

Continuous Wave (CW) VS Pulsed Laser Cleaning

Product Description

Fiber laser cleaning equipment is categorized into **Continuous Wave (CW)** and **Pulsed** types based on the integrated laser source.

To understand the difference: a CW laser is like a lamp that stays on constantly, emitting a steady and uninterrupted beam. In contrast, a pulsed laser is like a strobe light, emitting energy in a series of rapid, individual bursts.

1. Laser Output Mode

CW Laser Cleaning Machine: Outputs laser energy in a continuous wave form. It provides a steady stream of power rather than individual pulses, characterized by stable power output and sustained energy delivery.

Pulsed Laser Cleaning Machine: Outputs energy in discrete pulses. It generates high-energy bursts in extremely short durations, focused onto the target surface. It is characterized by **high peak power** and **short pulse widths**.

2. Cleaning Principle

CW Laser Cleaning: Operates through a continuous beam that dwells on the target surface. It relies primarily on the **thermal effect** to evaporate or ablate contaminants.

Pulsed Laser Cleaning: Uses high-energy pulses where each burst carries significant instantaneous power. This creates a "**laser impact**" or **shockwave effect** that strips away or shatters contaminants from the substrate.

3. Application Scenarios

CW Laser Cleaning: Due to its stable and sustained energy, it is best suited for **large-scale cleaning** and surfaces with **light contamination**. Its effect is relatively mild, ensuring it does not excessively damage the substrate when used correctly.

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Pulsed Laser Cleaning: Its instantaneous high energy allows it to rapidly evaporate or destroy heavy dirt, oxides, and thick coatings. It offers superior cleaning strength and is ideal for **high-precision tasks** or surfaces with **heavy contamination**.

4. Comparison of Advantages and Disadvantages

CW Laser Cleaning Machine

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Advantages: Excellent for cleaning large, flat areas. The process is highly stable, supports continuous operation, and generally offers **faster cleaning speeds** for bulk removal.

Disadvantages: May cause **overheating or thermal deformation** on thin-walled materials, heat-sensitive components, or materials with specialized surface treatments.

Pulsed Laser Cleaning Machine

Advantages: Ideal for tasks requiring **fine control**. The energy can be precisely concentrated, significantly reducing the Heat-Affected Zone (HAZ) on surrounding materials. It performs better on **complex geometries, uneven surfaces,** and high-precision industrial components.

Disadvantages: The cleaning speed may be **slower** than CW machines because the process prioritizes precision and controlled energy delivery over raw area coverage.

Technical Comparison: CW vs. Pulsed Laser Cleaning

Feature	Continuous Wave (CW) Laser	Pulsed Laser
Output Mode	Constant, uninterrupted beam	Short, high-energy bursts
Cleaning Mechanism	Thermal Ablation (heat-based)	Photomechanical / Shockwave effect
Heat-Affected Zone (HAZ)	Higher (risk of thermal buildup)	Minimal (cold processing)
Peak Power	Equivalent to average power	Extremely high (thousands of Watts)
Precision	Moderate	Very High
Cleaning Speed	Very Fast (for large areas)	Moderate (precision-focused)
Best Substrate	Heavy steel, thick structures	Thin metals, molds, precision parts

"How to Choose" Guide for Customers

Selecting the right equipment depends on your specific application requirements. Use the following criteria to guide your decision:

Choose Continuous Wave (CW) If:

Large Surface Areas: You need to clean large steel plates, ship hulls, or large-scale infrastructure.

Heavy Rust/Paint: You are dealing with thick layers of corrosion or industrial coatings where speed is the priority.

Budget-Conscious: CW machines generally offer a lower price-to-power ratio, making them more cost-effective for heavy-duty industrial bulk cleaning.

Durable Substrates: The material is thick enough (usually >5mm) to withstand heat without warping or changing properties.

Choose Pulsed Laser If:

High Precision Needed: You are cleaning injection molds, high-end components, or delicate historical artifacts.

Zero Substrate Damage: You must ensure the base material (like aluminum or stainless steel) is not damaged or discolored by heat.

Complex Geometries: You are working with intricate shapes, grooves, or uneven surfaces where fine control is required.

Thin Materials: You are cleaning thin sheets or foils where thermal deformation (warping) is a high risk.

Pulse Cleaning Ability

Power (W)	Material	Cleaning Speed (mm/s)	Cleaning Width (mm)	Cleaning Depth (um)	Cleaning Rate (m ³ /h)
100w	Surface Rust	20	130	20	3.5
	Paint	20	130	80	2
	Rust	20	130	100	1.5
200w	Surface Rust	20	130	20	6
	Paint	20	130	80	2.5
	Rust	20	130	100	2
300w	Surface Rust	20	100	20	9
	Paint	20	100	80	4
	Rust	20	100	100	3
500w	Surface Rust	25	120	20	12
	Paint	25	120	80	5
	Rust	25	120	100	3.5
1000w	Surface Rust	30	120	20	15
	Paint	31	120	80	6
	Rust	32	120	100	4

Note: The values listed in this table are theoretical references. Real-world cleaning performance, including speed and depth, is subject to variations in substrate properties and the thickness/type of contaminants.