

At Last! Affordable

warmplastic.com
Vacuum Forming Tables for Designers, Modelers and Engineers

WELCOME TO THE

KINGSTON VACUUM WORKS

**VACUUM FORMING FOR THE AMATEUR
AND THE SERIOUS PLASTIC MODELER—
PROFESSIONALS WELCOME TOO!**

HOME OF THE

KINGSTON CANOPY MASTER—3.5"x3.5" TABLE

KINGSTON MICRO—4"x6" TABLE

KINGSTON JUNIOR—6"x8" TABLE

KINGSTON MONO—8"x10" TABLE

AND THE ULTIMATE IN HOBBY VACUUM FORMING CAPABILITY:

ZEPPELIN MASTER—11.25"x16" TABLE

*Small Hemispheres, Dome Shapes and small part forming
are now a Table-Top Reality!*

The Mighty Mini Globe-O-Former!

(also-- 2.25"x6" Table)

CASUAL TABLE-TOP VACUUM FORMING THAT WORKS!

Congratulations! You have purchased a Kingston Vacuum Works vacuum forming table. Handmade and over-built to last a long time.

A word of **CAUTION!** Despite the ease and simplicity of using the tables, it is possible to drop these sturdy wooden boxes on your foot, reach into the oven with your bare hands or answer the phone while the plastic is heating and forget about it for too long. Please avoid all three—especially the last as the vapors from burning styrene can be very unpleasant. Almost as unpleasant as cleaning the melted plastic off of the oven rack! And don't forget to use **TWO** oven mitts!

Plastic is provided with your table so that you will feel comfortable during the experience-gathering period. With only a few tries, you will get the feel of the moves needed for great results.

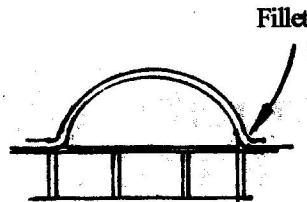
So vacuum form with fun and care!

Eliot R. Brown

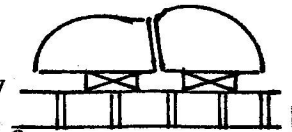
The history of vacuum-assisted thermo-forming goes back to the 1920s and before! Though what they were forming with back then, before "plastics" as we know them were invented, is a mystery. The idea is that some material is held in a frame, heated to the point of becoming "plastic" or soft, then placed over an original shape or pattern which is on a box with a perforated top. A vacuum is applied to the space between the pattern and the plastic through the perforations and atmospheric pressure then pushes the plastic onto the pattern. Toy packaging, consumer products of all sorts, salad bar "clamshell" food containers and refrigerator door liners are all vac-formed!

Welcome to the world of affordable, table-top vacuum-forming. Everything is provided for you to get started immediately! Adequate pattern preparation is the key to success. Here are a few considerations and tips.

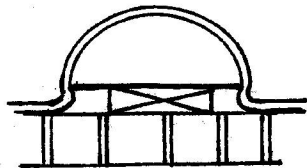
You can form right to the table, but "fillets" (or rounded corners) may be unacceptably large



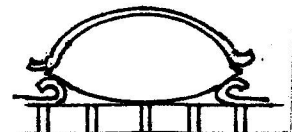
Depressions on upper surfaces require you to drill holes through the pattern to the table below to allow the vacuum to reach that area



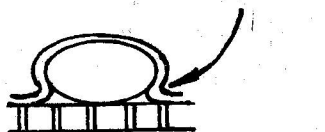
To move fillets to an unimportant part of the sheet, use small blocks to elevate the pattern



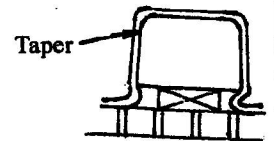
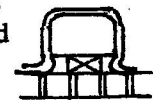
Sharp edges on a pattern can be a problem, try heavier plastic or less oven time (less "droop")



Undercuts can be formed but will require cutting the pattern out



Shapes with vertical sides can be formed, but tapered (or tilted) sides make removal from the formed plastic easier—do so while the set up is still warm



Use masking tape to cover most of the holes not in use to increase vacuum efficiency



Here are the steps:

- assemble and arrange your equipment
 - pre-heat the oven to 300-350°F. (150-175°C.) and arrange wooden blocks on rack
 - place the pattern on the vac-former table surface
 - clamp the plastic in the frames, place it on the blocks in the oven
 - when the droop is pronounced, quickly transfer the plastic/frames to the pattern/table
 - turn on the vacuum cleaner now (or have it running)—press the frame to the table
- Done! Turn the vacuum cleaner off

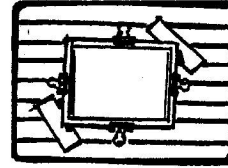
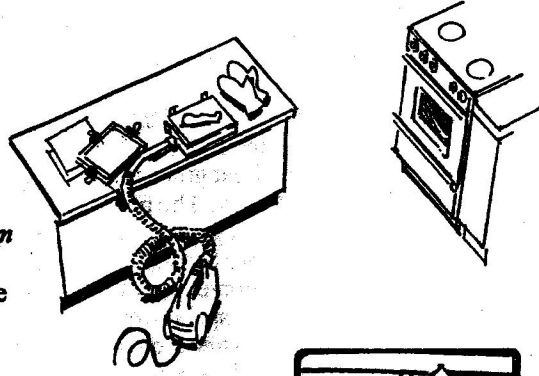
To begin:

Arrange your work area:

Place everything so that you can reach it quickly and easily. *Carefully remove the dust bag from your vacuum cleaner to get a little more 'oomph.'* Make sure your vacuum cleaner hose does not trip you. If your machine has a foot switch, arrange it so that it is close to where you will stand at the vacuum forming table.

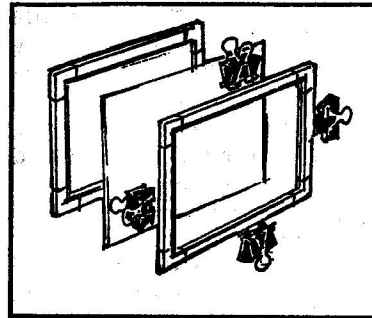
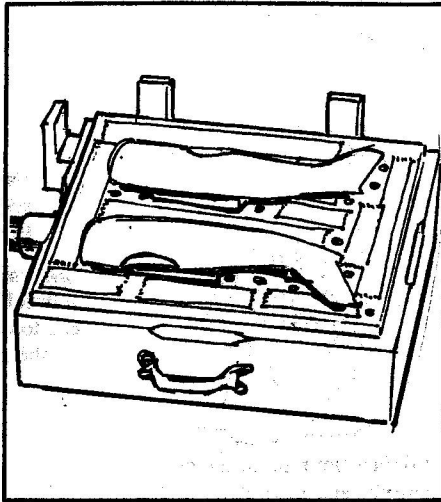
Set your oven to 300-350°F. (150-175°C.)— slide out the rack and use a plastic holding frame with the clamps in place to position the blocks of wood on the rack. The blocks should not wobble. Slide the rack back in.

The oven door should be able to close (Zeppelin Master frames might just hang out and prevent the door from closing completely).

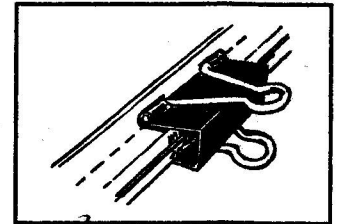


A steady arrangement of blocks and frames. You may have to change the height of your oven racks so that you can easily pick up the frames.

Place your pattern or original to be formed on the table surface. Unless stable, use double-sided tape to prevent the pattern from shifting. Generally it is a good idea to use small wooden blocks under the pattern, then tape off the holes on the rest of the table. Leave some holes near the pattern. You may find that one orientation or another is preferable.



Sandwich the plastic between the frames then apply the clamps. Center each clamp on each side (Zeppelin Masters use two clamps on two sides—use the table edge indentations to align them) and set them about half-way in from their edges— as shown:



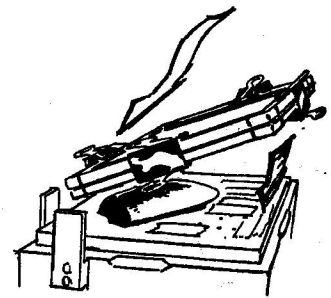
Place the frame on the blocks in the oven. Close the oven door and wait about 90 sec for the plastic to begin to sag or "droop." Check a few times. The right amount of droop is different for each pattern/shape. Take care that the plastic does not reach the oven rack! For low surface relief patterns, you may not want very much droop at all—experience will guide you. **You should wait with both oven mitts on.**

You should not allow yourself to be distracted at this point.

When the droop is where you want it (or just a little bit before as it will continue to sag a bit while in transit to the table) **QUICKLY**, take the frame from the oven and lay it on your pattern. Use the alignment jigs to "aim" when you can't see the working surface. A gentle "tipping in" or a combined *in-to* the alignment jigs *and down-to* the table, motion works well.



Pronounced droop



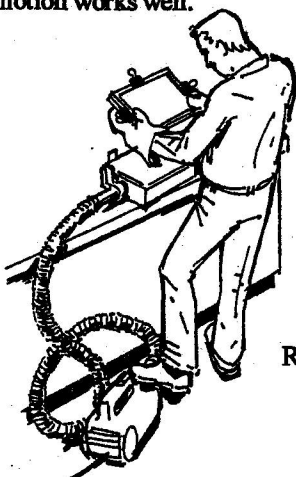
Gently "tipping in"

DON'T FORGET TO USE TWO OVEN MITTS!

If your vacuum cleaner does not have a foot switch, it must be on during the plastic heating—noisy but necessary. The frame should be pressed down to the table, forming a seal. This part is tricky, but with a little experience the gesture will become more natural. If you're dissatisfied with the form, you can put it back in the oven and try again. The only time you can't re-heat your sheet is when there are severe pleats, or drapes, that have melted together.

The process is complete— you have vacuum formed!

Red dot on the plastic's edge=.020"/Black dot on plastic's edge=.030"

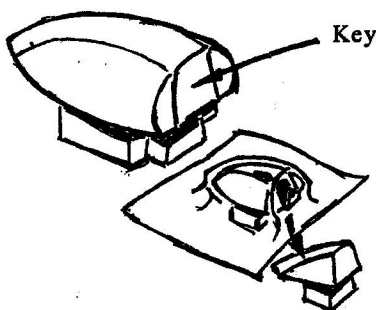
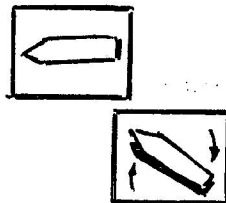


During a lengthy process of discovery trying to make chocolate molds, I found several references to using a heat gun to "fix" small problem areas*. This turned into using a paint-stripper heat gun as a complete heat source. This works pretty well but takes longer. The big consideration when using a heat gun is that a heat resistant pattern is needed. I had made a very complex figurine out of Super Sculpey—which I highly recommend—and also used a real horseshoe as patterns. I was able to re-apply the heat gun to particular spots over and over again. Both materials worked well, giving fillet-free molds right down to the table. (Cautionary note: I had applied a scratch-hiding glaze made by Super Sculpey to the figurine and which melted into the interior of the final mold— not good. To use this re-application of a heat gun method, finish the surface by hand!)

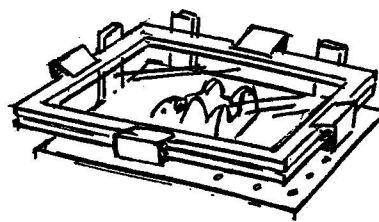
For those complex patterns with wild upper surfaces, simply lay the framed plastic right on top of the pattern. The frame must be aligned with the table edge— use the jigs— if it balances, fine; otherwise hold it with a mitted hand. Slowly work all around the pattern, paying attention to the perimeter area. This will allow the plastic to sag and reach the table edge. When the plastic reaches the table, hit the vacuum for just enough to form the seal. Then, without moving the plastic or pattern, inspect and re-apply the heat gun where needed, watch for more sag and "pulse" the vacuum cleaner. Repeat as necessary. Perfection can be achieved this way.

Making high-quality chocolate molds can be very straightforward. The key is in preparing the pattern. All the considerations for plastic modelers are there, but chocolatiers usually work smaller and more finely detailed (modeler translation: imagine trying to vac-form a human head in 1/35). Slight tapers to all vertical walls and no undercuts are the rule. The tiniest holes drilled into the pattern will show up and thus should be hidden in features. Tiny "finger drills" in number sizes (ex.: #80 is .0135" diameter) are available from Micro-Mark**.

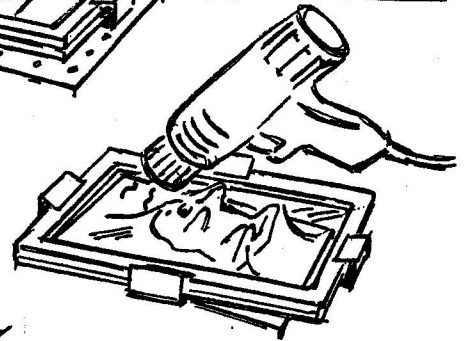
Because warmed and drooping plastic is very flexible, drapes and folds can occur when placing it on the pattern. Sometimes this can be prevented by re-orienting the pattern or using less droop. Elevating the pattern can also help.



Undercuts can be dealt with by using a "keyed" pattern. A tapered and removable middle section will allow the rest of the pattern to be pulled out of the undercut.



All these methods and ideas are applicable to styrene modeling.



Paint-stripper heat gun applied to trouble spot



Vacuum cleaner switched on long enough to cure trouble spot.



I drilled 'im right in the eye... and ampits and mouth!

If you use finger drills rather than a drill bit in a pin vice, you will need to open up the underside of the sculpture. Here's a cross section of the figure.



An improvement to the wooden blocks included with every table is the use of clean, de-labelled tin cans. They should be a little taller than the wood blocks are. The Zeppelin Master is already stuffed into an average oven so replacing those wooden blocks is not recommended. Here is the recommended placement for Zeppelin Master blocks:

Sometimes the plastic is slightly larger than the frames. Make sure that the edges to be placed against the alignment jigs have no plastic sticking out.

Webbing, or the gathering of excess material at corners or between patterns, can be difficult to eliminate. Once again, raising patterns with small blocks of wood or moving them apart, can reduce them or cause them to appear in an unimportant place. Plastic modelers can deal with webbing by wicking in solvent glue and sanding the corners down.

Substituting a shop-vac for a home vacuum cleaner may not work as well as one might think. There is a greater volume of air in the cannister to move than a smaller, home machine. But I still recommend the removal of the dirt bag during forming. Don't forget to put it back!

References: **Build an Affordable Vacuum Forming Machine, plus Thermoforming Scenery for Theatre*, by Nicholas Bryson, Metaphoric Publishing, Hanover, MA, 2001 ISBN 0-910482-39-4 www.metaphoricpublishing.com [The original and still the best! James' book draws from this seminal, vacuum forming theory and methods, source. Pictures alone are worth the price.]
The Prop Builder's Molding and Casting Handbook, Thurston James, Betterway Books, Cincinnati, OH, 1989 ISBN 1-55870-128-1 [Great section on building your own monster vac-former— otherwise, a casters' and mold-makers' bible.]
Architectural and Interior Models, 2nd Ed., Sanford Hoehner, Revised by Helen Demchyshyn, Van Nostrand Reinhold Company, New York, NY, 1984 ISBN 0-442-23668-9 [Fascinating, exhaustive how-to book that inspires with a lavishly illustrated history of modeling.]
 Tools and materials: **Micro-Mark— The Small Tool Specialists, www.micromark.com 1-800-225-1066 [Their catalog is educational!]