

This document will provide a quick guide to the set up and operating procedure of the Techno WinCNC Plasma Cutter.



**The Techno CNC Plasma System is powered by 220 volt single phase power.**

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# PLASMA FORKLIFT GUIDE

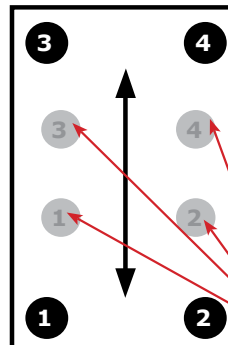
## I. SAFETY WARNING: DO NOT LIFT OR MOVE MACHINE USING GANTRY



**Fig. 1.1**

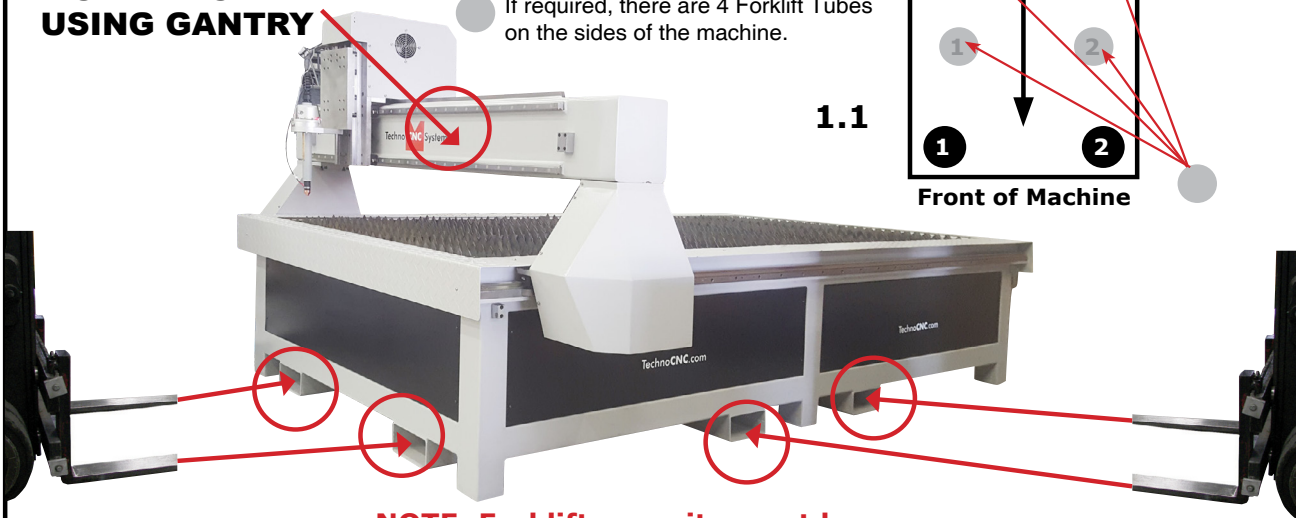
- Please note the 4 Forklift Tubes on the front and rear of the machine.
- If required, there are 4 Forklift Tubes on the sides of the machine.

Rear of Machine



Front of Machine

1.1



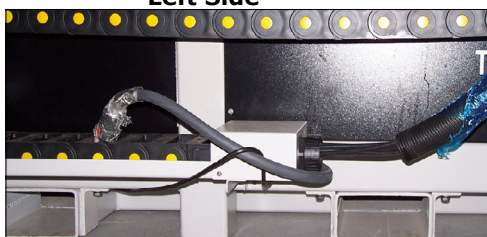
**NOTE: Forklift capacity must be adequate to safely lift the machine.**

**For safety and to prevent damage to the machine and cables, Lift Machine Using Forklift Tubes ONLY**

## II. MEASURING FORKS AND FORKLIFTING MACHINE

2.1

Left Side



23"

Right Side



23"

**Fig. 2.1**

Measuring the distance between the forks.

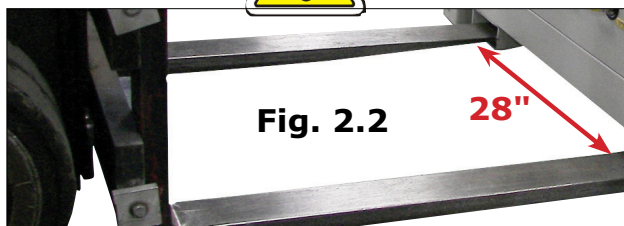
(shown in Fig 2.1).

2.2

**Be very careful not to damage the wiring and/or the plumbing underneath the machine.**

**Take care not to damage the machine.** Slowly move in close to the machine.

Forklift your machine up from the floor and remove the wooden pallet.



**Fig. 2.2**

28"

It is recommended that you have professional riggers conclude the installation if you are uncomfortable with this method.

# SAFETY INFORMATION

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However, the overall safety of the operator will drastically increase by proper installation and operation.

## **WARNING -**

**Do not install, operate, or repair the CNC, or torch equipment without reading the safety warnings within this manual.**

**Be very careful when maintaining, troubleshooting and operating this equipment.**

## **THE PLASMA TORCH CAN SCORCH SKIN AND CAUSE PERMANENT DAMAGE OR DEATH**

- PROTECT YOURSELF AND OTHERS FROM POSSIBLE SERIOUS INJURY OR DEATH.
- KEEP CHILDEN AWAY
- IF OPERATING WITH A PACEMAKER, IT IS IMPERATIVE YOU CONSULT WITH YOUR DOCTOR PRIOR TO USING THE MACHINE OR ANY OF ITS ACCESSORIES.
- ENSURE THAT ALL INSTALLATION, OPERATION, MAINTENANCE, AND REPAIR PROCEDURES ARE DONE ONLY BY QUALIFIED INDIVIDUALS.

## **FUMES AND GASES CAN BE DANGEROUS**

- The biproduct of plasma cutting produces fumes and gases that may be hazardous to health. Avoid breathing these fumes and gases. Keep your head out and away from the fumes.
- Use the appropriate amount of ventilation, water, and/or exhaust at the plasma arc to keep fumes and gases away from your breathing zone.
- Use an air-supplied respirator if water and ventilation is not enough to remove all fumes.
- When plasma cutting lead, or cadmium plated steel and other metals or coatings which produce toxic fumes, keep your exposure to a minimum within applicable OSHA PEL and ACGIH TLV limits using local exhaust or mechanical ventilation. In confined spaces, or, but not advised, outdoors, a respirator may be required.
- Disconnect the power source from all devices before performing any service or maintenance. When power sources are active, during operation, voltages in excess of 250V are produced. This creates the potential for serious electrical shock, or possible death.
- Insulate yourself from work and ground by using dry insulation. Always wear gloves and clothing that covers any exposed skin. Take extreme care when the work environment is moist or damp.
- The electrode and work (ground) circuits are electrically active, or "hot", when the power source is on. Do not touch these active parts with bare skin or wet clothing. Dry gloves and clothing without holes must be worn at all times during operation.
- Always ensure that the work ground makes a good electrical connection with the metal being cut. The connection should be as close as possible to the material being cut.
- Ground the metal substrate being cut to a good electrical, earth ground.
- Always replace damaged or worn insulation and consumables.

## **ARC RAYS WILL BURN**

- Arc Rays produced by the plasma torch can injure your eyes and burn your skin. The arcing process produces very bright infrared and ultraviolet rays. These rays will damage your eyes and burn your skin if the proper safety eyewear and clothing are not worn.
- Use safety glasses and a shield to protect your eyes from sparks and arc rays when operating or observing any plasma cutting.
- Use clothing suitable for plasma cutting or gouging, including, but not limited to, durable, flame resistant gloves and jacket.
- Protect those around the machine with suitable, non-flammable outer protection and/or warn them not to gaze at the arc or expose themselves to the arc rays and metal spatter.

## **CUTTING FLAME AND SPARKS CAN CAUSE EXPLOSION FIRE**

- Fires and explosions can be caused by oxygen fueled cutting flame, plasma arc, hot slag and sparks.
- A fire extinguisher should be ALWAYS readily available. When working in areas where fire hazard may exist, always provide a fire watch.
- When the machine is not in use, or not cutting, ensure that no part of the electrode circuit is touching the work ground. Accidental contact can cause overheating and create a fire hazard.
- Be sure there are no combustible or flammable materials near the workplace. Any material that can't be removed, must be protected.
- Sparks and hot slag from cutting can easily go through small cracks and openings to adjacent areas.
- Avoid cutting near hydraulic lines.
- Do not cut or burn through tanks, drums, or containers until proper steps have been taken to ensure that these processes will not cause flammable or toxic vapors from substances inside.
- Vent hollow castings or containers before heating or cutting. They may explode.
- Do not add fuel to engine driven equipment near an area where plasma cutting is being conducted.
- Connect the work cable ground as close to the cutting area as possible.
- Hydrogen gas may form and be trapped under aluminum work pieces when they are cut while using a water table. DO NOT cut aluminum alloys with the water table unless the hydrogen gas can be eliminated. Hydrogen gas that is trapped can ignite and cause an explosion.

## **WORKING WITH ELECTRICALLY POWERED EQUIPMENT**

- TURN OFF input power using the power disconnect at the machine as well as the switch at the main fuse box before working on the equipment.
- Install equipment in accordance with the U.S. National Electrical Code and manufacturer's recommendations.
- Ground the equipment in accordance with the U.S. National Electrical Code and the manufacturer's recommendations.

## **PLASMA ARC CAN INJURE**

- Keep your body away from the plasma nozzle and plasma arc.
- Operate the pilot arc with extreme caution. The arc is capable of burning the operator and others around.
- An EMF (Electric and Magnetic Field) is caused when an electric current flows through any conductor. An arc ray current creates EMF fields around torch cables and cutting machine.
- EMF fields may interfere with some pacemakers. Operators with a pacemaker, or other bioelectrical device should consult with their physician before using the plasma cutter.
- Exposure to EMF fields during cutting may have other health effects which are not known.
- Any and all operators should follow these procedures in order to minimize exposure to EMF fields from an arc ray circuit:
  - Route the torch and work cables together – Secure them with electrical tape or zip-ties when possible.
  - NEVER wrap or coil the torch and work cables around your body.
  - DO NOT place your body between the torch and work cables.
  - Connect the work cable to the workpiece as close as possible to the area being cut.
  - Do not work next to the cutting power source.

## **ELECTRICAL AND MAGNETIC FIELDS MAY BE DANGEROUS**

- WEAR THE PROPER EYE, EAR, FACE, AND BODY PROTECTION.
- PROTECT your eyes and face with welding goggles and/or helmet. These items should have the proper grade of filter plate.
- PROTECT your body from welding slag/spatter and arc flash with protective clothing including woolen clothing, flame-proof apron and gloves, leather leggings and high boots.
- Where ear protection when necessary.
- ENSURE that all protective clothing and eyewear is in good, working condition.
- Ensure that there is adequate lighting in the area of the machine.
- Safety Glasses should be worn in work area at all times.
- DO NOT CLIMB ON MACHINE. The machine is not intended to be used as a ladder or to support anything other than the material being cut. By climbing onto the machine, there is risk of falling which can result in injury or de



## **DANGER!**

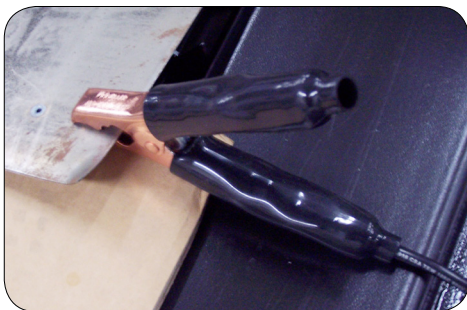
**MULTIPLE POWER SOURCES**  
Disconnect All Power  
Sources before Servicing

This Equipment has 2 Power Sources  
To Disconnect Power:  
Unplug power cord to this panel from receptacle.  
And Disconnect and lock out  
power to Plasma Torch.



The Techno CNC Plasma  
System is powered by 220 volt  
single phase power.

## **WORK LEAD TERMINAL**



Make sure the Ground Clamp  
(Work Lead) is connected to  
the material being cut, or the steel slats  
that the material is resting on.



Please make sure the CNC Plasma  
is properly grounded using the  
grounding lug provided on the rear  
leg of the machine.



Have a licensed electrician perform  
all electrical connections based on  
your electrical codes!

## II. Techno CNC Plasma Installation

### Machine and Controller Connections

**1.1** The Electronics are housed in the large controller box as shown in Figure 1.1. When unpacking the machine, avoid twisting the plastic conduit that guides the cables to the motors.

**1.2** Open the front and back of the controller box

**1.3** Unpack the computer and monitor and mount them on the controller. The PC fits on the side shelf and the monitor rests on top.

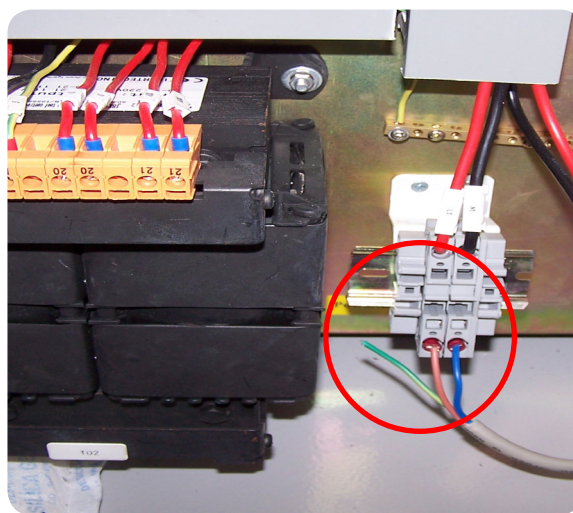
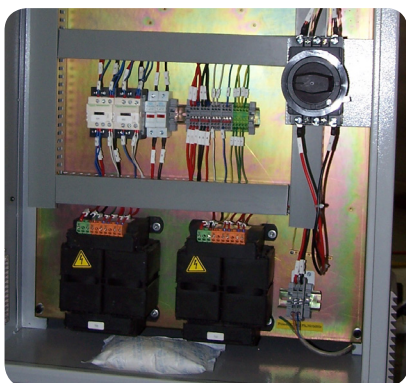
**1.4** Plug the labelled cables into their proper places. 2 labelled interface cables, 1 monitor and 2 USB for mouse and keyboard.



Fig. 1.4

**See PC and Controller Interface Connections on page 25.**

**1.5** The terminal for the 220 volt connection is located at the bottom front of the box.



Have a suitably qualified person connect the 220V to the terminals. Make sure that all local electrical codes are obeyed. For single phase machine, connect power to L1 and L3 only.

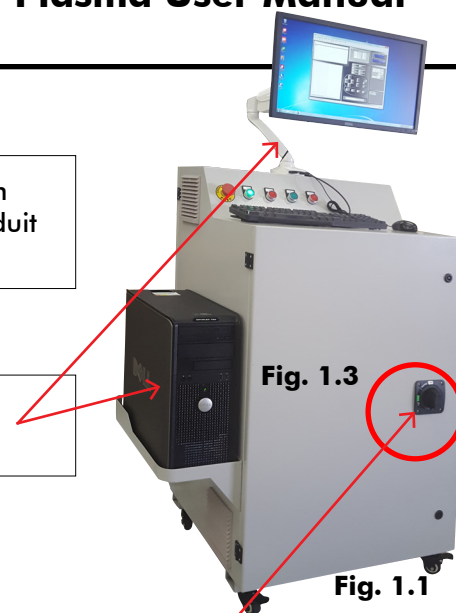


Fig. 1.3

Fig. 1.1





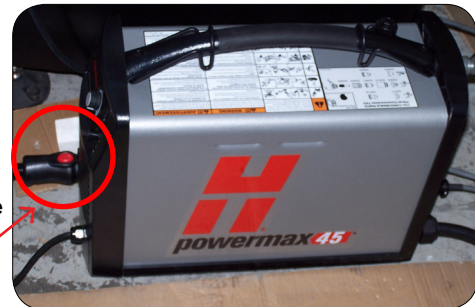


**WARNING:** Read this setup thoroughly before running the machine. Have a licensed electrician perform all electrical connections based on your local codes!

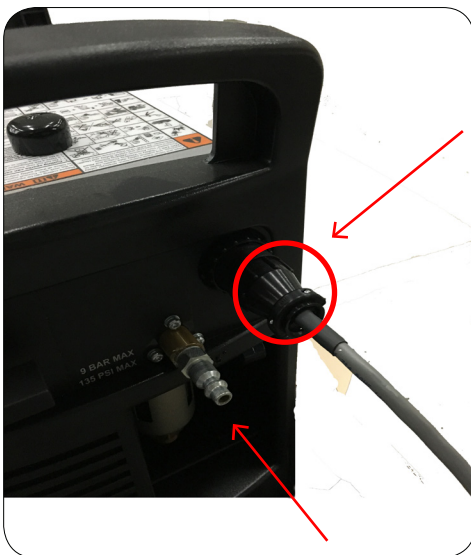
## IIb. Plasma Torch Connections

When hooking up the plasma torch, be sure to use appropriate power. See Hypertherm documentation or refer to quote for details.

Please read and understand the Hypertherm torch manual before operating the machine.



Make sure the torch and grounding clamp are plugged in.



Hypertherm Machine Interface Cable from  
Controller box

The Hypertherm torch requires a clean, dry, non-fluctuating 90 psi compressed air source to operate. Do not attempt to operate plasma with the air connected.

The error "check torch" will also appear when the torch is not in its correct position. This acts as an e-stop if the torch knocks into something while in motion.

### III. Controller Functionality

#### Machine Controls

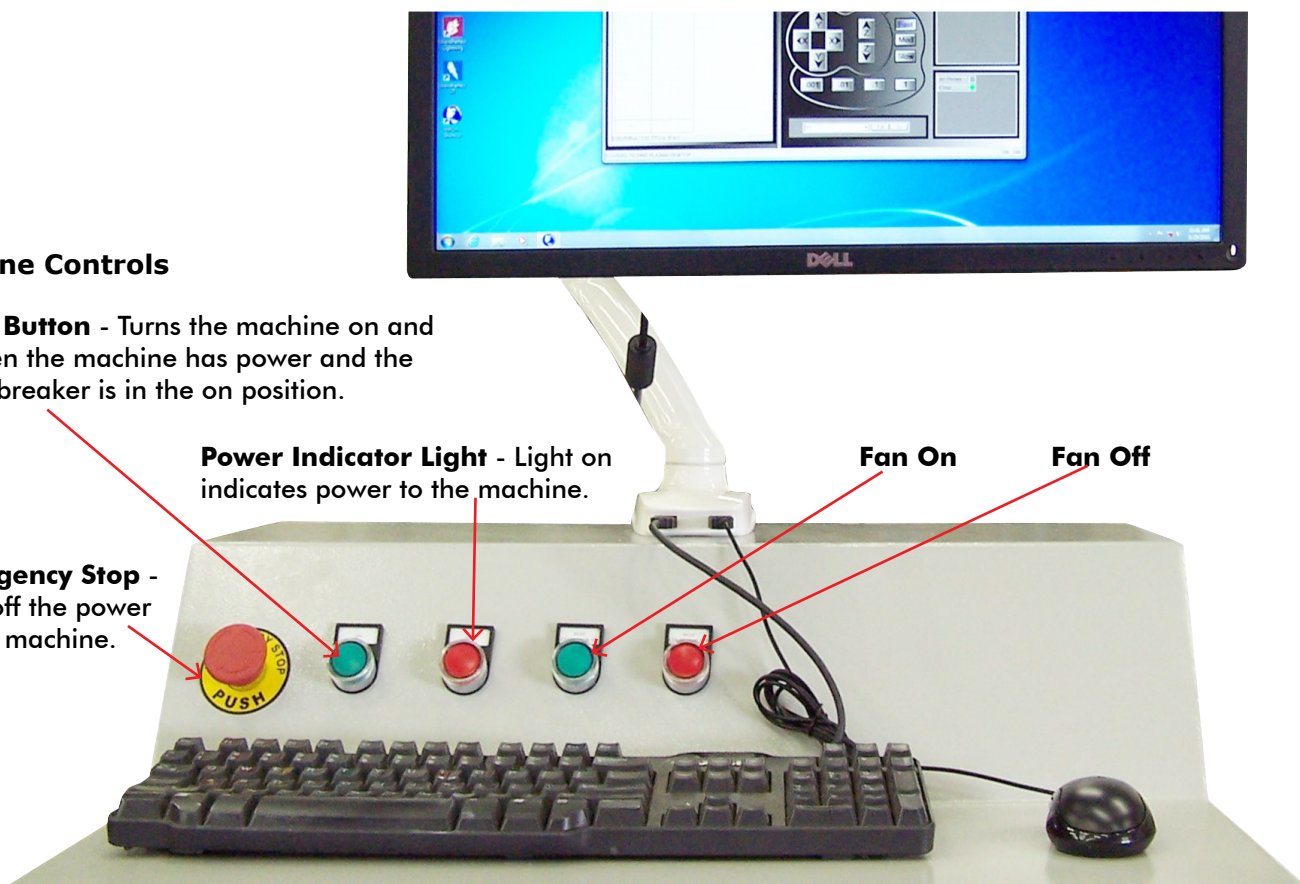
**Power Button** - Turns the machine on and off when the machine has power and the power breaker is in the on position.

**Power Indicator Light** - Light on indicates power to the machine.

**Fan On**

**Fan Off**

**Emergency Stop** - Cuts off the power to the machine.



#### Power Breaker

The power breaker is used as a safety feature. The machine will only power up when the breaker is in the vertical "ON" position. Spin the selector clockwise from "OFF" to "ON" in order to enable the machine and lock out access to the high powered electronics inside the controller cabinet

**"OFF" Position**

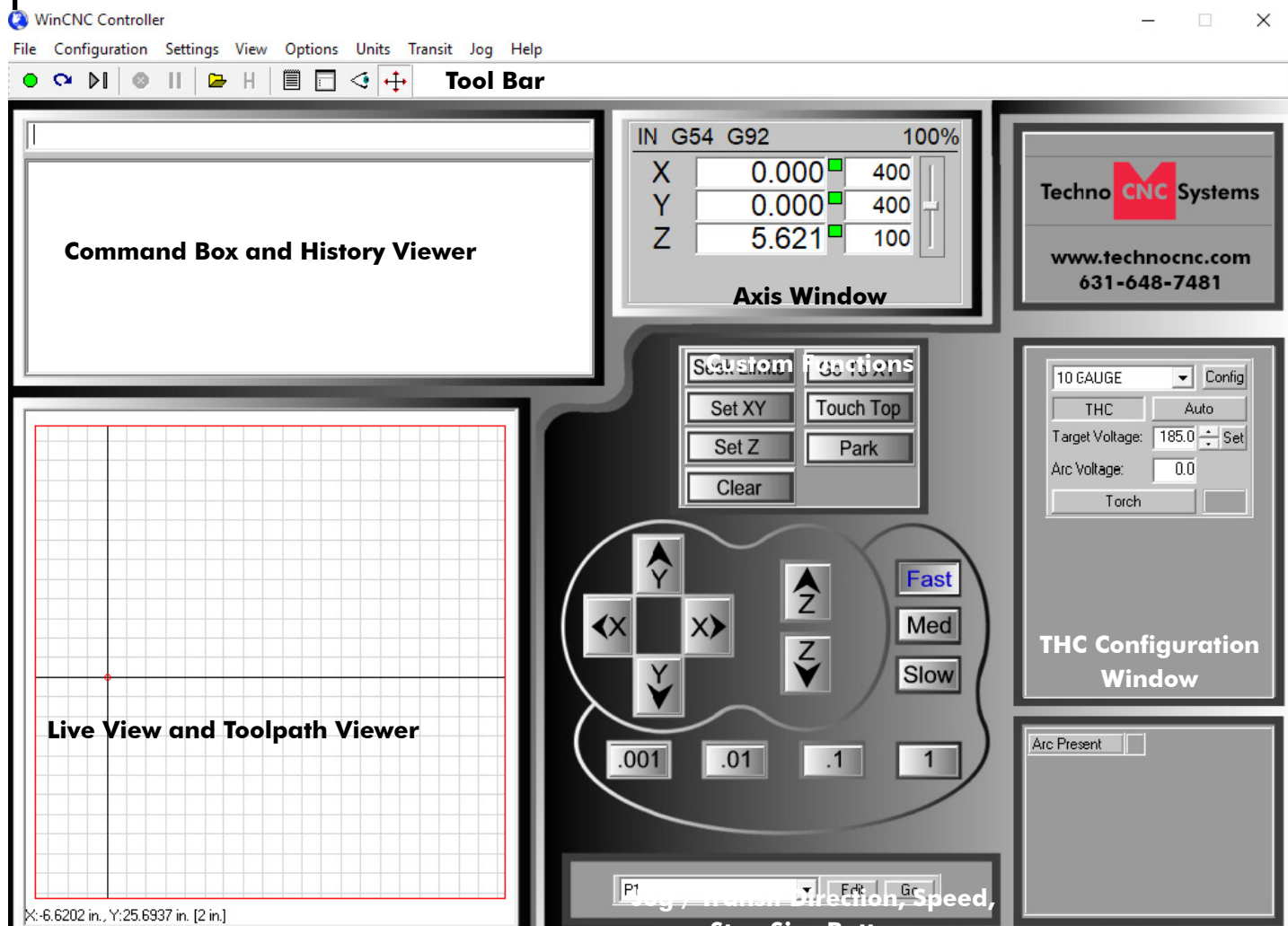


**"ON" Position**



## IV. Controller Screen Layout

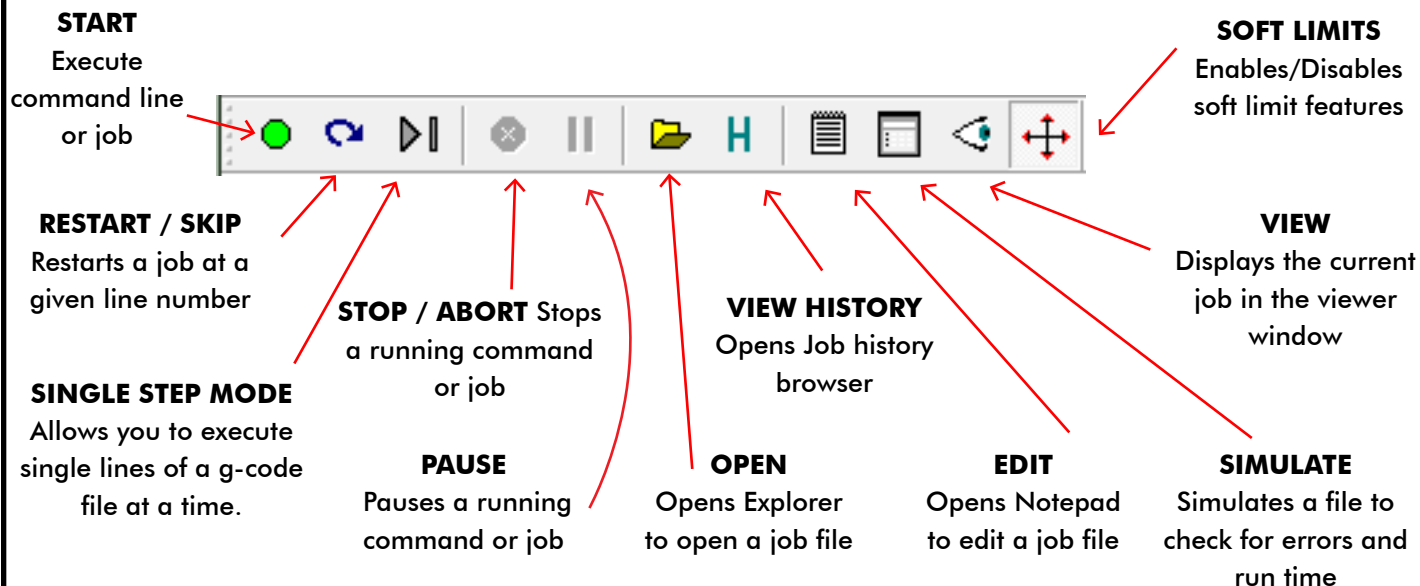
### Main Layout Controls and Description



## V. Controller Button Functions

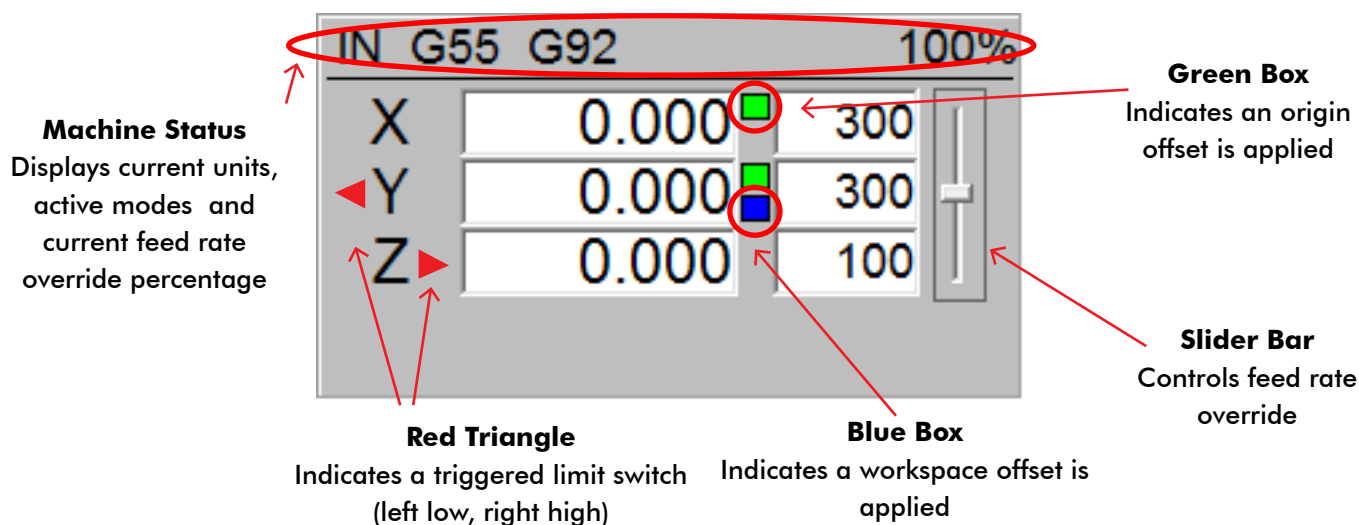
### Tool Bar

The tool bar is a collection of shortcut buttons that perform specific actions.



### Axis Window

The axis window is the primary display for current information about each axis on your machine.  
The current positions and velocities for each axis are displayed in the text boxes.

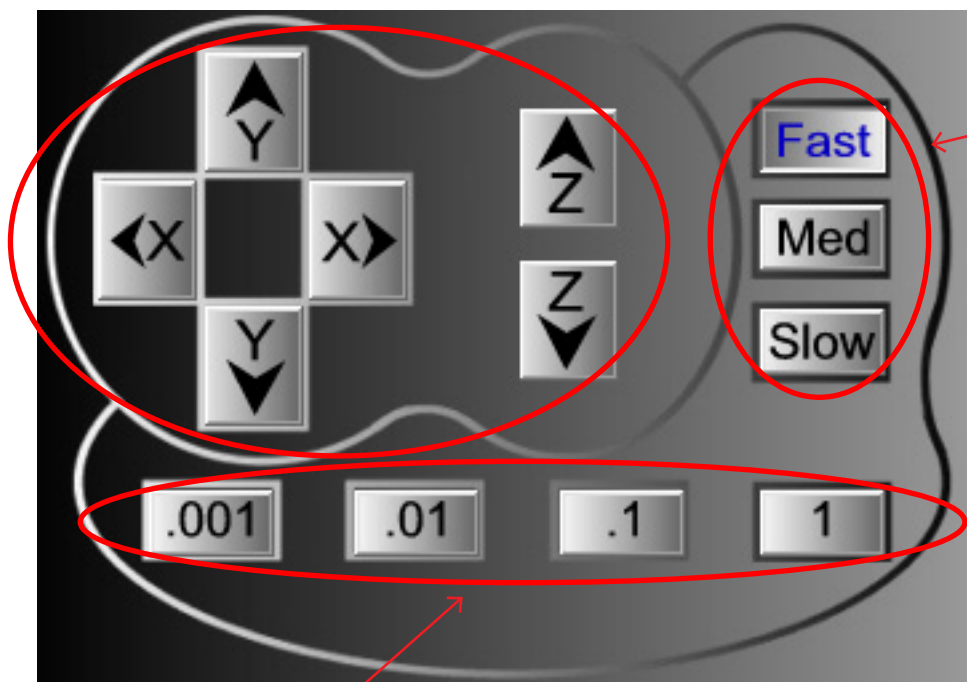


## Jog and Incremental Buttons

These buttons are what allow you to initiate a manual jog or incremental movement. In jog mode, holding the button down will continuously move the machine. In incremental mode, each time a button is pressed the machine will move according to the jog increment that has been selected. Holding the button down in incremental mode will move the machine only once.

### Movement Direction Buttons

When pressed, these buttons allow the machine to move in selected direction in the selected mode.  
(Jog or Incremental)



### Jog Speed Buttons

When pressed, these buttons allow the machine to move at predetermined continuous speeds.

### Jog Increment Buttons

When pressed, these buttons allow the machine to move in steps of the selected increment.



## Viewer

WinCNC contains a built in viewer window that will allow you to display the output of G-Code files before the job is actually run. By default, the viewer can also display a G-Code file line by line as it is run.

G0 rapid moves are shown as a black dashed line. G1 feedrate moves are displayed as a solid blue line.

To view a file before you run it, open the file in the command line and then press the viewer button on the toolbar.

Once the object is loaded into the viewer the following controls can be used:

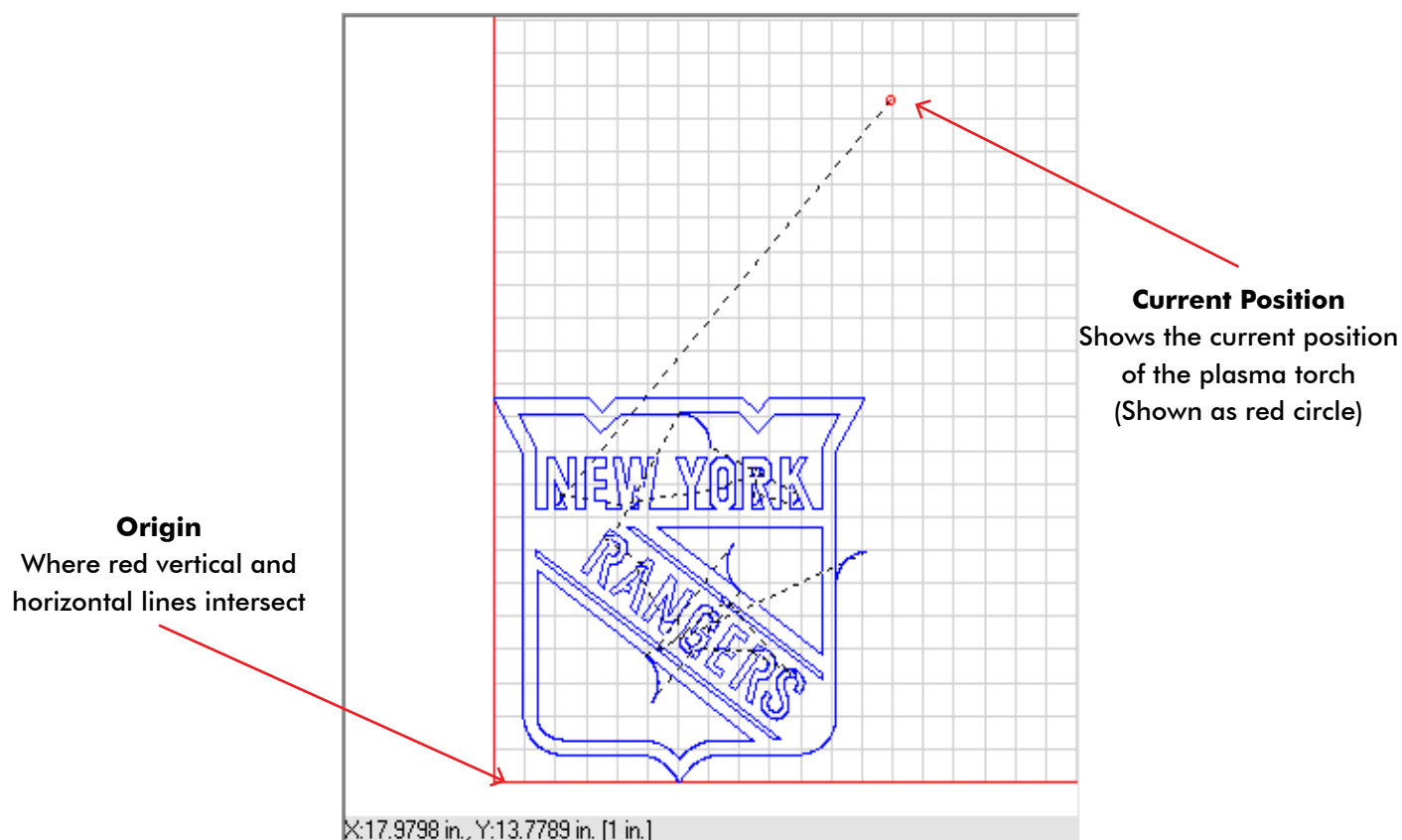
**Zoom In** - click the left mouse button.

**Zoom Out** - click the right mouse button.

**Selected Zoom** - hold down the left mouse button and drag the box around the area to zoom in on.

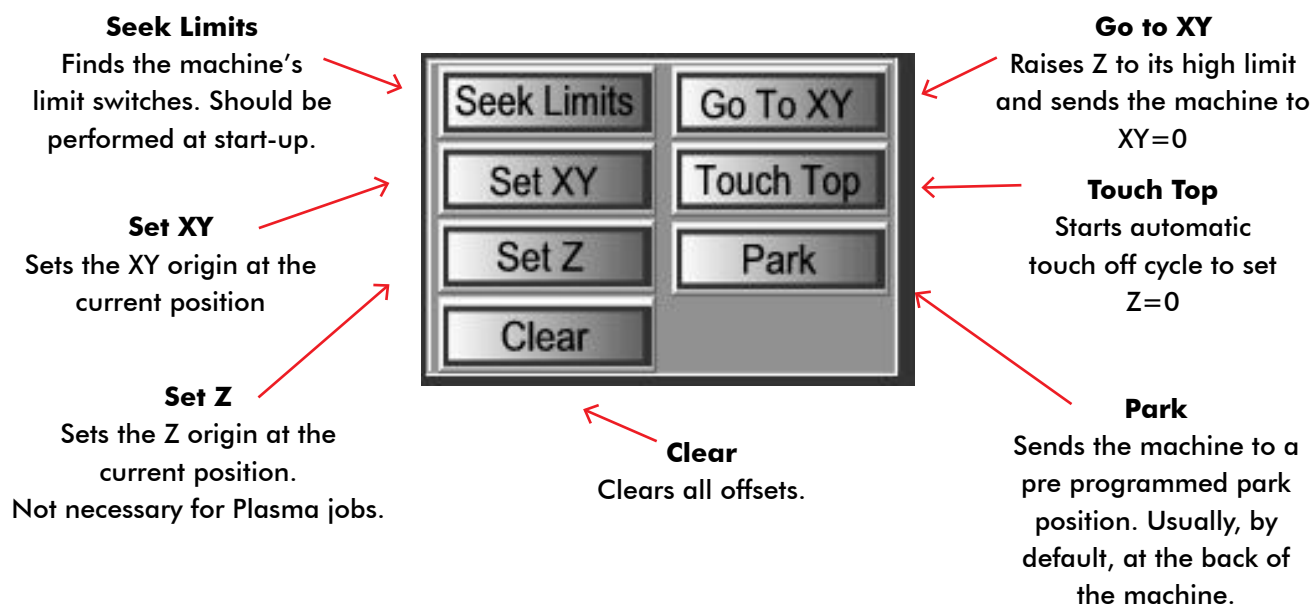
**Pan or Re-Center Object** - hold CTRL and click either mouse button.

**Reset Image** - hold shift and click either mouse button



## Function Buttons

These buttons perform preset functions. They are used as shortcuts for many G-code operations.



## Status Indicators

This window shows certain machine inputs and outputs.



### Arc Present

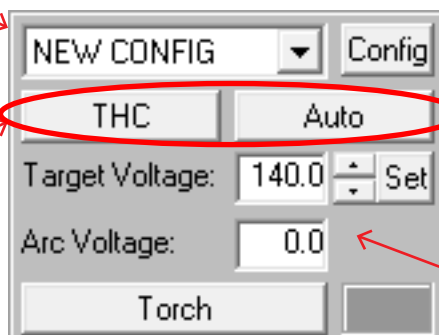
Green indicates that arc has successfully transferred

## Torch Height Control (THC) Quick View

This window allows the user to select preconfigured THC modes as well as perform basic commands.

**Quick Config Select**  
Shows the currently selected THC configuration. Drop down menu shows other options.

**THC / Auto**  
Enables / Disables Automatic THC  
Enables / Disables Autosense



**Config**  
Opens a window to create a new THC configuration profile. (See Next Section)

**Target Voltage**  
Sets the target voltage (height) for the given job

**Arc Voltage**  
Shows the actual (real time) voltage

**Torch**  
Turns the torch on or off.

**Indicator**  
Green is torch on  
Red is torch off

## THC Configuration Window

This window allows the user to save THC profiles for future usage. We recommend saving a new configuration profile for each material type and thickness used.

The highlighted variables should always be used. All values are taken directly from the Hyperthem Manual's Cut Charts.

**Please note:** Shop conditions vary from user to user. For this reason, we recommend disabling THC for new materials, so tests can be run and arc voltage can be read, which will allow the user to accurately set a target voltage.

**Material Name**  
Configuration name

**Torch Amps**

**Feed Rate**

**Target Voltage**

**Pierce Delay**

**Piercing Height**

**THC Mode**  
3 Options

**Config List**  
Shows a list of THC profiles. Select one to edit it.

**Cutting Height**

Saved THC Configurations

Material Name: New Config

Torch Amps: Torch Tip Info

PSI:

Feed Rate: 100.0 (inch/min)

Target Volts: 140.0

Cold Time: 0.000 seconds

Cold Pierce Delay: 0.000 seconds

Pierce Delay: 0.750 seconds

End Delay: 0.750 seconds

Slow Start Time: 0.000 seconds

Slow Feed: 0.000 %

Early Torch Off: 0.000 (inch)

Plunge Rate: 100.000 (inch/min)

Piercing Height: ☐ Enable ☒ Disable 0.000

Cutting Height: ☐ Enable ☒ Disable 0.000

THC Active Delay: 0.000 seconds

Cut Height Delay: 0.000 seconds

THC Mode: ☒ Disabled ☐ Automatic ☐ Auto Sense

Elevation Height: ☐ Enable ☒ Disable 0.000

Plasma Gas: None Plasma Prewflow: 0 Plasma Cutflow: 0

Shield Gas: None Shield Prewflow: 0 Shield Cutflow: 0

Save Add Delete

Disabled - No THC, maintains a fixed height

Automatic - THC On, maintains a fixed height above the material based on voltage (recommended)

Auto Sense - Uses voltage from initial touch off as fixed height

## VI. Using the Cut Charts

### Setting the Plasma Cut Parameters:

Please refer to your Hypertherm Powermax Manual's cut chart to ensure proper settings  
Maximum cut speeds are the fastest speeds possible to cut material without regard to cut quality.  
Recommended cut speeds are a good starting point for finding the best quality cut. You will need to adjust the speeds for your application and your table to obtain the desired cut quality.

					Recommended		Maximum		
Arc current (amps)	Material thickness	Torch-to-work distance (in)	Initial pierce height		Pierce time delay (sec)	Cut Speed (ipm)	Voltage (V)	Cut Speed (ipm)	Voltage (V)
30	0.018 in (26 Ga)	0.06	0.15 in	250%	0.0	360	117	400*	118
	0.030 in (22 Ga)					340	116	400*	117
	0.036 in (20 Ga)					320	115	400*	117
	0.060 in (16 Ga)				0.2	225	111	280	115
	0.036 in (20 Ga)				0.0	380	115	400*	112
	0.060 in (16 Ga)				0.0	350	116	400*	115
45	0.075 in (14 Ga)	0.06	0.15 in	250%	0.1	280	117	360	115
	0.3				190	117	240	115	
	0.4				140	117	175	115	
	0.5				85	118	110	115	
	0.6				60	120	75	116	
	0.9				32	122	40	116	
	0.500 in (1/2 in)	Edge start recommended				20	132	25	125
	0.625 in (5/8 in)					11	138	14	127
	0.750 in (3/4 in)					8	140	10	131
	1.000 in (1 in)					4	146	5	142



**The cut chart on the previous page is being used as an example. It is from the Hypertherm PowerMax manual. It represents the cut chart for shielded consumables on Mild Steel with English Units.**

In this example, we will be cutting 16 Ga mild steel and we will use the recommended settings. These are merely recommended settings, you will need to adjust accordingly.

We will use the cut chart from left to right.

First, we need to open the CNC Interface and open the THC config window.

Name the Material "16 Ga - 45 amps"

We will start with "Torch Amps". For our given setup, we will be using 45 amps. Input 45 into the "Torch Amps" box and make sure the Hypertherm torch is set to 45 using the front knob. If you have a more powerful unit, plug in the amperage that your torch will be set to.

Next, we choose our material thickness. In this example, we will be using 16 Ga.

As we move from left to right, we can use and set various parameters.

Torch-to-work distance is our "Cutting Height" value. Enable "Cutting Height" and set the value to .06"

Initial Pierce Height is our "Piercing Height" value. Enable "Piercing Height" and set the value to .15"

Now we will set our Pierce delay, under "Pierce Delay" enter 0.0.

For the best cut results, we will use the "Recommended" settings for feed rate and voltage.

Our cut speed will be 350 inches per minute. Put 350 in the spot marked "Feed Rate"

Our voltage will be 116. Put 116 in the spot marked "Target Volts"

Finally, choose a THC mode. In cases of flat sheet material, you can choose "disabled". If there may be any chance of variation of material thickness or height or the material may be warped, choose "Automatic"

Click "Save" to save the profile and "Done" to exit

**Please note: When saving, if the "material name" has any symbols, the configuration will not be saved correctly. Ensure that you spell out the full name, i.e)**

## VII. Plasma Quick Start Guide

-----

This guide will assume all machine, controller, plasma and PC connections have been made and that you are ready to run a file.

### Step 1 - Power Up

Turn on power to the machine, plasma torch and PC. Ensure the torch and machine have an adequate air supply and the ground clamp is properly on the material being cut.



### Step 2 - Seek Limits

Once powered up, please choose "Seek Limits" from the controller screen. This will move the machine to its limit switches, ensuring accurate positioning.



**WARNING: BEFORE SEEKING LIMITS, ENSURE THAT THE PLASMA TABLE IS FREE FROM OBSTRUCTION**

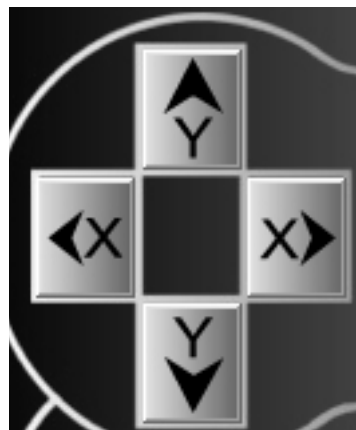
### Step 3 - Setting the Origin




Jog the machine to the desired X/Y start position by pressing the X and Y directional key, or use the arrow keys on the keyboard. "Page up" and "page down" control the z-axis.

Once located, press "Set XY".

The display should now show X and Y coordinate values of 0.000 with green boxes as indicators that the origin has been set.

Z may have a non zero number, as the z-axis lifts up to its "pierce height" after it touches off the meter.



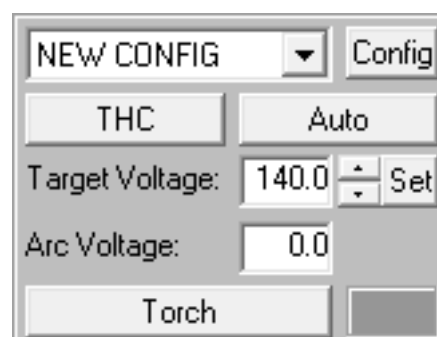
IN G55 G92			100%
X	0.000		300
Y	0.000		300
Z	0.000		100

**Step 4 - Testing the Touch Off**

Before running a file, we want to test the torch touch off. Make sure the material is under the torch for this test and the work lead is attached to the raw stock. Press "Touch Top" button. The torch should lower to the material, touch off, and retract to its "pierce height".

**Step 5 - Choosing the THC profile**

Choose a THC config from the Quick Config menu. Ensure all settings are consistent with Hypertherm Cut Charts.

**Step 6 - Load and Simulate G-Code file**

Press "Open" and navigate to and select the file you would like to run. Once selected, choose "Simulate" to check for errors. You may also choose "View" to show the tool paths in the Viewer window.

**OPEN****SIMULATE****VIEW****Step 7 - Start the File**

Press play.

The machine will automatically touch off and set the height for cutting then proceed to execute the G-code program.

**PLAY**

IN	G55	G92	100%
X	0.000	300	
Y	0.000	300	
Z	0.000	100	

**Step 5 - Setting Z=0**

Place the Pen in the pen holder. Carefully lower the Pen down using the Z down button. Once the tip is touching the material, press "Set Z".

**Step 6 - Load and Simulate G-Code file**

Press "Open" and navigate and select the file you would like to run. Once selected, choose "Simulate" to check for errors. You may also choose "View" to show the tool paths in the Viewer window.

**OPEN****SIMULATE****VIEW****Step 7 - Start the File**

Press play.

The machine will proceed to execute the G-code program.

**PLAY**

## IX. Supported Code

-----

G-Code	Description	Usage
G0	Rapid Movement	G0 X# Y#
G1	Feed Movement	G1 X# Y# F#
G2	Clockwise Movement at Feed (IJ or R)	G2 X# Y# I# J# / G2 X# Y# R#
G3	Counter Clockwise Movement at Feed (IJ or R)	G3 X# Y# I# J# / G3 X# Y# R#
G4	Dwell	G4 m (m is time in seconds)
G20	Units are in inches	
G21	Units are in centimeters	
G22	Units are in millimeters	
G28	Return to machine zero (all axes if none specified)	G28 Z / G28 XY / G28
G90	Absolute mode	
G91	Relative mode	

L-Code	Description	Usage
L36	Torch Height Control On	
L36.1	Auto Voltage Set Mode On	
L36.2	Reset Auto Voltage Set Status	
L37	Torch Height Control Off	
L37.1	Auto Voltage Set Mode Off	



## X. Error Codes

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Error	Description
Line Too Long	Input line longer than 256 characters
Unsupported G Code	G Code in input line not support / recognized
Unsupported L Code	L Code in input line not support / recognized
Unsupported M Code	M Code in input line not support / recognized
Multiple Commands	Input line contains more than one command
Command or File Not Found	Non-supported Code / Invalid File Name Entered
Arc Radius	Distance from start point to center is not equal to distance from end point to center. Check G2 vs G3 and G91 vs G90
Soft Limit Exceeded	Specified move would result in exceeding soft limits
Boundary Exceeded	Specified move would result in exceeding workspace
Acceleration Out of Bounds	Acceleration exceeds maximum resolution
Illegal Value	The specified value is invalid
Unknown Position Specified	The specified position is invalid
Subprogram Nesting Too Deep	Too many nested subprogram calls
L10 in Subprogram	L10 command not allowed in subprograms
File Not Found	The specified file name cannot be found
Parameter Not Specified	A required parameter is missing
Unknown	Unknown error has occurred
Memory Error	Insufficient or bad memory
Parameter Out of Range	Specified Parameter is out of range
Arc Too Small	Specified Arc is below resolution
Could Not Open File	File cannot be opened. May be used by another device
Limit Switches	Limit Switch encountered while running
Aborted by User	E-Stop or Escape used by user
Error Reading File	File may be corrupted

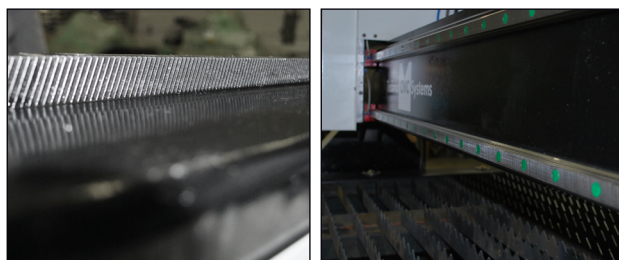
## XI. Machine Lubrication.

### Lubricating the X-Y Rack and Pinion.

Lubrication is important with rack and pinion gearing systems. A thin film of grease should always be present on the contacting tooth flanks to minimize metal to metal contact.

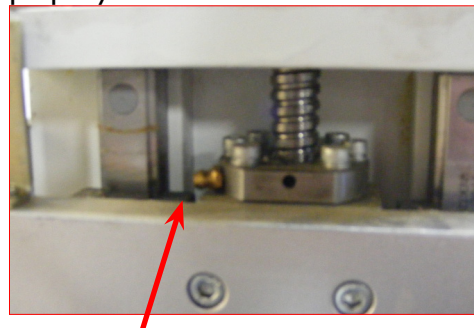
Lithium grease lubrication is recommended over oil, as the oil lubrication will flow away from tooth flanks.

The grease should be applied to the rails at regular intervals, depending on the usage of the machine. Use a small brush to coat both rails on the side of the Y-axis and the single rail across the X-axis.



### Lubricating Z Ballscrew

The Z axis uses a ballscrew and ballnut instead of a Rack and Pinion. You must apply oil directly to the ballscrew to properly lubricate the mechanism.

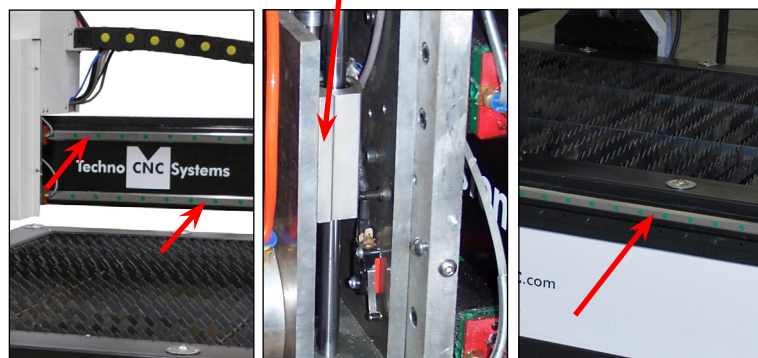


Lithium grease is pumped into the lubrication point with the application gun.



### Lubricating the X-Y-Z Rails

The rail carriage bearings are sealed and protected with wipers. The rails should be lightly oiled to allow smooth operation. Avoid a build up of debris on the rails by blowing them off with air, or wiping them down with a rag. The rails do not need to be lubricated as often as the rack, once a month should be sufficient.



X Axis

Z Axis

Y Axis

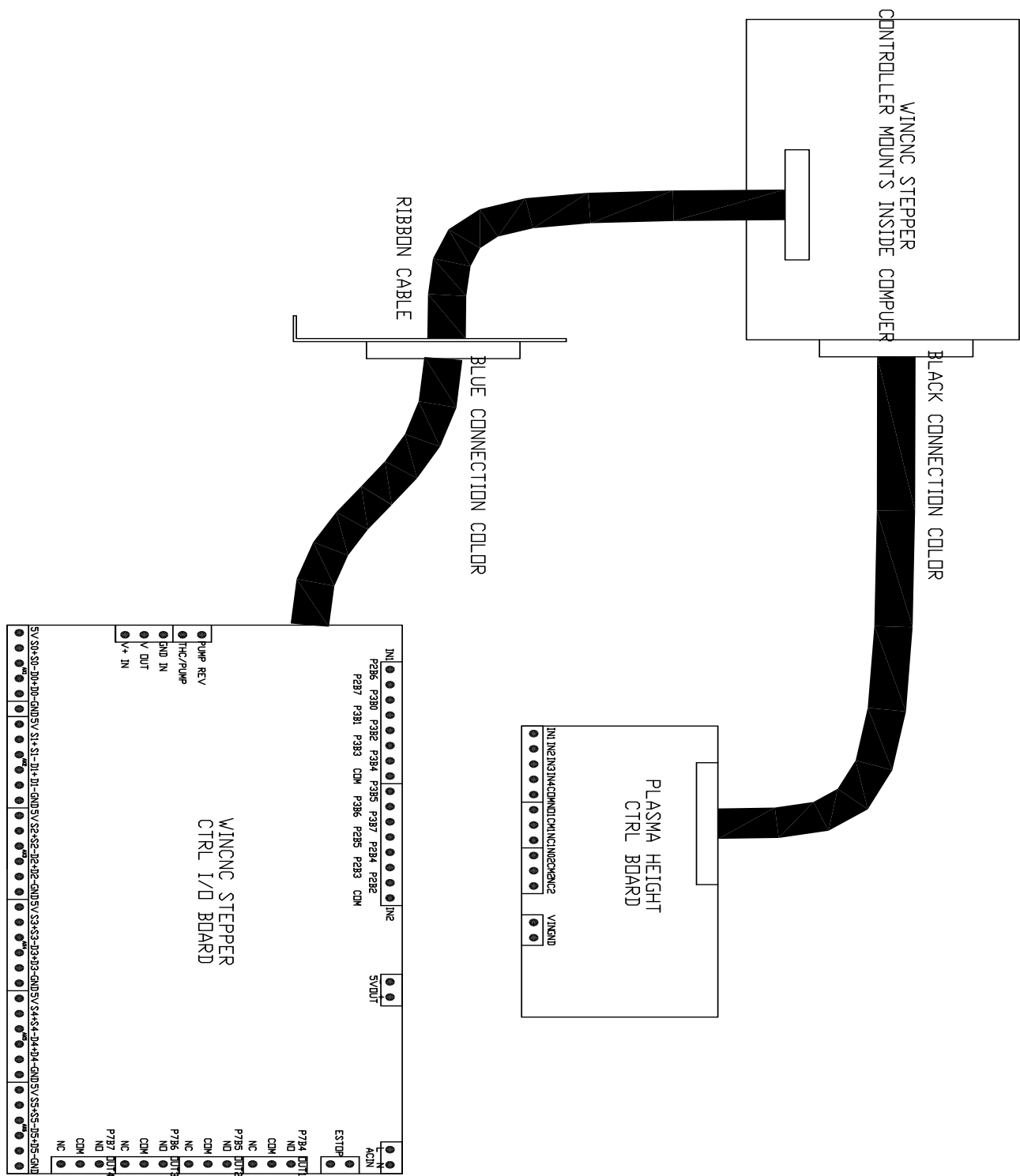
### Recommended Lubricants.

Lithium Based Grease:  
Alvania Grease No. 2(Shell)  
or Equivalent.  
Techno Part No.  
H90Z00-8670T8

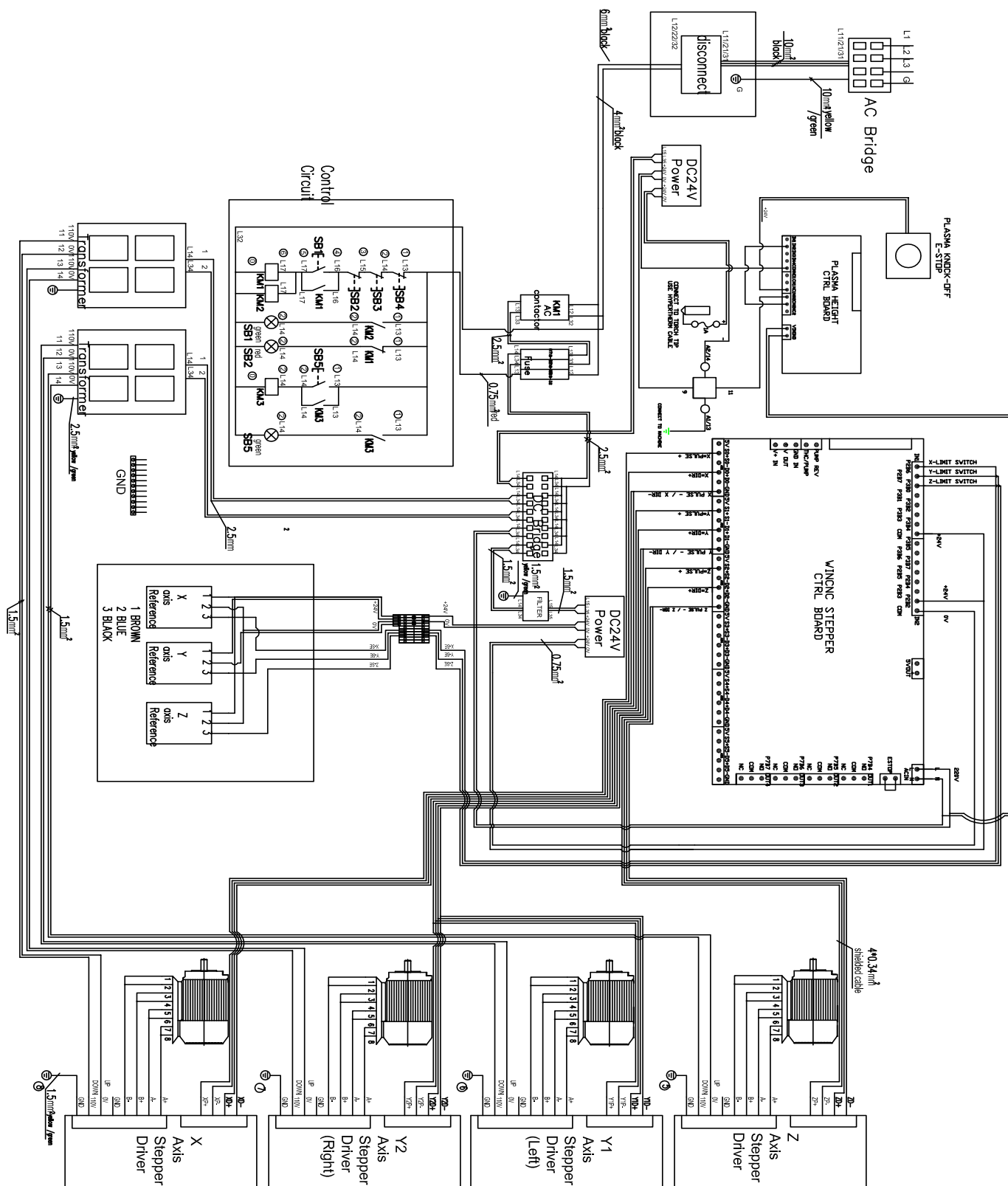
**NOTE: AVOID A BUILD UP OF DEBRIS ON MOVING PARTS. CLEAN OFF ANY DEBRIS TO AVOID DAMAGING THE MACHINE.**

# XII. Diagrams

PC and Controller Interface Connections



# Machine Diagram



## XIII. Cut Quality

### Reading the cut

There are four basic measurements used to determine good cut quality:

- Bevel angle
- Dross levels
- Appearance of cut
- Lag lines  
(Mild steel – O<sub>2</sub> cutting only)

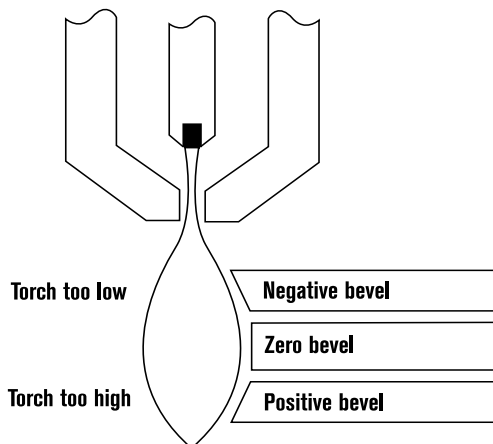
The adjustments that the operator can make to improve these qualities are:

- Torch height or arc voltage
- Cut speed

Remember: the cut charts are the place to start, but cut speed and torch height may need to be adjusted on some materials.

### Bevel angle

- By increasing or decreasing the height of the torch, the bevel angle can be changed.
- This is done by adjusting the Arc Voltage setting on plasma systems with arc voltage torch height control (THC). If the plasma system is not equipped with THC, then it must be manually adjusted.
- If the angle is not equal on all sides of a cut part, then the torch may not be square to the plate and will need to be adjusted.



EFFECTS OF TORCH HEIGHT

### Decreasing dross (slag)

#### Top dross

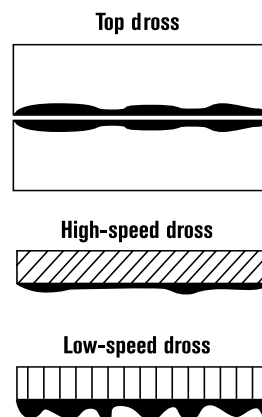
Splatter appears on the top edge of both pieces of the plate. Lower the voltage in increments of 5 volts (maximum) until top dross disappears. Usually only seen with air plasma.

#### High-speed dross

Fine, roll-over dross that welds to bottom edge. Cleaning requires chipping or grinding. Reduce cut speed to decrease high-speed dross.

#### Low-speed dross

Globular dross that forms in large deposits. Comes off very easily, in large pieces. Increase cut speed to decrease low-speed dross.





## More on dross

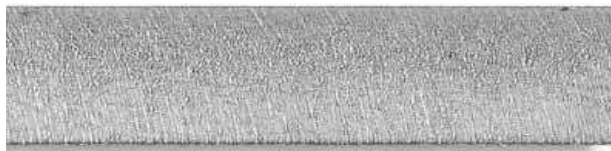
- Some types of metal inherently cut with more dross than others. Some of the more difficult plates and treatments are:
  - High carbon content    ■ Clean metal surfaces
  - Shot-blasted plate    ■ Aluminum
  - Hot-rolled steel    ■ Warm or hot metal
  - High silicon steel
- Some of the easier types are:
  - Cold-rolled steel
  - Oil-pickled steel
- If plate has an oily, scaly or rusty surface, cut with this side down.
- A water muffler or underwater cutting will tend to increase dross levels.

## Appearance of cut

- When cutting metals besides mild steel with O<sub>2</sub>, lag lines are not a good indicator of cut speed.
- Bevel angle, dross levels and appearance of the cut must be factored together. The smoothness or roughness of the face and the dross levels will determine correct speed.
- Concave cut face is due to torch-to-work distance being too low or consumables are worn.
- Convex cut face is due to torch-to-work being too high or consumables are worn.



Good quality stainless steel cut

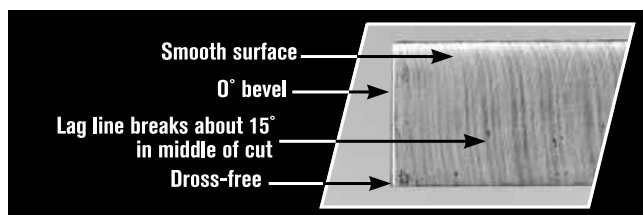


Good quality aluminum cut

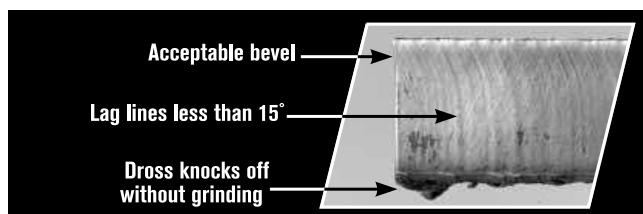
## Reading lag lines

### Mild Steel, O<sub>2</sub> cutting only

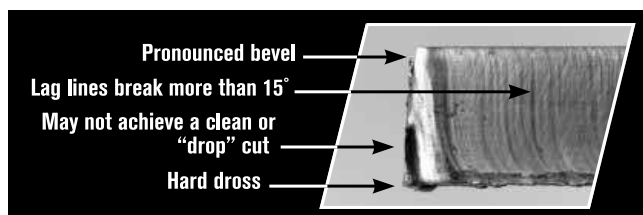
- Using the lag lines of a cut are an excellent way to determine proper cut speeds.
- The lines should generally trail the cut by approximately 10–15 degrees.
- When the lines are more vertical, the speed is too low.
- When the lines are more trailing, the speed is too high.



Correct speed



Too slow



Too fast

## Effects of cutting speed on arc voltage

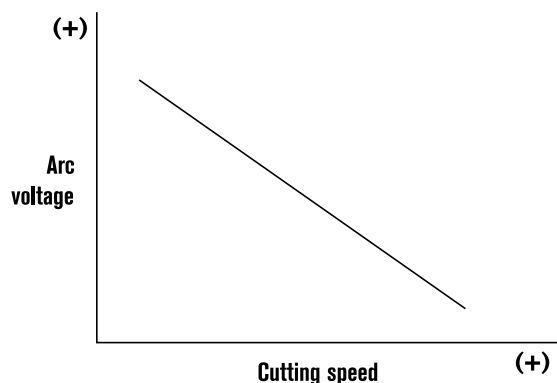
- As cutting speed *increases*, arc voltage *decreases* and vice versa.
- Cutting speed changes:
  - When going in and out of corners\*
  - At beginning and end of a cut\*
  - When cutting circles and contours\*

\* This will cause dross in corners and contours.

### ■ Reaction of THC

- Torch will dive as speed decreases\*\*
- Torch will rise as speed increases\*\*

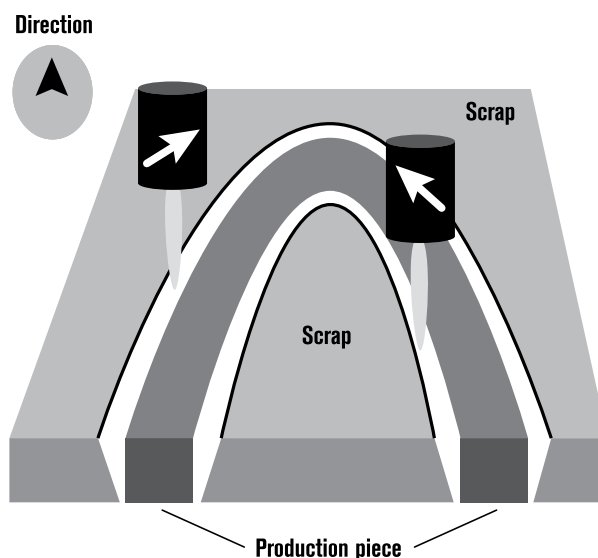
\*\* THC must be turned off or "Locked Out" when speed decreases.



Note: Graph is independent of system and metal thickness.

## Cutting direction

- Due to the swirling action of the plasma gas, one side of the cut will always have a bevel angle. This is called the "bad side" of the cut.
- In order to get the minimum amount of bevel on your production pieces, the torch must travel in the proper direction. The "good side" is on the right as the torch is traveling away from you. Refer to picture.
- The swirl direction can be reversed, by using different swirl rings on some models to achieve the opposite results (Used for cutting mirror image parts).



## What drives cut quality?

The cut sample can be an excellent way to visually represent the capabilities of metal cutting equipment. By evaluating the smoothness of the cut, bevel angle and dross levels an accurate depiction of the potential success of this process can be observed. However, the cut sample cannot and should not be the sole determining factor in the purchasing decision. Many parameters directly impact the quality of the cut part. An understanding of all the factors that contribute to a successful cut is critical before a purchasing decision should be made.

The plasma cutting process is directly influenced by four primary factors:

- Cutting machine (XY table, punch press, etc.)
- Motion control device (CNC)
- Process variables (gas purity, travel speed, material variability, etc.)
- Plasma cutting system (power supply, torch, etc.)

There are numerous manufacturers of metal cutting systems in the marketplace today producing a variety of different types of machines. Consequently, results may vary. Cut samples provided by Hypertherm represent cut quality attainable on **one type** of cutting machine and in no way indicate expected results on other cutting equipment.

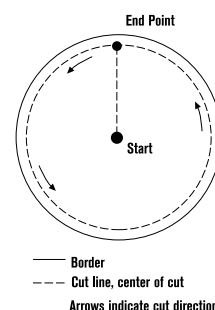
Hypertherm strongly recommends that you obtain a cut sample that has been made on equipment representative of the cutting machine being considered. Only then can a more accurate determination of expected results be possible.

## Cutting holes

- Cutting internal holes can be very difficult with plasma. The minimum hole sizes, assuming excellent motion control characteristics are:

- HyPerformance/HyDefinition (O<sub>2</sub> on mild steel)
  - 1/8" (3 mm) plate and less: 3/16" (4.7 mm)
  - Above 1/8" (3 mm): 1.5 times material thickness
- Conventional (O<sub>2</sub> on mild steel)
  - 1/8" to 1/2" (3 – 13 mm) plate: 2 times material thickness
  - Above 1/2" (13 mm): 1.5 times material thickness
- For best results:
  - Turn THC off.
  - Reduce speed.
  - Make lead-in perpendicular to side.
  - Minimize lead-out.  
Only enough for part to drop out.

PLATE WITH INTERNAL HOLE



## Operator troubleshooting

### Status LEDs

The green or amber lights on the front of the power supply are good indicators of common problems. If the LEDs are green then they should be on; if they are amber they should be off. Check your Instruction Manual to see how to troubleshoot with these LEDs.

### Note

- HyPerformance plasma has no indicator lights on the power supply.

### Tips

- System shuts off during cut or when trying to cut: Hold down on the Start button to see which LED "flickers". This may be the one causing the system to shut down.
- Constant bevel: Check for the proper direction of cut, torch height, cut speed, condition of consumables and torch alignment (perpendicular to plate). If all appear to be correctly set and in good condition, have maintenance check for any leak or restriction. If no other problems are found, it may be necessary to replace the torch.

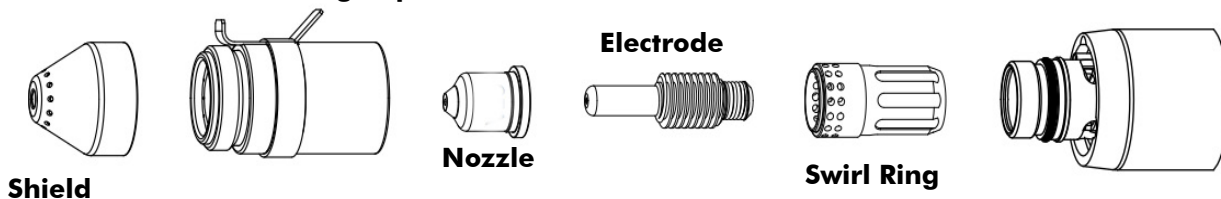
## XIII. Consumable Information

### Troubleshooting consumables

Learning how to evaluate consumables will allow the experienced operator to quickly evaluate the operation of his system and find any problem that may arise. The chart below shows common problems and solutions:

<b>Problem</b>	<b>Possible cause</b>	<b>Solution</b>	<b>Notes</b>
<b>Electrode quickly erodes</b>	Gas restriction, low gas flow	1. Verify proper flow setting and supply pressure/flow	Torch will dive if equipped with THC
		2. Verify proper consumables are installed	This problem could also cause misfiring
		3. Check swirl ring for blockage and proper amount of lubrication	
		4. Check for hose blockage or kink	
		5. Check for malfunctioning valve	
	High coolant temperature or low coolant flow	1. Verify proper temperature if equipped with external chiller 2. Perform coolant flow test	
	Excessive errors	Make programming changes to allow system to ramp up/down properly	
<b>Electrode pit wearing is non-concentric</b>	Blocked or defective swirl ring	Replace swirl ring	Excessive lubricant can block swirl rings
	Defective torch	Replace torch main body	
<b>Nozzle orifice wears out of round or orifice wears from the outside in</b>	Excessive pilot arcing	1. Verify proper pierce height	
		2. Check work cable connection	Excess slag on table can cause this problem
		3. Shorted torch	Measure resistance of torch
		4. Pilot arc relay is staying closed	
<b>Nozzle erodes on the inside</b>	Contamination	Check gas supply or check for leak	A leak when cutting with O <sub>2</sub> can cause contaminants to enter the plasma gas line
	Double arcing	Verify proper pierce height	Electrode and nozzle will be black. Torch will rise if equipped w/THC




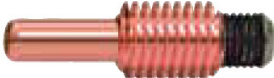
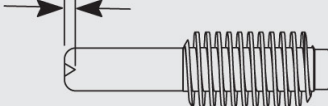

#### Ohmic Retaining Cap



### Troubleshooting

Consumable wear



Part	Condition	Action
<b>Nozzle</b> Check center hole 	Good 	No action required.
	Worn 	If out of round, replace
<b>Electrode</b> Examine center surface 	Maximum 1 mm 	Replace
<b>Swirl ring</b> Examine external surfaces 	Damage or debris	Replace
Examine gas holes	Blocked holes	Replace

## Troubleshooting

### Cut quality

#### Optimum cut

##### What to look for

1. Well defined lag lines with an angle of 10° - 15°
2. Minimal dross
3. Square edges
4. No top splatter
5. No discoloration



Lagline

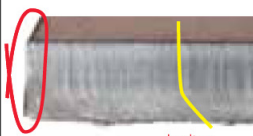
#### Excess bevel angle

##### Possible cause

1. Torch not square
2. Amperage too low
3. Speed too fast
4. Worn nozzle

##### Solution

1. Square torch to workpiece
2. Increase amperage
3. Decrease speed
4. Replace nozzle



Lagline

#### Hardened dross

##### Possible cause

1. Speed too fast
2. Amperage too low

##### Solution

1. Decrease speed
2. Increase amperage



Lagline

	PowerMax 45	PowerMax 65	PowerMax 85	PowerMax 105
<b>45 Nozzle</b>	H25XHY-220671	H25XHY-220941	H25XHY-220941	H25XHY-220941
<b>65 Nozzle</b>		H25XHY-220819	H25XHY-220819	H25XHY-220819
<b>85 Nozzle</b>			H25XHY-220816	H25XHY-220816
<b>105 Nozzle</b>				H25XHY-220990
<b>Electrode</b>	H25XHY-220669	H25XHY-220842	H25XHY-220842	H25XHY-220842
<b>Shield</b>	H25XHY-220674	H25XHY-220817	H25XHY-220817	H25XHY-220817 (45, 65, 85) H25XHY-220993 (105)
<b>Retaining Cap</b>	H25XHY-220719	H25XHY-220953	H25XHY-220953	H25XHY-220953
<b>Swirl Ring</b>	H25XHY-220670	H25XHY-220857	H25XHY-220857	H25XHY-220994

## **TECHNO CNC SYSTEMS LIMITED WARRANTY & COVERAGE**

### **Limited Warranty On Techno Brand Products**

Subject to the terms and conditions set forth in this warranty document, Techno CNC Systems LLC (“Techno”) warrants its Techno brand products (“Product” or “Products”) to the original purchaser for a period of one (1) year against defects in material and workmanship under normal use and conditions (“Product Limited Warranty”). The Product Limited Warranty commences on the date of Product shipment from Techno facilities and expires one (1) year from the ship date (“Product Warranty Period”).

Spare or replacement parts (“Part” or “Parts”) for Techno Products are warranted to the original purchaser for a period of ninety (90) days against defects in material and workmanship under normal use and conditions (“Parts Limited Warranty”). A Parts Limited Warranty commences on the date of a Part shipment from Techno facilities and expires ninety (90) day from the ship date (“Parts Warranty Period”).

A Product Limited Warranty may be validly transferred to one additional party by the original purchaser provided that a reregistration fee is paid to Techno within seven (7) days of transfer of the Product and prior to the expiration of the Warranty Period. Reregistration of any Product warranty does not extend the Warranty Period. A Parts Warranty is not transferable.

Product Limited Warranty and Parts Limited Warranty are hereinafter referred to collectively as “Limited Warranty.” Product Warranty Period and Parts Warranty Period are hereinafter referred to collectively as “Warranty Period.”

### **What Is Covered Under The Limited Warranty**

During the Warranty Period, Products and Parts that Techno deems validly subject to a warranty claim will be repaired or replaced, in Techno’s sole discretion, without charge. Repaired items may include new or refurbished replacement parts. Replaced items may be new or may be manufactured from serviceable used parts. Items that have been repaired and/or replaced will be warranted only for the unexpired portion of the applicable Warranty Period to the original purchaser.

**As a condition to this Limited Warranty, customers shall have read the operator’s manual and registered the Product or Part with Techno within 30 days of purchase.**

### **What Is Not Covered Under The Limited Warranty**

Events That Are Not Covered Under This Limited Warranty Include:

- \* Normal maintenance services as outlined in the operator’s manual or other operational instructions provided by Techno (such as oil change, cleaning, lubrication and adjustments).
- \* Replacement of consumable items such as oil, lubricants, belts, router bits, or other items subject to normal service replacement.
- \* Product/Part damage resulting from third-party parts, accessories or systems connected to or used in conjunction with the Product/Part that have adversely affected its operation, performance or durability.
- \* Product/Part damage caused by normal wear, accidents, improper maintenance, improper use or abuse, alterations, or failure to follow operation and maintenance instructions contained in the operator’s manual.



- \* Products/Parts purchased from any supplier, distributor or dealer not authorized by Techno.
- \* Labor costs including, but not limited to, such costs as the removal and reinstallation of a component or assembly.
- \* Insurance and packing costs for a defective items returned to Techno by the customer.
- \* Product/Part damage caused by electrical surges, improper venting, flooding, fire, freezing, corrosive atmospheric elements, abnormal external temperature, or any event of force majeure such as riot or act of war.
- \* Noise or vibration unless it is the result of defective material or workmanship of the Product/Part.
- \* Claims of defective Products or Parts not made in conformance with Techno's return policy as set forth below.
- \* Transport costs for defective items that require more than one (1) shipping to remedy a claimed defect.
- \* Claims for personal injuries, incidental or consequential damages, or economic loss (profit or revenue), however caused. i.e. any other incidental, consequential, indirect, special and/or punitive damages, whether based on contract, warranty, tort (including, but not limited to, strict liability or negligence), patent infringement, or otherwise, even if advised of the possibility of such damages. Some states do not allow the exclusion or limitation of certain damages, so the above exclusion or limitation may not apply to a particular customer depending on location.
- \* CLAIMS FOR PRODUCT COMPONENTS OR PARTS THAT ARE WARRANTED SEPARATELY BY THEIR RESPECTIVE MANUFACTURER(S) OR SUPPLIER(S). Available warranties covering those components are furnished with each Product and Part. Techno CNC Systems does not assume any warranty obligation or liability for components covered exclusively by the stated warranty of a component's respective manufacturer(s) or supplier(s).

Techno's Limited Warranty Shall Be Void In The Event Of An Occurrence Of Any Of The Following:

- \* Failure by the Original Purchaser to register the Product within thirty (30) days of its purchase.
- \* Where applicable, failure to validly reregister the Product within seven (7) days of transfer of the Product and prior to the expiration of the Warranty Period.
- \* Improper installation of the Product, including but not limited to, installation in violation of applicable rules, laws or building codes, and installation for non- recommended uses.
- \* Accident, abuse or misuse of the Product.
- \* Failure to follow or comply with the user's operational manual.
- \* Modification, alteration, addition of non-approved components, or misapplication of the Product or Part in any manner.
- \* Repairs and service conducted by personnel unauthorized by Techno.
- \* Modifications to, and tampering with, the Product or Part.

- \* Use of non-standard parts or accessories without prior written approval from Techno.
- \* Use of Product or part for purposes for which the item was not designed or intended.
- \* Cancellation or recall of equipment/parts payment to Techno without specific prior written authorization from Techno.

### **Warranty Limitations**

Techno's maximum liability hereunder is limited to the original purchase price of the Product or Part.

Techno assumes no responsibility for the selection of any Product or Part for a specific application absent Techno's written approval of such application, and makes no general representations whatsoever in respect to any such selection.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES EXPRESSED OR IMPLIED. ALL OTHER WARRANTIES, INCLUDING, BUT NOT LIMITED TO, ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, WHETHER EXPRESSED, IMPLIED, OR ARISING BY OPERATION OF LAW, TRADE USAGE, OR COURSE OF DEALING, ARE HEREBY DISCLAIMED. THERE ARE NO WARRANTIES THAT EXTEND BEYOND THE DESCRIPTION ON THE FACE OF THIS WARRANTY DOCUMENT.

TECHNO SHALL NOT BE LIABLE FOR INDIRECT, INCIDENTAL, SPECIAL, CONSEQUENTIAL, PUNITIVE OR OTHER SIMILAR DAMAGES THAT MAY ARISE, INCLUDING LOST PROFITS, DAMAGE TO PROPERTY OR INJURIES TO A PERSON, LOSS OF USE, INCONVENIENCE, OR LIABILITY ARISING FROM THE INSTALLATION, SERVICE OR USE OF THE PRODUCT OR PART.

UPON THE EXPIRATION OF THE LIMITED WARRANTY PERIOD, TECHNO'S LIABILITY UNDER THIS WARRANTY SHALL TERMINATE.

Some states do not allow the contractual exclusion or limitation of incidental or consequential damages or personal injury, so the limitations set forth herein may not apply to all customers in all locations.

### **How To Obtain Warranty Repair/Replacement**

All defective items covered under the Limited Warranty must be properly returned to Techno for inspection. Techno reserves the right to not accept returns unless the returned item is accompanied by proof of original purchase, a return authorization number ("RAN") from Techno, and shipped in accordance with packaging and shipping instructions given to the customer by Techno. Claims and requests for a RAN must be made within seven (7) days of discovery of a defect. Proper packaging and insurance for transportation is solely the customer's responsibility. All returned items must be sent to the Techno facility located in Ronkonkoma, New York (or such other place as Techno specifically designates to the customer) with a statement of the problem and transportation prepaid. If, upon examination, Techno determines that a warranted defect exists, the returned item will be repaired or replaced in Techno's sole discretion at no charge, and shipped prepaid back to the customer. Return shipment will be by common carrier of Techno's choosing. If rapid delivery is requested by customer, then such transport expense shall be borne by the customer.

Warranty inspections and repairs are performed at Techno's New York facility, where all necessary diagnostic and repair equipment is available. This equipment is difficult to transport and field service is accordingly severely limited and will only be supplied at Techno's sole discretion. If field service is required, all service call expenses, including transportation, travel time, subsistence costs, and the prevailing cost per hour (eight hour minimum) are the responsibility of the customer.

In the event that support diagnostics of a covered Product or Part requires an item to be shipped more than one (1) time for any given claimed warranty defect, then the customer shall bear all transport costs.

If an out-of-warranty situation exists, the customer will be notified of the repair or replacement cost. At such time, the customer must issue a purchase order to cover the cost of the repair/replacement or authorize the item to be shipped back to the customer at the customer's expense. In all cases, a restocking charge of twenty (20%) percent will be charged to the customer on all items returned to stock.

Warranty claims will not be reviewed or remedied unless the warranty registration is received by Techno within thirty (30) days of the purchase date. All warranty issues must be handled through Techno.

Techno customer service can be reached by calling 631-648-7481.

### **Additional Terms & Conditions**

TECHNO RESERVES THE RIGHT TO CHANGE DESIGNS, SPECIFICATIONS, PRICES AND ANY APPLICABLE DOCUMENTATION WITHOUT NOTICE TO THE CUSTOMER.

Techno is not liable for delay or failure to perform any obligation hereunder by reason of circumstances beyond Techno's reasonable control. These circumstances include, but are not limited to, accidents, acts of God, strikes or labor disputes, laws, rules, or regulations of any government or government agency, fires, floods, delays or failures in delivery of carriers or suppliers, shortages of materials, and any other event beyond Techno's control.

No legal action arising out of any claimed breach of this Limited Warranty may be brought by the more than one (1) year following date of purchase of a Product or Part. This Agreement shall be governed in all respects by the laws of the State of New York, United States of America. Any legal action brought by a customer against Techno must be brought in the state courts of the State of New York, Second Judicial Department. Some states do not allow the contractual limitation of time periods for bringing suit so the limitations set forth herein may not apply to all customers in all locations.

Once an order is placed by the purchaser, in no event shall purchaser cancel payment or any portion thereof (e.g. reverse charges on a credit card or stop payment on a check) without prior express written authorization from Techno. Failure to obtain prior express written authorization from Techno shall be an event voiding Techno's Limited Warranty on the Product or Part and purchaser shall be subject to liability for any damages sustained by Techno.

The terms and conditions contained herein shall constitute the entire agreement concerning the Limited Warranty described herein. No oral or other representations are in effect. No dealer, distributor, or individual is authorized to amend, modify, or extend this Limited Warranty in any manner and only the warranty expressed in this warranty document is extended herein by Techno. Statements made outside this warranty document, such as in dealer advertising or presentations, whether oral or written, do not constitute warranties by Techno and should not be relied upon.

Section headings contained in this warranty document are for informational purposes only and may not be used to limit the terms and conditions set forth in this warranty document. If any portion or provision contained in this Limited Warranty & Coverage shall to any extent be found to be invalid or unenforceable, the remainder of this coverage or the application of such portion or provision in circumstances other than those in which it is held invalid or unenforceable, shall not be affected thereby, and each remaining portion or portion of this Limited Warranty shall be valid and enforceable.