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Including 14 pages

TEST REPORT N° 2024B COU 48790

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Mons, December 09th, 2024

REQUESTED BY : **AGC Glass Europe - Technovation Centre**
Rue Louis Blériot, 12
B-6041 Gosselies
Belgium

REFERENCE OF THE REQUEST : Order 4500616251

CONCERNED MANUFACTURER: **AGC GLASS EUROPE**
4 avenue Jean Monnet
1348 LOUVAIN-LA-NEUVE
BELGIUM

NUMBER OF SAMPLES AND IDENTIFICATION : **Glass Configurator (Matrix 7.0.0-RC1)**

PURPOSE OF THE REQUESTED : **EN 17871 : 2024 - Glass in building - Spectrophotometric characteristics of glass products - Validation procedure for calculation tool**

SAMPLES RECEIVED ON : NA

DATE OF THE TESTS : NA

COMMENTS : ** Information given by the customer



Notified body (Id.N°1174)
according to Regulation (EU) No 305/2011 - Construction products

Introduction

EN 410 is both a measurement standard and a calculation standard, EN 673 is a calculation method based on input of the emissivity according to EN 12898.

The Annex ZAs of the harmonized standards for glass assign the initial determination of both radiation and thermal properties as tasks for a notified laboratory (AVCP system 3).

Under AVCP system 3, a notified laboratory has to perform a type test (TT) to determine the spectrophotometric and thermal characteristics of the glass product. However, when some characteristics have to be calculated (e.g. U value, g value, other glass thicknesses, other glass substrates...) according to the relevant standards, the manufacturer requires its calculation tool to be validated by a notified laboratory.

The present report gathers the validation procedure and results for the following characteristics :

EN 410:2011 Glass in building - Determination of luminous and solar characteristics of glazing

- light transmittance (t_v)
- light reflectance - both sides (r_v , r'_v)
- solar direct transmittance (t_e)
- solar direct reflectance – both sides (r_e , r'_e)
- total solar energy transmittance (solar factor or g value) (g)

EN 673:2011 Glass in building -Determination of thermal transmittance (U value) - Calculation method

- thermal transmittance (U value)

Validation procedure EN 17871 : 2024

The applicant shall provide the validator with access to the calculation program. Results obtained with the calculation tool to be validated shall be compared by the validator to results obtained with the reference calculation program of the validator for defined reference products.

The reference data for tasks 1 to 13 in Table 2 hereafter shall be agreed between the validator and the applicant.

Calculated products shall represent the calculation tool capability, and include float glass, body-tinted (absorbing) glass, coated low-e glass, coated solar control glass and laminated coated glass. The validation shall include a small change in thickness (e.g. from 4 to 6mm).

Calculation was realised on Glass Configurator (Matrix 7.0.0-RC1) program to obtain the precision required by the **EN 17871 2024** (one more digit than results according to EN 410 and EN 673).

Difference criteria :

The calculation result difference shall not exceed:

Parameter	Maximum difference
tv, rv, r'v, te, re, r'e	±0.002
g	±0.002
U value	±0.01 W/m ² K

Programmes used for validation

AGC programme: “Glass Configurator (Matrix 7.0.0-RC1)”

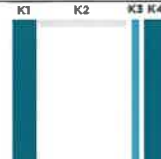
INISMa programmes :

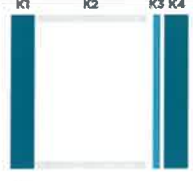
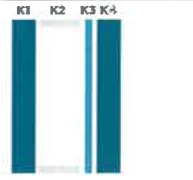
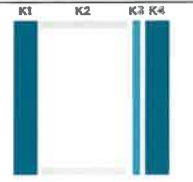
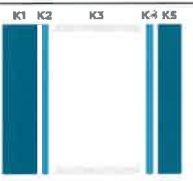
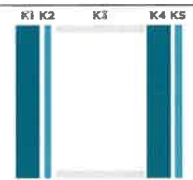
Table 1 : INISMA programmes for calculation

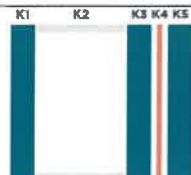
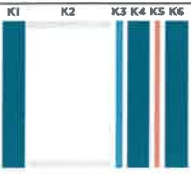
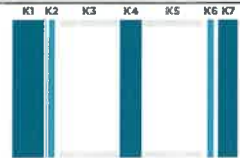
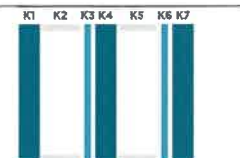
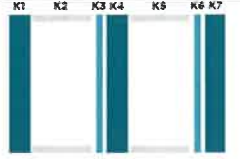
	Name of the programme	Update
Calculation of properties according to EN 410:2011 (single and double glazing)	EN410-2011 Double corrigé.xls	22/11/2013
Calculation of properties according to EN 410:2011 (Triple Glazing)	T-R triple.xls	16/09/2013
Calculation of U value according to EN 673:2011 (single, laminated and double glazing)	Coef (U) 2010.xls Coef (U) 2010 avec autres mélanges de gaz.xls	2010 08/10/2018
Calculation of U value according to EN 673:2011 (Triple Glazing)	Coef U triple avec face 6 2011.xls	22/08/2014
Calculation of U value according to EN 673:2011 (Laminated glass)	calcul U verre feuilleté Coef (U) 2010 DV verre feuilleté Coef U triple verre feuilleté avec face 6 2011	28/06/2021 28/06/2021 28/06/2021
Change of thickness	calcul-prop et trans des-verres sans couche.xls	11/2011
Change of substrate	Nouveaux verres et couches.xls couches-calcul-prop.xls couches-calcul-spectres.xls	11/2011

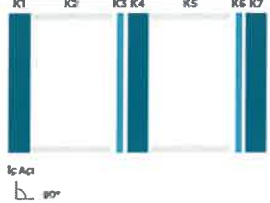
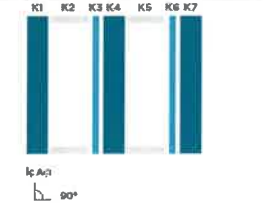
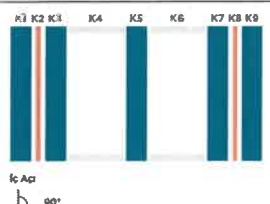
Choice of the reference products and data-Table 2

Task	Task description		
Single glazing			
1	Check calculation for uncoated	4 mm uncoated basic soda lime silicate float glass	 İç Açı 90° Cam : 4 mm Şişecam Renksiz Düzcam
2	Change thickness of uncoated glass	4 mm uncoated glass to 6 mm uncoated glass	 İç Açı 90° Cam : 6 mm Şişecam Renksiz Düzcam
3a	Check calculation for coated float glass	4mm coated glass	 İç Açı 90° Cam : 4 mm Şişecam Low-E Cam (#2)
3b	Change thickness of coated glass based on the same substrate	4 mm coated glass to 6 mm coated glass	 İç Açı 90° Cam : 6 mm Şişecam Low-E Cam (#2)

4	Change substrate of coated glass from clear float to tinted clear float glass	4 mm coated clear float to 4 mm coated green tinted glass	 <i>I_c Ap</i>  90° K1: Renkli Düzcam Yes/ K2: Low-E
5	Check calculation for uncoated laminated glass	44.2 laminated glass construction 4 mm uncoated clear float glass / 0.76 mm clear PVB interlayer / 4 mm uncoated clear float glass	 <i>I_c Ap</i>  90° Cam : (4+0,76+4) mm Şişecam Lamine Cam
Double glazing			
6	Check double glazing with solar control outer pane	6 mm solar control coated #2 outer pane and 4 mm uncoated inner pane	 <i>I_c Ap</i>  90° Dış Cam : 6 mm Şişecam Solar Low-E Cam (#2) Ara Boşluk : 16 mm %80 Argon İç Cam : 4 mm Şişecam Renksiz Düzcam
7	Check double glazing with low-e inner pane	4 mm uncoated outer pane and 4 mm low-e coated #3 inner pane with:	
a		8 mm 90% argon, 10% air	 <i>I_c Ap</i>  90° Dış Cam : 4 mm Şişecam Renksiz Düzcam Ara Boşluk : 8 mm %90 Argon İç Cam : 4 mm Şişecam Low-E Cam (K3)
b		16 mm 90% argon, 10% air	 <i>I_c Ap</i>  90° Dış Cam : 4 mm Şişecam Renksiz Düzcam Ara Boşluk : 16 mm %90 Argon İç Cam : 4 mm Şişecam Low-E Cam (K3)

c		20 mm 90% argon, 10% air	 İç Açı : 90° Dış Cam : 4 mm Şişecam Renksiz Düzcam Ara Boşluk : 20 mm %90 Argon İç Cam : 4 mm Şişecam Low-E Cam (#3)
d		8 mm 90% krypton, 10% air	 İç Açı : 90° Dış Cam : 4 mm Şişecam Renksiz Düzcam Ara Boşluk : 8 mm %90 Argon İç Cam : 4 mm Şişecam Low-E Cam (#3)
e		16 mm 45% argon, 45% krypton, 10% air	 İç Açı : 90° Dış Cam : 4 mm Şişecam Renksiz Düzcam Ara Boşluk : 16 mm %45 Argon İç Cam : 4 mm Şişecam Low-E Cam (#3)
8	Check double glazing with both panes coated (surfaces 2 and 3)	6 mm solar control coated #2 outer pane and 4 mm low-e coated #3 inner pane	 İç Açı : 90° Dış Cam : 6 mm Şişecam Solar Low-E Cam (#2) Ara Boşluk : 16 mm %90 Argon İç Cam : 4 mm Şişecam Low-E Cam (#3)
9	Check double glazing with two coatings, one of which is on surface 4	4 mm coated #2 outer pane and monolithic low-e coated #4 inner pane	 İç Açı : 90° Dış Cam : 4 mm Şişecam Low-E Cam (#2) Ara Boşluk : 16 mm %90 Argon İç Cam : 4 mm Şişecam Low-E Cam (#4)
10	Check double glazing with coated laminated inner pane (coating facing the cavity)	4 mm uncoated outer pane and 8.8 mm (44.2) coated laminated glass #3 inner pane	

a		without coating present	 İç Açı : 90° Diş Cam : 4 mm Şişecam Renksiz Düzcam Ara Boşluk : 16 mm %90 Argon İç Cam : (4+0,76+4) mm Şişecam Lamine Cam
b		with coating present	 İç Açı : 90° Diş Cam : 4 mm Şişecam Renksiz Düzcam Ara Boşluk : 16 mm %90 Argon İç Cam : (4+0,76+4) mm Şişecam Lamine Low-E Cam (R2)
Triple glazing			
11	Check triple glazing with solar control outer pane and low-e inner pane	6 mm solar control coated #2 outer pane, 4 mm uncoated glass mid-pane and 4 mm low-e coated #5 inner pane	 İç Açı : 90° Diş Cam : 6 mm Şişecam Solar Low-E Cami (R2) Ara Boşluk : 12 mm %90 Argon Orta Cam : 4 mm Şişecam Renksiz Düzcam Ara Boşluk : 12 mm %90 Argon İç Cam : 4 mm Şişecam Low-E Cami (R5)
12	Check triple glazing with two panes of low-e glass	4 mm uncoated glass outer pane, 4 mm low e coated #3 mid-pane and 4 mm low-e coated #5 inner pane with:	
a		8 mm 90% argon, 10% air	 İç Açı : 90° Diş Cam : 4 mm Şişecam Renksiz Düzcam Ara Boşluk : 8 mm %90 Argon Orta Cam : 4 mm Şişecam Low-E Cami (R3) Ara Boşluk : 8 mm %90 Argon İç Cam : 4 mm Şişecam Low-E Cami (R5)
b		12 mm 90% argon, 10% air	 İç Açı : 90° Diş Cam : 4 mm Şişecam Renksiz Düzcam Ara Boşluk : 12 mm %90 Argon Orta Cam : 4 mm Şişecam Low-E Cami (R3) Ara Boşluk : 12 mm %90 Argon İç Cam : 4 mm Şişecam Low-E Cami (R5)

c		16 mm 90% argon, 10% air	 Dis Cam : 4 mm Silecam Renkaiz Düzcam Ara Boşluk : 16 mm %90 Argon Orta Cam : 4 mm Silecam Low-E Cam (K3) Ara Boşluk : 16 mm %90 Argon İç Cam : 4 mm Silecam Low-E Cam (K5)
d		8 mm 90% krypton, 10% air	 Dis Cam : 4 mm Silecam Renkaiz Düzcam Ara Boşluk : 8 mm %90 Argon Orta Cam : 4 mm Silecam Low-E Cam (K3) Ara Boşluk : 8 mm %90 Argon İç Cam : 4 mm Silecam Low-E Cam (K5)
13	Check with triple glazing with two panes of uncoated laminated glass	8.8 mm (44.2) uncoated laminated glass outer pane, 4 mm uncoated glass midpane and 8.8 mm (44.2) uncoated laminated glass inner pane	 Dis Cam : (4+0,75+4) mm Silecam Lamine Cam Ara Boşluk : 12 mm %90 Argon Orta Cam : 4 mm Silecam Renkaiz Düzcam Ara Boşluk : 12 mm %90 Argon İç Cam : (4+0,75+4) mm Silecam Lamine Cam

Unless otherwise stated in the table, the U value for double glazing shall be calculated on the basis of 16 mm cavity width and a gas mix of 90% argon and 10% air.

Unless otherwise stated in the table, the U value for triple glazing shall be calculated on the basis of 12 mm cavity width and a gas mix of 90% argon and 10% air.

The reference spectral data used for the purpose of validation were found on the Glass for Europe website at: <https://glassforeurope.com/spectral-data/>.

Results

Task number	Calculation tool	Light transmittance	Light reflectance outside	Light reflectance inside	Solar transmittance	Solar reflectance outside	Solar reflectance inside	Solar factor	Ug value
Single			glass	coated		glass	coated		
1	INISMa	0.9060	0.0820	0.0820	0.8665	0.0775	0.0775	0.8796	5.751
	AGC	0.9060	0.0820	0.0820	0.8665	0.0778	0.0778	0.8796	5.751
	Difference	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
2	INISMa	0.9000	0.0820	0.0820	0.8430	0.0775	0.0775	0.8617	5.686
	AGC	0.9006	0.0815	0.0815	0.8435	0.0761	0.0761	0.8625	5.686
	Difference	0.001	0.000	0.000	0.001	0.001	0.001	0.001	0.00
3a	INISMa	0.7640	0.1770	0.1422	0.4941	0.3778	0.4073	0.5107	3.195
	AGC	0.7639	0.1771	0.1422	0.4941	0.3778	0.4073	0.5107	3.193
	Difference	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
3b	INISMa	0.7588	0.1752	0.1418	0.4845	0.3537	0.4068	0.5055	3.173
	AGC	0.7593	0.1755	0.1419	0.4848	0.3541	0.4069	0.5056	3.173
	Difference	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
4	INISMa	0.5224	0.1069	0.1280	0.2597	0.0963	0.3982	0.3431	3.193
	AGC	0.5223	0.1072	0.1278	0.2596	0.0968	0.3981	0.3429	3.193
	Difference	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
5	INISMa	0.8810	0.0803	0.0803	0.7493	0.0702	0.0702	0.7914	5.511
	AGC	0.8810	0.0801	0.0801	0.7491	0.0709	0.0709	0.7915	5.511
	Difference	0.000	0.000	0.000	0.000	0.001	0.001	0.000	0.00

Task number	Calculation tool	Light transmittance	Light reflectance outside	Light reflectance inside	Solar transmittance	Solar reflectance outside	Solar reflectance inside	Solar factor	Ug value
Double									
6	INISMa	0.5016	0.2610	0.2267	0.3017	0.3981	0.4195	0.3254	1.154
	AGC	0.5017	0.2615	0.2267	0.3019	0.3983	0.4196	0.3252	1.154
	Difference	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
7a	INISMa	0.7002	0.1987	0.2246	0.4459	0.3858	0.4030	0.5184	1.646
	AGC	0.7003	0.2001	0.2255	0.4461	0.3871	0.4034	0.5184	1.646
	Difference	0.000	0.001	0.001	0.000	0.001	0.000	0.000	0.00
7b	INISMa	0.7002	0.1987	0.2246	0.4459	0.3858	0.4030	0.5227	1.082
	AGC	0.7003	0.2001	0.2255	0.4461	0.3871	0.4034	0.5228	1.081
	Difference	0.000	0.001	0.001	0.000	0.001	0.000	0.000	0.00
7c	INISMa	0.7002	0.1987	0.2246	0.4459	0.3858	0.4030	0.5225	1.107
	AGC	0.7003	0.2001	0.2255	0.4461	0.3871	0.4034	0.5226	1.107
	Difference	0.000	0.001	0.001	0.000	0.001	0.000	0.000	0.00
7d	INISMa	0.7002	0.1987	0.2246	0.4459	0.3858	0.4030	0.5227	1.150
	AGC	0.7003	0.2001	0.2255	0.4461	0.3871	0.4034	0.5223	1.150
	Difference	0.000	0.001	0.001	0.000	0.001	0.000	0.000	0.00
7e	INISMa	0.7002	0.1987	0.2246	0.4459	0.3858	0.4030	0.5225	1.132
	AGC	0.7003	0.2001	0.2255	0.4461	0.3871	0.4034	0.5224	1.132
	Difference	0.000	0.001	0.001	0.000	0.001	0.000	0.000	0.00
8	INISMa	0.4278	0.2801	0.2806	0.2315	0.4217	0.4774	0.2792	1.054
	AGC	0.4278	0.2801	0.2806	0.2315	0.4217	0.4774	0.2792	1.054
	Difference	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00

Task number	Calculation tool	Light transmittance	Light reflectance outside	Light reflectance inside	Solar transmittance	Solar reflectance outside	Solar reflectance inside	Solar factor	Ug value
9	INISMa	0.5989	0.2829	0.2271	0.3354	0.4596	0.4843	0.3863	0.940
	AGC	0.5988	0.2829	0.2272	0.3354	0.4596	0.4843	0.3863	0.940
	Difference	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
10a	INISMa	0.8034	0.1483	0.1450	0.6596	0.1315	0.1170	0.7636	2.573
	AGC	0.8035	0.1482	0.1442	0.6592	0.1321	0.1186	0.7651	2.572
	Difference	0.000	0.000	0.001	0.000	0.001	0.002	0.002	0.00
10b	INISMa	0.6804	0.1988	0.2144	0.4051	0.3852	0.3054	0.5184	1.073
	AGC	0.6807	0.1990	0.2157	0.4055	0.3858	0.3065	0.5184	1.073
	Difference	0.000	0.000	0.001	0.000	0.001	0.001	0.000	0.00
Triple									
11	INISMa	0.3963	0.2985	0.3134	0.2096	0.4263	0.4824	0.2603	0.717
	AGC	0.3963	0.2985	0.3134	0.2096	0.4263	0.4824	0.2603	0.716
	Difference	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
12a	INISMa	0.5530	0.2720	0.3129	0.3062	0.4497	0.4732	0.4035	0.962
	AGC	0.5529	0.2721	0.3129	0.3062	0.4497	0.4732	0.4041	0.960
	Difference	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.00
12b	INISMa	0.5530	0.2720	0.3129	0.3062	0.4497	0.4732	0.4055	0.697
	AGC	0.5529	0.2721	0.3129	0.3062	0.4497	0.4732	0.4062	0.695
	Difference	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.00
12c	INISMa	0.5530	0.2720	0.3129	0.3062	0.4497	0.4732	0.4067	0.552
	AGC	0.5529	0.2721	0.3129	0.3062	0.4497	0.4732	0.4074	0.551
	Difference	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.00

Task number	Calculation tool	Light transmittance	Light reflectance outside	Light reflectance inside	Solar transmittance	Solar reflectance outside	Solar reflectance inside	Solar factor	Ug value
12d	INISMa	0.5530	0.2720	0.3129	0.3062	0.4497	0.4732	0.4067	0.640
	AGC	0.5529	0.2721	0.3129	0.3062	0.4497	0.4732	0.4067	0.639
	Difference	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
13	INISMa	0.7160	0.1961	0.1961	0.5368	0.1538	0.1538	0.6278	1.713
	AGC	0.7165	0.1965	0.1965	0.5376	0.1540	0.1540	0.6282	1.713
	Difference	0.001	0.000	0.000	0.001	0.000	0.000	0.001	0.00

Conclusion

Task	Task description	Criteria : Transmission and reflection: ± 0.002 U value: $\pm 0.01 \text{ W/m}^2\text{K}$
Single glazing		
1	Check calculation for uncoated	Validated
2	Change thickness of uncoated glass	Validated
3a	Check calculation for coated float glass	Validated
3b	Change thickness of coated glass based on the same substrate	Validated
4	Change substrate of coated glass from clear float to tinted clear float glass	Validated
5	Check calculation for uncoated laminated glass	Validated
Double glazing		
6	Check double glazing with solar control outer pane	Validated
7	Check double glazing with low-e inner pane	Validated
8	Check double glazing with both panes coated (surfaces 2 and 3)	Validated
9	Check double glazing with two coatings, one of which is on surface 4	Validated
10	Check double glazing with coated laminated inner pane (coating facing the cavity)	Validated
Triple glazing		
11	Check triple glazing with solar control outer pane and low-e inner pane	Validated
12	Check triple glazing with two panes of low-e glass	Validated
13	Check with triple glazing with two panes of uncoated laminated glass	Validated

“Glass Configurator (Matrix 7.0.0-RC1)” complies with the requirements of EN 17871:2024 standard (criteria described in 4.6)

D. LIBERT
 Head of Department
 Glazing and Components - INISMa