Perfect Laser Technologies

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Fiber laser cutting with compressed air. Is it practical?

In fiber laser cutting, the assist gas used plays a major role in ejecting molten material through the beam kerf path. Depending on which metal is being cut, either a reactive gas (like Oxygen) or a non-reactive, or inert gas is used (like Nitrogen or Argon).

Assist gas generally maintains constant material removal by being involved in the reaction (if reactive gas is used - an exothermic reaction), or to blow out the melted metal (if inert gas is used).

Nitrogen is still the assist gas of choice when it comes to laser cutting applications in which high-quality edges are required or blemishes are not allowed on the surface area near the edge, but air as an assist gas may make sense for other applications.

If you laser cut metal for a living, you will be familiar with assist gas. You may know that nitrogen and oxygen are the most popular of these gases, and you may have even heard that compressed air is a cost-effective alternative. Is it?

Lasers do not rely strictly on a light beam for cutting. Rather, the process includes the injection of an assist gas at the nozzle. The introduction of nitrogen, oxygen, or air helps transfer heat more effectively than the beam alone. Cutting thicker mild steel requires oxygen for the exothermic reaction that literally melts the steel before blowing away the molten part. Thinner mild steel (up to 3mm) can be accomplished with nitrogen or air, but at a lower speed. Compressed air carries with it a substantial return on investment for those cutting stainless steel.

Initially oxygen was the most popular gas for the laser cutting process. Later it was discovered that nitrogen produced a cooler cut, resulting in cleaner edges, perfect for industries where aesthetics and edge quality were critical. While nitrogen remains the most widely used laser cutting gas, compressed air is proving to be an effective and cost-saving alternative for a growing number of companies. Air is, after all, approximately 78 percent nitrogen, with the rest consisting primarily of oxygen. The goal with compressed air cutting is to use this high concentration of nitrogen while at the same time leveraging the added benefits of substituting a slightly more diluted gas.

The intense heat of fiber lasers, combined with injected air, creates cuts without producing an oxide formation on the cut surface. This means that secondary cleanup operations are significantly reduced or even eliminated.

As any laser operator using nitrogen will tell you, it is an expensive gas. In some instances, the cost of the gas alone can be as high as 90 percent of the total operating cost. Air is considerably less expensive than both nitrogen and oxygen.

While clearly not the best gas in all instances, generally speaking, air produces a laser-cut edge quality that almost compares to parts cut with oxygen or nitrogen. If nitrogen edge cut quality as a 10, then the edge quality from compressed air would be about a 7. Compressed air edge quality is more than satisfactory for most powder coatings to adhere to, eliminating the need for secondary cleaning operations.

There are, however, times when nitrogen remains the best gas choice. Nitrogen produces a cleaner cut. Additionally, some cosmetic parts cannot show any blemish whatsoever. Again, these types of parts would not be candidates for compressed air cutting, as oxidation on the surface may be an issue. Because the cutting is done with air and oxidation is already on the surface, which continues to react and will affect the original property of the material.

Compressed air also requires proper maintenance of your air generation setup, or the optics in the cutting head may fail sooner than expected. So is compressed air the best choice for your laser cutting operation? The short answer is maybe. It all depends on the industries you serve and how important edge quality is to you and your customers.

The bottom line is that when edge quality is absolutely critical, nitrogen remains the best option. It produces cooler cuts and is an inert gas, meaning that there is no chemical reaction when cutting stainless steel. This prevents oxidization from occurring, leaving a clean, shiny edge that eliminates secondary descaling operations. Although an initial investment for the proper equipment is necessary, you should be able to generate sustainable cost savings while boosting productivity.

While air is certainly not the optimal assist gas in all cases, it is an efficient and cost-effective alternative for many. Take a look at the parts you cut, and investigate how much you are spending on assist gas. Run some tests and determine for yourself if the answer to increased productivity and profitability isn't literally all around you.

What compressor to buy?
You must have a screw compressor with a large capacity tank. Maximum pressure of 16 Bar, and air displacement of one cubic meter per minute. An ordinary compressor with a smaller capacity will not work, as the quality of air and the amount of pressure may not be sufficient to achieve a satisfactory result, and frequent switching will be detrimental to productivity. The compressed air supplied to the laser cutter must be dry, clean, and oil-free.

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