8. SPECIAL CASES

8.11. Retractable Venetian Blinds in Fully Open Position

Integral venetian blinds (venetian blinds between two glazing layers in a glazing system) fall into the category of a dynamic glazing product. The rules for rating dynamic glazing products, according to NFRC 100 and 200, state that they must be rated in both their fully open and fully closed positions. In the case of modeling retractable integral venetian blinds as part of a dynamic glazing product, the fully open position is when the venetian blind is completely retracted. However, even when completely retracted, the stacked venetian blind slats become a "block" of material that must be modeled.

The following illustrates how to model a fully retracted venetian blind that has a stack of blind slats at the top of the glazing system.

In this discussion, only the Head section will be discussed. For Vertical Sliding windows where the lower sash contains an integral venetian blind, the lower sash portion of the Meeting Rail section will be modeled with the same venetian blind considerations as the Head section. The other cross sections (Jambs, Sills and Meeting Stiles) are modeled normally, without any venetian blind considerations. Two examples will be illustrated:

- The venetian blind fully retracted inside a double glazed system.

- The venetian blind fully retracted between a double glazed system and a third glazing layer (such as, but not limited to, an add-on panel).

8.11.1. Venetian Blind Fully Retracted Inside a Double-Glazed System

The following figure shows the Head cross section for a venetian blind in the fully-retracted position inside a double-glazed system.
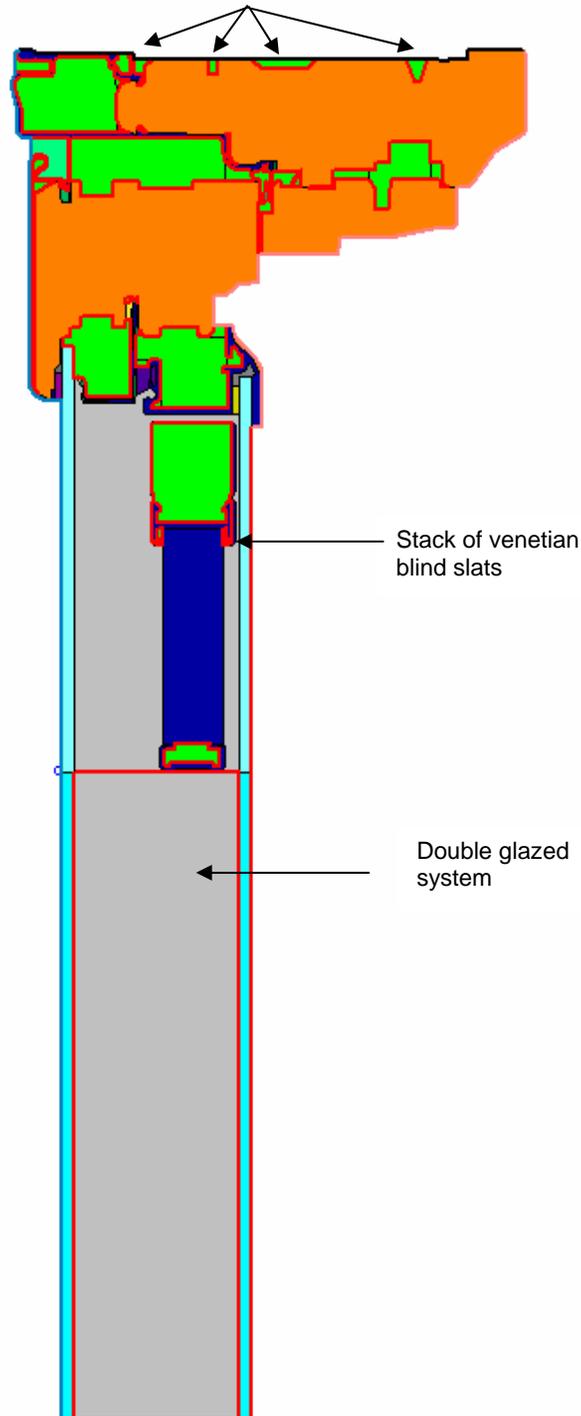
Figure 8-107. Head cross section with fully retracted venetian blind inside a double-glazed system.

Top of venetian blind assembly

Block of Aluminum Alloy used to represent the geometry and material properties of the stack of venetian blind slats in their fully retracted position

In this case the stack of blind slats is approximately 15 mm wide and 50 mm long.

Bottom of venetian blind assembly

Glazing system cavity

The space between the stack of venetian blind slats and the glazing layers is filled with a material "linked" to the glazing system cavity.
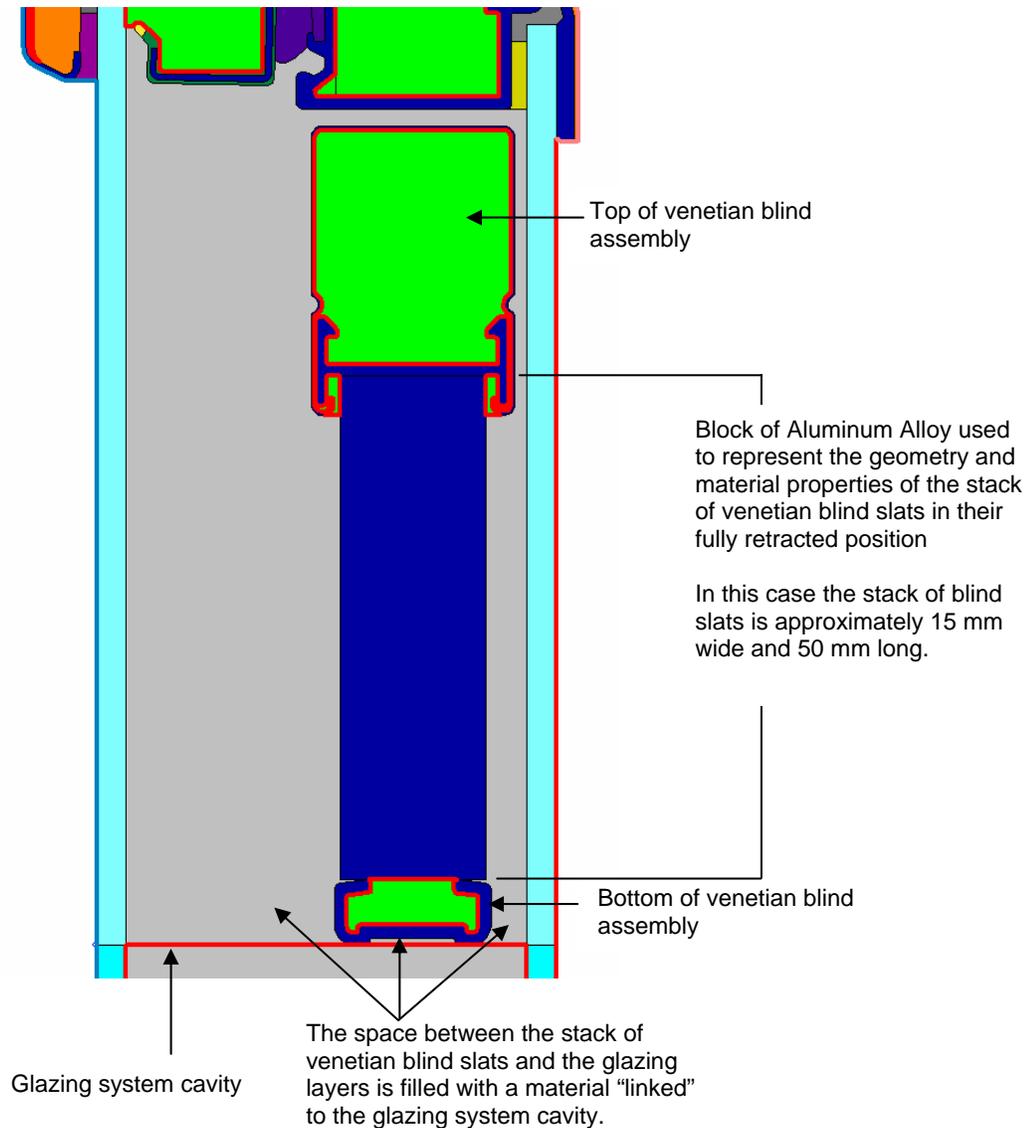
Figure 8-108. The Head cross section with the retracted venetian blind, including the stacked slats, and the top and bottom assemblies for the blind that are continuous across the section.

Follow these steps to model a fully retracted venetian blind:
(*Note: This example was done for Aluminum slat blinds. If the material of the blinds is not Aluminum, use the appropriate material properties from NFRC 101 "Procedure for Determining Thermo-Physical Properties of Materials for Use in NFRC-Approved Software Programs" for the stack of retracted venetian blind slats.*)

1. Draw the Head cross section of the product frame.
2. Draw the geometry of the retracted venetian blind, including the length and width of the stacked venetian blind slats and any continuous hardware that holds the blind in place (top and bottom). (*Note: In this case, the system seems to be "floating" because non-continuous hardware is used to attach the blind to the fenestration system.*)

3. Insert the glazing system.
   The example shown below has glazing layers that intersect the frame at two different heights. There are numerous methods for modeling this. The method shown is to "stretch" the glazing layers to meet the frame at the appropriate place, and this method also necessitates inserting points on the glazing system for the correct boundary conditions segments. Another method would be to insert "float glass" polygons for the glazing layer extensions – this method eliminates the need to insert the points in the glazing system for the boundary condition segments.

In this example the edges of the glazing system intersect the frame at different heights so the edges of the glazing system are "stretched" to meet the frame.

Insert the glazing system at the bottom of the venetian blind assembly with "Spacer height" and "Sight line to bottom of glass" set to 0.

Turn on "Allow editing of IG polygon" in Preferences/Drawing Options. Then pull the edges of the glazing in the glazing system up to the frame.

Insert a point on the outer surface of each glazing layer where the bottom of the venetian blind ends. This will ensure that the separate boundary condition segments will be created at these points, for proper boundary condition and U-factor surface definitions.
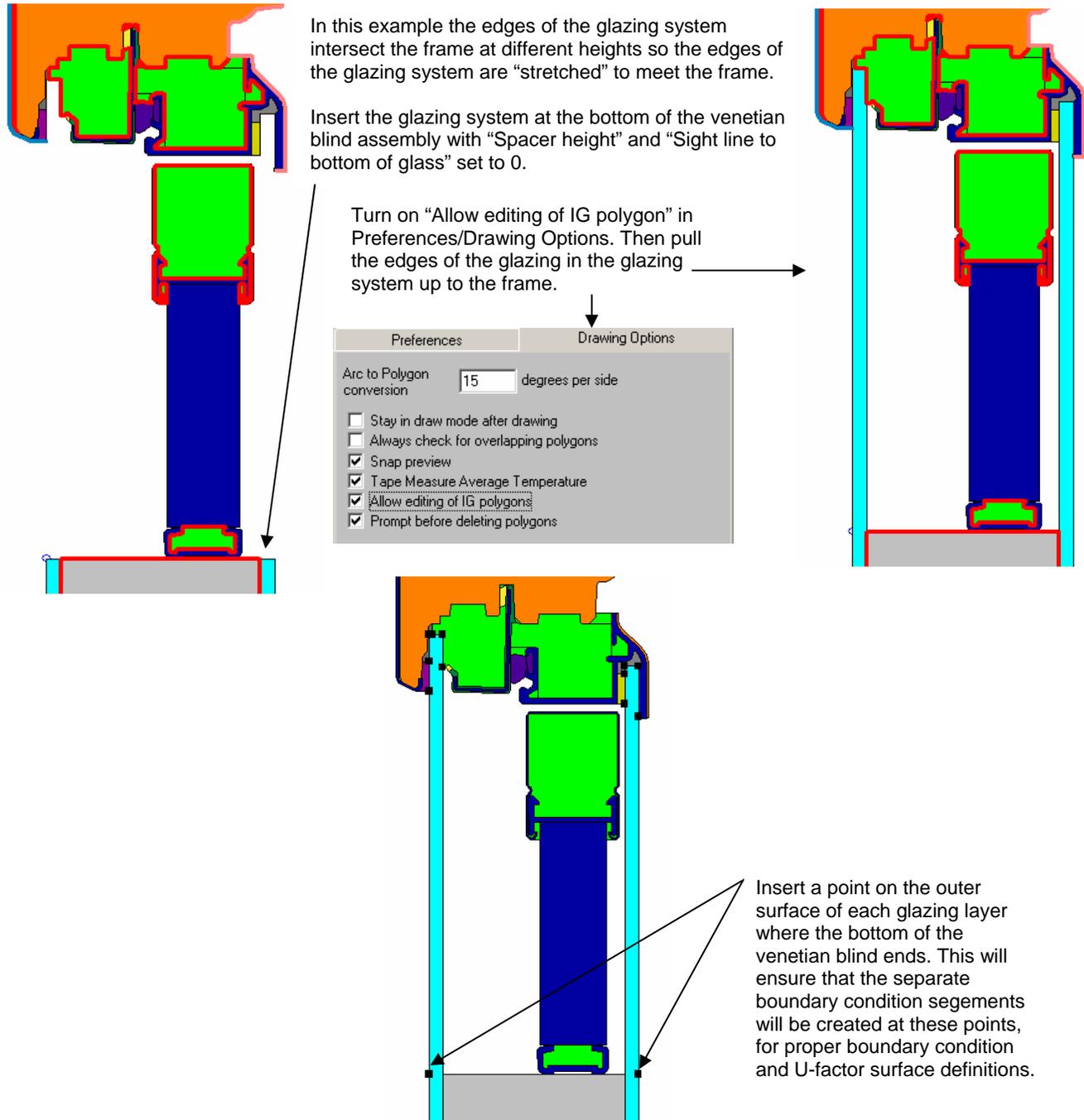

Figure 8-109. Insert the glazing system.

4. Fill the cavities around the venetian blind with a material, and then link that material to the cavity of the main glazing system. There may be several cavities to be linked, as shown in the figure below.

To link the cavity next to the venetian blind to the main glazing system cavity, do the following:
- fill the cavity with a material (any material will work)
- select the cavity you just filled
- go to the Library menu, Create Link option
- the "eyedropper" tool will appear – click on the main glazing cavity (the polygon to link to) and the other cavity will turn gray and have the same name as the glazing system cavity.
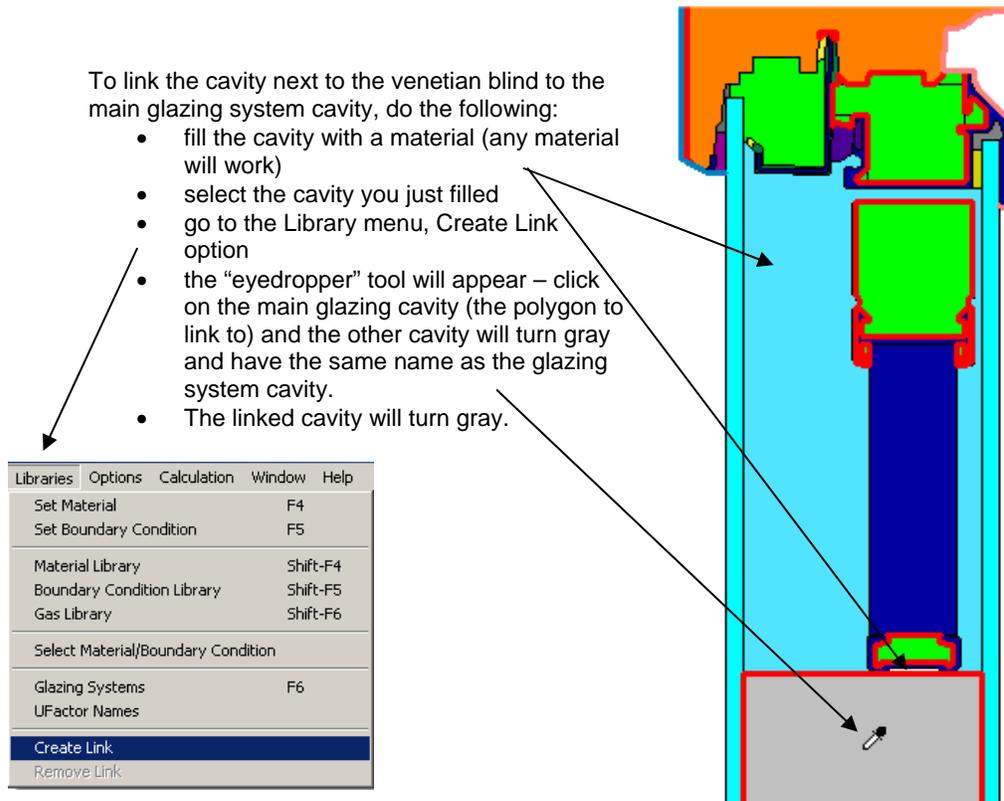- The linked cavity will turn gray.

Figure 8-110. Fill the cavity next to the venetian blind by linking it to the main glazing cavity.

5. Generate the Boundary Conditions. The section of the warm side of the glazing system adjacent to the retracted venetian blind should be defined with a U-factor Surface tag of "Frame".
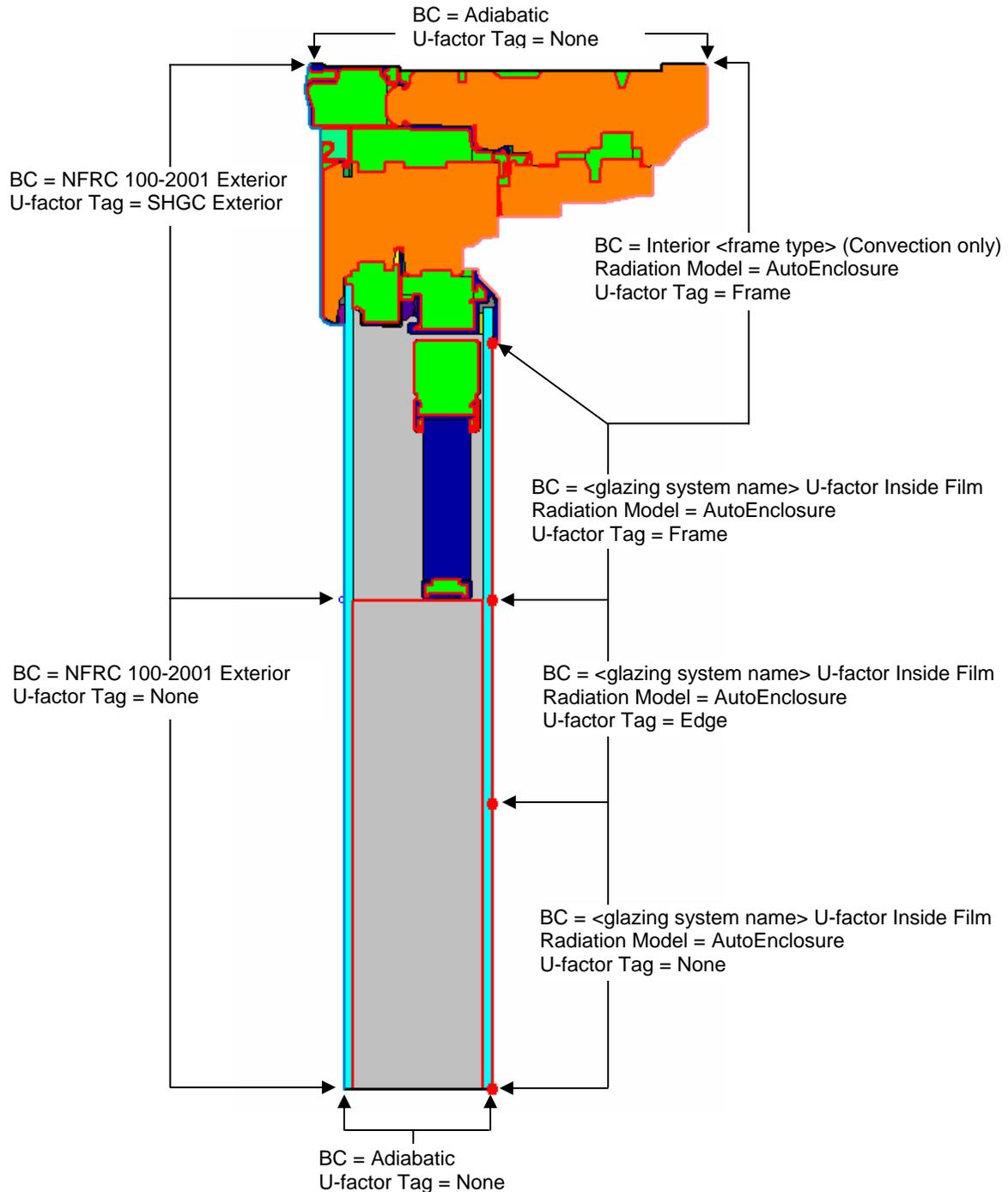
BC = Adiabatic
U-factor Tag = None

BC = NFRC 100-2001 Exterior
U-factor Tag = SHGC Exterior

BC = Interior <frame type> (Convection only)
Radiation Model = AutoEnclosure
U-factor Tag = Frame

BC = <glazing system name> U-factor Inside Film
Radiation Model = AutoEnclosure
U-factor Tag = Frame

BC = NFRC 100-2001 Exterior
U-factor Tag = None

BC = <glazing system name> U-factor Inside Film
Radiation Model = AutoEnclosure
U-factor Tag = Edge

BC = <glazing system name> U-factor Inside Film
Radiation Model = AutoEnclosure
U-factor Tag = None

BC = Adiabatic
U-factor Tag = None

Figure 8-111 Define the boundary conditions for the cross section

6. Calculate the results for this cross section.
7. Complete the calculations for the other product cross sections (Sill, Jambs and Meeting Rails / Stiles as appropriate).
8. Import all the cross sections into the WINDOW Frame Library and calculate the total product U-value, SHGC and VT.

8.11.2. Venetian Blind Fully Retracted Between a Double-Glazed System and a Third Glazing Layer

The following figure shows the Head cross section for a venetian blind in the fully-retracted position between a double-glazed system with a third glazing layer, such as, but not limited to, an add-on panel.
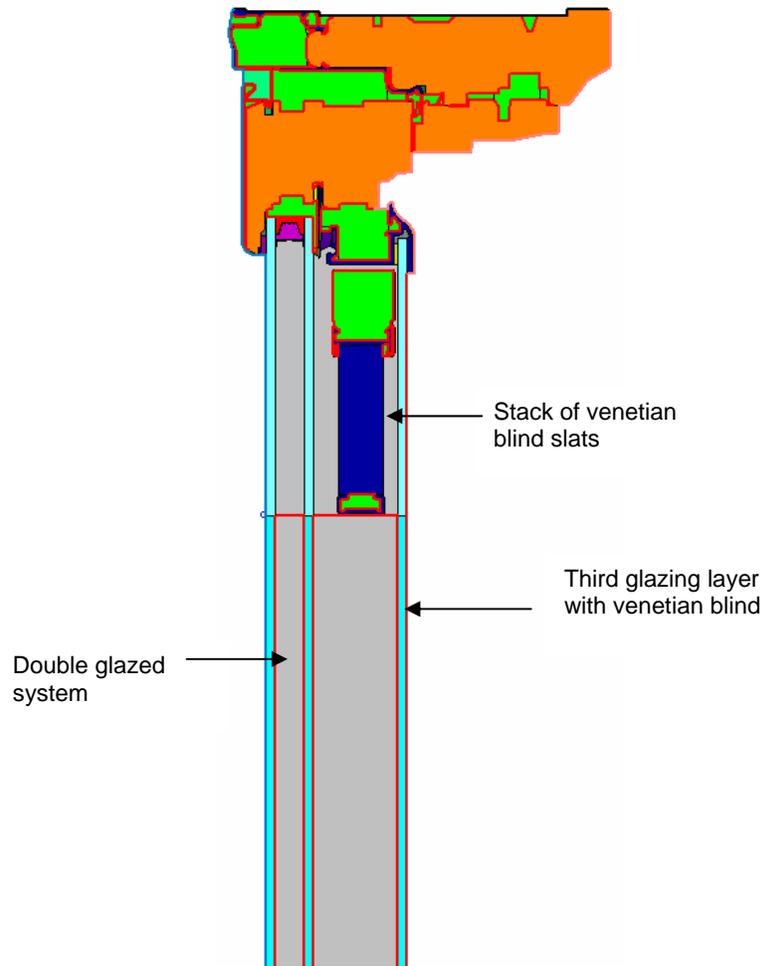

Figure 8-112. Head cross section with fully retracted venetian blind between a double-glazed system and a third glazing layer.

Top of venetian blind assembly

Block of Aluminum Alloy used to represent the geometry and material properties of the stack of venetian blind slats in their fully retracted position

In this case the stack of blind slats is approximately 15 mm wide and 50 mm long.

Bottom of venetian blind assembly

Dual glazed system cavity
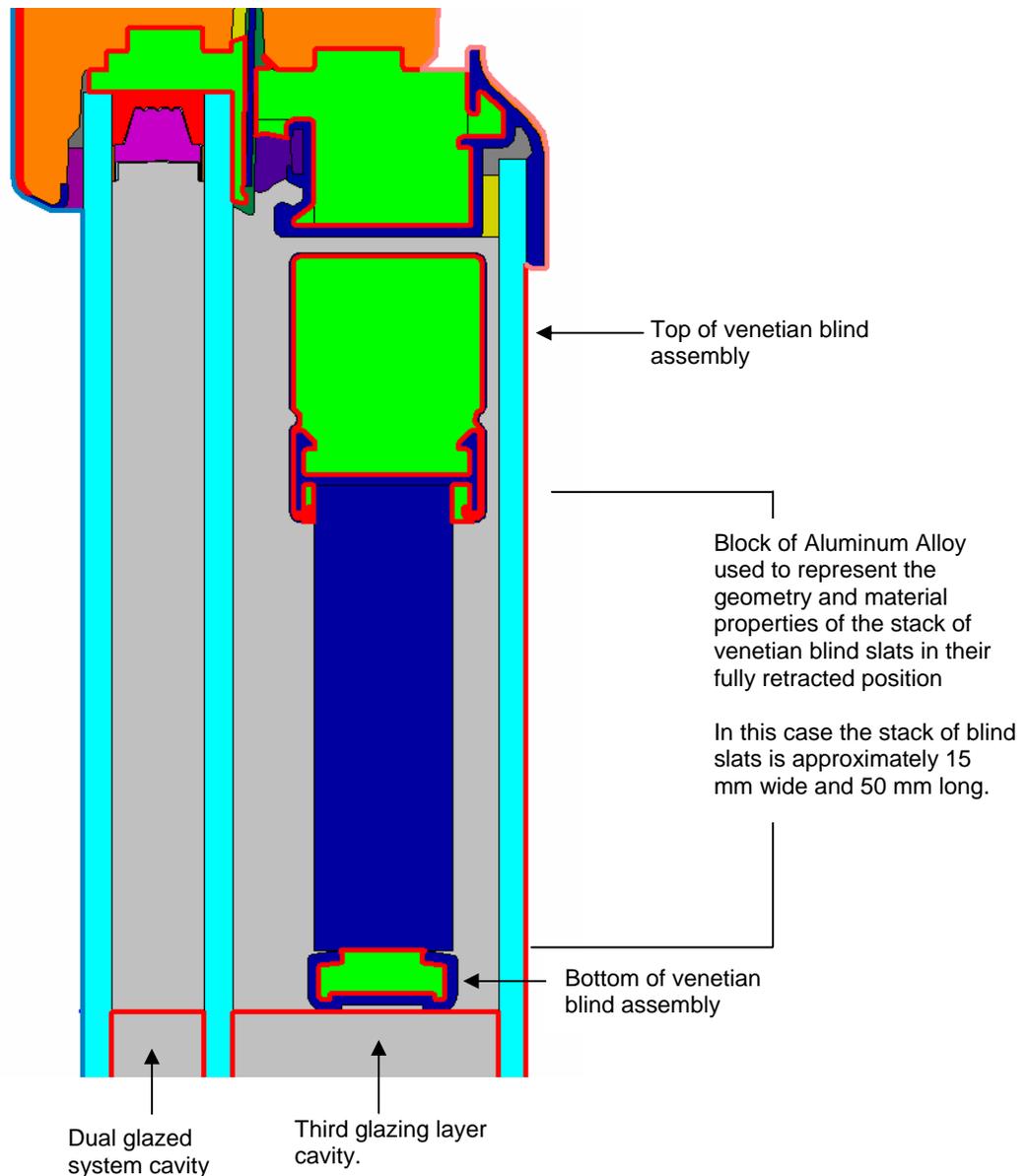
Third glazing layer cavity.

Figure 8-113. The Head cross section with the retracted venetian blind, including the stacked slats, and the top and bottom assemblies for the blind that are continuous across the section.

Follow these steps to model a fully retracted venetian blind between a double glazed system and a third glazing layer:

(Note: This example was done for Aluminum slat blinds. If the material of the blinds is not Aluminum, use the appropriate material properties from NFRC 101 "Procedure for Determining Thermo-Physical Properties of Materials for Use in NFRC-Approved Software Programs" for the stack of retracted venetian blind slats.)

1. Draw the Head cross section of the product frame.
2. Draw the geometry of the retracted venetian blind, including the length and width of the stacked venetian blind slats and any continuous hardware that holds the blind in place (top and bottom).
3. In WINDOW, make the appropriate glazing system (in this case a triple glazed system that represents the double glazed system and a third glazing layer (such as an add-on panel)).

4. Insert the glazing system.
    The example shown below has glazing layers that intersect the frame at two different heights. There are numerous methods for modeling this. The method shown is to "stretch" the glazing layers to meet the frame at the appropriate place, and this method also necessitates inserting points on the glazing system for the correct boundary conditions segments. Another method would be to insert "float glass" polygons for the glazing layer extensions – this method eliminates the need to insert the points in the glazing system for the boundary condition segments.
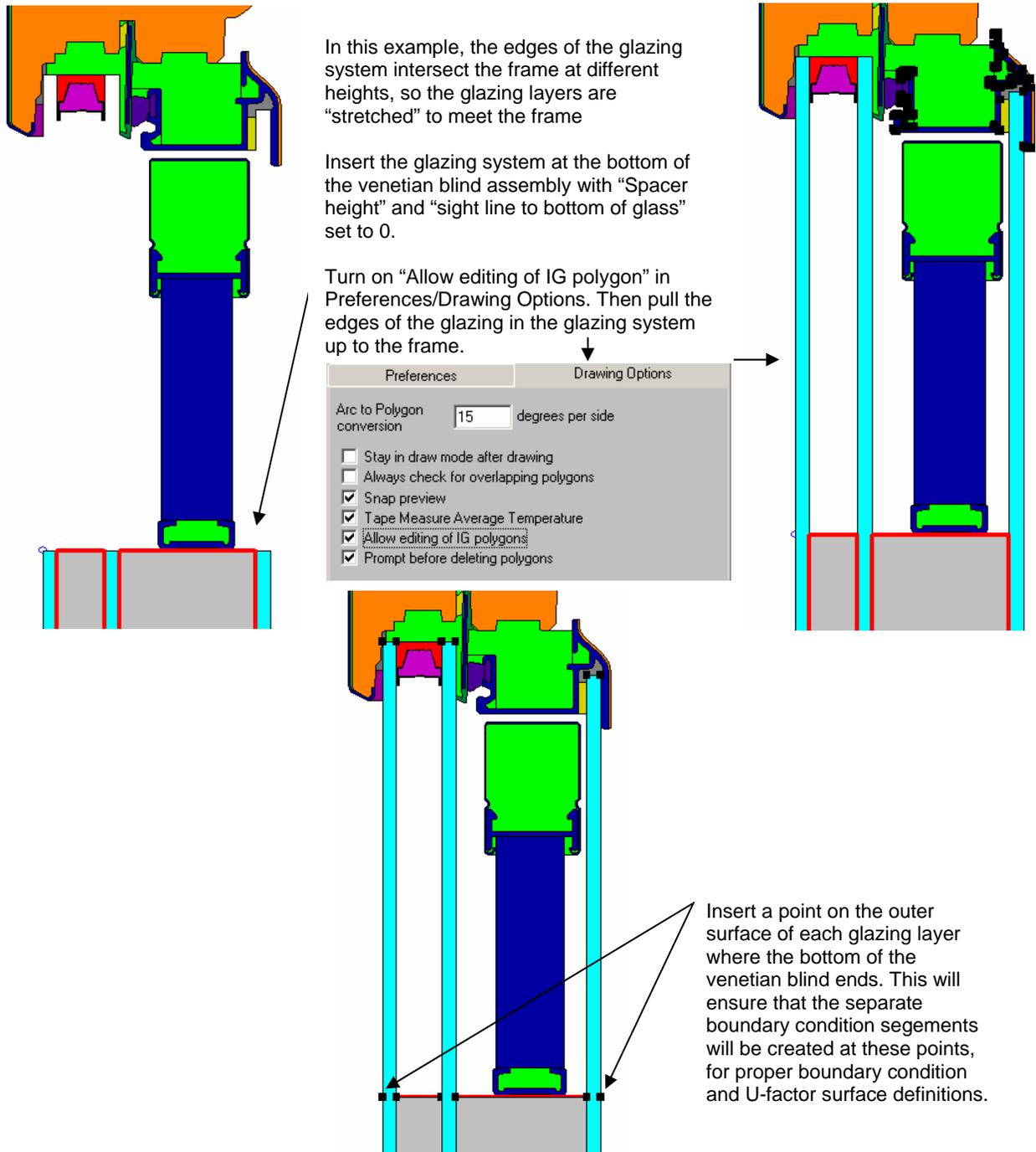

In this example, the edges of the glazing system intersect the frame at different heights, so the glazing layers are "stretched" to meet the frame

Insert the glazing system at the bottom of the venetian blind assembly with "Spacer height" and "sight line to bottom of glass" set to 0.

Turn on "Allow editing of IG polygon" in Preferences/Drawing Options. Then pull the edges of the glazing in the glazing system up to the frame.

Insert a point on the outer surface of each glazing layer where the bottom of the venetian blind ends. This will ensure that the separate boundary condition segements will be created at these points, for proper boundary condition and U-factor surface definitions.

Figure 8-114. Insert the glazing system and edit it if necessary to bring the glazing layers to the frame.

5.   Fill the cavities in the double glazing system and around the venetian blind in the third glazing layer with a material (any material), and then link that material to the appropriate cavity – the double glazing system cavity to the double glazing system and the third glazing layer cavity to the third glazing layer. There may be more than one area that is linked to a cavity, so make sure to link them all.
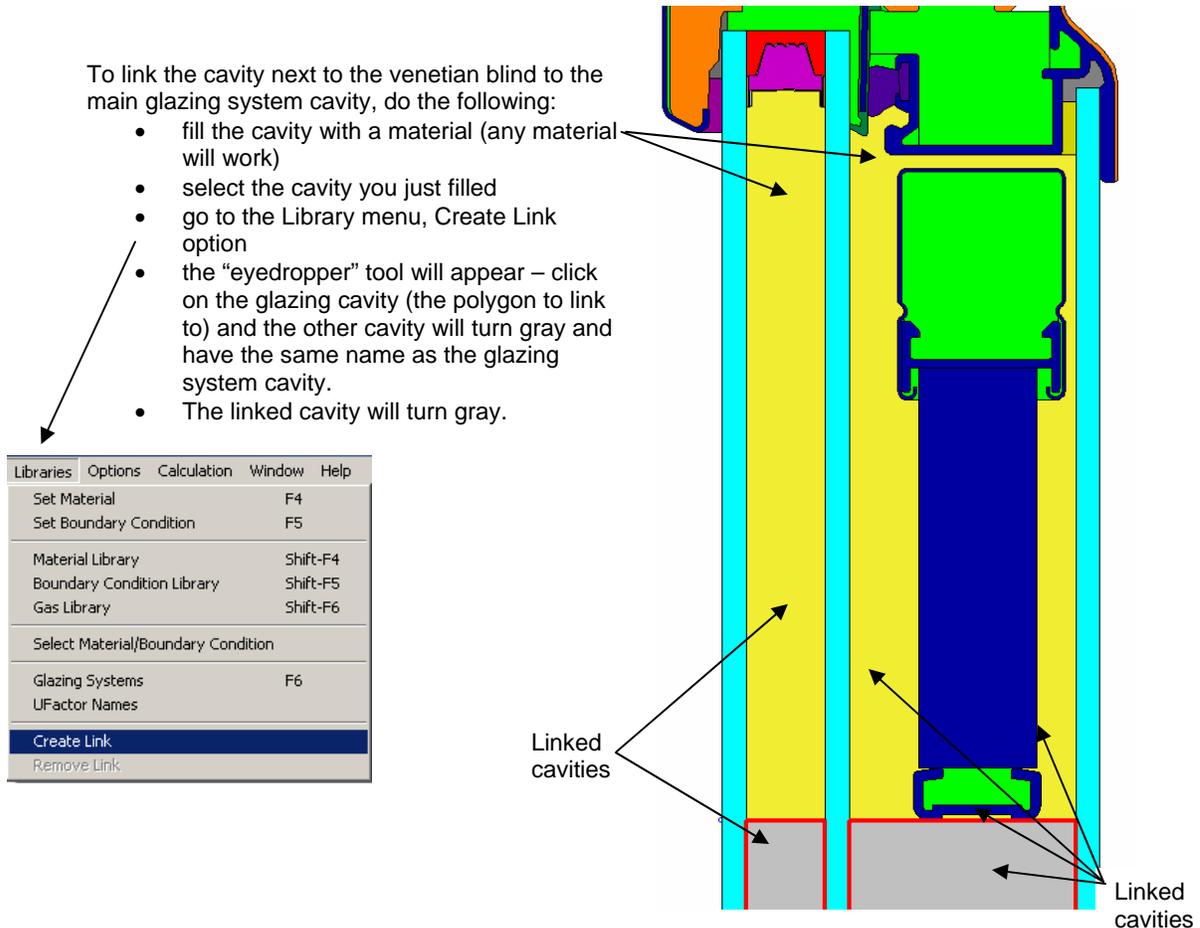
To link the cavity next to the venetian blind to the main glazing system cavity, do the following:

- fill the cavity with a material (any material will work)
- select the cavity you just filled
- go to the Library menu, Create Link option
- the "eyedropper" tool will appear – click on the glazing cavity (the polygon to link to) and the other cavity will turn gray and have the same name as the glazing system cavity.
- The linked cavity will turn gray.

Linked cavities

Linked cavities

Figure 8-115. Fill the cavity next to the venetian blind by linking it to the main glazing cavity.

6. Generate the Boundary Conditions. The section of the warm side of the glazing system adjacent to the retracted venetian blind should be defined with a U-factor Surface tag of "Frame".
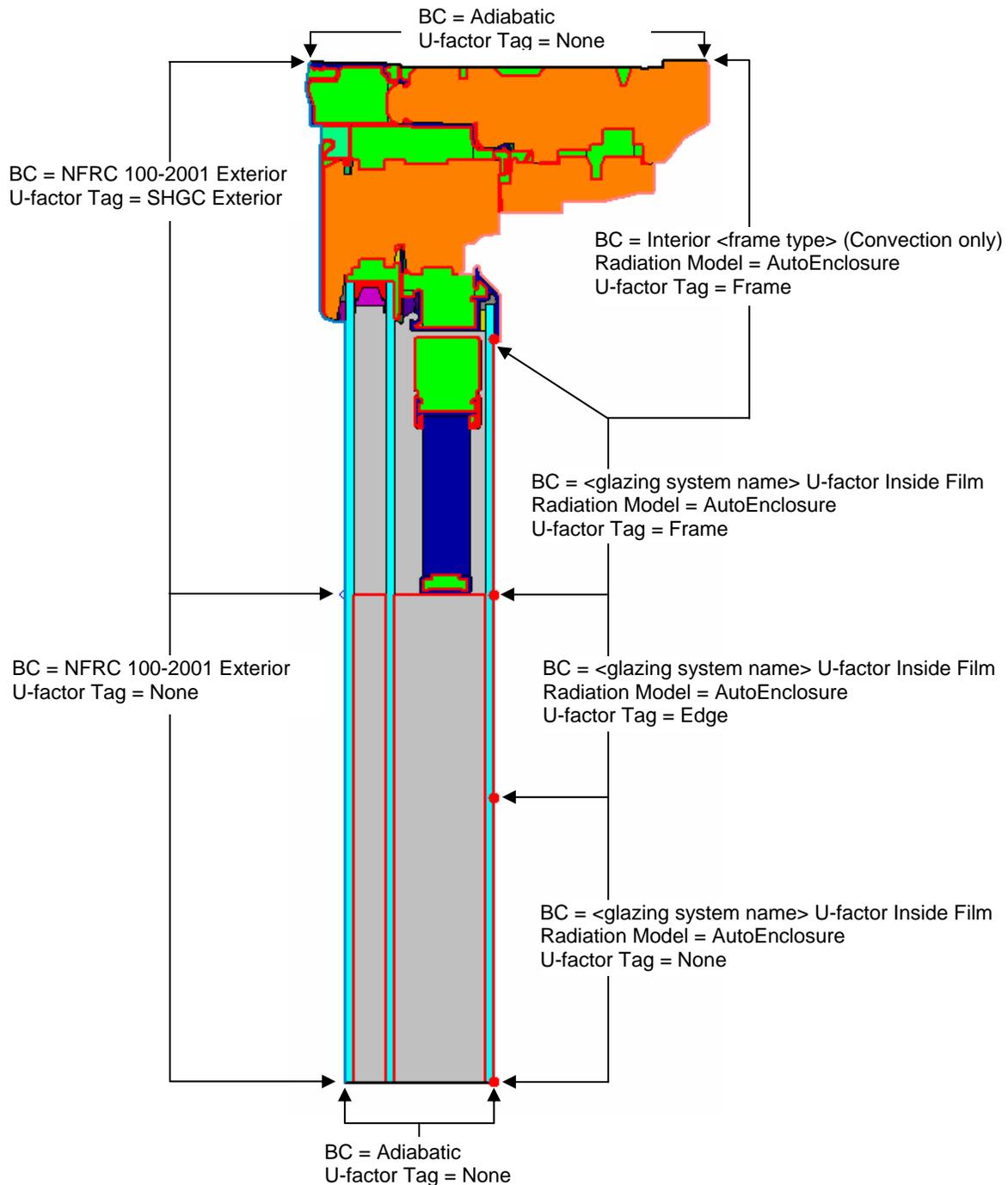
BC = Adiabatic
U-factor Tag = None

BC = NFRC 100-2001 Exterior
U-factor Tag = SHGC Exterior

BC = Interior <frame type> (Convection only)
Radiation Model = AutoEnclosure
U-factor Tag = Frame

BC = <glazing system name> U-factor Inside Film
Radiation Model = AutoEnclosure
U-factor Tag = Frame

BC = NFRC 100-2001 Exterior
U-factor Tag = None

BC = <glazing system name> U-factor Inside Film
Radiation Model = AutoEnclosure
U-factor Tag = Edge

BC = <glazing system name> U-factor Inside Film
Radiation Model = AutoEnclosure
U-factor Tag = None

BC = Adiabatic
U-factor Tag = None

Figure 8-116 Define the boundary conditions for the cross section

7. Calculate the results for this cross section.
8. Complete the calculations for the other product cross sections (Sill, Jambs and Meeting Rails / Stiles as appropriate).
9. Import all the cross sections into the WINDOW Frame Library and calculate the total product U-value, SHGC and VT.