

Lamination Standard Operating Procedure, PEI:
Rev. B – 8/03/2015



Step 1: Laminate adhesive to PEI

1. Install 468 adhesive in the center of the back upper roller as shown above. It needs to be in “underhand” orientation with the adhesive and backing coming forward off the bottom of the roll with the adhesive side facing upwards. Set the tension of the roller using the adjustment knob on the right end of the roller. With the 468 adhesive installed, loosen the tension on the adjustment knob so that the roll spins freely. Spin it away from you and hold the adjustment knob so that it comes to a stop, and then tighten the knob an additional 1/3 of a turn (2 of the markings on the knob). It should be difficult to turn by hand.
2. Install the PEI on the lower roller in an overhand fashion so that the PEI is feeding upwards off the back of the roll with the glossy side facing forward. Set the tension of the roller using the adjustment knob on the right end of the roller. Loosen the tension on the adjustment knob so that the roll spins freely. Spin it away from you and hold the adjustment knob so that it comes to a stop, and then tighten the knob an additional 1/6th of a turn (1 of the markings on the knob).
3. Attach 6-8” of butcher paper to the end of the adhesive, you'll use this to pull the adhesive tight into the laminator. With the silicone rollers 25mm apart, pull the adhesive over the front of the upper roller and between them. Now feed the PEI up past the front of the lower roller and pull through below the PEI. With one person pulling tight on the PEI and adhesive, make sure that the rolls are lined up perfectly by looking directly down the center of the laminate path and adjusting the positions until the 2 rolls are centered on each other. Rock both materials back and forth independently to confirm that each material is evenly snug to the silicone roller (make sure it isn't just statically stuck).
4. Once the PEI and adhesive are lined up, clamp down the rollers to 80% pressure (tighten until

- you hit 100% then back off until the reading drops to 80%).
5. Run the laminator on auto at the slowest speed possible and stand behind it, loosely (~1foot inside diameter) coiling the PEI / adhesive as it comes out of the laminator.
 6. Once the desired amount is laminated, shut off the laminator feed and cut off the produced roll. Relieve the pressure on the silicon rollers to avoid creating flat spots on the rollers. Leave the roller gap at 5mm or higher when not in use. Using a paper cutter, cut the sheets to the desired size (32cm for TAZ beds).

Step 2: Pre-heat (dry) the laminate

1. Attach the PEI sheets to the jig for keeping them upright and separated in the oven. Slide the jig into the oven preheated to 115C and set a timer for 1hr30min.
2. Leave the sheets heated for 1hr30min to bake out the absorbed water and help set the adhesive. Once this time is up collect begin removing the sheets one by one from the oven and laminating them to glass. They need to be laminated to glass within 40 minutes of coming out of the oven.

Step 3: Laminate to glass

1. Inspect all pieces of glass carefully for chipped corners, scratches, bubbles or other contaminants. Clean the side of the glass to be laminated carefully with API115 glass treatment (2 full sprays), and make sure the glass is fully dry before proceeding.
2. Take one of the TAZ glass bed plates and feed it into the laminator with the rolls ~10mm apart. With the glass in place, set the pressure to 80% and feed the plate of glass back out of the laminator. Take a sheet of heat-treated PEI with adhesive and feed it through the laminator manually onto the glass. Be sure to pay attention to tracking and that the pressure stays at 80% while the glass is feeding through the laminator. Make sure that the lamination feed doesn't stop at any point while feeding the glass through as this will cause a line of bubbles to appear.
3. After the sheets come out of the laminator, turn the bed plate PEI side down on the cutting mat and gently score the adhesive side of the PEI with an xacto knife. If you hear a popping sound, you're using too much pressure. With all the edges scored, bend the PEI towards the glass side until it snaps along the edges of the glass.
4. Inspect the heat bed for defects that would cause rejection; wrinkles in adhesive, edge effects for the adhesive, large bubbles or clusters of small bubbles, etc.

Step 5: Laminate the heat pad to the glass

1. Wipe down the non-PEI side of the glass bed with a paper towel coated with a small amount of acetone, be careful not to let any touch the PEI side of the bed.
2. Pull the first 2" of the adhesive backing up off of the side of the heat pad opposite the wires. Line it up with one edge of the glass and after making sure it's centered, use the roller to seal that entire edge.
3. Next, slowly pull the rest of the adhesive backing off while sealing the centerline with the roller. Working from the side that you started, use the roller to push the bubbles from the centerline outward to the edges, making passes of about ½ the length of the roller.
4. Make sure that the green PET covered section of the laminator is clean and free of debris, wipe down with isopropyl alcohol and water.
5. Run the heat bed through the laminator with the PEI side down on the butcher paper covered section of the laminator at 40% pressure

Step 6: Post-heat the bed

1. Once the PEI and heat pad have been laminated to the glass, place them in an oven at 115C for 40 minutes. Inspect them when removing them from the oven for silvering or defects.
2. Label all passing heatbeds with the date produced using a piece of masking tape and the completion stamp at the lamination station.
3. Seal 5 heat-beds in a large bag with 2 packs of desiccant and store on the shelf at the lamination station, or on one of the bottom shelves on either production line.

Step 7: Test beds

1. Prior to feeding beds to the line each day, test each one using the 8-LCD test station. Plug the beds in one at a time and power cycle the test fixture to kick off the test. Once all of the beds start temping down, shut off the power to safely remove.
2. Carefully inspect all beds tested for silvering, heat-pad delamination or scratches.

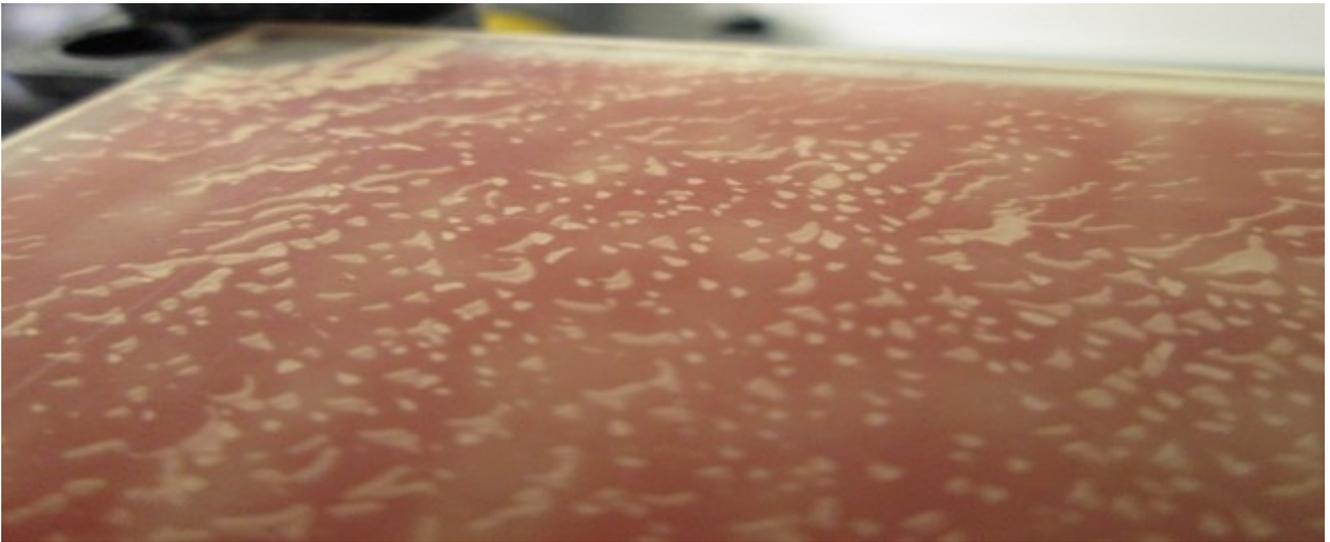
TAZ and Mini Heatbed QC Criteria

PEI Side

A bed fails QC if any of the following are true

- There is significant silvering more than 2" inwards from the edges of the bed plate. Most beds will form bubbles more on one edge of the plate due to the lamination procedure. Reject any beds with significant bubbles in the center section of the bed
- If the silvering forms interconnected bubbles upon heating (as shown in image 1). The only exception to this is the thin line of bubbles that forms 1/8" in from the leading edge to the lamination. (see image 2)

Image 1: Example of the bubbles forming together - Reject any beds that have a significant amount of this

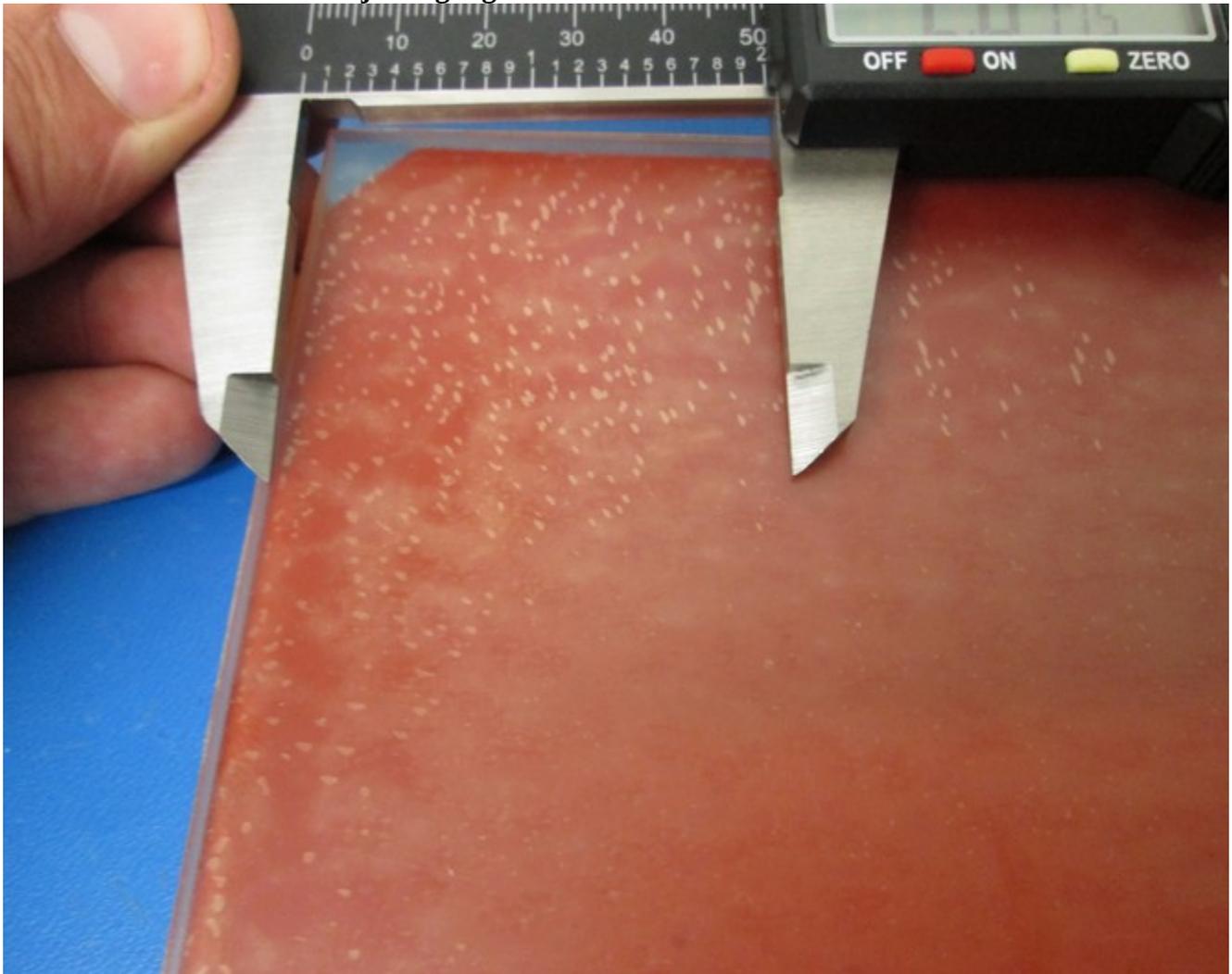


- Reject any beds that have PEI bubbles more than 1/8" across
- Reject any beds that have hairs, cardboard or other contaminants visible between the PEI and glass or heatbed and glass. Some small and or dark colored contaminants may be passed if they are not visible from 3 feet away.

Image 2: acceptable levels of heat pad delamination over the wires. The small amount of interconnecting bubbles is acceptable and normal within 1/4" of the edge of the glass only.



Example of a passable amount of silvering. Note that the silvering is within 2" of the edge and that none of the bubbles are joining together.



HeatPad Side

- All heat pads will foam and get a bit of a hazy appearance under heating, this is acceptable and will decrease with successive heat cycling.

Image showing acceptable discoloration.



- Some heat pads may fully separate from the glass, see image below. Reject these beds if any of the delaminated areas are greater than 1/2" in size.

Image showing section of the heat pad that has completely separated from the glass. Reject these



- All heat pads will have some air pockets above the connector on the edge of the bed.

Scratches in PEI:

Reject the bed if:

- Scratches are visible from 3 feet away
- scratches can be felt by hand

Note that the bed has been rejected for scratches, we will be able to refinish these and get them back into production.