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BLTF60 Intelligent Cutting Head Product Manual

Document Version: V1.0.0

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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	2025/09/16	First release of the BLTF60 Intelligent Cutting Head product manual.

Contents

Chapter 1 Product Specification

1.1 Product View

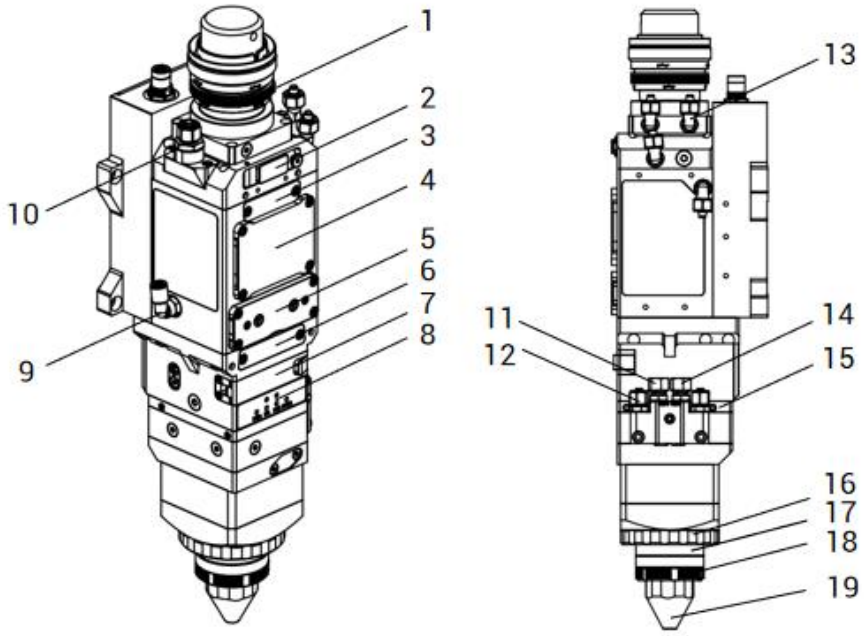


Figure 1-1 Product view

1. Fiber Optic Interface
2. 1st Upper Protective Window;
3. 2nd Upper Protective Window;
4. Collimation Unit
5. Focusing Unit
6. 2nd lower Protective Window;
7. 1st Lower Protective Window
8. Work Indicator Light
9. Nozzle Cooling Gas Interface
10. Cutting Gas Interface
11. Oxygen Interface
12. Cooling Water Outlet
13. Cooling Water Inlet
14. Fuel Gas Interface
15. Protective Screws
16. Ceramic Body Locking Ring
17. Ceramic Body
18. Nozzle Connector Locking Ring
19. Nozzle

1.2 Technical Parameters

Table 1-1 BLTF60 Cutting Head Technical Parameters

Parameters	Values
Laser Wavelength	1030 nm to 1090 nm
Laser Power	≤ 20 kW
Fiber Optic Interface	QD, Q+, QBH, ADD
Spot Magnification	M = 2.5/3.0
Max. Focus Adjustment Range	M = 2.5 (-70 mm to +50 mm); M = 3.0 (-100 mm to +50 mm)
NA	Max.0.13 Fc100
Alignment Adjustment Range	±1.5 mm
Focusing Acceleration	7.5 m/s²
Cutting Gas Interface	ø10, 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 3.0 L/min
Fuel Gas Interface	ø8, max 10 bar (1 MPa)
Oxygen Interface	ø8, max 10 bar (1 MPa)
Working Temperature	5℃ to 55℃
Storage Temperature	-25℃ to +55℃
Dimension	474.3 mm × 136.3 mm (This applies to the Q+, M = 2.5 version. For the size of other interfaces, please refer to the appendix chapters.)
Weight	About 6.97 kg (This applies to the Q+, M = 2.5 Interface version. Other versions may differ based on their specific specifications.)

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

⚠Caution:

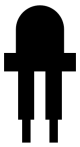
1. The cutting head should be stored in the environment within the allowed temperature and humidity range.

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

3. Avoid collision during transportation or usage.

1.3 LED Indicators

Table 1-2 LED Indicator Description

Icon	Status	Description
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.
	Green	Signal input normal.
	Red	Laser mode and laser-flame hybrid mode signals triggered simultaneously.
	Light off	No signal input.
	Green	Signal input normal.
	Red	Laser mode and laser-flame hybrid mode signals triggered simultaneously.
	Light off	No signal input.

Chapter 2 Gas Interfaces

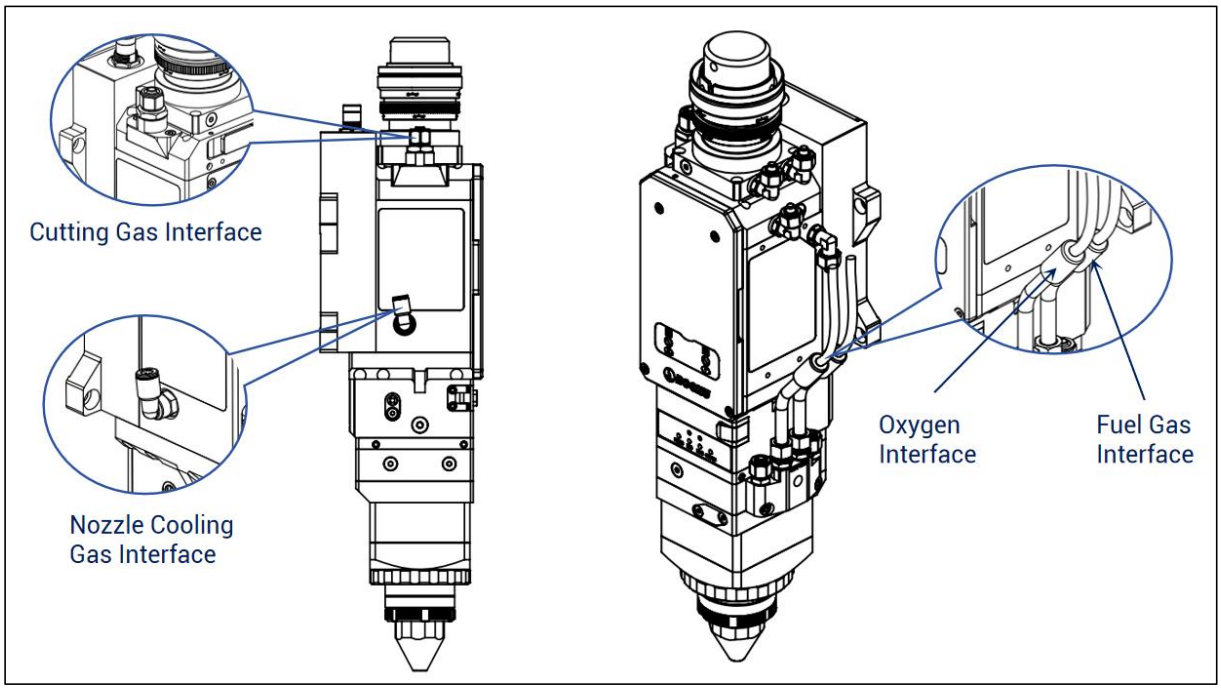


Figure 2-1 Gas interfaces

⚠Caution:

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

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. Cutting gas interface diameter (outer diameter) is 10 mm, while the nozzle cooling gas interface diameter (outer diameter) is 6 mm.

4. Fuel gas interface diameter (outer diameter) is 8 mm, while the oxygen interface diameter (outer diameter) is 8 mm.

Chapter 3 Cooling Water Interfaces

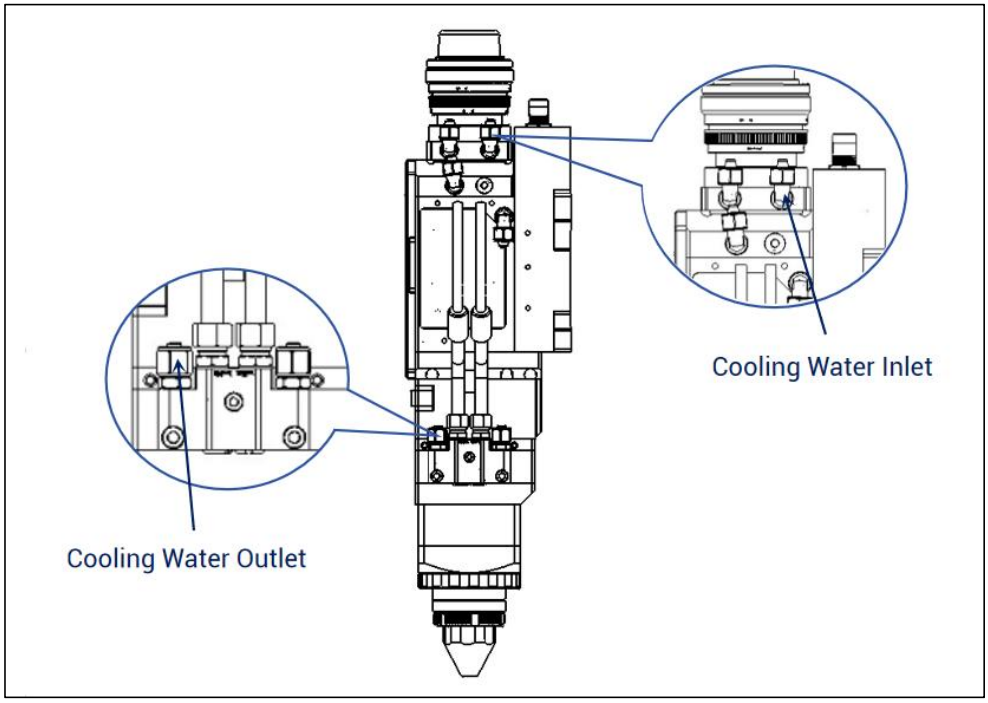


Figure 3-1 Water cooling interfaces

⚠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℃ to 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 ≥ 3.0 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 Wiring

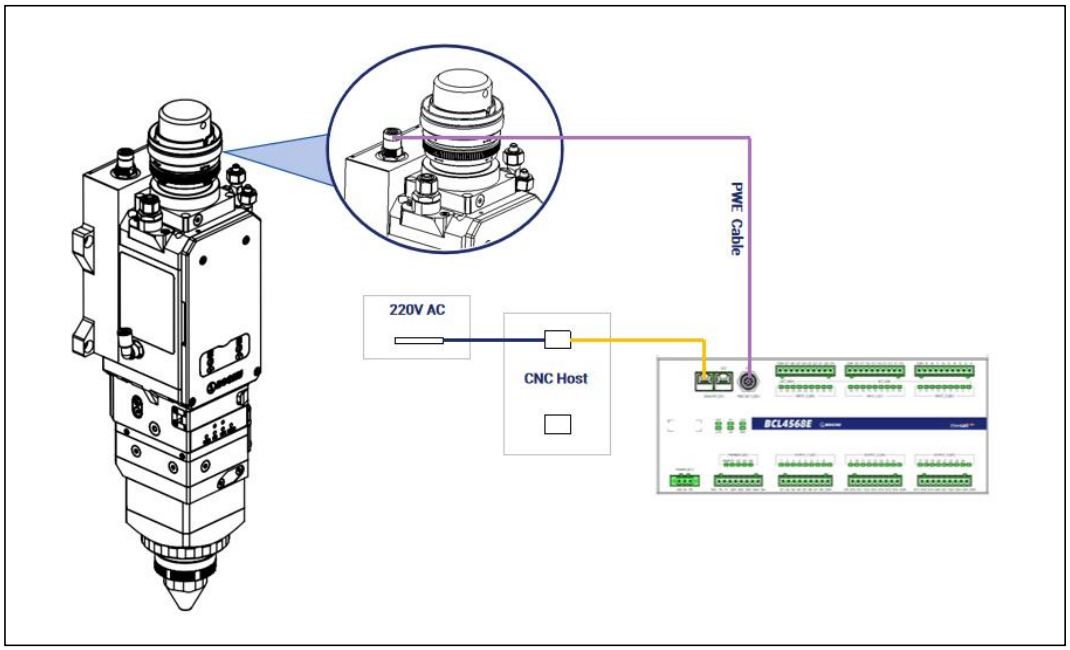


Figure 4-1 Bus system cutting head wiring

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

⚠Waterproof cautions for PWE interface:

1. The PWE interface comes with dust plugs at the factory, which can achieve a protection level of IP64 with the dust cap securely in place. At the same time, with the PWE cable connected properly, the protection level of IP64 can also be achieved.

2. After the dust plug is removed, it cannot achieve the protection level of IP64. If it encounters spraying or flushing, it will cause water to ingress into the product, affecting its function.

3. Ensure that the waterway is properly connected and the water pipe interface is tightened before removing the dust plug to prevent the water pipe from accidentally loosening and causing water to rush into the interface, resulting in water ingress into the product.

4. When adjusting the machine wiring, remove the dust plug for wiring, and it is recommended to keep the removed dust plug of the PWE interface. Install the dust plug immediately after removing the wire to prevent accidental water ingress during transportation, water connection, 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).
- Clean kit: High-intensity flashlight, anhydrous ethanol (or IPA), lint-free purification swabs, cleanroom wiper, compressed air dust removal can (or air blower).

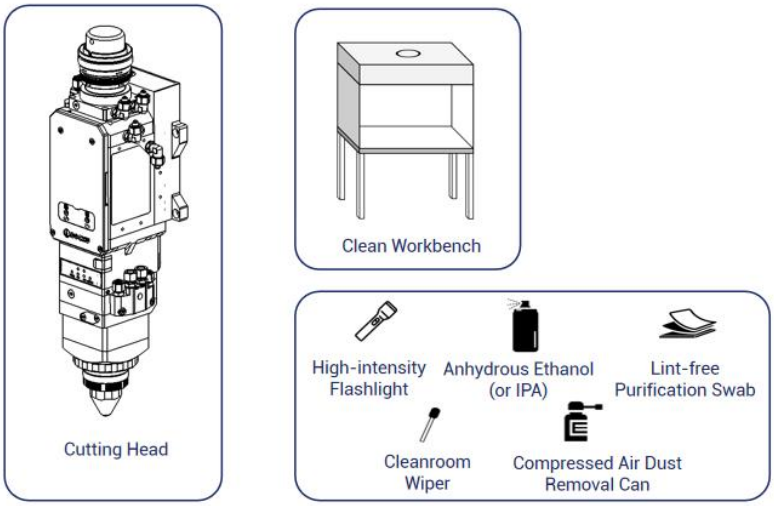


Figure 5-1 Preparation tools for the cutting head installation

⚠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 Procedure

5.2.1 Prepare the Clean Workbench

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

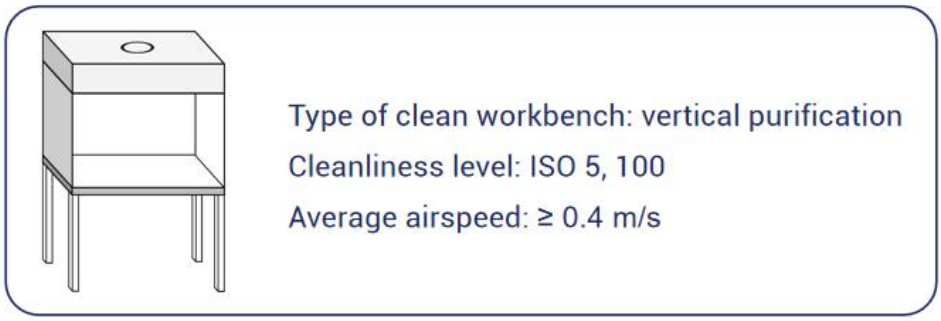


Figure 5-2 Prepare the clean workbench

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.

Start Procedure:

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.

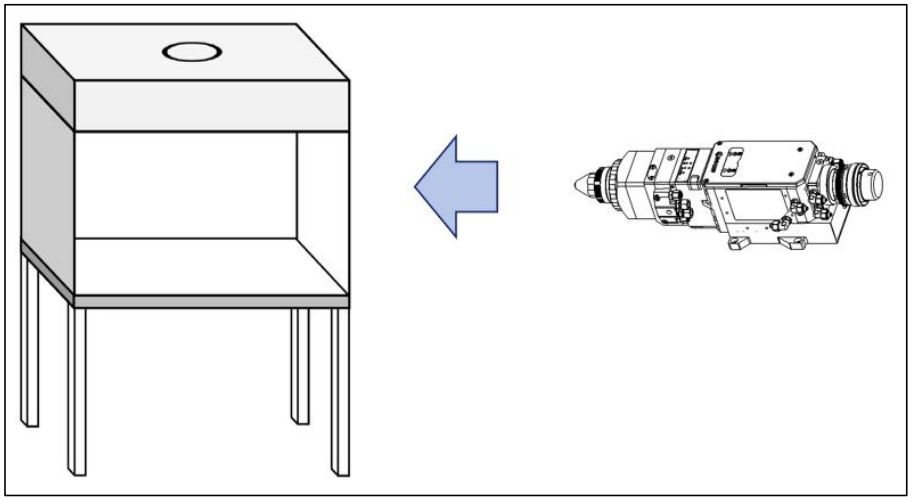


Figure 5-3 Put the cutting head inside the workbench

⚠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.

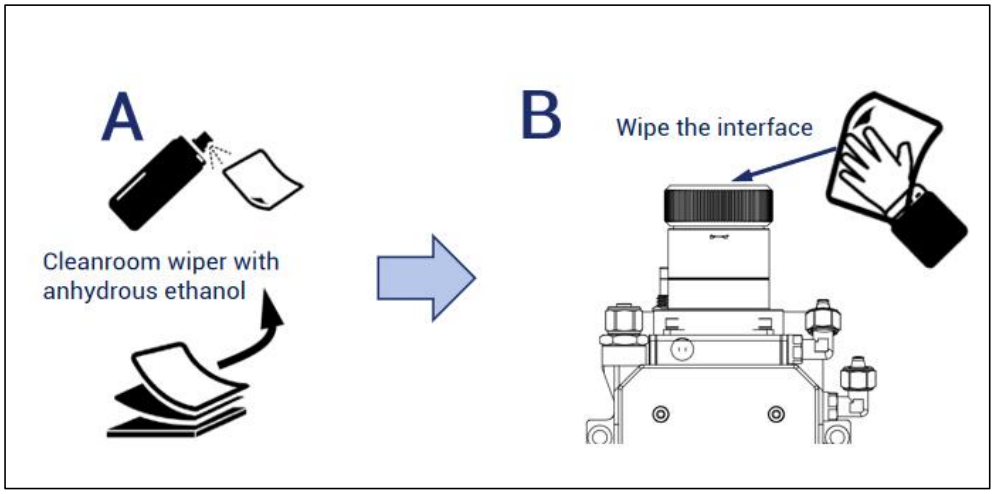


Figure 5-4 Clean the interface

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.

- QBH fiber optic interface

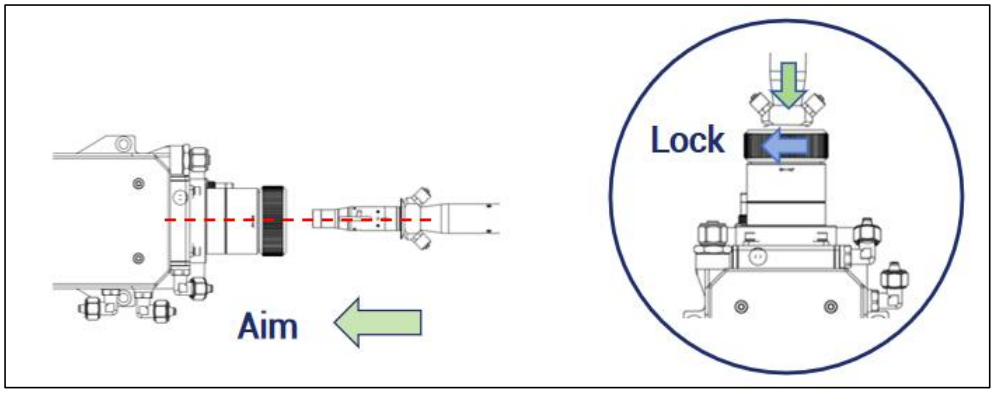


Figure 5-5 QBH interface

- QD fiber optic interface

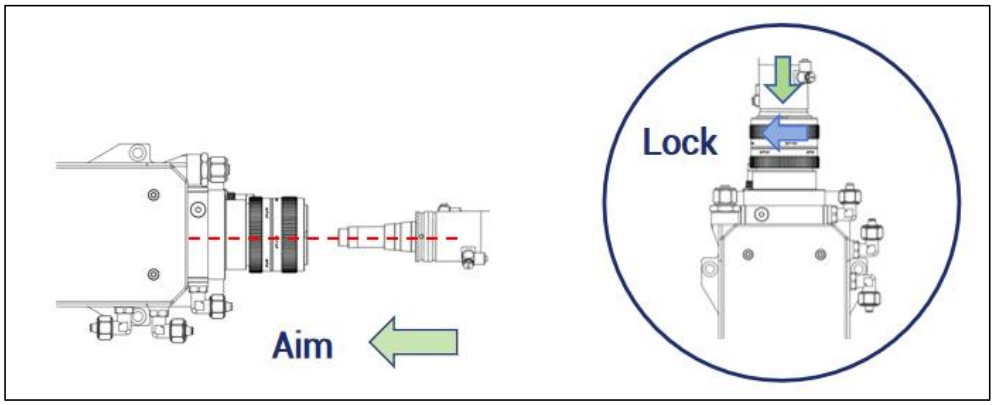


Figure 5-6 QD interface

- Q+ fiber optic interface

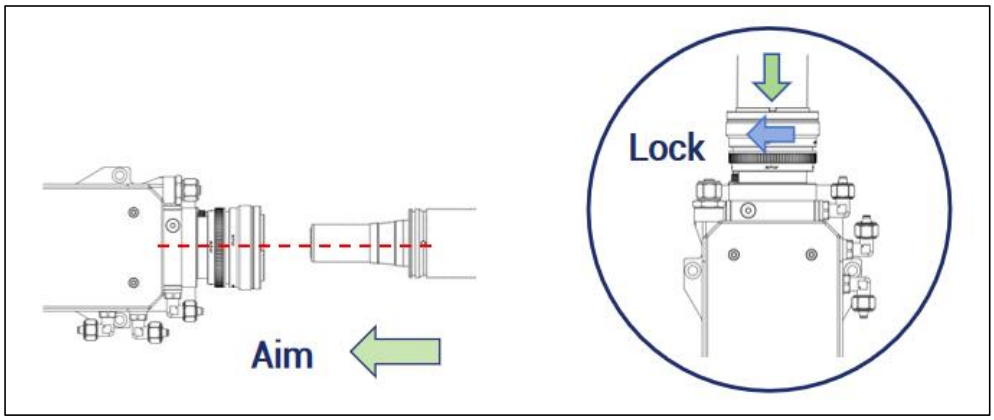


Figure 5-7 Q+ interface

- ADD fiber optic interface

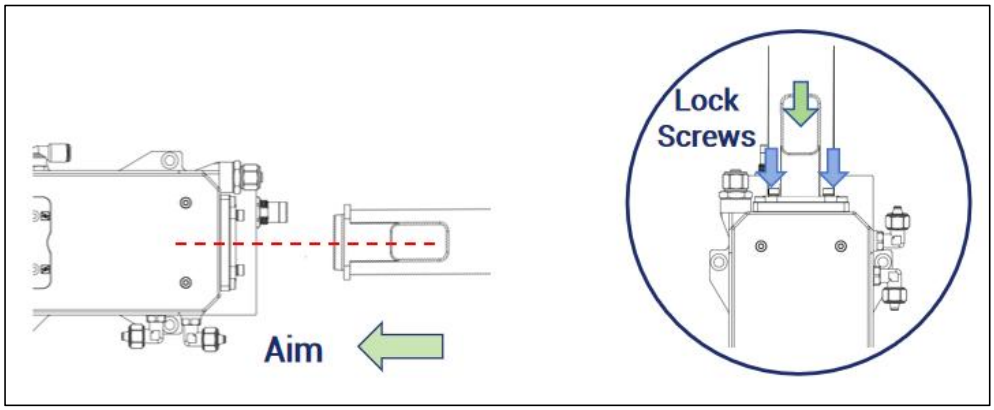


Figure 5-8 ADD interface

5.2.7 Wrap and Seal

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

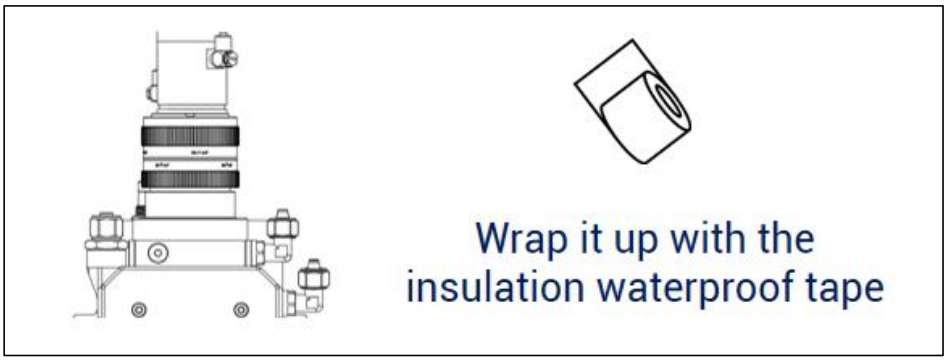


Figure 5-9 Wrap and seal

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

5.2.8 Mount 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.

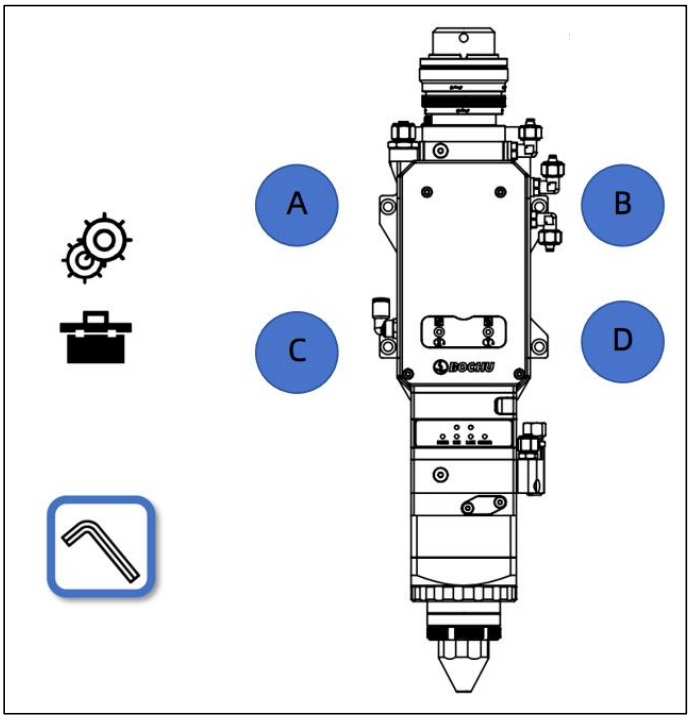


Figure 5-10 Cutting head installation

5.2.9 Install the Ceramic Body and Nozzle

- Install the ceramic body
  - When installing the ceramic body, check that the O-ring is properly in place and not dislodged. Align the pin hole of the ceramic body with the corresponding pin on the capacitor head. Use a wrench to tighten the ceramic body locking ring.

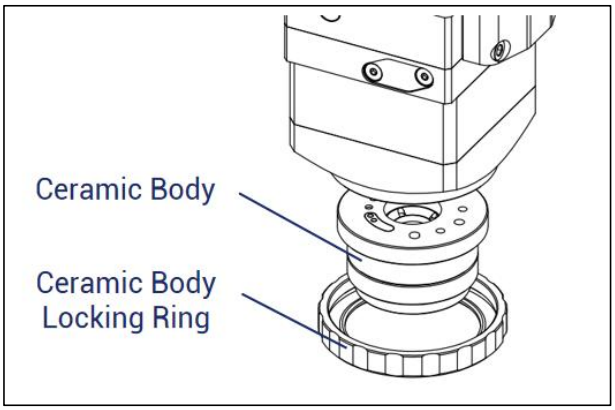


Figure 5-11 Install the ceramic body

- Install the nozzle assembly
  - When installing the nozzle connector, check that the O-ring is properly in place and not dislodged. Align the pin hole of the nozzle with the corresponding pin on the ceramic body. Use a wrench to tighten the nozzle connector locking ring.
  - Use the laser-frame nozzle when in laser + flame composite cutting mode; use the laser nozzle when in laser cutting mode.

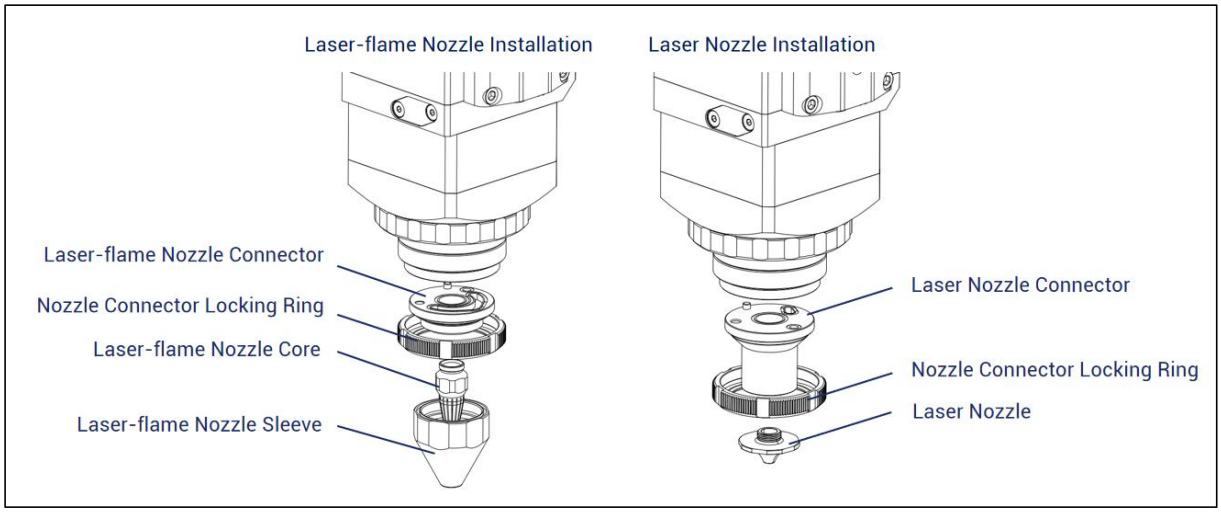


Figure 5-12 Install the nozzle assembly

5.2.10 Laser Beam Centering

Adjust the X-Y alignment knobs using low-power pinpointing to ensure the focus is at the center of the nozzle.

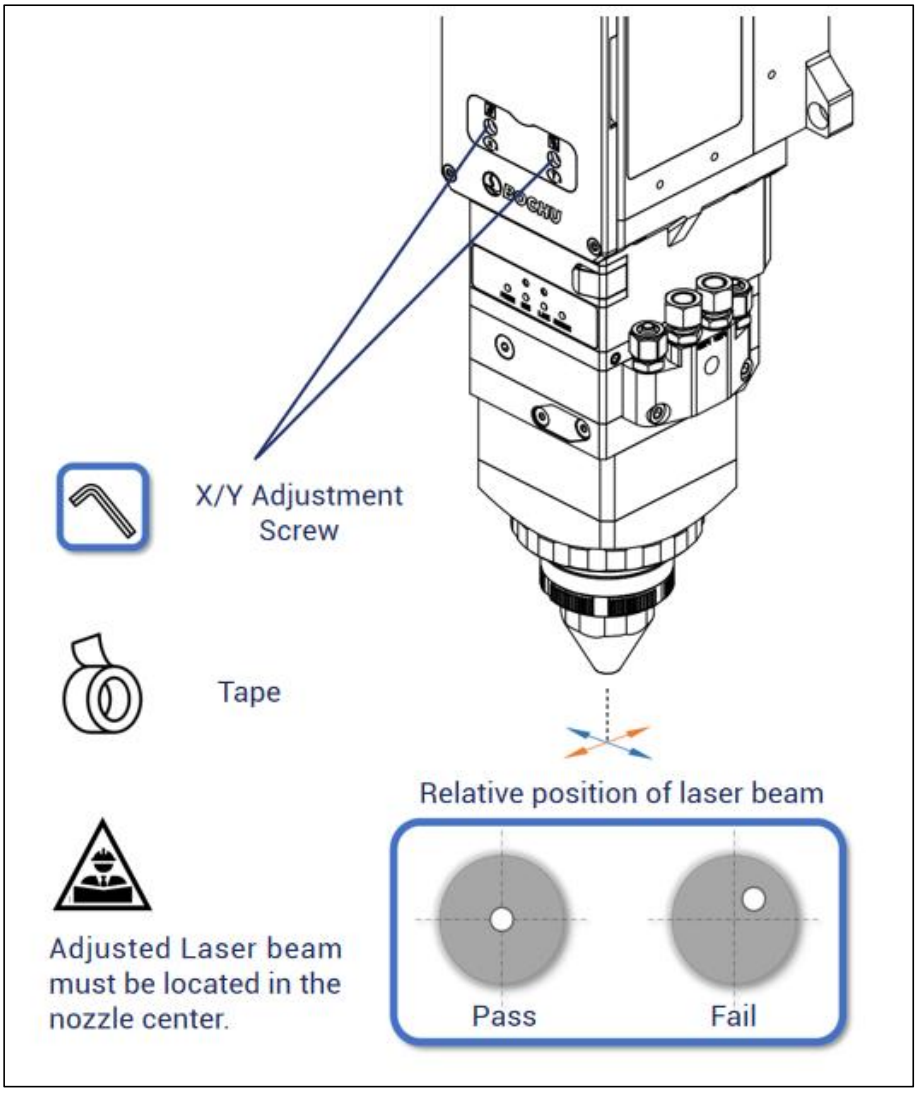


Figure 5-13 Laser beam centering

Manual operations for beam centering:

Step 1 Make sure the laser beam has been turned off.

Step 2 Put the tape below the nozzle.

Step 3 Click to trigger a low-power laser pulse and assess the position of the laser beam relative to the nozzle based on the penetration of the tape.

Step 4 Adjust the X/Y alignment screws to position the laser beam at the center of the nozzle.

Chapter 6 Appendix A: Maintenance

A.1 Product Structure Diagram

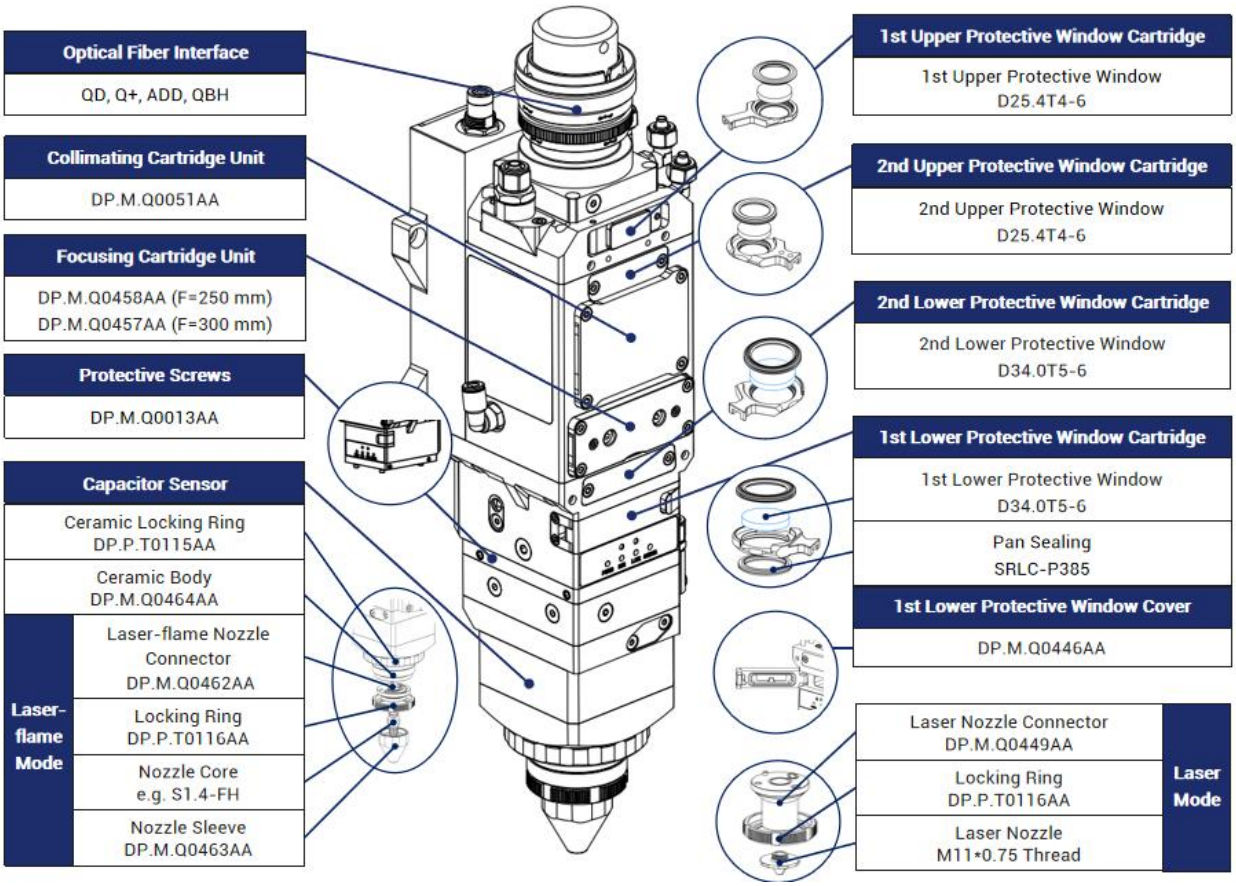


Figure 6-1 Product diagram

A.2 Replace the Upper Protective Window

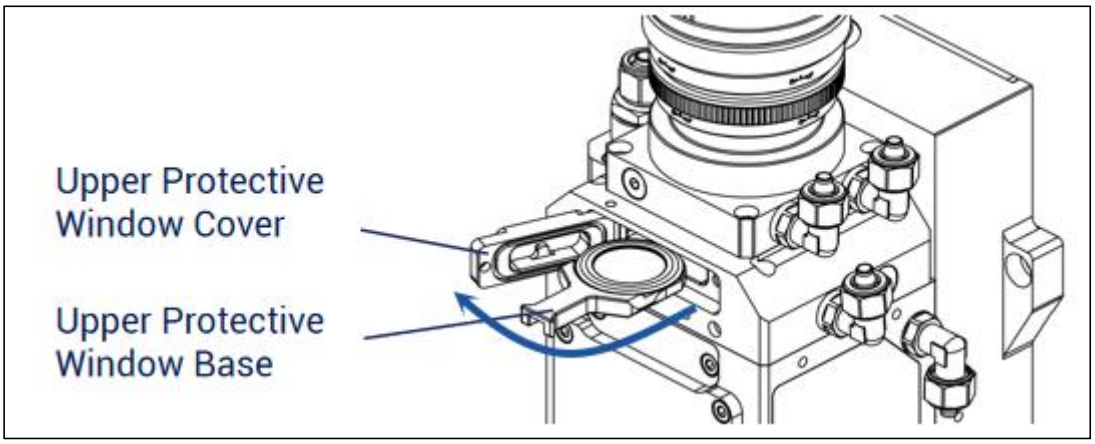


Figure 6-2 Replace the upper protective window

Procedures to change the upper protective window are shown below:

Step 1 Loosen the cover screws and open the upper protective window cover.

Step 2 Pull out the upper protective window cartridge.

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

Step 4 Remove the pressing ring from the protective window.

Step 5 Replace the upper protective window with the pressing ring installed.

Step 6 Open the upper protective window cartridge cover.

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

Step 8 Close the cartridge cover and tighten the screws.

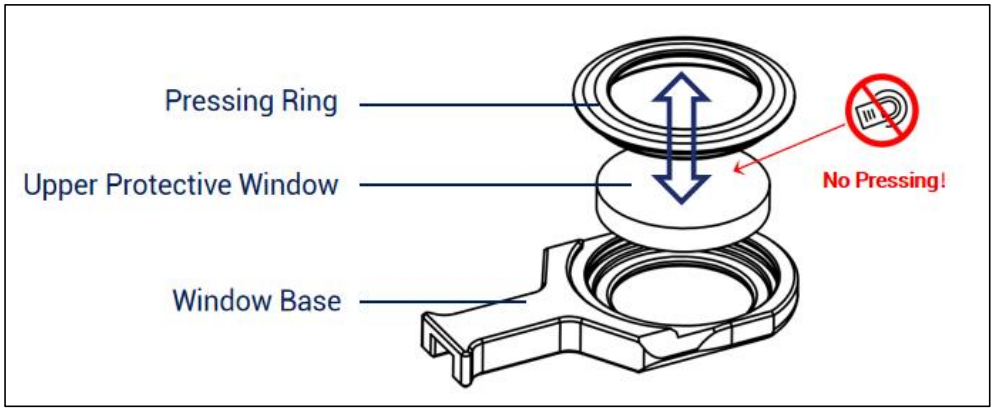


Figure 6-3 Replace the upper protective window

A.3 Replace the Lower Protective Window

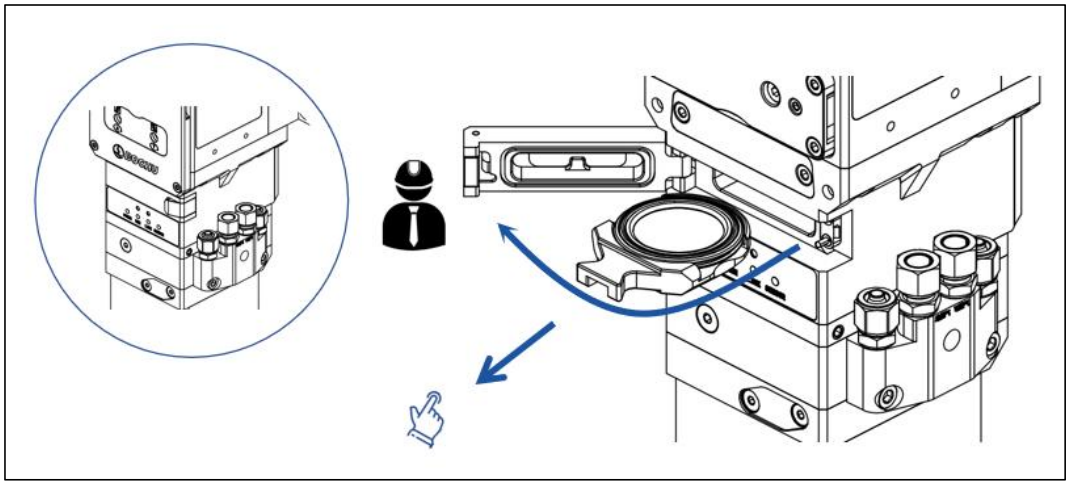


Figure 6-4 Replace the lower protective window

Procedures to replace the lower protective window are shown below:

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 Remove the pressing ring from the protective window.

Step 5 Replace the lower protective window with the pressing ring installed.

Step 6 Open the lower protective window cartridge cover.

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

Step 8 Close the cartridge cover.

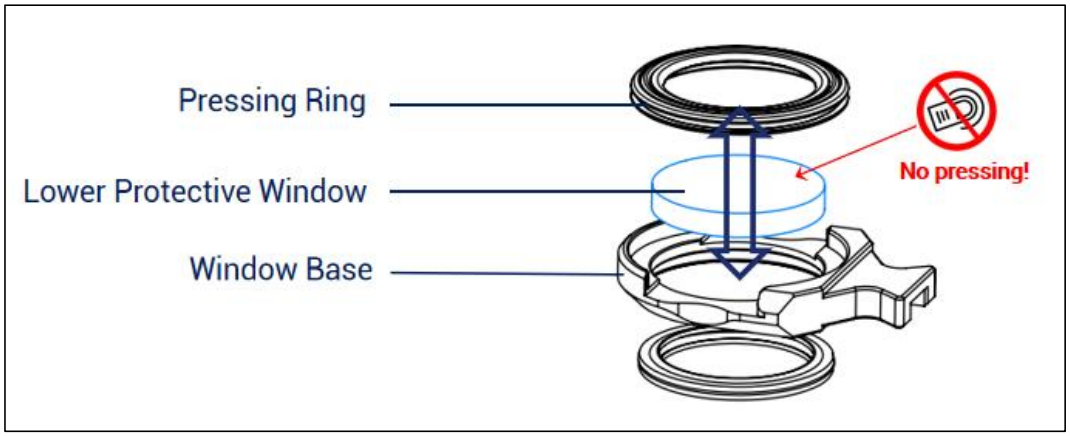


Figure 6-5 Replace the lower protective window

Chapter 7 Appendix B: Mechanical Dimensions

B.1 Cutting Head Installation Dimension

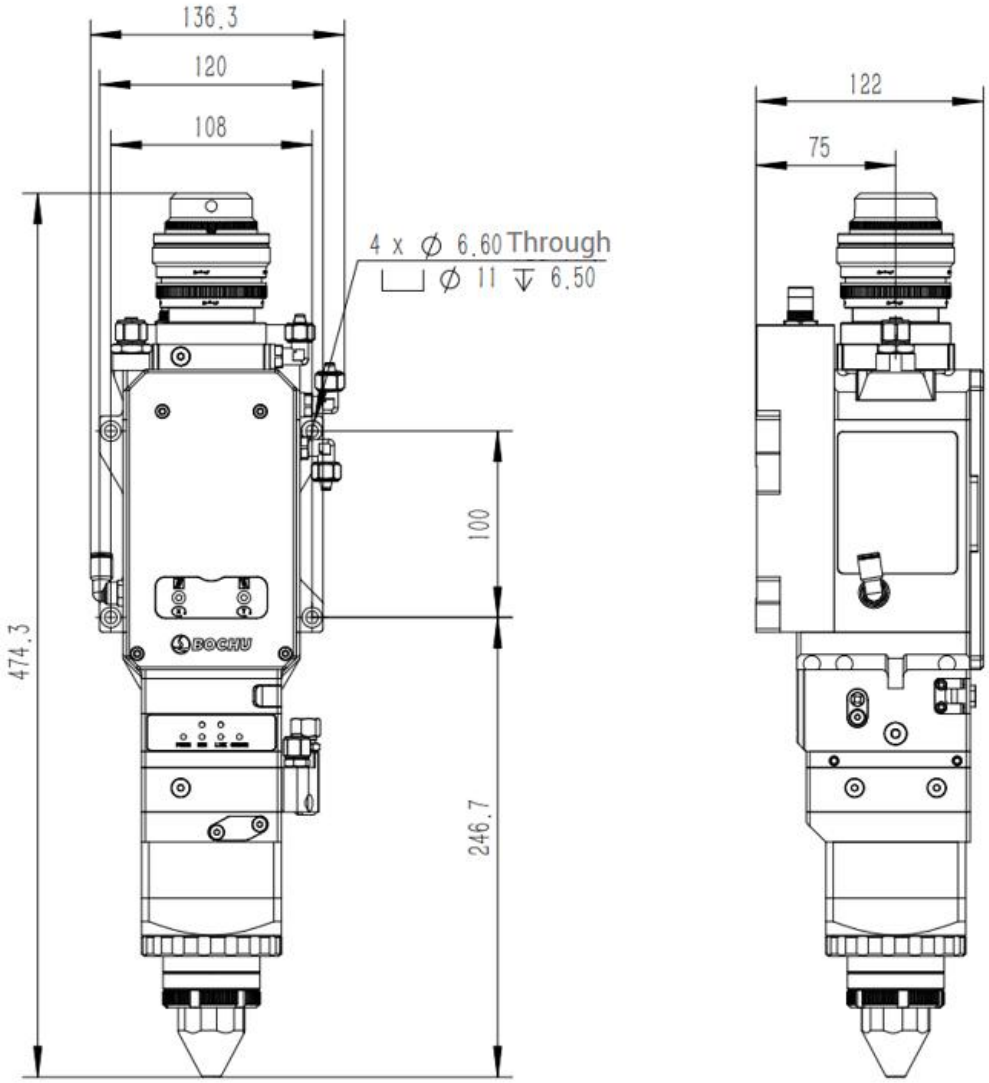


Figure 7-1 BLTF60-250-Q+ (mm)

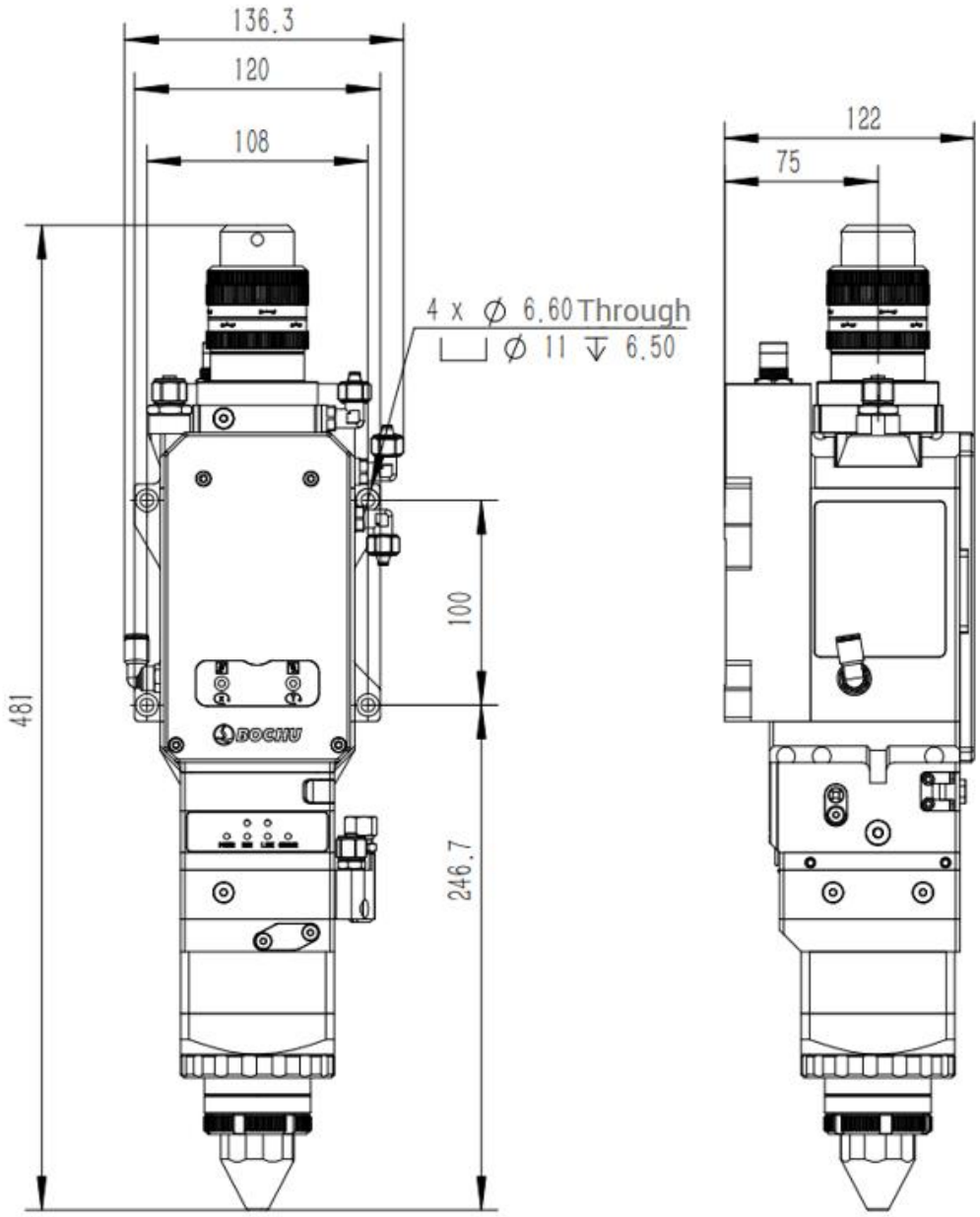


Figure 7-2 BLTF60-250-QD (mm)

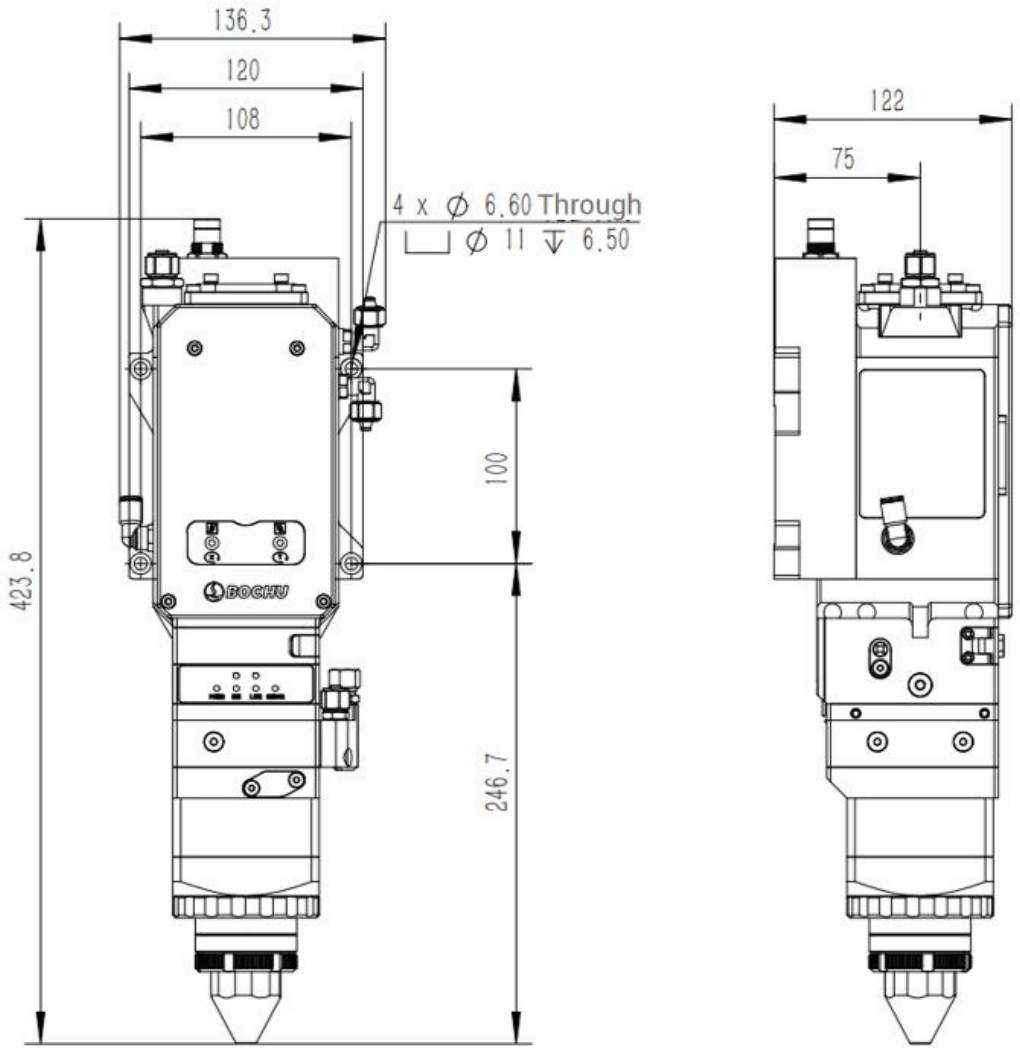


Figure 7-3 BLTF60-250-ADD (mm)

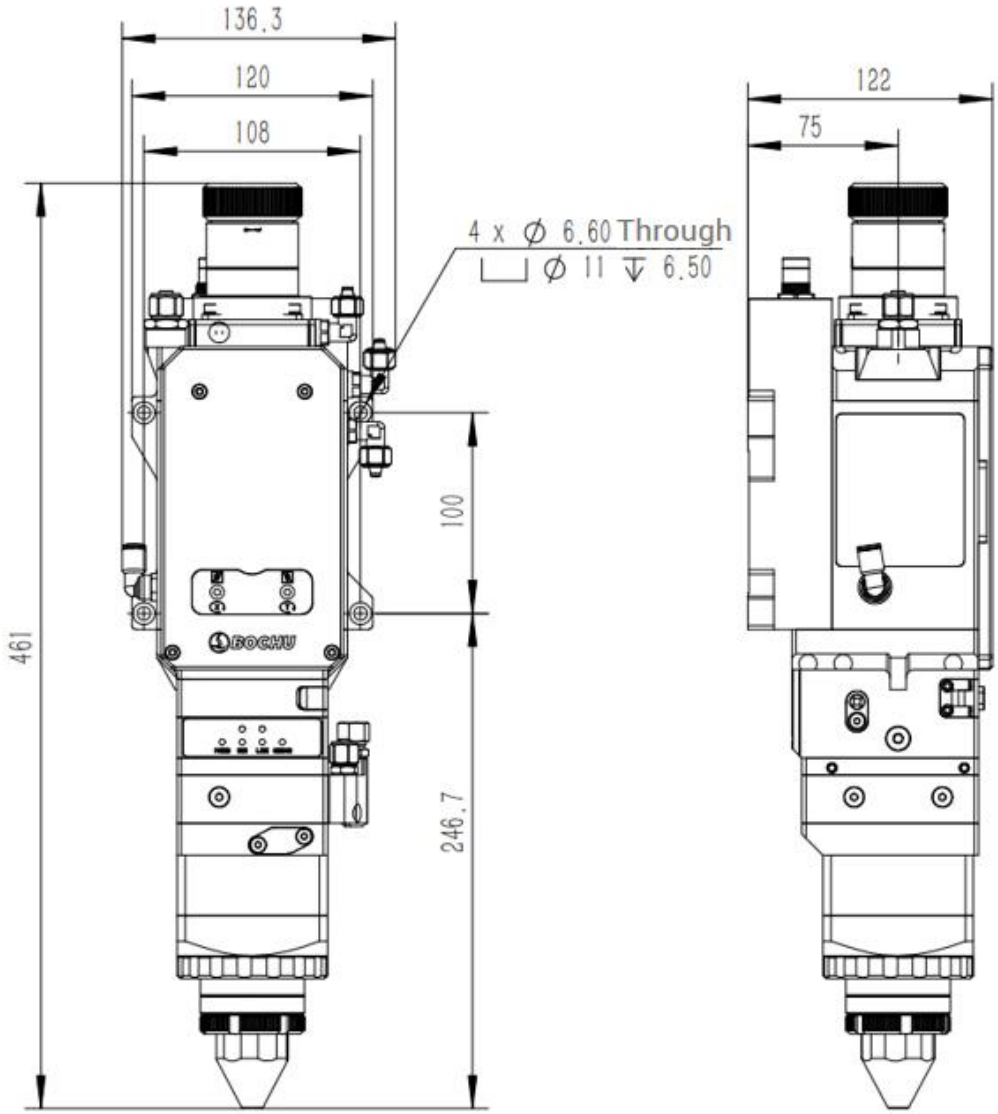


Figure 7-4 BLTF60-250-QBH (mm)

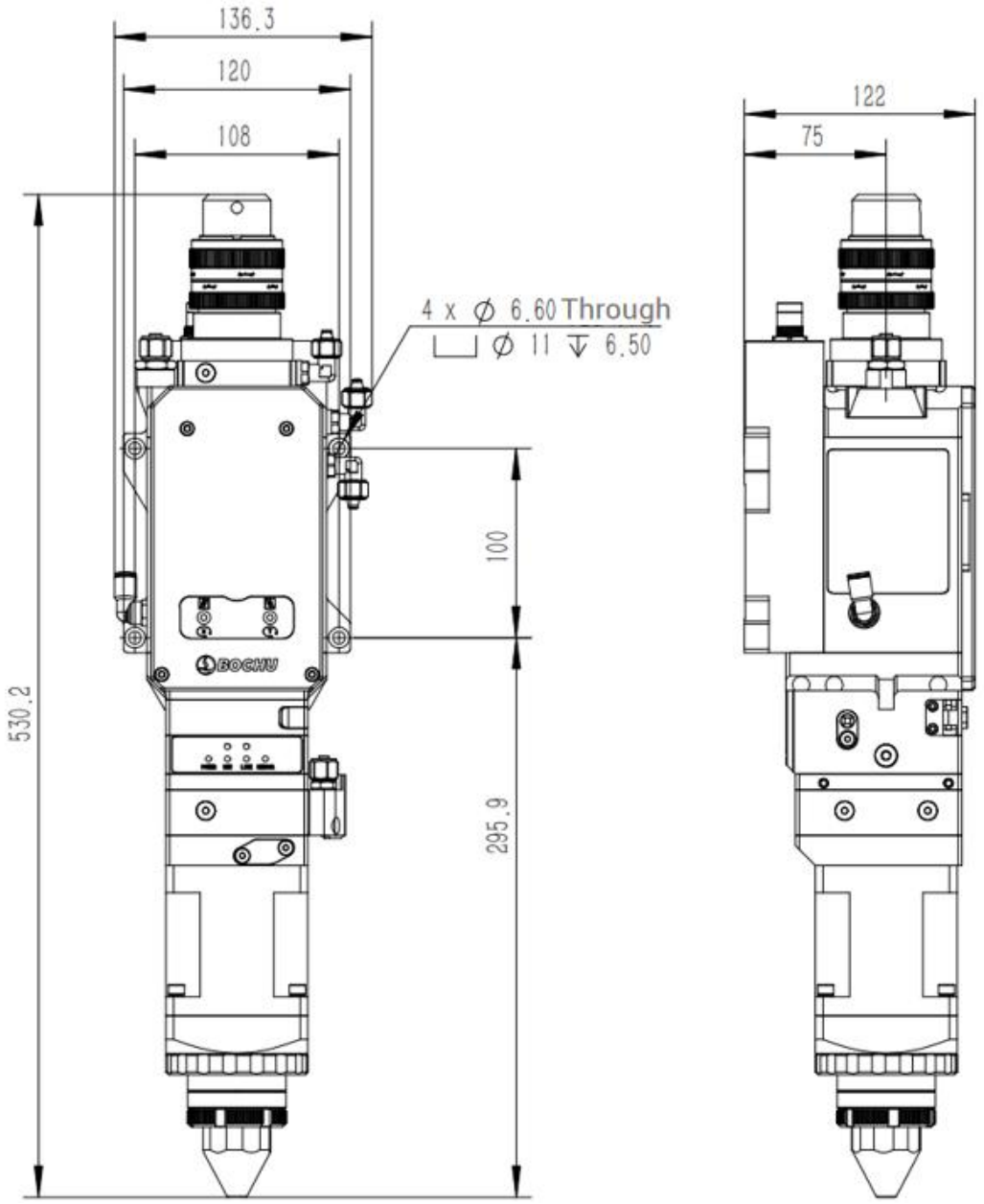


Figure 7-5 BLTF60-300-QD (mm)

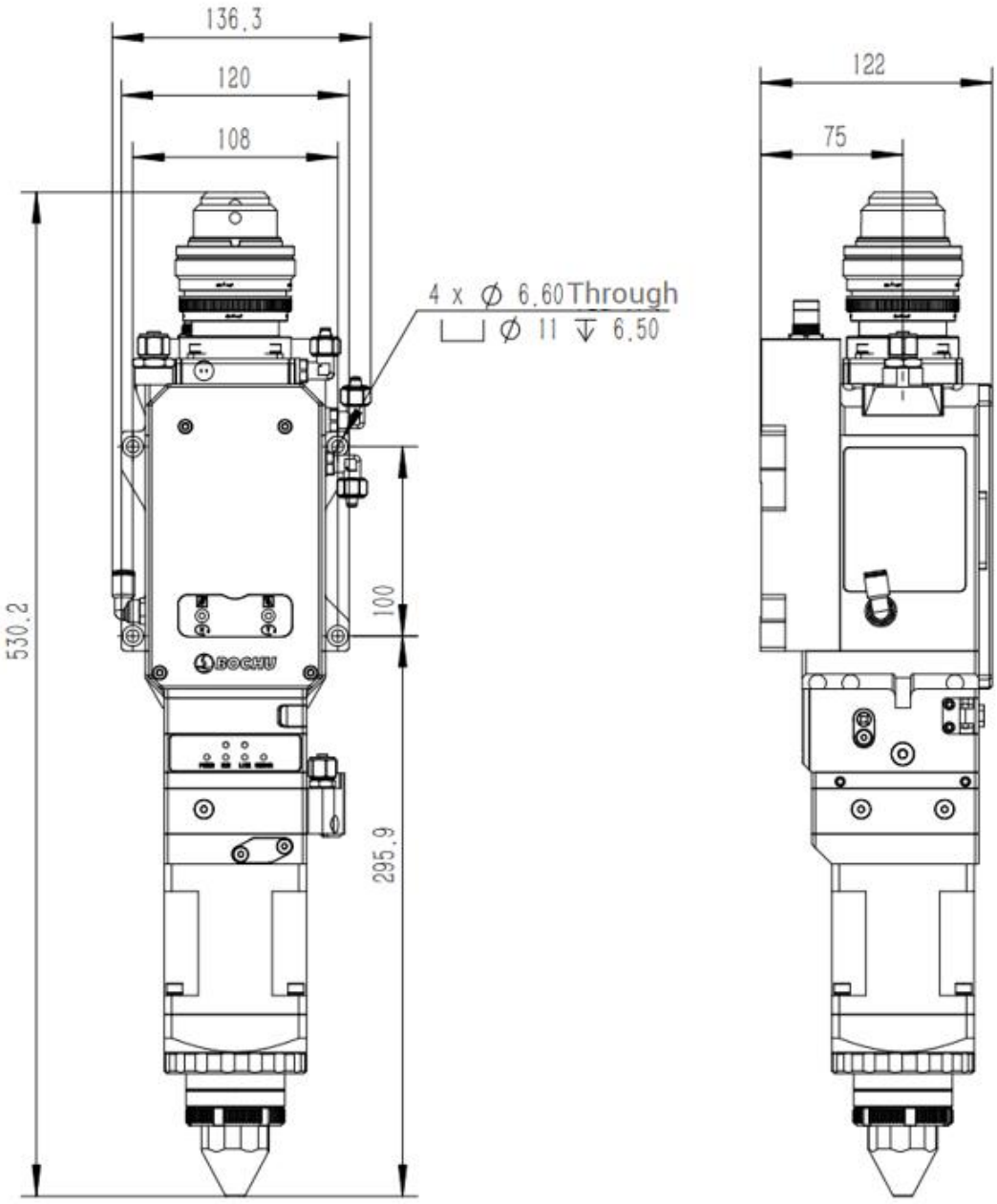


Figure 7-6 BLTF60-300-Q+ (mm)

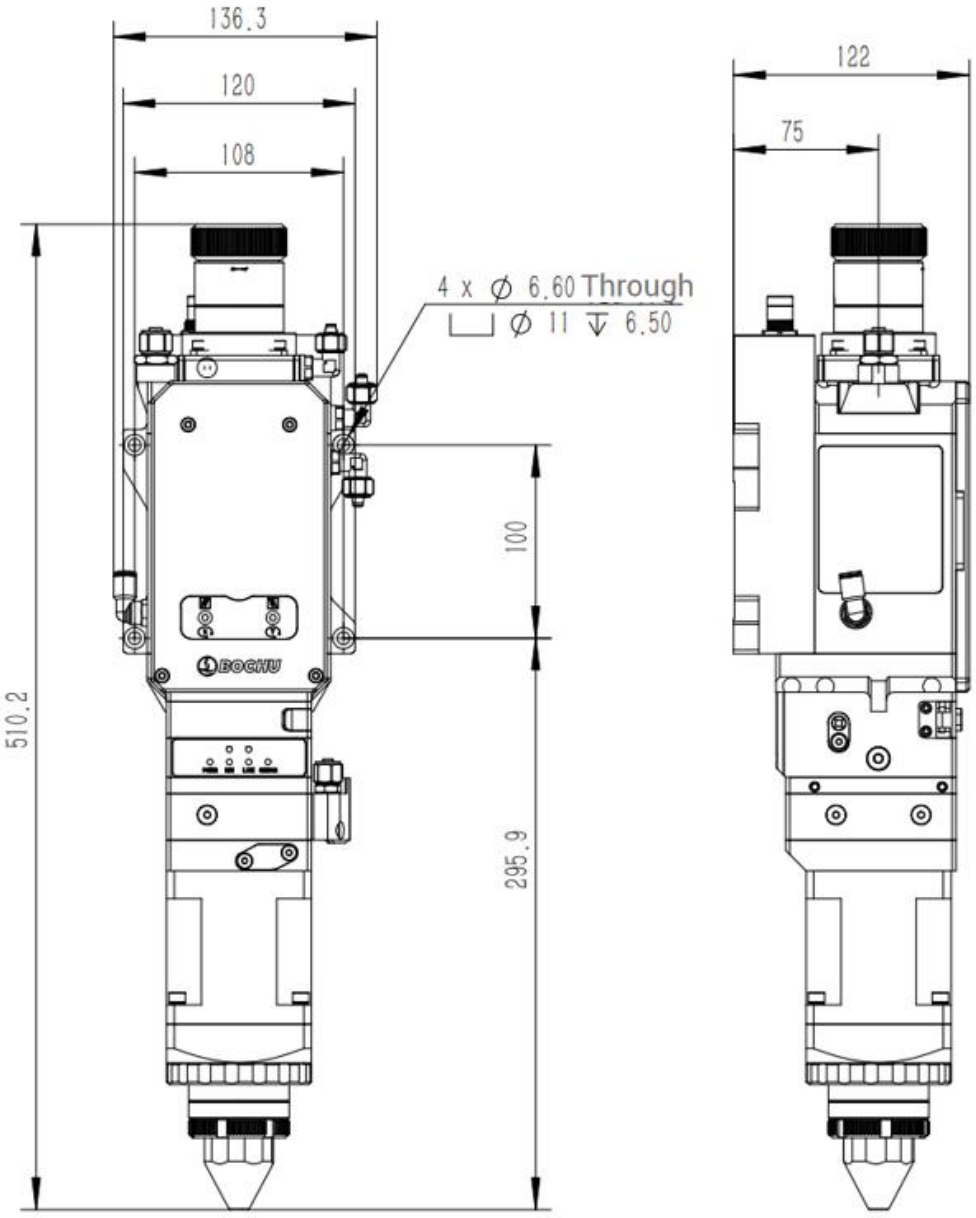
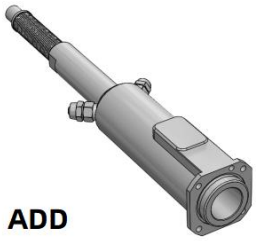


Figure 7-7 BLTF60-300-QBH (mm)

B.2 Interface Types

Table 7-1 Interface Types of BLTF60

General Type	Reference Graphic	Other Compatible Interface Types
Q+		• Raycus QP • IPG HLC-16
ADD		• BWT QF-D • MAX LOE 3.2 • FEIBO HOC
QBH		• Trumpf LLK-Q • IPG HLC-8/LC-8
QD		• Trumpf LLK-D • HIGHYAG LLK-Auto • IPG LCA

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