THE ABCs OF PAC
Understand All Aspects Of The Process To Ensure Better Performance

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Precision plasma technology provides many operational benefits, including control of cut surface quality, minimal distortion, and precise control of the significant taper on the cut surface (see Figure 1). Several considerations should be taken into account when selecting a precision plasma cutting system for your application, but before you do that, it is useful to understand the basics of plasma cutting.

Plasma Arc Cutting Defined

Plasma arc cutting (PAC) can be defined as an electric arc cutting process that severs or cuts metal by melting a localized area with a constricted arc that removes the molten material with a high velocity jet of extremely hot, ionized gas emerging from the constricting orifice in the torch.The high-velocity plasma arc melts and removes the base material. PAC can be used to cut any electrically conductive metal if its thickness and shape permit full penetration by the plasma jet. Typically, materials up to 3 inches thick can be cut. PAC also can be used to cut nonferrous base materials such as aluminum and copper. Cutting speed is increased on ferrous metals that are less than 3 inch thick.

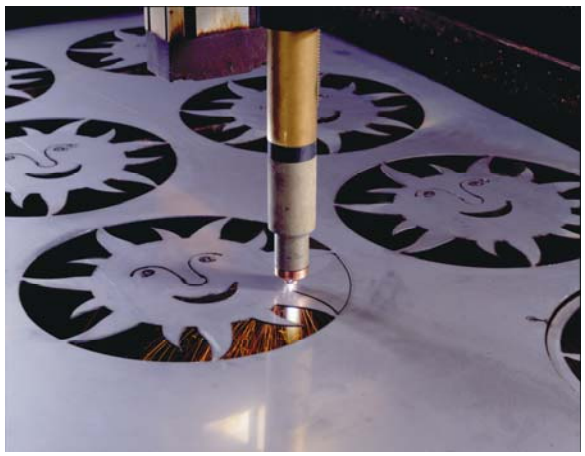
Figure 1: PAC does a nice job of cutting parts with irregular shapes.

Types Of Plasma Cutting

Conventional PAC. With this process, the arc is constricted only by the nozzle,and typically no shielding gas is added.The plasma gas usually is nitrogen or air, which is fed into the torch around the electrode. The electric arc is established between the nozzle and the substrate (transferred arc). Cutting capacity is reduced by up to 25 percent with the use of nitrogen when compared with air, but torch life is enhanced by the use of nitrogen, sometimes as much as 300 percent when compared with air. If air is to beused, steps should be taken to ensure that it is oil and moisture free.

<u>Oxygen Plasma Arc Cutting</u>. This process utilizes oxygen as the plasma (orifice) gas instead of nitrogen or air. The use of oxygen as the plasma gas produces an exothermic reaction that increases cutting speed. Oxygen plasma arc cutting is used primarily for mild steel.

<u>Underwater Plasma Arc Cutting</u>. This technology is ideally suited to numerically controlled shape cutting. Underwater cutting helps to eliminate the ultraviolet radiation and fumes associated with conventional PAC. In underwater PAC, the substrate being cut is supported on a cutting table, with the top surface of the plate 2 to 3 inches beneath the surface of the water. A device that locates the submerged metal is critical to this fully automated process. Accurate height control is maintained by a sensor that monitors arc voltage. This method is not recommended for cutting aluminum because the hydrogen that is generated as a byproduct may be trapped under the plate, creating the potential for an explosion.

Precision Plasma Arc Cutting. Also called high-definition PAC, precision plasma arc cutting uses a nozzle design intended to increase arc constriction and energy density. Because of the higher arc energy, cut edge quality and squareness may be improved, particularly on material less than 3/8 inches thick.

Gas Flow

The orifice gas often has a lower flow rate than the shielding gas, but both can vary as changes in cutting current are made to accommodate different base metals. Most PAC equipment uses an orifice gas with no shielding gas.Gas flow with most PAC systems is controlled by a gas pressure regulator and a flow meter. Precision gas flow panels are essential for the successful operation of HyDefinition systems.

System Selection

To make the best PAC system selection for your specific processing needs, take into account the following factors:

The Gantry. A robust gantry with dual side AC drives will increase reliability, improve arc length control, and have a tightwork envelope. A strong beam will reduce torch rocking, and improved drive technology will enhance torch positioning.

Gas Delivery. An optimized gas delivery system will match the operational duty cycle and type of material to be cut. It is possible to save on plasma gas costs with membrane nitrogen as the gas supply.

CNC. Optimized operating software will increase uptime and reduce scrap rates with features such as automatic plate alignment and uptime reporting. It also should allow job programming during operation.

Flexibility. A system that is capable of multiprocess work, such as oxyfuel and plasma cutting, will maximize system flexibility.

Pressure and Gas Flow Requirements.Use cutting charts supplied by the torch manufacturers, and follow the recommendations for pressure and tip size for the base metal being cut. The correct plasma gas pressure and flow control help to optimize process performance, which is critical for HyDefinition plasma technology.

Equipment Enhancements. High-quality equipment, such as a high precision torch positioning system, will maintain a consistent torch-to-work distance. Cut quality and consumable life also will be improved.

Consumables. High-speed plasma consumables enhance cutting travel speeds and will lower production costs (see Figure 2). Other important considerations are local service and repair, local inventory of plasma arc consumables, automatic feeding of the base material, downdraft technology for fume control, and remote programming for multiple locations.

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