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TEST REPORT : N° 2018B COU 35741

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Mons, October 18th, 2018

REQUESTED BY : **AGC GLASS EUROPE**
4 avenue Jean Monnet
1348 LOUVAIN-LA-NEUVE
BELGIUM

REFERENCE OF THE REQUEST : Validation of “Glass Configurator”

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

NUMBER OF SAMPLES AND IDENTIFICATION : Programme Glass Configurator -
See page 2

PURPOSE OF THE REQUEST : Spectrophotometric characteristics calculation
validation according to CEN TC 129 WI N783 -
13/07/2018

SAMPLES RECEIVED ON : Spectra received on 02/10/2018

TESTING DATE : Calculation started on 05/10/2018

REMARKS : * Test and/or sampling under accreditation



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 (tv)
- light reflectance - both sides (rv, r'v)
- solar direct transmittance (te)
- solar direct reflectance – both sides (re, 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 according to CEN TC 129 WI N783 - 13/07/2018

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 14 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, if relevant for the program, laminated coated glass (for both cases of the coating on an outermost surface and directly against an interlayer). The validation shall include a small change in thickness (e.g. from 6 to 8mm).

Calculation was realised on AGC Matrix v.4 program to obtain the precision required by the CEN TC 129 WI N783 (one more digit than results according to EN 410 and EN 673) and by the Glass Configurator interface on line (rounded value according EN 410 and EN 673 standards)

Criteria :

The calculation result difference shall not exceed:

Transmission and reflection: $\pm 0.5\%$

U value: $\pm 0.01 \text{ W/m}^2\text{K}$



Programmes used for validation

AGC programme: “Matrix v.4” and “Glass Configurator” (interface for calculation on line)

INISMa programmes:

Table 1 : INIS MA programmes for calculation

	Name of the programme	Date
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 properties according to EN 410:2011 (laminated glass)	EN410-annexeB - verre feuilleté.xlsx	28/09/2018
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
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

Calculated products

Table 2 : Reference data for calculation

Task number	Task description	Glazing general description	Composition of glass/glazing products	AGC number of spectrum used
Single glazing				
1	Check calculation for uncoated float glass	6mm uncoated basic sodalime silicate float glass	Clearlite 5.83 mm	Clearlite 5.83 mm 102164
2	Change thickness of uncoated glass	6mm uncoated glass to 4mm uncoated glass	Clearlite 5.83 mm to 4 mm	Clearlite 5.83 mm 102164
3	Change thickness of coated glass based on the same substrate	4mm coated glass to 6mm coated glass	Sunergy Azur 6mm	Sunergy azur on 8307 5.85 mm : 8333
4	Change substrate of coated glass from clear float to tinted	higher transmission glass to lower transmission glass - 4mm coated blue float to 4mm coated green tinted glass	Sunergy azur 5.85 mm to Sunergy green 6 mm	Sunergy azur on 8307 5.85 mm : 8333 Sunergy green 3.96 mm : 160
Double glazing				
5	Check double glazing with solar control outer pane	6mm solar control coated #2 outer pane and 6mm uncoated inner pane	Stopray vision 51 5.85 mm / 16 (90% Ar) / Clearlite 5.83 mm	Stopray vision 51 5.85 mm on 91091 : 98808 Clearlite 5.83 mm : 102164
6	Check double glazing with lowe inner pane	4mm uncoated outer pane and 4mm low-e coated #3 inner pane (calculate with 8mm Ar, 16mm Ar, 20mm Ar, 8mm Kr, 16mm 45% Ar, 45% Kr and 10% air)	Clearlite 5.83 mm / 16 (90% Ar) / Iplus advanced 1.0T on Clearlite 4 mm	Clearlite 5.83 mm : 102164 Iplus advanced 1.0T on 90839 : 91061

Task number	Task description		Composition of glass/glazing	AGC number of spectrum used
7	Check double glazing with both panes coated (surfaces 2 and 3)	6mm solar control coated #2 outer pane and 4mm low-e coated #3 inner pane	Stopray vision 51 on 91091 5.85 mm / 16 (90% Ar) / Iplus advanced 1.0T on Clearlite 4 mm	Stopray vision 51 5.85 mm on 91091 : 98808 Clearlite 5.83 mm : 102164 Iplus advanced 1.0T on 90839 : 91061
8	Check double glazing with two coatings, one of which is on surface 4	4mm coated #2 outer pane and monolithic low-e coated #4 inner pane (only U calculation)	Stopray vision 51 on 91091 5.85 mm / 16 (90% Ar) / Iplus advanced 1.0T on Clearlite 4 mm	Stopray vision 51 5.85 mm on 91091 : 98808 Clearlite 5.83 mm : 102164 Iplus advanced 1.0T on 90839 : 91061
9	Check double glazing with coated laminated inner pane (coating facing the cavity)	4mm uncoated outer pane and 6.8mm (33.2) coated laminated glass #3 inner pane	Clearlite 4 mm / 16 (90% Ar) / Iplus advanced 1.0T on Stratobel33.2	Clearlite 5.83 mm : 102164 Iplus advanced 1.0T on 90839 : 91061 Laminated glass 33.2 : 30351
Triple glazing				
10	Check triple glazing with solar control outer pane and low-e inner pane	6mm solar control coated #2 outer pane, 4mm uncoated glass mid-pane and 4mm lowe coated #5 inner pane	Stopray vision 51 on 91091 5.85 mm / 12 (90% Ar) / Clearlite 4 mm / 12 (90% Ar) / Iplus advanced 1.0T on Clearlite 4 mm	Stopray vision 51 5.85 mm on 91091 : 98808 Clearlite 5.83 mm : 102164 Iplus advanced 1.0T on 90839 : 91061

Task number	Task description		Composition of glass/glazing	AGC number of spectrum used
11	Check triple glazing with two panes of low-e glass	4mm uncoated glass outer pane, 4mm low e coated #3 mid-pane and 4mm low-e coated #5 inner pane (with 8mm Ar, 12mm Ar, 16mm Ar and 8mm Kr)	Clearlite 4 mm / 8 (90% Ar) / Iplus advanced 1.0T on Clearlite 4 mm / 12 (90% Ar) / Iplus advanced 1.0T on Clearlite 4 mm	Clearlite 5.83 mm : 102164 Iplus advanced 1.0T on 90839 : 91061
12	Check with triple glazing with two panes of uncoated laminated glass	6.8mm (33.2) uncoated laminated glass outer pane, 4mm uncoated glass mid-pane and 6.8mm (33.2) uncoated laminated glass inner pane	Stratobel 33.2 / 12 (90% Ar) / Clearlite 4 mm/ 12 (90% Ar) / Stratobel 33.2	Laminated glass 33.2 : 30351 Clearlite 5.83 mm : 102164
Laminated Glass				
13	Check laminated glass with thick interlayer (EN 410 2011 Annex B)	Laminated glass with configuration of 4mm uncoated glass / 3.04mm clear interlayer / 4mm uncoated glass)	Stratobel 44.6	Laminated glass 33.2 : 30351

Results

Single Glazing

Task number	Properties					
		INISMa	Matrix v.4	Difference	Glass Configurator interface	Conclusion
1	τ_v	89.5	89.5	0.0	89	OK
	ρ_v external	8.0	8.0	0.0	8	OK
	ρ_v internal	8.0	8.0	0.0	8	OK
	τ_e	84.6	84.6	0.0	85	OK
	ρ_e external	7.5	7.5	0.0	7	OK
	$\rho'e$ internal	7.5	7.5	0.0	8	OK
	g	86.4	86.4	0.0	86	OK
	U_g	5.69	5.69	0.00	5.7	OK

Task number	Properties					
		INISMa	Matrix v.4	Difference	Glass Configurator interface	Conclusion
2	τ_v	90.2	90.2	0.0	90	OK
	ρ_v external	8.0	8.0	0.0	8	OK
	ρ_v internal	8.0	8.0	0.0	8	OK
	τ_e	86.7	86.7	0.0	87	OK
	ρ_e external	7.5	7.7	-0.2	8	OK
	$\rho'e$ internal	7.5	7.7	-0.2	8	OK
	g	88.0	88.0	0.0	88	OK
	U_g	5.75	5.75	0.00	5.8	OK

Task number	Properties					
		INISMa	Matrix v.4	Difference	Glass Configurator interface	Conclusion
3	τ_v	55.3	55.3	0.0	56	OK
	ρ_v external	7.2	7.2	0.0	7	OK
	ρ_v internal	9.4	9.4	0.0	9	OK
	τ_e	33.5	33.5	0.0	34	OK
	ρ_e external	6.3	6.3	0.0	6	OK
	ρ_e internal	9.5	9.5	0.0	10	OK
	g	43.7	43.7	0.0	44	OK
	U_g	4.10	4.11	-0.01	4.1	OK

Task number	Properties					
		INISMa	Matrix v.4	Difference	Glass Configurator interface	Conclusion
4	τ_v	55.2	55.4	-0.2	56	OK
	ρ_v external	7.2	7.2	0.0	7	OK
	ρ_v internal	9.3	9.4	-0.1	9	OK
	τ_e	29.9	30.2	-0.3	31	OK
	ρ_e external	6.0	5.9	0.1	6	OK
	ρ_e internal	9.5	9.4	0.1	9	OK
	g	40.6	40.9	-0.3	41	OK
	U_g	4.10	4.11	-0.01	4.1	OK

Double glazing

Task number	Properties					
		INISMa	Matrix v.4	Difference	Glass Configurator interface	Conclusion
5	τ_v	50.6	50.6	0.0	51	OK
	ρ_v external	14.2	14.2	0.2	15	OK
	ρ_v internal		14.0		14	OK
	τ_e	24.7	24.7	0.0	25	OK
	ρ_e external	35.8	35.8	0.0	36	OK
	$\rho'e$ internal		38.7			OK
	g	27.2	27.3	-0.1	27	OK
	U_g	1.04	1.04	0.00	1.0	OK

Task number	Properties					
		INISMa	Matrix v.4	Difference	Glass Configurator interface	Conclusion
6	τ_v	80.4	80.4	0.0	80	OK
	ρ_v external	13.1	13.1	0.0	13	OK
	ρ_v internal		13.6		14	OK
	τ_e	55.0	55.0	0.0	55	OK
	ρ_e external	28.8	28.8	0.0	29	OK
	$\rho'e$ internal		30.0		30	OK
	g	60.5	60.4	0.1	60	OK
	U_g 16 mm 90 % Ar	1.04	1.04	0.00	1.0	OK
	U_g 8 mm 90% Ar	1.61	1.62	-0.01	1.6	OK
	U_g 20 mm 90% Ar	1.07	1.07	0.00	1.1	OK
	U_g 8 mm Kr	0.98	0.98	0.00	1.0	OK
	U_g 10 mm 45% Ar+45% Kr+10% air	1.16	1.17	0.01	Not possible on interface	OK

Task number	Properties					
		INISMa	Matrix v.4	Difference	Glass Configurator interface	Conclusion
7	τ_v	50.5	50.4	0.1	50	OK
	ρ_v external	13.7	13.7	0.0	14	OK
	ρ_v internal		13.2		13	OK
	τ_e	24.0	23.9	0.1	24	OK
	ρ_e external	35.8	35.8	0.0	36	OK
	ρ_e internal		39.7		40	OK
	g	26.9	26.9	0.0	27	OK
	U_g	1.02	1.02	0.00	1.0	OK

Task number	Properties					
		INISMa	Matrix v.4	Difference	Glass Configurator interface	Conclusion
8	U_g	0.90	0.91	0.01	Not possible on interface	OK

Task number	Properties					
		INISMa	Matrix v.4	Difference	Glass Configurator interface	Conclusion
9	τ_v	80.1	80.3	-0.2	80	OK
	ρ_v external	13.8	13.8	0.0	13	OK
	ρ_v internal		12.9		14	OK
	τ_e	51.1	51.3	-0.2	52	OK
	ρ_e external	30.2	30.0	0.2	30	OK
	ρ_e internal		24.6		25	OK
	g	61.1	61.3	-0.2	61	OK
	U_g	1.04	1.04	0.00	1	OK

Triple Glazing

Task number	Properties					
		INISMa	Matrix v.4	Difference	Glass Configurator interface	Conclusion
10	τ_v	46.0	46.0	0.0	46	OK
	ρ_v external	15.9	15.9	0.0	16	OK
	ρ_v internal		18.7		19	OK
	τ_e	21.5	21.7	-0.2	22	OK
	ρ_e external	36.6	36.7	-0.1	37	OK
	$\rho'e$ internal		40.0		40	OK
	g	24.2	24.5	-0.3	24	OK
	U_g	0.67	0.68	-0.01	0.7	OK

Task number	Properties					
		INISMa	Matrix v.4	Difference	Glass Configurator interface	Conclusion
11	τ_v	73.0	73.0	0.0	73	OK
	ρ_v external	17.5	18.0	-0.5	17	OK
	ρ_v internal		17.7		18	OK
	τ_e	44.3	44.3	0.0	44	OK
	ρ_e external	35.9	35.9	0.0	36	OK
	$\rho'e$ internal		35.6		36	OK
	g	51.2	51.2	0.0	51	OK
	U_g 8 mm 90 % Ar	0.78	0.79	-0.01	0.8	OK
	U_g 12 mm 90 % Ar	0.67	0.68	-0.01	0.7	OK
	U_g 16 mm 90 % Ar	0.59	0.59	0.00	0.6	OK
U_g 8 mm krypton	0.60	0.60	0.00	0.6	OK	

Task number	Properties					
		INISMa	Matrix v.4	Difference	Glass Configurator interface	Conclusion
12	τ_v	73.6	73.4	0.2	74.0	OK
	ρ_v external	19.8	19.8	0.0	20.0	OK
	ρ_v internal		19.8		20.0	OK
	τ_e	57.5	57.4	0.1	59.0	OK
	ρ_e external	15.5	16.0	-0.5	16.0	OK
	ρ_e internal		16.0		16.0	OK
	g	64.4	64.9	-0.5	66.0	OK
	U_g	1.73	1.72	0.01	1.70	OK

Laminated Glass

Task number	Properties					
		INISMa	Matrix v.4	Difference	Glass Configurator interface	Conclusion
13-1 33.2	τ_v	89.5	89.4	0.1	89.0	OK
	ρ_v external	8.0	8.0	0.0	8.0	OK
	ρ_v internal	8.0	8.0	0.0	8.0	OK
	τ_e	76.9	77.1	-0.2	77.0	OK
	ρ_e external	7.1	7.2	-0.1	7.0	OK
	ρ_e internal	7.1	7.2	-0.1	7.0	OK
	g	80.6	80.8	-0.2	82.0	OK
	U_g	5.56	5.56	0.00	5.60	OK

Task number	Properties					
		INISMa	Matrix v.4	Difference	Glass Configurator interface	Conclusion
13-2 44.6	τ_v	89.2	88.7	0.5	89	OK
	ρ_v external	8.0	7.9	0.1	8	OK
	ρ_v internal	8.0	7.9	0.1	8	OK
	τ_e	72.6	72.3	0.3	73	OK
	ρ_e external	6.9	6.9	0.0	7	OK
	ρ_e internal	6.9	6.9	0.0	7	OK
	g	77.5	77.2	0.3	77	OK
	U_g	5.28	5.28	0.00	5.3	OK

Conclusion

Task number	Task description	Criteria : Transmission and reflection: $\pm 0.5\%$ U value: ± 0.01 W/m ² K
Single glazing		
1	Check calculation for uncoated float glass	Validated
2	Change thickness of uncoated glass	Validated
3	Change thickness of coated glass based on the same substrate	Validated
4	Change substrate of coated glass from clear float to tinted	Validated
Double glazing		
5	Check double glazing with solar control outer pane	Validated
6	Check double glazing with lowe inner pane	Validated
7	Check double glazing with both panes coated (surfaces 2 and 3)	Validated
8	Check double glazing with two coatings, one of which is on surface 4	Validated
9	Check double glazing with coated laminated inner pane (coating facing the cavity)	Validated
Triple glazing		
10	Check triple glazing with solar control outer pane and low-e inner pane	Validated
11	Check triple glazing with two panes of low-e glass	Validated
12	Check with triple glazing with two panes of uncoated laminated glass	Validated
Laminated Glass		
13	Check laminated glass with thick interlayer (EN 410 2011 Annex B)	Validated

The difference of results between Matrix v.4 and the glass configurator interface is due to small differences in thickness of the glass (5.85 mm for 6 mm and 3.85 mm for 4 mm)

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