevato da terra, gli operatori devono usare un casco protettivo.

Il generatore va installato in un ambiente aerato. Se non c'e' sufficiente aria oltre al mal funzionamento esiste pericolo di surriscaldamento. Sulla porta di ingresso del locale ci deve essere un cartello indicante il divieto di accesso alle persone non autorizzate.

Assicurarsi che il basamento del generatore e del motore primario sia calcolato per sopportarne il peso e tutti gli eventuali sforzi dovuti al funzionamento.

E' responsabilità dell'installatore il corretto accoppiamento del generatore al motore, mettendo in atto tutti quegli accorgimenti necessari per garantire il corretto funzionamento del generatore ed evitare anomale sollecitazioni che possono danneggiare il generatore (come vibrazioni, disallineamenti, strane sollecitazioni etc).

La macchina è stata progettata per garantire la potenza nominale in ambienti con temperatura massima di 40 °C e altitudine inferiore ai 1000 metri (EN60034-1), se non diversamente indicato. Per condizioni diverse vedere il catalogo commerciale (depliant).



SAFETY REQUIREMENTS

Before installing the generator, arrangements must be made to earth the machine in compliance with any relevant electrical regulations.This is the reason why you must make sure that the grounding system is in good conditions and in compliance with the regulations of the country where the generator will be installed.

CAUTION
THE FINAL INSTALLER IS RESPONSIBLE FOR THE INSTALLATION OF ALL THE PROTECTIONS (SECTIONING DEVICES, PROTECTIONS AGAINST DIRECT AND INDIRECT CONTACTS, OVERCURRENT AND OVERVOLTAGE PROTECTIONS, EMERGENCY STOP, ETC.) NECESSARY FOR THE MACHINE TO COMPLY WITH THE EXISTING INTERNATIONAL/EUROPEAN SAFETY REGULATIONS.

For handling the unpacked generators, always use the special eyebolts only; use ropes having a suitable carriyng capacity and do not lift the generator too much from the floor (max 30 cm.).

When the machine is worn cut, contact the companies in charge of the disposal of ferrous material and do not throw away its parts into the environment.

The operators in charge of the installation, operation and maintenance of the generators must be skilled technicians who know the characteristics of the generators.

The people in charge of the handling must always wear work gloves and safety shoes. In case the generator or the whole plant must be lifted from the floor, the operators must wear a safety helmet.

The generator must be installed in an airy room. If there is not enough air, a malfunction or an overheating may occur. All entry doors into generator room should be clearly marked "Authorized persons only".

Take sure that gen-set foundations and baseframe are suitable to bear the combined weight of the alternators and prime mover.

The installer is responsible for the correct coupling of the generator to the engine and for the performance of all precautions necessary to guarantee the correct operation of the generator and avoid abnormal stress, which could damage the generator (such as vibrations, misalignment, strange noises or vibrations, etc.)

The machine was designed to guarantee the nominal power in environments with a maximum temperature of 40° C, at altitudes lower than 1000 m asl (EN60034-1), unless otherwise specified; for different operating conditions, see the commercial catalogue (brochure).

PRESCRIPTIONS DE SECURITE

Au moment de l'installation, les normes prévoient que l'alternateur soit relié à la terre.
Pour cette raison, s'assurer que l'installation de mise à la terre fonctionne bien, et soit en conformité avec les directives du pays où le générateur sera installé.

ATTENTION
L'INSTALLATEUR FINAL EST RESPONSABLE DE LA MISE EN PLACE DE TOUTES LES PROTECTIONS NÉCESSAIRES (DISPOSITIFS DE PROTECTION ET DE COUPURE, PROTECTIONS CONTRE LES CONTACTS DIRECTS ET INDIRECTS, PROTECTIONS CONTRE LES SURCHARGES ET LES SURTENSIONS, ARRÊT D'URGENCE ETC.), POUR RENDRE CONFORME LE MATÉRIEL ET SON IMPLANTATION AUX NORMES DE SÉCURITÉ INTERNATIONALES ET EUROPÉENNES EN VIGUEUR.

Pour le déplacement des alternateurs sortir de leur emballage, utiliser toujours et exclusivement les points d'encrage, utiliser les moyens de levage adéquates sans trop soulever l'alternateur du sol (max. 30 cm).

A la fin de la période de vie de la machine, s'adresser aux organismes de recyclage du matériel concerné.

Les ouvriers, conducteurs et manutentionnaires de l'alternateur doivent être techniquement qualifiés et connaître les caractéristiques du générateur.

Les personnes employées à la manutention doivent avoir des gants et des chaussures de sécurité. Dans le cas où l'alternateur ou le groupe électrogène doivent être soulevés de terre, les opérateurs doivent utiliser un casque de protection.

L'alternateur doit être installé dans un endroit aéré. Si la quantité d'air n'est pas suffisante, outre un mauvais, fonctionnement, il existe aussi un risque de surchauffe.
Sur la porte d'entrée du local il doit y avoir un écriteau indiquant "entrée interdite aux personnes non autorisées".

S'assurer que le chassis, support de l'alternateur et du moteur, est dimensioné pour supporter la masse totale.

L'installateur est responsable du couplage correct du générateur au moteur, par la mise en place des moyens nécessaires pour garantir le bon fonctionnement du générateur et éviter des sollicitations anormales qui pourraient endommager le générateur (comme les vibrations, les désalignements, sollicitations anormales, etc.).

La machine a été conçue afin de garantir la puissance nominale dans des lieux ayant une température maxima de 40 °C et à une altitude inférieure à 1000 mètres (EN60034-1), sauf indication différente ; pour des conditions différentes, consulter le catalogue commercial (dépliant).

SICHERHEITS VORSCHRIFTEN

Bei der installation ist, gemäß Vorschriften, darauf zu achten, daß der Generator geerdet wird. Aus diesem Grunde ist es erforderlich sicherzustellen, daß die Erdungsanlage leistungsfähig ist und mit den Vorschriften des Landes, in dem der Generator installiert wird, übereinstimmt.

ACHTUNG
DER ENDMONTEUR IST VERANTWORTLICH FÜR DIE VOREINSTELLUNG UND VORBEREITUNG ALLER SCHUTZVORRICHTUNGEN (TRENNVORRICHTUNGEN, SCHUTZVORRICHTUNGEN GEGEN DIREKTUND INDIREKT-KONTAKT, SCHUTZVORRICHTUNGEN GEGEN ÜBERSTROM UND ÜBERSPANNUNG, NOTAUS, ETC.), DIE MACHINE UND DIE ANLAGE DES ANWENDERS AN DIE GÜLTIGEN INTERNATIONALEN UND EUROPÄISCHEN SICHERHEITSVORSCHRIFTEN ANZUPASSEN.

Für den Transport der nicht verpackten Generatoren sind immer und ausschließlich die entsprechend geeigneten Transportösen zu verwenden. Es sind Seile mit geeigneter Tragfähigkeit zu verwenden, ohne den Generator zu sehr von der Bodenfläche anzuheben (max. 30 cm).

Am Ende der Lebendsdauer der Maschinen ist sich an die Entsorgungsunternehmen für Eisenmaterialen zu wenden; Teile dürfen nicht einfach weggeworfen werden.

Das für installation, Bedienung und Wartung zuständige Personal muß aus entsprechend qualifizierten Technikern bestehen, die die Eigenschaften des Generators genau kennen.

Die für den Transport zuständigen Personen haben stets Arbeitshandschuhe und Schuhwerk gemäß den Unfallverhütungsvorschriften zu tragen. Sofern der Generator oder die gesamte Anlage vom Boden angehoben werden müssen, haben die Arbeiter ein Schutzelm zu verwenden.

Der Generator muß in einem belüfteten Raum installiert werden. Wenn ausreichende Belüftung nicht gegeben ist, besteht die Gefahr fehlerhaften Funktionierens und der Überhitzung.
An der Eintrittstür zu diesem Raum ist ein Schild anzubringen, das den Eintritt für nicht autorisierte Personen untersagt.

Es ist sicherzustellen, daß der Untergrund für den Generator und den Hauptmotor so berechnet ist, daß er das Gewicht tragen kann.

Es liegt in der Verantwortung des Installateurs den Generator korrekt mit dem Motor zu verbinden und alle notwendigen Maßnahmen umzusetzen, die den richtigen Betrieb des Generators garantieren und Belastungen vermeiden, die den Generator beschädigen könnten (wie Vibrationen, Abweichungen, sonderbare Beanspruchungen etc.).

Das Gerät wurde entwickelt, um die Nennleistung in Ambienten mit einer maximalen Temperatur von 40 °C und einer Höhe unter 1000 Meter (EN60034-1) zu garantieren, wenn nicht anders angegeben; bei anderen Bedingungen bitte im Handelskatalog (Prospekt) nachschlagen.

PRECAUCIONES DE SEGURIDAD

Al momento de la instalación, las normas preveen la conexión a tierra del generador. Por lo tanto es necesario que la instalación de puesta a tierra sea eficiente y en conformidad con las directivas del país donde el generador será montado.

ATENCION
EL INSTALADOR FINAL ES RESPONSABLE DEL MONTAJE DE TODAS LAS PROTECCIONES (DISPOSITIVOS DE SECCIONAMIENTO, PROTECCIONES CONTRA CONTACTOS DIRECTOS E INDIRECTOS, PROTECCIONES CONTRA SOBRE-CORRIENTE Y SOBRETENSION, PARADA DE EMERGENCIA, ETC.), NECESARIAS PARA PRODUCIR LA CONFORMIDAD DE LAS MAQUINAS Y LA INSTALACION CON LAS NORMAS VIGENTES DE SEGURIDAD INTERNACIONALES Y EUROPEAS.

Para mover los generadores desembalados, usar siempre y exclusivamente los correspondientes ganchos que poseen los mismos.
Utilizar correas de resistencia adecuada sin necesidad de elevar demasiado el generador del pavimento (max 30 cm).

Al final del periodo de vida útil de la máquina, dirigirse a una agencia de reciclaje de materiales ferrosos, de manera de no perder partes en el ambiente.

Las personas dedicadas a la instalación, transporte y mantenimiento del generador deberán ser técnicos adecuadamente calificados y que conozcan las características de los generadores.

Las personas dedicadas al transporte deberán usar siempre guantes de trabajo y zapatos de seguridad. Siempre que el generador o el equipo completo sea elevado del suelo, los operadores deberán usar cascos de protección.

El generador debe ser instalado en un ambiente aireado.
Si no hoy suficiente ventilación, además del mal funcionamiento existirá el peligro de sobrecalentamiento.
A la puerta de ingreso del local se deberá colocar un cartel que prohiba el acceso a las personas no autorizadas.

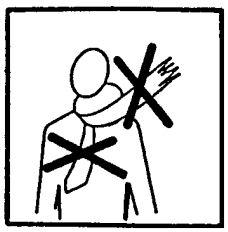
Asegurarse que la base de apoyo del generador y del motor primario sean calculadas para soportar el peso total.

Es responsabilidad de instalador la correcta conexión entre el generador y el motor, mediante el uso de todas las medidas de seguridad necesarias que garanticen el correcto funcionamiento del generaror y que eviten sobrecargas que puedan dañarlo (x.e. vibraciones, desajustes, conexiones irregulares, etc...)

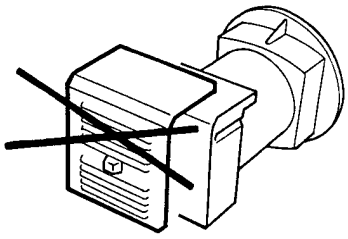
El mecanismo ha sido diseñado para garantizar la potencia nominal en ambientes con una temperatura máxima de 40° C, y en altitud inferior a 1000 metros (EN60034-1), salvo indicaciones distintas; para conocer condiciones diferentes de las indicadas, vea el catálogo comercial (folleto).

PRESCRIZIONI DI SICUREZZA

Nelle vicinanze della macchina non ci devono essere persone con indumenti svolazzanti tipo: sciarpe, fular, bracciali, etc e qualsiasi indumento deve essere chiuso con elastici alle estremita'.

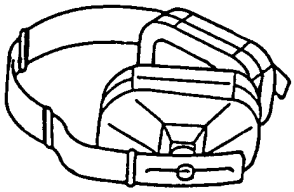


I generatori non devono mai e per nessuna ragione funzionare con le seguenti protezioni aperte:
- copertura frontale.
- protezioni delle ventole.

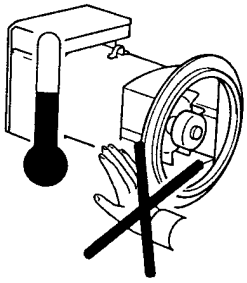


A richiesta puo' essere montato un tipo di regolatore corredato di segnalazioni a led, che sono:
Verde - funzionamento regolare
Giallo - intervento protezione sovraccarico
Rosso - intervento protezione bassa velocita'

I generatori sono rumorosi; anche se il livello acustico è sicuramente inferiore a quello del motore primario, devono essere installati in ambienti isolati (stanza, sala macchine, etc.) e chi vi accede deve munirsi di cuffie antirumore.

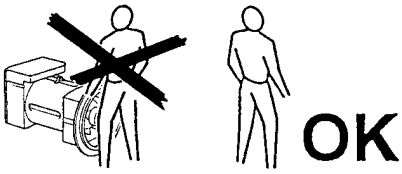


I generatori sviluppano calore anche elevato in funzione della potenza generata.
Pertanto non toccare il generatore se non con guanti antiscottatura e attendere, una volta spento, che esso raggiunga la temperatura ambiente.



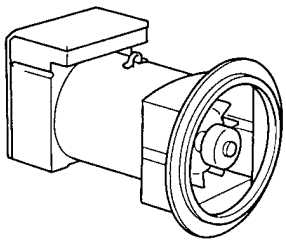
Anche se la macchina e' protetta in tutte le sue parti evitare di sostare nelle sue vicinanze.

Per nessuna ragione appoggiarsi o sedersi sul generatore.



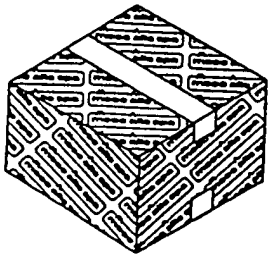
Non togliere per nessuna ragione le etichette, anzi richiederne la sostituzione in caso di necessita'.

PERICOLO DI CORTO CIRCUITO
Il generatore e' costruito con grado di protezione IP23; pertanto e' fatto divieto di spruzzare o di mettere contenitori di liquidi sopra le parti elettriche.



In caso di sostituzione di pezzi di ricambio richiedere esclusivamente ricambi originali.

Per la sostituzione di parti usurate comportarsi rigorosamente come descritto al capitolo manutenzione; queste manutenzioni devono essere eseguite da tecnici adeguatamente qualificati.



SAFETY REQUIREMENTS

No person must wear fluttering clothes (such as scarves, etc.) near the machine and any garment must be fastened with elastic bands at its ends.

The generators must never and for no reason run whith following guards removed:
- terminals cover
- fan guards.

If required, the generator can be equipped with a regulator with led display, as follows:
Green - regular operation
Yellow - overload protection activated
Red - low speed protection activated

The generators are noisy; even if the sound level is certainly lower than that of the prime motor, they must be installed in soundproof rooms (room, engine room, etc.) where it is necessary to wear antinoise car protectors.

The generators produce heat proportional to the output.
Therefore, do not touch the generator if you do not wear antiscorch gloves and, after switching it off, do not touch it until it has cooled down.

Even if all the machine components are protected, keep away from the machine.

Do not lean or sit on the generator for whatever reason.

Do not remove the labels for whatever reason; on the contrary, if necessary, replace them.

DANGER OF SHORT CIRCUIT
The degree of protection of the generator is IP23; short circuits may occur if liquids are spilt onto areas containing electrical parts.

In case of replacement of spare parts, use original spare parts only.

For the replacement of worn parts, carefully follow the maintenance instruction; these operations must be carried out by skilled technicians.

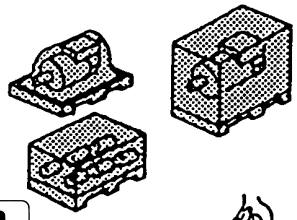
PRESCRIPTIONS DE SECURITE	SICHERHEITS VORSCHRIFTEN	PRECAUCIONES DE SEGURIDAD
Dans le voisinage de la machine, il ne doit y avoir aucune personne portant des vêtements flottants type écharpe, foulard...et quelque soit le vêtement, il doit être fermé avec un élastique à l'extrémité.	In der Nähe der Maschinen dürfen sich keine Personen aufhalten, die nicht anligende Kleidungs-oder Schmuckstücke tragen (wie z.B.Schals,Tücher, Armbänder, usw.).Jedes Kleidungsstück muß an den Gelenken durch Gummis geschlossen werden.	En próximidades de la máquina no deberá haber personas con indumentaria volante como pulseras, bufandas, etc. Qualquier otro tipo de indumentaria deberá ser fijada con elásticos en las extremidades.
Les alternateurs ne doivent jamais et pour aucune raison fonctionner avec les protections suivantes ouvertes: - couvercle de boite à bornes - protection du ventilateur.	Die Generatoren dürfen niemals und aus keinem Grund in Betrieb sein, wenn folgende Schutzvorrichten geöffnet sind: - Klemmenabdeckung - Schutzvorrichtungen des Lüfterrades.	Los generadores no deberán bajo ninguna condición funcionar con las siguientes protecciones descubiertas: - tapa de bornes - protección de ventilador.
Sur demande, on peut monter un type de régulateur doté de signalisations par voyants, qui sont : **Vert** - fonctionnement régulier **Jaune** - intervention protection surcharge **Rouge** - intervention protection faible vitesse	Auf Wunsch kann ein Regler mit folgenden Led-Anzeigen montiert werden: **Grün** - Normalbetrieb **Gelb** - Ansprechendes Überlastungsschutzes **Rot** - Ansprechen des Unterdrehzahlschutzes	A petición es posible incorporar un tipo de regulador provisto de los pilotos siguientes: **Verde** - funcionamiento regular **Amarillo** - intervención protección contra las sobrecargas **Rojo** - intervención protección baja velocidad
La machine génère du bruit même si son niveau est inférieur à celui du moteur, il doit être alors installé dans un local (isolé), et il est nécessaire pour les personnes d'être munies de casque antibruit.	Die Generatoren sind laut; auch wenn der Geräuschpegel durchaus unterhalb dem Pegel des Hauptmotors liegt, müssen sie in isolierten Räumlichkeiten (Räume, Maschinenräume, usw.) aufgestellt werden. Personen, die diese Räume betreten, müssen sich mit Kopfhöhrern vor dem Lärm schützen.	Los generadores son ruidosos, y si bien su nivel acústico es seguramente inferior al motor primario, los mismos deberán ser instalados en ambientes aislados (cabina, sala máquimas, etc.) y las personas que acceden deberán llevar auriculares antiruido.
Les alternateurs produisent de l'énergie calorifique directement proportionnelle à la puissance utilisée. Ainsi, ne pas toucher l'alternateur ou bien avec des gants appropriés, et attendre que celui-ci, une fois arrêté soit de nouveau à la température ambiante.	Die Generatoren entwickeln Wärme auch in erhöhtem Maße, jeweils in Abhängigkeit von der erzeugten Leistung. Aus diesem Grunde ist die Maschine nur mit Verbrennungsschutzhandschuhen zu berühren. Ist die Maschine ausgeschaltet, ist abzuwarten, daß diese wieder Umgebungstemperatur annimmt.	Los generadores producen calor, y el mismo puede ser elevado en función de la potencia generada, por lo tanto no tocar la máquina si no se posee quantes antiquemaduras, después de un tiempo de haber detenido el generador, hasta que el mismo alcance la temperatura ambiente.
La machine est protégée dans tout son environnement, éviter de rester dans son voisinage.	Auch wenn die Maschine vollständig abgesichert ist, ist der Aufenthalt in ihrer Nähe zu vermeiden.	Si bien la máquina está protegida en todas sus partes, evitar de pararse cerca de la misma.
Pour aucune raison, il ne faut s'appuyer ou s'asseoir sur l'alternateur.	Aus keinem Grunde darf man sich an den Generator lehnen oder sich auf ihn setzen.	Por ninguna razón apoyarse o sentarse sobre el generador.
Ne pas arracher non plus les étiquettes ou adhésifs, au contraire, les réclamer en cas de nécessité.	Aus keinem Grunde sind die Etiketten zu entfernen, stattdessen ist bei Bedarf Ersatz anzufordern.	No quitar por ninguna razón las etiquetas, por el contrario, pedir la sustitución en caso de necesidad.
DANGER DE COURT-CIRCUIT L'alternateur est construit avec un grade de protection IP23; il est formellement déconseillé d'asperger ou de mettre tout récipient contenant du liquide sur les parties électriques.	**GEFAHR VON KURZSCHLÜSSEN** Der Generator ist mit einem Schutzgrad IP23 Konstruiert; daher ist es verboten, die elektrischen Teile zu bespritzen oder Behälter mit Flüssigkeiten auf diese zu stellen.	**PELIGRO DE CORTO CIRCUITO** El generador está construido con grado de protección IP23; por lo tanto se prohibe salpicar o colocar recipientes con líquido sobre las partes eléctricas.
En cas de changement de tout composant, il est indispensable de les remplacer par les pièces d'origine.	Müssen Teile ausgewechselt werden, sind ausschließlich originale Ersatzteile anzufordern.	En caso de sustitución de partes de repuesto, exigir exclusivamente repuestos originales.
Ces modifications doivent être exécutées par du personnel technique qualifié.	Beim Austausch von Verschleißteilen müssen die im Kapitel "Wartung" angegebenen Vorschriften strengstens eingehalten werden; diese Wartungsarbeiten müssen von entsprechend qualifizierten Technikern durchgeführt werden.	Para la sustitución de partes usadas, comportarse rigurosamente como descripto en el capítulo mantenimiento; estas operaciones deberán ser realizadas por técnicos adecuadamente calificados.

TRASPORTO E IMMAGAZZINAMENTO

TRANSPORT AND STORAGE

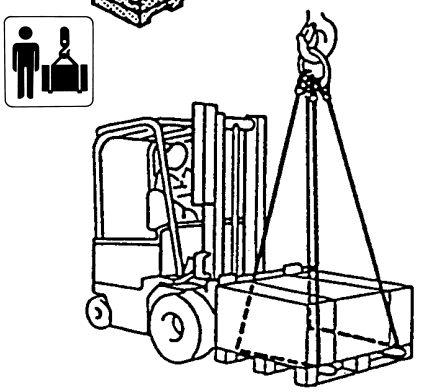
In funzione della destinazione gli alternatori possono essere imballati per la spedizione in vari modi.

Alternators will be packed for shipment in a manner suitable to their mode of transport and final destination.



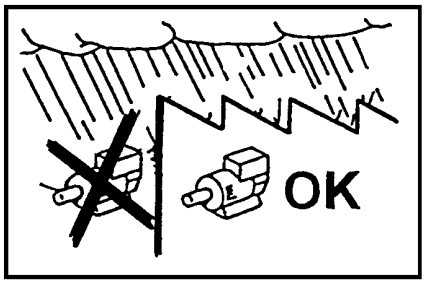
In ogni caso per movimentarli, osservare nella bolla di accompagnamento, il peso, e con mezzi adeguati, sollevare da terra il meno possibile.

Prior to handling goods, please ensure that lifting equipment is of sufficient capacity. Under lifting conditions machinery should be elevated to a minimal distance from the ground.



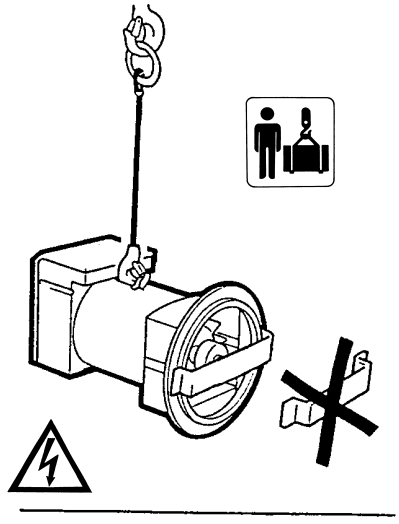
Nel caso che l'imballo debba essere movimentato con carrelli, occorre che le forche siano tenute il piu' larghe possibile in modo da evitare cadute o scivolamenti.

When lifting or moving goods by forklift apparatus, care should be taken to ensure that forks are correctly positioned to prevent slipping or falling of pallet or crate.



In caso di immagazzinamento, gli alternatori imballati e non, devono essere depositati in un locale fresco e asciutto o comunque mai esposto alle intemperie.

Both packed and unpacked alternators shall be stored in a cool and dry room, and shall never be exposed to the inclemency of the weather.



Una volta disimballato il generatore, (monosupporto) non scollegare il sistema di fissaggio rotore, in quanto quest'ultimo potrebbe scivolare.

With regard to single bearing alternators (form MD35) please ensure that the rotor securing device is in place. Failure to do so may lead to slippage or assembly.

Per la movimentazione al fine dell'installazione, sollevare i generatori, sempre, attraverso i propri golfari.

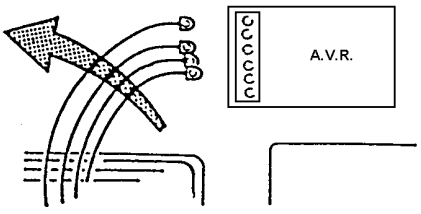
When installing the alternators, always lift them by using their eyebolts.

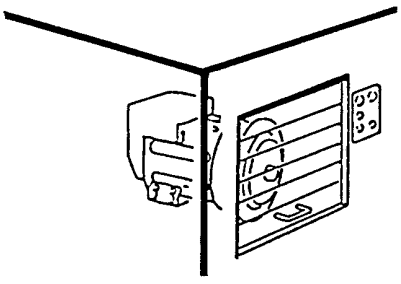
ATTENZIONE:

DOPO LUNGHI PERIODI DI IMMAGAZZINAMENTO O IN PRESENZA DI SEGNI EVIDENTI DI UMIDITA'/ CONDENSA, VERIFICARE LO STATO DI ISOLAMENTO.

LA PROVA DI ISOLAMENTO DEVE ESSERE ESEGUITA DA UN TECNICO ADEGUATAMENTE QUALIFICATO.

PRIMA DI ESEGUIRE TALE PROVA E' NECESSARIO SCONNETTERE IL REGOLATORE DI TENSIONE; SE LE PROVE DARANNO UN RISULTATO TROPPO BASSO (INFERIORE A 1 MΩ)(EN60204-1) SI DOVRA ASCIUGARE L'ALTERNATORE IN UN FORNO A 50-60C°.





PLEASE NOTE :

AFTER PROLONGER STORAGE OR IF THE MACHINES SHOW SIGNS OF CONDENSATION, ALL WINDINGS SHOULD BE SUBJECTED TO INSULATION TESTS PRIOR TO OPERATING.

THE INSULATION TEST SHALL BE MADE BY SKILLED PERSONNEL.

BEFORE CARRYING OUT THE TEST, THE VOLTAGE REGULATOR MUST BE DISCONNECTED; IF THE TEST RESULTS ARE TOO LOW (LOWER THAN 1 MΩ)(EN60204-1) THE ALTERNATOR MUST BE DRIED IN AN OVEN AT 50-60°C.

TRANSPORT ET STOCKAGE

En fontion de la destination des alternateurs, ils peuvent être emballés pour l'expédition de différentes manières.

En cas de déplacement des caisses, il est nécessaire de contrôler sur le bordereau de livraison le poids et, avec du materiél adéquate les soulever de terre le moins haut possible.

Dans le cas où l'emballage devra être déplacé avec des chariots élévateurs, il est nécessaire que les sangles soient mantenues le plus large possible de façon à éviter des chutes ou des glissements.

En cas de stockage, les alternateurs emballés ou non, doivent être déposés dans un local frais et aéré et jamais exposés aux intempéries.

Une fois l'alternateur sorti de l'emballage, (monopalier) ne pas enlever le système de fixation du rotor, car dans ce cas, ce dernier pourrait glisser.

Pour les manutentions à la fin de l'installation, soulever les alternateurs, toujours avec leurs propres anneaux de levage.

ATTENTION :

APRÈS DE LONGUES PÉRIODES DE STOCKAGE OU EN PRÉSENCE DE SIGNES ÉVIDENTS D'HUMIDITÉ / CONDENSATION, VÉRIFIER L'ÉTAT D'ISOLEMENT.

L'ESSAI D'ISOLEMENT DOIT ÊTRE ÉXECUTÉ PAR UN TECHNICIEN QUALIFIÉ.

AVANT DE PROCÉDER À UN TEL ESSAI, IL EST NÉCESSAIRE DE DÉCONNECTER LE RÉGULATEUR DE TENSION; SI LES VALEURS MESURÉES SONT INFÈRIEURES À CELLES REQUISES (NFÈRIEURES À 1 MΩ)(EN60204-1) IL EST NÉCESSAIRE DE SUPPRIMER L'HUMIDITÉ EN METTANT L'ALTERNATEUR DANS UN FOUR À 50-60°C.

TRANSPORT UND LAGERUNG

In Abhängigkeit von dem Zielort, können die Generatoren entsprechend auf verschiedene Art und Weise für den Versand verpackt werden.

In jedem Fall sind für den Transport die Angaben des begleitenden Lieferscheins bezüglich Gewicht zu beachten; der Generator soll mit geeigneter Hilfsmittel so wenig wie möglich vom Boden hochgehoben werden.

Sollte die Verpackung mit dem Generator mit Gabelstaplern bewegt werden müssen, ist es erforderilch, die Gabelstellung so weit wie möglich einzustellen, umdadurch zu verhindern, daß die Verpackung herunterfallen oder herunterrutschen kann.

Die Lagerung von verpackten und unverpackten Generatoren muß in einem kühlen und trockenen Raum erfolgen, der keinesfalls Witterungseinflüssen ausgesetz ist.

Sobald der Generator (1 Lager Schild) aus seiner Verpackung entnommen ist, darf die Sicherungsvorrichtung für den Rotor nicht entferntwerden, da dieser abrutschen könnte.

Zum Trasport der Generatoren für installationszwecke, dürfen diese stets ausschließlich an ihren dafür vorgesehenen Ringschrauben aufgehängt werden.

ACHTUNG :

NACH EINER LÄNGEREN LAGERUNGSZEIT ODER BEI DEUTLICHEN ANZEICHEN VON FEUCHTIGKEIT ODER KONDENSAT, IST DER ZUSTAND DER ISOLIERUNGEN ZU ÜBERPRÜFEN.

DIE ÜBERPRÜFUNG DER ISOLIERUNG DARF NUR VON EINEM FACHMANN DURCHGEFÜHRT WERDEN.

VOR DER DURCHFÜHRUNG EINER SOLCHEN PRÜFUNG IST ES ERFORDERLICH, DEN SPANNUNGSSREGLER ABZUTRENNEN; SOLLTE DIE ÜBERPRÜFUNG EIN ZU NIEDRIGES ERGEBNIS ERBRINGEN, (UNTERHALB VON 1 MΩ)(EN60204-1), MUß DER GENERATOR IN EINEM OFEN BEI 50-60°C GETROCKNET WERDEN.

TRANSPORTE Y DEPOSITO

En función del destino final, los alternadores podrán ser embalados para su expedición en varios modos.

En todos los casos, para moverlos, observar en la factura, el peso y con los medios adecuados, elevarlos del piso lo menos posible.

En caso que el embalaje sea movido por medio de un elevador, será necesario que las cuerdas del mismo ocupen todo la base de la caja, para evitar caídas o deslizamientos.

En caso de depósito, los alternadores con o sin embalaje, deberán ser puestos en un lugar fresco y seco o por lo menos nunca ser expuestos a la intemperie.

Una vez desembalado el generador, (Monosoporte) no quitar el sistema de fijación del rotor, pues de otra manera el mismo podría deslizarse y caer.

Para mover los generadores antes de su instalación, elevarlos siempre por medio de sus ganchos respectivos.

ATENCION :

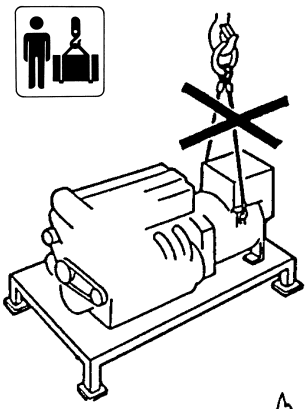
DESPUES DE LARGOS PERIODOS DE DEPOSITO O EN PRESENCIA DE EVIDENTES SIGNOS DE HUMEDAD O CONDENSACION, CONTROLAR EL ESTADO DE AISLACION.

LA PRUEBA DE AISLACION DEBE SER EFECTUADA POR UN TECNICO ADECUADAMENTE CALIFICADO.

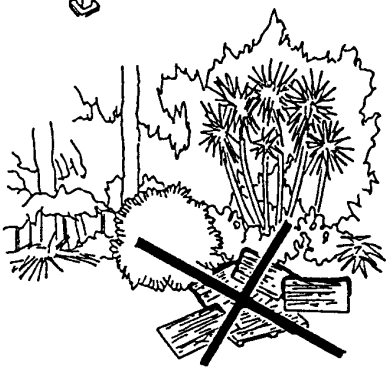
ANTES DE REALIZAR LA PRUEBA ES NECESARIO DESCONECTAR EL REGULADOR DE TENSION; SI LOS RESULTADOS SON DEMASIADO BAJOS (INFERIOR A 1MΩ)(EN60204-1), SE DEBERA SECAR EL ALTERNADOR EN UN HORNO A 50-60°C.

TRASPORTO E IMMAGAZZINAMENTO

Ricordarsi che, una volta che il generatore sara' accoppiato al motore primario, o montato su un basamento, o installato in un telaio in modo da formare un corpo unico, non dovra piu' essere sollevato dai propri golfari ma si dovranno seguire le indicazioni dell'installatore.



Non disperdere l'imballo nell'ambiente, ma rivolgersi alle agenzie di smaltimento.



TRANSPORT AND STORAGE

Once the generator is coupled with an engine, mounted on a baseframe, or installed on a complete generating set, it cannot be lifted by its lifting bolts.The relevant instructions for lifting complete generating set should be followed.

Any packing materials should be disposed of via correct waste disposal methods. Do not discard waste materials into the environment.

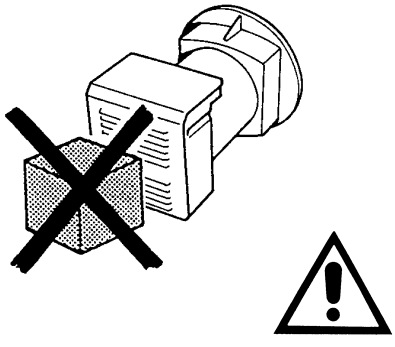
ACCOPPIAMENTO MECCANICO

L'accoppiamento del generatore al motore primo e' a cura dell'utilizzatore finale ed e' eseguito secondo la sua sola discrezione.

Le attenzioni richieste sono:

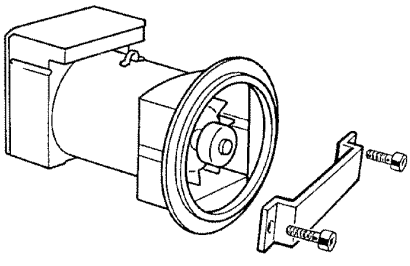
NELLA MESSA IN SERVIZIO AVER CURA CHE LE APERTURE DI ASPIRAZIONE E SCARICO DELL'ARIA DI RAFFREDDAMENTO SIANO SEMPRE LIBERE.

IMPORTANTE
IMPORTANT
WICHTIG



IL LATO DI ASPIRAZIONE NON DEVE ESSERE VICINO A SORGENTI DI CALORE. IN OGNI CASO, SE NON SPECIFICATAMENTE CONCORDATO, LA TEMPERATURA DELL'ARIA DI RAFFREDDAMENTO DEVE ESSERE QUELLA AMBIENTE E COMUNQUE NON SUPERIORE A 40°C.

IN CASO DI GENERATORI MONOSUPPORTO IN FASE DI ACCOPPIAMENTO CON IL MOTORE PRIMO, FARE ATTENZIONE CHE IL ROTORE NON SI SFILI; TOGLIERE IL SISTEMA DI FISSAGGIO ROTORE.



MECHANICAL COUPLING

The mechanical coupling is under the sole responsibility of the final user, and has to be done at his discretion.

Warnings:

BEFORE STARTING THE ALTERNATOR, CHECK THAT THE AIR INLETS AND OUTLETS ARE FREE OF ANY OBSTRUCTIONS.

THE AIR INLETS SHOULD NOT BE NEAR ANY HEATING SOURCES.
IN ANY CASE, IF NOT SPECIFICALLY REQUESTED, THE COOLING AIR TEMPERATURE MUST BE EQUAL TO THE ENVIRONMENT TEMPERATURE AND NEVER HIGHER THAN 40°C.

BEFORE MECHANICAL COUPLING OF SINGLE BEARING ALTERNATORS REMOVE THE ROTOR SECURING DEVICE PLACED THERE TO PREVENT ROTOR FROM SLIPPING.

TRANSPORT ET STOCKAGE

Se rappeler qu'une fois l'alternateur accouplé au moteur d'entrainement, ou monté sur socle, ou installé sur un châssis de manière à former un seul bloc, il ne devra plus être soulevé par ses propres anneaux de levage mais il faudra suivre les indications de l'installateur.

Ne pas jeter l'emballage dans la nature mais s'adresser à un centre de recyclage.

TRANSPORT UND LAGERUNG

Sobald der Generator eineal an einen Antriebsmotor angeschlossen wird, bzw. auf einem Unterbau montiert oder in einem Rahmen installiert wird, so daß ein einziger Block entsteht, darf er nicht mehr an den Ringschrauben angehoben werden.
Es sind die Vorschriften des Monteurs zu beachten.

Die Verpackung ist durch die entsprechen den Entsorgungsunternehmen zu entsorgen.

TRANSPORTE Y DEPOSITO

Recordar que, una vez que el generador será acoplado al motor primario, o montado en su base, o instalado en una estructura de manera de formar un cuerpo único, no deberá ser elevado por medio de sus ganchos, sino que se deberán seguir las indicaciones del instalador.

No dejar que el embalaje se pierda en el ambiente, dirigirse siempre a cualquier agencia que trate el reciclaje de residuos.

ACCOUPLEMENT MECANIQUE

L'accouplement de l'alternateur au moteur d'entraînement est à la charge de l'utilisateur final et est exécuté selon sa propre méthode.

Les précautions requises sont :

DANS LA MISE EN SERVICE, S'ASSURER QUE LES OUVERTURES D'ASPIRATION ET L'EVACUATION DE L'AIR DE REFROIDISSEMENT SOIENT TOUJOURS LIBRES.

LE CÔTÉ DE L'ASPIRATION NE DOIT PAS ÊTRE PRÈS D'UNE SOURCE DE CHALEUR. DANS CHAQUE CAS, S'IL N'Y A PAS DE SPÉCIFICATION PARTICULIÈRE, LA TEMPÉRATURE DE L'AIR DE REFROIDISSEMENT DOIT ÊTRE CELLE AMBIANTE ET DE TOUTE FAÇON, NE DOIT PAS ÊTRE SUPÈRIEURE À 40°C.

DANS LE CAS DES ALTERNATEURS MONOPALIER EN PHASE D'ACCOUPLEMENT AVEC LE MOTEUR D'ENTRAÎNEMENT, FAIRE ATTENTION QUE LE ROTOR N'AIT PAS GLISSÉ SUR SON AXE. ÔTER LE SYSTÈME DE FIXATION DU ROTOR.

MECHANISCHER ANSCHLUß

Der Anschluß des Generatores an einen Antriebsmotor obliegt dem Anwender und erfolgt nach eigenen Ermessen.

Folgende Punkte sind zu beachten :

BEI DER INBETRIEBNAHME IST ZU GEWÄHRLEISTEN, DAß DIE ÖFFNUNGEN FÜR DIE ANSAUGUNG BZW. FÜR DEN AUSTRITT DER KÜHLLUFT IMMER FREI BLEIBEN.

DIE ANSAUGSEITE DARF SICH NICHT IN DER NÄHE VON WÄRMEQUELLEN BEFINDEN. FALLS NICHT ANDERWEITIG VEREINBART, MUß DIE KÜHLLUFT RAUMTEMPERATURE AUFWEISEN UND DARF DEN WERT VON 40°C NICHT ÜBERSCHREITEN.

BEI EIN LAGER SCHILD GENERATOREN IST IN DER PHASE DES ANSCHLUSSES AN DEN ANTRIEBSMOTOR DARAUF ZU ACHTEN, DAß SICH DER ROTOR NICHT LÖST; EINE EVENTUELL VORHANDENE BEFESTIGUNGSSICHERUNG DES ROTORS IST ZU ENTFERNEN.

ACOPLAMIENTO MECANICO

El acoplamiento del generador al motor primario es responsabilidad del usuario final, y el mismo será efectuado a propia discreción.

Los puntos de atención requeridos son :

EN LA PUESTA EN SERVICIO ASEGURARSE QUE LAS ABERTURAS DE ASPIRACION Y DESCARGA DEL AIRE DE REFRIGERACION SE ENCUENTREN SIEMPRE LIBRES DE OBSTACULOS.

EL LADO DE ASPIRACION NO DEBE ESTAR CERCA A FUENTES DE CALOR.
DE CUALQUIER MANERA, SI NO ES PREVIAMENTE CONVENIDO, LA TEMPERATURA DEL AIRE DE RIFREGERACION DEBE SER AQUELLA DEL AMBIENTE, DE TODOS MODOS, NO SUPERIOR A 40 °C.

EN CASO DE GENERADOR MONOSOPORTE EN FASE DE ACOPLAMIENTO CON EL MOTOR PRIMARIO, ASEGURARSE QUE EL ROTOR NO SE DESLIZE; QUITAR EL SISTEMA DE FIJACION DEL MISMO.

ACCOPPIAMENTO MECCANICO

Nel caso di accoppiamento di un generatore serie ECP3 avente forma costruttiva B3/B9 seguire le seguenti istruzioni:

-) montare il coperchio anteriore sul motore fissandolo con le apposite viti e applicando una coppia di serraggio di 48±7% Nm se si impiegano viti M10 o 21±7% Nm nel caso di viti M8 (figura 1)

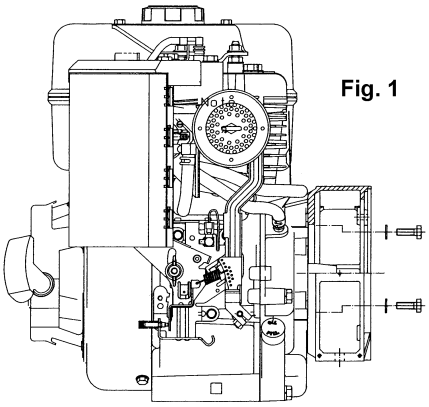


Fig. 1

-) bloccare l'alternatore sul coperchio fissando i quattro dadi M8 sui tiranti, applicando una coppia di serraggio pari a 16 ±7% Nm (figura 2)

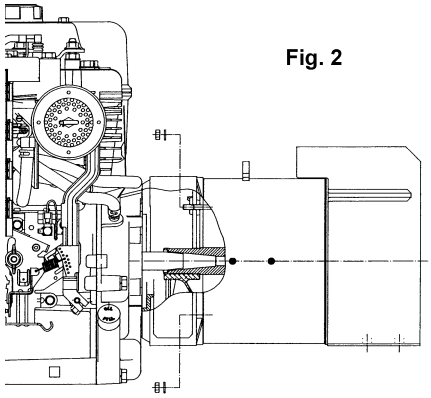


Fig. 2

-) inserire il tirante centrale nella sua sede ed avvitare il dado (figura 3)

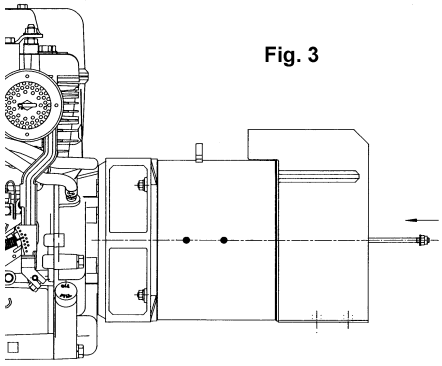


Fig. 3

-) bloccare il tirante centrale applicando una coppia di serraggio pari a 21±7% Nm se si impiegano tiranti M8, mentre, se si impiegano tiranti M14, applicare una coppia di serraggio pari a 120±7% Nm; rimontare le retine di protezione laterali e la griglia di chiusura posteriore applicando sulle viti M5 una coppia di serraggio pari a 3,5±7% Nm (figura 4).

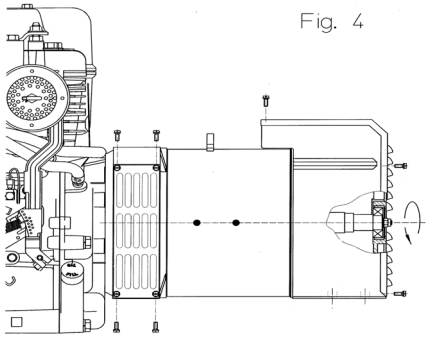


Fig. 4

MECHANICAL COUPLING

When coupling with an ECP3 series generator having a B3/B9 form, follow the instructions below:

-) mount the front cover on the motor, fixing it with the appropriate screws and applying a tightening torque of 48±7% Nm if using M10 screws or 21±7% Nm for M8 screws (figure 1)

-) lock the alternator into the cover by fixing the four M8 nuts onto the bolts, applying a tightening torque of 16±7% Nm (figure 2)

-) insert the central bolt into its housing and screw the nut (figure 3)

-) block the central stay rod, applying a tightening torque of 21±7% Nm if you are using stay rods of M8, while if you are using M14 stay rods, apply a tightening torque of 120±7% Nm; reassemble the lateral protective nets and the rear closing grid by applying a tightening torque of 3,5±7% Nm to the M5 screws (figure 4)

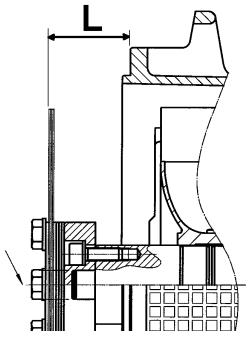
ACCOUPLEMENT MECANIQUE	MECHANISCHER ANSCHLUß	ACOPLAMIENTO MECANICO
En cas de montage d'un générateur série ECP3 ayant la forme constructive B3/B9, suivre les instructions suivantes:	Bei Anschluß eines Generators der Serie ECP3 mit Bauform B3/B9 müssen die folgenden Anweisungen befolgt werden :	En el caso de acoplamiento de un generador serie ECP3 con forma constructiva B3/B9, siga las instrucciones siguientes :
-) monter le couvercle avant sur le moteur en le fixant avec les vis prévues à cet effet et en appliquant un couple de serrage de 48±7% Nm si on utilise des vis M10 ou de 21±7% Nm en cas de vis M8 (figure 1)	-) den vorderen Deckel auf den Motor setzen und ihn mit Hilfe der entsprechenden Schrauben und einem Anzugsmoment von 48±7% festziehen, wenn Schrauben M10 verwendet werden, oder aber mit einem Anzugsmoment von 21±7% Nm bei Verwendung von Schrauben M8 (Abbildung 1)	-) monte la tapa anterior encima del motor sujetándola con sus tornillos y aplicando un par de torque de 48±7% Nm si utiliza tornillos M10, o de 21±7% Nm si utiliza tornillos M8 (fig. 1)
-) bloquer l'alternateur sur le couvercle en fixant les quatre écrous M8 sur les tirants, en appliquant un couple de serrage de 16±7% Nm (figure 2)	-) den Umwandler auf dem Deckel befestigen und ihn mit Hilfe der vier Schraubmuttern M8 an den Zugstangen befestigen bei Aufbringen eines Anzugsmoments von 16±7% Nm (Abbildung 2)	-) sujete el alternador en la tapa fijando las cuatro tuercas M8 en los tirantes, aplicando un par de torque de 16±7% Nm (fig. 2)
-) enfiler le tirante central dans son logement et visser l'écrou (figure 3)	-) Die mittlere Zugstange in ihrem Sitz einstecken und die Schraubmutter schrauben (Abbildung 3)	-) introducir el tirante central en su lugar y enroscar la tuerca (fig. 3)
-) bloquer le tirant central en appliquant un couple de serrage égal à 21±7% Nm si on utilise des tirants M8, alors que si on emploie des tirants M14, il faut appliquer un couple de serrage égal à 120±7% Nm; remonter les grilles de protection laterales et la grille de fermeture arrière en appliquant aux vis M5 un couple de serrage de 3,5±7% Nm (figure 4).	-) die zentralen Stellschraube mit einem Drehmoment von 21±7% Nm blockieren, sollten M8 Schrauben verwendet werden, während bei der Verwendung von M14 diese mit einem Drehmoment von 120±7% Nm anziehen; die seitlichen Schutznetze sowie das hintere Abschlußrost wieder aufsetzen und hierfür ein Anzugsmoment von 3,5±7% Nm auf die Schrauben M5 aufbringen (Abbildung 4).	-) bloquear el tirante central aplicando una pareja de cierre igual a 21±7% Nm si se emplean tirantes M8, mientras, si se emplean tirantes M14, aplicar una pareja de cierre igual a 120±7% Nm; vuelva a montar las redecillas de protección laterales y la rejilla de cierre posterior, aplicando a los tornillos M5 un par de torque de 3,5±7% Nm (fig. 4).

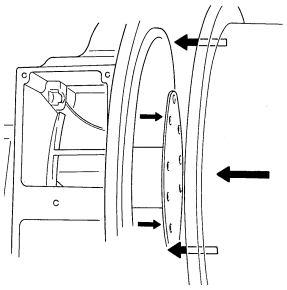
ACCOPPIAMENTO MECCANICO

Un allineamento impreciso può causare vibrazioni e danneggiamenti dei cuscinetti. E' consigliabile inoltre verificare la compatibilità delle caratteristiche torsionali del generatore e del motore (a cura del cliente). I dati sul generatore necessari per tale verifica sono disponibili nella relativa documentazione.

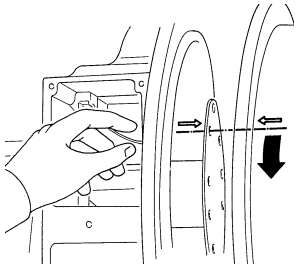
Nel caso di accoppiamento di un generatore serie ECP3 avente forma costruttiva MD35 seguire le seguenti istruzioni:

-) verificare il corretto posizionamento dei dischi (quota "L") in funzione del tipo di accoppiamento considerato (tavola 2 pag. 38); se necessario ripristinare la quota "L" spostando leggermente e assialmente il rotore. In posizione corretta il cuscinetto posteriore deve avere un gioco assiale da 0,5 a 2 mm.

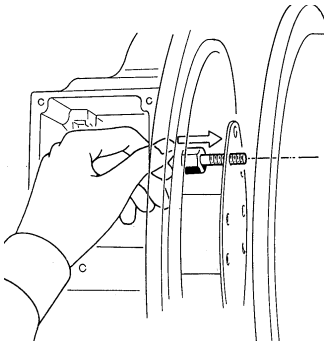




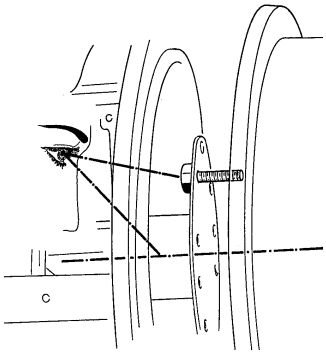
-) avvicinare l'alternatore al motore di accoppiamento



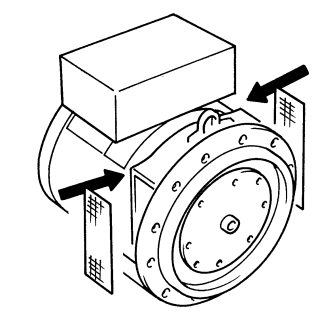
-) allineare uno dei fori di fissaggio dei dischi del volano con il foro dei dischi precedentemente posizionato



-) inserire ed avvitare parzialmente la relativa vite che blocca i dischi al volano. Ruotare il volano affinchè altri due fori si ripresentino nella stessa posizione ed avvitare parzialmente la relativa vite. Ripetere detta operazione per tutti gli altri fori



-) dopo aver verificato il corretto centraggio dei dischi nel volano motore, bloccare definitivamente dette viti



-) montare le due retine laterali di protezione, fornite a corredo del generatore.

Solamente dopo che il generatore e' stato ben fissato meccanicamente procedere all'accoppiamento elettrico.

MECHANICAL COUPLING

A bad alignment may cause vibrations and bearing damages. It is advisable to verify the compatibility of the generator torsional characteristics and the engine (by the customer). The necessary data for this verification are available on the concerning documentation.

When coupling with an ECP3 series generator having a MD35 form, follow the instructions below:

-) according to the type of the coupling, verify the correct placement of the discs (dimension "L") (table 2 pag. 38); if necessary restore the "L" dimension moving gently and axially the rotor. In the right position the clearance of rear bearing should be from 0.5 to 2 mm.

-) move the generator close to the coupling engine

-) align one of the flywheel disk fastening holes with the holes of the previously positioned disks

-) Insert and partially tighten the screws that lock the disks to the flywheel. Turn the flywheel until another two holes are in the same position and partially tighten the screw. Repeat this operation for all the other holes

-) after inspecting the correct centring of the disks on the engine flywheel, the screws must be completely tightened

-) fix the two lateral protection grids supplied with the generator.

Only after a correct mechanical coupling, proceed with the electrical connections.

ACCOUPLEMENT MECANIQUE

Un alignement non précis peut engendrer des vibrations et dommages sur les roulements. Il est en outre conseillé de vérifier la compatibilité des caractéristiques torsionnelles de l'alternateur et du moteur (à charge du client). Les données nécessaires pour cette vérification sur l'alternateur sont disponibles dans la documentation.

En cas de montage d'un générateur série ECP3 ayant la forme constructive MD35, suivre les instructions suivantes:

-) vérifier le positionnement correct des disques (dimension "L") en fonction du type d'accouplement considéré (tableau 2 pag. 38); si besoin remettre la cote "L" en poussant légèrement et axialement le rotor. En position correcte, le roulement arrière doit avoir un jeu axial de 0.5 à 2 mm.

-) approcher l'alternateur au moteur de couplage

-) aligner un des trous de fixation des disques du volant avec le trou des disques placé précédemment

-) Insérer et visser partiellement la vis correspondante qui bloque les disques au volant; afin que les autres trous se présentent à nouveau dans la même position et visser partiellement la vis correspondante. Répéter cette opération pour tous les autres trous

-) après avoir vérifié que le centrage des disques au volant de moteur est correct, bloquer définitivement les susdites vis

-) monter les deux grilles latérales de protection fournies avec le générateur.

Seulement après que l'alternateur soit bien fixé mécaniquement, procéder au raccordement électrique.

MECHANISCHER ANSCHLUß

Eine ungenaue Ausrichtung kann zu Vibrationen und Beschädigungen der Lager führen. Es sollte außerdem überprüft werden, ob die Dreheigenschaften des Generators und des Motors kompatibel sind (dafür ist der Kunde verantwortlich). Die erforderlichen Angaben für diese Änderung sind in den entsprechenden Unterlagen verfügbar.

Bei Anschluß eines Generators der Serie ECP3 mit Bauform MD35 müssen die folgenden Anweisungen befolgt werden :

-) Überprüfen Sie die ordnungsgemäße Position der Scheiben (abmessung "L") je nach gewünschter Kupplung (Tabelle 2, Seite 38); Falls erforderlich, können Sie das Maß "L" durch leichtes axiales Verschieben des Rotors wieder herstellen. In der korrekten Position muss das axiale Spiel des hinteren Lagers zwischen 0,5 und 2,0 mm liegen.

-) Den Wechselstromgenerator dem Koppelungsmotor annähern

-) Eines der zwei Befestigungslöcher der Schwungradscheiben mit dem vorher eingestellten Scheibenloch angleichen

-) Die entsprechende Schraube, die die Scheiben an dem Schwungrad blockiert, ist einzuführen und teilweise festzuschrauben. Das Schwungrad zum rotieren zu bringen, bis sich zwei weitere Löcher in gleicher Stellung befinden. Hierbei ist die entsprechende Schraube teilweise festzuschrauben. Für die restlichen Löcher ist dieser Vorgang zu wiederholen

-) Nach Feststellung der korrekten Zentrierung der Scheiben in das Motor-Schwungrad, sind die genannten Schrauben definitiv festzuziehen

-) Montage der zwei seitlichen Schutznetze, die mit dem Generator mitgeliefert sind.

Erst wenn der Generator mechanisch richtig befestigt ist, kann mit dem elektrischen Anschluß fortgefahren werden.

ACOPLAMIENTO MECANICO

Un alineamento incorrecto puede causar vibraciones o daños a los cojinetes.
Ademas se aconseja verificar la compatibilidad de las caracteristicas torsionales del generador y del motor (responsabilidad del cliente). Los valores del generador para realizar esta comprobacion estan disponibles en la respectiva documentacion.

En el caso de acoplamiento de un generador serie ECP3 con forma constructiva MD35, siga las instrucciones siguientes :

-) verificar el posicionamiento correcto de los discos (dimensiones "L") en funcion del tipo de acople considerado (tabla 2 pag. 38); si es necesario, restablecer la cuota "L" reposicionando leve y axialmente el rotor. En la posicion correcta el cojinete posterior debe tener un juego axial de 0.5 a 2 mm.

-) aproximar el alternador del motor de acoplaje

-) alinear uno de los agujeros de fijación de los discos del volante con el agujero de los discos antes posicionado

-) inserir y atornillar parcialmente el respectivo tornillo que bloquea los discos al volante. Dar la vuelta al volante para que los otros dos agujeros se pongan otra vez en la misma posición y atornillar parcialmente el respectivo tornillo. Repetir la operación para todos los otros agujeros

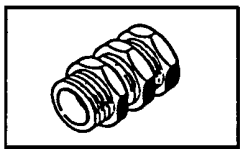
-) después de haber verificado el correcto centraje de los discos en el volante motor, bloquear definitivamente dichos tornillos

-) montar las dos redes laterales de protección, suministradas junto con el generador.

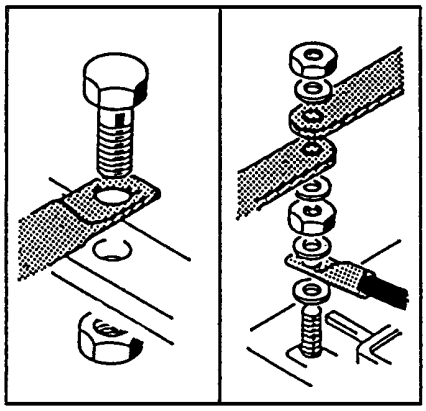
Solo después que el generador haya sido convenientemente fijado mecánicamente, efectuar la conexión eléctrica.

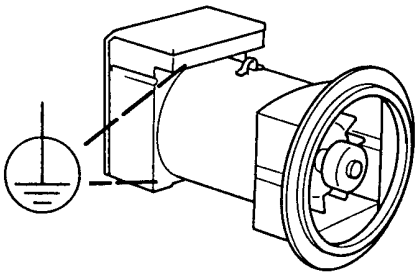
ACCOPPIAMENTO ELETTRICO

L'accoppiamento elettrico e' a cura dell'utilizzatore finale ed e' eseguito secondo la sua sola discrezione.
Per l'ingresso nella scatola morsetti si raccomanda di utilizzare passacavi e serracavi in accordo con le specifiche del paese di esportazione.

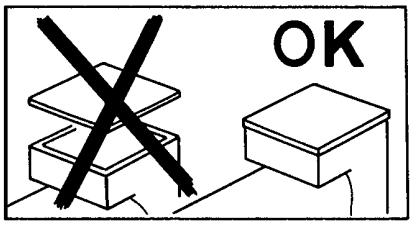


Collegamento avvolgimenti
(tav. 3 pag. 39)
Sono previsti entrambi i collegamenti, stella con neutro (Y) e triangolo (Δ) in tutti gli alternatori.
Per passare da un collegamento Y a Δ (es.da 400V a 230V) e' sufficiente spostare i ponti sulla morsettiera principale (vedere schema tav. 3 pag. 39). Nessun intervento e' richiesto, sul regolatore di tensione.
I generatori sono costruiti di serie con 12 cavi di uscita per consentire di ottenere tensioni diverse (es. 115 / 200 / 230 / 400V).
I generatori, vanno sempre collegati a terra con un conduttore di adeguata sezione utilizzando uno dei due (interno/esterno) appositi morsetti.
Dopo aver eseguito il collegamento, rimontare il coperchio scatola morsetti.

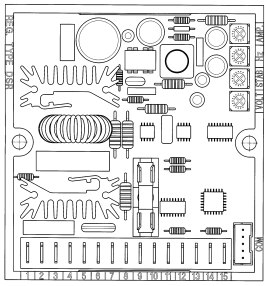




NOTA: variazioni di frequenza.
La macchina fornita per funzionare a 50Hz puo' funzionare anche a 60Hz (o viceversa); e' sufficiente tarare il potenziometro al nuovo valore nominale di tensione.
Passando da 50Hz a 60Hz, la potenza puo' aumentare del 20% (corrente invariata), se la tensione aumenta del 20%; se la tensione rimane invariata la potenza, puo' aumentare del 5% per effetto della migliore ventilazione.
Per generatori costruiti appositamente per una frequenza di 60Hz nel passaggio a 50Hz, la tensione e la potenza devono necessariamente diminuire del 20% rispetto a quelle riferite a 60Hz.

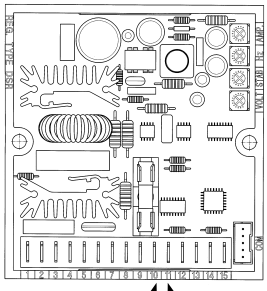


REGOLATORE DI TENSIONE
(tav. 4 pag. 39)
L'autoregolazione ottenuta tramite il regolatore elettronico tipo DSR garantisce in condizioni statiche una precisione della tensione del ± 1% con qualsiasi fattore di potenza e con variazione di velocita' compresa fra -10% e + 20%.



VOLT

ATTENZIONE :
Il controllo di tensione va eseguito a vuoto con l'alternatore funzionante a frequenza nominale.
Agendo sul potenziometro tensione dei regolatori elettronici si puo' ottenere la regolazione della tensione entro il ±5% del valore nominale.
E' anche possibile, inserendo un potenziometro da 10KΩ negli appositi morsetti (10-11), ottenere la regolazione della tensione entro il ± 5% del valore nominale.
Per maggiori dettagli sui regolatori consultare il manuale specifico.



10 -11

ELECTRICAL CONNECTIONS

All electrical output connections are the responsibility of, and are at the discretion of, the end user.
When making terminal box connections, all cable and terminal lugs should meet the relevant standards of the country of final destination.

Windings connection
(table. 3 pag. 39)
All alternators feature both star with neutral(Y) and delta (Δ) connections.
To reconnect from a star to delta connection (for ex. from 400V to 230V), modify the linking arrangements on the output terminal board (see diagram on table 3 page 39).
It is not necessary to adjust the voltage regulator.
Standard alternators are equipped with 12 cables to offer different voltages (for example 115 / 200 / 230 / 400).
The alternator must always be earthed by sufficiently rated cable, using one of the inside or outside terminals. After completing output connections, ensure that the terminal box cover is securely in place.

NOTE : frequency variations.
A standard production machine wound for 50 Hz can also function at 60 Hz (and vice versa) by resetting the A.V.R. voltage potenziometer to the new nominal voltage value.
When changing from 50 to 60 Hz the alternator power, and nominal voltage will increase by 20%, but the current does not change from 50 Hz value. Should voltage stay at 50 Hz nominal value, then the output power may be increased by 5% due to improved ventilation.
For machines wound for 60 Hz, changing to 50 Hz, the voltage and power values have to decrease by 20% of 60 Hz values.

VOLTAGE REGULATOR
(table 4 page 39)
Self-regulation by means of an DSR electronic regulator guarantees precise voltages of ±1% in static conditions with any power factor and with a variation in speed of between -10% and +20%.

PLEASE NOTE :
The generator output voltage must be checked under no-load conditions, with the correct setting of frequency.
The voltage may be adjusted by ± 5% of the nominal, by acting upon the voltage potenziometer on the electronic regulators.
By connecting a 10 KΩ potentiometer across the relevant terminals (10-11), it is possible to have a remote voltage regulation of ± 5% of nominal voltage.
For further details on regulators, please see the specific manual.

RACCORDEMENT ELECTRIQUE

Le raccordement électrique est à la charge de l'utilisateur final et il est exécuté par ses soins.
Pour le raccordement à la boite à bornes, il est recommandé d'utiliser des passecables et des serre cables en accord avec les spécifications du pays d'exportation.

Couplage des enroulements
(Tab. 3 pag. 39)
Tous les alternateurs sont prévus pour être couplés soit en étoile avec neutre (Y) ou soit en triangle (Δ). Pour passer de la connexion Y à Δ (par exemple de 400V à 230V) il est suffisant de modifier la position des barettes sur la planchette à bornes (vois schéma tab. 3 pag. 39). Aucune intervention n'est nécessaire sur le régulateur de tension.
Les alternateurs sont construits en série de 12 fils de sortie afin de permettre d'obtenir plusieurs possibilités de tensions (exemple 115 / 200 / 230 / 400 V).
Les alternateurs doivent toujours être reliés à la terre avec un conducteur de section adéquate en utilisant une des deux (interne/externe) bornes appropriées.
Aprés avoir fait la liaison, remonter le couvercle de la boite à bornes.

NOTE: variations de fréquence.
La machine fournie pour un fonctionnement en 50 Hz peut également être entraînée pour 60 Hz (ou vice et versa).
Il est suffisant de tarer le potentiomètre "Volt" à la nouvelle valeur de tension.
En passant de 50 Hz à 60 Hz, la puissance augmente de 20% (courant constant) si la tension augmente de 20%; par contre si la tension reste identique, la puissance est augmentée de 5% grâce à l'augmentation de la ventilation.
Pour les alternateurs produits à 60 Hz et passant à 50 Hz, la tension et la puissance doivent nécessairement diminuer de 20%.

REGULATEUR DE TENSION
(tableau 4 page 39)
L'autorégulation obtenue au moyen du régulateur électronique de type DSR garantie dans des conditions statiques une précision de la tension de ±1 % avec n'importe quel facteur de puissance et avec une variation de vitesse comprise entre -10% et +20%.

ATTENTION :
Le contrôle de la tension se fait à vide avec l'alternateur fonctionnant à la fréquence nominale.
En agissant sur le potentiomètre de tension du régulateur électronique, on peut obtenir la régulation de la tension entre + ou - 5% de la valeur nominale.
Il est aussi possible, en insérant un potentiomètre de 10 KΩ dans les bornes appropriées (10-11), d'obtenir le réglage de la tension à distance dans une plage de + ou - 5%.
Pour plus de détails sur les régulateurs, consulter le manuel spécifique.

ELETRISCHER ANSCHLUß

Der elektrische Anschluß obliegt dem Endanwender und erfolgt nach eigenem Ermessen. Für den Eingang des Klemmenkastens wird empfohlen, Kabelführungen und Kabelschellen zu verwenden, die den Vorschriften und Spezifikationen des Exportlandes entsprechen.

Anschluß Wicklungen
(Tab. 3 Seite 39)
Für alle Generatoren sind beide Anschlußarten vorgesehen: Stern mit Stempunktleiter (Y) und Dreieckschaltung (Δ). Um von einer Y-Schaltung auf eine Δ-Schaltung zu wechseln, (z.B. von 400V auf 230V), ist es ausreichend, die Brücken auf der Hauptklemmleiste zu verschieben (siehe Schema Tab. 3 Seite 39). Für den Spannungensregler ist keinerlei Eingriff erforderlich. Bei den Generatoren sind serienmäßig 12 Wicklungsenden auf das Hauptklemmbrett herausgeführt, so daß durch entsprechendes Umschalten 4 verschiedene Spannungen möglich sind (z.B. 115 / 200 / 230 / 400 V) lieferbar.
Die Generatoren müssen immer mit einem Leiter mit geeigneten Querschmitt unter Verwendung einer der dafür vorgesehenen Klemmen (innen / außen) geerdet werden.
Nach Durchführund des Anschlusses ist die Abdeckung des Klemmenkastens erneut anzubringen.

ANMERKUNG: Frequenzänderungen.
Ein für 50 Hz vorgesehener Generator kann durch entsprechende Drehzahländerung auch mit 60 Hz betrieben werden (oder umgekehrt).
Dazu ist lediglich am Sollwertpotentiometer die mit der geänderten Drehhzahl ebenfalls sich ändernde Spannung wieder auf die Nennspannung einzustellen.
Beim Übergang von 50 auf 60 Hz darf die abgenommene Leistung um 20% erhöht werden.
Beim Übergang von 60 auf 50 Hz muussen umgekehrt sowohl die Leistung als auch die Spannung wieder entsprechend reduziert werden.

SPANNUNGREGLER
(Abb. 4 Seite 39)
Die Selbstregelung durch den elektronischen Regler, Typ DSR, gewährleistet unter statischen Bedingungen eine Genauigkeit der Spannungseinstellung von ± 1%, mit jedem Leistungsfaktor und mit einer Drehzahländerung zwischen -10% und +20%.

ATTENTION :
Die Spannungskontrolle wird im Leerlauf bei Nennfrequenz durchgeführt.
Das Spannungspotentiometer der elektronischen Regler erlaubt die Spannungseinstellung. Diese Einstellung muß innerhalb ± 5% begrenzt sein.
Es ist ferner möglich, die geforderte Spannung mit einer Abweichung von ± 5% über Fernbedienung zu erziehen, und zwar durch Anschluß eines 10 KΩ Potentiometers an die entsprechenden Klemmen. Für weitere Einzelheiten bezüglich der Regler, schlagen Sie bitte in dem entsprechenden Handbuch nach.

CONEXION ELECTRICA

La conexión eléctrica es responsabilidad del usuario final y la misma se efectúa a discreción de este último. Para la entrada en la caja de bornes se recomienda utilizar pasa-cables con su sistema de fijación respectivo en conformidad con las especificaciones del país de exportación.

Conexión bobinados
(Tab. 3 pag. 39)
Se preveen ambas conexiones, estrella con neutro (Y) y triángulo (Δ) en todos los alternadores.
Para pasar de una conexión Y a Δ (ej. de 400V a 230V) es suficiente desplazar los puentes sobre los bornes principales (ver esquema tab. 3 pag. 39). Ningún tipo de intervención es requerido en el regulador de tensión. Los generadores son construidos de serie con 12 cables de salida para permitir diferentes valores de tensión (por ej. 115 / 200 / 230 / 400V).
Los generadores, deben ser siempre conectados a tierra con un conductor de sección adequada, utilizando uno de los dos bornes (interno/externo) previstos para la misma. Después de haber realizado la conexión, montar nuevamente la tapa de la caja de bornes.

NOTA: variación de frecuencia.
La máquina suministrada para funcionamiento a 50 Hz puede también funcionar a 60 Hz o viceversa. Para ello es suficiente tarar el potenciómetro al nuevo valor nominal de la tensión. Pasando de 50 a 60 Hz la potencia puede aumentar un 20% (corriente invariable) si la tensión aumenta un 20%. Si la tensión permanece invariable, la potencia puede aumentar un 5% por el efecto de una mejor ventilación.
Para generadores construidos a 60 Hz, al pasar a 50 Hz, la tensión y la potencia deberán disminuir necesariamente un 20% con respecto a los valores de 60 Hz.

REGULADOR DE TENSION
(tabla 4 pág. 39)
La autorregulación obtenida mediante el regulador electrónico tipo DSR garantiza en condiciones estáticas una precisión de la tensión del ± 1% con cualquier factor de potencia y con una variación de velocidad de entre -10% y +20%.

ATENCION :
El control de tensión se efectúa con el generador en vacío (sin carga) y a la frecuencia nominal.
Ajustando el potenciómetro tensión de los reguladores eletrónicos se puede obtener la regulación de la misma dentro del ± 5% del valor nominal.
Es también posible, conectando un potenciómetro de 10 KΩ en los bornes respectivos (10-11), obtener una regulación de la tensión a distancia dentro de un rango del ± 5%.
Para mayor información sobre los reguladores, consultar el manual especifico.

ACCOPPIAMENTO ELETTRICO

PROTEZIONI
Il regolatore elettronico DSR al fine di evitare anormali e pericolosi funzionamenti dell'alternatore e' provvisto di una protezione di bassa velocita' e di una per il sovraccarico.

Protezione bassa velocita':
Il suo intervento e' istantaneo e provoca la riduzione della tensione di macchina quando la frequenza scende al di sotto del 10% di quella nominale.
La soglia di intervento si regola agendo sul potenziometro "Hz".

Protezione di sovraccarico:
Un opportuno circuito compara la tensione parzializzata di eccitazione.
Se per piu' di 20 secondi viene superato il valore prestabilito per tale tensione (valore a cui corrisponde un valore di corrente di carico uguale a 1,1 volte la corrente di targa dell'alternatore), il regolatore interviene abbassando la tensione di macchina con conseguente limitazione della corrente entro valori di sicurezza.
Il ritardo e' appositamente inserito per permettere lo spunto dei motori che normalmente si avviano in 5÷10 secondi.
Anche questa soglia di intervento e' regolabile agendo sul potenziometro "AMP".

CAUSE CHE PROVOCANO L'INTERVENTO DELLE PROTEZIONI.

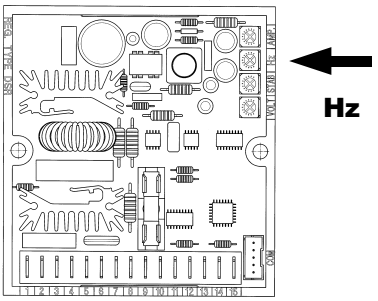
Intervento istantaneo protezione bassa velocita':
1 - velocita' ridotta del 10% rispetto ai dati di targa.

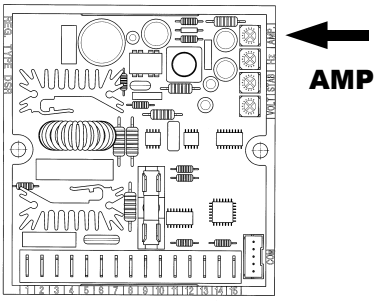
Intervento ritardato protezione sovraccarico :
2 - sovraccarico del 10% rispetto ai dati di targa.
3 - fattore di potenza (cos φ) inferiore ai dati di targa.
4 - temperatura ambiente oltre i 50°C.

Intervento di entrambe le protezioni :
5 - combinazione del fattore 1 con i fattori 2, 3, 4.

Nel caso di intervento delle protezioni, la tensione erogata dall'alternatore scendera' fino ad un valore che dipendera' dall'entita' dell'anomalia.
La tensione tornera' automaticamente al suo valore nominale qualora venga a cessare l'inconveniente.

Dopo aver eseguito tutti i collegamenti elettrici e **solo dopo aver chiuso tutte le protezioni** e' possibile effettuare la prova di primo avviamento del sistema.





ELECTRICAL CONNECTIONS

PROTECTIONS
The DSR electronic regulator is equipped with a low speed safety device as well as an overload safety device to prevent irregular and dangerous operation of the alternator.

Low speed safety device:
It is activated immediately to reduce the machine voltage when the frequency decreases to less than 10% of the rated value.
The activation level can be regulated using the "Hz" potentiometer.

Overload safety device:
A special circuit is used to compare the partial excitation voltage.
If, for a period longer than 20 seconds, this voltage is higher than the pre-set value (which corresponds to a charging current equal to 1,1 times the current indicated on the alternator data plate), the regulator is activated and lowers the machine voltage, thereby limiting the current to a safe amount.
The time delay is specifically set to give the motors time to pickup, as they usually require about 5÷10 seconds to start.
This activation level can be regulated using the "AMP" potentiometer.

INTERVENTION OF PROTECTION DEVICES CAUSES.

Underspeed protection instantaneous intervention :
1 - speed reduced by 10% of nominal RPM

Delayed intervention of overload protection :
2 - overload by 10% of nominal rating.
3 - power factor (cos φ) lower than the nominal-one.
4 - ambient temperature above 50°C.

Intervention of both protections :
5 - combination of factor 1 with factors 2, 3, 4.

In case of intervention the output voltage will drop down to a value which will depend on the fault.
The voltage will return automatically to its nominal value as soon as the fault is removed.

After all the electric connections have been made and **only after all the protections have been put in place,** can the system be started.

RACCORDEMENT ELECTRIQUE

PROTECTION
Le régulateur électronique DSR, en vue d'éviter des fonctionnements anormaux et dangereux de l'alternateur, est doté d'une protection à basse vitesse et d'une protection de surcharge.

Protection basse vitesse :
Son intervention est instantanée et provoque la réduction de la tension de la machine quand la fréquence descend au-dessous de 10% de la fréquence nominale.
Le seuil d'intervention est réglé en agissant sur le potentiomètre "Hz".

Protection de surcharge :
Un circuit spécial compare la tension partialisée d'excitation.
Si pendant plus de 20 secondes la valeur préfixée pour cette tension (valeur à laquelle correspond une valeur de courant de charge égale à 1,1 fois le courant de plaque de l'alternateur) est dépassée, le régulateur intervient en baissant la tension de la machine, avec limitation consécutive du courant dans des valeurs de sécurité.
Le retard est spécialement inséré pour permettre le démarrage des moteurs, qui normalement démarrent en 5÷10 secondes.
On peut régler également ce seuil d'intervention en agissant sur le potentiomètre "AMP".

CAUSES QUI PROVOQUENT L'INTERVENTION DES PROTECTIONS.

Intervention instantanée de la protection sous-vitesse :
1 - vitesse réduite de 10% par rapport aux réglages nominales.
Intervention retardée de la protection surcharge :
2 - surcharge de 10% par rapport aux valeurs nominales.
3 - facteur de puissance (cos φ) inférieur aux valeurs nominales.
4 - température ambiante supérieure à 50°C.
Intervention de toutes les protections :
5 - combinaison des facteurs 1 avec 2, 3 et 4.

Dans ce cas la tension de la machine diminuera jusqu'à une valeur qui dépendra de l'entité de l'anomalie.
La tension reviendra automatiquement à sa valeur nominale lorsque cessera la cause du problème.

Aprés avoir exécuté tous les raccordements électriques et **seulement après avoir contrôlé le fonctionnement de toutes les protections**, il est possible d'effectuer l'essai de la première mise en marche du système.

ELETRISCHER ANSCHLUß

SCHUTZEINRICHTUNGEN
Der elektronische Regler ist zwecks Vermeidung einer anomalen und gefährlichen Funktionsweise des Generators mit einem Unterdrehzahl- und Überlastschutz ausgerüstet.

Unterdrehzahlschutz :
dieser spricht unverzögert an und verursacht eine Spannungsabsenkung, sobald die Frequenz mehr als 10% unter die Nennfrequenz absinkt.
Der Ansprechwert wird auf dem Potentiometer "Hz" eingestellt.

Überlastungsschutz :
Ein zweckmäßiger Stromkreis vergleicht die gedrosselte Erregerspannung. Wenn der für diese Spannung festgelegte Wert für eine Dauer von mehr als 20 Sekunden überschritten wird (diesem Wert entspricht ein Ladestrom, der dem 1,1-fachem des auf dem Typenschild des Generators angegebenen Stroms gleich ist), spricht der Regler an und reduziert die Generatorspannung, wobei der Erregerstrom auf einen sicheren Wert begrenzt wird.
Die Verzögerung gestattet es, den kurzfristig erforderlichen erhöhten Anlaufstrombedarf von Motoren, die normalerweise innerhalb 5÷10 Sekunden anlaufen, zu decken. Auch dieser Ansprechwert ist auf dem Potentiometer "AMP" einstellbar.

STÖRUNGEN, DIE ZUM AUSLÖSEN DER SCHUTZEINRICHTUNGEN FÜHREN

Unverzögertes Ansprechen des Unterdrehzahzahlschutzes :
1 - Auslösung bei 10% under Nenndrehzahl gemäß Typenschild.
Verzögertes Ansprechen des Überlast schtzes, Auslösung bei :
2 - 10% Überlast im Vergleich mit Angaben auf dem Typenschild.
3 - Leistungsfaktor cosphi (cos φ) kleiner als Nennleistungsfaktor gemäß Typenschild.
4 - Umgebungstemperatur größer 50°C.
Ansprechen beider Schtzeinrichtungen :
5 - Kombination der Ursache 1 mit 2, 3 und 4.

Sofen Unterdrehzahl und eine oder mehrere Ursachen für das Ansprechen des Überlastschutzes auftreten, wird die Erregerspannung auf einen Wert zurückgeregelt, der vom Ausmaß der Fehlerursachen abhängt. Sobald die Störung beseitigt ist, kehrt die Spannung auf den Nennwert zurück.

Nachdem alle elektrischen Anschlüsse ansgeführt und **nur nachdem alle Schutzvorrichtungen geschlossen wurden,** ist es möglich, die Prüfung eines ersten Systemstarts durchzuführen.

CONEXION ELECTRICA

PROTECCIONES
El regulador electrónico DSR a fin de evitar el funcionamiento anómalo y peligroso del alternador, está provisto de una protección contra la baja velocidad y otra contra la sobrecarga.

Protección contra la baja velocidad:
Su actuación es instantánea y produce la reducción de la tensión de máquina cuando la frecuencia llega por debajo del 10% de la nominal.
El límite de actuación se ajusta actuando sobre el potenciómetro "Hz".

Protección contra la sobrecarga:
Un circuito oportuno compara la tensión excitadora seccionada.
Si durante más de 20 segundos se supera el valor prefijado para dicha tensión (valor al que le corresponde un valor de corriente de carga igual a 1,1 veces la corriente anódica del alternador), el regulador actúa bajando la tensión de máquina, así limitando la corriente dentro de los valores de seguridad.
El retardo está inserido especificadamente para permitir el arranque de los motores que generalmente tardan 5÷10 segundos para ponerse en marcha.
También este umbral de intervención se puede ajustar actuando sobre el potenciómetro "AMP".

CAUSAS QUE PRODUCEN LA INTERVENCION DE LAS PROTECCIONES.

Intervención instantanea, protección baja velocidad :
1 - velocidad reducida del 10% con relación a los datos de tarjeta.
Intervento retardado, protección de sobrecarga :
2 - sobrecarga del 10% respecto a los datos de tarjeta.
3 - factor de potencia (cos φ) inferior a los datos de tarjeta.
4 - temperatura ambiente superior 50 °C.

Intervención de ambas protecciones :
5 - combinación del factor 1 con los factores 2, 3, 4.

En el caso de intervención, la tensión suministrada por el alternador descenderá hasta un valor que dependerá de la entidad del problema.
La tension volverá automáticamente a su valor nominal en el momento cese el inconveniente.

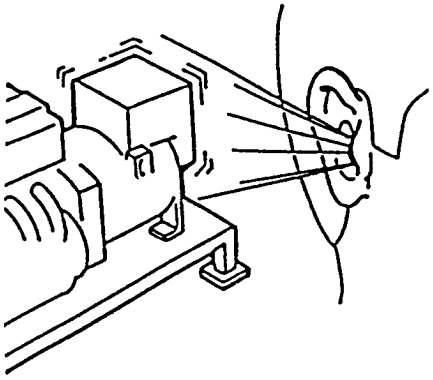
Después de haber realizado todas las conexiones eléctricas y **"solo después de haber cerrado todas las protecciones"** es posible efectuar el primer arranque del sistema.

AVVIAMENTO E ARRESTO

La strumentazione per l'avviamento, la conduzione e l'arresto del sistema e' a carico dell'installatore.

LE OPERAZIONI DI AVVIAMENTO, CONDUZIONE E ARRESTO DEVONO ESSERE ESEGUITE DA PERSONALE ADEGUATAMENTE QUALIFICATO E CHE ABBIA LETTO E COMPRESO LE PRESCRIZIONI DI SICUREZZA ALL'INIZIO DEL MANUALE.

ATTENZIONE :
Durante il primo avviamento, che deve essere eseguito a velocita' ridotta, l'installatore dovra' verificare che non si presentino rumori anomali.
In caso di rumori anomali provvedere a fermare immediatamente il sistema e intervenire per migliorare l'accoppiamento meccanico.



STARTING AND STOPPING OPERATIONS

All the instrumentation for starting, running and stopping the system shall be provided by the installer.

THE STARTING, RUNNING AND STOPPING OPERATIONS MUST BE CARRIED OUT BY SKILLED PERSONNEL WHO HAVE READ AND UNDERSTOOD THE SAFETY INSTRUCTIONS AT THE BEGINNING OF THIS MANUAL.

PLEASE NOTE :
When the system is set to work for the first time, which has to be done at a reduced speed, the operator shall check that no anomalous noises can be detected.
If an anomalous noise is detected, stop the system immediately and improve the mechanical coupling.

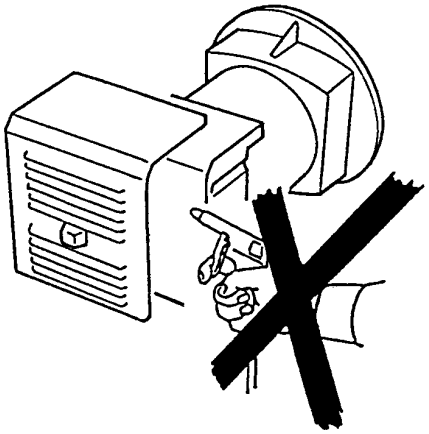
PULIZIA E LUBRIFICAZIONE

Prima di avvicinarsi al generatore assicurarsi che sia a stato energetico zero e a temperatura ambiente; a questo punto e' possibile pulirlo esternamente con aria compressa.

NON UTILIZZARE MAI LIQUIDI O ACQUA.

NON PULIRE CON ARIA COMPRESSA LE PARTI ELETTRICHE INTERNE, POICHE' POSSONO VERIFICARSI CORTOCIRCUITI O ALTRE ANOMALIE.

Per i generatori della serie ECP3 non è necessaria la lubrificazione per tutto il periodo di funzionamento (30.000 h).



CLEANING AND LUBRICATION

Prior to approaching or touching the alternator, ensure that it is not live and it is at room temperature; at this stage it is possible to clean it on the outside using compressed air.

NEVER USE LIQUIDS OR WATER.

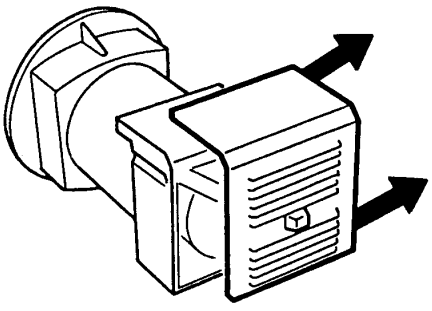
DO NOT CLEAN THE INSIDE ELECTRIC COMPONENTS WITH COMPRESSED AIR, BECAUSE THIS MAY CAUSE SHORT-CIRCUITS OR OTHER ANOMALIES.

For the alternator Series ECP3 it is not necessary the lubrification for all the period of functioning (30.000 h).

MANUTENZIONE

PERICOLO
DANGER

Per smontare l'alternatore della serie ECP3 è necessario attenersi alle seguenti istruzioni:



Togliere la chiusura posteriore

MANUTENTION

GEFAHR
PELIGRO

In order to disassemble the alternator series ECP3, follow the following instructions:

Remove the rear panel.

DEMARRAGE ET ARRET

La manipulation pour le démarrage, le fonctionnement et l'arrêt est à la charge de l'installateur.

LES OPERATIONS DE DEMARRAGE, FONCTIONNEMENT ET ARRET DOIVENT ETRE FAITES PAR DU PERSONNEL QUALIFIE AYANT LU ET COMPRIS LES PRESCRIPTIONS DE SECURITE AU DEBUT DU MANUEL.

ATTENTION:
Durant le premier démarrage, qui doit être exécuté à vitesse réduite, l'installateur doit vérifier qu'aucun bruit anormal ne se présente.
Dans le cas de bruits anormaux, interrompre immédiatement le fonctionnement et vérifier l'accouplement mécanique.

ANTRIEB UND STILLSETZUG

Die Instrumentierung für Antrieb, die Netzführung und die Stillsetzung der Systeme obliegt dem Monteur.

ANTRIEB, NETZFÜHRUNG UND STILLSETZUNG DÜRFEN AUSSCHLIEßLICH VON ENTSPRECHEND QUALIFIZIERTEN FACHPERSONAL DURCHGEFÜHRT WERDEN UND ZWAR ERST NACHDEM DIE SICHERHEITSVORSCHRIFTEN AM ANFANG DIESES HANDBUCHS GELESEN UND VERSTANDEN WORDEN SIND.

ACHTUNG:
Während der ersten Inbetriebnahme, die mit reduzierter Geschwindigkeit erfolgen muß, hat der Monteur zu überprüfen, ob Anomalien in der Geräuschentwicklung auftreten. Im Falle von Anomalien in der Geräuschentwicklung, ist dafür zu sorgen, daß die Anlage unverzüglich gestoppt wird. Die mechanischen Anschlüsse müssen in diesem Falle verbessert werden.

ARRANQUE Y PARADA

La instrumentación para el arranque, la conducción y la parada del sistema es a cargo del instalador.

LAS OPERACIONES DE ARRANQUE, CONDUCCION Y PARADA DEBEN SER REALIZADAS POR PARTE DE PERSONAL ADECUADAMENTE CALIFICADO Y QUE HAYA LEIDO Y COMPRENDIDO LAS NORMAS DE SEGURIDAD AL PRINCIPIO DEL MANUAL.

ATENCION:
Durante el primer arranque, que deberá efectuarse a baja velocidad, el instalador deberá controlar que no se presenten rumores anormales.
En caso de rumores anormales, detener inmediatamente el sistema e intervenir para mejorar el acoplamiento mecánico.

NETTOYAGE ET GRAISSAGE

Avant tout contact avec l'alternateur, s'assurer de sa propreté parfaite et qu'il soit à température ambiante; il est alors possible de le nettoyer exterieurement avec de l'air comprimé.

NE JAMAIS UTILISER DE LIQUIDE OU DE L'EAU.

NE PAS NETTOYER AVEC DE L'AIR COMPRIME LES PARTIES ELECTRIQUES INTERNES, CAR L'ON POURRAIT PROVOQUER UN COURT-CIRCUIT OU AUTRES ANOMALIES.

Pour les alternateurs de la series ECP3 aucun grausage n'est nécessaire durant toute la période de fonctionnement (30.000h).

REINIGUNG UND SCHMIERUNG

Bevor Sie sich dem Generator nähern, ist sicherzustellen, daß dieser nicht mehr stromführend ist und sich auf Raumtemperatur abgekühlt hat; zu diesem Zeitpunkt ist es möglich, den Generator von außen mit Preßluft zu reinigen.

NIEMALS FLÜSSIGREINIGER ODER WASSER VERWENDEN.

DIE INNENLIEGENDEN ELEKTROTEILE NIEMALS MIT PRESSLUFT REINIGEN, DA SICH KURZSCHLÜSSE ODER ANDERE STÖRUNGEN DARAUS ERGEBEN KÖNNTEN.

Für die Generatoren der Serie ECP3 ist keine Schmierung notwendig fridie ganze Funktrionsdarier (30.000 stunden).

LIMPIEZA Y LUBRIFICACION

Antes de acercarse al generador, asegurarse que el mismo sea a estado energético cero y a temperatura ambiente; en estas condiciones es posible limpiarlo externamente con aire comprimido.

NO UTILIZAR NUNCA LIQUIDOS O AGUA.

NO LIMPIAR CON AIRE COMPRIMIDO LAS PARTES ELECTRICAS INTERNAS, DEBIDO A LA POSIBILIDAD DE CAUZAR CORTOCIRCUITOS O CUALQUIER OTRO TIPO DE PROBLEMA.

Por los generadores de la series ECP3 no es necesario la lubrificion por todos el periodo de functionamiento (30.000h).

MAINTENANCE

PERICOLO DANGER

Pour démonter l'alternateur de la série ECP3, suivre les instructions suivantes :

Ôter la tôle de fermeture.

WARTUNG

Um den Generator der Serie ECP3 zu demontieren, ist es nicht notwendig, den Erregerrotor zu entfernen.

Den hinteren Verschluß entfernen.

MANTENIMIENTO

GEFAHR PELIGRO

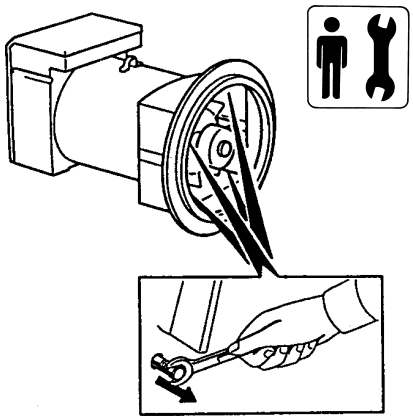
Para desmontar el alternador de la serie ECP3 cùmplanse las instrucciones siguientes:

Quitar la tapa posterior.

MANUTENZIONE

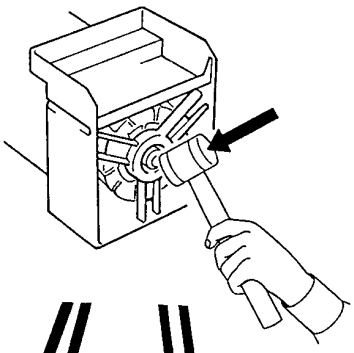
MANUTENTION

Smontare lo scudo anteriore svitando i 4 dadi di fissaggio.



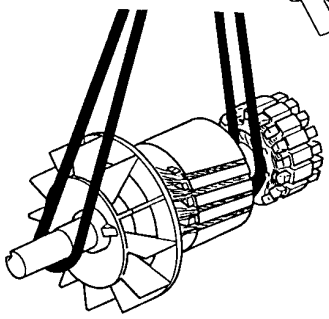
To remove the front shield, unscreaw the four fixing nut.

Battendo con un apposito martello in gomma sull'albero, lato opposto all'accoppiamento.



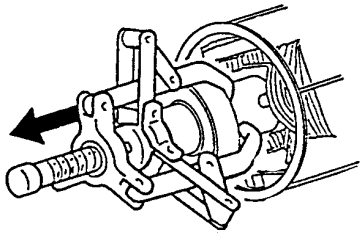
Beating with an appropriate rubber-hammer on the shaft, opposite coupling side.

SFILARE IL ROTORE UTILIZZANDO UN MEZZO DI SOLLEVAMENTO CON FUNI MORBIDE MA DI PORTATA ADEGUATA. ESEGUIRE L'ESTRAZIONE MOLTO DELICATAMENTE E APPOGGIARLO NELLA ZONA DI LAVORO PREDISPOSTA.



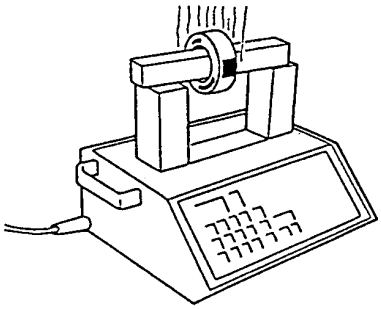
EXTRACT THE ROTOR USING A HOISTING MECHANISM WITH SOFT ROPES OF SUFFICIENT STRENGTH. SLOWLY AND CAREFULLY EXTRACT THE ROTOR AND PLACE IT IN THE WORK AREA WHICH HAS BEEN PREVIOUSLY PREPARED.

Per l'eventuale sostituzione del/i cuscinetto/i utilizzare un estrattore, del tipo illustrato in figura.



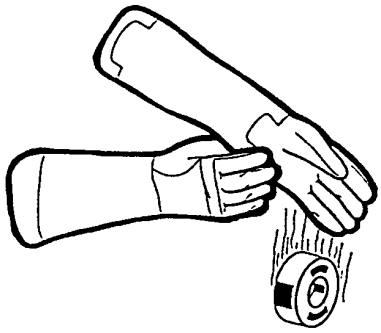
To replace the bearing/s, use a puller of the type shown in the figure.

Per il rimontaggio del cuscinetto, riscaldare lo stesso con un apposito dispositivo magnetico, del tipo illustrato in figura.



To reassemble the bearing, heat it with a special magnetic device of the type shown in the figure.

Indossando gli appositi guanti antiscottatura rimontare il/i cuscinetto/i.



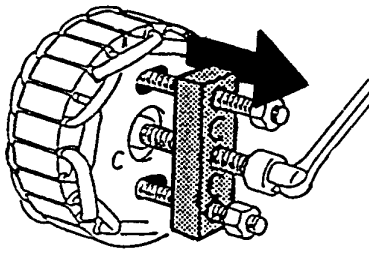
Wear special anti-scorch gloves, reassemble the bearing/s.

MAINTENANCE	WARTUNG	MANTENIMIENTO
Demonter le flasque avant en defaisant les 4 ecrous de serrage.	Das entsprechende Lagerschild abbauen, dem man die 4 Klemmutterm ausschraubt.	Desmontar el escudo anterior destornillando los 4 dados de fijato.
Taper avec un maillet en bois ou caoutchouc dur sur l'arbre du cote oppose o a l'accouplement.	Mit cinem Gummihammer auf die Welle schlagen, gegenüberliegende Verbin-dungsseite.	Golpeando con une deliberado martillo en goma sopra el àrbol, lato opuesto al empleme.
DEMONTER LE ROTOR EN UTILISANT UN MOYEN DE LEVAGE AVEC DES SANGLES SOUPLES MAIS DE DIMENSION ADEQUATE : EFFECTUER L'EXTRACTION TRES DELICATEMENT ET LE POSER SUR LA ZONE DE TRAVAIL PREVUE.	DEN ROTOR MIT HILFE EINER HEBEVORRICHTUNG (WEICHE SEILE MIT EINER ANGEMESSENEN TRAGFÄHI-GKEIT) VORSICHTIG HERAUSZIEHEN UND IM VORGESEHENEN ARBEITSBEREICH ABSTELLEN.	SACAR EL ROTOR UTILIZANDO UN EQUIPO DE ELEVACION DOTADO DE CUERDAS DE RESISTENCIA ADECUADA. REALIZAR LA EXTRACCION CON SUMO CUIDADO, LUEGO APOYARLO EN LA ZONA DE TRABAJO DISPUESTA A TAL FIN.
Pour le remplacement éventuel du/des roulement/s utiliser un extracteur, comme illustré sur la figure.	Für einen eventuellen Austausch des/der Lagers/Lager ist eine Ausziehvorrichtung, gemäß Abbildung, zu verwenden.	Para la sustitución eventual del/de los cojinetes/s utilizar un extractor, del tipo representado en la figura.
Pour remonter le roulement, réchauffer ce dernier avec un dispositif magnétique spécial, comme illustré sur la figure.	Für den Wiedereinbau des Lagers ist dieses mit einer Magnetvorrichtung zu erhitzen (siehe Abbildung).	Para volver a montar el cojinete, calentar este último por medio de un dispositivo magnético adecuado, del tipo representado en la figura.
En mettant les gants spéciaux anti-brûluré, remonter le/les roulement/s.	Beim Wiedereinbau des/der Lagers/Lager sind zweckmäßige Schutzhandschuhe zu tragen.	Llevando puestos los específicos guantes antiquemaduras, volver a montar el/los cojinete/s.

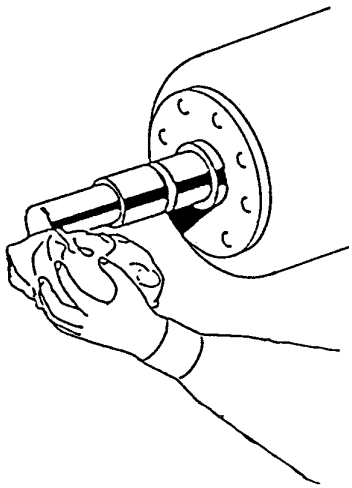
MANUTENZIONE

Nel caso di sostituzione dello statore eccitatrice, attenersi alle seguenti istruzioni.

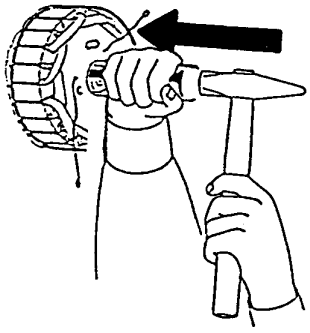
Dissaldare i 2 cavi di collegamento al rotore principale.



Inserire un adeguato estrattore, facilmente costruibile o reperibile presso la nostra sede, come illustrato in figura.
Tale estrattore consente di togliere l'eccitatrice con molta rapidita'.



Prima di rimontare l'eccitatrice, pulire bene la sede dell'albero e cospargere con un leggero strato "Permabond AO22" della Angst-Pfister o equivalenti, tale sede.



Rimontare seguendo a ritroso le operazioni fin qui descritte, facendo attenzione che i cavi di collegamento diodi siano rivolti verso l'esterno.

Utilizzando un attrezzo simile a quello rappresentato in figura, rimontare l'eccitatrice.

MANUTENTION

When replacing the exciter stator, follow the instructions below.

Unsolder the two cable of connection of the main rotor.

Insert a suitable puller, that can be easily made or supplied by our company, as shown in the picture.
This puller will enable to take out the exciter very easily.

Before replacing the exciter, clean the shaft seat thotoughly and cover it with a thin layer of "Permabond A022" of Angst-Pfister or a similar product.

Reassemble the exciter following the above-described steps inversely, carefully check that the diode connecting cables are turned toward the outside.

Using a tool similar to the one shown in the figure, reassemble the exciter.

En cas de remplacement du stator excitateur, suivre les instructions suivantes:

Bei einem eventuellen Austausch des Erregerstators müssen folgende Anleitungen befolgt werden:

En caso de sustituciòn del estator de la excitatriz, cùmplanse las instrucciones siguientes:

Defaire les 2 cables de liaison au rotor principal.

Die zwei Verbindungskabel die den Haupläufer verbinden, loslöten.

Desalder los huecos de connexiòn al rotor principal.

Insérer un extracteur adéquat, facilement constructible comme illustré sur la figure en référence. Un tel extracteur permet d'ôter l'excitatrice avec beaucoup de rapidité.

Eine geeignete Abziehvorrichtung wie in nebenstehender Abbildung, ansetzen. Diese Abziehvorrichtung kann leicht selbst angefertigt oder bei uns erhalten werden.
Damit kann der Erregerotor rasch herausgezogen werden.

Introducir un adecuado extractor, fácil de fabricar o disponible a través de nuestra sede, como se muestra en la figura.
Dicho extractor permite de quitar la excitatriz con mucha rapidez.

Avant de remonter l'excitatrice, bien nettoyer le siège de l'arbre et passer une couche légère de "Permabond A022 de l'Angst-Pfister ou équivalent."

Vor dem Wiedereinbau des Erregers, ist der Sitz der Welle sorgfältig zu reinigen und mit einer dünnen Schicht "Permabond A022" von Angst-Pfister oder einem ähnlichem Produkt, zu bestreuen.

Antes de montar nuevamente la excitatriz, limpiar adecuatamente la parte del eje en questión y pasar suavemente una tela esmeril "Permabond A022" de marca Angst-Pfister o equivalente sobre el mismo.

Remonter en suivant à rebours les opérations décrites jusqu'ici, en faisant attention à ce que les fils de liaison des diodes soient dirigés vers l'extérieur.

En utilisant un outil semblable à celui représenté sur la figure, remonter l'excitatrice.

Den Wiedereinbau in umgekehrter Reihenfolge durchführen, wobei darauf zu achten ist, daß die Dioden-Anschlußkabel nach außen gerichtet sind.

Unter Verwendung eines ähnlichen wie in der Abbildung dargestellten Werkzeuges ist der Erreger wieder zu montieren.

Volver a montarlo todo ejecutando al revés las operaciones que se acaban de detallar, cuidando que los cables de conexión de los diodos estén hacia fuera.

Utilizando una herramienta similar a la que está representada en la figura, volver a montar la excitatriz.

MANUTENZIONE

Procedura di verifica per diodi rotore eccitatrice.

Strumentazione necessaria :
- batteria 12V
- lampada 12V-21W (o in alternativa resistenza 6.8Ω-30W)
- voltmetro (Ex. Multimetro su scala VOLT d.c.)

Importante: Prima di eseguire le operazioni seguenti sconnettere i due cavi di collegamento del rotore principale al ponte diodi (+ e -).

TEST DEI DIODI SUL "NEGATIVO"

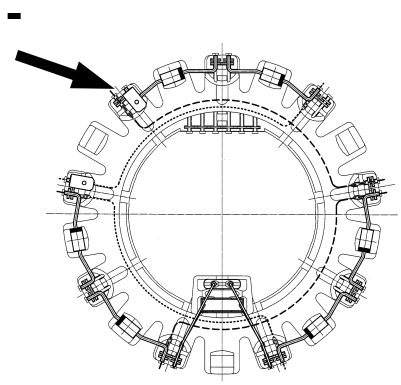
- Connettere gli strumenti come indicato in figura A (tabella 7 pag. 41)
- Fissare il cavo connesso alla lampada al morsetto negativo del ponte come indicato in figura A (tabella 7 pag. 41)

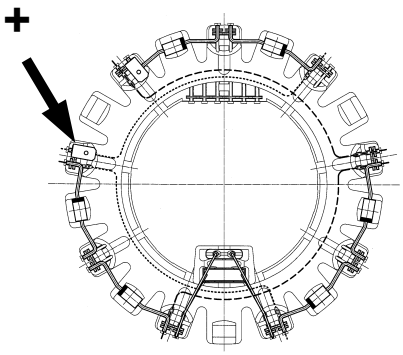
- Connettere il terminale "Probe" ai punti A1, A2 ed A3 in sequenza per verificare rispettivamente i diodi 1, 2 e 3. Verificare la lettura sul voltmetro in relazione a quanto indicato in tabella (tabella 7 pag. 41).

TEST DEI DIODI SUL "POSITIVO"
- Connettere gli strumenti come indicato in figura B (tabella 7 pag. 41)
- Fissare il cavo connesso al negativo della batteria al morsetto positivo del ponte come indicato in figura B (tabella 7 pag. 41)
- Connettere il terminale "Probe" ai punti A4, A5 e A6 in sequenza per verificare rispettivamente i diodi 4, 5 e 6; verificare la lettura sul voltmetro in relazione a quanto indicato in taella (tabella 7 pag. 41).

ISTRUZIONI PER LA SOSTITUZIONE DEL DIODO.
Qualora i valori riscontrati indichino un diodo danneggiato, occorrera' procedere alla sostituzione del componente.
A tale scopo si raccomanda di non estrarre i reofori dalle rispettive sedi ma di tagliarli in prossimità del corpo del componente; inserire il nuovo componente rispettando le polarità e saldare a stagno accuratamente i reofori con gli spezzoni rimasti nelle sedi.

IMPORTANTE
IMPORTANT
WICHTIG





MAINTENANCE

Procedure to check the diodes of the exciter rotor.

Necessary equipment :
- 12V battery
- 12V-21W lamp (or alternatively 6.8Ω-30W Resistance)
- Voltmeter (for instance, multimeter on scale VOLT d.c.)

Warning: before performing the following actions, it is necessaty to disconnect the 2 cables connecting the main rotor to the diode bridge (+and-)

TEST OF THE DIODES ON THE "NEGATIVE"
- Connect the equipment, as it is pointed out in the picture A (table 7 page 41)
- Fix the cable connected to the lamp to the negative terminal of the bridge, as it is pointed out in the picture A (table 7 page 41)
- Connect the terminal "Probe" to the point A1 (it is checked the diode 1), then to the point A2 (it is checked the diode 2) and finally to the point A3 (it is checked the diode 3); check the readings on the voltmeter in relation with what is reported on the table (table 7 page 41).

TEST OF THE DIODES ON THE "POSITIVE"
- Connect the equipment, as it is pointed out in the picture B (table 7 page 41)
- Fix the cable connected to the negative terminal of the battery to the positive terminal of the bridge, as it is pointed out in the picture B (table 7 page 41)
- Connect the terminal "Probe" to the point A4 (it is checked the diode 4), then to the point A5 (it is checked the diode 5) and finally to the point A6 (it is checked the diode 6); check the readings on the voltmeter in relation with what is reported on the table (table 7 page 41).

INSTRUCTIONS TO REPLACE THE DIODE
When the values measured point out a diode damaged, it is necessary to replace the component.
For this purpose it is recommended to not pull the rheophores out from their locations, but to cut them near to the body of the component; then fit in the new component respecting the polarity and soft-solder accurately the rheophores with the pieces remained in their locations.

MAINTENANCE

Procedure pour controler les diodes du stator d'excitatrice.

Equipment necessaire :
- Batterie 12 Volts
- Lampe 12V–21W (ou bien Résistance 6.8Ω-30W)
- Voltmètre (Exemple multimètre sur échelle VOLT d.c.)

Important : Avant d'effectuer les opérations suivantes, déconnecter les 2 câbles de connexion du rotor principal au pont de diodes (+ et -).

TEST DES DIODES SUR LE " NEGATIF "
- Connecter les instruments comme indiqué en figure A (tableau 7 pag. 41).
- Faire toucher le câble relié à la lampe à la borne négative du pont comme indiqué en figure A (tableau 7 pag. 41).
- Connecter la borne " PROBE " au point A1 (cela contrôle la diode 1) ensuite au point A2 (cela contrôle la diode 2) et enfin au point A3 (cela contrôle la diode 3); contrôler les lectures sur le voltmètre par rapport à ce qui est indiqué sur le tableau (tableau 7 pag. 41).

TEST DES DIODES SUR LE " POSITIF "
- Connecter les instruments comme indiqué en figure B (tableau 7 pag. 41).
- Faire toucher le câble connecté à la borne negative de la batterie à la borne positive du pont de diode comme indiqué sur la figure B (tableau 7 pag. 41).
- Connecter la borne " PROBE " au point A4 (cela contrôle la diode 4) ensuite au point A5 (cela contrôle la diode 5) et enfin au point A6 (cela contrôle la diode 6) ; contrôler les lectures sur le voltmètre par rapport à ce qui est indiqué sur le tableau (tableau 7 pag. 41).

INSTRUCTIONS POUR LE REMPLACEMENT DE LA DIODE

Lorsque les valeurs mesurées indiquent une diode endommagée, il est nécessaire de la remplacer.
Pour ceci, il est recommandé de ne pas extraire les réophères hors de leurs emplacements respectifs mais de les couper la plus près possible du corps du composant ; insérer le nouveau composant en respectant les polarités et souder soigneusement à l'étain les réophères avec les autres pièces à leur emplacement.

WARTUNG

Vorgehensweise zur Prüfung der Dioden im Erregerrotor.

BENÖTIGTE TEILE
- 12V Batterie
- 12V-21W Lampe (alternativ 6.8.Ω-30W Widerstand)
- Voltmeter (Multimeter oder Zeigerinstrument d.c.)

Wichtig : Bevor die folgenden Aktionen durchgeführt werden, ist es erforderlich die 2 Leitungen des Hauptrotors von der Diodenbrücke abzuklemmen (+ und -).

DIODENTEST AM "MINUSPOL"
- Teile anschließen wie in Bild A beschrieben (Abb. 7 Seite 41).
- Schließen Sie die von der Lampe kommene Leitung am Minuspol der Diodenbrücke an, wie in Bild A beschrieben (Abb. 7 Seite 41)
- Um die Dioden 1, 2 und 3 zu überprüfen , schließen Sie die freie Leitung an die Punkte A1, A2 und A3 an und messen jeweils den Spannungsabfall im Vergleich zur Tabelle (Abb. 7 Seite 41).

DIODENTEST AM "PLUSPOL"
- Teile anschließen wie in Bild B beschrieben (Abb. 7 Seite 41)
- Schließen Sie die von der Minuspol der Batterie kommene Leitung am Pluspol der Diodenbrücke an, wie in Bild B beschrieben (Abb. 7 Seite 41)
- Um die Dioden 4, 5 und 6 zu überprüfen, schließen Sie die freie Leitung an die Punkte 4, 5 und 6 an und messen jeweils den Spannungsabfall im Vergleich zur Tabelle (Abb. 7 Seite 41).

ANWEISUNG ZUM WECHSEL EINER DIODE

Falls bei den Messungen eine defekte Diode erkannt wurde, ist diese umgehend auszutauschen.
In diesem Fall schlagen wir vor die Anschlüsse der defekten Diode am Diodenkörper abzuschneiden; die neue Diode, unter berücksichtigung der Polarität, an die verbliebenen Anschlussenden mittels Lötzinn fachgerecht anzulöten.

MANTENIMIENTO

Procedimiento de control para diodos rotor excitatriz.

Instrumentacion necesaria :
- Bateria 12V.
- Lampara 12V-21W (o en alternativa resistencia 6.8Ω-30W)
- Voltimetro (Ex. Multimetro sobre escala VOLT d.c.)

Importante : Antes de ejecutar seguir las operaciones siguientes: desconectar los dos cables de conexion del rotor principal al puente diodos (+y-).

PRUEBA DE DIODOS SOBRE EL "NEGATIVO"
- Conexionar los instrumentos como indicado en figura A (tab. 7 pag. 41)
- Fijar el cable conectado a la lampara al terminal negativo del puente como indicado en figura A (tab. 7 pag. 41)
- Conexionar el terminal "Probe" a los puntos A1, A2 y A3 en secuencia para verificar respectivamente los diodos 1, 2 y 3. Verificar la lectura sobre el voltimetro en relacion a cuanto indicado en la tabla (tab. 7 pag. 41).

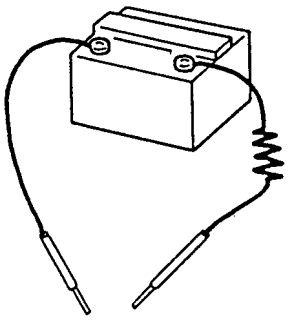
PRUEBA DE DIODOS SOBRE EL "POSITIVO"
- Conexionar los instrumentos como indicado en figura B (tab. 7 pag. 41)
- Fijar el cable conectado al terminal negativo de la bateria al terminal positivo del puente como indicado en figura B (ab. 7 pag. 41)
- Conexionar el terminal "Probe" a los puntos A4, A5 y A6 en secuencia para verificar respectivamente los diodos 4, 5 y 6; verificar la lectura sobre el voltimetro en relacion a cuanto indicado en la tabla (tab. 7 pag. 41).

INSTRUCCIONES PARA LA SUSTITUCION DEL DIODO

Si los valores comprobados indican un diodo dañado, habra que proceder al reemplazo del componente.
A tal efecto se aconseja de no extraer los reoforos de sus respectivos alojamientos y de cortarlos en proximidad del cuerpo del componente; insertar el nuevo componente respetando las polaridades y soldar a estaño con cuidado los reoforos con los recortes quedados en los alojamientos.

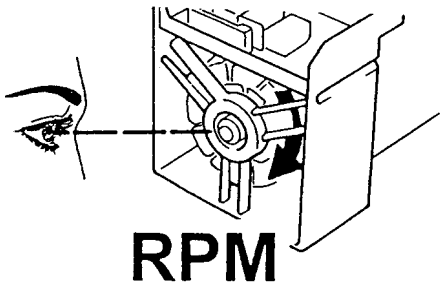
ANOMALIE E RIMEDI

IL GENERATORE NON SI ECCITA
- Controllare il fusibile e se necessario sostituire
- In caso di tensione residua insufficiente, aumentare la velocità del 15%.
- In caso di tensione residua nulla, applicare per un istante + e - del regolatore elettronico una tensione di 12 V di una batteria, con in serie una resistenza di 30 Ω, rispettando le polarità.



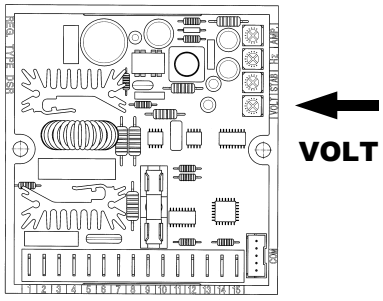
DOPO ECCITATO SI DISECCITA
- Controllare i cavi di collegamento servendosi dei disegni allegati.

A VUOTO TENSIONE BASSA
- Ritarare la tensione mediante l'apposito potenziometro.
- Controllare il numero di giri. (possibile intervento della protezione)
- Controllare gli avvolgimenti.



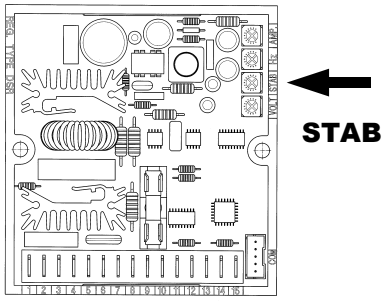
A VUOTO TENSIONE ALTA
- Ritarare la tensione mediante l'apposito potenziometro.
- Controllare il regolatore e se necessario sostituire.

A CARICO TENSIONE INFERIORE ALLA NOMINALE
- Ritarare la tensione mediante l'apposito potenziometro.
- Corrente troppo alta, cosφ inferiore a 0.8, velocità inferiore del 4% della nominale. (possibile intervento della protezione)
- Controllare il regolatore e se necessario sostituire.
- Controllare i diodi scollegando i cavi; sostituire se necessario.



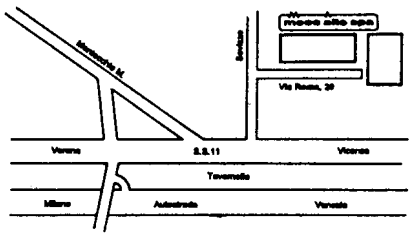
A CARICO TENSIONE SUPERIORE ALLA NOMINALE
- Ritarare la tensione mediante l'apposito potenziometro.
- Controllare il regolatore e se necessario sostituire.

TENSIONE INSTABILE
- Controllare l'uniformità di rotazione.
- Regolare la stabilità del regolatore agendo sul potenziometro "STAB.".



GENERATORE RUMOROSO
- Controllare e se necessario sostituire i cuscinetti.
- Verificare e se necessario migliorare l'accoppiamento.

Per qualsiasi altra anomalia rivolgersi al rivenditore, ai centri di assistenza autorizzati o direttamente alla Mecc Alte Spa.



DEFECTS AND REMEDIES

ALTERNATOR DOES NOT EXCITE
- Check the connection cables using the attached diagrams.
- Increase speed by 15%.
- For an instant apply on the electronic regulator a 12 V battery voltage with a 30Ω resistor in series respecting the polarities.

AFTER BEING EXCITED ALTERNATOR DOES NOT EXCITE
- Check connection cables as per attached drawings.

LOW VOLTAGE AT NO LOAD
- Calibrate the voltage using the special potentiometer.
- Check the number of turns. (possible safety device activation)
- Check the windings.

HIGH VOLTAGE AT NO LOAD
- Calibrate the voltage using the special potentiometer.
- Check the regulator and replace it if necessary.

AT LOAD CONDITIONS, VOLTAGE LOWER THAN RATED VALUE
- Calibrate the voltage using the special potentiometer.
- Current too high, cosφ lower than 0.8, speed lower than 4% of the rated value. (possible safety device activation)
- Check the regulator and replace it if necessary.
- Disconnect the cables and check the diodes; replace them if necessary.

AT LOAD CONDITIONS, VOLTAGE HIGHER THAN RATED VOLTAGE
- Calibrate the voltage using the special potentiometer.
- Check the regulator and replace it if necessary.

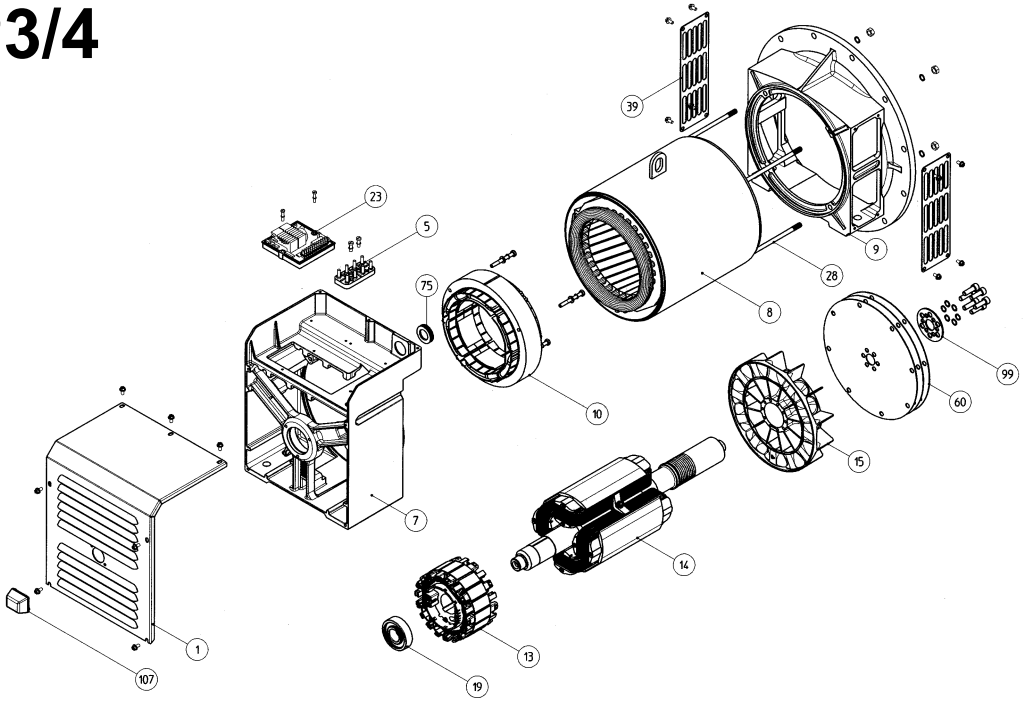
UNSTABLE VOLTAGE
- Check that rotation is uniform.
- Regulate the stability of the regulator with the "STAB" potentiometer.

NOISY GENERATOR
- Check if the bearings must be replaced.
- Check if the coupling can be improved.

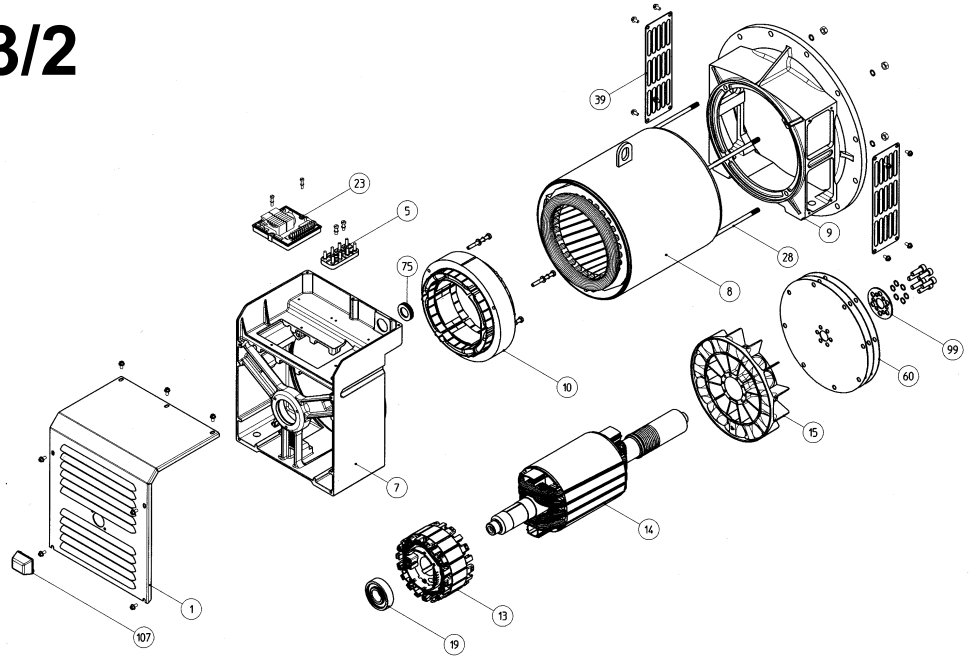
For any other defect, please contact the seller, the after-sales service or Mecc Alte Spa directly.

ANOMALIES ET REPARAT.	STÖRUNGEN UND ABHILFE	PROBLEM. Y SOLUCIONES
L'ALTERNATEUR NE S'EXCITE PAS - Contrôler le fusible et si nécessaire le remplacer. - En cas de tension résiduelle insuffisante, augmenter la vitesse de 15%. - En cas de tension résiduelle nulle, appliquer pendant un instant + et - du régulateur électronique une tension de 12V d'une batterie, avec en série une résistance de 30 Ω en respectant les polarités.	**DER GENERATOR ERREGT SICH NICH** - Die Schmelzsicherung kontrollieren und bei Bedarf austauschen. - Bei unzureichender Restspannung die Drehzahl um 15% erhöhen. - Bei mangelnder Restspannung ist für kurze Zeit an die Plus- und Minuspole des elektronischen Reglers eine Batteriespannung von 12 Volt anzulegen. Dabei ist ein Widerstand von 30 Ω in Reihe zur Batterie zu schalten. Polarität beachten.	**GENERADOR NO SE EXCITA** - Controlar el fusible y, de ser necesario, sustituirlo. - En caso de tensión residual insuficiente, aumentar en un 15% la velocidad. - En caso de tensión residual nula, aplicar durante un instante en los signos + y - del regulador electrónico la tensión de 12 V de una batería, con una resistencia de 30 Ω conectada en serie, observando las polaridades.
APRES REEXCITATION SE DESEXCITE - Contrôler les câbles de connections en se servant des schémas de raccordement.	**AUSFALL DES GENERATORS NACH ERREGUNG** - Anhand der beiliegenden Zeichnungen die Anschlußkabel kontrollieren.	**DESPUES DE EXCITADO SE DESEXCITA** - Controlar los cables de conexión, con el auxilio de los dibujos adjuntos.
A VIDE TENSION TROP BASSE - Retarer la tension au moyen du potentiomètre. - Contrôler le nombre de tours (intervention possible de la protection) - Contrôler les enroulements.	**NIEDRIGE SPANNUNG BEI LEERLAUF** - Die Spannung mit dem Potentiometer neu einstellen. - Die Drehzahl kontrollieren (mögliches Ansprechen der Schutzeinrichtung). - Die Wicklungen kontrollieren.	**EN VACIO TENSION BAJA** - Volver a calibrar la tensión mediante el potenciómetro correspondiente. - Controlar el número de revoluciones (posible actuación de la protección). - Controlar los devanados.
A VIDE TENSION TROP ELEVEE - Retarer la tension au moyen du potentiomètre prévu à cet effet. - Contrôler le régulateur et le remplacer si nécessaire.	**ZU HOHE SPANNUNG BEI LEERLAUF** - Die Spannung mit dem Potentiometer neu einstellen. - Den Regler kontrollieren und bei Bedarf austauschen.	**EN VACIO TENSION ELEVADA** - Volver a calibrar la tensión mediante el potenciómetro correspondiente. - Controlar el regulador y, de ser necesario, sustituirlo.
EN CHARGE LA TENSION EST INFERIEURE A LA TENSION NOMINALE - Retarer la tension au moyen du potentiomètre prévu à cet effet. - Courant trop élevé, cosφ inférieur à 0.8, vitesse inférieure de 4% à la vitesse nominale (intervention possible de la protection). - Contrôler le régulateur et le remplacer si nécessaire. - Contrôler les diodes en débranchant les fils; les remplacer si nécessaire.	**BEI BELASTUNG NIEDRIGERE SPANNUNG ALS NORMAL** - Die Spannung mit dem Potentiometer neu einstellen. - Zu hoher Strom, cosφ kleiner als 0.8 oder Geschwindigkeit um 4% niedriger als die Nenngeschwindigkeit (mögliches Ansprechen der Schutzeinrichtung). - Den Regler kontrollieren und bei Bedarf austauschen. - Kabel abklemmen und Dioden kontrollieren; bei Bedarf austauschen.	**EN CARGA TENSION INFERIEUR A LA NOMINAL** - Volver a calibrar la tensión mediante el potenciómetro correspondiente. - Corriente demasiado alta, cosφ inferior a 0,8, velocidad el 4% inferior a la nominal (posible actuación de la protección). - Controlar el regulador y, de ser necesario, sustituirlo. - Controlar los diodos desconectando los cables; de ser necesario, sustituirlos.
EN CHARGE, LA TENSION EST SUPERIEURE A LA NOMINALE - Retarer la tension au moyen du potentiomètre prévu à cet effet. - Contrôler le régulateur et le remplacer si nécessaire.	**BEI BELASTUNG HÖHERE SPANNUNG ALS NORMAL** - Die Spannung mit dem Potentiometer neu einstellen. - Den Regler kontrollieren und bei Bedarf austauschen.	**EN CARGA TENSION SUPERIOR A LA NOMINAL** - Volver a calibrar la tensión mediante el potenciómetro correspondiente. - Controlar el regulador y, de ser necesario, sustituirlo.
TENSION INSTABLE - Contrôler l'uniformité de rotation. - Régler la stabilité du régulateur en agissant sur le potentiomètre "STAB".	**UNSTABILE SPANNUNG** -Drehzahlpendelung beseitigen. -Die Stabilität des Reglers über das Potentiometer "STAB" regulieren.	**TENSION INESTABLE** - Controlar que la rotación sea uniforme. - Regular la estabilidad del regulador actuando sobre el potenciómetro "STAB".
ALTERNATEUR BRUYANT - Contrôler et remplacer si nécessaire les roulements. - Vérifier et si nécessaire améliorer l'accouplement.	**LÄRMENDEN GENERATOR** - Die Lager kontrollieren und bei Bedarf austauschen. - Den Anschluß prüfen und bei Bedarf verbessern.	**GENERADORE RUIDOSO** - Controlar y, de ser necesario, sustituir los cojinetes. - Verificar y, de ser necesario, mejorar el acoplamiento.
Pour n'importe quelles autres anomalies, se référer au revendeur, aux centres d'assistance ou directement à Mecc Alte Spa.	Bei Auftreten von anderen Störungen, wenden Sie sich bitte an den Händler, an die Service-Zentralen oder direkt an die Firma Mecc Alte Spa.	En caso de cualquier tipo de problema dirigirse siempre al revendedor, centros de reparación o directamente a la Mecc Alte Spa.

ECP3/4



ECP3/2



Nella richiesta di pezzi di ricambio specificare il tipo e il codice dell'alternatore.

When requesting spare parts always indicate the alternator's type and code.

Pour toute demande de pièces de rechange, prière de mentionner le type et le code de l'alternateur.

Bei Ersatzteilbestellung bitte immer die Teilbenennung den Typ und den Code des Generators angeben.

En cada pedido de piezas de recambio especificar siempre el tipo y el código del alternador.

N.	DENOMINAZIONE	NAME	DESIGNATION	NAMEN	DENOMINACION	CODICE CODE
1	cuffia	terminal box lid	couvercle	deckel	tapa	8500611200
5	morsettiera di utilizzazione	terminal board	planchette à bornes	klemmbrett	placa de bornes	9909915061
7	coperchio posteriore	non drive end bracket	flasque arrière	hinteres gehäuse	cierre posterior	6102204136
8	carcassa con statore	frame and stator	carcasse avec stator	gehäuse mit stator	carcasa con estator	* * *
9	coperchio anteriore	drive end bracket	flasque avant	vorderer gehäuse	cierre anterior	* * *
10	statore eccitatrice	exciter stator	stator de l'excitatrice	erregerstator	estator excitatriz	4500478657
13	rotore eccitatrice	exciter armature	induit d'excitatrice	erregeranker	inductor excitatriz	4500568151
14	induttore rotante	rotor assy	roue polaire	rotierender induktor	inductor rotante	* * *
15	ventola d.40	fan d.40	ventilateur d.40	lüfter d.40	ventilador d.40	9909514075
15	ventola d.50	fan d.50	ventilateur d.50	lüfter d.50	ventilador d.50	9909514076
17	cuscinetto anter. 6308-2RS C3	front bearing 6308-2RS C3	roulement avant 6308-2RS C3	vorderes lager 6308-2RS C3	cojinete delantero 6308-2RS C3	9900905110
19	cuscinetto post. 6305-2RS C3	rear bearing 6305-2RS C3	roulement arrière 6305-2RS C3	hinter lager 6305-2RS C3	cojinete posterior 6305-2RS C3	9900905095
23	regolatore elettronico DSR	electronic regulator DSR	régulateur électronique DSR	elektronischer regler DSR	regulador electronico DSR	4505005560
28	tirante coperchio S	cover stay bolt S	tige de flasque S	zugstange S	tirante del cierre S	9911190296
28	tirante coperchio L	cover stay bolt L	tige de flasque L	zugstange L	tirante del cierre L	9911190297
29	tirante centrale	securing stud	tige centrale	zentriersstift	tirante central	* * *
39	retina di protezione	protection screen	grille de protection	schutzgitter	rejilla de proteccion	8500626095
60	dischi	disc plates	disques	kupplungsscheiben	discos	* * *
75	gommino passacavo	cable grommet	pass cable en caoufchoul	gummi auge	goma pasacables	9909509105
99	anello bloccaggio dischi	disc locking ring-spacer	anneau blocage des disques	spannring distanzschiben	anillo de bloc. discos separad.	6110611508
107	tappo cuffia	rubber cap	obturateur	gummistopfen	tapa de goma	9909505006
123	anello distanziale	ring spacer	anneau espaceur	abstandring	anillo separadores	7502212040

Tavola
Table
Tableau
Abbildung
Tabla

1

RESISTENZA DEGLI AVVOLGIMENTI A 20°C AMBIENTE
WINDING RESISTENCES AT 20°C ROOM TEMPERATURE
RESISTANCE DES BOBINAGES A 20°C DE TEMPERATURE AMBIANTE
WIDERSTAND DER WICKLUNG BEI 20°C RAUMTEMPERATUR
RESISTENCIA DE LOS BOBINADOS A 20°C DE TEMPERATURA AMBIENTE

GENERATORI 2 POLI - 2 POLE GENERATORS - ALTERNATEURS 2 POLES
GENERATOREN 2 POLIG - GENERADORES 2 POLOS
3000 RPM 115/200/230/400V

TIPO TYPE TYP	GENERATORE GENERATOR PARTIE PUISSANCE GENERADORES			ECCITATRICE EXCITER EXCITATRICE ERREGER EXCITATRIZ	
	STATORE STATOR 1-2 Ω	ROTORE ROTOR Ω	AVVOLGIMENTO AUSILIARIO AUXILIARY WINDING HILFS WICKLUNG BOBINADO AUXILIAR Ω	STATORE STATOR Ω	ROTORE ROTOR Ω
ECP3 - 1S	1,608	6,702	2,200	15,71	1,453
ECP3 - 2S	1,084	7,364	1,930	15,71	1,453
ECP3 - 3S	0,678	8,238	1,740	15,71	1,453
ECP3 - 1L	0,512	9,487	1,680	15,71	1,453
ECP3 - 2L	0,443	9,627	1,480	15,71	1,453

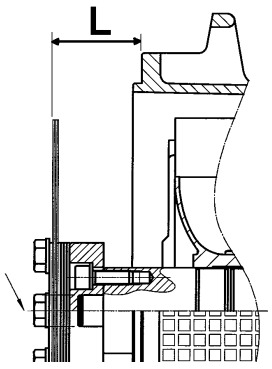
GENERATORI 4 POLI - 4 POLE GENERATORS - ALTERNATEURS 4 POLES
GENERATOREN 4 POLIG - GENERADORES 4 POLOS
1500 RPM 115/200/230/400V

TIPO TYPE TYP	GENERATORE GENERATOR PARTIE PUISSANCE GENERADORES			ECCITATRICE EXCITER EXCITATRICE ERREGER EXCITATRIZ	
	STATORE STATOR 1-2 Ω	ROTORE ROTOR Ω	AVVOLGIMENTO AUSILIARIO AUXILIARY WINDING HILFS WICKLUNG BOBINADO AUXILIAR Ω	STATORE STATOR Ω	ROTORE ROTOR Ω
ECP3 - 1S	1,938	6,078	4,380	15,71	1,453
ECP3 - 2S	1,272	7,141	3,900	15,71	1,453
ECP3 - 1L	0,914	8,539	3,800	15,71	1,453
ECP3 - 2L	0,732	9,743	3,500	15,71	1,453
ECP3 - 3L	0,628	10,884	3,750	15,71	1,453

Tavola
Table
Tableau
Abbildung
Tabla

2

TABELLA COPPIE DI SERRAGGIO PER DISCHI
COUPLING DISCS TIGHTENING TORQUE TABLE
TABLEAU DE COUPLE DE SERRAGE POUR DISQUES
KUPPLUNG AUZUGSMOMENT TABELLE
TABLA PAR DE TORQUE POR DISCOS



TIPO TYPE TYP	SAE	L	DIMENSIONE VITI SCREWS DIMENSIONS DIMENSIOS VIS SCHRAUBENBMESSUNGEN DIMENSIONES TORNILLOS TCCEI	COPPIA DI SERRAGGIO (Nm) TIGHTENING TORQUE (Nm) COUPLE DE SERRAGE (Nm) ANZUGSMOMENT (Nm) PAR DE TORQUE (Nm) CL. 8.8
ECP3	6 ½	30,2	M8 x 25	25
	7 ½	30,2	M8 x 25	25
	8	62	M8 x 55	25
	10	53,8	M8 x 50	25
	11 ½	39,6	M8 x 35	25

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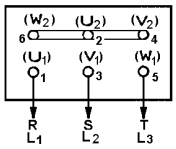
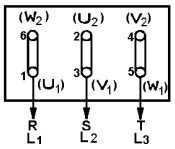
3

COLLEGAMENTI GENERATORI A 6 FILI
CONNECTIONS FOR 6 LEAD ALTERNATORS
CONNECTIONS ALTERNATEURS 6 FILS
ANSCHLUSSE DER GENERATOREN MIT 6 WICKLUNSENDEN
CONEXION ALTERNADOR DE 6 HILOS

COLLEGAMENTO A STELLA
STAR CONNECTION
CONNECTION ETOILE
STERNSCHALTUNG
CONEXION EN ESTRELLA

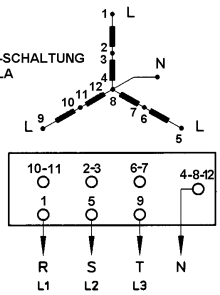




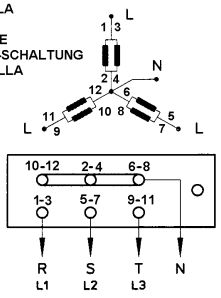
COLLEGAMENTO A TRIANGOLO
DELTA CONNECTION
CONNECTION TRIANGLE
DREIECKSCHALTUNG
CONEXION EN TRIANGULO

COLLEGAMENTI GENERATORI A 12 FILI
CONNECTIONS FOR 12 LEAD ALTERNATORS
CONNECTIONS ALTERNATEURS 12 FILS
ANSCHLUSSE DER GENERATOREN MIT 12 WICKLUNSENDEN
CONEXION ALTERNADOR DE 12 HILOS

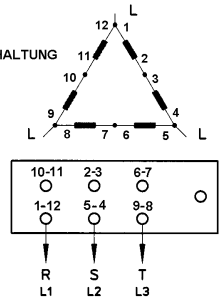
SERIE STELLA
SERIES STAR
SERIE ETOILE
STERN-REIHEN-SCHALTUNG
SERIE ESTRELLA



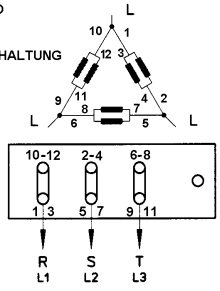
PARALLELO STELLA
PARALLEL STAR
PARALLELE ETOILE
STERN-PARALLEL-SCHALTUNG
PARALELO ESTRELLA



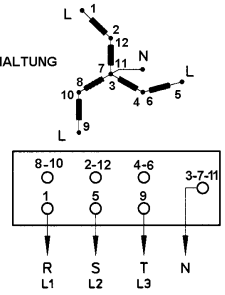
SERIE TRIANGOLO
SERIES DELTA
SERIE TRIANGLE
DREIECK-REIHEN-SCHALTUNG
SERIE TRIANGULO



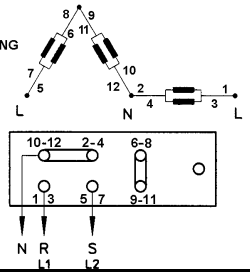
PARALLELO TRIANGOLO
PARALLEL DELTA
PARALLELE TRIANGLE
DREIECK-PARALLEL-SCHALTUNG
PARALELO TRIANGULO



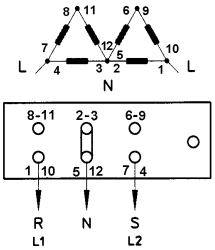
ZIG-ZAG TRIFASE
THREE-PHASE ZIG-ZAG
ZIG-ZAG TRIFASE
DREIPHASIGEN ZIG-ZAG SCHALTUNG
ZIG-ZAG TRIFASICA



MONOFASE PARALLELO ZIG-ZAG
SINGLE PHASE PARALLEL ZIG-ZAG
MONOPHASE PARALLELE ZIG-ZAG
EINPHASING ZIG-ZAG PARALLEL SCHALTUNG
MONOFASE PARALELO ZIG-ZAG



DOPPIO TRIANGOLO
DOUBLE DELTA
DOUBLE TRIANGLE
DOPPEL-DREIECK SCHALTUNG
DOBLE TRIANGULO



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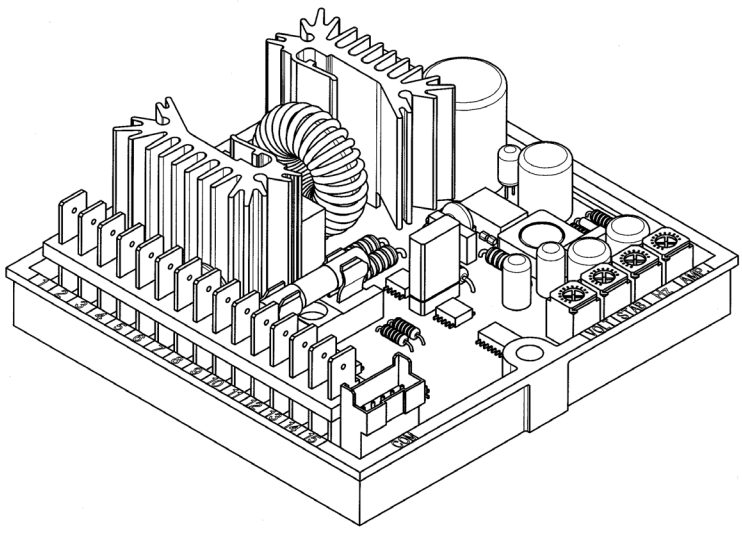
4

REGOLATORE ELETTRONICO DSR
ELECTRONIC REGULATOR DSR
RÉGULATEUR ÉLECTRONIQUE DSR
ELEKTRONISCHER REGLER DSR
REGULADOR ELECTRONICO DSR



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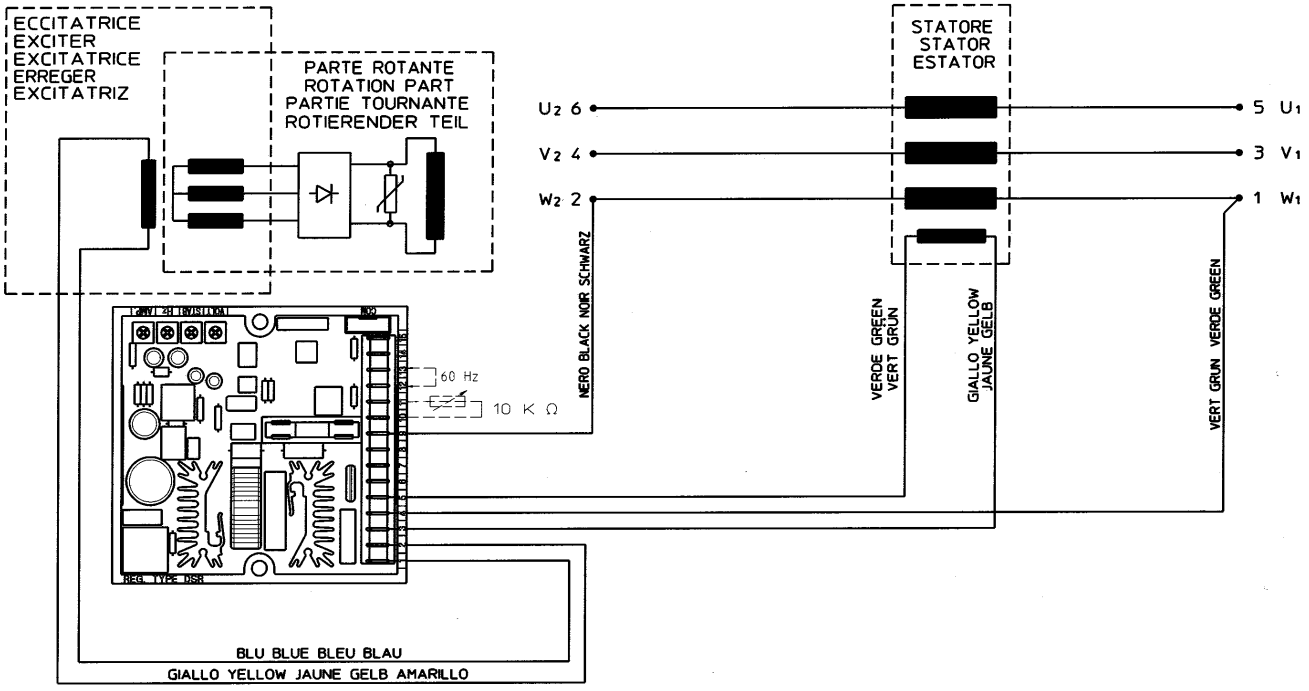
5

SCHEMA ELETTRICO ECP3 6 MORSETTI CON DSR
ECP3 6 WIRES ELECTRICAL DIAGRAM WITH DSR
SCHEMA ELECTRIQUE ECP3 6 BORNES AVEC DSR
SCHALTPLAN ECP3 MIT 6 KLEMMEN UND DSR
ESQUEMA ELECTRICO ECP3 6 HILOS CON DSR



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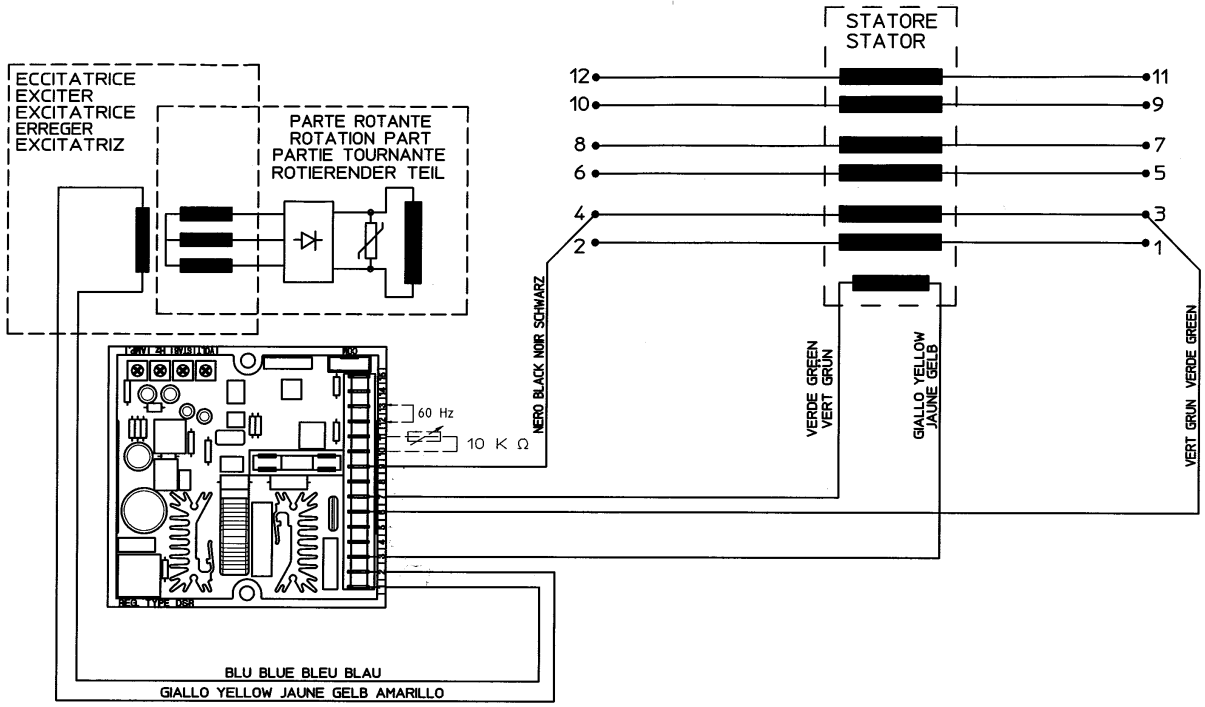
6

SCHEMA ELETTRICO ECP3 12 MORSETTI CON DSR
ECP3 12 WIRES ELECTRICAL DIAGRAM WITH DSR
SCHEMA ELECTRIQUE ECP3 12 BORNES AVEC DSR
SCHALTPLAN ECP3 MIT 12 KLEMMEN UND DSR
ESQUEMA ELECTRICO ECP3 12 HILOS CON DSR



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7

PROCEDURA DI VERIFICA PER DIODI ROTORE ECCITATRICE.
PROCEDURE TO CHECK THE DIODES OF THE EXCITER ROTOR.
PROCEDURE POUR CONTROLER LES DIODES DU STATOR D'EXCITATRICE.
VORGEHENSWEISE ZUR PRÜFUNG DER DIODEN IM ERREGERROTOR.
PROCEDIMIENTO DE CONTROL PARA DIODOS ROTOR EXCITATRIZ.

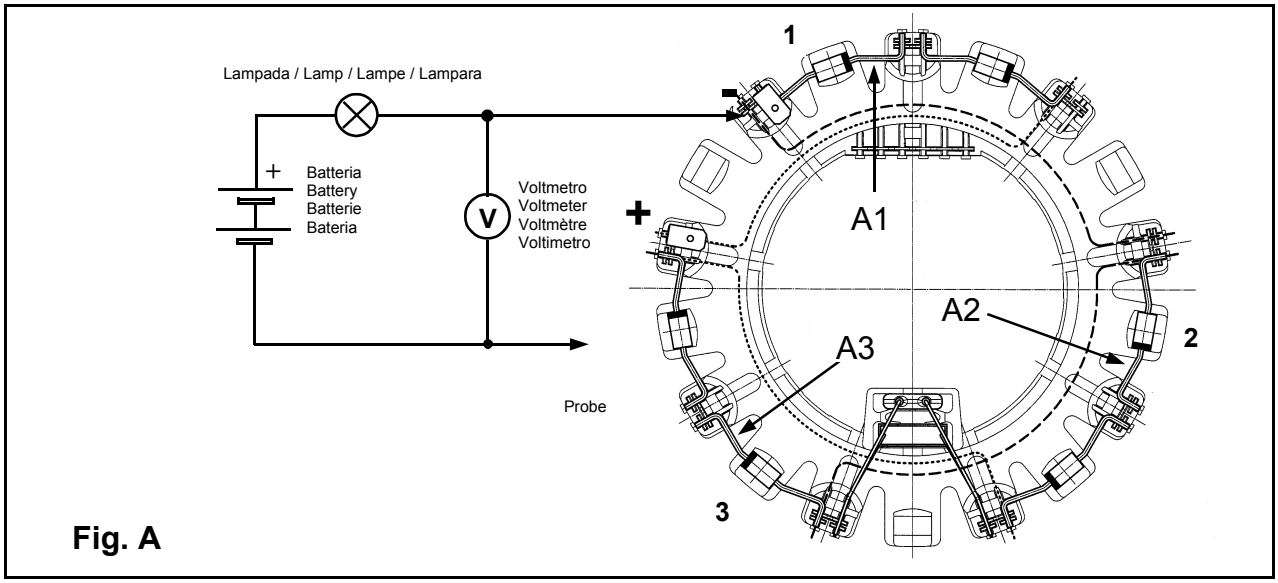
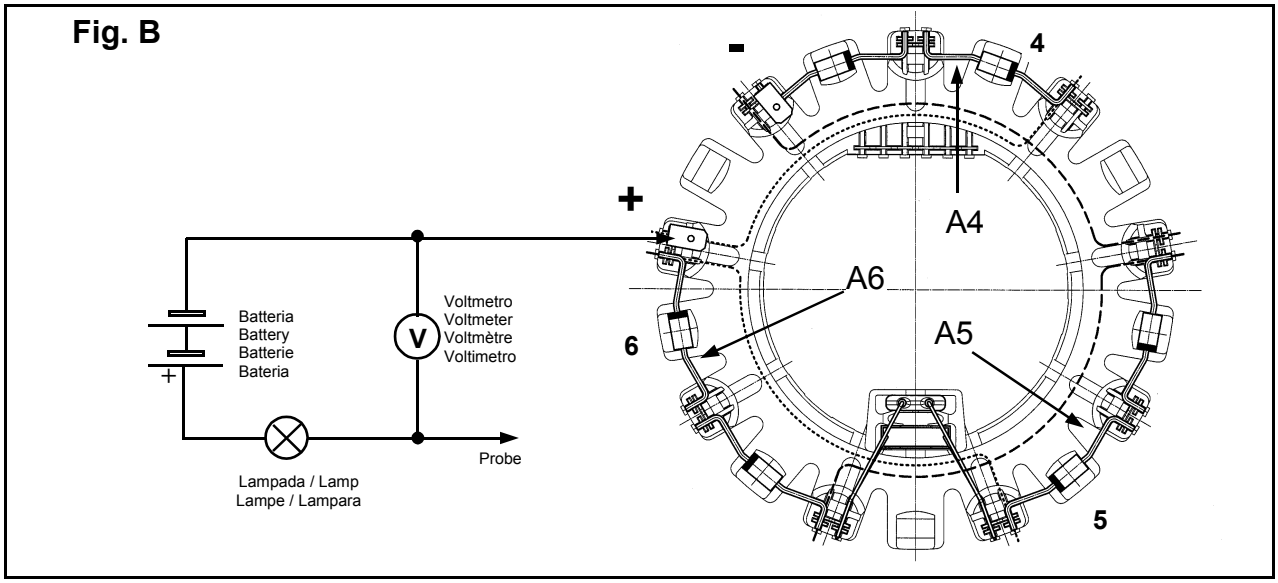


Fig. A

Fig. B



2 and 4 pole	TENSIONE MISURATA / VOLTAGE MEASURED TENSION MESUREE / GEMESSENE SPANNUNG *TENSION MEDIDA* (fig. A-B)		
ALTERNATORE TIPO ALTERNATOR TYPE ALTERNATEUR TYPE GENERATORTYP ALTERNADOR TIPO	Diodo buono Good diode Diode bonne Diode gut Diodo bueno	Diodo in corto *Diode in short* diode en court-circuit Diode in Kurzschlss Diodo en corto	Diodo aperto *Diode open* diode ouverte Diode offen Diodo abierto
SERIE 3 / SERIES 3	da 0,9V a 1,3V from to de à von bis de a	inferiore a 0,7V lower than Inférieure à Kleiner als Inferior a	*superiore a* 2V *more than* *supérieure à* *grösser als* *Superior a*

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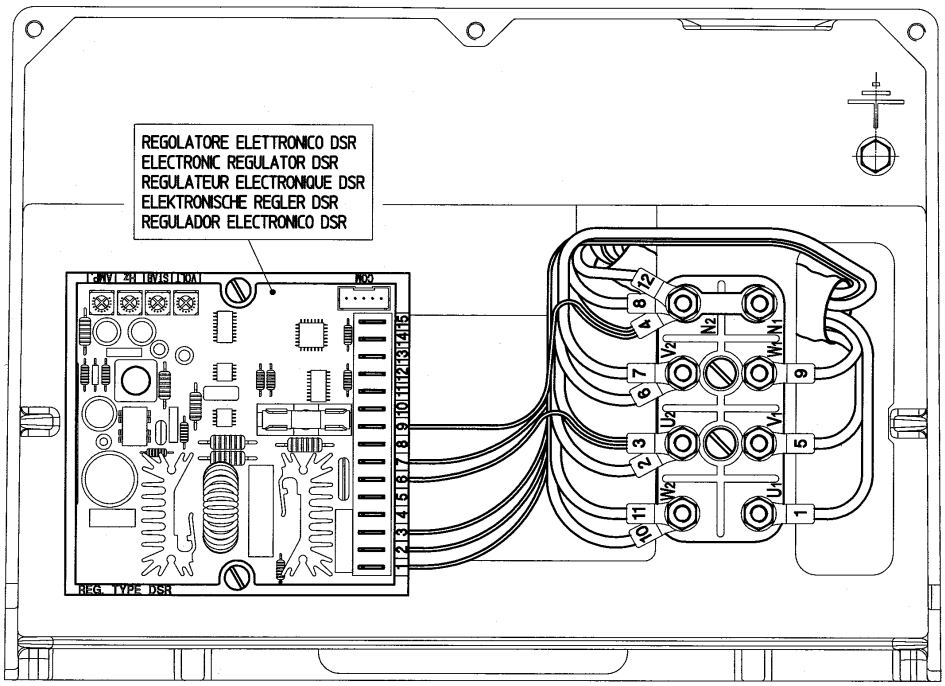
8

SCATOLA REGOLAZIONE ECP3
ECP3 TERMINAL BOX
BOITIER DE REGULATION ECP3
REGLERKASTEN ECP3
CAJA DE REGULATION ECP3



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9

VOLUMI D'ARIA E RUMOROSITA' (PRESSIONE SONORA (A) A VUOTO)
AIR FLOW AND NOISE LEVEL (NO LOAD (A) SOUND PRESSURE LEVEL)
VOLUME D'AIR ET NIVEAU SONORE (NIVEAU SONORE (A) à VIDE)
LUFTMENGE UND GERÄUSCHPEGEL (LAUTSTÄRKE (A) BEI LEERAUF)
VOLUMEN DE AIRE Y RUIDO (PRESION SONORA (A) EN VACIO)

Tipo Type Typ	Volume d'aria Air volume Volume d'air Luftmenge Volumen de aire m^3/min		Rumore Noise Bruit Gerausch Ruido 1500		Rumore Noise Bruit Gerausch Ruido 1800	
	1500 RPM	1800 RPM	7m dBA	1m dBA	7m dBA	1m dBA
ECP3 - 1S	3,5	3,9	58	72	60	78
ECP3 - 2S	3,5	4,1	58	72	60	78
ECP3 - 1L	3,3	4	58	72	60	78
ECP3 - 2L	3	3,5	58	72	60	78
ECP3 - 3L	3	3,5	58	72	60	78

Tipo Type Typ	Volume d'aria Air volume Volume d'air Luftmenge Volumen de aire m^3/min		Rumore Noise Bruit Gerausch Ruido 3000		Rumore Noise Bruit Gerausch Ruido 3600	
	3000 RPM	3600 RPM	7m dBA	1m dBA	7m dBA	1m dBA
ECP3 - 1S	6,4	7,8	70	85	73	89
ECP3 - 2S	6,3	7,8	70	85	73	89
ECP3 - 3S	6,2	7,8	70	85	73	89
ECP3 - 1L	6	7,2	70	85	73	89
ECP3 - 2L	5,8	6,8	70	85	73	89

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10

MOMENTI DI INERZIA E PESI
MOMENTS OF INERTIA AND WEIGHTS
MOMENT D'INERTIE ET POIDS
TRAGHEITSMOMENT UND GEWICHT
MOMENTO DE INERCIA Y PESO

Tipo Type Typ	J Kgm²			Peso Weight Poids Gewicht Kg		
	FORMA / FORM / FORME			FORMA / FORM / FORME		
	B3/B14	B3/B9	MD35	B3/B14	B3/B9	MD35
ECP3 - 1S/2	0,03561	0,03549	0,03591	52	50	56
ECP3 - 2S/2	0,03955	0,03943	0,03985	58	56	62
ECP3 - 3S/2	0,04564	0,04568	0,04594	64	62	68
ECP3 - 1L/2	0,05148	0,05144	0,05187	76	74	80
ECP3 - 2L/2	0,05735	0,05731	0,05774	84	82	88

Tipo Type Typ	J Kgm²			Peso Weight Poids Gewicht Kg		
	FORMA / FORM / FORME			FORMA / FORM / FORME		
	B3/B14	B3/B9	MD35	B3/B14	B3/B9	MD35
ECP3 - 1S/4	0,05231	0,05219	0,05261	56	54	59
ECP3 - 2S/4	0,05933	0,05921	0,05963	62	60	65
ECP3 - 1L/4	0,07231	0,07227	0,07270	76	74	79
ECP3 - 2L/4	0,08409	0,08405	0,08448	84	82	87
ECP3 - 3L/4	0,09027	0,09023	0,09066	90	88	93

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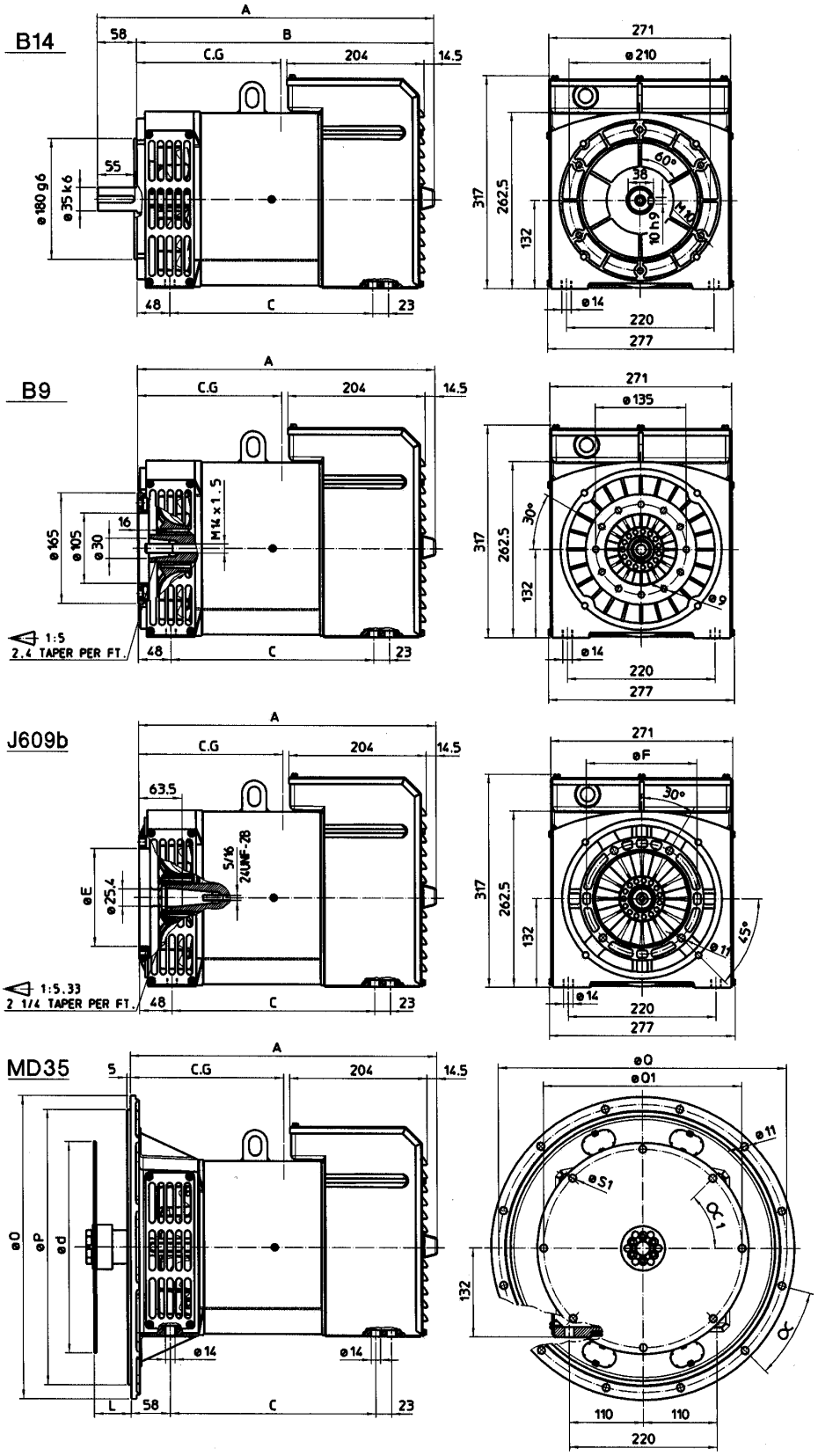
11

DIMENSIONI DI INGOMBRO
OVERALL DIMENSIONS
ENCOMBREMENT
BAUBMESSUNGEN
DIMENSIONES EXTERNAS

dimensions in mm



Forma Form Forme		A	B	C	E	F
B14	S	498	440	301	-	-
	L	568	510	371	-	-
B9	S	440	-	301	-	-
	L	510	-	371	-	-
J609b	S	440	-	301	146,1 163,6	165,1 196,8
	L	510	-	371	177,8	196,8
MD35	S	454	-	305	-	
	L	524	-	375	-	-

Forma Form Forme	Centro di gravità Center of gravity Centre de gravité Schwerpunkt Centros de gravedad 2 Poli - Pole - Polig - Polos				
	1S	2S	3S	1L	2L
B14	239	233	220	267	256
B9	243	237	223	274	261
J609b	245	239	225	275	262
MD35	237	232	221	271	260

Forma Form Forme	Centro di gravità Center of gravity Centre de gravité Schwerpunkt Centros de gravedad 4 Poli - Pole - Polig - Polos				
	1S	2S	1L	2L	3L
B14	237	228	270	256	249
B9	241	231	277	261	254
J609b	243	232	278	262	255
MD35	235	228	273	261	255

SAE N°	Flangia / Flange /Bride Flansch / Bridas				
	O	P	Q	n° fori	α
6	308	266,7	285,75	8	22°30'
5	356	314,3	333,4	8	22°30'
4	403	362	381	12	15°
3	451	409,6	428,6	12	15°

SAE N°	Giunti a dischi Disc coupling Disque de monopalier Scheibenkupplung Juntas a discos					
	L	d	Q1	n° fori	S1	α1
6 ½	30,2	215,9	200	6	9	60°
7 ½	30,2	241,3	222,25	8	9	45°
8	62	263,52	244,47	6	11	60°
10	53,8	314,52	295,27	8	11	45°
11 ½	39,6	352,42	333,37	8	11	45°

GARANZIA

A
La Mecc Alte garantisce la buona costruzione e qualita' dei propri alternatori per 24 mesi dalla data di spedizione dai propri stabilimenti o filiali.

B
Durante il suddetto periodo la Mecc Alte si impegna a riparare o sostituire (a proprie spese) nella propria sede, quelle parti che si fossero avariate, senza pero' essere tenuta a risarcimenti di danni diretti o indiretti.

C
La decisione sul riconoscimento o meno della garanzia e' riservata esclusivamente alla Mecc Alte previo esame delle parti avariate che dovranno pervenire in porto franco, alla sua sede di Vicenza.

D
Tutte le eventuali spese di viaggio, trasferta, trasporto, mano d'opera per lo smontaggio e rimontaggio dell'alternatore dall'apparecchiatura azionante sono sempre a carico dell'utente.

E
La garanzia decade se durante il periodo predetto, i prodotti fossero:

1
immagazzinati in luogo non adatto;

2
riparati o modificati da personale non autorizzato dalla Mecc Alte;

3
usati o sottoposti a manutenzione non in base alle norme stabilite dalla Mecc Alte;

4
sovraccaricati o impiegati in prestazioni diverse da quelle per le quali sono stati forniti.

La garanzia cessa comunque qualora il cliente fosse inadempiente nei pagamenti per qualunque ragione.

WARRANTY

A
Mecc Alte warrants the good manufacture and quality of all its products for 24 months, starting from the time of shipment from our factories or our branches.

B
During said period Mecc Alte obliges to repair replace at its cost, at its works, all those parts which failed without any other liability of any type, direct or indirect.

C
The decision for warranty approval is Mecc Alte's exclusive right and subject to a previous examination of the failed parts which are to be forwarded fob Mecc Alte Italy for analysis.

D
All the eventual expenses concerning travel, board, transport, and labour for assembly/disassembly of alternator from the drive unit are always at the user's charge.

E
The warranty shall be void if during the above described period the following anomalies should occur:

1
inadeguate storage;

2
repair or modification by unauthorized personnel;

3
use or maintenance conditions which do not conform whith norms established by Mecc Alte;

4
overload or application other than what the product was meant for.

Warranty coverage also expires whenever the client, for whatever reason, is late in payment.

GARANTIE

A
La société Mecc Alte garantit la bonne construction et qualité de ses produits pour une durée de 24 mois à compter de la date d'expédition de ses usines de fabrication ou filiales.

B
Durant la période indiquée, Mecc Alte s'engage à réparer ou à remplacer (à prix équivalent) dans la société, la partie qui serait endommagée sans tou-tefois être tenue de prendre en considération les frais directs ou indirects.

C
La décision sur la prise en charge ou non de la garantie est réservée exclusivement à Mecc Alte sur examen préalable des pièces endommagées qui devront parvenir en port Franco à l'usine de Vicenza.

D
Tout les éventuels frais de voyage, transfert, transport, main d'oeuvre pour le démontage de l'alternateur sont toujours à la charge de l'utilisateur.

E
La garantie ne s'applique pas si durant la période indiquée il y a:

1
emmagasinement dans un local non adapté;

2
réparations ou modifications personnelles non autorisées par Mecc Alte;

3
usage et manutentions non conformes aux normes établies par Mecc Alte;

4
surcharges et emplois des fonctions différentes de celles pour lequel ils sont fournis.

Il est bien évident que la garantie ne s'applique que sur le matériel payé en totalité.

GARANTIE

A
Die Firma Mecc Alte gibt 24 Monate Garantie ab dem Zeitpunkt der Auslieferung vom Stammhaus oder einer ihrer Filialen auf die einwandfreie Konstruktion und Qualität ihrer Generatoren.

B
Wahrend der genannten Periode repariert oder ersetzt Mecc Alte zu seinen Kosten alle fehlerhaften Teile, ohne Rucksicht ob direkt oder indirekt.

C
Mecc Alte behält sich das Recht vor, die fehlerhaften Teile frei Mecc Alte Vicenza zurückzufordern, zur Schadensuntersuchung

D
Alle eventuellen Kosten wie Transport, Fahrtkosten, Arbeitslohn für De-und Montage gehen zu Lasten des Kunden.

E
Die Garantie in O.A. Zeit wird fur nachstehende Faktoren ausgeschlossen:

1
nicht korrekte Lagerung;

2
Reparatur oder Modefizierung durch nicht von Mecc Alte autorisiertem Personal;

3
Gebrauch oder Einsatz bei Konditionen die nicht der Norm von Mecc Alte entsprechen;

4
Überlast Gebrauch oder Montage anders als wofür das Produkt bestimmt ist.

Die Garantie erlischt auch, wenn aus welchen Grunden auch immer, der Kunde in Zahlung überfällig ist.

GARANTIA

A
Mecc alte garantiza la buena construccion y calidad de los proprios productos por 24 meses desde la fecha de salida de sus fabricas o de sus filiales.

B
Durante disho periodo la Mecc Alte se obliga a reparar o sustituir a su cargo, en su establecimiento todas acquallas piezas que hubieran sido averiadas, sin hacerse cargo de otro tipo de danos, directos o indirectos.

C
La decision acerca del reconocimiento de garantia esta reservada exclusi-vamente a la Mecc Alte, previo examen de las partes averiadas que deberan permanecer en puerto franco o en su propia sede de Vicenza.

D
Todos los eventuales gastos de transporte, viaje, transferencia o mano de obra, para el desmontaje y nuevo montaje, del alternador o elemento accionante seran siempre a cargo del usuario.

E
La garantia caduca si durante el periodo descrito se produjeran las siguientes anomalias:

1
almacenaje en lugar inadecuado;

2
reparacion o modificacion por personal no autorizado por Mecc Alte;

3
utilizacion o condiciones de manuntencion que contravengan las normas establecidas por Mecc Alte;

4
sobrecarga o empleo en prestaciones distintas de aquellas para las que ha estado suministrado.

La garantia cesa igualmente en el momento que el cliente sea moroso de pago, cualquiera que sea la razon.

La lista degli indirizzi è aggiornata al :
The list of addresses was up-dated on :
La liste des adresses a été mise à jour le :
Die Adressenliste wurde erstellt am :
La lista de las direcciones ha sido puesta al día en fecha :

12/04/2011

Per verifiche successive, pregasi consultare il sito web : www.meccalte.com
To check recent changes, kindly consult our web site: www.meccalte.com
Veuillez consulter www.meccalte.com pour les mises à jours regulieres.
Aktualisierungen finden Sie unter: www.meccalte.com
Para una verificación después de esta fecha, les rogamos consultar nuestro sitio web: www.meccalte.com

CENTRI ASSISTENZA AUTORIZZATI ITALIANI

VALLE D'AOSTA
O.R.M.E. SNC DI JANIN SILVIA E JEAN F.NE CHEZ FORNELLE 11
11020 ARNAD (AO)
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PIEMONTE
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FAX 0321/825912

LOMBARDIA
EAM di MARAZIO ANNIBALE
VIA GEN.C.A. DALLA CHIESA, 10
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TEL 030/9913802
FAX 030/9913787

ESSE ERRE ESSE
VIA PO, 154
20032 CORMANO MILANO
TEL 02/36527703
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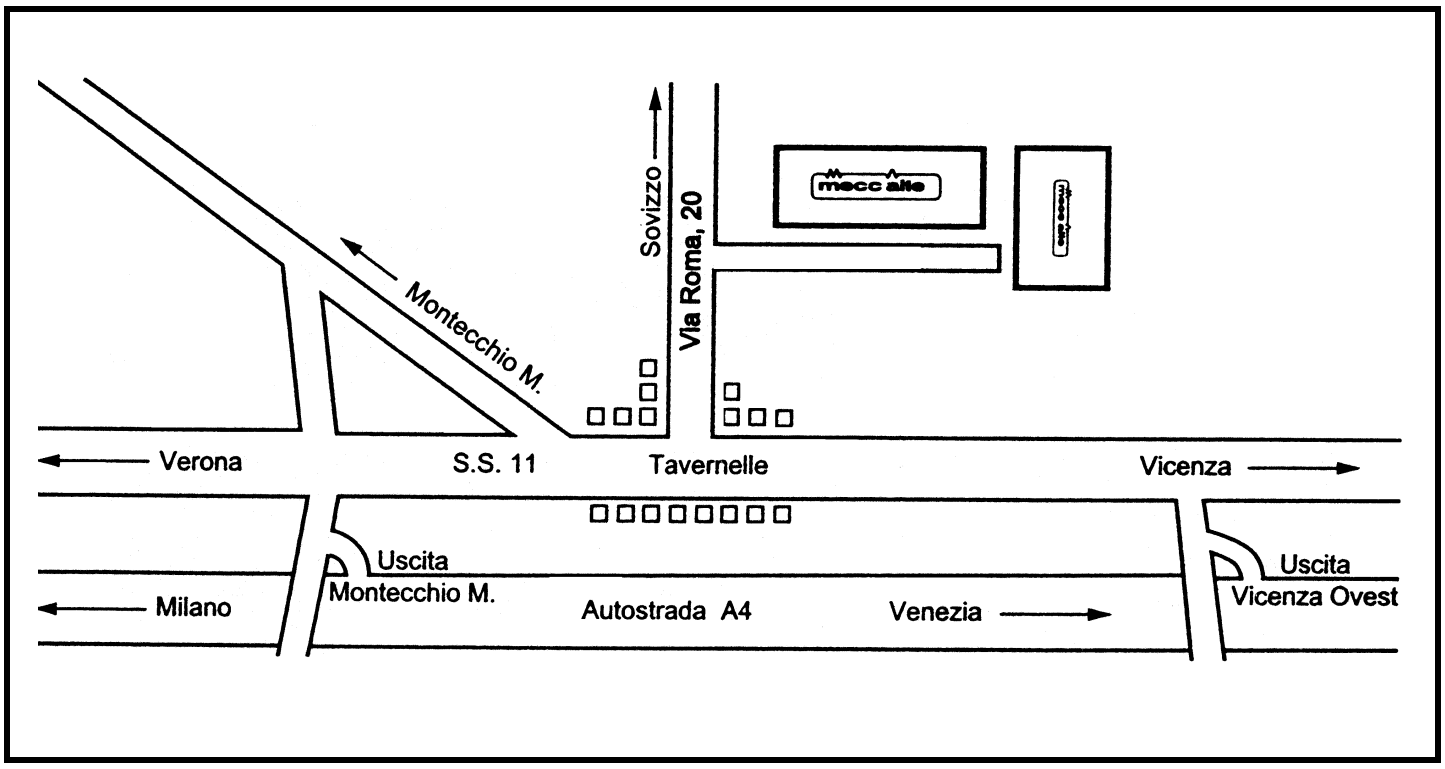

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