

Laser Engraving

Working with Acrylic Sheet Materials: Understanding the Causes and Effects of Cracking

Several processes and fabrication-related techniques can cause cracking in acrylic sheet materials. Many can be controlled by the fabricator to eliminate or greatly improve this type of result. Below are several of the most common causes and solutions when dealing with damage to acrylic materials, outlined within Rowmark's engraving troubleshooting guide on rowmark.com. For further questions, please contact Rowmark's Technical Support at techhelp@rowmark.com.

Improper Engraving Settings/Laser Heat Stress

In acrylic sheet materials, **laser heat stress** is usually identified as excessive melting of the material, cracking or deformation/warping of the work piece. This can be caused by 'concentrated' heat in a specific area, which may be attributed to running the laser at a power setting greater than what is required to "ablate" the surface. (Laser ablation is the process of removing material from a surface with a laser beam.) Moving the laser beam too slowly over the surface, setting an improper resolution (PPI), or an out-of-focus beam can all cause heat concentration.

It's important to note that acrylic materials are engineered to fabricate easily with a laser engraver. For best engraving results, review the following:

- **Focus:** to achieve optimal image and edge quality, the laser beam must be focused to its smallest spot size at the point where it contacts your material. Most laser systems can be focused automatically based on material thickness or by using a manual focus tool.
- **Power** is communicated as a percent of the total available wattage of your laser. The greater the power, the stronger the laser beam contacting your material. To begin the process of fine tuning your settings, Rowmark recommends setting the power at 100% to start and adjusting the speed first.

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High power combined with high speeds will remove the least surface material and should provide clean, crisp results. Parameters should be set to remove the cap layer just enough to expose the core color of the material. From there, decrease power by 5% increments to find the most optimal results.

- **Speed**, like power, is communicated as a percent of the maximum speed at which your unit can operate. Slowing the speed means that each pulse of the laser is in contact longer. This allows the laser to burn deeper into the material.
- **Pulses** are measured in 'pulses per inch.' *The laser beam is **not** constantly "on";* rather, it sends 'pulses' of light...the closer the pulses are together, the smoother the cut. Many lasers will default to 500 PPI, however, you can make proper adjustments to suit your application. Generally stated, increase PPI for fine detail work and decrease PPI when raster engraving larger text and objects.
- **Air Assist** – The purpose of air assist is to force air directly onto the surface of the material to reduce burning effects of the laser beam and help disperse smoke and fumes created when cutting materials. Industry experts recommend using air assist **only** during the vector cutting portion of your fabrication process.
- **Honeycomb Table** – this uniquely designed tool slides on top of your engraving bed (under the material) to vent out heat and smoke and avoid heat build-up in the acrylic.

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Use of Chemical Solvents/Improper Cleaning Agents/Paint

When acrylics come into direct or indirect contact with harsh solvents, the liquid or fumes may cause a drying effect that stresses the material to the point where it becomes brittle and suddenly cracks and/or crazes. This is due to a chemical reaction occurring between the solvent and the acrylic. These chemical solvents, including acetone, denatured alcohol or any chlorofluorocarbon (CFC) based agents, may be found in cleaners or in enamel paints that are incompatible with plastic sheet materials. When reverse engravable or laserable materials are “paint filled,” the pigment or color may also bleed from its intended spots into the crazed areas.

In light of the damaging effects of chemicals, ***Rowmark strongly recommends cleaning all plastic sheet material with warm water, mild dish soap, soft bristled brush and soft cloth and paint filling with compatible acrylic-based paints.***

Additional Tips for Best Results When Working with Rowmark Engravable Plastics

- ***Bottom-Up Engraving***

Changing the orientation of your laser to begin engraving from the bottom of the material upwards is known as ‘bottom-up engraving’. The benefit of this lasering method is that it will minimize the amount of cap material residue being exhausted over previously engraved material, which can re-deposit on the warm core and make cleanup a challenge. You can change the orientation of your laser to bottom-up engraving from the advanced tab in your laser print driver.

- ***Masking***

To minimize post fabrication cleaning, Rowmark recommends leaving the protective masking in place when vector cutting shapes and objects, though not all jobs lend themselves to this

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method. If your process is to laser raster engrave and then vector cut, Rowmark's recommendation is to remove the masking, laser raster engrave, re-mask with transfer tape, dampen and then vector cut as a second step.

- ***Soft Focus***
When lasering reverse engravable materials, a second pass with a soft focus can result in a smoother, 'glass like' finish. Focus the laser to the material and run the first engraving pass. Then drop your laser out of focus .020" (approx. gauge of Rowmark's FlexiBrass®) to run your second pass.