



BISCO v13 New program performances



BISCO v13

BISCO v13 – Overview

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A Implementation of NFRC 100/500

[overview](#)

Both NFRC 100* and NFRC 500** have an option to report thermal transmittance and condensation risk based on 2D numerical simulation. The underlying methodology to model heat transfer at boundaries and within frame cavities in the NFRC standards is adopted from ISO 15099***.

*ANSI/NFRC 100 (2023): Procedure for Determining Fenestration Product U-factors

**ANSI/NFRC 500 (2023): Procedure for Determining Fenestration Product Condensation Index Ratings

*** ISO 15099 (2003): Thermal performance of Window, Doors, Shading Devices – Detailed calculations

BISCO v13 includes new functions to calculate and report frame thermal transmittance and Condensation Index Rating according to NFRC 100/500

A.1 Implementation of underlying ISO 15099

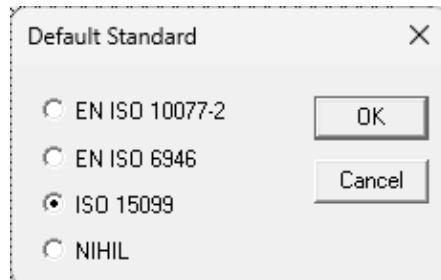
[overview](#)

Air cavities in ISO 15099 can be modelled with either:

- Single equivalent thermal conductivity method: [EQUIMAT](#)
- Radiosity method (detailed radiation): [TRANSMAT](#)

Col.	Type	Subtype	Physical flow dir.	Geometrical flow dir.	Name	ϵ_1 / ϵ_2 [-/-]	λ [W/mK]	ϵ Standard [-]
195	EQUIMAT	CAVITY	HOR	X		0.90 / 0.90	0.040	0.90 ISO15099
196	TRANSMAT	CAVITY	HOR	X			0.024	ISO15099

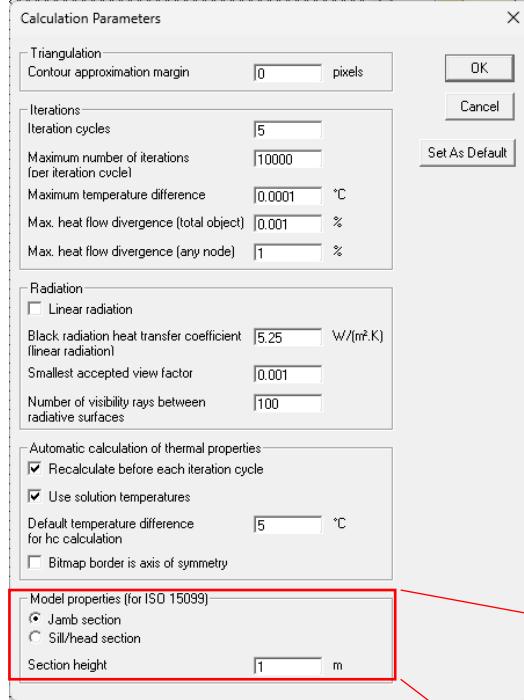
ISO 15099 can be set as default standard: Settings → Default Standard



A.1 Implementation of underlying ISO 15099

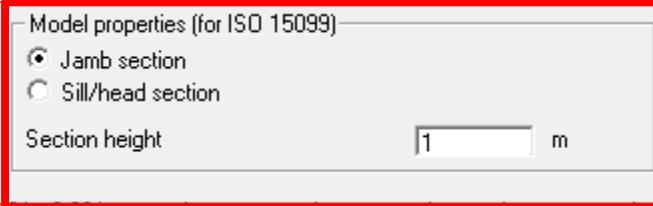
[overview](#)

For the calculation of convective heat transfer in frame cavities ISO 15099 differentiates between sill/head and jamb.
 → General setting in Calculation Parameters



Bitmap Border	U [W/m²K]	Enforced U [W/m²K]
Left	1.207	2.962
Right	5.094	
Top		
Bottom		

Setting indicated in status bar



A.1 Implementation of underlying ISO 15099

[overview](#)

According to ISO 15099 boundary conditions can be used with simplified or with detailed radiation (view factor method). Both options are available:

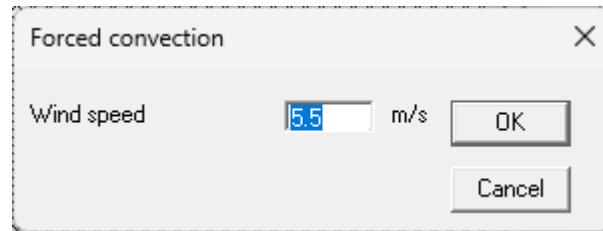
- Simplified infrared radiation: BC_SIMPL
- Detailed infrared radiation: BC_SKY

BC_SIMPL (global surface coefficient)

Physical flow direction can be set to horizontal, upwards, downwards or any

Col.	Type	Subtype	Physical flow dir.	Geometrical flow dir.	Name	θ [°C]	h [W/m²K]	Standard
196	BC_SIMPL	HE				-18.0	31.25	ISO15099

Double click to set wind speed



A.1 Implementation of underlying ISO 15099

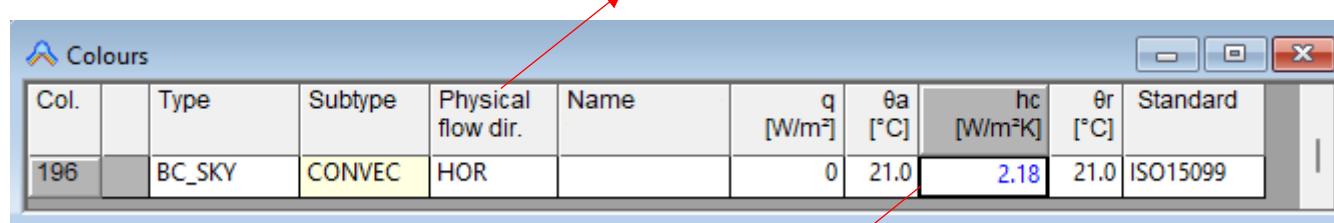
[overview](#)

According to ISO 15099 boundary conditions can be used with simplified or with detailed radiation (view factor method). Both options are available:

- Simplified infrared radiation: BC_SIMPL
- Detailed infrared radiation: BC_SKY

BC_SKY (view factor based)

Physical flow direction can be set to horizontal, upwards, downwards or any



Col.	Type	Subtype	Physical flow dir.	Name	q [W/m^2]	θ_a [$^\circ\text{C}$]	h_c [$\text{W}/\text{m}^2\text{K}$]	θ_r [$^\circ\text{C}$]	Standard
196	BC_SKY	CONVEC	HOR		0	21.0	2.18	21.0	ISO15099



Double click to set Glazing height and inclination (when physical flow direction is ANY)

A.2 Boundary conditions according to NFRC 100/500

[overview](#)

Boundary conditions prescribed by NFRC 100/500:

- Interior conditions:
 - Radiation model = "Automatic Enclosure Model" → BC_SKY
 - Frame: Standard to NIHIL, manual input of hc (convective film coefficient)

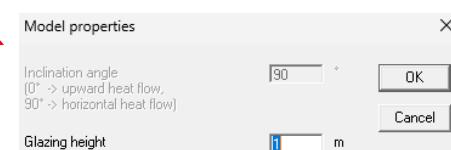
Col.	Type	Subtype	Name	θ_a [°C]	hc [W/m²K]	θ_r [°C]	Standard
169	BC_SKY	NIHIL	Interior Wood/Vinyl Frame	21.0	2.44	21.0	NIHIL

- Edge and Centre of Glass: Standard to ISO15099

Col.	Type	Subtype	Physical flow dir.	Name	θ_a [°C]	hc [W/m²K]	θ_r Standard
167	BC_SKY	CONVEC	HOR	Interior - centre of glass	21.0	2.18	21.0 ISO15099

Double click to adjust glazing height

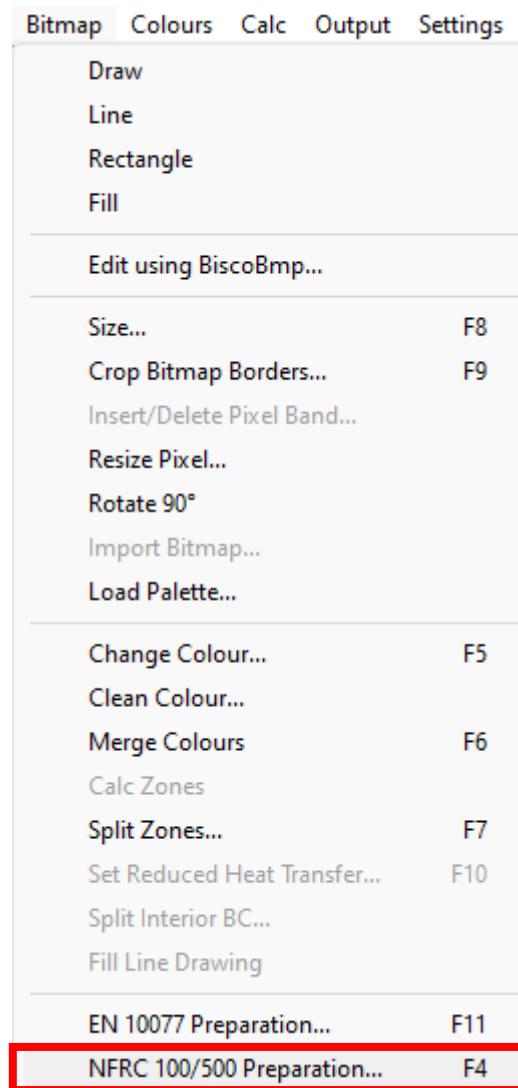
- Exterior conditions
 - Radiation model = "Blackbody Model" → BC_SIMPL
 - Default colour in Colour Database (colour 171)



Col.	Type	Subtype	Name	θ [°C]	h [W/m²K]	Standard
171	BC_SIMPL	HE	exterior NFRC 100 (Blackbody)	-18.0	31.25	ISO15099

Windspeed can be adjusted by double clicking
(default wind speed is 5.5 m/s)

A.3 Automatic preparation according to NFRC 100/500

[overview](#)

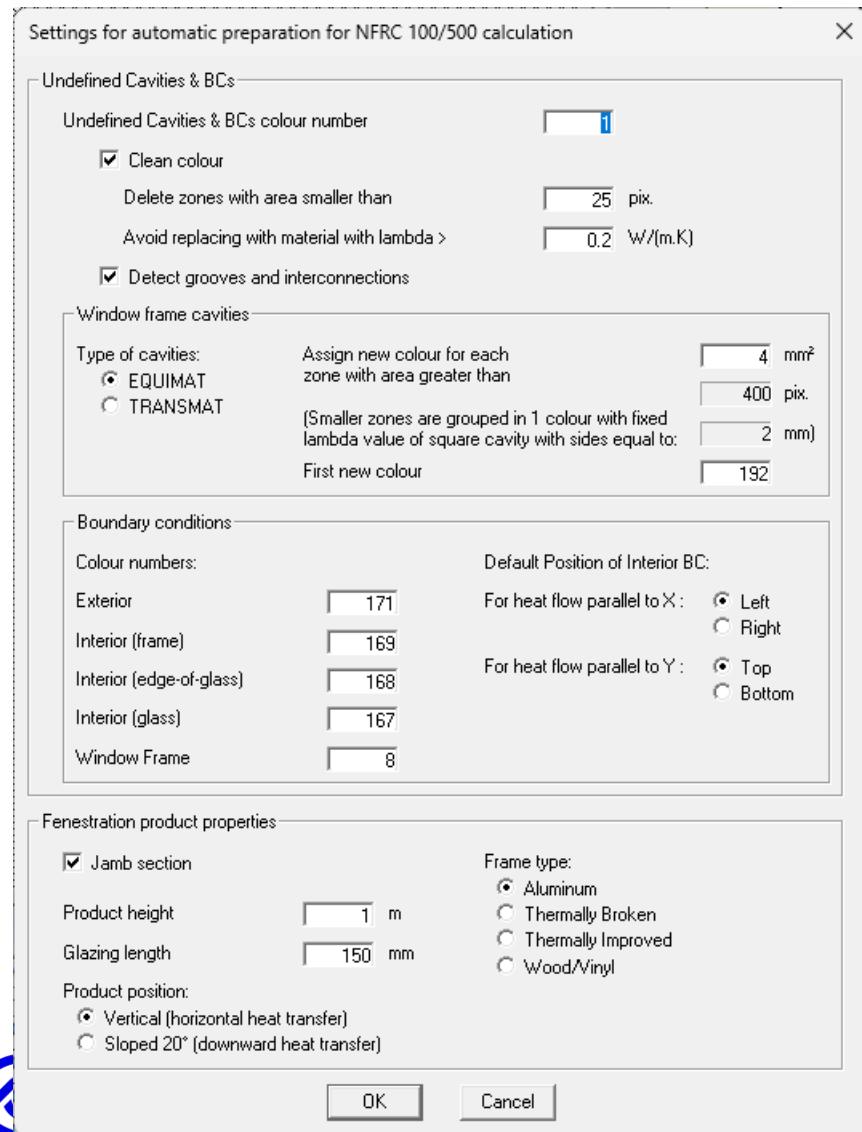
New function which prepares the geometry and report output according to NFRC 100/500:

- Defines boundary conditions (frame, edge of glass and centre of glass)
- Assigns properties to frame cavities according to ISO 15099
- Extends the length of glass to meet required 150mm
- Selects Derived thermal properties for reporting: Ufr and Ueg

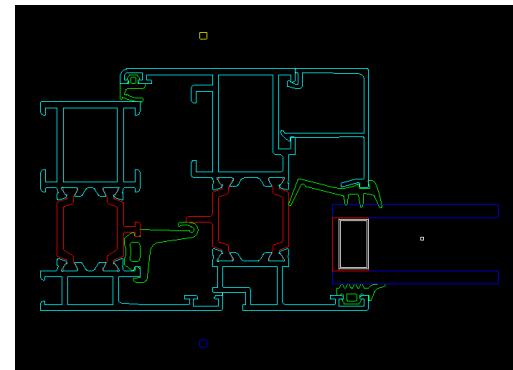
A.3 Automatic preparation according to NFRC 100/500

[overview](#)

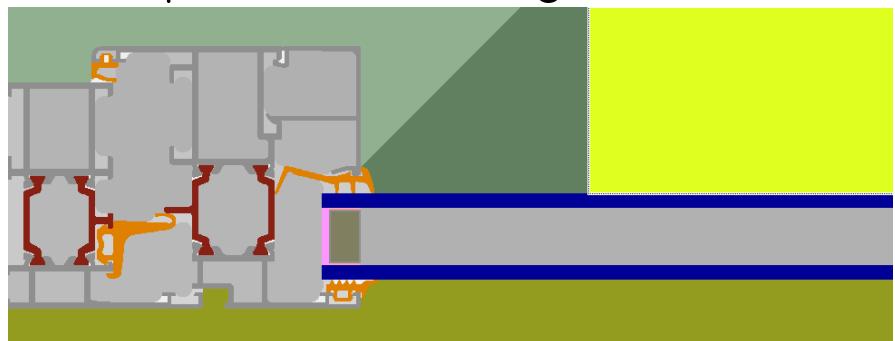
Settings → Settings for automatic preparation for NFRC 100/500 calculation



DXF format



Prepared according to NFRC



A.4 Output of Condensation index according to NFRC 500

[overview](#)

Edit → Derived thermal properties → Condensation → Condensation Index CI (NFRC 500)

Derived Thermal Properties

Transmittances Condensation

Temperature factor or Condensation Index

Prefered nomenclature: Temperature factor (EN ISO 10211) Condensation Index CI (NFRC 500)

Internal surface relative humidity

Inside zone RH: %

Surface RH = 100 % (surface condensation)

Surface RH >= %

OK Cancel

BISCO - Text Output [alu_1_frame_glazed.bsc]

File Edit View Settings

BISCO Calculation Results

BISCO data file: alu_1_frame_glazed.bsc

Number of nodes = 54018

Heat flow divergence for total object = 0.000889711

Heat flow divergence for worst node = 0.681271

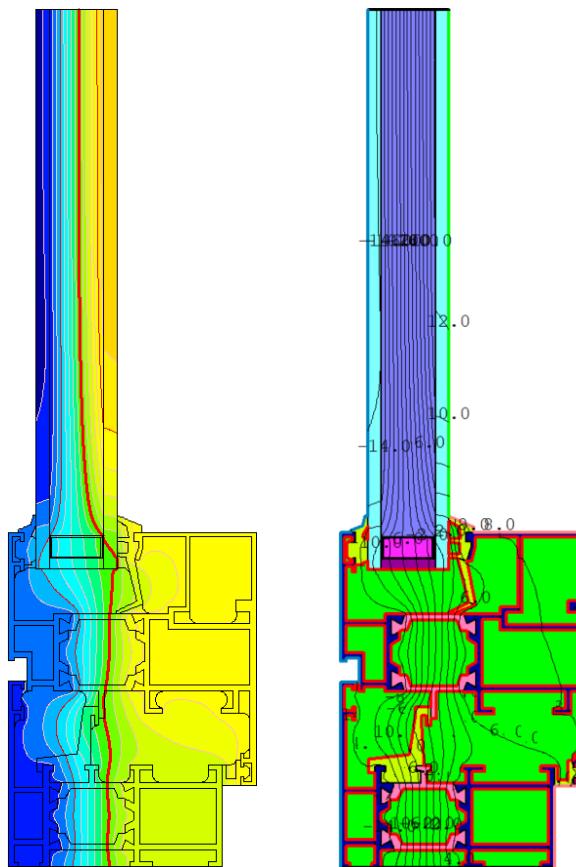
Condensation Index (NFRC 500) CI = 0.450
Surface condensation if RH > 24 % (at 21.00°C)

A.5 Validation report BISCO v13 vs. THERM 7.8

[overview](#)

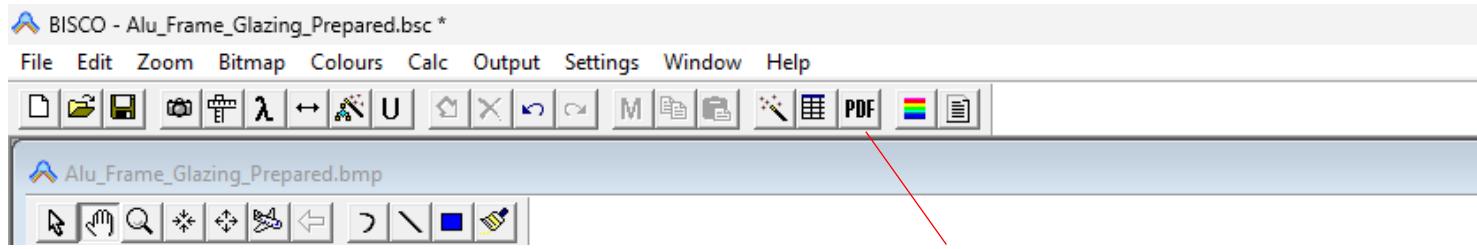
Validation report available on the [Physibel Knowledge Base](#):

"A14 - Validation of the program BISCO v13 according to NFRC 100 and ISO 15099:2003: BISCO vs. THERM"



B.1 New function 'Make PDF report'

[overview](#)

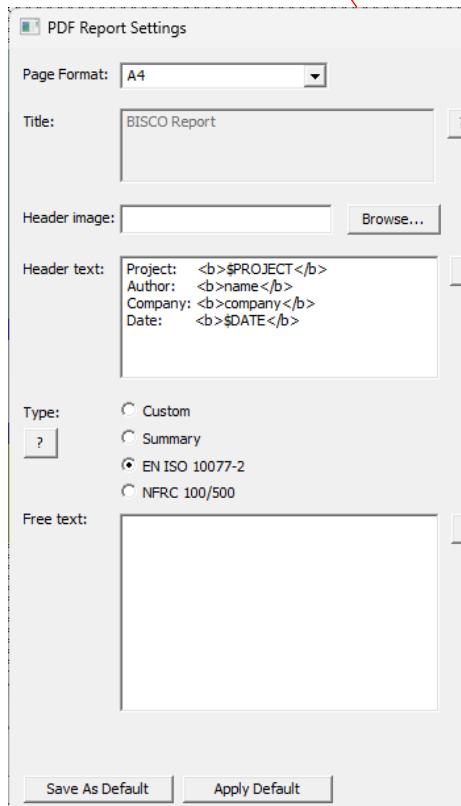
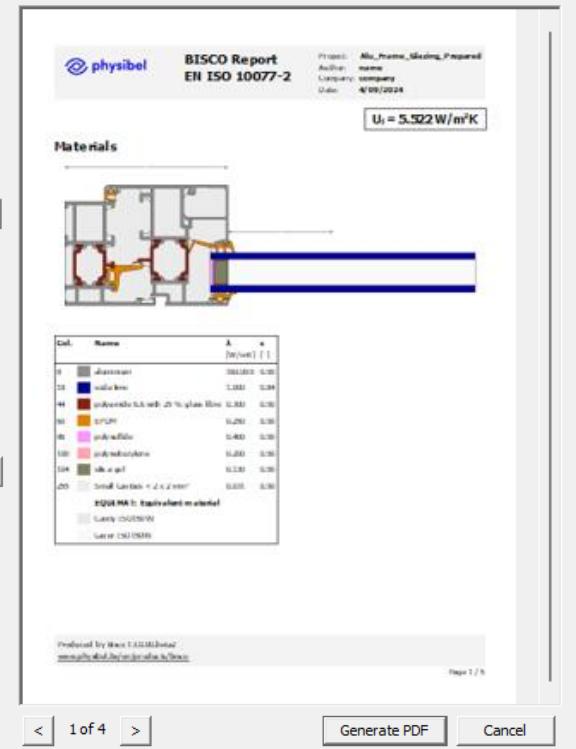
 PDF report Settings: live PDF preview

Add company logo ←

customize header text ←

Choose report type ←

Store settings ←

B.1 Type: Custom report

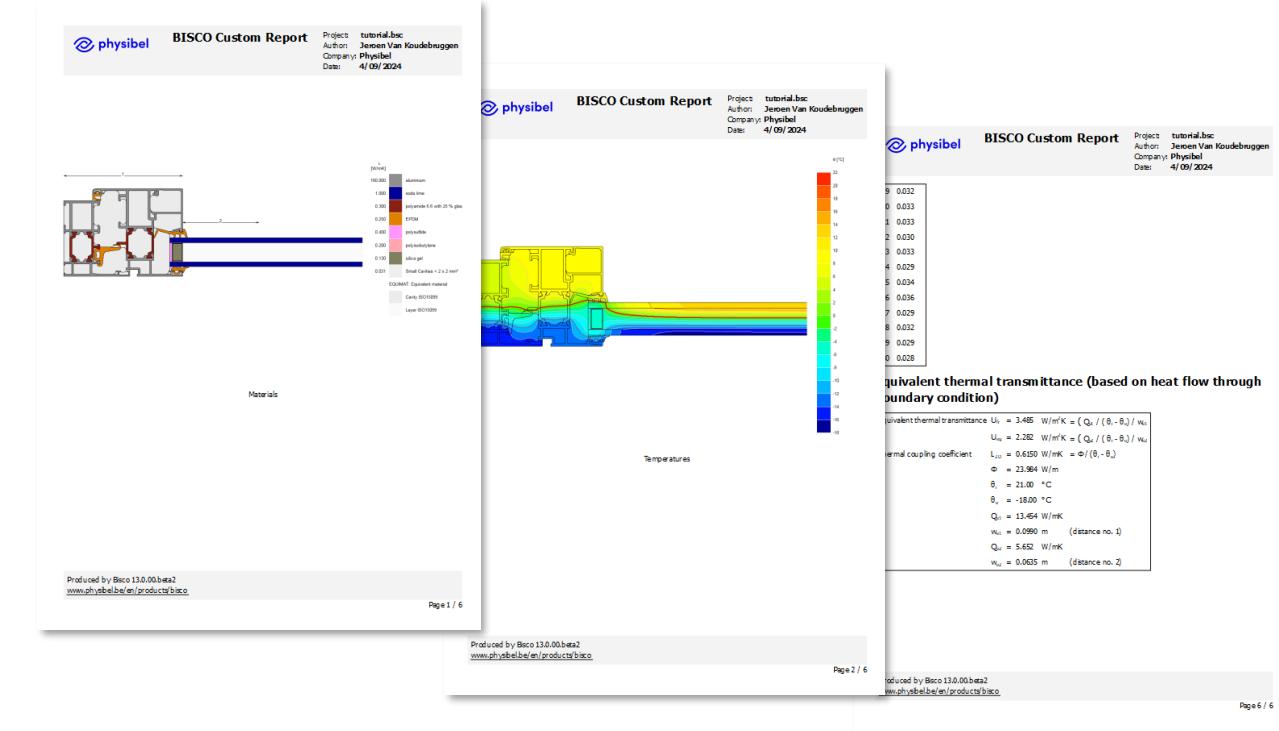
[overview](#)

Custom report includes:

- figures defined under 'Graphic Report Definitions'
- Text output defined under 'Derived thermal properties'

Graphic Report Definition									
Image	Create	Object Lines	Triang. Mesh	Isoth. Lines	Flow Lines	Distances	Fill	Legend	Caption
1	YES	YES	NO	NO	NO	YES	MATERIAL	YES	Materials
2	YES	YES	NO	YES	NO	NO	TEMP	YES	Temperatures
3	YES	YES	NO	NO	YES	NO	OFF	NO	Heat flow

Figure caption used in pdf report

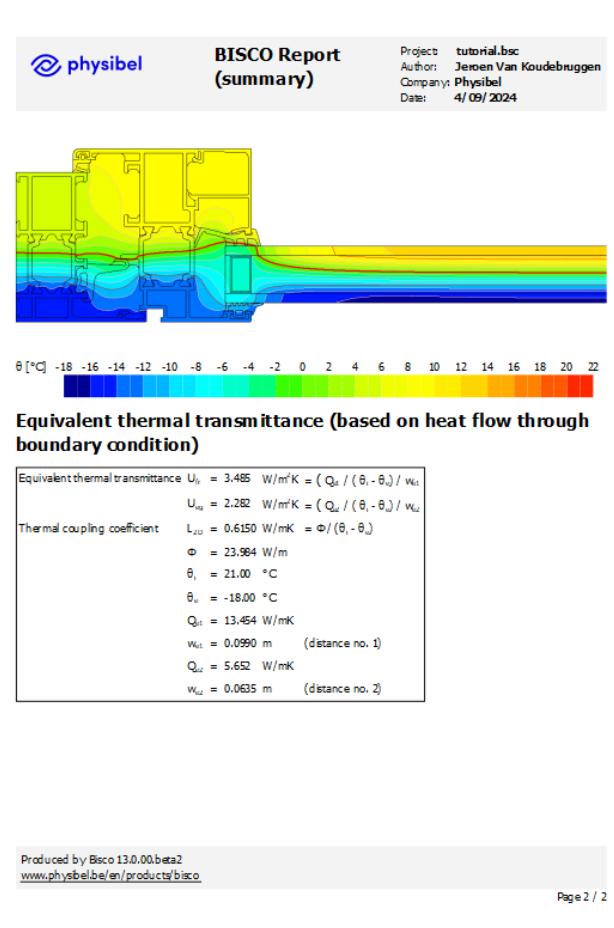
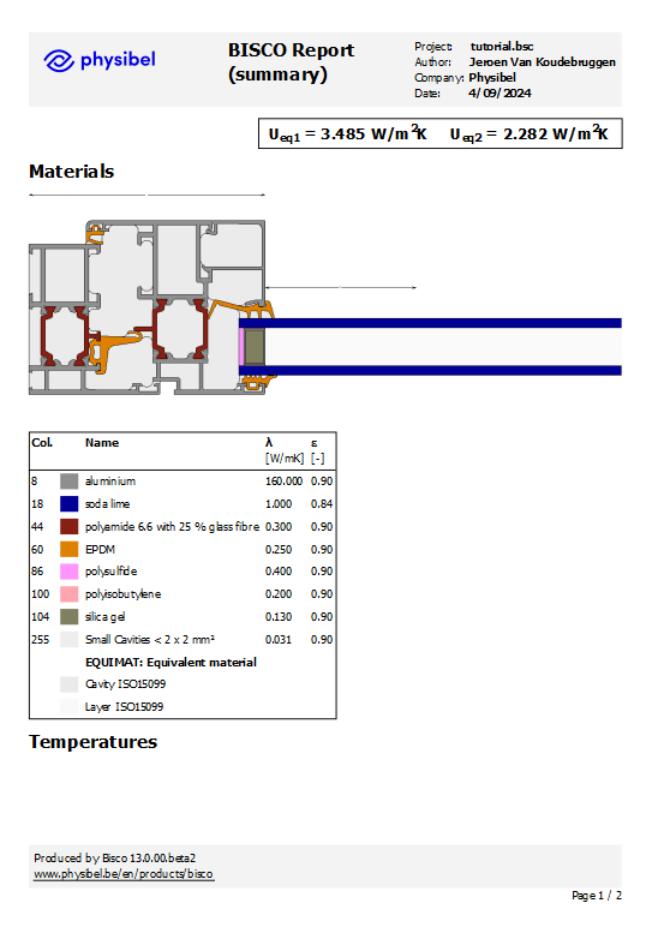


B.1 Type: Summary report

[overview](#)

Summary report:

- Concise auto report (2 pages)
- 'Derived thermal properties' + 2 figures (materials and temperatures)

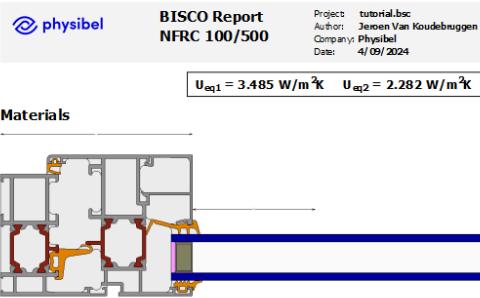


B.1 Type: Standard report (EN 10077-2, NFRC 100/500)

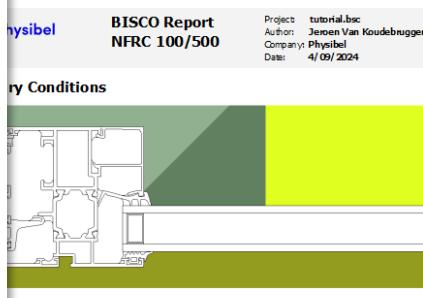
[overview](#)

Standard report according to EN 10077-2 or NFRC 100/500:

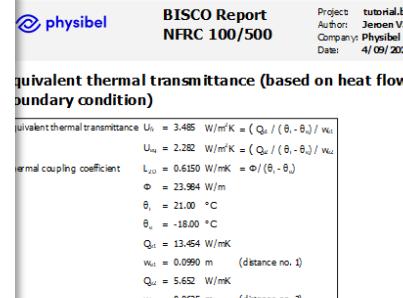
- Includes information as requested by corresponding standard



Col.	Name	λ [W/mK]	ϵ [-]
8	aluminum	160.00	0.90
18	soda lime	1.000	0.84
44	polyamide 6.6 with 25 % glass fibre	0.300	0.90
60	EPDM	0.250	0.90
86	polysulfide	0.400	0.90
100	polyisobutylene	0.200	0.90
104	silica gel	0.130	0.90
255	Small Cavities < 2 x 2 mm ²	0.031	0.90
EQUIMAT: Equivalent material			
Qv ISO15099			
Layer ISO15099			



name	θ [°C]	h [W/m ² K]
Exterior NFRC 100 (Blackbody)	-18.0	29.47



equivalent thermal transmittance (based on heat flow through boundary condition)

equivalent thermal transmittance $U_{eq} = 3.485 \text{ W/m}^2\text{K} = (Q_v / (\theta_i - \theta_o)) / w_{eq}$

$U_{eq} = 2.282 \text{ W/m}^2\text{K} = (Q_v / (\theta_i - \theta_o)) / w_{eq}$

thermal coupling coefficient $L_{ij} = 0.6150 \text{ W/mK} = \Phi / (\theta_i - \theta_o)$

$\Phi = 23.984 \text{ W/m}$

$\theta_i = 21.00 \text{ °C}$

$\theta_o = -18.00 \text{ °C}$

$Q_v = 13.454 \text{ W/mK}$

$w_{eq} = 0.0990 \text{ m}$ (distance no. 1)

$Q_v = 5.652 \text{ W/mK}$

$w_{eq} = 0.0635 \text{ m}$ (distance no. 2)

Produced by Bisco 13.0.00 beta2
www.physibel.be/en/products/bisco
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C.1 Gas mix according to EN ISO 673

[overview](#)

Cavity Emissivities

Emissivity of side 1	0.873	OK
Emissivity of side 2	0.03	Cancel

Double click to assign adjacent surface emissivity's

 Colours

Col.	Type	Subtype	Physical flow dir.	Geometrical flow dir.	Name	ϵ_1 / ϵ_2 [-/-]	λ [W/mK]	Standard
17	EQUIMAT	LAYER	HOR	Y	90%Argon 10%Air	0.87 / 0.03	0.022	EN673

'Single equivalent thermal conductivity method'

Glass Cavity Properties (EN 673)

Vacuum

Cavity inclination angle
(0° → upward heat flow,
90° → horizontal heat flow,
>90° → downward heat flow)
90

Gas mix:

10	% Air
90	% Argon
0	% Krypton
0	% Xenon
0	% SF6

OK Cancel

Double click to assign gas mix

 Colours

Col.	Type	Subtype	Physical flow dir.	Geometrical flow dir.	Name	ϵ_1 / ϵ_2 [-/-]	λ [W/mK]	Standard
17	TRANSMAT	LAYER	HOR	Y	90%Argon 10%Air		0.019	EN673

'Radiosity method'

C.2 Gas mix according to ISO 15099

[overview](#)

Cavity Emissivities

Emissivity of side 1	0.873	OK
Emissivity of side 2	0.03	Cancel

Double click to assign adjacent surface emissivity's

Colours

Col.	Type	Subtype	Physical flow dir.	Geometrical flow dir.	Name	c1 / c2 [-/-]	λ [W/mK]	ϵ [-]	Standard
17	EQUIMAT	LAYER	HOR	Y	90%Argon 10%Air	0.87 / 0.03	0.032		ISO15099

'Single equivalent thermal conductivity method'

Indicate a gas filling as a Subtype 'LAYER'

Glass Cavity Properties (ISO 15099)

<input type="checkbox"/> Vacuum	
Cavity inclination angle (0° → upward heat flow, 90° → horizontal heat flow, >90° → downward heat flow)	90
Glazing height (For inclination angle >= 60° and < 90°)	1 m
Gas mix:	
10 % Air	
90 % Argon	
0 % Krypton	
0 % Xenon	
0 % SF6	

Double click to assign gas filling

Colours

Col.	Type	Subtype	Physical flow dir.	Geometrical flow dir.	Name	c1 / c2 [-/-]	λ [W/mK]	ϵ [-]	Standard
17	TRANSMAT	LAYER	HOR	Y	90%Argon 10%Air		0.029		ISO15099

'Radiosity method'

C.3 Air cavities according to ISO 15099

[overview](#)

Cavity Emissivities

Emissivity of side 1: 0.873 OK
 Emissivity of side 2: 0.03 Cancel

Double click to assign adjacent surface emissivity's

Col.	Type	Subtype	Physical flow dir.	Geometrical flow dir.	Name	ϵ_1 / ϵ_2 [-/-]	λ [W/mK]	ϵ [-]	Standard
194	EQUIMAT	CAVITY	HOR	Y		0.90 / 0.90	0.118	0.90	EN10077

'Single equivalent thermal conductivity method'

Indicate frame cavity with Subtype 'CAVITY'

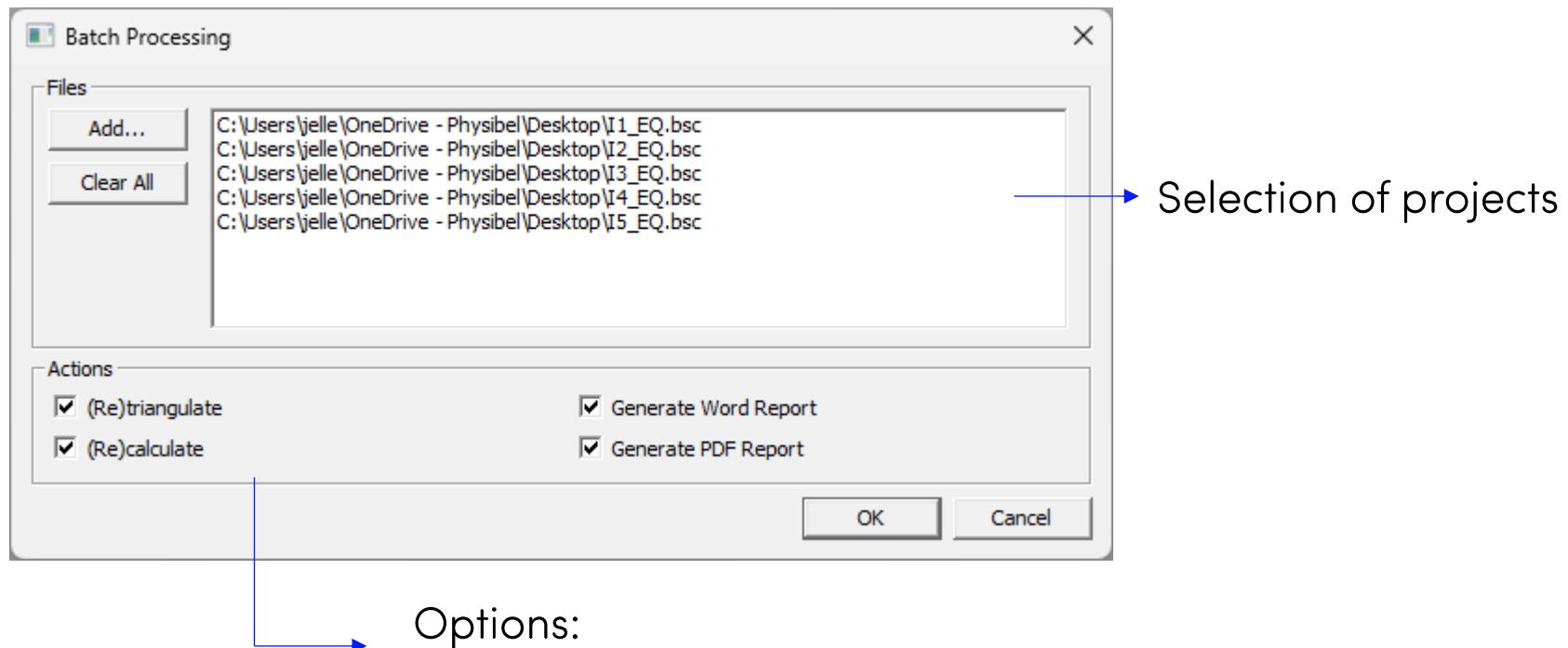
Col.	Type	Subtype	Physical flow dir.	Geometrical flow dir.	Name	ϵ_1 / ϵ_2 [-/-]	λ [W/mK]	ϵ [-]	Standard
194	TRANSMAT	CAVITY	HOR	X	air cavity ISO 15099		0.045		ISO15099

'Radiosity method'

D.1 New functions in Batch processing

[overview](#)

(Re)run multiple BISCO projects

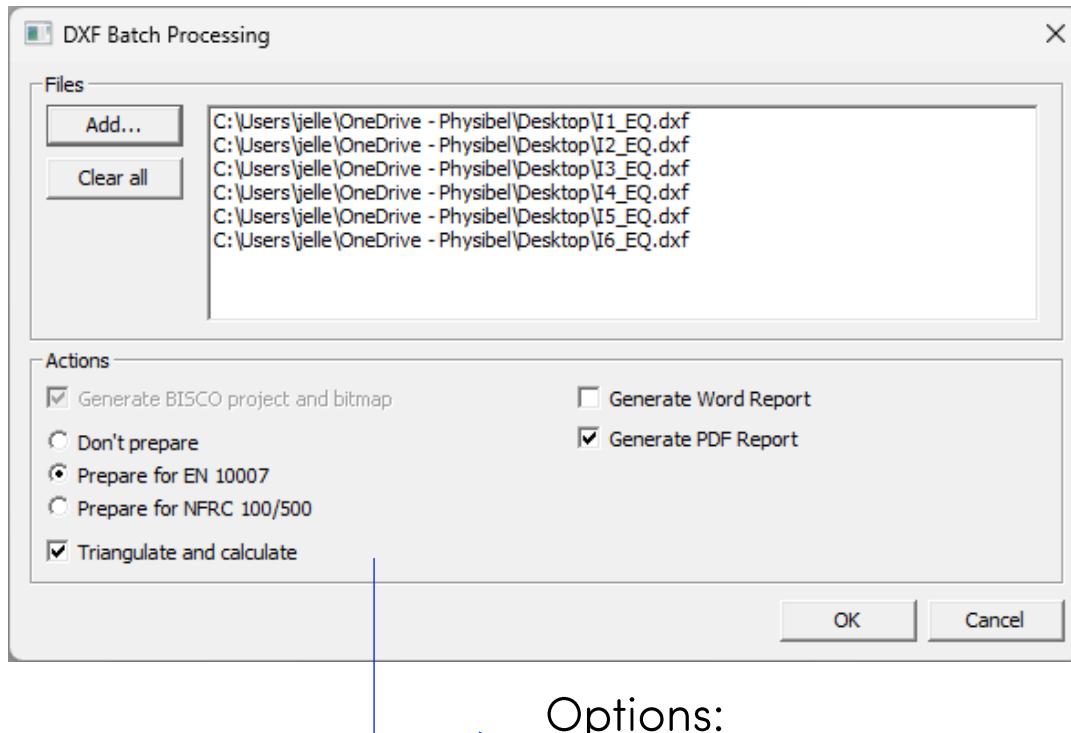


- Options:
- (Re)triangulate
 - (Re)calculate
 - Generate Word report
 - Generate PDF report

D.2 New functions in DXF Batch processing

[overview](#)

Multiple DXF files can be directly processed into a thermal report according to EN ISO 10077-2, NFRC or EN ISO 10211



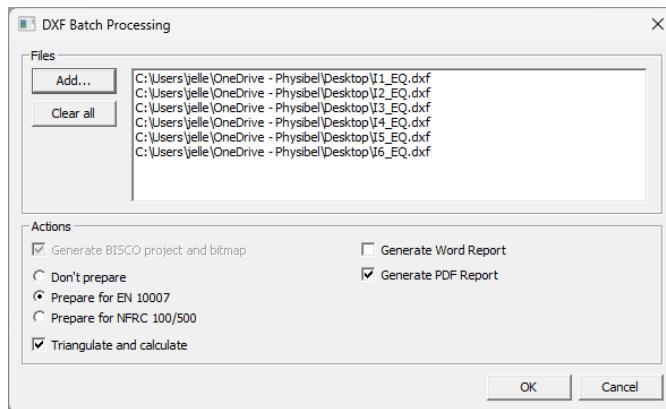
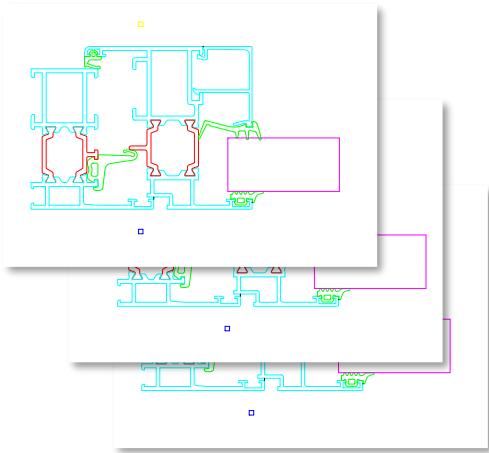
Options:

- Select standard, if preparation is desired (e.g. NFRC 100/500 or EN ISO 10077-2)
- Triangulate and calculate
- Generate Word report
- Generate PDF report

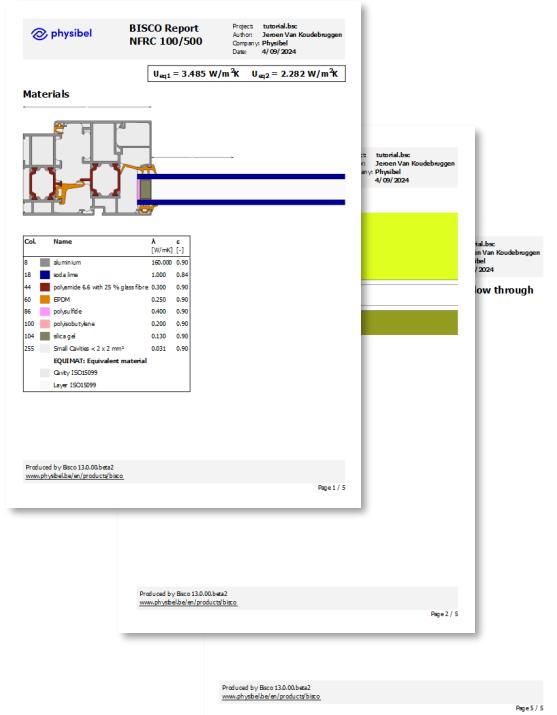
D.2 New functions in DXF Batch processing

[overview](#)

Multiple DXF files



Thermal reports (pdf)



E.1 Dialog box split in 'Transmittance' and 'Condensation'

[overview](#)

Derived Thermal Properties

Transmittances | **Condensation**

Linear thermal transmittance (psi)

Subscript:

1st flanking element

U value:
 Left bitmap border
 Right bitmap border
 Top bitmap border
 Bottom bitmap border
 Along distance no.:

Width along distance no.:
 Add width distance no.:

2nd flanking element

U value:
 Left bitmap border
 Right bitmap border
 Top bitmap border
 Bottom bitmap border
 Along distance no.:

Width along distance no.:
 Add width distance no.:

Equivalent thermal transmittance (U) - based on flanking elements with 1D U values

Subscript: F

Element width along dist. Add width distance no.:

1st flanking element

U value:
 Left bitmap border
 Right bitmap border
 Top bitmap border
 Bottom bitmap border
 Along distance no.:

Width along distance no.:

2nd flanking element

U value:
 Left bitmap border
 Right bitmap border
 Top bitmap border
 Bottom bitmap border
 Along distance no.:

Width along distance no.:

Equivalent thermal transmittance (U) - based on incoming heat flow from boundary condition

Element 1	<input type="checkbox"/> Element 2
Subscript: <input type="text" value="eq1"/>	Subscript: <input type="text" value="eq2"/>
Width along distance no.: <input type="text" value="1"/>	Width along distance no.: <input type="text" value="2"/>
Heat flow BC colour no.: <input type="text" value="174"/>	Heat flow BC colour no.: <input type="text" value="174"/>
<input type="checkbox"/> Add BC colour no.: <input type="text" value="182"/>	<input type="checkbox"/> Add BC colour no.: <input type="text" value="182"/>

OK | **Cancel**

Derived Thermal Properties

Transmittances | **Condensation**

Temperature factor or Condensation Index

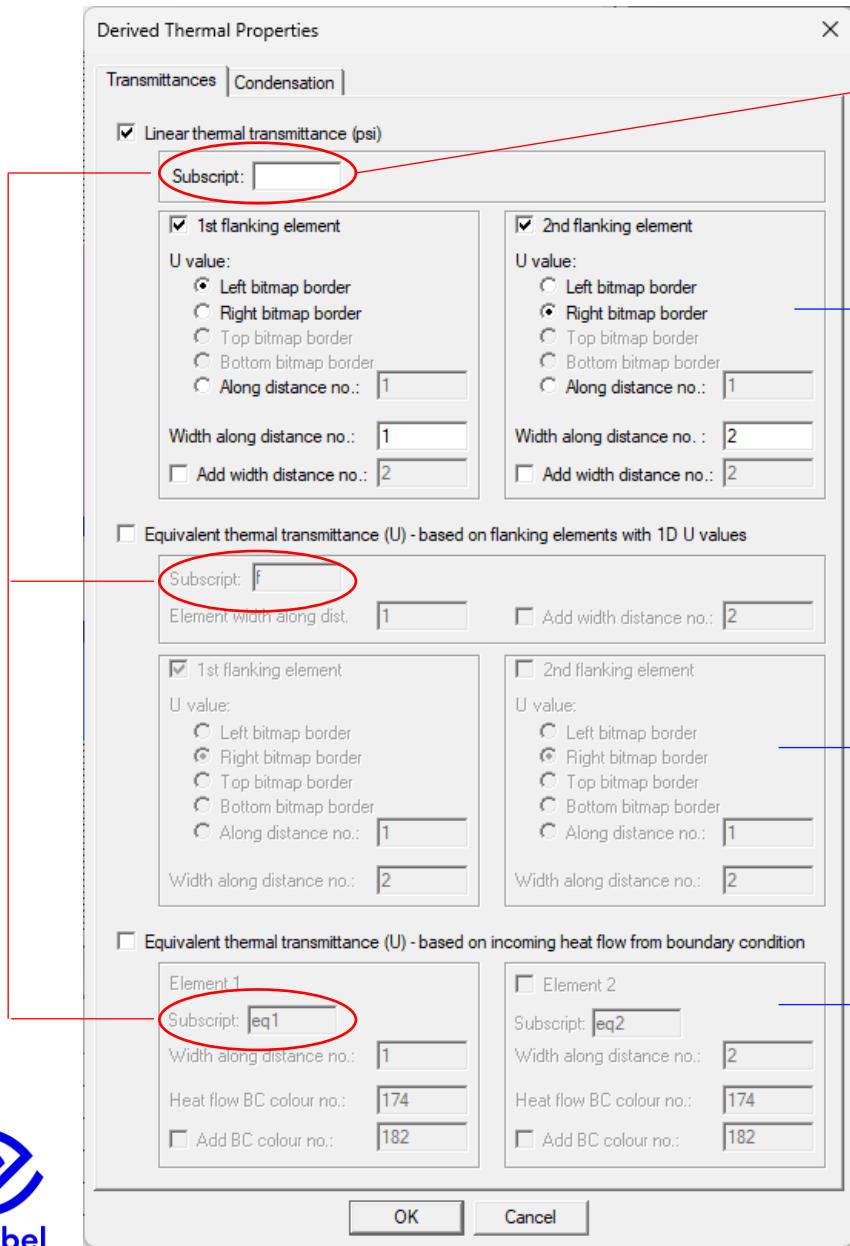
Preferred nomenclature: Temperature factor f (EN ISO 10211)
 Condensation Index CI (NFRIC 500)

Internal surface relative humidity

Inside zone RH: %
 Surface RH = 100 % (surface condensation)
 Surface RH >= %

OK | **Cancel**

E.2 Derived Thermal Properties extended

[overview](#)


Adjustable subscript
(e.g. Ψ_{tj} , U_{tj} , U_{eg} , U_f , ...)

Ψ : linear thermal transmittance

U : equivalent thermal transmittance
based on flanking elements with 1D
 U -value
(e.g. EN ISO 10077-2, EN ISO 12631)

U : equivalent thermal transmittance
based on incoming heat flow from
boundary condition
(e.g. NFRC 100)

F.1 Command line program execution

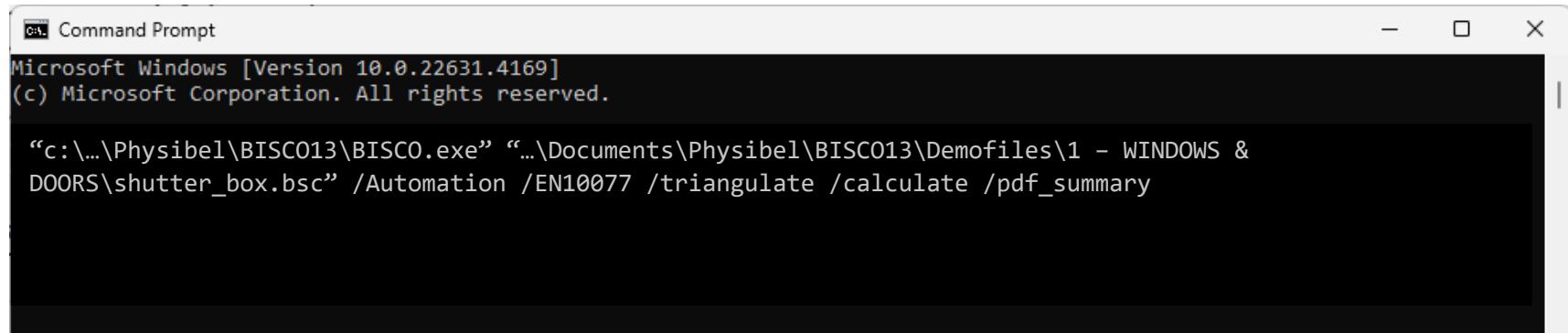
[overview](#)

New options in running BISCO via command line

BISCO can be run from the command line prompt with a data file path (including directory and file extension .bsc) as parameter.

The switch “/Automation” can be added to the command line prompt determining which actions need to be taken after opening the .bsc data file, analogous to the choices offered in the Batch Processing dialog box (D.7):

- Either “/EN10077” or “/NFRC” for preparation for EN ISO 10077-2 or NFRC 100/500, respectively.
- “/triangulate” to force triangulation.
- “/calculate” for the thermal calculation.
- “/word”, “/pdf” and/or “/pdf_summary” for the different types of reports.



A screenshot of a Windows Command Prompt window titled "Command Prompt". The window shows the following text:
Microsoft Windows [Version 10.0.22631.4169]
(c) Microsoft Corporation. All rights reserved.

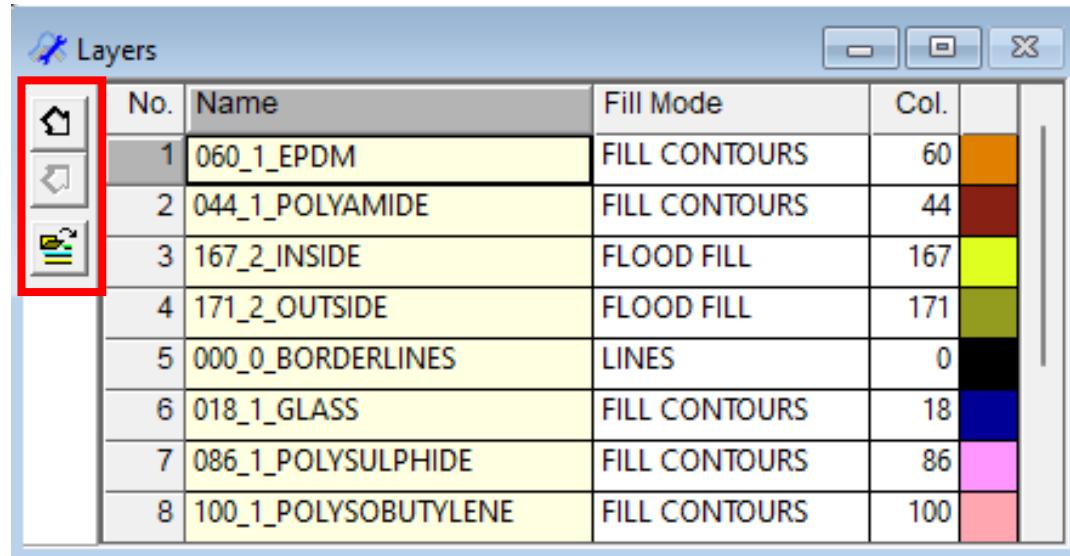
"c:\...\Physibel\BISC013\BISCO.exe" "...\\Documents\\Physibel\\BISC013\\Demofiles\\1 - WINDOWS & DOORS\\shutter_box.bsc" /Automation /EN10077 /triangulate /calculate /pdf_summary

Adding only the switch “/Automation”, prepares following: EN ISO 10077-2, triangulates, calculates and make MS WORD report files.

F.2 BiscoDxf: replaced icons for layer priorities

[overview](#)

Icons for layer priority and loading layer definitions replaced



G.1 BISCO Youtube Channel with tutorials

[overview](#)

Link to BISCO Youtube channel



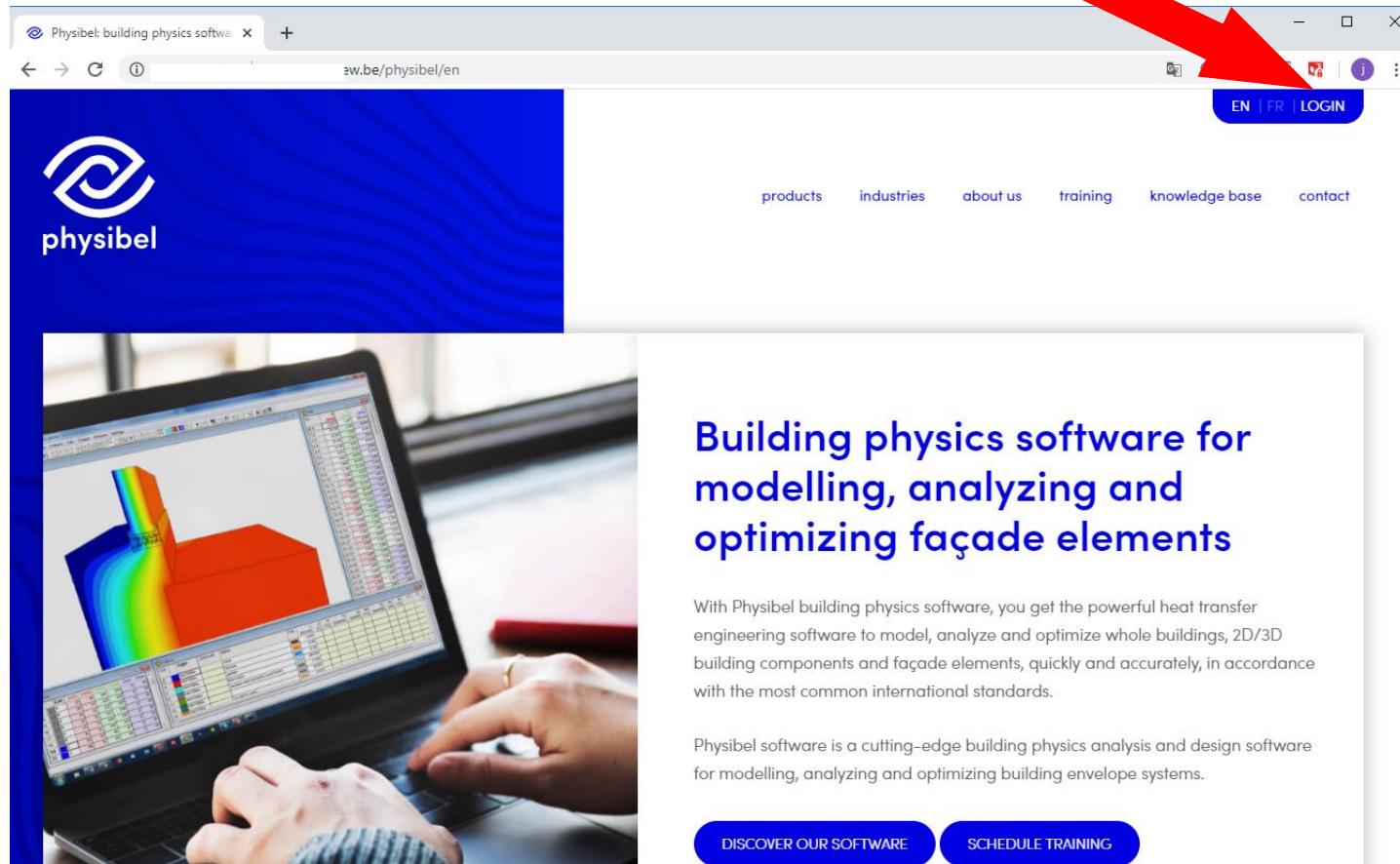
The screenshot shows the YouTube channel page for "Physibel BISCO Tutorials". The channel has 8 video's and 1.740 weergaven. The last update was on 10 ja... The channel description states: "BISCO is a part of Physibel software tools, where BISCO performs steady-state thermal simulation of 2D building components of any shape. BISCO can be used for all kind of 2D steady-state heat transfer problems, but it is optimized for automated use according to EN ISO 10077-2. This means thermal analysis of window and door frames, shutter boxes and curtain walls (EN ISO 12631). Further BISCO allows to model thermal bridges in line with EN ISO 10211 and EN ISO 6946, thermal transmittances of building components and elements (EN ISO 6946), heat transfer via the ground (ISO 13370), heat transfer in masonry and masonry products (EN ISO 1745,...). BISCO has a high work-efficiency due to the direct import of DXF files. The package has a minimal simulation time due to optimized finite element..."

- **Physibel BISCO Tutorials: Introduction**
PHYSIBEL • 447 weergaven • 9 maanden geleden
- **Physibel BISCO Tutorials: Basics**
PHYSIBEL • 416 weergaven • 9 maanden geleden
- **Physibel BISCO Tutorials : Importing Dxf to BISCO**
PHYSIBEL • 411 weergaven • 9 maanden geleden
- **Physibel BISCO Tutorials : Colour Types Part-1**
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- **Physibel BISCO Tutorials: Graphic and Text Output**
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G.2 Knowledge Base: new tutorials and documentation

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G.2 Knowledge Base: new tutorials and documentation

[overview](#)

The screenshot shows a web browser window for the 'physibel Portal'. The title bar says 'Knowledge | Physibel portal'. The address bar shows 'physibel-portal/public/knowledge'. The page header includes the 'physibel' logo, navigation links for 'Licences', 'Users', 'Knowledge base' (which is highlighted in blue), 'Support', 'Website', and a user profile for 'jelle'. A red arrow points from the text 'Search tool' to the search input field containing 'floor'. Another red box highlights the dropdown menu next to the search input, which shows 'All software'. A red arrow points from the text 'Access project files, document and/or video' to the 'Download Pdf' and 'Watch video' buttons, which are also enclosed in a red box. The main content area displays two projects: 'Bisco validation EN ISO 11855-2 floor heating' and 'Thermal analysis of a floor heating system'. Each project has a thumbnail image, a title, a brief description, and a color scale.

Search tool →

All software

Bisco validation EN ISO 11855-2 floor heating

EN 15377 Annex D of the standard EN ISO 11855-2:2015 contains a test example that must be used to verify a steady state numerical calculation program. The program BISCO is used to simulate the test example.

keywords: BISCO, EN ISO 11855-2, floor heating, validation, standard

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Access project files, document and/or video

Thermal analysis of a floor heating system

For a floor heating system, the water temperature course and the floor temperature distribution are simulated using the transient programs BISTRA and VOLTRA, both in steady and transient state.

Keywords: BISTRA, VOLTRA, floor heating, cooling, inertia



BISCO v13 New program performances



www.physibel.be/bisco

downloadable program demo version