BOCI BLT4 Fiber Laser Cutting Head

Owner's Manual

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If any details in this manual is unclear or if you need additional assistance setting up your laser, please feel free to call us at +1 (626) 671-4014 or email at service@gueagle.com.

Introduction

How to Use This Owner's Manual

Thank you for purchasing a GU Eagle fiber laser cutting system equipped with a BLT4 laser head.

The BLT4 laser head has been designed to be easy to use, but you will utilize it to its fullest potential by taking some time to read this owner's manual prior to use. You will be ready to use the laser head as soon as you read the first few sections. Then you can refer to topics in the remaining sections, as you work.

Notes Used in This Manual

Look for these kinds of notes to help you find valuable information throughout the text:

> **NOTE**
>
> Helpful notes to keep in mind while running the laser!

> **IMPORTANT**
>
> Important instructions you should always follow.

> **WARNING**
>
> Warnings and cautions to keep in mind while running the laser.

Safety

Laser Safety

Lasers use intense beams of light to create heat and fire as a normal part of their operation, and depending on the laser, the light might not be visible to you. If the proper safety measures are ignored, you could burn or blind yourself or someone else, or start a fire that could damage or destroy the building in which the laser system is housed.

> **IMPORTANT**
>
> ***ALWAYS*** wear protecting glasses while doing laser processing.

> **WARNING**
>
> ***DO NOT*** aim and fire laser on anything but the workpieces you want to process.

> **WARNING**
>
> ***DO NOT*** leave a running laser unattended.

The visible output beam of the Laser Diode Pointer (Red Dot Pointer) is accessible to the operator. While this device employs the same technology as the familiar laser pen-pointers, like them it is potentially hazardous if its beam is directed into the eye.

> **WARNING**
>
> ***DO NOT*** view directly into the beam of the Laser Diode Pointer (Red Dot Pointer).

Electrical Safety

> **WARNING**
>
> ***DO NOT*** make or break any electrical connections to the laser head while the unit is turned on.

Product Description

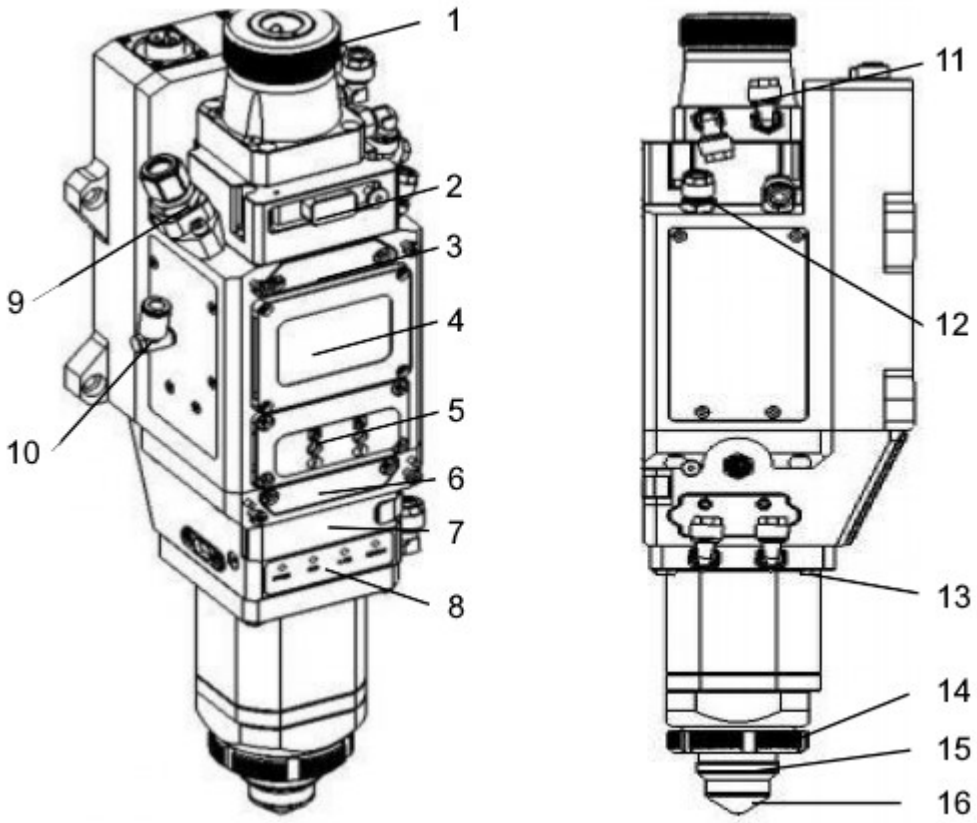
In this chapter, you will get to know the mechanical structure, the technical specifications, the dimensions, the electrical interface, the LED panel and the removable parts of the BLT4 laser head.

> **NOTE**
>
> There are a few sub-models of the BLT4 laser head family which are almost same in basic design and operations but a little bit different in details.

Mechanical Structure

The BLT4 fiber laser cutting head is designed and constructed in a modular way, composed by a set of blocks separated in function but connected and supporting each other, forming an advanced and intelligent unit.

> **NOTE**
>
> Sub-models of the BLT4 family may come with slightly different blocks, result in different dimensions, technical specifications, interfaces and removable parts. Please refer to the corresponding chapters for details.



#	Description	#	Description
1	Fiber optical interface	**9***	Cooling gas interface for the nozzle
2	1_{st} upper protective lens	**10**	Assist gas interface for cutting
3	2_{nd} upper protective lens	**11**	Cooling water outlet
4	Collimating unit	**12**	Cooling water inlet
5	Focus unit	**13**	Anti-collision screws
6	2_{nd} lower protective lens	**14**	Ceramic holder lock ring
7	1_{st} lower protective lens	**15**	Ceramic holder
8	LED panel	**16**	Nozzle

Blocks no.2-8 form the main unit of the laser head, guide the laser to the material and help the system monitor and control the laser cutting process with a group of optical, imaging and pressure sensors.

Technical Specifications

	BLT421	BLT441	BLT461	BLT481
Laser wavelength	1030~1090nm			
Laser power	≤8kW	≤15kW	≤20kW	≤30kW
Fiber interface*	QBH			
Beam magnification*	M=1.5/2.0/2.5 (100:150/100:200/100:250)			
Focus adjustment range	±50mm (100:200)			
Beam center adjustment range	±1.5mm			
Focusing acceleration	7.5m/s^2			
Assist gas interface	ø10, max pressure 25Bar/375Psi/2.5MPa			
Cooling gas interface*	ø6, max pressure 5Bar/75Psi/0.5MPa			
Cooling water interface	ø8, max pressure 5Bar/75Psi/0.5MPa, min flow rate 2.0L/min			
Operating temperature	5~55°C/41~131°F			
Storage temperature	-25~55°C/-13~131°F			

IMPORTANT

To avoid damage during storage and transportation,

- Avoid collision.
- The laser head should be stored in the allowable temperature and humidity range.
- Avoid storing in or near magnetic fields such as permanent magnets or strong alternating fields.

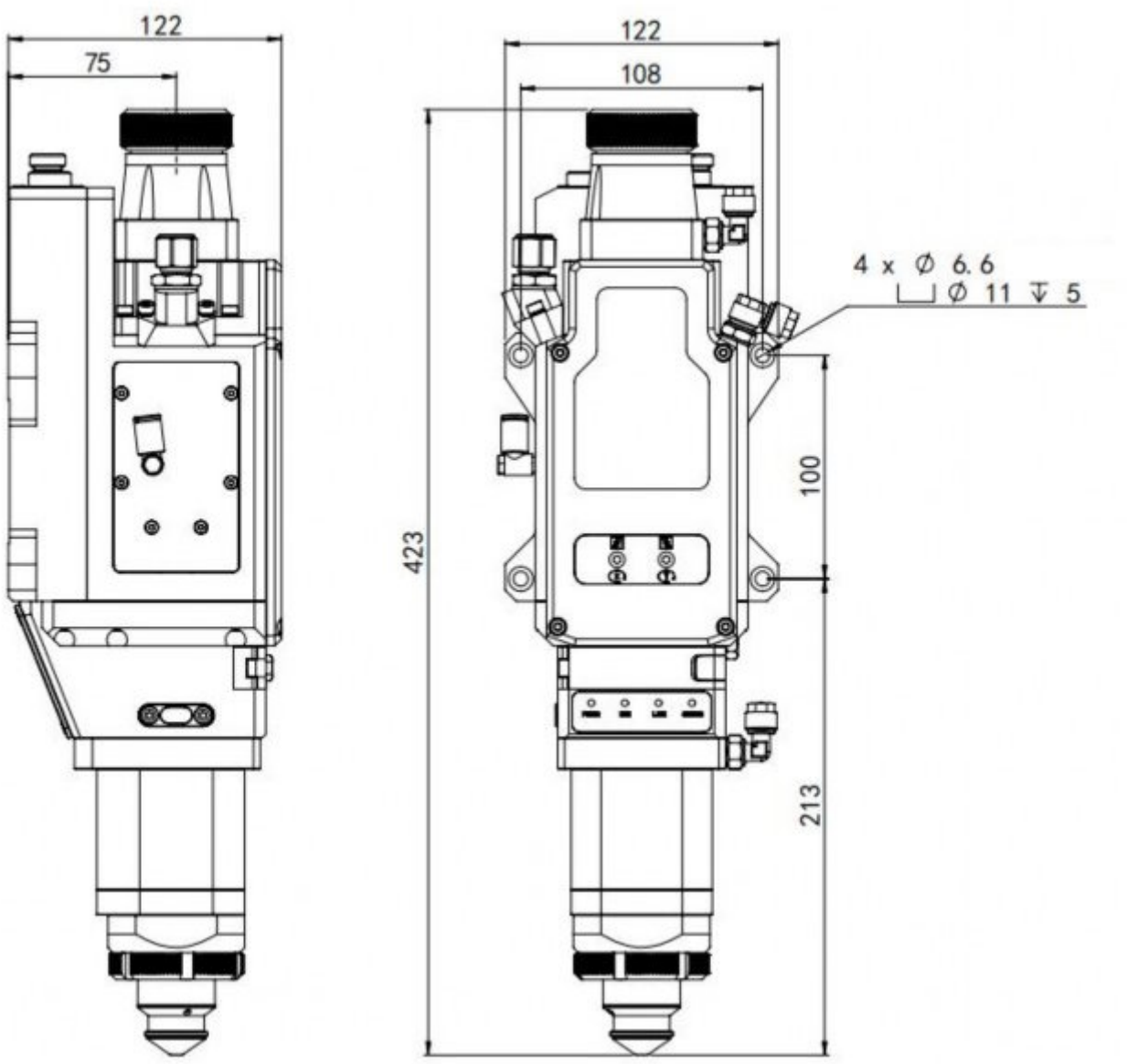
NOTE

According to the max power of the laser source and the target thickness range of materials, sub-models of the BLT4 family may come with different combinations of the collimating and focus lenses, resulting in different beam magnification and focus adjustment range.

And, sub-models for pipe cutting may not have the cooling gas interface.

Dimensions

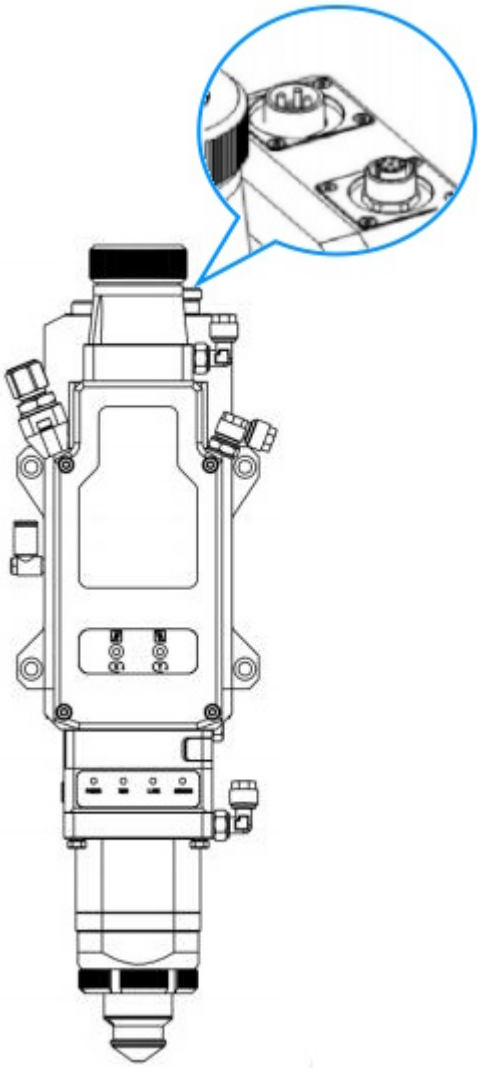
The pictures below show the dimensions of a BLT4 laser head. There should be enough room for the laser head to move along the Z axis without interfering with the surrounding parts; enough rooms for the fiber optics interface, the electrical cables, the water hoses and the gas pipes to be connected without much tension or twist; enough room for the laser head to pass over the material to its home position; and enough room for the installation and maintenance such as aligning the laser, replacing the protective lens, etc.



NOTE

Sub-models of the BLT4 family may have slightly different dimensions, e.g. a little bit taller with 100:250 beam magnification. The dimensions above are for reference only.

Electrical Interface



NOTE

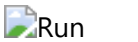
The inlets of the electrical interface come with the caps of IP64 water proof, and the connectors are also IP64 water proof too. Keep the caps in case of disconnecting and reconnecting for maintenance or troubleshooting.

WARNING

The electrical interface is designed as far as possible away from the cooling water interfaces, but there is still the risk of getting the inside wet and the resulting malfunctions. So, please connect the electrical interface as soon as possible after taking off the caps and make sure it is connected when connecting the cooling water and when the water is connected.

LED Panel

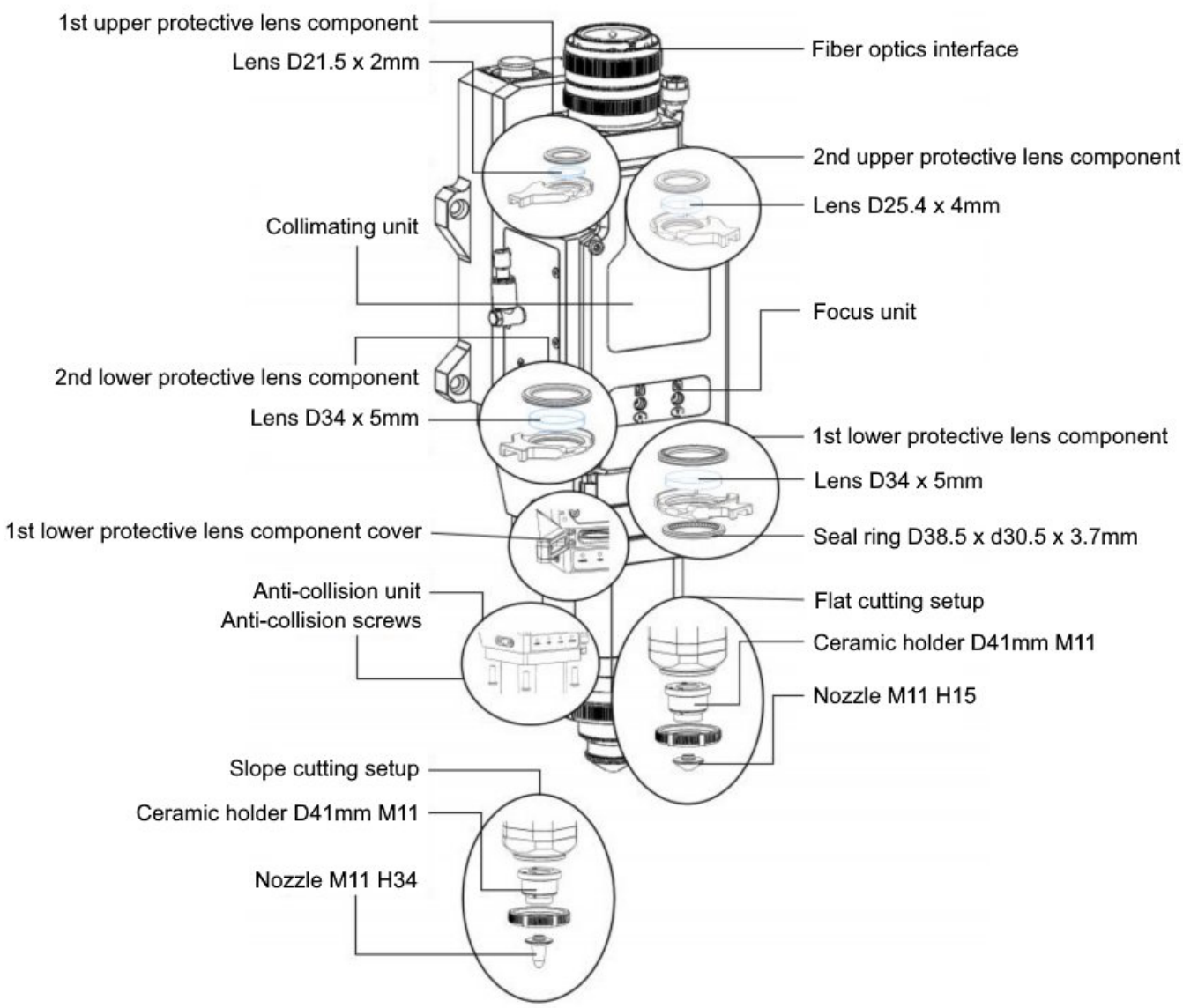
The LED panel gives you some basic information of the running state of the laser head and the system.

Indicator	State	Description	Troubleshooting
	green	Power OK	
	red	Power failure	Check the power voltage.
	N/A	No power	Power is off. The electrical interface is not well connected. The electrical cable is broken.
	green	Motor OK	
	red	Motor failure	There is something wrong with the motor itself or the transmission mechanics.
	N/A	No motor	The electrical interface is not well connected. The electrical cable is broken.
	green	Communication OK	
	red	Communication failure	There is something wrong with the system communication.
	N/A	No Communication	The electrical interface is not well connected. The electrical cable is broken.
	green	Sensor good	Everything is running well.
	red	Sensor bad	At least a sensor is reporting a warning or an error. Check the warning or error message in the software for more details.
	N/A	No sensor	The electrical interface is not well connected. The electrical cable is broken.

Removable Parts

The nozzles, the protective lenses, especially the 1_{st} lower protective lens, and even the ceramic holder are consumables, they are easy to be removed from the laser head, refer to Replace the Nozzle, The Lower Protective Lenses, Replace the Ceramic Holder and The Upper Protective Lenses for more details.

To protect the laser head from a hard collision with materials, the bottom part of the laser head, connected by four special anti-collision screws, is designed to be detachable from the main unit, refer to Fixing the Anti-Collision Unit for more details.



> **NOTE**
>
> Sub-models of the BLT4 family may come with different types of nozzles, protective lenses and ceramic holders, please refer to the parts list paperwork of your machine.

Installation

In this chapter, we will guide you to install the BLT4 laser head step by step.

Get Ready for the Installation

In this chapter, we will guide you to get everything ready and install the laser head in the right way with the right tools.

1. Make sure the laser head mount, the electrical cable, the water hoses and the gas pipes are ready in the position.

2. The laser head is the device to guide the high power laser and the lenses inside are very sensitive to dust and dirt, we need to connect the fiber optics interface to the laser head in the horizontal body position within a dust-free environment.

3. Get the tools ready.

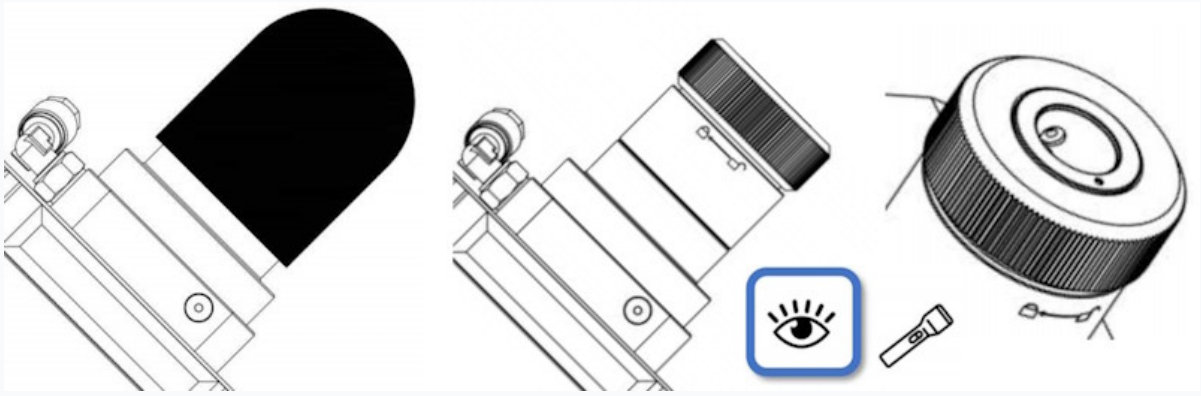
    - a dust-free box or an equivalent device
    - a flash light
    - some water-free alcohol and a spray bottle
    - some dust-free cleaning cloth and cotton swab
    - a dust blower
    - an allen wrench set
    - a wrench set or an adjustable wrench

4. Move the gantry of the machine close to the front side with enough space left in its front for the dust-free box; and put the box on the left side of the laser head mount if you are going to hold the fiber optics interface with your right hand when connecting, or on the right side if you want to use your left hand; then pull the fiber optics cable all the way forward out to reach the operating position.

Connect the Fiber Optics

Follow the steps below to connect the fiber optics to the laser head.

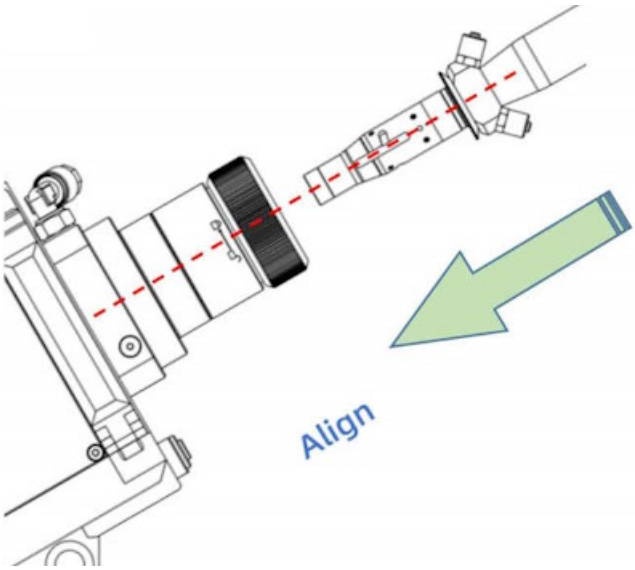
1. Clean the dust-free box with a vacuum and some dust-free cleaning cloth with alcohol.
2. Turn on the dust-free box and leave it running for 10-20 minutes.
3. Clean the laser head with some dust-free cleaning cloth with alcohol, put it in the dust-free box.

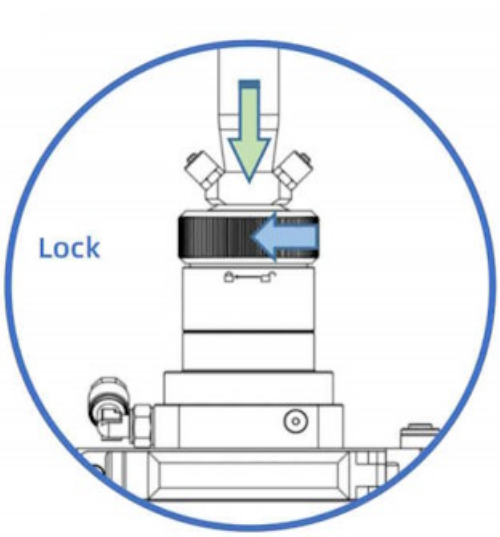
> **NOTE**
>
> Remove the cap, be aware of the aligning mark (a red dot), and check if there is another small cap on the inlet, if that is the case, just keep the small cap there and clean around it again, otherwise, put the cap back there on the interface.
>
> 
>
> Keep all the caps coming with the laser head, in case of disconnecting for maintenance or troubleshooting.

4. Clean the fiber optics interface with some dust-free cleaning cloth with alcohol, put it in the dust-free box.

> **NOTE**
>
> Remove the cap, be aware of the aligning mark (a red dot) and the protective film, then put the cap back there on the interface.
>
> 
>
> Keep the cap coming with the fiber optics interface, in case of disconnecting for maintenance or troubleshooting.

5. Remove the cap on the laser head, remove the cap and the protective film on the fiber optics interface, align the interface to the laser head by the marks, insert it in and rotate the ring to lock the connection firmly.

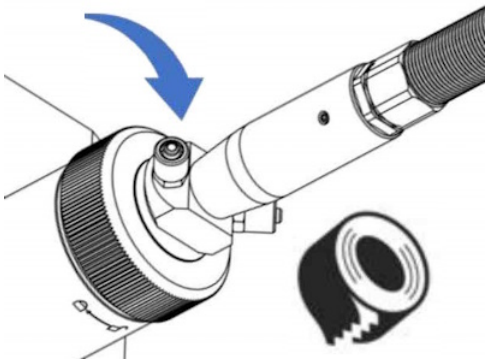




> **WARNING**
>
> The output window of the fiber optics interface will be burned up and broken when firing the laser if the protective film is not peeled off.

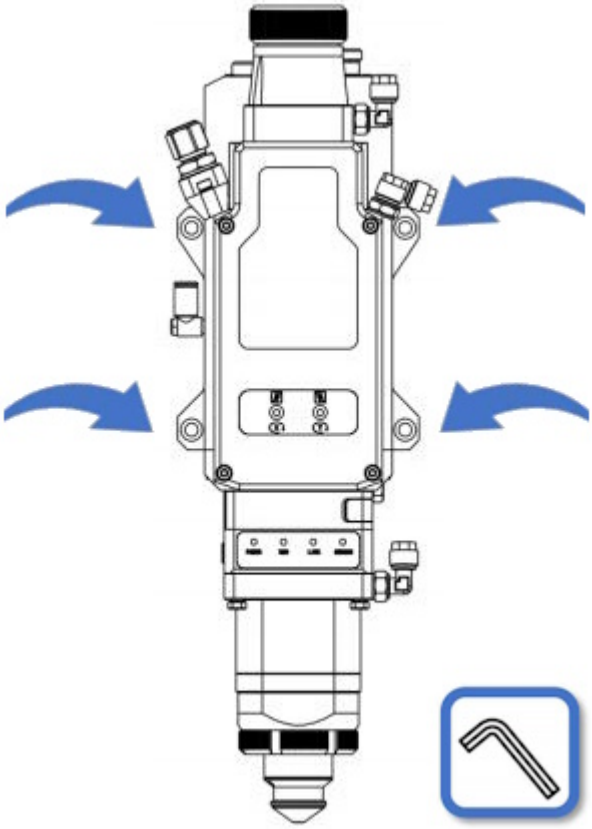
> **WARNING**
>
> The connecting operation ***MUST*** be done in a dust-free environment.

6. Wrap around the interface with the tape coming with the laser head, avoiding dust around the gap of the connection.



Mounting

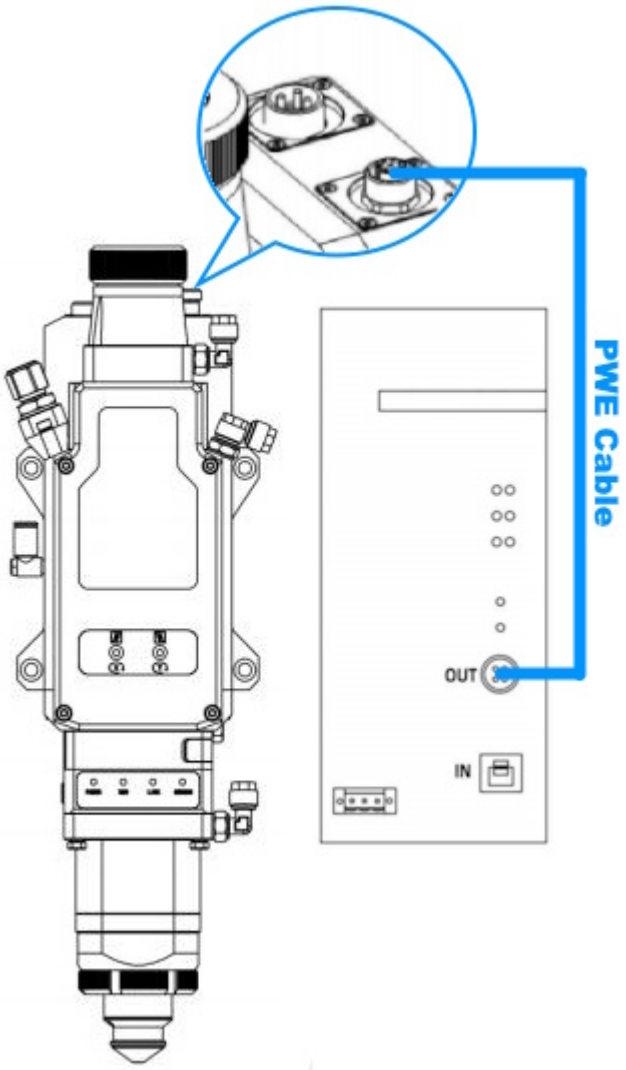
After connecting the fiber optics, please mount the laser head onto the machine as soon as possible, protecting the fiber optics cable from accidental damage outside the machine. Refer here for more details.



Organize the fiber optics cable all the way back into the drag chains after mounting.

Connecting the Electrics

Remove the cap on the electrical interface and connect the cable as soon as possible. Refer to Electrical Interface for more details.

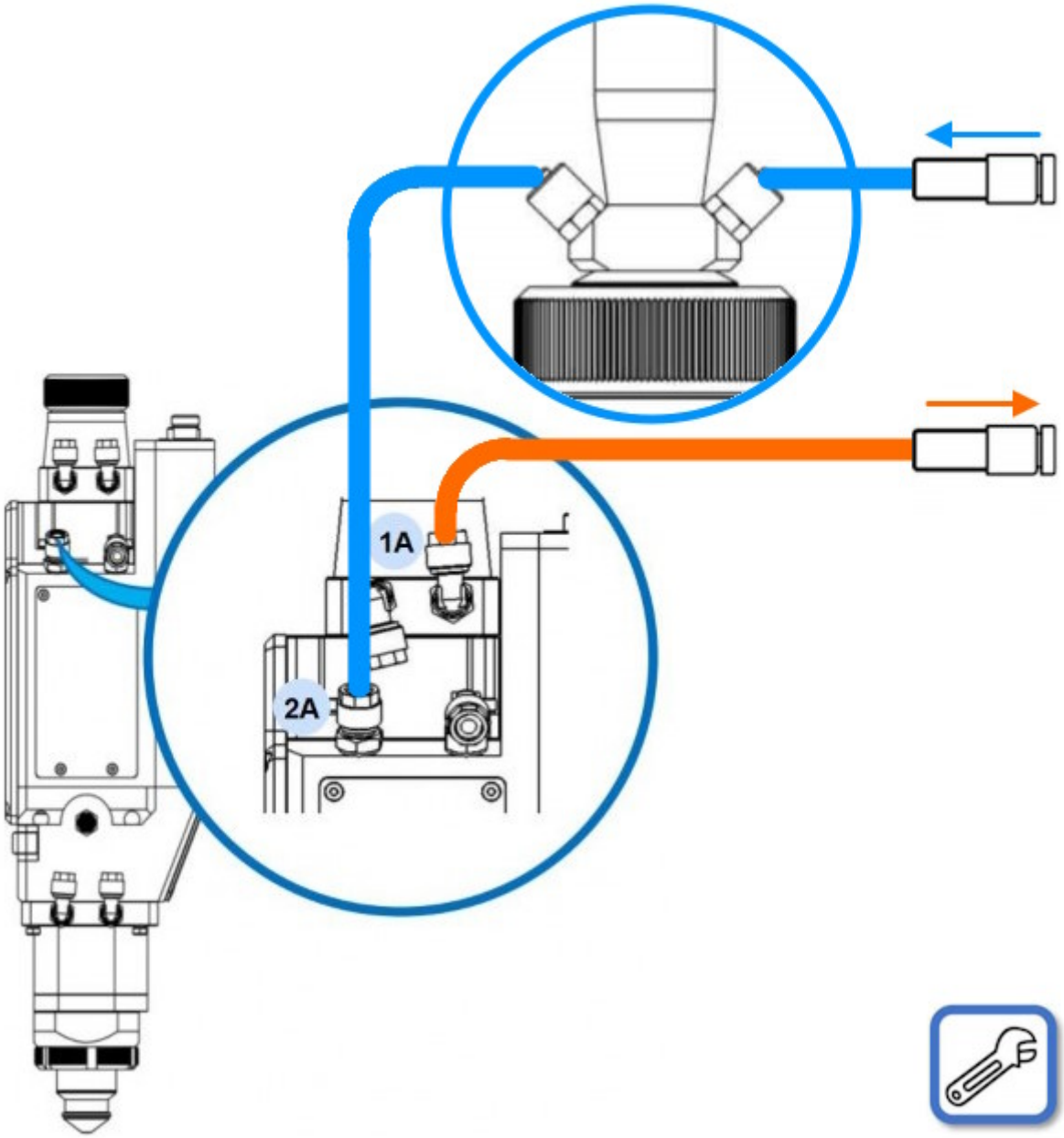


> **WARNING**
>
> The laser system ***MUST*** be powered off when connecting.

> **NOTE**
>
> Keep the caps in case of disconnecting and reconnecting for maintenance or troubleshooting.

Connecting the Cooling Water

Connect all the cooling water interfaces on the fiber optics interface and the laser head in series, then connect to the chiller. Refer to Mechanical Structure and Technical Specifications for more details.



IMPORTANT

Use ***DISTILLED*** or ***PURIFIED*** water for cooling, others may corrode the water hoses inside the laser head.

IMPORTANT

Add ***ANTIFREEZE*** to the cooling water to protect the laser head from freezing if the ambient temperature could be below 5°C (41°F). Otherwise, it may cause ***SEVERE DAMAGE*** to the core components.

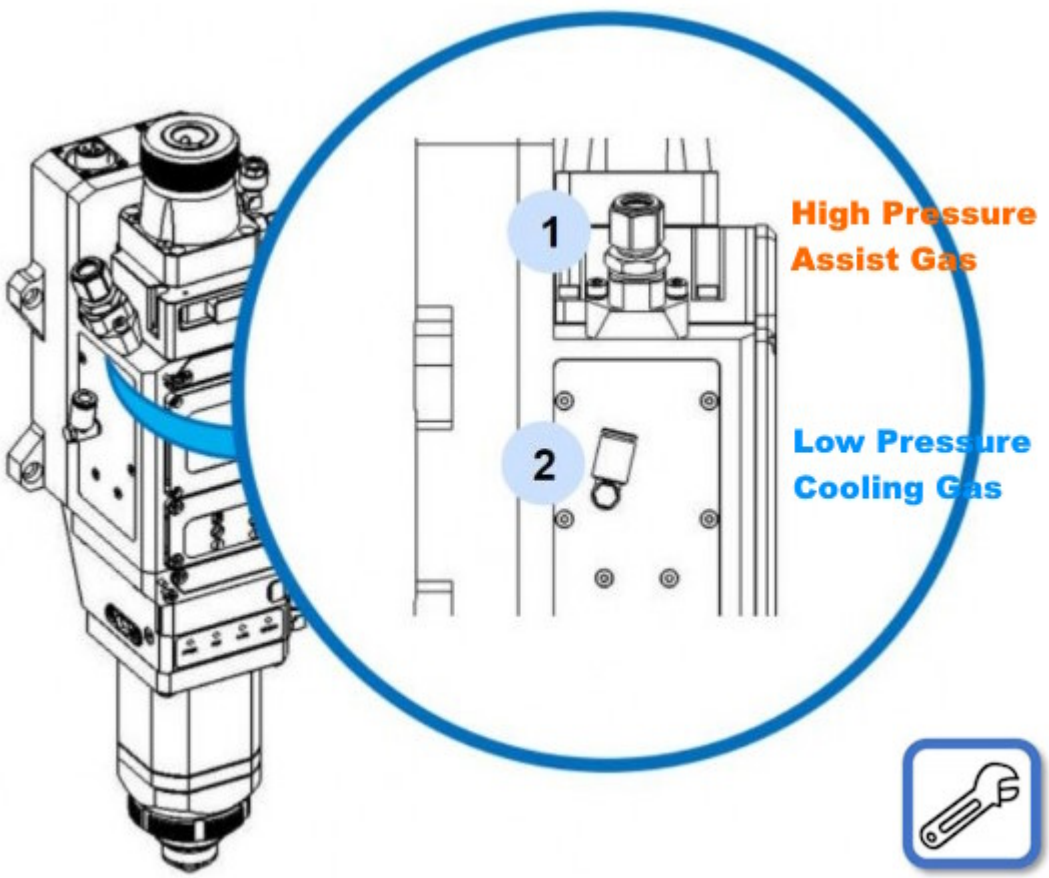
IMPORTANT

Set the cooling water temperature ***ABOVE*** the dew point according to the table below, avoiding condensation on the optics in the laser head.

Ambient Temperature	Relative Humidity %																		
°C	**100**	**95**	**90**	**85**	**80**	**75**	**70**	**65**	**60**	**55**	**50**	**45**	**40**	**35**	**30**	**25**	**20**	**15**	**10**
43	43	42	41	40	39	38	37	35	34	32	31	29	27	24	22	18	16	11	5
41	41	39	38	37	36	35	34	33	32	29	28	27	24	22	19	17	13	8	3
38	38	37	36	35	34	33	32	30	29	27	26	24	22	19	17	14	11	7	0
35	35	34	33	32	31	30	29	27	26	24	23	21	19	17	15	12	9	4	0
32	32	31	31	29	28	27	26	24	23	22	20	18	17	15	12	9	6	2	0
29	29	28	27	27	26	24	23	22	21	19	18	16	14	12	10	7	3	0	
27	27	26	25	24	23	22	21	19	18	17	15	13	12	10	7	4	2	0	
24	24	23	22	21	20	19	18	17	16	14	13	11	9	7	5	2	0		
21	21	20	19	18	17	16	15	14	13	12	10	8	7	4	3	0			
18	18	17	17	16	15	14	13	12	10	9	7	6	4	2	0				
16	16	14	14	13	12	11	10	9	7	6	5	3	2	0					
13	13	12	11	10	9	8	7	6	4	3	2	1	0						
10	10	9	8	7	7	6	4	3	2	1	0								

Connecting the Gas

Connecting the assist and the cooling gas to the laser head. Refer to Mechanical Structure and Technical Specifications for more details.



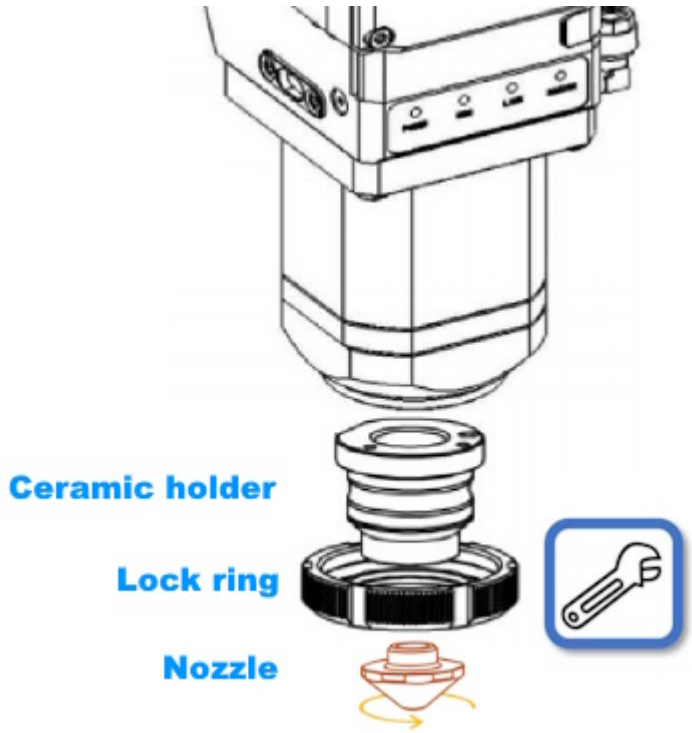
> **IMPORTANT**
>
> Keep the gas pressure ***UNDER*** the limits to protect the pipes from blowing out.

> **IMPORTANT**
>
> If compressed air is used as the assist gas, make sure it is ***WATER FREE AND OIL FREE***. Otherwise, the lower protective lens in the laser head will get dirty and wet, then broken while cutting.

> **NOTE**
>
> Some sub-models of the BLT4 family may not have the cooling gas interface.

Securing the Ceramic Holder and the Nozzle

Secure the ceramic holder and the nozzle onto the laser head. Refer to Replace the Ceramic Holder and Replace the Nozzle for more information.



> **IMPORTANT**
>
> The ceramic holder must be ***ALIGNED*** to the electrical interface of the anti-collision unit.

Testing

Follow the steps below to test if the laser head is working well.

1. Turn on the chiller to check if there is any leaking of all the water interfaces.

   > **WARNING**
   >
   > Make sure the electrical interface inlets are ***CONNECTED*** or ***COVERED*** by the cap before the cooling water test to avoid getting the inside wet and the resulting malfunctions.

   > **IMPORTANT**
   >
   > Set the cooling water temperature ***ABOVE*** the dew point to avoid condensation on the optics in the laser head.

2. Turn on the machine and manage the laser head to go back to its home position, including the focus unit inside, and then check if there is any warning or error message about the fiber optics connection, the electrics connection, the auto-focusing motor and the height sensor, etc.

   > **WARNING**
   >
   > Make sure that nothing blocks the way of the laser head.

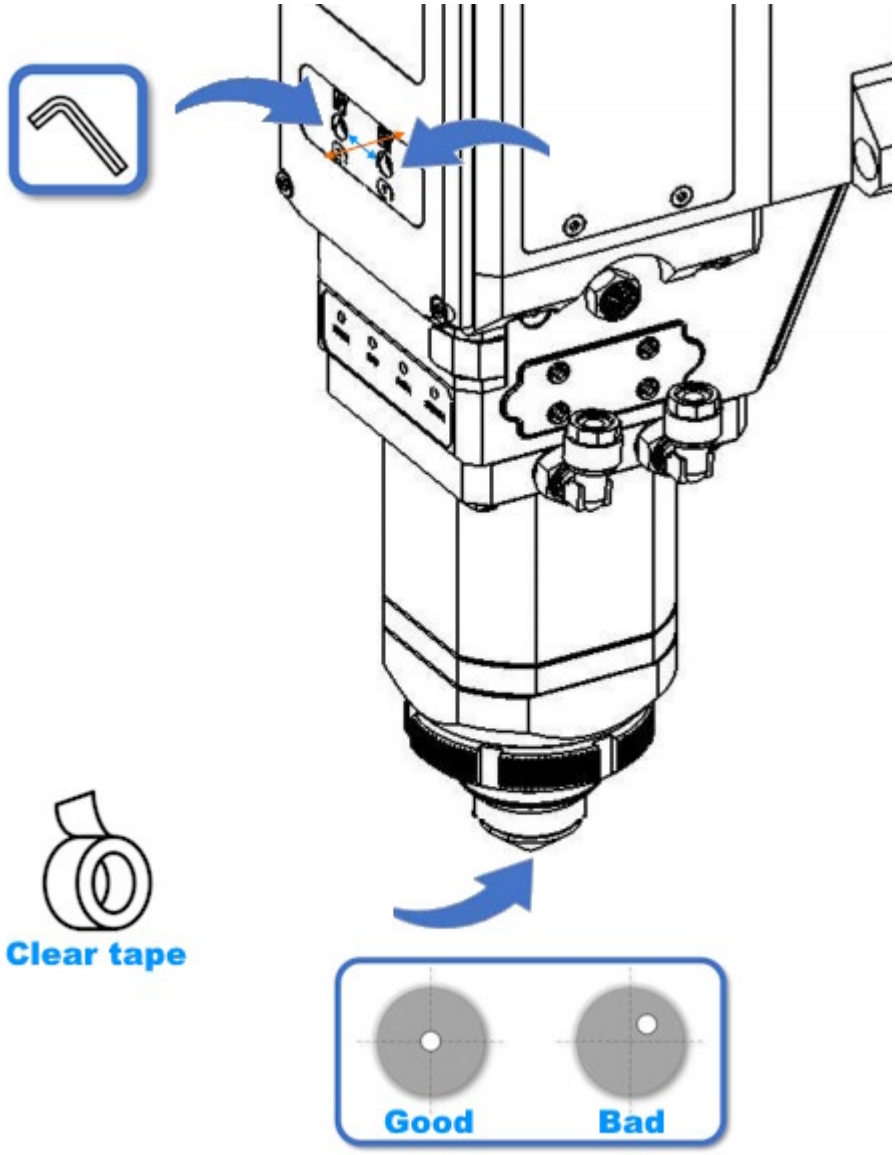
3. Calibrate the gas pressure, or blow the gas for testing on the machine without the calibration function.

   > **WARNING**
   >
   > Make sure the gas pressure is ***UNDER*** the limit.

4. Put a small work piece on the working bed and then calibrate the height sensor.

Refer to the corresponding machine's and software's manual for more instruction details.

Centering the Laser



Follow the steps below to center the laser.

1. Make sure the laser is turned off and set the power to 5%-10%.
2. Test with a big nozzle, such as ø3.0.
3. Stick a piece of clear tape to the nozzle and fire a laser pulse.
4. Check if the laser is in the center.
   If not, center it on the focus unit. And repeat steps 3-4 until the laser is centered.
5. Double check with a small nozzle, such as ø1.5.

> **NOTE**
>
> It is better to take a note on the adjustments in each step, in case of restoring.

Uninstall the Laser Head

When there is something wrong with the laser head, you need to uninstall and return it for fixing.

1. Get ready for uninstalling, refer to Get Ready for the Installation for more details.

   > **NOTE**
   >
   > Prepare the fiber optics cable all the way along the drag chains for pulling forward out.

2. Clean the laser head, remove all the dust and dirt completely.
3. Remove the nozzle and seal the thread hole with the tape coming with the laser head.
4. Disconnect the gas and seal the ports.
5. Disconnect the cooling water from the chiller and the water hose between the fiber optics interface and the laser head.

   > **NOTE**
   >
   > The hoses between the cooling water interfaces of the laser head could be left there.

   > **IMPORTANT**
   >
   > Seal the disconnected water hoses and ports, dry the laser head before disconnecting the electrics.

6. Disconnect the electrics and put the caps back onto the inlets as soon as possible to avoid getting the inside wet and the resulting malfunctions.
7. Unmount the laser head, pull it forward out with the fiber optics cable and put it down on a firm and soft support, avoiding bending the fiber.
8. Remove the wrap around the interface of the fiber optics connection, clean the laser head again with some dust-free cleaning cloth with alcohol, and then put it in the dust-free box.
9. Disconnect the fiber optics.

   > **WARNING**
   >
   > The disconnecting operation ***MUST*** be done in a dust-free environment.

   > **IMPORTANT**
   >
   > Put the caps back onto the laser head and the fiber optics interface as soon as possible to avoid contamination.

10. Wrap the fiber optics interface with some soft packing material and organize the cable all the way back into the drag chains as soon as possible to avoid accidental damage outside the machine.

11. Remove the seals on the disconnected water hoses and ports of the laser head, drain the remaining cooling water, and then seal them again.

12. Put the laser head back to its original package.

Maintenance and Troubleshooting

In this chapter, you will find the details of the maintenance and troubleshooting of the laser head, including the nozzle, the lower protective lenses, the ceramic holder, the upper protective lenses and the anti-collision unit.

> **NOTE**
>
> The basic maintenance operations are the same for all sub-models of the BLT4 family. However, some parts may be different. Please refer to the parts list paperwork of your machine.

General Troubleshooting Notes

The laser head should be always the top priority for maintenance and troubleshooting. If you get any issues with cutting quality, cutting speed, or other performance-related problems, please check the laser head first.

In general, the laser head would stay as cool as possible during cutting, and the consumable parts, e.g. protective lenses and ceramic holders, would last for a long time. Warming up a little bit is normal, especially for mild steel cutting with O_2.

After properly setting up a library of cutting parameters for different materials, there must be something wrong with the laser head if there is a sudden and significant drop in cutting quality during a cut.

> **NOTE**
>
> Double-check the cutting parameters and the related configurations (proper nozzle, enough gas pressure, etc) before troubleshooting the laser head.

1. If the lower part of the laser head gets hot, it usually means the 1_{st} lower protective lens is contaminated, please clean or replace it immediately. The 2_{nd} lower protective lens also takes a risk of being contaminated if the 1_{st} one is broken through, in this case, double-check by a test with the photographic paper after replacing. Please refer to The Lower Protective Lens and Check the Optics with the Photographic Paper for more details.

   > **IMPORTANT**
   >
   > Pause the job and check the lens as soon as possible when you notice a potential issue is always preferred to avoid further damage to the laser head. Cutting with a contaminated lens will lead to being broken through of the lens and high temperature on the ceramic holder, which will cause more damage to the laser head, more cost to fix it and more system downtime.

   > **NOTE**
   >
   > Advanced laser head models will give you an alarm on the software indicating possible contamination of the lens when its temperature gets higher. Entry-level models do not have this feature, so please keep an eye on the cutting process.

2. Check the nozzle, it must be clean and without any damage on the bottom surface. A damaged nozzle can cause improper gas flow and space between the nozzle and the work piece, leading to poor cutting performance. Please refer to Replace the Nozzle for more details.

3. Check the laser alignment. Please refer to Centering the Laser for more details.

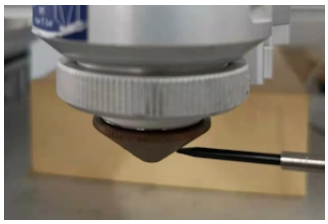
4. Being in a high temperature for a long time will lead to damage on the ceramic holder. Follow the troubleshooting steps in Replace the Ceramic Holder to check it out if the laser head cannot follow the work piece properly.

By checking these points, you can often identify and resolve issues with the laser head quickly and effectively.

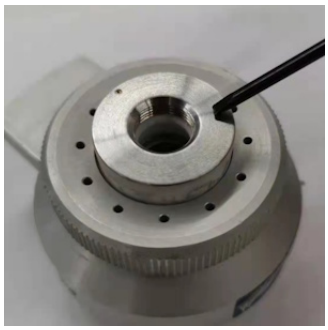
Troubleshoot Height Sensor Issues

Follow the steps below to troubleshoot height sensor issues when getting the capacitance diminished alarm while the machine is not cutting.

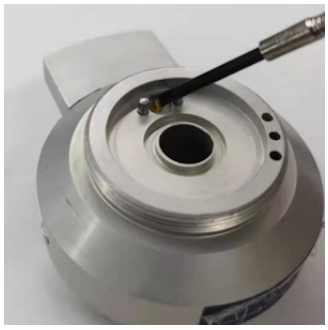
1. Check if the capacitance will change to 0 when touching the nozzle by hand or a conductor such as a screw driver, shown as below. If it will, calibrate the height sensor.



2. Remove the nozzle, and check if the capacitance will change to 0 when touching the metal part of the ceramic holder by hand or a conductor, shown as below. If it will, clean the nozzle, install it back and test again. If there is still the same issue, replace the nozzle.



3. Remove the ceramic holder, and check if the capacitance will change to 0 when touching the pin of the sensor body by hand or a conductor, shown as below. If it will, replace the ceramic holder with a new one.



4. Check if the capacitance will change to 0 when touching the terminal of the wire by hand or a conductor, shown as below. If it will, replace the sensor body. Otherwise, replace the wire with a new one.

Follow the steps below when getting the alarm while the machine is cutting.

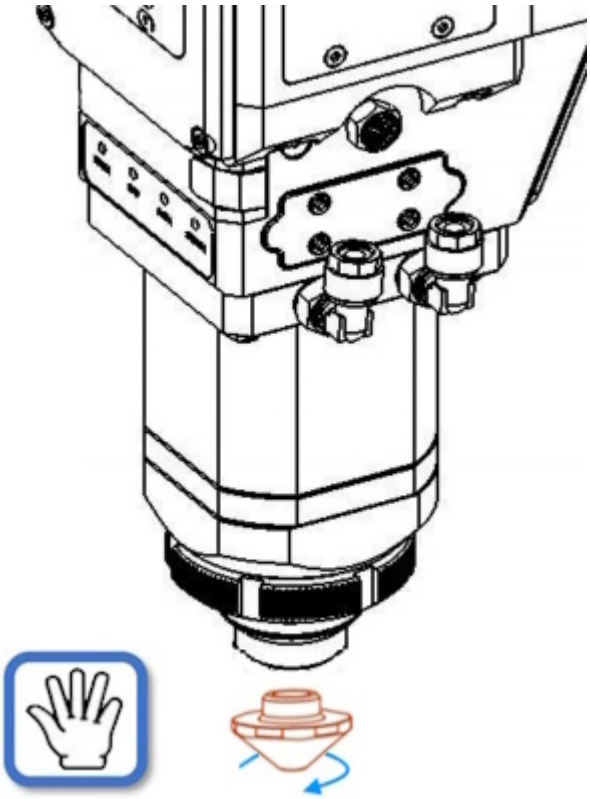
1. Check if all the parts of the sensor are fixed tightly (including the sensor body, the ceramic holder, and the nozzle).

   > **IMPORTANT**
   >
   > It is recommended to use a wrench to tighten the lock ring, especially when the ceramic holder comes with a sealing rubber ring. Otherwise, the high pressure gas may push the ceramic holder down a little bit and cause a electrical contact loose.

2. Check if the laser is aligned and can come out from the center of the nozzle.

Replace the Nozzle

In general, the laser needs different nozzles to cut different materials. And, for supporting a stable cutting process, the nozzle must be clean and without any damage on the bottom surface, otherwise, it needs to be replaced with a new one.

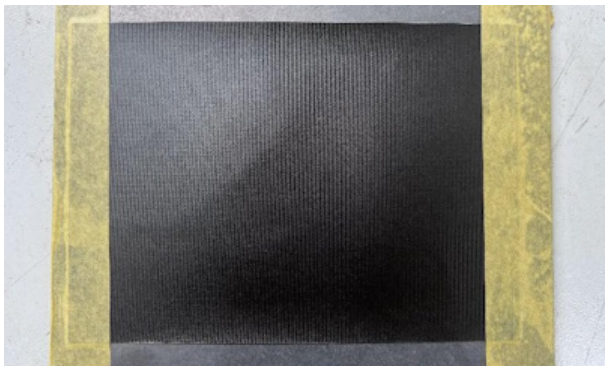


Check the Optics with the Photographic Paper

The best and the easiest way to check if the optics are contaminated is to fire a laser pulse on a photographic paper in a specific way, especially before checking the 2_{nd} lower protective lens and any of the upper protective lenses to avoid taking the risk of getting the inside contaminated with dust in air or by the operation itself.

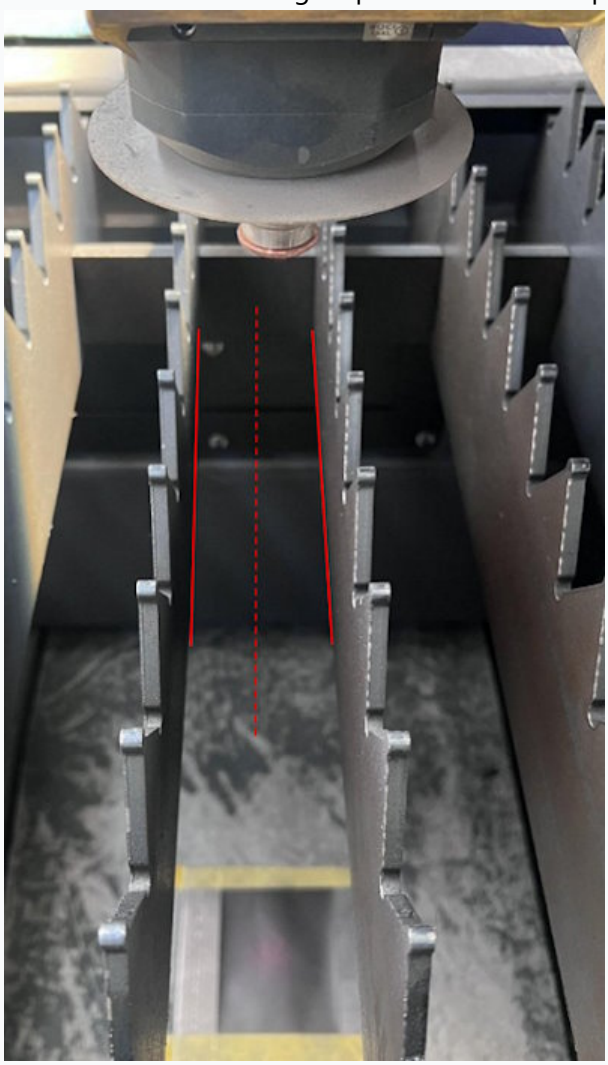
Follow the steps below to complete checking.

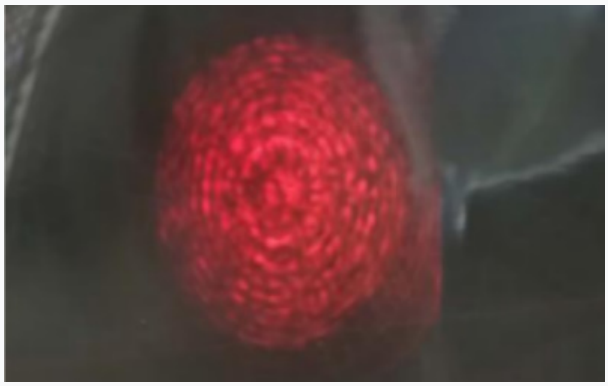
1. Stick a photographic paper, specific for the optics contamination testing, onto a small piece of thin sheet and put it into the pick-up drawer closer to the front side of the machine.



2. Lower the laser head closer to the work bed and align it to the top of the paper by the red indication light.

> **NOTE**
>
> Set the laser head in the middle of the gap between the blades to avoid shooting on them, and make sure the full red light spot falls within the paper.



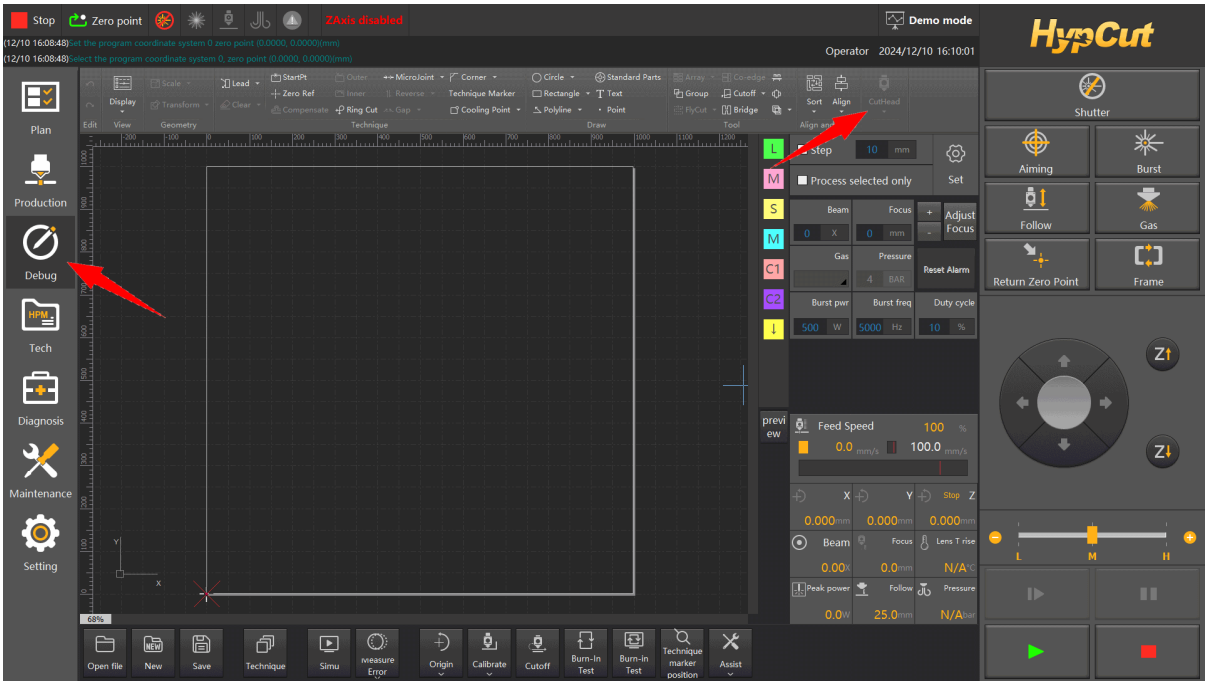


3. Test with a ≥3 nozzle.

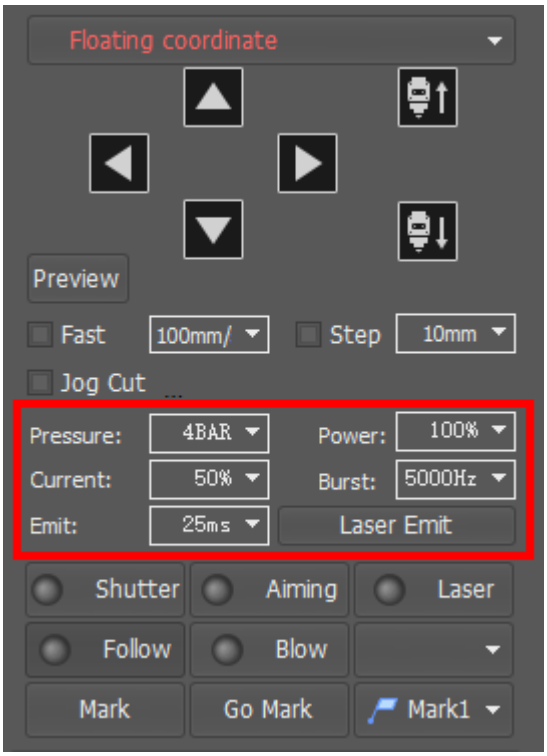
> **IMPORTANT**
>
> It is important using an appropriate nozzle to get a decent result.

4. Set testing parameters.

- HypCut
  In the view **Debug**, click **Photographic paper test** in the pulldown-menu **CutHead** to bring up the dialog, and set the parameters according to the CypCut settings below. Refer to HypCut User's Manual for more details.



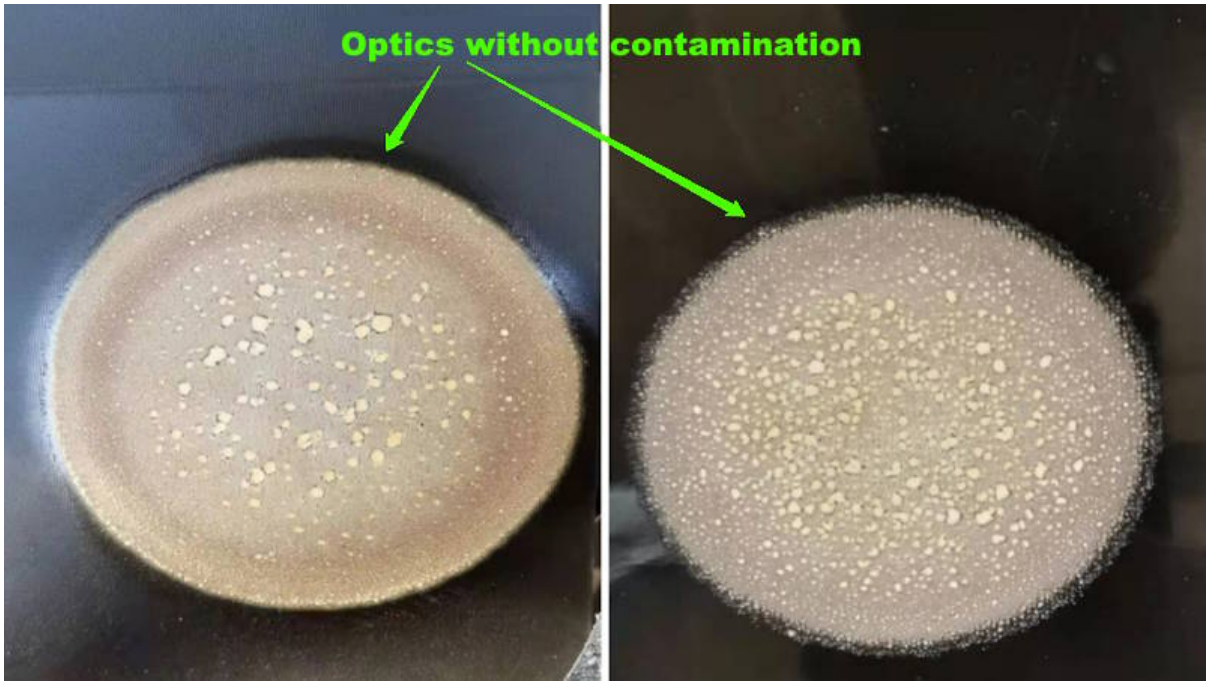
- CypCut series
  In the **Process Control Pane**, set the laser power to around 10kW, set **Current** to *50%* for a 20kW laser in this example (set to *100%* if the peak power of the laser is less then 10kW), set **Power** to *100%*, set **Burst** to *5000Hz* and set **Emit** to *25ms*. Refer to CypCutPro User's Manual for more details.



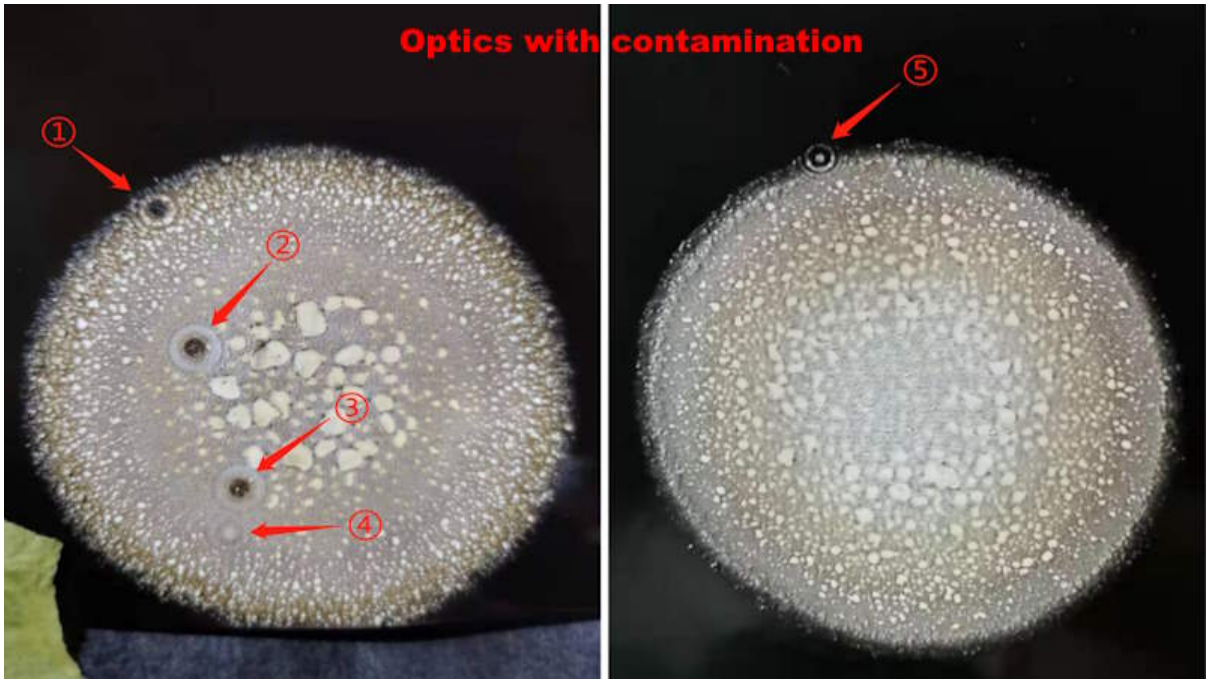
5. Click **Laser Emit** to fire the laser pulse.

> **IMPORTANT**
>
> Do ***NOT*** click the button **Laser** or use the handheld remote to fire the laser, you can not control the duration of the pulse by those functions.
>
> Move the laser head away ***IMMEDIATELY*** after pulsing to avoid contamination by the fume coming up.

6. Check the result.

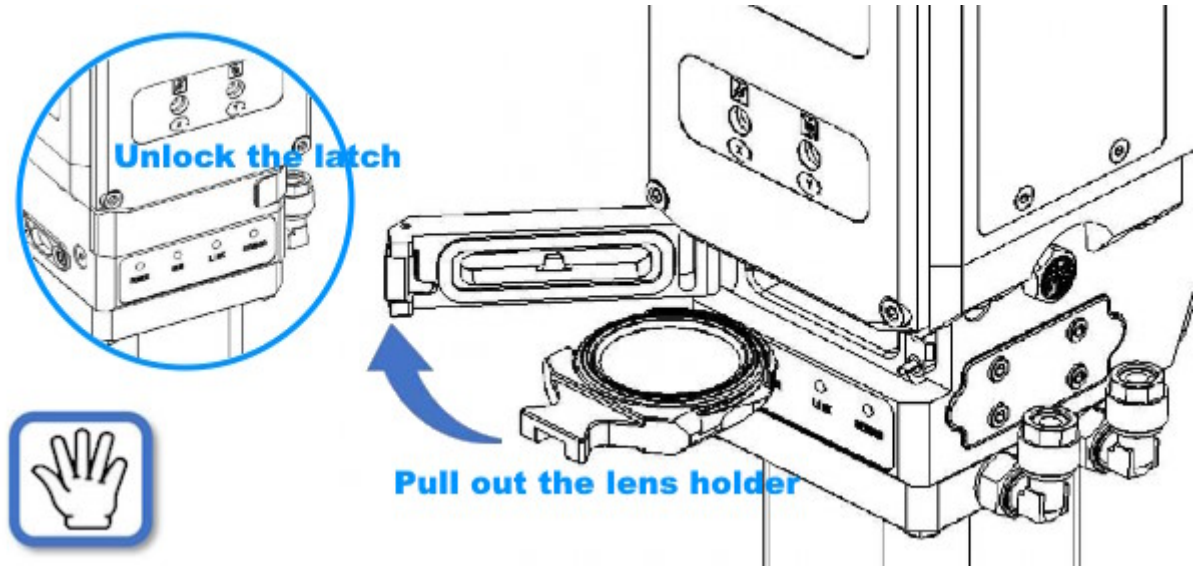


The picture below shows bad results with noticeable ring-shaped dark spots and black dots, means there must be some contamination on the optics, refer to The Lower Protective Lenses and The Upper Protective Lenses for more details on how to check it out.



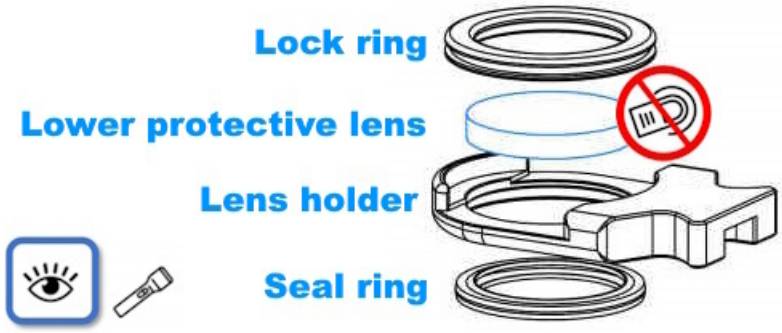
The Lower Protective Lens

The 1_{st} lower protective lens is the bottom barrier of the main unit of the laser head, and it is the most easily contaminated lens with the highest replacement rate.



Follow the steps below to take out the 1_{st} lower protective lens component.

1. Clean around the cover of the lens, remove all the dust and dirt.
2. Seal the nozzle.
3. Unlock the latch and open the cover.
4. Clean around the handle and pull out the lens holder.
5. Close the cover as soon as possible to avoid getting the inside contaminated.



Check the lens component.

1. The lens is not broken through.
    - Contamination on the bottom side comes from dust in air, particles in the gas and the spattered slag while cutting, etc.
    - Contamination on the top side means there is something wrong with the seal ring, you need to replace it immediately and check if the 2_{nd} lower protective lens is contaminated too.
2. The lens is broken through.
    - Replace the lens and the seal ring.
    - Check if the 2_{nd} lower protective lens is contaminated.
3. Check if there is any damage on the seal ring.

Clean the lens with the dust-free cleaning cloth or cotton swab with alcohol.

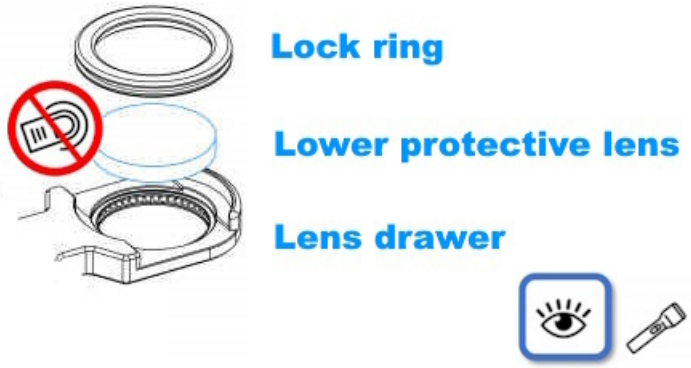
> **IMPORTANT**
>
> Clean the lens in one direction, do ***NOT*** wipe back and forth, and do ***NOT*** touch the surface with your finger.

Put the lens component back into the laser head as soon as possible after maintenance.

Follow the steps below to take out the 2_{nd} lower protective lens component.

> **IMPORTANT**
>
> Check the 2_{nd} lower protective lens ***ONLY*** if the 1_{st} one is broken through or contaminated on top.
>
> Always perform a photographic paper test ***BEFORE*** the visual inspection on the 2_{nd} lower protective lens, refer to Check the Optics with the Photographic Paper for more details.

1. Remove the front cover plate of the main unit.
2. Clean around the cover of the lens, remove all the dust and dirt.
3. Make sure the 1_{st} lower protective lens is in position.
4. Unscrew and remove the cover.
5. Clean around the handle and pull out the lens holder, refer to Mechanical Structure for more details.
6. Seal the hole with the tape coming with the laser head as soon as possible to avoid getting the inside contaminated.



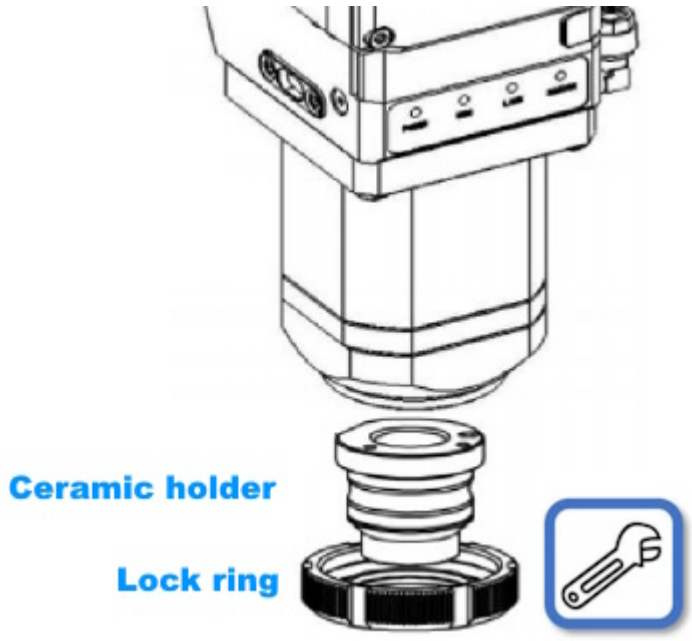
Check the lens component.

1. The lens is not broken through.
    - Contamination on the bottom side comes from the dust, particles or broken pieces coming through or from the 1_{st} lower protective lens.
    - Contamination on the top side means you need to check if the focus unit is contaminated too.
2. The lens is broken through.
    - Replace the lens.
    - Check if the focus unit is contaminated.

Clean the lens in the same way, and put the lens component back into the laser head as soon as possible after maintenance.

Replace the Ceramic Holder

The ceramic holder will be broken when the laser cuts with bad parameters and a lot of heat accumulated on it.



Follow the steps below to replace the ceramic holder.

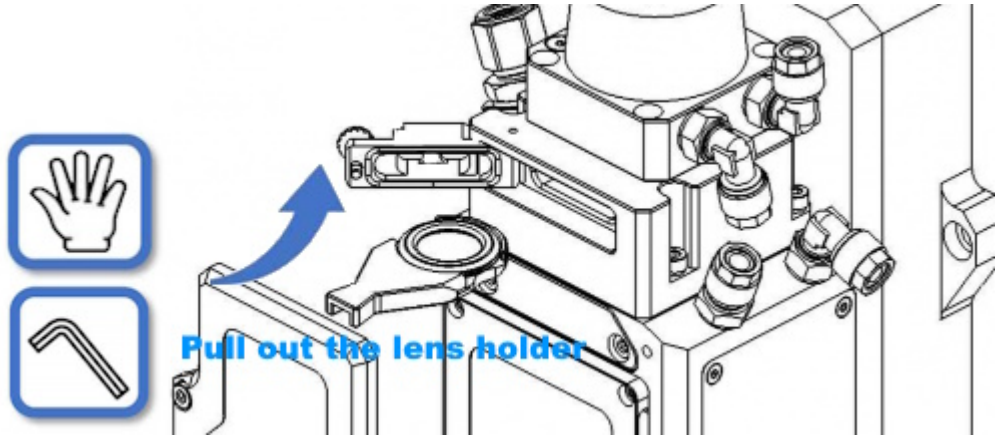
1. Remove the nozzle.
2. Remove the lock ring and the broken holder.
3. Put the new holder in the lock ring, and align the holder to the electrical interface of the anti-collision unit.
4. Lock the ring.
5. Screw the nozzle back.

> **IMPORTANT**
>
> If the laser get a capacitance related issue after replacing the ceramic holder, please check if the ceramic holder is aligned well to the electrical interface of the anti-collision unit, and if the lock ring is tightened well. It is recommended to use a wrench to tighten the lock ring, especially when the ceramic holder comes with a sealing rubber ring.

The Upper Protective Lens

The 1_{st} upper protective lens is the top barrier of the main unit of the laser head, and it could be contaminated if there is dust coming in while connecting the fiber optics interface.

> **IMPORTANT**
>
> Make sure the 1_{st} lower protective lens is clean ***BEFORE*** checking the 1_{st} upper protective lens, refer to The Lower Protective Lenses for more details.
>
> Always perform a photographic paper test ***BEFORE*** the visual inspection on the 1_{st} upper protective lens, refer to Check the Optics with the Photographic Paper for more details.



Follow the steps below to take out the 1_{st} upper protective lens.

1. Remove the front cover plate of the main unit.
2. Clean around the cover of the lens, remove all the dust and dirt.
3. Unscrew and open the cover.
4. Clean around the handle and pull out the lens holder, refer to Mechanical Structure for more details.
5. Close the cover as soon as possible to avoid getting the inside contaminated.

Check the lens component.

1. The lens is not broken through.
    - Contamination on the top side comes from dust in air while connecting the fiber optics interface.
    - Contamination on the bottom side means you need to check if the 2_{nd} upper protective lens is contaminated too.
2. The lens is broken through.
    - Replace the lens.
    - Check if the 2_{nd} upper protective lens is contaminated.

Clean the lens with the dust-free cleaning cloth or cotton swab with alcohol.

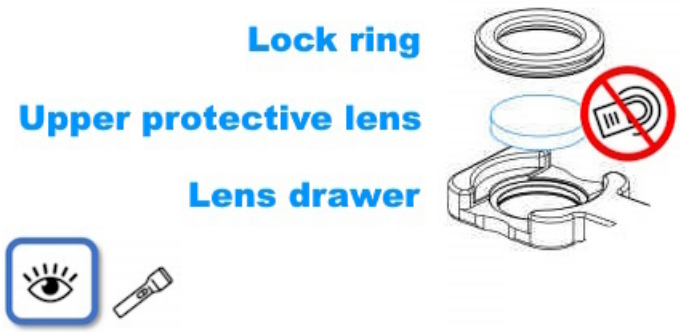
> **IMPORTANT**
>
> Clean the lens in one direction, do ***NOT*** wipe back and forth, and do ***NOT*** touch the surface with your finger.

Put the lens component back into the laser head as soon as possible after maintenance.

Follow the steps below to take out the 2_{nd} upper protective lens component.

> **IMPORTANT**
>
> Check the 2_{nd} upper protective lens ***ONLY*** if the 1_{st} one is broken through or contaminated on the bottom side.
>
> Always perform a photographic paper test ***BEFORE*** the visual inspection on the 2_{nd} upper protective lens, refer to Check the Optics with the Photographic Paper for more details.

1. Remove the front cover plate of the main unit.
2. Clean around the cover of the lens, remove all the dust and dirt.
3. Make sure the 1_{st} upper protective lens is in position.
4. Unscrew and remove the cover.
5. Clean around the handle and pull out the lends holder, refer to Mechanical Structure for more details.
6. Seal the hole with the tape coming with the laser head as soon as possible to avoid getting the inside contaminated.



Check the lens component.

1. The lens is not broken through.
    - Contamination on the top side comes from the dust or broken pieces coming through or from the 1_{st} upper protective lens.
    - Contamination on the bottom side means you need to check if the collimating unit is contaminated too.
2. The lens is broken through.
    - Replace the lens.
    - Check if the collimating unit is contaminated.

Clean the lens in the same way, and put the lens component back into the laser head as soon as possible after maintenance.

Fixing the Anti-Collision Unit

The anti-collision unit is attached at the bottom of the main unit, and is designed to be detachable, to protect the main unit from a hard collision with materials. The workflow is similar to the BLT642H/BLT662H laser head, refer to Fixing the Anti-Collision Unit in BLT642H/BLT662H Owner's Manual for more details.

Follow the steps below to prepare the laser head for fixing.

1. Seal the bottom of the main unit and the top of the anti-collision unit with the tape coming with the laser head immediately after collision.
2. Clean the main and the anti-collision units, remove all the dust and dirt.
3. Get ready for the fixing, refer to Get Ready for the Installation for more details.

Follow the steps below to get the anti-collision unit ready.

1. Remove all of the four anti-collision screws.
2. Remove the tape, check and replace the seal rings if there is any damage.
3. Check and clean the surface and inside, and seal it again.

Follow the steps below to get the main unit ready.

1. Remove the broken parts of the anti-collision screws.
2. Remove the tape, check and clean the surface and inside again.

Follow the steps below to attach the anti-collision unit back to the main unit.

1. Remove the tape on the anti-collision unit, double check the seal rings again.
2. Align and secure the anti-collision unit to the main unit.
3. Secure the new anti-collision screws.
4. Check if the anti-collision unit is firmly secured.

Gas Pressure Sensor Failed

Moisture in compressed air could cause gas pressure sensor failure and then pops up a message in the control software. In this case, just switch to O_2 and blow the gas for around 15 minutes, then restart the laser and test again. Check and fix the compressed air system if the issue is solved, or contact us after both the attempts.