

## Section 4

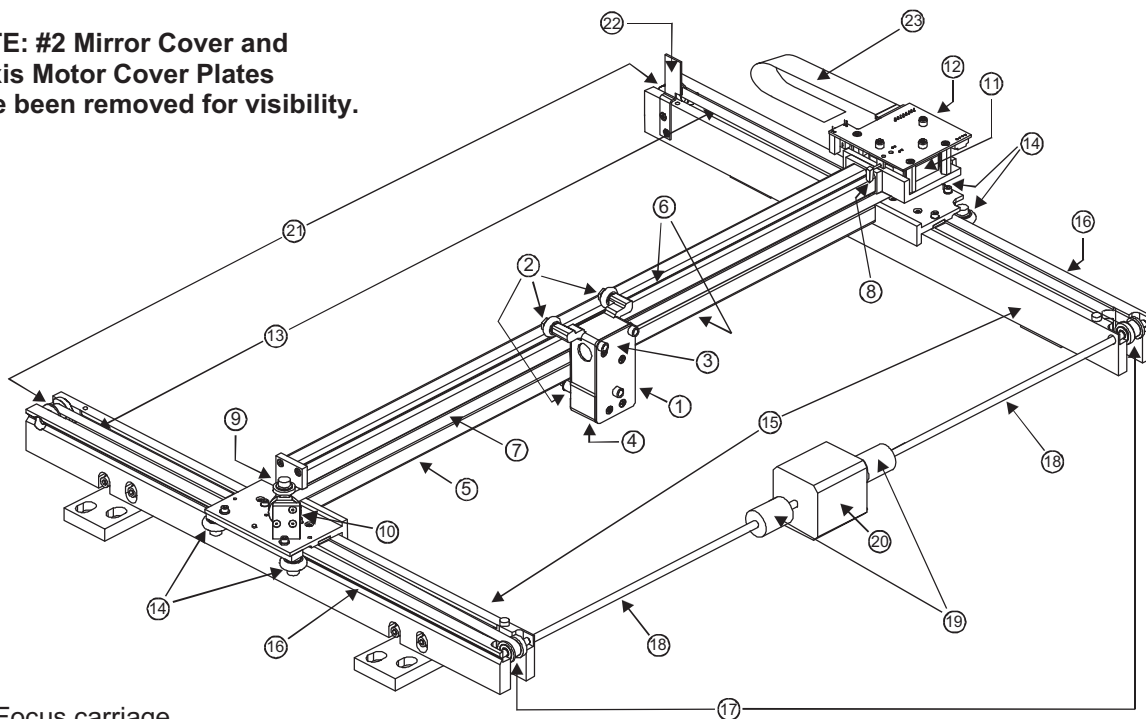
# 4

# Basic Maintenance

Keeping the laser system clean will ensure the highest quality engraving. The frequency of cleaning will depend entirely on the type of material being engraved, the performance of your exhaust system, the operating environment, and the amount of laser system usage over a given period of time. Dirt or debris that is allowed to build up on the motion system components will cause uneven or rough engraving, or loss of engraving position as well as premature component failure. Smoke or dirt buildup on the optics can cause damage to them, loss of laser power, or premature failure of these components. Use good judgment and keep in mind that a clean machine is the best performing machine. Always turn the laser engraving system OFF and unplug it before performing any cleaning procedures.

## Motion System Components Diagram

**NOTE: #2 Mirror Cover and X-axis Motor Cover Plates have been removed for visibility.**



- 1) Focus carriage
- 2) X-axis bearing (3)
- 3) #3 mirror (inside cover plate)
- 4) Focus lens (inside cover plate)
- 5) X-axis rail (arm)
- 6) X-axis bearing track (2)
- 7) X-axis belt
- 8) X-axis home sensor flag
- 9) X-axis idler pulley
- 10) #2 mirror and holder
- 11) X-axis motor and drive gear
- 12) X-Y home sensor board (upper flex board)
- 13) Y-axis belt (2)
- 14) Y-axis bearing (4) (2 on right side Y-axis rail, 2 on left side Y-axis rail)
- 15) Y-axis rail (2)(one right side and one left side)
- 16) Y-axis rail bearing track (2) (one on right side, one on left side)
- 17) Y-axis drive gear (2) (one on right side, one on left side)
- 18) Y-axis shaft (2) (one on right side, one on left side)
- 19) Y-axis shaft flex coupler (one on right side, one on left side)
- 20) Y-axis motor
- 21) Y-axis idler pulley (2) (one on right side, one on left side)
- 22) Y-axis home sensor flag
- 23) Flex cable

## Cleaning and Maintenance Supplies

- Soap solution mixture of 1 tablespoon (2 cl) liquid soap and 1 quart (liter) of water in a spray bottle
- Paper towels
- Cotton cloth
- Denatured alcohol (**NOT** to be used on any painted surface, plastic, or the Top Window)
- Acetone (can be used on the engraving table but nowhere else)

### CAUTION

**When using acetone or denatured alcohol, please follow the instructions on the printed label of these materials for safe handling procedures.**

- Cotton swabs (supplied)
- Lens cleaner (supplied)
- Vacuum cleaner
- Set of Allen wrenches sized from .050 to 3/16 inch

## System Cleaning and Maintenance

### Motion System

- Turn off and unplug the laser system.
- Open the top door and thoroughly remove all loose dirt and debris from inside the machine with a vacuum cleaner.
- Clean the engraving table surface with either a soap solution, or alcohol or acetone, and paper towels. **NEVER** pour or spray any solution directly into the laser system. Always dampen your paper towel or cloth outside of the machine with the cleaning solution and then wipe down the parts you are cleaning with the dampened cloth.
- Clean X-rail and the Y-rails by using either the cotton swabs or paper towels, and alcohol or soap solution. Pay close attention to the bearing tracks since any debris left to build up in these bearing tracks will cause the bearings to wear and the engraving quality to become rough.
- After the rails and tracks are cleaned, use a clean swab or paper towel, and alcohol to clean all of the bearings by holding the swab against each bearing and moving the motion system by hand to roll the bearings against the swab. There are seven bearings in the system, three (3) on the focus carriage, two (2) on the left side of the X-rail, and two (2) on the right side of the X-rail.
- Clean the top window with a cotton cloth and the soap solution. The top window is made out of acrylic. **DO NOT** use paper towels because they will scratch the acrylic. Also, **DO NOT** use window cleaner, alcohol, or acetone, as these chemicals will crack the acrylic. Only use cleaners compatible with acrylic.
- Use a soft cloth or paper towels and the soap solution to clean the enclosure. **DO NOT** use alcohol, acetone, or any other harsh chemical, as this will damage the paint.

### Optics

A visual inspection of the #2 and #3 mirrors, beam window, and focus lens should be performed at least once a day.

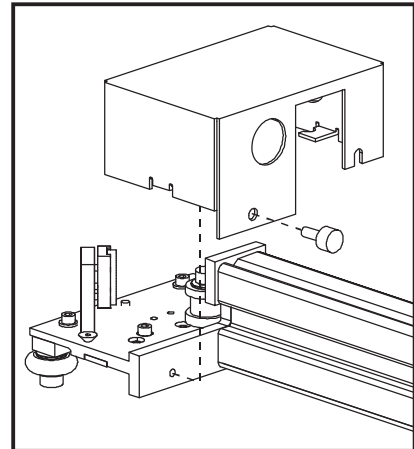
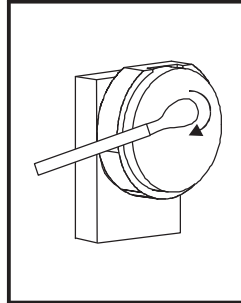


**DO NOT** clean an optic that is visually clean. Excessive cleaning can damage the optic. To prevent contamination, wash your hands thoroughly before cleaning any optic. **NEVER** touch any optic with your fingers. The acids from your skin can destroy the optical coatings. **NEVER** clean any optic right after engraving or cutting because the optic may be hot and the cool lens cleaning solution may thermally shock the optic and crack it.

**#2 Mirror**

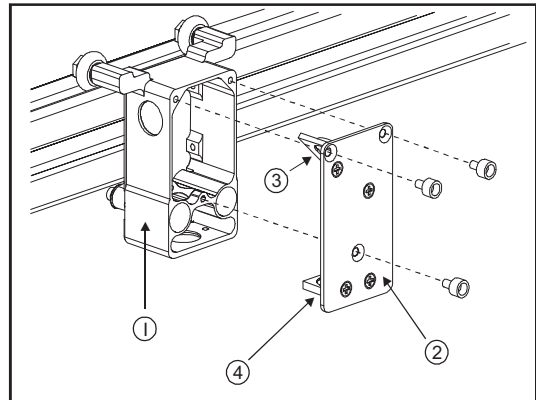
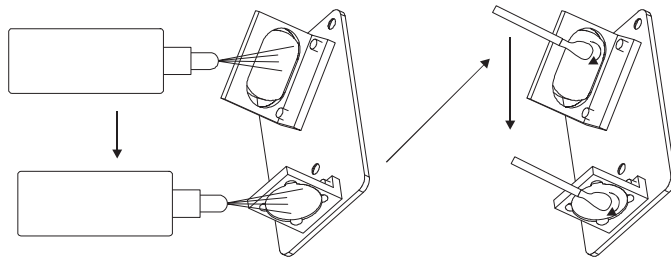
To gain access to the #2 mirror, the mirror cover must be removed. Remove the thumbscrew and slide the cover to the right and then lift the cover straight up.

Inspect the #2 mirror and clean it only if there is debris present. To clean the #2 mirror with a cotton swab, moisten the cotton swab with the lens cleaning solution supplied with the laser system. **DO NOT** use other types of cleaners or solutions. Gently roll the cotton swab across the mirror once. **DO NOT** drag the swab or roll it back and forth as this can scratch the mirror. If the mirror did not come clean, use a fresh cotton swab and repeat the procedure. Do not be concerned about small pieces of lint that come off of the cotton swab. They will be vaporized as soon as the laser hits it. You can cause more damage to the mirror by trying to remove the lint than by leaving it alone.



**#3 Mirror and Focus Lens**

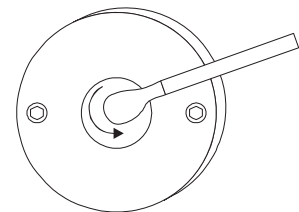
To gain access to the #3 mirror (3) and the focus lens (4), hold the front cover (2) with one hand, and remove the three thumbscrews with the other hand. Pull the front cover straight out. The #3 mirror and the focus lens are both mounted to the front cover.

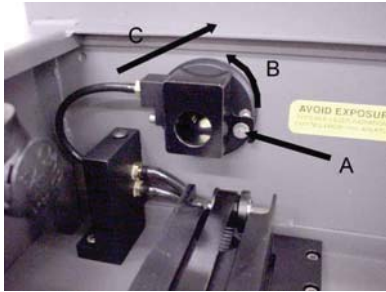


Tilt the front cover enough to enable you to apply the lens cleaning solution directly to the #3 mirror and to the focus lens. Flood the reflective surface of the #3 mirror with the solution. If heavy debris is present, let the solution soak in for a minute. Roll a fresh cotton swab across the mirror in one direction. Use a fresh swab for each pass. Be gentle when cleaning the optic to avoid scratching the surface. Repeat this procedure for the focus lens but make sure you clean both sides of the lens.

**Beam Window**

The beam window is where the laser beam enters into the engraving area. It is located in the upper left hand corner of the engraving area against the back wall and is yellow in color. It is only necessary to clean the front side of the beam window. Do not remove the optic to clean it, simply clean it in the same manner as the #2 mirror.

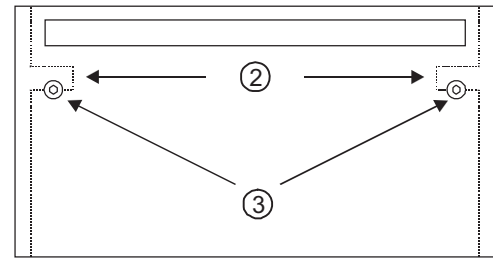
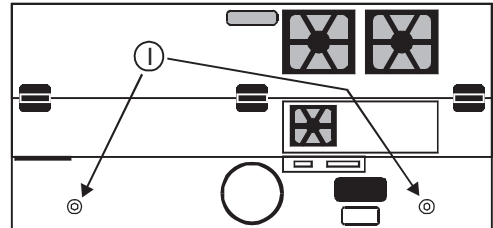




If your system is equipped with Air Assist, using your fingers, rotate the beam window cover counter-clockwise (B) and then off at a 45-degree angle. If the beam window cover is stuck use a 1/16 Allen wrench to loosen or remove the screw (A) and try again. Set the cover off to the side and clean the optic, if necessary. Reinstall the beam window cover opposite of removal being careful not to scratch the optic.

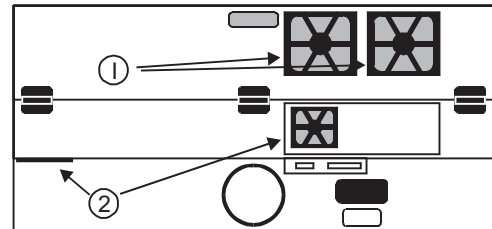
### Exhaust Plenum Cleaning

- Power system ON.
- Using the Z-axis controls, raise the Z-axis table as high as possible. Power the system OFF.
- Locate and remove the two button head screws (1) found on the back of the laser system.
- Open the front door. Using both hands, reach in and grab exhaust plenum. Lift the plenum straight up until the tabs (2) of the plenum clear the two flat head screws (3) they are resting on. Tilt the bottom of the plenum towards you and remove it from the system. Using your soap and water solution, clean the inside of plenum as well as the inside rear wall of the Laser System.
- Installation is opposite of removal. Make sure that the plenum tabs rest on the two flat head screws.



### Cooling Fan Filters

This air-cooled laser system will require periodic cleaning of the cooling fan filters. Since ambient air is used to cool the laser cartridge, the air must be filtered before it enters the inside of the laser system. Dirt or dust contamination may reduce the cooling fan's ability to keep the laser cartridge, as well as the CPU and power supply, from overheating. An overheated laser cartridge will lose laser power during engraving and will eventually shut down completely.



The cooling fan filters are located on the back of the laser system. To service the filters, first turn OFF and unplug the laser system. There are two large filters (1) and two small filters (2). To remove the filter(s), simply snap off the black cover and remove the foam element. Wash the element in a soap and water solution, dry, and re-install.



**NEVER OPERATE THE LASER SYSTEM WITH THE COOLING FAN FILTERS REMOVED.** This can permanently damage the laser system. Damage to the laser system, from this kind of abuse **IS NOT** covered under warranty.

## Adjustments and Lubrication

There are no periodic adjustments normally required. The bearings in the motion system will self adjust to take up any clearances as they begin to wear. The belts are fiber reinforced and will not stretch under normal use so that periodic tension adjustment is not necessary. Optical alignment is not necessary because the laser and the #2 mirror are fixed.

All bearings in the system are sealed and do not require lubrication. **DO NOT** lubricate the tracks that the bearings ride in. The only lubrication that may be required is the screw threads for the table lifting mechanism. After some time, contaminants can adhere to the lubricant, which can cause the engraving table to bind up or sound squeaky. If this is the case, wipe off the contaminated grease with a soft cloth dampened with alcohol and apply fresh white lithium grease to the screw threads. **NEVER SPRAY ANY DEGREASING SOLUTIONS DIRECTLY ONTO THE THREADS.** Run the table up and down to work in the fresh grease. Repeat if necessary.

## Maintenance Schedule

Since the maintenance requirements of the laser system is dependent on the type of material being run, the quantity of material being removed, the hours of operation, and the quality of the exhaust blower, it must be user defined.

As a starting point, we recommend the following schedule:

- As necessary
  - Engraving table
  - Main enclosure
  - Top door window
- Every 8 hours of engraving
  - Clean X-axis and Y-axis bearings
  - Clean X-axis and Y-axis rails and bearing tracks
  - Clean X-axis belt.
  - Check beam window, #2 mirror, #3 mirror, and focus lens for debris. Clean **ONLY** if dirty.
- Every month
  - Clean cooling fan filters
  - Clean and re-lubricate Z-axis lead screws
  - Check for X-axis and Y-axis belt wear – replace as necessary
  - Check and/or clean X-axis and Y-axis drive gears
  - Check for X-axis and Y-axis bearing wear – replace as necessary
  - Inspect system for loose screws and mechanical parts – tighten if necessary
- Every 6 months
  - Exhaust plenum

**If you are noticing a considerable buildup of debris on the optics and the motion system, clean the system at more frequent intervals. If your system has remained relatively clean, you can extend your cleaning intervals. Keep in mind that a clean machine is a better performing machine and can extend the life of the parts as well as reduce the possibility of down time. If you have any questions about maintaining the laser system, please contact our Service Department.**

## Troubleshooting Guide

### Engraving Quality

Problem	Possible Cause	Possible Solution
"Fuzzy" looking raster engraving or small text appears like a "double image"	<ul style="list-style-type: none"> <li>• Dirty laser system</li> <li>• Graphic, graphic software, graphic software setup, color palette, monitor display colors, or driver settings have changed</li> <li>• Speed too fast for the material</li> <li>• Out of focus</li> <li>• System needs tuning</li> <li>• Worn X-axis belt and/or drive gear</li> <li>• Laser Tube is faulty</li> </ul>	<ul style="list-style-type: none"> <li>• Clean all optics, rails, bearings and belts</li> <li>• Check to see what has changed. Refer to the "Computerized Controls" manual to properly setup the graphics software. Check driver settings.</li> <li>• Slow down engraving speed</li> <li>• Re-focus</li> <li>• Run "Tuning" feature in printer driver</li> <li>• Replace belt and/or drive gear, and run "Tuning" feature</li> <li>• Replace laser tube</li> </ul>
Fine detail is missing such as the serifs of characters or thin lines of script fonts when raster engraving	<ul style="list-style-type: none"> <li>• Speed too fast for the material</li> <li>• Laser cannot respond to low duty-cycle, high speed engraving</li> <li>• Out of focus</li> <li>• System needs tuning</li> <li>• Laser spot size too big</li> </ul>	<ul style="list-style-type: none"> <li>• Slow down engraving speed</li> <li>• Run enhancement feature in the printer driver</li> <li>• Re-focus</li> <li>• Run "Tuning" feature in printer driver</li> <li>• Use shorter focal length lens</li> </ul>
Vertical or diagonal background pattern present when raster engraving large areas and/or large amounts of material	<ul style="list-style-type: none"> <li>• Dirty laser system</li> <li>• Slight pattern is normal</li> </ul> <p>If the pattern is excessive:</p> <ul style="list-style-type: none"> <li>• Loose motion system components</li> <li>• Worn or damaged X-axis bearings</li> <li>• Worn or damaged X-axis rail</li> </ul>	<ul style="list-style-type: none"> <li>• Clean all optics, rails, bearings and belts</li> <li>• Don't remove so much material or try engraving shallower or deeper. Try changing PPI and or DPI. Use a 50% black fill to "halftone" the background which can hide the pattern</li> <li>• Check X-axis bearings, belt, optics</li> <li>• Replace X-axis bearings</li> <li>• Replace X-axis arm</li> </ul>
Horizontal background pattern present when raster engraving large areas and/or large amounts of material	<ul style="list-style-type: none"> <li>• Dirty laser system</li> <li>• Slight pattern is normal</li> </ul> <p>If the pattern is excessive:</p> <ul style="list-style-type: none"> <li>• Laser is too cold or hot</li> </ul> <ul style="list-style-type: none"> <li>• Laser tube is faulty</li> </ul>	<ul style="list-style-type: none"> <li>• Clean all optics, rails, bearings and belts</li> <li>• Don't remove so much material or try engraving shallower or deeper. Try changing PPI and or DPI. Use a 50% black fill to "halftone" the background which can hide the pattern</li> <li>• Check and/or clean filters</li> <li>• Make sure ambient temperature is within specifications</li> <li>• Replace laser tube</li> </ul>
Engraving disappears, becomes "lighter", or appears "choppy" when raster engraving at high speeds within 1/2 inch of Y-axis ruler	<ul style="list-style-type: none"> <li>• Normal condition. The laser system needs to accelerate and decelerate within this area</li> </ul>	<ul style="list-style-type: none"> <li>• Move graphic and/or material to the right, outside of this area</li> <li>• Slowing the raster speed down reduces the effect</li> </ul>

BASIC MAINTENANCE

<p>Raster engraving appears sharp on both ends of the engraving but fuzzy in the middle</p>	<ul style="list-style-type: none"> <li>• Dirty laser system</li> <li>• Something is loose</li> <li>• System needs tuning</li> <li>• Worn X-axis belt and/or drive gear</li> <li>• Faulty laser tube</li> </ul>	<ul style="list-style-type: none"> <li>• Clean all optics, rails, bearings, belts</li> <li>• Check X-axis bearings, drive gear, idler pulley, belt, and optics</li> <li>• Run "Tuning" feature in printer driver</li> <li>• Replace belt and/or drive gear, and run "Tuning" feature</li> <li>• Replace laser tube</li> </ul>
<p>Engraving does not appear as deep as it normally does</p>	<ul style="list-style-type: none"> <li>• Graphic, graphic software, graphic software setup, color palette, monitor display colors, or driver settings have changed</li> <li>• Out of focus</li> <li>• Material or material density has changed</li> <li>• Settings have changed</li> <li>• Dirty laser system</li> <li>• Laser tube cooling fan filters are dirty</li> <li>• Ambient temperature not within specifications</li> <li>• Laser beam out of alignment with the optics</li> <li>• Air Assist cone misaligned (air assisted versions only)</li> <li>• Faulty laser tube</li> </ul>	<ul style="list-style-type: none"> <li>• Check to see what has changed. Use "Software Setup Guide" to properly setup the graphics software to work correctly with the laser system. Check driver settings.</li> <li>• Re-focus</li> <li>• Check material</li> <li>• Check power, speed, PPI, and DPI settings</li> <li>• Clean all optics, rails, bearings and belts</li> <li>• Check and/or clean</li> <li>• Adjust ambient temperature to within specifications</li> <li>• Check and/or adjust laser beam alignment</li> <li>• Check and/or adjust cone so that laser beam is in center</li> <li>• Replace laser tube</li> </ul>
<p>Engraving is sharp, clear and at a good depth on one side of the table and fuzzy and shallow on the opposite side of the table</p>	<ul style="list-style-type: none"> <li>• Out of focus</li> <li>• Dirty laser system</li> <li>• Material is not level or varying in thickness</li> <li>• Table is not level</li> <li>• Laser beam out of alignment with the optics</li> <li>• Air Assist cone misaligned (air assisted versions only)</li> <li>• Faulty laser tube</li> </ul>	<ul style="list-style-type: none"> <li>• Re-focus</li> <li>• Clean all optics, rails, bearings, belts</li> <li>• Check focus point of material and different places, adjust height by shimming material or using more thickness-consistent material</li> <li>• Using the focus tool, focus directly on the surface of the table in all four corners. Table should be within +/- .020 inches from one corner to the other. Adjust if necessary.</li> <li>• Check and/or adjust laser beam alignment</li> <li>• Check and/or adjust cone so that laser beam is in center</li> <li>• Replace laser tube</li> </ul>
<p>Engraving appears "halftoned" and not solidly filled when using colors other than black</p>	<ul style="list-style-type: none"> <li>• Graphic, graphic software, graphic software setup, color palette, monitor display colors, or driver settings have changed</li> </ul>	<ul style="list-style-type: none"> <li>• Check to see what has changed. Refer to the "Computerized Controls" manual to properly setup the graphics software. Check driver settings.</li> </ul>

## BASIC MAINTENANCE

<p>Wavy lines when vector engraving or cutting</p>	<ul style="list-style-type: none"> <li>• Running too fast</li> <li>• Dirty laser system</li> <li>• Worn or faulty bearings</li> <li>• Arm is out of square</li> <li>• Firmware needs to be updated</li> </ul>	<ul style="list-style-type: none"> <li>• The highest quality vectors are obtained by running less than 5% speed</li> <li>• Clean all optics, rails, bearings and belts</li> <li>• Check and/or replace X and/or Y axis bearings</li> <li>• Square arm re-adjust left side Y-axis bearings so both are contacting Y-rail equally</li> <li>• Firmware advancements have been improving vector quality</li> </ul>
<p>Angled cuts when cutting through thick materials such as ¼" acrylic</p>	<ul style="list-style-type: none"> <li>• Angled cuts are a normal condition if they are equal on all sides of the object. The topside of the object will always be slightly smaller than the backside of the object due to the material "spreading more" at the focal point.</li> <li>• Angled cuts on only one or two sides indicates a slight beam misalignment at the #3 mirror or focus lens</li> </ul>	<ul style="list-style-type: none"> <li>• Cut a square and observe that each side is slightly tapered inward.</li> <li>• Check and adjust the beam alignment at the #3 mirror position and the focus lens</li> </ul>
<p>The start and stop points of circles, when cutting, do not meet up</p>	<ul style="list-style-type: none"> <li>• Slight "notching" when cutting circles is a normal condition due to the beam starting and stopping at the same point</li> </ul> <p>If the pattern is excessive:</p> <ul style="list-style-type: none"> <li>• Dirty laser system</li> <li>• Mechanical problem</li> </ul>	<ul style="list-style-type: none"> <li>• The laser beam has width and there is a heat effect from starting and stopping the laser system at the same point. Try extending the circle through the end point by adding a small line segment to reduce the effect. If cutting the material when elevated off the table, make sure that the center if the circles are supported.</li> <li>• Try rotating the circle 90 or 180 or 270 degrees. Sometimes this helps reduce the effect</li> <li>• Clean all optics, rails, bearings and belts</li> <li>• Turn machine off and check for binding in the x &amp; y directions. Check for excessive belt tension.</li> </ul>
<p>Flat edges on curves when vector cutting</p>	<ul style="list-style-type: none"> <li>• DPI setting too low</li> <li>• PPI setting too low</li> <li>• Software limitation</li> </ul>	<ul style="list-style-type: none"> <li>• 1000 DPI produces the smoothest edges when cutting</li> <li>• Higher PPI settings produce smoother edges but may cause excessive burning or melting</li> <li>• The graphic software you are using has limited vector smoothness capability</li> </ul>



## Operational

<p>Focus carriage loses X-axis position and slams into the left or right side of the rail during high speed raster engraving</p>	<ul style="list-style-type: none"> <li>• Mechanical interference</li> <li>• Dirty laser system</li> <li>• CPU overheating</li> <li>• X-belt too tight</li> <li>• Worn or binding X-axis bearings</li> <li>• Worn or binding X-axis idler pulley</li> <li>• Worn or binding X-axis motor</li> <li>• Firmware needs updating</li> </ul>	<ul style="list-style-type: none"> <li>• Check if focus carriage makes contact with material or other objects</li> <li>• Clean all optics, rails, bearings and belts</li> <li>• Clean CPU filters, correct ambient temperature to be within specifications</li> <li>• Check and/or adjust</li> <li>• Check and/or replace</li> <li>• Check and/or replace</li> <li>• Check and/or replace</li> <li>• Check with Service Department</li> </ul>
<p>When homing, the arm slams repeatedly for a few seconds</p>	<ul style="list-style-type: none"> <li>• Bent Y-flag</li> <li>• Dirty or faulty home sensor(s)</li> </ul>	<ul style="list-style-type: none"> <li>• Check and/or straighten</li> <li>• Replace upper flex board</li> </ul>
<p>When focusing, the Z-axis table only moves in one direction</p>	<ul style="list-style-type: none"> <li>• Dirty or faulty Z-axis sensor</li> </ul>	<ul style="list-style-type: none"> <li>• Try to clean sensor(s) with compressed air, otherwise replace sensor</li> </ul>
<p>When using Autofocus, the table moves all the way down to the bottom and gets stuck</p>	<ul style="list-style-type: none"> <li>• Autofocus sensor or reflector is dirty</li> <li>• Autofocus sensor is misaligned</li> </ul>	<ul style="list-style-type: none"> <li>• Clean sensor and/or reflector</li> <li>• With the Z-axis table out of the way of the Autofocus beam, check the sensor for only an illuminated green light. A red light, both lights, or no lights indicate a misalignment or dirty condition. Clean, re-check, and re-align the Autofocus sensor.</li> </ul>
<p>When printing to the laser system, the computer gives an error message "Printer out of paper" or "Printer offline and not responding"</p>	<ul style="list-style-type: none"> <li>• Laser not turned on</li> <li>• Computer is locked up</li> <li>• Parallel port cable not connected or not connected properly</li> <li>• Laser system is out of memory</li> <li>• Single file is too large for memory installed in laser system</li> <li>• Bad parallel port in computer system</li> <li>• Damaged port in CPU</li> </ul>	<ul style="list-style-type: none"> <li>• Turn on laser system</li> <li>• Re-boot computer and laser system</li> <li>• Connect cable or reseat connection at computer and/or laser system</li> <li>• Check "Free Memory" in laser system control panel. Clear laser system memory and try again</li> <li>• Purchase more memory</li> <li>• Try printing to another printer using the same port</li> <li>• Replace laser system's CPU</li> </ul>
<p>When running the laser system, the laser system will "freeze", the clock will keep advancing, but the operator will have no control over the system. The only way to restore the system is to power the laser off and then back on. This is a symptom of file corruption.</p>	<ul style="list-style-type: none"> <li>• Incorrect BIOS setting in computer</li> <li>• Using a printer cable longer than 6 ft.</li> <li>• Bad printer cable</li> <li>• Usage of device in between computer and laser system</li> <li>• Some other parallel port driver interfering with the laser system printer driver</li> <li>• Bad Parallel port in the computer</li> <li>• Damaged port in CPU</li> </ul>	<ul style="list-style-type: none"> <li>• Refer to manual on proper setting</li> <li>• Use only a 6 ft., IEEE1284 compliant printer cable</li> <li>• Replace printer cable</li> <li>• Connect the laser system directly from computer with the printer cable</li> <li>• Remove all other parallel port drivers and try again</li> <li>• Try another computer or change parallel ports</li> <li>• Replace laser system's CPU</li> </ul>

