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Clean Tech Lasers Promote Superior Welds

Industrial laser systems remove residue, corrosion and existing coatings.

By — Del Williams

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The longevity of low-maintenance laser systems further adds to their value, increasing ROI and making replacement unnecessary for decades.
Source: Laser Photonics

High quality welding begins with cleaning the base metal of any corrosion, contaminants or existing coatings that could compromise weld penetration and integrity. Ensuring the metal is properly cleaned from the start makes the job easier and eliminates the need to start over to achieve a clean weld.

However, conventional industrial cleaning methods like sandblasting, chemical stripping and grinding are messy, involve costly consumables and time consuming for preparation and cleanup. Regulators like the EPA and OSHA are also scrutinizing these methods, which can be potentially hazardous to technicians and the environment.

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Now, for industrial engineers and managers seeking to ensure operational efficiency and cost effective manufacturing, a superior alternative is using industrial-grade, precision laser-based systems. The laser systems can remove contaminants, rust, residues and paint from the weld surface with a high-energy laser beam that leaves the substrate unaffected. Preparation and cleanup time are minimal and the low-maintenance equipment can last for many years.

Vincent Galiardi, the owner of Galiardi Laser Clean, a surface cleaning operator based in St. Charles County, Missouri, points out that many people are surprised to learn that clean technology lasers are the most cost-effective, efficient and safest method of industrial surface preparation.

For welding applications, Galiardi said, “Pre-weld, laser technology can effectively clean the surface so there is no contamination [to interfere with the weld.] Post-weld, lasers can remove discoloration due to oxidation, which can help to improve stainless steel welds.”

Due to its effectiveness in treating metal surfaces, industrial laser systems are increasingly being used in welding applications. Technicians can use mobile handheld units, or the systems can be integrated into automated inline processing lines. With significant advantages in safety and efficiency, laser cleaning is poised to disrupt the welding surface treatment market.

Solving Traditional Cleaning Limitations

Pre-weld, any impurities on the surface of the base material such as grime, residue, corrosion, mill scale or old coatings will compromise the weld’s effectiveness. Any contaminants can interfere with the process, cause resistance or result in a weld splash when small metal particles become airborne or remain loosely attached to the welding area. Contamination on a weld’s surface leads to porosity or bubbles of trapped gas in a finished weld that can weaken its mechanical properties and requires rework.

Post-weld cleaning is also necessary, particularly for stainless steel. Stainless steel offers natural corrosion protection through an ability to “passivize” itself if the environment provides enough oxygen to repair a surface film comprised of chromium oxide. However, welding can cause a “heat tint” – a discolored, thickened top layer on the stainless steel around the weld bead within the heat affected zone – that compromises the corrosion resistance. Removing the heat tinted top layer is necessary to restore the full corrosion resistance as well as aesthetic value of stainless steel.

For treating weld surfaces, sandblasting, chemical stripping or grinding are often used as industrial cleaning processes but have limitations.

Sandblasting involves forcefully projecting a stream of abrasive particles onto a surface, usually with compressed air or steam. The silica sand used in abrasive blasting typically fractures into fine particles and becomes airborne, which can cause serious or fatal respiratory disease. Sandblasting is also time-consuming to clean up

since the sand essentially scatters everywhere, even though it is usually considered a "fast" method of cleaning.

Chemical stripping typically utilizes harsh, even toxic chemicals or pastes to strip welds and metal-based objects of contaminants, rust and paint to bare metal. However, for operators, exposure to corrosive acids and noxious chemical fumes is inherently dangerous. The process can also be time-consuming to prepare, achieve the required level of cleaning and dispose of the waste. In addition, disposing of toxic chemicals is costly and closely regulated.

An angle grinder can remove large contaminants and a sanding disc can remove rust, paint and mill scale. However, the aggressive nature of the grinding can quickly ruin the metal to be welded if great care is not taken. Disc grinders basically just chip off the rust and it becomes airborne and makes a mess. Grinders can also be dangerous because sparks or debris can shoot off the wheel or catch an article of clothing.

Laser Cleaning Promotes Safety, Operational Efficiency

For industrial engineers and managers, laser-based systems have significant advantages over conventional methods, including ease of use in which an operator simply points and clicks a high-energy laser beam at the surface. The substrate is not affected by the laser, and the systems do not create any mess or byproducts. The approach is eco-friendly, energy-efficient and completes the job in half the time of traditional methods including preparation and cleanup.

"Laser cleaning is as fast at removing rust or old coatings as other methods, but without the same amount of cleanup," said Galiardi. "When we treat a surface with lasers, any fumes or dislodged particulate is extracted into a HEPA filter and the job is done. There is no media [sand, chemicals] to replenish or clean up."

He notes that Galiardi Laser Clean uses laser systems made by Orlando, Florida-based Laser Photonics, a provider of patented industrial grade CleanTech laser systems for cleaning and surface conditioning. The American-made systems function either as mobile standalone units or can be integrated into production lines.

The laser systems are available in portable and stationary models ranging from 50 to 3,000-watts (a 4,000-watt version is in development) with chamber sizes from 3' x 3' in size to 6' x 12'. The systems can also be installed in manufacturing lines in cabinets or operated by a robotic arm.

Laser treatment of metal surfaces can be used to streamline weld cleaning processes even in relatively remote areas in the field, according to Galiardi.

He relates how he used a portable CleanTech laser system for a welding project for the iconic skywalk at the Grand Canyon. The skywalk extends over the rim of the Grand Canyon and provides a clear view thousands of feet to the canyon floor below.

"When I did the skywalk job at the Grand Canyon, I removed paint [from the skywalk welds] with the laser system to allow non-destructive testing of the welds [before

repainting]. The system's portability made it quick and easy to use in the field without the cleanup or safety issues of conventional cleaning processes," said Galiardi.

For industrial engineers, managers and technicians, clean laser technology is now an environmentally friendly alternative to abrasive blasting, chemical stripping and grinding for pre and post weld surface cleaning. The approach is safer for technicians and highly adaptable to a wide range of welding applications.

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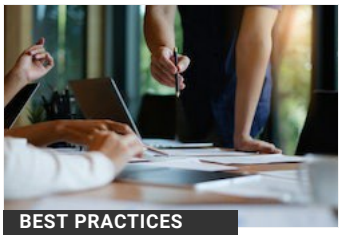

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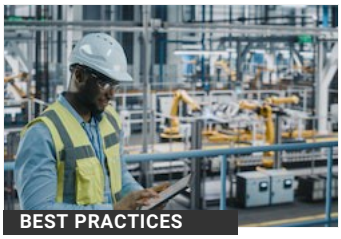

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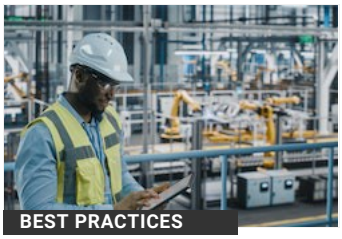

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