



# National Fenestration Rating Council Incorporated

**NFRC 304-2010**

Creating an Applied Film Layer  
in Optics for NFRC Certification

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## ***FOREWORD***

The National Fenestration Rating Council, Incorporated ("NFRC") has developed and operates a uniform rating system for energy and energy-related performance of fenestration products. The Rating System determines the U-factor, Solar Heat Gain Coefficient (SHGC), and Visible Transmittance (VT) of a product, which are mandatory ratings for labeling NFRC certified products and are mandatory ratings for inclusion on label certificates, and are supplemented by procedures for voluntary ratings of products for Air Leakage (AL), and Condensation Resistance. Together, these rating procedures, as set forth in documents published by NFRC, are known as the NFRC Rating System.

The Rating System employs computer simulation and physical testing by NFRC-accredited laboratories to establish energy and related performance ratings for fenestration product types. The Rating System is reinforced by a certification program under which NFRC-licensed responsible parties claiming NFRC product certification shall label and certify fenestration products to indicate those energy and related performance ratings, provided the ratings are authorized for certification by an NFRC-licensed certification and Inspection Agency (IA).

The requirements of the rating, certification, and labeling program (the "Certification Program") are set forth in the most recent versions of the following as amended, updated or interpreted from time to time:

- NFRC 700 Product Certification Program (the "PCP")
- NFRC 705 Component Modeling Approach ("CMA") Product Certification Program (the "CMA-PCP").

Through the Certification Programs and the most recent versions of its companion programs as amended, updated or interpreted from time to time:

- The laboratory accreditation program (the "Accreditation Program"), set forth in the NFRC 701 Laboratory Accreditation Program (the "LAP")
- The IA licensing program (the "IA Program"), set forth in NFRC 702 Certification Agency Program (the "CAP")
- The CMA Approved Calculation Entity ("ACE") licensing program (the "ACE Program") as set forth in the NFRC 708 Calculation Entity Approval Program (the "CEAP"),

NFRC intends to ensure the integrity and uniformity of NFRC ratings, certification, and labeling by ensuring that responsible parties, testing and simulation laboratories, and IAs adhere to strict NFRC requirements.

In order to participate in the Certification Programs, a manufacturer / responsible party shall rate a product whose energy and energy-related performance characteristics are to be certified in accordance with mandatory NFRC rating procedures. At present, a manufacturer/responsible party may elect to rate products for U-factor, SHGC, VT, Air Leakage, Condensation Resistance, or any other procedure adopted by NFRC, and to include those ratings on the NFRC temporary label affixed to its products, or on the NFRC Label Certificate. U-factor, SHGC and VT, AL, and Condensation Resistance rating reports shall be obtained from a laboratory, which has been accredited by NFRC in accordance with the requirements of the NFRC 701.

The rating shall then be reviewed by an IA which has been licensed by NFRC in accordance with the requirements of the NFRC 702. NFRC-licensed IAs also review label format and content, conduct in-plant inspections for quality assurance in accordance with the requirements of the NFRC 702, and issue a product Certification Authorization Report (CAR), or approve for issuance an NFRC Label Certificate for site-built or CMA products and attachment products. The IA is also responsible for the investigation of potential violations (prohibited activities) as set forth in the NFRC 707 Compliance and Monitoring Program.

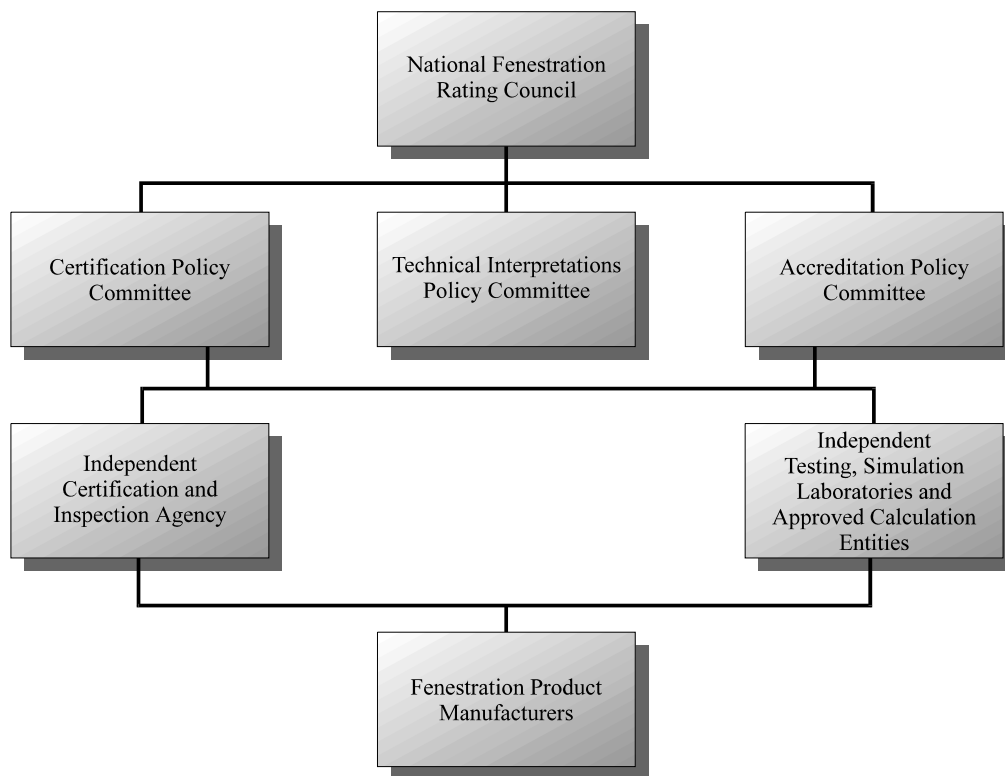
Ratings for products that are labeled with the NFRC Temporary and Permanent Label, or products that are listed on an NFRC Label Certificate, in accordance with NFRC requirements, are considered to be NFRC-certified. NFRC maintains a Certified Products Directory (CPD), listing product lines and individual products selected by the manufacturer/responsible party for which certification authorization has been granted.

NFRC manages the Rating System and regulates the Product Certification Program (PCP), Laboratory Accreditation Program (LAP) and Certification Agency Program (CAP) in accordance with the NFRC 700 (PCP), the NFRC 701 (LAP), the NFRC 702 (CAP), the NFRC 705 (CMA-PCP), and the NFRC 708 (CEAP) procedures, and conducts compliance activities under all these programs as well as the NFRC 707 Compliance and Monitoring Program (CAMP). NFRC continues to develop the Rating System and each of the programs.

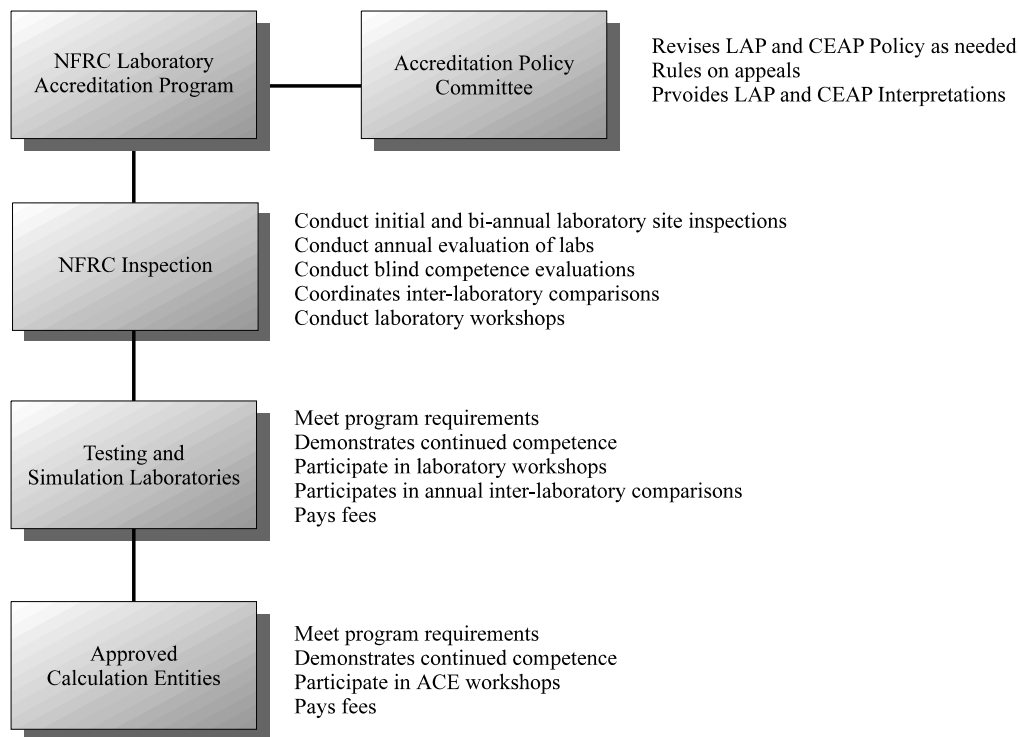
NFRC owns all rights in and to each of the NFRC 700, NFRC 701, NFRC 702, NFRC 705, NFRC 707, NFRC 708 and each procedure, which is a component of the Rating System, as well as each of its registration marks, trade names, and other intellectual property.

The structure of the NFRC program and relationships among participants are shown in Figure 1, Figure 2, and Figure 3. For additional information on the roles of the IAs and laboratories and operation of the IA Program and Accreditation Program, see the NFRC 700 (PCP), NFRC 701 (LAP), and NFRC 702 (CAP) respectively.

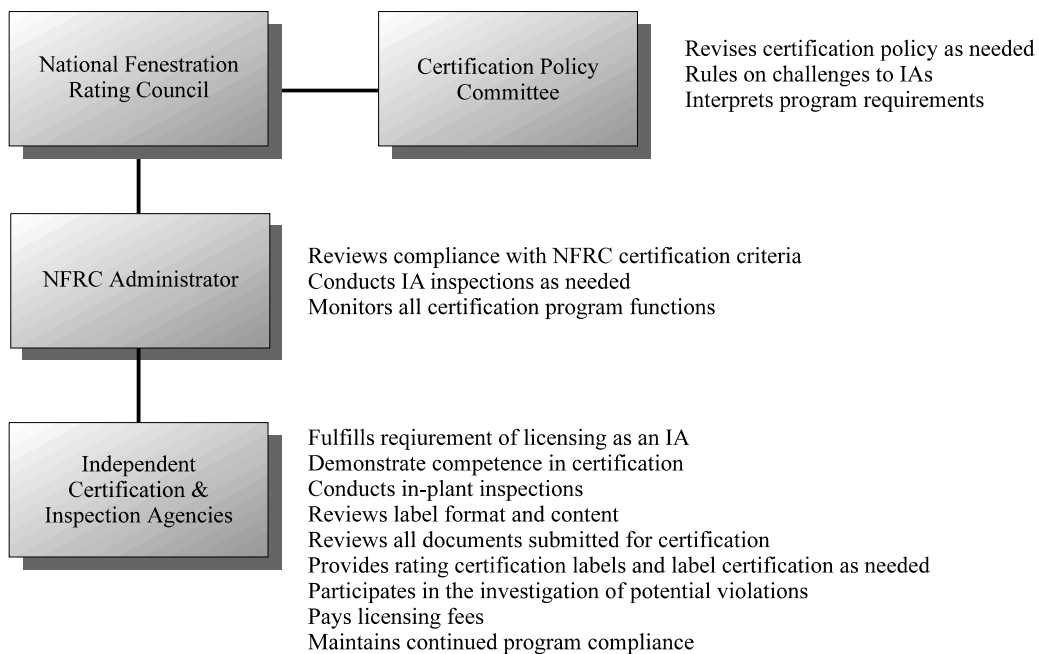
**Figure 1**



**Figure 2**



**Figure 3**



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

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### ***DISCLAIMER***

NFRC certification is the authorized act of a manufacturer/responsible party in: (a) labeling a fenestration or related attachment product with an NFRC Permanent Label and NFRC Temporary Label, or (b) generating a site built or CMA label certificate, either of which bears one or more energy performance ratings reported by NFRC-accredited simulation and testing laboratories and authorized for certification by an NFRC-licensed IA. Each of these participants acts independently to report, authorize certification, and certify the energy-related ratings of fenestration and related attachment products.

NFRC does not certify a product and certification does not constitute a warranty of NFRC regarding any characteristic of a fenestration or fenestration-related attachment product. Certification is not an endorsement of or recommendation for any product or product line or any attribute of a product or product line. NFRC is not a merchant in the business of selling fenestration products or fenestration-related products, and therefore cannot warrant products as to their merchantability or fitness for a particular use.

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NFRC program participants are required to indemnify NFRC from and against such liability.



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## 1. OVERVIEW

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

- A. 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.
- B. Only NFRC glass layers with the NFRC approval indicator “#” can be used as the substrate for applied film layers
- C. 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
- D. 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).

For NFRC verification of the laminate construction submitted by simulators:

- A. 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).
- B. 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
- C. 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.

- D. 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

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## 2. FILM DATA

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There are two types of films in Optics 5; the difference between them is how they were measured for submittal to the International Glazing Database:

- A. **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.
- B. **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.

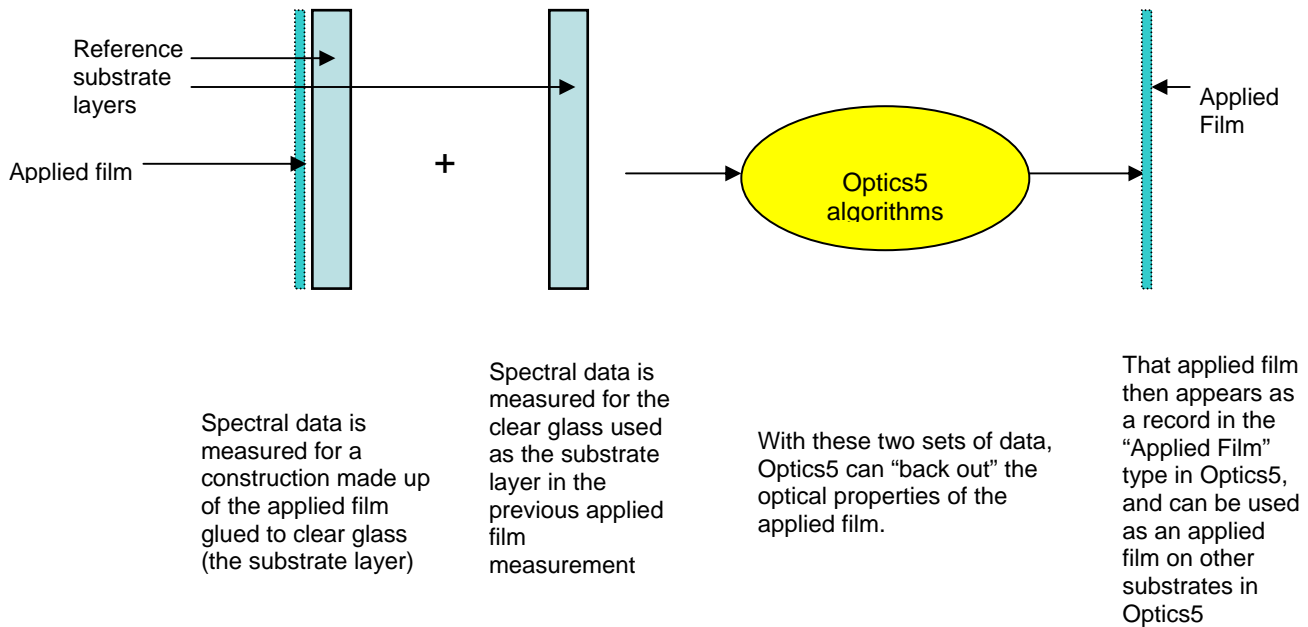
This means that in order for an applied film to be added to the Optics5 “Applied Film” type, and therefore used in making applied film glass layers in Optics5, the spectral data for the “reference” substrate to which that applied film was attached, is submitted to the IGDB as follows:

- A. 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

- B. 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.



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 200

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.

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

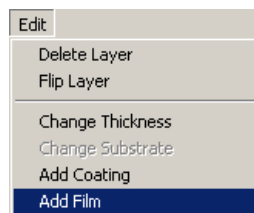
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### 3.1 Adding an Applied Film to an Uncoated Layer

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”).

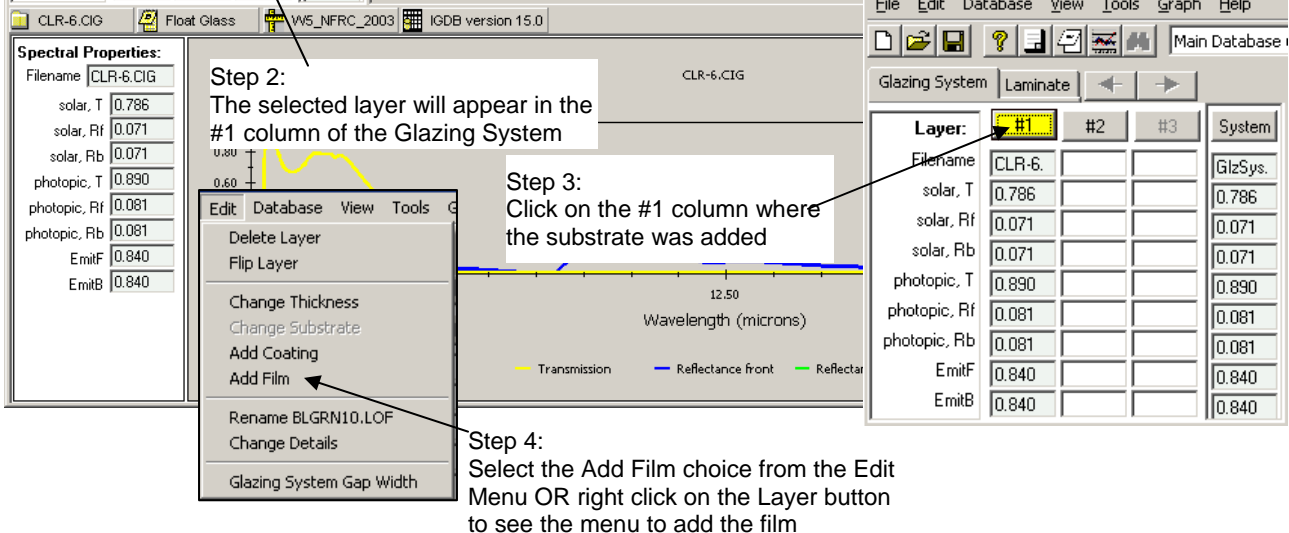
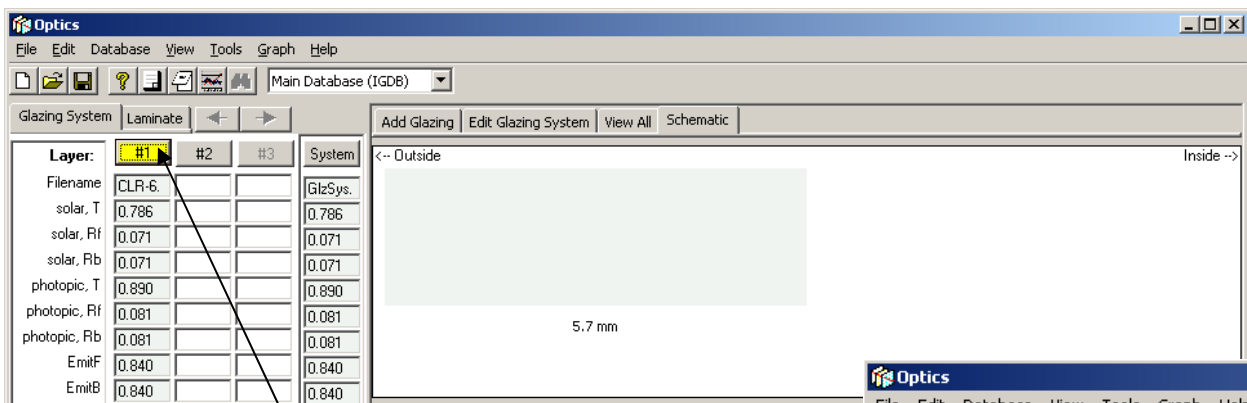
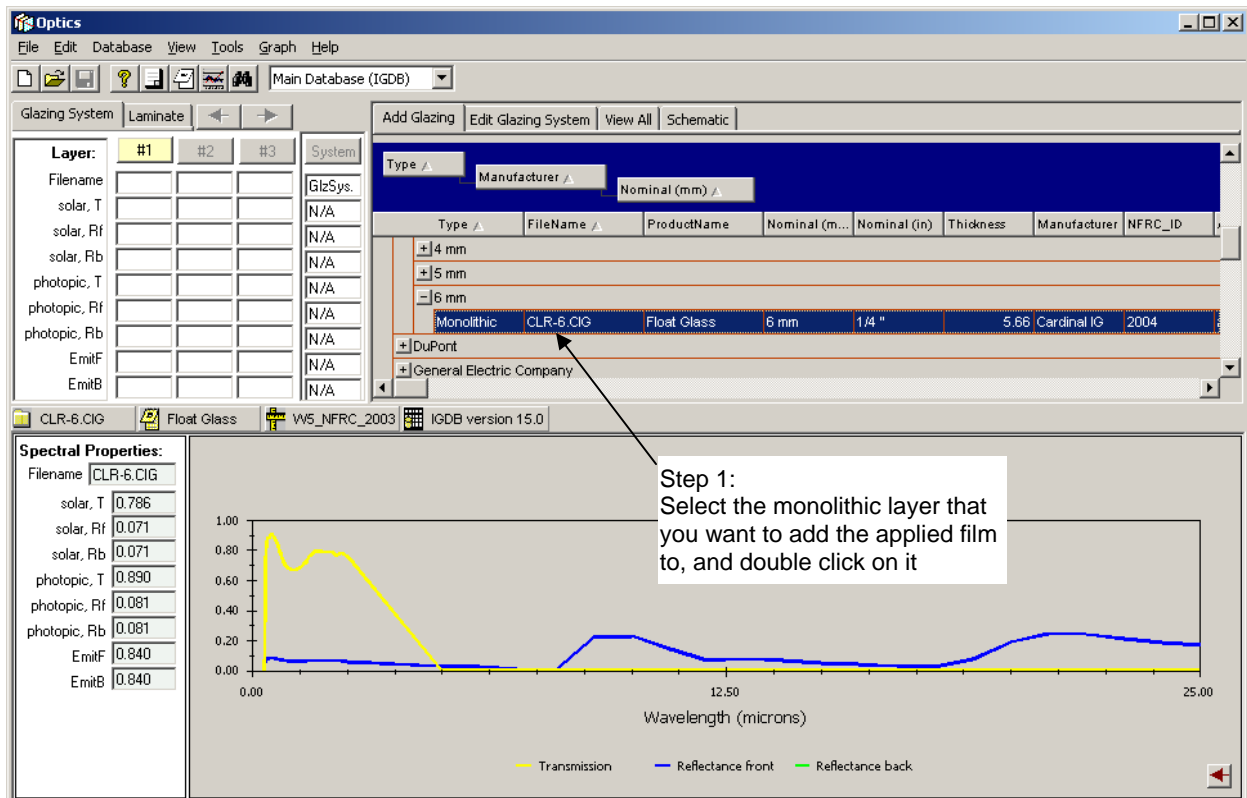
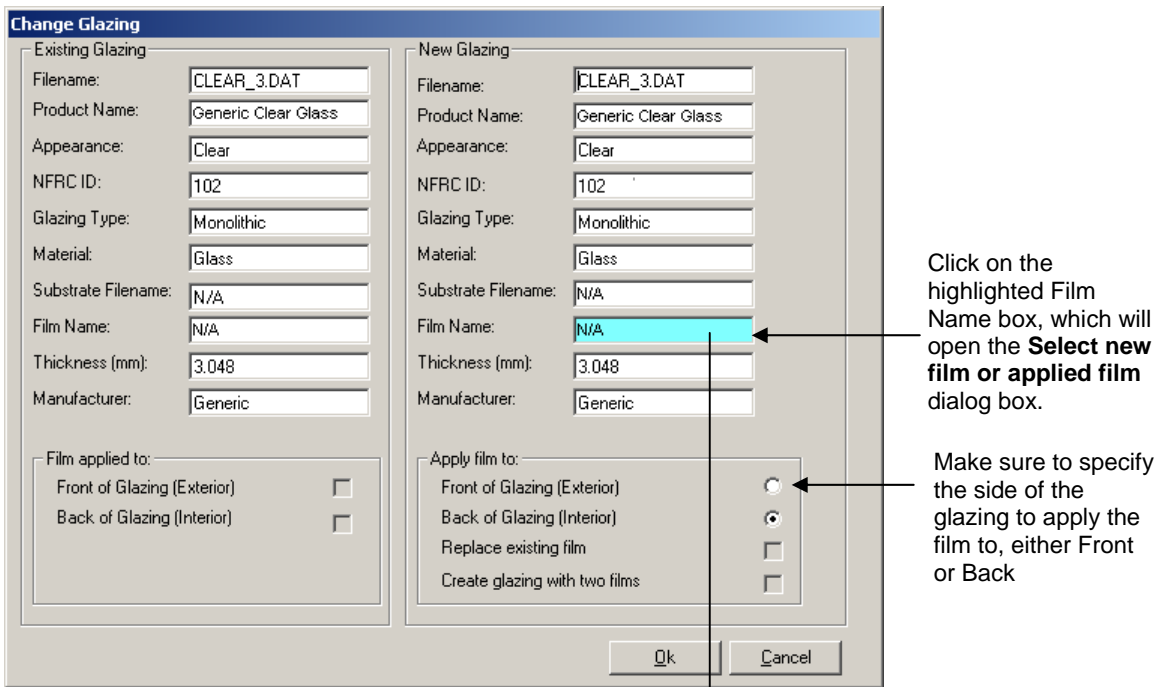


Figure 3-2. Select a monolithic glass layer, click on the **Layer** button, and select the **Edit/Add Film** menu choice



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

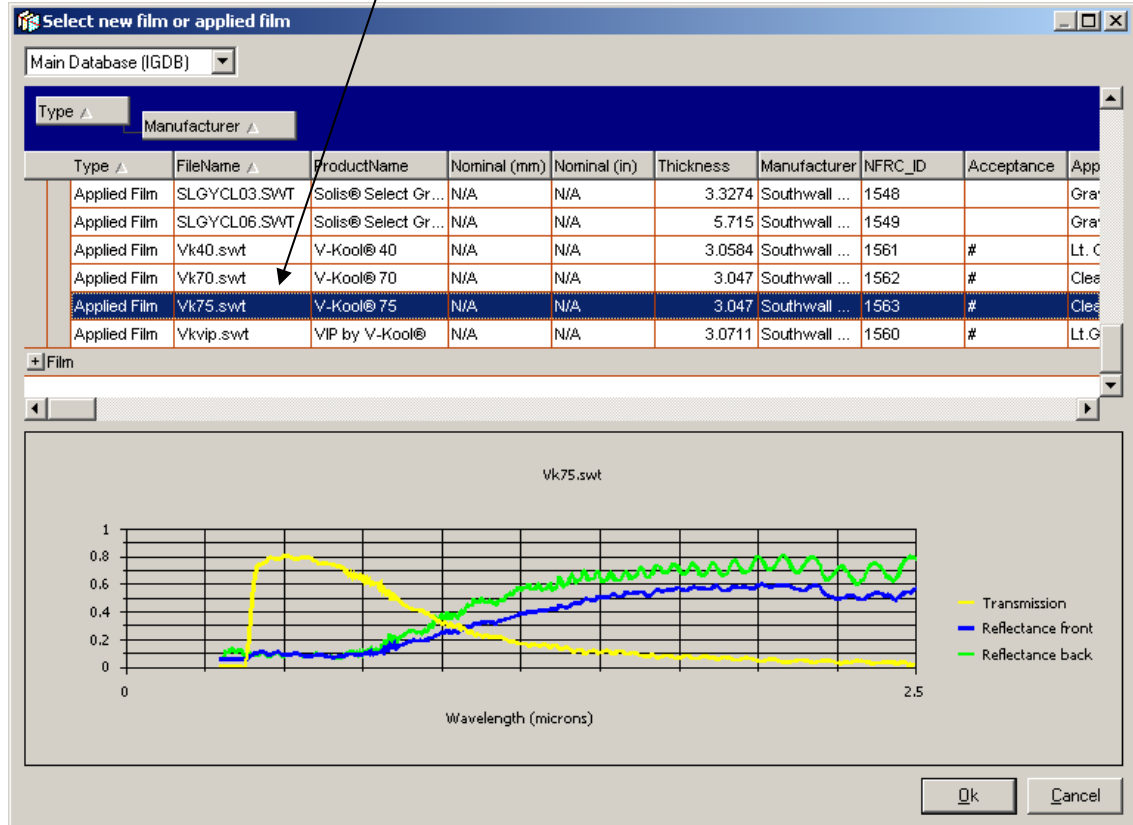
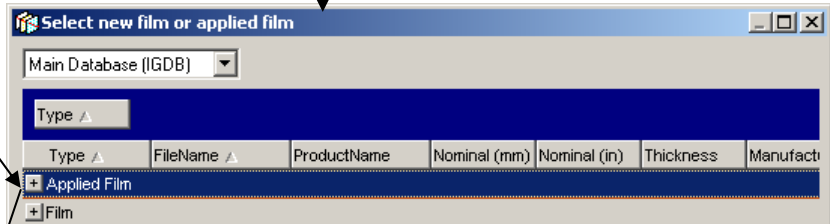


Figure 3-3. Choose the film to apply

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

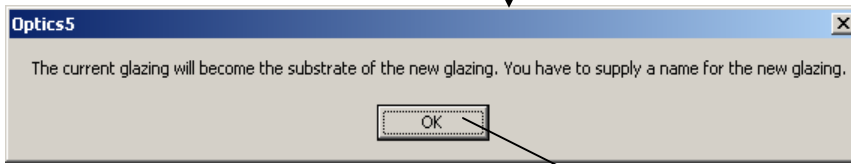
Create glazing with two films

Ok Cancel

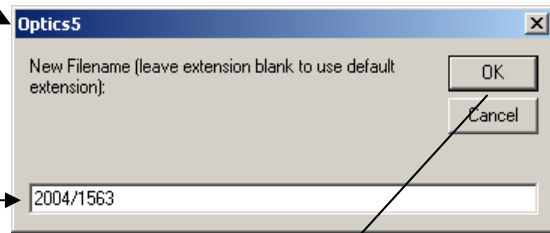
Click the OK button

Figure 3-4. Apply the film to the substrate

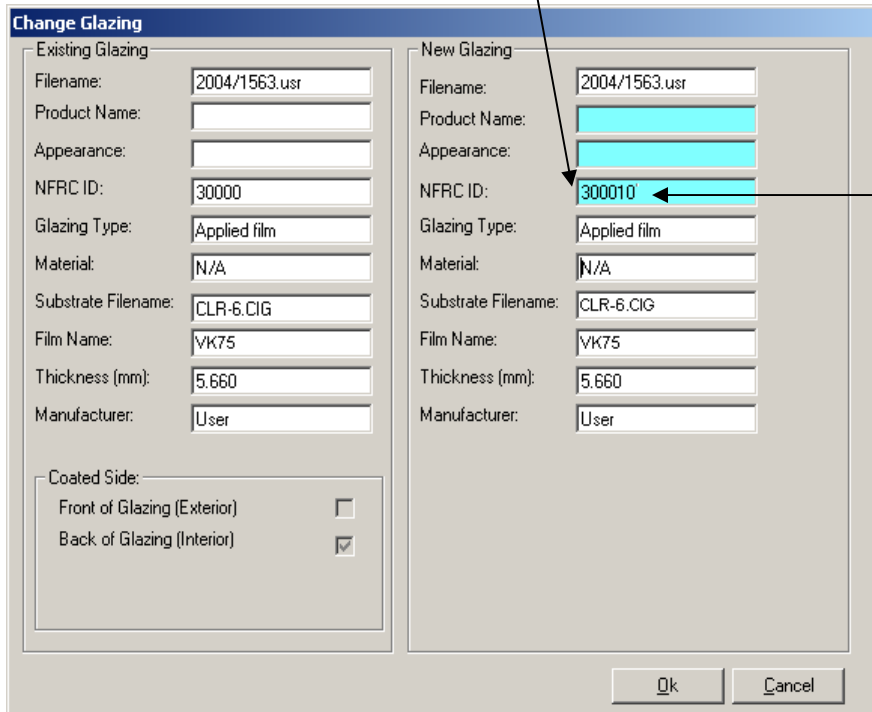
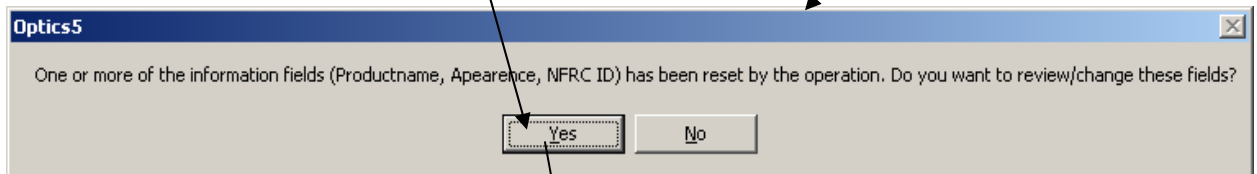
The dialog appears saying a new name must be applied to the new glazing (glass layer)



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 3-5. 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 (IGDB 15.1)

NFRC ID	File Name	Product Name	Substrate Name	NFRC Certified
<b>Energy Saving Products of FL</b>				
2802	AM3CLE.ESP	Armour Glass Clear	CLEAR_3.PPG	#
2805	AM3OBS.ESP	Armour Glass OBS	CLR_3.AFG	#
<b>Film Technologies International, Inc.</b>				
7050	JM-VI-97-2.FTI	Safe Gard 1500	OPTIW3.LOF	#
7051	JM-VI-97-1.FTI	Safe Gard 400	OPTIW3.LOF	#
7052	Safe-Gard_3.FTI	Safe-Gard	CLR_3.AFG	#
7053	Safe-Gard_5.FTI	Safe-Gard	CLR_5.AFG	#
<b>Southwall Technologies, Inc.</b>				
1570	Hopcer20.SWT	Huper Optik® Ceramic 20	CLEAR_3.PPG	#
1571	Hopcer30.SWT	Huper Optik® Ceramic 30	CLEAR_3.PPG	#
1572	Hopcer35.SWT	Huper Optik® Ceramic 35	CLEAR_3.PPG	#
1573	Hopcer40.SWT	Huper Optik® Ceramic 40	CLEAR_3.PPG	#
1574	Hopcer42.SWT	Huper Optik® Ceramic 42	CLEAR_3.PPG	#
1578	Hopcer50.SWT	Huper Optik® Ceramic 50	CLEAR_3.PPG	#
1575	Hopcer60.SWT	Huper Optik® Ceramic 60	CLEAR_3.PPG	#
1576	Hopdrei.swt	Huper Optik® Drei	CLEAR_3.PPG	#
1577	Hopsech.swt	Huper Optik® Sech	CLEAR_3.PPG	#
1560	Vkvip.swt	VIP by V-Kool®	CLEAR_3.PPG	#
1561	Vk40.swt	V-Kool® 40	CLEAR_3.PPG	#
1562	Vk70.swt	V-Kool® 70	CLEAR_3.PPG	#
1563	Vk75.swt	V-Kool® 75	CLEAR_3.PPG	#