



High Frequency Electrosurgical Unit

EB03

Instruction Manual

Version No: 2008-11-6

Operation manual

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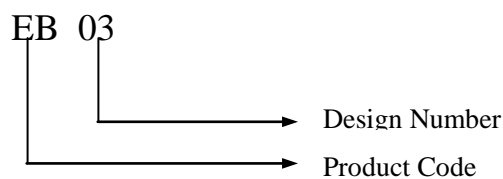
Brief Introduction

EB03 series High Frequency Surgical Unit can be used in many surgical fields, like the general surgery dept, Gynecology dept, the five sense organs (or called ENT) dept, Orthopedics dept, Urological dept, Cerebral dept, Dermatological dept, and the heart and chest dept, etc.

The unit features:

- Protection class I, CF Type equipment.
- The operation mode: Continuously running for 10/30 seconds, loading by intermission
- It can work under two modes such as cut and coag. Pure cut, blend 1, blend 2 and blend 3 are included in cut, and monopolar coag has two modes of soft coag and spot coag. It also has coag mode of bipolar forceps.
- It has a real-time detecting system for the detachment of stick area
- It can start volume control of tone (not including alarm).

The type includes the following:



Registration Number of EB03 series: 3251084

Control Standard Number of EB03 series: YZB/Guo 3912-25-2004

Disassembly & Installation

Disassembly

Take out EB03 surgical unit with care; keep the hard board and materials used for package so that these could be used for the next transportation or rework.

If there is any fault or question, please do not open the unit to repair by yourself; you should contact the manufacturer or local representative immediately.

Working Power Supply

Power supply voltage please refer to the nameplate

Working Environment

Temperature: 10-40℃

Humidity: $\leq 80\%RH$

Atmospheric pressure: 700hPa~1060hPa

Keep away from any corrosive & ignitable matter.

Placed in clean and ventilated room.

Transporting

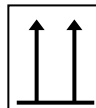
Temperature: -40 ~ +55℃

Humidity: $\leq 95\%RH$

Atmospheric pressure 500hpa ~ 1060hpa

No vibration, no collision, and no drenching in transporting.

Package Symbol



Installation

- Remove the packing of the equipment, check all accessories for damage according to package list.

- Insert power cord and connect its own patient plate and hand control pencil. Put a moist soap on the patient plate.

- Turn on the unit, apply proper power (less than 50W), and activate the hand control pencil, causing sparks when cutting soap.

- After confirming the power output, remove the accessories and deliver the complete machine to the customers.

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Device Description

Dimension & Weight

Package Dimension(mm): 516*616*460

Gross Weight(kg): 21.4

Net Dimension(mm): 495*395*205

Net Weight(kg): 14.4

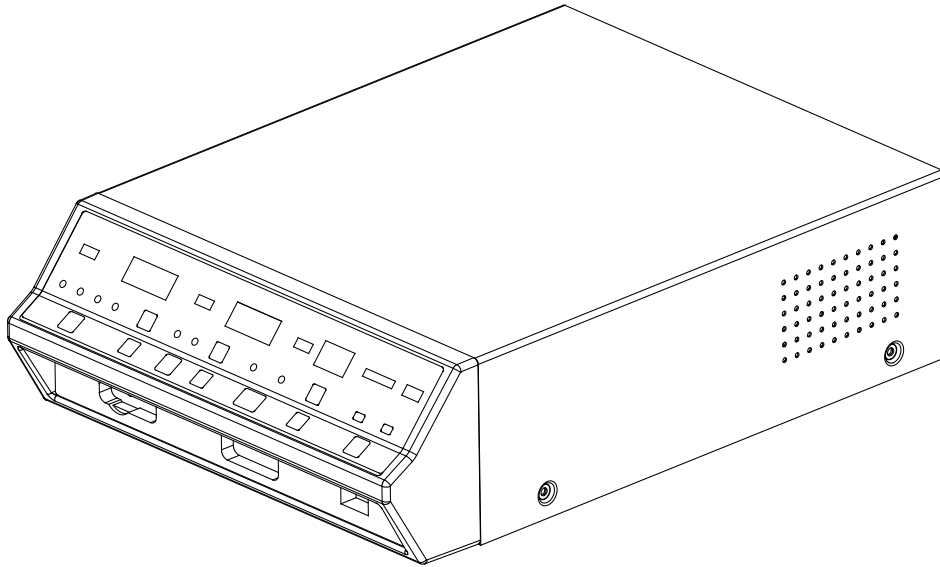
Standard Accessories

Order NO.	Name of Article	Quantity
7SB-EB03NO-SDB	Hand -control pen	5
HCB-99-00	Standard electrode	1
7RB-EB03JB-005	Patient dual return electrode (soft)	0
7DP-USAL-003	Connecting cable for patient soft electrode(dual)	0
1FS-T6.3A250-001	Unit Fuse (6.3A) (φ5X20)	2
1WC-10A250-SW1	Power cord	1

Optional Accessories

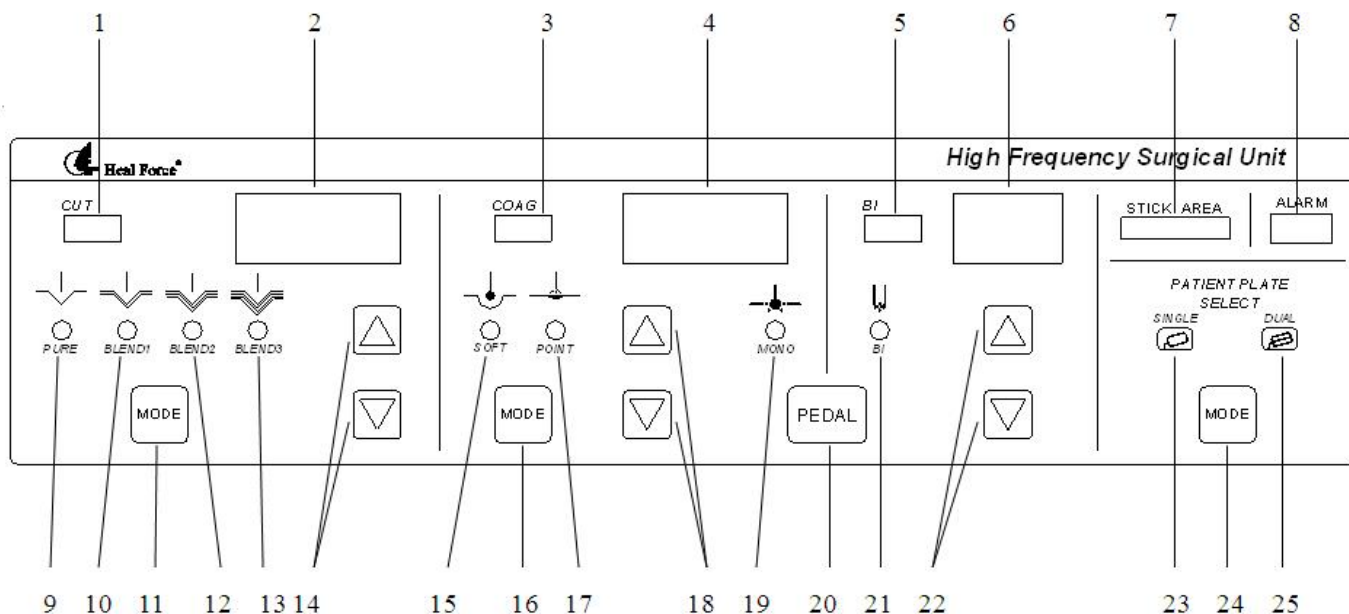
Order NO.	Name of Article	Quantity
NGD-020	Foot switch	1
7SB-EB05NO-JDB	Foot-control pen	5
7RB-EB03JB-001	Patient single return electrode (soft)	0
7DP-USAL-005	Connecting cable for patient soft electrode(single)	0
7NZ-310180-010	Bipolar coagulation forceps	1
1WC-EB03NZ-002	Connecting cable of forceps	1
7JB-EB0351-002	Hard Patient plate	1

Diagram



Operation manual

Control and Display Panel

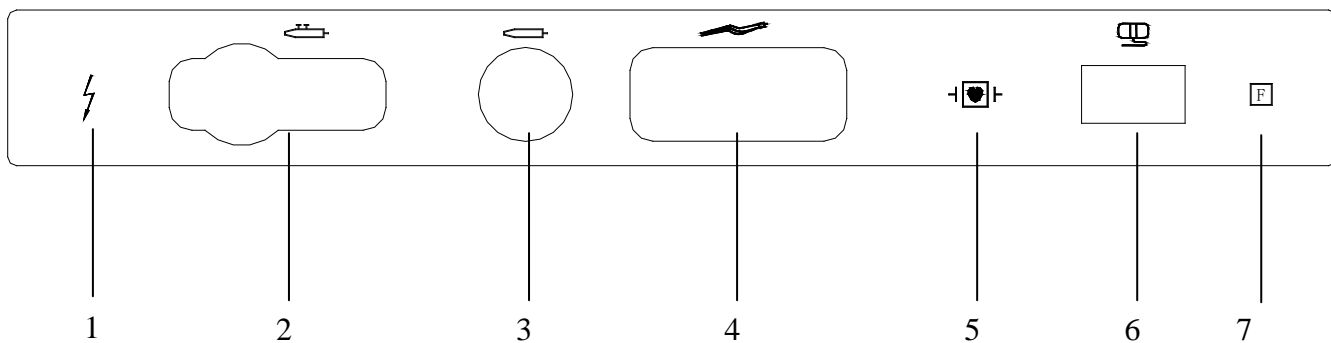









Operation State

- | | |
|----------------------------------|--|
| 1 LED - Cut | 14 Switch - Increase/Decrease Power Value |
| 2 Display - Cut Power | 15 LED - Soft Coag |
| 3 LED - Monopolar Coag | 16 Switch - Monopolar Coag Mode Selection |
| 4 Display - Monopolar Coag Power | 17 LED - Spot Coag |
| 5 LED - Bipolar Coag | 18 Switch - Increase/Decrease Monopolar Coag Power Value |
| 6 Display - Bipolar Coag Power | 19 LED - Pedal Switch Monopolar |
| 7 LED - Patient Plate Stick Area | 20 Switch - Pedal Switch Monopolar/Bipolar Selection |
| 8 LED - Alarm | 21 LED - Pedal Switch Bipolar |
| 9 LED - Pure Cut | 22 Switch - Increase/Decrease Bipolar Coag Power Value |
| 10 LED - Blend1 | 23 LED - Single Patient Plate |
| 11 Switch - Cut Mode Selection | 24 Switch - Patient Plate Single/Dual Mode Selection |
| 12 LED - Blend2 | 25 LED - Dual Patient Plate |
| 13 LED - Blend3 | |

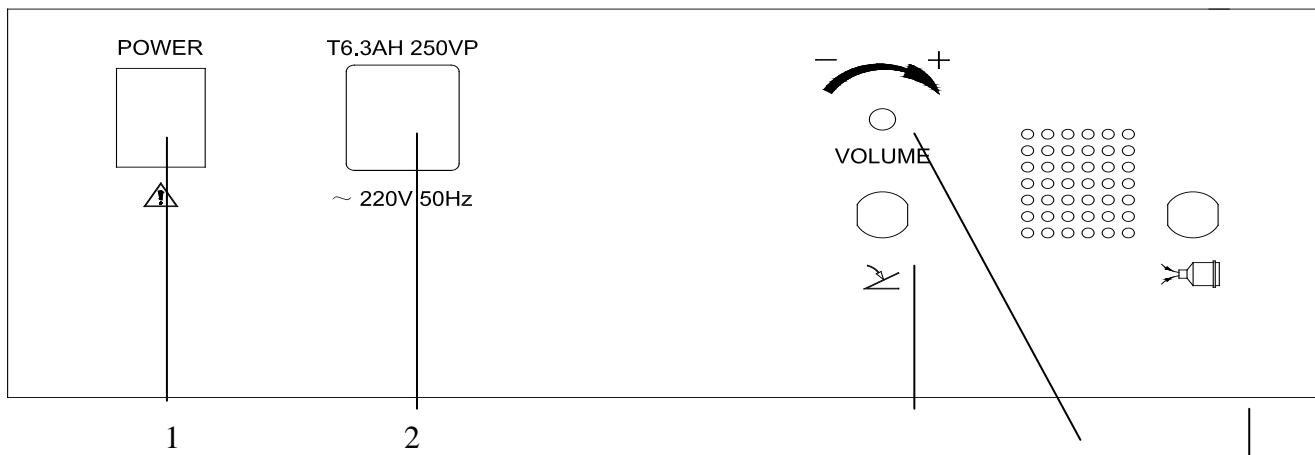
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Accessories Receptacles



-  1 Danger high voltage output receptacle
-  2 Hand-switch Pencil receptacle
-  3 Foot-switch Pencil receptacle
-  4 Forceps receptacle
-  5 CF type control fibrillation equipment
-  6 Polar plate receptacle
-  7 Full suspension tuned balance output

Rear Panel

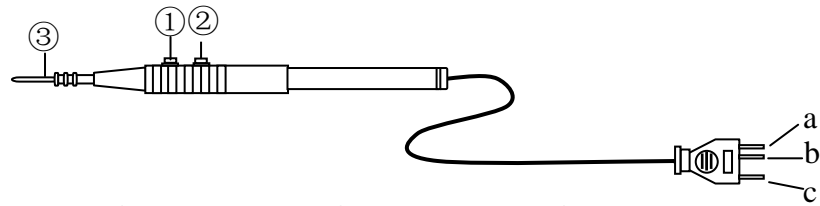


- 1 Power supply receptacle
- 2 Fuse receptacle
- 3 Grounding pole
- 4 Foot Switch receptacle
- 5 Volume potentiometer
- 6 Argon gas control

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Accessories

Hand Control Pencil

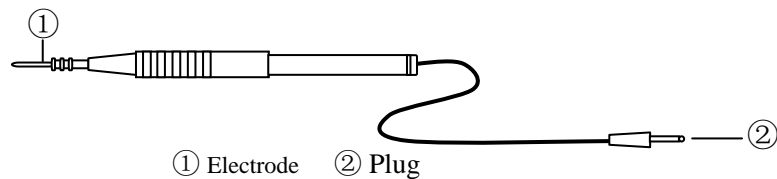


① Button "Cut" ② Button "Coag" ③ Electrode

a cut end b Coag end c common end

- The electrode ③ is communicated with the common end c
- Press cut button ①, the cut end a is communicated with the common end c
- Press coag button ②, the coag end b is communicated with the common end c

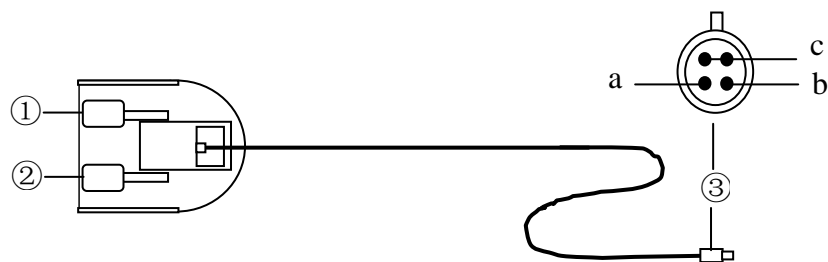
Foot Control Pencil



① Electrode ② Plug

- The electrode ① is communicated with plug ②

Pedal Switch

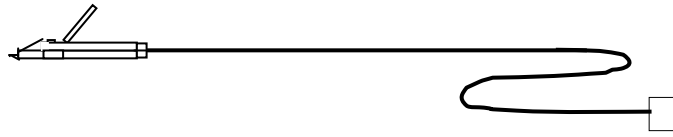


① cut pedal ② coag pedal ③ plug

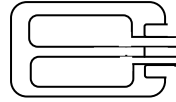
a cut end b coag end c common end

- Step on cut pedal ①, the cut end a of the plug ③ is communicated with common end c
- Step on coag pedal ②, the coag end b of the plug ③ is communicated with common end c

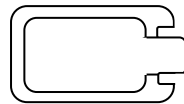
Plate Cord



Dual Soft Patient Plate



Single Soft Patient Plate



Forceps



Forceps Cord



Preparation Before Operation

Environment Demand

The surgical unit should be kept away from other electronic device in the operating room.

The surgical unit may have influence on other electronic device at power output.

Do not put any item on the surgical unit or put surgical unit on any item, so that to ensure heat dissipation.

Accessories selecting and Installation

Connection of Power Cord: Connect one end of the power cord with the machine, and then insert the plug to the 3-hole socket

Accessories selecting (according to the mode of power output):

Selecting the hand control pencil output: Insert the plugs of the hand control pencil and the plate into the desired place directly.

Selecting the foot control pencil output: Insert the plugs of the foot control pencil and the plate into the desired place directly; insert the plug of pedal switch into the rear panel.

Patient Plate Using

Patient Plate Classification

Two kinds of patient plates are offered, such as hard patient plate and soft patient plate.

Hard patient plate only offers a single patient plate and can be used for many times.

Soft patient plate includes two kinds, such as soft single patient plate and soft dual patient plate.

Hard Patient Plate Using

Insert the plug into the desired place, and the LED for single patient plate mode will illuminate. One must wrap a wet towel soaked in health salt water to the plate, and place it under the buttocks or leg of patient, so as to keep reliable contact with patient skin. If the hard patient plate cord is disconnected during the operation, the alarm LED of the machine will illuminate, the alarm sound will be heard when activation, and the power output will be interrupted.

Single Soft Patient Plate Using

Insert the plug of patient plate cord into the desired place, and the LED for single patient plate mode will illuminate. Clip the clamp on the other end of the cord with the single soft patient plate. Then the patient plate is evenly attached to the patient skin. If the patient plate cord is disconnected during the operation, the alarm LED of the machine will illuminate, the alarm sound will be heard when activation, and the power output will be interrupted.

Warning !

When using the hard patient plate and single soft patient plate in the operation, the medical staff must check whether the patient plate is attached evenly to the patient skin, so as to prevent the patient plate falling off and the burning accident of the patients.

Dual Soft Patient Plate Using

Insert plug of patient plate cord into the desired place, and clip the clamp on the end of the cord with the dual soft patient plate. Then the patient plate is evenly attached to the patient skin.

The LED for dual patient plate mode will illuminate, and the green stick area display will illuminate. The number of bars illuminating depends on impedance of patient's body and stick area between skin and plate. Normally, 2~9 bars will light. After the patient plate is fully attached to patient skin, the output of cut or coag mode can be activated, and at this time the data of stick area will be memorized in the machine. If the plate is loose or disconnected from patient skin causing the resistance value of contacting area to be increased by 30% when operation is going, the machine will activate alarm and stop output. Operator must re-attach the plate properly to patient skin so as to go on operating.

Power On

Turn on the power switch, and the machine type and version number will be displayed. The machine goes into the last using setting immediately (i.e. mode setting and power setting).

Operations During the Operation Process

Mode Setting

Monopolar cutting	Work mode	Power (watt)
	Pure cut	0-350w
	Blend 1	0-300w
	Blend 2	0-200w
	Blend 3	0-150w
Monopolar coagulation		
	Soft	0-100w
	Point	0-100w
Bipolar coagulation		
	Standard	0-50w

The working mode will be selected according to operation requirements by each mode selecting switch, and the LED corresponded to the mode will illuminate.

Power Adjustment

After performing the mode setting, press cut or coag power tuning switch to set output power and the set value will be displayed on the display.

Pressing the power tuning switch for more than 3 seconds, the power setting can be accelerated.

Note: When using this unit for the first time, you should be sure to start from lower power.

Output Startup

The cut and coag output are respectively controlled by cut and coag switch of the hand control pencil or cut and coag pedal of pedal switch. The yellow switch and yellow pedal control cut, while blue switch and blue pedal control coag.

When cut is activated, the LED for cut startup will illuminate and the sound with 750HZ will be sent; when coag is activated, the LED for coag startup will illuminate and the sound with 250HZ will be sent. The hand control pencil and foot control pencil can not be used at the same time because they share one output channel.

Stop Operating

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The unit stops working when the button or the pedal switch is loosened.

After operation, push the “POWER” button to turn off the power.

Remove all accessories, abandon the disposable accessories following the instruction, and take the treatment of cleaning and disinfecting for other accessories.

Maintenance After Operation

Accessory Cleaning and Sterilization

- The accessories such as Hand Control Pencil, Foot Control Pencil and Hard Patient plate, and the cords can be disinfected by 70% alcohol that is applied in hospital.
- Prior to using any accessories such as Hand Control Pencil, Foot Control Pencil and Hard Patient plate and the cords, please disinfect them by ethylene oxide. After the disinfection, please check them.
- The power cord, the pedal switch and cable should be maintained cleaning.
- Non-disposable accessories after the treatment of cleaning and disinfection should be properly kept, so as to provide convenience in the next operation.

Note: When cleaning and disinfecting the accessories such as Hand Control Pencil, Foot Control Pencil and Hard Patient plate, do not soak them in cleaning agent or disinfectant.

Replace the Fuse Unit

- Switch the power off, disconnect the power cord from the machine, and the shut time of the machine will last 10 minutes.
- Open the top cover of the fuse unit by a screwdriver.
- Select two fuse units of the same model and insert them into the socket.
- Reinstall the top cover of the fuse unit by a screwdriver.

Safety Instructions

- High Frequency Surgical Unit should only be operated by qualified and trained medical staff. Before operating the unit, please read the manual carefully to avoid any operating error.
- Please use a 3-hole socket that is properly grounded for power supply, so as to make sure that ground points of the outer metal shell, protection or function for the unit are connected to the ground to prevent risk of electric shocking.
- If performing the surgical operation near the chest or head, the ignitable anesthetic drug or oxidable gas such as nitrous oxide (N₂O) and oxygen can not be used unless the reagents are removed before the operation. If possible, the flame retardant reagent can be used in cleaning and disinfection. Before using High Frequency Surgical Unit, the ignitable reagent for cleaning and disinfection or as adhesive solvent should be vaporized. Please pay attention to the explosive gas or fluid that may exist in the holes of the patients' body (such as vagina) and get rid of these explosive elements. In addition, the gas in the body should be paid attention to because the gas may cause fire. Some materials (such as cotton, cloth and gauze) may be ignited by the High Frequency Surgical Unit when they are filled with oxygen.
- Please check the accessories before the operation:
 - A. Check the connection between accessories and the machine and the connection between soft patient plate cord and soft patient plate.
 - B. Check the insulation properties of the accessories and check the unit and cable for damage.
- Do not operate on the patient with heart pacemaker or other implantation materials, because the unit may cause disorder or stop of the heart pacemaker. If having any questions, we should follow the confirmed proper advice.
- This unit can not be acted on the heart directly.
- Prevent the contact between the patients' skin (e.g. the contact between the arm and body), for instance, we can put the dry gauze between them.
- Patient plate must be connected and installed correctly and the contact area should be large enough. This problem will be described in detail in the following contents.
- The output power of the unit must be on the proper level for best operation effect. Do not increase the output casually. The limitation of the output should be according to the operation effect. In the general monopolar unit operation, the level of the output power should be on or about 30-70W, while special operation may need higher output, but generally not beyond 200W. If the required setting output of a special operation is much higher than general operation, please check the installation of the patient plate, the condition of the patient plate and the cord, the machine state, and

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the floated level of the patient until normal output power is recovered. If you don't know the normal output power, please try from the low level. Make sure that output level of machine start and end is low to prevent any risk to the patient causing by high output power.

- The patients can not come in touch with the metal parts (such as bracket for operating table), so the antistatic diaphragm is recommended. The medical staff must be equipped with the rubber gloves with good insulation property in the operation to prevent burns.
- The patient can come in touch with the metal by disinfectant, flushing fluid and patients' body fluid, causing burns. Therefore, the bed mat, matters and patients should be kept dry.
- If the high frequency current might flow through the part of body with small cross section in the operation, the bipolar technique (mode) is recommended to prevent the undesired coagulation.
- When the high frequency surgical unit and physiological custodial unit are simultaneously acted on one patient, the other custody electrodes should be kept away from the operating electrodes and neutral electrodes, and you would better not use the needle-shaped electrode. Under all circumstances, it is recommended to use the custodial system with the restraint device for high frequency current.
- To prevent the operation electrode and neutral electrode cable coming in contact with patients or other wire, please place the electrodes which are not in use in insulated container.
- If a normal high frequency surgical unit have failures or the output decreases under normal work setting, the neutral electrodes may be misused or a poor contact may be between the electrodes. Under this circumstance, you should check the operation and connection before selecting the higher output power.
- To avoid the HF radiation, the operators must not wear metal glasses in endoscopic operation. Otherwise the operator's face may be burned.
- Pay more attentions to the patients with metal in their bodies. To avoid burns, the HF currents channel should be kept away from the metal in patients' bodies for this may cause the damage of their tissue.
- Do not touch the active electrode patient plate or electrode by the naked part of your body for there is HF radiation on both electrode and patient plate, and the HF radiation may cause pain and burns to the body.
- The accessories, including hand control pencil, foot control pencil and patient plate, are consumable components which need to be check for working condition before operating to prevent burns caused by false operation.
- Precautions to the burns of High frequency patient plate

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Patient plate burns often occurs in electrosurgery operation, the operators must grasp proper sticking method to avoid burning accidents. The unit can use hard patient plate, single soft patient plate and dual soft patient plate, the usage of which has been described in “Patient plate using” chapter. The following is some supplement contents.

- A. When fixing the hard patient plate, do not bend it. It may decrease the contacting area.
 - B. Do not use the single soft patient plate many times; otherwise the disabled patient plate may cause burns.
 - C. We recommend you to use the dual soft patient plate for the contact area can be monitored successively by the circuit-electrode monitoring system. When the contact area becomes too small, the unit will stop working and cut off the power output. Meantime the alarm will be activated. Thus, dual patient plate is much safer than the single one.
 - D. Besides ensuring that the plate is close and evenly contacted to the patient’s skin, the following must be abided:
 - a. The patient plate should be placed close to the operating part as much as possible. By decreasing the output impedance, the unit output power will too be decreased which can reduce the possibility of burns. If the patient plate is far away from the electrode, the area of high frequency current channel will be enlarged, so that more parts of the body will be placed in strong electromagnetic field and high electric potential, increasing the risk of burns not caused by patient plate.
 - b. To maintain a large contact area in operation, the patient plate should be placed on the clear, dry muscle part without any protrusion. Compared to the fat, muscle has lower impedance and better conducting ability. The protrusive part may not ensure the adequate contact area and have influence on the uniformity of the contact area, causing large current density and increasing the risk of burning.
- Precaution of burns not caused by patient plate
 - A. The burns not caused by the patient plate included this situation that though the patient plate is in good condition that suitable for operation, the possibility of patient burns still exists.
 - B. The main reason is that several parts on the patient body come in contact with the ground.
 - For example: a. The patient’s body may have more than two points touching the iron bed which is placed on the cement ground;

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- b. The accessories' cord is placed on the wet ground and touched the patient's skin;
- c. Operators do not wear the rubber gloves and the insulation to the ground is not good.

When the above occurs, the high frequency current forms the circulating current between earth points, causing burning accidents.

- Low Frequency

- A. High Frequency Surgical Unit has taken measures to strictly control the low-frequency leakage current, because the human nerve and heart is sensitive to low-frequency, and high low-frequency leakage current has bad impact on patients. But the unit can do nothing to the outside low-frequency current.
- B. When the connecting cables (patient plate and electrode cable including plug socket and the convert plug) are not in poor contact or partly broken, these may easily cause the electric sparks which contain low-frequency current, causing burns to the patients. This current is really dangerous to the patients.
- C. The burns caused by low-frequency leakage current often occur inside the body instead of on the body surface. **During the operation if the patient is obviously trembling, please stop the operation immediately and have a check.**

Therefore, it is absolutely necessary to ensure the good connection of the connecting cables (patient plate and electrode cable including plug socket and the convert plug) outside the machine.

All High Frequency Surgical Units supplied by our company have passed safety tests and are in compliance with the national standards.

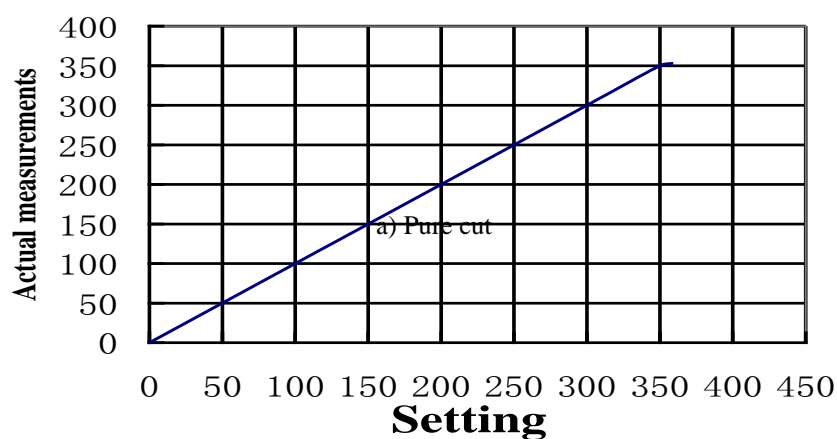
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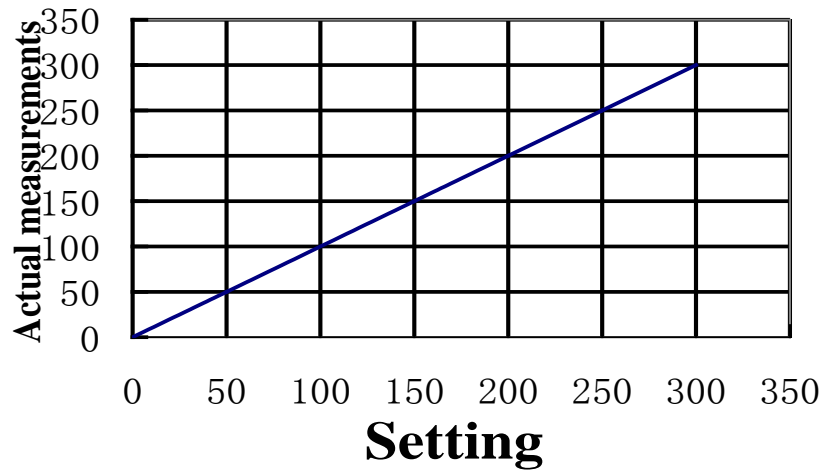
Technical parameters

Output parameters

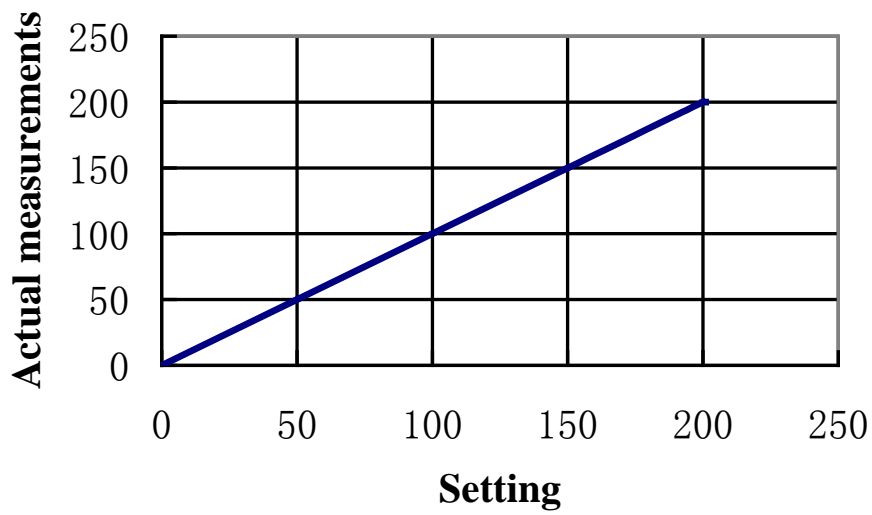
	Max. power (W)	Rated load (Ω)	Duty ratio	Max. open circuit voltage peak value (V)
Pure cut	350	500	100%	1800
Blend 1	300	500	68%	2700
Blend 2	200	500	56%	2400
Blend 3	150	500	24%	2900
Soft coag	100	500	16%	3600
Spot coag	100	500	16%	4600
Bipolar coag	50	100	100%	240

Curve showing the set power and actual power for every mode

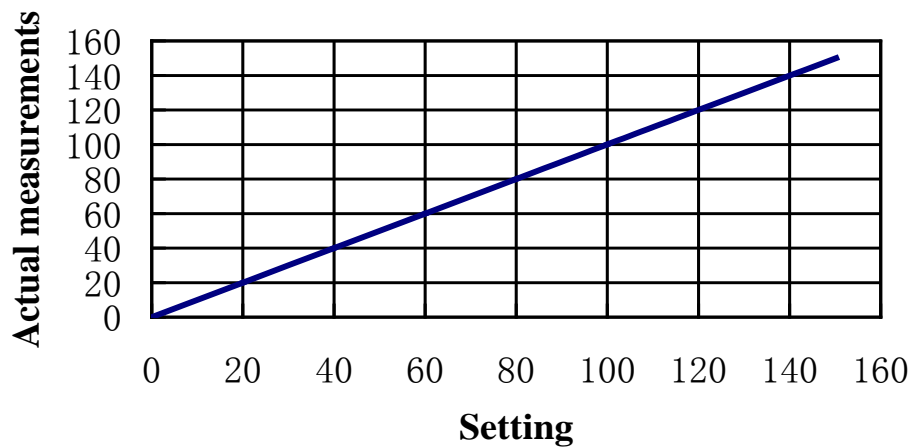




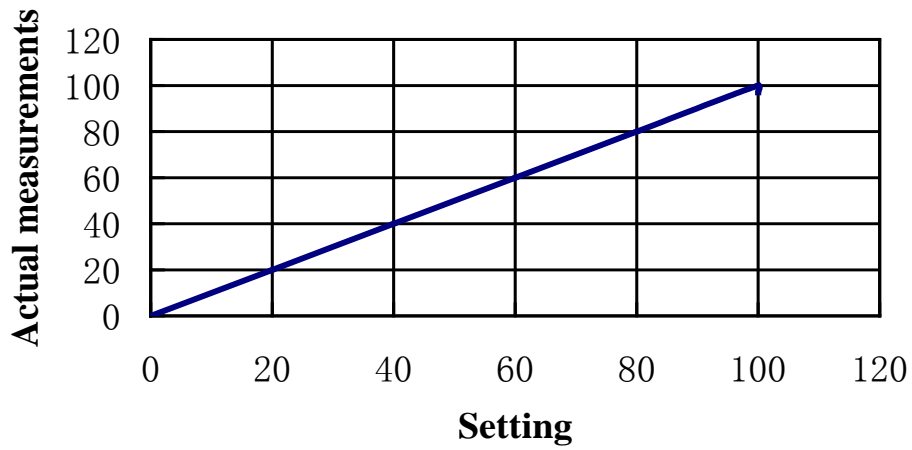
b) Blend 1



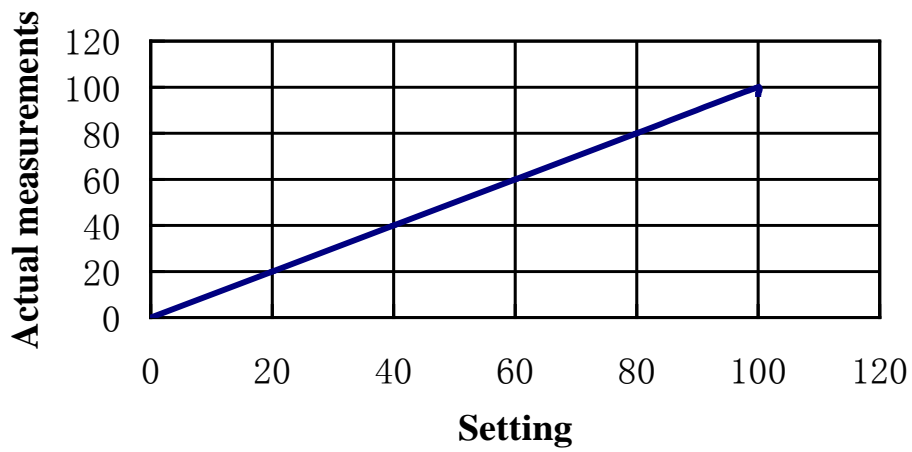
c) Blend 2



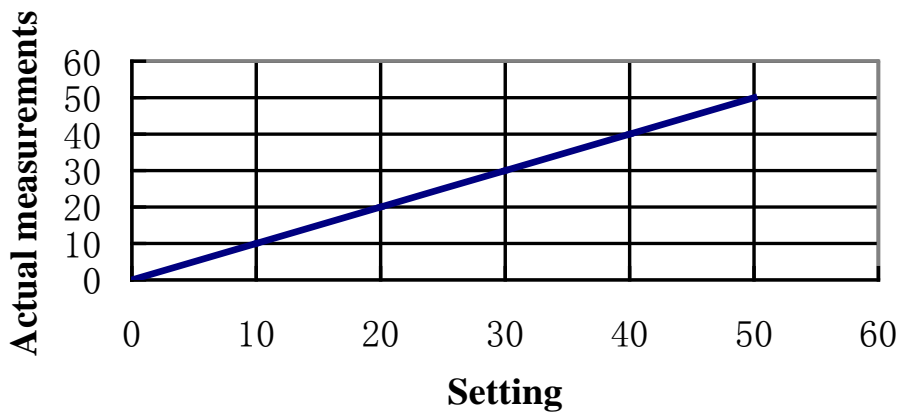
d) Blend cut3



e) Soft coag



f) Spot coag



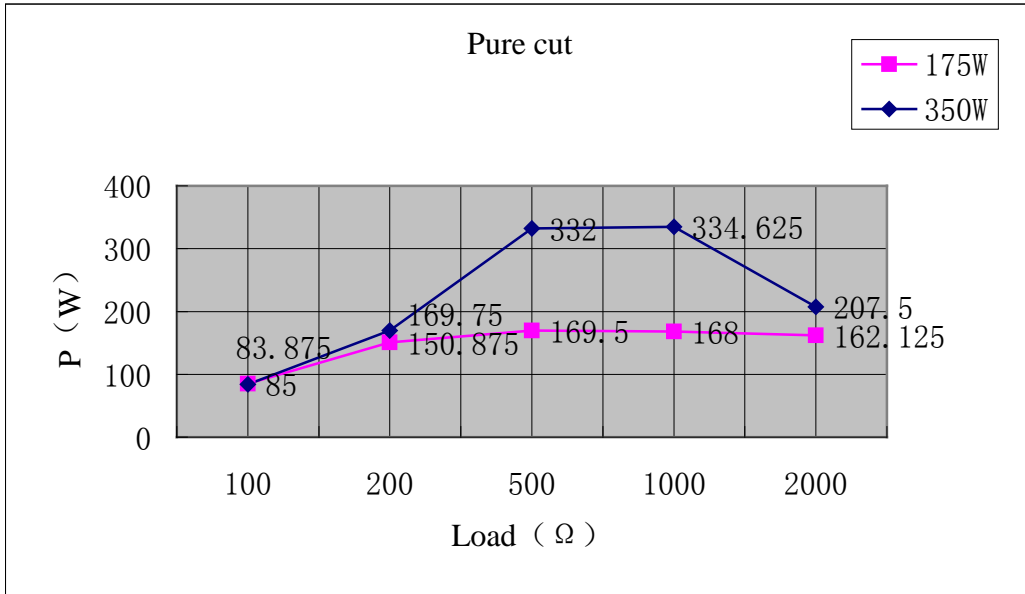
g) Bipolar coag

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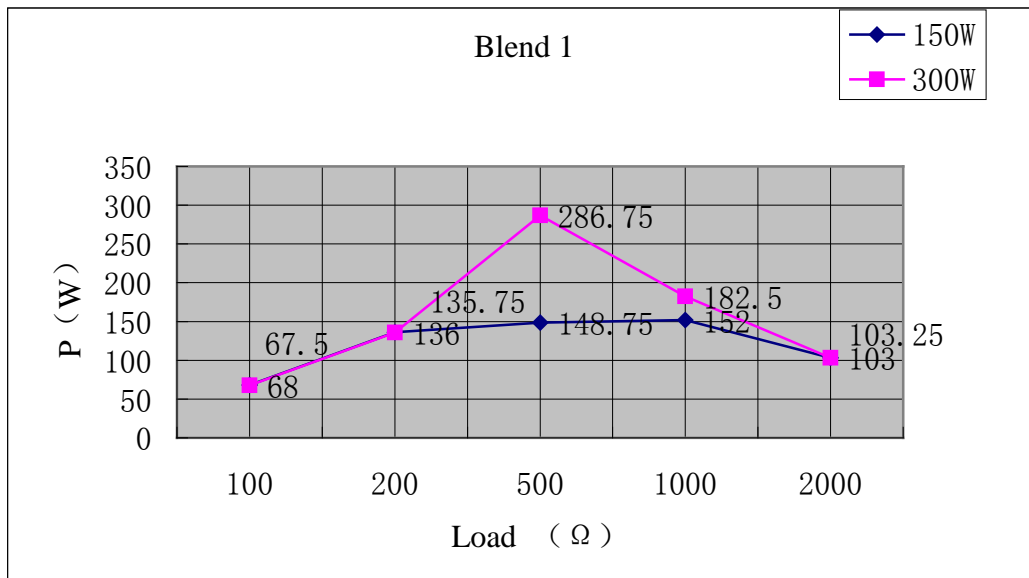
Load power curve for each mode

The curve below shows the output power P under full-power and semi-power for each mode changes with the changing of load R_L . (full-power setting in real line and semi-power setting in dotted line)

1、Pure cut

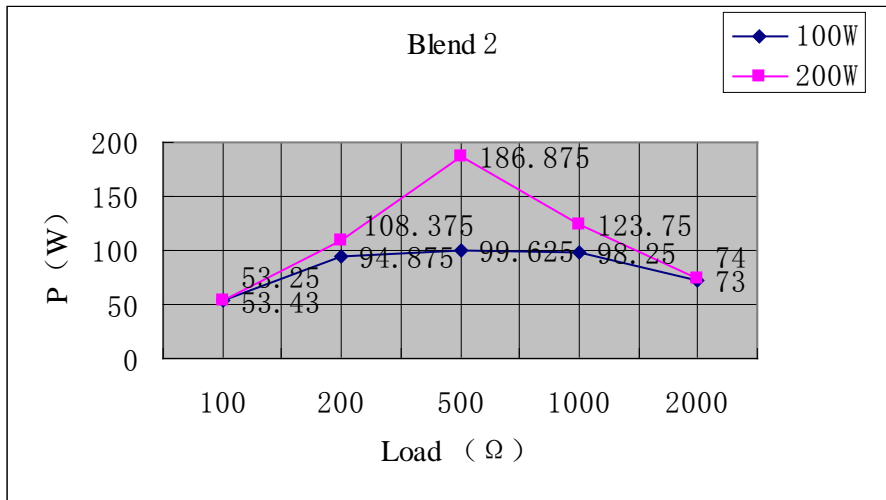


2、Blend 1

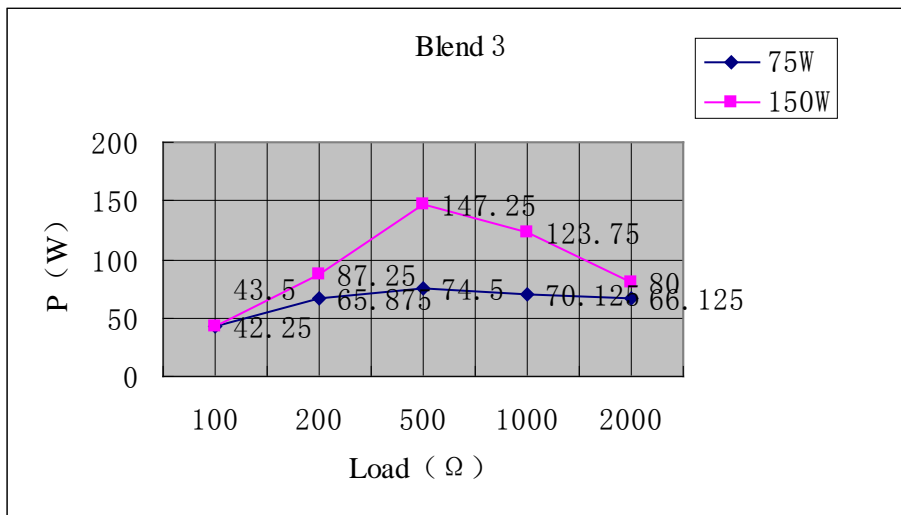


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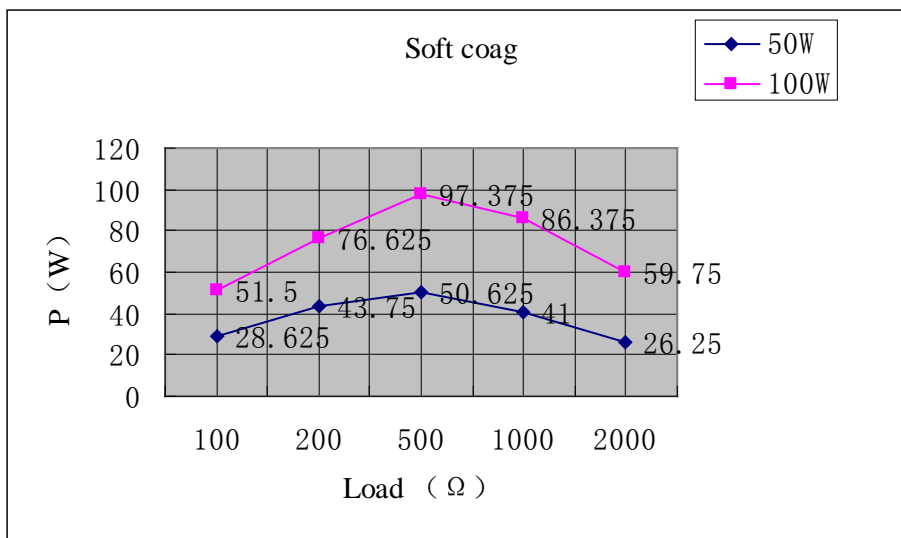
3、Blend 2



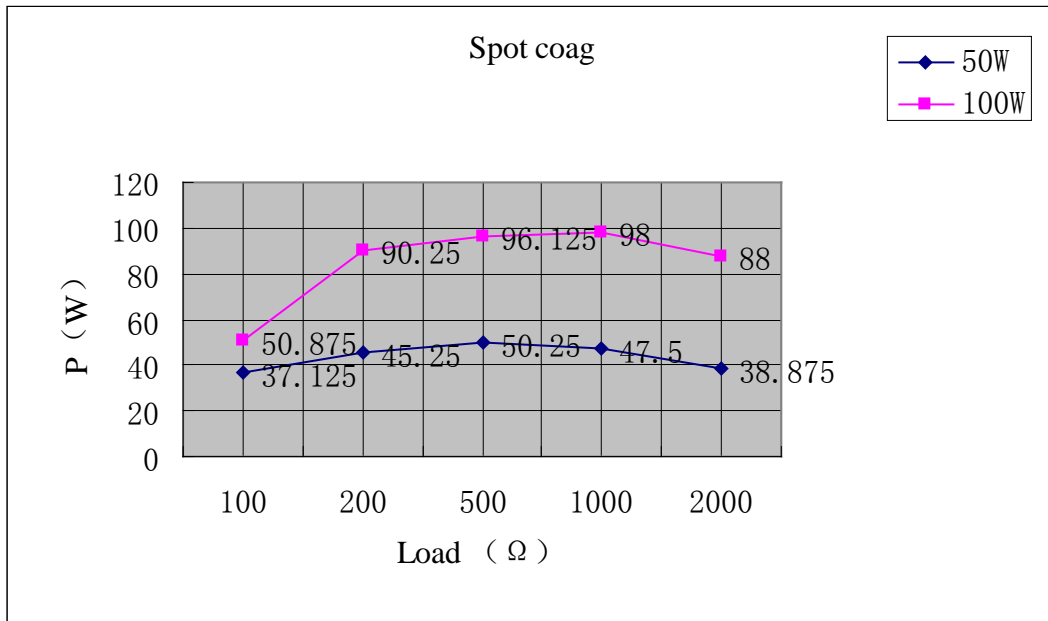
4、Blend 3



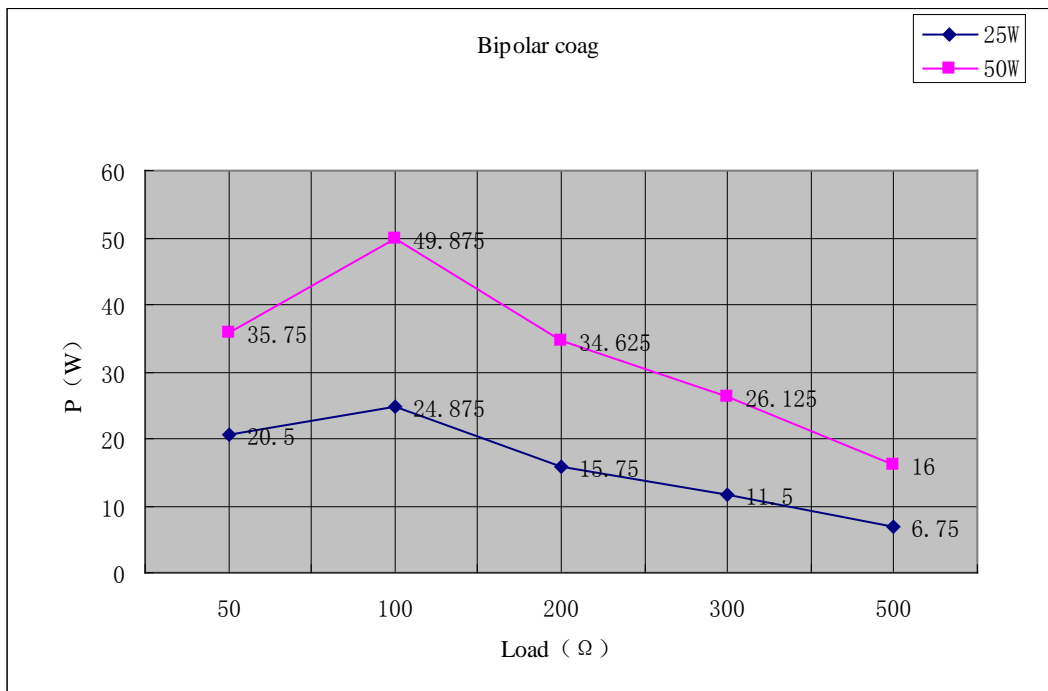
5、Soft coag



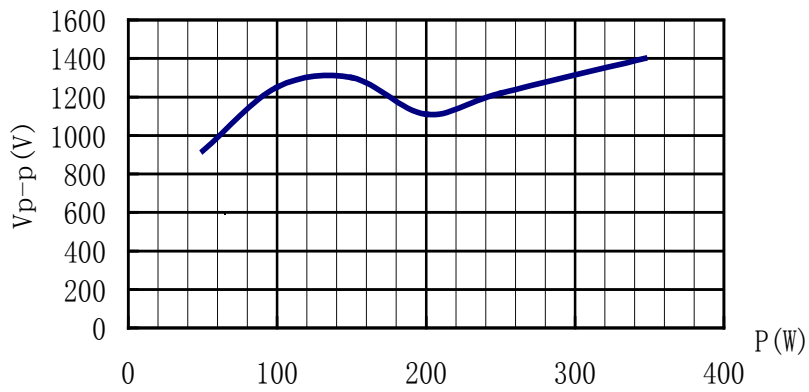
6、Spot coag



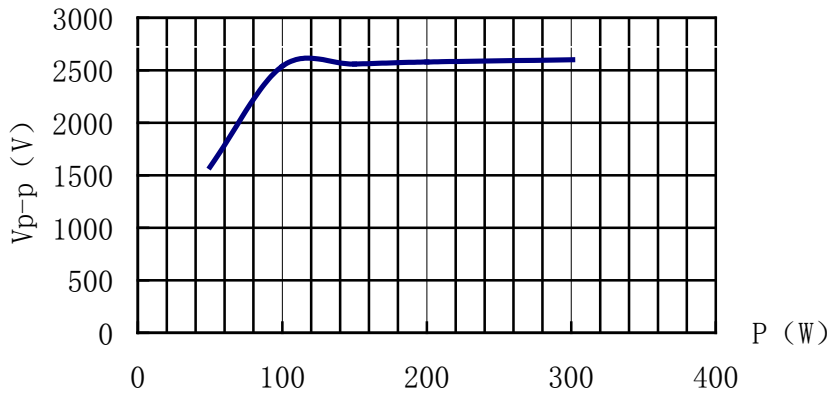
7、Bipolar coag



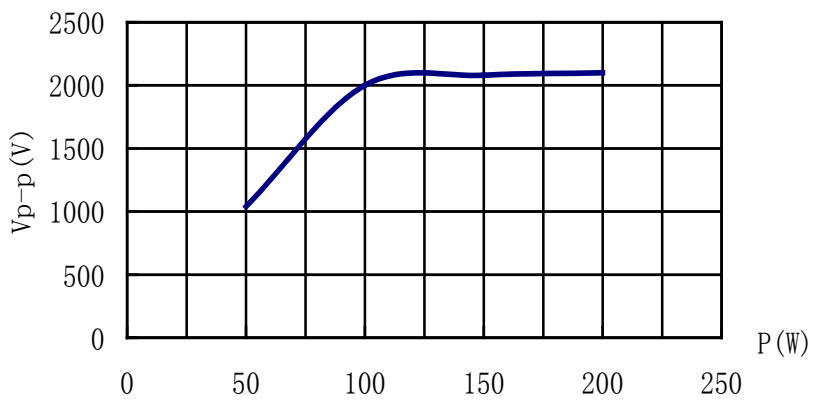
Curve on output power and voltage peak value for each mode



a.Pure cut

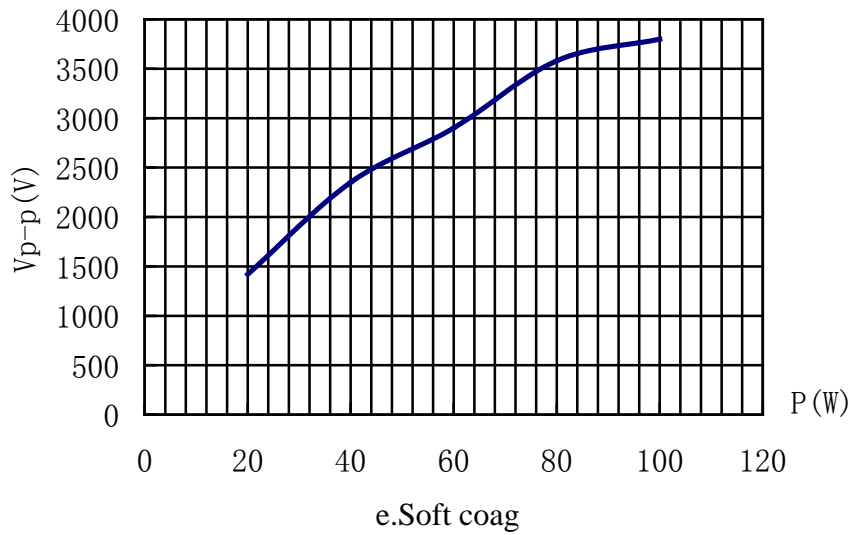
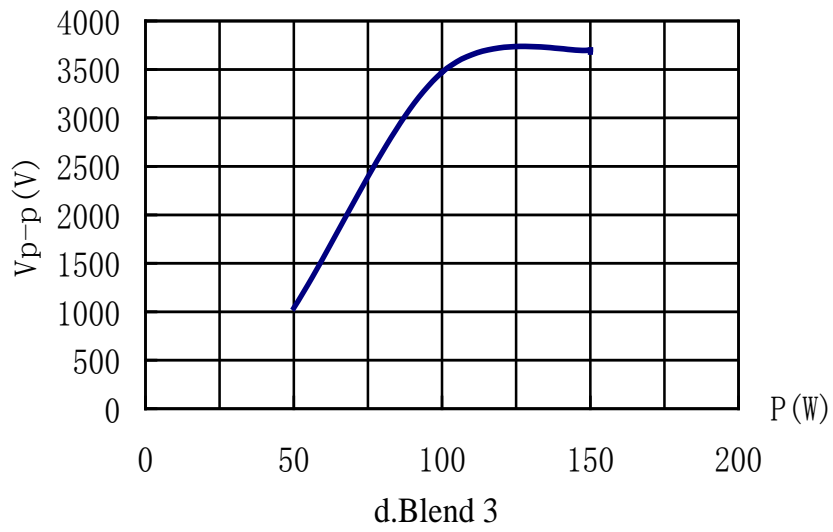


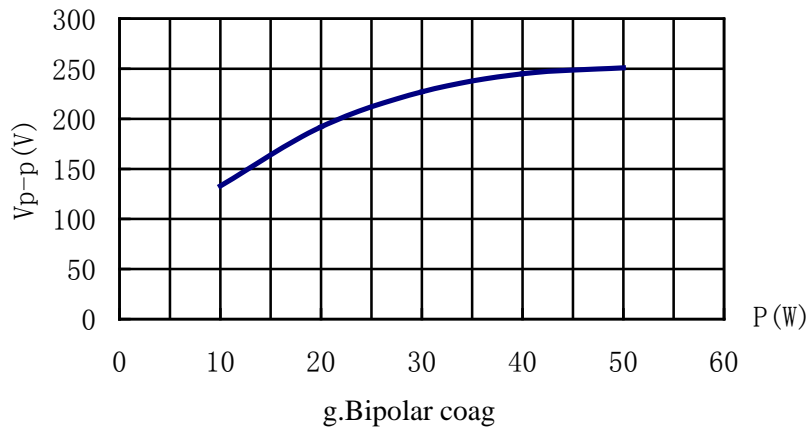
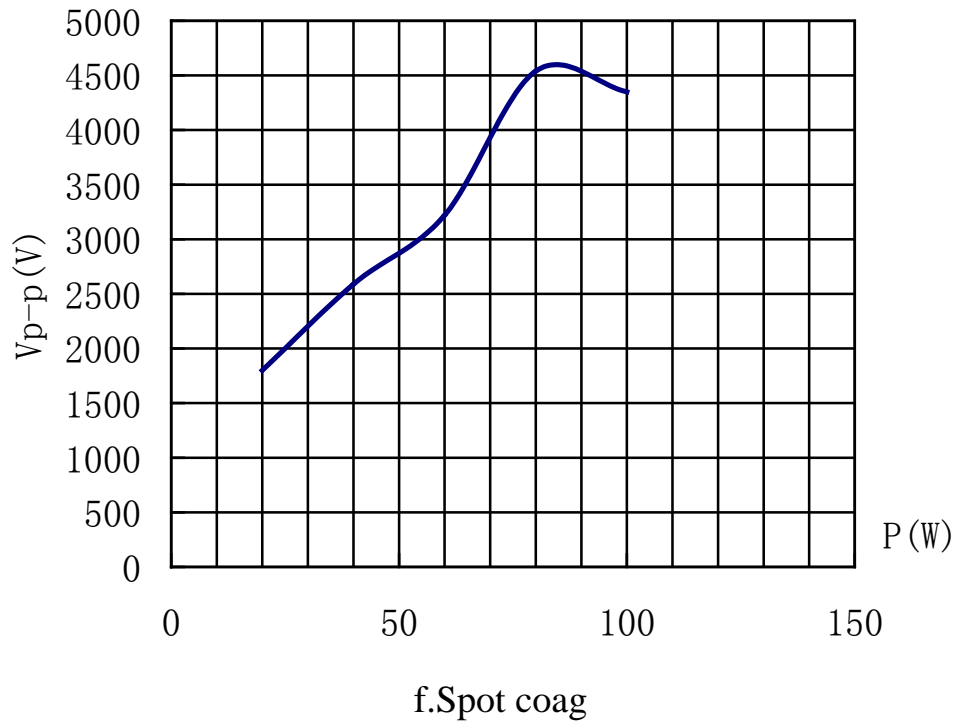
b.Blend 1



c.Blend 2

Operation manual





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Safety indices

The machine is manufactured in accordance with the state safety indices standard.

Neutral electrode is separated from the ground in case of high frequency.

High-frequency drain current <150mA

Low-frequency drain current: to ground <0.5mA

Casing<0.1mA

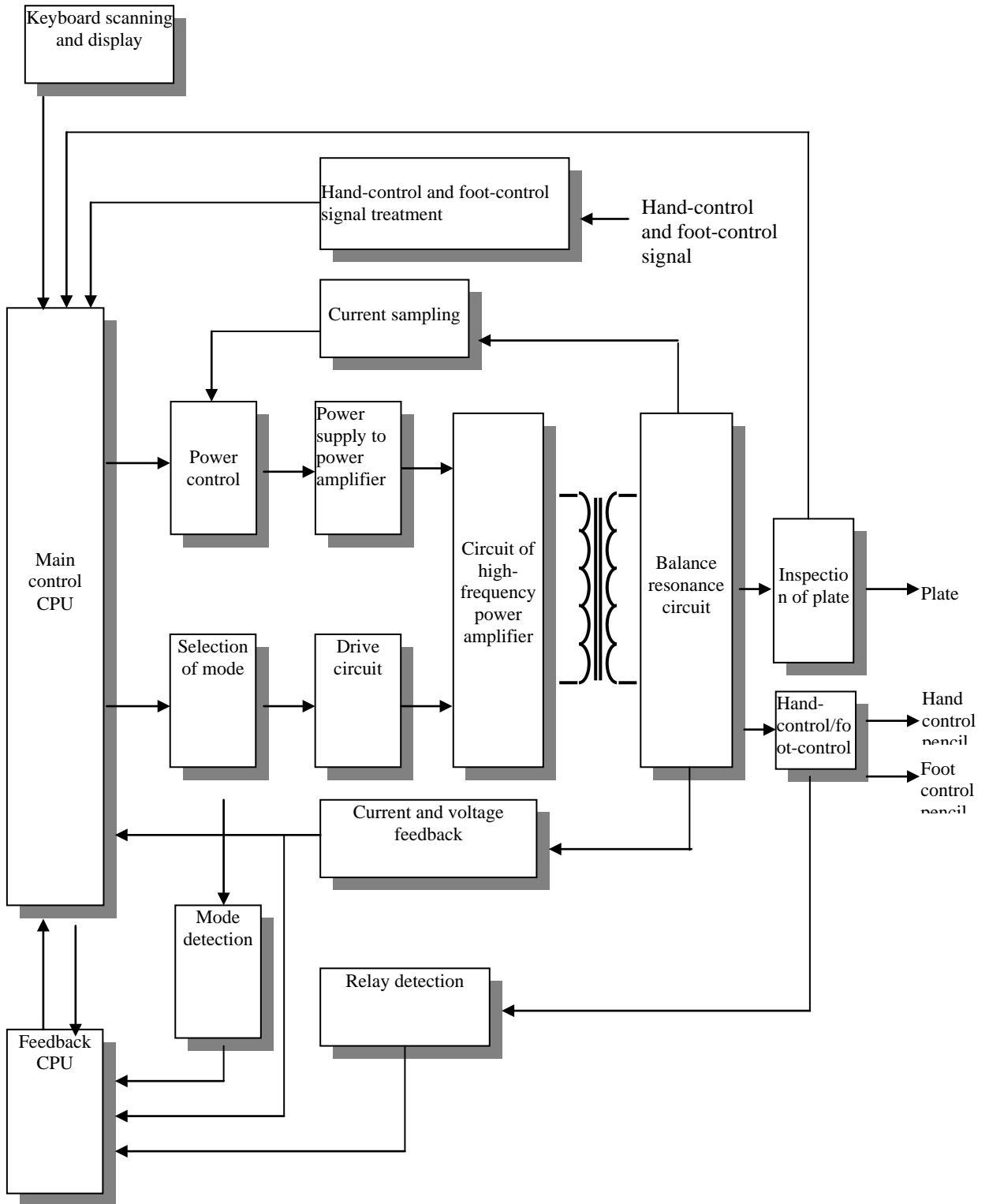
Patient<0.01mA

Classification of product

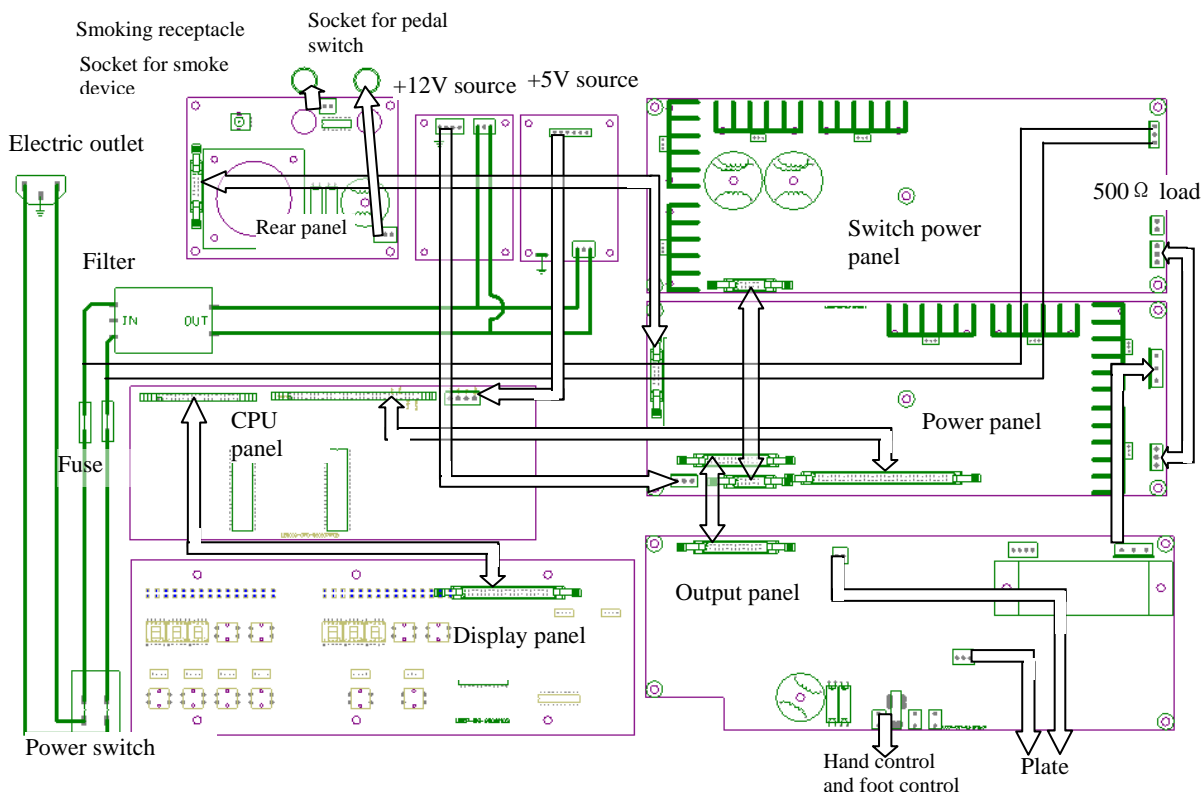
- Category of equipment: Category I
- Type of equipment: Type CF
- Power supply voltage please refer to the nameplate
- Rated input current of equipment: 5A
- Application appliances available with the equipment: output circuit for surgical electrode and neutral electrode
- Equipment's protection from discharge effect of defibrillator
- Classified as common equipment
- Operation mode of equipment: Continuous operation with loading in intermittent pattern
- Portable equipment

Description of circuit

Block diagram on principle of host machine



Block diagram on wiring of host machine



Description on operation principle of host machine

On pushing the Power (Power control) button to switch on the machine, the electrotome is placed ready for use and the control circuit is controlled by the operator (mode, power, etc.). During the standby and operation, main control CPU will continuously detect the signal from plate. In case of open circuit or any other upsets for the plate, main control CPU will send an alarm signal, stopping the startup. With the normal signal from the plate, the control panel will send a mode signal to power panel, a pulse modulation power signal to power panel and an audible signal to rear panel (not shown in the block diagram above). On receipt of mode signal from control panel, the power panel will produce, via mode selection and generation circuit, a modulation signal with period and width, which will be sent to the driving circuit for amplification and then converted to power amplification grid signal after phase splitting by high-frequency transformer. Meanwhile, the control panel will send the power panel a pulse-width modulation power signal corresponding to the set power and provide the power amplification the reliable and isolated d.c. current through switch circuit, high-frequency transformer. At the output terminal, there are current sampling circuits. Sampling signal is sent to the comparator control switch circuit to restrict the short-circuit current.

During the output of electrotome power, main control CPU and monitor CPU will detect the high-frequency signal, current and power signal at output terminal in a real-time manner so as to ensure the safe redundancy. Meantime, through the software calculation and compensation, the electrotome is enabled to output the appropriate power under the different impedance to ensure the electrotome to work in safety and reliability.

CPU panel circuit

CPU panel may work with main functions in two CPUs. U2, main control chip, may function to receive the startup signal and plate mode signal, send the mode signal and PWM signal for control power, control every light via operation of 7219 on the display panel, and scan the keyboard. Main control CPU is also to receive the feedback signal on power, voltage and current and control the output of final power. U10, feedback chip, may function to receive the feedback signal from the relay and feedback signal on power, voltage and current and activate the alarm in case of upset. Two CPU chips are linked in the way of bus.

Voltage and current feedback from the output panel on CPU panel are converted between d.c. and a.c. via AD536 and combined to power value via AD633.

Plate detection circuits are also provided on CPU panel.

The signal routing from CPU panel to the power panel is isolated with optical coupling 521.

Circuit of display panel

Display panel may function to receive the signal from main control chip on the control panel, activate every lamp and button and control the indication of nixie tube via a MAX7219.

Circuit of switch power panel

Switch power panel may function to provide power supply to the power amplifier based on the principle of switch power supply. The panel will receive a PWM signal from CPU panel and convert it to d.c. signal to be transferred to U1001 (UC3825 high-speed PWM controller), producing two alternating square waves being not overlapped. Driven by U1003 and U1004 (7667), it is sent to the coil T1001 and T1002, and then used to activate four VMOS tubes (IRF840) via the coil. On the other hand, alternating current may obtain a direct voltage through bridge rectification circuit (BR1001) and filter circuit, and then is conducted over the bridge circuit in a rotation manner structured by four VMOS tubes (840). Later, it will be output via transformer T1003 in a push-pull manner, bridge rectified by the diode (U860) and finally provide the d.c. voltage via L, C filter as required for the power amplifier.

Circuit of power panel

Power panel may function to output the appropriate power tube driving signal according to the mode as provided by CPU panel and output the power plus the power amplification power supply from the power panel. Power driving signal comprises VMOS tube (IRF510) and driving coil T2001 and T2002. Power output circuit may operate with full bridge power amplification circuit structured of 4 VMOS tubes (PMN1160). On the power panel, there are circuits used to restrict short-circuit current and high-frequency drain current. In case of pretty

Operation manual

high short-circuit current and high-frequency drain current beyond the limits, send a signal to the power panel to reduce the voltage of power amplification circuit.

Circuit of output panel

Output panel may function to route the power from full bridge power amplification to the resonance circuit comprising LC via power coil T5001, which will be finally output from the plate and electrode. On high voltage output, there are current sampling circuits, high-frequency drain current sampling circuits. Voltage sampling circuit and plate resistance sampling circuit are separately transferred to the power panel and CPU panel for analysis.

Produced on the output panel is hand control pencil startup signal via coil T5008 and isolated by home-made optical coupling O5001 and O5002.

Circuit of rear panel

Rear panel may function to allow NE555 to produce an oscillation and foot control pencil startup signal via coil T7001 and home-made optical coupling O7001 and O7002.

Provided on rear panel is also LM386 acoustic circuit.

Maintenance technology

Daily check on accessories

- Attached cable insulation layer shall not be exposed to decolour, deterioration or damage. Leading wire shall not be visibly folded.
- Cable joint shall not be loose and detached.
- Hard plate shall be wrapped and kept intact. Fouling shall not be seen on the plate.

Warranty commitments

We provide warranty commitments for the host machine and pedal switch.

- Warranty period may take effect since the date of procurement and last for one year.
- For the machine under warranty period, we will not take responsibility for the failure due to the misuse by the customer.
- Within the warranty period, the customer shall not uncover the host machine or disassemble the pedal switch. Otherwise, the warranty may become null and void.
- We will charge the repair beyond the warranty period.
- Provide the wiring diagram and list of components to the approved maintenance unit and people.

Troubleshooting

Since the whole electrotome system is quite complex, you shall abide by the following steps to do troubleshooting:

1. Assess if misoperation or equipment failure
For example: soft plate being used is not secured on the patient, leading to failure to activate the alarm.
2. Assess if host machine failure or damage to accessory
For example: failure to startup may somehow attribute to the hand control pencil switch or pedal switch.
3. Assess if problem outside the machine or inside the machine; The next section will give the details.
4. Assess that the exact part of machine inside fails.

Troubleshooting on the failure inside the machine require the training.

Regular check

The user shall carry out some necessary check on performance and safety on a regular basis.

Operation manual

- Power check (every half a year)
- Check on low-frequency drain current (every half a year)
Drain current to ground $< 0.5\text{mA}$
Drain current to patient $< 10\mu\text{A}$
- Check on high-frequency drain current (every half a year) $< 150\text{mA}$

List of common failure

List of external failure

Phenomenon	Cause	Solution
Turn on the power switch, showing nothing	<ul style="list-style-type: none"> ◆ No alternating voltage available in the outlet ◆ Fuse loose or broken 	<ul style="list-style-type: none"> ◇ Check the power supply ◇ Tighten or replace the fuse (If broken again after tightening, it is problem inside.)
Machine alarm	<ul style="list-style-type: none"> ◆ Plate plug is not properly inserted ◆ Plate clamp does not secure the conductor 	<ul style="list-style-type: none"> ◇ Secure the plate plug and replace the plate ◇ Secure the plate conductor
Failure to activate the machine by hand control pencil	<ul style="list-style-type: none"> ◆ Improper contact of hand control pencil 	<ul style="list-style-type: none"> ◇ Replace the hand control pencil
Failure to activate the machine by pedal switch	<ul style="list-style-type: none"> ◆ Improper contact of pedal switch ◆ Pedal switch not properly plugged 	<ul style="list-style-type: none"> ◇ Replace the pedal switch ◇ Securely plug
Dual plate fails to automatically changeover	<ul style="list-style-type: none"> ◆ Plate plug damaged 	<ul style="list-style-type: none"> ◇ Replace the plate wiring
Insert the hand control pencil and the machine startup	<ul style="list-style-type: none"> ◆ Hand control pencil is placed at normally-closed status. 	<ul style="list-style-type: none"> ◇ Replace the hand control pencil
Output electrode and cable overheated or output power greatly reduced	<ul style="list-style-type: none"> ◆ Cable broken somewhere or plug-in unsecured 	<ul style="list-style-type: none"> ◇ Replace the attachment or secure the plug-in
Casing charged	<ul style="list-style-type: none"> ◆ Ground wire of power cable is not correctly grounded or power supply wire in the machine is detached. 	<ul style="list-style-type: none"> ◇ Correctly connect the ground wire of power supply cable or secure the power conducting wire in the machine.

Operation manual

List of internal failure

Phenomenon	Cause	Solution
Machine alarm	<ul style="list-style-type: none"> ◆ Improper contact of plate plug ◆ Improper contact of soft plate base 	<ul style="list-style-type: none"> ◇ Replace the plate wiring ◇ Replace the plate wiring
Dual plate fails to automatically changeover	<ul style="list-style-type: none"> ◆ Switch in plate socket damaged ◆ Wires of connecting plate switch are detached from the output panel. 	<ul style="list-style-type: none"> ◇ Replace the outlet ◇ Secure the wires
Nixie tube not on	<ul style="list-style-type: none"> ◆ +5V switch power supply damaged ◆ Plug-in for +5V switch power supply to display panel detached ◆ Display panel or CPU panel damaged 	<ul style="list-style-type: none"> ◇ Replace +5V switch power supply ◇ Secure the wires ◇ Replace display panel or CPU panel
Hand control pencil unable to startup while pedal switch able to startup	<ul style="list-style-type: none"> ◆ Optoelectronic isolator in hand control pencil isolation circuit damaged 	<ul style="list-style-type: none"> ◇ Replace the output panel
Pedal switch unable to startup while hand control pencil able to startup	<ul style="list-style-type: none"> ◆ Optoelectronic isolator in foot control pencil isolation circuit damaged 	<ul style="list-style-type: none"> ◇ Replace the rear panel
Both hand control pencil and pedal switch unable to startup	<ul style="list-style-type: none"> ◆ Pick-up of JD5002 and JD5003 on output panel is due to CPU failure to receive the startup signal. ◆ Not pick-up of relay on output panel is due to no startup signal sending from the power panel. 	<ul style="list-style-type: none"> ◇ Replace the CPU panel ◇ Replace the power panel
High-frequency drain current increased	<ul style="list-style-type: none"> ◆ Excessive dust or machine exposed to damp 	<ul style="list-style-type: none"> ◇ Clean, dry and spray paint
Machine able to startup, without output power	<ul style="list-style-type: none"> ◆ Switch power supply fails to provide the power supply to power amplifier ◆ No driving shape of wave for power tube ◆ Resonance circuit damaged 	<ul style="list-style-type: none"> ◇ Replace the power supply panel ◇ Replace the power panel ◇ Replace the output panel
Output power greatly deviated	<ul style="list-style-type: none"> ◆ Memory damaged 	<ul style="list-style-type: none"> ◇ Replace the CPU panel

★ **Quality policy:**

Keeping Improving Satisfying Customers

- ★ **Shanghai Lishen is entitled to make alternation to the performance of the machine at any time without appropriate notification.**
- ★ **Any problem with our products, please contact our international distributors or service staff in our company at your convenience.**

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