DIATERMO

MB 300 D / MB 400 D

HIGH POWER MONOPOLAR AND BIPOLAR ELECTROSURGICAL UNIT



DIATERMO MB 400 D

GIMA SPA
Via Marconi 1 - 20060 Gessate (MI) - ITALY
Tel +39 02 9538541 Fax +39 02 95381167
www.gimaitaly.com
gima@gimaitaly.com - export@gimaitaly.com

CE 0051

MA398_BK

Instruction's Manual

ENGLISH

Summary

IMPORTANT ---- 3
INTRODUCTION ---- 4
Destination of Use / Sectors of Application ---- 4
Standard and Optional Composition ---- 4
General Description ---- 5
ELECTROPHYSICAL PRINCIPLES ---- 5
OPERATIVE TECHNICS ---- 7
Monopolar Cut ---- 7
Monopolar Coagulation ---- 7
Bipolar Cut and Coagulation ---- 8
CONTRAINDICATIONS AND COLLATERAL EFFECTS ---- 9
SAFETY ---- 9
General ---- 9
Installation ---- 10
Safety for the Patient ---- 10
HF Electrosurgical in Laparoscopy ---- 11
INSTALLATION ---- 12
CONNECTOR AND CONTROLS ---- 13
Label on the Rear Panel ---- 13
Manufacturer's Identification Data ---- 13
Technical Data ---- 13
Meaning of Graphics Symbols ---- 14
Frontal Panel ---- 14
Operation Mode ---- 15
Switch On ---- 15
Neutral Electrode's Circuit (Skin Plate Electronic Control) ---- 15
Program ---- 15
Monopolar ---- 15
Cut and Coagulated Cut (CUT) ---- 16
Current for Enhanced Cut (ENHANCED CUT) ---- 16
Mixed Current (BLEND) ---- 16
Current for Superficial Coagulation (SPEEDY COAG) ---- 16
Current for Deep Coagulation (DEEP COAG) ---- 17
Current for Spray Coagulation (SPRAY COAG) ---- 17
Current for Spray Argon Coagulation (SPRAY ARGON) ---- 17
Handle and Footswitch (MONOPOLAR 1, MONOPOLAR 2) ---- 17
Bipolar ---- 17
Bipolar Current Cut (BIPOLAR CUT) ---- 18
Mixed Current (BIPOLAR BLEND) ---- 18
Bipolar Coagulation Current (BIPOLAR COAG) ---- 18
Autostart and Autostop ---- 18
Forceps and Foot Switch (BIPOLAR) ---- 18
Signaling of Excessive Time of Delivery ---- 18
Signaling of Excessive Impedance in the Circuit of Neutral Electrode (OC) ---- 19
Presettable Setting by User ---- 19
Automatic Control of the Internal Parameters ---- 19

Connectors ---------- 19
Back Panel ---------- 20
Connectors ---------- 20
Power Supply Module of the Equipment and Voltage Selector ---------- 20
Power On-Off Mechanical Switch ---------- 20
TECHNICAL CHARACTERISTICS ---------- 21
MAINTENANCE ---------- 23
General ---------- 23
Cleaning of the Cabinet ---------- 23
Cleaning and Sterilization of the Accessories Items ---------- 23
Guide to the Solution of the Problems ---------- 23
Repairs ---------- 23
Fuses Substitution ---------- 23
Checking of the Equipment Before Each Use ---------- 24
Function and Safety Check and Test ---------- 24
DIAGRAMS ---------- 25

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.

Produttore / *Manufacturer*

[TS b¡ P

_a^ V TccP iX^] XT _a^ S diX^] XT[Tcca^] XR WT

e xp bt {r xp ¥t {{p ;C? ?C?@@ P _aX[XP 7[c8 XcP [XP

CE
0051

MA398C_EN *Edition 01.2021* *2021 © LED SpA*

No part of this document could be photocopied, reproduced or translated in other language without the written consent of LED SpA. All right reserved.

INTRODUCTION

Destination of Use / Sectors of Application

The **DIATERMO MB 300 D** and **DIATERMO MB 400 D** high frequency electro-surgical units' use is exclusively reserved to specialized medical personnel. The equipments are intended for temporary use, during surgical treatments where monopolar or bipolar cut and / or coagulation are requested. The equipment is conceived for being used in the following sectors:

Description	DIATERMO	
	MB 300 D	**MB 400 D**
Electrosurgical unit code	GMA10400.801	GMA10400.901
Dermatology	1	6
Endoscopy	1	6
Gastroenterology	1	1
General Surgery	1	1
Gynecology	1	6
Neurosurgery	1	1
Orthopedics	6	1
Otorhinolaryngology	1	6
Pediatric Surgery	1	1
Plastic Surgery	1	1
Pneumology	1	6
Thorax Surgery	6	1
Trans Urethral Resection (TUR)	6	1
Urology	1	1
Vascular Surgery	6	6
Veterinary	1	6

1 = Recommended 6 = Usable

Standard and Optional Composition

Code	Description	DIATERMO	
		MB 300 D	MB 400 D
-	Electrosurgical unit code	GMA10400.801A	GMA10400.901A
00100.01	Power supply cable 5m SIE-IEC	1 /1	1 /1
00205.00	PENCILS S – Handle with switch	1 /1	1 /1
00305.04	Double water-proof foot switch HP	1 /2	1 /2
00404.08	CONNECTION - Cable for neutral electrode disposable type 5365/6429/FLEX	1 /1	1 /1
152-110	ELECTRODE - Blade electrode 7 cm	1 /3	1 /3
152-115	ELECTRODE - Blade electrode 16 cm	1 /3	1 /3
152-150	ELECTRODE - Ball electrode @ 4mm 6 cm	1 /3	1 /3
755VL	Disposable handle with finger switches (F4797)	1 /5	1 /5
F7520	Electrode cleaning sponge 47x50mm	1 /1	1 /1
F7920	Disposable Split Neutral electrode (F7820)	1 /5	1 /5
00100.00	Power supply cable 2m IT-IEC	6	6
00100.03	Power supply cable 2m SIE-IEC	6	6
00100.04	Power supply cable 2m USA-IEC	6	6
00100.05	Power supply cable 2m GB-IEC	6	6
00100.07	Power supply cable 2m BR-IEC	6	6
00100.09	Power supply cable 2m AU-IEC	6	6
00100.10	Power supply cable 5m JP-IEC	6	6
00206.00	PENCIL - Handle without switch	6	6
00401.01	NEUTRAL - Steel Neutral Electrode 24x16 cm with cable	6	6
00401.03	NEUTRAL - Steel Neutral Electrode 24x16 cm with cable autoclavable	6	6
00401.10	NEUTRAL - Steel Neutral Electrode FLEX 120x210mm	6	6
00401.11	NEUTRAL - Steel Neutral Electrode FLEX 120x210mm with cable	6	6
00401.12	NEUTRAL - Steel Neutral Electrode FLEX 120x210mm with cable autoclavable	6	6
00401.20	NEUTRAL - Steel Neutral Split Electrode FLEX S 120x210mm	6	6
00401.21	NEUTRAL - Steel Neutral Split Electrode FLEX S 120x210mm with cable	6	6
00401.22	NEUTRAL - Steel Neutral Split Electrode FLEX S 120x210mm with cable autoclavable	6	6
00402.00	CONNECTION - Monopolar cable M4-F4 3mt	6	6
00402.01	CONNECTION - Monopolar cable M4-F2.8 3mt	6	6
00402.02	CONNECTION - Monopolar cable M4-MP4 3mt	6	6
00404.07	Cable for connection neutral electrode F7915/F7930	6	6
00411.00	CONNECTION - Bipolar cable EUR	6	6
0350	Disposable Neutral electrode (F7805)	6	6

Code	Description	DIATERMO	
		MB 300 D	MB 400 D
152-112	ELECTRODE - Blade curved electrode 7 cm	6	6
152-120	ELECTRODE - Needle electrode 7 cm	6	6
152-122	ELECTRODE - Needle curved electrode 7 cm	6	6
152-125	ELECTRODE - Needle electrode 13 cm	6	6
152-130	ELECTRODE - Ball electrode @ 2mm 6 cm	6	6
152-132	ELECTRODE - Ball curved electrode @ 2mm 6 cm	6	6
152-140	ELECTRODE - Ball electrode @ 3mm 6 cm	6	6
152-142	ELECTRODE - Ball curved electrode @ 3mm 5 cm	6	6
152-145	ELECTRODE - Ball electrode @ 3mm 14 cm	6	6
152-152	ELECTRODE - Ball curved electrode @ 4mm 6 cm	6	6
152-160	ELECTRODE - Ball electrode @ 5mm 6 cm	6	6
152-162	ELECTRODE - Ball curved electrode @ 5mm 6 cm	6	6
152-165	ELECTRODE - Ball electrode @ 5mm 14 cm	6	6
152-175-10	ELECTRODE - Loop electrode 10x10 l.15 cm	6	6
152-190-13	ELECTRODE - Loop electrode 20x13 l.15 cm	6	6
152-190-20	ELECTRODE - Loop electrode 20x20 l.15 cm	6	6
152-195	ELECTRODE - Conization electrode 13 cm	6	6
310-110-05	BIPOLAR - Bipolar Forceps 11,5cm TIP0.5mm	6	6
310-112-05	BIPOLAR - Bipolar Forceps Curved 11,5cm TIP0.5mm	6	6
310-140-10	BIPOLAR - Bipolar Forceps 20cm TIP 1mm	6	6
310-140-20	BIPOLAR - Bipolar Forceps 20cm TIP 2mm	6	6
310-142-10	BIPOLAR - Bipolar Forceps Curved 20cm TIP 1mm	6	6
310-142-20	BIPOLAR - Bipolar Forceps Curved 20cm TIP 2mm	6	6
310-180-10	BIPOLAR - Bipolar Forceps Angled 20cm TIP 1mm	6	6
310-180-20	BIPOLAR - Bipolar Forceps Angled 20cm TIP 2mm	6	6
310-182-10	BIPOLAR - Bipolar Forceps Angled Curved 20cm TIP 1mm	6	6
310-185-10	BIPOLAR - Bipolar Forceps Angled Curved 20cm TIP 1mm	6	6
310-510	BIPOLAR - Bipolar electrode 20cm – direct	6	6
310-550	BIPOLAR - Bipolar electrode 20cm – curved 1	6	6
310-590	BIPOLAR - Bipolar electrode 20cm – curved 2	6	6
330-134-20	MONOPOLAR - Monopolar Forceps 20cm TIP2mm	6	6
330-160	MONOPOLAR - Monopolar Surgical Scissors 18cm	6	6
6429A	NEUTRAL - Steel Neutral Electrode 24x16 cm	6	6
F7915	Conductive rubber neutral electrode without cable	6	6
F7930	Conductive rubber split neutral electrode without cable	6	6
TR003W	Trolley 3 shelves	6	6
TR005W	Trolley 5 shelves	6	6

1 / Pcs= STANDARD 6 = OPTIONAL

General Description

DIATERMO MB 300 D and **DIATERMO MB 400 D** are high frequency electro-surgical equipments suited to deliver current for monopolar cut, coagulated cut (with different levels of coagulation), in monopolar modality and cut and coagulation in bipolar modality. In the bipolar modality, for the coagulation, the automatic system of activation/not-activation can be started when the coagulation is happened (AUTOSTOP – AUTOSTART).

A total of ten different modes of use and levels of power, can be stored and recalled for the use simply. It is possible to use either single plate neutral reference electrodes or electrodes with split conductive zone so to watch the stability of the plate to patient impedance 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 selected parameters are recalled.

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

The units can work either through holder-handles with or without pushbuttons with double foot switch command.

It's possible to connect bipolar forceps to the unit for the bipolar functions.

ELECTROPHYSICAL PRINCIPLES

In the electrosurgical interventations 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:

1. Joule Effect
2. Faradic Effect
3. Electrolytic Effect

1) Joule Effect

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

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

The thermical 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 thermical 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 effects.

… **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 x 10^3	Silver 0,16 x 10^{-5}
Muscle, kidney, heart 0,2 x 10^3	Copper 0,17 x 10^{-5}
Liver 0,3 x 10^3	Gold 0,22 x 10^{-5}
Brain 0,7 x 10^3	Aluminum 0,29 x 10^{-5}
Lung 1,0 x 10^3	
Fat 3,3 x 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 ºC 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 ºC 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 the 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/m^2) 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 ($I^2\cdot t$) 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 TECHNICS

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.

Transurethral resection
A particular use of the cut is represented by the immersion of the active electrode (for this scope it's used a metal loop) in a liquid, for re-move tissue from the bladder and prostate. In this circumstance it's realized a high dispersion of the energy through the liquids and so it's important to use cut current that compensate these energetical dispersions.
By using coagulation currents and/or mixed cut currents the blood loss are reduced.

Monopolar Coagulation
When there is a temperature increment, for the heat produced for Joule effect in the tissue, it's realized the thermical coagulation and that is the partial solidification of the liquids and so the precipitation of colloidal substances. In particular fibrin forms in the blood and it, solidifying itself, obstructs the blood vessels.
To obtain the coagulation by the electrosurgical needle it needs to supply the active electrode with intermittent current so that the water goes out from the cell without destroying it. However also with the intermittent current, if the intensity of the current is too intense, the cut effect is realized.
Active electrodes particularly adapted for the coagulation are the electrodes with sphere shape, plate, or lanceolate used laterally.

The coagulation can be obtained by two different methods: by desiccation and fulguration.

Coagulation by desiccation
It's obtained supplying the electrode by low voltages that not generate sparks (this guarantees that the action is pure coagulum and so every effects of the cut is absent). The electrode is placed in direct contact with the tissue and the quantity of heat developed desiccates it.
Generally the coagulated cellular surfaces act like an insulation layer, that prevents that the heat had to the successive applications of the current penetrates too much in depth.
The current normally used for the coagulation is the modulated type. In function of the percentage of the modulation is realized the precision of the cut, the goodness of the haemostasis and the level of the tissue destruction. A bigger modulation of the current gives a cut more irregular, and a bigger depth of tissue destroyed but a better coagulation.
The following rules help the operator to obtain a good coagulation:
… select a ball electrode or a large wire;
… localize the vessel bleeding after have been dried the exceeding blood from the area;
… touch lightly the vessel bleeding before to activate the electrode;
… stop the activation of the electrode when the tissue whiten to prevent to damage it.
… maintain clean the point of the electrode(for this scope it's advisable to use (for this scope it's advisable using the electrode cleaning sponges F7520);

Coagulation by fulguration or spray
The electrode is supplied by high voltages so that, with the electrode separated from the tissue, can be one or more electrical arcs that die out in different places. The produced heat is so distributed on a surface of tissue bigger than it doesn't verify in the case of the single arc produced for the cut and that produces mostly coagulation. This method is ideal for the treatment of big surfaces with a diffuse blood loss and superficial one (for example hepatic resection) and/or to realize coagulation at open sternum in the cardiac-surgical.

Coagulation with anatomical forceps by the clamping
The more used coagulation consists to stop the haematic flow by the clamping pressure between the ends of the forceps.
After have clamped the portion of the tissue or the blood vessel seat of the coagulation, the active electrode puts in contact with the proximal metal part of the forceps. The activation of the high frequency must be happen after this contact (forceps – active

electrode) to prevent faradic effect (primer of an electric flat that exploits like conductor the air) that would cause electrical shock, burns to the operator, etc.

Bipolar Cut and Coagulation

In a different way from monopolar technical, with bipolar technique the portion of tissue interested by current passage in high frequency is very small. In this technique the bipolar forceps are used (with different dimensions and shapes) on which distal ends there are active and neutral electrodes. Clamping the interested tissue between the ends forceps, the current passage in high frequency will happen from an end to another one, exploiting the portion of tissue to treat like an electrical bridge.

… The bipolar cut consists in a dissection of the biological tissue by the passage of the high density current in high frequency concentrated by the two points of the bipolar forceps. Lately there is a great interest for this method, above all for the greater security offered and for the diffusion of the endoscopic and mininvasive surgical techniques.

… The bipolar coagulation is the haemostasis of small blood vessels of the body tissue between the two points of the forceps. When the current density is reduced the consequent effect is the desiccation of the cellular surface, without penetration in depth, with consequent coagulation.

The bipolar technique is extremely more safe because the current direction in high frequency is always determinate and not has unknown factors and probable erroneous directions, and the used powers are lower than those used in monopolar technique. For these reasons this technique is used above all in the more critical surgical operations, so it's important to maintain clean the distal ends of the forceps during the operation, because they are subject to accumulation of coagulated tissue, which limits the current passage and favors the sticking of the tissues.

The application of the neutral electrode (used obligatorily in the monopolar technique) isn't necessary, even if in a practical point of view it's always advisable the application on the patient during the initial preparatory phase.

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 equipe 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.

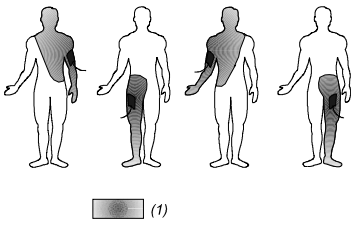
The accessories supplied with the unit have characteristics compatible with this supplied unit, they could be incompatible with others electrosurgical units; the user must check, before connecting other accessories to this unit, that they have characteristics of insulation compatible with those of this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

General

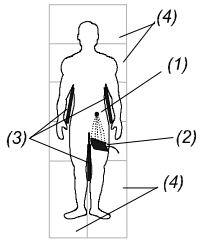
The following precautions reduce the risk of accidental burnings

- 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. Unless for veterinary use, the use of gelatinoids substances for the electrodes is not advised.
- 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.



(1) Treatment area



(1) Active electrode - (2) Neutral Electrode
(3) Dry gauze - (4) Antistatic cloth

- 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 desiderable 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.

Installation

- 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 of the installation. 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 300 D** and **DIATERMO 400 D** 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.

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 thermical necrosis. So it is recommended to inspect the equipment and its accessories before using and to respect all safety rules.

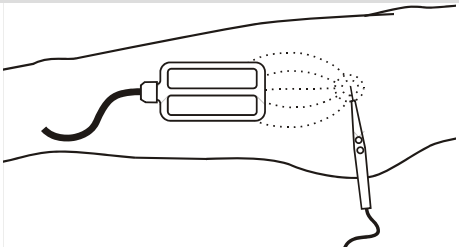
Correct Position of the Patient

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

- The patient 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 eliminating 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 anesthetics quantity to avoid a great sweating.

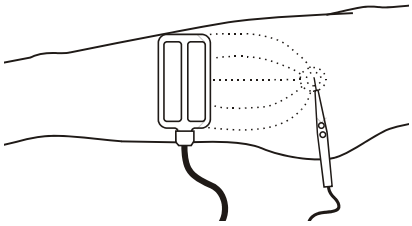
Correct Position of Neutral Electrode

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.



(CORRECT application)

In this picture it is shown the correct position of the neutral electrode by the two surfaces. The patient-plate must be placed perpendicularly to the operative field. It is important to avoid the transversal way and prefer the vertical or diagonal one, thereby it is allowed a uniform distribution of the current on all two surfaces and reduces the risk of burns for the patient.



(WRONG application)

Neutral electrode is often applied in an incorrect way, in parallel to the operative field. So the current distribution is not uniform on the two surfaces. If possible that the OC acoustic signal is started and the unit starting is not allowed.

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

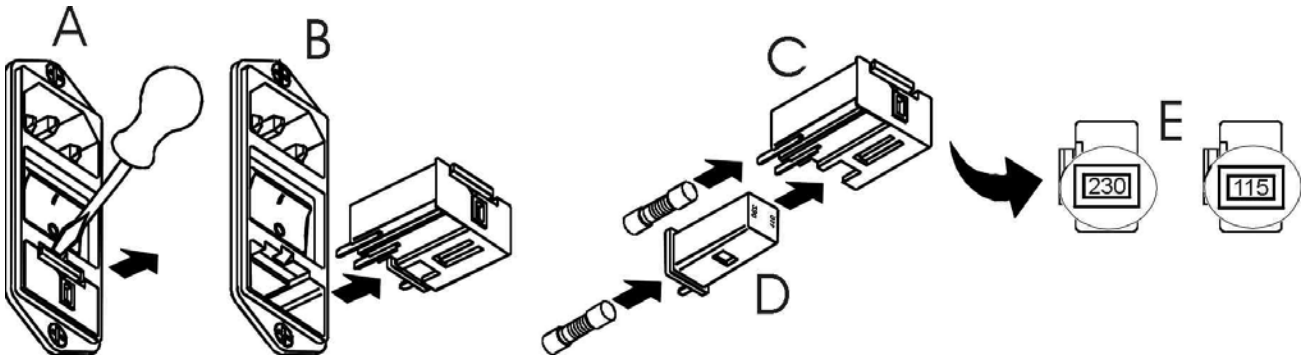
Direct coupling occurs when the active electrode touches another metal instrument, transferring electrical current to it and possibly injuring tissue with which it comes in contact (for example bowel or other organs).
Insulation failure occurs when there is an excessive voltage, abuse, wear and tear, 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.

INSTALLATION

- 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 T10 A / 5 x 20 mm
  Mains Voltage 220-240 V Delayed Fuse 2x T5 A / 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 double to the connector on the frontal panel (in the MONOPOLAR 1 section, for monopolar cut and coagulation; in the BIPOLAR section, for bipolar cut and coagulation) present on the frontal panel of the unit.
- Connect handle to the corresponding connectors and in the case of use of handle without push-buttons it shall be connected on the "ACTIVE" buckle.
- 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:

	WORK	*TRANSIT/STORAGE*
Temperature:	*10/40°C*	*-10/+50 °C*
Relative moisture:	*30/75%*	*10-100 %*
Pressure:	*70/106k Pa*	*50/106 kPa*

- When the unit is switched on, through the on/off switch on the frontal 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).
- Before using the unit, it is necessary connect the cable to the patient plate. Both when single plate electrodes and when split plate electrodes are used it is necessary to confirm the impedance acceptance by pressing the key OK (see page 15). In this way, if the value of the impedance is acceptable, the OC indicator light will stop flashing.
- The handle for CUT and COAG 1 functions of the MONOPOLAR1 section must be connect to the corresponding output CUT/COAG1.
- For the monopolar cut and coagulation (CUT e COAG 2), with the MONOPOLAR 2 currents, connect the handle to the connector CUT/COAG 2 and the foot-switch to the corresponding output, present in this section.
- For bipolar cut and coagulation, connect the bipolar forceps (optional) and/or the double foot-switch to the respective outputs in the BIPOLAR section.
- The equipment can be connect to external Argon unit by the connector on the back panel (see page 20).

NOTE: *For BIPOLAR procedure you need other optional accessories:*



1 ***2***

1 Cable for bipolar accessories connection
2 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 300 D and **DIATERMO MB 400 D** HF electrosurgical unit are designed, manufactured and tested by the LED SpA in its own laboratories in Aprilia (LT) – Italy.

Technical Data

DIATERMO MB 300 D

MONOPOLAR APPLICATION		*BIPOLAR APPLICATION*	
FREQUENCY:	425kHz	FREQUENCY:	525kHz
Output CUT (CUT):	300W - 300Z	Output BIPOLAR CUT (CUT):	95W - 150Z
Output ENHANCED CUT (CUT):	200W - 500Z	Output BIPOLAR BLEND (CUT/COAG):	90W - 150Z
Output BLEND (CUT /COAG):	200W - 300Z	Output BIPOLAR COAG (COAG)	70W - 100Z
Output SPEEDY (COAG):	100W - 500Z		
Output DEEP (COAG):	100W - 200Z		
Output SPRAY (COAG):	70W - 2000Z		

MAIN POWER:	115/230 V - 50/60 Hz selecting
INLET POWER:	1000VA
FUSE:	(230Vac) 2xT 5A / (115Vac) 2xT 10A
DUTY - CYCLE:	intermittent 10 seconds emission / 30 seconds of pause
CLASS:	I CF

DIATERMO MB 400 D

MONOPOLAR APPLICATION		*BIPOLAR APPLICATION*	
FREQUENCY:	425kHz	FREQUENCY:	525 kHz
Output CUT (CUT):	400W - 300Z	Output BIPOLAR CUT (CUT):	95W - 150Z
Output ENHANCED CUT (CUT):	250W - 500Z	Output BIPOLAR BLEND (CUT/COAG):	90W - 150Z
Output BLEND (CUT /COAG):	250W - 300Z	Output BIPOLAR COAG (COAG):	70W - 100Z
Output SPEEDY (COAG):	120W - 500Z		
Output DEEP (COAG):	120W - 200Z		
Output SPRAY (COAG):	100W - 2000Z		

MAIN POWER:	115/230 V - 50/60 Hz selecting
INLET POWER:	1000VA
FUSE:	(230Vac) 2xT5 A / (115Vac) 2xT10 A
DUTY - CYCLE:	intermittent 10 seconds emission / 30 seconds of pause
CLASS:	I CF

Meaning of Graphics Symbols

The meaning of the graphic symbols printed on **DIATERMO**'s cabinet is the following:
1- Floating Patient's plate: neither at low-frequency nor at high frequency earth connected.
2- The equipment is CF class, protected against Cardiac Defibrillator discharge.
3- Not Ionizing Radiation emitted.
4- Read carefully INSTRUCTION MANUAL before to attempt the use of the equipment.
5- Corresponding to the Directive Medical Device 93/42/EC
6- The product mustn't be threw in the containers for urban wastes but it must be swallowed by a separate picking.

					
1	*2*	*3*	*4*	*5*	*6*

Frontal Panel



1. Supplied unit indicator led's array
2. Switch on unit indicator led
3. Switch on key
4. Switch off key
5. Section for control and indication cut level MONOPOLAR 1
6. Selection key for monopolar cut 1, 100%, 80%, 60%, 40%
7. Lights for cut 100%, 80%, 60%, 40%
8. Selection keys and cut function way MONOPOLAR 1
9. Warning light for cut output MONOPOLAR 1
10. Section for control and indication of coagulation level MONOPOLAR 1
11. Selection keys and coagulation function way MONOPOLAR 1
12. Warning light coagulation output MONOPOLAR 1

13. Section for control MONOPOLAR 2

14. Selection keys and coagulation function way MONOPOLAR 2

15. Warning light coagulation output MONOPOLAR 2
16. Section for control and indication of bipolar cut level
17. Selection key for bipolar cut 100%, 80%, 60%, 40%
18. Lights for bipolar cut 100%, 80%, 60%, 40%
19. Selection key for bipolar cut
20. Warning light for bipolar cut output
21. Section for control and indication of coagulation level
22. Select key for bipolar automatic coagulation
23. START warning light
24. STOP warning light
25. Bipolar coagulation warning light
26. Display and informative keys
27. Section for impedance reading and acceptance
28. Alarm indicator for excessive impedance in the neutral electrode circuit
29. Connector for neutral electrode connection
30. Handle connector for active electrode-holder for monopolar cut and coagulation (CUT/COAG1)
31. Handle connector for active electrode-holder for monopolar cut and coagulation (CUT/COAG2)
32. Foot-switch connector for MONOPOLAR 2currents distribution
33. Bipolar output connector
34. Foot-switch connector for bipolar currents distribution

Operation Mode

Switch On

When switched on the electrosurgical unit reports on the LCD display (PROGRAM section) the code of used deepware and performs automatically a test to establish the correct operation of itself and of the connected accessories as well. In case anomaly is found, a description of the error is visualized on the LCD display and in the same time an alphanumeric message 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, and activate the signal of alarm OC (open circuit).

Neutral Electrode's Circuit (Skin Plate Electronic Control)

The neutral electrode's circuit is continually watched by a special circuit (Skin Plate Electronic Control) that prevents danger of burns to the patient due the loss of contact between the reference plate and the patient skin. The circuit is also watched to avoid that the variation of the characteristics of conductibility of the plate can provoke reduction of conductibility of the circuit, and therefore danger of burns to the patient.
The value of impedance found in the circuit of the neutral electrode is shown (by OC alarm lightening) to the operator that, if he considers it suitable to the job to develop, he accepts it by pressing the OK push button (the written 'YES' appears on the display). If the value of impedance is excessive its acceptance it is not acknowledged by the microcontroller of the equipment (written 'UP' appears on the display), therefore the signal OC is not extinguished and the distribution of power has not allowed.

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

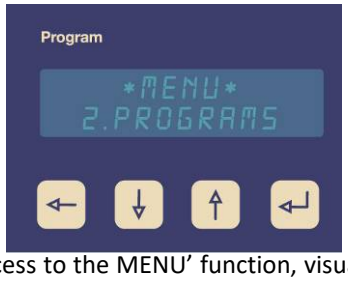
If a single plate electrodes use watched only the connection of the neutral electrode plate to the unit.



If the impedance value is accepted, the impedance indication is recognized and the display and OC indicator are extinguished.
If the shown impedance is accepted, but the impedance increases respect the accepted value, the unit avoid the distribution, shows the OC condition, without acoustic signal (only present during distribution) and shows the new impedance value. The operator can know the impedance value on the patient, by pressing one time (in not distribution phase) the OK key. The value checks on the patient is visualized for 2 seconds on the display that, than switches off itself.

Program

In the distribution phase, on the LCD display of the PROGRAM section, the operator receives the informations about used parameters.



In the case of not distribution, the operator can access to the MENU' function, visualized on the LCD display of PROGRAM section, by pressing the acceptance key (enter) '˘' and choice, by skiming through the menù with '‡' and '–' keys, between the four following settings:

1. Save. Press the acceptance key (enter) '˘' to enter in this section in which modify the name (max 11 letters long) of the program. By the keys (down) '‡' and (up) '–' select the letters and save them, once at a time, by the acceptance key (enter) '˘'. When the memorization is finished, after the last pressure of the enter key '˘' you can esc from this section. If you don't want to save the name of the program and to esc from this section, press the esc key '←'.
2. Program. Press the enter key '˘' to enter in this section and read the different memorized programs by the keys (down) '‡' and (up) '–'. Press the enter key '˘' to select the desired program. By pressing the esc key '←' you can esc from this function but without any selection .
3. Errors. Press the enter key '˘' to enter in this section and by the keys (down) '‡' and (up) '–' read the errors list (event-error description is visualized on the seven segments LCD display) verified in the equipment since the last event-error to the older (more than one hundred memorized errors). To esc from this section press the esc key '←'.
4. Delay Clamp. Press the enter key '˘' to enter in this section and to set, by the keys (down) '‡' and (up) '–', a delay for the distribution respect to the contact bipolar forceps-tissue. Select the enter key '˘' to confirm the set delay. This function can be set if you have been chosen with automatic bipolar coagulation (see Autostart and Autostop paragraph).
5. Language. Press the enter key '¿' to enter in this section and to set the language, by the keys (down) '¯' and (up) '', select your preferred language.

Monopolar

The supplying currents in the monopolar way for cut, coagulated cut and coagulation can be predisposed by the keys present in the MONOPOLAR 1, MONOPOLAR 2 sections. The power level for every function can be predisposed by the knob of CUT , COAG1 and COAG 2 sections. The set power levels remain in the memory.



(Fig. 1)

MONOPOLAR 1

CUT	COAGULATION	HANDLE CONNECTOR
1 Cut and coagulated cut (CUT) 2 Enhanced Cut 3 Blend	4 Speedy Coag 5 Deep Coag	

Using the CUT or COAG 1 functions it will need to connect the handle to the corresponding output CUT/COAG 1, in the MONOPOLAR 1 section.

MONOPOLAR 2

CUT	COAGULATION	HANDLE AND FOOT-SWITCH CONNECTOR
1 Cut and coagulated cut (CUT) 2 Enhanced Cut 3 Blend	6 Speedy Coag 7 Deep Coag 8 Spray Coag 9 Spray Coag with Argon	

Using the CUT or COAG 2 it will need to connect the handle and/or the foot-switch to the corresponding output CUT/COAG 2, in the MONOPOLAR 2 section.

The description of the supplying currents is in the next paragraphes, according to the predisposition order of the selection keys, in the MONOPOLAR 1 and MONOPOLAR 2 section (see Fig. 1).

Cut and Coagulated Cut (CUT)

The better current for the cut is the sinusoidal pure without modulation, that is by 100%duty-cycle.
This current, suitable for cut without coagulation, can be moderately modulated to obtain cut with different level of coagulation:



The modulation is an interval thanks to which it's possible to distribute suitable "pulse trains" of energy.
The level of modulation can be changed, between 100%, 80%, 60% e 40% values, choosing the duty-cycle of supplied current, by + and – keys, the duty cycle value selected is shown by the lightening of the corresponding warning light.
Naturally the level of coagulation increases when the duty-cycle value decreases.

Current for Enhanced Cut (ENHANCED CUT)



The ENAHNCED CUT current is a sinusoidal current characterized by modulation in amplitude and it is suitable to cut the tissues, in particular adipose tissues.

Mixed Current (BLEND)



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

Current for Superficial Coagulation (SPEEDY COAG)



The modulated current (SPEEDY 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.
SPEEDY Coag also said Fulgurate or Forced.

Current for Deep Coagulation (DEEP COAG)



The low voltage and low modulation current (DEEP COAG) it is suited for coagulation of deep layers of the fabric 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 Speedy coagulation.

DEEP Coag also said Pin Point, Dessicate or Soft.

ATTENTION The currents CUT, BLEND, SPEEDY COAG, DEEP COAG, are distributable from the CUT/COAG 1 (by handle) and from CUT/COAG 2 too (by handle and foot-switch)

Current for Spray Coagulation (SPRAY COAG)



The high-tension SPRAY COAG goes in the active electrode that isn't in contact with the portion of tissue to treat and mostly produces coagulation. This method is ideal to treat big surfaces with diffuse and surface blood loss (hepatic resection) and/or to realize coagulation at level of the open sternum in heart surgery.

Current for Spray Argon Coagulation (SPRAY ARGON)



The equipment can be connect to, by the external output connector placed on the back panel (see Back Panel paragraph), an Argon unit and supplies by handle or foot-switch the Spray Argon coagulation current.
Argon is an inert gas that is used to obtain a coagulative effect on the patient tissue. The gas in the bottle is supplied low pressure in direction of the tissue, while a function with output tension is activated, suitable to prime the spark of argon and, so, to start the coagulation process (without contact between active electrode and tissue), that results extremely effective and useful in the open sky traditional surgery, like in the hepatic resections, but also in the laparoscopic and endoscopic one.

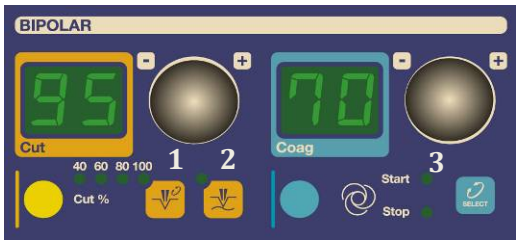
ATTENTION The spray Argon must be made preferably by the handle without push-buttons, because the high frequency could damage the push-buttons of the handle (see chapter TECHNICAL CHARATERISTICS), and by the foot-switch.

Handle and Footswitch (MONOPOLAR 1, MONOPOLAR 2)

Handle with two push-buttons without foot-switch: press the yellow push-button of the handle to supply cut current (the choice between CUT, CUT/COAG 80%, CUT/COAG 60%, CUT/COAG 40%, ENHANCED CUT, BLEND, must be made by pressing the corresponding push-button on the device) or the blue push-button of the handle to supply the coagulation current (the choice between SPEEDY COAG, DEEP COAG, SPRAY COAG, must be made by pressing the corresponding push-button on the device).
An handle with two push-buttons and double foot-switch: press the yellow foot-switch or the yellow push-button of the handle to select and to supply the cut current (the choice between CUT, CUT/COAG 80%, CUT/COAG 60%, CUT/COAG 40%, ENHANCED CUT, BLEND, must be made by pressing the corresponding push-button on the device) or the blue foot-switch or the blue push-button of the handle to select and to supply the coagulation current (the choice between SPEEDY COAG, DEEP COAG, SPRAY COAG must be made by pressing the corresponding push-button on the device).
An handle without push-buttons and double foot-switch: connect the handle on the 'active' connector and press the yellow foot-switch to select and to supply the cut current (the choice between CUT, CUT/COAG 80%, CUT/COAG 60%, CUT/COAG 40%, ENHANCED CUT, BLEND, must be effected by the corresponding push-button on the device). remember that in the Spray Argon coagulation mode it must be used an handle without push-buttons and the double foot-switch.

Bipolar

The distributable currents in the bipolar modality for the cut, coagulated cut and coagulation ca be selected by the keys of the BIPOLAR section. The power level for every function can be selected by the knob of the CUT, COAG sections. The power levels selected remains in memory.



(Fig. 2)

BIPOLAR

CUT	COAGULATION	FORCEPS AND FOOT SWITCH CONNECTOR
1 Cut and coagulated cut (CUT) 2 Blend	3 Bipolar Coag	

Using the CUT or COAG function it will need to connect the bipolar forceps to the connector for this function (BIPOLAR) or to use the foot-switch connecting it to the connector of this section.
The description of the supplying currents is in the next paragraphes, according to the predisposition order of the selection keys, in the BIPOLAR section (see Fig. 2).

Bipolar Current Cut (BIPOLAR CUT)

The current supplied by the bipolar forceps is high tension sinusoidal pure and adapted to the cut without coagulation, monopolar and bipolar too.



The level of modulation can be change, between the values 100%, 80%, 60% e 40%, choosing the duty-cycle of the supplied current, by the push-buttons + e – , the value of the selected duty cycle is shown by the lightening of the corresponding warning light.
Naturally the level of coagulation increases when the duty-cycle value decreases.

Mixed Current (BIPOLAR BLEND)

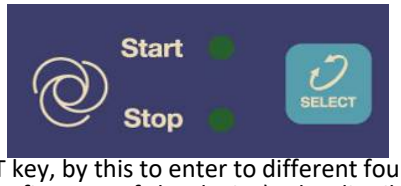


The mixed current BIPOLAR BLEND, supplied by the bipolar forceps is adapted to the cut and to the coagulated cut when a deep coagulation together the cut is desired. this current is made by sinusoidal current adapted to the cut associated to current for low-tension coagulation (deep coag).

Bipolar Coagulation Current (BIPOLAR COAG)

Type of coagulation practicable with bipolar forceps and that allows to supply, by handle or foot-switch, the RF output power on a impedance value of 100 ohm. This value is normally on the section of tissue between the forceps. This modality is practicable by SELECT key (see Autostart and Autostop paragraph).

Autostart and Autostop



In the 'BIPOLAR COAG' section there is the SELECT key, by this to enter to different four settings for the bipolar coagulation:

1) **No automatism** for the distribution (at the first use of the device). The distribution is realized by pressing the foot-switch and stops by leaving again the foot-switch;
2) **START**. The selection of this function is realized at a first pressure of the SELECT key and it's indicated by the lightening of the corresponding warning light. The distribution is started, by pressing the foot-switch, if there is contact between active electrode and tissue, and it stops by leaving again the foot-switch;
3) **STOP**. The selection of this function is realized at a second pressure of the SELECT key and it's indicated by the lightening of the corresponding warning light. The distribution is started, by pressing the foot-switch, (if also there isn't a contact between tissue and active electrode) and stops itself for the impedance value higher than 200 Ohm.. So by pressing the foot-switch, if there is an impedance value higher than 200 Ohm, the distribution doesn't start.
4) **AUTOSTART/AUTOSTOP**. By this setting, practicable by three pressures of the SELECT key indicated by the lightening of the START and STOP warning lights, the bipolar coagulation can automatically be activated and disarmed. The destribution starts, by pressing the foot-switch, if there is a contact between tissue and active electrode and stops for the impedance values higher than 200 Ohm. So by pressing the foot-switch, if there is an impedance value higher than200 Ohm, the distribution doesn't start.

Another pressure of the SELECT key brings again to the no automatism function (1).

The distribution is always stopped by leaving again the foot-switch.
The Delay Clamp function can't be useful if the automatism for bipolar coagulation has been chosen. This function can be selected from the Program section (see *Program* paragraph) and allows to set a delay for distribution respect to the contact bipolar forceps-tissue.

Forceps and Foot Switch (BIPOLAR)

Bipolar forceps and double foot-switch: Connect the bipolar forceps to the 'BIPOLAR' connector. The equipment isready to supply the only functions BIPOLAR (BIPOLAR CUT, BIPOLAR CUT/COAG 80%, BIPOLAR CUT/COAG 60%, BIPOLAR CUT/COAG 40%, BIPOLAR BLEND e BIPOLAR COAG). Supply the BIPOLAR CUT or BIPOLAR BLEND current by pressing the foot-switch associated to the cut (yellow) or supply the BIPOLAR COAG current by pressing the foot-switch associated to the coagulation (blue). To not damage the forceps don't short-circuit the points.

Signaling of Excessive Time of Delivery

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.
The warning light OC lightening if the circuit is open, it is extinguished by closing the plate and there is a respect for parameters selected and, in phase of distribution it's with an acoustic signal.

Presettable Setting by User

The equipment allows to the user to change the following settings: the level of the acoustic signal for the distribution (between min and max), power regulation
To modify the level of the acoustic signal for the distribution it must use the regulator 'speaker volume' placed on the back panel, setting a level between min and max.
To modify the power level press the keys + e – of the CUT e COAG section. The power step will be unitary for power values between 0W and 50W, it will be 10 for power values higher than 50W.

Automatic Control of the Internal Parameters

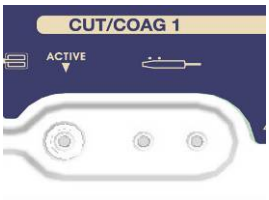
The unit has an automatic control system of some of the internal parameters. When it switched on, the unit makes a control on the monopolar and bipolar logics, indicates, on the seven segments display, respectively by Check A. e Check B. The positive result of the control is signaled on the display LCD of the PROGRAM section, by 'Check Monopolar OK' and 'Check Bipolar OK'. If the result is negative, the presence of errors will be marked by **Err xxx**, and the description of the event-error will be visualized on the LCD display.See Guide to the Problems' Solution for further information.

Connectors

Patient plate connector
This is the point of connection for the neutral electrode to apply on the patient.
Remember that the neutral electrode can be disposable and reusable.



Handle connector for the monopolar1 cut and coagulation
This is the point of connection for the handle with double push-buttons to realize the functions of the cut CUT and coagulation COAG1.



Handle connector for the monopolar2 cut and coagulation
This is the point of connection for the handle with double push-buttons (if the handle without push-buttons, it must be connected to the 'active' point) to realize the functions of the cut CUT and coagulation COAG2.
Remember that with the yellow push-button there is the control for the distribution of the monopolar currents for the cut and with the blue push-button there is the control for the monopolar coagulation.
Remember that the handle without push-buttons must be connected to the 'active' connector of CUT/COAG2.



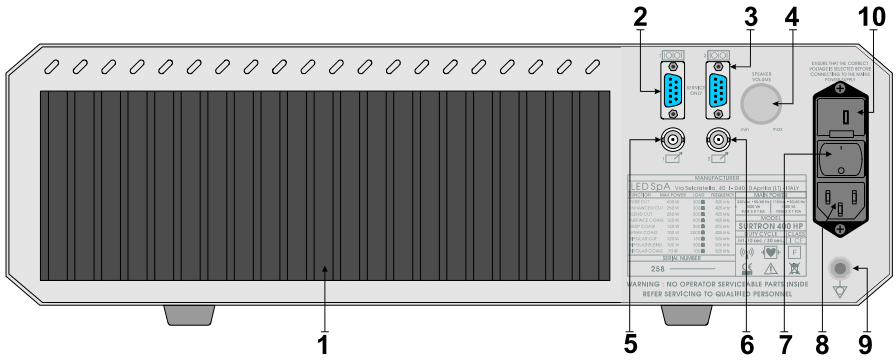
Foot-switch connector for the monopolar2cut and coagulation
This is the point of connection for the foot-switch to realize the monopolar cut and the coagulation (MONOPOLAR 2).
Remember that by the pressure of the yellow foot-switch the cut function is activated, while by the pressure of the blue one the coagulation function is activated.

Bipolar forceps connector
Point of connection for the bipolar forceps, by which the bipolar currents can be distributed to realize the bipolar cut and coagulation.



Double foot-switch for the bipolar cut and coagulation
Point of the foot-switch connection. Remember that by the pressure of the yellow foot-switch the cut function is activated, while by the pressure of the blue one the coagulation function is activated.

Back Panel

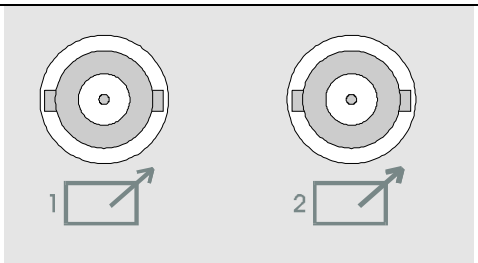


1 Spendthrift
2 Socket RS-232 (for assistance services)
3 Socket RS-232 (for assistance services)
4 Speaker Volume
5 Connector for external Argon unit
6 Connector for external unit
7 Mains mechanical switch
8 Mains socket
9 Socket for the equipotential connection
10 Fuse holder / Voltage selector

Connectors

1 - Connector for external Argon unit
Point of connection to an external Argon unit.
After the push-button for the selection of the spray Argon coagulation has been pressed and by activating the distribution (preferably by the foot-switch with the handle without push-buttons), the connector 1 received a signal that activate the distribution of this gas.

2 – Connector for external unit (except Argon unit)
Point of connection to an external unit, except Argon unit) (see point 1) to which the signal of distribution comes or, for example, of activation of surgical aspirator.



Power Supply Module of the Equipment 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 chap. INSTALLATION).

Power On-Off Mechanical 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 (i.e. left part). When the equipment is powered, the light inside the power on-off mechanical switch and the READY red Led on the right side of 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 a emergency stop switch, in the event of any fault. When the equipment is powered can be switched-on by the mains electronic switch located on the front panel.

TECHNICAL CHARACTERISTICS

Tollerance	Description	DIATERMO MB 300 D	DIATERMO MB 400 D
B	Electrosurgical unit code	GMA10400.801	GMA10400.901
B	Work condition memorization	1	1
B	Digital power visualization	1	1
B	Continuous check control	1	1
B	Automatic control of the plate-patient connection	1	1
B	Automatic control of the supplied power level	1	1
B	Bipolar coag with automatic activation/disactivation	1	1
B	Automatic control of the impedance (bipolar coag – autostart/autostop)	1	1
B	Consistent with Argon unit	1	1
B	Minimum preselectable power	0	0
B	Step power unitary for powers from 0W to 50W	1	1
B	Step power 10 for powers higher than 50W	1	1
B	Selection of the power through encoder knob	1	1
± 20%	Maximum output power CUT (W)	300W→ 300Ω	400W → 300Ω
± 20%	Maximum output power CUT 80% (W)	250W→ 300Ω	300W → 300Ω
± 20%	Maximum output power CUT 60% (W)	200W→ 300Ω	250W → 300Ω
± 20%	Maximum output power CUT 40% (W)	150W → 300Ω	200W → 300Ω
± 20%	Maximum output power ENHANCED (W)	200W → 500Ω	250W → 500Ω
± 20%	Maximum output power BLEND (W)	200W → 300Ω	250W → 300Ω
± 20%	Maximum output power SPEEDY COAG (W)	100W → 500Ω	120W → 500Ω
± 20%	Maximum output power DEEP COAG (W)	100W → 200Ω	120W → 200Ω
± 20%	Maximum output power SPRAY COAG (W)	70W → 2000Ω	100W → 2000Ω
± 20%	Maximum output power SPRAY COAG ARGON (W)	70W → 2000Ω	100W → 2000Ω
± 20%	Maximum output bipolar power BIPOLAR CUT (W)	95W → 150Ω	95W → 150Ω
± 20%	Max output bipolar power BIPOLAR CUT 80% (W)	95W→ 150Ω	95W → 150Ω
± 20%	Max output bipolar power BIPOLAR CUT 60% (W)	95W→ 150Ω	95W → 150Ω
± 20%	Max output bipolar power BIPOLAR CUT 40% (W)	60W → 150Ω	60W → 150Ω
± 20%	Maximum output bipolar power BIPOLAR BLEND(W)	90W → 150Ω	90W → 150Ω
± 20%	Maximum output bipolar power BIPOLAR COAG (W)	70W → 100Ω	70W → 100Ω
± 5%	Modulation factor CUT 80% (kHz)	10	10
± 5%	Modulation factor CUT 60% (kHz)	10	10
± 5%	Modulation factor CUT 40% (kHz)	10	10
± 5%	Modulation factor ENHANCED (Hz)	1.25	1.25
± 5%	Modulation factor SPEEDY COAG (kHz)	8-12	8-12
± 5%	Modulation factor SPRAY COAG (kHz)	10	10
± 5%	Modulation factor SPRAY COAG ARGON (kHz)	10	10
± 5%	Modulation factor BIPOLAR CUT 80% (kHz)	10	10
± 5%	Modulation factor BIPOLAR CUT 60% (kHz)	10	10
± 5%	Modulation factor BIPOLAR CUT 40% (kHz)	10	10
± 0.2	Crest Factor CUT	1.6	1.6
± 0.3	Crest Factor CUT 80%	1.8	1.8
± 0.3	Crest Factor CUT 60%	2.1	2.1
± 0.3	Crest Factor CUT 40%	2.6	2.6
± 0.3	Crest Factor ENHANCED CUT	1.6	1.6
± 0.3	Crest Factor BLEND	1.6	1.6
± 0.3	Crest Factor SPEEDY COAG	3.4	3.4
± 0.3	Crest Factor DEEP COAG	1.6	1.6
± 0.3	Crest Factor SPRAY COAG	3.4	3.4
± 0.3	Crest Factor SPRAY COAG ARGON	3.4	3.4
± 0.2	Crest Factor BIPOLAR CUT	1.5	1.5
± 0.3	Crest Factor BIPOLAR CUT 80%	1.7	1.7
± 0.3	Crest Factor BIPOLAR CUT 60%	2.0	2.0
± 0.3	Crest Factor BIPOLAR CUT 40%	2.4	2.4
± 0.3	Crest Factor BIPOLAR BLEND	1.7	1.7
+0.1	Crest Factor BIPOLAR COAG	1.5	1.5
± 15%	Working frequency MONOPOLAR	425 kHz	425 kHz
± 15%	Working frequency BIPOLAR	525 kHz	525 kHz
± 15%	Maximum output voltage CUT (Vpp)	1500	1500
± 15%	Maximum output voltage CUT/COAG 80% (Vpp)	1500	1500
± 15%	Maximum output voltage CUT/COAG 60% (Vpp)	1500	1500
± 15%	Maximum output voltage CUT/COAG 40% (Vpp)	1500	1500
± 15%	Maximum output voltage ENHANCED CUT (Vpp)	1500	1500
± 15%	Maximum output voltage BLEND (Vpp)	2500	2500
± 15%	Maximum output voltage SPEEDY COAG (Vpp)	2500	2500
± 15%	Maximum output voltage DEEP COAG (Vpp)	800	800
± 15%	Maximum output voltage SPRAY COAG (Vpp)	4500	4500
± 15%	Maximum output voltage SPRAY COAG ARGON (Vpp)	4500	4500
± 15%	Maximum output voltage BIPOLAR CUT (Vpp)	800	800
± 15%	Max output voltage BIPOLAR CUT 80%(Vpp)	800	800
± 15%	Max output voltage BIPOLAR CUT 60%(Vpp)	800	800
± 15%	Max output voltage BIPOLAR CUT 40%(Vpp)	800	800
± 15%	Maximum output voltage BIPOLAR BLEND (Vpp)	1100	1100
± 15%	Maximum output voltage BIPOLAR COAG (Vpp)	400	400
± 0.5	Size LxHxP mm	470x150x400	470x150x400
± 10	Weight (kg)	17,5	17,5
± 5%	Selectable mains power (Vac)	115 – 230	115 – 230
± 1%	Mains frequency (Hz)	50-60	50-60
± 0	Fuses 230Vac (5x20) TIMED	2xT 5A	2xT 5A
± 0	Fuses 115Vac (5x20) TIMED	2xT 10A	2xT 10A
± 10%	Electrical input power (VA)	1000	1000
± 10%	Electrical input current (230Vac) (A)	4.5	4.5
± 10%	Electrical input current (115Vac) (A)	9	9
B	Adjustable sound level	1	1
B	Self-check	1	1

Tollerance	Description	DIATERMO MB 300 D	DIATERMO MB 400 D
B	Power accuracy output warning	1	1
B	Skin Plate Electronic Control[1]	1	1
B	Split or not split patient plate allowed	1	1
B	Working condition storing[2]	10	10
B	Electrical Class (EN60601-1)	I CF	I CF
B	MDD 93/42/EC Class	II b	II b
B	EN55011 (CISPR 11) Class (Class/Group)	2 / B	2 / B
B	Patient circuit	F	F
B	Duty Cycle (action / pause) in seconds	10 / 30	10 / 30
B	Output power control by foot-switch or finger-switch	1	1
B	Defibrillation-proof	1	1
B	Equipotential binding	1	1
B	ABS and metallic cabinet	1	1

1 = PRESENT B = NOT PRESENT

[1] Patient to plate contact monitoring system
[2] Continuous storing of the last settings

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 installation 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.
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 011	Foot switch pressed	Verify the state of the foot-switch
Error Code 011	Foot switch pressed	Verify the state of the foot-switch
Error Code 013	Bipolar DAC not verified	Call for Service
Error Code 014	Bipolar Power not verified	Call for Service
Error Code 016	Fuse module blown BIPO	Call for Service
Error Code 017	Fuse blown 12V o -8V BIPO	Call for Service
Error Code 018	Fuse blown 20 BIPO	Call for Service
Error Code 019	Fuse blown +HV BIPO	Call for Service
Error Code 020	MONO. broken circuit	Call for Service
Error Code 021	BIPO. broken circuit	Call for Service
Error Code 022	Info MONO interrupted	Call for Service
Error Code 023	Info BIPO interrupted	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

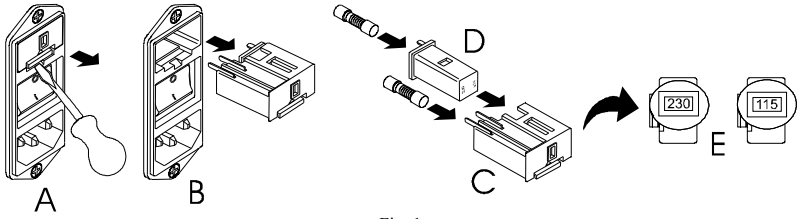
Before substituting the fuse, disconnect the unit from the mains system

Only use fuse of the kind 5x20; they must have those characteristics: T5A (slow) (230Vac mains voltage), T10A (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 T10 A / 5 x 20 mm
Mains Voltage	220-240 V	Delayed Fuse 2x T5A / 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

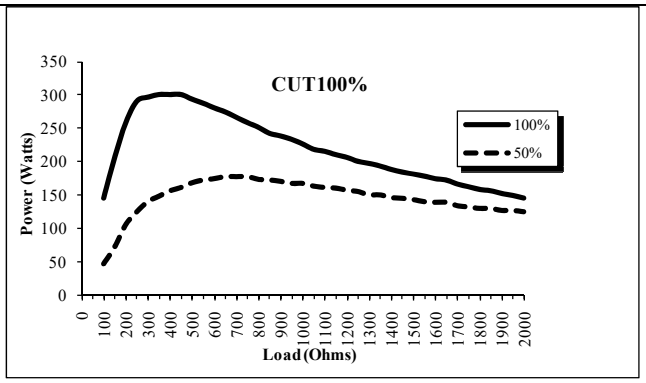
Function and Safety Check and Test

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

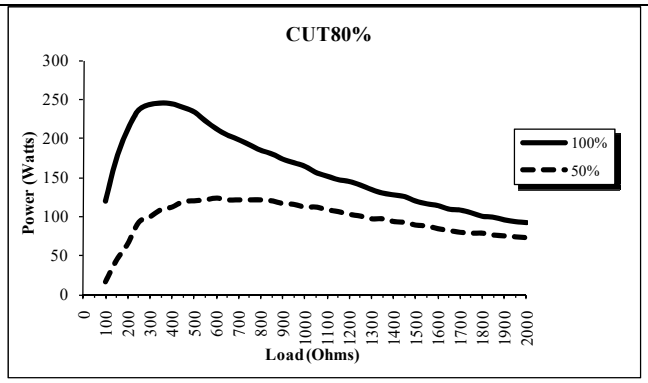
- … Check of the connectors and mains supply cord conditions;
- … Visual check of the mechanical protections;
- … Check of the protections against the danger due to liquid's pouring, dripping, moisture, liquid's penetration, cleanliness, sterilization and disinfection.
- … Check of the Equipment's Data 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

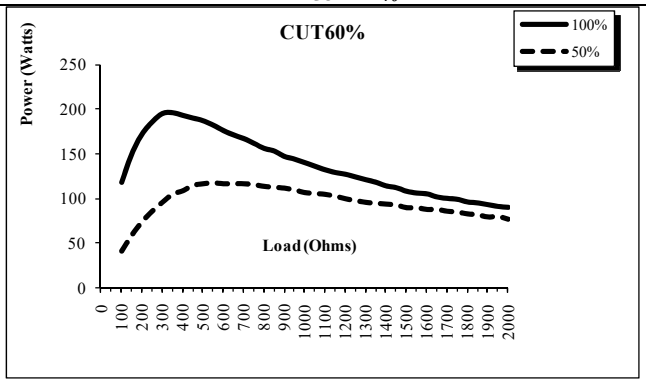
DIATERMO MB 300 D



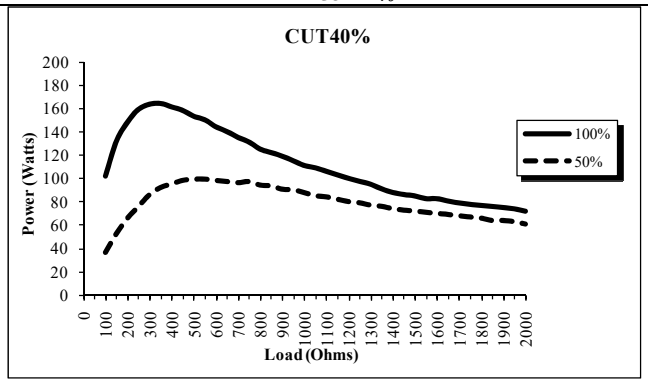
Diagrams of half and maximum output power versus impedance load 100-2000Ω CUT100%



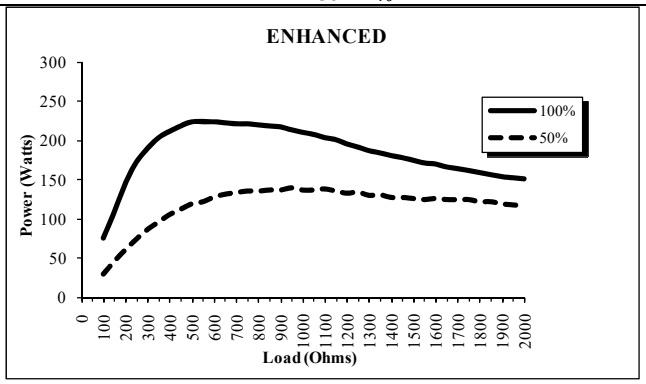
Diagrams of half and maximum output power versus impedance load 100-2000Ω CUT80%



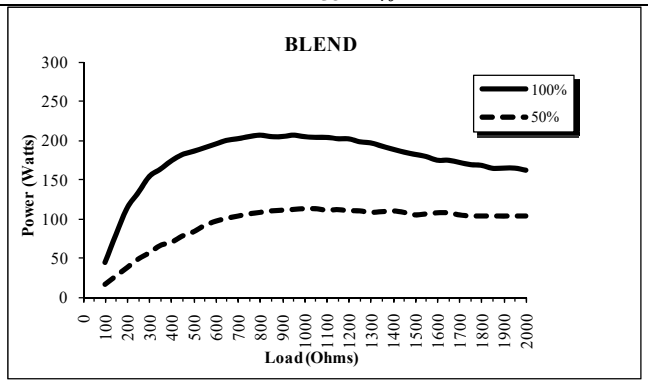
Diagrams of half and maximum output power versus impedance load 100-2000Ω CUT60%



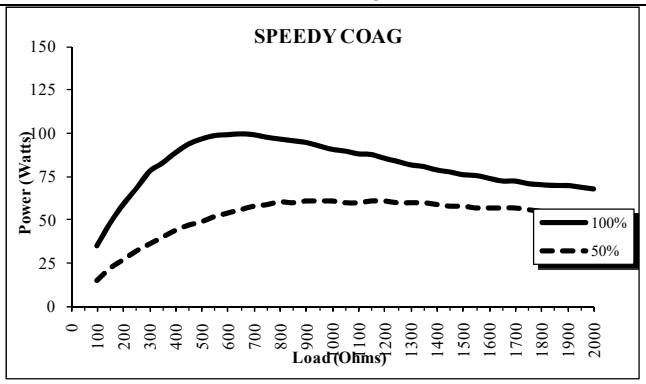
Diagrams of half and maximum output power versus impedance load 100-2000Ω CUT40%



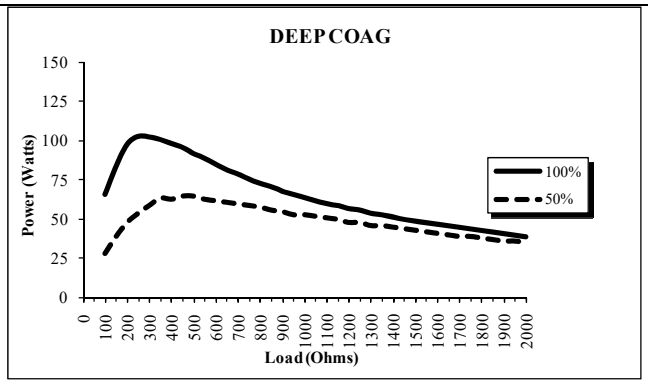
Diagrams of half and maximum output power versus impedance load 100-2000Ω ENHANCED



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

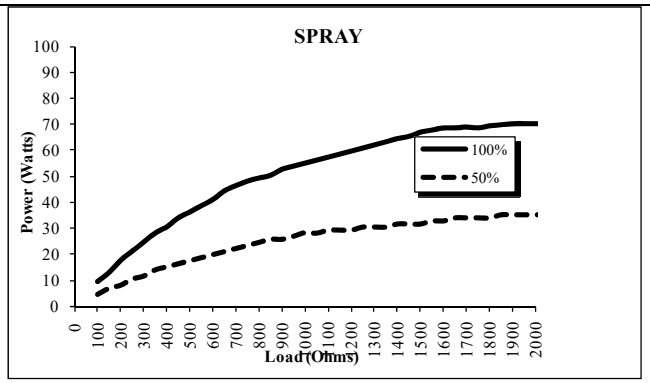


Diagrams of half and maximum output power versus impedance load 100-2000Ω SPEEDY COAG

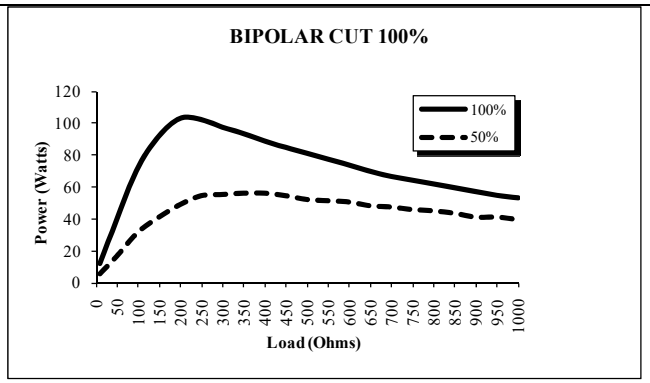


Diagrams of half and maximum output power versus impedance load 100-2000Ω DEEP COAG

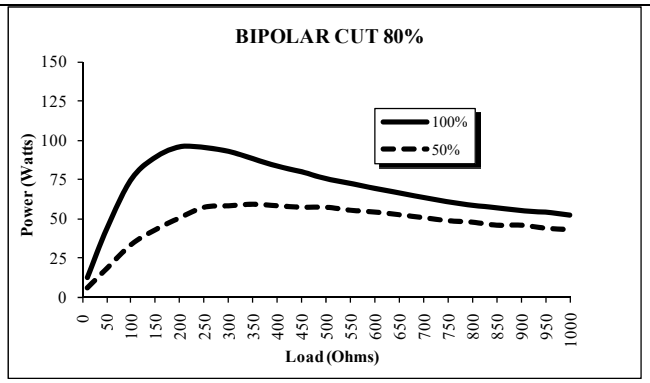
DIATERMO MB 300 D



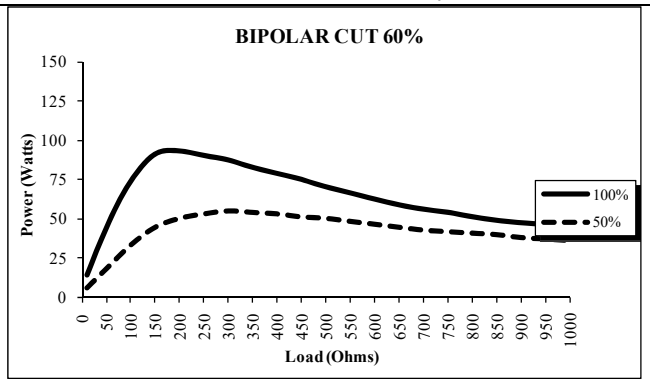
Diagrams of half and maximum output power versus impedance load 100-2000Ω SPRAY



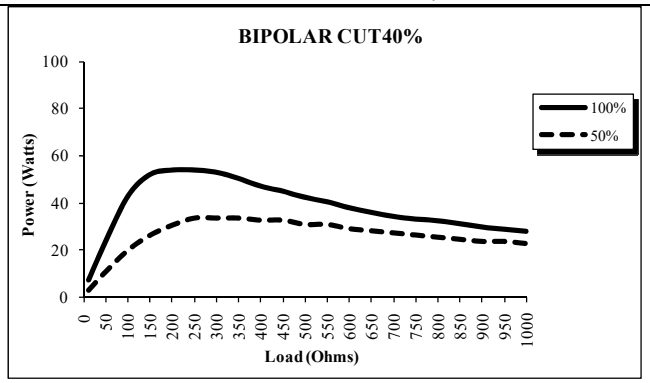
Diagrams of half and maximum output power versus impedance load 10-1000Ω BIPOLAR CUT100%



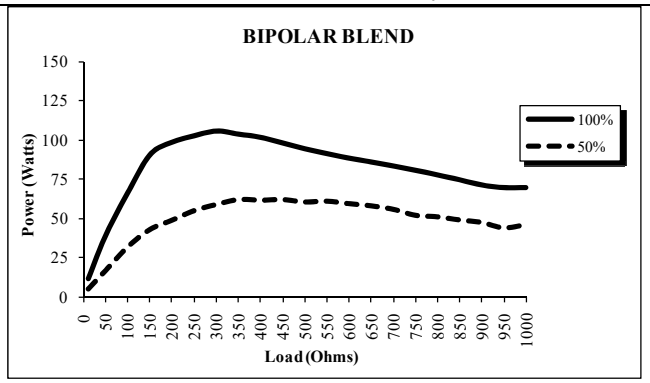
Diagrams of half and maximum output power versus impedance load 10-1000Ω BIPOLAR CUT80%



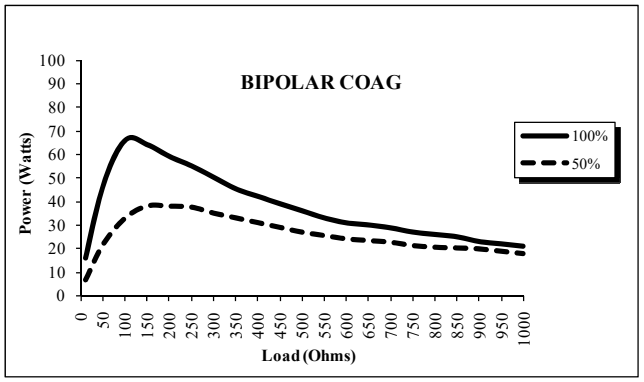
Diagrams of half and maximum output power versus impedance load 10-1000Ω BIPOLAR CUT60%



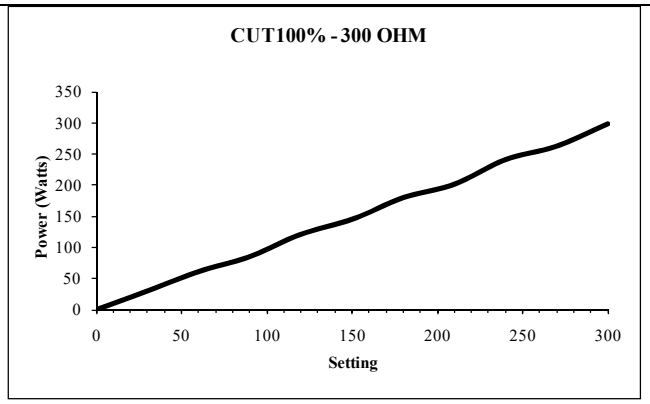
Diagrams of half and maximum output power versus impedance load 10-1000Ω BIPOLAR CUT40%



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

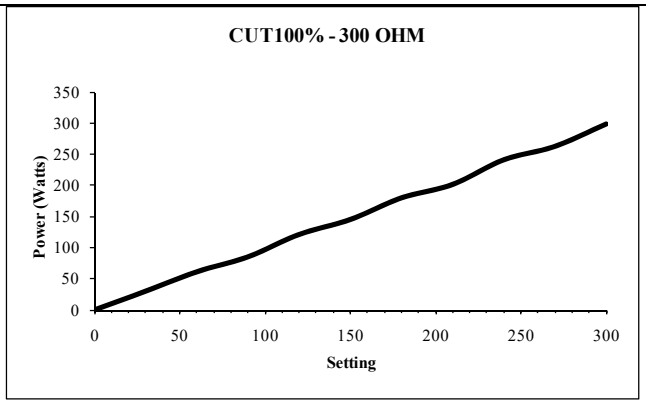


Diagrams of half and maximum output power versus impedance load 10-1000Ω BIPOLAR COAG

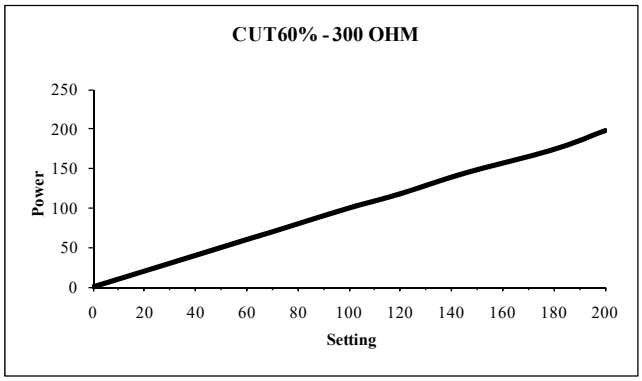


Diagrams of output power versus nominal value CUT100%

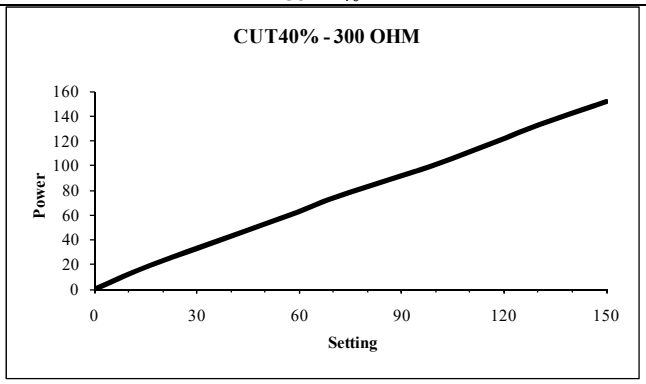
DIATERMO MB 300 D



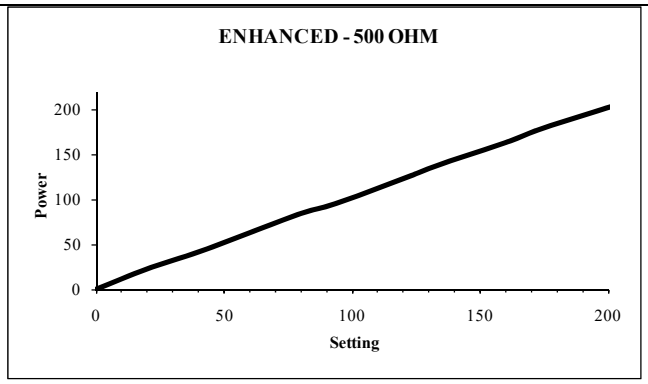
Diagrams of output power versus nominal value
CUT80%



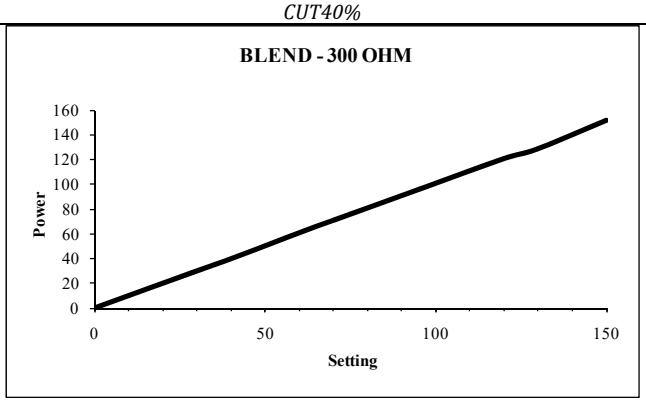
Diagrams of output power versus nominal value
CUT60%



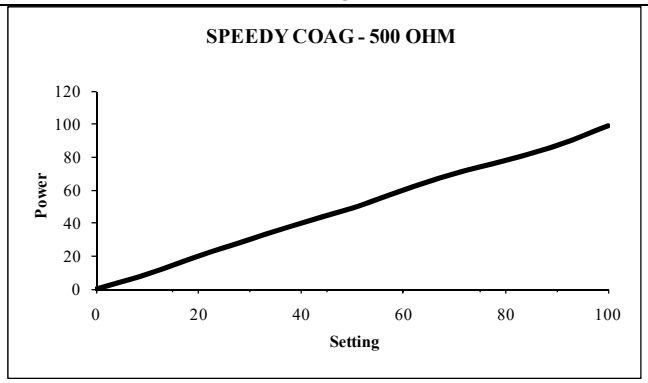
Diagrams of output power nominal value
CUT40%



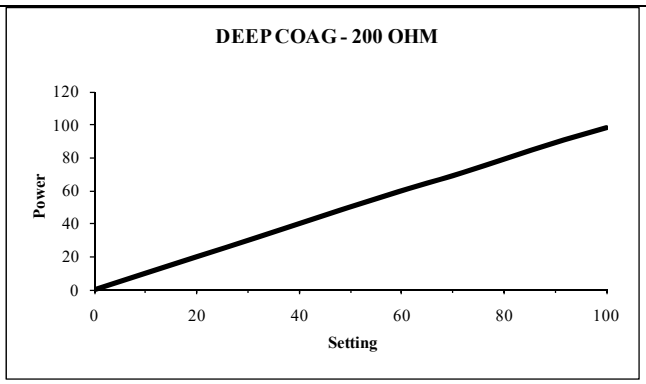
Diagrams of output power versus nominal value
ENHANCED



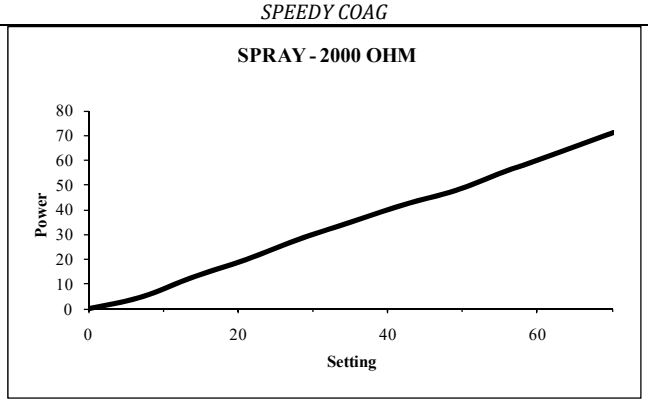
Diagrams of output power versus nominal value
BLEND



Diagrams of output power versus nominal value
SPEEDY COAG

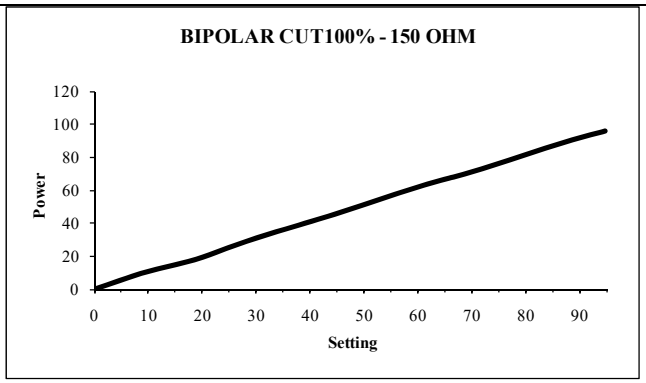


Diagrams of output power versus nominal value
DEEP COAG

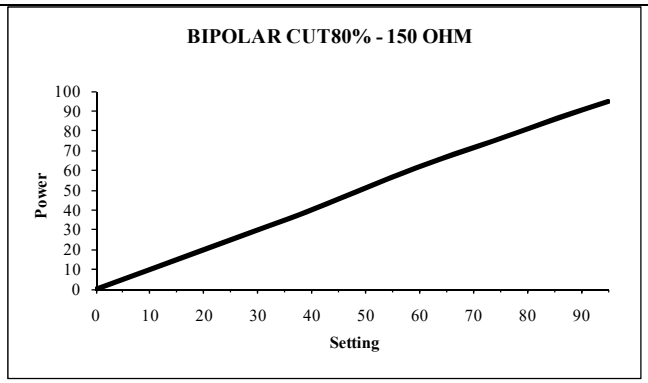


Diagrams of output power versus nominal value
SPRAY COAG

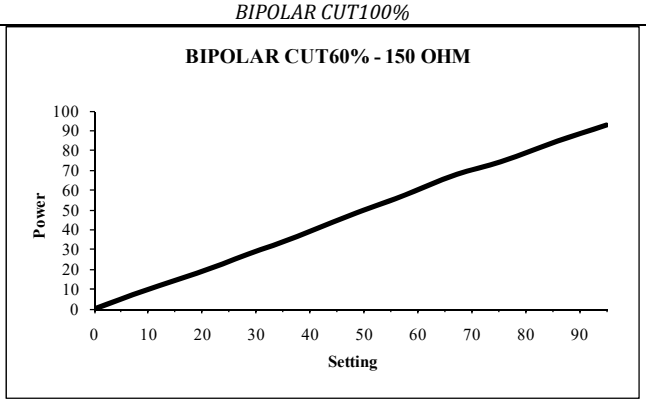
DIATERMO MB 300 D



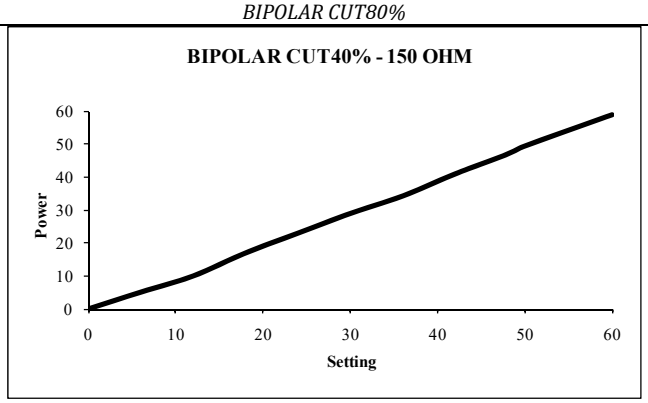
Diagrams of output power versus nominal value
BIPOLAR CUT100%



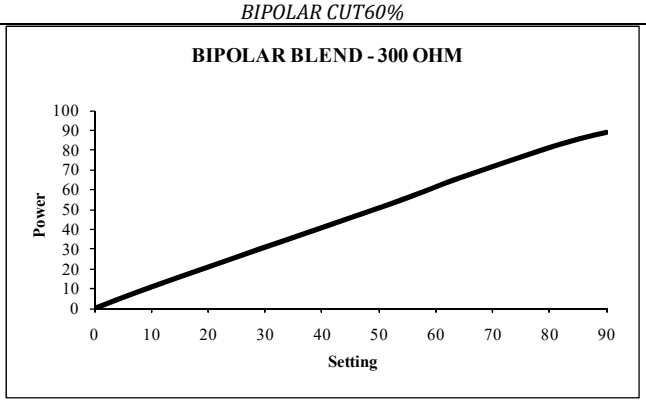
Diagrams of output power versus nominal value
BIPOLAR CUT80%



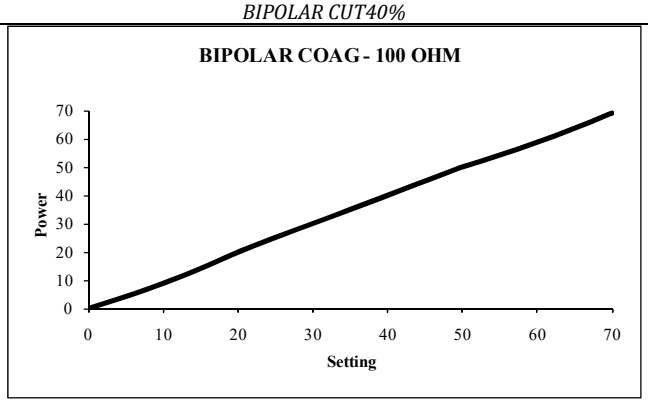
Diagrams of output power versus nominal value
BIPOLAR CUT60%



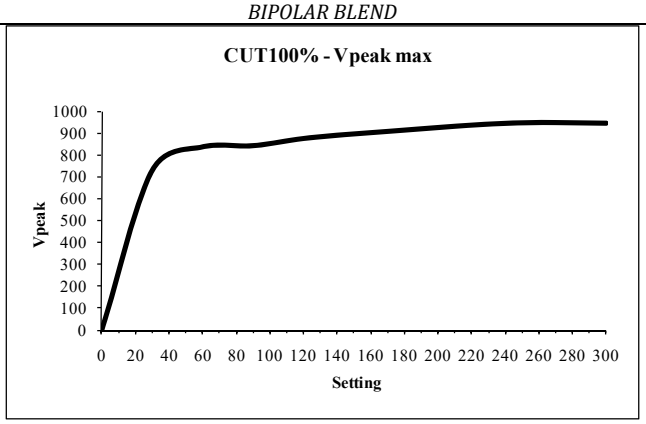
Diagrams of output power versus nominal value
BIPOLAR CUT40%



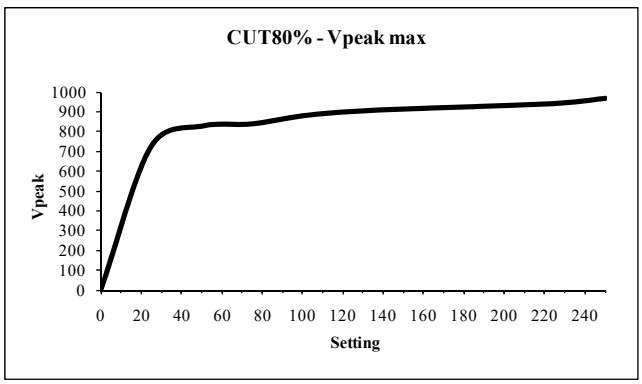
Diagrams of output power versus nominal value
BIPOLAR BLEND



Diagrams of output power versus nominal value
BIPOLAR COAG

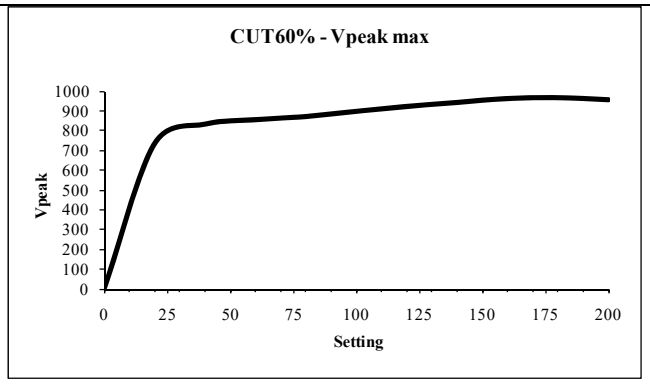


Diagrams of maximum mains voltage output versus Vp
CUT100%

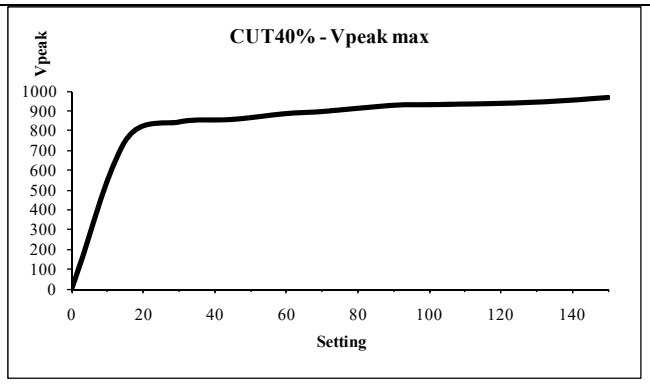


Diagrams of maximum mains voltage output versus Vp
CUT80%

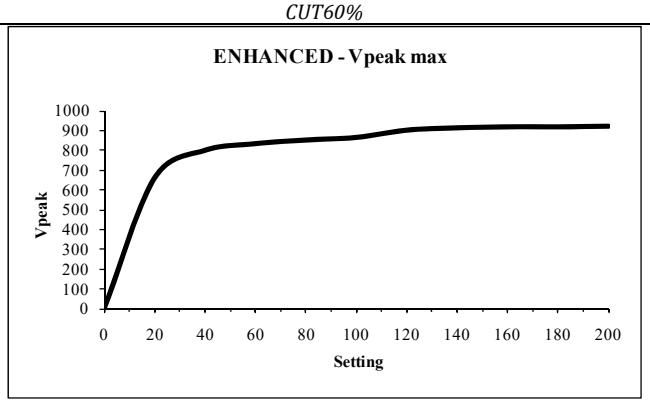
DIATERMO MB 300 D



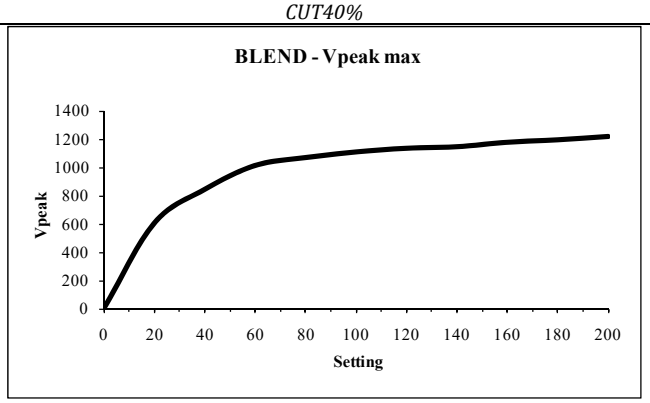
Diagrams of maximum mains voltage output versus Vp
CUT60%



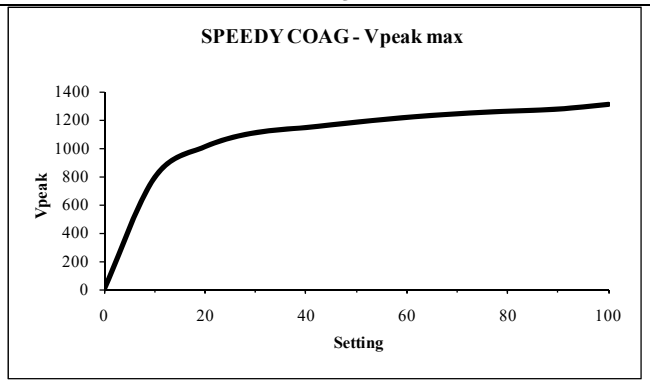
Diagrams of maximum mains voltage output versus Vp
CUT40%



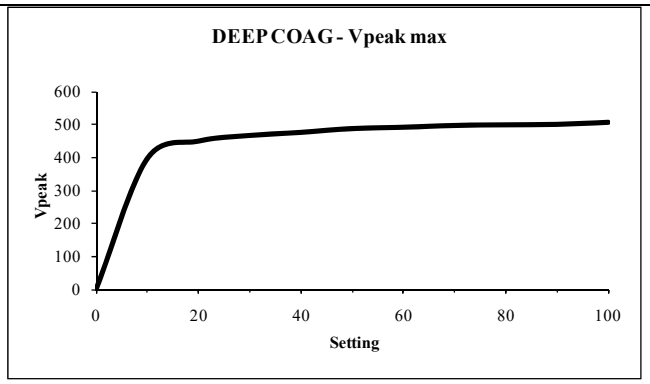
Diagrams of maximum mains voltage output versus Vp
ENHANCED



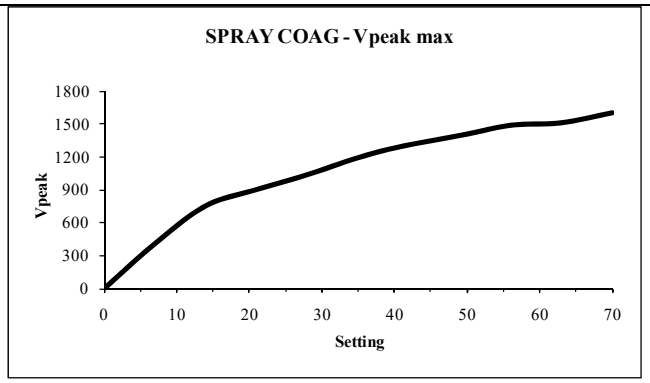
Diagrams of maximum mains voltage output versus Vp
BLEND



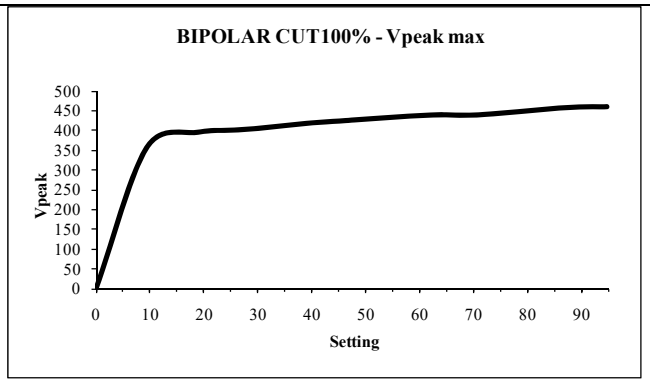
Diagrams of maximum mains voltage output versus Vp
SPEEDY COAG



Diagrams of maximum mains voltage output versus Vp
DEEP COAG

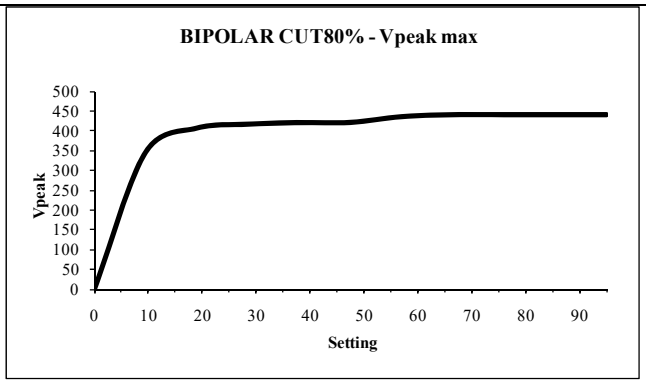


Diagrams of maximum mains voltage output versus Vp
SPRAY COAG

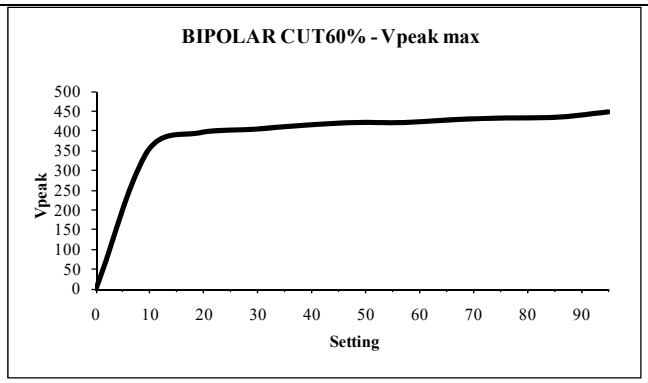


Diagrams of maximum mains voltage output versus Vp
BIPOLAR CUT100%

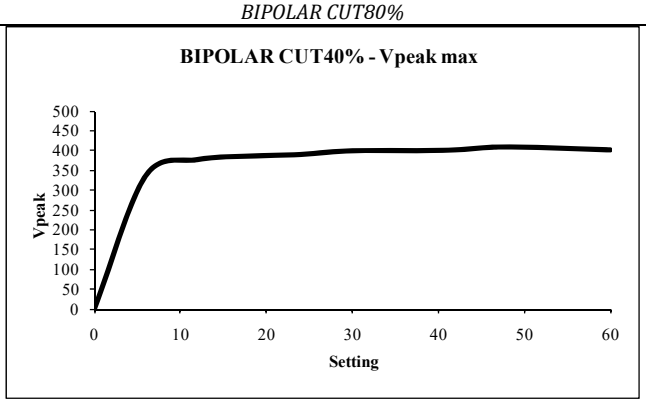
DIATERMO MB 300 D



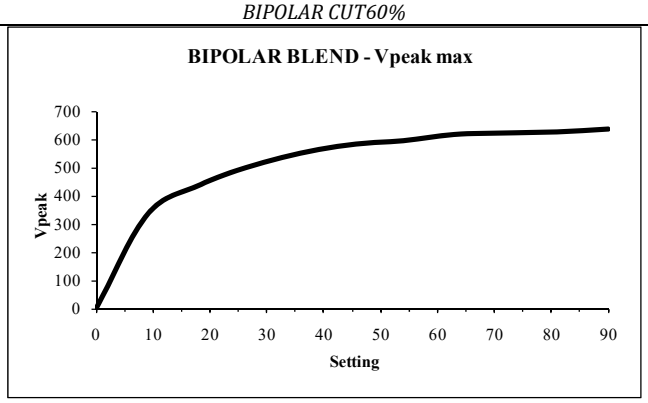
Diagrams of maximum mains voltage output versus Vp
BIPOLAR CUT80%



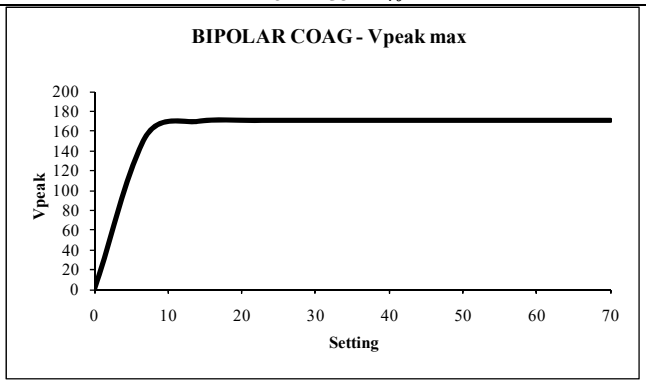
Diagrams of maximum mains voltage output versus Vp
BIPOLAR CUT60%



Diagrams of maximum mains voltage output versus Vp
BIPOLAR CUT40%

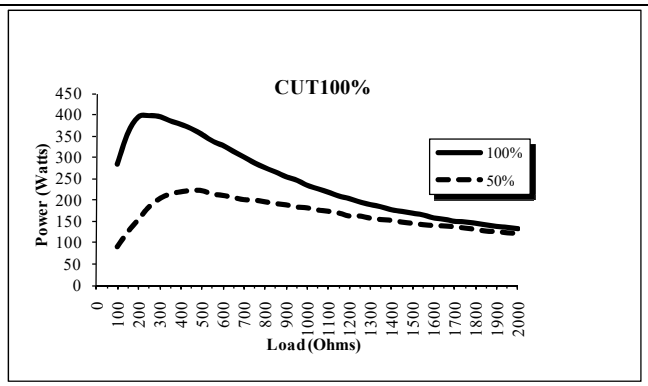


Diagrams of maximum mains voltage output versus Vp
BIPOLAR BLEND

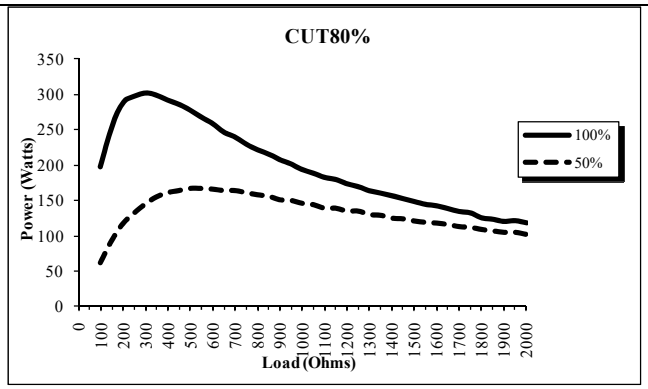


Diagrams of maximum mains voltage output versus Vp
BIPOLAR COAG

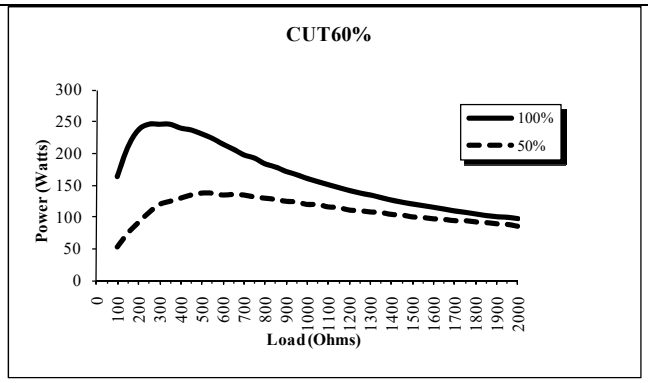
DIATERMO MB 400 D



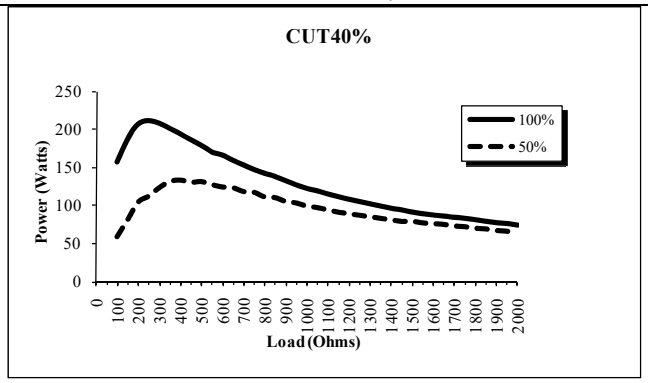
Diagrams of half and maximum output power versus impedance load 100-2000Ω CUT100%



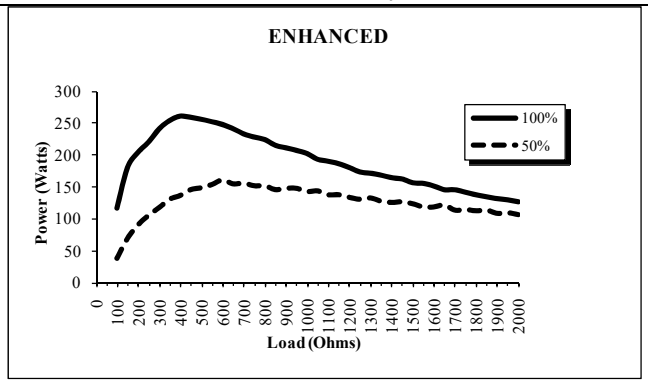
Diagrams of half and maximum output power versus impedance load 100-2000Ω CUT80%



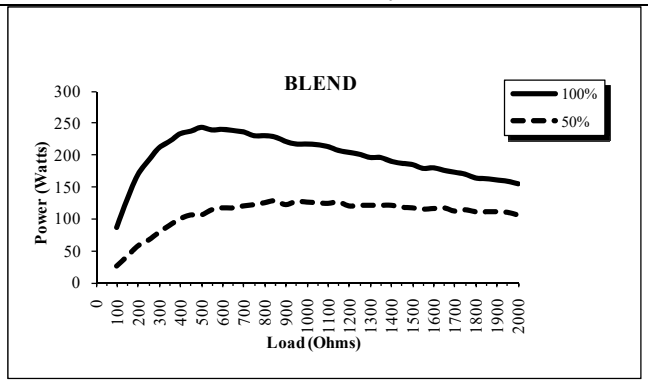
Diagrams of half and maximum output power versus impedance load 100-2000Ω CUT60%



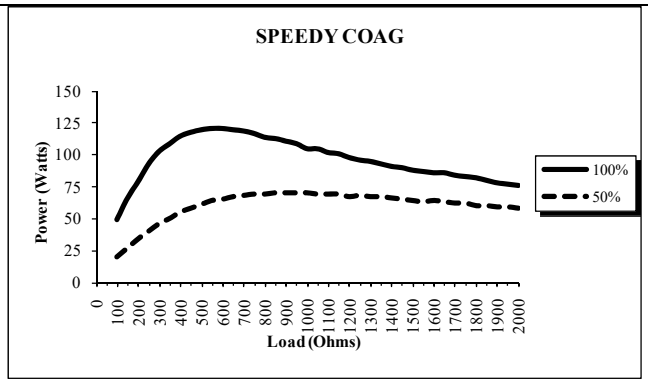
Diagrams of half and maximum output power versus impedance load 100-2000Ω CUT40%



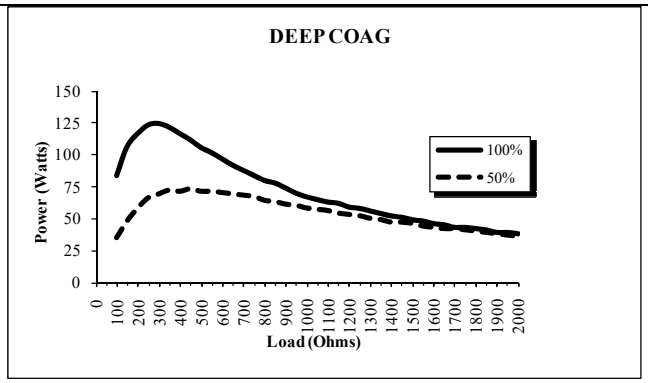
Diagrams of half and maximum output power versus impedance load 100-2000Ω ENHANCED



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

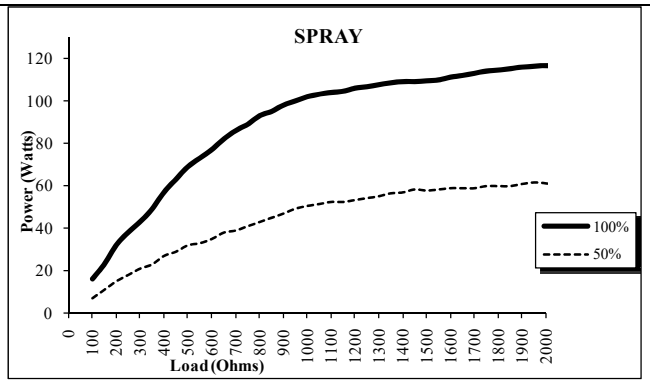


Diagrams of half and maximum output power versus impedance load 100-2000Ω SPEEDY COAG

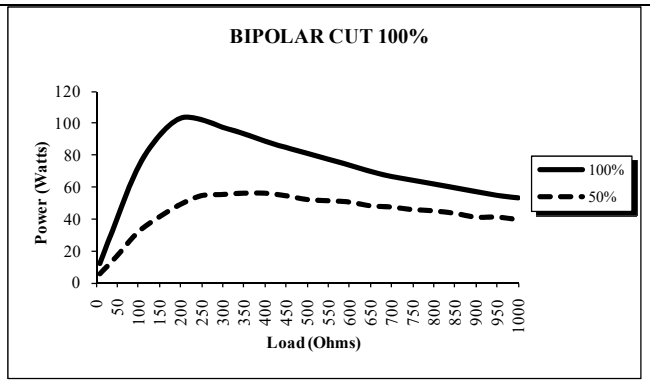


Diagrams of half and maximum output power versus impedance load 100-2000Ω DEEP COAG

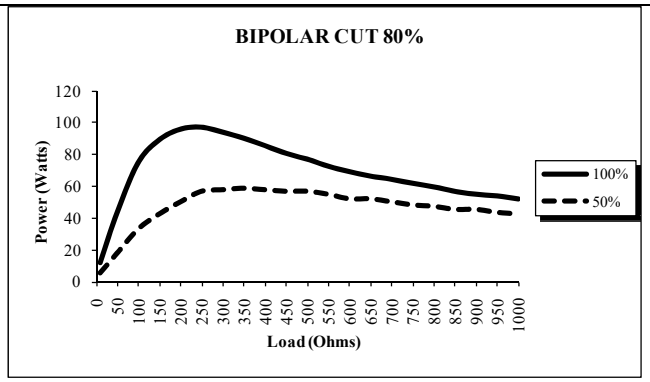
DIATERMO MB 400 D



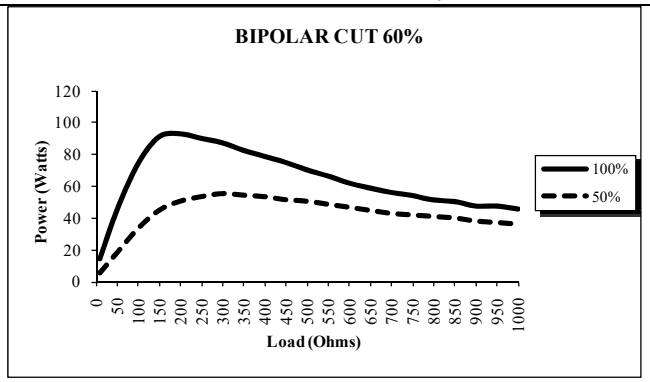
Diagrams of half and maximum output power versus impedance load 100-2000Ω SPRAY



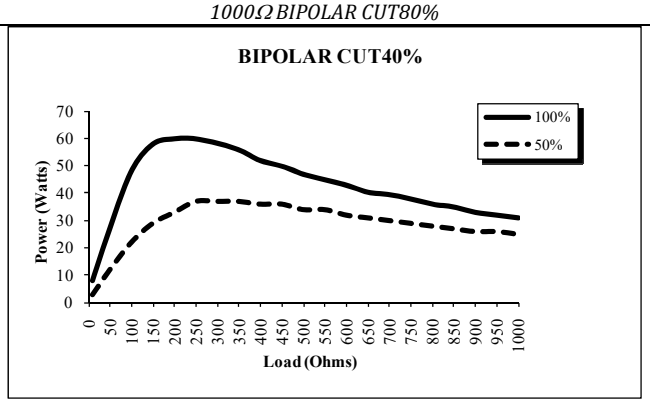
Diagrams of half and maximum output power versus impedance load 10-1000Ω BIPOLAR CUT100%



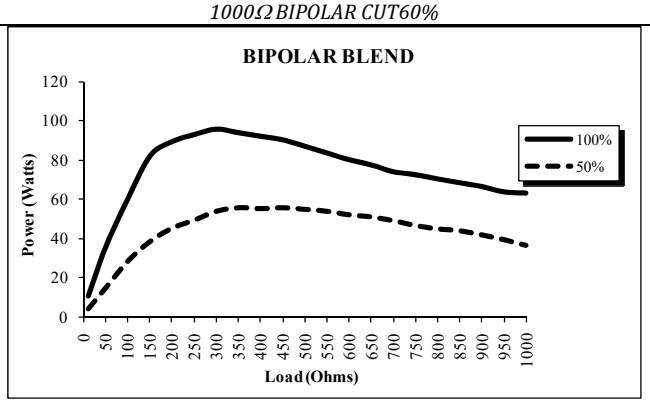
Diagrams of half and maximum output power versus impedance load 10-1000Ω BIPOLAR CUT80%



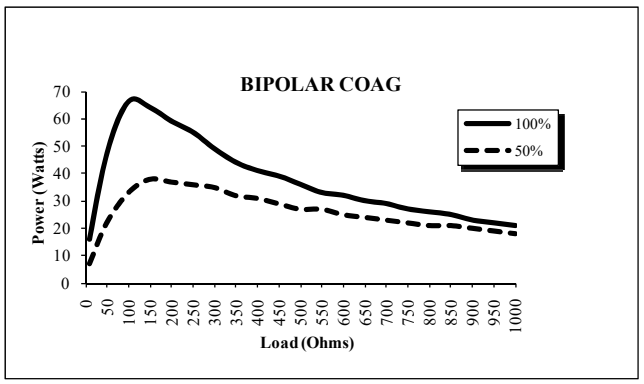
Diagrams of half and maximum output power versus impedance load 10-1000Ω BIPOLAR CUT60%



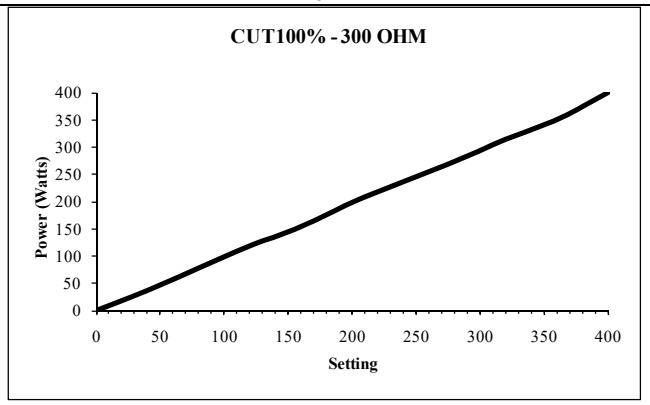
Diagrams of half and maximum output power versus impedance load 10-1000Ω BIPOLAR CUT40%



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

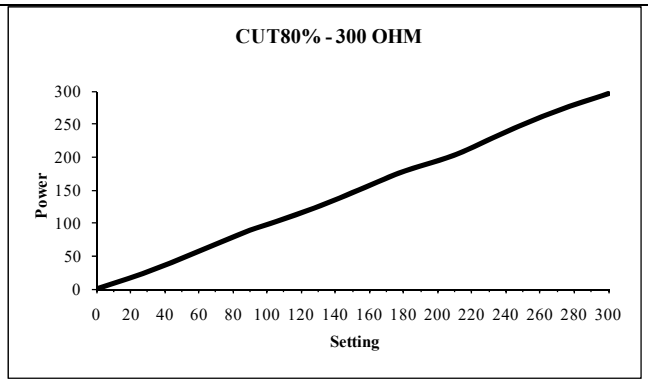


Diagrams of half and maximum output power versus impedance load 10-1000Ω BIPOLAR COAG

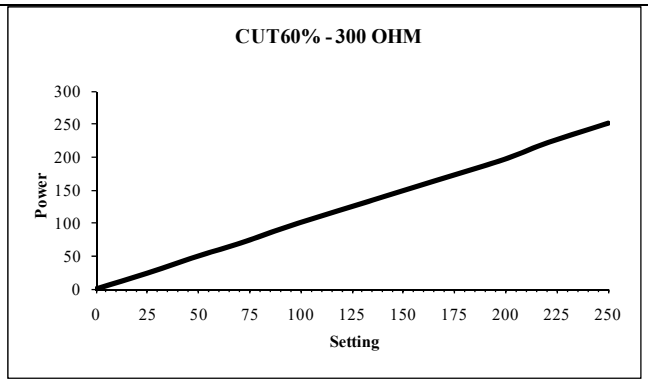


Diagrams of output power versus nominal value CUT100%

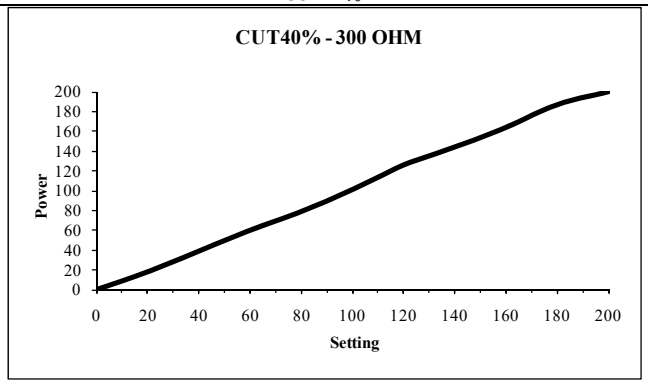
DIATERMO MB 400 D



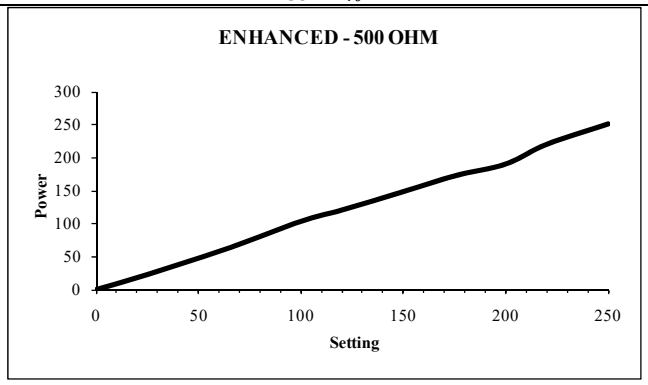
Diagrams of output power versus nominal value
CUT80%



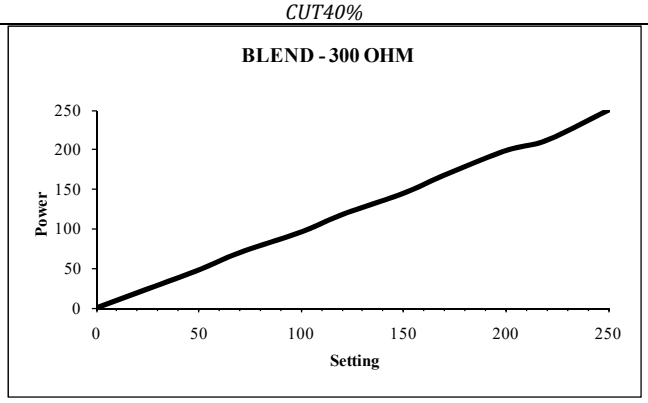
Diagrams of output power versus nominal value
CUT60%



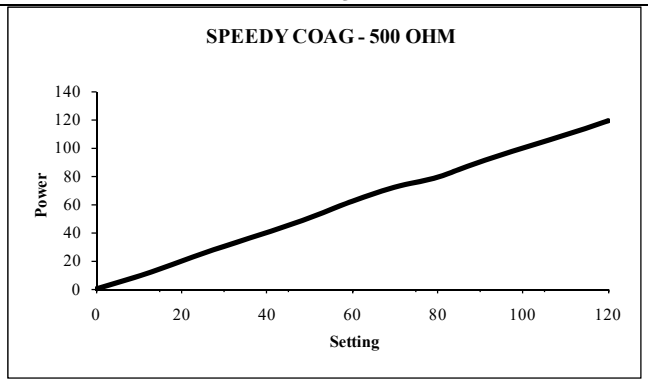
Diagrams of output power nominal value
CUT40%



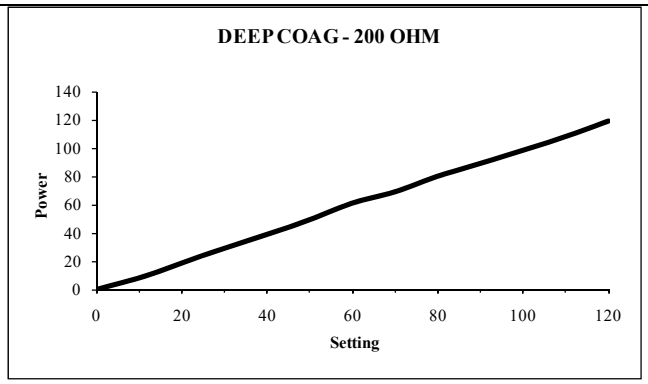
Diagrams of output power versus nominal value
ENHANCED



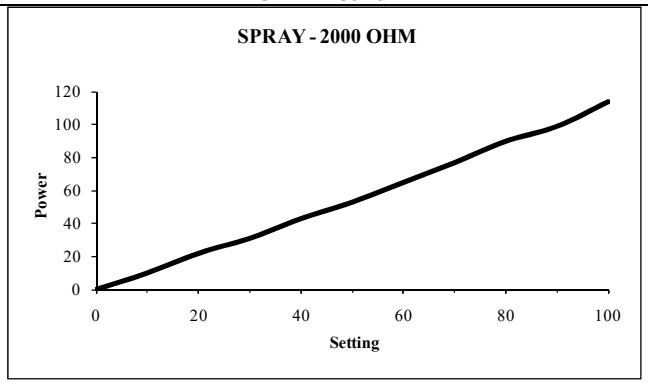
Diagrams of output power versus nominal value
BLEND



Diagrams of output power versus nominal value
SPEEDY COAG

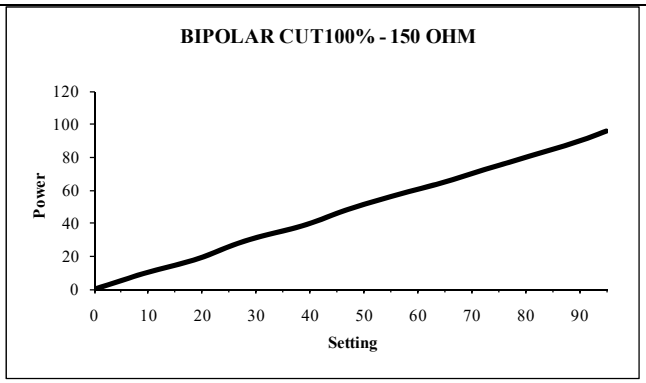


Diagrams of output power versus nominal value
DEEP COAG

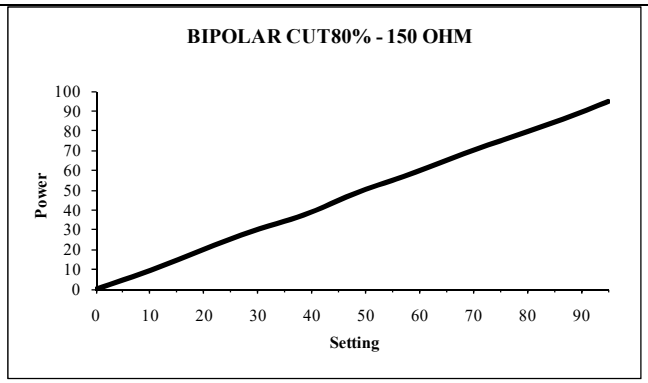


Diagrams of output power versus nominal value
SPRAY COAG

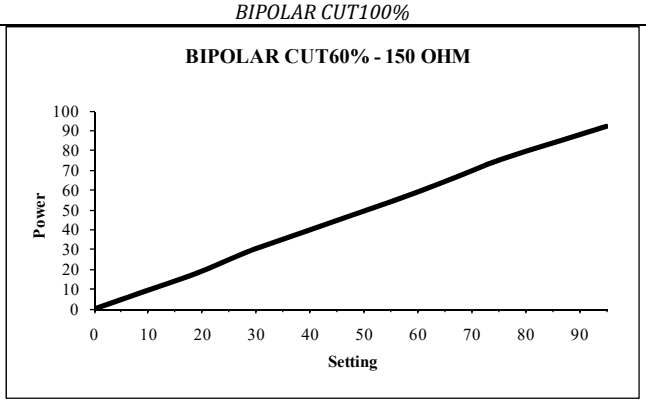
DIATERMO MB 400 D



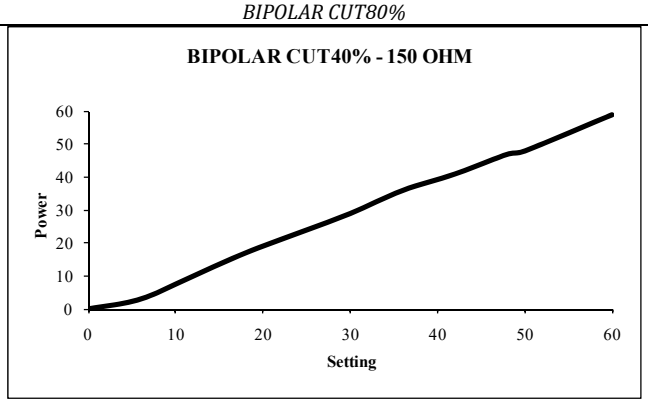
Diagrams of output power versus nominal value
BIPOLAR CUT100%



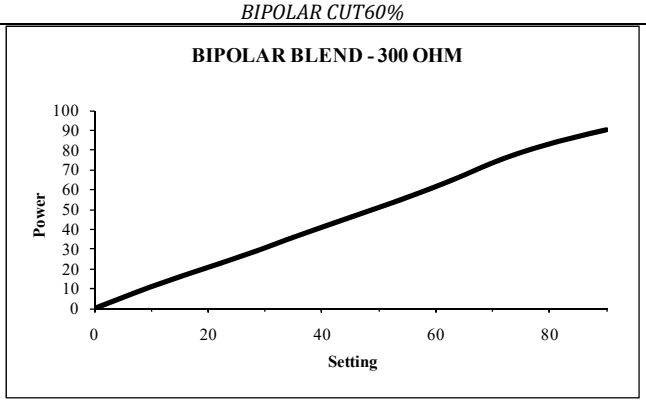
Diagrams of output power versus nominal value
BIPOLAR CUT80%



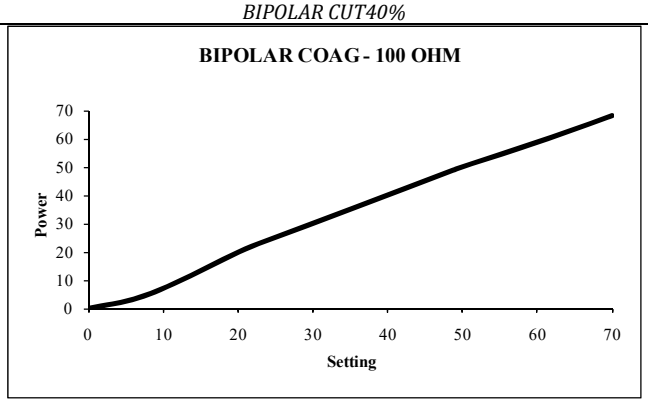
Diagrams of output power versus nominal value
BIPOLAR CUT60%



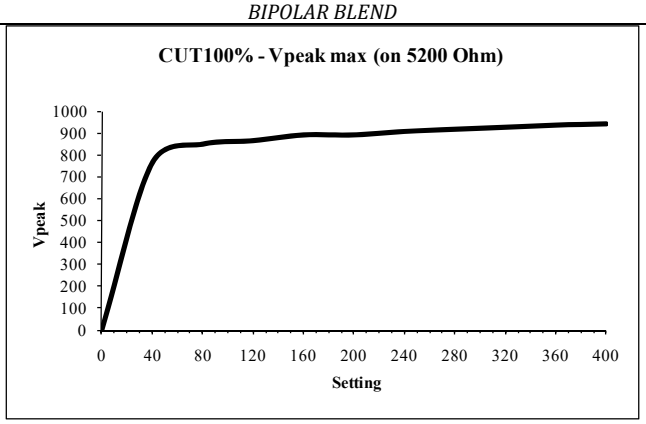
Diagrams of output power versus nominal value
BIPOLAR CUT40%



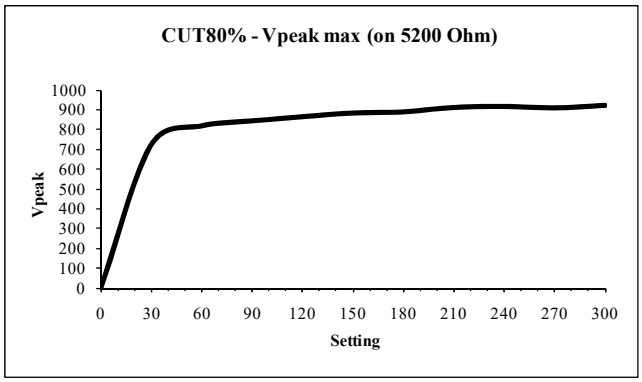
Diagrams of output power versus nominal value
BIPOLAR BLEND



Diagrams of output power versus nominal value
BIPOLAR COAG

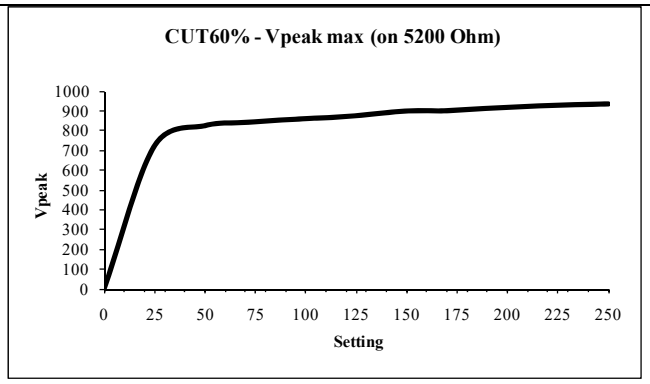


Diagrams of maximum mains voltage output versus Vp
CUT100%

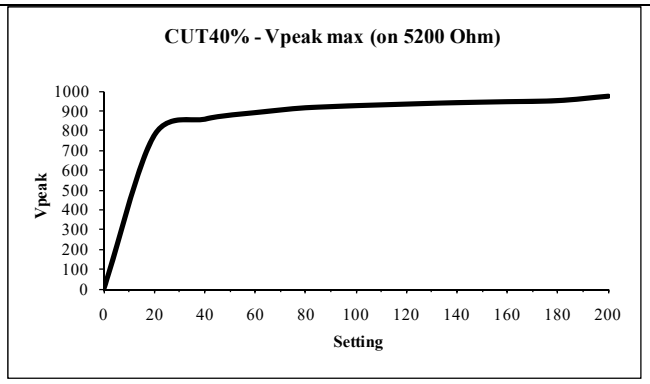


Diagrams of maximum mains voltage output versus Vp
CUT80%

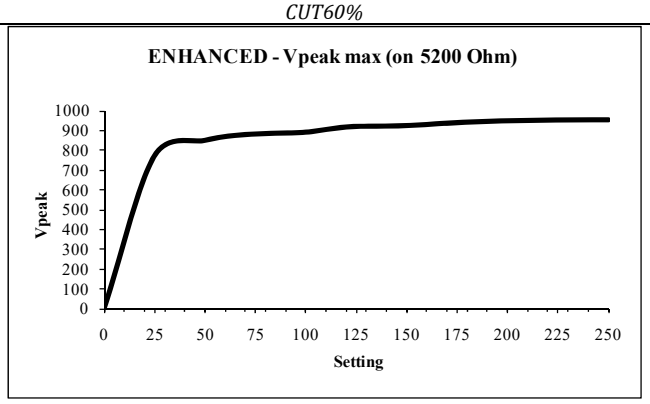
DIATERMO MB 400 D



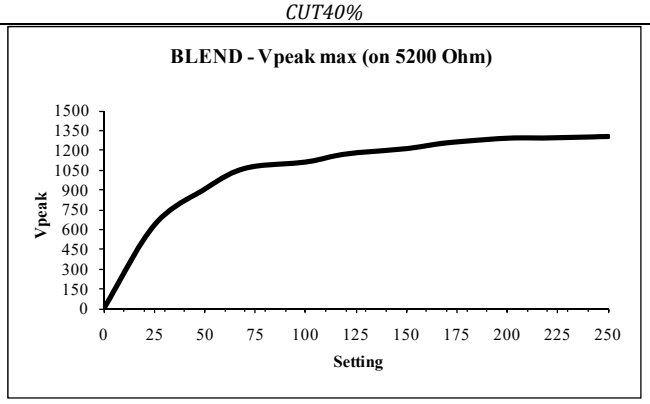
Diagrams of maximum mains voltage output versus Vp
CUT60%



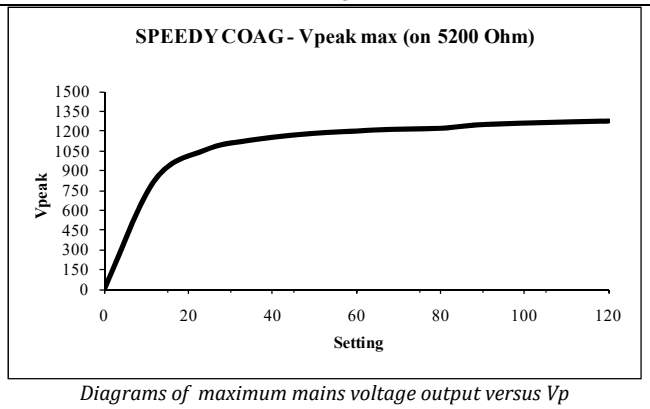
Diagrams of maximum mains voltage output versus Vp
CUT40%



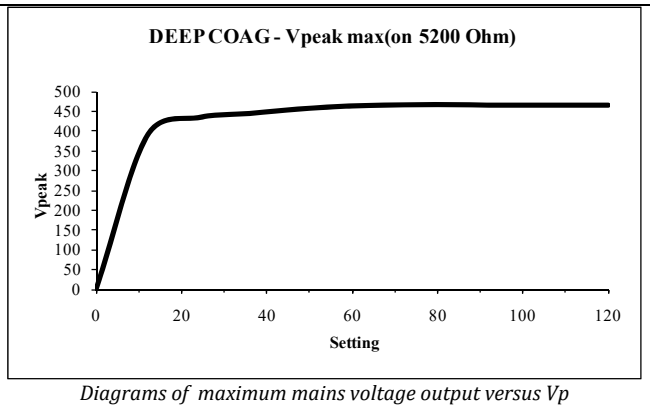
Diagrams of maximum mains voltage output versus Vp
ENHANCED



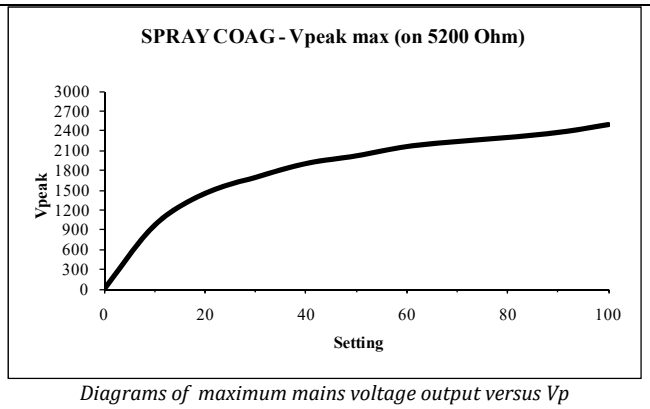
Diagrams of maximum mains voltage output versus Vp
BLEND



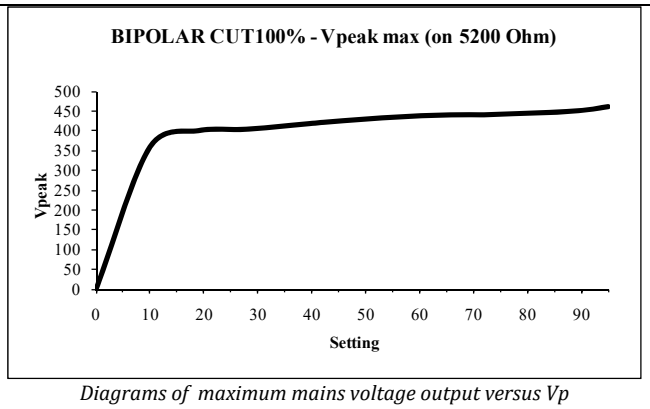
Diagrams of maximum mains voltage output versus Vp
SPEEDY COAG



Diagrams of maximum mains voltage output versus Vp
DEEP COAG

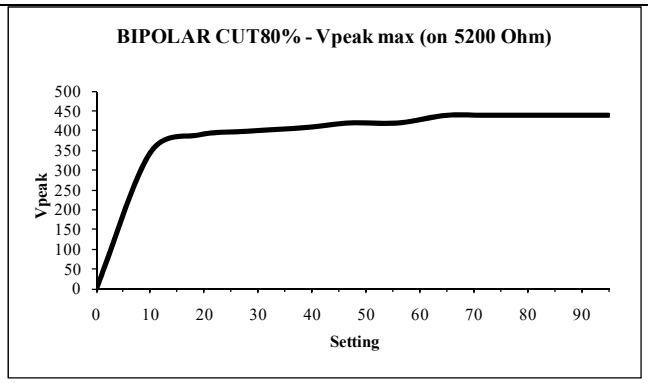


Diagrams of maximum mains voltage output versus Vp
SPRAY COAG

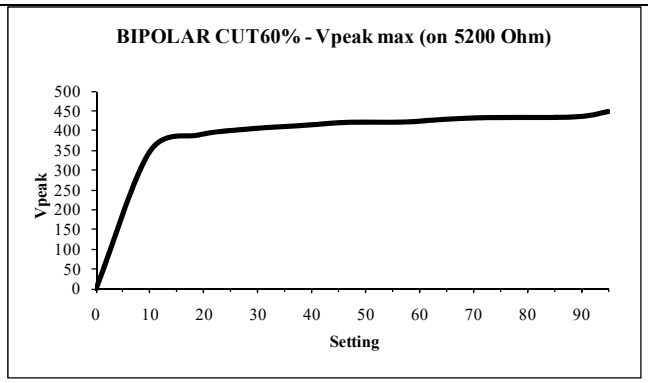


Diagrams of maximum mains voltage output versus Vp
BIPOLAR CUT100%

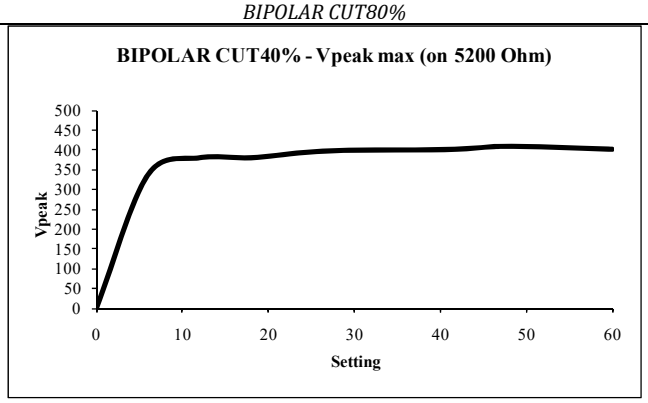
DIATERMO MB 400 D



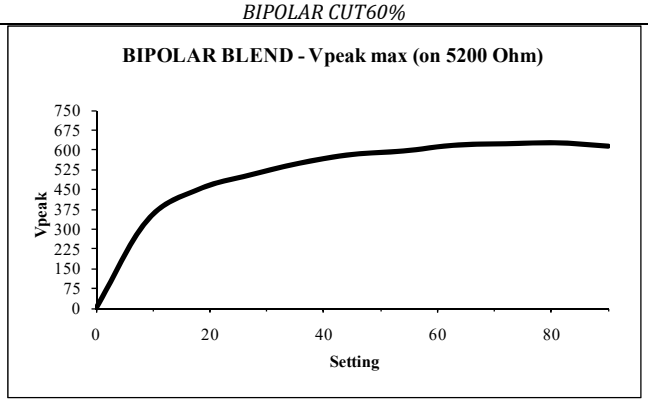
Diagrams of maximum mains voltage output versus Vp
BIPOLAR CUT80%



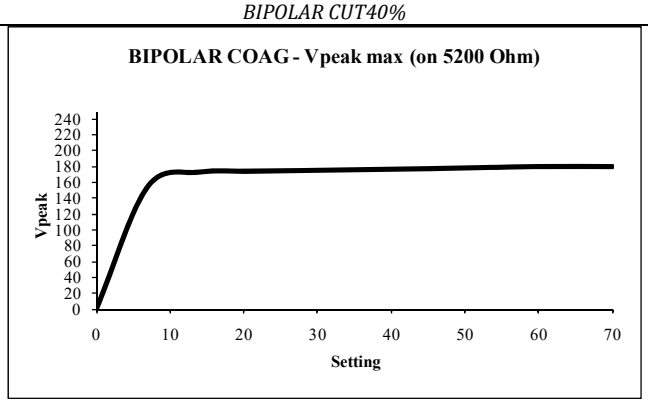
Diagrams of maximum mains voltage output versus Vp
BIPOLAR CUT60%



Diagrams of maximum mains voltage output versus Vp
BIPOLAR CUT40%

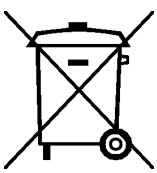


Diagrams of maximum mains voltage output versus Vp
BIPOLAR BLEND



Diagrams of maximum mains voltage output versus Vp
BIPOLAR COAG

Information about elimination of this product
(Applicable in the European Union and other European countries with separate collection systems)



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.