

Holmium Laser Therapeutic Apparatus User's manual



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Holmium Laser Therapeutic Apparatus Use's Manual

Chapter 1 Overview

Thank you for using our company's holmium laser therapeutic apparatus (hereinafter refer to as the treatment machine), we will promptly assist you to use and maintain.

The treatment machine can produce a high-power density laser beam which wavelength is 2100nm, and through the optical fiber transmission system, it will transmit laser energy to target tissue for treatment.

Both the treatment machine and accessories are mainly used in the endoscopic treatment of urology system stones or BPH (Benign prostate hyperplasia).

This manual includes the introduction of treatment machine's specification and its annexes, security, installation and basic operation. Also synchronously introduces the optical transmission systems, eye protection, equipment maintenance, fault diagnostic and warranty information of the treatment machine.

Before using this treatment machine, users should read the introductory statement intensively. And pay attention to the prospectus or other warning about indication, contraindication and preventive alerts in relevant materials. Any negligence in the above course may result in harms to patients or the operators in use of the treatment machines.

NOTE: If the machine is used incorrectly, it will bring dangerous radiation exposure.

Chapter 2 Working principle

2.1 Laser basic knowledge

"Laser" is the abbreviation of "Light Amplification by Stimulated Emission of Radiation". In essence, the laser is a coherent single-frequency beam in a very narrow range. The beam is in the form of an excess energy which is released by electrons in the electronic excited state transfer to photon.

The laser from the material of working is divided into ultra-violet laser, visible light and infrared light. Laser's wavelength depends on the work material.

Why laser plays an important role in the medical treatment is because it is based on the laser photoluminescence effect, photo-induced thermal effects, pressure effects caused by light, light-induced chemical effects, the function of

light in electromagnetic field and bio-stimulation effects of weak laser

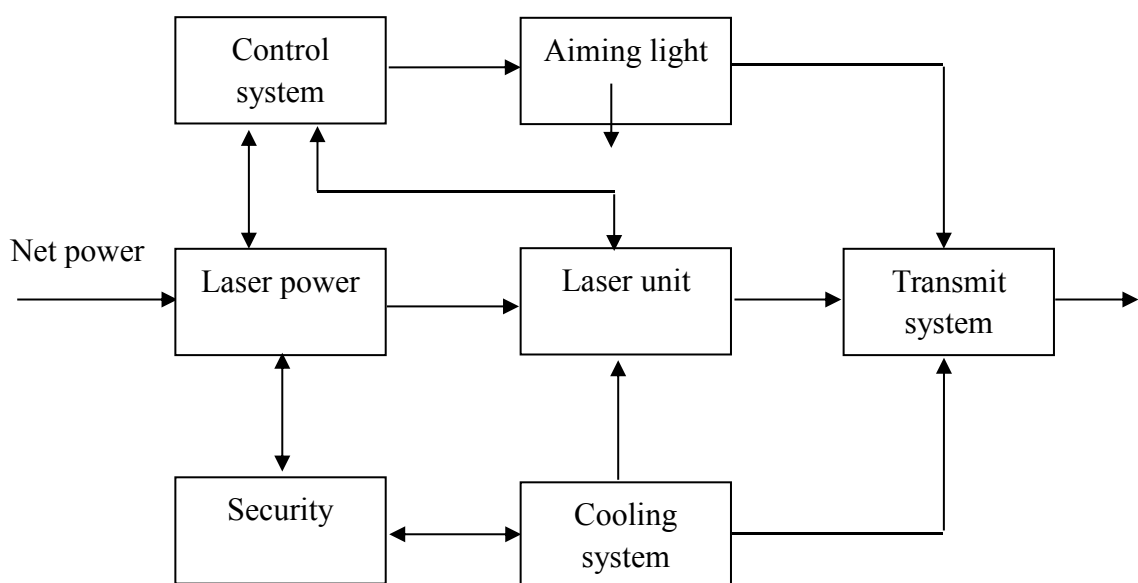
The laser of different wavelengths through different medium have different rates of transitivity and absorption rate, which determines different effect of human tissues, such as: the absorption rate of 532nm laser by oxyhemoglobin is more than a hundred times than the 1064nm laser, while absorption rate of 2100nm laser by water is more than a hundred times than the 1064nm laser. This is the basic theory in medical laser equipment design.

2.2 Holmium laser apparatus working principle

The products are used by Yttrium Aluminum Garnet (YAG) as the matrix material, doped pulse solid lasers which made by laser crystal of chromium (Cr), thulium (Tm), holmium (Ho) ions, produce 2100 nm laser, and this is just at the peak range of water absorption. When using for urinary calculi bombardment, the laser energy is absorbed high-effectively by stone surface and internal water, then instantly micro-expansion of the vaporization have burst, these micro-blasting can cause the secondary shock waves that crush all kinds of composition of urinary calculi immediately. The efficient absorption of water for holmium laser makes the penetration depth in organization less than 0.5 mm, which can guarantee high precision and unique surgical clotting effect.

2.3 Configuration of the treatment apparatus

Treatment Machine consists of laser unit, laser power, control systems, transmission systems, cooling systems and security system. See the working principle block diagram 1:



Picture 1 Treatment machine principle block diagram

Of which: According to the laser emit conditions (temperature, setting, security settings etc.), the control system controls the electric energy of laser power injecting into the laser unit, cooling system provides the working environment for laser unit at room temperature, the aiming light is used for indicating the working laser location of micro-energy laser (<5mW) , optical fiber transmission system transmits the laser energy (also known as the working laser) to the treatment position through quartz optical fiber.

Chapter 3 Storage and delivery requirements

The treatment machine should be kept in an environment of ventilated, dry, temperature $-40\text{ }^{\circ}\text{C} \sim 55\text{ }^{\circ}\text{C}$, RH is not more than 93%, in order to avoid acid, alkali and corrosive substance pollution.

It must be specified in the original carton or other delivery package by reasonable means to reduce the bumpy road vibration (vertical or horizontal loading and unloading) in order to avoid damage.

Note: If the treatment machine is put in storage at $0\text{ }^{\circ}\text{C}$ environment, it should be placed for more than 48 hours in environment of more than $0\text{ }^{\circ}\text{C}$ before using, and take smooth flow as a prerequisite for normal use.

Chapter 4 Installation

4.1 Overview

Unboxing and installation of the treatment machine is finished by manufacturers or the designated agent on behalf of service providers, and they are responsible for on-site testing and inspection.

4.2 Opening and inspection

Treatment machines have packaged rigorously when are delivered out of the factory, please double-check the package before unboxing, and check whether there is any damage to the packaging, whether the integrity of the ordered device is complete according to the packing list. If there are any questions, please immediately notify the manufacturer or authorized dealers.

Please save all packaging materials. When store or transport your equipment, we need packing materials.

4.3 Workplace requirements

Except warning signs, when the 4th class lasers works, the entrance to the workplace should be set laser work alarm.

4.3.1 Entrance logo

Each laser at each entrance to the workplace must have the interlock switch.

The entrance of each laser work place must have laser safety warning signs, indicating the laser wavelength.

4.3.2 Laser radiation protection from window

The laser beam of the treatment machine should be prevented from radiating through the window of workplace, to avoid danger to outsiders.

4.3.3 Prevent the laser reflection

It should be ensured that no material of highly reflective performance in laser workplaces, such as mirrors, glass and so on, to prevent the laser beam generated through the reflection of these materials and cause laser radiation danger. As surgical instruments are always made of glass, chrome plated or nickel-plated metal, the light reflection rate is high, while operating the laser, not let the beam irradiate on their surface, otherwise, it will bring harm to humans by the laser beam reflected from these instruments.

4.4 Laser security warning

The windows of workplace must be pasted laser safety label and laser warning.

4.5 Electrical requirements

The electric power provided for this machine is 220V-240V AC power supply, 16A (40W), 25A(70W/80W), 50-60Hz, voltage fluctuation will not exceed 10%, single-phase with earth wire.

4.6 Cooling water requirements

This laser adopts internal circulating cooling system, it needs to infuse distilled water or deionized water. And change cooling water every 6 months.

4.7 Host unit location requirements

The indoor power outlet should be maintained within distance of three meters from the laser host, distance between the center line of the laser host and the operating table should not more than two meters in order to ensure the normal operation of optical fiber.

Chapter 5 Security and technical assurance

The treatment machine is a sophisticated laser medical equipment, can only be used for medical care. It has been undergone a rigorous safety testing, standardized operation will not produce security incidents. Therefore, in order to protect staff and patients' personal safety and avoid damage by laser radiation, please read the contents of this chapter carefully. In addition, the operation staff should go through an appropriate technical training.

The treatment machine is the 4th class laser product, belongs to high-energy laser. Therefore, be careful when using, prevent danger happening. Absolutely avoid any inflammable substances near the laser beam.

5.1 Eye protection

2100nm wavelength light will cause corneal burns when it aims at eyes. The extent of damage to the eyes depends on the light energy, focus level and the time of eye irradiated. To avoid eye injury suffered, the operator and patient should wear special protective glasses.

According to the nominal distance between the eyes against the (NOHD) and specific protective wave band, as for our provided protective glasses, it's the optical density D_λ required for eye protection, the laser protective eyewear configured for the effective protection has the smallest value D_λ in a optical safety complies with GJB1762-93 "laser lens physical health protective standards."

Protection microscopy parameters: laser 2100nm-band attenuation in the 1000-fold; visible light transmittance larger than 80%.

Note:

1. Prohibit direct observation to the optical fiber output laser beam or reflected and scattered laser beam. Otherwise it will cause damage to the cornea;
2. Recommend all operating room staff wear appropriate protective goggles;
3. Even if you have wore the protective glasses, you can not face up to the laser beam and its scattered or reflected beam;
4. Glasses consist of the polymer materials, can not be scrubbed and immerged by organic solvents;
5. Glasses are valid for three years normally, please replace it duly;
6. Due to different wavelengths, protective goggles of specific wavelength

can't be used alternatively.

5.2 Burn Protection

If this wavelength laser emits to other position which is not target tissue, it will cause burns. To abate severity of the risk caused by operating mistake, you can use wet cotton yarn or dipped enough salt water cotton yarn to cover the surrounding parts of the tissue and maintain moisturized. Therefore you must be cautious when laser radiating. Proper use of laser energy is important and indispensable.

5.3 Risk of reflected light scattering

Be sure to avoid phenomenal light reflecting or scattering equipment , especially those with flat smooth surface, because these can produce strong reflection of laser and result in a high degree of potential danger, so be sure to wear laser protective glasses when laser emitting.

5.4 Electrical Protection

The treatment machine has built in security restrictions to stop laser output when system in risk condition. But the followings still need to be abided by.

1. To ensure good grounding when using.
2. The treatment machine and the workplace should be kept clean and dry, ensure no water on or around the equipment when using.
3. If the system fails, please stop it immediately and contact service provider agents.
4. Only authorized technical engineer or trained personnel could open the machine for maintenance or repair, others shouldn't , or else bear the consequences.

5.5 Fire Protection

Avoid the laser and laser beam close to combustibles, narcotic drugs or other flammable solvents. In laser working area, shall no paper and plastic products. Because in a certain distance, once these materials have absorbed considerable energy it will lead to burning and cause fire.

When the laser is not in use, or replace patients, during intermittent treatment process, please switch to the "standby" state.

5.6 Main switch management

The main switch of treatment machine is the key switch on the front panel. Key shall be kept by specialist doctors that passed medical training. The key switch controls the laser power. When the key switched to "ON", the system starts and conduct self-test automatically, then it enters "standby". Rotate the key switch to "OFF" will cut off the laser power. The air switch on back plate is the master power switch of the equipment.

5.7 “Standby” and “ready”

When treatment machine starts automatically at "standby" state, the entire laser is turned off. Only enters into "ready" state, can laser work and the foot switch can control the laser output and stop.

5.8 Manual restoration

For any abnormal situation, the system immediately shows errors, meanwhile activate a warning. User shall turn off the laser through the key switch, switch off master power supply, then restart the laser. If the fault still exists, please do not hesitate to contact manufacturer or service agents.

5.9 Remote interlock connector

The back plate of treatment machine is fixed a remote connector (Interlock), which is connected to the door interlock switch of workplace through cables. Once the door opened, the machine will stop emitting laser and return to "standby" state. By default, interlock connector is disconnected.

5.10 Auxiliary security protection

The treatment machine has the following security measures:

1. While foot switch not depressed, no laser emission.
2. As long as the power over load, automatically the air switch completely shut down the equipment.
3. The equipment is configured interlock (optional), and it could be installed by hospital equipment maintenance personnel.
4. Only at the state "OFF",the key switch can be removed.
5. Random microprocessor continuously monitor system status, once error happens, laser will stop, and showing what error it is.
6. Only system fully connected, can it emit laser at “ready”.
7. Only press the "ready" key ,laser prepares to launch, and power output could not be changed, ensure steady output when operating. If want to change power and other parameters, please back to “standby” state.
8. Fiber supporting bar can be raised and lowered, you could place the

handle in safety condition.

9. When system enter into "ready" mode, there is 2 seconds' delay before the laser emission

10. As long as the laser emit (depress the foot pedal), the system will sound continuously.

11. Except the laser output window, no other laser outlets exist.

12. In emergency situation, you can press the Emergency switch immediately, stop the system at once.

5.11 Laser security signs

Note:

1. All 4th type lasers can produce dangerous diffuse reflectance, which can burn the skin, cause fire, you should be especially careful in use of such lasers.

2. If you control or adjust the device not abide by regulation or operate not step by step in compliance with it, there may be harmful radiation.

Chapter6 Scope of indication and contraindication

6.1 Indication

Both the treatment machine and its accessories are mainly used in the endoscopic treatment of urology problems, including:

- 1: Calculi treatment, which comprise (1) Kidney stones (2) Ureter stones (3) Bladder stones (4) Polypus encapsulated stones
- 2: Urinary polypus resection treatment, BPH (enlarged prostate)
- 3: Stricture treatment, comprise (1) Ureterostenosis (2) Urethral stricture
- 4: Others

6.2 Contraindication

- 1: Patient with severe bleeding tendency
- 2: The patient with organic obstruction on treatment position
- 3: Other high-risk patient that not suitable for laser treatment.

6.3 Potential complication and possible risks

Although urinary calculi complications by holmium laser treatment are few, there are still existing potential complications and risks similar to the traditional surgery. Including the following (not limited to):

1. With laser endoscopic treatment, there may be a short-term pain.
2. The phenomenon of a slight hematuria will appear after the patients accept the laser treatment, usually 1 or 2 days it will go away.
3. Ureteral wall injury (if laser not properly used by doctor), and result in localized edema ,which can cause acute obstruction easily.

6.4 Preventive measures

1. Before laser activated (“ready” state), operating room personnel, including all patients should have finished preparations especially ensure safety measures.
2. Before the operation, doctor should be fully aware of the possible clinical effects that treatment machine may have.
3. It should only be fired at the target stones or tissue and emit laser when doing treatment.
4. In order to avoid endoscopic burns by laser or the harm from laser beam scattering reversely, we propose that the length of fiber should extend

beyond the peripheral endoscope about 1-2cm, so in full of the vision.

5. Prudently use the laser energy and irradiation time, until the doctors have a full grasp of the effect and adjustment of operation parameters.

6. The machine must be operated by professional surgery doctors who has passed laser surgery training, assessment or under other professionals' guidance who have extensive laser experience.

7. Only irradiate laser to the lesions which in full vision.

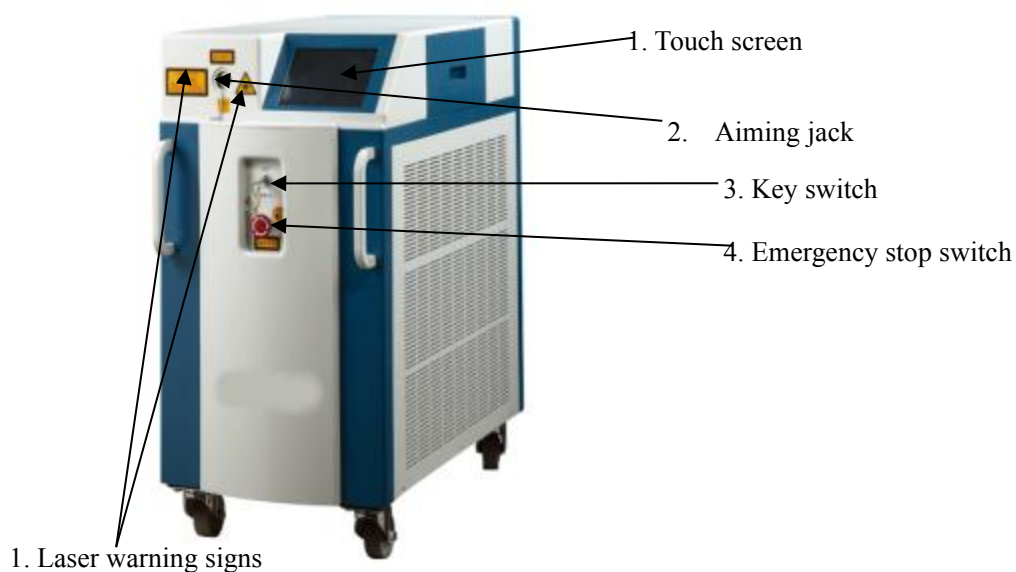
8. Operation doctors should arrange a return visit after the surgery as same as the other doctors' manner.

Chapter 7 Product description

7.1 Model and Specifications

Model	40W	70W	80W
Output power	2.5-40W	2.5-70W	2.5-80W
Pulse energy	0.5-4.0J	0.5-4.0J	0.5-4.5J
Repetition rate	5-20Hz	4-40Hz	4-40Hz
Wave length	2100nm		
Aiming beam	532nm Green, Optional 635nm Red		
Optical fiber	550µm reusable, Optional 800µm and 1000µm and 365µm		
Cooling system	Built-in water cooling system		
Dimensions	89×45×90cm		
Weight	135KG	140KG	
Power supply	AC 220-240V/50-60Hz, Single phase		

7.2 Front sheet



Picture 2 the front sheet of main unit (new model using the same parts)

7.2.1 Laser output window:

The laser output window follows the application of international standards SMA-905 connector, laser energy output is from the end of fiber finally. The window has been set up with fiber-phased safety interlock devices. When connecting the fiber, please ensure that the interface is in place, otherwise there is no energy output. After remove of the fiber, please do not hesitate to use optical interface protection caps to cover on the connector to prevent the window from contamination. Also must prevent the laser output window from liquid, oil pollution and other objects which can cause a decline in laser output power, even do harm to laser internal systems. It is prohibited to remove fiber in process of use.

7.2.2 Key switch

Key switch controls on and off of the laser power supply, (the total power supply is controlled by the air switch behind the host) spin the key switch to "OFF" position, the laser power supply is switched off.

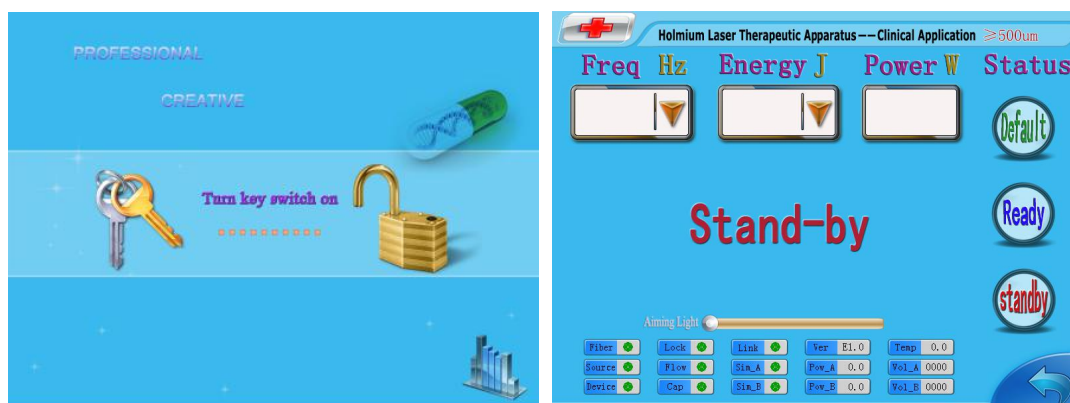
Products are equipped with two keys; only the key switch at "OFF" position, can the key be pulled out. Plate the key switch to "ON" position, laser power supply turned on, power indicator is light, operation panel starts to work..

Key switch should be managed by professionally trained staff.

7.2.3 Emergency stop switch (laser termination)

Emergency stop switch connects the laser power system, press the switch, it will cut laser power immediately. Before restarting the machine, you should follow the following four steps: (1) shut down from the touch screen; (2) rotate the key switch to "OFF" position; (3) cut off power supply from the back; (4) rotate emergency stop switch back as arrow direction on the cap. Then start machine as normal.

7.2.4 Operation sheet



Picture 3 Operation sheet

7.2.4.1 Working conditions

When the "key switch" turned on, self-checking system starts. If no error occurs, all items at bottom of the panel turn green (see Picture 3), otherwise items not passed self-checking will turn red. When self-checking finished without error, there will be a buzzer sound, and machine enters "standby" state.

7.2.4.2 Pulse energy

The pulse energy can be adjusted by "▲", "▼" through "Energy" button.

7.2.4.3 Aiming light

Can be adjusted through the belowing horizontal stripe on panel.

7.2.4.4 Frequency

The number of pulse per second is adjusted by "▲", "▼" in "Frequency" button.

You can also click on the "default setting" button, and the frequency is 10Hz, energy is 2.0J (output power is 20W).

7.2.4.5 Output power

Real time output power is showed on "Power" button automatically. (It equals to the product of energy and frequency.)

7.2.4.6 Standby button

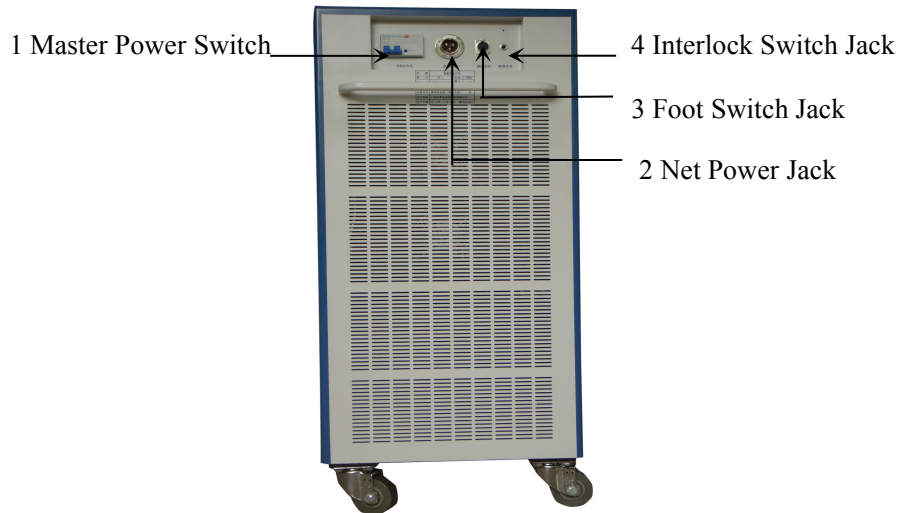
When passed self-checking, the treatment machine will automatically show "standby", at this time you can pre-set "energy" and "frequency" by "▲", "▼" respectively. During laser treatment, if you need to regulate "energy" and "frequency", press the "standby" button first.

7.2.4.7 Ready button

When everything is ready, press this button will activate buzzer sound alerts (four long buzzer sounds at first and then a short buzzer), then depress the foot switch, there will be laser output.

NOTE: When touch/press buttons, if you could hear the reminder sound, it indicates that the function the button refers to is activated, if not it indicates button failure (for example, adjusting energy and frequency at "ready" state you will not hear the reminder sound, because changing energy and frequency is not allowed at "ready".)

7.3 The back sheet



Picture 4 Back sheet of main unit (new model using the same parts)

7.3.1 Master power switch

The master power switch of machine controls the opening and closing of total power, Plate switch to the "ON" position, then the total power in the connected state, "OFF" position, then the total power in a disconnected state.

7.3.2 Net power jack

Net power input, should be inserted and tightened up when using.

7.3.3 Interlock switch jack

Insert the plug of the interlock switch which is randomly configured into this jack, install the other side on the entrance of the laser operating room, in order to prevent others going into operation room, resulting in laser radiation harm.

7.3.4 Foot switch jack

Insert the foot switch into this jack, it control the emission and stop of laser.

7.4 Optical peeling exploitation and cutting pen



Fiber stripping tool



Fiber cutting pen

Picture 5 Optical fiber tools

Chapter 8 Laser transmit system

8.1 Product introduction

It is the fiber directs laser energy to the fiber termination, by this way the laser can be used to conduct treatment.

8.2 Optical fiber specification

Core specifications	365um、 550um、 1000um, default configuration is 2 550micron
Fiber length	$\cong 3m$

8.3 Calibration introduction

Optical fiber has been tested in the production to ensure the effect of the transmission, so the hospital does not require maintenance personnel to carry out the calibration of optical fiber.

For laser output power calibration after repair, this operation could only be done by agent or trained engineer authorized by manufacturer (Guangzhou Potent). Doctors or any other routine maintenance personnel are not allowed to do this.

8.4 Conventional use introduction

1. Remove optical fiber from its packing carton by using aseptic methods, connect the fiber to the optic fiber installation port, there is a indication of whether fiber in place on the screen, optical fiber must be inserted in place and tighten the nut at the fiber input end. Even if machine passed self-test when starting, if fiber not tightened, it will also be broken when laser emitting.
2. Before treatment, you should check whether there is damage on the fiber, place the equipment in "standby" state and start aiming light. Note: do not step foot switch when checking aiming light. Put the end of fiber on the sterile surface and non-reflective area, and then slowly rotate optical fiber until you see the light. If you can not see light, the optical fiber may be defective, it should not be used; check the entire optic -fiber along and see whether there are twisted part or bright spots. If the fiber is damaged, do not use;
3. After fiber inspection, at "standby" state, place the optical fiber to the

selected treatment position, if you use the endoscope, the optic -fiber vision must be clear and the end of the length exceed the endoscope about 1-2cm;

4. Place the equipment in "ready" state, depress the foot switch;
5. Treatment effect varies with the distance, the energy settings and other factors, the effect will reduce with distance increasing;
6. Do not let the end of fiber touch the tissue, during the treatment, if there is many gathered debris on fiber end, please set the equipment at "standby" state, remove the fiber from endoscope, wipe fiber end gently with sterile cotton;
7. Optical fiber is brittle material, so it should be taken and removed carefully, and can not be bent over, and avoid broken or bring harm to the human body. In endoluminal surgery, fiber should reach out endoscope more than 10mm and exposed bare quartz part does not exceed 2mm;
8. When putting the fiber into endoscope, ensure to straight the turning part of the endoscope firstly, and then slowly insert the optical fiber until it reach out of endoscope, only at this time, could you rotate endoscope. When laser emitting in surgery, the optical fiber can not be contracted in the endoscope, to avoid endoscope damaged.

Warning: Don't use tools such as jig to fix fiber, or it will cause danger when using. When installing the fiber, do not let the fiber connector, fiber end and any other part of fiber touch unclean or not disinfected materials.

8.5 Sterilization Instruction for Fiber

For disposable fibers, normally they are already disinfected, could be used directly in hospital. For reusable fibers, it shall be disinfected before use again, by using of 75% medical ethanol or ethylene oxide etc.

8.6 Storage requirements

Fiber should be placed under normal temperature environment. Avoid any abrasive, alkali and other corrosive circumstances. Keep fiber package well sealed.

Chapter 9 Normal working conditions

- 1, Temperature: 10°C ~ 30°C
- 2, Relative humidity: ≤93%
- 3, Atmospheric pressure: 86.0KPa ~ 106.0 KPa
- 4, No obvious vibration and air currents around

Chapter 10 Operating method

10.1 Preparation before power on

(1) Open the annex box, connect foot switch to socket "4" and power cable to jack "2" (see Picture 4) respectively and tighten up the nut. Plug the interlock switch to "3" and fix the other end to the door.

(2) Remove the optical fiber, screw fiber connector end into the laser output window (see Picture 2).

10.2 Startup and operation

(1) When everything needed is in good condition (with power supply and accessories connected), plate "master power switch" (see Figure 4) up to "ON" position, then pump work, cooling system starts.

(2) Insert key switch (see Picture 2), rotate 90 ° clockwise to "ON" position, laser power supply turned on, the machine begins self-checking and initialize for 5 seconds or so. Click "start" button, then it enters "standby" state. (If the startup fails, the buzzer will keep sound for warning.)

(3) According to required power to select the frequency and energy through the submenu. If depressing "default setting" button, then the frequency is 10Hz, energy is 2.0J (power is 20W).

(4) At the "standby" state, press horizontal stripe to change the strength of aiming light at the fiber end, which is helpful for laser positioning.

(5) Place sterilized fiber to patient's target lesion (for example by using of endoscopes).

(6) Press "ready" button, the panel will display "ready", after buzzer sound (four long one short) depress foot switch will launch the laser. Screen panel will show output power, release foot switch, laser output will stop.

(7) If need change power, must back "standby" state, then set "energy" and "frequency" again. During the operation process, if any error occurs, the machine will automatically return to "standby" state for protection, and stop laser output.

(8) Except built-in automatic protection system, the machine also equipped with an emergency switch in order to be more safe and reliable (see Picture2) which used for emergency stop to prevent any subjective and objective adverse situations. When pressing, laser power will immediately be cut off.

(9) After treatment, turn state from "ready" to "standby" then click "close" button to shut down the laser, the middle of screen will pop-up a window to

let you confirm, click "OK", the panel will show "Please turn off the laser power" to guide you shut down the machine, anti-clockwise rotate the key switch to close the laser power. Then shut off the power switch from back of the machine.

Note: The items shown on the bottom of panel screen are the conditions for laser output, if any condition goes wrong (shown red), equipment can not be shifted from "standby" to "ready" state.

10.3 Attentions

1. When laser power supply or control system fails, only manufacturer authorized agent or trained personnel can open the machine shell to do maintenance and repair.

2. Laser is precise device, it is not allowed to open laser cavity without manufacturer's permission, or laser will not work correctly.

3. The treatment machine can not be placed under strong direct sunlight in order to avoid aging of the machine case and instrument, it should be placed in dry, ventilated, non-corrosive gas circumstances. When moving the machine, also should avoid vibration and collision.

4. Remote interlock switch shall be installed in the operating room door, when the door is opened, laser output will stop.

5. A good way to check the integrity of fiber is to irradiate the aiming light on a piece of board, wall for example. If the light spot of the beam is not at the end of fiber, or its intensity reduced, or does not focus, it indicate that fiber transmission may be damaged or not working properly. The fiber shall not be used.

6. When operating, must avoid using flammable anesthetics or oxidizing gases such as nitrous oxide (N₂O) and oxygen. Some materials such as cotton material, when in oxygen-rich status, they will be ignited by high temperature from working laser equipment. As for flammable cleaning and disinfecting solvents, should let them evaporate before using the machine.

7. The key should be removed from key switch pocket when machine is not in use, keep it in safe custody, in order to prevent inappropriate use.

8. After removal of the optical fiber from the coupler on laser window, the coupler should be covered with protective cap.

9. When "master power switch" is off, the key switch should be placed in "OFF" position before restart.

10 This machine can only be lifted/carried from the bottom. The handle

in the front can only be used to push and pull, can not be used to carry.

Chapter 11 Maintenance of basic fault

When machine is detected some errors, there will be related error information displayed on the screen. The system will be in need of error exclusion or repair. Main common errors and their troubleshooting methods are as follows. If errors can not be eliminated through these methods, please contact the trained after sale service provider or directly contact manufacturer.

Common faults and related methods to solve

Phenomenon	Checking method	Solution
No power	Net power on or not	Fix the outside lines
	Whether power is connected	Plug the power in
	Whether master switch on or not	Plate the switch to "ON" position
	Key switch is screwed in place or not	Rotate the key switch 90 ° clockwise
	The emergency stop switch status is correct or not	Rotate emergency switch clockwise to resume normal state
No laser output	Whether the self-checking passed or not	Waiting for self-checking
	Whether or not switch to the "ready" state	Set required "energy" and "frequency" , and press the "ready" button
	Foot switch is connected or not	Connect foot switch
Laser output energy: low	Whether "Energy" and "frequency" are adjusted to the appropriate value	Reset "energy", "frequency" values

Chapter 12 Repair and maintenance

12.1 Overview

Repair and inner parts maintenance only be supplied by authorized agent and personnel who responsible for equipment after-sale normal operation. Other organization or personnel are prohibited to do this.

Laser cavity, cooling system and control circuits are integrated as inner parts, they are not in the scope of users' routine maintenance.

Users' routine maintenance mainly is equipment clean and disinfection. Keeping equipment clean is essential in almost any industry. Medical equipments need to be thoroughly cleaned and sterilized in order to be reused. These machines need to be kept clean at all times as bacteria can easily find its way to them, leading to the spread of infection and disease.

The holmium treatment machine provides users with convenient operation and maintenance, this chapter provides daily routine maintenance of system and some attentions required.

12.2 Cleaning method

About cleaning of the host, instructions as follows:

1. Wear appropriate protective gear , so as not to transfer bacteria and viruses to cleaned equipment or transfer bacteria and viruses from the equipment to you. Appropriate gear includes gloves, masks, eye gear and aprons.

- 2 .Disconnect optical fiber and cables from electrical outlets. Carefully wipe the equipment down with an antibacterial solution and a damp cloth. Spray the solution (medical alcohol e.g.) onto the cloth instead of directly onto the equipment. Also ensure that the equipment is completely dry before you reconnect any wires or plugs.

- 3 . Store cleaned machine in a clean and disinfected room if it won't be used immediately. If it has not been used for some time, make sure that it is cleaned first before use again.

When cleaning the equipment, following tips should be noticed:

1. Do not use rough or abrasive cleaning agent, especially the LCD display panel, or it may cause damage.

2. Do not allow liquid pour into the system mainframe.

3. Should not disassemble the equipment for interior cleaning except

manufacturer designated personnel.

12.3 Periodic maintenance

In order to maintain the normal operation of the treatment machine better, apart from the measures above, you should insist on carrying out regular preventive maintenance for the machine.

1. Check the wire and accessories connect part, be sure there is no conducting metal comes out of the insulate stripe by long time wear and tear.
2. Keep ambient environment clean, make the equipment away from dust, to avoid dust to the aperture of laser output.
3. Inspect screw on every components connect joint. If there is any loose fastener on electrical junction pieces, it should be tightened.

Chapter 13 Equipment warranty

13.1 Warranty clause

The company committed that in the warranty period, for defects of host and related accessories, we provide free warranty service. Warranty period is from the date of installation, default warranty time is one year, could be adjusted according to provisions of transaction.

In warranty period, if manufacturer or authorized agents receive notification of product defects, we can choose the option to replace or repair defective parts contingent upon the situation.

Our company and authorized agents choose the place for repair, no matter in our factory or user's place or both parties stipulated place, this service is totally free in warranty time.

Only if there is a written notice by manufacturer and the agent/user, can the laser be returned back.

13.2 Warranty reference

In case of damage due to product quality problems, our company will be responsible correspondingly.

In case of the following circumstances, the warranty is null and void, and the ultimate right of interpretation is vested by manufacture.

1. Improper use or maintenance of the laser;

2. Unauthorized changes to system settings and appearance
3. Not operate the equipment under regulated environmental requirements, including improper use of electrical, water supply facilities,
4. Use accessories which is not qualified.