

LASER BASICS

Automated Laser Corporation

Special Points of Interest:

- Lasers are used in the most sophisticated manufacturing facilities in the world.
- Lasers can be used for cutting, welding, drilling and even marking.
- With no point of contact with the work surface, lasers prevent collateral damage from processing.
- You may be surprised how cost-effective a laser solution may be.

WHAT ARE LASERS GOOD FOR?

While you may think that lasers are only useful in extremely exotic applications like silicon wafer dicing and micromachining of nano components, the reality is that lasers are practical and cost-effective devices that can be used by almost everyone. This is especially true in the manufacturing fields.

CUTTING, DRILLING AND TRIMMING

Lasers are typically thought of as a cutting tool. Lasers can be used to cut virtually any material with no contact and no wear. This means no more buying cutting blades or sharpening dull ones. No more scrap parts from blades that have broken or gone dull. No more downtime replacing blades or lubri-

cating moving parts. In most cases cut lines are literally hair thin as well, making virtually no scrap. A laser provides an uninterrupted beam that can make quick work of your processing needs with precision like no other.

Similar to cutting, lasers are excellent tools for many types of other mechanical processes from

drilling, trimming and surface treating. Often times, a single laser can accomplish several of these tasks by simple programming changes not hours of mechanical set-ups. Try doing that with an expensive mechanical tooling.

But that isn't the end for lasers, either.

PART MARKING, ETCHING AND FINISHING

Also becoming very common on the manufacturing floor is part marking with programmable laser markers. This cost effective process offers more flexibility in part marking including high speeds, the ability to print real time information from a date or time stamp, to printing part numbers and complex data matrices. Even logos and

precision art work are all incredibly easy utilizing laser technology.



Laser marking is one of the most widely used forms of laser processing. Lasers are capable of marking or "etching" on many surfaces without the need for inks or other disposable resources. Lasers alter the surface of the material they touch therefore producing either a contrast to the original surface or

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Lasers can be used in many applications including stripping (top) and welding (bottom).



Inside this issue:

| | |
|-------------------------------|---|
| Welding, Fusing and Soldering | 2 |
| How Lasers Work | 2 |
| Light and Wavelengths | 3 |
| Carbon Dioxide Lasers | 3 |
| Fiber, YAG and Excimer lasers | 4 |
| About Automated Laser | 4 |
| Laser Automation | 5 |

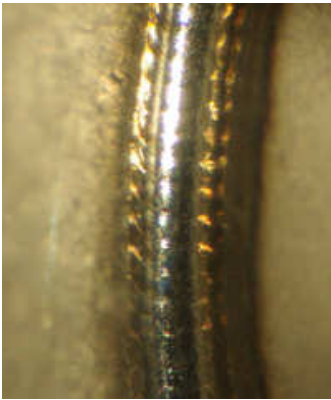
PART MARKING, ETCHING AND FINISHING (CONTINUED)

a slightly inscribed mark that is discernable from its surroundings.

Lasers can be used to remove paint, coatings or etch films from base materials such as metals, ceramics or glass. Paint on air-

craft parts can be stripped. With the right laser selected for these processes, the absorptive properties of the coating allow the laser beam to evaporate the coating while the reflective properties of the base material keep it safe from excessive heat.

Lasers can even reach places that other methods cannot, including depressions and holes and even through transparent materials such as glass and plastic.



Close-up view of a laser weld on stainless steel. This process uses no filler whatsoever.

WELDING, FUSING SOLDERING AND BRAZING

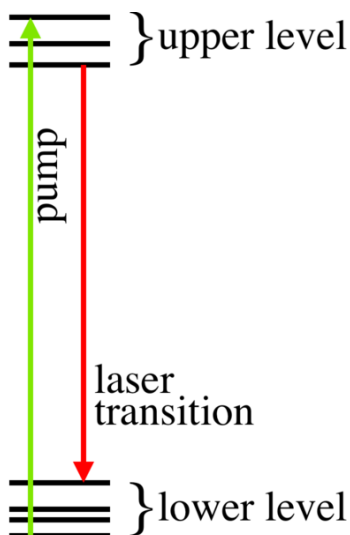
Precision component welding is another area of rapid growth and broad reach. Hermetic sealing of plastic housings, plastic tube welding and many others are quickly moving to laser processing. Metal welding, soldering or metallic bonding is also ideal.

Microscopic fillets are possible with near machined finish appearance. Laser fusing eliminates heat distortion and consumables as well as minimizes scrap due to its exceptional repeatability.

Truly, lasers are one of the most versatile pieces

of equipment of the century.

Call the Automated Laser Team for more information on how laser technology solves big problems with easy answers!



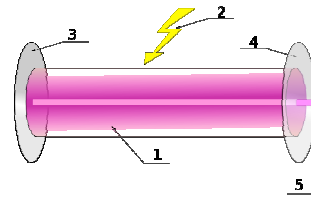
The pump source drives electrons to their upper level. They then fall back to their lower level, emitting a photon of light. This cycle continuously repeats.

HOW LASERS WORK

The term “Laser” is actually an acronym for Light Amplified by Stimulated Emission of Radiation. This radiation is actually just electromagnetic energy in the form of light. Most lasers operate within the wavelengths between 125 and 10,600 nanometers, just bordering the visible light we see every day.

A laser is produced by providing energy to a “gain medium” which is the substance that produces the light in the specific wavelength of the laser. This light is made up of photons which collide in the gain medium with electrons producing light that is coherent—or travelling the same direction. The light is bounced back and forth between two

mirrors all the while producing even more light before finally escaping through a “half-silvered” mirror on one side.



1. “Gain Medium”
2. Laser Pumping Energy
3. High Reflector
4. Output Coupler
5. Laser Beam

This concentrated energy is then focused on the part to be processed which reacts in different ways depending on

the wavelength of the laser, the type of material, and the specific settings of the laser. Some materials may be completely destroyed by one laser while unaffected by another. For this reason lasers for industrial uses are generally one of the following:

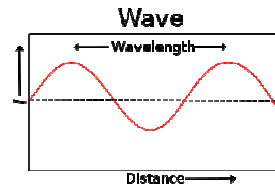
1. CO₂
2. YAG/Fiber
3. Excimer

Most materials can be processed with at least one of these types of lasers.

“This property determines whether or not this radiation is a deadly Gamma Ray or the light from a beautiful sunset”

LIGHT AND WAVELENGTHS

Light is the result of electromagnetic radiation as are Gamma Rays, X-Rays, Microwaves and Radio Waves. While all of these rays are created by the same principles, their properties depend on their wavelength—or distance between repeating points along a wave. This property determines whether or not this radiation is a

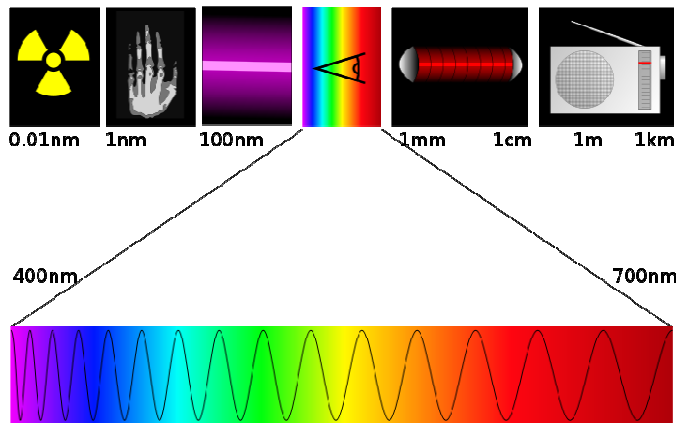


deadly Gamma Ray or the beautiful light from a sunset.

Since lasers use very specific materials to produce their

beams the radiation emitted is often very pure and of a very specific wavelength. This property is the most important factor in determining what type of work a laser will do.

In the next section we will examine some of the more common industrial lasers.



This chart shows the type of radiation each range of wavelength produces from Gamma Rays to Radio.

CO₂ (CARBON DIOXIDE) LASER

The CO₂ laser is one of the earliest gas lasers created. It is also one of the cheapest lasers to produce and is therefore used most often in part marking and basic cutting applications. The laser beam is created by exciting the atoms inside a sealed tube filled with CO₂, Nitrogen, Hydrogen, and Helium. The resulting beam is generally 10,600 nm in wavelength and is excellent at processing plastics, glasses, acrylics and natural materials such as cloth and wood. This wavelength is in the far infrared and can be

dangerous to eyesight if certain precautions are not made. Fortunately this wavelength is absorbed by most glass and acrylic windows and eyewear making protection relatively easy.

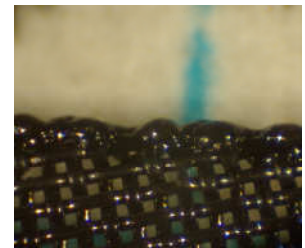
This same property makes the CO₂ laser the ideal laser for use on clear materials as other lasers tend to pass right through.

At Automated Laser we use CO₂ lasers to produce our own line of versatile laser machines capable of marking,

cutting and drilling many common materials. Our choice of CO₂ provides excellent versatility and power while keeping the overall cost down.



Automated Laser's LSG-10 Laser Marker

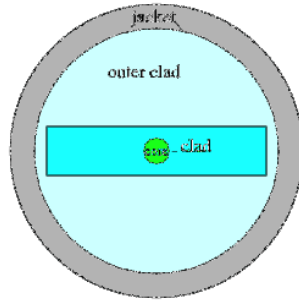


Close-up view of fine mesh fabric cut by the LSG-10. Notice the cauterization of the edge which prevents fraying.

LASER BASICS

ND:YAG / FIBER LASERS

Nd:YAG (Neodymium doped: Yttrium Aluminum Garnet) and Fiber lasers share a lot in common, namely their wavelength: 1,064 nm—in the near infrared. Where they differ is in size and price. While Nd:YAG lasers typically use flash lamps to excite the gain medium to produce a laser output. Fiber lasers, on the other hand, use a fiber optic core doped with, typically, Neodymium surrounded by a cladding that supplies the pumping energy surrounded



by another cladding that contains the energy. This energy travels along the length of the fiber gaining strength until it exits out the end through a

series of lenses to focus the beam.

The advantage of the Fiber laser is that of cost, size, and maintenance. Typical Nd:YAG lasers need to be water-cooled and have their flash lamps replaced as they burn out, while fiber lasers produce identical results in a smaller, cheaper package less prone to downtime. Typical Nd:YAG lasers easily run upwards of \$100,000 while fiber lasers start under \$20,000.

“The advantage of the Fiber laser is that of cost, size, and maintenance.”

EXCIMER LASERS

The Excimer laser is one of the most expensive and least known of all the industrial lasers but is capable of many things the other lasers aren't. Excimer lasers operate in the ultraviolet area (125-350 nm) of the light spectrum and are capable of very small spot sizes. These lasers rely on a combination of inert (argon, krypton and/or xenon) and reactive gasses (chlorine and fluorine) to produce ultraviolet light. Excimer lasers are

unlike the other types of lasers in that they do not burn or melt material to remove it but rather add enough energy to disrupt the molecular bonds that hold materials together effectively disintegrating them and leaving the surrounding material unchanged. This makes Excimer lasers invaluable in the manufacturing of precision micro-machining, integrated circuits, and solar cells. They are even used in LASIK eye surgery

because of their nature of disintegration rather than burning.



ABOUT AUTOMATED LASER

Automated laser was founded in 1998 by Adaptive Technologies, Inc. Our first entry into the laser processing market was with the LS-10, an extremely affordable albeit simple laser marker. This marker uses a simple X-Y plotter head which is good for date and lot code marking on relatively low volume products; up to 50 or 60 a minute. The LS-10 was then followed by the LSG-10 which uses a galvanometer based marking

head capable of up to 300 characters per second. Through the expertise of our sister company, Adaptek Systems, we have grown into a leader in custom laser integration into both old production lines as well as designing new lines from scratch. We have worked with top companies from around the world, mostly right here in the United States.

Custom solutions from Auto-

mated laser help boost productivity by eliminating downtime and scrap. Our experts in efficiency will design you a custom solution to meet your needs.



CUSTOM AUTOMATION

“The Automated Laser Team can develop custom process solutions for your most demanding laser applications.”

Automated Laser Corporation is an industry leader in standard and custom turnkey laser systems for a wide range of precision cutting, welding and marking applications.

The Automated Laser Team can develop custom process solutions for your most demanding laser applications. From small to large format tables, robotic integration and highly customized sys-

tems, we can be an important link to your production success. For our current clients this includes multi-head focus assemblies, complex 3D motion patterns and integrated material handling to mention only a few.

Typical custom applications from Automated Laser Corporation may also consist of other automated processes such as:

- Stock Handling from Rolls or Sheets
- Post or Pre-Welding Assembly
- Vision Camera Detection
- Laser Marking
- Dimensional Checks
- Completed Product Testing
- Finished Product Handling and packaging

STANDARD AUTOMATION: LC, RD & LT SERIES

In addition to custom systems, Automated Laser has developed three standard laser platforms.

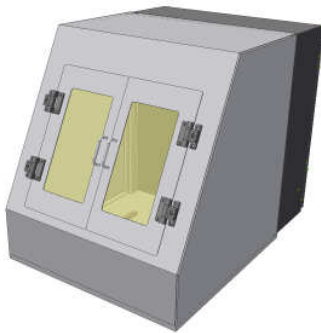
The **LC Series** unit is a lower cost unit for lab testing, prototyping and lean production workcells. The **LC Series** is perfect where single part load and unload cycles are preferred, lower volume production is anticipated and change over flexibility is desired. The small footprint

of the LC unit is perfect as a bench top unit or is available with a free-standing base with options for wheels or leveling feet.

The **RD Series** is a high throughput unit designed for applications where rapid change over is desired due to a high mix of product types of high or low volume. The system is provided with our patent pending servo driven rotary platen transfer

with quick change tooling for 8 or 12 part fixtures.

The **LT Series** platforms allows for complete multi-cavity trays of parts to be loaded and processed in a single load cycle. Operators can load a configured tray, initiate the cycle and return at completion to reload the system.



LC Series Standard Laser Platform.



RD Series Standard Laser Platform.



LT Series Standard Laser Platform.



Integrated Laser Processing Solutions

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Automated Laser Corporation is a proven industry leader in standard and custom laser systems for a wide range of precision cutting, welding and marking applications.

Whether your needs are best suited for Fiber, CO2, Diode, YAG, or others, Automated Laser can provide the right system to meet your exact specifications.

Automated Laser offers you one of the best long term cost advantages available. Laser processing eliminates maintenance issues such as perishable tool replacement, significantly improves quality, minimizes stock scrap and greatly reduces time consuming set-ups. Simply, our laser systems offer precision and repeatable



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