

# The Laser Line

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## DLI Laser Systems Technologies

### New Systems-Level Solutions Integrate Automated Parts Handling with Inert Atmosphere Welding

For many production-level welding applications, the ability to combine efficient automated part handling with controlled-atmosphere welding environments can provide an ideal solution for optimal quality and sustained throughput. As the industry leader in systems-level integration for targeted laser applications, Directed Light, Inc. has leveraged its proven inert atmosphere chamber technologies with state-of-the-art automation technologies to create complete integrated solutions for meeting even the most demanding production requirements.



These state-of-the-art Nd:YAG laser welding systems provide a completely enclosed, consistent high purity inert atmosphere which controls oxygen and water moisture

to less than one part per million. Using custom-tailored modules for automated loading/unloading of parts, along with precision linear motor tables and multi-axis CNC controllers, DLI's total system solutions maintain precision programmable control over the entire welding process both inside and outside the inert gas chamber. By providing a complete automated production-cell that incorporates controlled atmosphere welding, DLI's automated system solutions give our customers the ability to treat the entire optimized welding process as a robust "black box" operation within their overall manufacturing environments, thereby eliminating the process tweaking and inefficiencies involved with non-integrated approaches.

DLI's inert gas automated welding systems

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## Industry-Leading DLI Job-Shop Provides

### Full Spectrum of Custom Cutting Services for RF/Flex Circuits

The use of advanced micro flex circuit technology has become a critical enabling factor in the development and manufacture of many of today's advanced wireless RF devices, however, the widening use of ultra-small and complex flex circuits is also creating tough new challenges for cutting and trimming operations. In most cases, the demands for complexity and product flexibility have surpassed the practical limitations of traditional hard-tooled die cutting approaches. Similarly, the need for consistent precision edges and sustained

high production throughput have outstripped the capabilities of conventional routing processes.

For the majority of leading-edge micro flex circuit applications, laser cutting has now emerged as the most viable process for combining the required high levels of precision and consistent quality, along with manufacturing flexibility and sustained throughput for high volume production.


Directed Light Inc.'s industry-leading laser


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**FROM THE DESK OF  
JEFF SMITH**



*Jeff Smith is Directed Light's Chief Operating Officer*

## DLI employees perform “beyond the norm”

Directed Light continuously reviews and upgrades its business processes to achieve and retain world class manufacturing and service; its success can be attributed to its dedicated employees who are intent in providing you, our customers, with exceptional products, services, and value. We like to recognize outstanding customer service with two quarterly awards: **Employee of the Quarter**, and the **Quarterly Quality Award**. I'd like to take this opportunity to acknowledge the recipients of last year's awards.

The **Employee of the Quarter** award is presented to the individual who makes a “beyond the norm” contribution to the business: making a customer “really, really” happy, closing a “really big” sale, or masterminding a major business improvement. Last year's recipients were:

<u>Quarter</u>	<u>Recipient</u>	<u>Department</u>
Spring 2000	Stan Wight	Job Shop
Summer 2000	Nitin Gandhi	Job Shop
Fall 2000	Ed Berticevich	Components Sales
Winter 2000	Pia Concepcion	Accounting

The **Quarterly Quality Award** is given to the employee who best embodies DLI's “Quality Starts with Me” philosophy. It can be given for a specific “kaizan” action, idea, or process improvement, or for producing top-notch quality results in their job day after day:

<u>Quarter</u>	<u>Recipient</u>	<u>Department</u>
Spring 2000	Saybe Gibson	Inventory Control
Summer 2000	Phuong Nguyen	Systems Manufacturing
Fall 2000	Randy Brodresser	Systems Manufacturing
Winter 2000	Vladimir Solovyev	Job Shop

If you speak to one of these recipients, be sure to congratulate him or her on a job well done, and if one of our employees provides you with exceptional customer service ... tell me! \*

### RF/FLEX CIRCUITS (continued from page 1)

job shop now offers advanced cutting and trimming services for precision RF/flex circuit applications. Using fast and highly accurate CO<sub>2</sub> laser technology with a beam size of .005 inches or less, DLI can cut the whole spectrum of required materials, including Kapton and Duroid, while holding tolerances to .0015 inches or better. The use of a tightly focused CO<sub>2</sub> laser beam ensures excellent cutting results within a minimal heat-affected zone to allow ultra-close trimming without damaging the metallized portions of the circuits.

The bottom line is that DLI's laser cutting services provide not only optimal flexibility for cutting around complex features but also deliver a faster process and cleaner cut than with conventional blade-routing techniques. In addition, because of the inherent flexibility of DLI's laser cutting processes, the technique is also cost-

effective for shorter production runs or even prototype work. In effect, DLI's job shop can leverage the same basic laser cutting processes to work with our customers from their product development efforts all the way up through high volume production, thereby helping to shorten product development cycles and smooth overall manufacturing ramp-up. \*

### PARTS-HANDLING (continued from page 1)

are designed to meet or exceed CDRH Class I design and manufacturing standards. By leveraging the systems' modular building block architecture and inherent configurability, Directed Light is able to quickly configure and deliver the optimal blend of automation and custom-handling techniques to meet specific customer requirements without unnecessary deployment delays or costly redesign. \*

### The Laser Line



*The Laser Line is a quarterly publication of Directed Light, Inc. and is available free of charge to all interested parties. Additional copies may be obtained by contacting Directed Light, Inc. at 408-321-8500. Any comments regarding this publication should be directed to the Marketing Department.*

*Address changes should be sent to: The Laser Line, c/o Directed Light, Inc., 633 River Oaks Parkway, San Jose, CA 95134-1907.*

*This publication is designed to provide accurate and authoritative information in regard to the subject matter covered.*

# Minimizing & Removing Laser Scale when Laser-Cutting Ferrous Metal Parts

As laser cutting of metal parts becomes increasingly important in many production environments, process engineers need to be aware of the potential risks from the formation of unwanted laser scale (oxidation, or rusting) along the edges of the materials being cut. The primary issues that must be addressed for optimal process results are:

1. How to minimize laser scale formation
2. How to remove laser scale from affected materials

Although a stream of oxygen is typically used as an assist gas to blow away molten metal from the cutting edge, it can significantly contribute to the creation of scale. In effect, laser scale can accumulate along the cut edge and the bottom of the cut as the laser heats the metal to its oxidation temperature and the stream of the oxygen in the assist gas reacts with the ferrous metal to create scale. Because the creation of laser scale is essentially an oxidation process, one alternative that can help to reduce its formation is the substitution of a non-oxygen alternative as the assist gas. For example, the use of a nitrogen stream can effectively blow away the molten metal while simultaneously maintaining a relatively oxygen free environment around the cutting process, thereby minimizing the oxidation process that forms laser scale. Of course, the substitution of nitrogen is not appropriate for all materials. Because of the difference in the oxidation temperature and melting point of carbon steel, for example, oxygen can often deliver a more effective cutting process. Similarly, when cutting heavier gauge steels, nitrogen assisted cutting can result in "blowout" because a wider than acceptable area of the metal may reach its melting point before being blown away by the assist stream.

The second critical issue in minimizing laser scale involves maintaining consistent preci-

sion control over the feed-rate and nozzle pressure throughout the cutting process. Generally, as the metal is moved through the cutter at a faster feed rate, the assist gas also must be delivered at a higher flow rate. However, scale formation also generally increases with higher assist gas pressures. The process control "sweet-spot" typically can be achieved by maintaining a 10-degree rearward angle of deflection for the spark plume beneath the cutting point, which helps minimize the formation of laser scale. In addition, the pre-application of an anti-spatter agent to the metal prior to cutting can also help reduce scale formation.

Depending on the overall process requirements, it may be impossible to completely prevent laser scale formation and/or it may be more cost-effective to focus on simply removing scale after it is formed. Scale generally can be removed prior to painting parts by using a combination of either physical and/or chemical means. Because scale is relatively brittle, physical means such as grinding or sanding can be effective, however, with some complex part geometries, physical methods can be difficult to control for optimal results. In these instances, the use of chemical methods such as acid immersion or spray cleaning can effectively substitute for or complement physical methods. Of course, the deployment of such acid or solvent based chemical methods solely for the removal of laser scale can carry significant cost and complexity with regard to controlling both the effectiveness of the process and the safety of the materials being used.

The bottom line is that it is generally better to avoid the formation of laser scale whenever possible through tight control over the cutting process. As described above, optimal

## Pay with American Express at DLI

*As part of our ongoing commitment to tailor our support systems to mesh with customer needs, Directed Light has now added American Express to our growing list of payment alternatives.*

*In order to expedite and streamline internal purchasing processes, many companies are turning to the use of credit cards for ordering smaller expense items such as spare parts, consumables, maintenance kits, etc. Instead of going through the potentially cumbersome and time-consuming process of creating purchase orders for routine maintenance items and/or small emergency requirements, buyers can get the parts they need with virtually no delays. In many cases, the ability to make immediate purchases with credit cards can be the critical difference between keeping production lines running or experiencing costly interruptions.*

*In addition to our long-standing policy of accepting Visa and Mastercard, we've now also given our customers the option for using American Express cards to quickly and conveniently purchase support items in a single one-contact transaction. Using any of these major credit cards, a customer can directly call DLI's customer service ordering desk between 8 AM and 5 PM Pacific Time in order to receive immediate shipment on virtually any component or spare part in stock.*

*For more information call DLI Customer Service at **800-468-2326**.*

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## DIRECTED LIGHT NEWS

*Directed Light would like to welcome **Jim Johnson, Sr. Sales Engineer, Laser Systems**. Jim comes to Directed Light with over 13 years experience in laser sales and application development. He holds a Bachelor's degree in Mechanical Engineering from Santa Clara University.*

*Jim would be happy to discuss your precision materials processing applications with you. Contact him at [jim@directedlight.com](mailto:jim@directedlight.com) or 800-468-2326 x149.*

### Leverage Your System Maintenance Program via DLI's Inventory Blowout Sale!

For the second year in a row, Directed Light Inc. is offering all customers a limited-time opportunity to purchase selected laser components at low blowout prices.

Hundreds of items are being offered for sale at discounts ranging from 25% to 50% off of standard list prices.

Available inventory consists of both brand new components and a small number of refurbished items, all at very attractive prices. The available devices cover virtually all laser types (YAG, CO<sub>2</sub>, etc.) and include a full spectrum of filters, rods, lamps, optics, cavities, housings, and other components. All of the parts on the list carry DLI's standard 90-day warranty and are available for immediate shipment.

Quantities are limited – so don't hesitate to check out the inventory blowout list and get

a jump on significantly reducing the cost of your on-going laser support and maintenance programs.

For a complete listing by part number of the specific components available, please visit the Directed Light Web site at [www.directedlight.com](http://www.directedlight.com) or call DLI Customer Service at **800-468-2326**. \*

### LASER SCALE (continued from page 3)

process control and scale minimization requires a thorough understanding of the critical inter-relationships between material characteristics, heating profiles, feed-rates and assist gases. If you need expert assistance in designing, deploying and optimizing any laser cutting application, please don't hesitate to contact DLI's job shop services staff or systems design division at **800-468-2326**. \*