Epilog's New FiberMark System

By Mike Dean, Epilog Laser Director of Sales and Marketing

Spurred by the increasing need of industry to permanently mark and engrave metal parts, Epilog Laser offers the new FiberMark flying optic fiber laser system. Breaking the boundaries of traditional metal marking lasers, the Epilog FiberMark incorporates state-of-the art fiber laser technology with flying optics beam delivery to create a system that is economical, easy to use, and offers advantages over traditional Nd:YAG galvo based beam delivery systems.

The demands on industry to permanently mark or identify metal parts, tools, and capital equipment in an economical way has generated an opportunity for Epilog Laser to introduce the new FiberMark metal marking laser system at the 2006 IMTS exhibition in Chicago. This new fiber laser system is an entirely new way to think about how lasers can mark metal and other materials. Epilog's new FiberMark laser system breaks new ground in metal marking by offering a large 24 x 12 inch (605 x 303mm) marking/engraving area at a price in the mid-$30Ks for a complete system. With many of the attributes of traditional Nd:YAG lasers, fiber lasers are becoming increasingly popular as the preferred laser choice for metal marking applications.

Fiber lasers were first developed in the late 1980s for tele-communications and military applications. As with most technology, fiber technology has evolved into a wide variety of applications, and metal marking is just one of the many uses that fiber lasers have revolutionized. With the introduction of the FiberMark, Epilog will be using the fiber laser technology for commercial and industrial applications to mark bar codes, data matrix, serial numbers, and even graphics onto tools, production parts, and many other metal surfaces that need to be engraved or marked. "The industrial marketplace has been looking for a way to easily mark metal with unique identifiers in a way that combines affordability and speed," explained James Stanaway, marketing director of Epilog Laser. "This addition to the Epilog Laser product line is exciting because it offers a unique format for metal marking applications that has not existed until now."

Since 1988, Epilog Laser has been designing and manufacturing flying optics based CO2 laser systems that can engrave and cut wood, acrylic, plastic, fabric, rubber and many other non-metallic materials. All Epilog systems use a flying optics mechanical approach to steer the laser beam, and Epilog's current table sizes range from 18 x 12 inches (457mm x 305mm) to 36 x 24 inches (914mm x 610mm) in marking area.

In addition to non-metallic materials, CO2 lasers engrave exceptionally well on coated metals like anodized aluminum. However, the wavelength of the CO2 laser makes it time consuming and difficult to mark directly onto bare metals like stainless steel, titanium, and other metals without using a two-step metal marking process. The metal must be coated first with Cermark® or Thermark® metal marking spray before being engraved. While the mark is permanent, the process can be too time consuming for higher volume industrial applications. The wavelength of the fiber laser in the FiberMark system is the same as an Nd:YAG laser and allows for direct marking on metals, increasing throughput of metal parts requiring permanent identification.

Epilog feels that it is in an ideal position to combine the proven mechanical technology of their flying optic CO2 laser systems with the fiber laser technology. "We've been incorporating the most technologically advanced motion control components in our laser systems for years by combining linear encoder technology along with servo motors for the highest quality engraving at top speeds from a CO2 laser system. We realized that we could take the proven flying optics technology and add the fiber laser technology to produce a unique metal marking laser system for a wide variety of industrial marking applications," stated Stanaway.

Understanding Metal Marking Systems

There are two primary components that make up a metal marking system. The first is the laser source, and the second is the beam delivery method. For many people familiar with metal marking systems there has never been a distinction between the laser source and the beam delivery system because all metal marking lasers used YAG lasers and all beam delivery systems were galvanometer based. Also, flying optics based laser systems have traditionally used only CO2 lasers, so there has been little need until now to make a distinction between laser source and beam delivery. However, with three different types of laser sources and two different types of beam delivery, there is a need to explain how lasers and beam delivery systems are being integrated today to manufacture systems that are more versatile than ever before.

Nd:YAG, Nd:YVO_4 or Fiber Laser

There are three primary laser technologies used for marking metals - Fiber lasers, Nd:YAG, and Nd:YVO. Nd:YAG lasers have been used in industrial marking applications for many years and are probably the most recognized method of industrial metal marking. Nd:YVO and fiber lasers are relatively new to the metal marking industry, but the technology behind the lasers is very well established.

Since the three laser technologies can all mark metal, you can imagine that they all share some commonality. They all produce a laser beam with a wavelength of 1064nm. A wavelength of 1064nm is ideally suited for marking, annealing, vaporizing, and welding metals, and can also be used to mark some plastics and ceramics. Where these three laser types differ is in how they produce this wavelength of light that is so effective with these materials.

Without getting very technical, all three of these common laser types generate a laser beam by first pumping a crystal or other medium with energy in the form of light – typically from a diode source. When the crystal or other medium is excited by the energy from the diode source it in turn lases and produces a single wavelength of light with a wavelength of 1064 nm. This wavelength is invisible and resides in the near-infrared light spectrum. An Nd:YAG (YAG) laser beam is generated by pumping a crystal of Yttrium Aluminum Garnet that has been doped with small quantities of the rare-earth ion neodymium. An Nd:YVO_4 (Vanadate) laser beam is generated by pumping a Yttrium Vanadate crystal that has also been doped with neodymium. The fiber laser beam is generated by pumping an optical fiber (as opposed to a crystal) that has been doped with Ytterbium.

While the wavelength from all three technologies is the same, the system characteristics and the resulting laser beams can differ in significant ways. One of the largest differences is in the maintenance required for the laser source. Fiber laser manufacturers are saying that the fiber laser and diode light sources need no maintenance and have life expectancies as great as 100,000 hours. This lack of maintenance is a result of the fact that the entire system is a solid-state system that does not require any optical alignment or maintenance, any super-rigid mechanical configuration, or any replacement of diode components or lasing rods (crystals).

Galvo vs. Flying Optics

In addition to the differences that are found in the three methods of producing a 1064 nm wavelength laser beam, there are two differing methods of delivering the laser beam from its source to the piece being marked. The first method is achieved by moving a set of optics (mirrors and focus lens) that are attached to an X-Y plotter type mechanism. The laser beam follows the mirror's path in the X/Y directions and is directed through a focus lens that is mounted directly below the last steering mirror. This method of beam steering is called a "flying optics" system because the mirrors and focus lens are moving in two dimensional space. Since the focus lens is mounted to the moving X and Y axis beams of the system, these systems can focus the laser beam over the entire bed of the table and therefore allow for very large work areas – for instance, 24 x 12 inches in the Epilog FiberMark.

The second method of directing the laser beam is to use a set of galvanometers and is referred to as a "galvo" system.. The galvanometers are positioned at a 90 degree angle to each other with a mirror affixed to each galvanometer. The laser beam is directed at a 90 degree angle to the galvo mirrors and the rotating mirrors direct the beam through a fixed field focus lens. Because a galvo uses a focus lens that is fixed in place its engraving area is limited to a much smaller area that is defined by the focus length of the lens. Typical engraving areas for a galvo system are about 2.6 x 2.6 inches to 6 x 6 inches. "All of the fiber systems on the market today feature the galvo design for beam delivery which can offer some benefits in speed and throughput," explained Stanaway. "But they suffer when it comes to piece size, flexibility, ease of use and price. Our flying optics system is a unique format for a metal marking laser system," explained Stanaway. "The FiberMark is the first fiber laser system to feature a large field engraving area with a flying optic design. We decided that it was best for our applications because we were able to take our highly successful flying optics design from our CO2 systems and incorporate fiber laser technology. We've created a metal marking solution that is extremely easy to use, has an enormous engraving/marking area relative to a galvo system, and is affordable even for small shops."

One of the big advantages of the large engraving area in the FiberMark laser is how easy it is to place and position parts. The upper left-hand corner of the FiberMark engraving table is the "Home" or Zero,Zero (0,0) position and the table is an X/Y grid that is referenced from the Home position. Additionally, since virtually all software uses some sort of X/Y grid for character or graphics positioning, there is a one-to-one relationship between where you place objects on your computer screen and where you place the parts. There's no more guesswork about whether a part is positioned properly and there is no need for expensive optical positioning systems that many galvo systems incorporate.

Another advantage that the large format table provides is the ability to palletize as many parts as will fit onto the table and start the laser and let it run until the entire pallet of parts has been marked. Many users develop palletizing methods where they have three pallets – one for loading, one in the laser being marked, and one for unloading. In many cases this allows an operator to run multiple machines which results in reduced operating costs for personnel and provides dramatic increases in productivity. Setup times and changeover times can be almost non-existent, especially for repeat jobs, and parts placement is always predictable and repeatable.

One of the more technical advantages that a flying optics system has over a galvo system is the consistency of the spot size and shape over the entire work area. Since the focus lens in a flying optics system is always at a normal angle to the piece being marked, and is always a fixed distance from the point of engraving, the spot stays the same size and shape whether the engraving is done in the upper-left corner or the lower-right corner of the table. In a galvo system, the distance between the lens and the piece being marked can vary greatly because the laser beam is directed through the focus lens at an angle (except at the exact center of the lens). Depending on the angle of incidence and the quality of the focus lens, the spot size typically grows and becomes oval in shape as the area being marked moves towards

the outer edges of the marking area. This results in lower power density, poorer image quality, and in many cases longer processing times for images where the beam moves away from the center of the focus lens. This change in spot size is one of the reasons that most of the marks you see from a galvo system cover relatively small areas. This is especially true of very fine detailed marks.

With all of these differences in laser marking technology, Epilog would like to invite you to visit www.epiloglaser.com for more information.