

Section VIII

Laser Processing

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1.0 Laser Processing

Laser processing or laser beam machining (LBM) uses a laser to vaporize or chemically ablate materials. A laser is an intensely focused, coherent stream of light. Lasers can be used for joining, heat treating or fabrication. The laser system in the AML is used for engraving and cutting. It is a 40 watt CO2 system.

Table 8.1 lists some of the available commercial laser systems and their applications.

Laser Type	Mode of Operation	Power Watts	Application	Comments
Argon	Pulse	20 Peak	Scribing Thin Films	Power Low
Ruby	Pulse	200,000 Peak	Large Material Removal in One Pulse, Drilling Diamond Dies, Spot Welding	Often Uneconomical
Nd-glass	Pulse	2,000,000 Peak	Large Material Removal In One Pulse	Often Uneconomical
Nd-YAG	Continuous	1000	Welding	Compact, Economical at Low Powers
Nd-YAG	Repetitively Q-Switched	300,000 Peak 30 Average	Resistor Trimming, Electronic	Compact and Economical
Nd-YAG	Pulse	400	Spot weld, Drill	
CO2	Continuous	15,000	Cutting Organic Materials, Oxygen-assisted Metal	Very Bulky at High Powers
CO2	Repetitively Q-Switched	75,000 Peak 1.5 Average	Resistor Trimming	Bulky but Economical
CO2	Pulse	100 Average	Welding, Hole Production, Cutting	Bulky but Economical
KrF	Pulse	2000	Micromachining, Industrial Materials Processing and Laser Annealing	Short Wavelength, High Energy and High Average Power
KrF	Pulse	200		

Table 8.1: Commercial Laser Applications

Source: Materials and Processes in Manufacturing, Degarmo, Black and Kohser, 2003

2.0 Pinnacle Laser Engraver

The laser system in the AML is a Pinnacle M-40 laser engraving system. Applications include engraving and cutting. The system can be used to process materials such as acrylics, wood, fabrics, glass, leather, marble, stone, rubber stamps, paper products, coated metals and plastics. Table 8.2 lists the system specifications. Table 8.3 in Section 3.0 lists recommended starting power and speed settings.

Laser Source	40 Watt Sealed CO2 Laser
Work Area	25" X 18"
Max. Working Piece (W X D X Thickness) (back/front door closed)	31.5" X 22.4" X 5.5"
Max Working Piece (W X D X Thickness) (back/front door opened)	26.8" X unlimited X 6.5"
Table Size	31" X 20.9"
Overall Dimensions (W X D X H)	44.3" X 28.3" X 39.6"
Drive	DC Servo Control
Speed Control	Adjustable from .01 to 42 in/sec with Up to 16 color linked speed settings per job
Power Control	Adjustable from 0-100% and 16 color linked Power settings per job
Z Axis Moving	Automatic (Auto Focus)
Resolution (DPI)	1000, 600, 500, 300, 250, 200

Table 8.2: Pinnacle M-40 Specifications

3.0 Power and Speed Settings

Material	Speed and Power Setting	Max Thickness for Cutting
Acrylic (Engraving)	SP-100% PO-40%	
Acrylic (Cutting)	SP-.5% PO-100%	3/8"
Back of Mirror	SP-100% PO-75%	Engrave Only
Bear Metal with Ferro	SP-25% PO-100%	Engrave Only
Ceramic Tile	SP-100% PO-85%	Engrave Only
Coated Brass	SP-100% PO-20%	Engrave Only
Crystal	SP-100% PO-20%	Engrave Only
Glass	SP-100% PO-60%	Engrave Only
Hardwood (Engraving)	SP-100% PO-50%	
Hardwood (Cutting)	SP-.4% PO-100%	3/8"
Imitation Leather	SP-100% PO-45%	Engrave Only
Laserable Plastic (Engraving)	SP-100% PO-55%	
Laserable Plastic (Cutting)	SP-2.7% PO-95%	3/8"
Leather	SP-100% PO-25%	Engrave Only
Marble	SP-100% PO-75%	Engrave Only
Mat Board	SP-75% PO-100%	Engrave Only
MDF (Engraving)	SP-100% PO-60%	
MDF (Cutting)	SP-2.5% PO-100%	3/8"
Rubber Stamp (Engraving)	SP-75% PO-100%	
Rubber Stamp (Cutting)	SP-2.5% PO-100%	1/4"
Sign Foam	SP-100% PO-60%	Engrave Only
Softwood (Engraving)	SP-100% PO-45%	
Softwood (Cutting)	SP-.9% PO-100%	7/16"

Table 8.3: Power and Speed Settings

4.0 Laser System Operating Instructions

The laser system uses CorelDRAW as the CAD/CAM interface. You can import any number of file types and engrave or cut them using the laser system.

Using CorelDRAW

Select CorelDRAW

Select File New or Open

For DXF file select File New

Set paper size to 25 by 18

Select File Import

Select File

When Import AutoCAD File box appears make sure Auto-Reduce Nodes is checked

Select OK

Place image where you want it.

When ready to cut or engrave select File Print

Select Properties

Select Pen

Select pen color (usually black)

Set speed and power for material. For a line drawing or DXF file usually unselect Raster

Select OK

Select Print (Laser System must be on before attempting to send file to machine)

Operation of the Laser System

Start rooftop exhaust system. Switch is on column by Arburg injection molder.

Turn on laser system. Switch is on right side towards the back. Machine will go to its home position.

Turn on compressor. Switch is on right.

Turn on filter system. This is the large gray box with the blower on top to the right.

Load material onto cutting table. Table zero is upper left corner.

Use arrow keys on control panel to move cutting head over material.

Loosen thumbscrew holding focusing probe and push probe down to its stop. Tighten thumbscrew.

Press autofocus button on control panel. Z axis will raise and machine will autofocus.

Loosen thumbscrew, raise probe and tighten thumbscrew.

Download file to laser system. Make sure file name appears on LCD display.

Press start.

When finished turn off laser system, compressor, filter system and rooftop exhaust.

5.0 Questions

Please submit the answers to these questions on a separate sheet. Please answer in complete sentences.

- 1) The AML Laser System uses a CO₂ laser. What does CO₂ refer to?
- 2) What is the work area size of the AML Laser System?
- 3) What is the maximum resolution of the AML Laser System?
- 4) Can the AML Laser System be used to cut metal parts?
- 5) How do you define different power and speed settings in a drawing to be used in the Laser System?
- 6) There are health and safety issues with cutting certain materials in the laser system. List two and the health issues associated with each. Please include references.