

# 激光管用户手册（H 系列）

## CO<sup>2</sup> Laser Tube User Manual (H Series)

海目（北京）激光与数控发展有限公司

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<http://www.hmlaser.com>

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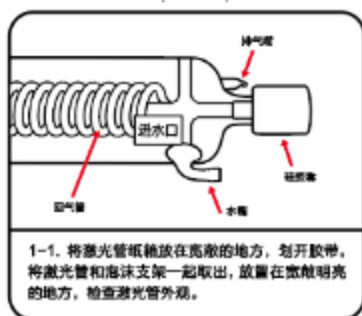
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# CO<sup>2</sup>激光管安装步骤（H系列）

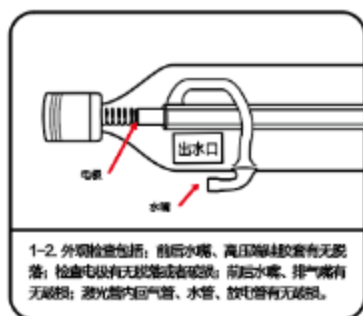
## 开箱和外观检查

将激光管纸箱放在宽敞的地方，划开胶带，将激光管和泡沫支架一起取出，放置在宽敞明亮的地方，检查激光管外观。

### 1-1 (高压端)

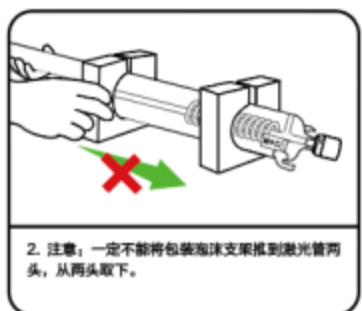


### 1-2 (低压端)



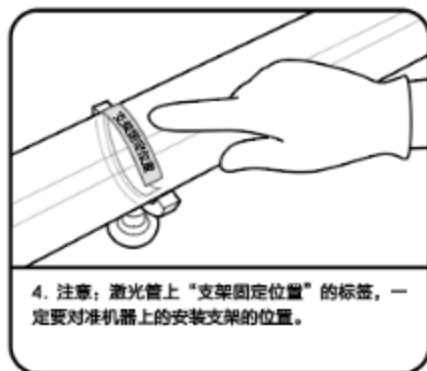
外观检查包括：前后水嘴、高压端硅胶套有无脱落；检查电极有无脱落或者破损；前后水嘴、排气嘴有无破损；激光管内回气管、水管、放电管有无破损。

外观检查无误后，请双手握住激光管，一人双手掌管，另一人配合拆掉激光管上的包装。



## 安装前的准备工作

请将激光管放置在雕刻机或者切割机的安装支架上。



在放置激光管的时候，请一定注意激光管的水嘴、管口这些位置不能与设备的外壳磕碰，以免损坏。激光管放置在机器内后，请检查一下激光管的前、后端是否已经正确放置。

## 连接冷水机和激光管

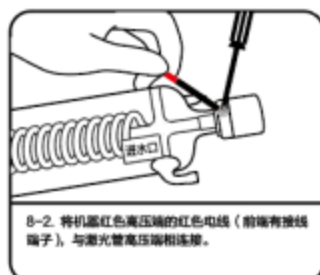
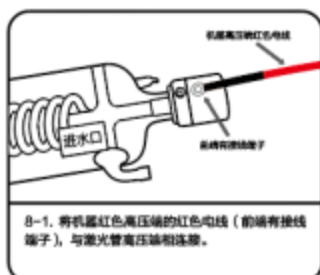
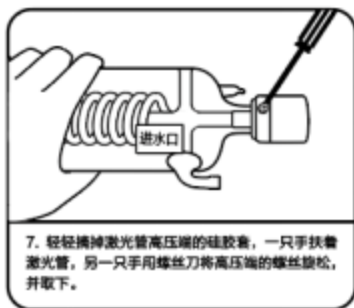
使用硅胶管，将机器设备冷却水的输出口，连接到激光管高压端的进水口水嘴上（这一侧的激光管壁上贴有“进水口”标签）。安装硅胶管时一定要注意：必须使用内径为 6-7mm，壁厚 1.5-2.0mm 的硅胶管。安装硅胶管时，先沾下水再去套硅胶管；硅胶管一定要套到水嘴根部，以免漏水或者脱落。禁止使用洗洁精或者润滑剂。



使用硅胶管，将设备冷却水的回水口（进水口），连接到激光管出光口的出水口水嘴上（这一侧的激光管壁上贴有“出水口”标签）。安装硅胶管时一定要注意：必须使用内径为 6-7mm，壁厚 1.5-2.0mm 的硅胶管。安装硅胶管时，先沾下水再去套水嘴；硅胶管一定要套到水嘴根部，以免漏水或者脱落。

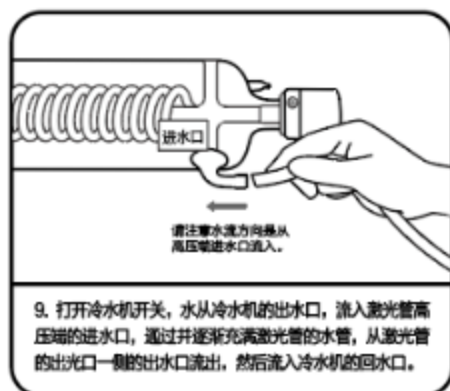


## 连接机器和激光管

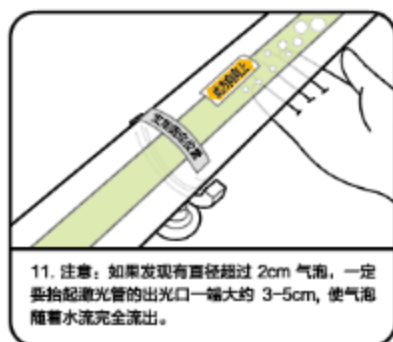
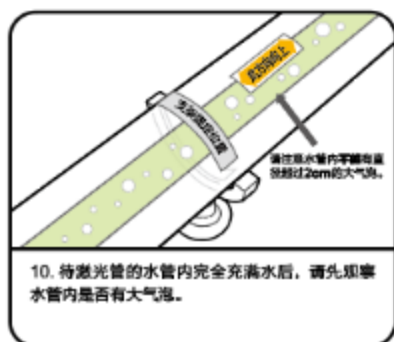


然后，将机器红色高压端的红色电线（前端有接线端子），与激光管高压端相连接。同样步骤，将低压端的螺丝旋松，并取下。用螺丝刀将机器低压端的黑色电线（前端有线鼻子），与激光管低压端相连接。

## 打开机器的冷水机，连接水路

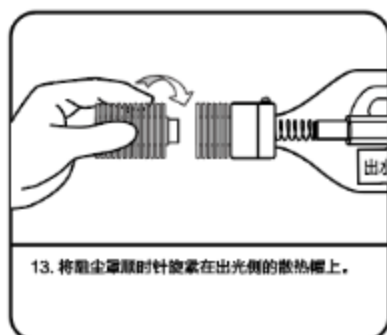
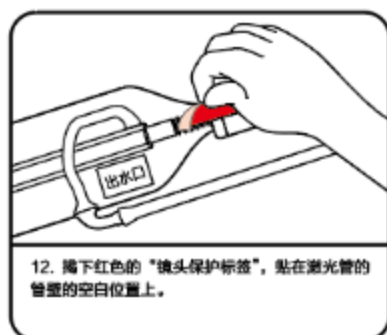


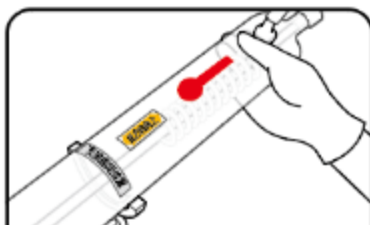
注意：如果水流方向不正确，将导致冷却水不能充满整个水管，造成冷却不良、功率降低甚至是爆管。（激光管分为里外3层，最里面一层是放电管，中间一层是水管，最外层是储气管）



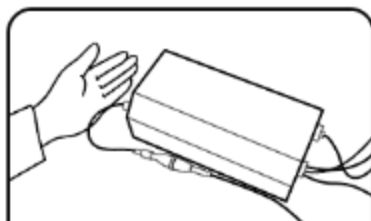
一定不能使激光管的水管内残留任何一个大气泡（直径超过2cm），否则会导致冷却不良，有可能造成爆管。如果抬起激光管一端超过30秒，水管内仍残留气泡，请检查冷水机是否缺水，冷水机流量是否存在不足。如果冷水机流量不足，建议更换冷水机。

## 打开激光电源

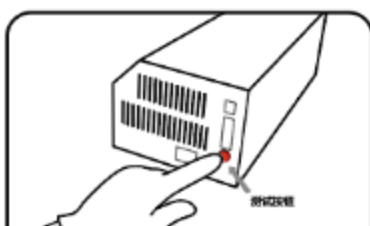




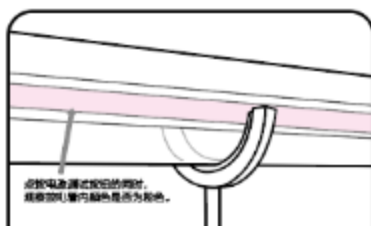
14. 顺时针使激光管的管身, 保证“此方向向上”的标签垂直向上。



15. 打开激光电源开关, 检查激光电源的风扇是否正常运转。如果电源供电正常但是风扇不转, 建议更换电源。



16. 点按激光电源上的测试按钮, 并听一下电源是否有异响。



点按电源测试按钮的同时, 观察激光管内的放电管, 颜色应为粉红色。

17. 同时, 观察激光管内的放电管。激光管正常工作时, 放电管应显示粉红色。

如激光管放电管内颜色是紫色、白色、或者无颜色, 请联系我司售后。  
将激光管固定在机器的固定支架上。激光管的安装步骤结束。  
下一步开始调整机器的光路。光路调整完毕后, 就可以正常操作机器了。

## CO<sup>2</sup>激光管使用说明 (H 系列)

### 1. 安装要求

请严格按照 H 系列安装示意图进行安装。激光器配备专用电源 (具体电源型号见下表)。正极带高压, 起辉电压见下表。  
未按要求安装导致的不良后果: 打火; 内管击穿漏水。

Model	Power Supply	Trigger Voltage
H1	P2	24
H2	P2	28
H2+	P2	26
H4	P4	30
H4+	P4	30
H6	P6	37
H6+	P6	37
H8	P6	41

### 2. 运行条件

水冷: 冷却液为纯净水, 流量为每分钟 3—5 升, 标准水温 10°C—40°C。使用环境: 温度 2-40°C, 湿度为 10-60%。

型号	检测电流 (mA)	允许最高工作电流 (mA)	长期工作电流应低于 (mA)	长期工作电流下的工作寿命(小时)
H1	25	25	18	15000
H2	28	28	21	15000
H2+	28	28	21	15000
H4	30	30	22	15000
H4+	30	30	22	15000
H6	30	30	24	10000
H6+	30	30	24	10000
H8	30	30	28	8000

上表说明（以 H1 为例说明）：检测电流 25mA，允许最高工作电流应控制在为 25mA 及以下，长期工作电流一定要控制在 24mA 及以下。使用电流在 24mA 及以下时寿命能达 10000 小时。以上电流要求必须以串联在阴极线上电流表的实际电流为依据。

未按要求使用导致的不良后果：长期超电流使用时负电极会出现变色，同时大幅缩短使用寿命。为防止灰尘进入高压护套内的电极附近，请在套上高压护套后缠上保鲜膜。

### 3. 工作性能

- 1) 切割功能。
- 2) 雕刻功能。

### 4. 注意事项

本输出镜窗口外表面不能用棉球等任何工具擦洗，否则严重影响功率。指定的去除窗口镜外表面污染的方法：

- 1) 当镜片污染时，不要开激光，
- 2) 用气球斜吹镜片表面，
- 3) 用针筒压缩分析纯酒精喷淋镜片表面，
- 4) 等酒精挥发后再开激光，
- 5) 如以上清洗方法都无明显效果时，必须由专业人员用棉球粘酒精由内向外旋转擦洗镜面。
- 6) 最好的办法还是保护好窗口避免污染。特别提示：不能用丙酮擦洗镜片。
- 7) 在有机玻璃上测试光斑时，离输出镜 300mm 处。

### 5. 安全

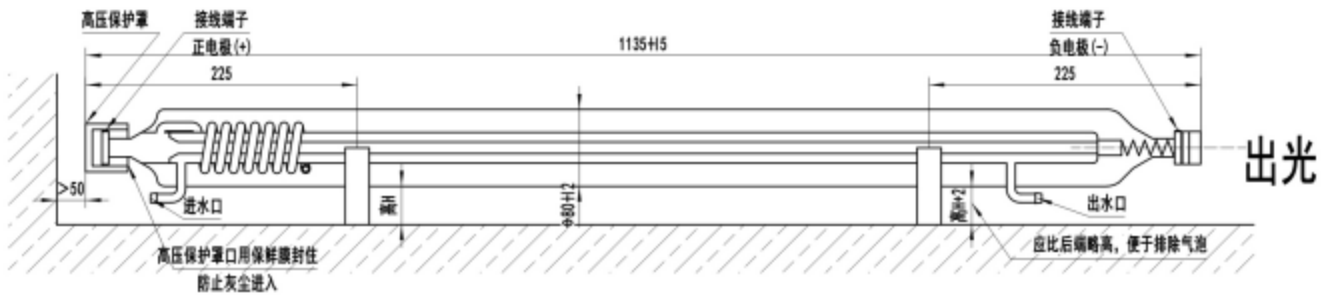
本激光器输出的是非可见光，调试时必须戴防护镜。正极带高压。注意安全标识。

### 6. 存储及运输要求

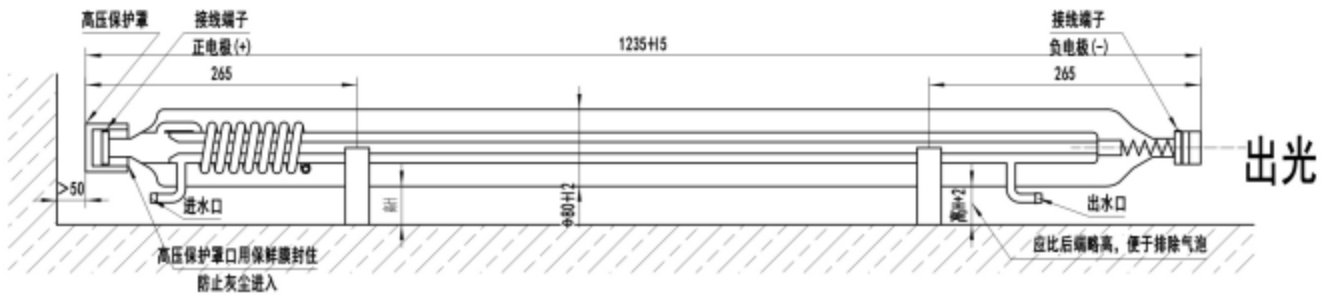
存放或运输时必须排尽冷却液，用防尘塑料袋套住输出端管口，存储环境温度 2-40°C，湿度为 10-60%。并按出厂时的包装方式包装。包装重要提示：一定要用胶带把海绵和激光管粘牢，防止运输时激光管纵向滑动。输出镜一头包装海绵要突出 70 毫米，全反镜一头要突出 50 毫米。

### 7. 未按使用说明书的操作不享有质量承诺

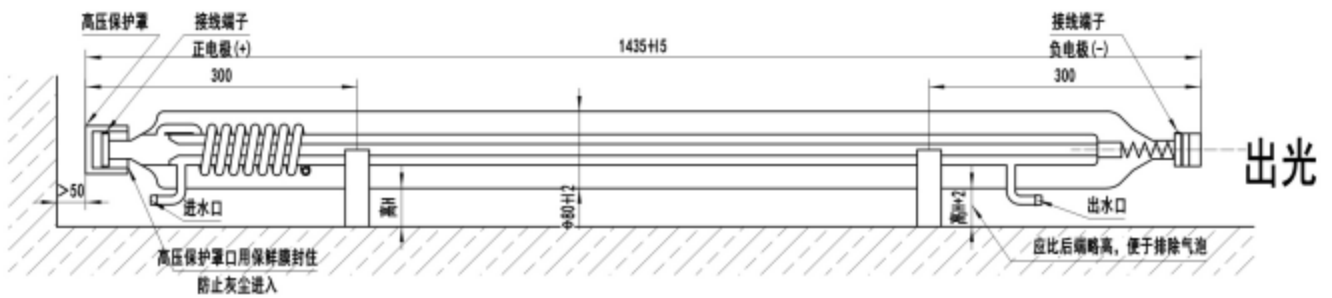
## H1型激光管安装示意图



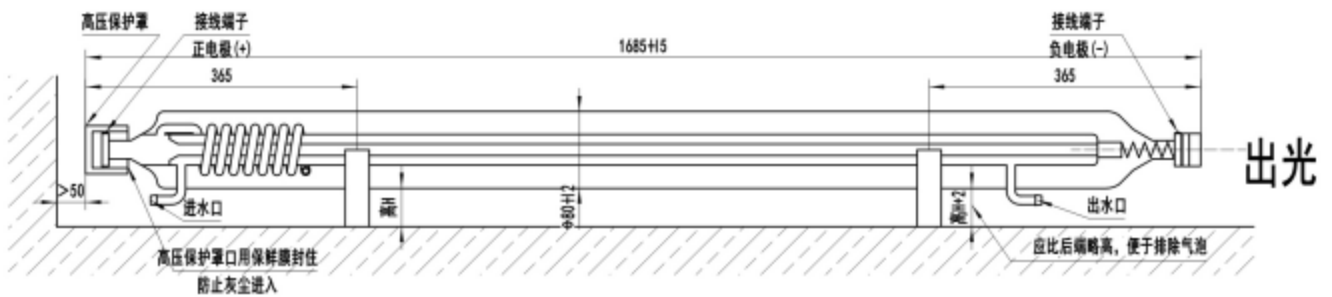
## H2型激光管安装示意图



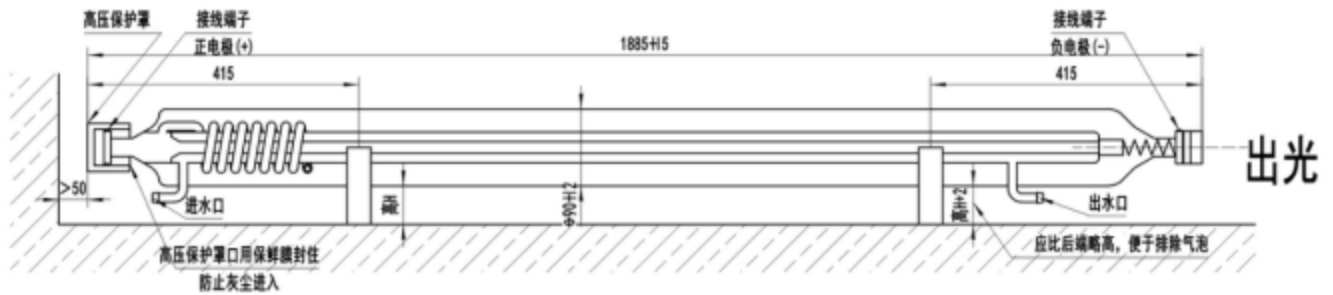
## H4型激光管安装示意图



## H6型激光管安装示意图



## H8型激光管安装示意图



## 注意事项

### 1. 激光管进、出水方式（见下图）



- 1) 为了使激光管冷却水充分循环，需要保证水流从低点进入，随着水的压力从高点排出，这样才能冷却整支激光管。
- 2) 如果水流方向相反，有可能出现冷却水未能充满整支管，造成冷却不良、功率降低、爆管的现象发生。
- 3) 如果激光管内有气泡，可在调光之前，抬起出水一端，待气泡完全排出，再固定激光管。请一定要注意：不能让激光管内残留气泡。一方面会影响出光效果，另一方面会损失激光功率，如果长期有气泡而导致冷却不良，有可能会造成爆管。

### 2. 安装说明

- 1) 将激光器固定在设备上，按照激光管上标注的位置进行固定，并保持在同一水平面上。
- 2) 将激光电源的正、负极线别与激光器的正、负极线一一对应相连接，注意不可错接，并做好绝缘。（激光管后部有螺旋管的一端为正极）。
- 3) 连接冷水机与激光器，冷水机出水口连接激光器的进水口；冷水机进水口连接激光器的出水口。
- 4) 打开冷水机，确保冷却水充满激光器水冷管内，气泡完全排出。
- 5) 激光管刚开始使用时，一般调节 50-60%功率进行工作。
- 6) 在建议最大电流以内使用的激光器，仍可输出额定功率；超过建议最大电流使用激光器，将缩短激光管的寿命。

### 3. 出现如下故障时请检查如下几项：

- 1) 功率弱
  - ◇ 激光器的输出镜表面是否有划痕和污垢，支撑点的正确放置；
  - ◇ 输出电流、供电电压、冷却水的温度、清洁度、流量大小；
  - ◇ 聚焦镜、反射镜表面清洁度，在工作时是否发热、光路偏移等。
- 2) 高压打火



- ◇ 检查高压接头周围是否有杂物或离金属部分太近；
- ◇ 室内环境过于潮湿造成导电现象，夏天使用冷水机需注意冷凝水；
- ◇ 激光电源高压连接装置内部是否出现断线和破坏。

### 3) 激光器破裂、水冷头脱落

- ◇ 水温控制在 15°C-25°C 范围，寒冷地区冷却水不能结冰，激光关闭后，0 度以下不得让冷却水储留在激光管内；
- ◇ 发光时必须在水保护的控制下工作（测试激光器会不会随着水的通断发光或不发光）；
- ◇ 冷却水的连接管路有没有出现压折现象；
- ◇ 激光器内是否存有气泡；
- ◇ 水压水流是否正常，水流方向是否低进高出；

### 4) 激光管输出镜脏污

激光管日常工作时，因室内环境和切割材料产生的烟尘，极易对输出镜造成污染。根据实际情况至少需要每 2 周检查一次激光管输出镜。

本输出镜窗口外表面不能用棉球等任何工具擦洗，否则严重影响功率。指定的去除窗口镜外表面污染的方法：

- ◇ 当镜片污染时，不要开激光，
- ◇ 用气球斜吹镜片表面，
- ◇ 用针筒压缩分析纯酒精喷淋镜片表面，
- ◇ 等酒精挥发后再开激光，
- ◇ 如以上清洗方法都无明显效果时，必须由专业人员用 75% 酒精完全浸湿棉球，从输出镜的中心位置起向外同一方向进行擦拭镜面。注意不可来回擦拭，以免造成输出镜划痕，进而影响输出功率。
- ◇ 最好的办法还是保护好窗口避免污染。特别提示：不能用丙酮擦洗镜片。
- ◇ 在有机玻璃上测试光斑时，离输出镜 300mm 处。

警告：若未能每两周检查一次，及时清理已脏污的输出镜，造成输出镜在脏污的状态下长时间工作，不仅极大的影响激光管的输出功率，还一定会产生输出镜炸裂。此类情况下产生的激光管问题，我司不予保修。

## 4. 警告

在没有冷却水循环的情况下，打开激光器会迅速使其爆裂，由此产生的损失，产品将不能保修。

警告：须按规定佩戴安全防护眼镜后，才可对激光器进行安装调试。

如果激光器需要返厂处理，必须使用完整的原包装，并事先与海目（北京）激光与数控发展有限公司联系并获得准许后再运输。

注意：在包装前，须将激光器中的冷却水放空。

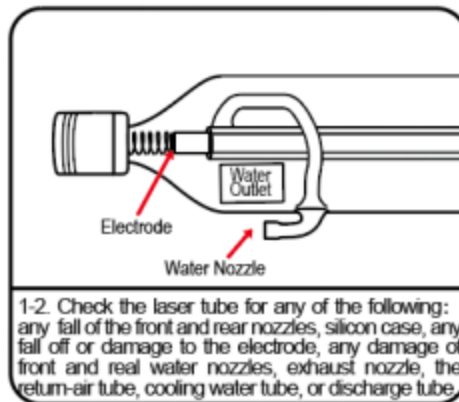
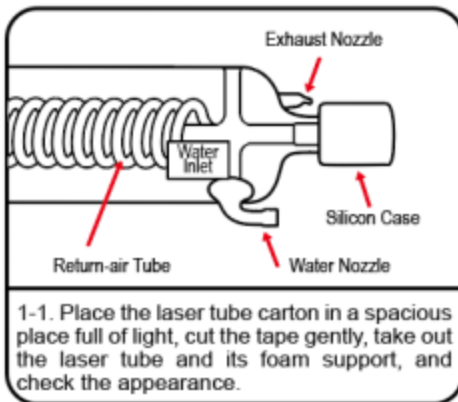
# Guide for Laser Tube Installation (H series)

## Box-opening and Appearance Inspection

Place the laser tube carton in a spacious place full of light, cut the tape gently, take out the laser tube and its foam support, and check the appearance.

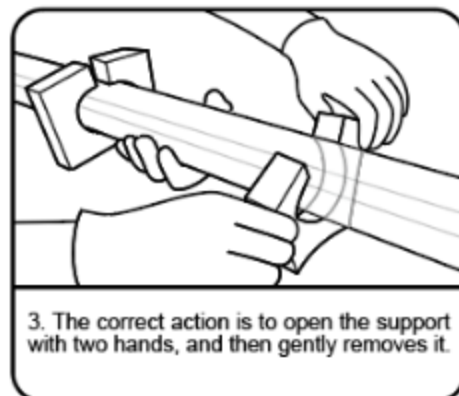
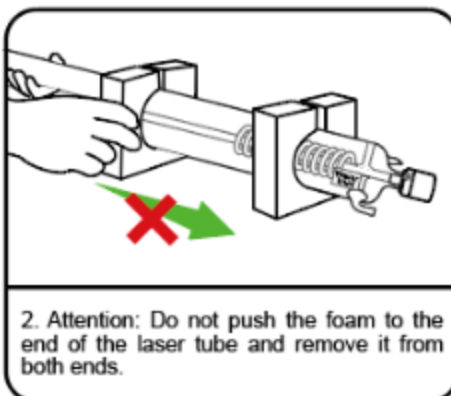
### 1-1 High Voltage Side

### 1-2 Low Voltage Side



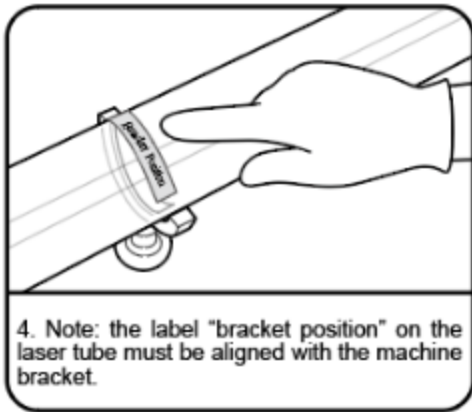
Check the laser tube for any of the following: any fall of the front and rear nozzles, silicon case, any fall off or damage to the electrode plate, any damage of front and rear water nozzles, exhaust nozzle, and any damage to the return-air tube, cooling water tube, or discharge tube inside the laser tube.

After the appearance inspection, operator A holds the tube with two hands and operator B removes the foam support on tube.



## Preparing for installation

Place the laser tube gently on the machine bracket.

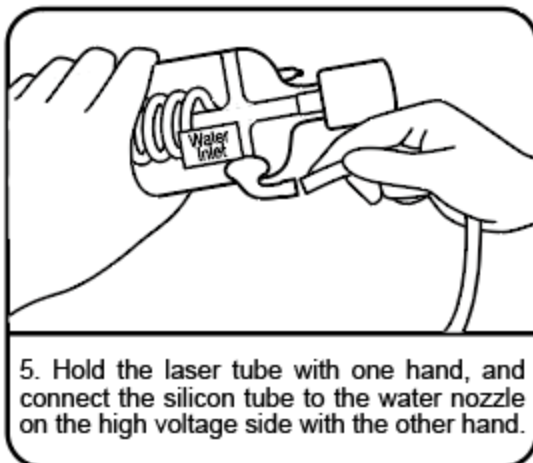


Avoid these parts touches the machine: welding wires, water nozzle, tube ends and electrode pins.

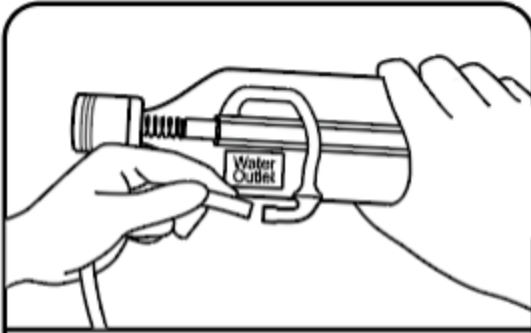
Check the high voltage side and laser output side, if they are correctly placed on.

## Connect the water chiller and laser tube

Use only silicon tubes with an inner diameter of 6-7mm and tube thickness of 1.5-2.0mm, connect the water chiller outlet to the water nozzle on the high voltage side (marked "water inlet"). The silicon tube should be set to the nozzle root so that the silicon tube will not drop neither no water leaking. Do not use detergent or lubricant.

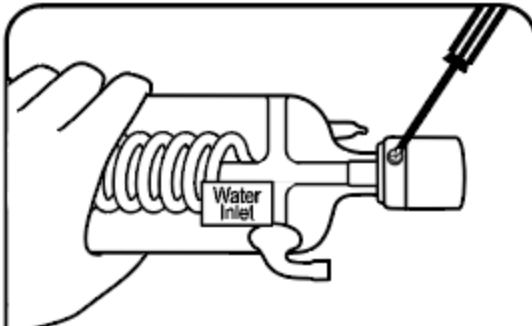


Use only silicon tubes with an inner diameter of 6-7mm and tube thickness of 1.5-2.0mm, connect the water chiller inlet to the water nozzle on the laser output side (marked "water outlet"). The silicon tube should be set to the nozzle root so that the silicon tube will not drop neither no water leaking.

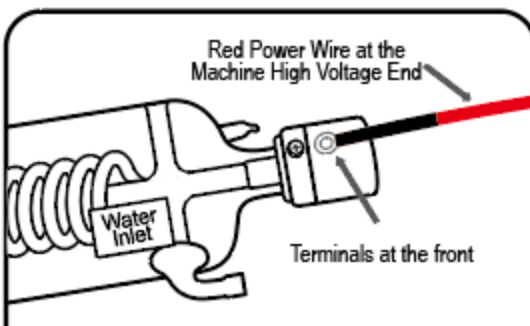


6. Hold the laser tube with one hand, and connect the silicon tube to the water nozzle on the low voltage side with the other hand.

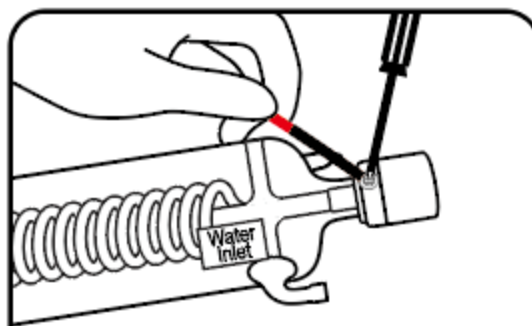
### Connect the machine with laser tube



7. Gently remove the silicone cover at the high voltage end of the laser tube, hold the laser tube with one hand, and loosen the screw with a screwdriver with the other hand, then remove it.



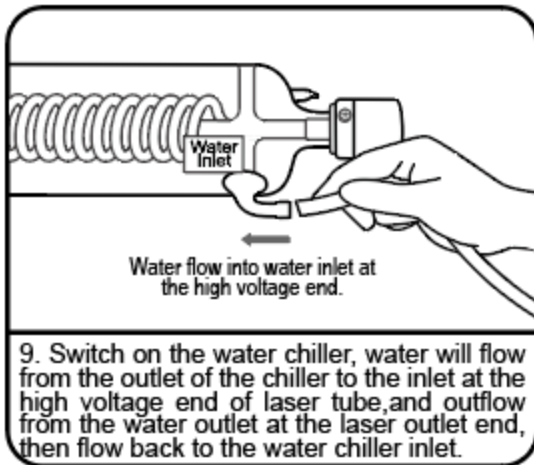
8-1. Connect the red power wire at the machine high voltage end (with terminals at the front) to the high voltage side of the laser tube.



8-2. Connect the red power wire at the machine high voltage end (with terminals at the front) to the high voltage side of the laser tube.

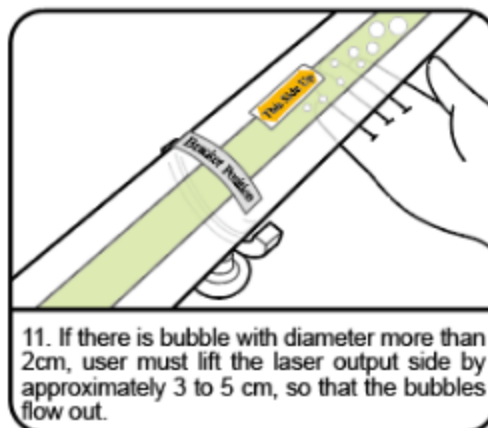
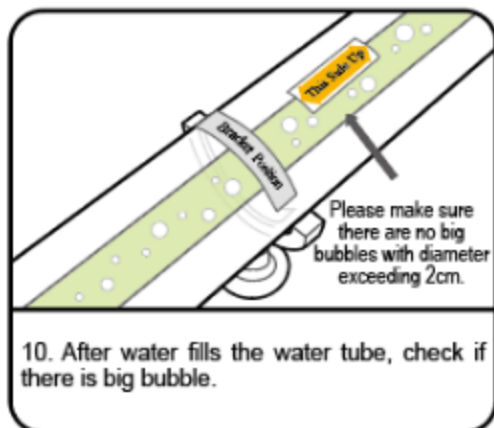
Use a screwdriver to loosen the screw at the low voltage side and remove it. Use a screwdriver to connect the black power wire at the machine low voltage end (with terminals at the front) to the low voltage side of the laser tube.

## Connect the water cooling system



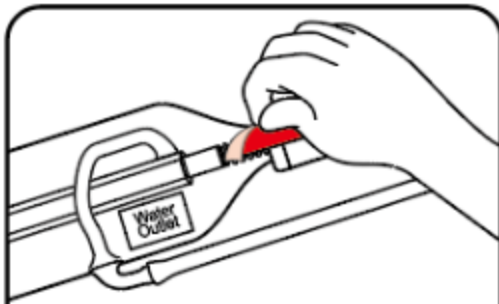
Note: Please check the water flow direction, water flow into water inlet at the higher voltage end, and flow out from the water outlet at laser outlet end. If the direction is not correct, cooling water will not fulfill the water tube. Then the cooling efficiency is low, the laser power is low, and the explosion risk increases.

(The laser tube has three layers. The inner layer is the discharge tube, the middle layer is the water pipe, and the outer layer is the gas storage pipe.)

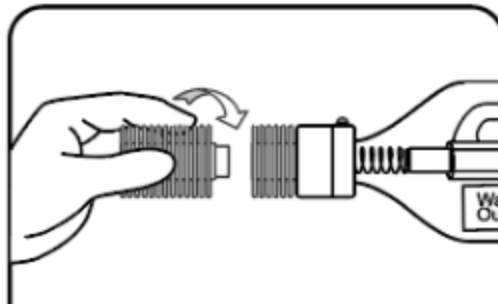


Please make sure there are no big bubbles with diameter exceeding 2cm, as they will reduce the cooling efficiency and increases the explosion risk. If the big bubbles cannot be removed by lifting the laser output end for 30 seconds, please check if the chiller has enough water or not, the chiller flow is enough or no. If the chiller flow is insufficient, please replace the chiller.

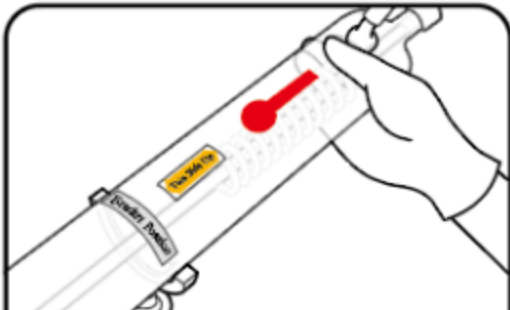
## Power on the laser machine



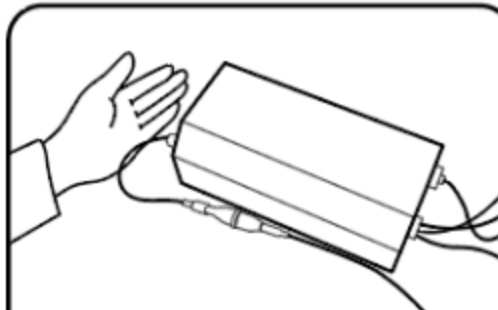
12. Peel off the red label "Please tear the label before use", and attach it to the blank space.



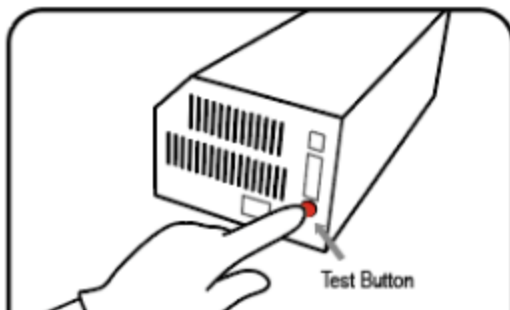
13. Rotate the dust mask clockwise and fix it on the heat dissipation cap on the laser output end.



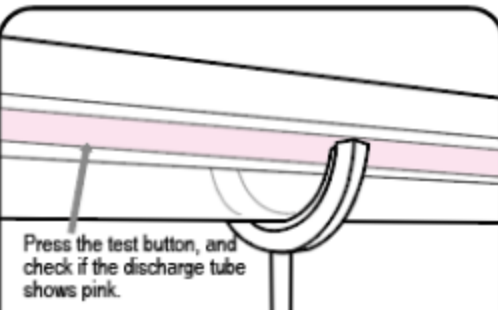
14. Turn the laser tube clockwise, and make sure the label "This Side Up" faces up.



15. Turn on the power supply and check if the fan is running or not. If the fan is not running, please change the power supply.



16. Press the test button on the power supply and check if there is abnormal sound from the laser power supply.



Press the test button, and check if the discharge tube shows pink.

17. Meanwhile, check the discharge tube in the laser tube. The discharge tube should show pink color when the laser tube is working normally.

If the laser discharge tube shows purple, white, or no color, please contact us for further instruction.

Fasten the laser tube on the machine brackets, once this is complete, installation is finished.

The next step is to adjust the laser delivery system of the machine. After that, you can operate the machine normally.

# CO<sup>2</sup> Laser Tube Operating Instruction (H series )

## 1. Installation Request

Please install in strict accordance with the Installation diagram of H series. The laser is equipped with a special power supply (see the table below for specific power supply model). The positive electrode zone is high voltage. The starting voltage is shown in the table below.

Results caused by wrong installation: firing, the inner tube was broken and leak water.

Model	Power Supply	Trigger Voltage
H1	P2	24
H2	P2	28
H2+	P2	26
H4	P4	30
H4+	P4	30
H6	P6	37
H6+	P6	37
H8	P6	41

## 2. Working Request

Water Cooling: cooling liquid must be pure water, flow is 3-5 Liter per minute, standard water temperature: 10°C-40°C.

Working Environment: 2-40°C, humidity: 10-60%.

Model	Test Current (mA)	Max Working Current (mA)	Recommended Working Current (mA)	Working Life (Hours) under Recommended Working Current
H1	25	25	18	15000
H2	28	28	21	15000
H2+	28	28	21	15000
H4	30	30	22	15000
H4+	30	30	22	15000
H6	30	30	24	10000
H6+	30	30	24	10000
H8	30	30	28	8000

Table description (take H1 as an example) : Detected current 25mA, allowed maximum working current 25mA, daily working current must be less than 24mA. If working current is less than 24mA, the laser tube working life can be 10000 hours. The above mentioned current is the current showed in the Ammeter which is series connected to cathode.

If the user does not operate as this request: the cathode will change color when used for a long period of ultra-current, and the laser tube service life will be greatly shortened.

To protect the electrode from dust, please wrap the high voltage cap by plastic wrap.

### **3. Performance**

Cutting.

Engraving.

### **4. Notification**

The output mirror surface cannot be cleaned by anything even if cotton ball. Otherwise the power will be reduced a lot.

Cleaning Instruction is as follows: 1) do not turn on the laser if the mirror is dirty, 2) blow the mirror surface by oblique front balloon, 3) spray pure alcohol to the mirror surface by injector, 4) do not turn on laser till the alcohol is volatilized, 5) If none of the above cleaning methods is effective, a professional staff can use the cotton ball which is completely soaked with 75% alcohol, wipe the output windows from the center towards the edge in the same direction. Please do not clean it back and forth which may scratch the windows, and reduces output power. 6) It is best to protect the output mirror from dust. Please note, do not clean it by acetone. 7)When test the light spot on acrylic, please keep the acrylic 300mm away from output mirror.

### **5. Safety**

Since the laser tube is making invisible light, goggles is requested during operation. The anode has high voltage. Please note the safety signs.

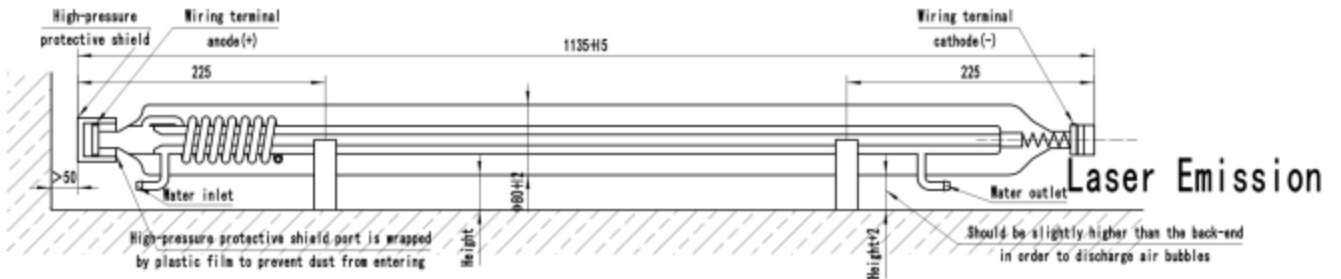
### **6. Storage and Transportation**

Before storage or transportation, please drain out the cooling liquid, cover the output side by plastic bag. The storage environment should be 2-40°C, humidity is 10-60%, and pack it in factory way. Packing notification: please do stick the laser tube and sponge strongly by tape, which will avoid the laser tube longitudinally sliding. At the end of the output mirror, the packing sponge should protrude 70 mm; At the end of the full mirror, the packing sponge should protrude 50mm.

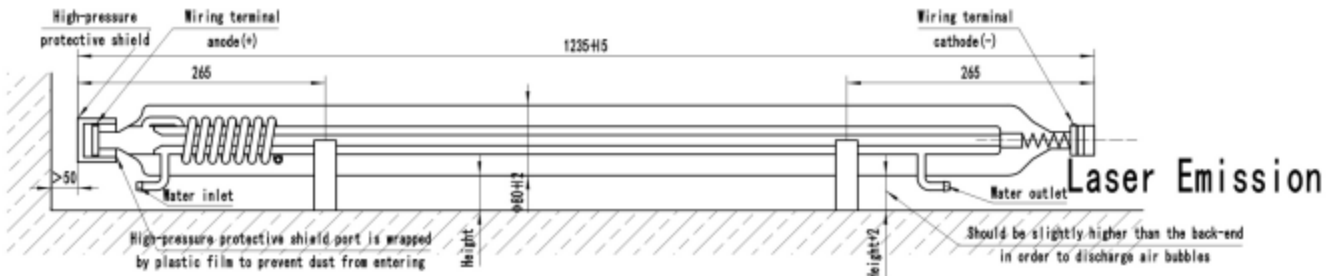
### **7. Operation goes against this manual has no quality promise.**



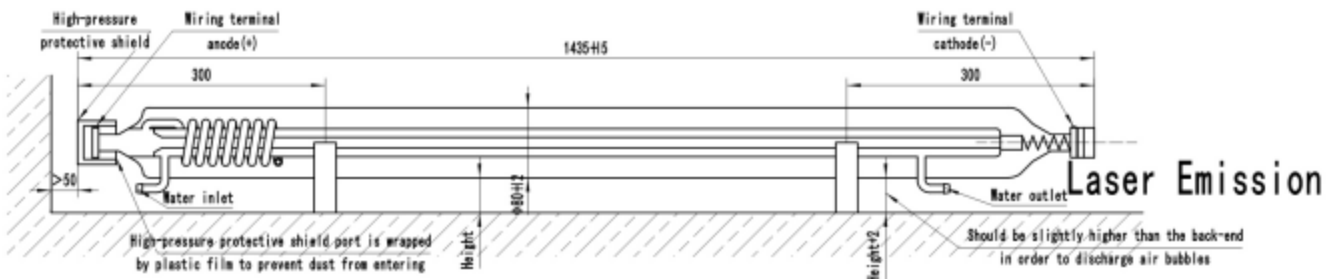
## INSTALLATION DIAGRAM OF CO2 LASER TUBE MODEL H1



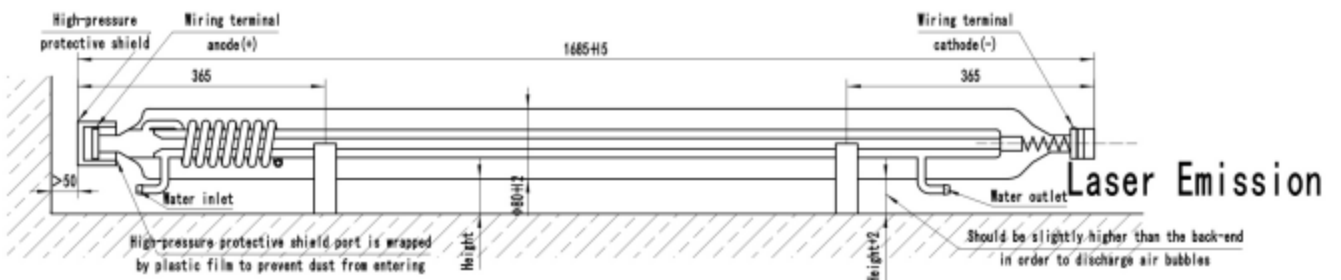
## INSTALLATION DIAGRAM OF CO2 LASER TUBE MODEL H2



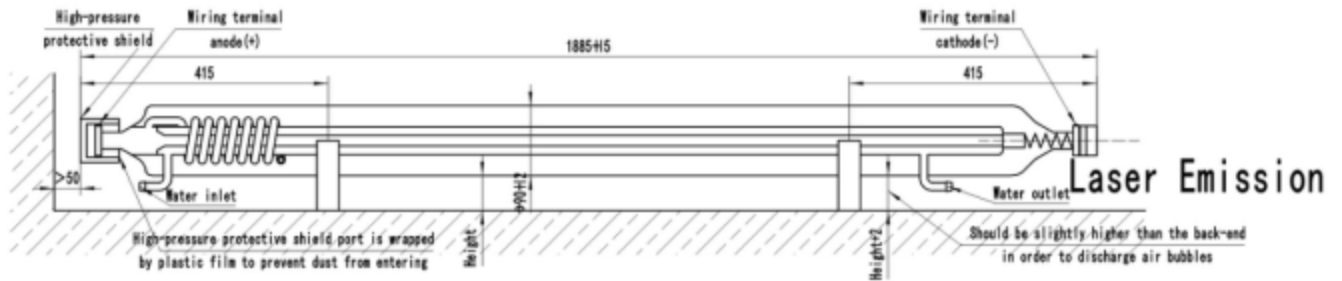
## INSTALLATION DIAGRAM OF CO2 LASER TUBE MODEL H4



## INSTALLATION DIAGRAM OF CO2 LASER TUBE MODEL H6



## INSTALLATION DIAGRAM OF CO2 LASER TUBE MODEL H8



## Cautions

### 1. Water Inlet and Outlet of Laser Tube

Attention: The water inlet and outlet shall follow the principle of low into higher drainage. Please refer to the following diagram.



- 1) In order to fully circulate the cooling water of the laser tube, it is necessary to ensure that the water flow enters from the low point and drain away from the high point under the pressure of the water so as to achieve the cooling of the entire laser tube.
- 2) If the flow direction is opposite, it is possible that the cooling water can not fill the whole pipe, resulting in poor cooling, power reduction and the phenomenon of tube burst.
- 3) If there is air bubbles in the laser tube, before the dimming, lift the water outlet side, until the bubble is completely discharged, and then fixed laser tube. Please be careful not to allow residual bubbles in the laser tube. On one hand it will influence the luminous effect, on the other hand it will lose the laser power. If the laser tube is poor cooling caused by bubble for long time, it may burst.

### 2. Installation Instructions

- 1) According to the marked fixed position on the tube, fix the laser tube on the machine and keep it be fixed on the horizontal plane.
- 2) Connect respectively the positive and negative line of laser power supply to the positive and negative line of laser tube. Pay attention to avoiding incorrectly connected line and make sure good insulation. (The rear end with the spiral glass tube is positive end)

- 3) Connect the chiller with the laser, the chiller outlet is connected to the laser inlet, and the chiller inlet is connected to the laser outlet.
- 4) Open the chiller to ensure that the cooling water is filled with the laser water cooling tube and the bubbles are completely drained.
- 5) When the laser tube is started, it normally adjusts 50-60% of the power to work.
- 6) Within the recommended maximum current, using laser can still be output rating power. Exceeding the recommended maximum current, using the laser will shorten the life of the laser tube;

### **3. If the following fault occurs, please check the below items.**

#### 1) Weak Power/Low Power, please check:

- ✧ The windows of laser tube is clean or not. If there is scratch, dirt or dust. The bracket is placed correctly or not.
- ✧ Output current and voltage, cooling water temperature, cleanliness and water flow.
- ✧ Lens & mirror surface is clean or not, hot or not. Laser path is shifted or not.

#### 2) High voltage side firing.

- ✧ High voltage is close to metal or not; if there is something around high voltage cap or not.
- ✧ Indoor humidity is too high to conduct electricity; Avoid condensation in summer
- ✧ Power supply and laser tube high voltage wire and connections is damaged or not.

#### 3) Laser tube broken, water cooling cap dropped.

- ✧ Water temperature should be between 15°C-25°C, and should avoid cooling water freezing In cold area. After laser is power off, please discharge the water if the temperature is under ZERO.
- ✧ When laser is working, the water cooling must be working on same time to protect laser tube(please test if the laser is on/off along with water on/off.)
- ✧ Cooling water pipe is folded or pressed or not.
- ✧ There is bubble inside laser tube or not.
- ✧ Water pressure and water flow is working or not; water flows in low level and flows out on high level.

#### 4) Laser tube windows dirt.

- ✧ During laser tube working, the environment and material cutting smoke may pollute the windows easily. We recommend user check the windows at least every two weeks, and clean it if any pollution.

The output mirror surface cannot be cleaned by anything even if cotton ball. Otherwise the power will be reduced a lot. Cleaning Instruction is as follows:

- ✧ Do not turn on the laser if the mirror is dirty,
- ✧ Blow the mirror surface by oblique front balloon,
- ✧ Spray pure alcohol to the mirror surface by injector,
- ✧ Do not turn on laser till the alcohol is volatilized,
- ✧ If none of the above cleaning methods is effective, a professional staff can use the cotton ball which is completely soaked with 75% alcohol, wipe the output windows from the center towards the edge in the same direction. Please do not clean it back and forth which may scratch the windows, and reduces output power.
- ✧ It is best to protect the output mirror from dust. Please note, do not clean it by acetone.
- ✧ When test the light spot on acrylic, please keep the acrylic 300mm away from output mirror.

- ◇ Warning: if user cannot check every two weeks, and clean the pollution in time, the laser tube runs with pollution in long time, not only the laser power will down, the windows will break also. We will not give warranty for any problem because of this reason.

#### **4. Warning**

If the laser tube is powered on without circling cooling water, it will break immediately. In this condition, the laser tube will have no warranty.

Before install and test the laser tube, please wear the protection glasses first.

If the laser needs to be returned to the manufacturer for repair, please make sure to use the complete original packaging.

Before package and transport, please make sure to contact Beijing HM Laser Co., Ltd. and get agreement in advance.

Before packaging, the cooling water in the laser tube must be vented completely.