Making an Educated Decision on Automated Plasma Shape Cutting Machines *-by Oliver Osterhues*

Whether you are a first time buyer or have existing installations of plasma and/or oxy-fuel shape cutting systems, continuous advancements in technology and a growing landscape of low-cost manufacturers and integrators has clouded the automated plasma shape cutting machinery landscape.

Plasma cutting is the result of introducing an electrical arc through a gas that is blown through a nozzle at high pressure, causing the gas to turn into plasma and producing a focused flame that reaches temperatures of 50,000 degrees Fahrenheit. Automated plasma cutting systems are classified as either conventional or precision (high-definition), based on the characteristics of the cutting flame. Precision plasma systems are capable of producing parts to tighter tolerances, achieving faster cut rates, and producing less kerf and bevel than conventional plasma systems. The cost of these units can also be significantly higher than conventional plasma systems. It is therefore extremely important to properly match the shape cutting machine with the appropriate plasma cutting system.

One of the most common and costly pitfalls buyers encounter is when manufacturers or integrators mismatch machines and power sources. This is often the result of manufacturers not taking the time to understand the buyers' requirements, having a limited or single-product line of machines, limited OEM access to power sources, and a lack of industry/application knowledge. The manufacturer will then sell with a focus on lowest price instead of lowest cost of ownership, highlighting the strong point of the plasma system or the machine without regard to the limitations of the other. The best precision plasma power source available will not provide users with the desired cut quality and accuracy if it is not mated to an appropriate base machine.

There are many types of plasma shape cutting machines available in the market today. The most common machines are bridge or gantry style machines made from either fabricated steel or extruded aluminum. Construction of the machine is extremely important relative to your application. Machines constructed of extruded aluminum are typically considered to be "hobbyist" or "artisan" machines and most appropriate when doing a limited amount of cutting or when cutting light gauge materials. The plasma and oxy-fuel cutting processes create large amounts of heat which is retained in the materials being cut and can cause deflection or warping of aluminum machine components traveling over the hot cutting surfaces. Fabricated steel machines are highly recommended for any type of continuous cutting process, cutting of plate steel, and where auxiliary oxy-fuel torches may be used. Auxiliary heat shields may also be available to further protect the machine and components from extreme heat conditions.

Cutting machines are available with a variety of drive systems including single side drive, single-motor dual-side drive, and true two-motor dual-side drive systems. A well constructed single-side drive system or single-motor dual-side drive system will perform extremely well in conventional plasma applications. The benefit of the extra precision offered by two-motor dual-side drive systems will not be realized in conventional plasma applications due to the limitations in the precision of the conventional plasma cutting process itself. Two-motor dual-side drive systems will provide the accuracy and performance required to achieve optimal results from a precision plasma process.

Sizing of the motors and gear boxes relative to the mass of the machine is also extremely important. Undersized motors and gearboxes will not be able to effectively change the direction of the mass of the machine at high traverse and cut speeds, resulting in un-uniform cut quality and washed-out corners. This not only affects the cut quality, but will also lead to premature motor failure.

The CNC control is the unit that ties together all of the functionality and features of the machine and plasma source. There are basically two classes of controls used on most of these machines today. Most industrial applications use industrial PC-based control systems such as those produced by ***Burny*** or ***Hypertherm***. These units have user-friendly touch screen control panels and are housed in enclosures that can stand up to the harsh environments they operate in. Smaller machines of the

“hobbyist” or “artisan” types often utilize standard PC’s with I/O cards to control the drives and plasma systems. Industrial based controls are highly recommended for any application, are designed for industry specific requirements, are less prone to the typical PC problems, but can be cost prohibitive in smaller applications.

Another important, and often overlooked, feature to consider when selecting a machine is the construction of the rail system. Plasma cutting machines produce and reside in a harsh environment. It is therefore important that the components used in the construction of the rail system be robust enough to exist in this environment. All rail surfaces should be constructed of hardened materials and cleaned frequently so that they do not become pitted and gouged by the splatter of molten steel that will inevitably fall on them. Self-cleaning wheels are also a recommended feature to keep the wheels clean between regular preventive maintenance (PM) cycles. Sizing of the rails should also be robust enough to prevent deflection as the machine travels across them.

The combination of all of the above factors results in the precision and accuracy of a system. Unlike other mechanical machining processes, it is difficult to assign a standard tolerance to plasma cutting processes. Many manufacturers will strongly promote the fact that their machines have positional accuracy of +/-0.007” and repeatability of +/-0.002”. The fact is that just about any machine on the market can hold tolerances that far exceed the tolerance and capability of the plasma cutting process itself. There are many factors that will influence the cut quality you will achieve on your parts including: the characteristics of the part itself, power settings, consumables, gases used, material type, gauge/thickness of material, part layout on plate, etc.. Ask the manufacturer to provide you with cut samples of your parts or parts that closely approximate the parts you will be cutting, made on a machine/plasma combination that is comparable to what you are looking at. This will give you the most realistic representation of what to expect from a specific machine/plasma combination and the plasma cutting process itself.

Before talking to any cutting machine manufacturer, clearly identify your requirements:

1. Identify the types of materials will you be cutting with your system (ferrous/non-ferrous, mild steel, stainless steel, aluminum, etc.).
2. Identify the range of material thicknesses you will be cutting.
3. If you will be cutting a variety of materials and thicknesses, estimate the percentage of each type and identify the primary types and thicknesses.
4. Determine the size (length, width, and thickness) of plate you will be purchasing in order to properly size the table, effective cutting area, and weight capacity of your new system.
5. You may also want to look to the future in anticipation of any future types and sizes of materials you may need to process. The upfront cost of anticipating these requirements may be substantially less than upgrading or retrofitting your system in the future.
6. Identify the tolerances you will need to maintain. This will help determine whether you need a conventional or precision plasma system, as well as the type and construction of the base machine.
7. Determine how many hours-per-day and days-per-week the machine will be used. This will determine the type of base machine construction you will need, help estimate the cost of operation, and allow you to compare the cost/benefit of consumables life of various manufacturers’ power supplies.
8. Determine how you will exhaust your equipment. Water tables do not require exhaust systems, but down-draft tables do. If there is an existing exhaust system in place, identify the capacity of the system in cubic feet per minute (CFM).
9. Determine if you will need the flexibility to expand the system or add additional plasma and/or oxy-fuel cutting stations in the future. Some machines are capable of only carrying one or two torches, while others can accommodate slave stations for up to a combination of 10 plasma and oxy-fuel torches. Likewise, some machines have fixed cutting areas while others can be extended in length to increase cutting area or accommodate multiple cutting tables.
10. Define the area in your facility where the machine will be located. Make note of any obstructions, hazards, or access points that will need to be taken into consideration when

laying out the new system. Also, identify how your material will be handled in and out of the area (forklift or crane, aisle locations, etc.).

11. Identify the power you have available, both voltage and amperage.

A reputable manufacturer should ask you for most of this information before making any proposals on a system. If a manufacturer does not have this information, they cannot adequately evaluate your requirements and propose a system that will best work for you and your specific application. Spending the time to identify your requirements up front will not only save you countless hours of frustration resulting from living with the wrong machine, but also save you money by not over- or under-buying a system to meet the requirements of your specific application.

Full product line manufacturers of CNC plasma shape cutting systems, such as C&G Systems in Itasca, IL (www.cgsystems.com) , offer a full line of machines from entry level units all the way up to precision and large format machines. Their full in-house staff of sales/application, electrical, mechanical, and manufacturing engineers will take the time to understand and custom build a solution around your requirements. They are approved OEM suppliers for automated plasma cutting manufacturers such as ***Thermadyne***, ***Kaliburn***, and ***Hypertherm***, giving them access to and the ability to customize application-based solutions with products from the leaders in the industry. A large installation base of machines and a nationwide staff and network of service technicians assure that customers receive the training, support, and service they need to get the most out of their plasma cutting investment. Call C&G Systems today at (630) 467-0600, to consult with one of their highly qualified sales representatives.