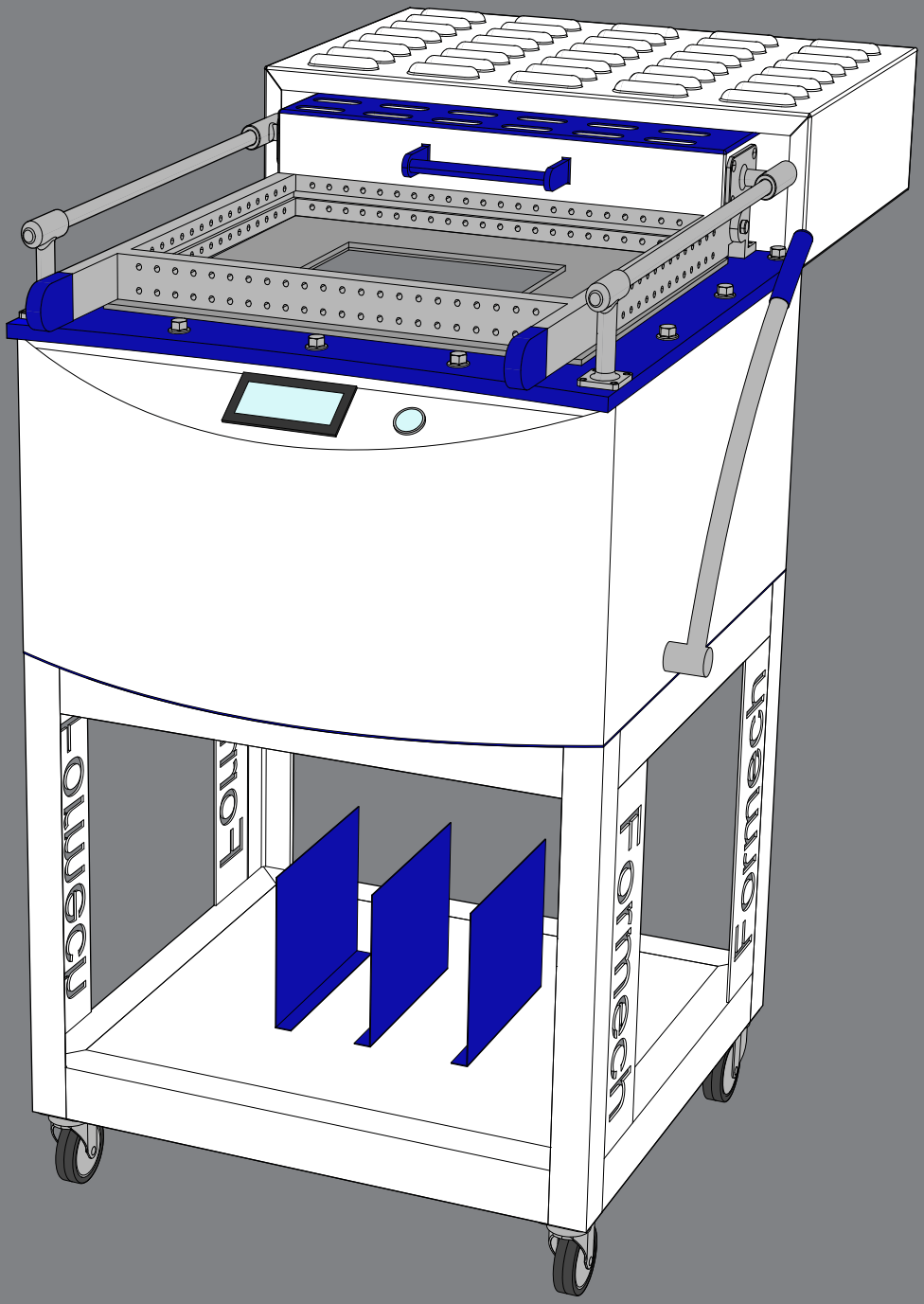
UMass Amherst Digital Fabrication Lab

Formech 508DT Vacuum Former

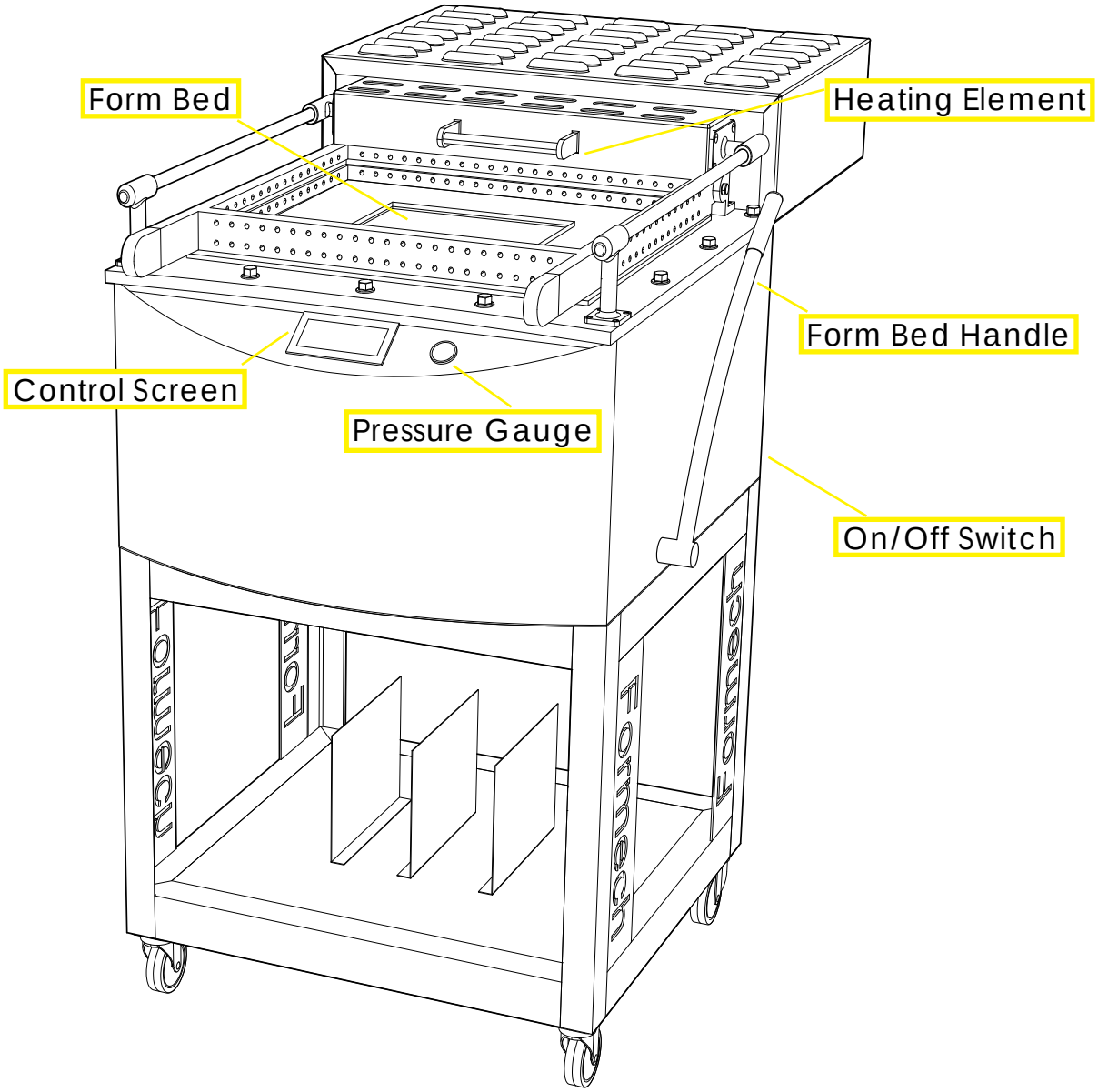


John Olver Design Building
Fall 2022

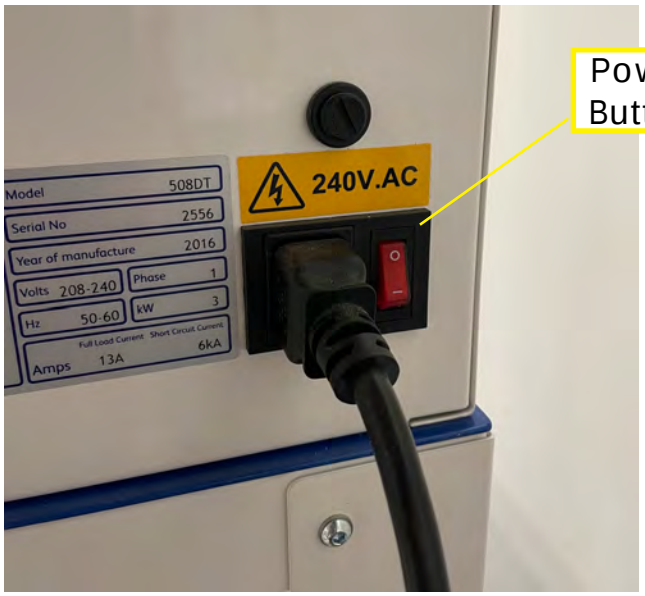
Formech 508DT: Summary

Vacuum Forming is a manufacturing and fabrication method used to shape plastic materials. During the process a sheet of plastic is heated and pulled around a mold using a vacuum suction. Vacuum Forming is used to manufacture a wide range of custom parts both large and small. It can be very useful in rapid prototyping/iterative design as well creating molds or for experimentation.

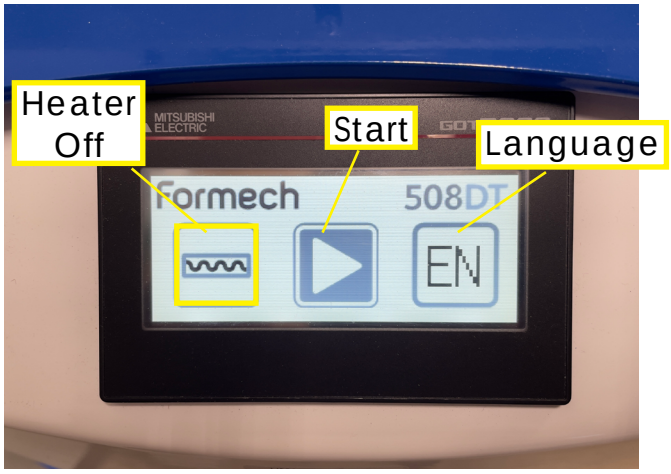
This machine can use a range of different types of plastic sheet materials. A full list of these materials can be found on the fablab website, however, some common ones include HIPS, ABS, PETG, and Polycarbonate (Lexan). If you have questions about these see the lab TA or shop manager.



Formech 508DT: Turning on the Machine



Use the power button on the back of the machine to turn on the vacuum former, it will glow when on. When first turned on the control screen will look like the left image below. There are three buttons, the middle one will take you to the heater settings which will be covered in the next pages. The left button will turn on the heating element.

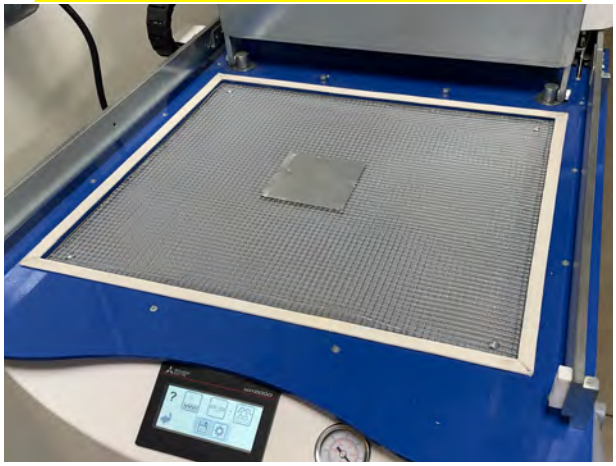


When first turning on the machine all of the metal elements will be cold. It is a good idea to turn on the heating element and pull it over the mold plate to warm up the metal a bit while you prep your molds and heater settings.

Formech 508DT: Preparing

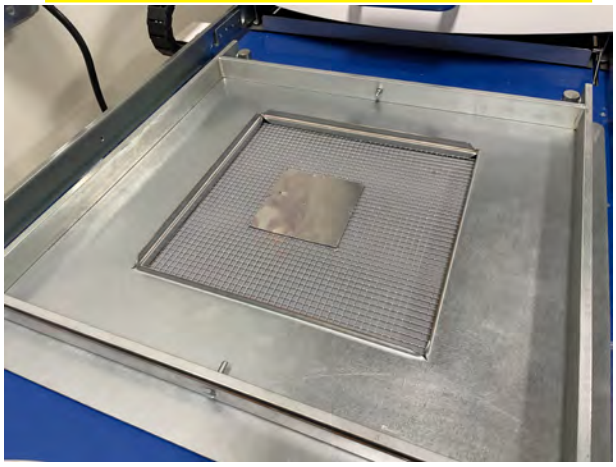
STEP ONE: Preparing your Material

17” x 17” Form Bed



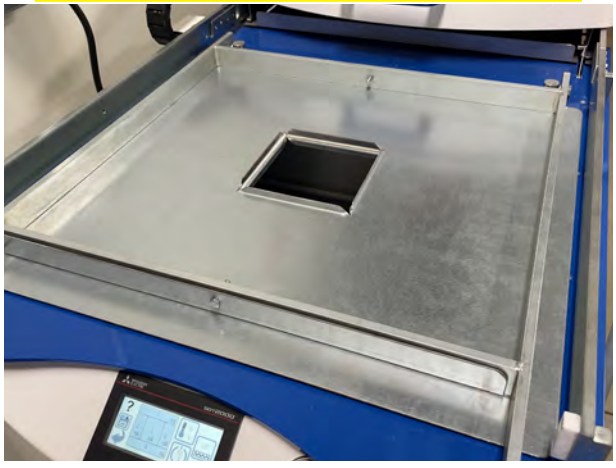
The vacuum former bed has three different window sizes. When cutting material for the window it is best to add at least a 2” overlap, so your material should be 19” x 19”, 13” x 13”, and 7” x 7” respectively. There are some templates in the lab that can be used to make this easier.

11” x 11” Reduction Window



Consider which size would be most suitable for your object, large sheets will stretch more over large or tall objects while smaller sheets are easier to build models for and create fast iterations. Different sizes of sheets and types of plastic will also effect the quality and results of your form.

5” x 5” Reduction Window

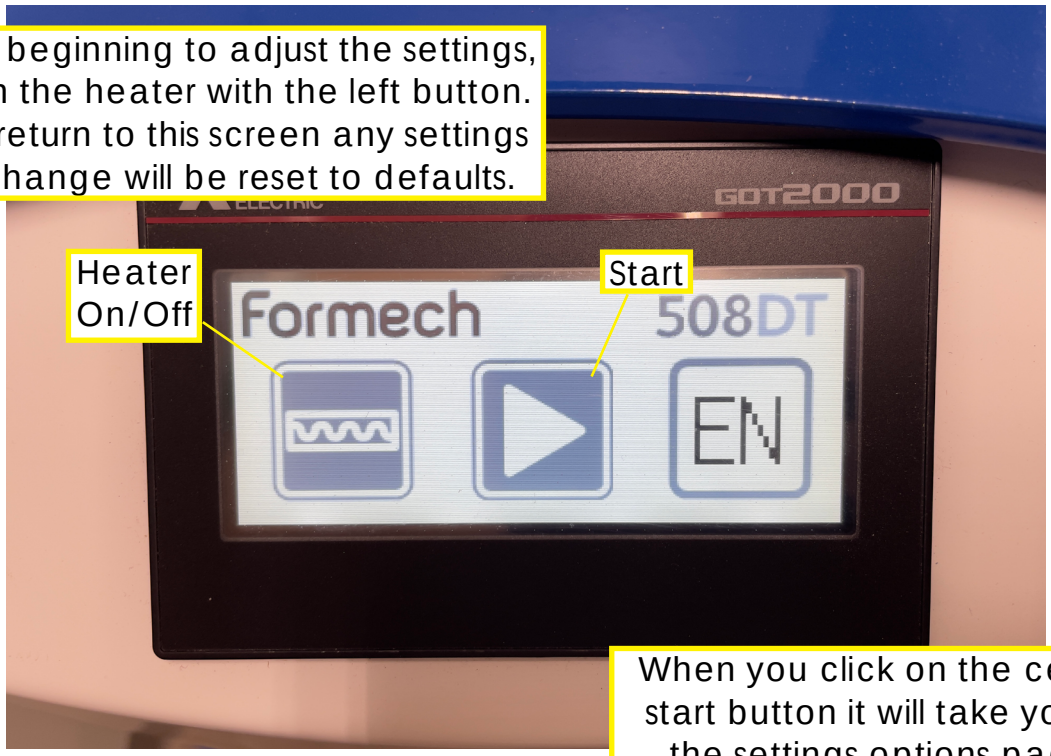


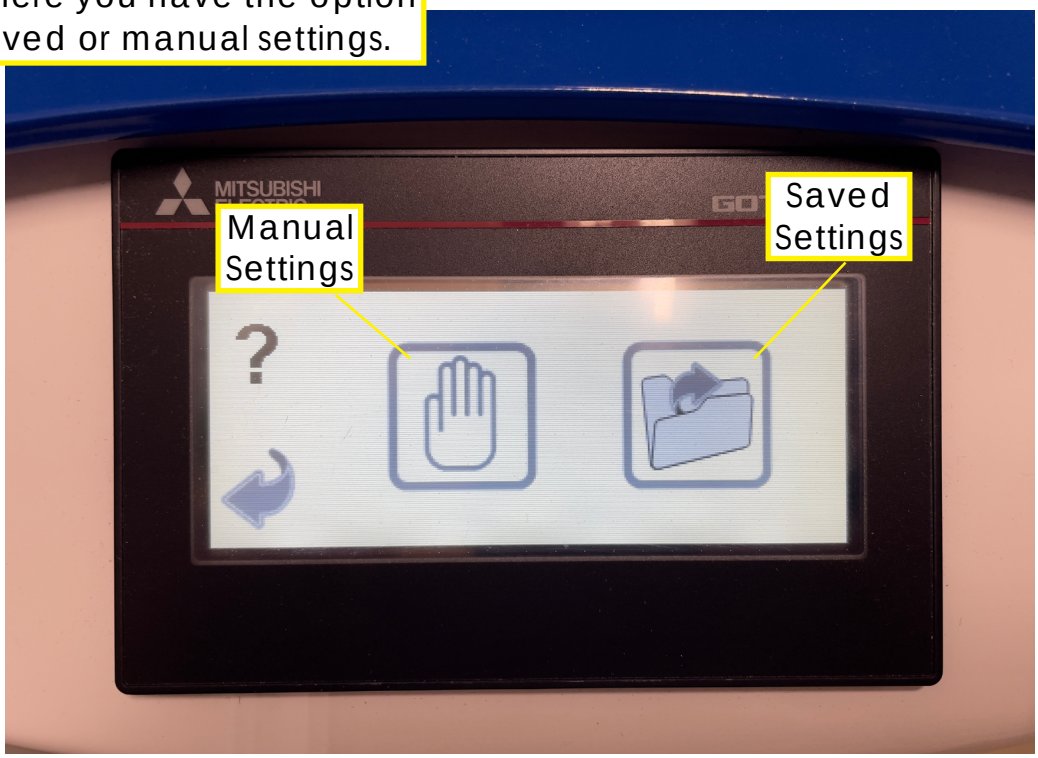
Material Cutting Templates

Formech 508DT: Preparing

STEP TWO: Preparing The Settings

.



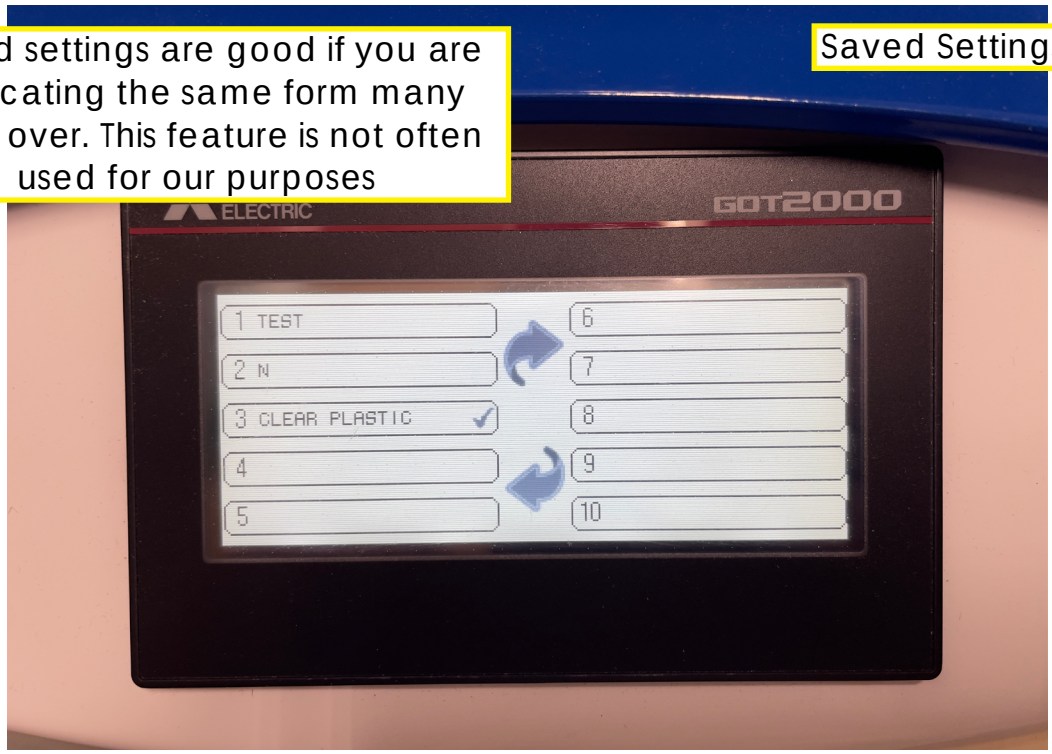


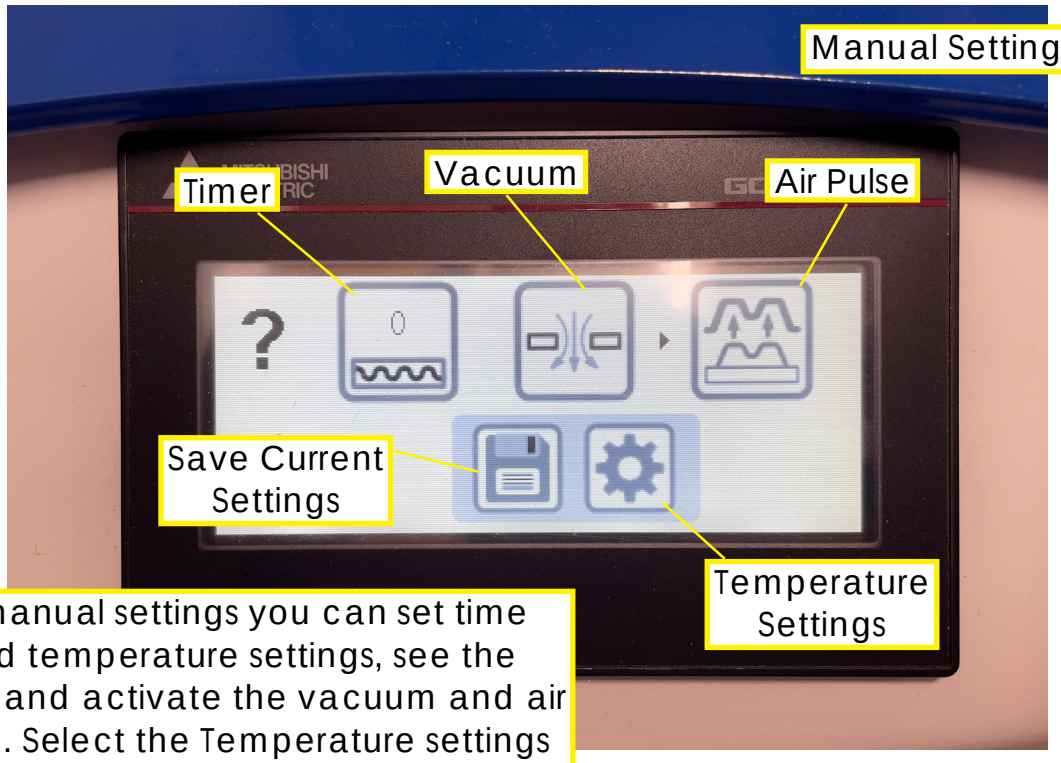
Formech 508DT: Preparing

STEP TWO: Preparing The Settings

.

Saved settings are good if you are replicating the same form many times over. This feature is not often used for our purposes



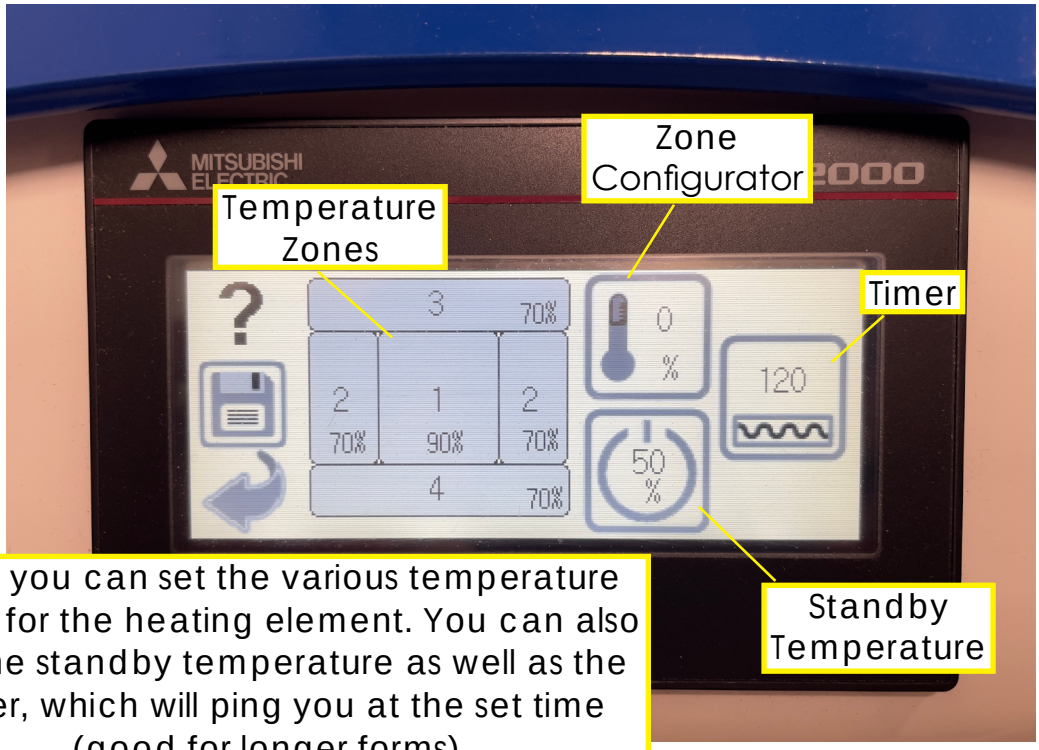


In manual settings you can set time and temperature settings, see the timer, and activate the vacuum and air pulse. Select the Temperature settings button to adjust the settings manually.

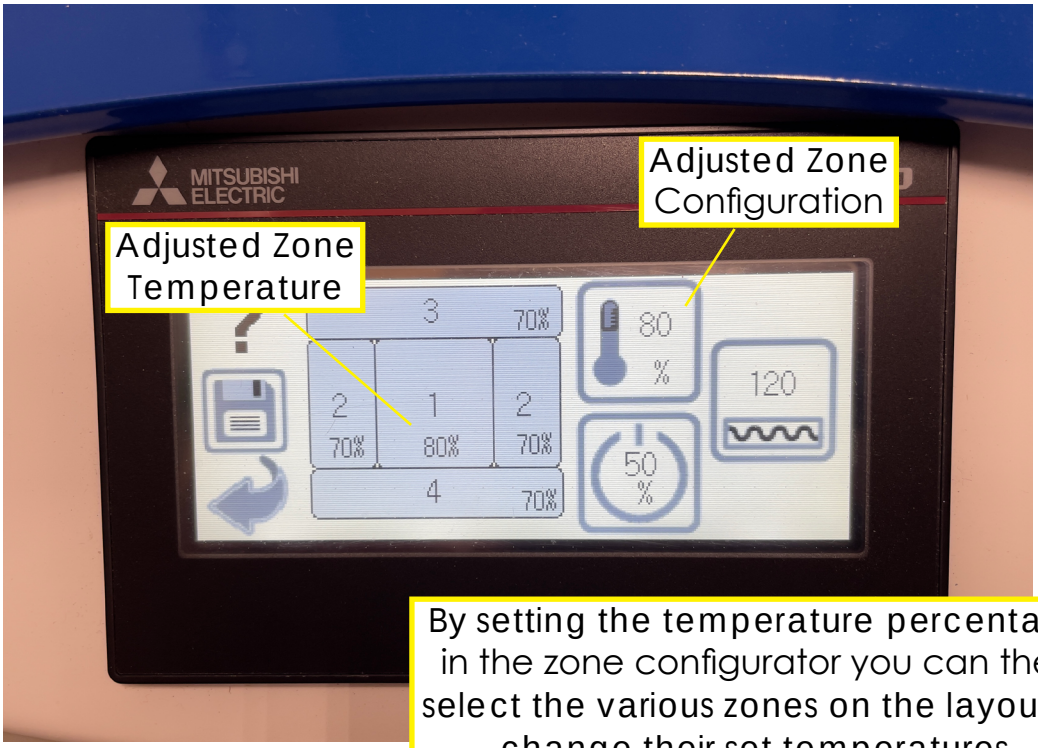
Formech 508DT: Preparing

STEP TWO: Preparing The Settings

.



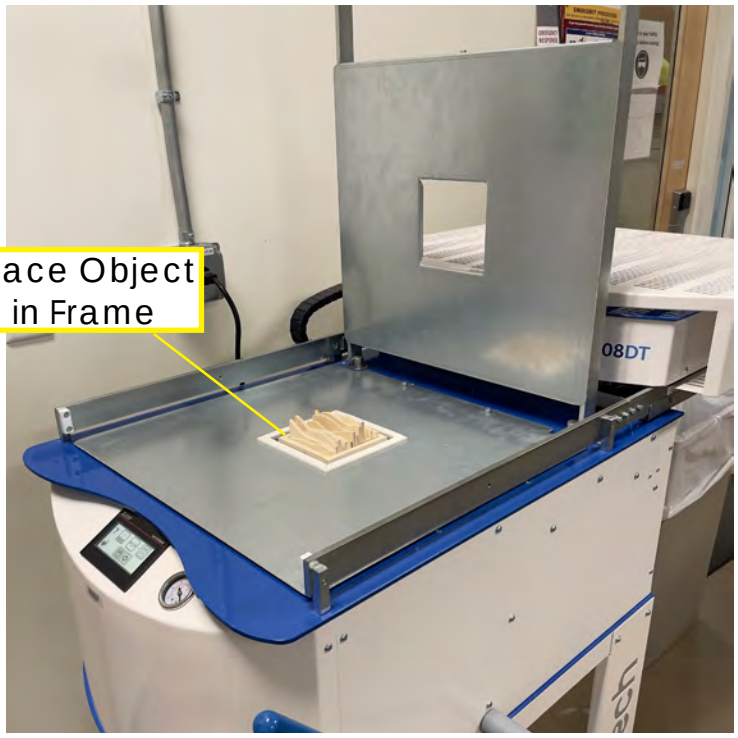
Here you can set the various temperature zones for the heating element. You can also set the standby temperature as well as the timer, which will ping you at the set time (good for longer forms).



By setting the temperature percentage in the zone configurator you can then select the various zones on the layout to change their set temperatures.

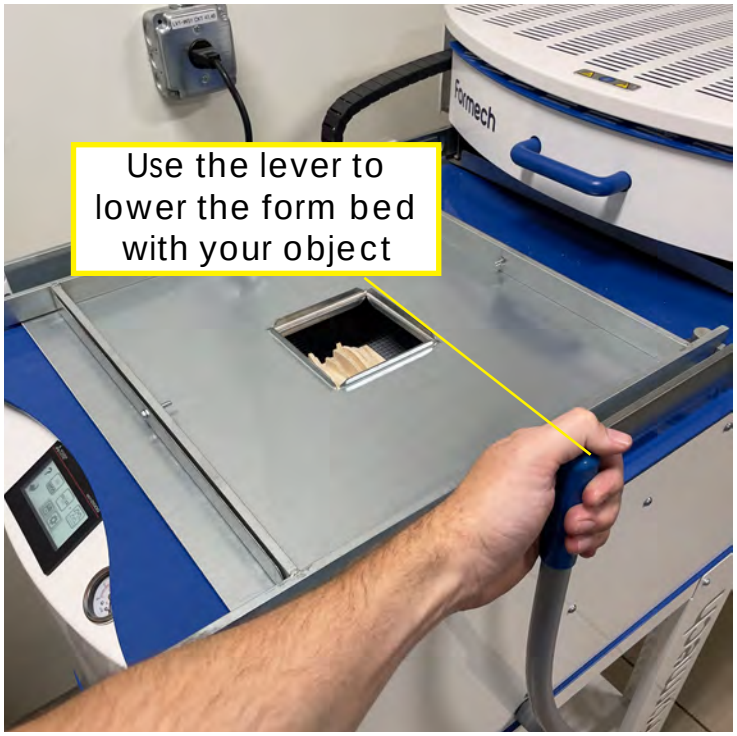
Formech 508DT: Preparing

STEP THREE: Preparing Your Object



Lift the reduction window and place your model in the form bed frame.

Consider avoiding tall or sharp objects that may puncture the plastic sheet. Also avoid creating under hanging areas as they may cause your object to become trapped in your plastic form.

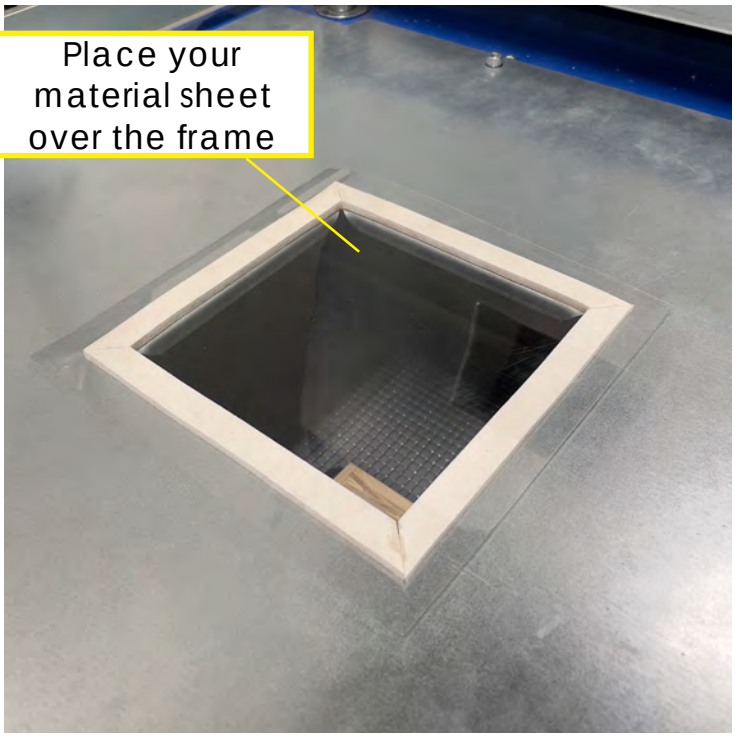


Vacuum forming relies upon air flow, so avoid covering the entire bed with objects. Consider adding holes to objects or using porous materials to allow proper suction.

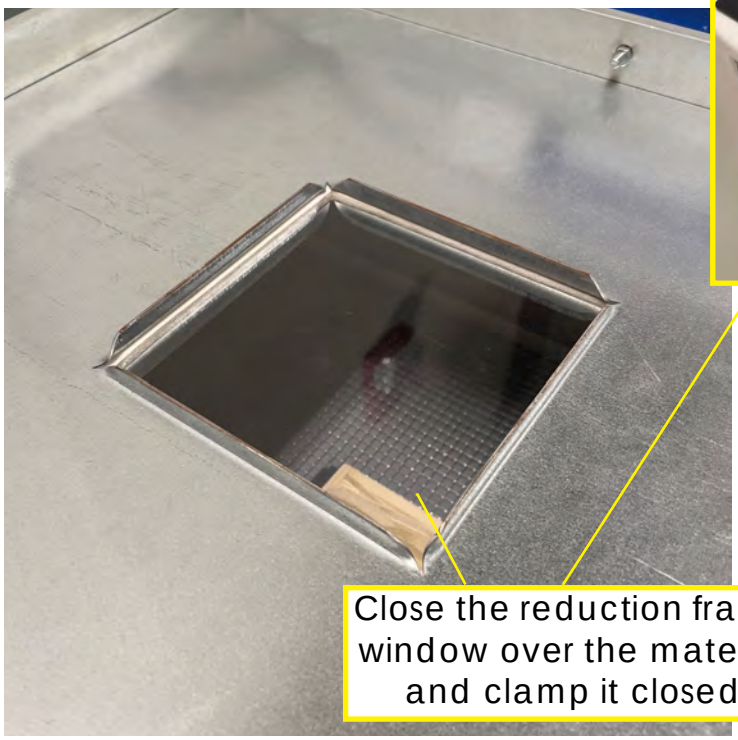
Vacuum forming is very iterative so adjusting your model and settings is common until you get your desired effect.

Formech 508DT: Preparing

STEP THREE: Preparing Your Object



Place your material sheet over the frame window. Your sheet should have at least a 2” overlap from the window size. When your material is in place lower the reduction frame down and clamp it closed. The material sheet should be tight in the window.

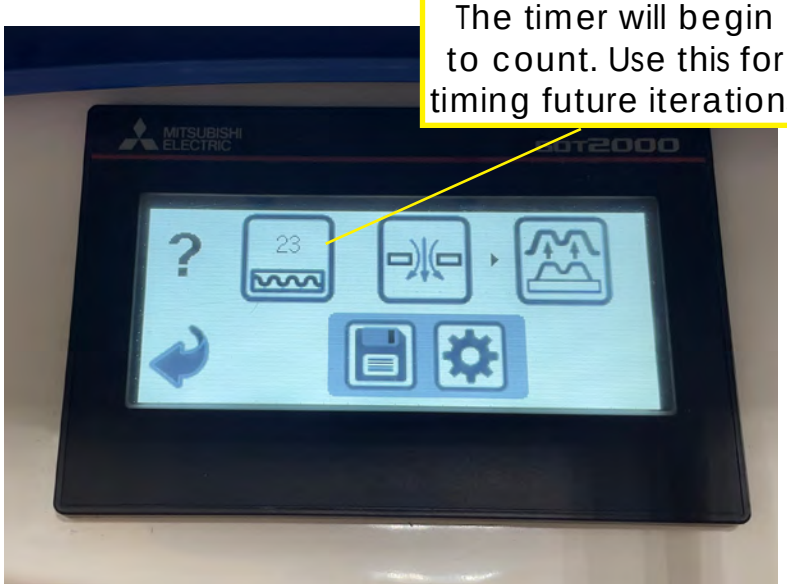


Formech 508DT: Forming

STEP FOUR: Heating Your Material Sheet

Pull heating element over the material sheet and form bed

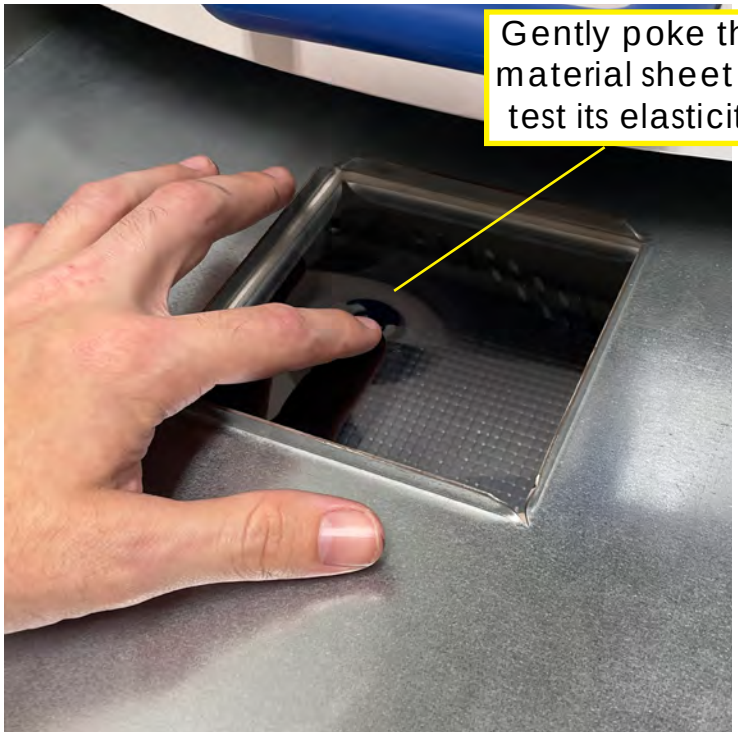
When you're ready, pull the heating element forward all the way so its fully over your material sheet. You will see the timer begin to start counting. Type and size of your material sheet will effect how long you heat the plastic so you will check it frequently to see if its ready to start forming.



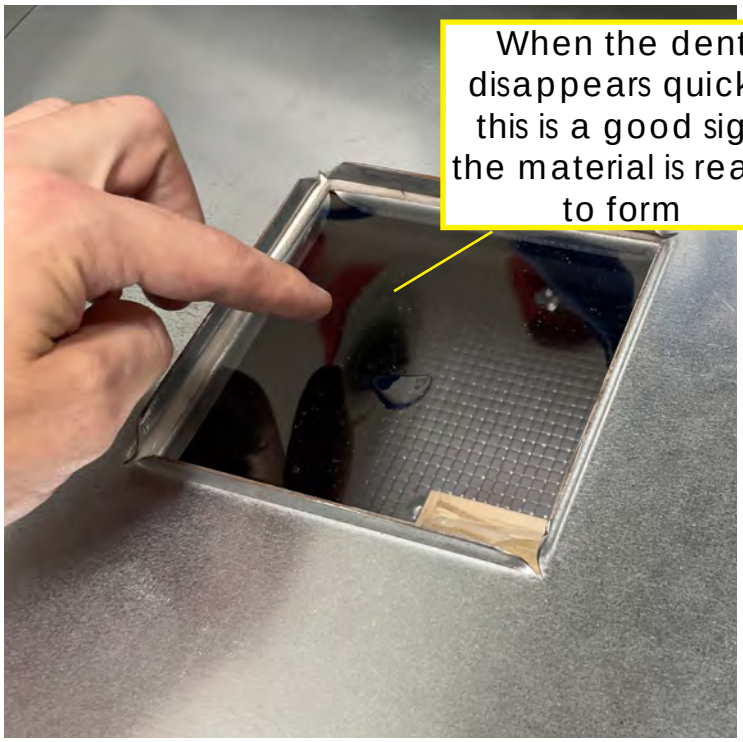
The timer will begin to count. Use this for timing future iterations

Formech 508DT: Forming

STEP FOUR: Heating Your Material Sheet



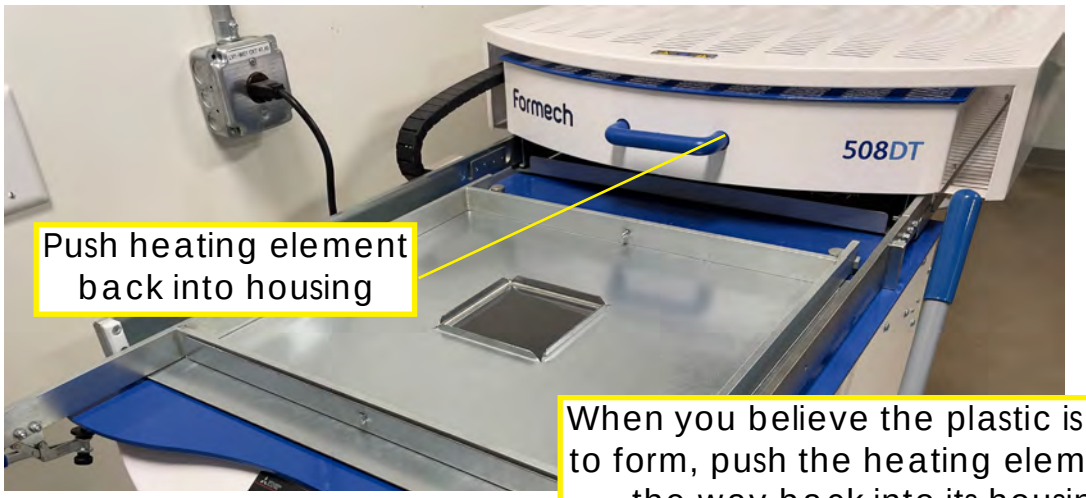
To check the material slide the heating element back far enough to see the plastic. First when heated the plastic will begin to droop and grow soft. It will then next start to tighten and draw back up, this is due to the materials elasticity properties.



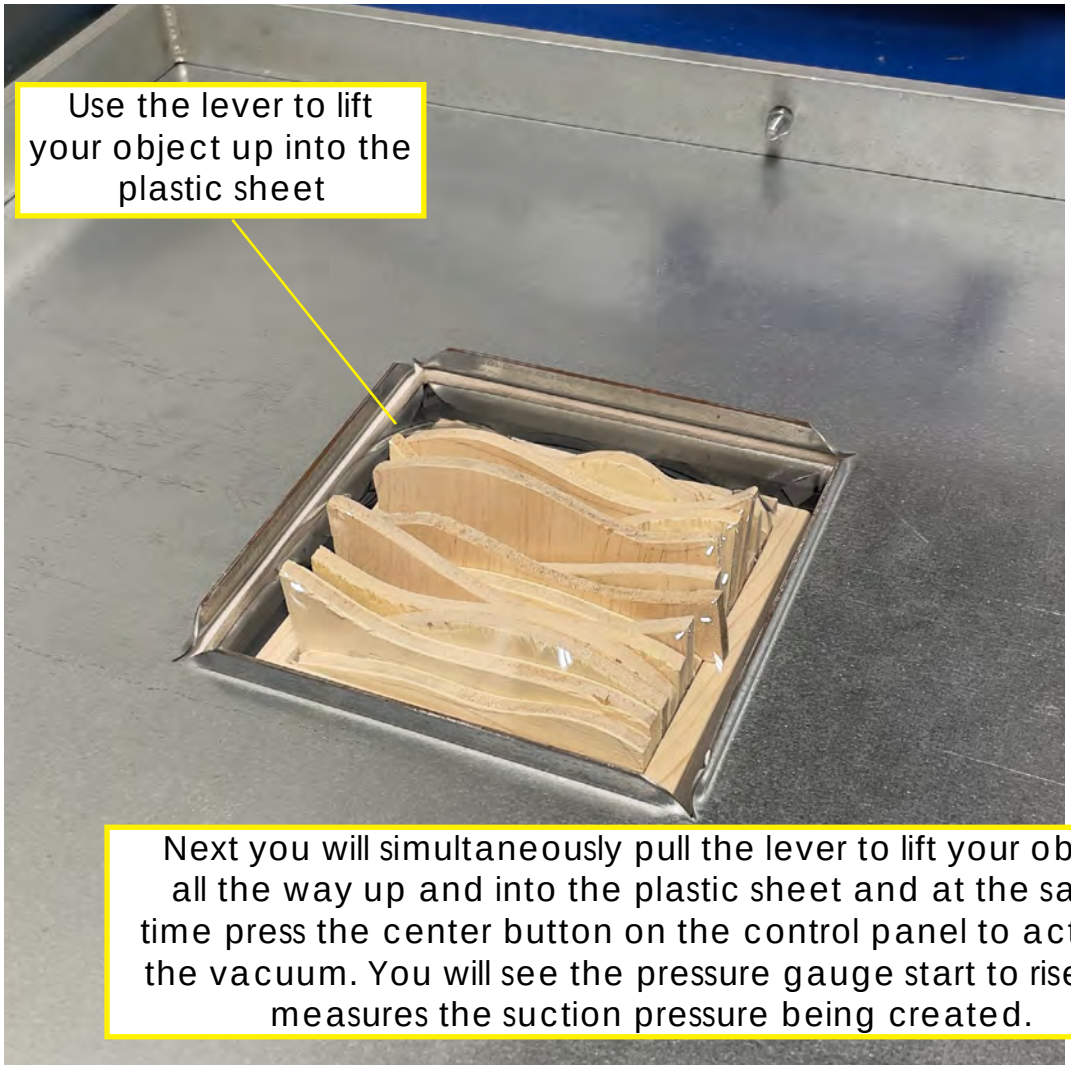
The optimal time to form is right at this stage. You can test it by gently poking the material. If the deformation your finger makes lingers then it is not ready yet, when it disappears moments after you make it, then the sheet is likely ready to form.

Formech 508DT: Forming

STEP FIVE: Vacuum Forming Your Object



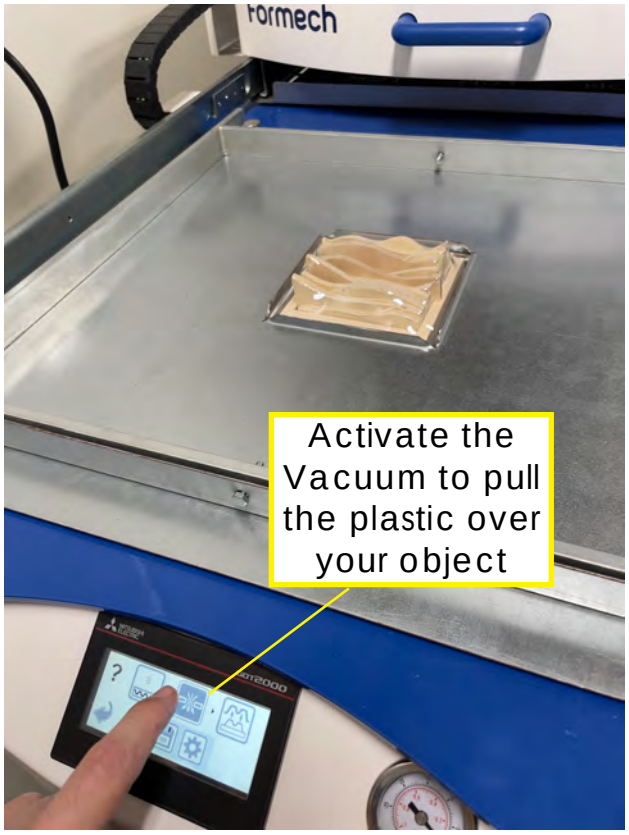
When you believe the plastic is ready to form, push the heating element all the way back into its housing.

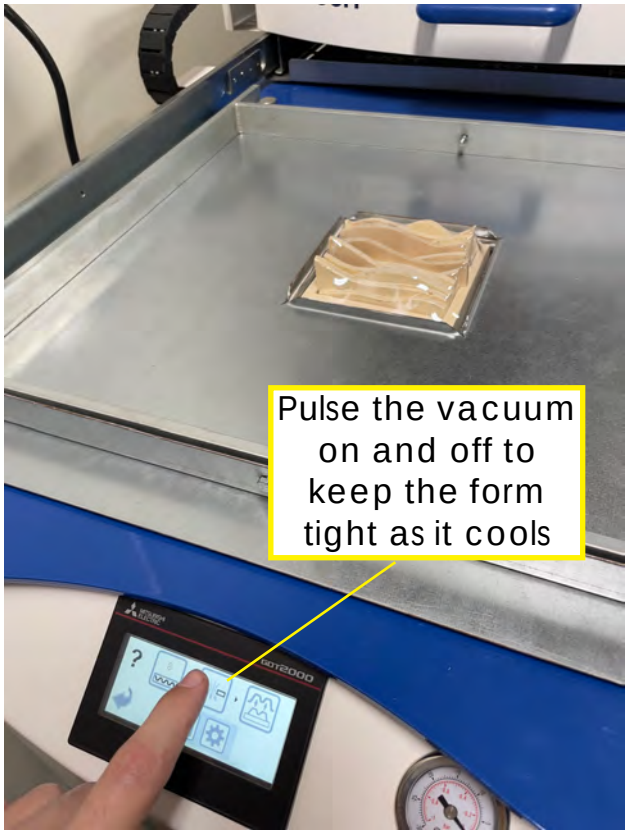


Next you will simultaneously pull the lever to lift your object all the way up and into the plastic sheet and at the same time press the center button on the control panel to activate the vacuum. You will see the pressure gauge start to rise as it measures the suction pressure being created.

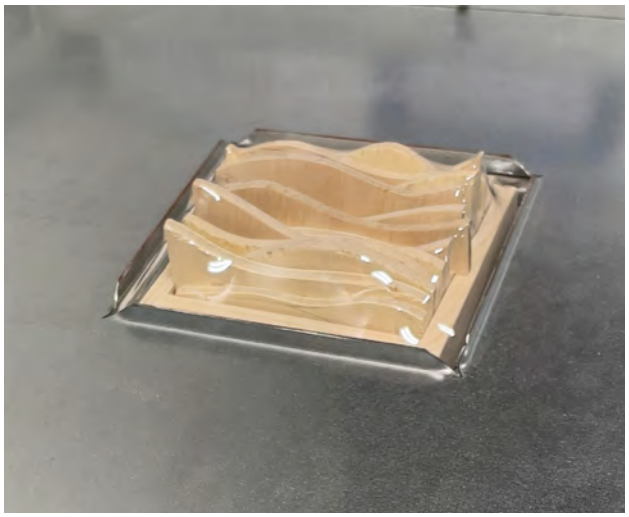
Formech 508DT: Forming

STEP FIVE: Vacuum Forming Your Object





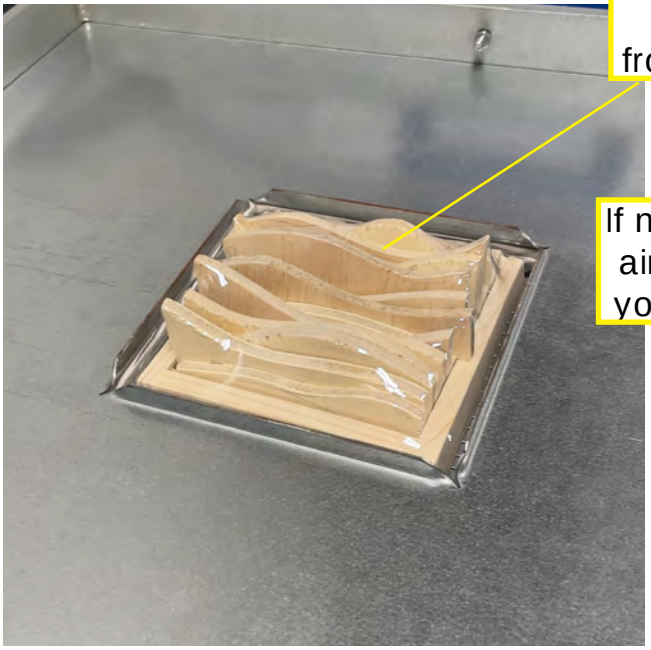
As you activate the vacuum be careful not to leave it on too long or areas of the plastic that are stretched thin will blow out and leave a hole in your form. It may be necessary to pulse the vacuum on and off to hold the plastic down against your object as it cools and hardens. This should only take a matter of seconds.



Formech 508DT: Forming

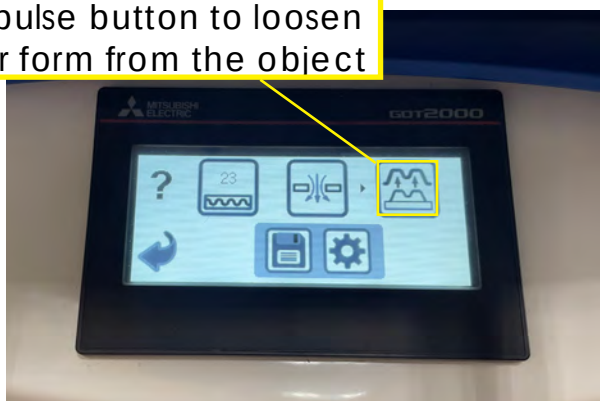
STEP SIX: Removing Your Form

After you've waited a moment for your form to cool you can use the right button (if needed) to send an air pulse up into the form to loosen it from your object. You can then lift your form from the vacuum bed. From here you can adjust your object or settings and produce another iteration until you get your desired results.

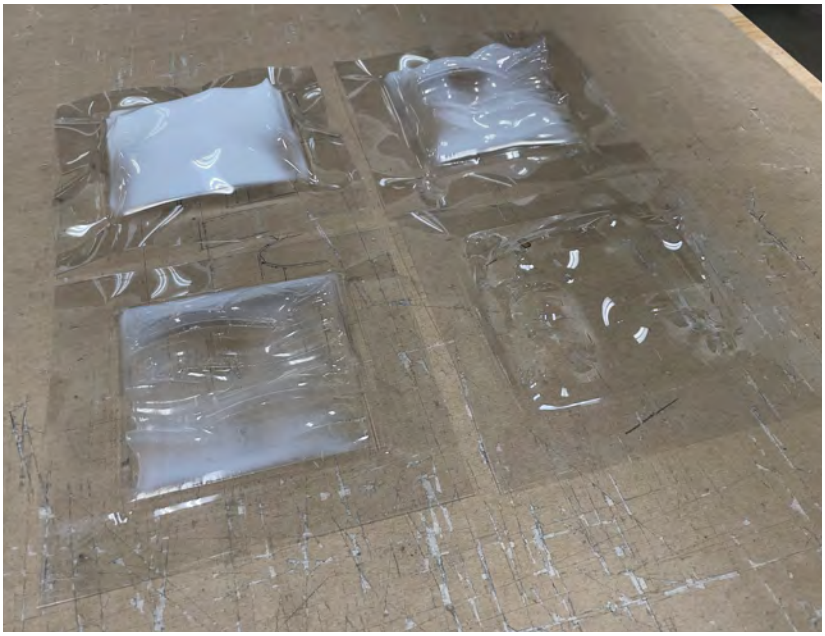


When cool you can remove your form from the vacuum bed

If needed you can use the air pulse button to loosen your form from the object



By adjusting the orientation of your object, the temperature zone percentages, the length of time you heat the plastic, and the method in which you vacuum your form you can produce a number of different effects and results. (*When working with clear materials, if heated too long it will start to turn white like pictured)



Formech 508DT: Troubleshooting

Problem:	Cause:
If material (clear) starts to turn cloudy and white while being heated.	The material is being heated too much.
If during vacuuming your material sheet blows out and produces a hole	Too much pressure on the plastic from the vacuum suction
Not getting as much detail from objects as desired.	Could be lack of proper vacuum suction in that area or another object is interfering.
Form is losing vacuum suction.	There is an area of the form that is not creating a tight seal and is losing suction.

Formech 508DT: Troubleshooting

Solution:

You may still use this material sheet to vacuum form and sometimes this may be a conscious choice, however the material sheet is weaker in this state. To prevent this decrease the time the material is heated.

Adjust your object to prevent weak stretched areas and decrease the time the form is being vacuumed or pulse it to decrease overall stress on the form.

Consider using porous materials to allow good air flow for proper suction. Rearrange your objects to allow better vacuuming in the desired area. Rearrange any tall objects to prevent them from interfering with your form.

Check to see if the form has blown out in any locations. Also check to see if any of your objects have shifted and have prevented the form bed from lifting all the way up preventing a tight seal from being created.