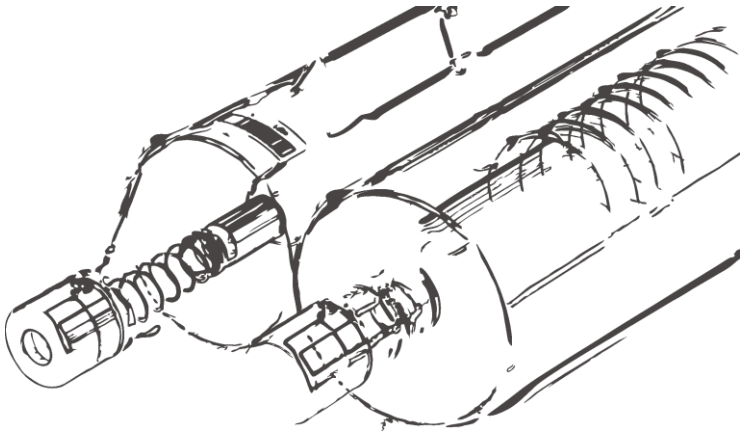
CO_2 Laser Tube

User Manual



SPT Laser Technology CO., LTD

www.sptlaser.net

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Chapter 1 Clarification

1.1 Copyright Ownership

No organization or individual is allowed to copy or reproduce part or all of the content of the document without the permission of SPT Laser Technology CO., LTD. All rights reserved.

1.2 Trademark Statement

SPT and other SPT trademarks are registered trademarks of SPT Laser Technology Co., Ltd. and enjoy exclusive use, license, transfer, renewal and other legal rights.

1.3 Notice

Before you install and use this product, please read this manual in detail, the operation, installation and precautions listed in the manual in order to achieve safety and comfort results.
After reading, please keep this manual for future reference, thank you for your cooperation. Due to the continuous improvement, update and replacement of products, the CO_2 laser you get may not be exactly the same as the illustration in the manual, we apologize for that.

1.4 Implementation Standards

GB/T15301-1994 General specifications for gas lasers

Chapter 2 Preface

Please take the time to read this manual, which contains precautions and safety reminders during the use of laser of this model, and detailed information such as installation and warranty. This manual consists of laser tube information, installation and use, warranty terms, etc. Please keep it carefully and review it at any time. We especially remind you to pay attention to the following matters: These lasers belong to Class IV lasers, avoid all direct contact with the naked eye and body.

This product has high voltage and strong light output, make sure the operator has understood the relevant safety information before use. Do not adjust any parts of the laser.
Make sure the operator has been trained and understands the safety procedures of this laser before using it. Place warning signs around the laser while it is in operation and do not approach without permission.

2.1 Safety Instruction

Optical Safety

This laser belongs to Class IV laser with a laser beam wavelength of 10.6 μm and all personnel are recommended to wear approved laser protection glasses when working with the system. Direct vision of the laser beam or any reflected laser beam is not permitted even when laser protective glasses are worn.
Warning: Laser radiation can cause serious injury to the eyes - including blindness.

- It is forbidden to direct the beam at reflective objects.
- It is highly recommended that the laser be placed where its beam is at a different level from the eye and not pointed at the entrance to the room. Be careful not to let the laser beam out of the window.
- The interaction of the beam with certain materials can cause visible radiation and may cause the same potential hazards as visible radiation. Appropriate protective measures must be taken in such cases.

Electrical Safety

WARNING: This device contains lethal DC voltages. This hazard may remain even after a power interruption.

- -Do not open the outer cover of the laser power supply. Only qualified technicians who are familiar with the equipment should perform relevant operations.
- -There is no electrical hazard during normal operation of the system. However, it is necessary that: 1) the high-voltage insulation cover is correctly positioned and 2) it is well grounded.
- -There may be a risk of exposure to high voltage when the high voltage insulation shield is removed or when the high voltage power supply is not shielded from the operating system, so please pay special attention to safety. Warning: The ignition voltage of the CO_2 laser tube is close to 35KV, which is present in the laser tube, the high voltage power supply and the high voltage connection line between them.

Chapter 3 Parameters

3.1 C-Series Laser Tube

Laser Tube Model	C25	C35	C40	C42	C43	C45	C50	C60	C65	C70	C75	C76	C80	C90	CS100	C100	C130	C150
Output Power (W)	30	35	40	45	40	45	50	60	60	60	60	80	80	90	95	100	130	150
Maximum Output Power (W)	35	40	50	55	50	55	70	80	80	80	70	90	110	100	120	130	150	180
Length (mm)	600	720	800	850	800	850	1000	1200	1200	1250	950	1150	1600	1250	1350	1450	1650	1850
Diameter(mm)	50	50	80	80	50	50	50	50	55	55	80	80	60	80	80	80	80	80
Catalytic	Yes																	
Wavelength (μm)	10.6																	
Laser Mode	Multi-Low Order Mode																	
Excitation Mode	Electrical excitation																	
Starting Current(mA)	4	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	6	7
Starting Voltage(kV)	11	15	15	16	16	17	18	22	22	23	16	20	28	22	24	24	27	30
Working Voltage (kV)	9	10	10	10	12	13	15	16	16	16	12	14	19	15	16	16	17	20
Spot Diameter (mm)	4	4	4	4	4	4	5	5	5	5	5	5	5	5	5	5	6	6
Recommended Current (mA)	15	15	18	18	16	16	17	18	18	18	22	22	20	22	23	24	28	28
Maximum Working Current (mA)	≤20	≤20	≤20	≤20	≤20	≤20	≤20	≤20	≤20	≤20	≤25	≤25	≤25	≤25	≤25	≤25	≤30	≤30
Stability	≤±5%																	
Cooling	Water- cooled 15-25℃																	
Carton Package (cm)	84*13*11	84*13*11	94*17.3*15.5	94*17.3*15.5	99*13*11	99*13*11	113*13*11	133*13*11	133*13*11	138*13*11	109*17.3*15.5	129*17.3*15.5	173*15*13	138*17.3*15.5	149*17.3*15.5	158*17.3*15.5	178*17.3*15.5	198*17.3*15.5
Gross Weight(kg)	1	1.5	2.1	2.3	1.5	1.7	1.84	2.22	2.3	2.36	3	3.5	3.82	3.78	4	4.3	4.8	5.42
Net Weight(kg)	0.6	1	1.5	1.6	1	1.1	1.24	1.44	1.54	1.62	1.5	2.5	2.64	2.52	2.5	2.9	3.3	3.76

3.2 T-Series Laser Tube

Laser Tube Model	T30	T40	T45	T50	T75	T90	T100	T130	T150
Output Power (W)	30	40	45	50	60	90	100	130	150
Maximum Output Power (W)	40	50	55	70	75	100	130	150	180
Length (mm)	700	800	850	1000	1050	1250	1450	1650	1850
Diameter(mm)	50	80	50	50	80	80	80	80	80
Catalytic	Yes								
Wavelength (μm)	10.6								
Laser Mode	Multi-Low Order Mode								
Excitation Mode	Electrical excitation								
Starting Current(mA)	4	5	5	5	5	5	5	6	7
Starting Voltage(kV)	14	17	18	18	18	22	24	27	30
Working Voltage (kV)	9	10	11	14	13	15	16	17	19
Spot Diameter (mm)	4	4	4	4	5	5	5	6	6
Recommended Current (mA)	15	18	18	18	22	22	24	28	28
Maximum Working Current (mA)	≤20	≤25	≤20	≤20	≤25	≤25	≤25	≤30	≤30
Stability	≤±5%								
Cooling	Water- cooled 15-25℃								
Carton Package (cm)	83*12.5*11	94*17.3*15.5	99*13*11	113*13*11	118*17.3*15.5	138*25*23	158*25*23	178*25*23	198*25*23
Gross Weight(kg)	1.52	2.64	1.76	1.84	3.16	4.66	5.18	5.78	6.42
Net Weight(kg)	0.96	1.66	1.12	1.24	2.14	2.64	2.96	3.4	3.84

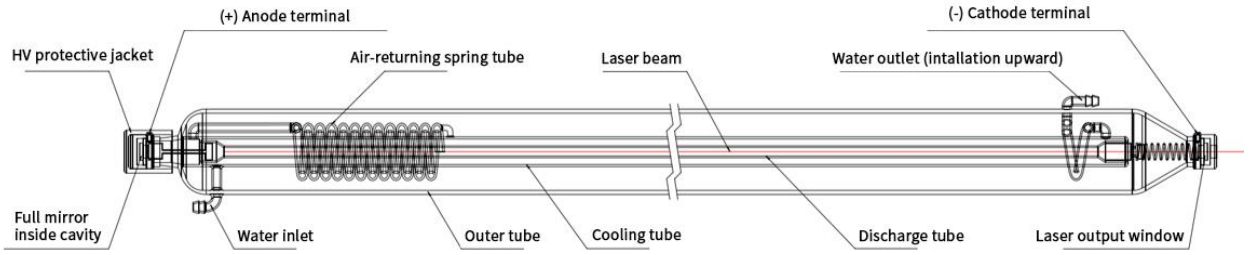
3.3 TR-Series Laser Tube

Laser Tube Model	TR30	TR40	TR45	TR50	TR75	TR90	TR100	TR130	TR150
Output Power (W)	30	40	45	50	60	90	100	130	150
Maximum Output Power (W)	40	50	55	70	75	100	130	150	180
Length (mm)	730	830	880	1030	1080	1280	1480	1680	1880
Diameter(mm)	50	80	50	50	80	80	80	80	80
Catalytic	Yes								
Wavelength (μm)	10.6								
Laser Mode	Multi-Low Order Mode								
Excitation Mode	Electrical excitation								
Starting Current(mA)	4	5	5	5	5	5	5	6	7
Starting Voltage(kV)	14	17	18	18	18	22	24	27	30
Working Voltage （kV)	9	10	11	14	13	15	16	17	19
Spot Diameter （mm）	4	4	4	4	5	5	5	6	6
Recommended Current （mA)	15	18	18	18	22	22	24	28	28
Maximum Working Current （mA)	≤20	≤25	≤20	≤20	≤25	≤25	≤25	≤30	≤30
Stability	≤±5%								
Cooling	Water- cooled 15-25℃								
Carton Package (cm)	83*12.5*11	94*17.3*15.5	99*13*11	113*13*11	118*17.3*15.5	138*25*23	158*25*23	178*25*23	198*25*23
Gross Weight(kg)	1.62	2.74	1.86	1.94	3.28	4.78	5.3	5.9	6.54
Net Weight(kg)	1.06	1.76	1.22	1.34	2.26	2.76	3.08	3.52	3.96

3.4 V-Series Laser Tube

Laser Tube Model	V20	V26	V26+
Output Power (W)	180	220	220
Maximum Output Power (W)	220	260	260
Length (mm)	1450	1800	1905
Diameter(mm)	80	80	80
Catalytic	Yes		
Wavelength (μm)	10.6		
Laser Mode	Multi-Low Order Mode		
Excitation Mode	Electrical excitation		
Starting Current(mA)	8	8	8
Starting Voltage(kV)	28	30	30
Working Voltage (kV)	18	20	20
Spot Diameter (mm)	7	7	7
Recommended Current (mA)	30	30	30
Maximum Working Current (mA)	≤35	≤35	≤35
Stability	≤±5%		
Cooling	Water- cooled 15-25℃		
Carton Package (cm)	158*25*23	198*25*23	190.5*104*126
Gross Weight(kg)	6.1	8	15.3
Net Weight(kg)	4	5.4	11.9

Chapter 4 Structure & Principle



The structure of classic sealed-off CO_2 laser tube is what is shown above, it includes three main parts, hard glass, resonator cavity and electrodes.

4.1 Hard Glass

This part is made of GG17 frit, includes discharge tube, cooling tube, gas tube and the gas returning tube (the spring tube in the drawing) . The discharge tube matters most, and it decides the basic property of laser output due to the principle that the length of the discharge tube is proportional to the output power of the laser tube.

The cooling tube is to take away extra heat generated from laser to make sure it runs stable. And protect the laser tube from broken because of overheat. Gas tube is important on two sides: firstly, it increases the capacity of stored gas which is the gain medium, reduce the change of the working gas composition and pressure during the discharge process, which can extend the operating life of laser tube; on the other hand, it enhances the mechanical strength and stability of the discharge tube.

Gas returning tube is the spring tube which connects the space between two electrodes in the discharge tube. Its existence can help to reduce the unbalanced distribution of voltage between electrodes caused by electrophoresis and a longer spring tube can also keep the discharge only happens in the discharge tube, not between the gas tube and electrodes.

4.2 The resonator cavity

This part covers the full mirror and the laser output window. Full mirror in resonator cavity is generally made from optical glass, coated with gold film. The reflection rate of this gold film for wavelength at around 10.6μm can reach more than 98%.

The output window is made from infrared materials (Ge) that can transmit 10.6um wavelength, coated with multi-layer dielectric film.

4.3 Electrodes

CO_2 laser tube generally adopts cold cathode in cylindrical shape. The material of this cathode matters a lot to the service life of laser. The basic requirements for the material are: low sputtering rate and low gas absorption rate.

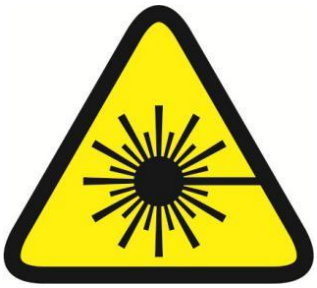
Chapter 5 Labels

5.1 Label Identification

The labels on laser tube are very important, please do not remove it from laser tube.

5.2 The main labels on laser tube

5.3 Laser Emission Direction Label



Laser output direction sign
To show laser output From end to front

5.4 Laser Hazard Label

Laser hazard label

Class 4 laser product

AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED LASER RADIATION

5.5 Laser Tube Certification Label

Laser qualified certificate

It shows laser tube serial number, Model, Length,
Diameter, Power, MFD Inspector, CE certificate, FDA

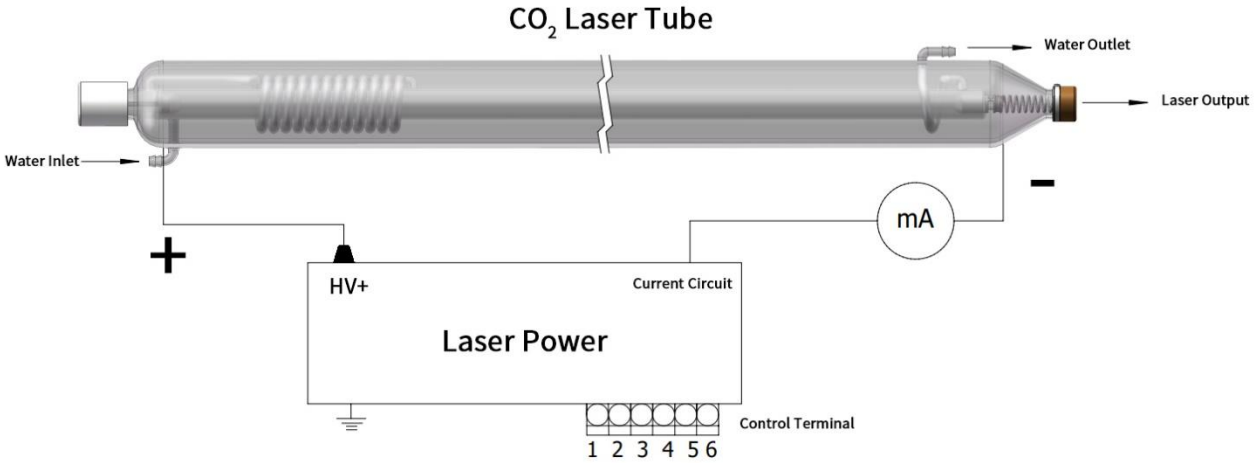
5.6 Support Point Labels

Supporting point label Show correct place to support the tube

Chapter 6 Instructions for Use and Precautions

6.1 Connecting to laser power supply

The “HV+” on laser power supply must be connected to the anode on laser tube. And the cathode can be directly connected to the cathode of laser tube or through a series circuit with Ameter.



6.2 Cooling

Make sure the water cooling is on and normal before you start the laser. The water flows according to the “lower inlet” and “higher outlet” principle with no bubbles in it. And the cooling pipe is fulfilled with water.

Request: soft water (distilled water or purified water) is recommended, and check the temperature of the cooling water regularly. It should be between 15℃-30℃, not too high or too low. Especially in summer, please turn off the machine for a while or replace the coolant when you found the coolant temperature is too high.
In some cold area, make sure the coolant won’t be frozen. Dry out the cooling water in the laser tube after turning off the machine, in case the laser tube is broken because of frozen water.

Special note: the chiller must be grounded if your machine is powered with AC power.

The flow of coolant must be 2L-7L/min. Insufficient cooling can cause laser mode change, laser spot distortion, which ends up in laser power drop. The water outlet must be under
the water in the chiller, otherwise the laser tube can’t be fulfilled with water when start the chiller again.

6.3 The optimal mounting point

The “supporting point”(refer to the labels) on laser tube must match the laser tube mount location.

6.4 Protection for laser output aperture

Protect the laser output aperture away from the contamination (the smoke and dust) produced during operation (including the laser alignment). Clean it gently with soak absorbent cotton or silk cloth with absolute alcohol if it is contaminated. Contamination on laser output lens can cause laser tube power drop.

6.5 Other Precautions

(1) During machine tuning, twist the laser tube direction or the supporting point to get its best performance and then fix the laser tube;
(2) Keep the high voltage part dry and clean (no contamination) and keep the laser tube anode away from machine shell (metal) in case any high voltage discharge ignition.
(3) Make sure no scale in the coolant in laser tube operation, it can cause block in the cooling pipe and the laser tube will be insufficiently cooled. Remove it with 20% dilute hydrochloric acid once there is scale found in your laser cooling tube.
(4) Finish the mounting gently because laser tube is made of glass and it's fragile.
(5) Run the laser tube reasonably. Do not run it with the current which is higher than its Max. working current.

Chapter 7 Trouble shooting

7.1 Can't engrave deep

Check with the following sequence if your machine can't engrave deep when it starts engraving:

1. Check if the supporting point of laser tube is on the laser tube mount;
2. Check if the current is too low;
3. Check if the laser alignment is correct;
4. Check if it is the right focus;
5. Check if there is scratches or contamination on the surface of laser optics;
6. Check if the flow and pressure of cooling water is sufficient.

The problem shows up in the middle of operation:

1. Check if the supporting point of laser tube is on the laser tube mount;
2. Check the cooling temperature is ok or not;
3. Check if the optics get hot during operation;
4. Check if the flow and pressure of cooling water is normal;
5. Check if the cooling water is clean.

7.2 High voltage discharge ignition

1. Check if there is moist or contamination around where the high voltage cable connected;
2. Check if the high voltage cable is too close to the metal frame of machine;
3. Check if the connector on high voltage cable falls off from the mount;
4. Check if the high voltage cable is damaged inside or broken;
5. Check if there is condensation on the laser tube and water pipe because the coolant is too cool;

7.3 Laser tube broken

1. Water is frozen due to very low temperature (generally this happens in winter);
2. The laser tube is not water cooled;
3. The water pressure is too low;
4. The coolant flow doesn't follow the " lower inlet" and " higher outlet" principle, in that case, the laser tube is partially overheat because part of the tube is not well cooled with water.

7.4 The possible reasons for breakage caused by high voltage discharge

1. The power of power supply and laser tube don't match (e.g. a higher power supply to power a lower power laser tube). The output voltage of power supply exceeds what the laser tube can take, causes laser tube damage.

2. Insufficient cooling, there are bubbles in the cooling water. The spot which can't get well cooled can be damaged by high temperature (the high temperature can cause glass property change, end in laser tube partial damage).

3. There are tiny bubbles in the glass or the material is not very even due to the temperature, material, craft in the production process, it can also cause laser tube damage when high voltage discharge occurs.

7.5 Instructions for laser power supply failure detection

The following detection has to be conducted when there is no damage on laser tube surface.

1. The laser power supply comes with detection. Push the "TEST" button on laser power supply (the red one) when it's standby, the "LASER" led on and there is laser generated from the laser tube. If the "LASER"led is OFF, the laser power supply fails; If the "LASER" led is ON and no laser comes out from laser tube, the laser tube fails.

2. The laser power supply has no detection function.Short the 5V and IN on 6pin terminal, short the pin L, P, G. Turn on the power supply, the laser tube does not fire or the laser power is very weak when the current is up to more than 10mA, the laser tube fails. If the current can't reach up to 10mA, the laser power supply fails.

If none of the above problems exist, please contact SPT for further info.

Chapter 8 Warranty Policy

8.1 Warranty Period

The warranty period of laser tubes produced by SPT LASER is counted from the delivery date (including storage):
C collections, C30-C80, 4 months; C90-150, 10months;
T/ TR collections, 10months;
V collections: 10months

8.2 Scope of Warranty

If any of the following problem occurs under warranty with proper operation, please send us the laser tube serial number to check, then send the laser tube back to us completely (without damage) for warranty replacement after confirmation.

1. The laser tube power drops more than 20% of its rated power;
2. The laser tube outlook is complete, but it can't be triggered with power in;
3. The glass tube is broken caused by stress;
4. Damage caused during logistics from SPT to customers.

NOTE: For overseas customers, the laser tube is not necessarily sent back us for warranty claim. But need to send full video for us to check and confirm the problem, then smash the laser tube, take a picture which shows the 2 heads of laser tube as well as its full label (show its model and MFD info, etc) for us to keep in file..

The conditions are not covered:
1. Warranty expired;
2. The laser tube power drop or breakage caused by insufficient cooling;
3. The laser power drop due to contamination on the surface of laser aperture (output lens);
4. Breakage caused by external force.

Any further question or help needed, please refer to www.sptlaser.net or email us at support@laserwd.com.