# 9.6. Adding New Glazing Systems to the Type56 Window Library

# 9.6.1. Introduction

This tutorial will lead the TRNSYS user through the process of adding a new glazing system, generated by the Berkeley Lab WINDOW 7.x software to TRNBuild for use with the multizone building model Type 56. Users working with this tutorial should have a basic understanding of using TRNBuild and of how TRNBuild and Type 56 model windows. This tutorial deals with the standard window model only – a complex fenestration including "Bidirectional Scattering Distribution Function" (BSDF) is described by another tutorial.

A nearly endless variety of windows are available commercially. Window standards and the data available to describe their performance differ from region to region and certainly from county to country. Furthermore, the modeling of window performance is complex; numerous pieces of specialized software exist for simply modeling windows. For these reasons, a conscious decision was made on the part of the TRNSYS develop-ment team not to attempt to redo work already completed in modeling windows but instead to depend upon specialized software to create new windows, and then provide a method for importing those results into TRNSYS for use with Type56. Specifically, you will be using a freely available piece of software called WINDOW, developed by Lawrence Berkeley National Labs in Berkeley, California. The current version of the soft-ware at the writing of this tutorial is 7.4 (November 2018). It can be downloaded under: https://windows.lbl.gov/tools/window/software-download

The method described in this tutorial has successfully been applied to WINDOW 7.4 to WINDOW 7.6.

To add a new glazing system in a building project, the following steps have to be performed:

- Step 1: Composing glazing systems in WINDOW 7
- Step 2: Exporting the glazing system from WINDOW 7
- Step 3: Importing the glazing system into TRNbuild

# 9.6.2. Creating a Glazing System in WINDOW 7

Berkeley Lab WINDOW is a publicly available computer program for calculating total window thermal performance indices (i.e. U-values, solar heat gain coefficients, shading coefficients, and visible transmittances).

The resulting thermal and optical properties depend on the selected analysis method given by different standards. TRNSYS 18 has its own standard file (Trnsys18.std) defining the spectrum sources. Apart from that the user has the choice to select different standards in some dialog windows related to the thermal calculation method and the environmental conditions. Type 56 performs the thermal calculation itself every iteration step and applies the environmental conditions given by the simulation project. Therefore, these setting don't influence the data used by the TRNSYS simulation but they effect the resulting thermal performance indices calculated and displayed by WINDOW.

In general, this manual follows the default settings using US standards (ISO 15099, NFRC 100-2010). Information for the use of European standards is given in Appendix A.

### 9.6.2.1. Setting Preferences

To generate the data used by Type 56, the default settings of WINDOW have to be adapted. The default settings can be changed under *File*  $\rightarrow$  *Preferences*.

File	Edit Libraries	Record	Tools	View	Help
	New				Ctrl+N
	Open				Ctrl+0
	Save As				
	Print				Ctrl+P
	Print Preview				
	Print Setup				
	Preferences				
	1 C:\Users\\WI	NDOW7.6	w7.mdl	b	
	2 promega_glass	_TS.mdb			
	3 promega glass	.mdb			
	4 C:\Users\\pro	omega gla	ss.mdb		
	Exit				

Figure 9-248: WINDOW Preferences

• Tab Options: Set Unit system to SI

Internal Cales   Optical Cales   Optical		naularice	Dellection	opulates	
ocalization					
Unit system O IP (• [5]					
Language choice English	•				
Misc. options					
Don't show CR warning messages					
Create debug output					
✓ Create log file					
Use Nominal Heights					
Glazing system height: 1000.0 mm					
Nominal window height: 1000.0 mm					
Use Nominal Glass Thickness					
Display precision:					
Default Frame Absorptance 0.300					
Frame Clazing Surtem					
Thickness Tolerance %					
V Use Torr for Gas Library Pressure Units					
Database integrity check before					
database close (recommended)					

Figure 9-249: WINDOW Preferences: Options

• Tab Thermal Calcs: Default Setting (ISO 15099) can be used. (Note: Type 56 performs the thermal calculation itself every iteration step. The optical properties and the assembly of the glazing system is used from the WINDOW report.)

		in las las	1	
ptions Therma	Calcs Optical Calcs Opt	ical Data   Radiance   Deflection	n Updates	
- Thermal calcula	ation options			
Calculation star	ndard ISO 15099	<b>_</b>		
Convection mo	dels			
	Outside	Integral Model	Inside Model	
Venetian blinds	ISO 15099	- ISO 15099 -	ISO 15099	-
	150 15099			
Woven shades	130 13033		ISO 15099	-

Figure 9-250: WINDOW Preferences: Thermal Calcs

- Tab Optical Calcs: nothing to do
- Tab Optical Data: Select Trnsys18.std as the Standards File.

	×
Options Thermal Calcs Optical Calcs Optical Data Radiance Deflection Updates	
Use the following database for optical data:	
GDB or IGDB Update	
C:\Users\Public\LBNL\BNL Shared\Glazing.mdb Browse	
C Optics User database	
Browse	
Standards File	
OK Abbrechen Obernehmen Hilfe	

Figure 9-251: WINDOW Preferences: Optical Data

This is not available by default as it is created by *Transsolar*. It can be found in your TRNSYS installation under

<TRNSYS18>\Building\Lib\Trnsys18.std

The file references another file Trnsys18\_evis.ssp (available in the same folder) containing the visual energy solar spectrum. This file must be placed in the same folder:

c:\Program Files (x86)\LBNL\LBNL Shared\Standards\

(Note: In order to consider selective glazing systems, the thermal window model of Type 56 divides the solar spectrum into 2 bands, a visual and non-visual band. Therefore, the integral characteristic of transmittance and reflectance for the visible range have to be based on the energy spectrum. For most other standard files available for the program WINDOW, these integral characteristics for the visible wave lengths do not represent the entire visible range, owing to spectral sensitivity of the human eye which means that they differ from the energy related characteristics required by Type56.

Integral characteristics for the visible wave lengths which consider the spectral sensitivity of the human eye are used for daylight calculations.)

- Tab Radiance: Nothing to be done here
- Tab Deflection: Nothing to be done here
- Tab Updates: Nothing to be done here

#### 9.6.2.2. Creating a Glazing System

- In the main menu, go to Libraries > Glazing System or press F5
- Click the New button to create a new Glazing System (see Figure 9-252)
- Choose Detailed View to edit the new Glazing System (see Figure 9-253)

<u>F</u> ile	<u>E</u> dit <u>L</u> ibrarie	s <u>R</u> eco	ord Tools	<u>V</u> iew	<u>н</u>	elp															
: D	🗃 🔚   🐰 🛛	è 🛍	l 📾 🛛 🕅 🕅	E K	•	•	N 🗄 🖉 🍨	00	<mark>.</mark> C	#	8	<b>Z</b> 7	5   <b>?</b>	<b>\?</b>							
	List Calc (F9) New Copy Delete Save Repgtt Radiance	Ov	ID ‡ # Layer: Environment Condition Commen rerall thicknes	#: 3 s: 2 tal NFF nt:	RC 10	Na • 00-2011	me: Double Low-e A Tilt: 90 ° 0 🔽	Air IG Hi IG V	eight: Vidth:	1000.0	l( mr l( mr	n n on	1			2					
						ID	Name	М	lode	Thick	Flip	Tsol	Rsol1	Rsol2	Tvis	Rvis1	Rvis2	Tir	E1	E2	Cond
			▼ G	ilass 1	••	1042	CSR42_3.afg		#	3.2		0.452	0.359	0.397	0.714	0.207	0.148	0.000	0.840	0.047	1.000
			0	Gap 1	••	1	Air			12.7											
			- G	ilass 2	••	103	CLEAR_6.DAT		#	5.7		0.771	0.070	0.070	0.884	0.080	0.080	0.000	0.840	0.840	1.000

Figure 9-252: Create New Glazing System

- Customize your glazing system by defining glass layers and gaps. (Note: Shade or frit layers can't be used because they aren't included in the report procedure used by TRNBuild!):
  - Use a descriptive Name, avoid special characters and spaces. In the program glazing library of TRNBuild the names (e.g. GU\_ClimaGuard\_N\_#3\_Ar90) are made up of the following composition:

YY\_name\_NN\_filling

YY - Manufacturer code (GU...Guardian, IP...Interpane, SG...SaintGobain, GT Glas Trösch) name - Glazing system name

NN - Coating position e.g #3 (numeration starts on the outer face)

Filling - Filling between glass panels

- Select the number of layers via # Layers.
- Set Environmental Conditions to NFRC 100-2010. (for European standards see Appendix A) (Note: selection not relevant for TRNBuild import)
- Define height/width. (Note: The entered values aren't relevant because they are redefined by the window type of TRNBuild)
- Glass layers are either chosen from the existing data base (Glass Library) or created by the user (see section 9.6.6). Click on the "double arrow" for opening the Glass Library. The option "flip" turns the glazing layer. This feature is useful the coating is on the wrong side.
- Select gap properties from the existing data base Gap Library. Click on the "double arrow" for opening the Gap Library
- Adapt the gap thickness
- Click on Save and Calc to finish the definition of the glazing system

<u>File Edit Libraries</u>	<u>R</u> ecord Tools <u>V</u> iew	v <u>H</u> elp														
0 🗃 🖬 👗 🖻	) 🛍   🎒   🏢 🔳	• • •	🕨 🗏 🖽 🌒	0 🔛 🛛	#	8	🛛 🏹	8 N	?							
List Calc (F3) <u>N</u> ew <u>C</u> opy <u>D</u> elete <u>S</u> ave Rep <u>o</u> rt Radiance	ID #; 3 # Layers: 2 Environmental NF Conditions: NF Comment: Overall thickness: 21	RC 100-20	ame: Double Low-e A Tilt: 90 * 10 •	ir IG Height IG Width	: 1000.0 : 1000.0 odel Del	( mm ( mm (lection		1			2					
		ID	Name	Mode	Thick	Flip	Tsol F	Rsol1	Rsol2	Tvis	Rvis1	Rvis2	Tir	E1	E2	Cond
	<ul> <li>Glass 1</li> </ul>	▶ 1042	CSR42_3.afg	#	3.2		.452 (	0.359	0.397	0.714	0.207	0.148	0.000	0.840	0.047	1.000
	Gap 1	▶ 1	Air		12.7											
	▼ Glass 2	2 🕨 103	CLEAR_6.DAT	#	5.7		.771 (	0.070	0.070	0.884	0.080	0.080	0.000	0.840	0.840	1.000

Figure 9-253: Customize New Glazing System

# 9.6.3. Exporting the Glazing System from WINDOW 7 to TRNSYS 18

TRNBuild still uses the DOE-2 report of WINDOW for importing which differs from the reports available in the glazing system dialog. Therefore, before writing the report, the glazing system has to be used in a window assembly.

#### 9.6.3.1. Embedding a Glazing System in a Window Assembly

- In the main menu, go to Libraries > Window or press F2
- Click the New button to create a new window assembly. A dialog pops up showing a new ID #. Enter "OK". (Note: This ID # used for identifying the window)
- Use a descriptive Name (avoid special characters and spaces). It is recommended to use the same name as for the glazing system
- Select Mode: NFRC
- Choose Type: Fixed (picture): (Note: It is important to select a FIXED window because the DOE-2 report format does not support other types of windows such as operable windows, vertical sliders, double doors etc.
- Choose Environmental conditions: NFRC 100-2010 (for European products see section 9.6.5)
- Defining Glazing System:
  - The glazing system is selected by clicking in the middle of the representative picture. When the glazing system is selected, it is shown with hatched, diagonal lines instead of as a solid color. (see Figure 9-254, Step 1 and 2)
  - The pull down menu beneath the representative picture appears and gives choices of predefined glazing systems. Choose the Glazing System as defined in section 9.6.2.2
- Selecting frame (optional frame properties are not used by the TRNBuild import)
  - Click on one of the four frame components and the information about that component is displayed as well as a pull down menu showing all possible options included in the frame library. (Note: The DOE-2 file format does not support windows that have different types of frames; the window must have the same kind of frame on all four sides.)
- Click Save and Calc to calculate the properties

<u>File Edit Libraries</u>	<u>R</u> ecord Tools <u>V</u> iew <u>H</u>	lelp	
🗅 🚅 🖬 👗 🖻	) 🛍   🍜   🖩 🔳 🔳 🖊 🖪		🛎 🍨 🖩 📴 # 🐰 🛎 🎋 🛛 🛠
List Calc (F9) <u>N</u> ew <u>C</u> opy <u>D</u> elete <u>S</u> ave Rep <u>ort</u> Dividers Dividers	ID # 2 Name default Mode NFRC Type Fixed (picture) Width 1200 mm Height 1500 mm Area 1.800 m2 Tilt 90 Environmental Conditions NFRC 100-2010	<b>v</b> <b>v</b> <b>v</b> >>	
Display mode: Normal 💌 SHGC/VT Detail CR Detail	Total Window Results	W/m2-K	Click on a component to display characteristics below Glazing System 2. Name Double Low-e Air ID 3 Ucenter ? W/h2-K Nlayers 2 SC ? Area 1.207 m2 SHGC ? Edge area 0.298 m2 Vtc ?

Figure 9-254: Create New Window

## 9.6.3.2. Writing the DOE-2 Report in WINDOW 7

- In the Window dialog, click the Report button (see Figure 9-255, Step 1) to output all necessary
  information. (Note: If you created more than one window, you can output several windows into
  one report by using the List view, marking multiple windows (Ctrl + click) and then clicking the
  Report button)
- Click Report and select Report type "DOE-2" and click OK for saving the report

<u>File Edit Libraries</u>	<u>R</u> ecord Tools <u>V</u> iew <u>H</u> elp
🗅 🚅 🔲 🖌 🖻	B 🛍   🗁   🎟 🔳   🖌 🔸 🕨   🔠 🖉 🎈 🖩 👯 🗖 🕂 🕷   🤶 隆
List Calc (F9) New Copy Delete Save Dividers Dividers Dividers Dividers Dividers Display mode: Normal	ID # 2       Image: Second Secon

Figure 9-255: Output Window Information as DOE-2 Report

## 9.6.3.3. Editing the DOE-2 Report with a Text Editor

Open the previously written report file with a text editor or copy the report from. Figure 8 presents a DOE-2 report with a highlighting scheme showing the relevant values for TRNBuild/Type 56:

grey text	is ignored by TRNBuild and not used during simulation by Type 56
red text	is displayed in TRNbuild but not used during simulation by Type 56
black text	is imported by TRNBuild and used during the simulation by Type 56
blue text	is imported by TRNBuild and used during the simulation by Type 56 if the option "Spacer ID = 0" is selected in the window type dialog of TRNBuild

For each reported glazing systems make the following adaption:

• Add in line 1 ": generated with Trnsys18.std" (highlighted in yellow in Figure 9-256)

(Unfortunately, DOE-2 report doesn't contain information about the standard file (see section 9.6.2.1) used for the multiband calculation. Type56 needs this information for a correct energetic weighting of the visible and non-visible band)

- Optional: Modify the Name of the new window entry to read "TRNSYS 18 Glazing Lib"
- Optional data: Adding visible transmittance for daylight simulation (highlighted in green in Figure 9-256) which is helpful for selecting the radiance material for daylight simulation.

Line 36:Replace SC: 0.XX with Tvis\_daylight: 0.XXX

(Note: Dynamic daylight simulation based on DaySIM has been integrated into the TRNSYS multi-zone building model Type56. In contrast to the thermal model of Type56, the visible transmittance considering the spectral sensitivity of the human eye is needed for the daylight simulation. This value can be obtained from a product data sheet or from an additional calculation of the glazing system with a different standard file for example W5\_NFRC\_2003.std and prEN\_410.std, respectively).

BERKELEY	LAB WI	INDO	W v7.4	.6.0	DOE-2	Data	File :	Multi	Band	Calcul	ation	: generated	with Trnsys18.st	d
Unit Sys	tem : S	SI												
Name	: 1	CRN SI	YS 18	Glasis	ng Lib									
Desc	: (	su_c	limaGu	ard_N	#3_Ar9	90								
Window I	D : 3	3201												
Tilt	: 5	90.0												
Glasings	= 1	2				-								
frame	-	3 10	bod			2.	270							
Spacer		2 C.	lass2			0.	068 .	1.550	-0.14	13				
Total ne	ight: J	1000	.0 mm											
Class He	ath : J	1260	.0 mm											
Glass Ne	deb - 1	1060	2											
Mullion	- 1 ach	Ione												
Gan	Thie	- k	Cond	dCor	nd 1	71 -	dVi =	Dens	dDer		Pr-	dPr		
1 4-90/4	ir1 16	0 0	01712	5 41	10 2 0	162 6	300	1 711	-0 006	50 0 6	87 -0 0	0001		
2		0			0	0	0	0	0.000	0	0	0		
3		ŏ	0		õ	ő	ő	ő		ů.	õ	ő		
4		õ	0		õ	õ	õ	ő		o	õ	õ		
5		0	0		0	0	0	0		0	0	0		
Angle	0	10	20	30	40	50	60	70	80	90	Hemis	-		
Tsol 0.	562 0.5	5 6 2	0.558	0.552	0.544	0.522	0.467	0.353	0.175	5 0.000	0.483			
Abs1 0.	104 0.1	105	0.107	0.110	0.114	0.119	0.125	0.130	0.121	0.000	0.116			
Abs2 0.	095 0.0	095	0.097	0.098	0.097	0.095	0.092	0.082	0.051	L 0.000	0.091			
Abs 3	0	0	0	0	0	0	0	0		0 0	0			
Abs 4	0	0	0	0	0	0	0	0		0 0	0			
Abs 5	0	0	0	0	0	0	0	0		0 0	0			
Abs 6	0	0	0	0	0	0	0	0	) (	0 0	0			
Rfsol 0.	239 0.2	2 38	0.238	0.240	0.246	0.265	0.317	0.435	0.641	1.000	0.300			
Rbsol 0.	249 0.2	249	0.250	0.252	0.260	0.280	0.332	0.449	0.666	5 1.000	0.314			
Tvis 0.	741 0.1	740	0.735	0.729	0.718	0.689	0.616	0.465	0.230	0.000	0.638			
Rfvis 0.	129 0.1	128	0.129	0.133	0.143	0.170	0.240	0.394	0.653	3 1.000	0.215			
Rbvis 0.	126 0.1	125	0.126	0.129	0.139	0.165	0.230	0.373	0.621	7 1.000	0.207			
SHGC 0.6	60 N/	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			
Tvis_day	light:	0.8	00											
				0.00/				~			~			
Layer ID	Ŧ	3	3000	3 300	09	0		0			0			
Frie F			8.60	0.00	40									
Emis P			8.60	0.01	50	ŏ			š		ő			
Thickner	r (mm)		4 0	0.00	0	ŏ			ŏ		ő			
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				20 000										
Overall	and Cer	iter	of G1	ass Io	u U-val	lues (	W/m2-K	)						
Outdoor	Tempera	atur	e			-17.8	c	15.6	с	26.7	с	37.8 C		
Solar	WdS	od 1	hcout	hrout	hin						-			
(W/m2)	(m/:	5)	(W/	m2-K)										
0	0.0	0.0	0.00	0.00	0.00	1.37	1.37	1.09	1.09	1.12 1	.12 1	.14 1.14		
0	6.1	71	0.00	0.00	0.00	1.37	1.37	1.09	1.09	1.12 1.3	12 1.3	14 1.14		
783	0.0	00	0.00	0.00	0.00	1.37	1.37	1.09	1.09	1.12 1	.12 1	.14 1.14		
783	6.1	71	0.00	0.00	0.00	1.37	1.37	1.09	1.09	1.12 1	.12 1	.14 1.14		

#### Figure 9-256: DOE-2 Report with Highlighted Values Relevant for TRNBuild/Type56

• Save the file with a meaning full name (for example W7\_xxxx.dat). It is recommended to save the file in the standard library path of TRNBuild (see TRNBuild *Option* → *Settings*).

╘ TRNBuild	uals Options Window Help	
	Settings	_
	Path for standard libraries	
	W:\Tmsys18\Building\Lib\German	

Figure 9-257: TRNBuild's Standard Library Path

For easy access it is useful to save all user generated glazing systems in a single file (for example W7-lib\_user.dat)

• Copy the text of the new window data file and paste it into an existing the file below the rest of the windows. If a line that reads "\*\*\* END OF LIBRARY \*\*\*" it has to be placed before.

Note: You need to paste the new text directly following the previous entry. DO NOT leave any spaces between entries!!

• Modify the Window ID in order to be unique within the file.

# 9.6.4. Importing the New Glazing System into TRNBuild

In TRNBuild, the window properties are defined by the window type manager. For importing a new glazing system open an existing or a new window in the window type manager (see Figure 9-258)

- Click on Lib for opening a so-called WinID-Lib which contains reports for glazing systems
- Select the file which contains your previously generated and edited report file.
- Select the desired glazing system
- Close the dialog window
- If the ID number of the selected glazing systems already exists in the current building project, a dialog pops ups asking you whether to overwrite the existing data in the project or to add the glazing with a new unique ID number.

new window type:	" Manager	WINDOW001								
<ul> <li>standard model</li> <li>Glazing</li> </ul>	C comple	x fenestration model (B	SDF data required)							
ID number: slope of window: For 1 glazing module	▶ 201 Cuserdefined width: [	0.77 m height	N WinID Lib	u - value: g - value: ID spacer:	T Alur	0 W/m^2 0 %/100 ninum - ASHRE	K valu glazi refer A Metallic	es acc. to ing library (f rence only)	or	
WinID-Lib										<b>V</b> X
Program Library			R1							
No. Used	WinID WinID 2	Description default		Design 3.2/12.7/5.7	U-Value 1.6	g-Value 0.454	T-sol 0.397	Rf-sol 0.354	T-vis-daylight 0.568	

Figure 9-258: Open WINDOW Report File in TRNBuild

# 9.6.5. Appendix A: European Standards

The following section describes the modifications for adaption the WINDOW calculation to European standards only. Other settings, especially the standard file Trrnsys18.std, have to remain.

#### 9.6.5.1. Thermal Calculation Standard

In *Preferences*  $\rightarrow$  *Thermal Calcs:* EN673 can be selected as "Calculation Standard".

Options Thermal	Calcs Optical Calcs	s Optical Data Radiance	e Deflection Update	s
Thermal calcula Calculation star Convection mo	tion options Indard EN673 ISO 15099 dels EN673	<b>.</b>		
Venetian blinds Woven shades	Model ISO 15099 ISO 15099	Model ISO 15099 ▼ ISO 15099	ral Model ISO 1	Inside 5099 <b>v</b> 5099 <b>v</b>

Figure 9-259: WINDOW 7 Preferences: ThermCalcs

#### 9.6.5.2. Environmental Conditions

Environmental conditions can be selected in the glazing system dialog as well as in the window dialog.

The environmental conditions library (main menu, go to Libraries > Environmental Conditions or press F6) includes predefined CEN conditions. For DIN EN 673 and DIN EN 410 no predefinition exists.

According to DIN EN 673:2011 and DIN EN 410 the combined heat transfer coefficient is set to

•	Outside heat transfer coefficient	he	= 25 W/(m2K)
•	Inside combined heat transfer coefficient	hi	= 7.7 W/(m2K)

(valid for glass with a corrected emissivity of 0.837 on the inner surface)

The DIN EN673 also defines the temperature difference between the outermost and innermost glazing surface with  $\Delta T$ =15 K, while the mean gap temperature is fixed to 10 °C. However, in WINDOW only the outside and inside temperature (see Figure 9-260) can be defined.



Figure 9-260: WINDOW 7 Environmental Conditions Input Dialog

Note: For calculating SHGC a reference irradiation value can be entered, but it doesn't influence the results of calculations according to DIN EN 410.

To keep the surface temperatures at a certain level the outside and inside temperatures need to be adapted depending on the heat transfer through the glazing. Calculating exactly according to EN 673 with WINDOW would require the determination of the outside and inside temperature for every single glazing. In order to keep it simple and avoid pre-processing in other software, three environmental conditions with

different heat transfer assumptions (U=0.65 W/m<sup>2</sup>K; U=1.1 W/m<sup>2</sup>K; U=2.5 W/m<sup>2</sup>K) turned out to be useful (see **Error! Reference source not found.**).

ID	Name	U-factor Tin	U-factor Tout	SHGC Tin	SHGC Tout	SHGC Solar	
		С	С	С	С	W/m2	
1	NFRC 100-2010	21.0	-18.0	24.0	32.0	783	
2	NFRC 100-2010 Winter	21.0	-18.0	21.0	-18.0	0	
3	NFRC 100-2010 Summer	24.0	32.0	24.0	32.0	783	
4	CEN	20.0	0.0	25.0	38.9	500	
12	DIN EN410/673 U=0.65	18.9	2.1	18.9	2.1	800	
13	DIN EN410/673 U=1.1	20.1	1.7	20.1	1.7	800	)
14	DIN EN410/673 U=2.5	26.0	-0.2	26.0	-0.2	999	
17	NFRC 100-2001	210	-10.11	24.11	32.0	783	

Figure 9-261: WINDOW 7 Environmental Conditions

Depending on the U-Value given by the manufacturer the environmental conditions with the best matching U-Value are allocated to every glazing (see Figure 9-262).

Note: The U-value of single glazed windows (about 5.5  $W/m^2K$ ) seems to mismatch the categories. Because of the neglect of the temperature dependency of the glass thermal conductivity in WINDOW, the environmental conditions don't influence the results of single glazing at all.

0.vi	#   Enviror Con Co	ID #: 320 Laye : 2 mmental DIN nditions: DIN mment: ckness: 24.1	)1 N EN	Na •	me: GU_ClimaGuard_N, Tilt: 90 IC 3 U=1.1 I	_#3_Ar\$ à Heighl G Width	30 :: 1000.1 :: 1000.1 odel De	D m D m	m m		Er Overa	ID #: 330 # Layers: 3 vironmental DIR Conditions: DIR Comment: I thickness: 44.	02 N E1	Na •	me: GU_ClimaGuard_NL Till: 90 IG 3 U=0.65 IC Mode:	_#2#5 <u></u> Height Width	_Ar90 : 1000.C : 1000.C	) mr	n n on
				ID	Name	Mode	Thick	Flip	Tso		Г			ID	Name	Mode	Thick	Flip	Ts
	-	Glass 1	**	33000	33000_GU_FloatClear_	4	4.0		0.84	L I	-	Glass 1	++	33008	33008_GU_ClimaGuard	r	4.0		0.6
	_	Gap 1	**	5	Ar90/Air10		16.0					Gap 1	**	5	Ar90/Air10		16.0		
	-	Glass 2	**	33009	33009_GU_ClimaGuard	1E	4.0	×	0.64	L .	-	Glass 2	++	33000	33000_GU_FloatClear_4	e i	4.0		0.8
												Gap 2	**	5	Ar90/Air10		16.0		
											-	Glass 3	**	33008	33008_GU_ClimaGuard	t	4.0	$\mathbf{X}$	0.6
C-	•	Class David									•	f Glass Based				1.		1.0	
Le	nter of	ulass Hesul	ts	Temper	ature Data   Optical Dal	a   Ang	jular Da	ta   I	Color F	ŀ	Cente	r or cliass Hesu	its	Temper	ature Data   Uptical Data	a   Ang	ular Dat	aļt	;olor
Γ	HE	ector		SC	SHGC	Rel.	Ht. Gai	in				Ufactor		SC	SHGC	Rel.	Ht. Gair	n	
-	WI	'm2-K				1	√/m2				6	W/m2-K				V	V/m2		
	1.	131		0.744	0.643		478					0.588		0.586	0.506		374		

Figure 9-262: Examples – Allocating Environmental Conditions

#### 9.6.5.3. Calculation Mode for Whole Window Assembly

For the whole window assembly (go to Libraries > window or press F2) the calculation mode can be set to CEN (see Figure 16). In addition, the Environmental conditions can be set to the previously defined conditions according to DIN EN 410/673.

File Edit Libraries	Record Tools View	Help		
🗅 🚅 🖬   👗 🖻	a 🛍   🍜   🏢 🔳 🔣	<ul> <li>▶ ▶   ■</li> </ul>	🗖 🌒 🛯 📴 # 🐰   ½   🤋 🍂	
List Calc (F9) New Dopy Delete Save Report Dividers Dividers Display mode: Normal	ID # 1 Name Devide low of Air Mode CEN Type Hited (picture) Width 1200 mm Height 1500 mm Area 1.800 m2 Tilt 90 Environmental Conditions DIN EN410/673 U=1.1			
SHGC/VT Detail CR Detail	U-factor ? SHGC ? VT ? CR N/A	W/m2·K	Click on a component to display characteristics below         Glazing System         Name       Double Low-e Air       Image: Colspan="2">Image: Colspan="2" Image: Colspan="2">Image: Colspan="2" Image: Colspan="	

Figure 9-263: Using CEN Mode Instead of NFRC

# 9.6.6. Appendix B: Import Spectral Data into WINDOW 7 via OPTICS 6

OPTICS is a program for processing and analyzing glazing systems with spectral resolved data. It is possible to vary some parameters like thickness and the substrate. However, for our task we use OPTICS mainly to import given spectral data into an \*.mdb data base readable by WINDOW 7.4. Therefore, this manual just describes the import function of OPTICS 6.

## 9.6.6.1. Database in Optics

OPTICS 6 gives access to the IGDB and a user database. Select the database by using the dropdown menu in the toolbar. (See Figure 9-264)

🚯 Optics

File Edit	Database V	/iew Too	ls Graph	Help			
0 🛩 🖬	? 5 4	📉 🗛	Main Datab	ase (GDB)	•		
Glazing Syste	m Laminate	- (	Main Datab User Datab	ase (IGDB) ase		Edit Glazing System	/iew All Schematic

Figure 9-264: OPTICS Database Selection

If an already existing database should be accessed through the user database, the corresponding file can be chosen under Tools  $\rightarrow$ , data base locations "(see Figure 9-265).

Main database (IGDB)	C:\Users\Public\LBNL\LBNL Shared\6
User database	INL\OPTICS6\New user database.mdb
Default I/O folder:	c:\temp\
Standards / Wavelengthsets folder	C:\Program Files (x86)\LBNL\LBNL Sh:

Figure 9-265: OPTICS Database Preferences

A new database can be created under Database  $\rightarrow$  "create new user database". The path described in Figure 9-265 can then automatically be created (see Figure 9-266)



Figure 9-266: OPTICS Create New Database

#### 9.6.6.2. Import spectral data files

Data from spectral data text files needs to be converted to the format described in the International Glazing Database: Data Submission Procedure and Reference Manual. Figure 9-267 shows an example of such a file.

```
{ Units, Wavelength Units } SI Microns
{ Thickness } 6
{ Conductivity } 1
{ IR Transmittance } TIR=0
{ Emissivity, front back } Emis= 0.037 0.837
{ }
{ Ef_Source: Text File }
{ Eb_Source: Text File }
```

```
{ IGDB Checksum: 0 }
{ Product Name: iplus E - 6 mm }
{ Manufacturer: INTERPANE GLAS INDUSTRIE AG }
{ NFRC ID: 37003 }
{ Type: Coated }
{ Material: N/A }
{ Coating Name: 44107tw }
{ Coated Side: Front }
{ Substrate Filename: 44107ip6.SPC }
{ Appearance: clear }
{ Acceptance: }
{ Uses: }
{ Availability: }
{ Structure: }
0.300
         0.0004
                   0.0610
                              0.0663
0.305
         0.0002
                   0.0610
                              0.0655
...
••••
2.495
         0.2128
                   0.0659
                              0.0621
         0.2216
                   0.0689
                              0.0732
2.500
```

#### Figure 9-267: IGDB Text File Format for Spectral Data

A suitable template can also be generated by choosing a similar product from the Main Database (IGDB) and exporting it as a text file (see Figure 9-268).



Figure 9-268: Export Suitable Template

The wavelength unit, thickness, conductivity and emissivity of the front and back surface are necessary in-formation in the header for a proper calculation in WINDOW.

Depending on the format of your original data file, you need to modify your file to match this format. The best way to do this is to copy the header of a working file and adapt the values and names. When you use the import function and some information is missing a window will pop up and ask if you would like to enter the missing information. However, we recommend entering as much information as possible already into the text-file, to avoid inconsistency when reading-in the file repeatedly.

The first column shows the wavelengths, usually given in microns. If it is given in nanometer you may adapt the data or substitute Microns for Nanometer in the first line, note almost everything in this program is case sensitive. The following columns are transmissivity, front reflectivity and back reflectivity.

#### 9.6.6.3. Import function in Optics

Importing spectral data text files is the most used function for OPTICS in this context. The imported data is converted into an mdb format, which is readable by WINDOW.

This function can be chosen under File  $\rightarrow$  Import Text Files. In the following pop-up window up to one hun-dred files can be chosen to be imported in sequences. If some information is missing you will be asked if you would like to fill in the missing information. (See Figure 9-269)

This file.	file is missing some inform Would you like to fill in th	nation, it could be a V ne missing information	Vindow4 style text n?	
	[	Ja <u>N</u> ein	Abbrechen	
nange Glazing				
Existing Glazing		New Glazing		
Filename:	SpectralDataImport_V2.1	Filename:	SpectralDataImport_V2.1	
Product Name:	iplus E - 6 mm	Product Name:	iplus E - 6 mm	
Appearance:		Appearance:	Clear	
NFRC ID:	99991	NFRC ID:	99991	
Glazing Type:	Coated	Glazing Type:	Coated	
Material:	N/A	Material:	N/A	
Substrate Filename:	44107ip6.SPC	Substrate Filename:	44107ip6.SPC	
Coating Name:	44107tw	Coating Name:	44107tw	edit
Thickness (mm):	6.000	Thickness (mm):	6.000	
Manufacturer:	INTERPANE GLAS IND	Manufacturer:	INTERPANE GLAS IND	
- Coated Side				
Front of Glazing	(Exterior)			
Back of Glazing	(Interior)			
-				

Figure 9-269: OPTICS Import

#### 9.6.6.4. Import Glass from Optics \*.mdb file into WINDOW 7 Glass Library

Open the WINDOW program and follow these steps:

- Go to File > Preferences > Optical Data and choose the OPTICS user database, generated in the step before
- Choose your user defined OPTICS 6 \*.mdb database as shown in Figure 9-270.

- In the main menu, go to Libraries > Glass or press F3 and choose the List view (not Detailed View)
- Click on the Import button and choose Format IGDB or Optics User Database (see Figure 9-270)
- Choose self-created glass from menu.

Detailed View	Glass	Library	(C:\Users\Public\LBNL\WINDOW7.	4\w7.mdb)													
Calc		ID	Name	ProductName	Manufacturer	Source	Mode Color	Thickness	Tsol Rs	ol1 Rsol2	Tvis	Rvis1	Rvis2	Tir	emis1	emis2	Cond
New								mm									W/m-K
Carry	•	100	BRONZE_3.DAT	Generic Bronze Glass	Generic	IGDB v11.4	#	3.124	0.646 0.0	62 0.063	0.680	0.065	0.066	0.000	0.840	0.840	1.000
Cobà		101	BRONZE_6.DAT	Generic Bronze Glass	Generic	IGDB v11.4	#	5.740	0.486 0.0	53 0.053	0.533	0.056	0.056	0.000	0.840	0.840	1.000
Delete		102	CLEAR_3.DAT	Generic Clear Glass	Generic	IGDB v11.4	#	3.048	0.834 0.0	75 0.075	0.899	0.083	0.083	0.000	0.840	0.840	1.000
Find		103	CLEAR_6.DAT	Generic Clear Glass	Generic	IGDB v11.4	#	5.715	0.771 0.0	70 0.070	0.884	0.080	0.080	0.000	0.840	0.840	1.000
ID 💌		104	GRAY_3.DAT	Generic Grey Glass	Generic	IGDB v11.4	#	3.124	0.609 0.0	60 0.061	0.617	0.062	0.063	0.000	0.840	0.840	1.000
		200	SilAg25LE_3ww.bsf	Silver AG 25 Low-E	Saint-Gobain Solar Gard LLC	IGDB v16.3	#	3.023	0.156 0.5	46 0.616	0.222	0.417	0.476	0.000	0.840	0.330	0.942
		201	AutBr30_3ww.bsf	Autumn Bronze 30	Saint-Gobain Solar Gard LLC	IGD8 v17.0	#	3.023	0.244 0.4	67 0.318	0.343	0.238	0.156	0.000	0.840	0.770	0.942
Advanced		202	H70_3.bsf	Hilite 70	Saint-Gobain Solar Gard LLC	IGDB v16.3	#	3.277	0.368 0.3	53 0.415	0.721	0.088	0.088	0.000	0.840	0.770	0.950
1706 records found	1	203	H70-8_3.bsf	8 Mil Hilte 70	Saint-Gobain Solar Gard LLC	IGDB v16.3	#	3.404	0.381 0.3	16 0.403	0.722	0.095	0.096	0.000	0.840	0.790	0.878
Import		204	NS20_3.bsf	NightSky 20	Saint-C Import					× 08	0.201	0.132	0.116	0.000	0.840	0.860	0.966
Tubox	/	205	NS30_3.bsf	NightSky 30	Saint-C					92	0.316	0.098	0.088	0.000	0.840	0.880	0.966
Export		206	H40_3.bsf	Hilite 40	Saint-C Format	IGDB or Ontics User Da	tabase	-		94	0.420	0.059	0.066	0.000	0.840	0.750	0.950
Rep <u>o</u> rt		207	SBr20_3vvw.bsf	Solar Bronze 20	Saint-C	WINDOW Database				10	0.223	0.383	0.361	0.000	0.840	0.660	0.942
Print		209	SBr35_3ww.bsf	Solar Bronze 35	Saint-C	IGDB or Optics I Ser Da Frit from IGDB or Motics	itabase User Databa	se	_	2 32	0.353	0.300	0.275	0.000	0.840	0.680	0.942
Under JODR		210	SBr35-4_3ww.bsf	4 Mil Solar Bronze 35	Saint-C Avoid creating	duplicate records in exp	on database	by searching		20	0.322	0.296	0.272	0.000	0.840	0.680	0.891
update IGDB		211	SBr50_3ww.bsf	Solar Bronze 50	Saint-C for identical rec	cords				48	0.453	0.235	0.211	0.000	0.840	0.690	0.942
NFRC only		212	NS10_3.bsf	NightSky 10	Saint-C	OK	Cancel	1		30	0.095	0.155	0.140	0.000	0.840	0.870	0.966
		213	Sil20_3ww.bsf	Silver 20	Saint-C	01	Gunco			29	0.166	0.605	0.585	0.000	0.840	0.700	0.942

#### Figure 9-270: Import Glass from OPTICS User Database

## 9.6.6.5. Summary: How to Import Data Text Files in OPTICS

- Select the database to be extended or create a new database
- Convert spectral data from unknown format information into IGDB format
- Import file into OPTICS 6