

# Diode Laser Hair Removal Machine



## User manual



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# Preface

Welcome to use the Diode laser hair removal system produced by OUR Company. It is the high-tech product that is independently developed by our company and with independent intellectual property right.

If it is the first time that you use Diode laser hair removal system, be sure to carefully read this manual before powering on the system.

It is not suggested to use the hair removal machine with the existence of electromagnetic interference, vibration or other environmental conditions with interference. During operation, the system does not interfere other equipments/devices.

Avoid to use this system when there are the flammable anesthetics or oxidative gases such as nitrous oxide (N<sub>2</sub>O) and oxygen. When there is enough oxygen in the air, some materials such as the cotton and wool materials may easily be ignited by the high temperature resulting from the normal operation of laser equipment. The solvent and combustible solution for cleaning or sterilization purpose shall be volatilized before using laser equipment.

The abandoned components from the scrapping or replacement of this system should be delivered to the designated agency or manufacturer for joint treatment, so as to avoid environmental pollution.

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# Chapter 1: Introduction

## I. Theory

The system uses the optimal hair removal wavelength of 808nm+1064nm+755nm diode for deep penetration into the dermis where the hair follicle is located.

In treatment procedure, a series of low fluence, high repetition pulses increases the temperature of both the hair follicle and the surrounding, nourishing tissue to 45 degree Celsius. This more gradual heat delivery uses the chromophores into the surround tissue as reservoirs to effectively heat up the hair follicle. This, along with the heat energy absorbed directly by the hair follicle, damages the follicle and prevents re-growth.

## II. Application

Permanent hair removal for men and women, areas like face, arms, armpits, chest, back, bikini, legs...

## III. Specification

Laser type	Diode laser
Laser wavelength	808 nm+1064nm+755nm
Display	8.4" color touch LCD screen
Output power	1000W
Treatment laser spot	12 × 12 mm <sup>2</sup>
Pulse width	8~685ms (continuously adjustable)
Energy density	2 ~120J/cm <sup>2</sup> (continuously adjustable)
Temperature of probe	0~3 <sup>0</sup> C
Pulse frequency	0.5~10Hz
Cooling mode	Water + air + semiconductor
Dimension of device	42*63*54cm
Dimension of package	66*66*73cm
Net weight	30 kg
Gross weight	52kg
Voltage	AC 220/50Hz ; AC 110/60Hz
Packing	Aluminum alloy case

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## IV. Contraindications

- ◆ The patients with the keloid history and photosensitivity diseases.
- ◆ Having the history of skin infections or herpes simplex in the treatment region.
- ◆ Within 6 weeks, other ways for hair removal had been used.
- ◆ The patients who are allergic to hydroquinone drugs or other bleaching agents.
- ◆ Pregnant women and the patients with the malignant tumor.
- ◆ The patients with the history of taking Isotretinoin within 6 months.

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# Chapter 2: Safety Precautions

## I. Security Introduction

These who have been trained can use this system. No matter the operator , the assistant, or the maintainer need to understand this chapter well. However, people's safety is most important; it has been taken into consideration during the design process.

- a) When the device is turned on, the auto-inspection safety system is also initiated and keep working through whole treatment process.
- b) Independent safety circuit design can cut off the power supply while electric leakage happens
- c) Red "Emergency" button can cut off the power supply immediately in emergency situation.

### **【WARNING】**

Please ready following notice carefully for safe operation.

- a) Except the authorized mechanic, any others have no right to examine and repair the system, especially the inside components including electrical source, cooling system, optic organs and treatment head.
- b) Make sure the voltage is accordant to your resident voltage
- c) Maintenance must be done after turning off the machine and unplug the power cord. Or there is risk to injure people or damage the equipment.
- d) Stop turning on machine when finding slack on treatment head. If the machine is ON, turn off right now.



### **Warning**

Diode laser hair removal machine can emit high-intensity infrared laser beam, in order to protect the eyes, the users and patients are requested to wear appropriate safety goggles in accordance with (NOHD) standard.

Pay attention to the following precautions:

- ※DO NOT point the laser directly to the eyes and skin.
- ※DO NOT cut off power supply when the machine is working.
- ※Be sure to get familiar with structures and specifications of the machine before using.

## II. Electrical and mechanical safety

- a) Keep all panels and covers closed, or there may be danger.

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- b) There is high pressure inside the equipment. It's possible to deposit electricity in some parts even after switching off. So it's not allowed to open equipment except the authorized mechanics.
  - c) When do maintenance, please unplug power, cover board, and observe in person.
  - d) Moving the machine incorrectly may cause personal injury. The machine is well balanced and is movable, but only move slowly and carefully.
  - e) The machine via three-wire power cord grounding the earth, good ground is essential for safe operation.

### 【PREVENT FIRE】



- a) The temperature will raise after absorbing light energy, so please take actions to reduce the flammable risk on treatment parts or around area.
- b) Do not use ethanol, acetone or other flammable things on skin before treatment. If necessary, please use soap or water.
- c) When listerizing the treatment head or other parts with alcohol, please wait till dry.

### 【SAFETY SETTINGS】

There are some safety settings with equipment, so please know their places and using methods.

- a) **Keys:** it's used to switch ON/OFF the power, only provided by the manufacturer.
- b) **Emergency button:** the red switch is used to switch off power on emergency. Press it can switch off the power immediately. Turn it clockwise, the machine will be go on working. Or the machine keeps turning off.

### 【AUTOMATICAL INSPECTION】

After turning on the machine, the system will do an automatic inspection. About 1-3 minutes running automatically, then it enters into the next step.

### 【CLASS OF EQUIPMENT】

- a) Class: II b
- b) Anti-corrosive liquid: general
- c) Not allowed to use in the air mixed flammable anesthetic and nitrous oxide
- d) Operation manner: continuous operation

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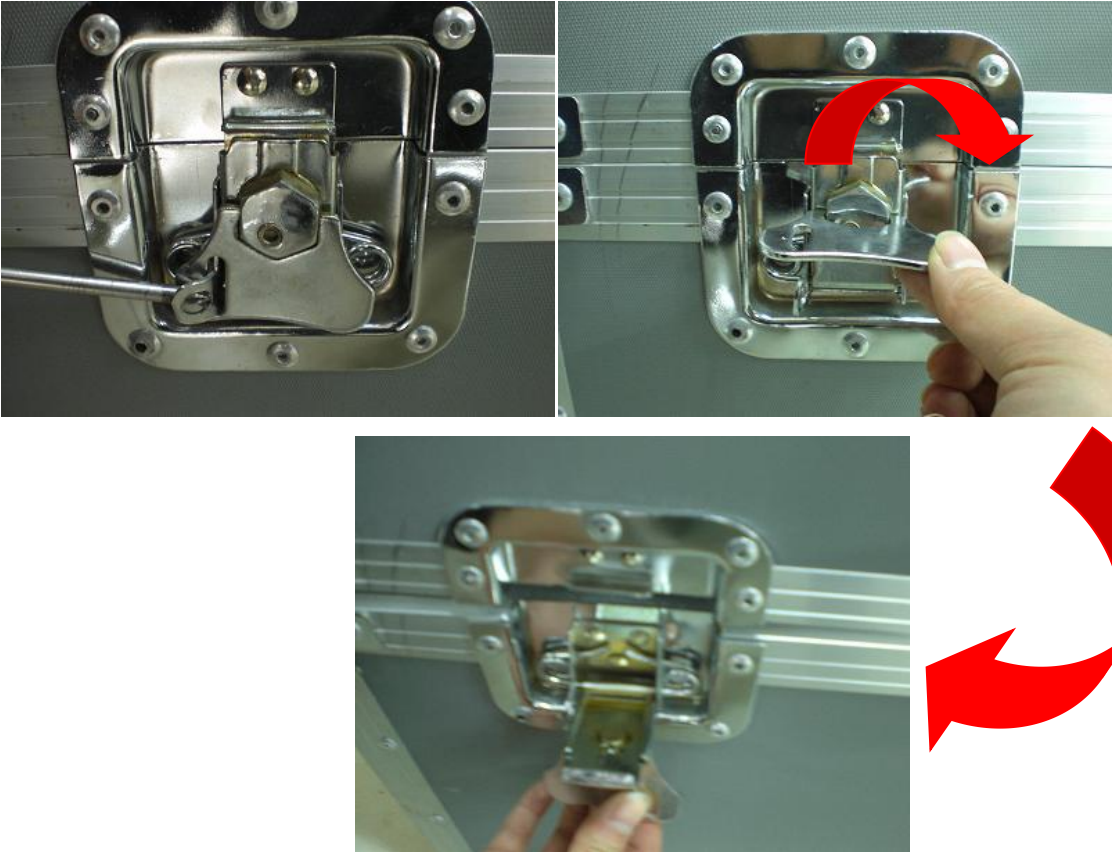
# Chapter 3: installment

## I. Packing box

The package when you received is same as shown in the photo. If any damages happened during transportation, please contact us or carrier immediately!



*How to open the box?*









## II. Accessories

The following are the main unit and accessories of Diode Laser Hair Removal Instrument:


c	Name	Photo	Qty.
1	Handpiece & holder		1 set
2	Foot switch (IPX1)		1 pc
3	Safety eyepatch for patient		1 pair
4	Safety goggles for operator		1 pair
5	Remote interlock switch		1 pc
6	Water filter core		2 pcs
7	Power cord		1 pc

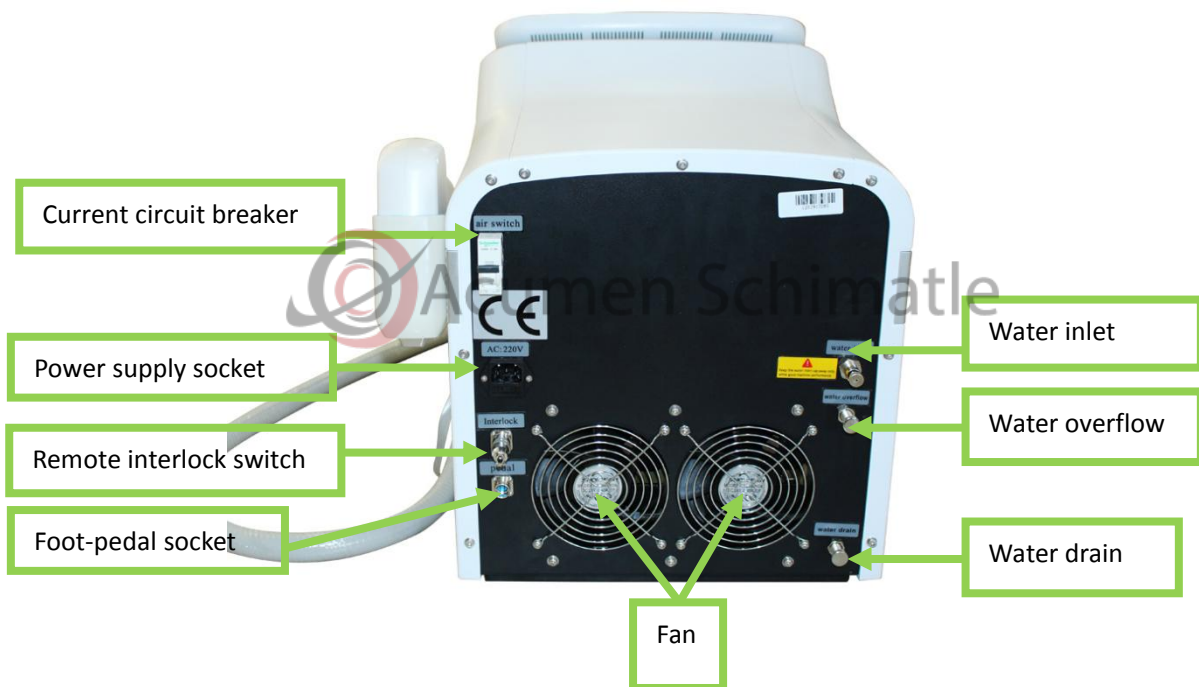
8	Water funnel & pipe				1 set
9	Water connector				2 pcs
10	Short circuit clip				1pc
11	keys				

Please check up whether the accessories are complete, if the accessories have lost in transportation, please contact us immediately. We will offer help at the first time.

### III. Main machine



 When the handpiece is pulled off machine, please short-circuited the two pins with the red clips because the static electricity may affect using life of diode laser.



## IV. Installation

Installation and debugging of the device must be performed by professional technical personnel who have been trained by equipment manufacturer and are approved to be qualified.

### CAUTION

- ◆ Do not install the product in the oily, smoky, damp and dusty area or the area which is easy to get splashed by water(rain)
- ◆ Install the product on a level area
- ◆ Do not bend the electrical cord or accessories using force or place a sharp or heavy object on them. (There may be a risk of electrical shock or fire.)
- ◆ Do not plug several power cords of electrical appliances into one receptacle at the same time. (There may be a risk of fire.)
- ◆ Check out for the rated voltage when you install the product. ( There may be a risk of circuit damage or file unless the rated voltage is not used.)
- ◆ The person in charge of the handling the appliance should be familiar with all safety regulations.
- ◆ Every accessories needed to plug in with accurate postion
- ◆ Problems occurring due to carelessness in using or managing the system in the middle of using it are excluded from warranty coverage for service.

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### **Working conditions**

- a) Ambient temperature range: 16°C~28°C;
- b) Relative humidity range: ≤80%;
- c) Atmospheric pressure range: 860hPa~1060hPa;
- d) Power supply: 220V+10%, 50Hz; or 110V+10%, 60Hz

### **Transportation and storage conditions**

- a) Ambient temperature range:-10°C~60°C;
- b) Relative humidity range: ≤100%;
- c) Atmospheric pressure range: 500hPa~1060hPa.

### **Installation procedures:**

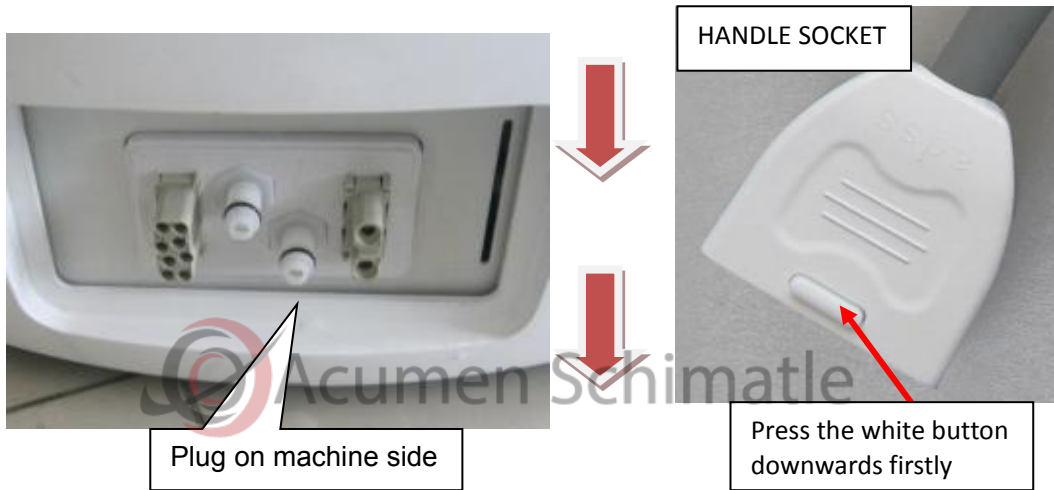
1. Place the appliance in the special working area as above requirements.
2. Mount the handpiece holder on main machine with screws



3. Plug in the handle connector on main machine and ensure good connection

#### **Methods:**

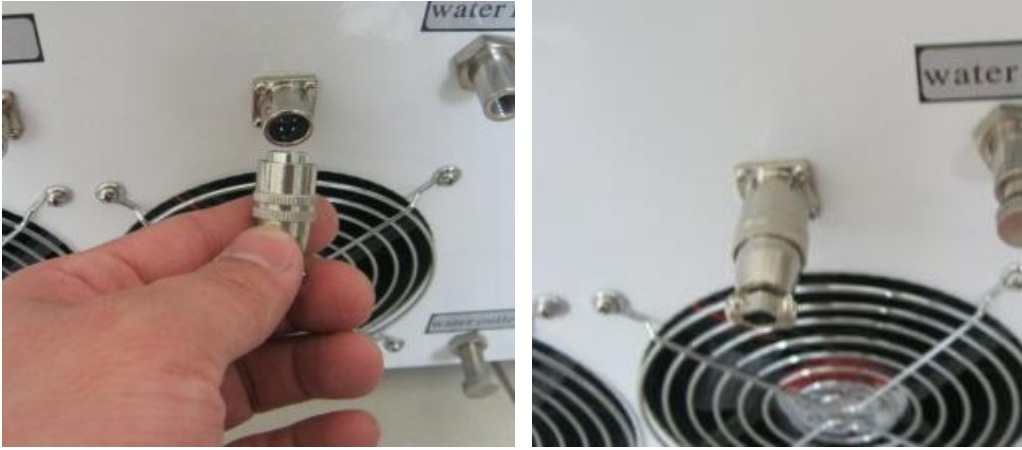
- a) press down the button on connector
- b) plug into the socket on main machine until you hear click sound, the button bounce back



Plug the handle socket downwards till one "click" sound, means good handle connection.



4. Plug in the Remote Interlock Switch



5. Plug the foot pedal into the socket marking "foot pedal"



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6. Add water into machine

- a. Water Source: deionized water ( PH value of water 5.5-8, hydronium water resistance:  $5M\Omega/cm^2$ ) or distilled water
- b. How to add water? (CAUTION: please change water every 1-2 months approximately.)



**Screw off the caps of water inlet and water overflow**



**Connect the tube and funnel**



**Start to add water, please use DEIONIZED WATER or DISTILLED WATER only**

**Water spilt from this socket means enough water**

**Notice:**

- ◆ After adding water, please do not screw on the caps immediately. Turn on machine to make water run inside and let air exhaust, then screw on the caps of water overflow, but leaving the faucet of water inlet still open !
- ◆ Under transportation, water must be drained and all caps have been screwed on!

7. Connect power cord with device and plug into a wall socket with grounded
8. Check the Emergency button is in release state
9. Switch on keys, the device is powered on.

Waiting for a few seconds, the device will automatically complete preheating and enter into operation interface. (If there are problems in the cooling system, the temperature can't be controlled to the preset temperature; this condition is regarded as faulty. The appliances can't enter into operation interface and will always remain at the initial startup image).





## WARNING

- ◆ If you have any problems with this product, immediately stop using it and contact us.
- ◆ Do not put any inflammables on the product.
- ◆ Do not disassemble, repair or remodel the product at discretion of a user. Please contact us for help to repair it. (There may be a risk of electrical shock or fire).
- ◆ Please contact us for a check or repair of the product for the following cases:
  - ◇ There is damage on a cable or plug, and the product doesn't work properly
  - ◇ The product was dropped and damaged
  - ◇ the product is wet with water.
- ◆ Please insert a plug in a wall socket with grounded
- ◆ Do not use a damaged electrical cord or aged receptacle. (There may be a risk of electrical shock or fire)
- ◆ Do not give a shock to the product or accessories
- ◆ If the output laser is too weak, or there is something wrong with laser output, turn to professional technical personnel for debugging. Do not debug the appliance without permission so as to prevent eye or skin from being damaged by laser radiation or scattered radiation.

# Chapter 4: Operation Instruction

## I. User Interface



1. Touch the **Women** or **Men** picture, go into below interface.

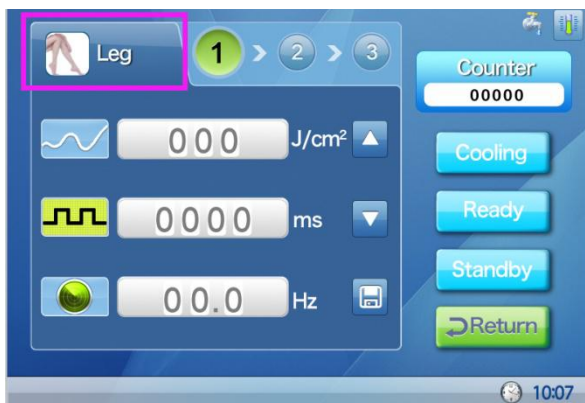


**For women**

**For men**

**Optional 6 treatment menus:**

**a. For women:**





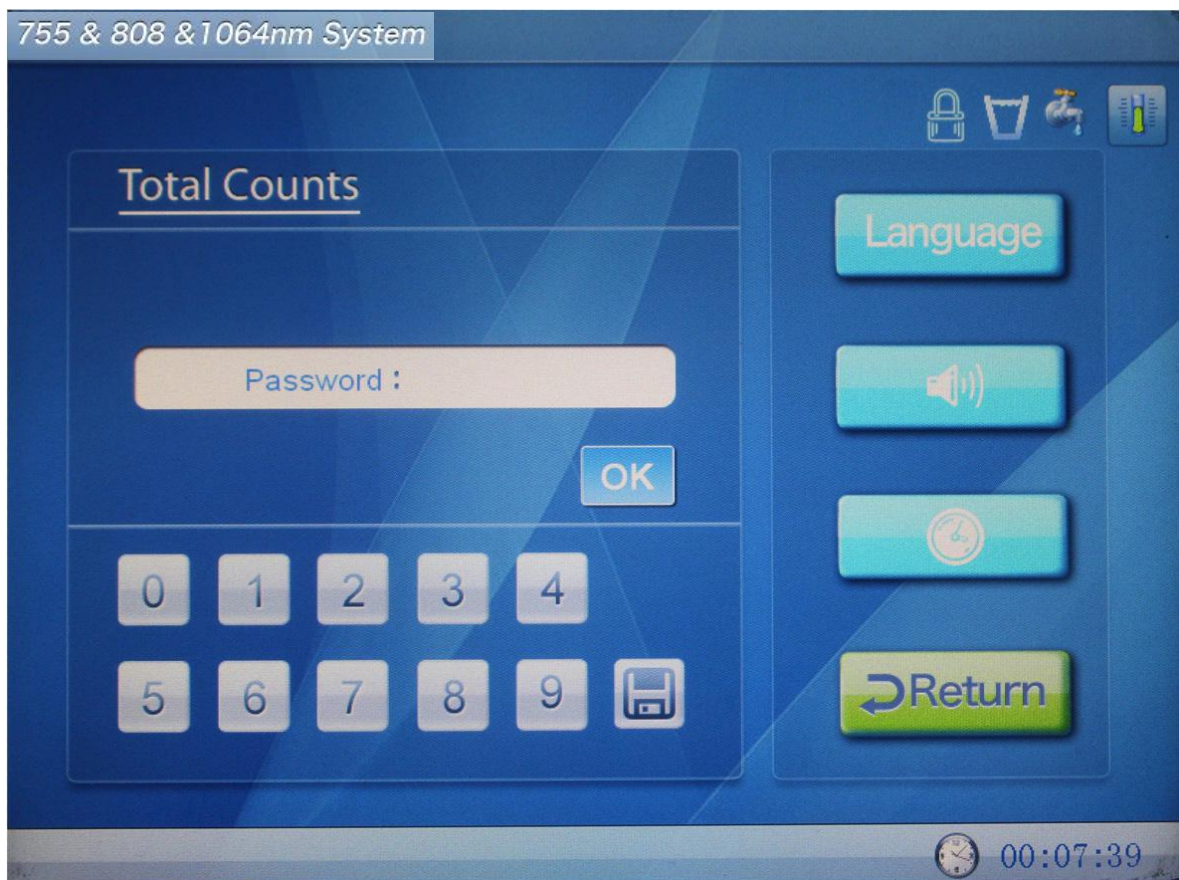
**b. For men:**







2. Touch “**Setting**” button, you can enter system setting interface



## II. Setting Instruction

### 1. Faulty Alarm Indication





From left to right: **alarm for interlock, water lever, water flow, water temperature.**

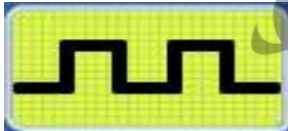
Any abnormal condition, it will alarm automatically at the first time and stop all working immediately.


### 2. Parameters Setting


Parameters can only be set under standby mode!


 Save 3 groups of parameters


 Fluence, range 1-120J, step 1J  
Touch this button first, then touch up & down arrow to increase or decrease fluence


 Width pulse, range 8-685  
Touch this button first, then touch up & down arrow to increase or decrease width pulse (this setting is self-matching with fluence)


 Repetition Rate: 0.5-10Hz  
Touch this button first, then touch up & down arrow to increase or decrease repetition rate


 Up & Down arrow to increase or decrease Fluence, Width pulse, Repetition rate


 Save the parameter settings


 **Counter:** shots counter for each switch ON/OFF

 **Cooling:** once you touch Ready, Cooling is activated automatically

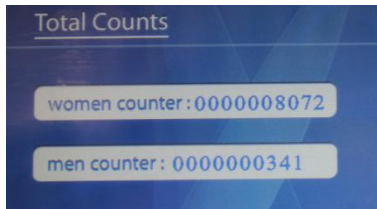
 **Ready:** touch Ready, the appliance enter the ready state

 **Standby:** touch Standby, the appliance enter the standby state

 **Return:** touch Return back to last interface

 Cooling for machine

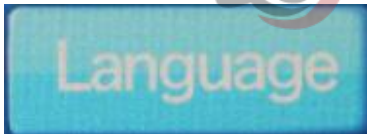
### 3. System Setting



Total counts for Women treatment and Men Treatment



Number input keys and save button



Standard language English, can't change

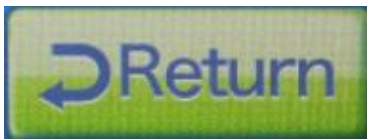


Touch-tone ON/OFF



Clock setting, Methods:

1. Touch clock button, use number keys to input hours and save
2. Use number keys to input minutes and save
3. Use number keys to input seconds and save



Back to last interface

### III. Shutdown

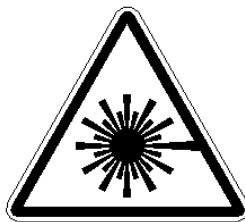
**After all operation, please shut down the appliance as per below procedures:**

1. Touch the "standby" button
2. TURN OFF the key and keep it separately in order to prevent any unauthorized use by other person a
3. Keep the power cord separating it from the socket

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## Chapter 5 Clinical Application



**Warning:** please use the device after careful reading of the User Manual before operation!



### **DANGER**

- ◆ Do not put the handpiece to people's eyes directly to prevent from eye damage
- ◆ Be careful not to directly look at the light and lest it be reflected on the reflective surface
- ◆ In order to prevent the emitted or reflected light from being exposed accidentally, all persons in charge who are using this system should be sure to wear the protective glasses.
- ◆ Also be careful lest the light face eyes. Even in case that the output is low, you may suffer a fatal eye injury.
- ◆ Do not pull the power cord using force or touch the power plug with a wet hand. ( There may be a risk of electrical shock or fire).
- ◆ Stop using the product and unplug the power cord immediately when there is thunder and lightning or an earthquake. ( There may be a risk of electrical shock or fire)
- ◆ Dangers of explosions and fire
- ◆ Do not operate the device in a place where there are volatile substances like ductile anesthetics, alcohol, gasoline or solvents
- ◆ We recommend you to use nonvolatile substances or tools, if possible
- ◆ Always keep a fire extinguisher near the device

It requires an experienced therapist to use it and also patient cooperation for getting good results.

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## I. Before treatment

- ◆ The first step in the treatment procedure is asking whether your patient has taboos (specified in Chapter 1) and did below things which decrease either the safety or effectiveness of their treatment.
  - a) Tanning should be avoided for 3-4 weeks prior to treatment. During the course of treatment, if a patient is exposed to sun, sunscreen with an SPF of at least 30 applied as a thick layer 20 minutes before sun exposure is recommended.
  - b) Patients should not wax, tweeze, bleach, thread, or use depilatory agents for 4 weeks prior to treatment. If facial hair is being treated, usually avoidance of these methods for only 2 weeks is necessary because facial hair grows faster. If a form of hair removal is necessary, shaving or clipping can be done because these methods allow the hair to stay in the follicle. It is usually advisable to see some hair growth on the day of treatment.
  - c) Lotions, creams, makeup, and deodorant should be removed before treatment as well. These can obstruct or refract laser light negatively.
  
- ◆ Evaluating your patient. Observe and document your patient skin color, hair color, hair type, hair density, and the treatment area.
  
- ◆ Discuss the treatment goals with your patient and establish realistic expectations based on the treatment area, her hair color and hair type. If your patient has fine, light colored hair, explain to her that it may take longer to achieve desired results.
  
- ◆ Be sure to photograph your patient's treatment area before the first session in order to establish a baseline. It's important to rephotograph the patient before subsequent treatments in order to document the results achieved.
  
- ◆ Explain to your patient that during the course of the session, she may feel a gradual build-up of heat into the area being treated.
  
- ◆ Have your patient lied down, then shave and white clean the area to be treated. Using a red skin marker draw grids of boxes of approximately 10 by 10 cm or 4 by 4 inches in size on the entire treatment area. For larger areas such as the chest or back, draw grids of 5 by 10 cms or 2 by 4 inches. Apply a thin layer of pre-cooled ultrasound gel to a section of treatment area that includes at most 4 grids, the maximum area to be treated at a time.



## II. Starting treatment

- ◆ For eye protection, the last step before starting the laser treatment is to ensure that the treatment room door is locked, and that you, your patient and anyone else in the treatment room has put on protective eyewear.
- ◆ Let's set the system parameters to start treatment. We suggest you do a patch test with following method to get the appropriate parameters for each patient because each person has different skin impedance even same skin type

### How to get appropriate parameters?

- a) **Fluence** is the joules per square meters. Start from 5J to do patch test, if patient feels a gradual build-up of heat into the area being treated, the joules are right for doing treatment. If patient feels nothing, you need to rise the joules by 1 or 2 steps. (when you rise joules by one step, if patient feels a little hot, you can pass the handpiece over treated area faster or decrease width of pulse a little bit, so patient feels comfortable.)
- b) **Pulse width** is how long time one pulse working on skin. E.g., 10ms means light lasting 10ms on skin. When you rise joules, pulse width may also rise itself to match.
- c) **Frequency** is repetition rate, means you press the trigger, how fast the shots are coming out. 3Hz means 3 shots per second. We suggest you use 3-5Hz. If you use it higher, you have to pass the handpiece quicker on skin, otherwise the shots overlapping on same area, patients may feel uncomfortable.

	Joules	Width of pulse	Frequency
Range	2J	8-12ms	0.5-10Hz adjustable
	3J	11-17ms	
	4J	15-23ms	
	5J	19-29ms	
	6J	23-35ms	
	7J	26-40ms	
	8J	30-46ms	
	9J	34-52ms	
	10J	38-58ms	0.5-8Hz adjustable
	11J	42-62ms	0.5-8Hz adjustable
	12J	46-68ms	0.5-7Hz adjustable
	13J	50-74ms	0.5-6Hz adjustable
	14J	54-80ms	
	15J	57-85ms	
	16J	61-91ms	0.5-5Hz adjustable
	17J	65-97ms	0.5-4Hz adjustable
	18J	69-103ms	
	19J	72-108ms	
	20J	76-114ms	

	21J	80-120ms	0.5-3Hz adjustable
	22J	84-126ms	
	23J	88-132ms	
	24J	91-137ms	
	25J	95-143ms	
	26J	99-149ms	
	27J	103-155ms	
	28-42J	106-240ms	0.5-2Hz adjustable
	43-84J	164-480ms	0.5-1Hz adjustable
	85-120J	324-685ms	0.5Hz

**Notice:** Dark skin absorbs light easily, please always start fluence from low setting!

**Parameters Recommendation:**

		Face	Armpit	Arm	Body	Bikini	Leg
<b>Woman 1</b>	J/cm <sup>2</sup>	5	6	8	8	4	8
	MS	19	29	38	38	19	38
	HZ	2-3	2-3	3-4	3-4	2-3	3-4
<b>Woman 2</b>	J/cm <sup>2</sup>	8	9	12	12	5	12
	MS	38	38	52	52	19	52
	HZ	3-4	3-4	4-5	4-5	2-3	4-5
<b>Woman 3</b>	J	8	10	14	14	6	14
	MS	38	38	67	67	29	67
	HZ	3-4	3-4	4-5	4-5	2-3	4-5
<b>Man 1</b>	J	6	8	10	10	5	10
	MS	29	38	38	38	19	38
	HZ	2-3	2-3	3-4	3-4	2-3	3-4
<b>Man 2</b>	J	9	9	13	13	6	13
	MS	38	38	52	52	29	52
	HZ	3-4	3-4	4-5	4-5	2-3	4-5
<b>Man 3</b>	J	10	10	15	15	8	15
	MS	38	38	67	67	38	67

	HZ	3-4	3-4	4-5	4-5	2-3	4-5
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**Notice: 1 is for black skin, 2 is for other skin, 3 is for white skin.**

These parameters for your reference only. Please always start 5 and increase accordingly as per patients' feeling.

- ◆ The first step in the treatment is to apply the handpiece to the treatment area and ensure there is complete contact with the patient skin. With your foot holding on the foot switch, and press the trigger on the handpiece to initiate release of energy.

**Treatment Method:**

Starting at the top left corner, immediately perform one pass of horizontal sweeping paintbrush movements over the treatment area. Then release the trigger, reposition the handpiece at the top left corner and perform one pass of vertical sweeps over the area. The sweeps should be performed at the rate of 5 centimeter or 2 inches per second as demonstrated. Repeat this until you see below skin signs.

- ◆ Observe the treatment area for signs of skin erythema, Perifollicular erythema and possible edema. If these are apparent, you have reached the endpoint of treatment. You can reassure the patient that this redness and swelling is normal, and would disappear within a few hours. If the signs are not visible, as maybe the case with the fair skin and light color hair, immediately perform more sweeps over the area.
- ◆ Gently remove the ultrasound gel from the treated area, and apply Aloe Vera gel to enhance healing.
- ◆ Apply ultrasound gel to the next 3 or 4 grids, and continue treatment until you completed the entire treatment area.
- ◆ After treatment, take soft gauze mat for to clean handpiece 100% and keep it dry.

### III. Post treatment

Instruct your patients that:

- ◆ In order to avoid hyper or hyper pigmentation, your patient should apply sun cream (SPF 30 plus) daily on the treatment area, and from sun bathing and tanning bed for 3 weeks.
- ◆ your patient should also avoid solars, hot bathes, and other leisure activities which can increase skin temperature for a period of 2 days following the treatment.
- ◆ if your patient had the treatment done on the face, he can put makeup on almost immediately unless

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there is blistering. If he do use makeup, make sure it is new makeup to prevent any sort of infection and make sure he has moisturizer under the makeup. The moisturizer will help his skin heal.

- ◆ your patient can shower but he should make sure that he gently wash with a mild soap. If he had her underarms treated, do not put on deodorant for the first 24 hours at least, ideally use a powder instead of deodorant for 24 hours after the treatment to reduce skin irritation.
- ◆ we recommend avoid clothing that is tight or coarse and lightly to cause friction with skin for 2 days following treatment.
- ◆ your patient should expect to observe some normal shading of hair in the treatment area within 7 days. Emphasize to him that he observes any regrowth of individual hairs, he should not remove them by plucking, tweezing or any other means during the entire course of treatment.

## IV. Sessions

Hair grows in three cycles, anagen (active growth phase – laser hair removal only affects this stage), catagen (regression phase) and telogen (resting phase). At any one time, only a certain percentage will be in the anagen phase (approximately varies from 10 to 25%), which is the reason why you need multiple treatments.

For large treatment areas, the interval between treatments should be 6-8 weeks. While for small treatment areas, the interval should be 4-6 weeks. The average number of total treatments is between 6 and 8.

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# Chapter Six: Working Principle



## I. System Principle

Diode laser hair removal machine is a device which adopts the high-energy and continuous diode laser to realize the conversion of electricity, light and heat energy, and thus achieves hair removal treatment. Therefore, this is a laser therapeutic product that integrates laser technology, electronic technology, computer science and medical science.

Working principle of diode laser hair removal machine is as follows: under the control of microprocessor, laser power supply can provide the adjustable constant current for the laser module, the high power laser diode in the laser module can transform the electric energy into the light, generate the continuous laser beam with a wavelength of 808nm. Through the light crystal, the laser beam can irradiate the tissue to be de-haired, pass through the external layer of skin and arrive the roots of hair follicles, the light energy is absorbed and converted into the thermal energy for destroying hair follicles, so that make the hair to be lost and lose the regeneration capacity, reaching the permanent hair removal purposes.

Parameters that needed in the treatment course, such as laser energy density etc, shall be set by users according to actual conditions.

## II. System composition

Diode laser hair removal instrument is composed of the power system, microprocessor control systems, and operational display systems, cooling systems, laser module and the security alarm system, as shown in Figure 1.

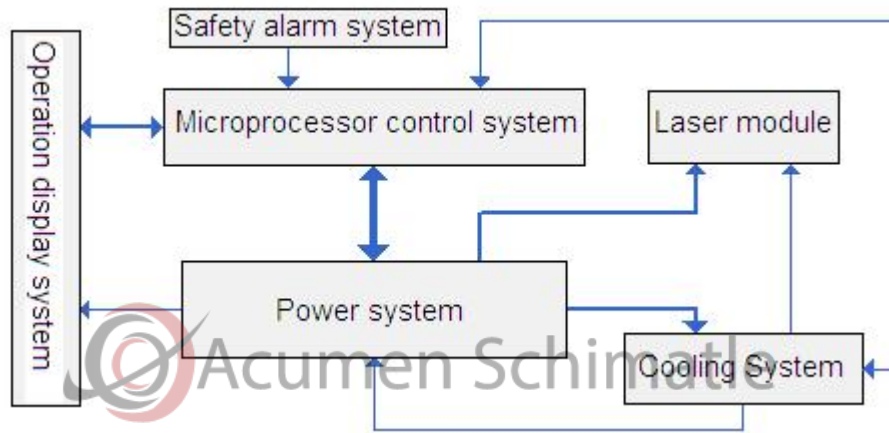


Figure 1 System block diagram for Diode Laser Hair Removal Instrument

### a) Power System

Power system including network power supply, laser power supply system, refrigeration power supply system and auxiliary power supply system, as shown in Figure 2

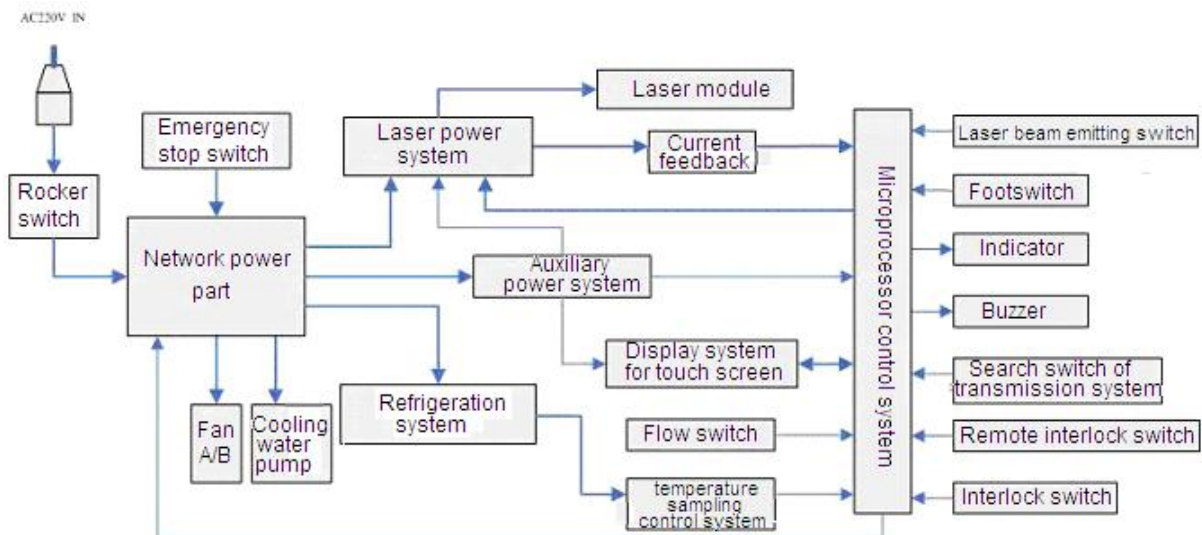


Figure 2 circuit block diagram

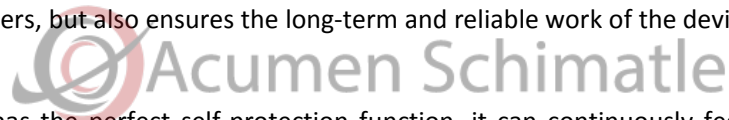
The power lines and rocker switch are used to control the on-off of hair removal instrument with the outside power supply. The key switch, emergency stop switch are used to control the on-off of network power, and then through the auxiliary power supply, provide the work current for the microprocessor control system, touch screen operation display system and other functional components, meanwhile, the on-off of power system for refrigeration and laser are realized by the pick-up and switching off of the relay that controlled by micro - processor. The power-on , energizing and the light emission process of main unit are subject to microprocessor control, in order to achieve controlling the hardware with software through microprocessor, so that the appliance operation are more stable and reliable.

Laser power system adopt the power devices to constitute current regulation loop, thus can change the volume of output current through system regulation power devices of microprocessor, thereby controlling the

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volume of output laser energy and work pulse width, through the feedback loop, export the current sampling signal and send to the micro - processor for real-time monitoring.

Various power supply components from the power system of laser hair removal instrument mostly adopt the safe and reliable switching power supply to achieve AC-DC conversion, these components passed through CE-certification, so that the safe effectiveness of the system get adequately guarantee, not only ensure the personal safety of users, but also ensures the long-term and reliable work of the devices itself.



The power system has the perfect self-protection function, it can continuously feed a number of important signal back to the microprocessor, once the important signal has an error, the microprocessor will promptly notify the users through the friendly man-appliance interface (Touch Screen) and take automatic protection treatment .After the error signal is released, the power system can automatically return to normal state.

### **b) Microprocessor Control System**

Diode laser hair removal instrument adopt the microprocessor control system. The microprocessor control system is composed of microprocessor, control loop and detection circuit, see Figure 4.2.

Control module of hair removal instrument is highly automated, the user just needs to turn on rocker switch and key switch and eject emergency stop switch, after power-on, the system will automatically perform the self-check for the control system (include all the preset checks against some possible damages to the appliance and the user) and the calling of treatment parameters and other a series of actions.

If error occurs for self-check, the fault information will be displayed on the touch screen after system initialization, system self-check and parameter call-up are finished. This helps the user and the service personnel to get to know the running state of the appliance. If no error alarm arises, the user can turn on/off laser power supply, adjust output laser parameters and adjust laser operation mode through the touch screen. And through the touch screen, the user can also control whether to ignite lamp and whether to yield laser.

### **c) Operation Display System**

Operation Display System is composed of touch screen, indicator and buzzer.

Among them, the touch screen connect directly to the host microprocessor, the operator can operate the touch screen to control the microprocessor to work, and through the information that is displayed on the screen to understand the main unit state and the relevant parameters, the hair removal instrument adopt the safe and reliable touch screen that passed through CE certification, also, the manufacturer designed a simple and intuitive operational interface, which can be easy to realize man-machine dialogue.

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The indicators are used to display the work state of main unit; meanwhile, the buzzer is used as the prompt for laser output and fault alarm.

#### **d) Cooling System**

Cooling system consists of cooling fan, cooling water recirculation system and water temperature regulation system.

After the laser hair removal instrument starting, the cooling system begins to work and adjust the water temperature to the pre-set temperature scale. The cooling fan give air cooling for the electric parts and radiator in the main unit, through air flow in the appliance to take away the generated heat.

When the laser is running, internal circulating water can displace and takes away the heat and deliver to the water temperature regulation system, where the heat can be displaced and sent to the radiator for dispersion. Therefore, the circulation water temperature is maintained within a dynamic balance range, this ensures the normal working temperature of laser. By monitoring cooling water temperature in real time through temperature sampling, the control system can start the cooling components from the water temperature regulation system in due time to adjust water temperature, also, it can automatically judges whether the temperature is normal. If the temperature exceeds the early warning value that pre-set, the system will automatically disable laser output and give alarm so as to avoid damage to the laser.



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# Chapter 7: Daily Maintenance

## I. Fault Alarm

The hair removal machine has multiple protection function including: **interlock, water flow, water level, water temperature.**

When there is abnormal condition in the main unit, the system will disconnect the laser power and display itself in the way of indicators from the protecting designator of touch screen (under the normal circumstances, the indicator shows green, in the event of a failure, the indicator shows red), at the same time, the buzzer will make continuous alarm sound. Once the fault clearance is detected, the alarm screen and the alarm sound will automatically disappear. During treatment, if the same warning screen appears more than three times, please contact the personnel of after-sale maintenance.

### **Before calling for Service**

#### **1. Safety interlock switch alarm:**

Check whether the shell is opened or loose, whether the remote interlock is in open circuit condition.

#### **2. Water flow alarm**

Check whether there are water shortages in water tank, or leakage from water pipes and radiator

#### **3. Water level alarm**

Higher or lower flow level, it can't work normally. You need to check up whether enough water at the first time and turn off machine immediately.

#### **4. Water temperature alarm**

Restart the appliance after shutdown or stopping emitting flashes for some time.

If there are no above mentioned conditions, please contact the personnel of after-sale maintenance.

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## II. Maintenance

Maintenance is necessary to ensure that the hair removal machine works in a good condition.

Great care shall be taken in maintaining the hair removal machine since the laser medical device is a precision appliance.

### 1. Check or replace the power fuse

Shut down all the power switch, pull out the power cord plugs; Use one small flat screw driver to gently turn the protective tube casing in an counterclockwise manner and then take out the protective tube, then take out the fuse from protective sheath;

Only the fuses with standard type which specified by the manufacturers can be used for replacement (fuse type: 10A/250VAC); put in the fuse tube and the sheath and tighten the sheath up clockwise, re-insert the power cord to the back of machine, then connect the electricity, turn the power switch and key switch on , verify that whether the machine is working correctly.

### 2. Main unit maintenance

A shield should be covered if the equipment is not used for long time, this can prevent the pollutants as dust and water vapor from entering into the inside of main unit, these pollutants could lead to the decrease of laser output energy, and even affect their normal operation, therefore, it is requested that the equipment installation sites must be clean, dry and dust-free ,also ,the ambient temperature is preferably maintained at  $4 \sim 40$  °C. In order to avoid the appliance casing and components aging, the main unit can't be put in strong direct sunlight; it should be installed in a dry, ventilated place with no corrosive gases. In the region with the temperatures below 0 °C, it is proposed that the cooling water in the main unit should be emptied out during transport process or not to be in use for long time, this can prevent the liquid icing and expansion and damage the related components in the equipment (it is recommended that the discharge should be conducted by the qualified professionals from manufacturers or directly contact to the manufacturers).

### 3. Laser handle maintenance


Laser handles is composed of precision optical components, therefore, it should avoid falling and getting blunt force, the laser handles couldn't be collided or turned on arbitrarily, otherwise, the laser module will not emit light normally; the cleanliness of end plane of light guide crystal has significant impact on the laser output, so the inspection and proper cleaning must be given before application. When using the handle transmission system, it should try to avoid the damage caused by extreme bending.

### 4. Cooling System


Regularly check to ensure the cooling fan works normally. If the cooling fan or cooling module fails, therefore, the appliance lose heat exchange path with the external environment and heat will accumulate inside the appliance, and as a result, the laser may fail to work normally, or even cause damage to hair removal machine. On overhauling the appliance, the maintenance personnel should detect the storage

volume of water tank and water quality, as well as refrigerating capacity of the appliance, if any exception occurs, the cooling water should be added or replaced timely.



: the cooling water used for the hair removal machine must be deionized water( PH value of water 5.5-8, hydronium water resistance:  $5M\Omega/cm^2$  ),change new water every 2-3 months

#### 5. Change Water Filter Core

: Water filter core must be replaced every 2-3 months.

#### Steps:

- ① open the window at the right side of machine, see below A picture
- ② use screwdrivers to unscrews the 2 screws in red circles in below B picture, take the water filter out.



- ③ change the filter core



**Figure 1** is the water filter and spanner which used for disconnecting the water filter.

**Figure 2 -3** shows how to take apart the water filter

**Figure 4-5** is the photo after taking apart the filter core (please take out the filter core and clean the shell of filter, put a new filter core inside, then screw up the filter).

**Figure 6** shows after put a new filter core,

**Figure 7** is the photo after change the new filter core well.

5. During transport process, if you want to lift the appliance, the force point must be in the frame, the casing and the handle may not be imposed on force, since the handle is only for movement. On normal application (emitting laser beam), the hair removal machine can not be moved and can not be over-tilt (gradient  $\leq 5^\circ$ ).
6. Non-professional maintenance personnel shouldn't dismount the main unit, laser handle, foot switch as well as other accessories, if there are quality problems, please contact your local dealer.
7. During storing process, the hair removal machine should be tested once a week, the power-on and off condition for "power switch", "key switch" and "emergency stop switch" are detected. If any exception occurs, please pull out the plug of power supply and contact the manufacturer.