

Thermoforming

Thermoforming Formica® Solid Surfacing

Formica® Solid Surfacing is a thermoset polymer that has limited flexibility when heated. It can be, however, successfully thermoformed to meet a great number of curved solid surface material applications.

Thermoforming Formica® Solid Surfacing involves heating the material until it is pliable, bending it to a desired shape, then allowing it to cool and hold its shape.

Please keep the following two points in mind when thermoforming Formica Solid Surfacing:

1. Formica® Solid Surfacing's minimum bending radii vary from those of other solid surface materials and generally are greater than the radii required for thermoplastic solid surface.
2. The temperature and dwell times for thermoforming detailed in this chapter are specific to Formica® Solid Surfacing and vary from those required for other solid surface materials.

This chapter recommends methods and gives specific guidelines to successfully thermoform Formica® Solid Surfacing. Formica Corporation does not express or imply any warranty or suitability of equipment that may be used in the thermoforming process.

Additionally, Formica Corporation is unable to control or regulate an individual fabricator's adherence to the recommended methods listed herein. Consequently, Formica Corporation does not warrant the condition of Formica® Solid Surfacing while being thermoformed or such material which is unsuccessfully thermoformed. However, when the material is successfully thermoformed and subsequently incorporated into a finished assembly, it has the same warranty as other Formica® Solid Surfacing installations.

Formica Corporation recommends that only fabricators who have experience with the techniques, methods and equipment described in this guide, should perform thermoforming. Because Formica® Solid Surfacing has properties that are different than other solid surface materials, individuals thermoforming Formica® Solid Surfacing for the first time must completely read this chapter before beginning the process in order to insure success.

Safety Practices

When working with Formica® Solid Surfacing, Formica Corporation recommends that you follow the standard safe working practices described in this Fabrication Guide. Because thermoforming involves working with equipment and materials that are extremely hot; gloves, clothing and goggles that can withstand high temperatures should be worn.

Design Guidelines

Evaluate design requirements by following these minimum radii recommendations:

Strips less than 6 in. wide

| | |
|------------------------------|--------------------------|
| 1/4 in. (6mm) Solid Color | 4 in. (102mm) radius |
| 1/4 in. (6mm) Pattern | 4 in. (102mm) radius |
| 1/2 in. (12mm) Solid Color | 7 1/2 in. (190mm) radius |
| 1/2 in. (12mm) Light Pattern | 7 1/2 in. (190mm) radius |
| 1/2 in. (12mm) Dark Pattern | 12 in. (305mm) radius |

Strips larger than 6 in. wide

| | |
|------------------------------|-----------------------|
| 1/4 in. (6mm) Solid Color | 5 in. (127mm) radius |
| 1/4 in. (6mm) Pattern | 5 in. (127mm) radius |
| 1/2 in. (12mm) Solid Color | 12 in. (305mm) radius |
| 1/2 in. (12mm) Light Pattern | 12 in. (305mm) radius |
| 1/2 in. (12mm) Dark Pattern | 18 in. (457mm) radius |

For pieces with very tight radii, Formica® Solid Surfacing must be machined rather than thermoformed.

Thermoforming

Thermoforming Procedures

To thermoform Formica® Solid Surfacing, follow the steps in this section.

1. Set up mold clamps and have all tools available.
2. Preheat the oven and maintain a consistent temperature window between 245°F (118°C) and 260°F (127°C). If a highertemperature is used, Formica® Solid Surfacing becomes more pliable, however, it tears on tight radii. A lower temperature leaves the Formica® Solid Surfacing too stiff to thermoform.
3. Cut strips of Formica® Solid Surfacing slightly larger than the finished size requirement.
4. Heat the strips of Formica® Solid Surfacing until they are uniformly hot.

| <u>Size of Material</u> | <u>Time*</u> |
|---|---------------|
| Up to 2 square feet 1/4 in. (6mm) material | 8 minutes |
| Up to 2 square feet 1/2 in. (12mm) material | 12 minutes |
| 2 to 4 square feet 1/4 in. (6mm) | 10 minutes |
| 2 to 4 square feet 1/2 in. (12mm) material | 15 minutes |
| Over 4 square feet 1/4 in. (6mm) | 12-15 minutes |
| Over 4 square feet 1/2 in. (12mm) material | 17-20 minutes |

* Approximate time in hot air/convection oven with 15kw duct heater, 1.400CFM blower and 64 cubic feet of cavity space.

5. Remove the Formica® Solid Surfacing from the oven once it has reached the recommended temperature and has become pliable.

NOTE: After removing 1/2 in. Formica® Solid Surfacing from the oven, you have a total of 2 1/2 to 3 minutes to work before it becomes too stiff. With 1/4 in. Formica® Solid Surfacing, you have less than 2 minutes to work.

Immediately begin bending the heated Formica® Solid Surfacing over the appropriate mold, taking 15 to 20 seconds to induce the bend. If a bend is induced too quickly, Formica® Solid Surfacing will exhibit whitening in the surface.

Clamp the Formica® Solid Surfacing into place over the appropriate mold. Clamp curved areas first, followed by flat run out areas. The total allowable time for clamping a curved area is 2 1/2 minutes; for flat run out areas the total allowable time is an additional 30 seconds.

6. Release the Formica® Solid Surfacing from the mold when the temperature reaches 100° F or lower. Depending on the size of the thermoformed piece and the type of mold used, this will take from 15 to 60 minutes.
NOTE: Although forced cooling seems to have no detrimental effect, Formica Corporation recommends that Formica® Solid Surfacing cool gradually on its own.
7. Additional fabrication should occur after the process of heating, forming, clamping over a mold and cooling is complete.

8. Refer to the appropriate chapters in this Fabrication Guide for instructions on cutting, seaming, routing, sanding and performing other fabrication techniques on Formica® Solid Surfacing.

NOTE: Cuts on curved surfaces require special router bases designed specifically for curved surfaces.

Thermoforming

Equipment

An oven is the recommended heat source for thermoforming Formica® Solid Surfacing. There are two types of ovens you can use to thermoform Formica® Solid Surfacing: a hot air/convection oven and an infrared/radiant deck oven. There are advantages and disadvantages to each type of oven. The oven most recommended for thermoforming Formica® Solid Surfacing is the hot air/convection oven. Instructions for using both types of ovens are provided in this section.

Hot Air/Convection Oven

The hot air/convection oven has the heating element outside the oven cavity, which allows even heat distribution inside the oven. Maintaining even heat distribution permits all Formica® Solid Surfacing colors and sizes, including large pieces, to be easily accommodated.

Because hot air/convection ovens are not widely available at economical prices, you may want to build one that is customized to your specifications. Inexpensive, yet effective hot air/convection ovens may be shop built using firecode plywood for oven cavities and blowers, duct heaters and controls to provide heat and to control temperature. Before constructing an oven, consult with a local mechanical engineer for plans and directions.

Infrared/Radiant Oven

Most solid surface fabricators use infrared/radiant deck ovens because they are readily available and inexpensive. However, they are not easy to calibrate and do not hold as even a temperature as a hot air/convection oven. Some manufacturers (e.g. Pinsky Edge Systems and SpecialtyTools.com) now offer infrared/radiant ovens with electronic controls that provide much better temperature control and heat distribution.

Infrared/radiant ovens must be individually calibrated according to the thickness, color and specific manufacturer of each piece of solid surface material. Because this type of oven has uneven and erratic temperatures, it is least acceptable for thermoforming Formica® Solid Surfacing.

Molds

Heated Formica® Solid Surfacing should be shaped over a mold. The best type of mold to use depends on the design of the piece. To determine the mold that is the best for your design, refer to the chart below.

| Type of Mold | Ease of Use | Ease of Construction | Suitability for Tight Radii | Cooling Speed | Suitability for Large Surfaces |
|------------------|-------------|----------------------|-----------------------------|---------------|--------------------------------|
| Radial Clamp | Very Good | Excellent | Poor | Fast | Excellent |
| Web Clamp | Very Good | Excellent | Poor | Fast | Excellent |
| Male/Female Comb | Very Good | Poor | Very Good | Slow | Excellent |
| Hinged | Good | Poor | Very Good | Slow | Excellent |
| Sweep Arm | Excellent | Poor | Excellent | Fast | Good |

For the best results, construct the molds according to these guidelines.

- Use frame construction to provide for adequate heat dissipation.
- Use 3/4 in. cabinet grade plywood stringers placed three inches on center with a minimum section of six inches and sheathed with 1/4 in. hardboard. This maintains the design integrity of the mold at 22 pounds per square inch.

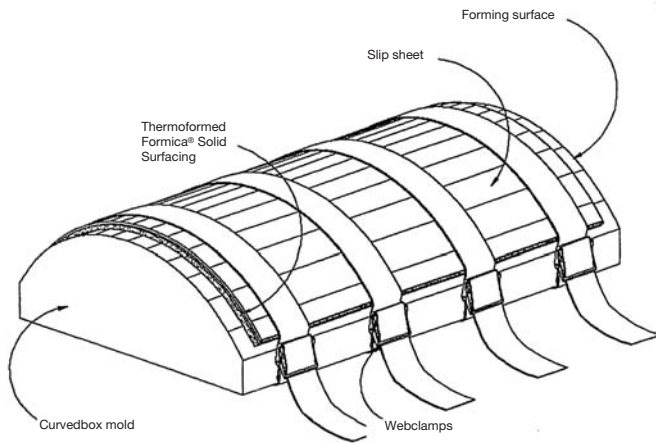
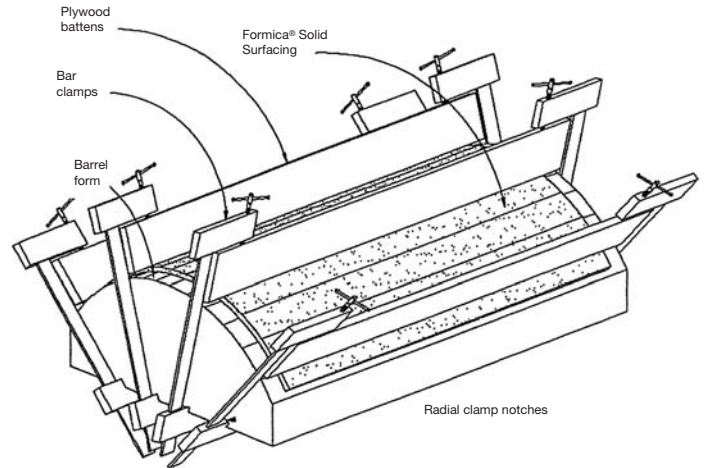
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Following are descriptions of five types of molds that can be used to bend heated Formica® Solid Surfacing.

Simple Molds

1 Radial Clamp Mold

This is a simple male mold with radial clamping.



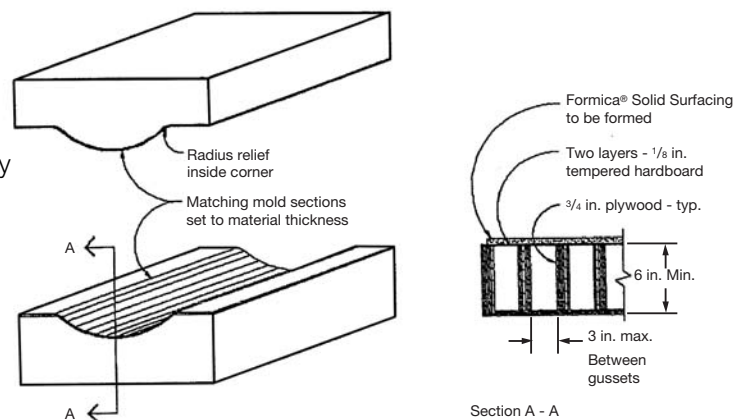
2 Web Clamp Mold

This is a simple male mold with web clamping. A protective slip-sheet must be used to prevent indentations in the Formica® Solid Surfacing.

Complex Molds

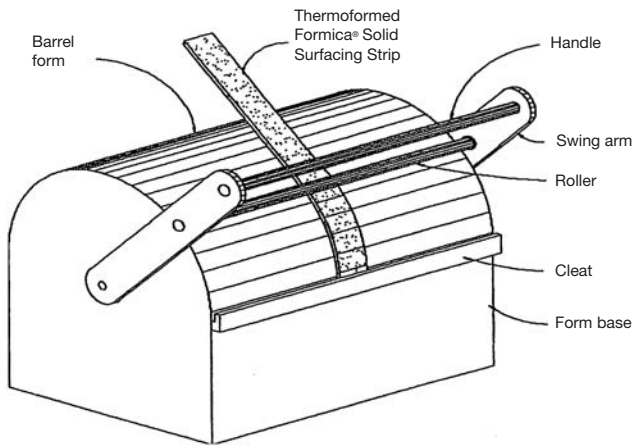
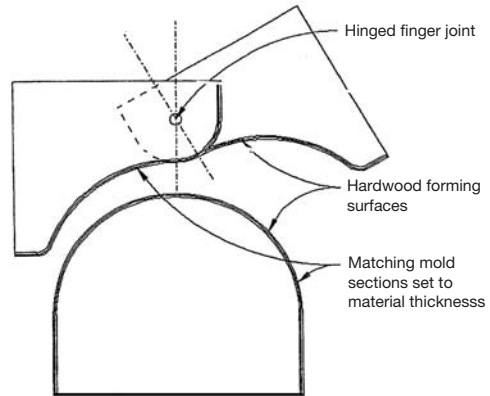
3 Combination Two-Sided Mold

A male to female combination mold is generally appropriate for forming tighter radii on larger pieces, such as columns.



4 Hinged Mold Design

A hinged or articulated female mold with male mold is used when the tightest possible radii are attempted over long lengths perpendicular to the axis of the curve.



5 Sweep Arm Mold

A sweep arm mold is useful when forming narrow strips of Formica® Solid Surfacing.