MAINTANENCE AND REPLACE PROTECTIVE LENS

LC-CLEAN

INDEX

1. INTRODUCTION

This document defines the correct procedures for:

- Replacing protective lenses
- Preventing contamination during handling
- Identifying when replacement is required
- Applying correct usage practices to extend lens life

Proper handling of protective lenses is critical to avoid:

- Performance loss
- Overheating
- Optical damage
- Internal system contamination

2. GENERAL CONSIDERATIONS

Protective lenses are exposed to:

- Dust
- Fumes
- Vaporized material
- Metallic particles

Over time, this leads to:

- Contamination
- Reduced efficiency
- Increased thermal load

Failure to replace a damaged lens may result in damage to internal optical components.

3. DIFFERENCES BETWEEN SYSTEMS

3.1 300W PULSED LASER

- Uses a **single protective lens**
- Can be replaced manually

3.2 1500W CW LASER

- Uses two consecutive protective lenses
- Much more sensitive to contamination
- Higher thermal load accelerates degradation

Critical note:

The **second protective lens must NOT be replaced by default**.

- It should only be replaced if it is **clearly damaged or broken**
- Unnecessary removal increases the risk of contamination

Internal Risk Warning

Behind the second protective lens, the system contains internal mirrors and optical components.

Any dust particle entering this area may cause:

- Immediate optical damage
- Internal burning
- Failure of the laser head

This may result in:

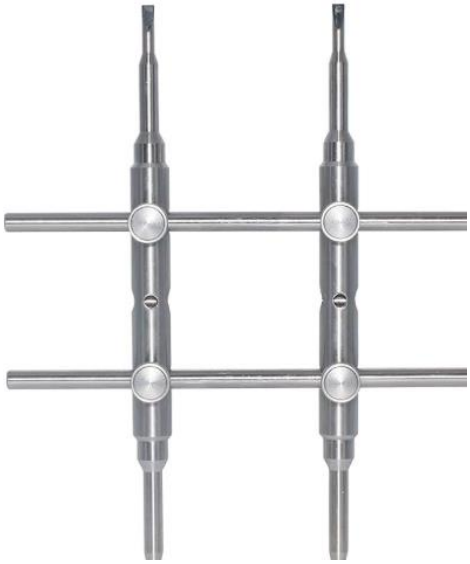
- Complete replacement of the optical head

Important Diagnosis

If the second protective lens is damaged, this usually indicates:

- Incorrect replacement of the first protective lens
- Improper operation or working conditions
- Excessive contamination or thermal stress

A tool called **"tic tac toe"** can be used to assist removal, although it is not strictly required



4. WHEN TO REPLACE THE PROTECTIVE LENS

4.1 VISUAL INSPECTION

Replace the lens if:

- Dirt or particles are visible
- Dark spots appear
- Burn marks are present

4.2 TEMPERATURE BEHAVIOR

- Faster temperature increase than normal
- Unexpected overheating

A broken or damaged lens causes heat to accumulate more rapidly.

4.3 REDUCED CLEANING PERFORMANCE

- Lower efficiency
- Need to reduce speed to achieve results
- Irregular or inconsistent cleaning

5. REPLACEMENT PROCEDURE

5.1 PREPARATION

Before starting:

- Turn off the laser completely
- Allow sufficient cooling time
- Work in a **clean and controlled environment**

Use:

- Clean gloves (powder-free)
- Lint-free optical wipes
- Approved optical cleaning materials

Avoid:

- Dusty environments
- Airflow over open optical components

5.2 HANDLING POSITION (CRITICAL)

When replacing a protective lens:

- **Never position the lens facing upward**

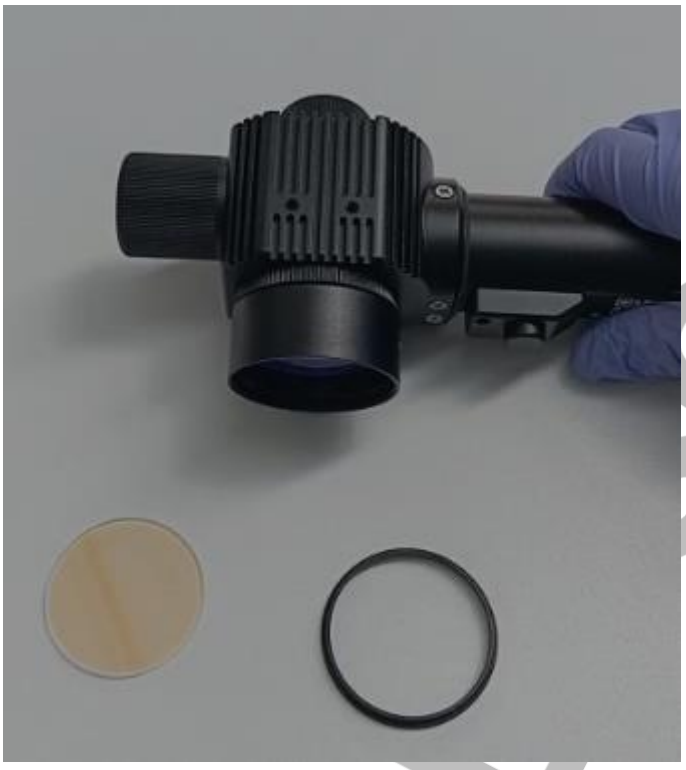
Correct practice:

- Keep the lens **facing sideways**

This prevents airborne particles from settling on the optical surface.

5.3 300W PULSED LASER PROCEDURE

1. Open the protective lens housing
2. Carefully remove the lens
3. Inspect the housing for contamination
4. Insert the new lens
5. Close and secure the system



5.4 1500W CW LASER PROCEDURE

1. Open the protective lens housing
2. Remove the **first (external) protective lens only**
3. Use the tic tac toe tool if needed
4. Inspect the second lens visually without removing it
5. Clean the accessible area if needed
6. Install the new first protective lens
7. Close and secure the system

Important Restriction

- Do NOT remove the second protective lens unless it is broken
- Do NOT expose internal optics unnecessarily

If the Second Lens Must Be Replaced

Only proceed if clearly damaged:

- Work in a **strictly clean environment**
- Minimize exposure time
- Avoid any dust entry

Any contamination may permanently damage internal mirrors.

6. CLEANING MATERIALS

Only appropriate optical-grade materials must be used.

Recommended characteristics:

- Lint-free wipes specifically designed for optical use
- High-purity solvents (optical-grade), such as:
    - Isopropyl alcohol (≥ 99%)
    - Ethanol (optical grade)

Optional tools:

- Optical cleaning swabs
- Oil-free compressed air (filtered, dry)

Important Restrictions

- Do not use standard cloths or paper

- Do not reuse wipes
- Do not use low-purity solvents
- Do not touch the optical surface

7. CONTAMINATION PREVENTION

To minimize contamination:

- Work quickly and carefully
- Keep lenses protected until installation
- Avoid breathing directly over the lens
- Keep tools and environment clean

8. OPERATING GUIDELINES TO EXTEND LENS LIFE

8.1 BEAM ANGLE

Avoid working at 90° (perpendicular).

Recommended angle:

- **20° to 70°**

This reduces:

- Back reflection
- Direct contamination

8.2 DIRECTION OF WORK

Whenever possible:

- Work **downwards**

This helps:

- Prevent debris from reaching the lens
- Reduce contamination buildup

8.3 PROCESS CONTROL

- Avoid excessive heat accumulation
- Adjust parameters when overheating occurs
- Monitor lens condition regularly

8.4 CW LASER SENSITIVITY

The 1500W CW laser is significantly more sensitive due to:

- High thermal input
- Continuous energy delivery

This results in:

- Faster lens degradation
- Higher risk of damage

9. KEY RECOMMENDATIONS

- Inspect protective lenses regularly
- Replace immediately if contamination is visible
- Never expose internal optics unnecessarily
- Do not remove the second protective lens unless required
- Maintain correct working angles
- Avoid perpendicular operation
- Work in downward direction whenever possible

10. CONCLUSION

Protective lens maintenance is critical for:

- Performance
- Safety
- Equipment longevity

The CW laser requires stricter handling due to its thermal behavior and sensitivity to contamination. Improper handling, especially when accessing internal optics, can lead to severe and costly damage.

Correct procedures and working practices significantly reduce risk and improve overall system reliability.