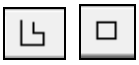
3. QUICK START

This chapter is intended to provide a summary of the steps for drawing a cross section and calculating the results. Each section references places in this manual that explain procedures in more detail.

The examples shown are for typical window cross sections. However, all of THERM's features (except for the Condensation Index Model which only applies to glazing systems) can be used to model two-dimensional representations of products.

3.1. Draw Cross Section and Select Materials (for detailed instructions, see Chapter 5, "Drawing Cross-Section Geometry")

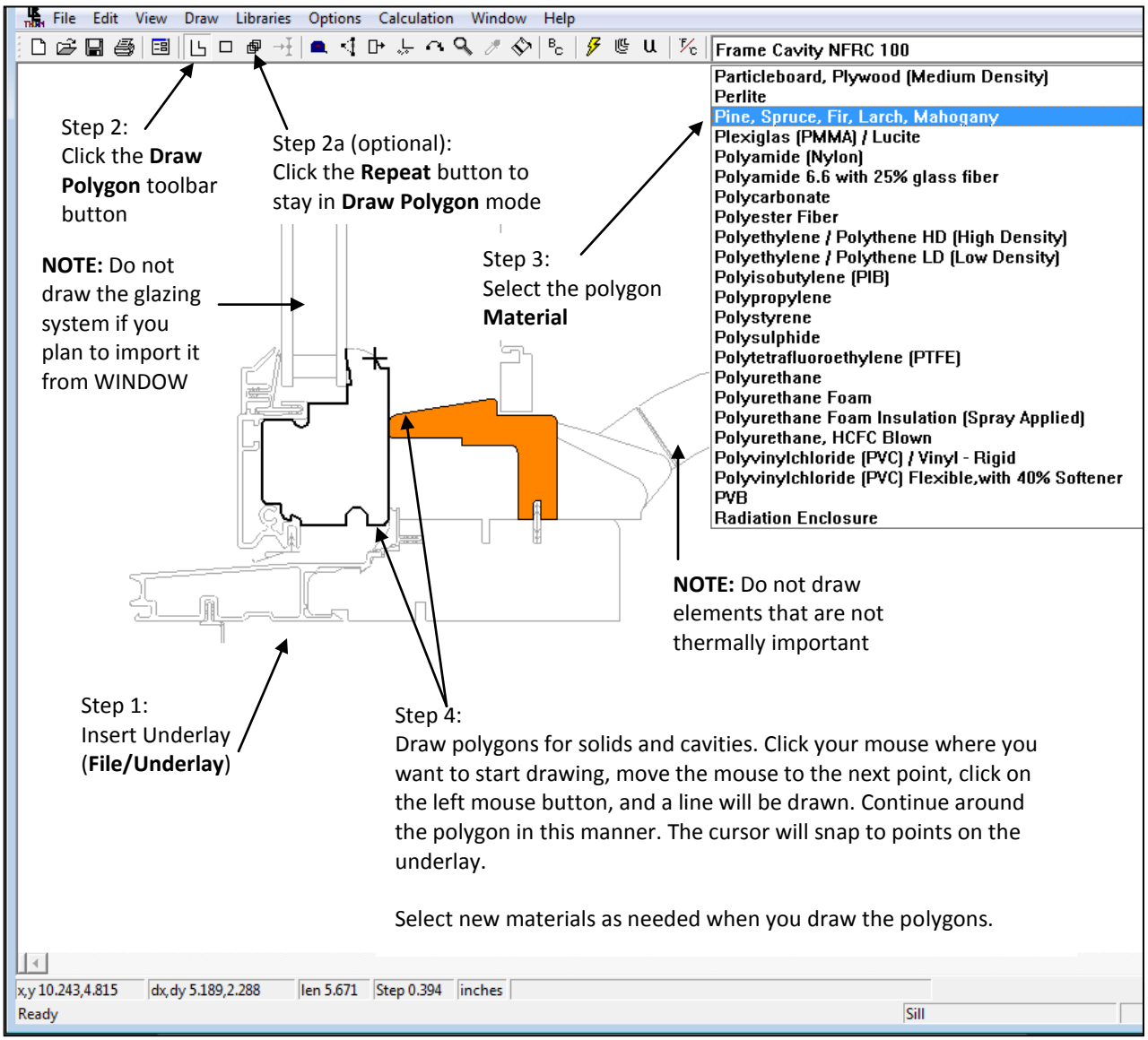
1. If tracing an underlay, bring in a DXF or bitmap file (using **File/Underlay**); to draw the cross section geometry yourself, go to the next step.

2. Press the **Draw Polygon** or **Draw Rectangle** toolbar button. 

3. Select the material for the element you are drawing from the pull-down list in the upper right of screen. (Type the first few letters of the material to scroll through the list without using the mouse).

4. If using an underlay, trace the cross-section elements with your mouse, or work from a dimensioned drawing using THERM's step function (type a value to set the step size; when you press an arrow key the cursor will move by the step distance in the direction of the arrow key; see Section 5.5, "Drawing Using the Keyboard"). THERM recognizes the vertices of the DXF file and will snap the lines being drawn to the underlay. Select new materials as needed before you draw each component, and the materials will be automatically assigned to that component. Draw all components except the glazing system, which will be inserted later.

   If the cursor is snapping to lines or points inappropriately, zoom in (click on the right mouse button) to reduce cursor sticky distance (**Shift-right** mouse click zooms out), or use **Draw/Snap Settings**.


File Edit View Draw Libraries Options Calculation Window Help
Frame Cavity NFRC 100
Particleboard, Plywood (Medium Density)
Perlite
Pine, Spruce, Fir, Larch, Mahogany
Plexiglas (PMMA) / Lucite
Polyamide (Nylon)
Polyamide 6.6 with 25% glass fiber
Polycarbonate
Polyester Fiber
Polyethylene / Polythene HD (High Density)
Polyethylene / Polythene LD (Low Density)
Polyisobutylene (PIB)
Polypropylene
Polystyrene
Polysulphide
Polytetrafluoroethylene (PTFE)
Polyurethane
Polyurethane Foam
Polyurethane Foam Insulation (Spray Applied)
Polyurethane, HCFC Blown
Polyvinylchloride (PVC) / Vinyl - Rigid
Polyvinylchloride (PVC) Flexible,with 40% Softener
PVB
Radiation Enclosure
Step 2: Click the Draw Polygon toolbar button
Step 2a (optional): Click the Repeat button to stay in Draw Polygon mode
NOTE: Do not draw the glazing system if you plan to import it from WINDOW
Step 3: Select the polygon Material
NOTE: Do not draw elements that are not thermally important
Step 1: Insert Underlay (File/Underlay)
Step 4: Draw polygons for solids and cavities. Click your mouse where you want to start drawing, move the mouse to the next point, click on the left mouse button, and a line will be drawn. Continue around the polygon in this manner. The cursor will snap to points on the underlay.
Select new materials as needed when you draw the polygons.
x,y 10.243,4.815
dx,dy 5.189,2.288
len 5.671
Step 0.394
inches
Ready
Sill

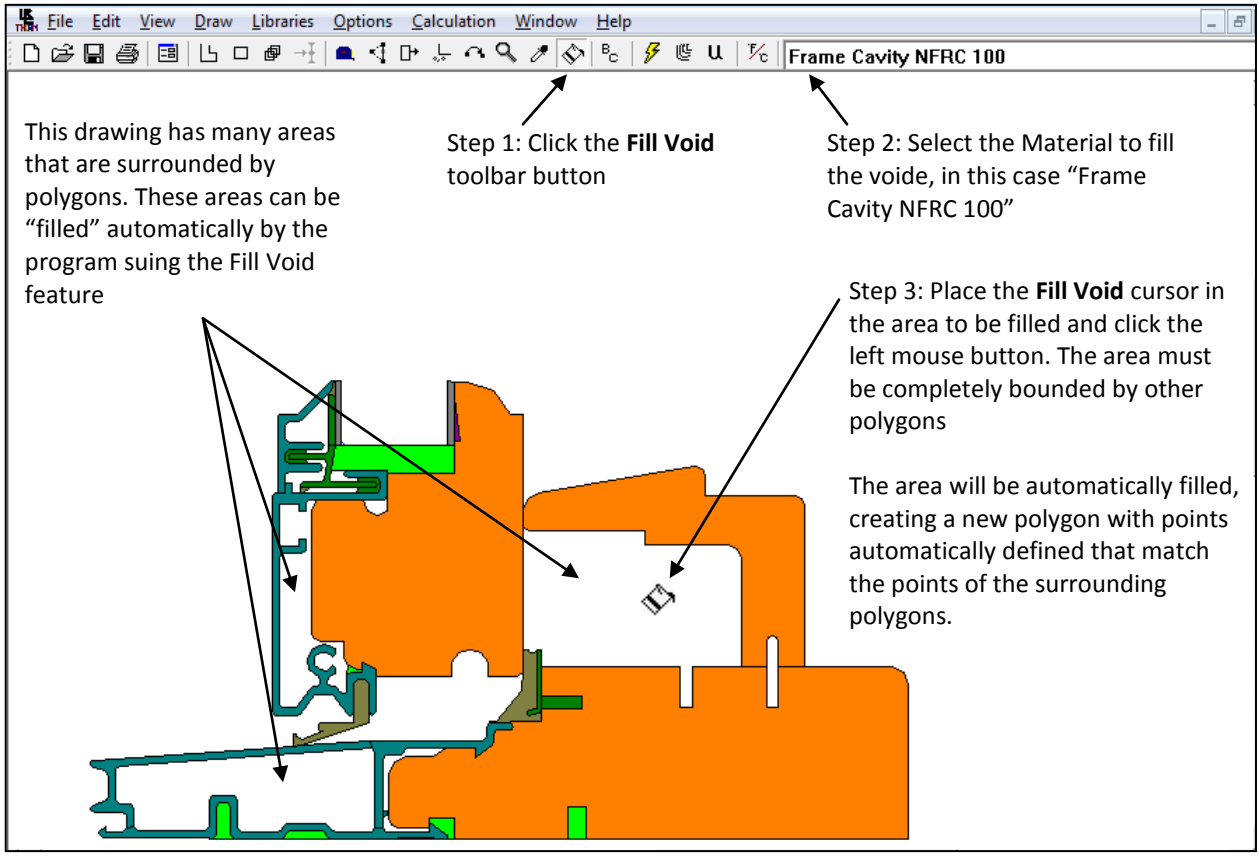
3.2. Drawing Features

There are several drawing features in THERM, including fill void; insert, move and delete points; move, cut, copy, and paste polygons; and flip and rotate the entire cross section. See Section 5.6 "Editing Polygons" for an in-depth discussion of these features.

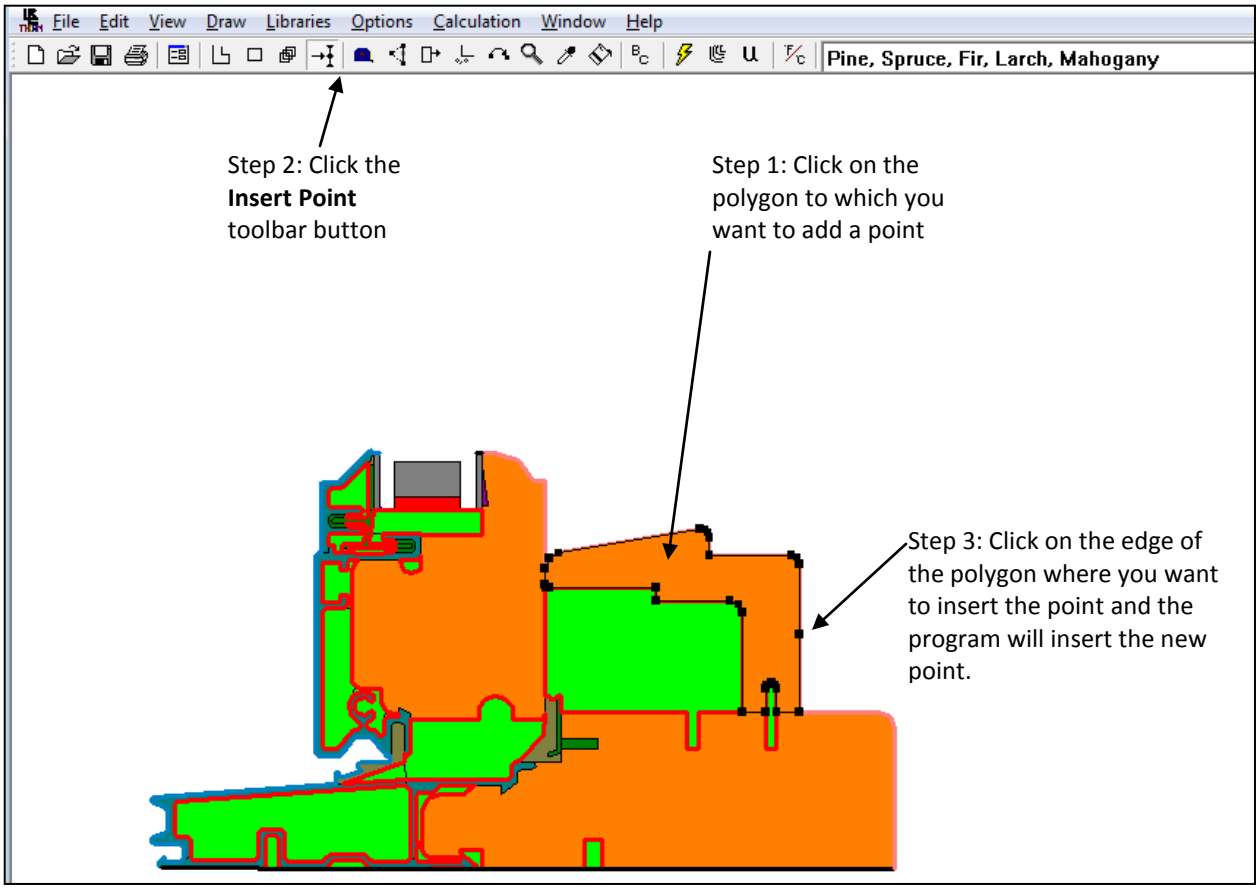
1. **Fill Void feature:** An area of the drawing that is completely surrounded by polygons can be automatically "filled" by THERM, using the **Fill Void** toolbar button.

   To fill an area, first select the **Material** you want to "fill" with, such as the **Frame Cavity (NFRC Simplified)** material shown in the figure below. Then push the **Fill Void** toolbar button, and a **Fill Void** cursor will be displayed. Put the cursor inside the area to be filled and press the left mouse button. (If the area to be filled is smaller than the cursor, zoom in by pressing the right mouse button). THERM will automatically create a polygon that fills the area.

   For THERM to calculate the model, the cross section must not contain any voids or overlaps (see Section 6.3.2, "Finding Voids and Overlaps"). THERM drawing features that are designed to minimize unintentional creation of voids and overlaps as you are drawing include the fill void feature, the "snap" feature (see Section 5.3.3, "Snap Settings") and the dynamic overlap checking as you draw polygons.



2. **Insert Points**: If you need to insert new points into a polygon, use the following steps:
   - Click on the polygon to which you want to add the point
   - Click on the **Insert Points** toolbar button
   - Move the mouse cursor over the location on the polygon where you want to add the point.
   - Click the left mouse button. A new point will be added.

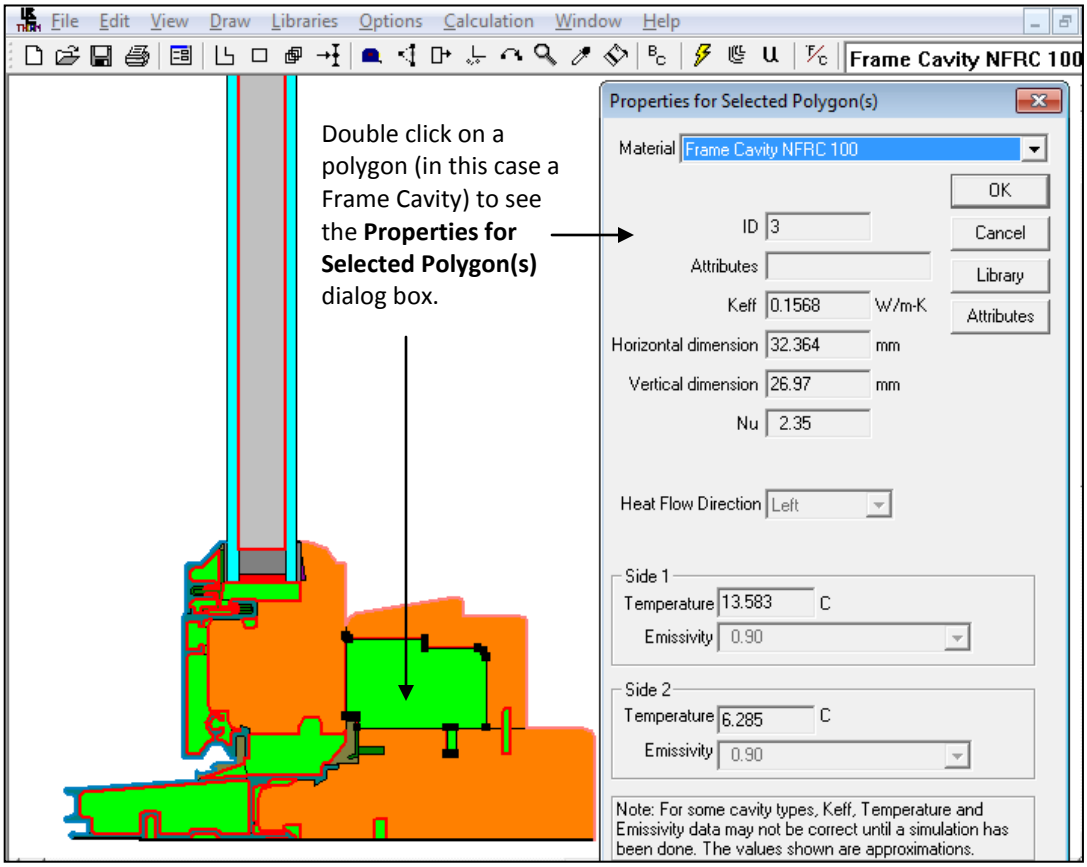


3.3. Materials

(see Section 5.10, "Assigning Materials After Drawing Polygons" and Section 5.11, "Defining New Materials")

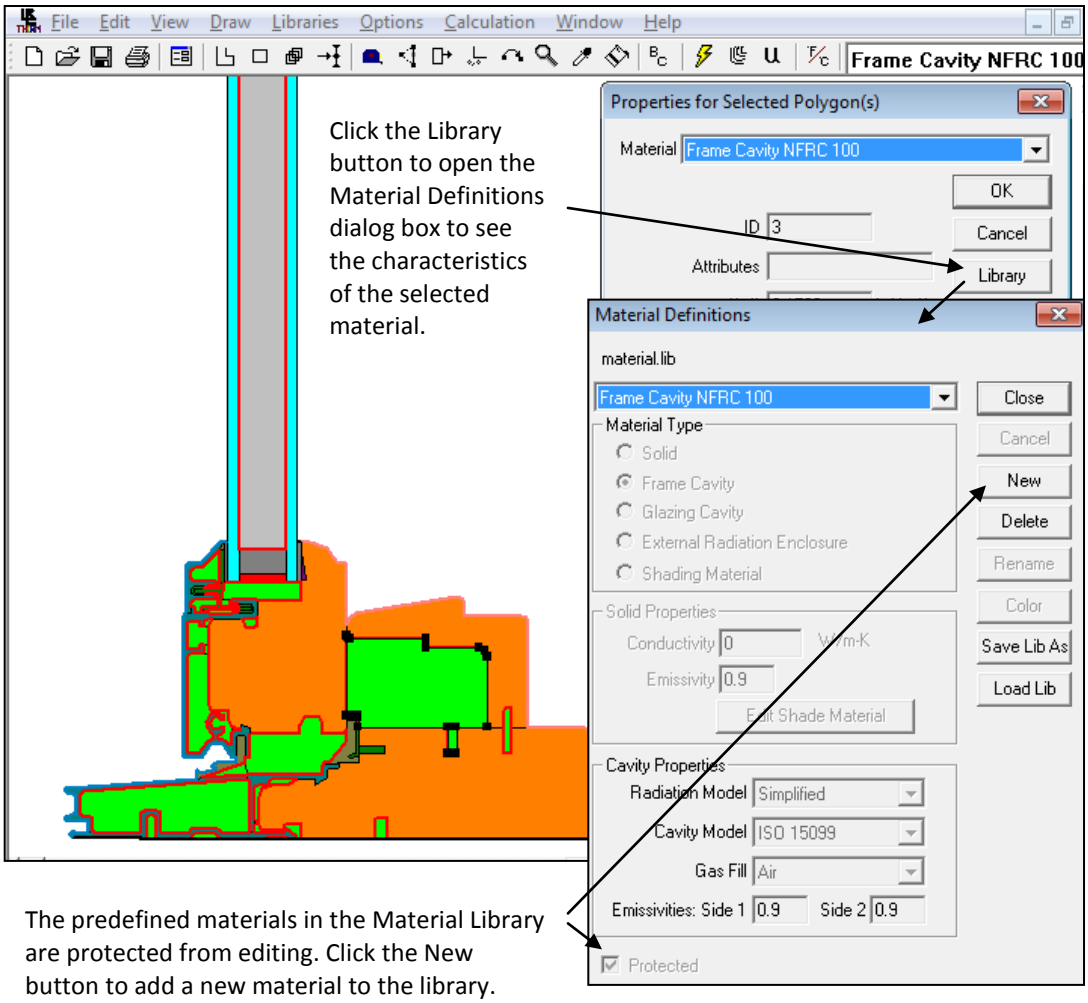
Materials can be specified as you are drawing; they can also be changed after polygons have been created.

1. Double-click on a polygon; the **Properties for Selected Polygon(s)** dialog box will be displayed. Depending on the type of material selected for the polygon (**Solid**, **Frame Cavity**, or **External Radiation Enclosure**), different values will be displayed in the dialog box.



2. From **Properties for Selected Polygon(s)**, you can press the **Library** button, and the **Material Definitions** dialog box will be displayed. From **Material Definitions**, you can view all the entries in the **Material Library** in order to see more detailed characteristics of each material.

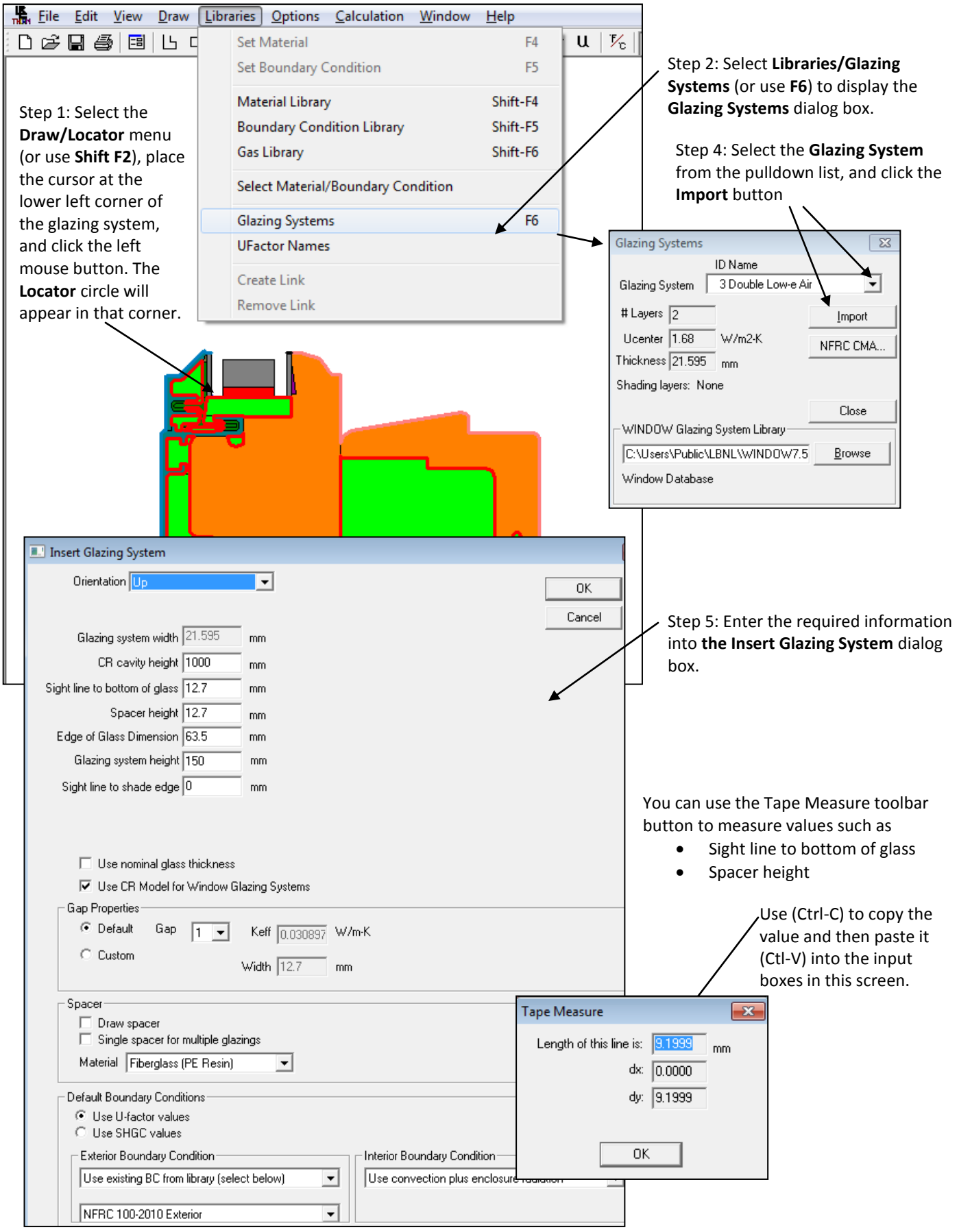
3. The THERM material library contains predefined materials that cannot be edited; however, from the **Material Definitions** dialog box you can create new material library entries, using the **New** button.



3.4. Insert Glazing System

(see Chapter 5, "Drawing Cross-Section Geometry")

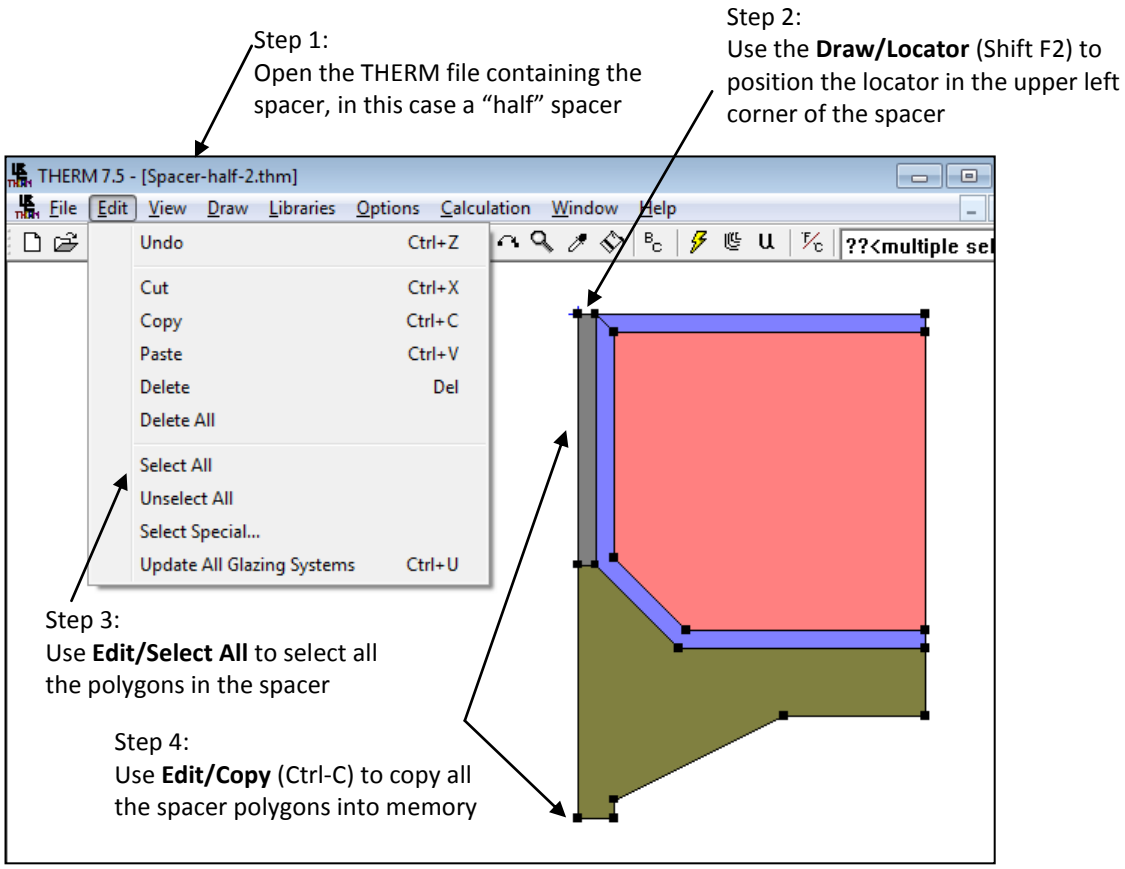
1. On the left-hand side of the glazing unit, draw a rectangle to represent the sealant between the glazing and the frame.
2. Use the **Locator**, accessed from **Draw/Locator**, to define the lower left corner of the glazing system to be inserted.
3. Select the **Libraries/Glazing System** menu choice to access the **Glazing Systems** dialog box, and choose a glazing system previously created in WINDOW 4.
4. From the **Glazing System** dialog box, use the pull-down list to select a glazing system from the WINDOW4 (glzsys.w4) library; click on the **Import** button. You can use the **Browse** button to change to a glazing system library in another directory.
5. The **Insert Glazing System** dialog box will appear. Enter all information in the input fields, in particular the cavity height (if you are using the Condensation Index Model), sight line, and spacer height dimensions. Leave the **Draw Spacer** box unchecked if you want to paste in a spacer from another THERM file. Press the **OK** button.
6. THERM will insert the glazing system automatically. If you get a message that the glazing system won't fit, adjust the frame components as needed.
7. Add another rectangle for the sealant to fill in any gap between the right side of the glazing system and the frame.

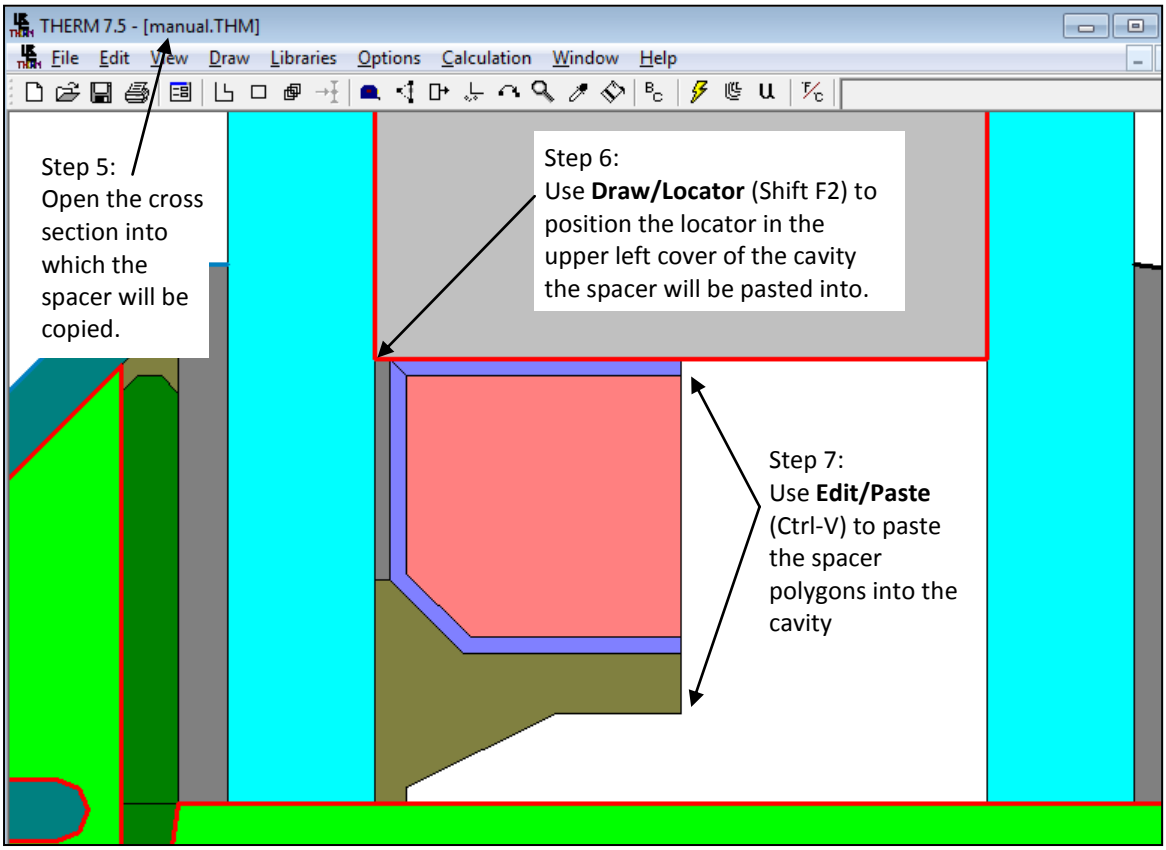

File Edit View Draw Libraries Options Calculation Window Help
Set Material F4
Set Boundary Condition F5
Material Library Shift-F4
Boundary Condition Library Shift-F5
Gas Library Shift-F6
Select Material/Boundary Condition
Glazing Systems F6
UFactor Names
Create Link
Remove Link
Step 1: Select the Draw/Locator menu (or use Shift F2), place the cursor at the lower left corner of the glazing system, and click the left mouse button. The Locator circle will appear in that corner.
Step 2: Select Libraries/Glazing Systems (or use F6) to display the Glazing Systems dialog box.
Step 4: Select the Glazing System from the pulldown list, and click the Import button
Glazing Systems
ID Name
Glazing System 3 Double Low-e Air
Layers 2
Import
Ucenter 1.68 W/m2-K
NFRC CMA...
Thickness 21.595 mm
Shading layers: None
Close
WINDOW Glazing System Library
C:\Users\Public\LBNL\WINDOW7.5
Browse
Window Database
Insert Glazing System
Orientation Up
OK
Cancel
Glazing system width 21.595 mm
CR cavity height 1000 mm
Sight line to bottom of glass 12.7 mm
Spacer height 12.7 mm
Edge of Glass Dimension 63.5 mm
Glazing system height 150 mm
Sight line to shade edge 0 mm
Use nominal glass thickness
Use CR Model for Window Glazing Systems
Gap Properties
Default Gap 1 Keff 0.030897 W/m-K
Custom
Width 12.7 mm
Spacer
Draw spacer
Single spacer for multiple glazings
Material Fiberglass (PE Resin)
Default Boundary Conditions
Use U-factor values
Use SHGC values
Exterior Boundary Condition
Use existing BC from library (select below)
NFRC 100-2010 Exterior
Interior Boundary Condition
Use convection plus enclosure
Step 5: Enter the required information into the Insert Glazing System dialog box.
You can use the Tape Measure toolbar button to measure values such as
Sight line to bottom of glass
Spacer height
Use (Ctrl-C) to copy the value and then paste it (Ctl-V) into the input boxes in this screen.
Tape Measure
Length of this line is: 9.1999 mm
dx: 0.0000
dy: 9.1999
OK

3.5. Adding a Custom Spacer

THERM's **copy** and **paste** drawing features allow you to have libraries of components that can be used in many different cross sections. You could, for example, store a spacer in a separate THERM file that can be copied into any cross section you are drawing. You can also make use of the **flip** and **drawing locator** features during this process.

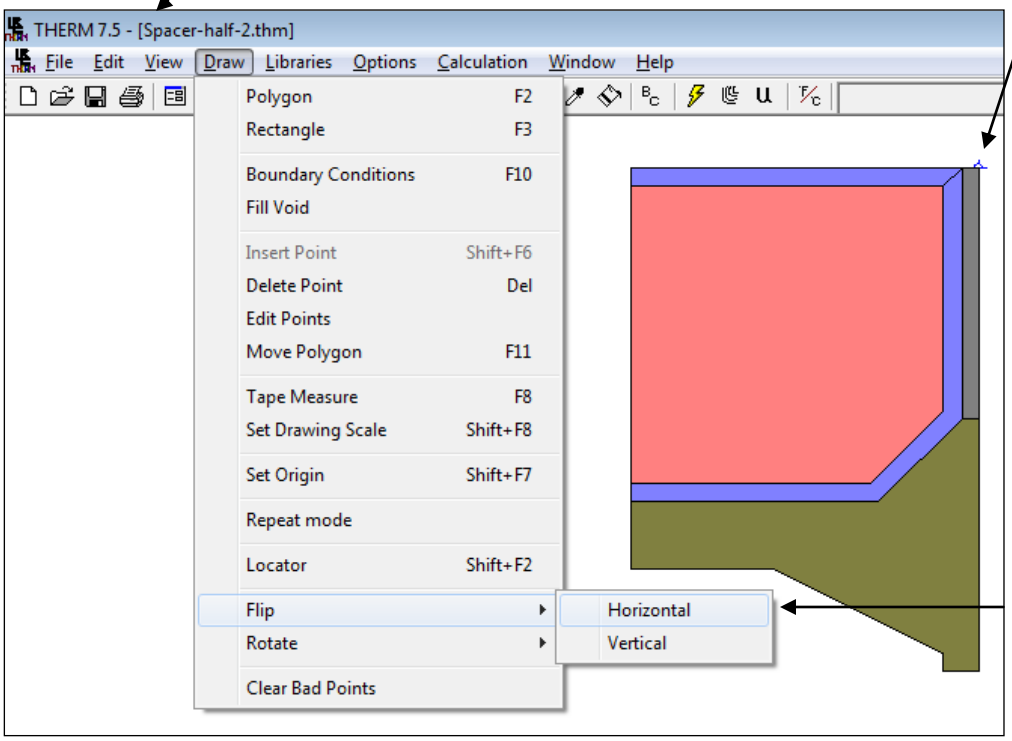
1. Open the THERM file containing the spacer. In the example shown, the file contains half of a spacer.
2. Use the **Draw/Locator** menu choice and click your left mouse button on the upper left corner of the spacer.
3. Use the **Edit/Select All** menu choice to select all the polygons in the spacer.
4. Use the **Edit/Copy** menu choice or **Ctrl-C** to copy all the selected polygons into memory.
5. Use the **File/Open** menu choice to open the cross section into which you want to copy the spacer.
6. Use the **Draw/Locator** menu choice to position the locator in the upper left corner of cavity where the spacer will go. The location of the Locator in this file should match the position where you placed the locator on the spacer; the program will match up the two locator positions when you paste the spacer.
7. Use the **Edit/Paste** menu choice or **Ctrl-V** to paste the spacer into the second cross section. The program will place the copied spacer by matching the two locator positions. Now you have positioned your half spacer in the cross section. To complete the spacer, continue with the following steps.


Step 1:
Open the THERM file containing the spacer, in this case a “half” spacer
Step 2:
Use the **Draw/Locator** (Shift F2) to position the locator in the upper left corner of the spacer
THERM 7.5 - [Spacer-half-2.thm]
File Edit View Draw Libraries Options Calculation Window Help
Undo Ctrl+Z
Cut Ctrl+X
Copy Ctrl+C
Paste Ctrl+V
Delete Del
Delete All
Select All
Unselect All
Select Special...
Update All Glazing Systems Ctrl+U
??<multiple sel
Step 3:
Use **Edit/Select All** to select all the polygons in the spacer
Step 4:
Use **Edit/Copy** (Ctrl-C) to copy all the spacer polygons into memory


THERM 7.5 - [manual.THM]
File Edit View Draw Libraries Options Calculation Window Help
Step 5:
Open the cross section into which the spacer will be copied.
Step 6:
Use **Draw/Locator** (Shift F2) to position the locator in the upper left cover of the cavity the spacer will be pasted into.
Step 7:
Use **Edit/Paste** (Ctrl-V) to paste the spacer polygons into the cavity

8. Use the **Window** menu to select the “half” spacer file.
9. In the spacer file, use the **Draw/Flip/Horizontal** menu choice to flip the spacer; this new shape will form the second half of the spacer when pasted into the cross section. (THERM applies the flip and rotate functions to the entire cross section).
10. Use the **Draw/Locator** menu choice and click your left mouse button on the upper right corner of the spacer.
11. Use the **Edit/Select All** menu choice to select all the polygons in the spacer geometry.
12. Use the **Edit/Copy** menu choice or **Ctrl-C** to copy the "flipped" spacer polygons.
13. Use the **Window** menu to view the cross section into which you already pasted the first half of the spacer.
14. Use the **Draw/Locator** menu choice to position the locator in the upper right corner of the cavity to which you want to match the upper right corner of the spacer.
15. Use the **Edit/Paste** menu choice or **Ctrl-V** to paste the spacer into the cross section. The program will place the copied spacer by matching the two locator positions. Now the second half of the spacer is in position.
16. Use the **File/Save** menu choice to save the cross section containing the new spacer.

Step 8:
Use the **Window** menu to select the "half" spacer file



Step 10:
Use **Draw/Locator** (Shift-F2) to position the locator in the upper right corener of the spacer

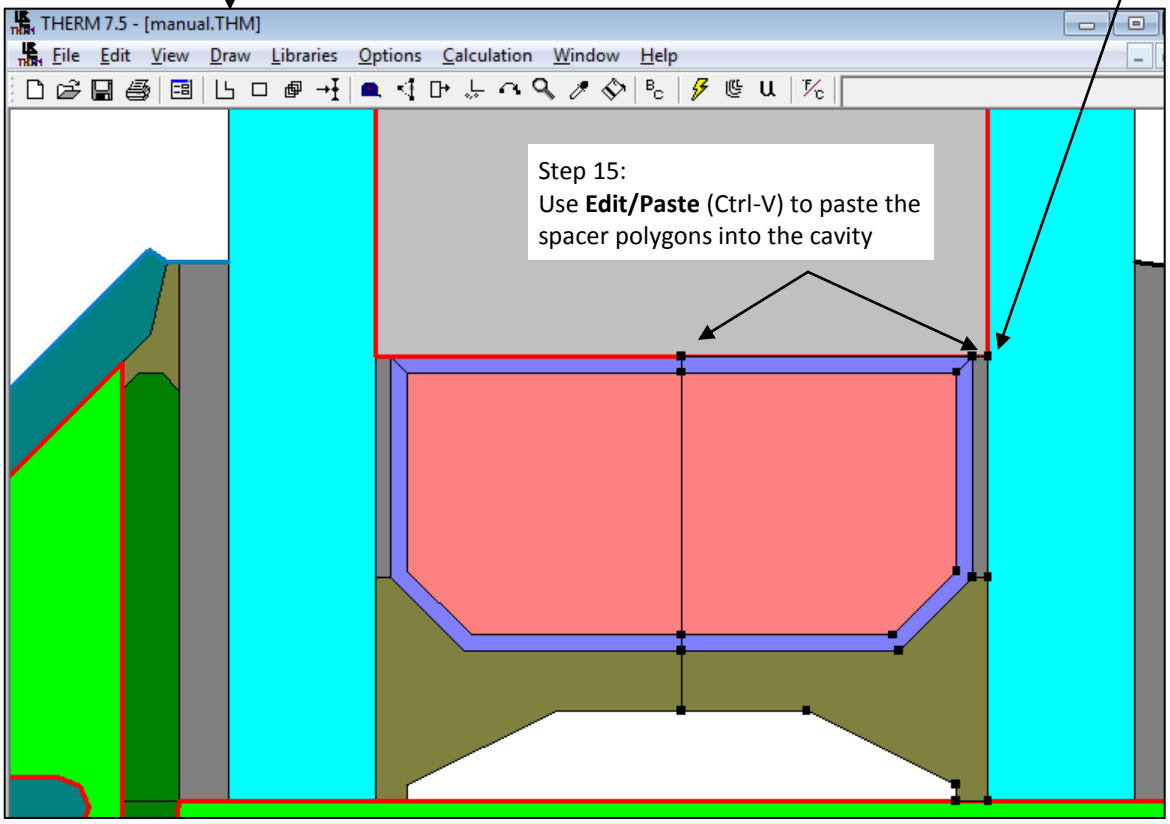
Step 11:
Use **Edit/Select All** to select all the spacer polygons

Step 12:
Use **Edit/Copy** to copy the selected polygons into memory

Step 9:
Use **Draw/Flip/Horizontal** to flip the spacer

Step 13:
Usethe **Window** menu to select the file to copy the spacer into

Step 14:
Use **Draw/Locator** to position the locator in the upper right corner of the cavity where the spacer will be copied



3.6. Specify Boundary Conditions

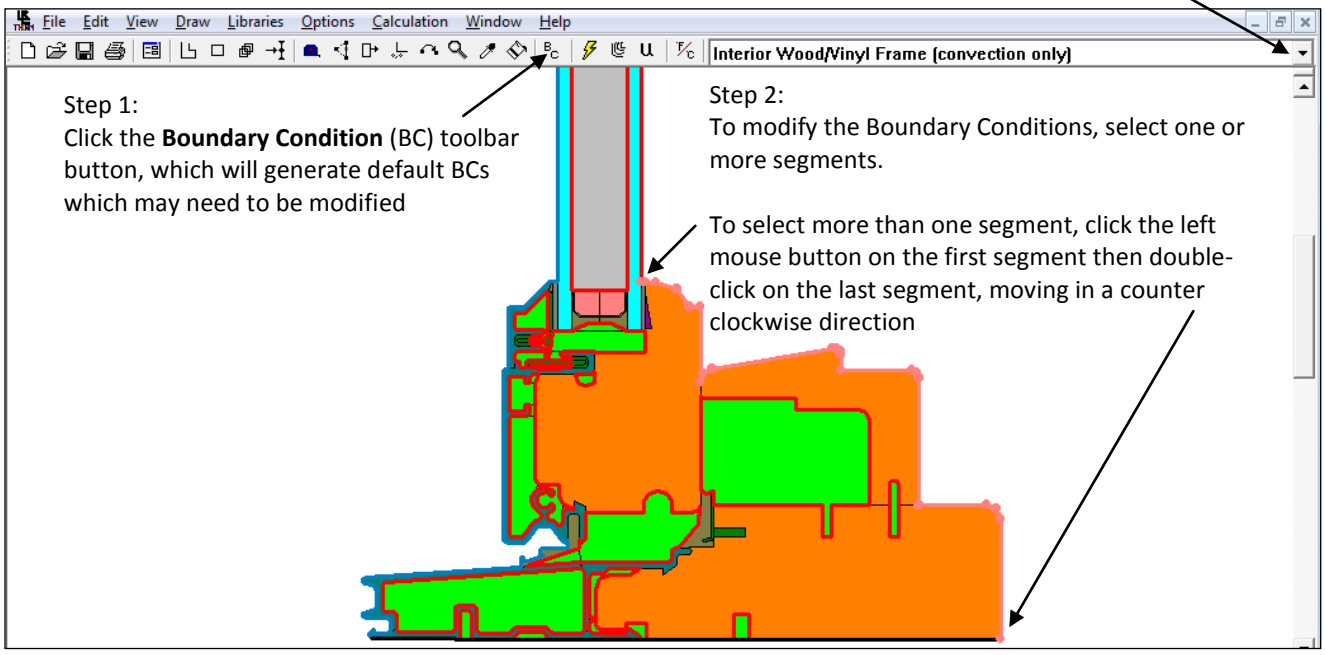
(see Section 6, "Defining Boundary Conditions")

1. Press the **Boundary Conditions** toolbar button. The external boundary is automatically drawn, indicated by a thick line. (A default boundary condition of **Adiabatic** is assigned).

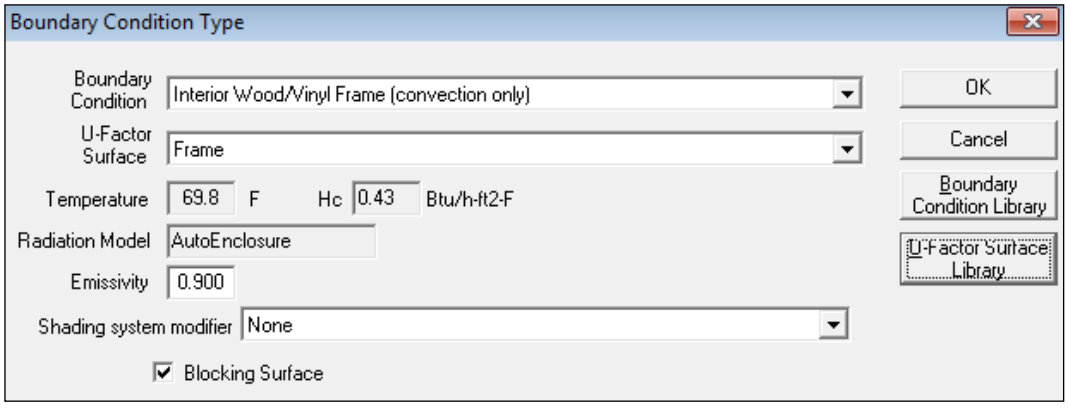
2. To change the default boundary condition, select a boundary segment (double-click the left mouse button on a boundary segment) or multiple contiguous boundary segments (hold the **Shift** key down, click the left mouse button on the first segment and the last segment, moving in a counter-clockwise direction, and then press **Enter**; use the **Ctrl** key in the same manner to select multiple non-contiguous boundary segments). You must have at least two non-adiabatic boundary conditions for the program to perform a simulation.

3. The Boundary Condition Type dialog box will appear. Pick the appropriate Boundary Condition and U-Factor Surface choices for each boundary segment.

Step 3a:
The Boundary Condition for the selected segments can be chosen from the pulldown list in the toolbar



Step 3b:
Double clicking on the last segment in Step 2 will open **the Boundary Condition Type** dialog box, where the Boundary Condition can be selected. Pressing the **Enter** keyboard button with Boundary Condition segments selected will also open this dialog box.

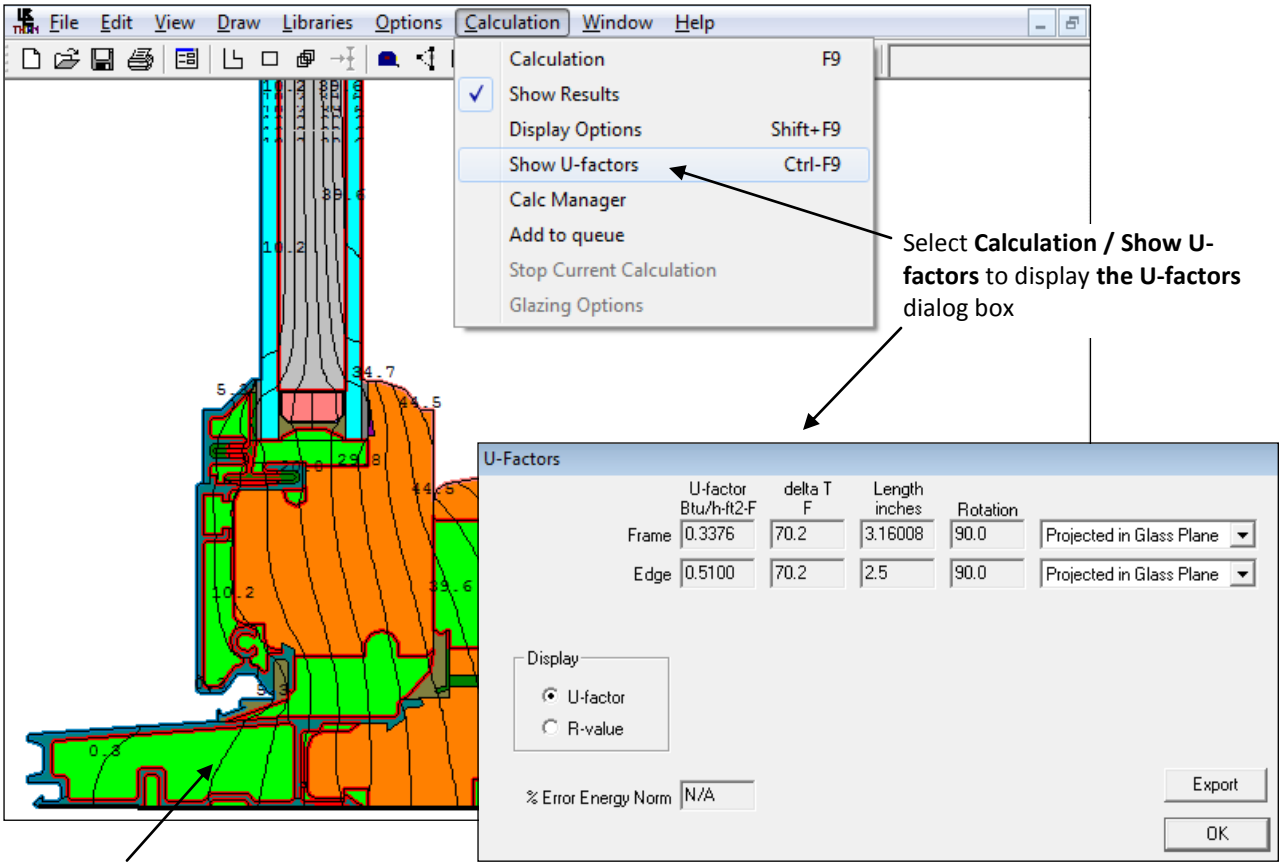


3.7. Run Simulation and View Results

(see Chapter 7, "Calculating Results")

1. Press the **Calculation** toolbar button. 
2. THERM automatically generates a finite-element mesh to perform the calculation. The status of the calculation is displayed in the status bar at the bottom of the THERM window.
3. Results will be displayed as isotherms on the cross section when the calculation is completed.
4. From the **Calculation** menu, select **Display Options**.
5. Select the desired graphic display option and check the **Draw Results** box.
6. Select the **Calculation/Show U-factor** menu choice to see the U-factor values. If U-Factor values are blank, then you need to assign **U-Factor Surface** labels to the surfaces of interest (double-click on the boundary segment to assign these labels.)

Other graphic results can be accessed using the **Calculation/Display Options** menu choice.



Isotherms are the default result that is automatically displayed after a calculation.

Use **Calculations/Display Options** to selec other results

3.8. Toolbar Reference Table

Button	Description	Menu / Choice	Short cut
	New THERM file	File / New	Ctrl+N
	Open existing THERM file	File / Open	Ctrl+O
	Save THERM file	File / Save	Ctrl+S
	Print THERM file	File / Print	Ctrl+P
			
	Draw Polygon	Draw / Polygon	F2
	Draw Rectangle	Draw / Rectangle	F3
	Repeat Mode This button can be used with the Draw Polygon, Draw Rectangle, Insert Point, Tape Measure, Edit Points, Move, and Fill Void buttons to repeat those functions.	Draw / Repeat Mode	
	Insert Point	Draw / Insert Point	Shift F6
	Turn on Tape Measure	Draw / Measures	F8
	Edit Points	Draw / Edit Points	
	Move polygon or rectangle	Draw / Move	F11
	Set drawing origin	Draw / Set Origin	Shift F7
	Change Snap Settings		F12 *(opens Options/Preferences)*
	Turn on Zoom to enlarge view of drawing	View / Zoom	*Zoom to fit: F7* *Zoom In*: right mouse button *Zoom Out*: shift right *Center:* Ctrl-right mouse button
	Select Materials or Boundary Conditions		
	Fill void	Draw / Fill Void	
	Draw Boundary Conditions	Draw / Boundary Conditions	F10

	Calculate	Calculation / Calculation	F9
	Show Results	Calculation / Show Results	
	Show U-factors	Calculation/ Show U-factors	Ctrl-F9
	Switch Unit Systems between SI and IP	Options / Switch Units	

3.9. Other Shortcuts

Description	**Menu/Choice**	**Shortcut**
Set Material	Libraries/ Set Material	F4
Material Library	Libraries/ Material Library	Shift-F4
Set Boundary Condition	Libraries/ Set Boundary Condition	F5
Boundary Condition Library	Libraries/ Boundary Conditions	Shift-F5
Glazing Systems	Libraries/ Glazing Systems	F6
Display Options	Calculation/ Display Options	Shift-F9
Snap to point or polygon within sticky distance of the cursor		Space bar
Snap to the last point drawn		End
Decrease the step size by a factor of 10.		Ctrl-Arrow key
Open the Step Size dialog box		*Press the period button on your keyboard*