

English

Technical data

Interlayers

Classification according to EN16612:2019
and EN16613:2019 - Simplified method

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kuraray

Trosifol®

SentryGlas®

European codes

Introduction

This document provides the technical data for Trosifol® PVB and SentryGlas® ionoplast interlayers which is required in the two following European codes:

EUROPEAN CODES

- EN 16612:2019 – Glass in building – Determination of the lateral load resistance of glass panes by calculation
- EN 16613:2019 – Glass in building – Laminated glass and laminated safety glass – Determination of interlayer mechanical properties

The technical data is provided for the following Trosifol® interlayers:

- Trosifol® Clear / Trosifol® Ultra Clear
- Trosifol® Extra Stiff
- Trosifol® SC Monolayer
- Trosifol® SC Multilayer
- SentryGlas®
- SentryGlas® Xtra™

The data provided in the following tables allows the calculation of laminated glass stress and deformation according to the simplified method as described in Annex D of EN16612:2019

This method allows to calculate the equivalent thickness of a specific laminated glass make-up using a factor ω which characterizes the coupling characteristics of the interlayer. This factor can vary between 0 (no coupling) and 1 (full coupling).

Since the coupling function of the interlayer is time and temperature dependent, the method also defines 12 load cases for which the ω factors are shown in the attached tables.



• The Eiffel Tower, Paris, France

The ω factor is derived from the Young Modulus of the interlayer. Kuraray has calculated and published the Young modulus for all its interlayers and they are available on the website in our **Elastic Properties Data Sheet**.

The Young modulus is derived from the Shear modulus which is measured using test method EN ISO 6721. Kuraray has elected to calculate and publish the Young Relaxation Modulus $E(t)$ since load tests on laminated glass have shown excellent correlation between calculation with that modulus and the measurements. More information can be found in the following paper: **Determination of Interlayer Mechanical Properties for Use in Laminated Glass Design**

The simplified method also groups different interlayers in stiffness families 0,1 and 2. The tables show in which families the Trosifol® interlayers are classified.

Beside the simplified method, EN 16612:2019 also allows the use of the mechanical properties of the interlayer ($E(t)$, $G(t)$) of a specific interlayer in numerical simulation tools (FEA). In that case the tables with the mechanical properties of the Trosifol® interlayers on our website should be used.

Kuraray also offers a number of tools for the calculation of laminated glass properties on the website. They can be found on our website in **the architect's and engineer's corner**.

Young modulus E(t)

Trosifol® Extra Stiff, SentryGlas® and SentryGlas® Xtra™

Load case according to EN16612:2019	Load duration	Max. temperature		Trosifol® Extra Stiff	Trosifol® Clear / UltraClear	SentryGlas® SG 5000	SentryGlas® Xtra™
		[°C]	[°F]	E(t) [MPa]	E(t) [MPa]	E(t) [MPa]	E(t) [MPa]
Wind gust load – Mediterranean areas	3 sec	35	95	17	1.5	302	208
Wind gust load – other regions	3 sec	20	68	690	20	612	459
Wind Storm load – Mediterranean areas	10 min	35	95	2.3	0.95	141	65
Wind Storm load – other regions	10 min	20	68	140	1.9	525	340
Balustrade loads – no crowds	30 sec	30	86	29	1.5	349	250
Balustrade loads – crowds	5 min	30	86	5.8	1.2	243	163
Maintenance loads	30 min	40	104	1.8	0.58	34	20
Snow load – external canopies, roofs of unheated buildings	3 weeks	0	32	13	4.0	639	222
Snow load – roofs of heated buildings	5 days	20	68	3.1	0.9	380	87
Climatic loads – IGU summer	6 hours	40	104	1.4	0.2	17	7.8
Climatic loads – IGU winter	12 hours	20	68	7.7	1.2	438	148
Permanent	50 years	60	140	-	-	2.2	0.2

TAB1 • E(t): Young relaxation modulus

E(t) was calculated according $E(t) = 2 \times G(t) \times (1+\nu)$ for isotropic materials with: $\nu = 0.47$ (Trosifol® Extra Stiff), $\nu = 0.48$ (SentryGlas®, SentryGlas® Xtra™)
The Poisson ratio ν was measured in accordance to EN ISO 527 (23°C, 30% r. H.).
Data source: https://www.trosifol.com/fileadmin/user_upload/TROSIFOL/support/downloads/technical_information/Elastic_Properties_Data_Sheet.pdf

Stiffness family and ω (omega) coupling factor

Trosifol® Extra Stiff, SentryGlas® and SentryGlas® Xtra™

Load case according to EN16612:2019	Load duration	Max. temperature		Trosifol® Extra Stiff		Trosifol® Clear / UltraClear		SentryGlas® SG 5000		SentryGlas® Xtra™	
		[°C]	[°F]	ω	Stiff-ness family	ω	Stiff-ness family	ω	Stiff-ness family	ω	Stiff-ness family
Wind gust load – Mediterranean areas	3 sec	35	95	0.1	1	0.1	1	0.5	2	0.5	2
Wind gust load – other regions	3 sec	20	68	0.7	2	0.3	1	0.7	2	0.7	2
Wind Storm load – Mediterranean areas	10 min	35	95	0.1	2	0	1 & 0	0.1	2	0.1	2
Wind Storm load – other regions	10 min	20	68	0.5	2	0.1	1	0.5	2	0.5	2
Balustrade loads – no crowds	30 sec	30	86	0.5	2	0.1	1	0.5	2	0.5	2
Balustrade loads – crowds	5 min	30	86	0.1	1	0.1	1	0.3	2	0.3	2
Maintenance loads	30 min	40	104	0.1	2	0	0 & 1	0.1	2	0.1	2
Snow load – external canopies, roofs of unheated buildings	3 weeks	0	32	0.3	2	0	1	0.3	2	0.3	2
Snow load – roofs of heated buildings	5 days	20	68	0.1	2	0	0 & 1	0.1	2	0.1	2
Climatic loads – IGU summer	6 hours	40	104	0.1	2	0	0 & 1	0.1	2	0.1	2
Climatic loads – IGU winter	12 hours	20	68	0.1	1	0.1	1	0.3	2	0.3	2
Permanent	50 years	60	140	0	0 & 1 & 2	0	0 & 1 & 2	0	0 & 1 & 2	0	0 & 1 & 2

TAB2 • ω : Omega coupling value according to table D.3 of Annex D of EN16612:2019
Stiffness family according to tables in Paragraph 7.3 of EN16613:2019

Young modulus E(t)

Trosifol® Clear / UltraClear, Trosifol® SC Monolayer, Trosifol® SC Multilayer

Load case according to EN16612:2019	Load duration	Max. temperature		Trosifol® Clear / UltraClear		Trosifol® SC Monolayer		Trosifol® SC Multilayer	
		[°C]	[°F]	E(t) (MPa)	Stiffness family	E(t) (MPa)	Stiffness family	E(t) (MPa)	Stiffness family
Wind gust load – Mediterranean areas	3 sec	35	95	1.5	1	1.1	1	(*)	1
Wind gust load – other regions	3 sec	20	68	20	1	2.0	0	(*)	0
Wind Storm load – Mediterranean areas	10 min	35	95	0.95	1 & 0	0.52	1 & 0	(*)	1 & 0
Wind Storm load – other regions	10 min	20	68	1.9	1	1.1	1	(*)	1
Balustrade loads – no crowds	30 sec	30	86	1.5	1	1.0	1	(*)	1
Balustrade loads – crowds	5 min	30	86	1.2	1	0.78	0	(*)	0
Maintenance loads	30 min	40	104	0.58	0 & 1	0.26	0 & 1	(*)	0 & 1
Snow load – external canopies, roofs of unheated buildings	3 weeks	0	32	4.0	1	1.2	1	(*)	1
Snow load – roofs of heated buildings	5 days	20	68	0.98	0 & 1	0.32	0 & 1	(*)	0 & 1
Climatic loads – IGU summer	6 hours	40	104	0.27	0 & 1	0.09	0 & 1	(*)	0 & 1
Climatic loads – IGU winter	12 hours	20	68	1.2	1	0.59	0	(*)	0
Permanent	50 years	60	140	-	0 & 1 & 2	-	0 & 1 & 2	(*)	0 & 1 & 2

TAB 3 • E(t): Young relaxation modulus

E(t) was calculated according $E(t) = 2 \times G(t) \times (1 + \nu)$ for isotropic materials with: $\nu = 0.49$ (Trosifol® Clear, Trosifol® SC Monolayer). The Poisson ratio ν was measured in accordance to EN ISO 527 (23°C, 30% r. H.).

Data source: https://www.trosifol.com/fileadmin/user_upload/TROSIFOL/support/downloads/technical_information/Elastic_Properties_Data_Sheet.pdf

(*) No E(t) data for Trosifol® SC Multilayer due to anisotropic material behavior.

Stiffness family and ω (omega) coupling factor

Trosifol® Clear / UltraClear, Trosifol® SC Monolayer, Trosifol® SC Multilayer

EN 16613 load case	Load duration	Max. temperature		Trosifol® Clear / UltraClear		Trosifol® SC Monolayer		Trosifol® SC Multilayer	
		[°C]	[°F]	ω	Stiffness family	ω	Stiffness family	ω	Stiffness family
Wind gust load – Mediterranean areas	3 sec	35	95	0.1	1	0.1	1	0.1	1
Wind gust load – other regions	3 sec	20	68	0.3	1	0	0	0	0
Wind Storm load – Mediterranean areas	10 min	35	95	0	1 & 0	0	1 & 0	0	1 & 0
Wind Storm load – other regions	10 min	20	68	0.1	1	0	1	0	1
Balustrade loads – no crowds	30 sec	30	86	0.1	1	0.1	1	0.1	1
Balustrade loads – crowds	5 min	30	86	0.1	1	0	0	0	0
Maintenance loads	30 min	40	104	0	0 & 1	0	0 & 1	0	0 & 1
Snow load – external canopies, roofs of unheated buildings	3 weeks	0	32	0	1	0.1	1	0.1	1
Snow load – roofs of heated buildings	5 days	20	68	0	0 & 1	0	0 & 1	0	0 & 1
Climatic loads – IGU summer	6 hours	40	104	0	0 & 1	0	0 & 1	0	0 & 1
Climatic loads – IGU winter	12 hours	20	68	0.1	1	0	0	0	0
Permanent	50 years	60	140	0	0 & 1 & 2	0	0 & 1 & 2	0	0 & 1 & 2

TAB 4 • ω : Omega coupling value according to table D.3 of Annex D of EN16612:2019

Stiffness family according to tables Paragraph 7.3 of EN16613:2019

Stiffness family for Trosifol® SC Multilayers has been determined through the following steps:

1. Converting the boundary Young modulus values(EL) as specified in the tables of paragraph 7.3 of EN 16613:2019, to G boundary values using the formula $E=3G$.
2. Comparing the published G(t) values of the Trosifol® SC Multilayer to the G boundary values for each stiffness family.

Contact



FOR FURTHER INFORMATION

on products from Kuraray, please visit www.kuraray.com.

You can find further information on our Trosifol® and SentryGlas® products at www.trosifol.com.

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