LASER CUTTING WITH PURE COMPRESSED AIR

Laser cutting is a popular technique for cutting metal profiles, especially for stainless steel and carbon steel due to higher cutting speeds with exceptional quality.
Different gases can be used based on their properties and how they affect cut quality. Most laser cutting of stainless steel uses nitrogen at 16 bar that is injected coaxially with the laser beam to blow away molten metal without leaving any oxide build-up on the cut surface. Not every application can benefit from using 95 percent pure nitrogen. There are still situations where the metallurgy of the material, the part's process to follow, or where the part is to be deployed requires 99.999 percent pure nitrogen.

This is an industrial process that is becoming increasingly common, alongside high-definition plasma cutting. The commonly used gas. Nitrogen is a relatively expensive gaseous form. An alternative to pure nitrogen is the use of perfectly conditioned compressed air, provided the correct compressed air configuration is used, more details below. The obtained high-quality compressed air, which finally consists of 78% nitrogen, is the perfect and less expensive alternative

When cutting with compressed air, the presence of oxygen causes an exothermic chemical reaction, which releases heat, increasing cutting speed, but also leaving a slightly tinted brown rash on the edge. (Pickling removes this, by the way)
Apart from this slight discolouration, the edge is fine. It was also noted that cutting speeds vary between compressed air and nitrogen. Using compressed air as the auxiliary gas produces a higher cutting speed than that of nitrogen. The results obtained show a cutting speed at production level of 3.6 m/min with compressed air and of 2.8 m/min with nitrogen. This on profiles of 5.0 mm. In general, nitrogen provided a cleaner cutting surface than with compressed air, but the speed was noticeably lower with nitrogen. Certain grades of aluminum cut faster and with a better edge finish with compressed air as a pilot gas than with the more expensive nitrogen.

In addition, the compressed air support only requires 10 bar of air, compared to 16 bar with nitrogen. In contraction, when using nitrogen as the auxiliary gas, there is no chemical reaction at the cutting edge. Instead, nitrogen does protect the metal rim, resulting in a shiny rim. Now, with a rather small and targeted investment in a compressor and ditto dryer, apart from the slight discolouration, which for many applications does not in any way affect the quality (because welding takes place), a considerable saving is achieved on laser work, compared to the "traditional" auxiliary gases.

The laser energy is brought tightly into the focal point and the introduction of compressed air creates a plasma ball on the surface of the material, similar to that of a CNC plasma cutter using electricity. The plasma transfers heat more effectively than the beam alone. In general, compressed air is an essential component for the operation of a CO2 laser machine. Low to medium pressure air is used as a blast purifier in the jet delivery system to prevent external contaminants from entering the enclosed jet path, causing changes in shape, size and

propagation characteristics of the laser beam itself. An additional benefit of the blast purge air is that the optics of the beam delivery remain cleaner, extending the life of the mirror.

Importantly, cutting with compressed air practically produces a cut approximately equivalent to workpieces cut with nitrogen. The cut edges are perfect enough to adhere most powder coatings, eliminating the need for secondary cleaning. When compressed air was first used for laser cutting, the size of the resonator was a major limitation. Thanks to high wattage lasers - those of 4000 W and above - air-assist is now an efficient method for cutting steel, stainless steel and aluminum up to 3 mm thick. Lasers with 6000 W resonators can cut material up to 9 mm. In the early days, the possibility of cutting with air support was tested for its feasibility, after an intensive test period to determine which materials and thicknesses would work best.

For example, it was assumed that the low compressed air quality would be a limiting factor, so the first tests were carried out with medical breathing air to assess the first results. The first tests were carried out with compressed air at 7 bar, provided an absorption dryer with a dew point of -40C°. After several days of testing with many parameters, the result was more than decent, the aim was to obtain a workpiece that can be welded without further processing. We need a nice, clean edge for a good weld, and that is achieved on the fiber laser with 10 bar compressed air support for a perfect result, and this in thickness from 1.0 to 7 mm in 304 stainless steel, but 316 and various other Ferro and non -ferrous.

In addition to higher productivity, the result is a significant saving of 90% on cutting costs, and therefore a better margin. The required compressor is sufficient with 15 hp, the scroll 16 bar (working pressure 10 bar) is the most suitable compressor for this, count on a cost price of 5 euros per hour! Ultimately, the ability to provide customers with a faster lead time from raw material to finished part with an edge quality that eliminates the need for secondary processing will keep customers coming back to place repeat orders.

A tip add a cover for above and below the lens that extends the life of the lens indefinitely. Also a very important cost factor