

Vacuum Infusion flat panel

Purpose: To properly set up, infuse, cure a flat panel.

Safety Warnings: Always be aware of your surroundings. Use caution and the correct PPE when using chemicals, material, and equipment to protect yourself and the product you are making. Good ventilation should be used while using epoxy resins.

Permits Required: N/A

Standard PPE: Safety glasses with side shields and safety footwear are required on the production floor. Nitrile Gloves for managing the resin and catalyst. Leather gloves to manage the heater elements.

Non-Standard PPE Required:

- Tyvek Suits/ Plastic Apron/ Protective Clothing.
- Coppus Blowers with Tubing if required to ventilate.

Tools Required:

- Knife or scissors.
- Scale
- Sheet Metal Clamps
- Vacuum Gauges
- Vacuum Tubing
- Vacuum Pump (25-29inHg)

materials:

- XTEND CX-500 Mold Cleaner
- XTEND UMS Mold Sealer
- XTEND ACR-HS External Mold Release
- Acetone – cleaning fluid
- EPIKOTE Resin MGS RIMR035C
- EPIKURE Curing Agent MGS RIMH 034
- EPIKURE Curing Agent MGS RIMH 036b
- Carbon Fiber Cloth
- Clean white rags
- AT-200Y sealant tape (1-2 rolls)
- Econotape 2 (1 roll)
- Flowrunner PP2
- ½" OD Polyethylene tubing
- IPPLON KM1300 nylon vacuum bagging film

INSTRUCTIONS:

Mold Cleaning and Setup:

- Ensure you have a clean aluminum plate free of dust and debris.
- Use acetone or XTEND CX-500 to clean off any prior resin on the aluminum plate if present.
- Use XTEND UMS Mold Sealer. This compound is used as a means of re-surfacing the mold. The appropriate Axel releasing agent should be applied on molded surface and allowed to dry. For sealing purposes, a wipe on/wipe off application technique is used.
- Tape off the area where the vacuum bagging tape/ tacky tape is applied. Roughly 2" around the perimeter.
- You need to apply the XTEND UMS Mold Sealer twice. After the first layer let it evaporate before applying the second layer.
- After the second layer let the mold sit for 15 mins before applying XTEND ACR-HS External Mold Release.
- The XTEND ACR-HS External Mold Release is a semi-permanent mold release compound developed for the composite molding industry.

- Saturate clean cotton cloth (not dripping) and wipe on a smooth continuous film. Apply no more than a few square feet at a time.
- When the film begins to evaporate at the edge, wipe the surface with a second clean dry cotton cloth. Use a circular motion from the outside, working inwards until film is left dry and clear.
- Repeat above procedures until entire mold surface has been covered. Apply 4-5 coats, allowing 15 minutes between each complete coat. Allow 30 minutes for full cure. Proceed with production.
- We need to only apply one coat of XTEND ACR-HS External Mold Release for the next set of parts.



Material Setup:

- Remove the 2" masking tape around the perimeter of the aluminum plate.
- Apply one row of AT-200Y sealant tape around the perimeter of the aluminum plate about 0.5" from the edge. Overlap the corners.
- Center one ply of carbon fiber (12"x18") on the aluminum plate making sure not to distort the shape of the ply.
- Place the remaining five plies of carbon fiber on top of the first ply making sure not to distort the shape of the ply.
- Cut two pieces of the Flowrunner PP2 to 11" long. Tuck the "leg" of the Flowrunner PP2 under on each end of the 12" edge of the carbon fiber ply. Tape in place with the Econotape.
- Place a plastic caul plate (if used) on top of the material which has been prepped i.e., sealed and mold released, the same way as the aluminum plate. This would ensure the part is compressed evenly on all sides



Vacuum Bagging Setup:

- Ensure the table surface the bag is sealing to, is wiped clean of any loose fibers. Use masking tape to go around the edges to pick up loose fibers.
- Use a 3-mil IPPLON KM1300 vacuum sealing bag which is rated for temperatures above 121C (250F).
- The vacuum film needs to be cut larger than the part being molded with additional considerations for the height of the part to ensure there is enough slack for the bag to sit tight against the side of the part being molded.
- If needed, you can add another row of the vacuum bagging tape/ tacky tape 2" away from the internal row on all sides to ensure the bag sticks to the plate.
- Place a strip of sealant tape from the spiral tube in the Flowrunner PP2 to the edge of the bag.
- Cut a long enough ½" tube to reach the vacuum pot.
- Remove about 5" of the white paper covering the sealant tape where the sealant tape T's into the perimeter. Stick the tube into the spiral tube of the Flowrunner PP2 and push down on to the sealant tape. Secure the tube to the aluminum plate using the Econotape make sure to tuck the tape as close to the tube as possible.
- Cut two 1" long strips of sealant tape. Place the strips on either side of the tube tucked in as close to the tube as possible. These will be on the top of the parameter sealant tape.
- Cut two 1.5" long strips of sealant tape. Place the strips on either side of the tube on top of the 1" strips tucked in as close to the tube as possible.
- Cut a 4" long strip of sealant tape. Place this over the 1.5" strips and tube. Please down firmly leaving the white backing on.
- Repeat steps 5 -10 for the resin inlet tube.
- Ensure the table surface the bag is sealing to, is wiped clean of any loose fibers. Use masking tape to go around the edges to pick up loose fibers.
- Place the vacuum bag over the top of the sealant tape perimeter. Vacuum bag should overhang 5-6".
- From the center of one edge remove the white backing from the sealant tape and firmly press the vacuum bag to the sealant tape working your way to the corner. Work your way around the perimeter of the aluminum plate.
- If you end up with a large gap make a pleat. Before you get to a corner leave around 5" of white backing on the sealant tape. Pinch the vacuum bag together to get a feel of what the pleat size would be. Cut a length of sealant tape the height of the pleat size plus 1". Leave the white backing on and place the sealant tape on the pleat side that is connected to the sealant with ½" overlap tape firmly pressing. Remove the backing tape on the pleat sealant tape. Fold the top of the bag over about ½" to form an upside down J and press the vacuum bag firmly in place.
- Firmly press the vacuum bag to sealant tape. Take extra care in the corners, pleats, and tube penetrations.

Vacuuming the bag:

- Connect the vacuum line to the vacuum resin pot. Clamp off the resin inlet tube.
- Conduct a vacuum drop test on the pump using a vacuum gauge. Make note of the pressure reading. Disconnect the pump and let the gauge sit for about 10 minutes. We would want the gauge to read -28inHg or lower. If the reading on the gauge has not dropped, you have a good vacuum on the pressure pot side.

Drop test calculation:

(Initial Vacuum – Final Vacuum) / 10 minutes

If < 0.1 inHg PASS

If > 0.1 inHg FAIL

- If the pressure reading is not close to the reading before then check for the following:
 - All ends are sealed with a hose clamp.
 - Press down on the tape on all sides for any major leaks.
 - Check the pleats for any leaks.
 - Check if the tubing is tight and not causing any leaks.
 - If any fittings are used to connect the hoses, check them for leaks.
 - Use additional tacky tape as necessary.

- The general rule is trying to get a good seal within a reasonable amount of time. Usually, the amount of time it would take to re-bag the whole table.
- Once the pressure reading is close to what it was during the vacuum drop test on the pot. Let the bag sit under vacuum for about 30-60 minutes. This is to let all the air entrapped between the layers to make its way out of the bag.
- After the initial 30-60 minutes under vacuum. Turn off the vacuum and let the part sit for about 10-15 minutes. The pressure reading on the pot should not have dropped by more than 0.5inHg. If it does, then there is a leak somewhere in the system. Repeat step 4 as needed. If the leak persists, redo the bagging process.
- If the pressure reading does not change, you have a good seal, and the bag is ready to be injected with resin.



Mixing Resin and Catalyst:

- Weigh out the correct amount of epoxy resin to infuse the part and fill the lines.
- Fill the degassing pot with the resin and put in stir bar. Turn on the stir plate to about half speed. The idea is that the air entrapped in the resin when agitated should rise to the surface as a small air bubble and pop. Thereby removing air from the resin.
- "De-gas" the resin for about 20-30 minutes using a vacuum pump rated lower than -28inHg.
- Weigh out the curing agent.
- Mix the curing agent into the resin and let the resin/curing agent mix for about 5 minutes in the degassing pot. Note the time.



Injection Process:

- Clamp of the resin tube with a hose clamp. And put it into the resin pot.
- Gently remove the clamp off. This should let the air in the line be vacuumed out before the resin reaches the part.

- Once the clamp is off the resin should reach the part. Ensure that the resin tube is completely submerged in the resin for the duration of the injection process.
- Let the resin fill the part.
- Once the resin reaches the vacuum side, clamp the vacuum side first before clamping the resin side. This is so that the vacuum in the part still draws more resin in.
- The part should be left overnight to cure.

Cleaning up and Demolding:

- Once the resin side is clamped off, clean the de-gassing pot, the mixing auger and any other component that has interacted with the resin with acetone.
- The excess resin in the pot will eventually cure on its own and get hard.
- To demold the part off the table once the entire process is complete. Use plastic wedges to get underneath the part and gently tap it with a rubber mallet. Ensuring not to damage the part with excessive force.
- If the mold was cleaned and set up well as indicated in the **Mold Cleaning and Setup** phase, the part should demold easily.
- Clean the aluminum plate to remove any residue, absolutely no metal tools are to be used to clean the table.