

DIATERMO

MB 120 VET / MB 160 VET

MONOPOLAR - BIPOLAR ELECTROSURGICAL UNIT



DIATERMO MB 120 VET / MB 160 VET



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IMPORTANT

These operating instructions form an integral part of the equipment and must be available to the operating personnel at all times.

All the safety instructions and advice notes are to be observed. Be sure that these operating instructions are furnished together the equipment when this is transferred to other operating people.

In case of necessity of technical, or other type, assistance contact your own retailer.

Report any serious incident in relation to the device to the manufacturer and the competent authority of the Member State where the user is established.

Produttore / Manufacturer

LED SpA

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INTRODUCTION

Destination of Use / Sectors of Application

Medical devices, reserved for use by specialized medical personnel, intended for temporary use for surgical operations in which cutting and/or coagulation of soft tissues is required, with a monopolar or bipolar technique, for minor open and endoscopic surgery.

The equipment is conceived for being used in the following sectors:

Description	DIATERMO	
	MB 120 VET	MB 160 VET
Electrosurgical unit code	GMA10100.V201	GMA10100.V301
Casualty Surgery	●	●
Dental	○	—
Dermatology	●	●
Endoscopy	—	○
First Aid	●	●
Gastroenterology	—	○
Gynecology	○	●
Neurosurgery	—	○
Orthopedics	—	○
Otorhinolaryngology	○	●
Pediatric Surgery	—	○
Plastic Surgery	—	○
Pneumology	—	○
Urology	—	○
Vascular Surgery	●	●

● = Recommended

○ = Usable

— = Not Recommended

Standard and Optional Composition

Code	Description	DIATERMO	
		MB 120 VET	MB 160 VET
-	Electrosurgical unit code	GMA10100.V201	GMA10100.V301
00100.03	Power supply cable 2m 3x1mm SIEMENS-IEC	●/1	●/1
00401.00	Steel neutral electrode 120x160mm with cable	●/1	●/1
00500.00	Kit of assorted electrodes(10pcs) 5cm	●/1	●/1
755VL (30551)	Disposable handle with finger switches	●/1	●/1
00304.00	Waterproof foot switch	●/1	●/1
152-132	Ball curved electrode ∅ 2mm 6 cm	○	○
152-142	Ball curved electrode ∅ 3mm 5 cm	○	○
152-152	Ball curved electrode ∅ 4mm 6 cm	○	○
152-162	Ball curved electrode ∅ 5mm 6 cm	○	○
152-130	Ball electrode ∅ 2mm 6 cm	○	○
152-145	Ball electrode ∅ 3mm 14 cm	○	○

Code	Description	DIATERMO	
		MB 120 VET	MB 160 VET
152-140	Ball electrode Ø 3mm 6 cm	○	○
152-150	Ball electrode Ø 4mm 6 cm	○	○
152-165	Ball electrode Ø 5mm 14 cm	○	○
152-160	Ball electrode Ø 5mm 6 cm	○	○
500500.L10/L	Bent ball electrode Ø 3mm (5pcs) 10cm	○	○
500500.L10	Bent ball electrode Ø 3mm (5pcs) 5cm	○	○
500500.L5/L	Bent hook electrode (5pcs) 10cm	○	○
500500.L5	Bent hook electrode (5pcs) 5cm	○	○
500500.L6/L	Bent thick wire electrode (5pcs) 10cm	○	○
500500.L6	Bent thick wire electrode (5pcs) 5cm	○	○
500500.L2/L	Bent thin wire electrode (5pcs) 10cm	○	○
500500.L2	Bent thin wire electrode (5pcs) 5cm	○	○
00498.00	Bipolar adapter	○	○
00412.00	Bipolar cable 3mt	○	○
00411.00	Eur Bipolar cable 3 mt	○	○
310-550	Bipolar electrode 20cm – curved	○	○
310-590	Bipolar electrode 20cm – curved 2	○	○
310-510	Bipolar electrode 20cm – direct	○	○
310-110-05	Bipolar Forceps 11,5cm TIP 0.5mm	○	○
310-140-10	Bipolar Forceps 20cm TIP 1mm	○	○
310-140-20	Bipolar Forceps 20cm TIP 2mm	○	○
310-180-10	Bipolar Forceps Angled 20cm TIP 1mm	○	○
310-180-20	Bipolar Forceps Angled 20cm TIP 2mm	○	○
310-182-10	Bipolar Forceps Angled Curved 20cm TIP 1mm	○	○
310-185-10	Bipolar Forceps Angled Curved 20cm TIP 1mm	○	○
310-112-05	Bipolar Forceps Curved 11,5cm TIP 0.5mm	○	○
310-142-10	Bipolar Forceps Curved 20cm TIP 1mm	○	○
310-142-20	Bipolar Forceps Curved 20cm TIP 2mm	○	○
152-112	Blade curved electrode 7 cm	○	○
152-115	Blade electrode 16 cm	○	○
152-110	Blade electrode 7 cm	○	○
00404.08	Cable for connection neutral electrode disposable-type/5365	○	○
00404.07	Cable for connection neutral electrode F7915/F7930	○	○
F7915	Conductive rubber neutral electrode without cable	○	○
F7930	Conductive rubber split neutral electrode without cable	○	○
152-195	Conization electrode 13 cm	○	○
0350	Disposable Neutral electrode	○	○
F7920	Disposable Split Neutral electrode	○	○
00305.03	Double water-proof foot switch	○	○
500500.L7/L	Drop electrode (L7) (5pcs) 10cm	○	○
500500.L7	Drop electrode (L7) (5pcs) 5 cm	○	○
F7520	Electrode cleaning sponge 47x50mm	○	○
00201.01	Handle for microsurgical needle	○	○
00202.00	Holter for handle and electrodes	○	○
00500.00/L	Kit of assorted electrode length 10cm (10pcs)	○	○
500500.L3/L	Loop electrode Ø 4mm (5pcs) 10cm	○	○
500500.L3	Loop electrode Ø 4mm (5pcs) 5cm	○	○
500500.L4/L	Loop electrode Ø 8mm (5pcs) 10cm	○	○
500500.L4	Loop electrode Ø 8mm (5pcs) 5cm	○	○
152-175-10	Loop electrode 10x10 l.15 cm	○	○
152-190-13	Loop electrode 20x13 l.15 cm	○	○
152-190-20	Loop electrode 20x20 l.15 cm	○	○
190-260	Monopolar cable M4-MP4 3mt	○	○
330-134-20	Monopolar Forceps 20cm TIP 2mm	○	○
330-160	Monopolar Surgical Scissors 18cm	○	○
152-122	Needle curved electrode 7 cm	○	○
152-125	Needle electrode 13 cm	○	○

Code	Description	DIATERMO	
		MB 120 VET	MB 160 VET
152-120	Needle electrode 7 cm	○	○
500500.L11	Needles for micro-surgery (10pcs)	○	○
500500.L8/L	Noose electrode (L8) (5pcs) 10cm	○	○
500500.L8	Noose electrode (L8) (5pcs) 5 cm	○	○
00100.01	Power supply cable 5m SIEMENS-IEC	○	○
00205.00	Reusable handle with finger switches PENCL S	○	○
00206.00	Reusable handle without finger switches PENCIL	○	○
00400.00	Rod neutral electrode with cable	○	—
5365A	Steel neutral electrode 120x160mm	○	○
00401.02	Steel neutral electrode 120x160mm with cable 3 mt autoclave	○	○
00401.01	Steel neutral electrode 240x160mm with cable 3 mt	○	○
00401.03	Steel neutral electrode 240x160mm with cable 3 mt autoclave	○	○
500500.L9/L	Straight ball electrode ∅ 3mm (5pcs) 10cm	○	○
500500.L9	Straight ball electrode ∅ 3mm (5pcs) 5cm	○	○
500500.L1/L	Straight thin wire electrode (5pcs) 10cm	○	○
500500.L1	Straight thin wire electrode (5pcs) 5cm	○	○
TR003	Trolley 3 shelves	○	○
TR003W	Trolley 3 shelves wide	○	○
TR004	Trolley 4 shelves	○	○
TR005	Trolley 5 shelves	○	○
TR005W	Trolley 5 shelves wide	○	○

●/ Pcs= STANDARD ○ = OPTIONAL — = NOT COMPATIBLE

General Description

DIATERMO MB 120 VET – MB 160 VET are electro-surgical equipments suited to deliver current for monopolar cut, soft coagulation, forced coagulation or bipolar coagulation. The current can be delivered for the whole time of activation of the output circuit.

It is possible to use either single plate neutral reference electrodes or electrodes with split conductive zone so to watch the plate to patient contact during the surgical intervention.

Control of the units is via front panel keys and display; mains inlet is located on the rear panel.

The units have automatic control systems that, monitoring the internal parameters, signal the possible damages/errors that are found.

The operational parameters that are used are constantly stored so that, every time the unit is switched on or the operative method is changed, the last utilized parameters are recalled.

The level of the emission sound can vary; every operator can choose his own level according to the noise of his working ambient.

Power output can be active either through holder-handles with pushbuttons or through single or double foot switch command. Moreover, applying a special optional adapter it is possible the unit connection to bipolar forceps.

ELECTROPHYSICAL PRINCIPLES

In the electrosurgical interventions the traditional use of blade surgical is substituted by electrosurgical needle that allows making in a fast, simple and effective way the cut and coagulation of.

The electrosurgical needle is made on the principle of electrical energy conversion in heat and it's constituted by:

- a sinusoidal oscillator in radiofrequency;
- a generator of wave packets, with repetition frequency of packets equal to 15 – 30 kHz;
- a mixer for the transfer, to the power amplification block, of the only wave form adapt to the cut, or the only wave form for the coagulum, or a signal obtained by an opportune mixing of the two;
- a power amplification block able to supply the necessary power in terms of current and to transmit to the electrodes, by transformer, the amplified signal;
- a security circuit for the return electrode, to take possible cable interruptions and disarm the radiofrequency supply;
- by an active electrode opportunely shaped (handle);
- by a return electrode (neutral) that close the circuit by the patient.
The current that crosses the biological tissue can cause:
- Joule Effect
- Faradic Effect
- Electrolytic Effect

1) Joule Effect

In the biological tissue, crossed by electrical current, it's produced a heating (thermal effect), dependent by the electrical resistance of the tissue, by the current density, by the application time and that can determine many cellular transformations.

$$Q = I^2 \times R \times T$$

The thermal effect influence (Joule Effect) is made by:

- **Current Intensity and output power**
- **Modulation level**

Parameters interpretable by the wave form of the high frequency current produced by the generator.

- **Electrode shape**

The electrode shape can be needle or rounded according to the necessity, it has reduced dimension; for this the current density on the point surface [$A \cdot m^{-2}$] is highest. The electrodes with a thin section create a high current density, and high temperature, favoring the cut action. Those with a big surface create a smaller current density, a smaller temperature, realizing a coagulation effect.

- **State of active electrode**

The thermal effects can be reported to the human body resistance, to which must be added the electrode contact resistance. It's indispensable to maintain the active electrodes perfectly clean to not have a reduction of the.

- **Characteristics of the tissue**

The resistive characteristics change according to the biological tissues.

Biological tissue (range from 0,3 to 1 MHz)	Metals
Blood $0,16 \times 10^3$	Silver $0,16 \times 10^{-5}$
Muscle, kidney, heart $0,2 \times 10^3$	Branch $0,17 \times 10^{-5}$
Liver $0,3 \times 10^3$	Gold $0,22 \times 10^{-5}$
Brain $0,7 \times 10^3$	Aluminum $0,29 \times 10^{-5}$
Lung $1,0 \times 10^3$	
Fat $3,3 \times 10^3$	

(Example of specific resistances of organic and metallic materials)

According to the come temperature and in function of used pulse form, it's possible to recognize many types of effects produced by the current in radiofrequency on the human body:

Coagulation

Temperatures from 60 to 70 °C in the area around the active electrode cause a slow heating of intra-cellular liquid, the water contained in the cell evaporates and an action of coagulum is obtained, so the blood flow is stopped.

Cut

Temperature over 100 °C in the area around the active electrode determines the evaporation of the intracellular liquid and the cell explosion. The vapor around the electrode baits a chain reaction in the direction where the active electrode is worked, transmitting the evaporation energy to the tissues around it.

The cut isn't, for this, a mechanical resection. If the temperature comes to 500 °C it's verify the tissue with an action of cauterization.

Mixed currents

They are obtained by the mixing of coagulation and cut effects. There is a reduction of blood loss during the cut procedure, or like cut that develops a substantial eschar coat. The high frequency used by electrosurgical needle, don't allow to the electromagnetic field to penetrate deeply in the matter and so the current crosses the conductor mostly in the external surface, reduces in an exponential way and becomes negligible in the centre of the conductor section. This effect, called 'skin-effect' cause a reduction of the useful section for the current passage, an increase of the electrical resistance and becomes an important problem in the neutral electrode. In fact in this electrode the current density is very high (KA/m²) on the edge, where the excessive increase of temperature by Joule effect causes burns for the patient. So it isn't accidental that the burns for the patient, during the electrosurgical interventations, have the shape of the edge neutral electrode. To reduce the burns risk have to dose opportunely the supply power (I²·t) and to follow the rules for the application of the neutral electrode on the patient (see cap. SAFETY).

2) Faradic Effect

The pulsed current causes the neuro-muscular stimulation, originated by stimulation of physiologic process of ionic exchange, responsible of the transmission of stimulus that cause muscular spasms and cardiac symptoms of extra systole and ventricular fibrillation. The effect of this stimulus is known like faradic effect and it is expressed by:

$$R = I / \sqrt{F}$$

The physiologic system of stimulus transmission follows a limit curve in which the pulsed currents or by low frequency produce an impulse of stimulation. By alternating current in high frequency (higher than 200 kHz), used in the electrosurgical needle, don't have neuro-muscular reactions (the change of polarity is so fast that the patient doesn't have consequences at a level of the neuro-muscular reactions), and there isn't an electrolytic damage of the organism.

For this reason all the equipments generator of the high frequency for surgical use (electrosurgical needle) work on base frequencies higher than 300 kHz so that they don't produce electric stimulation.

3) Electrolytic Effect

The use of high frequency currents reduces the electrolytic effect (ionic division) in the tissues, caused by the shortest period of unidirectional conduction of the current.

OPERATIVE TECHNICIS

Monopolar Cut

Monopolar cut is the sectioning of the biological tissue achieved by the high-density passage of HF current, which is concentrated at point of the active electrode. The HF current, when it is applied to the tissue, through the point of the active electrode, it creates intense molecular heat in the cells so high that explosion of it is caused. The cut effect is achieved by moving the electrode through the tissue and destroying the cells one after the other. The movement of the electrode prevents the propagation of the side heat in the tissue, thus limiting to a single line the cells' destruction. The best HF current for cutting is pure sine wave without any modulation that cuts very smoothly and provides the least thermal effect with poor haemostasis while cutting. Because its effects can be precisely controlled, it can be used safely without damage to the bone, but since good coagulation while cutting is one of principal benefits of using electro surgery a current with a certain amount of modulation is desirable. The following rules help the operator to obtain good cutting, however every user must follow first of all his professional judgment as he does every time in his practice.

- Keep the tissues moist but not wet;
- Survey the stroke before activate the electrode;
- Keep the electrode perpendicular to the tissue;
- Activate the electrode before making contact with the tissue;
- Maintain clean the electrode's tip (the optional sponges F7520 to clean the electrodes are advised);
- Wait at least five seconds before to repeat a stroke.

When the output power is properly set there should be:

- no resistance to the electrode movement through the tissue;
- no change in the cut surfaces color;
- no fibers of tissue remained onto the electrode.

Monopolar Coagulation

Monopolar coagulation is the haemostasis of small blood vessel of the bodily tissue through passing of high frequency current in correspondence of active electrode. When the current density is reduced and a broad-surfaced electrode is used, to dissipate the energy over a larger area, the effect is to dry out the surface cells, without deep penetration, resulting in coagulation. These coagulate surface cells then serve as a layer of insulation, preventing heat derived by successive applications of current from penetrating too deeply. The current normally used for coagulation is modulated and depending from the modulation percentage is the smoothness of cutting, goodness of haemostasis and likelihood of tissue destruction. Deeper current modulation brings to somewhat roughly cutting and the chance of some slight depth of tissue destruction but more efficient coagulation. The following rules help the operator to obtain good coagulation: however every user must follow first of all his professional judgment as he does every time in his practice.

- Select a ball or heavy wire electrode;
- Locate the bleeder, after have wiped the excess blood from the area, contact lightly the bleeder before activating the electrode;
- Stop the electrode activation as soon as the tissue blanches to avoid tissue damage;
- Maintain clean the electrode's tip (the optional sponges F7520 to clean the electrodes are advised).

Bipolar Coagulation

Bipolar coagulation consists in the hemostasis of small blood vessels of the body tissue between the two tips of the forceps.

When the current density is reduced, the drying of the cellular surface is obtained, without deep penetration and its consequent coagulation. These superficially coagulated cells act as a layer of insulation that prevents the heat, due to successive current applications, to penetrate too deeply.

CONTRAINDICATIONS AND COLLATERAL EFFECTS

Electro surgery is not recommended in the following subjects:

- having pacemaker;
- with stimulating electrodes;
- with metal prosthesis plant;
- with important arterial pressure unbalance;
- with important nervous disorders;
- with renal insufficiency;
- in state of pregnancy.

Burns are the most consequences of the HF electro surgery for the patient, even if these are not the only one. In fact necrosis by compression, allergic reactions to the disinfectant, gas or inflammable liquids ignition.

Some important causes of burns are by:

- insufficient medical equipie training about all modalities to avoid or reduce the risks of burns by using HF electrosurgical units;
- use of disinfectants with high alcol content;
- incorrect position of the patient during the electrosurgical operation;
- contact between active electrode and the skin;
- contact with liquid;
- long application of HF currents;
- incorrect application of the patient-plate.

To avoid or reduce the common HF electrosurgical risks it is very important to respect the rules and safety measurements exposed illustrate on the next chapter.

SAFETY

WARNING: Electro-surgery can be dangerous. Careless use of any element in the electrosurgical system may subject the patient to a serious burn. Read and understand all warnings, precautions, and directions for use before attempt to use any active electrode. Neither LED SpA, can be considered responsible for personal, material or consequential injury, loss or damage that results from improper use of the equipment and accessories.

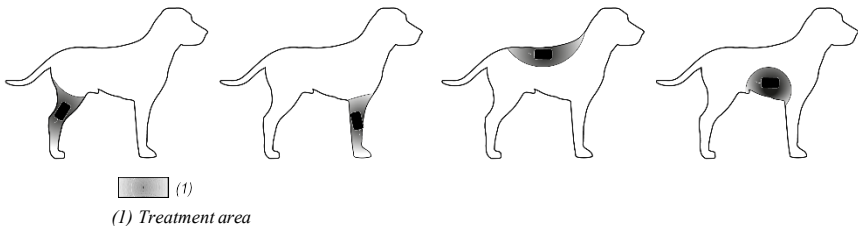
The accessories supplied with the unit have characteristics compatible with this supplied unit, they could be incompatible with others electrosurgical units; the user must check, before connecting other accessories to this unit, that they have characteristics of insulation compatible with those of this unit and utilized function (see Technical Characteristics).

It is recommended to inspect the integrity of the packaging of the sterile products.

General

The following precautions reduce the risk of accidental burnings

- The whole surface of the patient plate must be placed on a well-vascularized muscle as next as possible to surgical area. Avoid connecting the patient plate to bony protrusions, prosthesis, cicatricial tissues, and parts of the body subjected to liquid accumulation or that present subcutaneous adipose tissue. The part of the body must be without hair, dry and clean. Do not use alcohol to clean the skin. With steel neutral electrode, unless for veterinary use, the use of gelatinoids substances for the electrodes is not advised. For reusable rubber electrode read relative instructions.
- By using the disposable neutral electrodes respect the date of expire.
- By using the reusable electrodes ascertain that the fixing systems give warranty of stability.
- When you apply the neutral electrode avoid the transversal course and prefer the vertical or diagonal course, in particular if a split neutral electrode is used. That to allow a uniform distribution of the current on the surface of the neutral electrode and reduce the risk of burn to the patient.
- If it isn't possible to use correctly the neutral electrode, consider, if it's possible, the bipolar technique instead of the monopolar one.
- The patient does not must be in contact with metal parts that are connected to the earth or have a large electrical coupling capacity to the earth (for example: operating-table or metallic support). The use of antistatic sheets is advised.
- Avoid the skin to skin contact (for example between arm and body of the patient). Insert an interface material like dry surgical gauze. Moreover, the parts of the body subjected to abundant perspiration must be maintained dry.



- When high frequency electrosurgical unit and physiological monitoring devices are used at a time in the same patient, all the monitoring electrodes, that have not resistive or inductive elements tested in high frequency interference environment, must be as far as possible from the electrodes of the electrosurgical unit. Avoid the use of monitoring needles.
- The connection to the electrodes should be located in such a way to avoid the contact both with the patient and with other cables.
- For surgical procedures where the HF current could flow through parts of the body having a relatively small cross-sectional area; the use of bipolar techniques may be desirable in order to avoid unwanted coagulation.
- The power level should be the lowest useful to the work to do.

- Always check the return plate whenever electrosurgical unit fails to produce the desired effect. Reason for a low output power level, or for an incorrect functioning of the electrosurgical unit when arranged for a normal output, may be lack of connection of the return plate or its imperfect placement.
- The use of flammable anesthetics, of oxygen and of nitrogen protoxide should be avoided in the case of operation at the head or at chest level except the possibility of evacuating gas. Flammable materials used to clean, or to disinfect, should be let to evaporate before the use of the electrosurgical unit. There is risk of stagnation of flammable solutions under the patient or in body cavities as the umbilicus and the vagina. The fluid that deposits in these areas should be removed before the equipment use. The danger of endogenous gas ignition has to be considered. Some materials like cotton wool or gauze, when saturated with oxygen, may burst into flames because of the sparks produced by the equipment in the normal use.
- There is a risk for the patients fitted with heart pacemaker or other stimulation electrode: interference may occur with the stimulator signal or the stimulator itself can be damaged. Please refer to Cardiology Unit when in doubt.
- Electrosurgical equipment does emit unnoticed radiation of high frequency energy that may effect other medical equipment, unrelated electronics, telecommunications, and navigational systems.
- The accessory must be regularly checked, particularly the cables for the electrodes and the possible accessories for the endoscopy to verify that the insulation is not damaged.
- To avoid the connection of incompatible accessories to the unit, the insulation characteristics of the items to be replaced must be requested to the manufacturer and compared to those of the supplied unit (see Technical Characteristics)).
- **Attention:** a damage of the electrosurgical unit could result in an unwanted increase of the output power.
- Inadvertent stimulation of a patient's muscle and nerves can be caused by low frequency currents originating in electric sparks between electrode and tissue of the patient. Should neuromuscular stimulation occur stop surgery and check all connections to generator. If this does not solve the problem, qualified service personnel must inspect generator.

Putting into service

- The electric safety is insured only when the same are correctly connected to an efficient net linked to the earth in conformity with the actual safety requirements. It is necessary to verify this fundamental safety requisite and, in case of doubt, to require an accurate control of the plant from part of qualified personnel. The manufacturer cannot be considered responsible for possible damages caused from the lack of efficient connection to earth. Operation without a protective earth connection is forbidden.
- Before connect the equipment ascertain that the required voltage (showed on the rear panel) corresponds to the available mains.
- In case of incompatibility between the available wall socket and the feeding cable of the equipment, replace only with legally approved connectors and accessory items. The use of adapters, multiple connections or cable extensions is not advised. Should their use become necessary it is mandatory to use only simple or multiple adapter conforming to the actual safety requirements.
- Don't let the apparatus exposed to atmospheric agents. The unit must be protected from seepage of liquids. Don't obstruct openings or cracks of ventilation or heathsink

- Don't leave the equipment uselessly inserted. Switch off the equipment when not in use.
- The use of the unit is not suited in explosive rooms.
- **DIATERMO MB 120 VET** or **MB 160 VET** must be destined only to the use for that have been expressly designed. Any other use is to be considered improper and dangerous. The manufacturer can not be considered responsible for possible damages due to improper, wrong and unreasonable uses.
- It is dangerous to modify or try modifying the characteristic of the equipment.
- Before effect any operation of cleaning or maintenance, disconnect the apparatus from the electric net, either unplugging it from the mains or switching off the mains switch of the plant.
- In case failure and/or bad operation of equipment switch off it. For the possible reparation address only to an authorized service centre and ask for the use of original spare parts. The lack to follow the above requirements could risk the safety of the equipment and can be dangerous for the user.
- Do not reduce or disable the audible signal warning the activation of the generator. A functioning activation signal can minimize or prevent patient or staff injury in the event of accidental activation.
- Avoid verifying the functioning of the unit by shorting the active electrode with the reference one or the active electrode with metallic parts.
- If necessary use a smoke-plume extraction system.

WARNING: When the electrosurgical unit is used in operating rooms it is necessary to just use waterproof foot-switches (REF 00304.00 Water-proof pedal with single switch – REF 00305.03 Water-proof pedal with double switches)

Safety for the Patient

During the HF electrosurgical operations the patient is a conductor of electrical voltage against earth potential. So if there is a contact between patient and electrical conductive objects (metal, wet clothes, etc.), in the contact's point could be electrical current that causes thermal necrosis. So it is recommended to inspect the equipment and its accessories before using and to respect all safety rules.

Correct Position of the Patient

It is important to avoid any intention or accidental contact between patient and grounded metallic parts and to make sure that:

- The animal is not in contact with metallic parts (operative table, supports..).
- The flexible tube of the respirator do not touch the body of the patient.
- On the operative table with grounded connection there are always coatings that allow to discharge the electrostatic charges.
- The patient is on a thick basic tissue with insulating properties, covered by a sufficient number of nets.
- The patient is not in contact with nets or wet mattress.
- The eventual organic secretions and the cleaning and other liquids do not wet the nets.
- There are not liquid under the patient.
- Urinary secretions are eliminate by the catheters.
- The body zones characterized by a higher sweating, the extremities in direct contact with trunk or the points of skin-skin contact are dried by the nets interposition (arm/trunk, leg/leg, breast, skin folds, etc.).
- All conductive and grounded supports, stirrups, are correctly insulated.
- Control the anaesthetics quantity to avoid a great sweating.

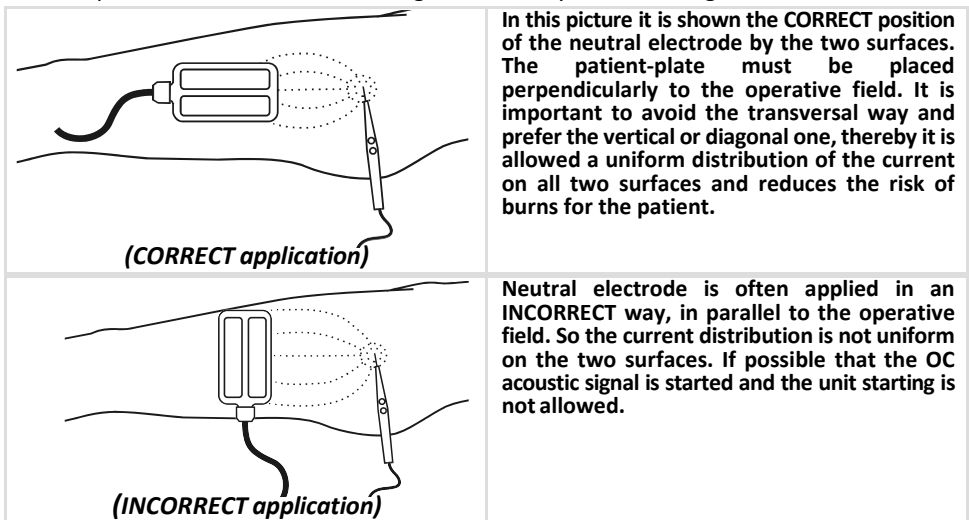
Correct Position of Neutral Electrode

The use of the neutral electrode (or patient-plate for the leakage of current) is necessary in the monopolar technique, because it allows the "return" of the cutting or coagulation current to the scalpel. The types of the neutral electrode are two:

neutral electrode by single surface (with joint cables) where there is not a check on the contact between neutral electrode and patient.

neutral electrode by two surfaces (with divided cables) where there is a check on the contact between neutral electrode and patient.

Keep attention on the correct position of the patient-plate to avoid burns and other risks for the patient, we recommended regard to this by the following information.



Before to apply the neutral electrode, clean and eliminate any external substances from its surface.

Do not apply the neutral electrode on cicatrix, bony protrusion or near prosthesis or monitoring electrodes. But apply it on sprinkled tissues, such as muscles and near the operative site. If you use a disposable neutral electrode respect the date of use, if you use a not disposable neutral electrode make sure that the fixing systems guarantee stability.

It is very important that the neutral electrode is firmly applied on its entire surface to avoid burns. When the neutral electrode is partially taken off from the patient, the current density on the remaining applied part is higher. Because the density of the current flow under the neutral electrode is not uniform, it verifies a not uniform heating, especially near the borders of the neutral electrode.

HF Electrosurgical in Laparoscopy

Since its introduction minimally invasive surgery has revolutionized surgical operation offering any significant benefits to the patient of faster healing and less postoperative pain. In laparoscopy the monopolar HF electro surgery is the most used because it is highly versatile (pure cut, coagulation, blended cut that combines these two functions), but this modality can compromise patient safety by burns.

The constricted view of the surgical field, the poor maintenance of the laparoscopic instrumentation, interference on the video monitor, the insufficient training of the surgeon or his inattention, the smoke, the insulation failure, the capacitive currents, the contact of the tip of the active electrode with the surrounding tissue, these are all factors that increase the hazard of burns, intra-abdomen lesions, necrosis of the tissue, perforation of internal organs. The nature of the surgical environment – in which the active electrode is in close proximity to other conductive instruments and to tissue- may make the electrical currents transmission to unseen tissue off the laparoscope, causing unintentional tissue burns at non-targeted sites, by:

- direct coupling
- insulation failure
- capacitive coupling

Direct coupling occurs when the active electrode touches another metal instrument, transferring electrical current to it and possibly injuring tissue with which it comes in contact (for example bowel or other organs).

Insulation failure occurs when there is an excessive voltage, abuse, wear and tear, poor handling, or mechanical accident of the electrode shaft that happens during a single laparoscopic procedure or during disinfection and sterilization procedures. The breakdown along the unseen shaft of an activated electrode can allow electrical current to leak into surrounding non-targeted tissues, causing unobserved damage. Paradoxically, small cracks are more dangerous than large breaks because the current is more focused, and is therefore more likely to produce burns.

Capacitive coupling occurs when electrical current is induced from the active electrode to nearby conductive material, despite intact insulation. During HF electrosurgical operations the rapidly varying electrical field around the active electrode is only partially impeded by electrical insulation and creates stray electrical currents by alternately attracting and repelling ions in surrounding body tissue. Currents transferred in this way in nearby tissue can cause irreversible damage. The movement of electrically charged ions in capacitive coupled tissue can cause currents that can heat tissue sufficiently to produce burns.

Several measures are used during electrosurgical operations to limit and minimize the risks of patient injury:

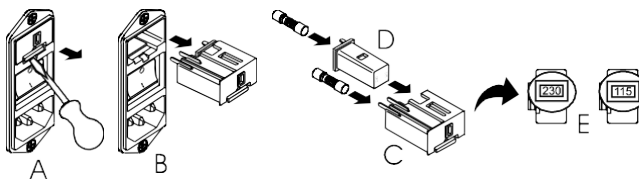
- a better and more complete training for the medical staff;
- visual examination of the surgical instrumentation (active electrode, laparoscope);
- use of disposable electrodes (but the thinner insulation doesn't reduce the risk of breakdown or capacitive coupling);
- prohibiting the use of hybrid (plastic-metal) cannulas;
- adopting bipolar electro surgery (not-versatile, but safer, because the necrosis happen only if there is a long and continuous application of the current).

In the HF electro surgery burns are a real hazard that can be minimized by the knowledge of the causes and especially if the surgeon is prepared against these.

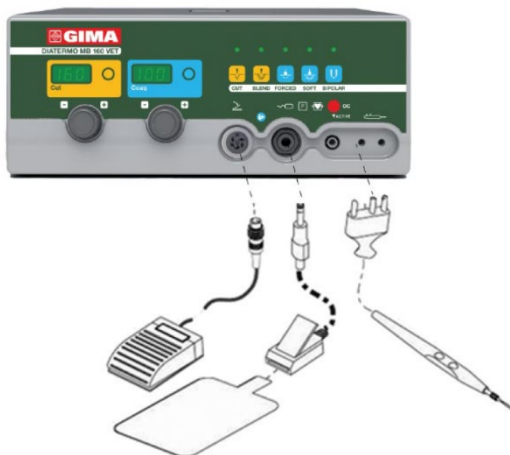
PUTTING INTO SERVICE

- Inspect the unit for damages during transport. The claims for possible damages will be accepted only in case they are immediately communicated to the carrier; the damages that are found must be written down and presented to LED SpA or to your own retailer. If the unit is returned to the LED SpA or to your own retailer, it is necessary to use the original equipment's package or another equivalent one, to guarantee the safety during the transport.
- Unpack the equipment and carefully study the documentation and operating instruction supplied. Mains voltage, indicated above the inlet, must agree with the local mains voltage (mains voltage frequency: 50-60 Hz). The correct voltage (see above) setting is selected as shown in fig. E. Insert the correct fuses in the module referring to the value written on the label.
- The predisposition of the correct mains voltage is performed in the following way:
 - (A-B) Extract the fuse holder drawer from the power module.
 - (C) Insert the fuses making reference to the following chart:

Mains Voltage 110-120 V	Delayed Fuse 2x T6,3 A / 5 x 20 mm
Mains Voltage 220-240 V	Delayed Fuse 2x T3,15A / 5 x 20 mm
 - (D) Extract and rotate the detachable part in way to read the correct voltage in the (E) window – reinsert the fuse holder in the module.



- Connect mains cable to a mains outlet having good hearth connection.
- **OPERATION OF THE EQUIPMENT WITHOUT EARTH CONNECTION IS FORBIDDEN.**
- The unit must be installed on a level surface, with dimension, at least, correspondent to those of the base of the unit itself. Around the unit must be left a space of 25cm, at least.
- Connect the mains cable to the mains socket on the rear panel of the unit.
- Connect, if request, the equipotential binding post located at the left of the unit's back panel to eventual equipotential socket of the plant.
- Connect the single foot switch or the double foot switch (optional) to the connector on the rear panel.
- Connect handle, in the case of use of handle without finger switch it shall be connected on the buckle indicated "ACTIVE".
- In case of use of bipolar forceps (see BIPOLAR operation page 22) it is necessary to use the special optional adapter (REF 00498.04).
- Let unit work in dry environment only. Any verified condensate must be let evaporate before putting in operation the unit. Don't exceed the temperature environment or the allowed moisture.
- Environments condition:
Temperature: 10/40°C
Relative moisture: 30/75%
Pressure: 70/106k Pa
- Before using the unit, it is necessary connect the cable to the patient plate, and these connected to unit. The neutral electrode must apply to patient (see Safety chapter). Single plate electrodes and split plate electrodes can be. When the unit is switched on if the value of the impedance is acceptable, the OC indicator light will stop flashing.
- When the unit is switched on, through the on/off switch on the rear panel, after having checked the internal parameters, it will work with the function and the power level utilized during the last switching (when the unit is switched for the first time the level will be 00).



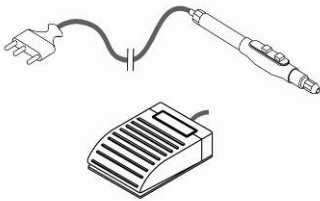
Monopolar typical configuration

- Use for **MONOPOLAR**:

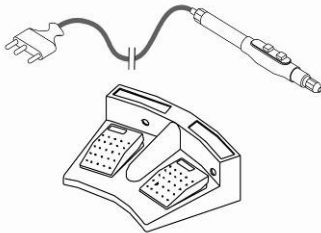


coagulating current (the choice between FORCED COAG, SOFT COAG or BIPOLAR must be done pressing the correspondent pushbutton on the unit).

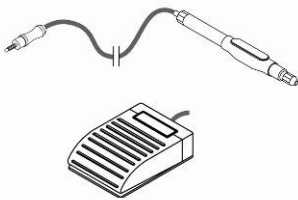
Holder-handle with two pushbuttons without foot switch: press the yellow pushbutton on the holder-handle to deliver the cutting current (the choice between CUT or BLEND must be done pressing the correspondent pushbutton on the unit); or the blue pushbutton on the holder handle to deliver



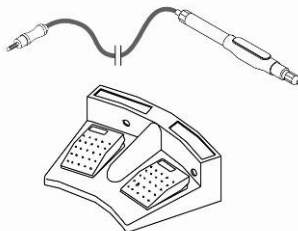
Holder handle with two pushbuttons and a single foot switch: choose the cutting current CUT or BLEND and the coagulation current FORCED COAG, SOFT COAG or BIPOLAR. Pre-set through the yellow pushbutton on the holder handle, the function for the cut that appears on the unit or, through the blue pushbutton on the holder handle, the function for the coagulation that appears on the unit. The current delivery takes place through the foot switch.



Holder handle with two pushbuttons and optional double foot switch: press the yellow foot switch or the yellow pushbutton of the holder handle to pre-set and deliver the cutting current (the choice between CUT or BLEND must be done pressing the correspondent pushbutton on the unit) or the blue foot switch or the blue pushbutton of the holder handle to pre-set and deliver the coagulating current (the choice between FORCED COAG, SOFT COAG or BIPOLAR must be done pressing the correspondent pushbutton on the unit).

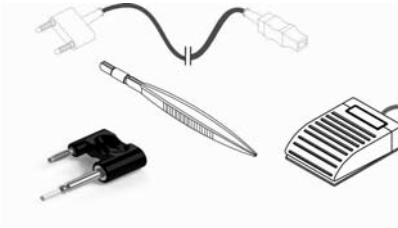


Holder handle without pushbuttons (optional) and single foot switch: connect the holder handle to the buckle indicated "ACTIVE" and pre-set the current for the cut (CUT or BLEND) or the coagulation (FORCED COAG, SOFT COAG or BIPOLAR), press the foot switch to deliver the pre-set current.



Holder handle without pushbuttons (optional) and double foot switch (optional): connect the holder handle to the buckle indicated "ACTIVE" and press the yellow footswitch to pre-set and deliver the cutting current (the choice between CUT or BLEND must be done pressing the correspondent pushbutton on the unit); press the blue foot switch to pre-set and deliver the coagulating current (the choice between FORCED COAG, SOFT COAG or BIPOLAR must be done pressing the correspondent pushbutton on the unit).

- Use for **BIPOLAR**:

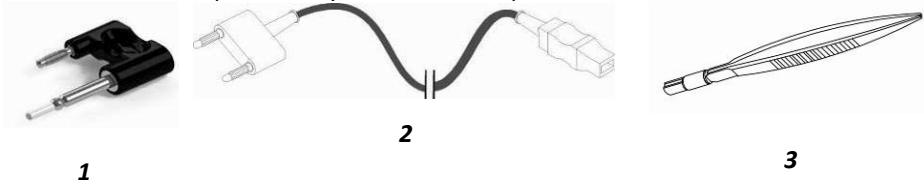


Bipolar forceps (optional) and single foot switch: connect the optional adapter (REF 00498.00) (see page 22). The equipment will select the BIPOLAR operative mode. To deliver the current press the foot switch. To avoid the forcep's damage don't make short circuit with its tips.



Bipolar forceps and double foot switch: connect the optional adapter (REF 00498.04) (see page 22). The equipment will select the BIPOLAR operative mode. To deliver the current press the foot switch for the coagulation (blue). To avoid the forcep's damage don't make short circuit with its tips.

NOTE: For BIPOLAR procedure you need other optional accessories:



- 1 Bipolar adapter
- 2 Cable for bipolar accessories connection
- 3 Bipolar accessory (ex: bipolar forceps)

For optional accessories see page 4

CONNECTOR AND CONTROLS

Label on the Rear Panel

The requirements for the safety of H.F. surgical equipment ask data and graphic symbols must be printed on the cabinet or on at least one of the panels of generator unit to define its features and oversee its condition of work.

Manufacturer's Identification Data

DIATERMO MB 120 VET and MB DIATERMO 160 VET HF electrosurgical unit are designed, manufactured and tested by the LED SpA in its own laboratories in Aprilia (LT) – Italy.

Operation Mode

Switch On

When switched on the electrosurgical unit performs automatically a test to establish the correct operation of itself and of the connected accessories as well. In case anomaly is found an alphanumeric message it is shown coded according to the chart codes brought in the chapter MAINTENANCE. This test lasts about 10 seconds. At the end of the control the equipment restores last use operational conditions.

Neutral Electrode's Circuit

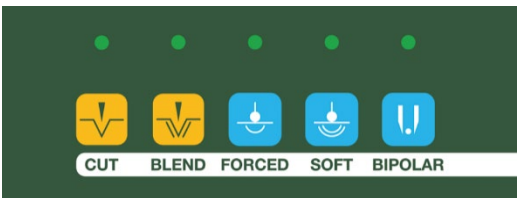
The neutral electrode is continually watched by a special circuit that prevents, danger of burns to the patient due the loss of contact between the neutral electrode and the patient skin, if split electrode is used. If the impedance value of the patient circuit is more than 200 ohm the value is not accepted, in this case the OC indicator light flashing, and if the output circuit is activated no power out and there is a sound alarm.

In order to reduce the acoustic pollution, the sound alarm is present only when pressed the foot-switch.

If a single plate electrodes use watched only the connection of the neutral electrode plate to the unit.

Preselection of the Deliverable Current

The deliverable current for the surgical operations can have preselected through push button for:



Cut Current (CUT)



The best current for the cut is the pure sinusoidal wave without modulation that means with duty-cycle 100%. Such current, proper for cut without coagulation.

Coagulated-Cut Current (BLEND)



The coagulated-cut current (BLEND) it is suited for coagulated cut when a deep coagulation together the cut is desired. This current is made by sine current e suited for the cut associated to low voltage current suited for coagulation (soft coag). With this blending, a current suited for cut coagulated in absence of eschar and carbonization is obtained, particularly suitable for endoscopic surgery.

Superficial Coagulation Current (FORCED COAG)



The modulated current (FORCED COAG) it is characterized by good property of surface coagulation behaving at the time it probable production of eschar and partial carbonization of the tissue. The advantage of this type of coagulation resides in the rapidity with which the effect is gotten.

Deep Coagulation Current (SOFT COAG)

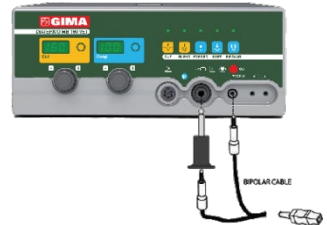


The low voltage and low modulation current (SOFT COAG) it is suited for coagulation of deep layers of the tissue in which the coagulation of the cellular albumin is gotten in absence of carbonization and without production of eschar. The process of coagulation is in this case more time expensive than that of the forced coagulation.

Bipolar Coagulation Current (BIPOLAR)



This current is low voltage pure sine current suited for coagulation without carbonization either monopolar or bipolar. The use of bipolar forces it is allowed only with this current. To allow the connection of the cable for bipolar forces it is necessary the use of an optional adapter (REF 00498.00) that prevents any other type of current from delivering.



Signaling of Excessive Time of Delivery (OVT)

If the operator exceeds the maximum time of disbursement, recommended by the international norms, that is 10 seconds, after a time depending from the type of current, and from the level of the same one, the equipment could generate a signal of warning consisting in the text **Hot** flashing on the display and in impediment to the delivering of current. The interdiction lasting of the current delivery depends from the previous conditions of delivery.

Signaling of Excessive Impedance in the Circuit of Neutral Electrode (OC)

For the meaning of this warning signal please refer to the previous description of the neutral electrode circuit.

Adjustment of the Acoustic Signal Level

To modify the emission acoustic signal it is necessary to follow those indications:

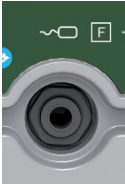
1. Switch on the unit through the mains switch while the CUT pushbutton is maintained pressed
2. When the unit has finished to check internal parameters, on the display CUT appears the message **SOU.**, while on the COAG one, the value of the preset level. Now, the CUT pushbutton can be released.
3. Through the COAG knob it is possible varying the emission acoustic level. During the variation the sound emitted by the unit corresponds to the preset level.
4. Press the CUT pushbutton to confirm the level

Level	Sound emission until 1m distance from the frontal panel
1	55 dBA
2	60 dBA
3	65 dBA
4	70 dBA
5	75 dBA

Automatic Control of the Internal Parameters

The unit has an automatic control system of some of the internal parameters. When switched on, the control is indicated on the display through the message **SEL FCh**. If there are not errors, the message **PAS Sed** appears; if there are errors, **Err 001** appears. See Guide to the Problems' Solution for further information.

Connectors



Neutral Electrode Connector

This is the point of connection of the return plate or of the bipolar optional adapter (**REF 00498.00**) for BIPOLAR function.



Handle Connector

This is the point of connection of electrode handle. In the case of use of handle without finger switch it shall be connected to the buckle indicated "ACTIVE".



Foot-switch Connector

On the left part of the front panel it is foot-switch connector.

Back Panel

DIATERMO (mod. MB 160 VET)

1 Fuses holder/Voltage selector

3 Mains voltage connector

2 Power On-Off switch

4 Equipotential connector



Power Supply Module and Voltage Selector

Power supply module is the connection point of mains voltage feeding to the unit. This module is provided with line fuses and the voltage selector.

WARNING: before switch on the unit, operator has to verify that requested mains voltage corresponds to the voltage available from the electrical net. (see chapter Putting into service).

Power On-Off Switch

The POWER ON/OFF mechanical switch is used to control power to the equipment. To power the equipment, press the switch in the direction of the 1. When the equipment is powered the front panel will illuminate. Pressing the switch in the 0 direction will cut power to the equipment, this operation allows it to be used as an emergency stop switch, in the event of any fault.

TECHNICAL CHARACTERISTICS

Toll.	Description	DIATERMO	
		MB 120 VET	MB 160 VET
–	Electrosurgical unit code	GMA10100.V201	GMA10100.V301
± 0%	Minimum presectable power	0	0
–	Level step	1	1
–	Digital level display	●	●
±20%	Maximum output power CUT (W)	120 → 250Ω	160 → 250Ω
± 20%	Maximum output power BLEND (W)	90 → 200Ω	120 → 200Ω
± 20%	Maximum output power COAG FORCED (W)	80 → 150Ω	100 → 150Ω
± 20%	Maximum output power COAG SOFT (W)	60 → 100Ω	80 → 100Ω
± 20%	Maximum output power BIPOLAR (W)	40 → 100Ω	60 → 100Ω
± 5%	Modulation factor CUT	Pure 100%	Pure 100%
± 5%	Modulation factor BLEND	Pure 100%	Pure 100%
± 5%	Modulation factor COAG FORCED	Mod. 60%	Mod. 60%
± 5%	Modulation factor COAG SOFT	Mod. 90%	Mod. 90%
± 5%	Modulation factor BIPOLAR	Pure 100%	Pure 100%
-0.1+0.2	Crest Factor CUT	1.5	1.5
± 0.3	Crest Factor BLEND	2.1	2.1
± 0.3	Crest Factor COAG FORCED	2.0	2.0
± 0.3	Crest Factor COAG SOFT	1.7	1.7
-0.1+0.2	Crest Factor BIPOLAR	1.5	1.5
± 10%	Working frequency	600 kHz	600 kHz
± 15%	Maximum output voltage CUT (Vpp on 5.2kΩ)	1050	1050
± 15%	Maximum output voltage BLEND (Vpp on 5.2kΩ)	1050	1050
±15%	Maximum output voltage FORCED (Vpp on 5.2kΩ)	1050	1050
± 15%	Maximum output voltage SOFT (Vpp on 5.2kΩ)	540	540
± 15%	Maximum output voltage BIPOLAR (Vpp on 5.2kΩ)	540	540
± 0.5	Weight Kg	5	5
± 10	Size WxHxD mm	254x104x288	254x104x288
± 5%	Selectable power (Vac)	115–230	115–230
± 1%	Mains frequency (Hz)	50-60	50-60
–	Fuses (230Vac) 5x20 type TIMED	2x T3.15A, 250V	2x T3.15A, 250V
–	Fuses (115Vac) 5x20 type TIMED	2x T6.3A, 250V	2x T6.3A, 250V
± 10%	Electrical input power (VA)	300	350
± 10%	Electrical input current (A) 230Vac	1.3	1.5
± 10%	Electrical input current (A) 115Vac	2.6	3
± 5	Five steps adjustable sound level (from 55- to 75dBA)	●	●
–	Self-check	●	●
–	Power accuracy output warning	●	●
–	Split or not split patient plate allowed	●	●
–	Last working condition storing	●	●
–	Electrical Class (EN60601-1)	I CF	I CF
–	MDR 2017/745/UE Class	II b	II b
–	EN55011 (CISPR 11) Class (Group / Class)	2 / A	2 / A
–	Patient circuit	F	F
–	Duty Cycle (action / pause) in seconds	10 / 30	10 / 30
–	Output power control by foot-switch or finger-switch	●	●
–	Defibrillation-proof	●	●
–	Equipotential binding	●	●
–	ABS cabinet	●	●

● = PRESENT

MAINTENANCE

General

No user adjustable parts are within the equipment, either for calibration or service purposes.

The equipment housing must not be opened: the warranty is invalidated by any unauthorized entry into the unit. In the event any repair or adjustment work being necessary, the whole equipment should be returned to the LED SpA. Service Centre 04011 APRILIA (LT) - ITALY, or to an other Authorized Centre, together with a description of the fault.

Maintenance work by the user is mainly the cleaning of the exterior of the cabinet, cleaning and sterilization of the accessory items and checking of the equipment before each use. Carrying out function and safety check for verification of the parameters is demanded to specialized technical people.

Cleaning of the Cabinet

Switch the equipment off completely and disconnect the mains supply before any cleaning is undertaken. Clean the outside of the cabinet with a damp cloth. No chemical should be used; a mild non abrasive cleanser may be used when necessary.

Cleaning and Sterilization of the Accessories Items

The best thing to do is to use only one time use accessories and discard them after use. Since some of the accessory items are to be used more than once it is mandatory to clean carefully and sterilize those accessories before the new use. The best way to clean and sterilize the reusable items is to follow the direction of the supplier of each item. When original reusable accessories supplied by LED SpA are applied, the cleaning by using deep cleanser and sterilization through steam sterilization at 121 °C / 134 °C is recommended.

Guide to the Solution of the Problems

In case of problems before all it is advised to check for the correct Putting into service of the unit and for the correct connection of the accessories.

Problems	Probable Cause	Solution
The equipment doesn't switch on.	Interruption or absence of the main feeding.	Verify the connection of the main cable. Verify the fuses and replace them, where necessary, with new ones of the proprie type.
Alarm OC always active	Interruption or lack of contact on the neutral electrode circuit.	Check the connection of the cable to the neutral electrode. Replace the cable of connection of the neutral electrode.
The unit doesn't respond to the command of activation	Breakdown of the handpiece or of the pedal. Wrong connection of the handpiece or of the pedal. Alarm OVT activated.	Replace the handpiece or the pedal. Verify the connection of the handpiece or of the pedal. Wait for the OVT warning signal getting out.
Error Code 001	Current delivery control activated during switching on.	Disconnect the handpiece or the pedal and switch on the unit again.

Problems	Probable Cause	Solution
Error Code 002	Error in the management board.	Call for Service.
Error Code 003	Error in the management board.	Call for Service.
Error Code 004	Error in the data conversion circuit.	Call for Service.
Error Code 005	Error of the reference voltage value.	Verify the main voltage. Call for Service.
Error Code 009	Error in the output power activation circuit.	Call for Service.
Error Code 010	Error in the output power activation circuit.	Call for Service.

Repairs

High frequency cables and electrode holder handle cannot be repaired. Always substitute a damaged part with a new one.

Fuses Substitution

Before substituting the fuse, disconnect the unit from the mains system

Only use fuse of the kind 5x20; they must have those characteristics: T3.15A (slow) (230Vac mains voltage), T6.3A (115Vac mains voltage), proceed as follows:

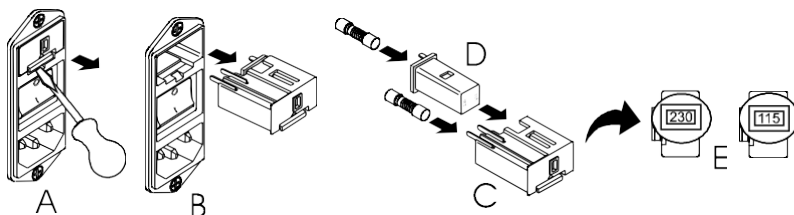
(A-B) Extract the fuse holder drawer from the power module.

(C) Insert the fuses making reference to the following chart:

Mains Voltage 110-120 V Delayed Fuse 2x T6,3AL, 250V / 5 x 20 mm

Mains Voltage 220-240 V Delayed Fuse 2x T3,15A / 5 x 20 mm

(D) Extract and rotate the detachable part in way to read the correct voltage in the (E) window – reinsert the fuse holder in the module.



Checking of the Equipment Before Each Use

Each time the use of the electrosurgical equipment is planned a check of the most important safety aspects has to be implemented considering at least the following:

- Check the integrity of cords, connections, wires breakage, etc.
- Assure that all the electrical equipment is properly grounded.
- Assure that all the accessories that should be used are available and sterilized.
- Check, by disconnecting the reference electrode cable, the functioning of the OC light. Active unit and check OC light and sound alarm warning.
- Check, by activating the CUT and COAG power switch, the functioning of the emission lights and sounds warnings

Function and Safety Check and Test

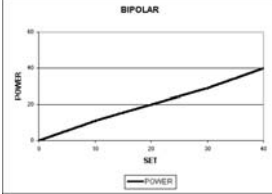
At least once a year, the biomedical engineering department or other qualified personnel should do the following check and test:

- Check of the connectors and mains supply cord conditions.
- Visual check of the mechanical protections.
- Check of the protections against the danger due to liquid's pouring, dripping, moisture, liquid's penetration, cleanliness, sterilization and disinfection.
- Check of the Equipment's Data on the Label.
- Check of the availability of the Instruction's Manual.
- Check the functioning of the H.F. output controls.
- Check the uniformity of the resistance through the surface of the patient plate.
- Test the earth conductivity resistance.
- Test the earth leakage current.
- Test H.F. leakage current.
- Control of the neuromuscular stimulation.
- Control of the accuracy of the output power.

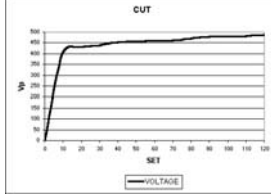
DIAGRAMS

DIATERMO MB 120 VET		
<p>CUT</p>	<p>BLEND</p>	<p>FORCED</p>
<p><i>Diagrams of half and maximum output power versus impedance load 100-2000Ω CUT</i></p>	<p><i>Diagrams of half and maximum output power versus impedance load 100-2000Ω BLEND</i></p>	<p><i>Diagrams of half and maximum output power versus impedance load 100-2000Ω FORCED</i></p>
<p>SOFT</p>	<p>BIPOLAR</p>	<p>CUT</p>
<p><i>Diagrams of half and maximum output power versus impedance load 100-2000Ω SOFT</i></p>	<p><i>Diagrams of half and maximum output power versus impedance load 10-1000Ω BIPOLAR</i></p>	<p><i>Diagrams of output power CUT versus nominal value</i></p>
<p>BLEND</p>	<p>FORCED</p>	<p>SOFT</p>
<p><i>Diagrams of output power BLEND versus nominal value</i></p>	<p><i>Diagrams of output power FORCED versus nominal value</i></p>	<p><i>Diagrams of output power SOFT versus nominal value</i></p>

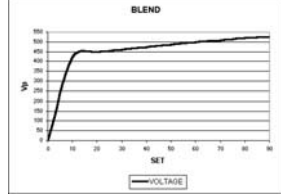
DIATERMO MB 120 VET



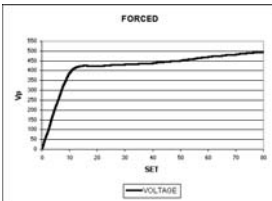
Diagrams of output power BIPOLAR versus nominal value



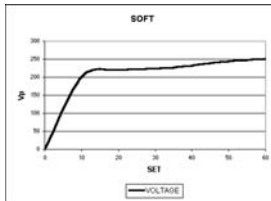
Diagrams of CUT maximum mains voltage output versus Vp



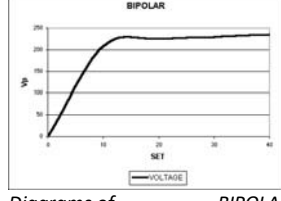
Diagrams of BLEND maximum mains voltage output versus Vp



Diagrams of FORCED maximum mains voltage output versus Vp

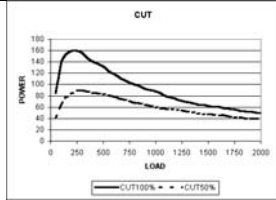


Diagrams of SOFT maximum mains voltage output versus Vp

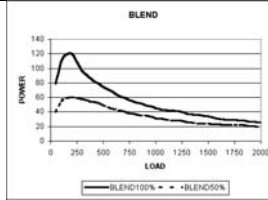


Diagrams of BIPOLAR maximum mains voltage output versus Vp

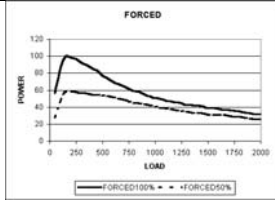
DIATERMO MB 160 VET



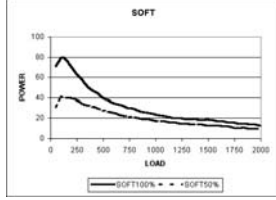
Diagrams of half and maximum output power versus impedance load 100-2000Ω CUT



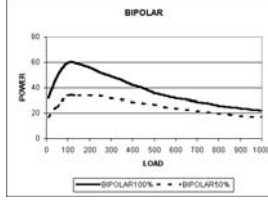
Diagrams of half and maximum output power versus impedance load 100-2000Ω BLEND



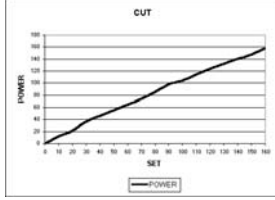
Diagrams of half and maximum output power versus impedance load 100-2000Ω FORCED



Diagrams of half and maximum output power versus impedance load 100-2000Ω SOFT

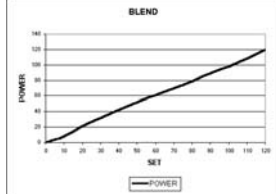


Diagrams of half and maximum output power versus impedance load 10-1000Ω BIPOLAR

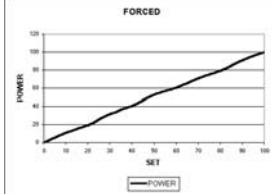


Diagrams of output power CUT versus nominal value

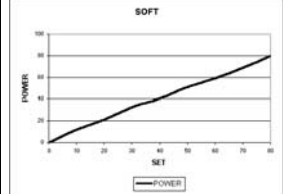
DIATERMO MB 160 VET



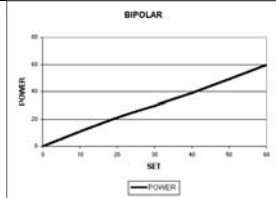
Diagrams of output power BLEND versus nominal value



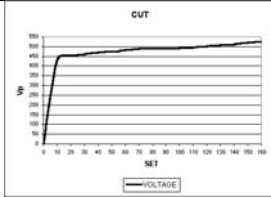
Diagrams of output power FORCED versus nominal value



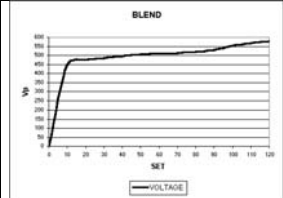
Diagrams of output power SOFT versus nominal value



Diagrams of output power BIPOLAR versus nominal value



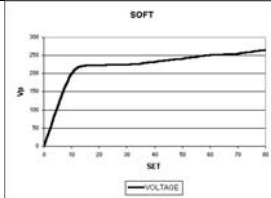
Diagrams of CUT maximum mains voltage output versus Vp



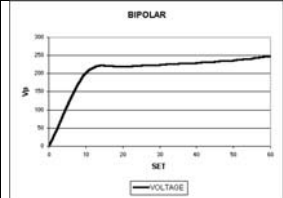
Diagrams of BLEND maximum mains voltage output versus Vp



Diagrams of FORCED maximum mains voltage output versus Vp



Diagrams of SOFT maximum mains voltage output versus Vp



Diagrams of BIPOLAR maximum mains voltage output versus Vp



On the end of the life, the present product mustn't be eliminated as urban refusal, but it must be eliminated in a separated collection.

If the product is eliminated in unsuitable way, it is possible that some parts of the product (for example some accumulators) could be negative for the environment and for the human health.

The symbol on the side (barred dustbin on wheel) denotes that the products mustn't throw into urban refuses container but it must be eliminated with separate collection.

In case of abusive elimination of this product, could be foreseen sanctions.



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