Kalstein

High Frequency Electrosurgical Unit

Model YR02144

User Manual

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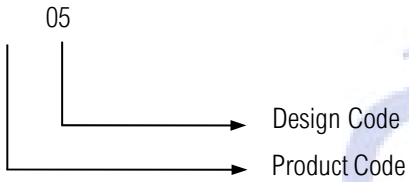
Catalog

1 Brief Introduction

YR02144 series High Frequency Surgical Unit is developed and manufactured by Kalsteinwith high technology under total quality control.

This High Frequency Surgical Unit can be used in lots of fields including the general surgical dept, the heart and chest dept, gynecology dept, the five sense organs dept, Orthopedics dept, Urological dept, and Dermatological dept, etc. It can also work under different modes such as pure cut, blend 1, blend 2, blend3, point coag, soft coag, spray coag, bicoag and bicut. Different main frequencies have been adopted in ways of monopolar and bipolar in order to make the best clinic effect. Besides, micro-controller, neutral electrode stick area test circuit, floating harmonies equilibrant output circuit have been adopted to strengthen the safety of the unit.

Unit Serial Numbers and MeaningsEB



YR02144 Registered No. : 3251195

YR02144 Standard No. : YZB/GUO3737-2010

2 Unpacking

2.1 Unpacking

Remove the packing of the equipment; check all the accessories for damage according topackage list.
Store the whole package properly in case of transportation or after-sale service
In case of any question, please do not disassemble the unit without authorization and contact a qualified service representative immediately.

2.2 Electrical Power

Power Supply: AC220V, 50/60Hz

2.3 Operation Environmental Conditions

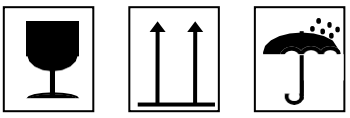
Temperature:	+10 ~ +40℃
Humidity:	≤80%RH Atmospheric
pressure:	860hPa～1060hPa

Placed in clean and ventilated room.

2.4 Transporting and Storage Environment

Temperature:	-40 ~ +55℃
Humidity:	≤95%RH Atmospheric
pressure	500hpa ~ 1060hpa

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



2.5 Check

- Remove the packing of the equipment; check all the accessories for damageaccording to package list.
- Connect the power supply and the accessories (Patient Plate, F.C electrode, H.Celectrode, Foot Switch, Forceps and cords)
- Switch on. Set the output power at least 50W. During the output, there will be asparkle between electrode and return electrode.

- To set the forceps as the output, please select bipolar mode. Press the foot switch,short both end point of the forceps and then there will be a sparkle.
- After check, return the accessories to the customers. Before using the accessories,please sterilize them.

3 Description

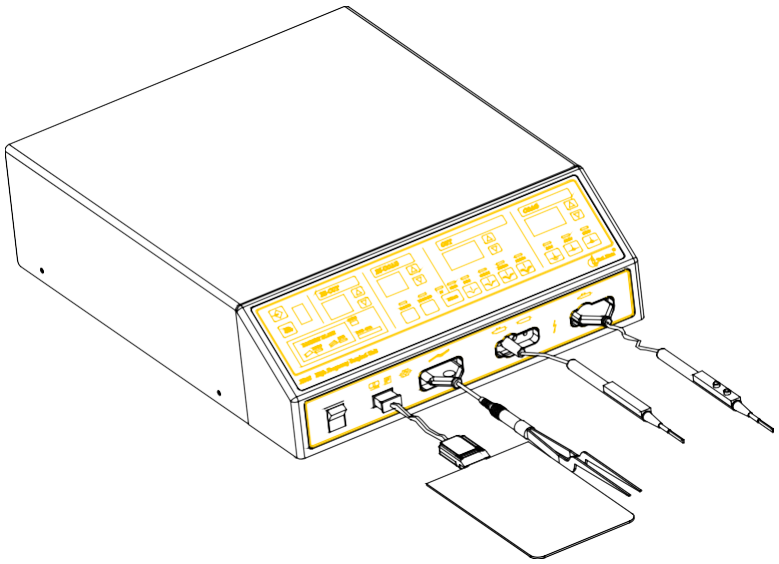
3.1 Dimensions and Weight

Package dimensions (mm): 550*460*400Gross
weight (kg): 23
Net dimensions (mm): 516*410*160Net
weight (kg): 20

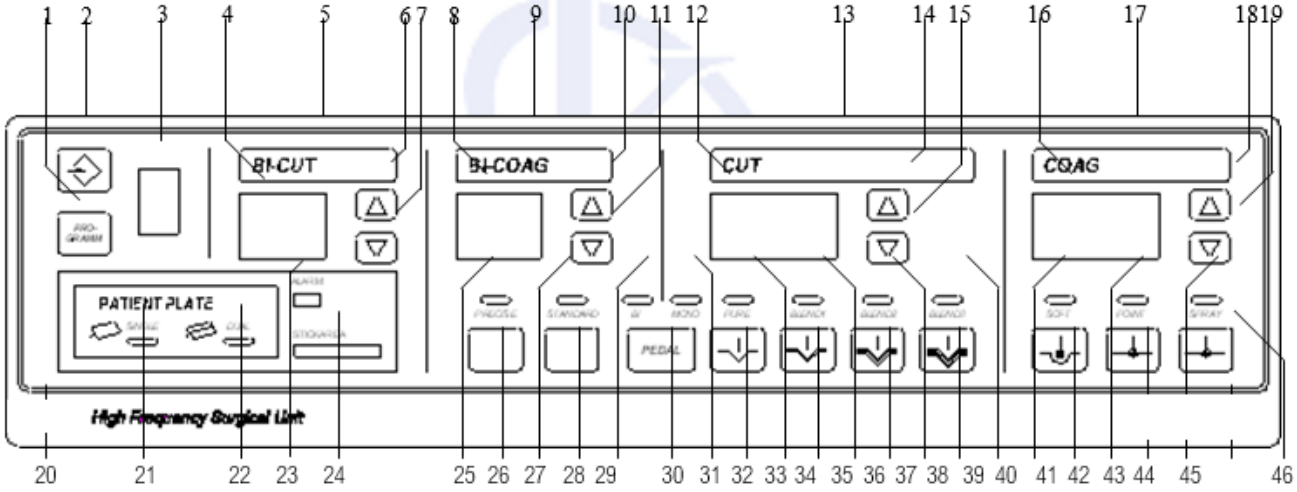
3.2 Accessories

PART-NAME	PART-NO	PER	REMARK
Power Cord	1WC-10A250V-SW1	one	
Hand Control Electrode	7SK-EB03NO-002	one	
Foot Control Electrode	7JK-EB03NO-002	one	Optional
Foot Switch	7JT-EB03JT-001	one	Optional
Plate Cord (dual)	7DP-USAL-003	one	
Plate Cord（single） Standard knife electrodeDual Soft Patient Plate	7DP-USAL-005 HCB-99-00 7RB-EB03JB-002	one one one	Optional Optional
Single Soft Patient Plate	7RB-EB03JB-001	one	Optional
Hard Patient plate	7JB-EB0351-002	one	Optional
Forceps	7NZ-310180-010	one	Optional
Forceps Cord	1WC-EB03NZ-002	one	Optional
Unit Fuse (250V6.3A)	1FS-T6.3A250-001	two	
Argon Unit		one	Optional

3.3 Diagram of YR02144



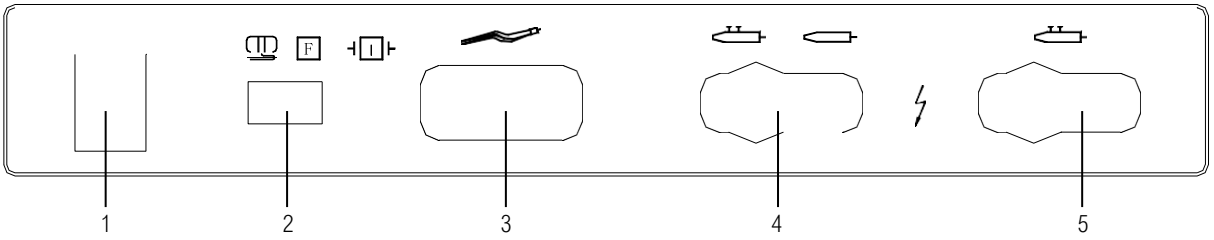
3.4 Control and Display Panel



1. Key System preset mode program
2. Key System preset mode set
3. Display Preset mode code
4. Display Bicut power set value
5. LED Mode “Bicut” is on
6. Key Increase bicut power value
7. Key Decrease bicut power value
8. Display Bicoag power set value
9. LED Mode “Bicoag” is on
10. Key Increase bicoag power value

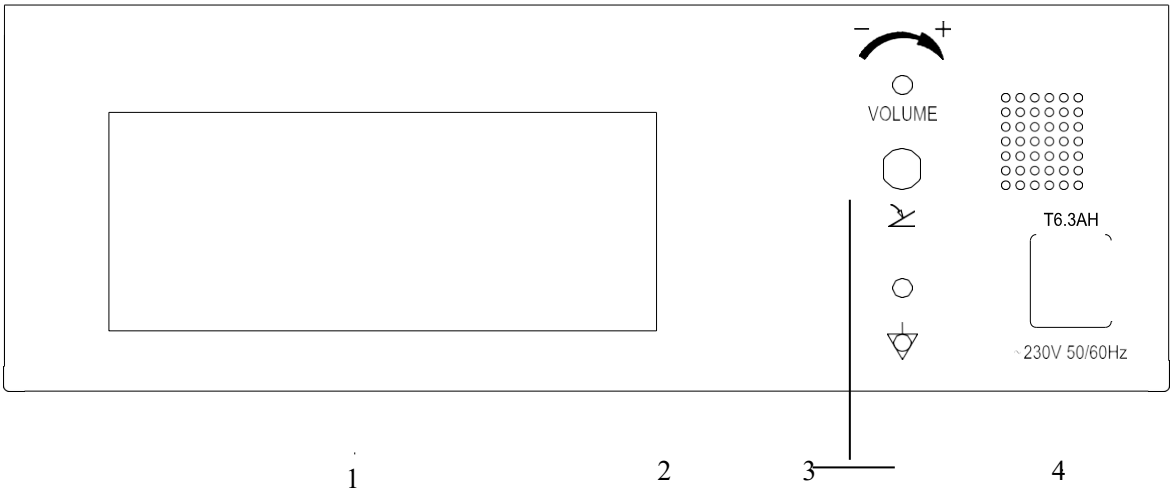
11. Key Decrease bicoag power value
12. Display Monocut power set value
13. LED Mode “Monocut” is on
14. Key Increase monocut power value
15. Key Decrease monocut power value
16. Display Monocoag power set value
17. LED Mode “Monocoag” is on
18. Key Increase monocoag power value
19. Key Decrease monocoag power value
20. Model
21. LED Single patient plate
22. LED Dual patient plate
23. LED Alarm
24. Display Stick area
25. LED Precise mode for bipolar
26. Key Precise mode for bipolar
27. LED Standard mode for bipolar
28. Key Standard mode for bipolar
29. LED Bipolar for foot switch
30. Key Foot switch mode
31. LED Monopolar for foot switch
32. Key Pure cut
33. LED Pure cut
34. Key Blend1
35. LED Blend1
36. Key Blend2
37. LED Blend2
38. Key Blend3
39. LED Blend3
40. LED Soft coag
41. Key Soft coag
42. LED Point coag
43. Key Point coag
44. LED Spray coag
45. Trade Mark
46. Key Spray coag

3.5 Accessories Receptacles



1. Power switch
2. Patient plate receptacle
3. Forceps receptacle
4. Monopolar output channel 1 (receptacle for Hand Control electrode1and Foot Control electrode)
5. Monopolar output channel 2 (receptacle for Hand Control electrode2)

3.6 Rear Panel



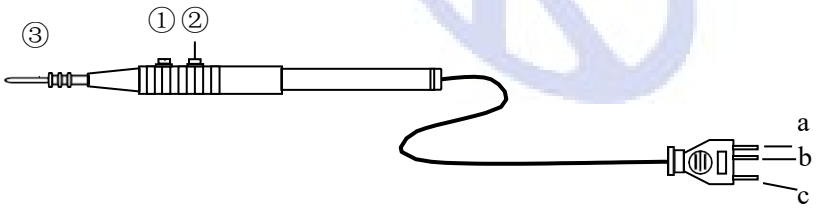
1. Nameplate
2. Foot Switch
3. Fuses T6.3AH
4. Volume control of activation tone
5. Mains power receptacle(Fuses T6.3AH)

3.7 Sign of Manual or Machine

	Type CF Equipment /Defibrillator Proof
	To reduce the risk of electric shock, do not remove the coverAttention: Consult
	accompanying documents
	The unit output is floating with respect to ground
IPX8	Foot Switch is water proof
	Protective earth
	Non-ionizing radiation

3.8 Accessories Description

Hand Control electrode

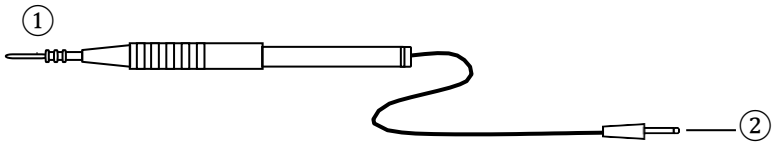


1. Button “Cut”（yellow）
2. Button “Coag”（blue）
3. Electrode

a. Cut end
b. Coag end
c. Common end

- Electrode is connected with Common end
- Press Button “Cut”, cut end is connected with Common end
- Press Button “Coag”, coag end is connected with Common end

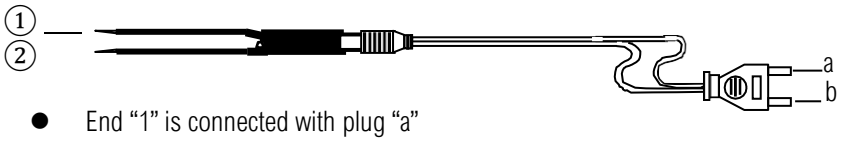
Foot Control electrode



1. Electrode
2. Plug

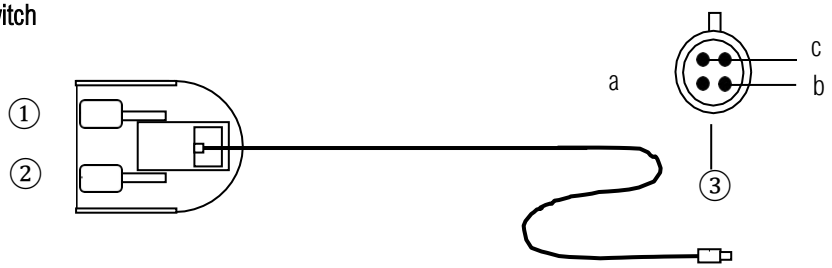
- Electrode is connected with plug

Forceps and forceps cords



- End “1” is connected with plug “a”
- End “2” is connected with plug “b”

Foot Switch

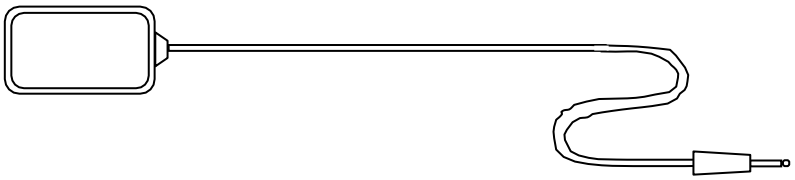


1. cut pedal（yellow）
2. coag pedal（blue）
3. plug

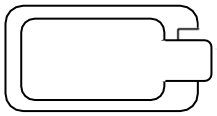
a. cut end
b. coag end
c. common end

- Press cut pedal, cut end is connected with common end
- Press coag pedal, coag end is connected with common end

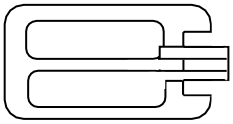
Hard Patient Plate (Return electrode)



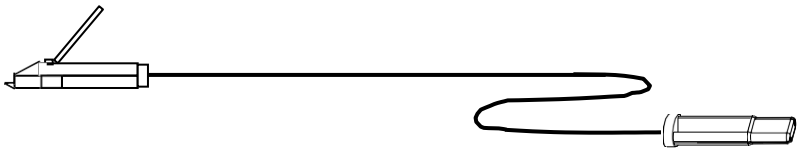
Single Soft Patient Plate (Return electrode)



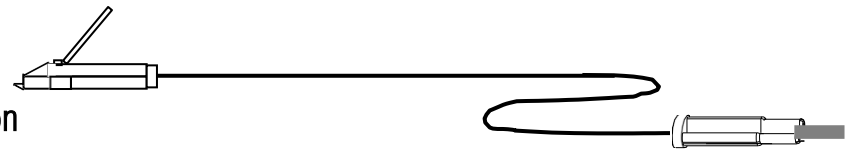
Dual Soft Patient Plate (Return electrode)



Soft plate cord(single)



Soft plate cord(dual)



4 Operation

4.1 Before Surgery

4.1.1 Environmental Conditions

Provide as much distance as possible between the high frequency surgical unit and other electronic equipment. An activated high frequency surgical unit may cause interference with them.

Do not stack equipment on the top of high frequency surgical unit or place the unit on the top of other electronic equipment. These configurations do not allow for adequate cooling.

4.1.2 Accessories Selecting and Installation

Connect one end of the cord with the machine and then insert the other end to the 3-holesocket.

Accessories selecting (according to the output mode):

- Selecting the hand control electrode output: insert the plug of the hand controlelectrode and the plate into the desired place directly.
- Selecting the foot control electrode output: insert the plug of the foot control electrode,foot switch and the plate into the desired place directly.
- Selecting forceps output: insert the plug of forceps and the foot switch into the desired place directly

Attention:

Patient plates (Return electrode) will be described in detail in "*Patient Plate Using*".All the accessories must be supplied by Kalstein.

4.1.3 Patient Plate Usings

Type of Patient Plate

Hard Patient Plate: for reusable; only in single plate

Soft Patient Plate: only for single-use; having single Soft Patient Plate and dual Soft Patient Plate

Hard Patient Plate Using

When using hard patient plate, one must wrap a wet tower soaked in standard saline and put it on the plate. Then place them under the buttocks or leg of patient, so as to keep reliable contact with patient skin

At this time the LED for "Single patient plate" is lightened.

If the plate is not attached to the machine well (unplugged, loose or cord breaking) during the surgery, the alarm will be activated. The output will be cut off.

Single Soft Patient Plate Using

Connect plug of the plate cord to the proper receptacle and fasten the cord to theplate with the clip of the cord.

The plate should be contacted to the patient skin properly. At the same time, LED for "Single Patient Plate" is lightened.

If the plate is not attached to the machine well (unplugged) during the surgery, thealarm will be activated. The output will be cut off.

Dual Soft Patient Plate Using

Connect plug of the plate cord to the proper receptacle and fasten the cord to the plate with the clip of the cord.

The plate should be contacted to the patient skin properly.

At the same time, LED for "Dual Patient Plate" is lightened and the green stick area display will illuminate.

The number of bars illuminating depends on impedance of patient's body and contacting area between skin and plate. Normally, 2~9 bars will light.

If the plate is not attached to the machine well (unplugged) during the surgery, the alarm will be activated. The output will be cut off.

If the plate is loose or disconnected from patient skin causing 40% contacting area to be reduced 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.

4.1.4 Power on

Switch on and then the unit will display the model code and the version code.
After power on, the unit will enter the last setting condition. (The last setting will bekept, including mode and power setting.)

4.2 During the Operation

4.2.1 System Mode Pre-Setting

System mode presetting includes mode set and power set.
System can keep 9 different kinds of preset mode in the memory (mode code 1-9). Press Key for “System preset mode program”, in the display window for “preset modecode”, the code number will cycle from 0 to 9.
Code 0 indicates all the values of power are zero.Code A
indicates last setting condition.
Set Step:

1. Setting the mode and the output power
2. Press key for “system preset mode set” and hold for 3sec to enter the userprogramming condition.
3. Press key for “system preset mode program” to select a preset mode code (1-9).The LED for code flickers.
4. Press key for “system preset mode set” and hold for 1sec to save it and quit theuser programming condition. The LED for code stops flickering.
5. Press key for “system preset mode set” and hold for 3sec to quit during the setprocedure.

Attention:
Latest setting parameter for one mode will cover all the old data in it.

4.2.2 Mode Setting

Monopolar mode

Under Monopolar mode, the output is sent out from the Hand control electrode or
Foot control electrode.
During the surgery, the patient plate should be contacted with the skin firmly.
If the foot control electrode is selected as the output, the foot switch mode mustbe “Monopolar mode”
Press key for ”Foot mode switch” and LED for “Monopolar” will be lightened.Type of monocut

Pure cut	0-400W
Blend1	0-300W
Blend2	0-200W

Blend3 0-150WType of monocoag

Soft coag 0-120W Point coag 0-120W Spray coag 0-120W

Bipolar mode

Under bipolar mode, the output is sent out from the forceps

If the forceps is selected as the output, the foot switch mode must be “Bipolarmode”

Press key for ”Foot mode switch” and LED for “Bipolar” will be lightened.Bicut 0-70W

Type of Bicoag

Precise coag 0-70w

Standard coag 0-70W

Under Bicut mode, there is no LED illuminated because this mode has only onetype. While under Bicoag, there are different modes for various types of surgery. Under a certain mode, the relevant LED will be illuminated.

4.2.3 Output Power Adjustment

Holding the buttons for more than 3 seconds, the setting can be accelerated.The recommended operation setting power:

Cut: 30-100W. Generally, less than 70W.Coag:

20-50W. Generally, less than 60W **Attention:**

During the first time operation, please try from the lowest output.

4.2.4 Output Startup

Monopolar startup

Press the button on Hand control electrode or pedal on Foot switch to make the monopolar mode on, blue one for coag while yellow one for cut.

Press the yellow button on the hand control electrode or step the yellow pedal onthe foot switch. The LED for “monocut” is illuminated and there is a tone of 750Hz.

Press the blue button on the hand control electrode or step the blue pedal on thefoot switch. The LED for “monocoag” is illuminated and there is a tone of 250Hz. There are two channels for Monopolar output, channel 1 and channel 2.

Channel 1 can connect both hand control electrode and foot control electrode.But it is designed to accept only one electrode at a time.

Channel 2 can only connect hand control electrode.

Attention:

When monocut output is generated from one channel, only this channel has the output power. When monocoag output is generated from one channel, both two

channels have the output power. If the output from one channel is enough, please do not connect the electrode to the other channel. If the surgery does need two channels for coag, the electrodes cannot be placed inadvertently.

Bipolar startup

Step the pedal on foot switch to make the bipolar mode on, blue one for coagwhile yellow one for cut

Step the yellow pedal on the foot switch. The LED for "monocut" is illuminatedand there is a tone of 750Hz.

Step the blue pedal on the foot switch. The LED for "monocoag" is illuminatedand there is a tone of 250Hz.

4.2.5 Stop Operating

The unit stops working when the button on the hand control electrode or the pedal ofthe switch is loosened.

After operation, push the "POWER" button again to turn off the power.

Remove all the accessories. Single-used accessories should be disposed accordingto the instruction.

Reusable accessories should be sterilized.

4.3 After the Operation

4.3.1 Accessories Cleaning and Sterilization

The accessories (Hand Control Electrode, Foot Control Electrode, Forceps and Hard Patient plate) and the cords can be sterilized by 70% alcohol.

Prior to using any accessories (Hand Control Electrode, Foot Control Electrode, Forceps and Hard Patient plate) and the cords, please sterilize them by formalin vaporizing (adding $KMnO_4$ is better).

The formalin liquid: a saturation solvent of formaldehyde.Time: more than 8h.

The power supply cable, the foot switch and its cord should be kept clean.Reusable accessories, after sterilized, should be kept properly.

Attention:

When cleaning and disinfecting the accessories (Hand Control Electrode, Foot Control Electrode, Forceps and Hard Patient plate), do not soak them fully in the solvent of detergent or disinfectant.

4.3.2 Replace The Fuse

Switch off and power cord is disconnected with the machine.

After 10min power off, open the top cover of the fuse by a screwdriver.Select two fuses of the same model and insert them into the sockets. Reinstall the top cover.

5 Safety Instruction

- High Frequency Surgical Unit should only be operated by qualified, trained personnel or expert technicians. 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. Please make sure that the outer metal shell of the unit is connected to the ground to prevent risk ofelectric shocking.
- Keep away from ignitable and explosive substance. The anesthetic used by patientscannot include the ignitable and explosive element. Before the operation, please get rid of any ignitable and explosive element that may exist in the holes of the patients' body (such as rectum, vagina etc.), to prevent any burning or explosion.
- Do not operate on the patient with heart pacemaker, which may cause disorder or stop of the heart pacemaker. If the High Frequency Surgical Unit has to be used, please operate it under the requirement of the heart pacemaker.
- Avoid skin to skin contact points, e.g. arm touching body
- YR02144 cannot be used on heart directly.
- For surgical procedures where the h.f. current could flow through parts of the body having relatively small cross-sectional area, the use of bipolar techniques may be desirable in order to avoid unwanted coagulation.
- Apparent low output or failure of High Frequency Surgical Unit to function correctly at the normal operation settings may indicate faulty application of the neutral electrode or poor contact in its connects. In this case, the application of the neutral electrode and its connections should be check before selecting a higher output power.
- Advice for the users regularly to inspect the accessories. In particular, electrode cables and endoscopically used accessories should be checked for possible damageto the insulation
- Plate should be connected and placed properly. The stick area should be as large as possible.
- Do not increase the output casually. The output power must be on the proper level forbest operation effect. The limitation of the output should be according to the operationeffect. In the general operation the level of the output should be on or about 30-70W, while special operation may need higher output, but generally not beyond 200W. If the output of a special operation is much higher than general operation, please checkthe installation of the patient plate, the condition of the patient plate and the cord, the machine state, and the floated level of the patient until normal output is recovered. If you don't know the normal output 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 highoutput.
- The system of the High Frequency Surgical Unit, which is combined with patient plate,electrode, connecting cable and patient, can not come in touch with the metal. The

patients must not have metal conductor with them in operation. The operators must be equipped with the rubber gloves to prevent burns.

- To reduce the risk of interference, place the electrode or probe of other equipment asfar away as possible from the electrosurgical area. Metal electrode is not recommended in order to avoid more than one ground point.
- Place the electrode in insulated container if they are not in use. To avoid burns, the unit should not be placed on the patient body.
- YR02144 cannot be used on finger-shaped part for the h.f. current could flow through it having relatively small cross-sectional area and cause damage
- 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 should be kept away from the metal in patients' bodies for this may cause thedamage of their tissue.
- Do not touch the active electrode or patient plate by the naked part of your body for there is HF radiation on both active electrode and patient plate may pain the body.
- The accessories, including hand control electrode, foot control electrode and patient plate, are consumable components that need to be check for working condition before operating.
- Precautions to the burns of patient plate

  Patient plate burns often occurs in electrosurgery operation, the operators must properly grasp the sticking method to avoid burns.

  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.

  When fixing the hard patient plate, do not bend it. It may decrease the contacting area.

  Do not use the single soft patient plate many times; otherwise the disabled patient plate may cause burns.

  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 more safe thanthe single one.

  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.

  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 decrease the contact area.
- Precaution of burns not caused by patient plate

  Though the patient plate is in good condition that is suitable for operation, thepossibility of patient burns still exists. The main reason is that several parts on the patient body come in contact with the ground. For instance, the patient's body may

have more than two points touching the iron bed which is placed on the cement ground; The wet accessories' cord is placed on the ground and touch the patient's skin; Operators do not wear the rubber gloves, etc.

- Low-frequency

  Generally speaking, High Frequency Surgical Unit has taken measures to strictly control the low-frequency leakage current. The unit should not output low-frequency current for it is much more dangerous than the high one. But the unit can do nothing to the outside low-frequency current especially caused by the electric spark resulting from the broken of the connecting cord. Thus, it is absolutely necessary to guarantee the good condition of the connecting cord.

  Connecting wires of the active electrode and the patient plate consists of plug socket and the convert plug. If it is broken thoroughly, there is no output current through the operating part on the patient's body so that it will not cause any dangerous accident. But when the cord is partly broken, two sides of the broken point may cause the electric spark that contain low-frequency current. This current is really dangerous to the patients. 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, please check the accessories, accessory receptacles and connectingcable before operation. Moreover, correctly operate the High Frequency Surgical Unitaccording to the Instruction manual.

All of the units supplied by our company have passed safety tests and are incompliance with the national standards.

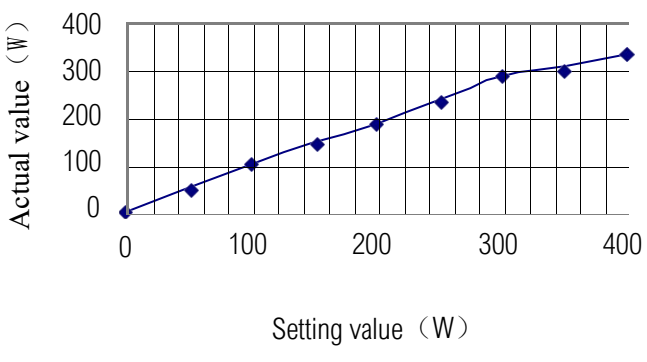
6 Technological Data

6.1 Output Parameters

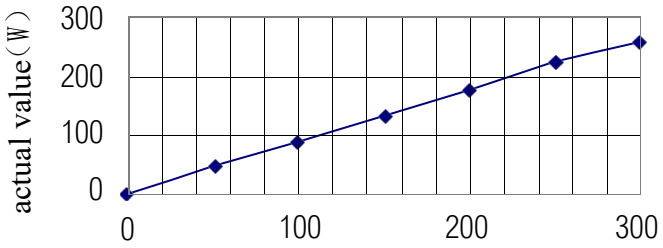
MODE		Frequency (MHz)	Power (W)	Load (Ω)	Period (μS)	Pulse width (μS)	Factor	Power testpoint (W)
Mono-polar	Pure	0.512	400	500	--	/	/	0,50,100,150,200,250，300,350，400
	Blend1	0.512	300	500	50	30	0.40	0,50,100,150,200,250，300
	Blend2	0.512	200	500	50	22	0.56	0,50,100,150,200
	Blend3	0.512	150	500	50	14	0.72	0,50,100,150
	Soft	0.512	120	500	--	/	/	0,20,40,60,80,100,120
	Point	0.512	120	500	50	8	0.84	0,20,40,60,80,100,120
	Spray	0.512	120	500	32	2	0.937	0,20,40,60,80,100,120
Bipolar	Standard	0.512	70	500	--	/	/	0,25,50，70
	Precise	0.512	70	200	--	/	/	0,25,50,70
	Bicut	0.512	70	500	--	/	/	0,25,50,70

6.2 Setting Value vs. Actual Value

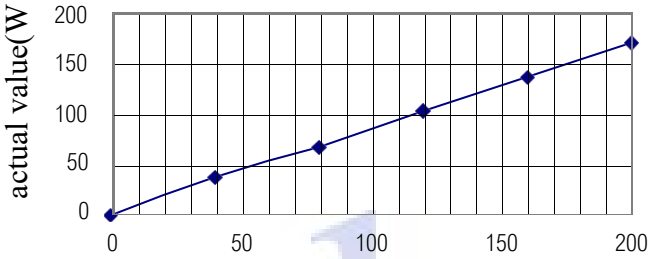
a.Pure cut



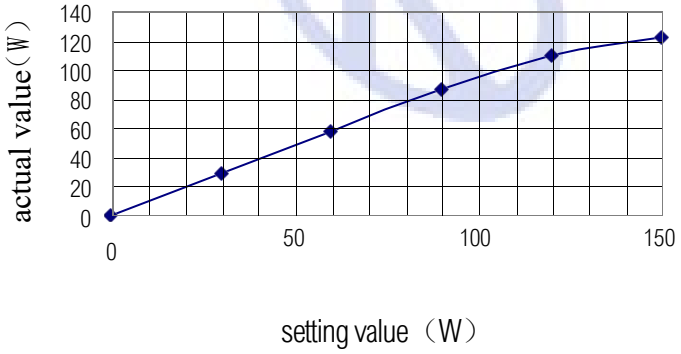
b.Blend1



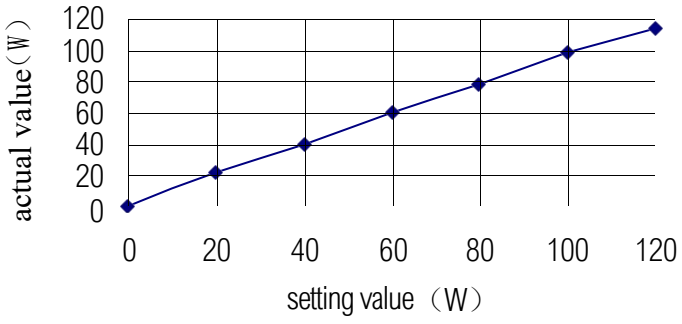
c.Blend2



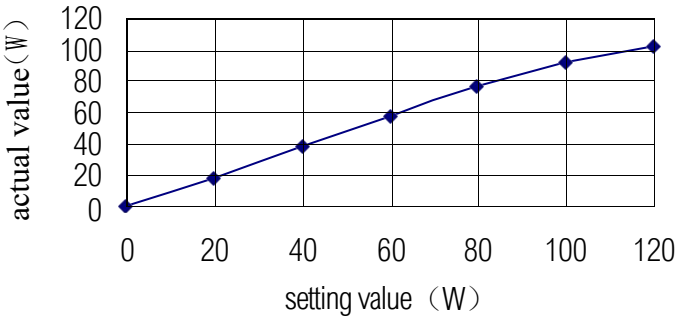
d.Blend3



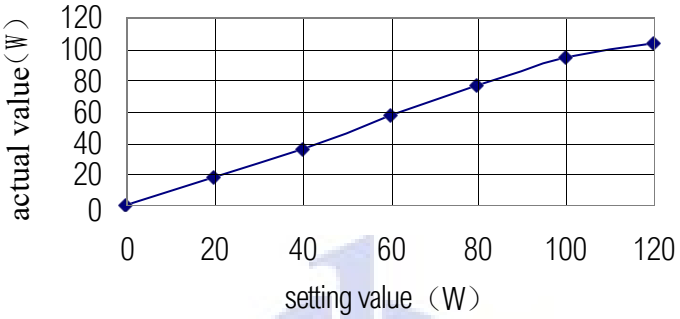
e.Soft coag



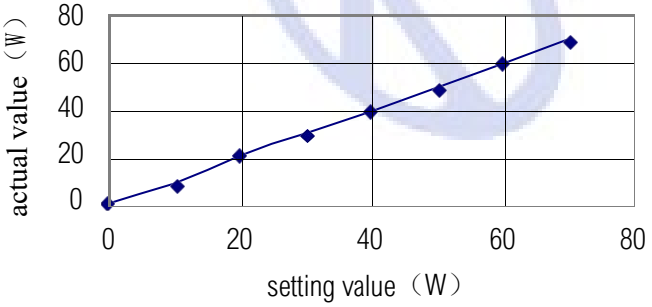
f.Point coag



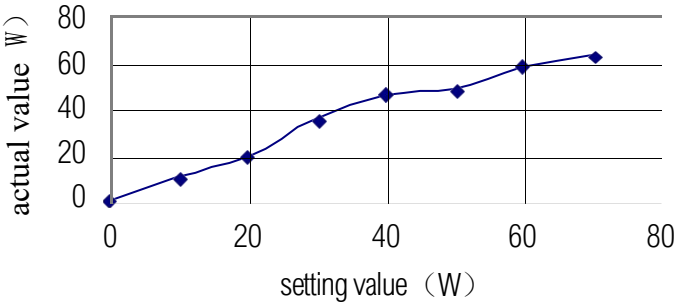
g.Spray coag



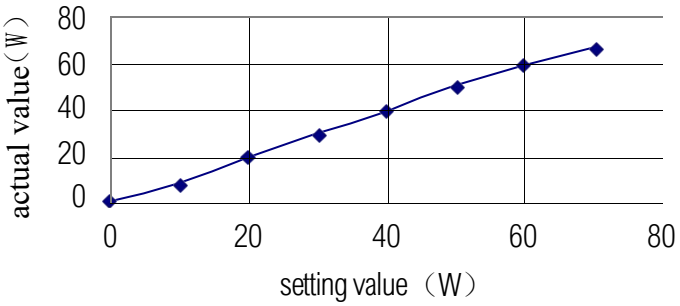
h.Bicut



e Precise coag



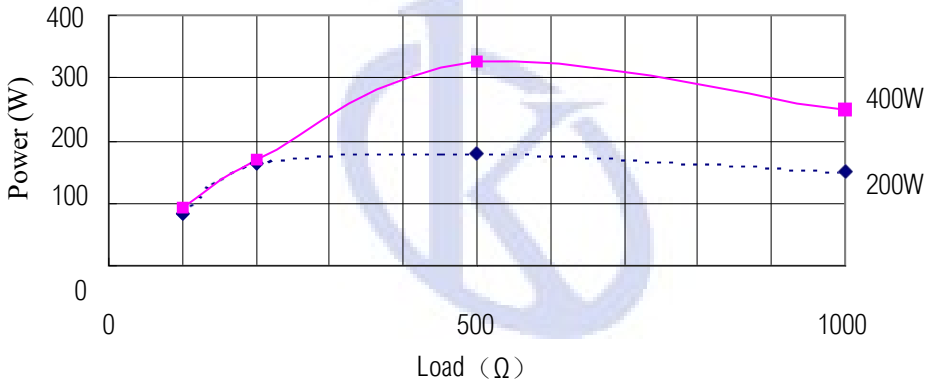
j.Standard coag



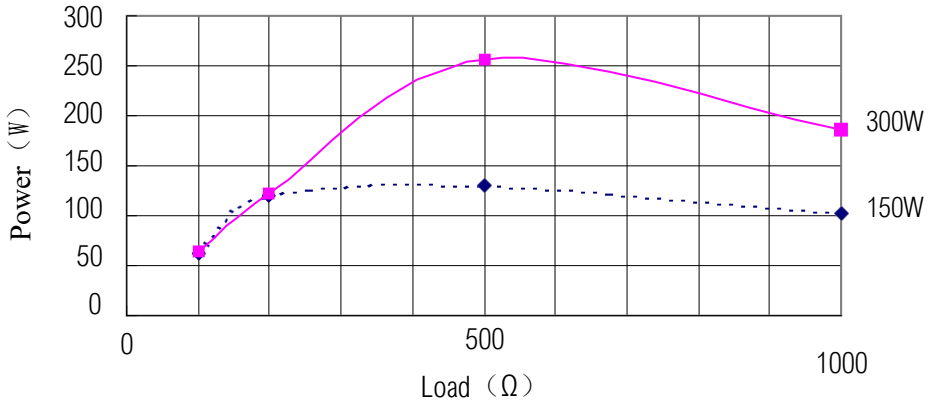
6.3 Load Power Diagram

The following figures show the relationship between the output power and the output impedance RL under all kinds of mode (the lines indicate the total output power while the dotted line indicate the half output power.)

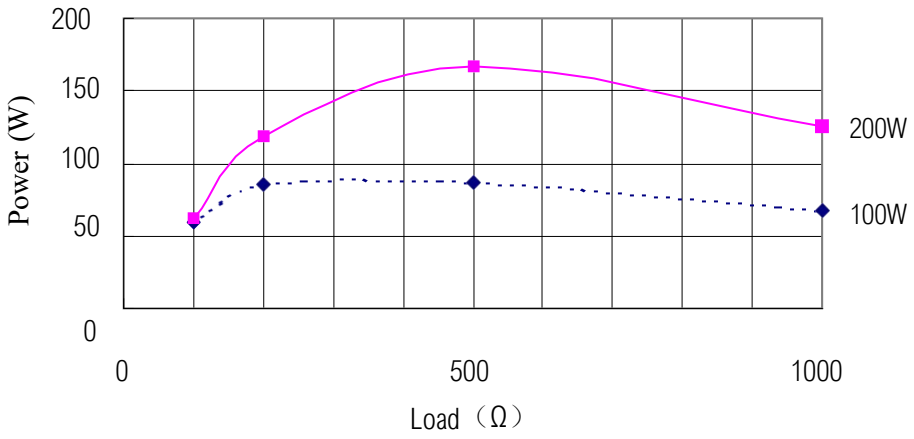
a.Pure Cut
（below 100Ω is inapplicability）



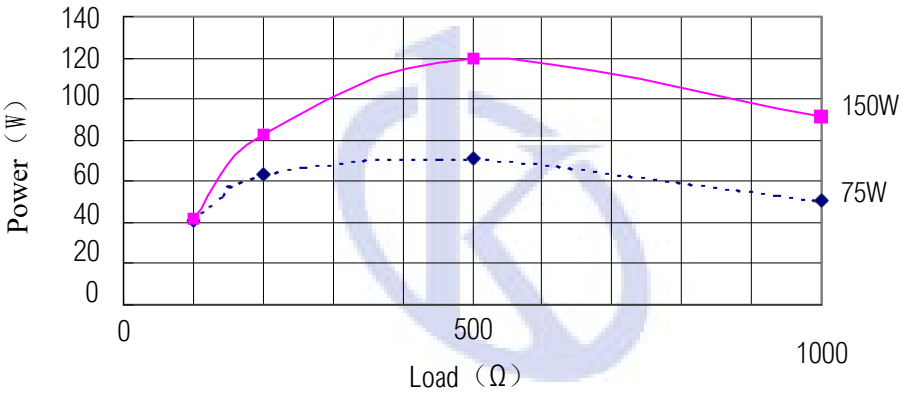
b.Blend1
（below 100Ω is inapplicability）



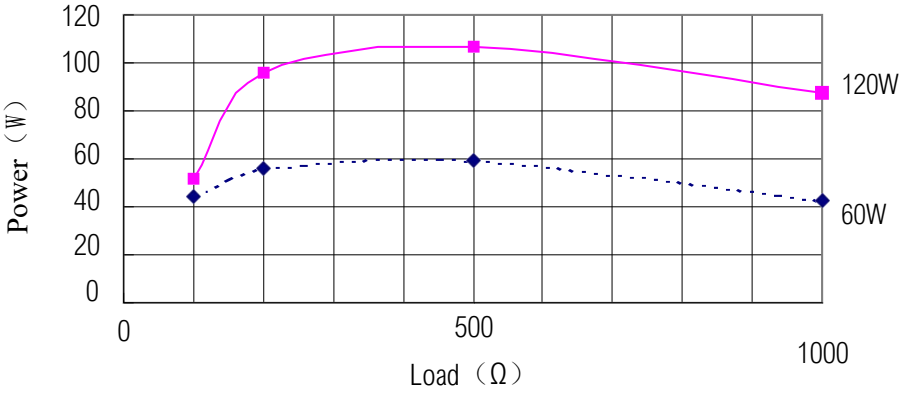
c.Blend2
(Below 100ohm is inapplicability)



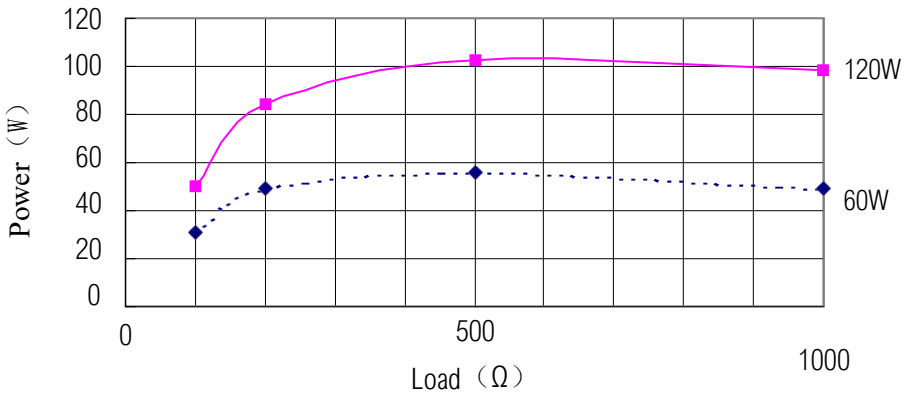
d.Blend3
(below 100ohm is inapplicability)



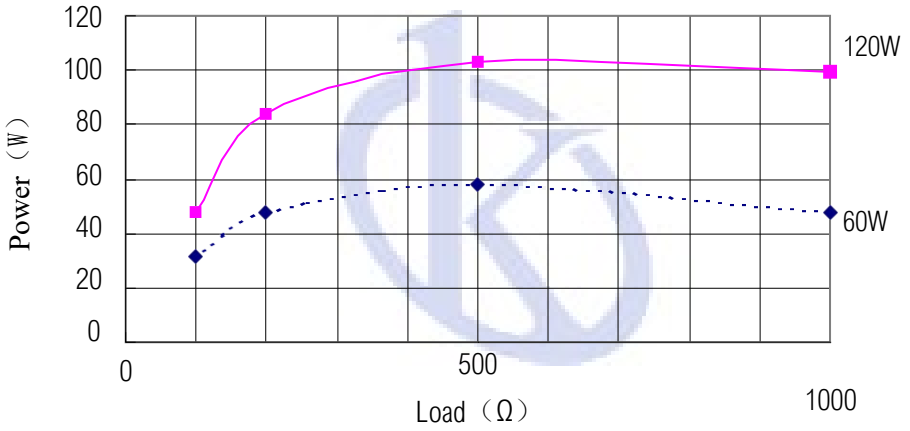
e.Soft coag
(below 100ohm is inapplicability)



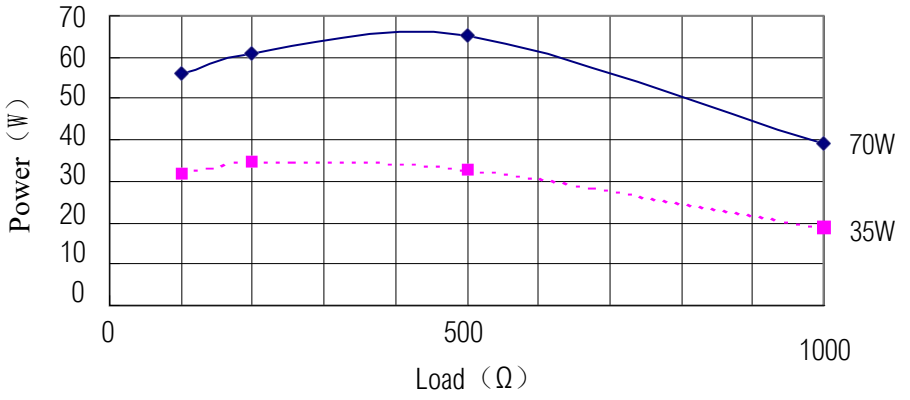
f.Point coag
(below 100ohm is inapplicability)



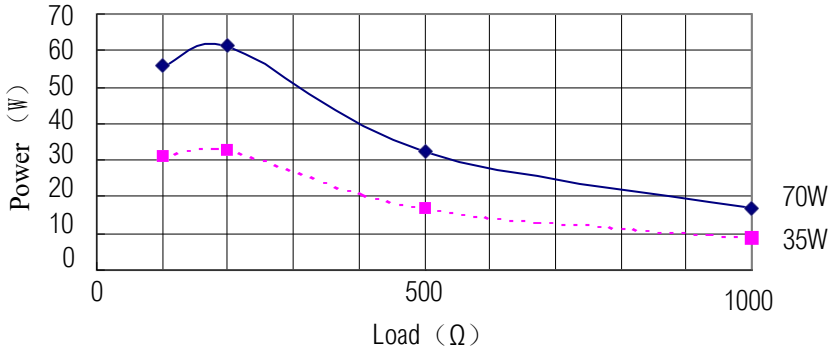
g.spray coag
(below 100ohm is inapplicability)



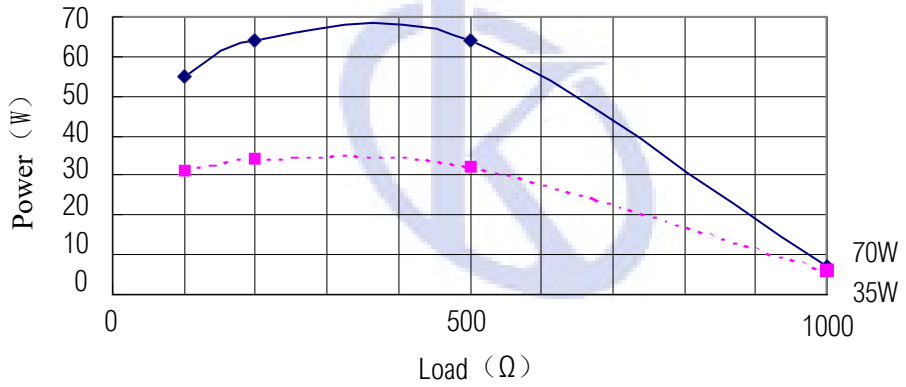
h.Bicut
(below 100ohm is inapplicability)



i. Precise coag
(below 100ohm is inapplicability)

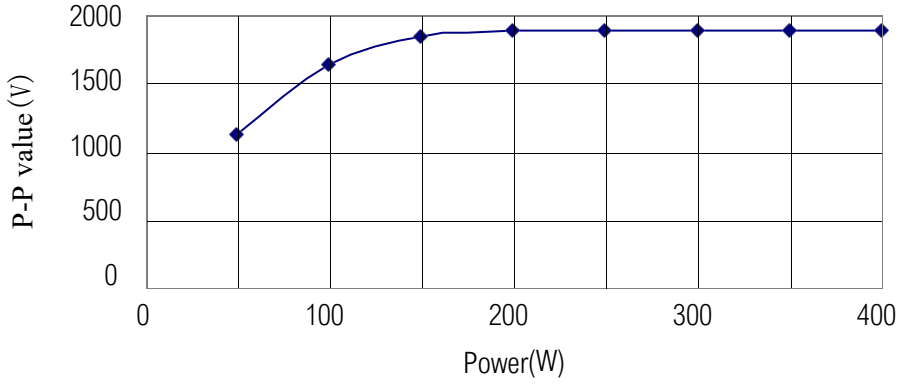


j.Standard coag
(below 100ohm is inapplicability)

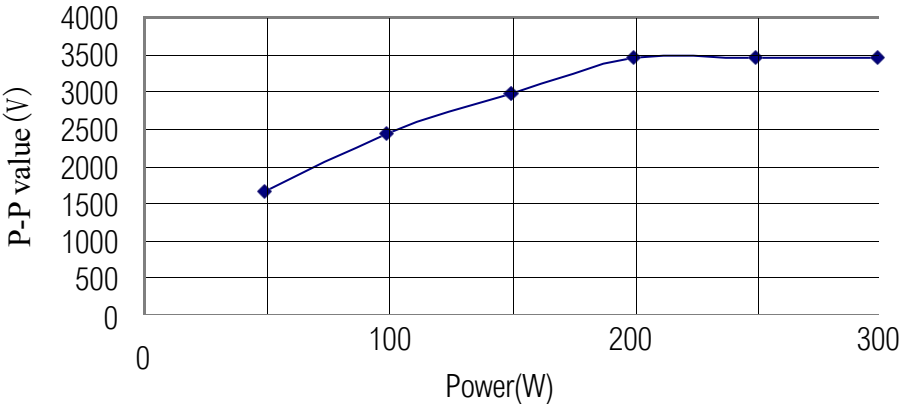


6.4 Output power vs. peak voltage

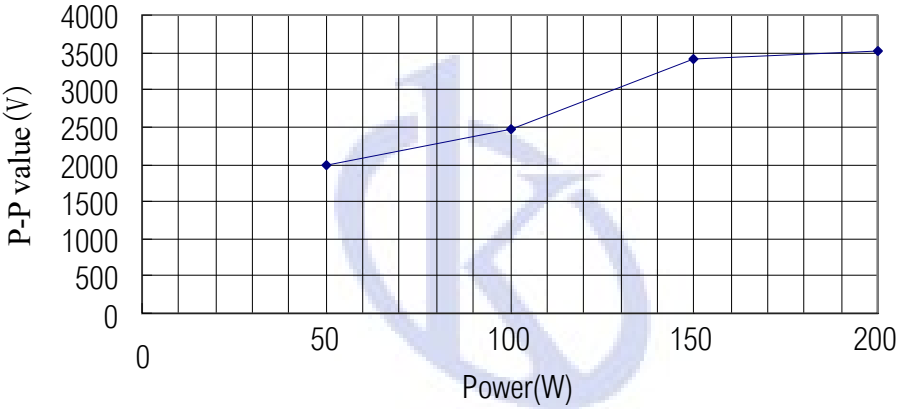
a.Pure cut



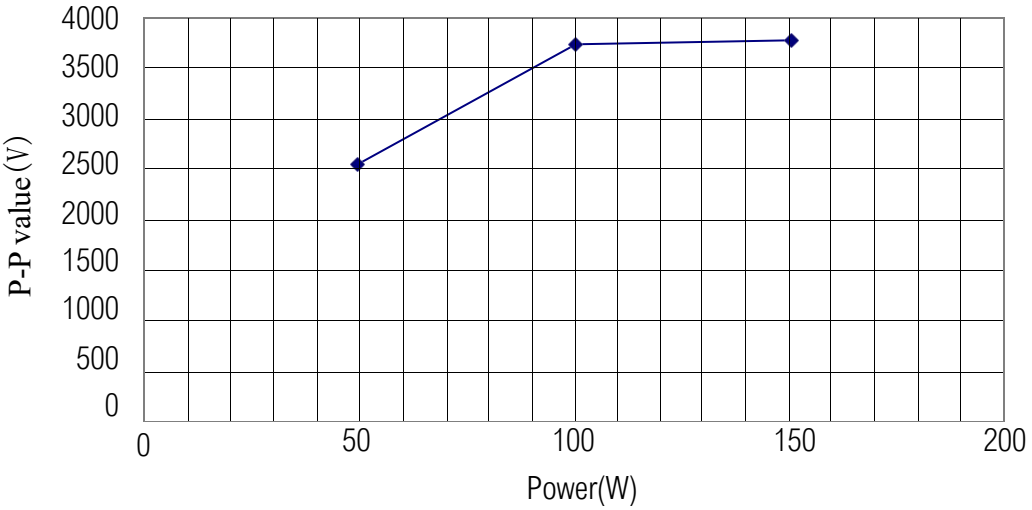
b.Blend1



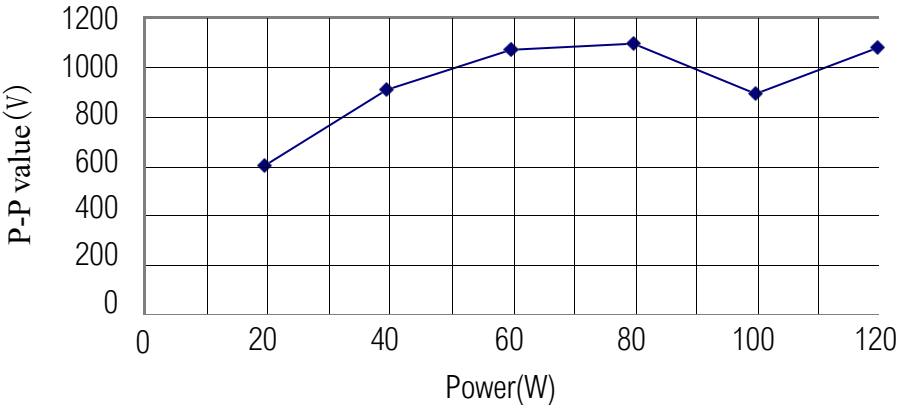
c.Blend2



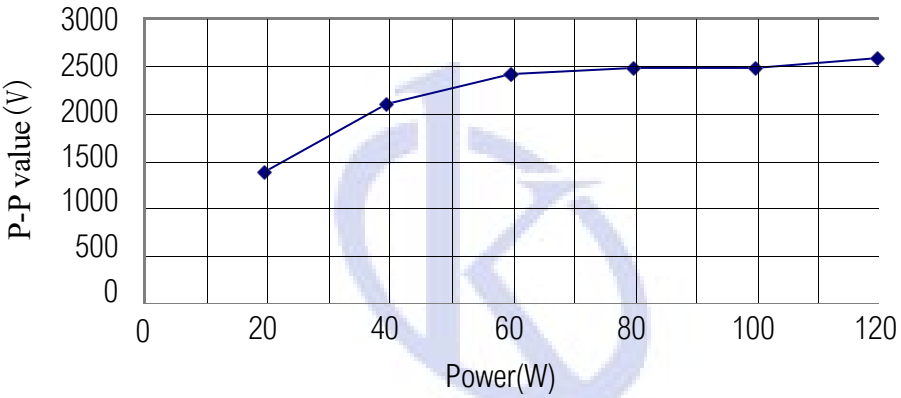
d.Blend3



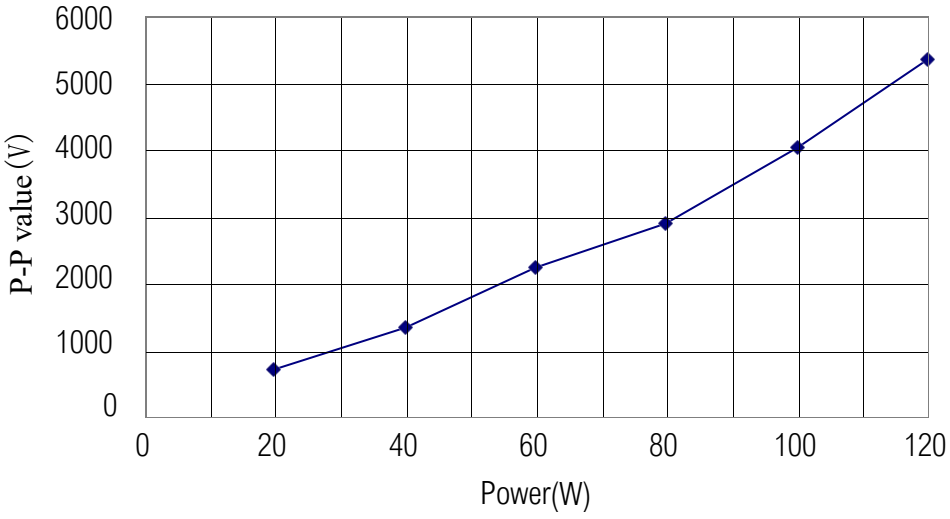
e.Soft coag



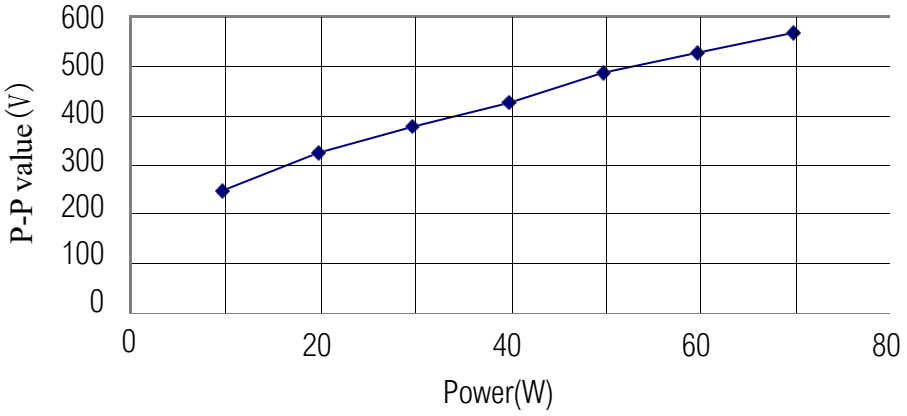
f.Point coag



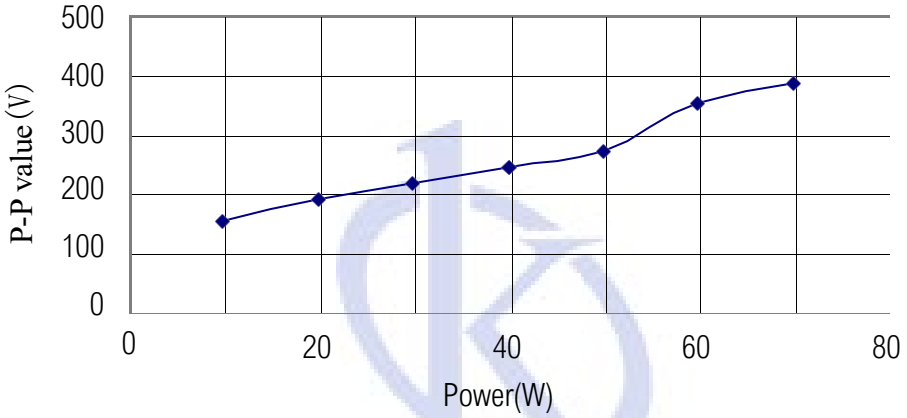
g.Spray coag



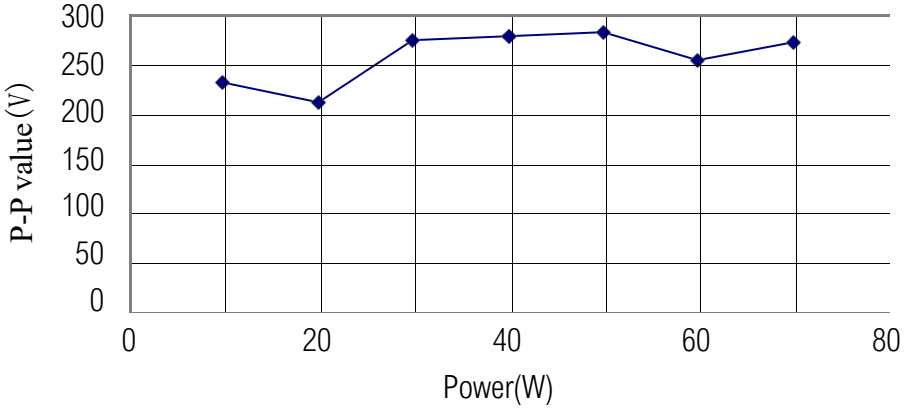
h.Bicut



i. Precise coag



j.Standard coag



6.5 Safety Standards

EB0X series according to the National Safety Standard.

High frequency leakage current : monopolar <150mA
bipolar <110mALow

frequency leakage current: ground <0.5 mA
out shell <0.1mApatient < 0.01mA

Insulation strength : application part and the power
monopolar≥5700v
bipolar≥4630V
application part and grounded shall
monopolar≥4800V
bipolar≥4000V

6.6 Product Classification

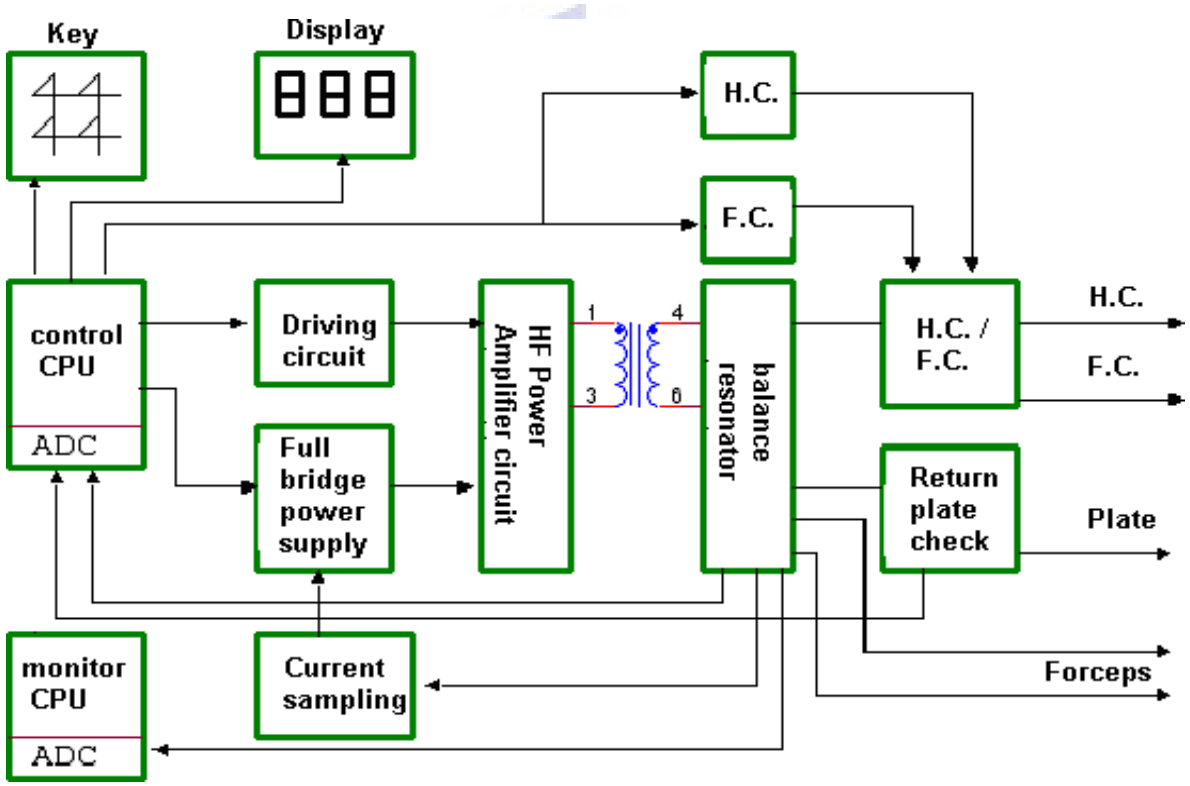
- The unit belongs to Class I
- The unit is CF type
- Power supply: AC110.
- Rate input current: 5A
- The unit has application part: output circuit of operation and neutral electrode.
- The unit is Defibrillator Proof
- The unit is of normal equipment
- Continuously running, loading by intermission duty cycle: 10s/30s
- Transportable Equipment

7 Maintenance

7.1 Routine check for accessories

- The insulation cover of the cords for accessories should not be damaged.And the cord should not have creases
- The connector of the cord should not be loose or damaged
- The cover for edge of hard patient plate should not be damaged. And itssurface should be clean

7.2 Main Unit Diagram



7.3 Theory Of Operation

After the unit power on, it is standby and the control circuit is under the operator's control, such as mode and power. In the standby or working condition, control CPU will detect the plate signal continuously. If the plate circuit is open or there is any other abnormal situation, control CPU will activate an alarm signal and forbid startup. If the plate signal is correct, control CPU will send a mode signal, a PWM signal and a sound signal to power

board (not shown in the diagram). After receiving the mode signal, power board sends a PWM of a certain duty cycle to impelling-circuit via the mode selection and generation circuit. Then, it will be converted to a power gate signal by the high-frequency transformer.At the same time, control board sends a power PWM signal to the power supply board which will provide power amplifier with a stable and insulated DC via switch circuit and high-frequency transformer. At the output end, there is a current sampling circuit. The sampling signal will be sent to the compare circuit to limit the short current.

During the procedure of output, control CPU and monitor CPU inspect the h.f. voltage, current and power signal of the output to achieve safety redundancy. And in order to promise the unit working in a safe and reliable way, the unit can keep a constant power output under different impedance via the compensation made by software.

7.4 Errors Judgment

If the unit has errors, please check it according to the following steps:

1. Please judge if the malfunction is caused by abnormal operation or the quality of the unit. e.g.: the patient plate used is not correspond to the setting(abnormal operation)
2. Please judge if the malfunction is caused by main unit or the accessories.
   e.g.: if the unit can not be activated, it is most probably caused by problem of hand control electrode.
3. Please judge if the malfunction occurs Inside or outside of the unitRefer to the table in next chapter
4. Please judge which part of inside unit is damaged. The correcting of insidemalfunction should be performed by qualified and trained personnel.

- The easy way to judge whether the unit has power output:
  Check by sparks: Touch the active electrode to the hard patient plate; if there is spark,it indicates that the unit has the output.

7.5 Warranty

Our company guarantees the quality of the main unit and foot switch.

- The warranty period for the unit is 1 year from the date of purchase.
- During the warranty period, if the disorder of the unit is caused by incorrect operationby the operator, it is not covered in our warranty.
- During the warranty period, the user must not open the cover of the unit or dismantlethe foot switch; otherwise it will too not be covered in our warranty.
- Repairing beyond the warranty period will be charged.
- To the qualified repairing company or personnel, we will offer the circuit diagram andlist of the components to them.

7.6 Routine check

- Power check (every six months)
- Low frequency leakage current: (every six months)ground <0.5
  mA
  patient <0.01mA
- High frequency leakage current (every six months): <150mA

8 Troubleshooting

8.1 List Of External Errors

Situation	Possible Reason	Recommended action
Power on but no display.	● Socket has no 220V. ● Fuse is loose or burned. ● Power switch is damaged	● Check power supply. ● Replace or tighten it. (If the problem still exit after replacement, it must bean inner problem) ● Replace the power supply module
Alarming	● The plug of the plate is notproperly connected. ● Plate cord is not tightly connected to plate conductor	● Tighten the plug and replace the plate ● Tighten single soft patient plate
Hand control electrode can not be activated	● The buttons of hand control electrode work out of order.	● Replace hand control electrode.
Foot switch can not activate the unit	● Foot switch is badly contacted ● Foot switch is not properlyconnected to the unit.	● Replace foot switch ● Tighten the connection ofthe foot switch to the unit.
The unit startups as soonas hand control electrode is inserted	● The switch of hand controlelectrode is constantly closed.	● Replace hand control electrode.
The cable of output is toohot or output power decreases obviously.	● The cable is broken or the connection is loose.	● Replace the cable or tighten it.
No output in the forcepsor the output is very low. The forceps connectingcover is too hot.	● Liquid may enter the connecting socket	● Dismantle the protecting cover and wipe the liquidoff
Cover of machine carries electricity.	● The grounding cord is not properly grounded or powercord inside the unit is loose	● Make cable properly grounded or fix the power cord.

8.2 List Of Internal Errors

Situation	Possible Reason	Recommended action
Alarm	● Plate connector is badly connected ● REM signal cable from output board to display board is loose	● Change the connector ● Tighten the connector forthe cable
Fuse on powerboard supply is blown	● IR840 is broken on the powersupply board	● Change IR840 on the board ● Change fuse
Fuse on power board isblown	● IR840 is broken on the powerboard	● Change IR840 on the board ● Change fuse
LED is not illuminated	● Power supply for display boardis damaged ● The connector from power supply board to display board is loose	● Change power supply board ● Tighten the connector
H.C. electrode cannot activate output while F.C. electrode can	● Photo Coupler for H.C. electrode is damaged	● Check and change
F.C. electrode cannot activate output while H.C. electrode can	● Photo Coupler for F.C. electrode is damaged	● Check and change
H.F. leakage current increases	● Too much dust or the unit affected with damp	● Clean, dryness
LED for startup is illuminated but there is no output	● The connector from output board to front panel is loose ● The output relay is damaged	● Tighten the connector ● Change the relay
Serious deviation of output	● Data error in EEPROM	● Change IC and re-calibration

9 Test Record Form

9.1 Test record of General Requirements for Safety

9.1.1 Test for voltage

(pass if the leakage current is 5mA and lasts for 1min, no breakdown or flicker)

Num	Test Items		Fail	Pass
1	Net power supply to earth：AC1500V			
2	Insulation part on shell to earth：4000V			
3	Monopolar electrode to earth 4700V	Hand Control Electrode		
		Foot Control Electrode		
4	Monopolar electrode to mains 5600V	Hand Control Electrode		
		Foot Control Electrode		
5	Neutral electrode to earth：4700V			
6	Neutral electrode to mains：5600V			
7	Bipolar electrode to earth：3000V			
8	Bipolar electrode to mains：4200V			

9.1.2 Test for HF leakage current (power: 242V)

Mode	Test Point	Range（mA）	Value（mA）	Pass or Fail
CUT	Hand Control Electrode	〈150		
	Patient Plate			
BL1	Hand Control Electrode			
	Patient Plate			
BL2	Hand Control Electrode			
	Patient Plate			
BL3	Hand Control Electrode			
	Patient Plate			
SO	Hand Control Electrode			
	Patient Plate			
PI	Hand Control Electrode			
	Patient Plate			
SP	Hand Control Electrode			
	Patient Plate			
BCUT		〈50		
BPR				
BST				

9.1.3 Test for LF leakage current (mA)

		Normal Status		Single Failure Status	
		Allowable Value	Test Value	Allowable Value	Test Value
Earth Leakage Current		<0.5		<1	
Enclosure Leakage Current		<0.1		<0.5	
Patient Leakage Current		<0.01		<0.05	
Patient Auxiliary Current	DC	<0.01		<0.05	
	AC	<0.01		<0.05	

9.1.4 Protective earth Resistance:_____(pass if less than0.1Ω) □Pass

9.2 Test of Plate

Plate Mode	Status	Requirement	Pass or Fail
Single Soft Patient Plate	Plate Unconnected	Alarm，All LED on	
	Plate Connected	No Alarm, All LED off	
Dual Soft Patient Plate	Plate Unconnected	Alarm, All LED off	
	Plate Connected (Short circuit)	Alarm, All LED on	
	Resistance(<9Ω) connected between plates	Alarm, All LED on	
	Resistance(9-130 Ω) connected between plates	No Alarm, 2-9 LED on	>
	Resistance(>130 Ω) connected between plates	Alarm	
	After startup cutting or coagulation, the plate resistance increased	Num of LED that are on decrease. Alarm until decrease to 30%	

9.3 Test of output current under rating load (power supply 220V)

Mode	Load（Ω）	Test point（W）	Output current（A）	value（A）	P/F
CUT	500	400	0.8-0.89		
		350	0.75-0.83-0.89		
		300	0.72-0.77-0.84		
		250	0.65-0.71-0.76		
		200	0.59-0.63-0.68		
		150	0.5-0.55-0.58		
		100	0.41-0.45-0.48		

		50	0.29-0.32-0.34		
		30	0.22-0.24-0.27		
		10	0.12-0.14-0.17		
		1-5	Normal or not		
		0	0		
BL1	500	300	0.72-0.77-0.84		
		250	0.65-0.71-0.76		
		200	0.59-0.63-0.68		
		150	0.5-0.55-0.58		
		100	0.4-0.45-0.48		
		50	0.29-0.32-0.34		
		30	0.22-0.24-0.27		
		10	0.12-0.14-0.17		
		1-5	Normal or not		
		0	0		
BL2	500	200	0.59-0.63-0.68		
		150	0.51-0.55-0.58		
		100	0.41-0.45-0.48		
		50	0.29-0.32-0.34		
		30	0.22-0.24-0.27		
		10	0.12-0.14-0.17		
		1-5	Normal or not		
		0	0		
BL3	500	150	0.51-0.55-0.58		
		100	0.41-0.45-0.48		
		50	0.29-0.32-0.34		
		30	0.22-0.24-0.27		
		10	0.12-0.14-0.17		
		1-5	Normal or not		
		0	0		
SO	500	120	0.45-0.49-0.54		
		100	0.41-0.45-0.48		
		80	0.37-0.40-0.42		
		60	0.32-0.35-0.37		
		40	0.26-0.28-0.30		
		20	0.19-0.20-0.21		
		1-5	Normal or not		
		0	0		
PI	500	120	0.45-0.49-0.54		
		100	0.41-0.45-0.48		
		80	0.37-0.40-0.42		
		60	0.32-0.35-0.37		
		40	0.26-0.28-0.30		

		20	0.19-0.20-0.21		
		1-5	Normal or not		
		0	0		
SP	500	120	0.45-0.49-0.54		
		100	0.41-0.45-0.48		
		80	0.37-0.40-0.42		
		60	0.32-0.35-0.37		
		40	0.26-0.28-0.30		
		20	0.19-0.20-0.21		
		1-5	Normal or not		
		0	0		
BCUT	500	70	0.33-0.37-0.41		
		50	0.29-0.32-0.34		
		25	0.20-0.22-0.24		
		10	0.12-0.14-0.17		
		1-5	Normal or not		
		0	0		
BPR	200	70	0.530.59-0.65		
		50	0.45-0.50-0.55		
		25	0.32-0.35-0.39		
		10	0.20-0.22-0.24		
		1-5	Normal or not		
		0	0		
BST	500	70	0.33-0.37-0.41		
		50	0.29-0.32-0.34		
		25	0.20-0.22-0.24		
		10	0.12-0.14-0.17		
		1-5	Normal or not		
		0	0		