

Plasma FAQs

Use this guide to assist you in your Plasma Cutter requirements

Buying A Plasma Cutter

Find information regarding Air Plasma definitions, types of metal and applications best suited for plasma cutting, necessary air requirements, purchasing assistance, skill needs and safety information.

Plasma Cutting VS Oxyfuel

Discover the advantages over Oxyfuel, basic costs and users for car restoration.

Power Requirements

Read about voltage requirements and generator options.

Maintaining A Plasma Cutter

Read about consumable and maintenance questions.

{mospagebreak title=Buying a Plasma Cutter}

Q: What is Air Plasma?

A: Plasma arc cutting is a process where an open arc, much like in TIG welding, can be constricted by passing through a small nozzle, or orifice, from the electrode to the work-piece. The gas used, typically air, combines with an electrical current to create a high temperature plasma arc. When placed in contact with an electrically conductive material, the arc passes through the metal, melting a thin area. The force of the arc pushes the molten metal through the work-piece and severs the metal.

Q: What types of metal and applications can be used with a Plasma cutter?

A: Plasma will cut any metal that is electrically conductive including steel, aluminum, copper, and stainless steel. Keep in mind that your cut will be de-rated a little with the softer metals like aluminum, copper, and stainless. Rating refers to the thickness a plasma cutter can cut at a rate of 10 Inches Per Minute.

Q: Is there a lot of skill involved with Plasma cutting?

A: No. Depending on what you are cutting and a steady hand there is not a lot of training involved to operate a Plasma cutter. The torch should remain at a 90-degree angle and depending on the machine you can keep a standoff or drag either the tip or the drag shield on the metal.

As far as controls on the machine there are only two, which include the on/off switch and the amperage control. The on/off speaks for itself and the amperage is only going to change when you want to cut thicker material, but most operators will leave the amperage switch on full output for all thickness of metal.

Q: What are the necessary air requirements?

A: Compressed air is the most popular gas used for plasma cutting. You can use an air compressor or a bottle of compressed air. The CFM (Cubic Foot per Minute) is important because that is the amount of air that will be distributed per minute and will keep your Plasma machine running consistently. The PSI (Pounds per Square Inch) is the actual air pressure required to operate the machine. All machines need different PSI and CFM. For instance the Miller Spectrum 375 requires 4.5 CFM at 60 PSI to achieve a 3/8-inch rated cut, while the Spectrum 375 X-TREME requires 5 CFM at 90 PSI.

The other gas used is nitrogen, but the only advantages to using it are when cutting stainless steel. You will get a cleaner cut but the cut thickness will be diminished a little. With some exotic metals a gas mixture may be needed.

You will also want to have dry air when operating a plasma cutter. Miller offers a couple of Dryer/Filters that are designed to keep the air dry and clean. Dry air is important because if there is moisture in the line it will travel with the air and exit the end of the torch. This is not necessarily dangerous but will shorten the life of your consumables because the arc will follow the moisture in all directions and erode the tip prematurely.

Q: How big of a Plasma cutter do I need to buy?

Start by determining the type and thickness of metal you'll be cutting and the desired cutting speed. Miller uses three standards: rated, quality and sever cuts. A rated cut is the thickness of mild metal that an operator can manually cut at a rate of 10 inches per minute (IPM). A quality cut is rated at a slower speed but on thicker metal. A sever cut is the maximum thickness a plasma cutter can handle. The travel speed is slower and the cut may require clean up.

For instance, at 10 IPM the Spectrum 1251 with an output of 100A @160 VDC is rated for a mild steel thickness of 1-1/4" . By slowing the travel speed, the operator can achieve a quality cut on a thickness of 1-1/2" . At a slower travel speed, the same machine can achieve its maximum cutting thickness of 1-3/4" .

An example of cutting capability. The above is for an inverter -based plasma cutter with an output of 25-55A @ 110VDC. Each model's cutting capability can be found on its product pages or specification sheets.

Q: What kind of input power will I need?

A: Miller Spectrum plasma cutters have a wide range of power options.

The Spectrum 125C is available in 115V or 230V options. The Spectrum 375 and Spectrum 375 X-TREME can operate off 115V or 230V. The Spectrum 375 X-TREME can easily switch between the two, since the operator only has to choose the correct Multi-Voltage Plug for the receptacle.

Both 375 models as well as the Spectrum 625 (230V) offer Line Voltage Compensation, (LVC™), which allows the voltage to vary by +/- 10 percent without affecting output. This will be an important consideration if you're work area is subject to dirty power or brownouts.

Others can automatically adapt to a wide range of voltages, single or three-phase and compensate for power fluctuations in the supply. The Spectrum 2050, Spectrum 1000 and Spectrum 1251, using Auto-Line™ technology, can accept input voltages ranging 190 through 630 V, single- or three-phase, 50 or 60 Hz. This means you can plug this plasma cutter in anywhere in the world. Even with brownouts or other power fluctuations, as long as the voltage stays anywhere in that range, the cutting quality is unaffected.

These types of units are especially suited for working in the field, using an engine drive's auxiliary power. In the field, units without this type of technology are prone to erratic cutting arcs, frequent breaker trips and blown circuit boards because they can place a load on the line such that voltage levels drop below the plasma cutter's operating range.

Q: What about portability?

A: In addition to the ability to work with available power supplies, consider the plasma cutter's weight and size. All of Miller's plasma cutters weigh less than 100 lbs. (The Spectrum 625, Spectrum 375 and Spectrum 125C all weigh about 60 lbs.) Miller offers the No. 30A Economy Cart for these machines.

For the ultimate in portability, the Spectrum 375 X-TREME weighs only 18 lbs. and comes with its own shoulder strap to allow the operator to easily carry it.

Q: What safety procedures do I need to follow?

A: Proper welding clothing should be worn, as well as a number 5 or 6 shade full-face shield. Good ventilation is a must just as when you are welding. Be aware of potential hazards involved with the process including, high voltages, noise, temperatures, flammable materials, fumes, ultraviolet radiation and molten metal.

{mospagebreak title=Plasma Cutting vs Oxyfuel}

Q: What advantage does Plasma have over Oxyfuel?

A: Plasma cutting provides numerous advantages over Oxyfuel. It cuts faster; does not require a pre-heat cycle; produces a small and more precise kerf width (the width of the cut); and has a smaller heat-affected zone, which prevents the surrounding area from warping or damaging the paint.

The Plasma process also cuts any type of electrically conductive metal (the Oxyfuel process cannot cut stainless steel or aluminum). Plasma cutting is a cleaner, less expensive and more convenient method of metal cutting because clean, dry air is used for most plasma cutting applications.

Q: What are the basic costs involved in Plasma vs Oxyfuel?

A: To get started in Oxyfuel you will need the complete torch set-up costing around \$250. You will need an oxygen and acetylene bottle costing around \$250 to own. The tips that have to be replaced over time will go for about \$5. As you gas bottles are emptied they can be refilled for about \$30 each. After all is said and done you still can only cut steel.

Plasma will require an initial cost \$1100 to \$2000 depending on what size machine you require. After purchasing the machine your air compressor will provide free air so the only additional cost will be tips and electrodes for about \$11 for the pair.

Oxyfuel is going to be less expensive at the start, but as time goes on the purchase of gas, and the limitations will make it more expensive in the long run. Plasma has the initial cost of the machine but after that it is mostly tips and electrodes. So in the long run Plasma is going to be cheaper and more practical for cutting any metal that is electrically conductive.

Q: Is Plasma cutting a good tool for restoring cars?

A: Excellent!! The Miller Spectrum 375 Spectrum 375 X-TREME are both perfect for auto work. Both have a 3/8" rated cut and will sever 1/2". That cut rating will cover anything on a car.

Both models can also plug into 110 or 220V and will give you the same cut off of either input. The difference is portability, which may be a concern if you plan to work in a variety of environments.

Your need for portability may also factor into your decision.

The Spectrum 375 X-TREME is more portable, weighing 18 lbs. compared to the Spectrum 375's 55 lbs. It is also easier to switch between 110V and 220V with Spectrum 375 X-TREME since it uses Multi-Voltage Plugs (MVP). Simply pick the MVP that matches the power receptacle, plug it into the power cord and the unit is ready to go.

What is real nice about plasma is when you're doing body-work you do not have to worry about warping or burning the paint. With plasma, the arc is so hot and tight the heat does not have time to spread out and effect the metal. Plasma is much faster and cleaner than anything else you could use (hacksaw, grinding wheel, etc.)

{mospagebreak title=Power Requirements}

Q: Can I plug a plasma cutter into a 110V outlet?

A: Yes, but only a limited amount of machines. The simple theory of what you put into the machine is what you can get out is true for any mechanical device that requires electricity to operate. The only plasma cutting machines that will run off of 110V will have up to a 27 amp output.

They will have a rated cut of 1/8" to 1/2". Miller offers the Spectrum 125C, which is available for either 110V or 230V and has a rated cut of 1/8" or the Spectrum 375 and Spectrum 375 X-TREME, which will operate off of 110 or 220V and have a 1/2" rated cut with 27amps of output.

The Spectrum 375X-TREME has the added benefit of being able to switch quickly between the two voltages. It uses Miller's Multi-Voltage Plugs (MVP), which can be switched in a matter of moments, depending on the type of receptacle.

Q: What about the higher voltages?

A: The Miller Spectrum 625 is a 208 or 230V machine with 40 amps of output. It has Line Voltage Compensation (LVC), which will give you a range from 176 to 264V. The machine will automatically handle any line fluctuations between those voltages.

The Spectrum 2050, Spectrum 1000 and Spectrum and uses Miller's Auto-Line[®] technology. Auto-Line allows direct connection to ANY primary power level: 50 or 60 Hz, single or three phase, 208 through 575 VAC. Simply connect the power cord to the correct plug or junction box and start cutting. Auto-Line lets you plasma cut at any location, on any job site and in any country without worrying about opening and manually linking the machine or damaging the machine from incorrect hookup.

Q: Can I run a plasma cutter off of a generator?

A: Miller plasma cutters are designed to operate off of generator power. Not all plasma cutters can do this because of the "Dirty Power" produced by generators. Dirty power means that the voltage being produced will fluctuate enough to cause a machine to shut down or even break because of the fluctuation. Miller Plasma machines have LVC or Line Voltage Compensation, which handles fluctuations of plus or minus 15% to perform very well off of engine, driven power.

{mospagebreak title=Maintaining a Plasma Cutter}

Q: What is consumed on a Plasma cutter?

A: There are two parts that will be used up in the torch. The first part is the tip. The tip has a perfectly round hole in the end that will become oblong over time. As it becomes oblong the arc will go to the to the other side and wear the tip even more. At this point it is time to change the tip.

The second part is the electrode. It is located under and inside the tip. There is a rare piece of metal called Hafnium in the tip of the electrodes that breaks off every time the arc is started. When the Hafnium is depleted there will be a 1/16" deep, and round crater in the tip of the electrode. At this point it is time to change the electrode.

Keep in mind that you will still get an arc and will be able to cut, but at a diminished thickness. By continuing to cut with depleted parts you will run the risk of ruining other parts of the torch that should normally last for a long time. Most people change both of these consumables at the same, but in reality you should change two tips to one electrode since the tip takes the brunt of the amperage and arc flowing through the torch.

Q: How do I clean the inside of a plasma cutter?

A: With the Spectrum 125C, 375 and 375 X-TREME, just take the cover off and, using an air-hose blow the components off with a stream of air. With the Spectrum 625, 2050, 1000 and 1251 there is a Miller exclusive called "Wind Tunnel Technology". WTT prevents abrasive dust particles from damaging internal components. There is an actual tunnel through the machine in which the parts of the machine that get hot are placed. All of the electrical components and boards are protected from the dirty air that is drawn into the machine thus extending the life of the plasma cutter. To clean the inside of the machine just take off the louvers on the front and back and use an air hose to blow out the wind tunnel.

Another Miller exclusive is called "Fan on Demand". The fan will only come on when the unit has heated to a certain temperature. This reduces the amount of airborne dust/dirt pulled through the unit, cuts down on the power bill, and reduces noise in your shop.

Miller also offers custom covers for the 125C, 375, 625, 1000, 2050 and 1251. They are high quality covers that fit over the machine to protect your investment from water, mildew and abrasions. Available for the 375 X-TREME is the X-CASE[®], A durable, impact resistant hard case with additional storage space for Multi-Voltage Plugs, consumables, gloves, eye protection and more.