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Intelligent Cutting Head
BLT 683H 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

Note: 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	2024/12/17	First English Version
V1.1.0	2025/04/30	Modified the optional module anti-collision backplate, and updated pictures in Chapter 6

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Chapter 1 Product Specification

1.1 **Product Overview**

The Intelligent Laser Cutting Head BLT 683H is specifically designed for laser beams with wavelengths of 1030 to 1090 nm and a maximum power of 30 kW. It utilizes a bus control system for data transmission between the cutting head and the host machine, enabling intelligent control of the cutting head. The cutting head is equipped with water and gas interfaces: water interfaces are used to connect to an external water cooler to cool the cutting head; gas interfaces are used to connect to cutting or auxiliary gases, which are essential for supporting cutting operations and other functionalities.

Carefully take out the cutting head from its packaging upon receiving the product. The nameplate of the cutting head provides detailed information, including the product model, serial number, power rating, and interface specifications. Verify that the nameplate information matches your purchase. If any discrepancies are found, contact BOCHU personnel immediately.

⚠ Caution:

1. The packaging box is specifically designed to protect the product during transportation. Retain the original packaging for later use when returning the cutting head for maintenance.

2. New cutting heads are typically shipped with an accessory box containing a list of included items. These items may be needed for operation or basic maintenance. Store the accessory box carefully to avoid losing any components.

3. Handle the cutting head with care during unpacking and transportation. Uncontrolled impacts or collisions may damage the product.

1.2 Product View

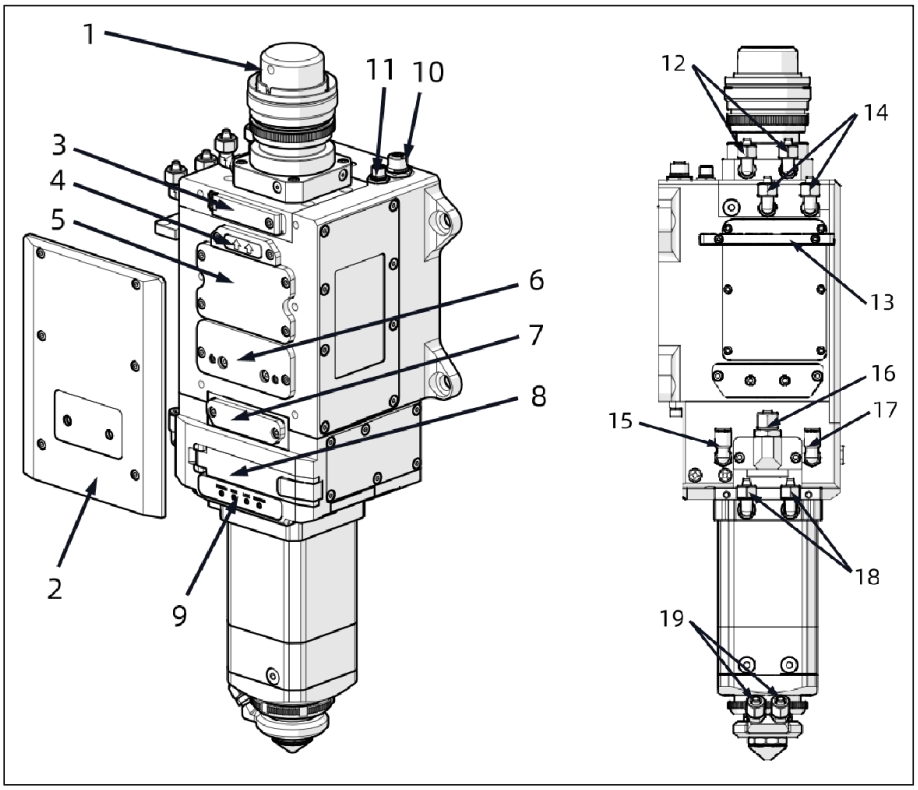


Figure 1-1 Product view

1. Fiber optic interface;
2. Front cover board;
3. 1st upper protective window;
4. 2nd upper protective window;
5. Collimating module;
6. Focusing and alignment cartridge;
7. 2nd lower protective window cartridge;
8. 1st lower protective window cartridge;
9. LED work indicator light;
10. PWE interface;
11. Communication interface for anti-collision backplate;
12. Fiber optic water cooling interface;
13. Hose mount;
14. Cutting head water cooling interface;
15. Pneumatic cover interface;
16. Cutting gas interface;
17. Nozzle cooling gas interface;
18. Amplifier water cooling interface;
19. Nozzle water cooling interface.

1.3 Technical Parameters

Table 1-1 **BLT 683H Cutting Head Technical Parameters**

Cutting Head Parameters	Values
Laser Wavelength	1030 ~ 1090 nm
Laser Power	≤ 30 kW
Fiber Interface	Q+/ADD
Spot Magnification	M = 2.0/3.0
Max Focus Adjustment Range	M = 2.0 (-50 mm ~ +40 mm); M = 3.0 (-100 mm ~ +50 mm)
NA	Max.0.14 at Fc100
Centering Adjustment Range	±1.5 mm (±0.059 inches)
Focusing Acceleration	7.5 m/s² (24.6 ft/s²)
Cutting Gas Interface	ø10, max 25 bar (2.5 MPa)
Nozzle Cooling Gas Interface	ø6, max 5 bar (0.5 MPa)
Pneumatic Cover Interface	ø6, 4 ~ 6 bar (0.4 ~ 0.6 MPa)
Water Cooling Interface	ø8, max 5 bar (0.5 MPa), min flow 2.0 L/min
Working Temperature	5 ~ 55°C (41 ~ 131°F)
Storage Temperature	-25 ~ +55°C (-13 ~ +131°F)
Dimension	519.7 x 181 mm (20.46 x 7.13 inches). This applies to the Q+ Interface version. For the size of other versions, refer to the appendix chapters.
Weight	About 9.8 kg. This applies to the Q+ 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 collisions during transportation or usage.

1.4 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, or 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 readings of the sensors.
	Light off	The connecting wires are damaged or malfunctioning, or the interface is loose.

Chapter 2 Gas Interfaces

As shown in Figure 2-1, the gas interfaces of the cutting head mainly include the cutting gas interface, the pneumatic cover interface, and the nozzle cooling gas interface. Connect the cutting gas pipe and gas cooling pipe, and tighten them by wrench.

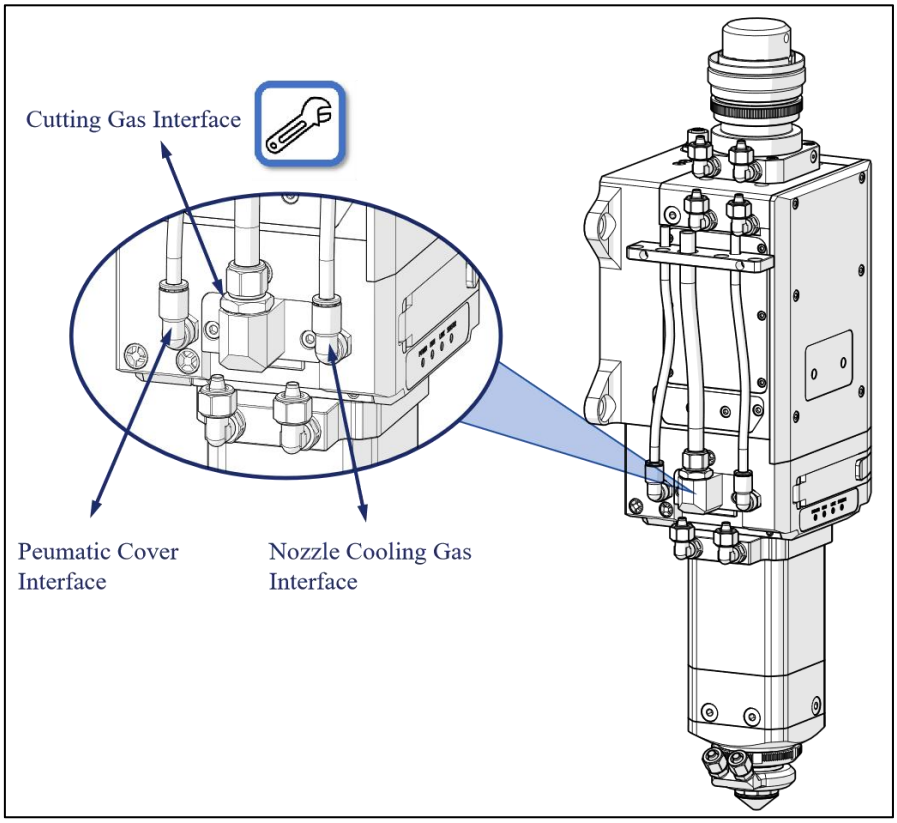


Figure 2-1 Gas interfaces

⚠ Caution:

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

2. For ø12 air pipe, please replace the pipe interface of ø12 from accessory box.

3. The intake pressure must be strictly maintained between 0.4 MPa and 0.6 MPa. Exceeding 0.6 MPa may cause damage to the internal structure.

4. 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.

5. Since the nozzle of the cutting head is already equipped with water cooling, the nozzle gas cooling interface is optional.

Chapter 3 Water Cooling Interfaces

After connecting the laser fiber optic interface, there are a total of 5 water cooling modules:

1. Laser Fiber Optic Interface Water Cooling Module (1A and 1B)
2. Fiber Optic Interface Water Cooling Module (2A and 2B)
3. Cutting Head Water Cooling Module (3A and 3B)
4. Amplifier Water Cooling Module (4A and 4B)
5. Nozzle Water Cooling Module (5A and 5B)

It is recommended to first connect these 5 water cooling modules in series, then connect the main inlet and outlet.

⚠ Caution: Please connect the outlet of the nozzle water cooling module directly to the water cooling tank.

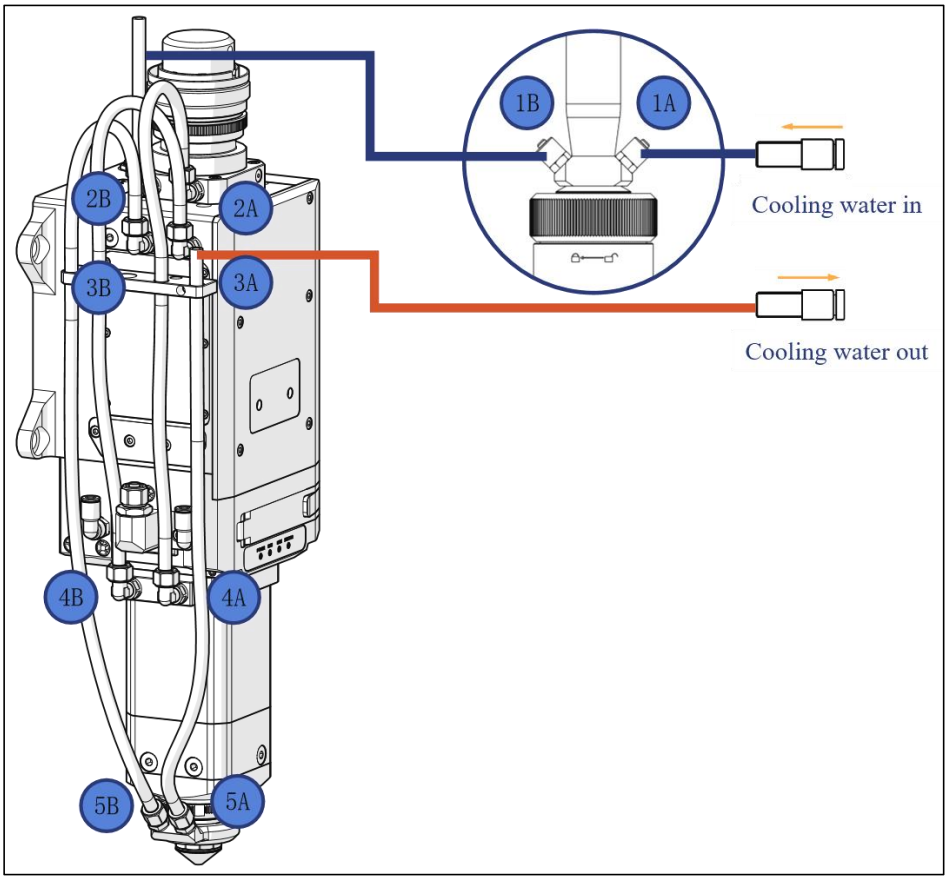


Figure 3-1 Cooling water interfaces

⚠ 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 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

4.1 PWE Interface

The PWE interface supports 100 Mbps network communication and delivers power and data to the BLT series cutting heads via the PWE cable.

2, 3: Power

4, 5: Reference Ground

1, 6, 7, 8: Network Signal

Figure 4-1 PWE interface

⚠ Caution:

1. The PWE interface of the cutting head must be connected using the high-flexibility PWE towline cable provided by BOCHU, linking it to BCS210E or BCL4568E.

2. For users of BCL4568E, select an appropriate 24 V power supply based on the power requirements of the cutting head and other devices on the board.

3. During installation, the PWE cable must not be twisted in enclosed spaces. Separate strong and weak electrical cables during wiring. And it is recommended to use isolators to the cables apart, ensuring at least a gap of 10% of the cable diameter between adjacent cables.

4.2 Grounding

When the cutting head is installed on the Z-axis of the machine tool, it must be properly grounded. Improper grounding may introduce electromagnetic interference, affecting the normal functionality of the cutting head.

⚠ Caution: The cutting head is grounded primarily through the mounting screw holes that connect it to the machine's back plate. Therefore, ensure that both the machine and the screw holes on the cutting head's back plate are properly grounded.

4.3 Electrical Interface

The electrical connections of the cutting head are shown in the figure below:

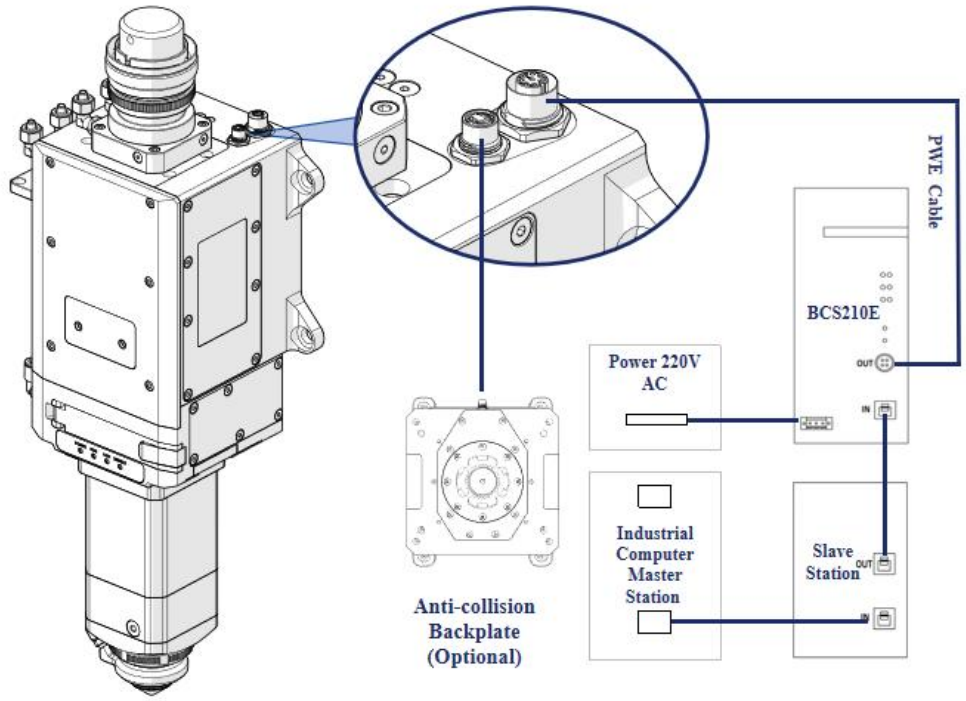


Figure 4-2 The electrical connections of the cutting head

⚠ Caution:

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

2. BCS 210E shall be powered off when connected to the cutting head.

The cutting head has two main electrical interfaces: the PWE interface and the communication interface for collision protective plate. The PWE interface must be connected, while the interface for collision protective plate is optional and should be connected only if the user has selected the collision protection plate set.

⚠ Waterproof cautions for PWE and collision protective back plate interface:

1. The PWE interface and collision protective back plate 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 line and plate line 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 Safety Instructions

The installation and use of the cutting head involve certain risks. Only trained personnel familiar with proper procedures should handle it. Ensure necessary protective gear, such as safety goggles, heat-resistant gloves, and masks, is available near the machine to protect workers.

The common safety risks during the installation and use of the cutting head are listed in the table below:

Table 5-1 **Safety Instructions**

Type	Indicator	Description
Caution		Before replacement or installation, ensure that all components of the laser cutting system (such as the laser, water cooler, controller, power supply, computer, etc.) are turned off. Verify that the laser wavelength range, power level, and fiber interface are compatible with the cutting head.
		If the cutting head is subjected to impact, inspect the affected area. Replace any damaged components promptly to ensure proper operation.
		When the machine is shut down or under maintenance, ensure the laser is disabled via the host computer. Implement safety measures and place warning signs to prevent accidental operation, which could cause injury or equipment damage.
Laser Radiation		The cutting head itself does not generate laser radiation; however, it only guides the laser radiation generated by the laser source. Improper operation, such as a collision, may cause the laser beam to escape uncontrollably, posing a risk to nearby personnel or equipment.
Do Not Disassemble		Users are prohibited from modifying or disassembling the cutting head without the authorization from qualified personnel. Any consequences arising from unauthorized modifications or disassembly will be the sole responsibility of the user.

Type	Indicator	Description
Do Not Look Directly at Laser lights		Do not stare directly at the laser beam during debugging or cutting operations. If necessary, wear appropriate protective goggles and maintain a safe distance to avoid health hazards caused by laser radiation.
Do Not Touch		After the cutting head is powered off, the nozzle may remain hot. Avoid touching it directly to prevent burns.
Must Wear Dust Mask		During operation, the cutting head generates a significant amount of smoke and dust. Wear a mask promptly to protect users from potential harm caused by cutting fumes.

Chapter 6 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.

6.1 **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).

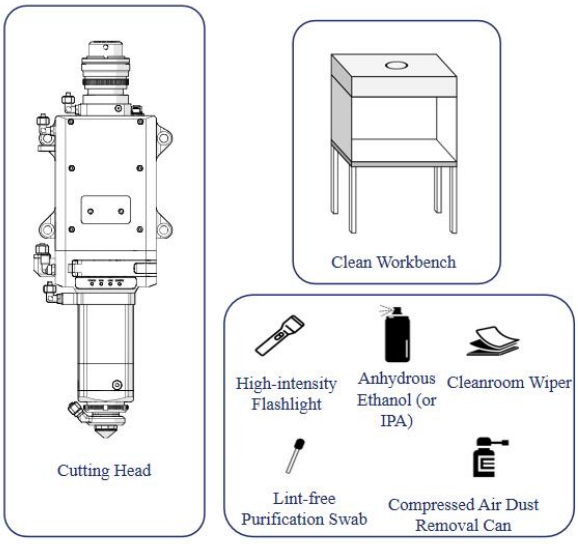


Figure 6-1 Preparation tools for the cutting head installation

⚠ 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.

6.2 Specific Procedures

6.2.1 Prepare the Clean Workbench

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

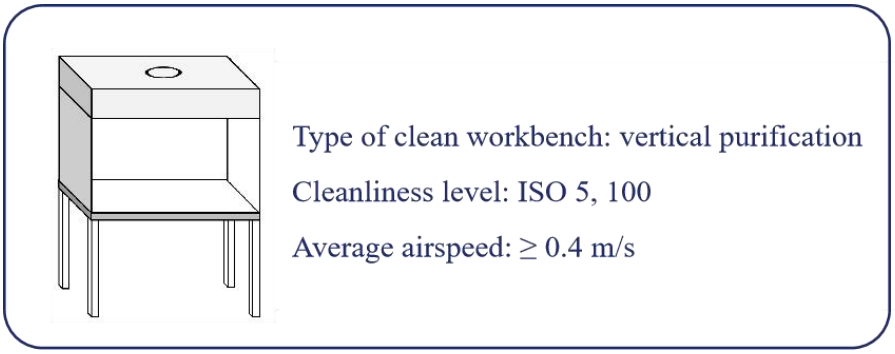


Figure 6-2 Clean workbench

Step 1 Check the cleanliness of the equipment (use a particle counter to check cleanliness) and confirm that the FFU (Fan Filter Unit) 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 a 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.

6.2.2 Put the Cutting Head inside the Clean Workbench

Put the cutting head horizontally inside the clean workbench.

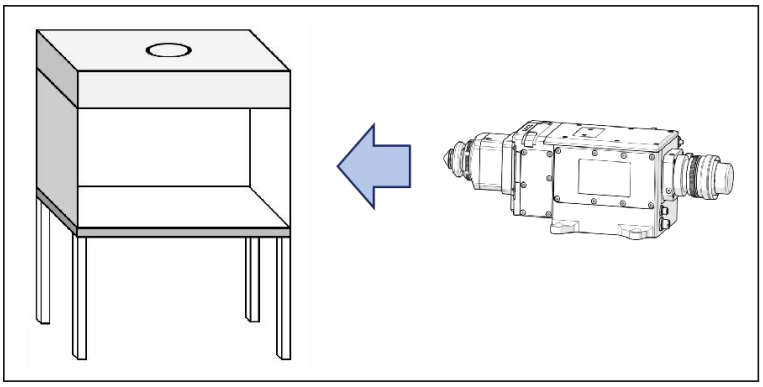


Figure 6-3 Put the cutting head inside the workbench

⚠ 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.

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

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

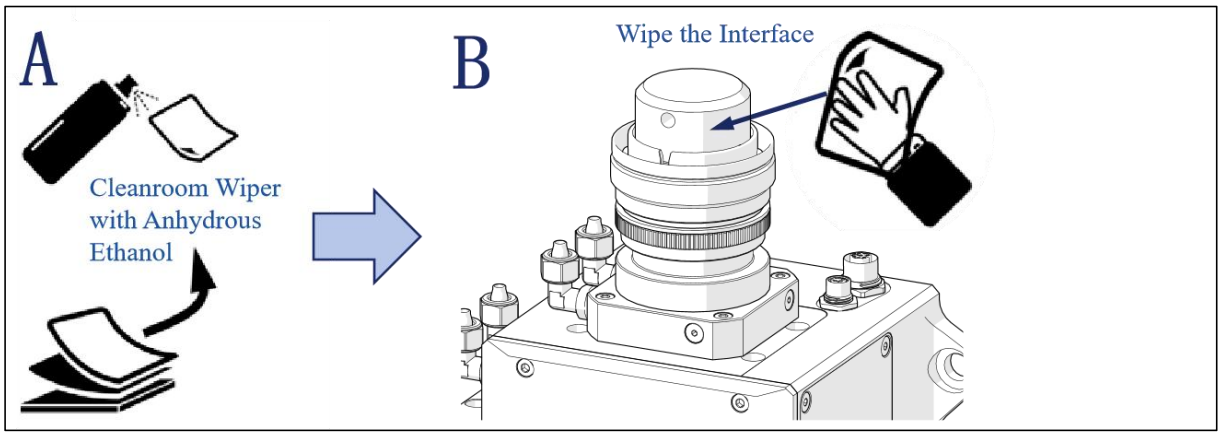


Figure 6-4 Clean the interface

6.2.4 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.

6.2.5 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.

6.2.6 Insert the Laser Fiber Connector into the Cutting Head

Align the positioning pin on the fiber optic plug with the notch on the connector, and then insert it into the unlocked fiber optic connector, ensuring it is fully inserted. Rotate the locking cap until it is tightly secured.

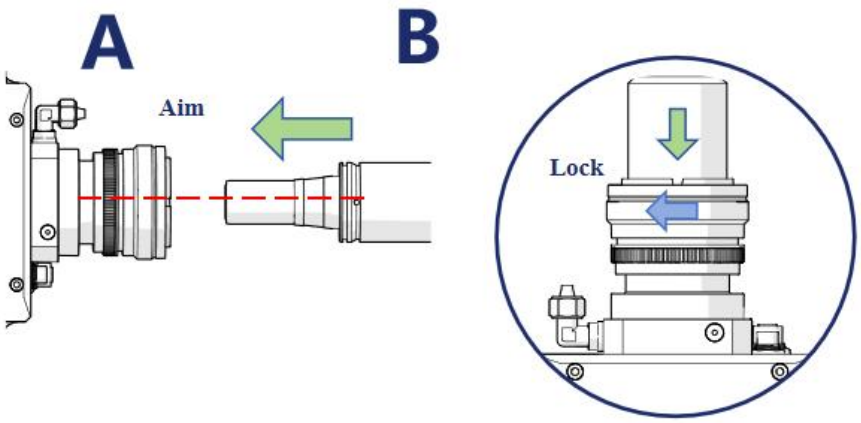


Figure 6-5 Insert the Q+ fiber connector

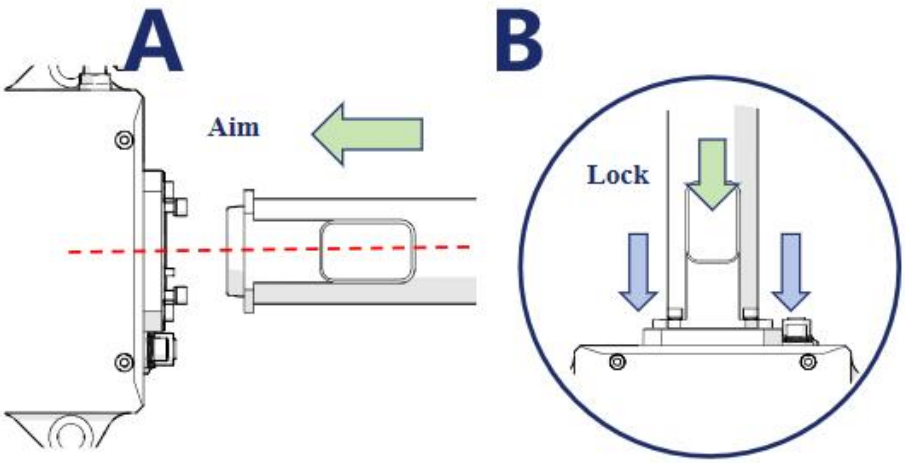


Figure 6-6 Insert the ADD fiber connector

6.2.7 Wrap and Seal

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

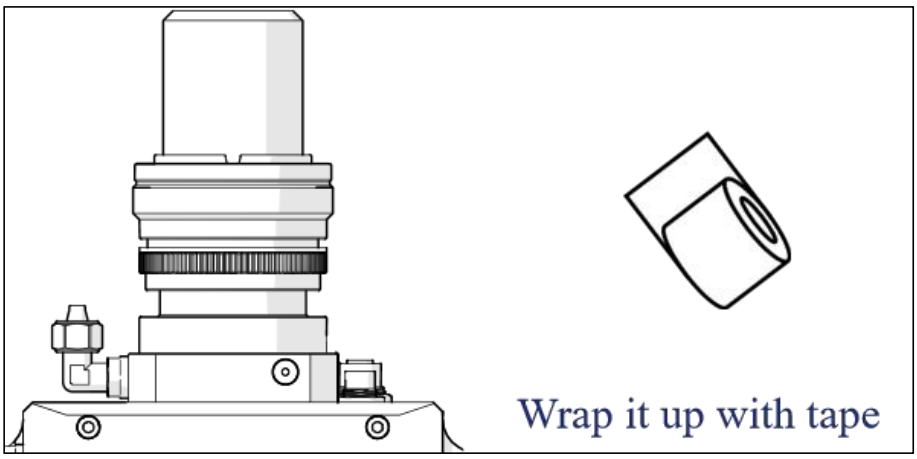


Figure 6-7 Wrap & Seal

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

6.2.8 Install the Cutting Head

The cutting head can be mounted onto the machine's Z-axis back plate using four M10 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.

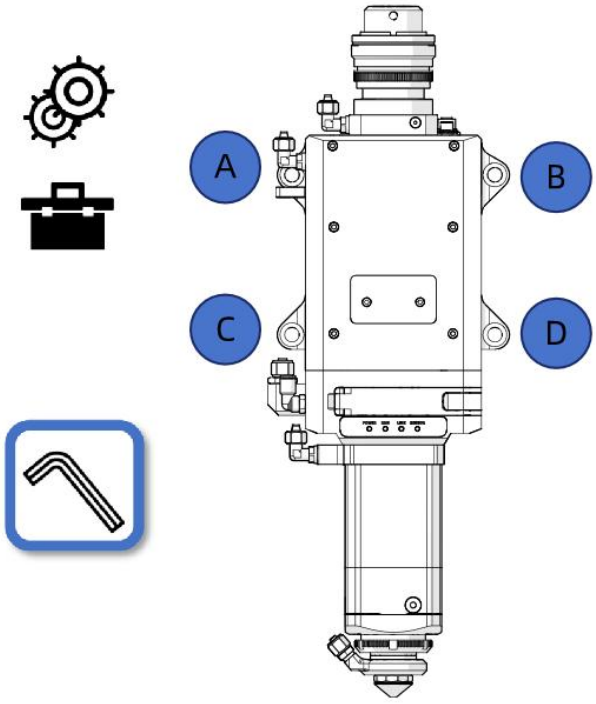


Figure 6-8 Screw A, B, C, D

6.2.9 Install the Cutting Head with Anti-collision Backplate (Optional)

The anti-collision backplate can be installed on onto the machine's Z-axis back plate using four M10 screws: E, F, G, and H. Then, mount the cutting head onto the anti-collision backplate using four M10 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.

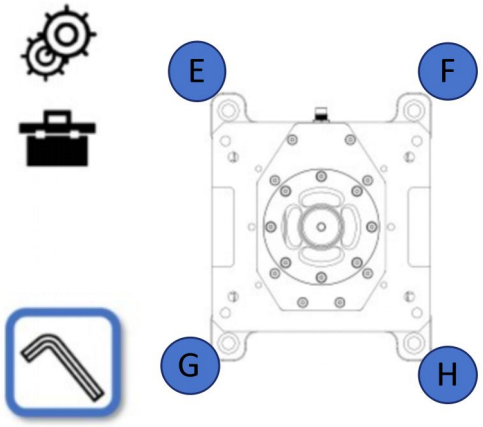


Figure 6-9 Install the anti-collision backplate

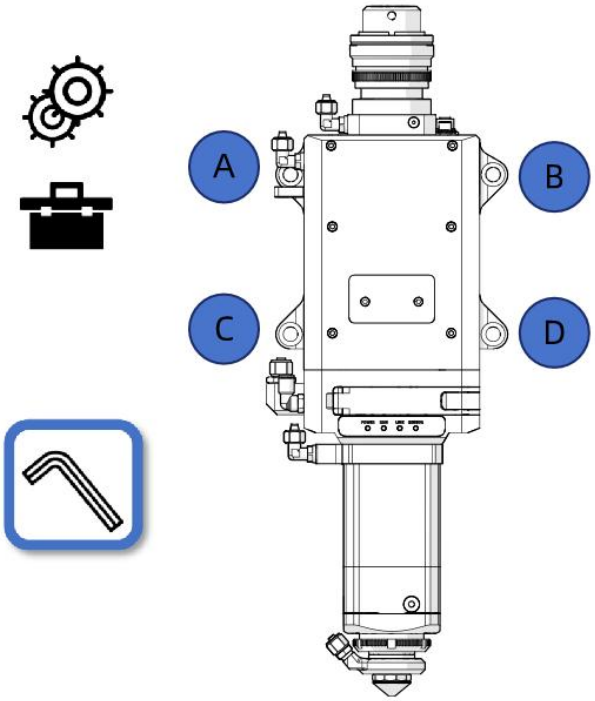


Figure 6-10 Cutting head installation

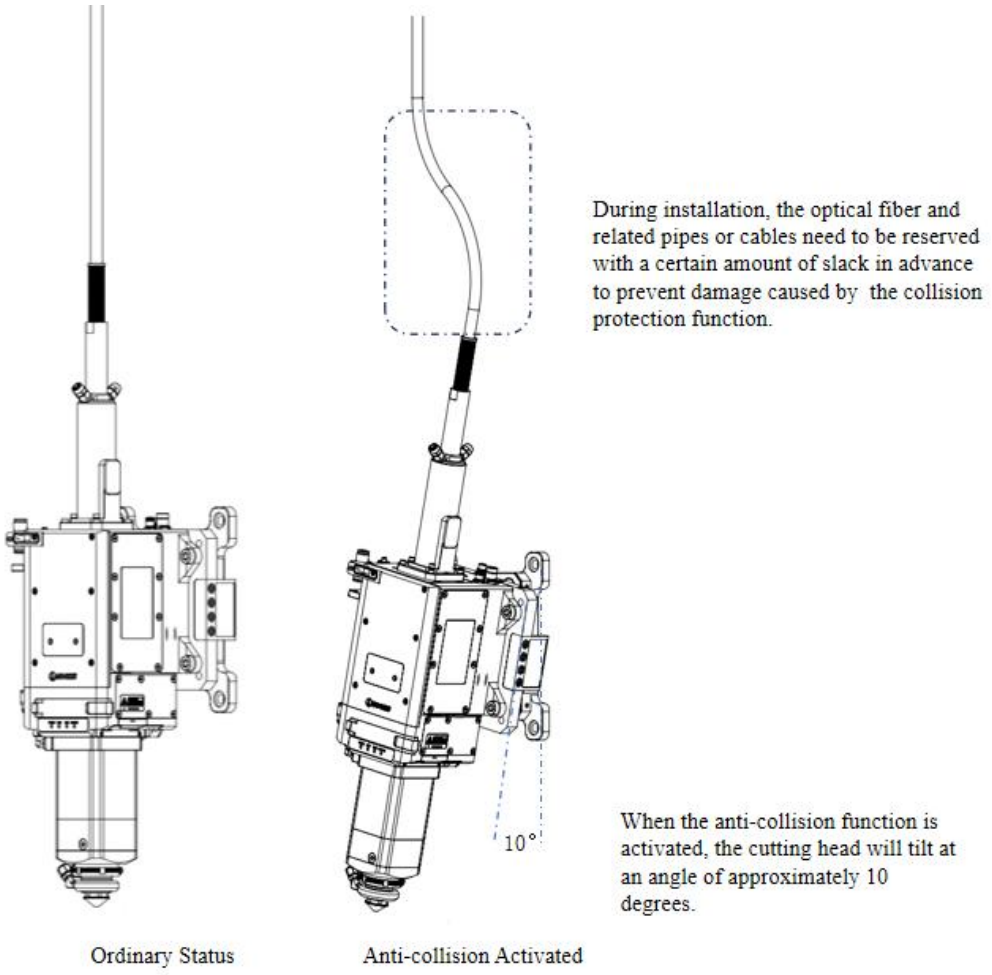


Figure 6-11 Cutting head and optical fiber status after collision

⚠ Caution: When the anti-collision backplate is optionally equipped, the cutting head will tilt to a certain extent (less than 10°) when it is impacted. In order to avoid damaging the optical fiber, the optical fiber must be reserved with a slack of more than 100 mm, and the distance between the fixed point of the optical fiber and the end of the optical fiber cable should be ensured to be more than 270 mm.

6.2.10 Install Nozzle and Ceramic Body

The nozzle is often damaged due to laser burning or collision, so it is essential to check and replace the nozzle regularly. For the replacement of the nozzle, twist it off by hand in the direction shown in the diagram, then replace it with a new one and tighten it.

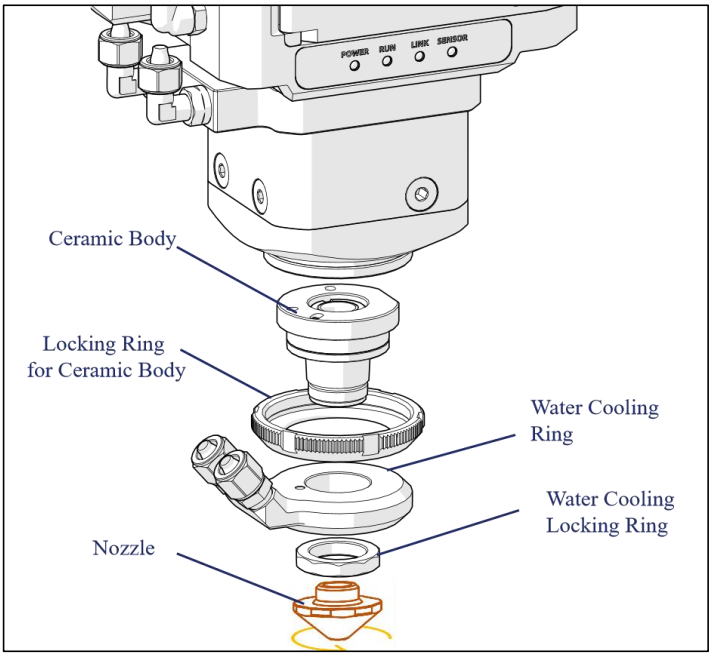


Figure 6-12 Ceramic body and nozzle

If the ceramic body is damaged due to collision or other reasons, replace it with the procedures below:

Step 1 Unscrew the nozzle by hand.

Step 2 Use a wrench to remove the water cooling locking ring.

Step 3 Remove the water cooling ring (the water cooling ring is mounted on the outside of the ceramic body).

Step 4 Use a wrench to remove the ceramic locking ring, and then take out the damaged ceramic body.

Step 5 Align the new ceramic body with the locating pin hole, press it up by hand, and then tighten the ceramic locking ring.

Step 6 Install the water cooling ring onto the new ceramic body and tighten the water cooling locking ring.

Step 7 Reinstall the nozzle.

6.2.11 Laser Beam Centering

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

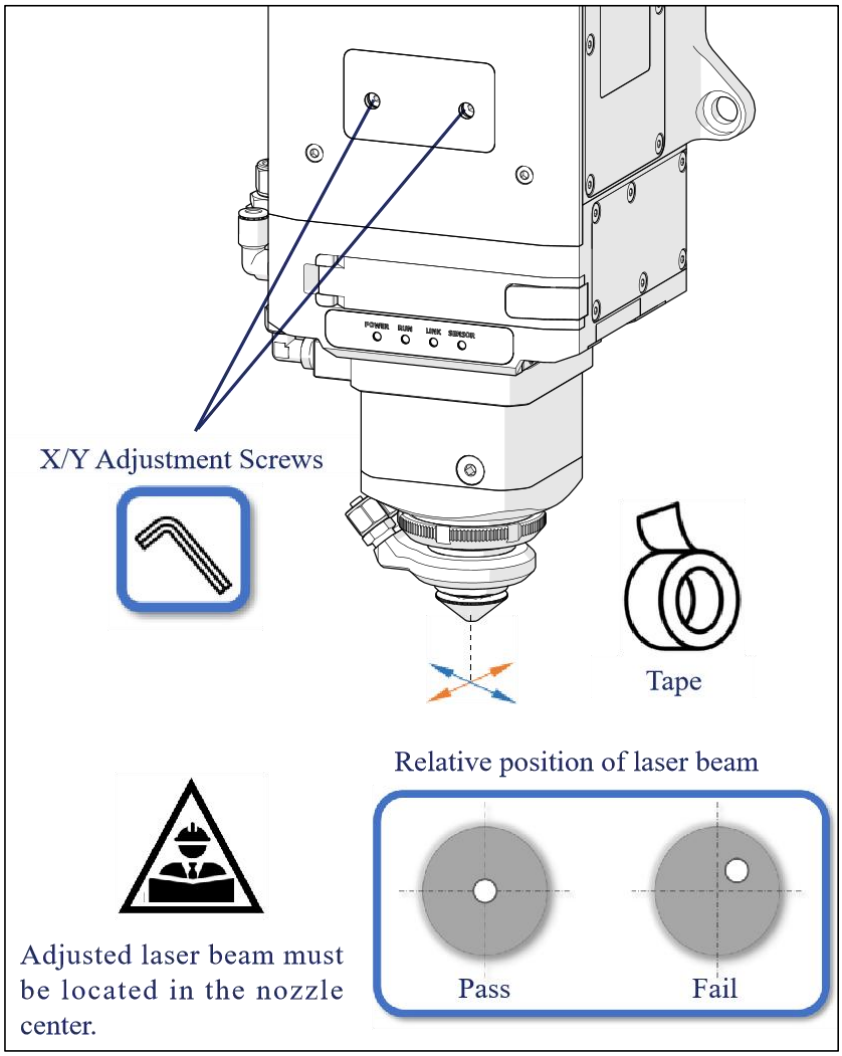


Figure 6-13 Laser beam centering

Manual Operations for Nozzle Centering:

Step 1 Confirm that the laser beam is turned off.

Step 2 Place 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 by observing the tape's penetration.

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

Chapter 7 Appendix A Maintenance

A.1 Product Structure Diagram

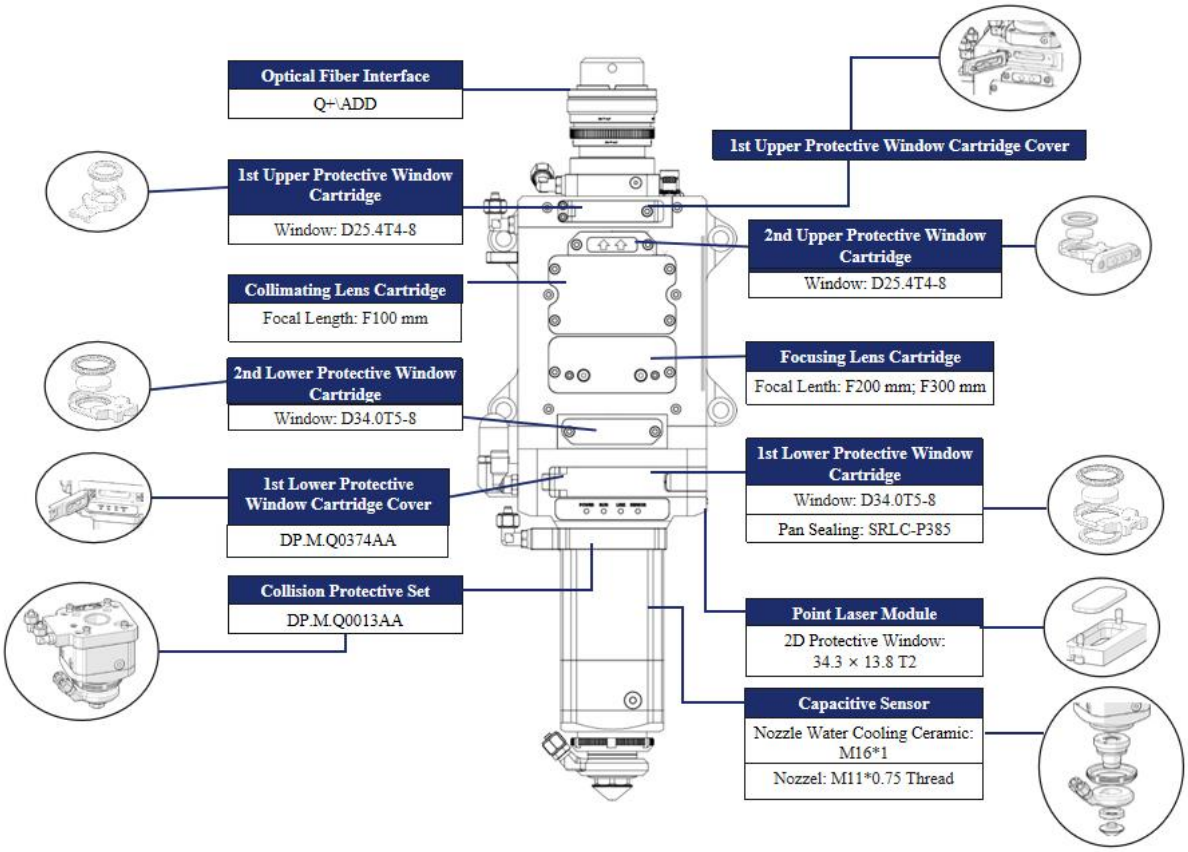


Figure 7-1 Product diagram

A.2 Change the Upper Protective Window

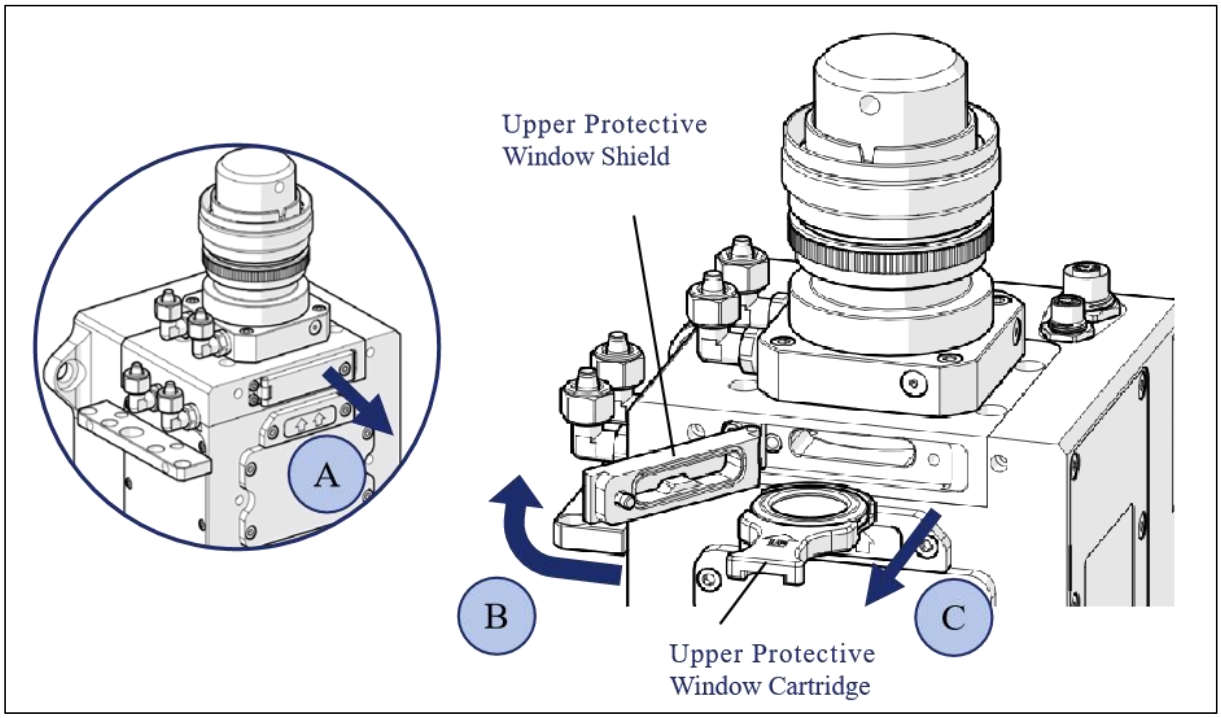


Figure 7-2 Change protective window

Follow the procedures below to change the upper protective window:

Step 1 Open the upper protective window shield.

Step 2 Pull out the upper protective window cartridge.

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

Step 4 Remove the pressing ring from the protective window.

Step 5 Replace the upper protective window.

Step 6 Place the pressing ring and tighten it.

Step 7 Open the upper protective window cartridge shield.

Step 8 Insert the upper protective window cartridge with the window into the cutting head.

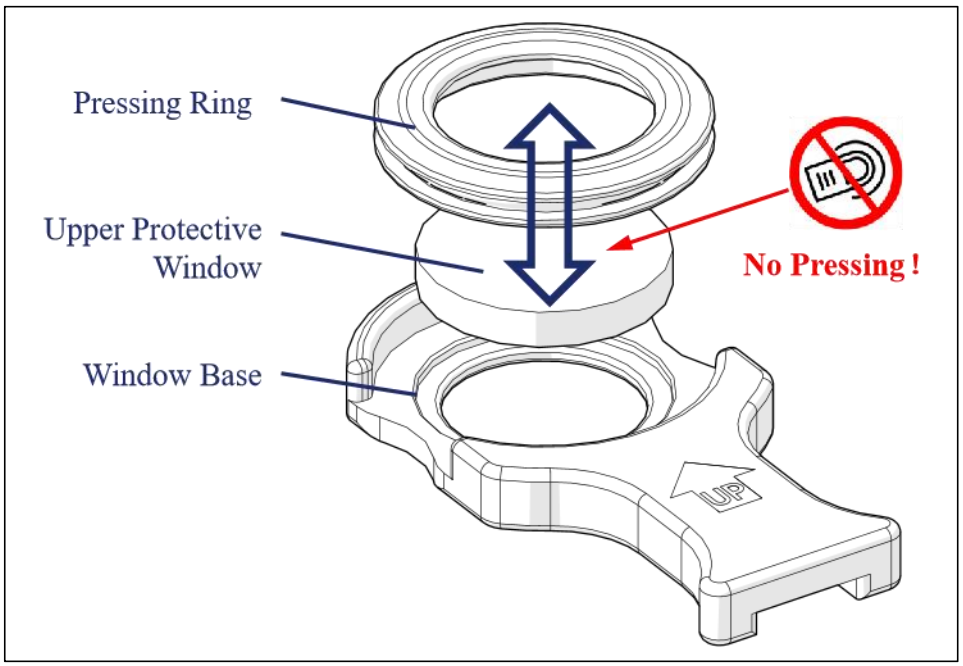


Figure 7-3 Insert window cartridge

A.3 Change the Lower Protective Window

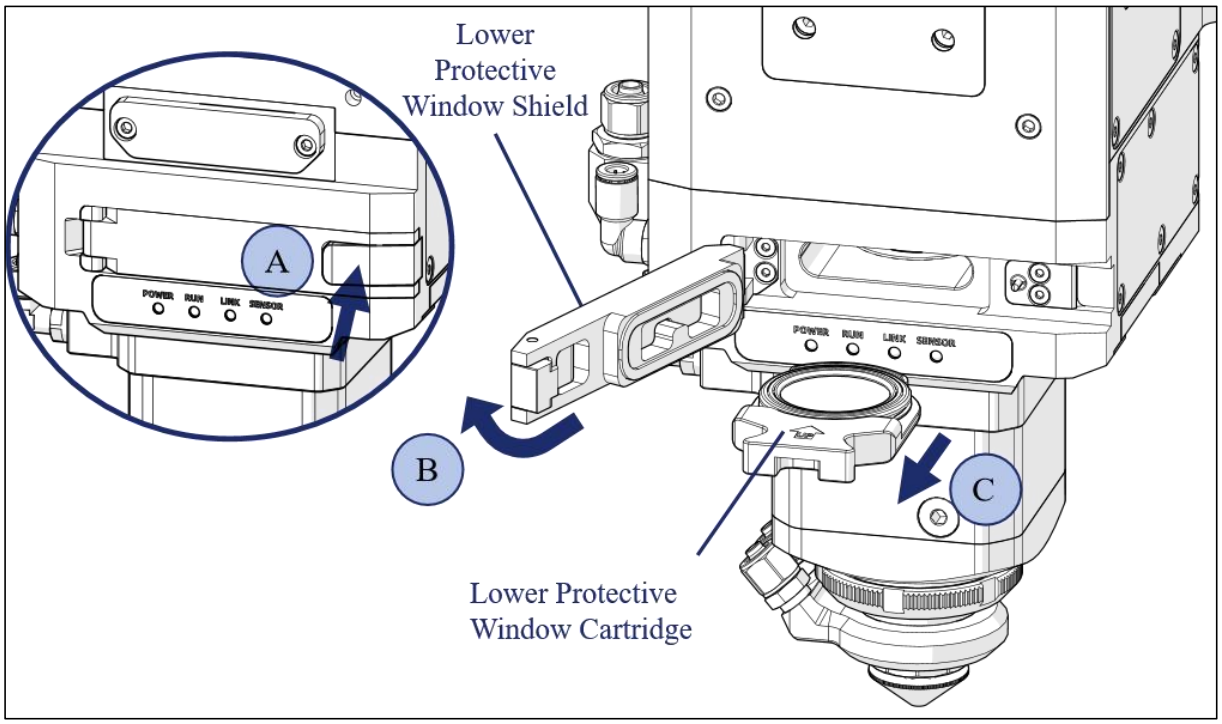


Figure 7-4 Change the lower protective window

Follow the procedures below to change the upper protective window:

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

Step 2 Pull out the lower protective window cartridge.

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

Step 4 Remove the pressing ring from the protective window.

Step 5 Replace the lower protective window.

Step 6 Place the pressing ring and tighten it.

Step 7 Open the lower protective window cartridge shield.

Step 8 Insert the lower protective window cartridge with the window into the cutting head.

Step 9 Shut the cartridge shield.

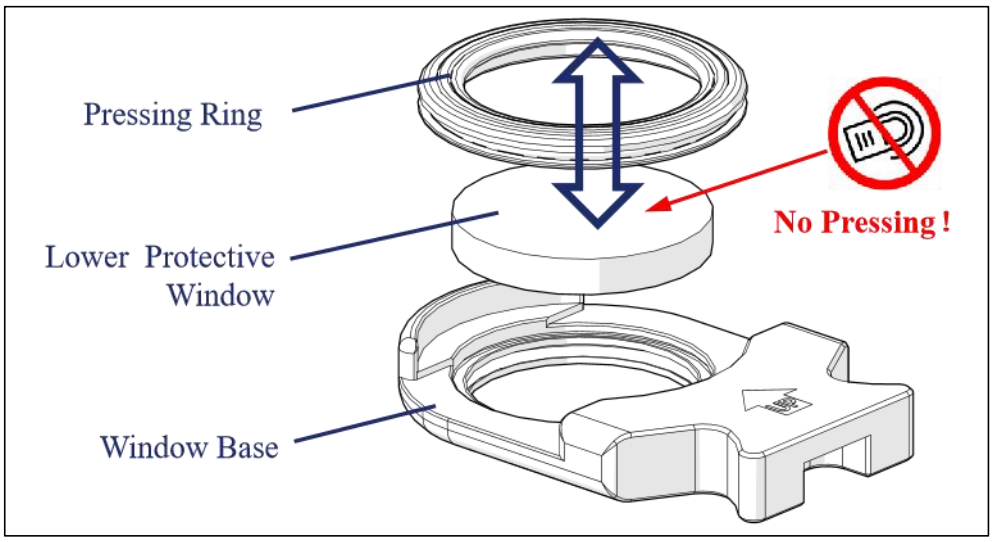


Figure 7-5 Insert window cartridge

A 4 Change the Protective Window for Point Laser Sensor

The laser cutting head generates a large amount of smoke and dust during its actual operation. Over time, the accumulation of these particles could potentially contaminate the protective window of the point laser sensor, which could affect its normal operation. Therefore, it is necessary to regularly inspect or replace the protective window of the point laser sensor.

Here are the steps for replacing the point laser sensor protective window:

Step 1 Ensure that the laser beam is turned off and the pneumatic cover plate interface is connected to pressing gas that meets the required pressure.

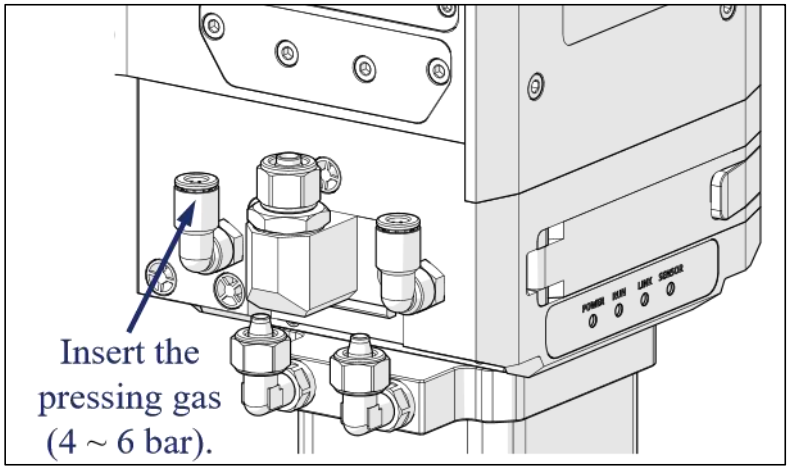


Figure 7-6 Insert gas (4~6 bar)

Step 2 Open the HypCut software, click on ***BLT Point Light Source***, and open the pneumatic cover plate for the laser point sensor.

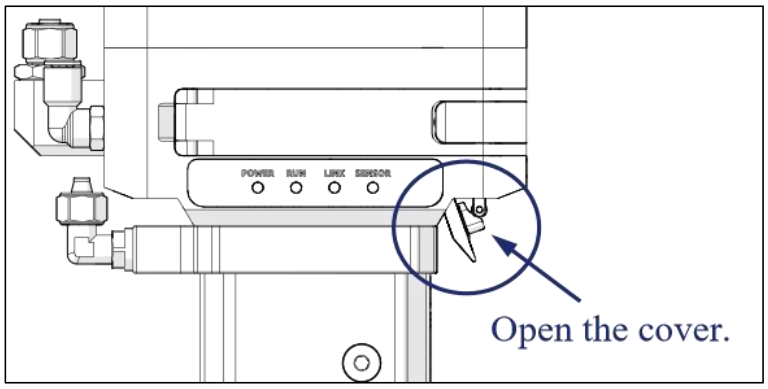


Figure 7-7 Open the cover plate

Step 3 Use an Allen wrench to loosen the screws on the protective window base and remove the base.

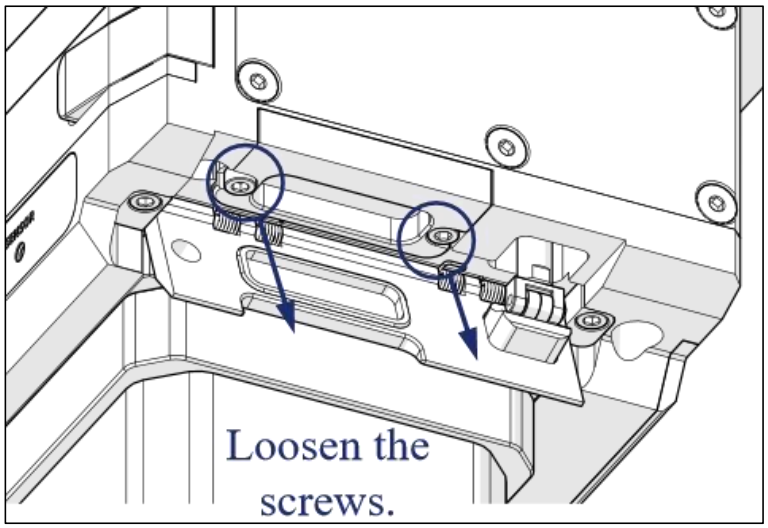


Figure 7-8 Loosen the screws

Step 4 Take out the contaminated protective window from the base, clean it, or replace it with a new one.

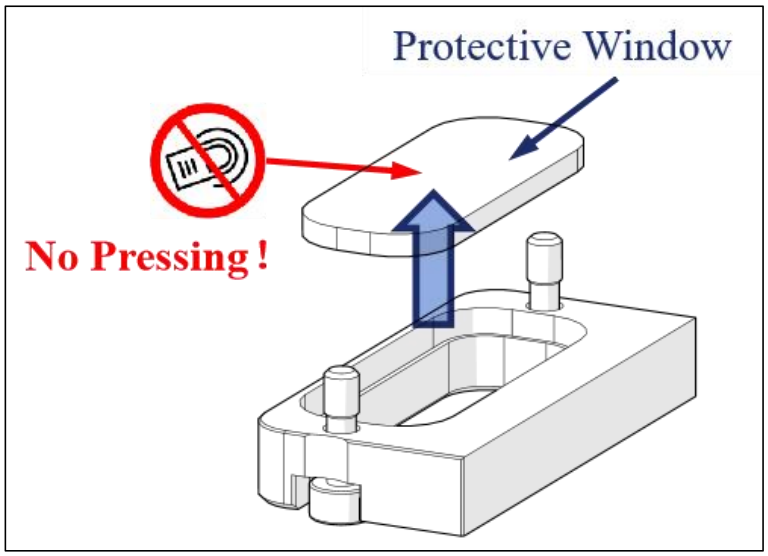


Figure 7-9 Take out the contaminated window

Step 5 Place the clean protective window into the base and reinstall it onto the cutting head.

Step 6 Clean the protective window seal plug and the surrounding dust.

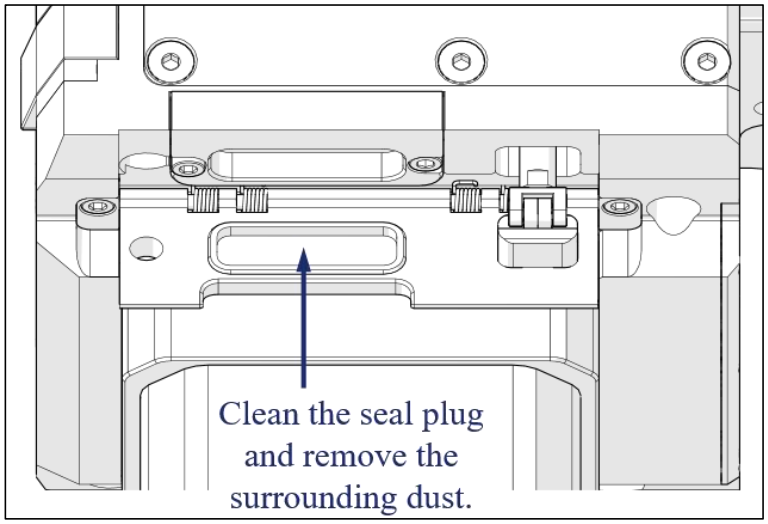


Figure 7-10 Clean dust

⚠ Caution: The cleanliness requirement for the point laser sensor protective window is not as strict as that for the lens/window cartridge. Simply clean off any visibly noticeable dust before continuing to use it.

Chapter 8 Appendix B Mechanical Size

B.1 Installation Size for Cutting Head

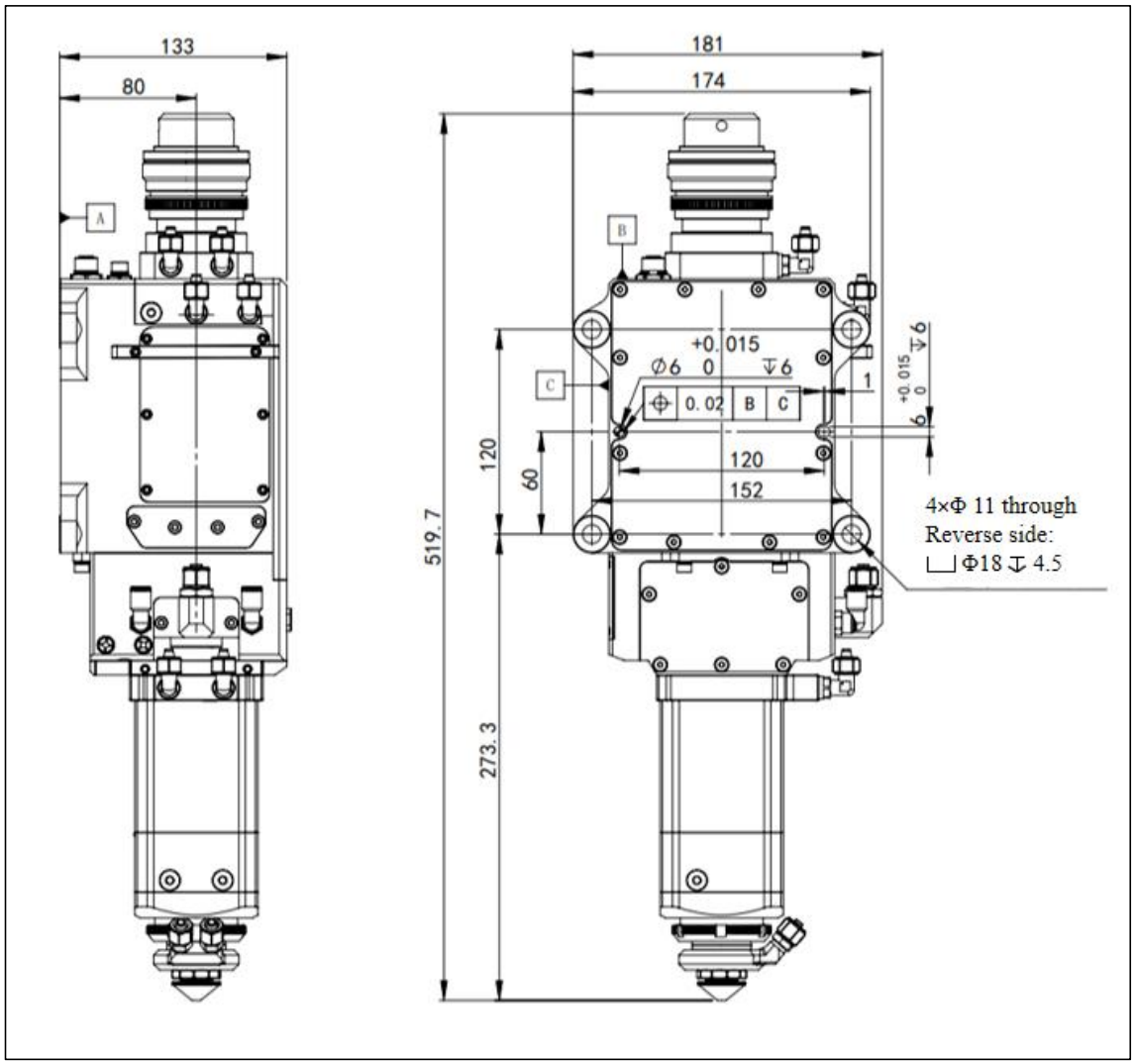


Figure 8-1 BLT 683H-Q+

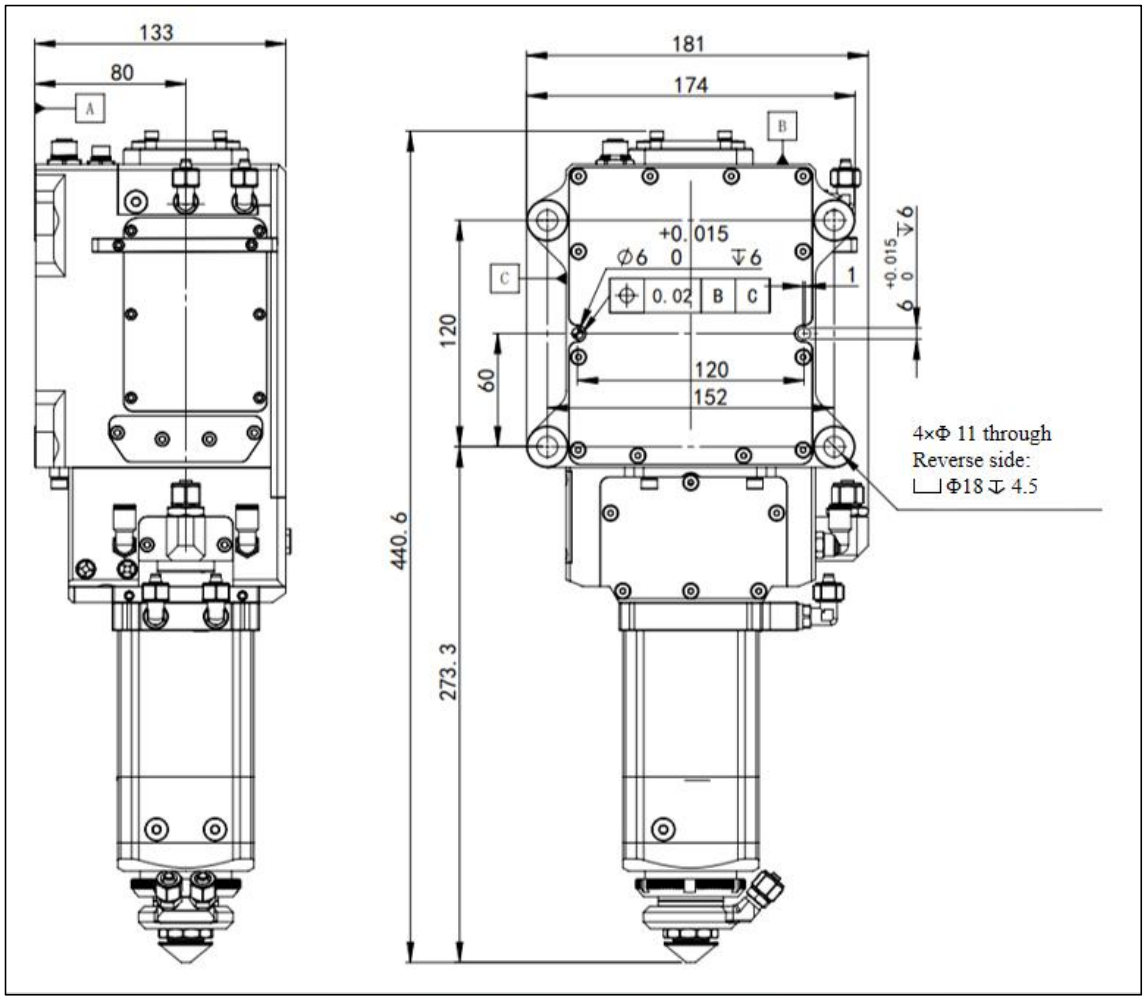


Figure 8-2 BLT 683H-ADD

B.2 Installation Size for Anti-collision Backplate

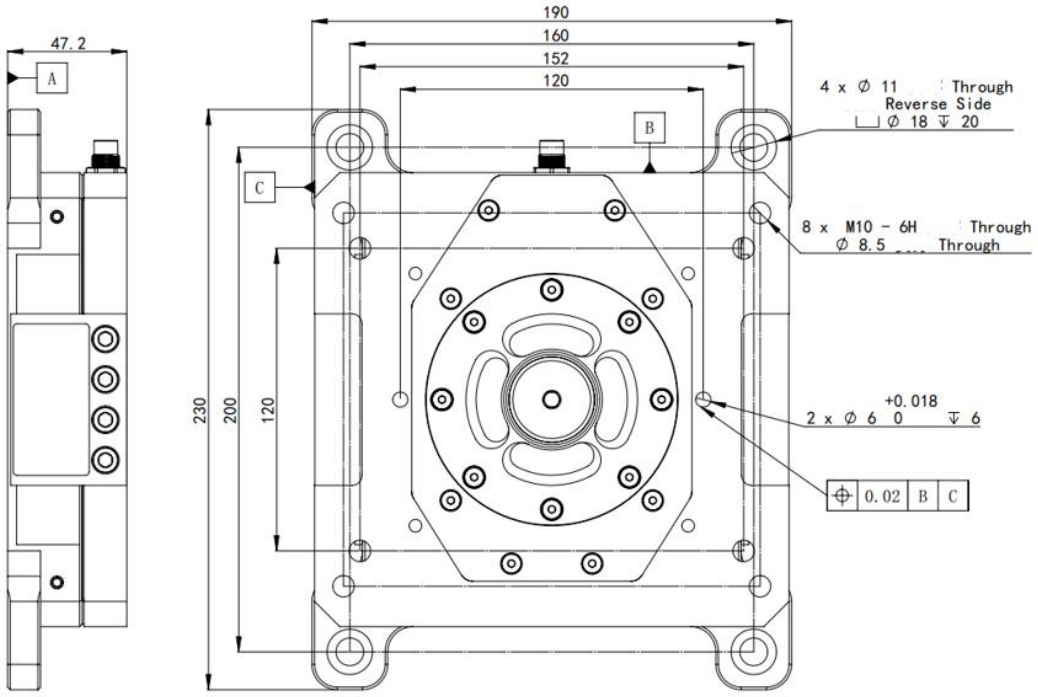
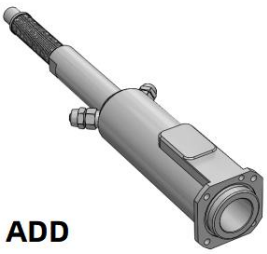


Figure 8-3 Anti-collision backplate

B.3 Interface Types

Table 8-1 **Interface Types of BLT 683H**

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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