



National Fenestration  
Rating Council®

---

# National Fenestration Rating Council Incorporated

**NFRC 304-2009**

Creating an Applied Film Layer  
in Optics for NFRC Certification

---

© 2009 NATIONAL FENESTRATION RATING COUNCIL, INC.

**PREPARED BY:**

National Fenestration Rating Council  
6305 Ivy Lane, Suite 140  
Greenbelt, MD 20770-6323  
Voice: (301) 589-1776  
Fax: (301) 589-3884  
Email: [info@nfr.org](mailto:info@nfr.org)  
Website: [www.nfrc.org](http://www.nfrc.org)



## ***FOREWORD***

The National Fenestration Rating Council has developed a uniform national rating system for energy performance characteristics of fenestration products.

The rating system is reinforced by a product certification program under which ratings determined by NFRC accredited laboratories are reviewed and authorized by NFRC licensed independent certification and inspection agencies (IAs) as conforming to NFRC requirements. Under the certification program, fenestration manufacturers may label products using an NFRC certification mark to indicate these ratings.

Questions on the use of this procedure should be addressed to:

---

|                                                                                                                                                                                                                                                                             |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>National Fenestration Rating Council<br/>6305 Ivy Lane, Suite 140<br/>Greenbelt, MD 20770-6323<br/>Voice: (301) 589-1776<br/>Fax: (301) 589-3884<br/>Email: <a href="mailto:info@nfr.org">info@nfr.org</a><br/>Website: <a href="http://www.nfr.org">www.nfr.org</a></p> |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

---



## Table of Contents

|                                                            |                                                                                                                                 |            |
|------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>Foreword</b>                                            |                                                                                                                                 | <b>ii</b>  |
| <b>Table of Contents</b>                                   |                                                                                                                                 | <b>iii</b> |
| <b>1. Overview</b>                                         |                                                                                                                                 | <b>1</b>   |
| 1.1                                                        | GLAZING LAYERS WITH APPLIED FILMS CAN BE CONSTRUCTED USING OPTICS5 FOR NFRC CERTIFIED SIMULATIONS USING THE FOLLOWING CRITERIA: | 1          |
| 1.2                                                        | FOR NFRC VERIFICATION OF THE LAMINATE CONSTRUCTION SUBMITTED BY SIMULATORS:                                                     | 1          |
| <b>2. Film Data</b>                                        |                                                                                                                                 | <b>2</b>   |
| 2.1                                                        | IGDB SUBMITTAL FOR APPLIED FILMS                                                                                                | 2          |
| 2.2                                                        | USING THIS PROCEDURE FOR NFRC 100 AND NFRC 200                                                                                  | 4          |
| <b>3. Creating a Layer with an Applied Film in Optics5</b> |                                                                                                                                 | <b>4</b>   |
| 3.1                                                        | ADDING AN APPLIED FILM TO AN UNCOATED LAYER                                                                                     | 4          |
| 3.2                                                        | ADDING AN APPLIED FILM TO A COATED LAYER                                                                                        | 10         |
| 3.3                                                        | ADDING AN APPLIED FILM TO A LAMINATE                                                                                            | 10         |
| 3.4                                                        | CHANGE A FILM                                                                                                                   | 10         |
| 3.5                                                        | SAVING LAYERS TO THE USER DATABASE                                                                                              | 11         |
| 3.6                                                        | RENAMING A LAYER                                                                                                                | 11         |
| <b>Appendix A: Approved Applied Film List</b>              |                                                                                                                                 | <b>12</b>  |

---

# 1. OVERVIEW

---

## 1.1 Glazing layers with applied films can be constructed using Optics5 for NFRC certified simulations using the following criteria:

- The substrate for the applied film *cannot* have embedded coatings, where embedded coatings are defined as a coating on a substrate that touches the applied film.
- Only NFRC glass layers with the NFRC approval indicator “#” can be used as the substrate for applied film layers
- The glass layers used as the substrate for the applied film can be tinted or coated as long as the coatings do not face the applied film
- Only the layers of the Type “Applied Films” in Optics5 that have a “#” on them and are also on the “Approved Applied Films List” (see Appendix A) can be used. This means that the data for those applied films was submitted to the IGDB using the criteria specified in Section 1.2 of this document, and that the Applied Film manufacturers are participating in the NFRC rating program. The Approved Applied Films List will be updated with each release of the International Glazing Database (IGDB).

## 1.2 For NFRC verification of the laminate construction submitted by simulators:

- Glass Layers with an applied film constructed by simulators in Optics5 will not have a # next to them when imported into WINDOW 5. (Future versions of the WINDOW software could determine if the applied film layer was constructed from NFRC approved # layers, and report/display this information).
- The simulator shall specify in simulation reports the NFRC ID’s of the applied film and the substrate, which shall all meet the # criteria, such as:  
  
2802 / 5038
- The simulator shall provide the properties for the applied film layer, including solar transmittance (solar, T), visible transmittance (photopic, T), solar reflectance front (solar, Rf), solar reflectance back (solar, Rb), visible reflectance front (photopic, Rf), visible reflectance back (photopic, Rb), Emissivity front (EmitF), Emissivity back (EmitB). These values are reported on the Optics screen when the laminate is

calculated, and also in the WINDOW5 Detailed Report from the Glazing System Library. This requirement can be met by submitting the Optics5 User Database containing the applied film glass layers with the certification documentation.

- An IA (or anyone else wanting to check the results) can open the Optics5 User Database to verify the film and substrates used, as well as recreate the applied film layer from the specified film and substrate to verify the calculated values

---

## 2. FILM DATA

---

Two types of films are in Optics 5. The difference between them is how they were measured for submittal to the International Glazing Database:

- **Films:** These films were measured without a substrate and may appear in and be inputs to Optics5 calculations. However, the IGDB submittal process no longer accepts this type of submittal, and **they cannot be used for the NFRC Applied Film procedure**. Data in this category can be resubmitted to the IGDB, measured as an applied film with a substrate, and thus be added to the Applied Film category.
- **Applied Films:** These films are measured with a substrate. For the purposes of the NFRC Applied Film procedure, the only films that can be used are those that were measured with a clear substrate, the substrate having the properties of  $T_{sol} > 0.820$  and  $T_{vis} > 0.890$

Optics5 can accurately calculate the optical properties of applied films on glass layers as long as the applied films were measured following the guidelines listed below (and only applied films submitted with these characteristics will be included in the “Approved Applied Films” list for use in NFRC certified product calculations):

### 2.1 IGDB Submittal for Applied Films

As discussed in the LBNL document which contains guidelines for submitting data to the IGDB (*International Glazing Database: Data File Format, Version 1.4*, April 2003), “an applied film glazing is an adhesive backed film applied to a Monolithic substrate.” If the measured data submitted to the IGDB includes the substrate information, Optics5 can apply the film to another substrate.

This means that in order for an applied film to be added to the Optics5 “Applied Film” type, and therefore used in making applied film glass layers in Optics5, the spectral data for the “reference” substrate to which that applied film was attached, is submitted to the IGDB as follows:

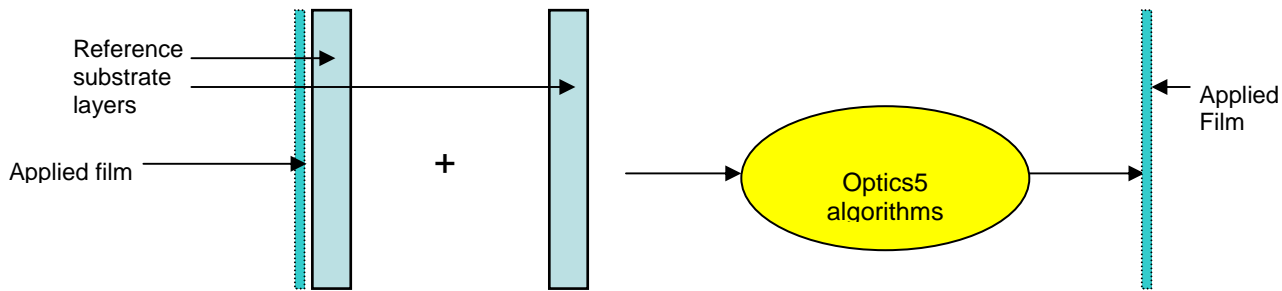
- Applied films are measured with transparent glass with a solar transmittance greater than 0.820 ( $T_{sol} > 0.820$ ) and a visible transmittance greater than 0.890 ( $T_{vis} > 0.890$ ). Glass that meets this criteria includes 3mm clear glass, 3 mm low-iron glass, 6 mm low-iron glass. This ensures that an applied film layer in Optics5 will always

have a similar or lower transmittance than the reference substrate which determines the applied film properties

- Substrate layers (the base glass to which the applied films are applied) are measured separately, without the applied films attached, and submitted to the IGDB. This is the responsibility of the manufacturer submitting data to the IGDB, as discussed below.

The applied film manufacturer can submit to the IGDB two spectral data files, single 3 mm clear with the applied film on a clear substrate and the clear substrate by itself. With this data in the IGDB, simulators, using this Applied Film Procedure, can then create the other two cases, the single 6 mm clear with the film, and the single 6 mm gray with the film, to do the SHGC and VT calculations.

This will allow a film manufacturer to submit to the IGDB several different films with the same clear substrate, if they are all measured on the same clear 3 mm substrate (from the same glass batch). For example, if a film manufacturer wanted to submit data for 20 different applied films, they would submit one spectral data file for the substrate of all 20 measurements (assuming the substrates for each film all came from the same glass batch), and 20 spectral data files, one for each film on the substrate, resulting in 21 files submitted. Each of the 20 spectral data files for the films applied to the substrate would reference the substrate spectral data file.



Spectral data is measured for a construction made up of the applied film glued to clear glass (the substrate layer)

Spectral data is measured for the clear glass used as the substrate layer in the previous applied film measurement

With these two sets of data, Optics5 can “back out” the optical properties of the applied film.

That applied film then appears as a record in the “Applied Film” type in Optics5, and can be used as an applied film on other substrates in Optics5

Additionally, the glass manufacturer will not have to submit spectral data for the applied films attached to 6 mm clear or 6 mm gray cases, as they can be simulated in Optics5 from the applied film on the 3 mm clear substrate.

## 2.2 Using this Procedure for NFRC 100 and NFRC 200

NFRC 100 specifies a procedure for calculating U-factor and NFRC 200 specifies a procedure for calculating SHGC and VT for attachments, which applies to “Applied Films”. This procedure specifies that reference glazing systems shall be calculated “with and without the film installed” from the following glass layers:

- Single 3 mm clear
- Single 6 mm clear
- Single 6 mm gray

The first case, “Single 3 mm clear” is what the applied film manufacturers submit to the IGDB and will be in that database. The other two cases, “Single 6 mm clear” and “Single 6 mm gray” can now be calculated with Optics5.

---

## 3. CREATING A LAYER WITH AN APPLIED FILM IN OPTICS5

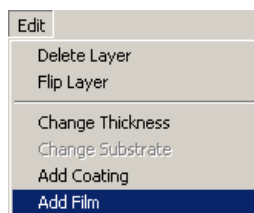
---

### 3.1 Adding an Applied Film to an Uncoated Layer

You can apply a film to a monolithic layer in Optics5 to create a new applied film layer.

To apply a film to a monolithic layer follow the steps below:

- Click on the Glazing System tab
- Add the desired layer to a layer column under the Glazing System tab
- Select the monolithic layer by clicking on the desired layer number button
- Add an Applied Film to the selected glazing layer in one of the following ways:
  - Choose the menu option Edit|Change/Add Film



*Figure 3-1. Select a monolithic glass layer, click on the Layer button, and select the Edit/Add Film menu choice*

OR

- Right click on the selected glazing layer button and select the choice “Add Film”

- The Change Glazing dialog box will appear. The film name box is highlighted in blue – click on it to select an applied film from the database (you must select an “Applied Film” layer , not a “Film” layer). You must choose a film that is on the “Approved Applied Films” list.
- The new film will be added to the side you select in the ‘Apply Film to’ section of the dialog box:
- You will be prompted to enter a new name for the glazing
- If you want to keep the new layer, save it to the user database (see “Saving Layers to the User Database”).

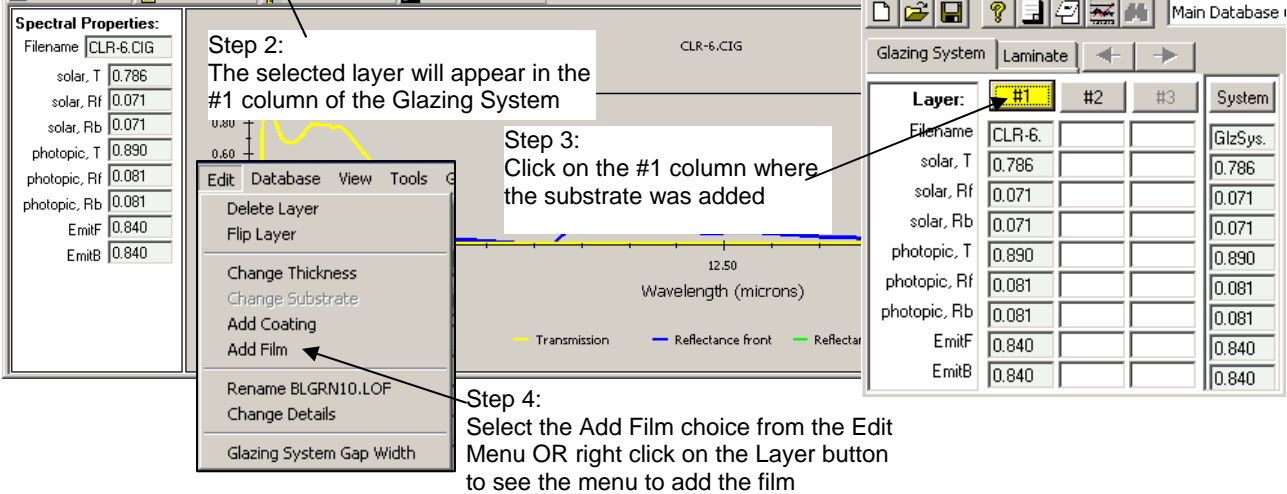
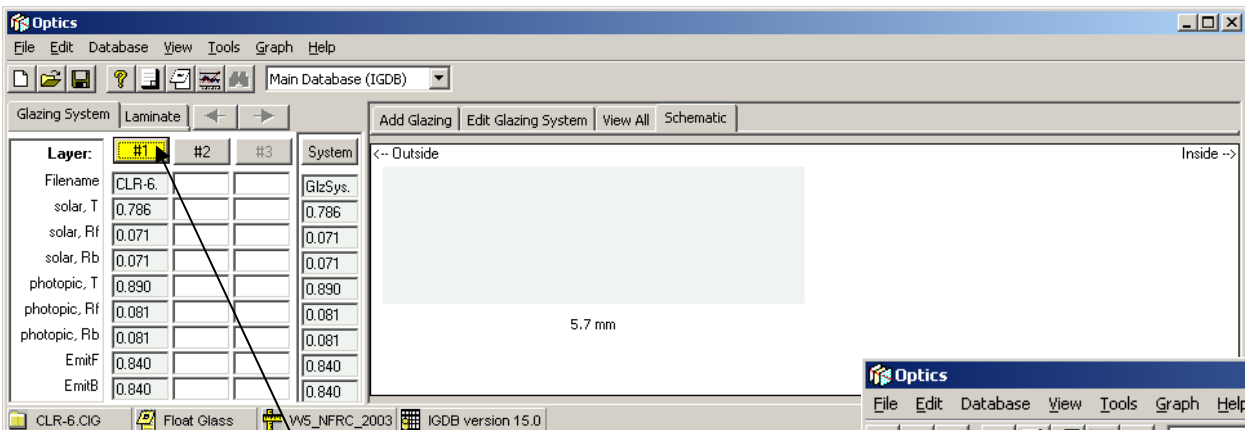
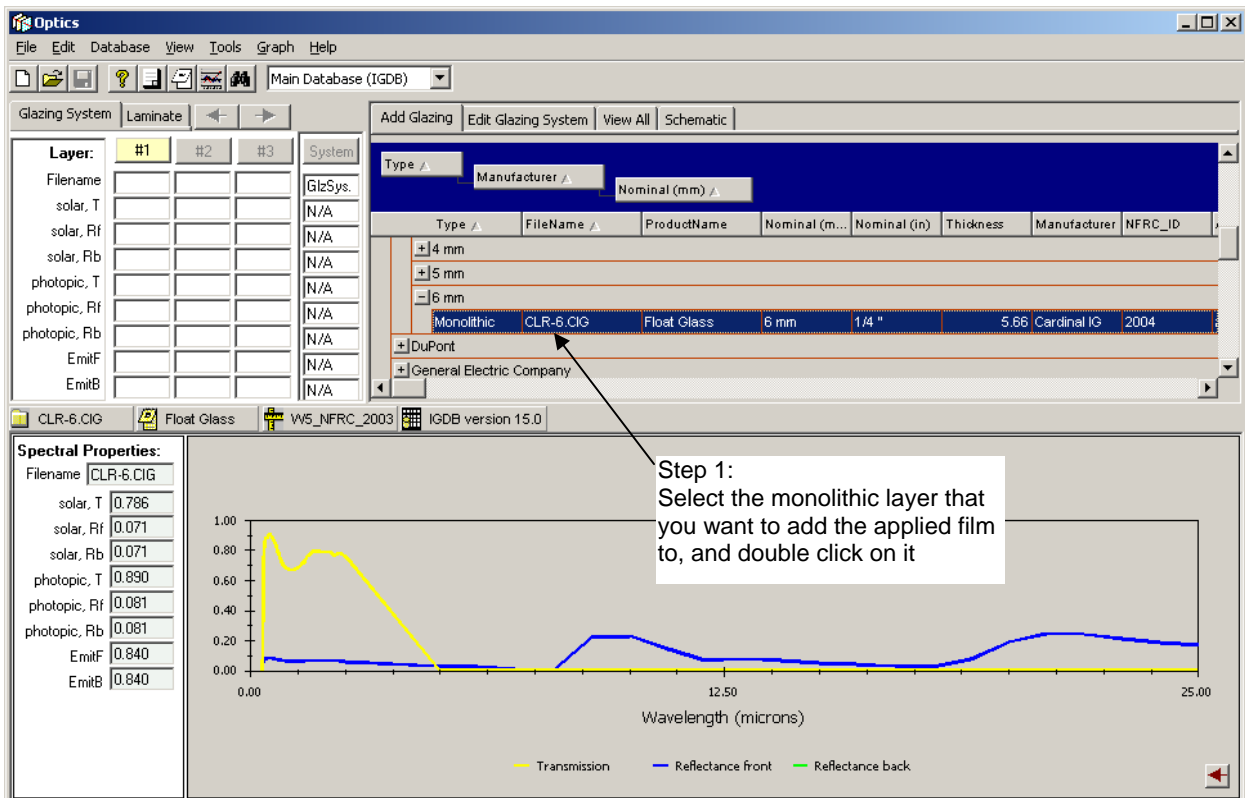
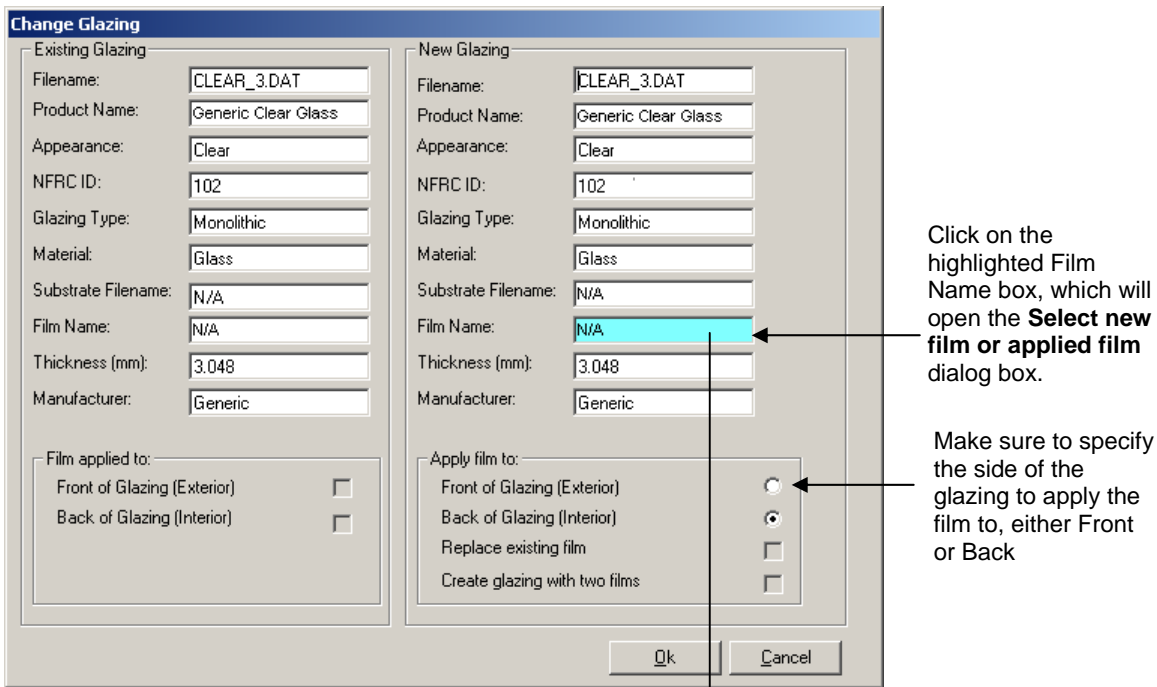


Figure 3-1. Select a monolithic glass layer, click on the **Layer** button, and select the **Edit/Add Film** menu choice



Click on the highlighted Film Name box, which will open the **Select new film or applied film** dialog box.

Make sure to specify the side of the glazing to apply the film to, either Front or Back

Only select films from Type = **Applied Films**

Click on the + to expand the list. Only select Applied Films that are on the Approved Applied Film List

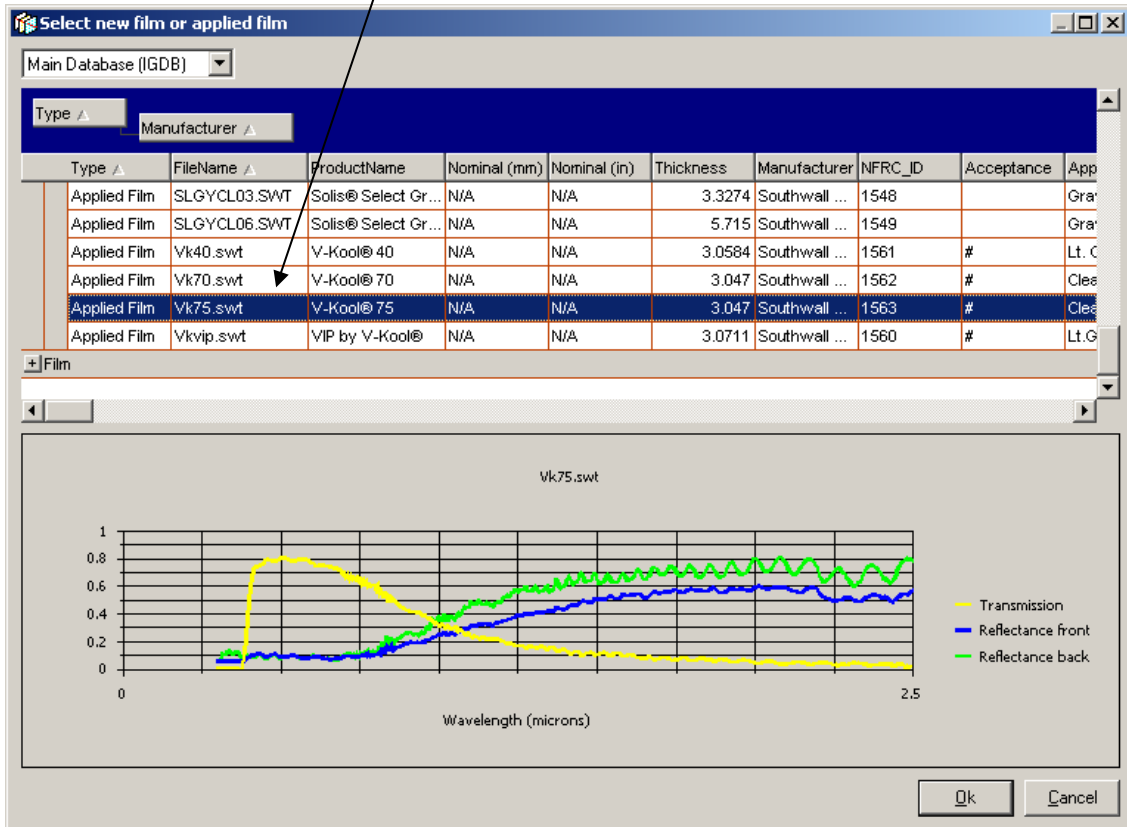
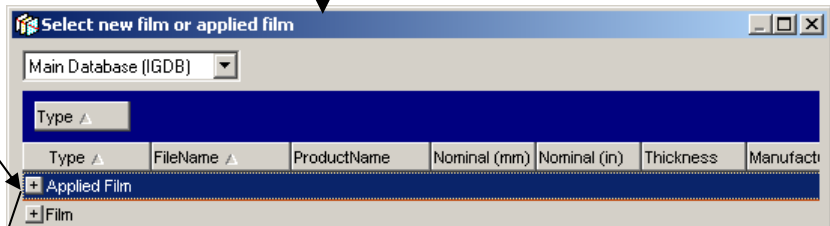


Figure 3-2. Choose the film to apply

Select new film or applied film

Main Database (IGDB)

Type ▲ Manufacturer ▲

| Type ▲       | FileName ▲   | ProductName         | Nominal (mm) | Nominal (in) | Thickness | Manufacturer  | NFRC_ID | Acceptance | App   |
|--------------|--------------|---------------------|--------------|--------------|-----------|---------------|---------|------------|-------|
| Applied Film | SLGYCL03.SWT | Solis® Select Gr... | N/A          | N/A          | 3.3274    | Southwall ... | 1548    |            | Gr... |
| Applied Film | SLGYCL06.SWT | Solis® Select Gr... | N/A          | N/A          | 5.715     | Southwall ... | 1549    |            | Gr... |
| Applied Film | Vk40.swt     | V-Kool® 40          | N/A          | N/A          | 3.0584    | Southwall ... | 1561    | #          | Lt. C |
| Applied Film | Vk70.swt     | V-Kool® 70          | N/A          | N/A          | 3.047     | Southwall ... | 1562    | #          | Clea  |
| Applied Film | Vk75.swt     | V-Kool® 75          | N/A          | N/A          | 3.047     | Southwall ... | 1563    | #          | Clea  |
| Applied Film | Vkvip.swt    | VIP by V-Kool®      | N/A          | N/A          | 3.0711    | Southwall ... | 1560    | #          | Lt. G |

±|Film

Vk75.swt

Wavelength (microns)

— Transmission  
— Reflectance front  
— Reflectance back

Double click on the selected film, or highlight the film and click the OK button.

Ok Cancel

Change Glazing

Existing Glazing

Filename: CLR-6.CIG  
Product Name: Float Glass  
Appearance: Clear  
NFRC ID: 2004  
Glazing Type: Monolithic  
Material: Glass  
Substrate Filename: N/A  
Film Name: N/A  
Thickness (mm): 5.660  
Manufacturer: Cardinal IG

Film applied to:  
Front of Glazing (Exterior)   
Back of Glazing (Interior)

New Glazing

Filename: CLR-6.CIG  
Product Name: Float Glass  
Appearance: Clear  
NFRC ID: 2004  
Glazing Type: Monolithic  
Material: Glass  
Substrate Filename: N/A  
Film Name: Vk75  
Thickness (mm): 5.660  
Manufacturer: Cardinal IG

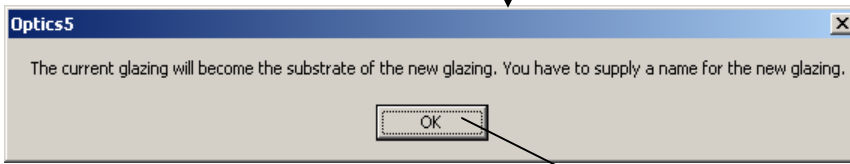
Apply film to:  
Front of Glazing (Exterior)   
Back of Glazing (Interior)   
Replace existing film   
Create glazing with two films

Ok Cancel

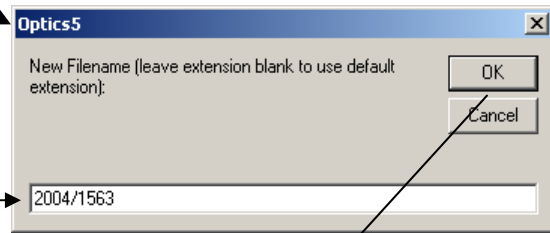
Click the OK button

Figure 3-3. Apply the film to the substrate

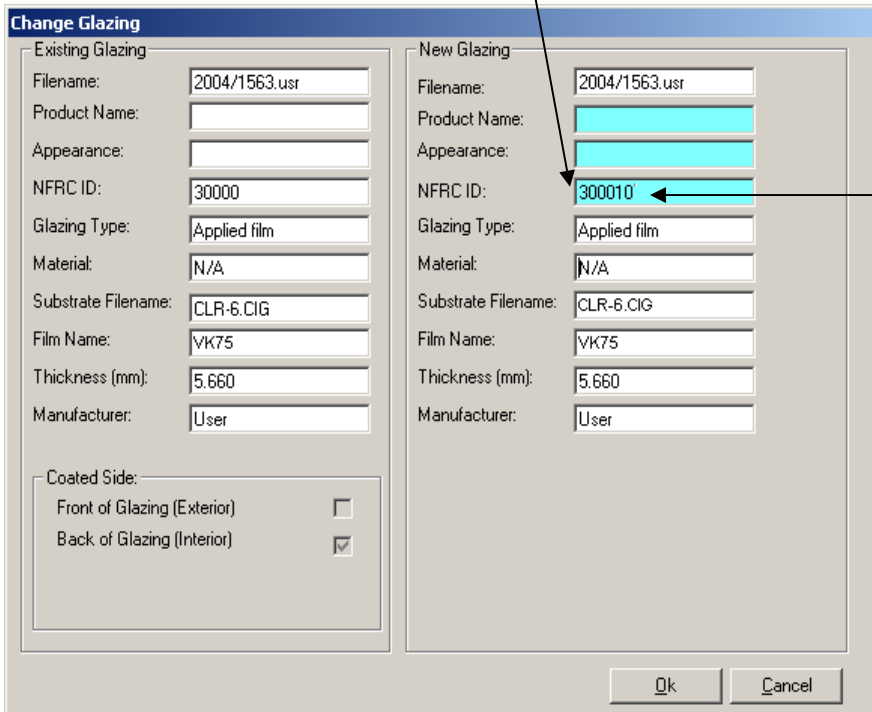
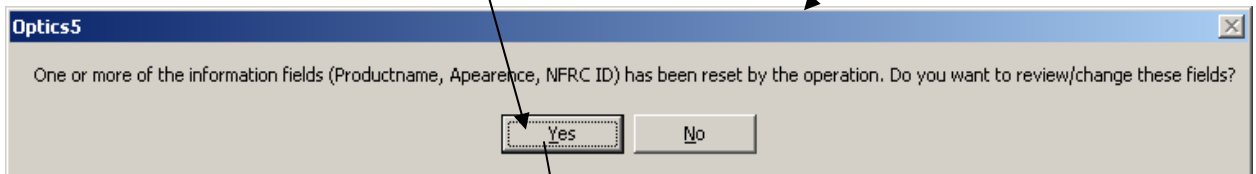
The dialog appears saying a new name must be applied to the new glazing (glass layer)



Type a new name for the glazing (glass layer). Then name should be the NFRC IDs of the glass layer and the applied film.



A dialog box appears asking if you want to review the information fields of the new glass layer. Click Yes, to change the NFRC ID # of the new layer.



The Change Glazing dialog box will be displayed. Change the NFRC ID to an appropriate (and unique for your user database) number.

Figure 3-4. Give the new applied film layer a name and a new NFRC ID number if needed to ensure uniqueness.

### 3.2 Adding an Applied Film to a Coated Layer

You can apply a film to the uncoated side of a coated glazing, creating a double-coated layer with the coating on one side and the film on the other.

To apply a film to a coated layer:

- Click on the Glazing System tab
- Add the desired layer to a layer column under the Glazing System tab
- Select the coated layer by clicking on the desired layer number button
- Choose the menu option Edit|Change/Add Film

OR

- Right click on the selected glazing layer button and select the choice “Add Film”
- The Change Glazing dialog box will appear. The film name box is highlighted in blue – click on it to select an applied film from the database (you must select an “Applied Film” layer, not a “Film” layer). You must choose a film that is on the “Approved Applied Films” list.
- The new film will be applied to the uncoated side of the glazing to create a double-coated layer with the film on one side and the coating on the other – this is indicated in the ‘Apply Film to’ section of the dialog box.
- You will be prompted to enter a new name for the glazing. Use the naming convention specified in the beginning of this document, i.e., NFRC IDs for both the glazing layer and the applied film.
- If you want to keep the new layer, save it to the user database (see “Saving Layers to the User Database”).

### 3.3 Adding an Applied Film to a Laminate

In the same manner as adding an applied film to either a coated or an uncoated layer, a film can be applied to a laminate. This laminate can already exist in the IGDB or can be a laminate constructed using the NFRC Laminate Procedure. The laminate is treated as a glass layer in the Glazing System tab, and the applied film is then added to that layer.

### 3.4 Change a Film

To change the film applied to an applied film layer:

- Select the applied film layer by clicking on the appropriate layer button
- Choose the menu option Edit/Change/Add Film
- The Change Glazing dialog box will appear. The film name box is highlighted in blue – click on it to select an applied film from the database (you must select an “Applied Film” layer, not a “Film” layer). You must choose a film that is on the “Approved Applied Films” list.
- The new film will replace the current film – this is indicated in the ‘Apply Film to’ section of the dialog box

- You will be prompted to enter a new name for the glazing. Use the naming convention specified in the beginning of this document, i.e., NFRC IDs for both the glazing layer and the applied film.
- If you want to keep the new layer, save it to the user database (see “Saving Layers to the User Database”).

### 3.5 Saving Layers to the User Database

You can save a glazing layer with an applied film to the user database if it has a different filename from any layer currently in the user database or in the IGDB. If you save a layer that has components (such as a glazing layer that has an applied film), the component layers will be saved to the user database at the same time (unless they already exist in the IGDB or user database). This allows you to load and edit those layers at a later time.

To save a layer to the user database:

- Select the layer or system to save by clicking on a layer button
- Click the ‘Save’ button on the toolbar  
*or*  
Choose menu option File/Save *filename*  
*or*  
Right-click to display the pop-up menu and select the option Save *filename*
- If the layer or system you saved had components, or if the save operation fails, you will be asked ‘Do you want to view the details of the save operation?’. If you answer yes, you can view information about components that were saved to the user database, and components that were not saved to the user database along with an explanation of why some components were not saved.

**Note:** to change the filename and save in one operation, choose menu option Save As... instead.

**Note:** You cannot save data for a layer with the same filename as another layer in the IGDB or your current user database. If a conflict is detected, Optics will ask you to rename the layer before saving it, or cancel the import. The most common reason a component is not saved is that its filename already exists in the IGDB or user database. In this case Optics assumes that the component layer information is already available and does not need to be saved again.

### 3.6 Renaming a Layer

To rename a layer with an applied film:

- Select the layer you want to rename by clicking on a layer button.
- Choose menu option Edit|Rename *filename*  
*or*  
Right-click on the layer button to display the pop-up menu, and select item Rename *filename*

- Enter a new filename and click 'OK'
- If you want to save the layer under the new name, save it to the user database (see "Saving Layers to the User Database"). You could also achieve the same result by using the File|Save As... menu option to rename and save the layer in one operation.

---

## **APPENDIX A: APPROVED APPLIED FILM LIST**

---

### Reference 1: APPROVED APPLIED FILM LIST

The NFRC, with the Lawrence Berkeley National Labs, maintains a full list of films on this page:

<http://windows.lbl.gov/materials/IGDB/default.htm>