

RAYTOOLS

BW210 SERIES

Low Power Laser Welding Head

User Manual



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Thank you for purchasing this product from *RayTools*.

The user manual includes detailed introductions for using BW210. IF there is any other question, contact us without worry.

Please read this manual carefully before using the welding head and other BW210-related equipment, which enables users to use it better.

Due to the continuous updating of product functions, the product you receive may differ from the introduction in this manual in some aspects.

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If there are any errors in the document, please inform us as soon as possible. The data contained in this manual is only used to describe the product and shall not be regarded as a statement of security interest.

For the benefit of our customers, we will constantly try to ensure that the products we develop comply with the latest technology.

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Disclaimer

- We reserve the right to change the design to improve the quality or expand the application or comply with manufacturing workmanship.
- We will not bear any responsibility for losses and accidents caused by wrong operation or improper handling of our products.
- Dismantling of the product will lose all warranty claims excluding the normal replacement of worn parts and components required for maintenance or commissioning operations.
- Unauthorized modification of products or use of non-original spare parts will directly lead to the invalidation of warranty and liability exemption.
- It is recommended to only use the spare parts provided by us or submit them to our designated professional team for installation.

Use Regulations

- Ensure that the product is used in a dry environment.
- Ensure that the product is used in the environment required by EMC standards.
- The product is only allowed to run within the parameters specified in the technical data.

Personnel Responsibilities

- Be familiar with the basic provisions of work safety and accident prevention, having received equipment operation guidance.
- Read and understand basic safety instructions and operations.
- Must have studied the relevant regulations and safety instructions and understand the possible hazards.
- Comply with relevant regulations and implement corresponding protective measures.

Safety Instructions

Prevent Electric Shock



- Parts of the laser head such as the nozzle, sensor, sensor interface, and attached fasteners may not be fully protected by the ground wire due to function fault. These parts may have low voltage. When installing electrical equipment, please pay attention to taking anti electric shock measures for relevant personnel.



- Note that the equipment shall be grounded as specified.

Guard against Danger

- Never put your hands or other body parts under the laser head.
- Repair and maintenance can only be carried out after the power is turned off.
- Do not exceed the specified maximum pressure.
- It must be ensured that the laser head is in normal condition at all times.
- All fasteners such as bolts and nuts must be tightened.



Laser Caution

- Avoid direct laser radiation or scattering to the skin.
- Do not stare at the laser beam even when wearing optical equipment.
- Use special laser protective eyeglasses that meet the requirements of safety standards IEC 60825-1.

Prevent Water Circuit Corrosion

- To avoid corrosion, use the specified coolant and comply with relevant requirements and specified maintenance intervals.

Noise Prevention

- The corresponding measures shall be specified or explained and observed to prevent personnel from being harmed by noise.

Storage and Transportation

- Observe the storage temperature range allowed by the technical data.
- Take reasonable measures to prevent fire, vibration, or impact.
- Do not store in or near the magnetic field.

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1 Overview

The manual includes but is not limited to the instructions for installation, operation, and maintenance, mainly describing the major modules.

Series BW210, the laser processing head is applicable to medium and low power industrial laser productions.

The integrally optimized optical focusing system, annular gas circuit, and water cooling module of this product can fully meet requirements from material welding of different applications and various customized industrial laser processing environments.

Flexible options of fiber interface and various optical collimation and focusing configurations enable the product to suit most mainstream fiber lasers.

1.1 Features

- compact structure design
- different configurations for optical lens
- drawer style holder for cover glass
- efficient water cooling system
- high-quality gas flow design
- various options of fiber interfaces
- diversified expansion modules
- reliable sealing design

1.2 Structure Diagram

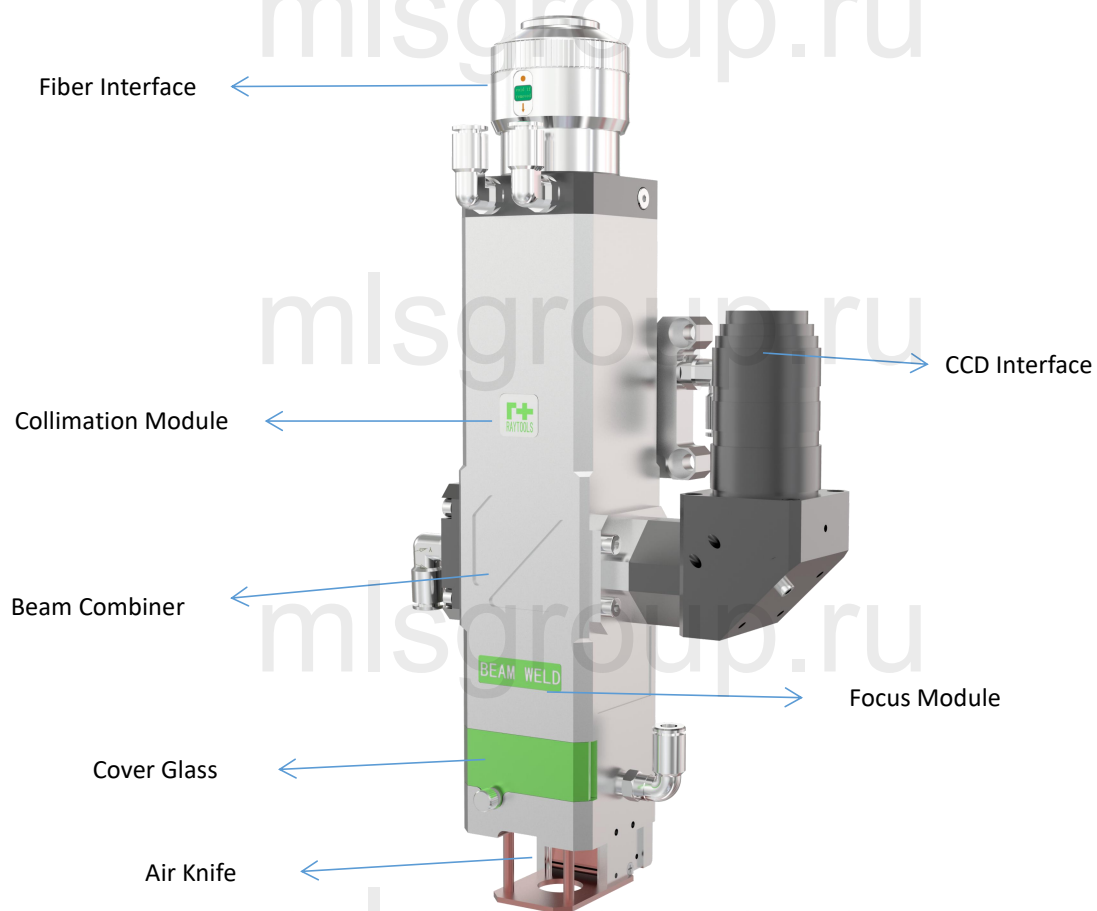


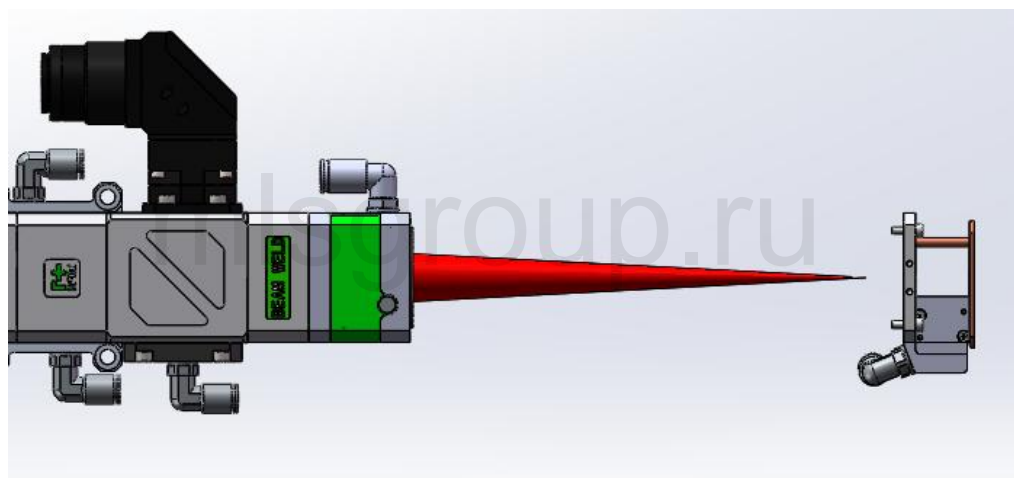
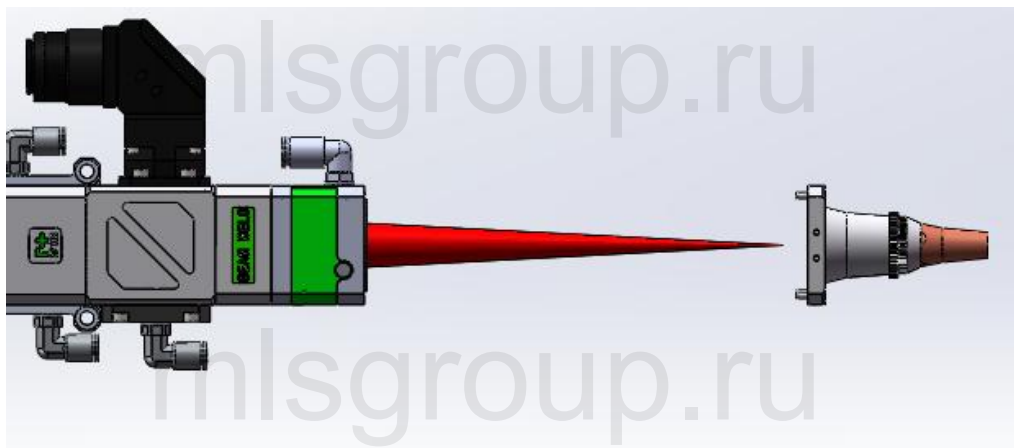
Fig. 1-1 Product Structure

2 Installation and Operation

2.1 Preparations

As tip assembly of the product (Series BW210) is selected by customers, before installation, please ensure the package includes these modules of tip assembly: coaxial nozzle, air knife, and side blow.

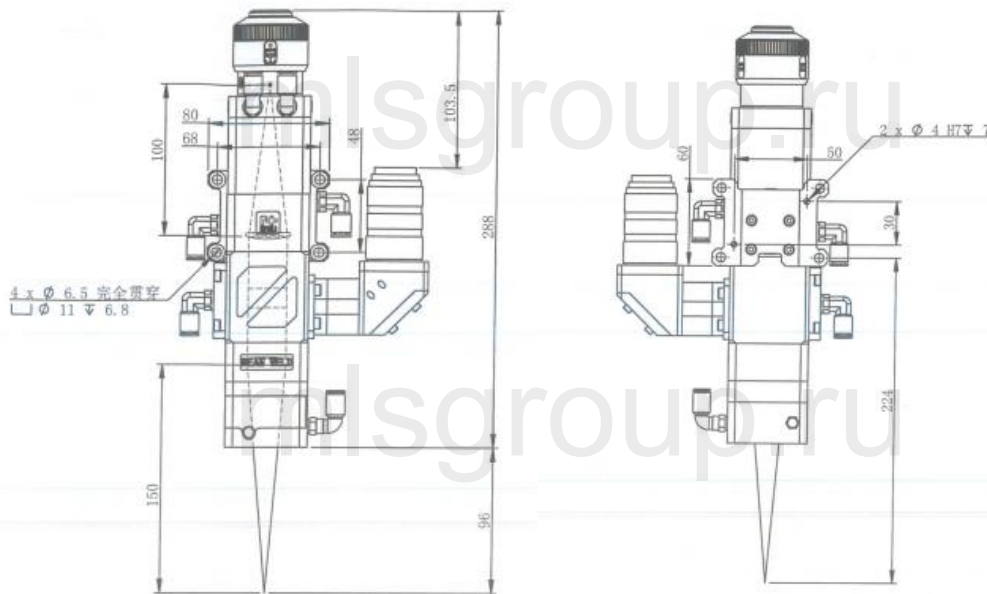
The laser head and tip assembly shall be locked firmly with M3x10 hex cap screws, as shown below:



2.2 Mounting Holes

Fasten BW210 to the machine tool by installing a mounting plate. The size and site of holes on the plate are shown below.

Suggestion: For a stable welding effect, please Install the laser head perpendicular to the processing surface, and ensure that the laser head is locked, with no shaking while processing.



Mounting Holes Diagram

100:150 as an example – with CCD Interface

Technical data

Wavelength	1064nm, 15nm, 450nm
Fiber interface	QBH (standard configuration), QD
Clear aperture	28mm
Collimation length	50mm, 100mm, 125mm, 150mm
Focus length	100mm, 150mm, 200mm, 250mm, 300mm
Cover glass specifications	Φ27.9mm*4.1mm (focus)
CCD connection module	Standard C/CS interface

Model description

Take BW2103FA4B as an example:

BW210 Series BW210

- 3 Power rating of the welding head: 3KW
- F Wavelength
- A Fiber interface: QBH
- 4 Optical configuration: 100:150
- B with CCD; without lens temperature monitoring

2.3 Water & Gas Circuit Connection

2.3.1 Water Circuit

Figure 2-1 indicates a suggested connection method.

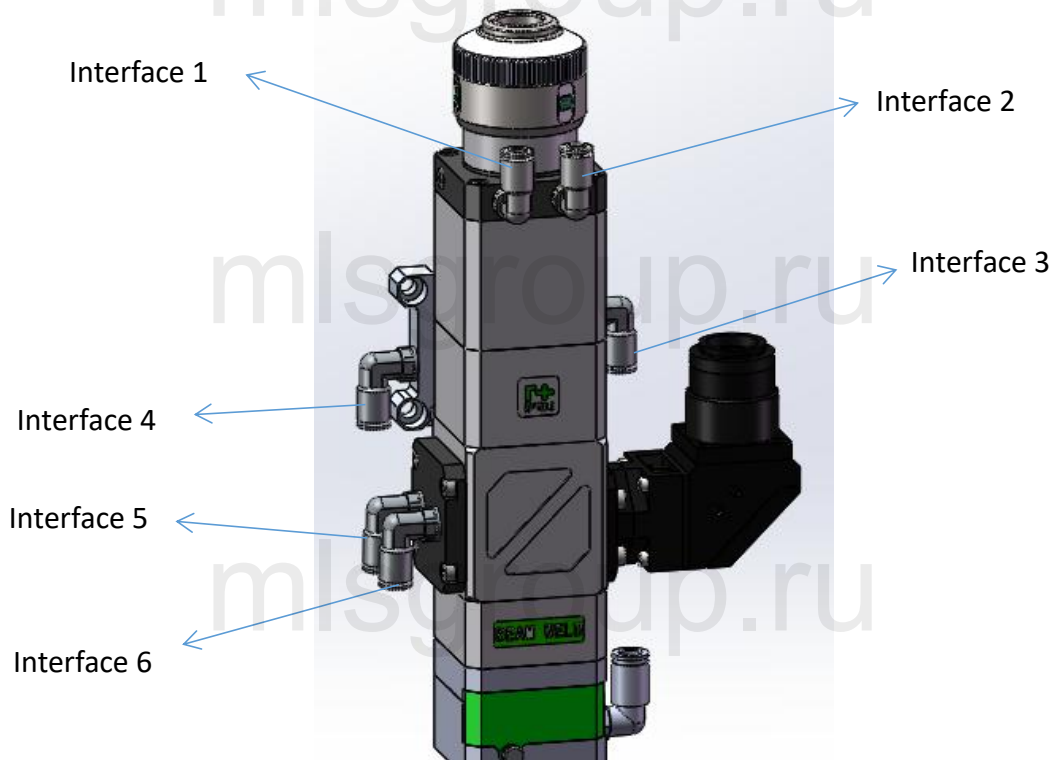


Fig. 2-1 Water Circuit Connection

Use a water tube ($\Phi 6\text{mm}$) to make a loop by connecting interface 2-3-4-5

Interface 1: water inlet; Interface 6: water outlet

Water cooling specifications

Minimum flow speed	1.8L/min (0.48gpm)
Water pressure	> 0.4Mpa
Entry temperature	$\geq$ room temperature > dew point
Hardness	(relative to CaCO_3) < 250mg/L
PH range	6 to 8 (deionized or distilled water)
Particle size allowed	< 200 μm (diameter)

2.3.2 Gas Circuit

Gas circuit connection of side blow assembly and coaxial nozzle assembly are shown in below figure 2-2 (A) & (B).

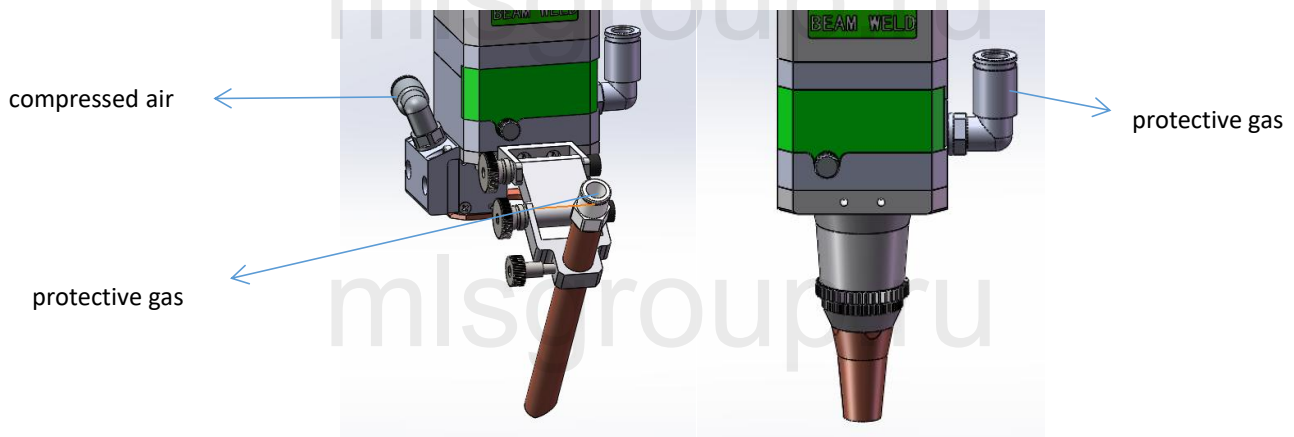


Fig. 2-2 Gas Circuit Connection

Requirements for gas are shown below. Generally, the air pressure rate of compressed air is 0.4-0.6Mpa. The protective gas shall be nitrogen, argon, or helium and the pressure is around 0.1Mpa. Adjustment can be taken for actual needs.

Gas	Maximum content of water vapor (ppm)	Maximum content of hydrocarbon (ppm)
Nitrogen	<5 ppm	<1 ppm
Argon	<5 ppm	<1 ppm
Helium	<5 ppm	<1 ppm
Air	<5 ppm	<1 ppm

2.4 Fiber Connection

Fiber interface refers to the connection between the fiber end and welding head. BW210 fits most industrial lasers. Common fiber interfaces include QBH, QD, and other types that also fit. Each one has its way to fasten the fiber. Please refer to the relative introduction.



Warning: Must keep optical devices clean, or clean any dust before using. Before inserting fiber, rotate the laser head in the horizontal direction to prevent dust from dropping on the glass surface. Fasten the laser head firmly after the fiber has been inserted.

The way to connect QBH and the optical fiber is shown as follows

1. Rotate the outer sleeve, and align its red point to the inner sleeve's.
2. Take off the fiber dust cap, and check whether the fiber end protection glass is clean; For Any dust, must clean it first.
3. Align the clean fiber end to QBH and ensure the red point on QBH and the longest groove on the fiber end are on one straight line.
4. Insert the fiber end into QBH, then lift and rotate the outer sleeve until two contact surfaces fit.

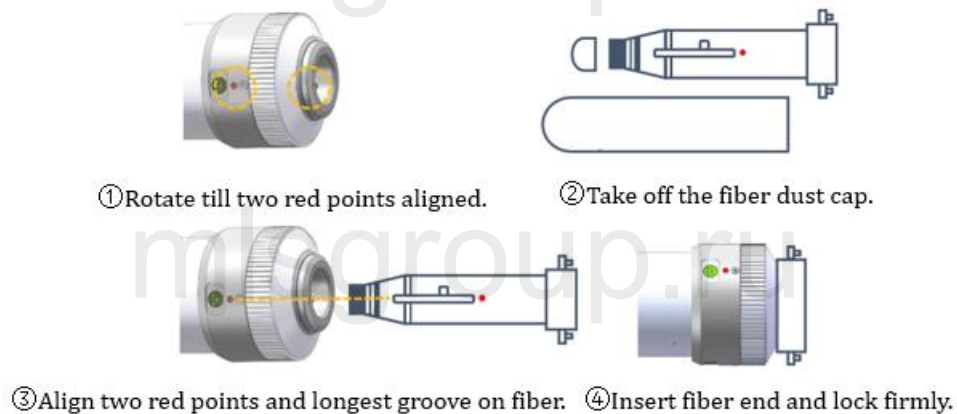


Fig. 2-3 QBH and Fiber End Connection

2.5 CCD Adjustment

- **Luminance Adjustment**

Adjust luminance by turning the knurled knob as shown in the following figure.

- **Sharpness Adjustment**

Adjust sharpness by turning around the protruding circle as pointed out.

- **Field centering**

Center the field of view by tightening or loosening the two M4 screws as indicated.

- **Field Adjustment**

As shown below, loosen four M3x6 inner hex screws 1 or 2 laps and loosen the M3x3 jack screw 1-2 laps. Hold the cylindrical structure (on the sharpness adjuster) and rotate it clockwise to achieve a target angle. After adjustment, hold the cylindrical structure still and tighten four M3x6 inner hex screws. Tighten the M3x3 jack screw to finish the field adjustment.



Fig. 2-4 CCD Adjustment

3 Maintenance

3.1 Cover Glass: Installation and Disassembly

Steps are shown in figure 3-1:

1. Loosen screws;
2. Pull open the lens cover plate;
3. Pull out the cover glass holder;
4. Press the glass with fingers and push out the lens from the holder at the side without the seal ring;
5. Install the cover glass into its holder;
6. Seal the cover glass with the seal ring;
7. Replace the cover glass holder;
8. Tighten screws.



Caution: Do not take out the seal ring on the cover glass with fingernails or any hard tool, which will cause gas leakage and serious damage to the lenses. Place the seal ring properly to guarantee its use.

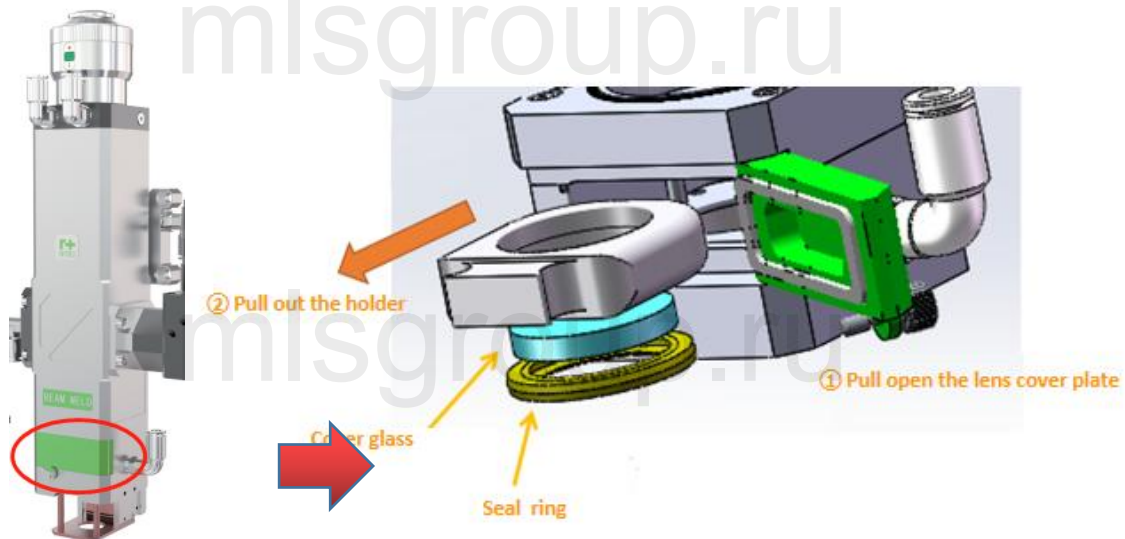


Fig. 3-1 Cover Glass: Installation and Disassembly

3.2 Cover Glass Cleaning

The cover glass should be cleaned regularly according to the steps shown below:

1. Take the side face of the glass with gloves, refer to figure (A). Do not touch the top and bottom faces with fingers;
2. Put the cleanroom wiper on the glass, and use 2-3 drops of lens cleaner, as shown in figure (B);
3. Slowly drag the cleanroom wiper horizontally and ensure no mark. Then, the glass will be clean. This step can be repeated till it is clean. A new piece of cleanroom wiper shall be used every time. Refer to figure (C);
4. With serious stains, a cleaning swab will be needed. Spray the lens cleaner on the swab, and then use it to clean the glass. Move the cleaning swab from the inside, anticlockwise, in a circular motion, with gentle force on the glass surface. Rotate the swab along the vertical axis gently to ensure the effect. Refer to figure (D).

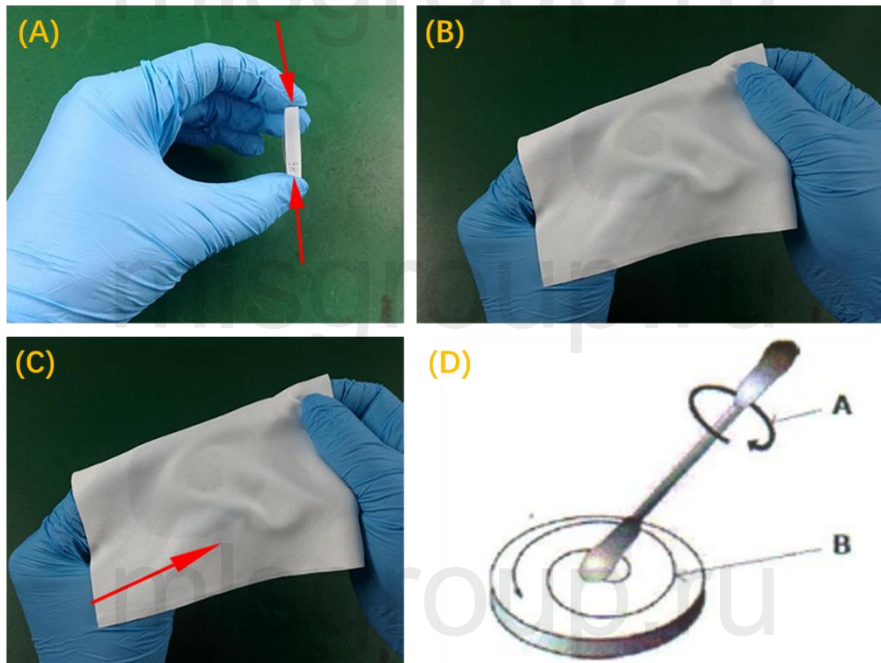
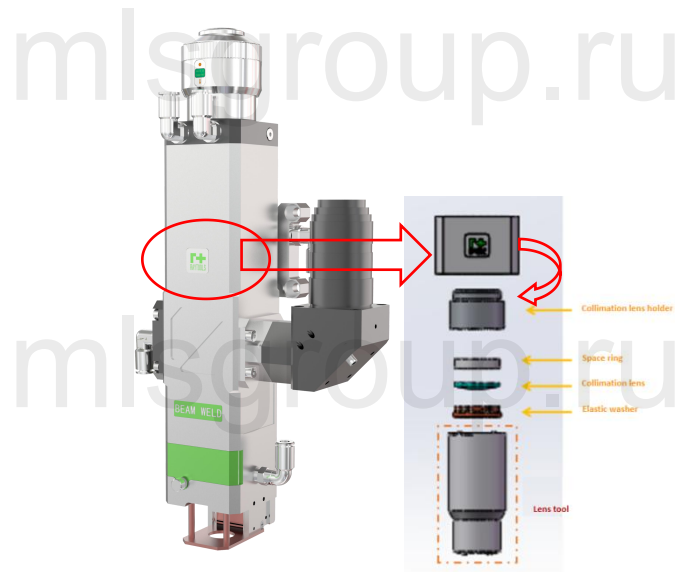


Fig. 3-2 Cover Glass: Cleaning

3.3 Collimation Lens Maintenance



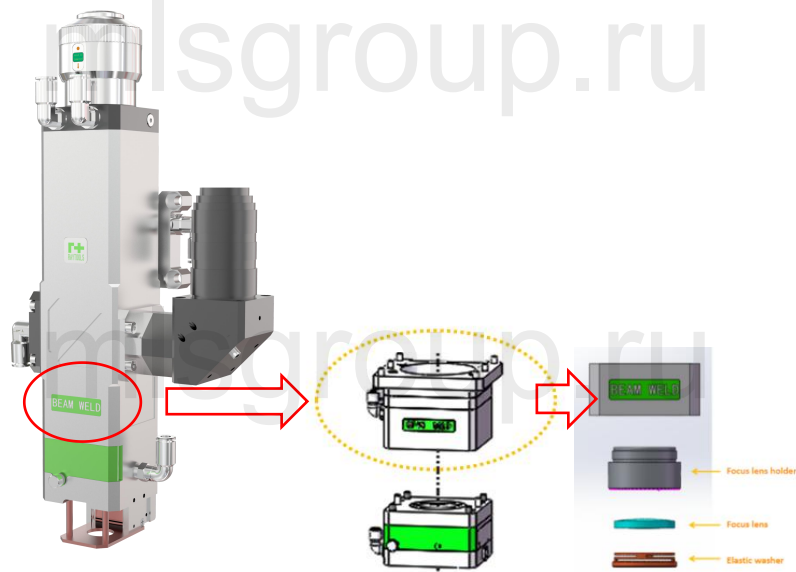
Process: change of collimation lens

The collimation lens should be replaced while the laser processing head is removed from the machine. Only the collimation from *Raytools* will be illustrated in the manual.

Using equipment from other manufacturers, please refer to the corresponding installation guides.

1. **Caution:** Keep the lens holder vertically when moving it in case of falling off. The installation and disassembly shall be operated on a clean table.
2. Remove screws on the collimation lens with a hex key and put them in a clean place;
3. Remove retaining screws and take out the lens holder, elastic washer, and space ring;
4. Insert a new collimation lens with space rings and elastic washers into a new lens holder. **Put the convex face downward.** Screw the new collimation lens and lens holder into the CM module and tighten retaining screws;
5. Reverse steps above.
6. Ensure the focal position is aligned with the nozzle center; if not, operate and ensure the XY alignment.

3.4 Focus Lens Maintenance



Process: maintenance of focus lens

Change the focus lens after removing the laser head from the machine tool. Operate optical lens with clean gloves or finger stalls.

Caution: Keep the lens holder vertically when moving it in case of falling off. The installation and disassembly shall be operated on a clean table.

1. Remove the locking screws from the bottom to the top;
2. Unscrew the pressing plate and take it off. Take out the holder mountings with the lens tool;
3. Unscrew the elastic pressing ring and take out the lens with lens tool;
4. Install the new focus lens in the new holder. **Put the convex face upward.** Rotate the new focus lens and lens holder into the focus module and tighten retaining screws.
5. Reverse steps above.

3.5 Consumables: Material Code

3.5.1 Cover glass

Laser head	Size	Material code
BW2103FA4B	D27.9×4.1mm (Bottom)	211LCG0037

3.5.2 Seal ring

Laser head	Type	Material code
BW2103FA4B	Bottom cover glass	11021M2110007

3.5.3 Coaxial nozzle assembly

Laser head	Specifications	Material code
BW2103FA4B	150/200mm	120AP2800A
	250/300mm	120F20200A

3.5.4 Paraxial nozzle assembly

Laser head	Type	Material code
BW2103FA4B	Paraxial nozzle	120AP3400A

3.5.5 Air knife

Laser head	Type	Material code
BW2103FA4B	Air knife	120AP2700A

3.5.6 Nozzle

Laser head	Type	Material code
BW2103FA4B	Coaxial nozzle	120AP2805B