

## 1) Basic Speed and Voltage settings

This is a starter guide to cutting with a Thermal Dynamics CutMaster series plasma cutter. You can use the speed setting as a starting point for your Imported XY Feedrates, and will want to adjust the Continuous Contouring and Max Arc Feedrate to 80%-90% of the XY Feedrate. This will keep the torch at a comparable speed when cutting around arcs and slight direction changes. If these values have a large gap between them the machine will slow down to much in the corners which may distort the shape or dross accumulation. The volts number will apply to the Arc Voltage Height control (AVHC), if you change the switches on the front of the AVHC box to Set and Automatic, you can use the large Set-Volts knob to set these number

\*\*While these are good starting numbers, because every machine is different these numbers can and will vary based on several factors including elevation, material vendors, humidity, and general machine setup. It is always recommended to perform a test cut to determine your correct speed and Arc-Voltage settings, which will be discussed further down in this article\*\*

Always match the amperage setting with the rated tip inside of the machine torch. Failure to do so will cause premature consumable failure and these numbers will have no true bearing on cut quality.

	20A		40A		60A		80A	
Thickness	Speed	Volts	Speed	Volts	Speed	Volts	Speed	Volts
22G	110IPM*	89V	175IPM	92V	-	N/R	-	N/R
20G	85IPM*	92V	150IPM	98V	-	N/R	-	N/R
18G	65IPM*	92V	130IPM*	105V	200IPM	97V	-	N/R
16G	50IPM	95V	90IPM*	108V	150IPM	110V	200IPM	110V
14G	35IPM	95V	70IPM*	110V	130IPM*	111V	195IPM	112V
1/4"	-	N/R	28IPM	110V	40IPM*	111V	60IPM*	112V
3/8"	-	N/R	19IPM	110V	28IPM*	112V	43IPM*	112V
1/2"	-	N/R	-	N/R	15IPM	112V	22IPM*	112V

\* Recommended for best Speed/Quality Ratio

Thicker materials receive better cut with higher amperage tips. If the amperage is too low the tip may not pierce entirely or leave too much bevel on the side.

Thinner materials are better cut with a low amperage tip. If the amperage is set too high, the kerf width will suffer dramatically, and the Arc Voltage Height Control will have trouble maintaining a specific height. Also higher amperage tips will produce more heat and cause the material to warp quicker.

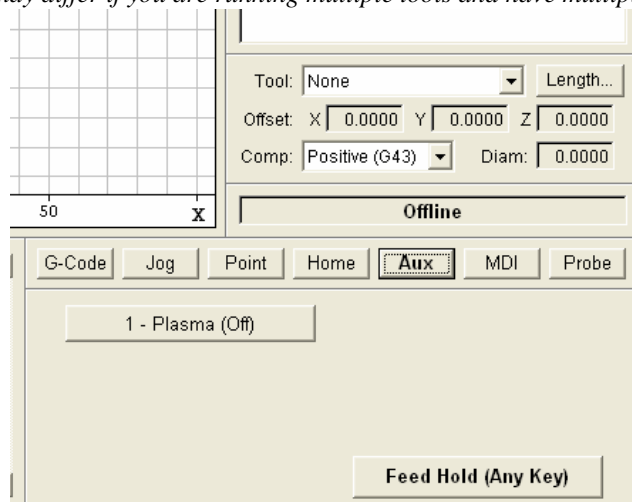
## 2) Setting up the Pierce height to determine Arc-Voltage and Cut Speed

Before being able to cut to help determine our correct Arc-Voltage numbers and the cut speed you have to set up the Pierce Height for the material. The pierce height is determined by a potentiometer on the front of the AVHC control box. The position of this will determine how far to

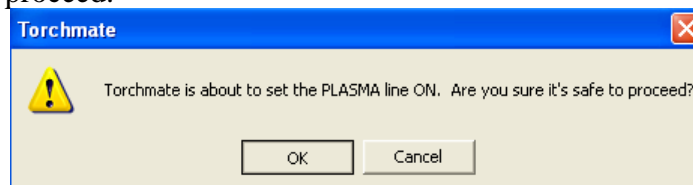
retract the torch, after sensing the material. The way you will determine what position the switch needs to be in is to 'Dry Run' a piercing cycle with the equipment. In order to do this you have to have the torch-head positioned above the piece of material, and the switches on the front of the AVHC control box set to Read – Manual – and No Cut. This will not allow the torch to fire and the height control will not try to adjust for voltage. The pierce height knob at first should be at a 'Noon' position.



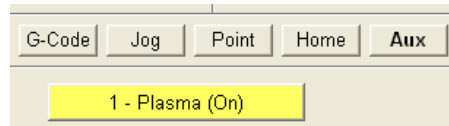
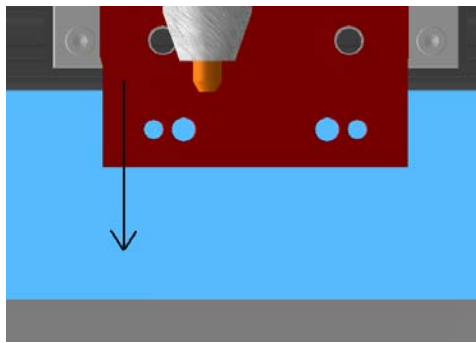
Next, in the Torchmate 2 software, go to the Aux menu, and you will see a button that says '1 – Plasma (Off)'. *\*Your setup may differ if you are running multiple tools and have multiple output lines.*



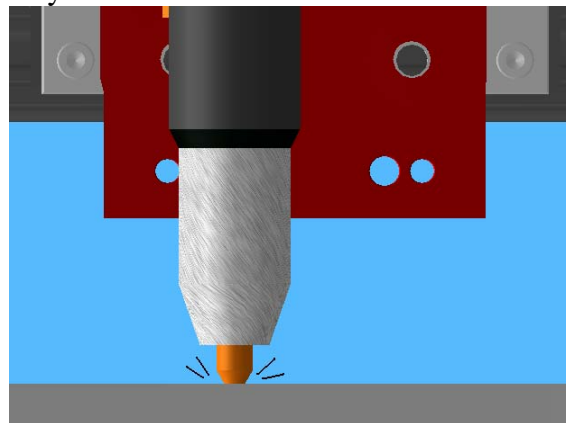
When you click this button, it will give you a warning that you are about to activate line 1 which will turn on your plasma cutter. As the AVHC box is the 'NO-CUT' position it will not fire the torch, and you can click OK to proceed.



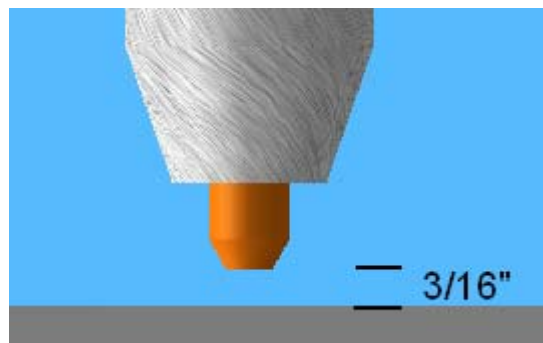
This will send the torch down to sense the material position and then retract to its pierce height as if it were going to fire. Once again our AVHC control box is set to 'NO-CUT' and the torch will not fire.



Once the torch has sensed the material and backed up to its pierce height, you can proceed to measure how far the torch actually retracted.



Typically you would want  $\frac{3}{16}$ " retract distance as well as a static cutting distance between the tip and the material, although this can vary between  $\frac{1}{8}$ " to  $\frac{1}{4}$ ".



If the torch is too close to the material it will not be able to produce a cutting arc, and will likely fizz out. If the torch is too high from the material, it will struggle to gap the distance and create an arc. To change the pierce height, you would just have to make an adjustment to the pierce height knob. Counter clockwise will decrease the retract distance, and clockwise will increase the retract distance. Then click the '1 - Plasma (On)' button which will send the unit back to its home position, and then re-activate the '1 - Plasma (Off)' button again to send it down and back up to its new height. Repeat the procedure until the desired pierce height is accomplished.

Typically the pierce height nob ends up being right between 9 and 10 o'clock with a pierce height of 3/16".



### **3) Determining best Cut Speed**

To determine the best cut speed for a certain material at a certain amperage setting, you have to run what we call a 'Line Speed Test' that will cut a small coupon cut 3.5" x 2.5" with 13 individual lines, each will each cut at a different speed. The first line will cut at 130 inches per minute (i/pm) and each line thereafter will decrease its speed by another 10 i/pm, leaving you with a line cut at everything from 130 i/pm, down to 10 i/pm. Then by looking at this coupon after it has been cut out, you will be able to determine which line (and therefore speed) gives you the best cut quality. What you are looking for in cut quality is a straight bevel, very little to no dross, and an acceptable kerf width. Once you have this line and speed picked out, you can also measure this straight line cut to determine the appropriate amount of kerf compensation to set-up in the Torchmate CAD. This Line Speed test g-code file is available for download here: [http://fab-solutions.com/download\\_sites/downloads/](http://fab-solutions.com/download_sites/downloads/)

Once this program is downloaded and loaded into the Torchmate 2 software, you will have to have the Pierce Height set correctly and the AVHC control box set to Read – Manual – Cut for this program. You will also have to have the plasma cutter set to the correct amperage, based on the chart above. With this set, Zero out the program coordinates on the piece of material, and run the program.

This is what a completed set of 13 lines looks like after being cut. Line 1 was cut at 130 i/pm and line 13 was cut at 10 i/pm. You can see the difference in the amount of dross and the kerf width of the torch, as the torch speed gets slower. This picture is of an aluminum cut pictured from the bottom, but the principles are exactly same for all material.

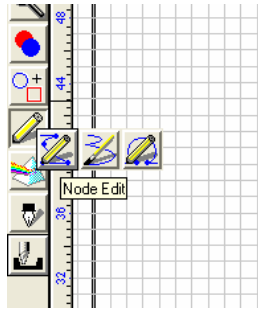


#### 4) Setting the Arc-Voltage for operation in Automatic Mode

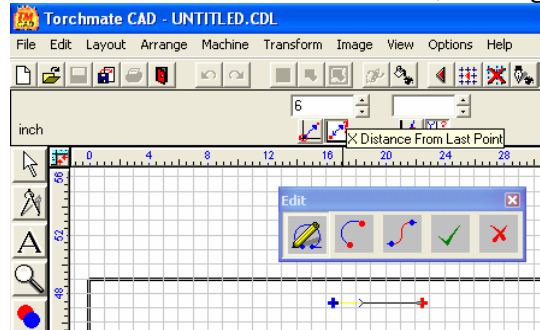
To determine what we need to set the arc voltage to, we will have to have determined the correct pierce height (section 2) and cut speed (section 3) to continue on. With both the pierce height set, and our speed determined, we can proceed to determine what we need to set the Arc-Voltage reading to in order to maintain the correct tip to work distance for cutting in Automatic mode. To do this, we will cut a simple cut in the material while in Manual mode and with the program set to run at the correct speed. What program to run is personal preference, we would recommend creating a file with a simple straight line cut on it, with a length of at least 6". This simple cut will tell us what we need to set the Arc-Voltage too.

Creating this file is very simple. Open your Torchmate CAD and create a line for doing this test.

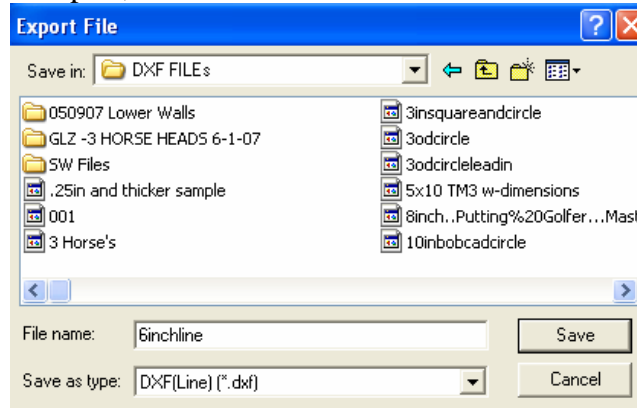
Using the Node Edit tool on the left hand side of the screen, place one node on to the material sheet.



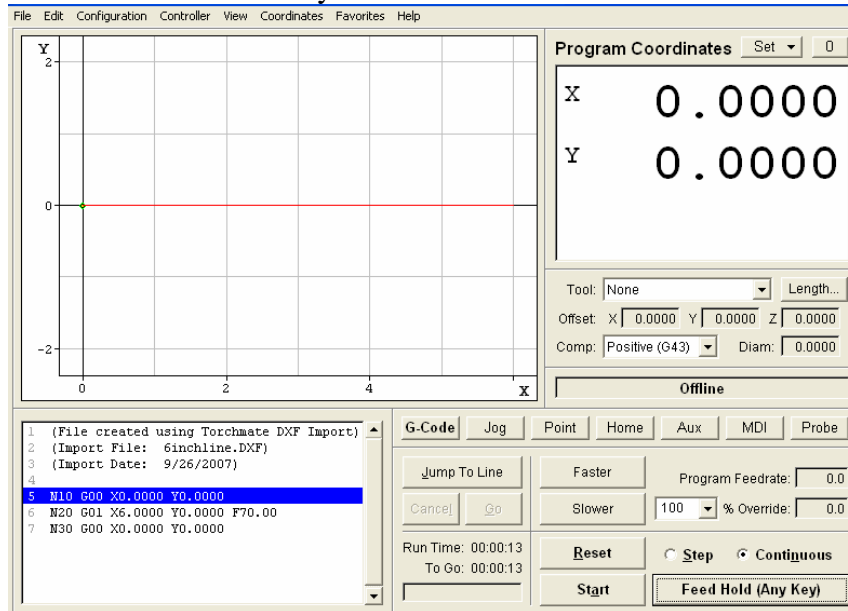
With one red cross node placed, on the top of the screen there are two white boxes. In the left box type in 6 and hit enter. This will draw a line with two nodes, 6" long.



In the file menu click Export, and name the file '6inchline'.



Then import this 6inchline.dxf file into the Torchmate 2 software. Once imported, zero out the program coordinates in order to cut this on your material.



When the initial cut begins, the torch will pierce the material then move along the cut path, while it is cutting, watch the LCD display for the voltage fluctuations, which will usually be somewhere between ---60 to -200. The voltage reading will smooth out after the initial pierce to a consistent number. The number at which the torch settles and consistently runs should be the appropriate setting for running the height control in Automatic mode.

To set the voltage, flip the switch the Manual and Auto switch to Auto, put the Set – Read switch to Set, and then turn the large dial labeled Set Volts to the most consistent voltage setting that you recorded while in the Manual mode. Push the switch to Read before running the program. The torch should now be able to control its height, adjusting up and down as the material warps. Once the arc voltage is set, you may notice it riding slightly to high or slightly too low, at any time you may flip the switches to Set and Automatic mode and make adjustments to the Arc Voltage number to either increase or decrease the distance between the tip and the material. Lowering the voltage will decrease the distance and move the tip closer to the material, and increasing the voltage will increase the gap between the tip and the material. When using this method, don't change the voltage in increments larger then 2-3 volts. Doing so can cause the torch to either dive too close to the material, or back up to far away from the material.

Once all of these settings have been reached, be sure to record them in some way so that if you change materials and come back later on and what to re-create the same cuts, you will know what you need to change the settings to. Every material thickness has it's own settings, and one should not be expected to work on another.

Manual mode testing is essential in finding the consistent voltage that will allow the torch to stay at the necessary height above the material, and maintain it when the material rises from the resulting heat exchange during the cutting process. We recommend that you start with manual cutting whenever you are changing type, or thickness of material. It is also recommended that you consult the manufacturer's Cut Chart for your plasma cutter, as it will help you to define the amount of amperage, air pressure, and cutting speeds to give you the best results possible.