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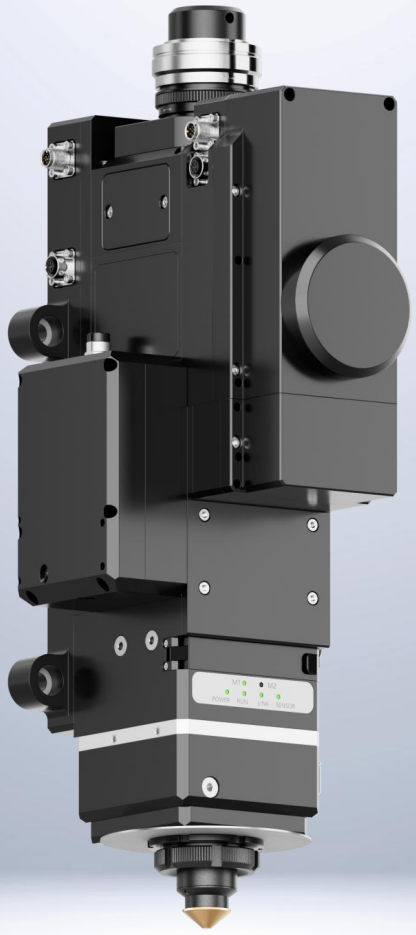


Intelligent Cutting Head
BLT9120MA Product Manual

Document Version：V1.0.0

www.bochu.com

Foreword

Thank you for choosing the BLT intelligent cutting head. This manual provides you with important information such as product parameters, installation, and maintenance. Please read this manual carefully before using the product. At the same time, to ensure both operational safety and optimal product performance, please carefully adhere to the precautions outlined in this manual.

BOCHU is constantly updating/upgrading products, so our company reserves the right to modify the product models and descriptions in this manual without prior declaration.

If you have any questions or suggestions during use, please contact us using the information provided in this manual.

Symbol Definitions

Notice: Provides supplementary explanations or clarifications for the product.

Caution: Indicates that non-compliance with the instructions may result in minor injuries or equipment damage.

Warning: Indicates that non-compliance with the instructions may result in severe injuries or death.

Danger: Indicates that non-compliance with the instructions will result in severe injuries or death.

Declaration

Disassembly of the product is strictly prohibited without the technical authorization from BOCHU, otherwise the warranty will be invalid!

Revision History

Version No.	Date	Description
V1.0.0	2025/04/30	First English version.

Contents

Chapter 1 Product Specification

1.1 **Product View**

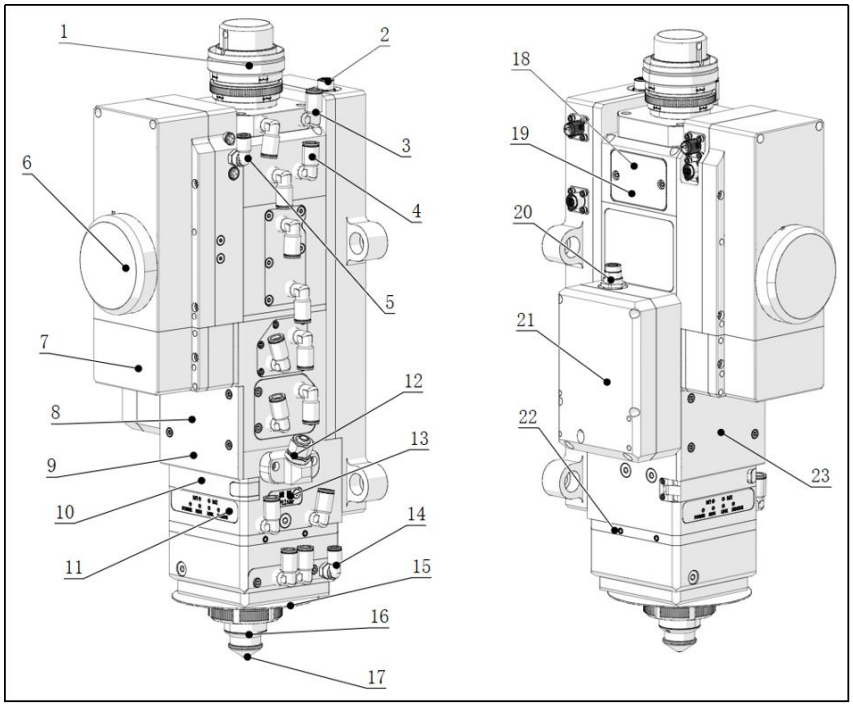


Figure 1-1 Product view

1. Fiber Optic Interface;
2. PWE Interface;
3. Cooling Water Inlet;
4. Cooling Water Outlet;
5. Switching Gas Inlet;
6. Switching Mechanism;
7. Auto-alignment Mechanism;
8. Core Unit;
9. 2nd Lower Protective Window Cartridge;
10. 1st Lower Protective Window Cartridge;
11. LED Indicator;
12. Cutting Gas Interface;
13. Filter Unit;
14. Nozzle Cooling Gas Interface;
15. Slag Stopper;
16. Ceramic Body;
17. Nozzle;
18. 1st Upper Protective Window Cartridge;
19. 2nd Upper Protective Window Cartridge;
20. Visual Communication Interface;
21. Visual Unit;
22. Protective Screws;
23. Front Cover.

1.2 Technical Parameters

Table 1-1 **BLT9120MA Cutting Head Technical Parameters**

Parameters	Values
Laser Wavelength	1030 ~ 1090 nm
Laser Power	60 kW
Fiber Interface	Q+, ADD
Spot Magnification	M = 2.5/4.5
Max. Focus Adjustment Range	M = 2.5 (-70 mm ~ +50 mm); M = 4.5 (-200 mm ~ +75 mm)
NA	Max.0.14 at Fc100
Centering Adjustment Range	±2.3 mm
Focusing Acceleration	7.5 m/s^2
Cutting Gas Interface	ø12, max 25 bar (2.5 MPa)
Nozzle Cooling Gas Interface	ø6, max 5 bar (0.5 MPa)
Water Cooling Interface	ø8, max 5 bar (0.5 MPa), min flow 2.0 L/min
Working Temperature	5 ~ 55℃ (41 ~ 131°F)
Storage Temperature	-25 ~ +55℃ (-13 ~ +131°F)
Dimension	507 mm x 180 mm (Q+)
Weight	About 15 kg (Q+)

To avoid the damage of cutting head during storage or transportation, the following shall be taken into consideration：

⚠ Caution:

1. The cutting head should be stored in the environment within the allowed temperature and humidity range.

2. Avoid storing in magnetic fields (such as permanent magnets or strong alternating fields) and their vicinity.

3. Avoid collisions during transportation or usage.

1.3 LED Indicators

Table 1-2 **LED Indicator Description**

Icon	Status	Indication
POWER 	Green	The power is normal.
	Red	Under-voltage alarm due to insufficient electrical power.
	Light off	Power off. The cause might be that no power is on; the connecting wires are damaged or malfunctioning; the interface is loose.
RUN 	Green	The system is normal.
	Red	Motor exception. The motor current consumption is too high, and the mechanical components cannot operate smoothly.
	Light off	The connecting wires are damaged or malfunctioning, or the interface is loose.
LINK 	Green	The communication is normal.
	Red	Communication exception.
	Light off	The connecting wires are damaged or malfunctioning, or the interface is loose.
SENSOR 	Green	The readings of each sensor are normal.
	Red	There are exceptions in the sensors' readings.
	Light off	The connecting wires are damaged or malfunctioning, or the interface is loose.
M1	Green	The current beam size is 2.5.
	Light off	The current beam size is not 2.5.
M2	Green	The current beam size is 4.5.
	Light off	The current size is not 4.5.

Chapter 2 Gas Interfaces

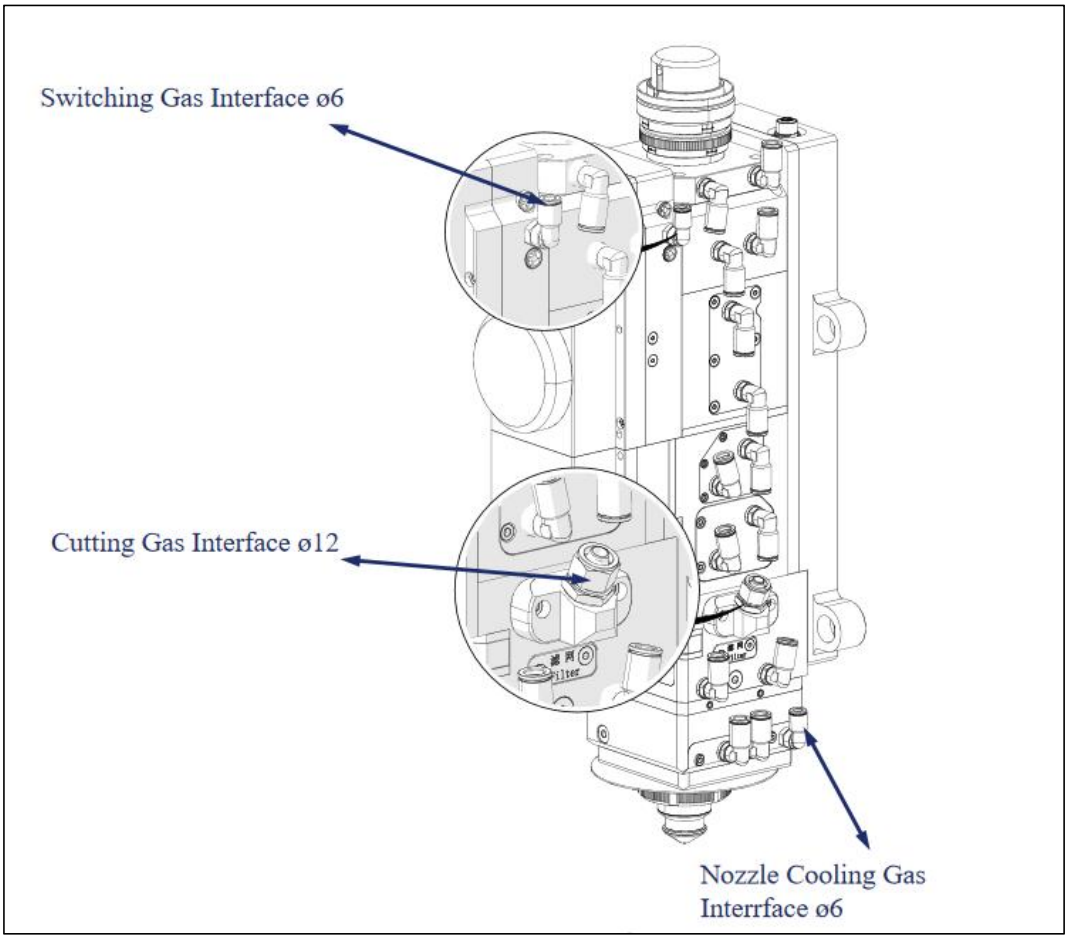


Figure 2-1 Gas interfaces

⚠ Caution:

1. For switching gas inlet ø6, the intake pressure must be strictly maintained between 0.35 MPa and 0.8 MPa. Exceeding 0.8 MPa may cause damage to the air cylinder.

2. The quality of cutting gas should meet the requirements of ISO 8573-1:2010: solid particles - class 2, water - class 4, oil - class 3. The purer the cutting gas, the longer the service life of the protective window.

3. When using ø12 gas pipe, please replace the pipe interface of ø12 from accessory box.

4. The maximum pressure of cutting gas is 25 bar (2.5 Mpa).

5. The cutting gas pipe diameter (outer diameter) is 10 mm, and the nozzle cooling gas pipe diameter (outer diameter) is 6 mm.

Chapter 3 Water Cooling Interfaces

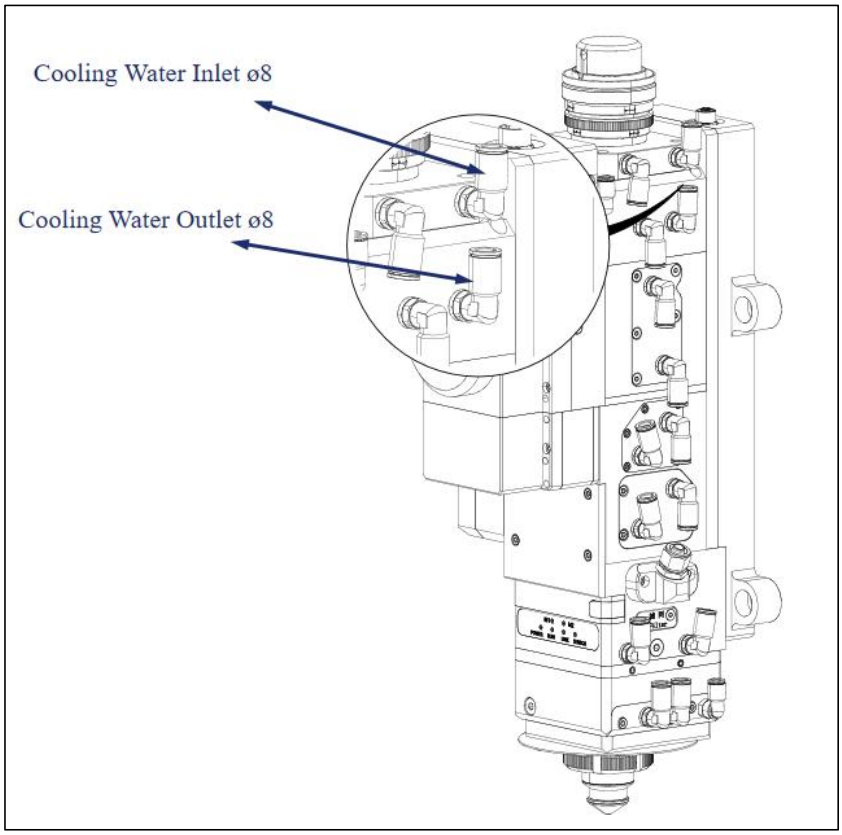


Figure 3-1 Cooling water interfaces

⚠ Caution:

1. Use purified water for the cooling water; purified drinking water is adoptable.

2. To prevent the pipeline blockage caused by mold growth in the water of the water cooler, it is recommended to add alcohol (CH3CH2OH) to purified water with an alcohol content of 10% of the purified water.

3. When the temperature around the device is between -10 ~ 0℃, a 30% ethylene glycol solution must be used and replaced every two months.

4. When the temperature around the device is below -10℃, a water cooler machine with a dual functioning system must be used, and the cooling system must operate continuously.

5. Recommended settings for cooling water: cooling water pressure ≤ 5 bar (0.5 MPa), water flow rate ≥ 2.0 L/min.

6. Please refer to the dew point table for setting the cooling water temperature to prevent condensation on optical components.

Table 3-1 **Dew Point Temperature at Different Temperatures and Humidity Levels**

Air Temperature ℃	Relative Humidity																		
	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	26	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								
7	7	6	6	4	4	3	2	1	0										
4	4	4	3	2	1	0													
2	2	1	0																
0	0																		

Chapter 4 Electrical Interfaces

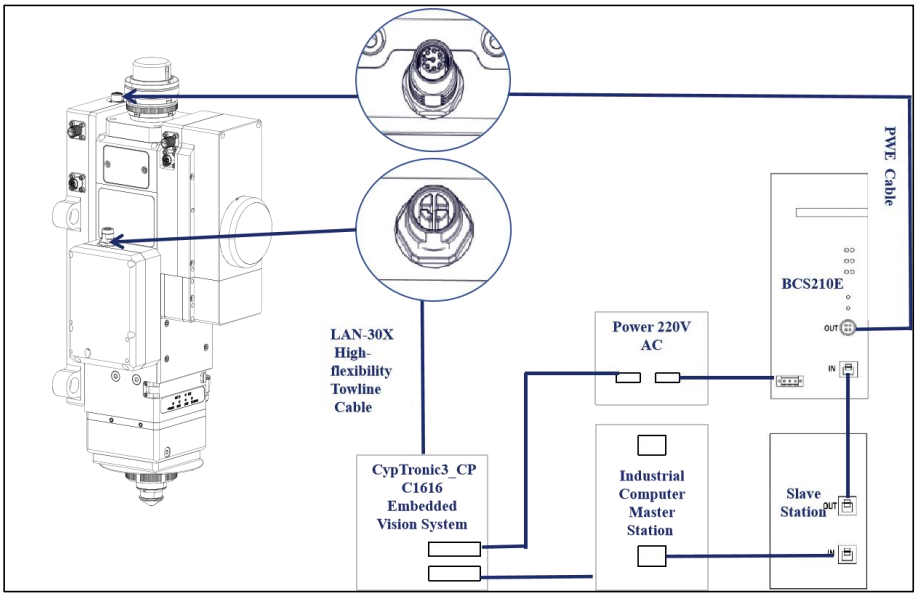


Figure 4-1 The electrical interfaces of the cutting head

The cutting head has two main electrical interfaces: the PWE interface and the visual communication interface. Only the personnel who have received the training and possess the necessary expertise are permitted to perform the operations mentioned above. BCS210E shall be powered off when connected to the cutting head.

⚠ Waterproof cautions for the PWE interface and the visual communication interface:

1. The PWE interface and the visual communication interface come with dust plugs from the factory, which can achieve a protection level of IP64 with the dust cap securely in place. Meanwhile, with the PWE cable and LAN-30X high-flexibility towline cable connected properly, the protection level of IP64 can also be achieved.

2. Once the dust plug is removed, the IP64 protection rating cannot be guaranteed. If exposed to spraying or water splashes, water may enter the product, affecting its functionality.

3. Ensure that the water pipes are properly connected, and the fittings are tightened before removing the dust plug to prevent accidental loosening of the pipes, which could result in water splashing onto the interfaces and causing internal damage to the product.

4. When adjusting the machine wiring, remove the dust plug for wiring, and it is recommended to keep the removed dust plug. Install the dust plug immediately after removing the wire to prevent accidental water ingress during transportation, water piping connections, and other processes.

Chapter 5 Cutting Head Installation

During the installation of the cutting head, dust or dirt may accidentally enter the cutting head and contaminate the optical window, affecting its normal use. Please refer to the following installation instructions to avoid contamination.

5.1 **Preparations before Installation**

Prepare the items listed below:

- Cutting head.
- Clean workbench (Type of clean workbench: vertical purification; Cleanliness level: ISO 5, 100; Average airspeed: ≥ 0.4 m/s).
- Cleaning kit: high-intensity flashlight, anhydrous ethanol (or IPA), lint-free purification swabs, cleanroom wiper, compressed air dust removal can (or air blower).

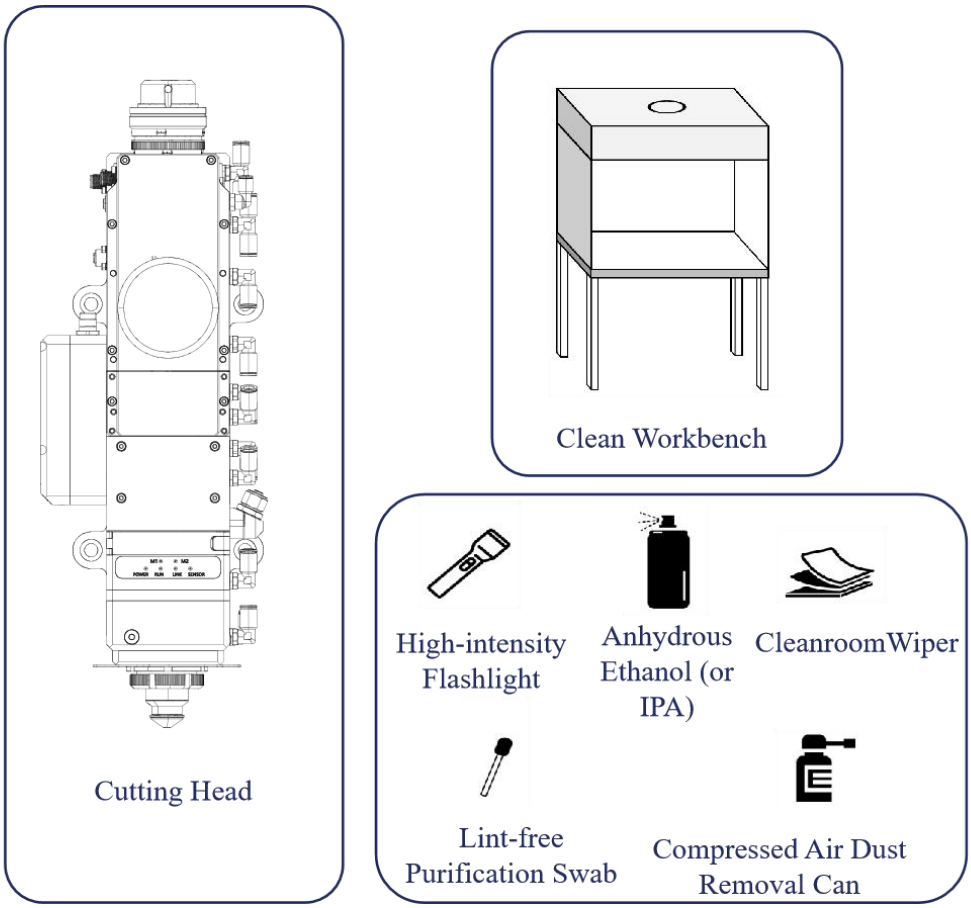


Figure 5-1 Preparation tools for the cutting head installation

⚠ Caution:

1. Only the personnel who have received the training and possess the necessary expertise are permitted to perform the operations mentioned above.

2. To ensure the proper function of the laser equipment and the safety of the operators, please adhere to the relevant operating instructions.

5.2 Specific Procedures

5.2.1 Prepare the Clean Workbench

Prepare the clean workbench, and start it to work properly.

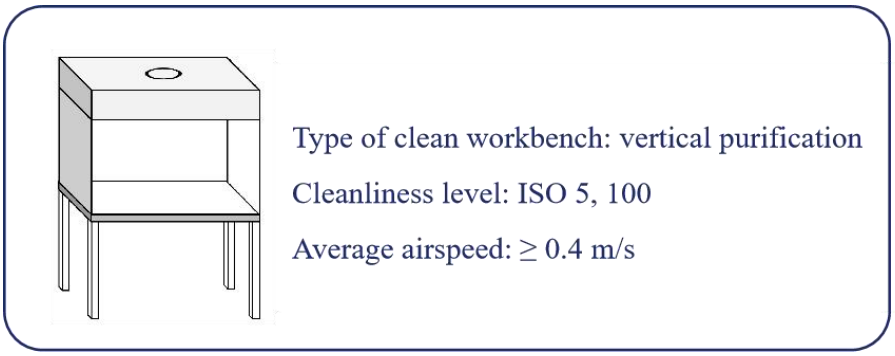


Figure 5-2 Clean workbench

Step 1 Check the cleanliness of the equipment (use a particle counter to check cleanliness) and confirm that the Fan Filter Unit (FFU) is within its validity period (measure the average airflow speed in the work area; if the airflow speed is below 0.3 m/s, the FFU must be replaced).

Step 2 Check that all switches are functioning properly and verify that the fan is operating normally.

Step 3 No unnecessary items should be installed in the clean workbench to prevent the clean airflow from being obstructed.

Step 4 For newly installed or long-unused clean workbenches, clean the surface with the cleanroom wiper and anhydrous ethanol before use.

Startup Procedures:

Step 1 Connect the power supply and slide the glass door of the clean workbench down to the lowest position, leaving a gap of approximately 10 cm.

Step 2 Start the fan, and it is recommended to allow the workbench to purify for about 30 minutes before use.

Step 3 After normal operation, turn on the clean workbench's lighting.

5.2.2 Put the Cutting Head inside the Clean Workbench

Put the cutting head horizontally inside the clean workbench.

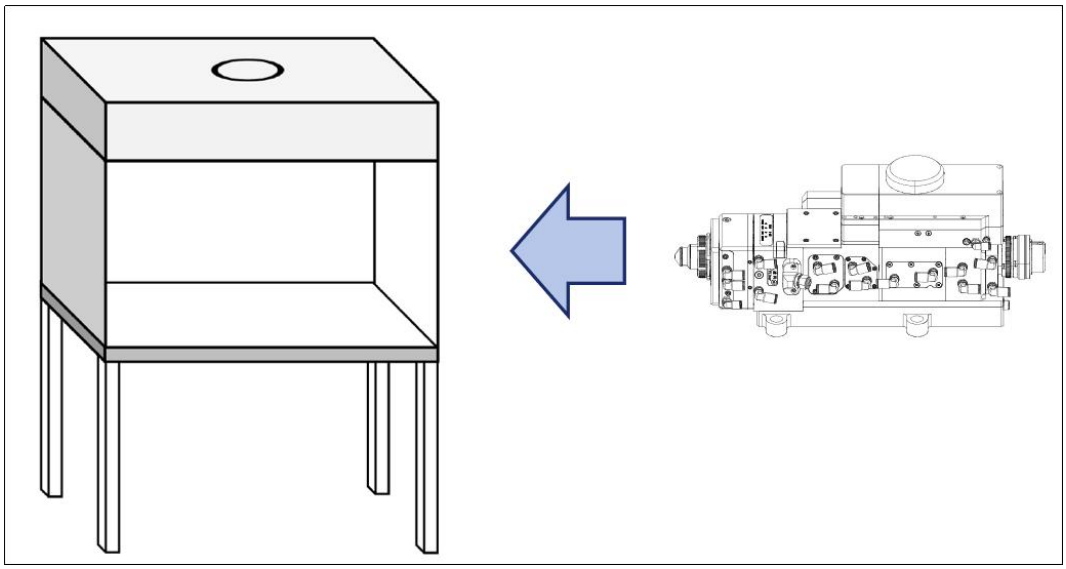


Figure 5-3 Put the cutting head inside the workbench

⚠ Caution: To prevent dust from falling inside the chamber, please check the integrity of the specified protection film/cap for the fiber interface before inserting or removing the fiber optic cable.

5.2.3 Clean and Wipe the Fiber Optic Interface of the Cutting Head

Clean the fiber interface with the cleanroom wiper soaked in anhydrous ethanol.

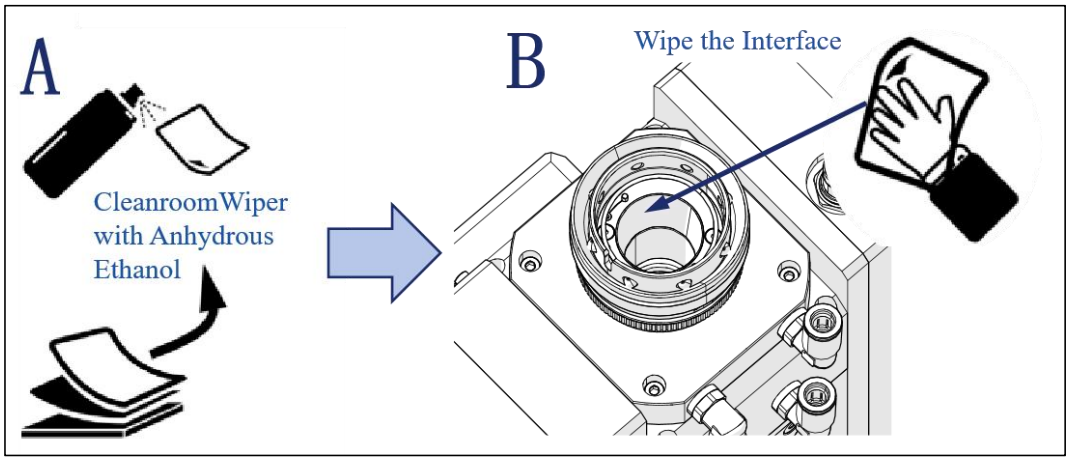


Figure 5-4 Clean the interface

5.2.4 Check the Laser Fiber Optic Connector End Face

Remove the protective cap from the laser fiber optic connector. Use the high-intensity flashlight to inspect the fiber end face for contamination. If clean, the fiber can be directly inserted; if not clean, clean it with a swab dipped in anhydrous ethanol or IPA.

5.2.5 Remove the Protective Film / Remove the Protective Cap

Remove the dedicated protective cap or protective plug from the fiber optic connector on the cutting head.

5.2.6 Insert the Laser Fiber Connector into the Cutting Head

Align the fiber optic connector with the red reference line, insert it into the unlocked fiber optic connector, and ensure it is fully seated. Rotate the locking cap until it is tightly secured.

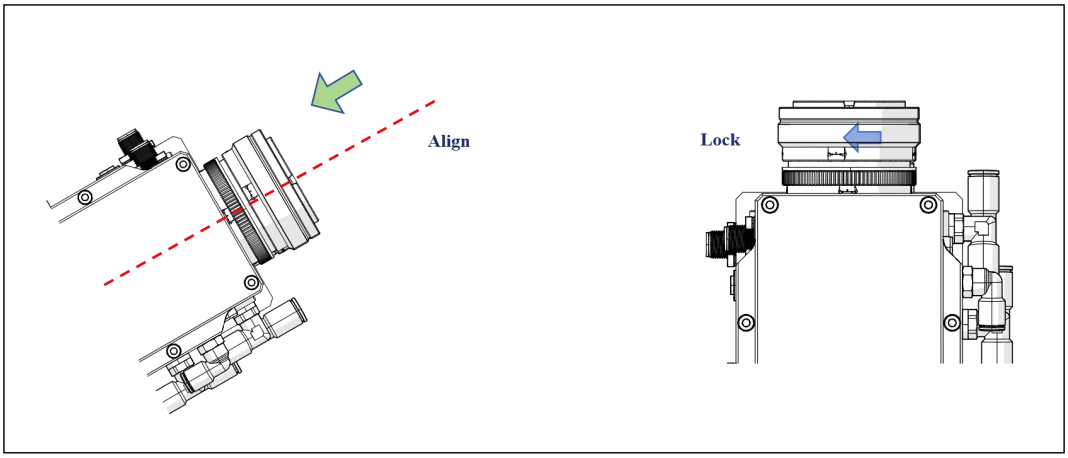


Figure 5-5 Insert the laser fiber connector

5.2.7 Wrap and Seal

After inserting the fiber, use the tape to wrap and seal the connection between the fiber and the interface of the cutting head.

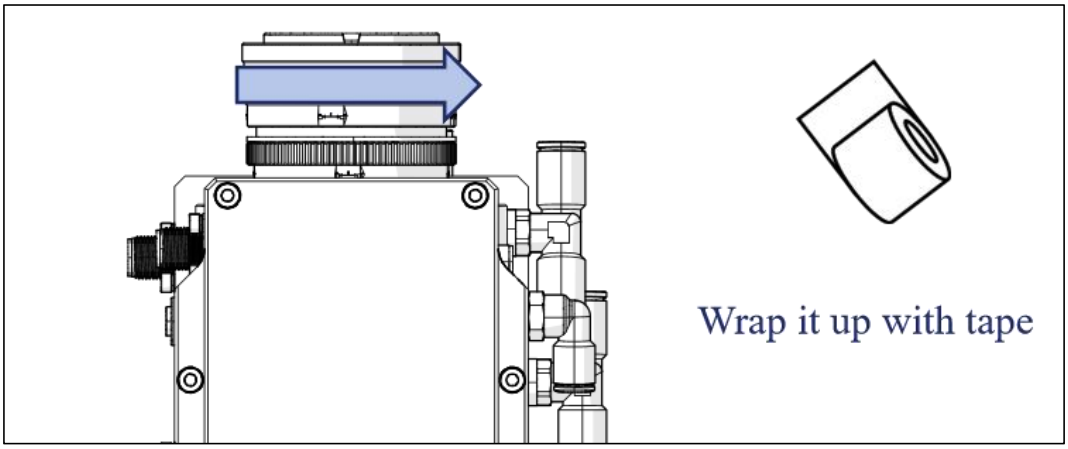


Figure 5-6 Wrap and seal

⚠ Caution: To ensure a proper seal, it is recommended to wrap at least three layers of tape for sealing.

5.2.8 Install the Cutting Head on the Back Plate

The cutting head can be mounted onto the machine's Z-axis back plate using four screws: A, B, C, and D. When securing the cutting head to the machine, it is essential to ensure that the cutting head is properly tightened and free from any wobbling.

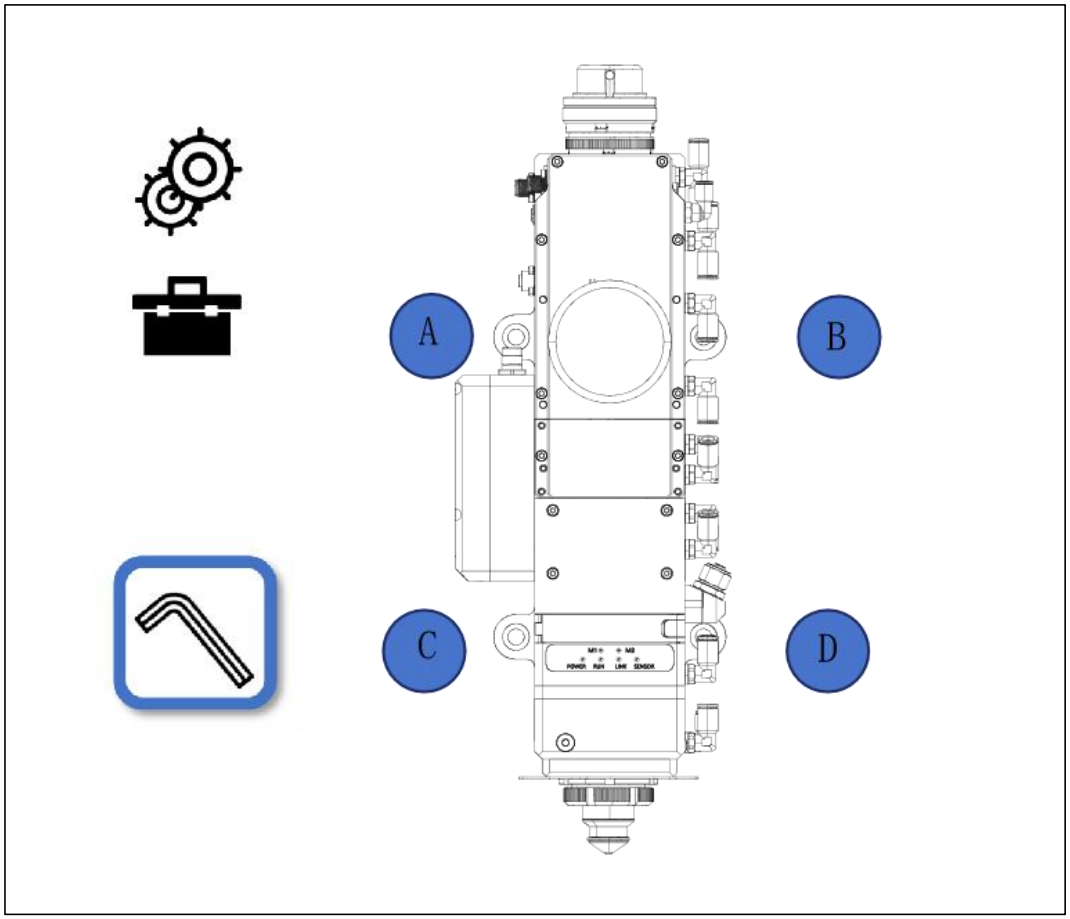


Figure 5-7 Screw A, B, C and D

5.2.9 Install Nozzle and Ceramic Body

Install the ceramic body and secure it with the locking ring, then install the nozzle.

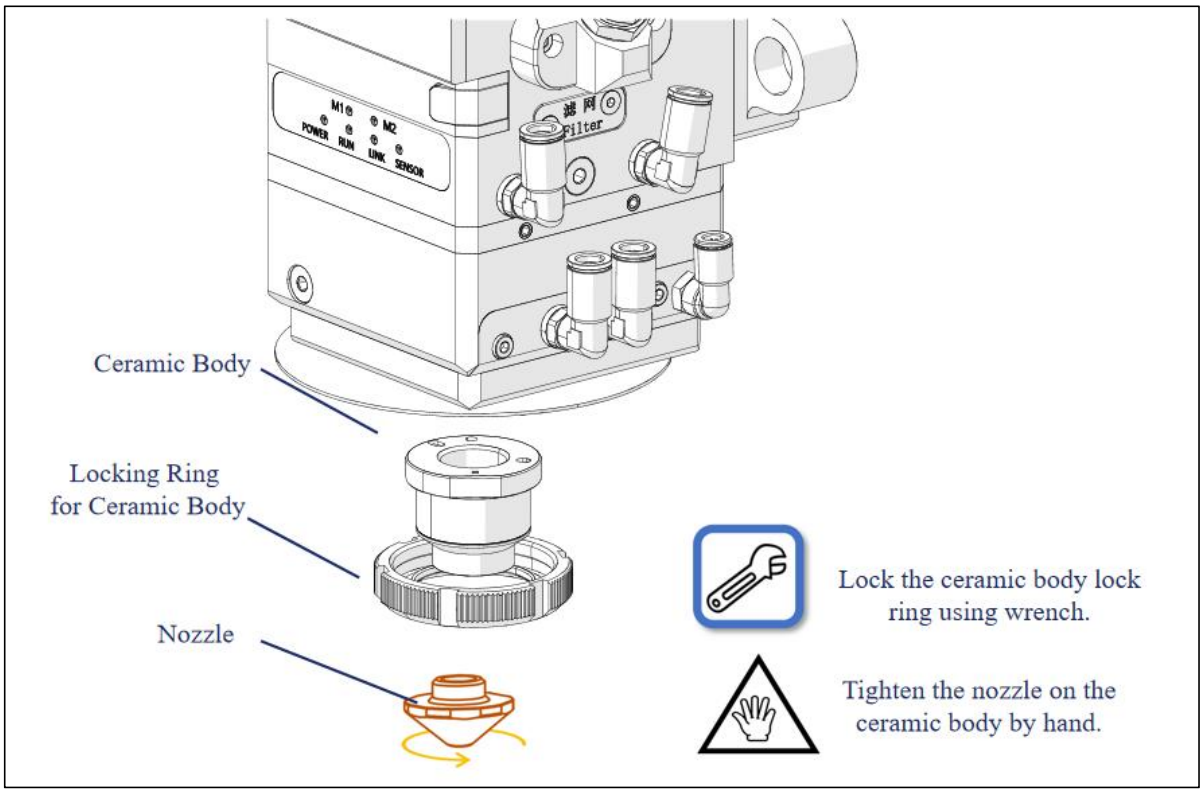


Figure 5-8 Ceramic body and nozzle installation

5.2.10 Laser Beam Centering

Operations for Auto-centering:

Step 1 Turn off the laser beam and stop blowing air.

Step 2 Remove the nozzle and install the calibration tool until the the indicator light turns on.

Step 3 Open HypCut, and navigate to ***Diagnosis*** → ***Cutting head*** → ***Auto center*** interface.

Step 4 Click ***Auto Center***. Wait until the calibration process is finished.

Step 1 Remove the calibration tool and install the nozzle.

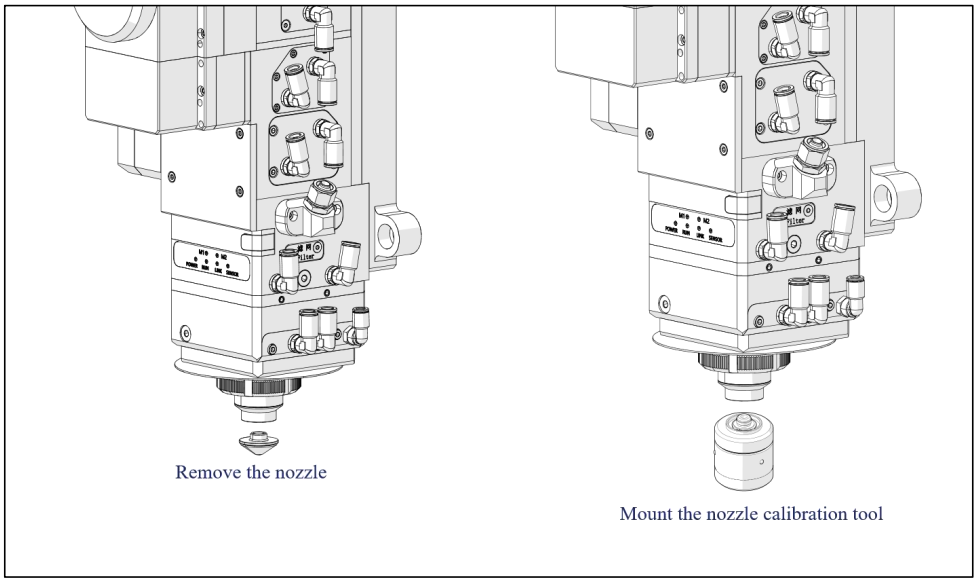


Figure 5-9 Laser beam centering

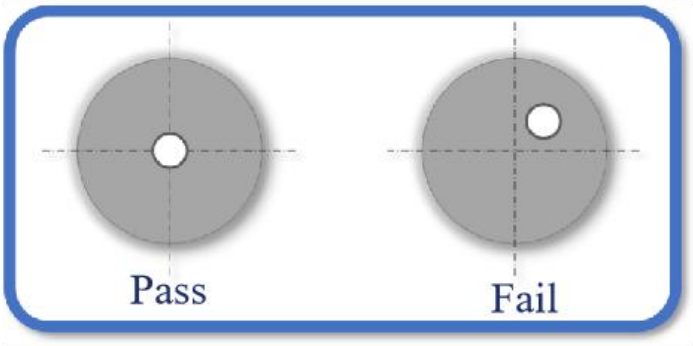


Figure 5-10 Relative position of laser beam

⚠ Caution: The adjusted laser beam must be centered on the nozzle.

Chapter 6 Appendix A Maintenance

A.1 Product Structure Diagram

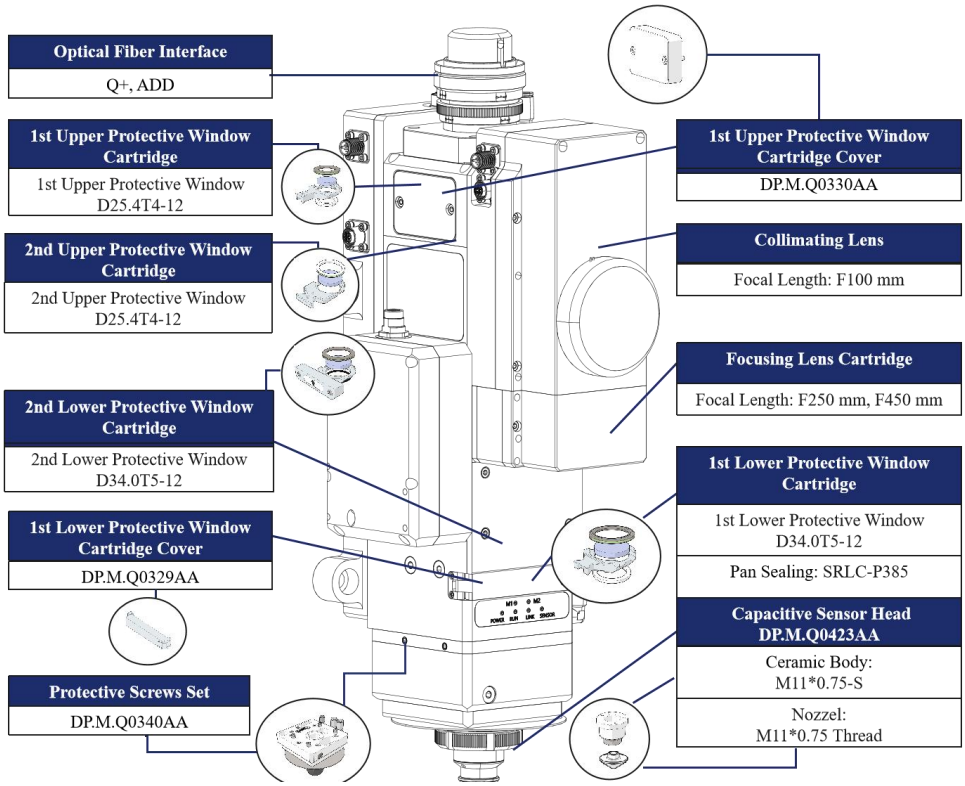


Figure 6-1 Product diagram

A.2 Replace the Upper Protective Window

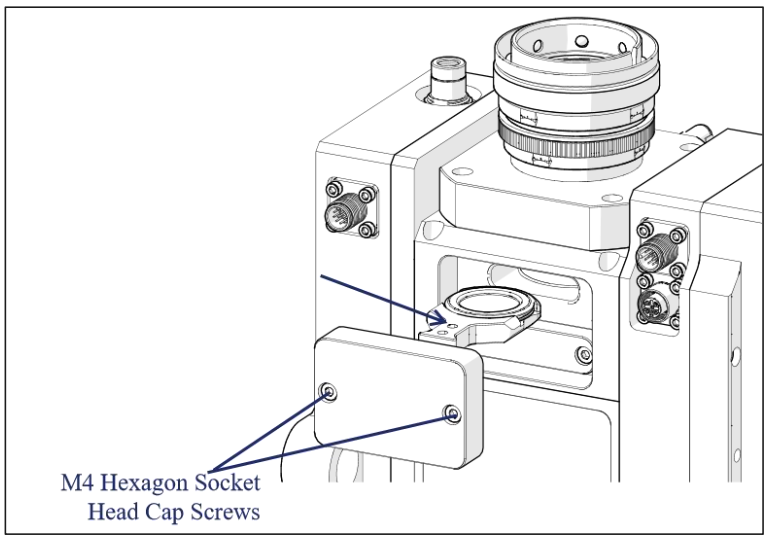


Figure 6-2 Replace the 1st protective window

Follow the procedures below to replace the 1st upper protective window:

Step 1 Loosen the two screws on the upper protective window cover.

Step 2 Pull out the upper protective window cartridge.

Step 3 Seal the cartridge with the masking tape to prevent dust from entering.

Step 4 Remove the pressing ring from the protective window.

Step 5 Replace the upper protective window.

Step 6 Tear off the tape.

Step 7 Insert the upper protective window cartridge with the window into the cutting head.

Step 8 Tighten the two screws.

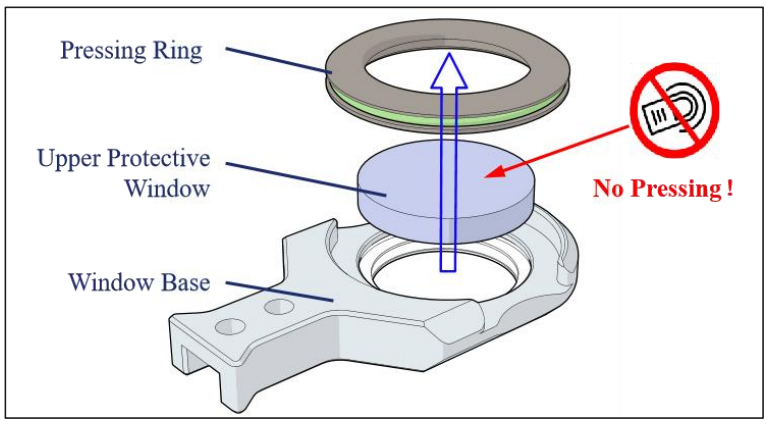


Figure 6-3 Insert window cartridge

A.3 Replace the Lower Protective Window

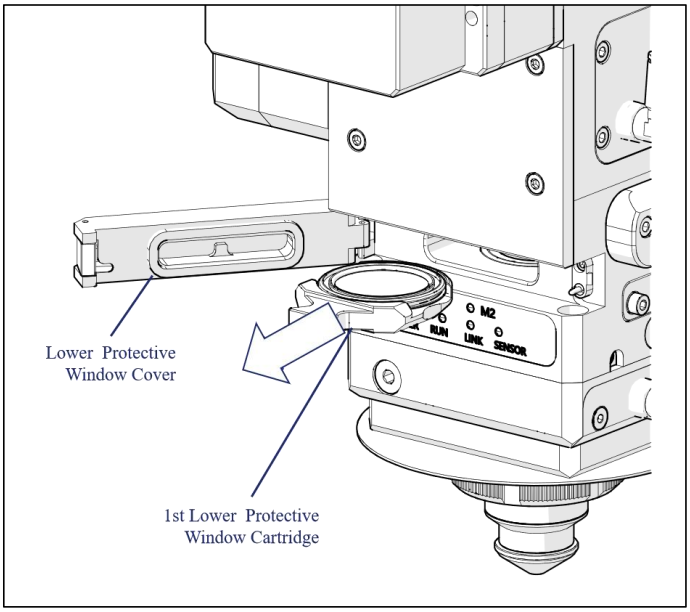


Figure 6-4 Replace the 1st lower protective window

Follow the procedures below to replace the 1st lower protective window:

Step 1 Press the button to open the lower protective window cartridge cover.

Step 2 Pull out the lower protective window cartridge.

Step 3 Close the lower protective window cartridge cover to prevent dust from entering.

Step 4 Replace the lower protective window. Place the pressing ring and tighten it.

Step 5 Open the cartridge cover.

Step 6 Insert the lower protective window cartridge with the window into the cutting head.

Step 7 Shut the cartridge cover.

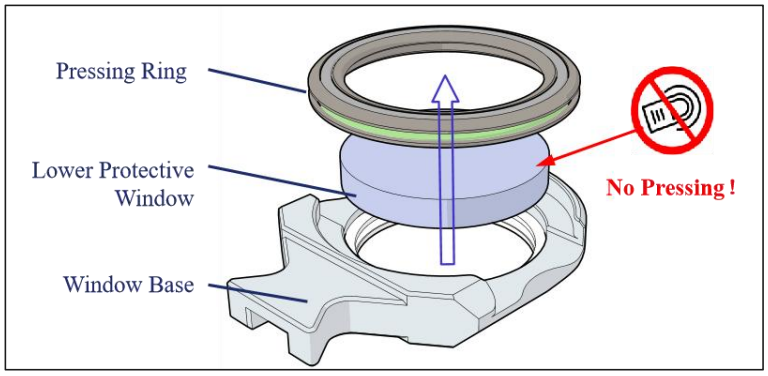


Figure 6-5 Insert window cartridge

Chapter 7 Appendix B Mechanical Dimensions

B.1 Cutting Head Installation Size

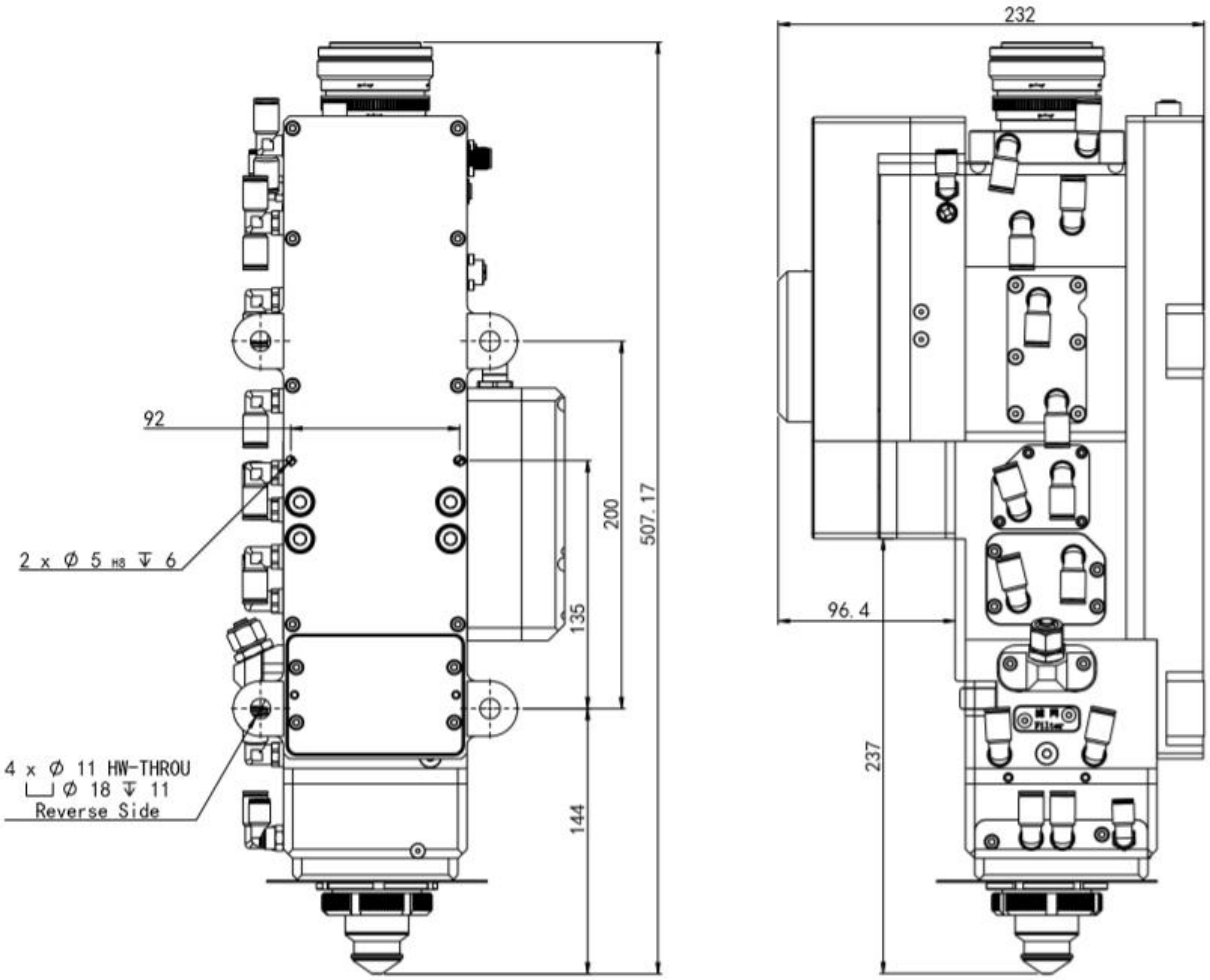


Figure 7-1 BLT9120MA-Q+ (250 & 450)

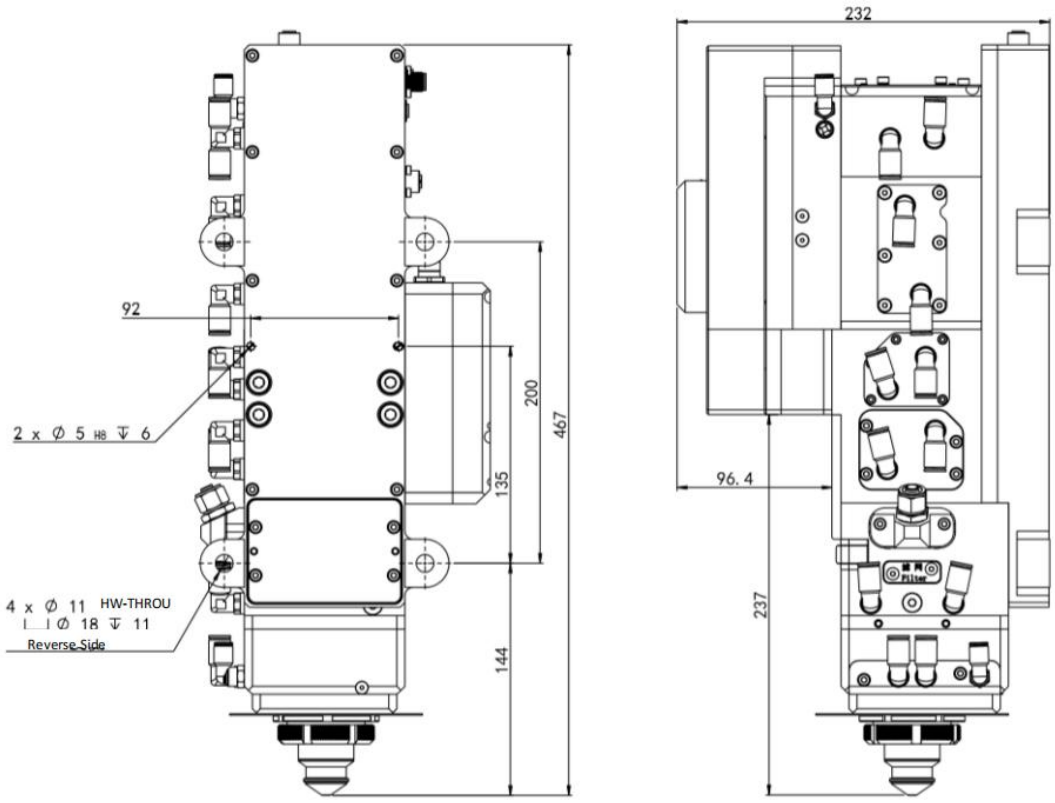
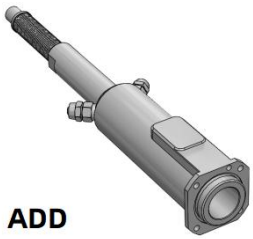


Figure 7-2 BLT9120MA-ADD (250 & 450)

B.2 Interface Types

Table 7-1 **Interface Types of BLT9120MA**

General Type	Image	Other Compatible Interface Types
Q+		● Raycus QP ● IPG HLC-16
ADD		● BWT QF-D ● Maxphotonics LOE 3.2 ● FEIBO HOC

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