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Simple Tips to Longer Consumable Life

By Kent Swart

Plasma systems come in many makes and sizes ranging from the portable 30 Amp units to the automated, high-precision systems that can cut up to 6" material with a 100% duty cycle. All plasma systems use consumables that have an expected life. In high-use environments, the cost of consumables can become considerable over time. However, knowing what causes pre-mature wear and how to prevent it can help extend the life of your consumables. Depending on the manufacturer, plasma consumables carry many names and include: cutting/gouging tips, electrodes, swirl rings, gas distributors, shield cups, and start cartridges. This article will focus on the most common issues effecting premature consumable wear.

Precision machined pathways ensure proper gas management. Most manufacturers recommend using filters to prevent contaminants from entering the torch and clogging passageways.

Tips

Plasma tips are designed and machined to very tight tolerances in order to optimize the pilot and cutting arcs. Anything that alters the physical characteristics of the tip will have a detrimental effect on its performance and parts life. Most "tip" issues stem from the blockage or expansion of the tip orifice. Blockage results when molten material cools and hardens as it comes in contact with the tip. If located near the orifice, it could alter the plasma flow resulting in poor or degraded cutting capacity. This most commonly occurs while piercing. Moving the torch slightly away from the material after the pilot arc transfers, then slowly lowering as the piercing-hole gets deeper, will reduce material build up on the tip. For manual applications, the torch can be tilted slightly (off perpendicular to work piece) so the material is forced away from the torch tip.

Performance will also be affected if the tip orifice becomes distorted, enlarged, or out-of-round. Orifice distortion can be attributed to several issues. One of the more common causes is excessive piloting. This refers to the amount of time the arc is initiated prior to transferring to the work piece. This will erode the orifice exit, allowing the arc to widen and diffuse prematurely.

Another likely cause of orifice distortion is improper edge starting. "Edge starts" should be performed using a "roll in" technique, holding the torch at a slight angle when the arc is initiated and the top edge of the work is cut first. Once the arc transfers, the torch should be moved to a perpendicular position as it moves along the cutting plane. This method ensures that the tip is in the appropriate position when the arc transfers and that the plasma stream flows straight out of the tip orifice. If for example, the tip is below the work surface when the pilot is initiated, the arc could transfer and force the plasma stream to the side. This angled flow direction will "blow out" the tip as the orifice becomes more oval or enlarged. Once the tip suffers this effect, performance will begin to deteriorate at an increasing rate and the tip will have to be replaced to regain full cut capacity and performance.

Proper tip sizing will also help operators reach the expected life of plasma consumables. Most modern plasma systems have operator-selectable amperage output. Cutting thicker material requires higher-amperage consumables and output setting. Moving

from thinner material to thicker is not as easy as increasing the cutting amperage, an operator must also ensure that the appropriate consumables are in place to match the application. Using lower-amperage consumables with a higher-amperage setting will result in an enlarged tip orifice, loss of cut quality/capacity, and part failure. Failing to properly size the consumables to the application will accelerate normal consumable wear.

Lastly, excessive heat built up at the tip will also accelerate tip wear. Plasma systems are designed to move gas over the electrode and out of the tip orifice in a swirling motion. This swirling motion allows the plasma stream to be centered around the electrode. This also ensures that the cutting arc exits the tip centered in the orifice. As mentioned earlier, having the plasma stream off-center will prematurely wear the tip orifice.

Gas flow through the tip also helps to dissipate heat and prevent excessive built up which leads to premature wear and failure. Anything that impacts gas flow through the torch will have a detrimental effect on performance and consumable life. Heat dissipation is even a larger issue with automated systems where amperage levels and duty cycles are much higher than that of manual plasma units. While automated systems use liquid-cooled torches, there should be a heightened level of concern for cooling to be functioning properly as the cost of consumables is much higher. Coolant should be free of contaminants, filtered properly, and changed on a regular basis to provide proper cooling. (Note: coolant is a specialized mixture. It is not simply tap water.)

Manufacturers often recommend that incoming gases are “Dry & Clean”. Foreign contaminants can reduce efficiencies by clogging critical passageways through the torch. These passageways can be found in tips or “swirl rings” but are critical to the performance of the plasma system.

If incoming gas is humid or “wet”, it can cause excessive built up of contaminants as the water is exposed to excessive heat, becomes vaporized, and leaves deposits on the consumables. Normally found on the electrode and the interior of the plasma tip, damage caused from moisture first appears on the electrode in a “swirl” pattern. As operation continues, the electrode can become covered in black deposits and performance will eventually be reduced. When this occurs, the consumables will need to be replaced.

Electrodes – both new and worn, showing signs of possible moisture in the incoming gas. Excessive moisture will alter the characteristics of the plasma stream degrading performance. The use of a filter is recommended with some manufacturers advising air dryers.

Conclusion:

The variables that effect consumable life are not limited to the ones described in this article but keeping these concepts in mind when programming your automated application or running your manual plasma system will help extend the life of your consumables…and reduce your cost.

A. Minimize slag build up by using good “Piercing” technique

B. Minimize pilot time prior to transfer

C. Use proper technique for “Edge Starts”

D. Assure proper cooling by using “Dry & Clean” air and proper gas distribution

Once the damage occurs or wear has been identified, changing the consumables will restore the system’s cut capacity/performance.

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