THERMAL SIMULATION IN ACCORDANCE WITH CSA A440.2-19

UL Laboratory Canada Inc.	Submitted to:
Report No.: **AT-01207**	**Skyreach Group Inc.** **112A Snidercroft Road** **Concord ON, Canada** **L4K 2K1**

Report Summary

Operation Type:	DATT
Series/Model:	8100 Tilt & Turn Window
Report Date:	2024-10-29
Revision Date:	N/A
Simulation Date :	2024-10-29
Number of Pages:	6

Note: Reference must be made to UL Laboratory Canada Inc. complete report for specimen description and detailed simulation results.

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THERMAL SIMULATION IN ACCORDANCE WITH CSA A440.2-19

1 INTRODUCTION

UL Laboratory Canada Inc. has been retained by Skyreach Group Inc. to evaluate *a tilt turn window* in accordance with ANSI/NFRC 100 Procedure for Determining Fenestration Product U-Factors, ANSI/NFRC 200 Solar Heat Gain Coefficient and Visible Transmittance and NFRC 500 Procedure for Determining Fenestration Product Condensation Resistance Values. The product components and manufacturing details are documented in section 4 of this report. Rounding is per NFRC 601 NFRC Unit and Measurement Policy. All imperial values are for reference only. Appendix A of this report includes drawings and information of the product.

Simulations were conducted in full compliance with CSA requirements. Air infiltration test results were taken from report number TF-00369-A1 from UL Laboratory Toronto

2 SPECIFICATION

CSA A440.2-19:	Fenestration energy performance
ANSI/NFRC 100-2023:	Procedure for Determining Fenestration Product U-Factors
ANSI/NFRC 200-2023:	Solar Heat Gain Coefficient and Visible Transmittance
NFRC 101-2023:	Procedure for Determining Thermophysical Properties of Materials for Use in NFRC-Approved Software
NFRC 500-2017:	Procedure for Determining Fenestration Product Condensation Resistance Values
NFRC 601-2020:	NFRC Unit and Measurement Policy
WINDOW 7:	Software by Lawrence Berkeley National Laboratory
THERM 7:	Software by Lawrence Berkeley National Laboratory
IGDB v.101.0:	International Glazing Database by Lawrence Berkeley National Laboratory

3 DISCLAIMER

Data required for this evaluation were taken from the best available sources and every effort was taken to accurately perform the simulation documented in this report. Because of the large amount of input data and analysis it is possible that errors or omissions could occur. Neither UL Laboratory Canada Inc. nor any of its employees shall be held responsible for any loss or damage resulting directly or indirectly from any default, error or omission.

4 PRODUCT DESCRIPTION

4.1 OPERATOR TYPE:

DATT, Tilt Turn

4.2 SERIES/MODEL:

8100 Tilt & Turn Window

4.3 FRAME:

4.3.1	Material:	AT, Aluminum w/ Thermal breaks - All members
4.3.2	Finish:	Anodized Aluminum
4.3.3	Reinforcement:	None
4.3.4	Weatherstripping:	Compression weatherstripping at all perimeter
4.3.5	Continuous Hardware:	No hardware was required to be modeled
4.3.6	Overall dimensions:	1200 mm W. x 1500 mm H. (47.24 "x 59.06")

4.4 SASH(ES)

4.4.1	Material:	AT, Aluminum w/ Thermal breaks - All members
4.4.2	Sash 1:	
4.4.2.1.	Finish:	Anodized Aluminum
4.4.2.2.	Reinforcement(s):	None
4.4.2.3.	Weatherstripping(s):	Compression weatherstripping at all perimeter
4.4.2.4.	Continuous Hardware:	No hardware was required to be modeled
4.4.3	Sash 2:	N/A
4.4.4	Sash 3:	N/A
4.4.5	Sash 4:	N/A

4.5 GLAZING METHOD:

4.5.1	Exterior face:	EPDM gasket
4.5.2	Interior face:	EPDM gasket

4.6 SPACER:

Spacer type:	Material:	Primary sealant:	Secondary sealant:
Chromatech Ultra (TS-D)	Vinyl and Stainless Steel	Polyisobutylene	Polysulphide

4.7 GRID:

4.7.1	Grid:	None
4.7.2	Material and finish:	N/A
4.7.3	Standard NFRC Grid Pattern:	N/A

4.8 GLAZING:

4.8.1	Filling Technique:	Single probe
4.8.2	Capillary tube:	No
4.8.3	Gas fill percentage:	90% Argon, 10% Air
4.8.4	Comment:	None

5 SIMULATION RESULTS

Table 1: Center of glazing results

ID	Name	Insulating Glass Unit											U factor		SHGC	VT
		Emissivities	Glass 1		Gap 1		Glass 2		Gap 2		Glass 3		Tint				
			Type	mm	mm	gas	Type	mm	mm	gas	Type	mm		W/m2-K	Btu/hr-ft2-F		
1	5mm-ClrCGI-Arg90-180#3	0.068 (#3)	Clear	5.0	16.00	Arg90	Cardinal180	5.0					CL	1.52	0.27	0.66	0.78
2	5mm-272#2-Arg90-ClrCGI	0.042 (#2)	Cardinal 272	5.0	16.00	Arg90	Clear	5.0					CL	1.46	0.26	0.41	0.71
3	5mm-ClrXYG-Arg90-S1.16#3	0.076 (#3)	Clear	4.8	16.00	Arg90	Optilite S1.16	4.8					CL	1.53	0.27	0.59	0.79
4	5mm-ClrCGI-Arg90-ClrCGI-Arg90-180#5	0.068 (#5)	Clear	5.0	12.00	Arg90	Clear	5.0	12.00	Arg90	Cardinal180	5.0	CL	1.05	0.18	0.59	0.71
5	5mm-272#2-Arg90-ClrCGI-Arg90-ClrCGI	0.042 (#2)	Cardinal 272	5.0	12.00	Arg90	Clear	5.0	12.00	Arg90	Clear	5.0	CL	1.06	0.19	0.37	0.64
6	5mm-ClrXYG-Arg90-ClrCGI-Arg90-S1.16#5	0.076 (#5)	Clear	4.8	12.00	Arg90	Clear	5.0	12.00	Arg90	Optilite S1.16	4.8	CL	1.06	0.19	0.54	0.72

Table 2: Overall fenestration products results

ID	Option Name	Insulating Glass Unit					Overall Product					
		W7 COG ID	Spacer	Grid	Grid Size	Tint	U Factor		SHGC	VT	CR	ER CSA
							W/m2-K	Btu/hr-ft2-F				
1	CH_5mm-ClrCGI-Arg90-180#3	1	TS-D	N		CL	1.85	0.33	0.46	0.54	59	26
2	CH_5mm-272#2-Arg90-ClrCGI	2	TS-D	N		CL	1.81	0.32	0.29	0.49	59	17
3	CH_5mm-ClrXYG-Arg90-S1.16#3	3	TS-D	N		CL	1.86	0.33	0.42	0.55	59	23
4	CH_5mm-ClrCGI-Arg90-ClrCGI-Arg90-180#5	4	TS-D	N		CL	1.47	0.26	0.41	0.49	66	31
5	CH_5mm-272#2-Arg90-ClrCGI-Arg90-ClrCGI	5	TS-D	N		CL	1.47	0.26	0.26	0.44	67	23
6	CH_5mm-ClrXYG-Arg90-ClrCGI-Arg90-S1.16#5	6	TS-D	N		CL	1.48	0.26	0.37	0.50	66	29

*** Air tightness values from TF-00369-A1**

Infiltration: 0.058 l/s.m^2

Exfiltration: 0.078 l/s.m^2

**** ER calculated using metric U Factor.**

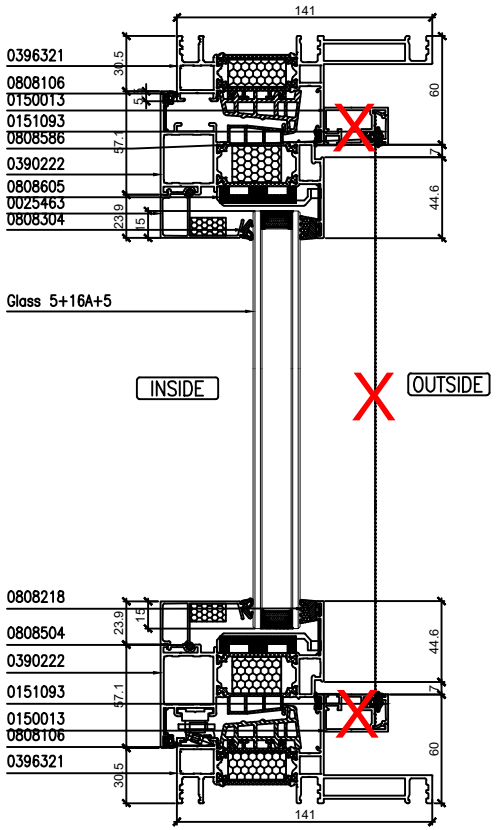
6 REVISION LOG

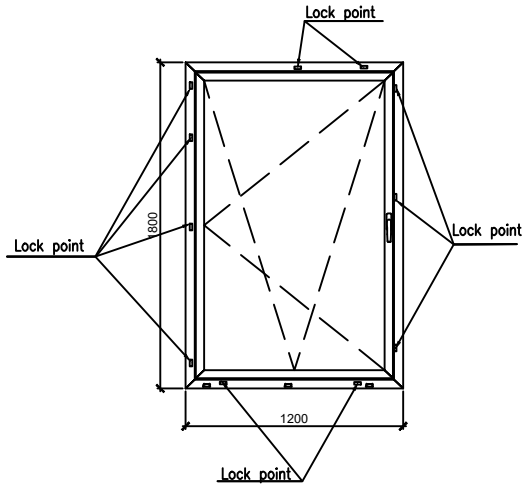
Revision Number	Revision Date	Description

APPENDIX A: DRAWINGS AND PRODUCT INFORMATION

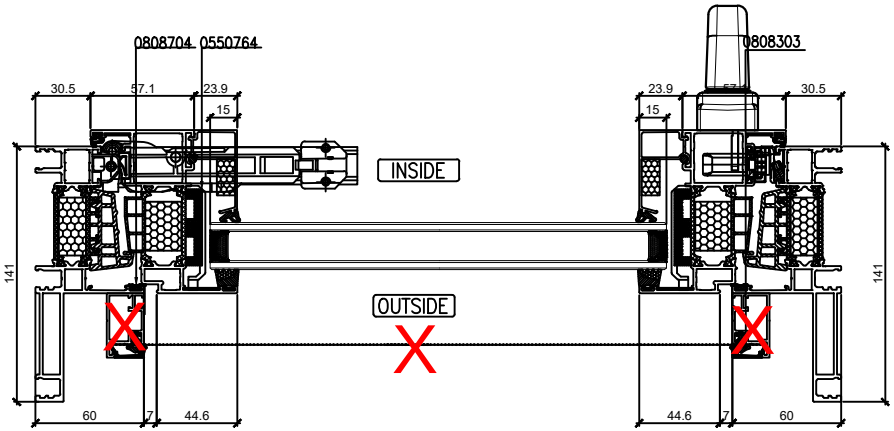
Simulation in accordance with CSA-A440.2-19

COMPLIES TO FILE
AT-01207
CONFORME DOSSIER





Dual action Window



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DRAWING TITLE	**8100 Alum Tilt & Turn window assembly**	DRAWN BY:	**T.H**
REVISION	**00**	DATE	**May 2024**
SCALE	**1:2**	PAGE	**E1**

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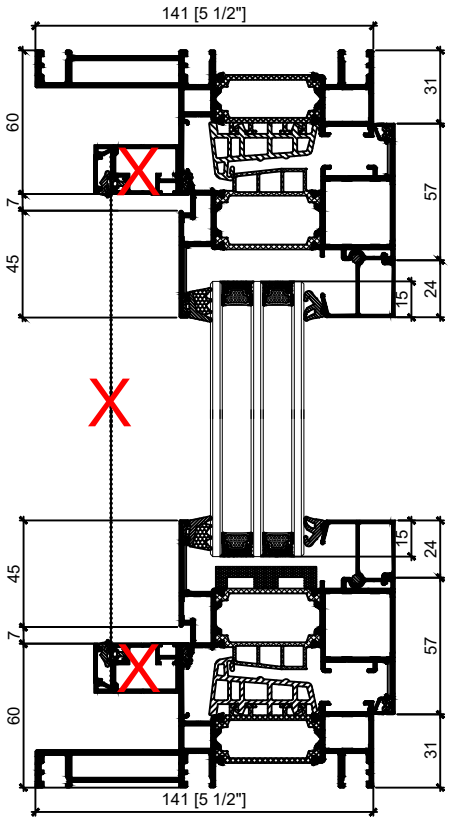
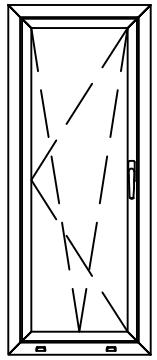
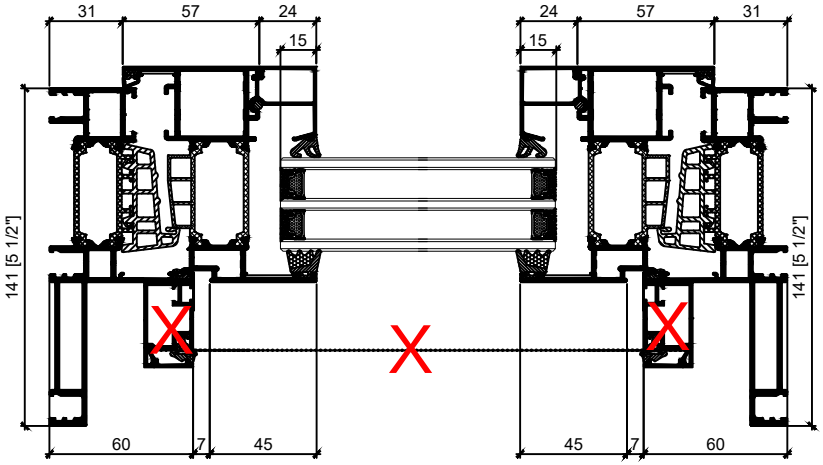




Tilt & Turn window



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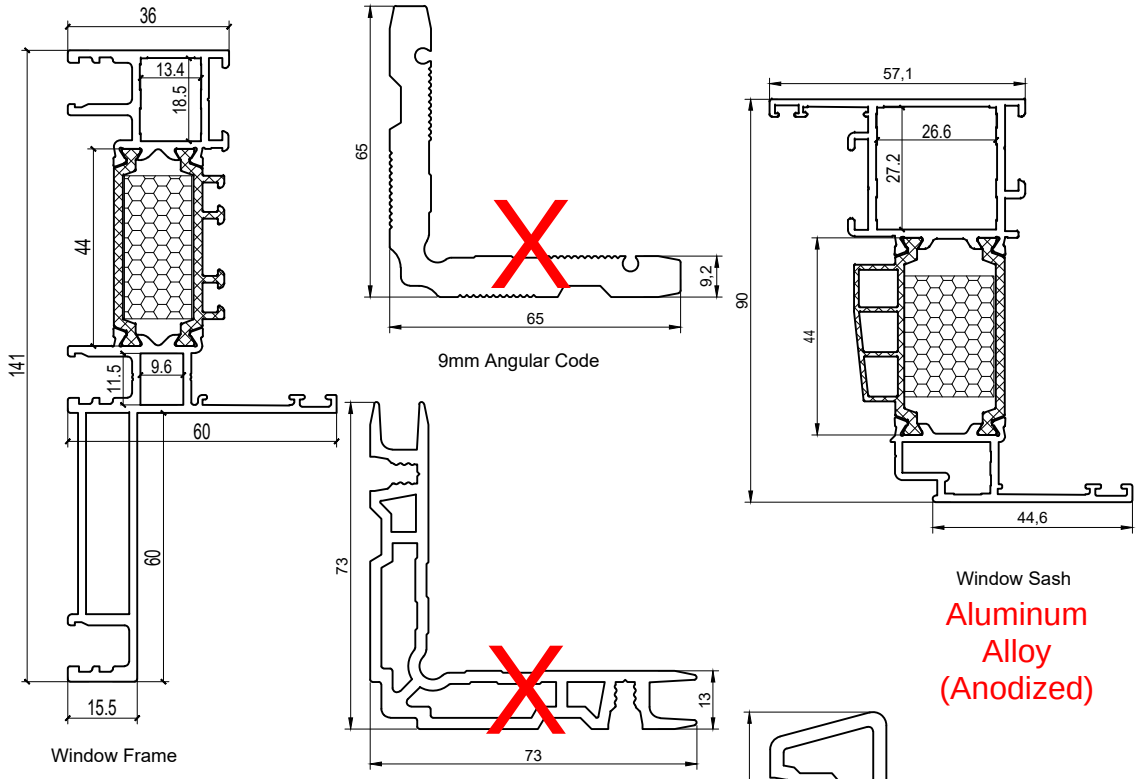
8100 Aluminum Tilt & Turn Window Profile



Window Frame

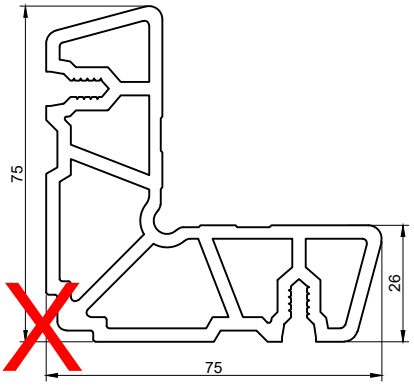
Aluminum
Alloy
(Anodized)

9mm Angular Code

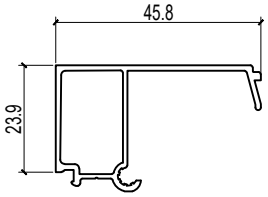
Window Sash

Aluminum
Alloy
(Anodized)

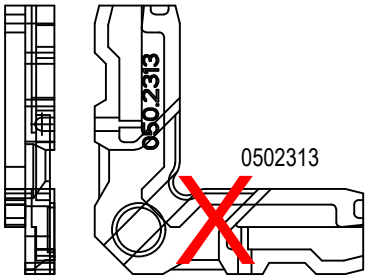
13mm Angular Code



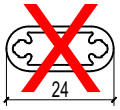
26mm Angular Code



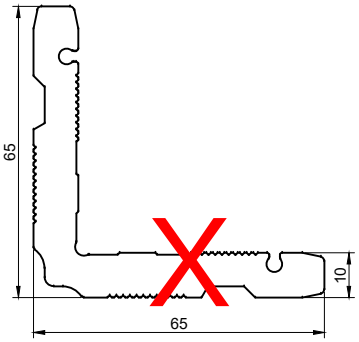
Glazing Bead



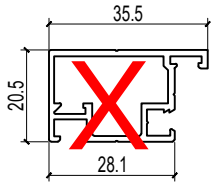
Aluminum
Alloy
(Anodized)



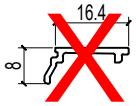
Flat tube



10mm Angular Code



Screen Window



Screen Window Glazing Bead

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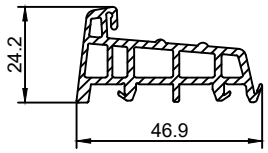
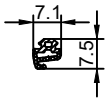
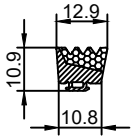
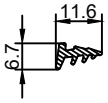
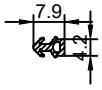
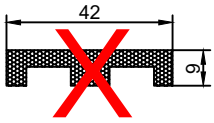
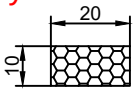
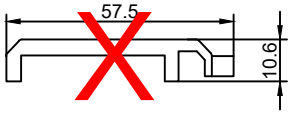
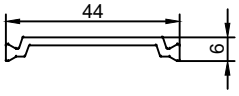
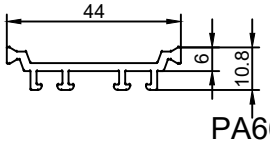
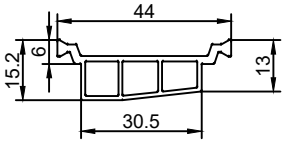
8100 Aluminum Tilt & Turn Window Accessories Profile

0808082	Central Gasket	0808106	Interior Sash Gasket
 EPDM		 EPDM	
0808218	Exterior Glazing Gasket	0808301	3.2mm Interior Glazing Gasket
 EPDM		 EPDM	
0808304	Interior Glazing Gasket	0808504	Round bar adhesive strip
 EPDM		 EPDM	
0808586	Screen window tape	0808605	ES81 Foam
 EPDM		 PE	
0808704	Glazing Gasket	0971020	Obturator sponge
 EPDM		Polyurethane Foam  Obturator sponge	
0550764	Glass Pallet	0965747	Heat-insulating strip
 PA66		 PA66GF25	
0965748	Heat-insulating strip	0965749	Heat-insulating strip
 PA66GF25		 PA66GF25	

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1. Spacer properties

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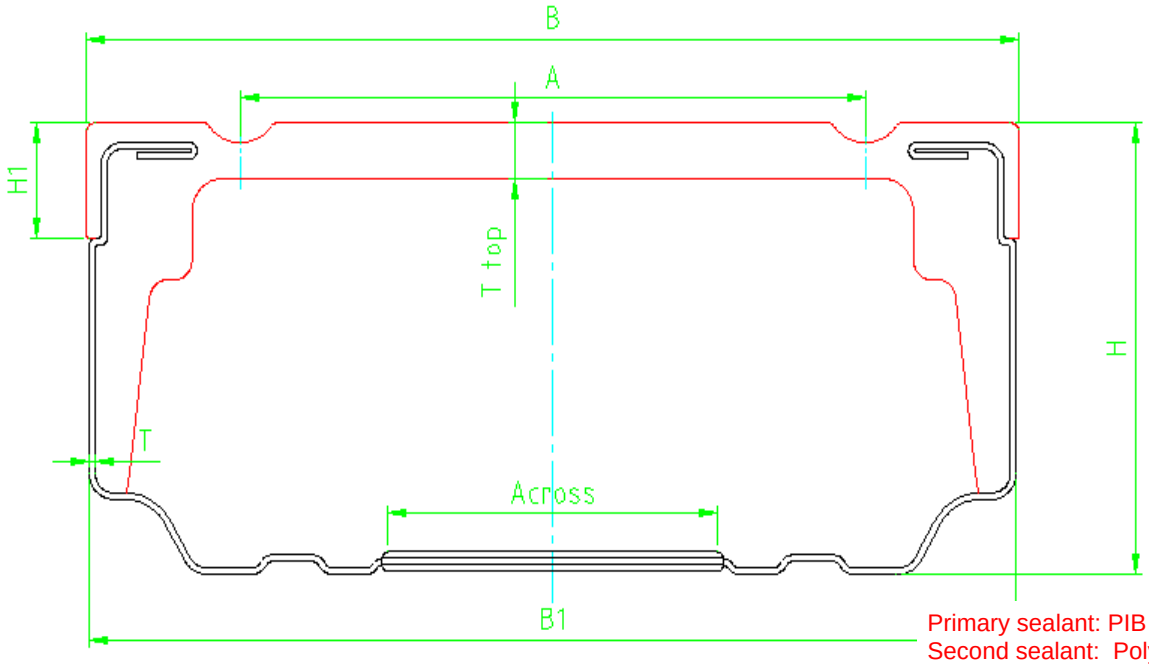

Primary sealant: PIB
Second sealant: Polysulfide
Second sealant height: 5mm

1.1 Cross section and tolerances

Spacer bar / cavity available	**H** - 0.05 +015 [mm]	**H1** +/- 0.3 [mm]	Back Corrugation Across	**B** -0.30 +0,10 [mm]	**B1** -0,05 +0,25 [mm]	**A** +/- 0.1 [mm]	**Volume** Desiccant Grace 551 g/m	**T top** -0.05 +0.15 [mm]
CUS 8	6.85	1.8	NO	7.6	7.5	2.45	22,4	0.85
CUS 10	6.85	1.8	NO	9.6	9.5	4,45	31,0	0.85
CUS 12	6.85	1.8	YES	11.6	11.5	6,45	39,5	0.85
CUS 13	6.85	1.8	YES	12.6	12.5	7,45	43,8	0.85
CUS 14	6.85	1.8	YES	13.6	13.5	8,45	48,1	0.85
CUS 15	6.85	1.8	YES	14.6	14.5	9,45	52,4	0.85
CUS 16	6.85	1.8	YES	15.6	15.5	10,45	56,6	0.85
CUS 18	6.85	1.8	YES	17.6	17.5	12,45	65,2	0.85
CUS 20	6.85	1.8	YES	19.6	19.5	14,45	73,7	0.85
CUS 22	6.85	1.8	YES	21.6	21.5	16,45	82,3	0.85
CUS 24	6.85	1.8	YES	23,6	23.5	18,45	90,8	0.85
CUS 26	6.85	1.8	YES	25,6	25.5	20,45	99,4	0.85

T steel is 0,104 mm for all sizes.

EN 1279-6 reference to table A.2 & A.5 – *Note. Present list is valid until old norm expire 31.01.2019.*

Ref. No.	EN Ref.	**Description/specification**	**Internal test method**
Further Spacer properties			
1.2	**2.3** **2.4**	**Geometry/shape** The spacer geometry is shown in the cross section picture above. On enquiry a specific drawing can be delivered. Tolerances above.	Slide gauge and inspection drift
1.3	**2.2**	**Length and straightness** Standard length is 6,000 mm +/- 10 mm. Straightness deviation up to 15 mm/m at room temperature.	Steel ruler. Visual.

1.4	**2.7**	**Undesired openings** The spacer is tight as the backside is one uninterrupted piece of material. Plastic and steel are extruded together.	Process validation.
1.5	**2.6**	**Perforation. Se comments below **** Controlled perforation hole size, measured with airflow for optimal performance.	Air flow meter.
2.0 Spacer material			
2.1		**Material for calculations** Steel material used according to DIN EN 10088 type 1.4372 (AISI 201) or similar grades. Thermal conductance λ_s = 15 W/mK at 20 °C. These values are to be used for calculations.	*Documented by supplier.*
2.2	**2.5**	**Surface** The surface is clean and do not undergo any treatment with chemicals. Colours similar to RAL 9004, 9016, 7035, 7040, 8003 and 8016.	Visual test & Adhesion test.
2.3		**Tolerances of the steel material** The wall thickness of the spacer “S” is standard 0.104 mm.	Micro meter.
2.4		**Lubrication** During the forming of the spacer lubrication is used. The lubrication will evaporate fully leaving no volatile elements.	Adhesion test.
2.5	**2.8**	**Volatile elements** Volatile elements are tested according to EN 1279-6 annex G.	Weight loss test. M_v measured

**** 1.5.1 Level of perforation**
The ROLLTECH standard perforation will reduce the absorption of aqueous vapour to be no less than 1.0 weight % over a period of 24 hours (16 mm cavity tested by Grace Davidson Europe) - relative to the spacer size. The perforation is targeted EN 1279 - 6 annex A – specified maximum preload $H_2o \leq 3$ %.

**** 1.5.2 Function of the perforation**
The perforation holes are until a certain particle size able to detain dust from the desiccant. This point is particular related to the performance of the bending machine and to the desiccant quality. An incorrect adjustment of the bending tool can cause damage to the perforation.

3.0 Quality aspects

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3.1 Quality management
ROLLTECH A/S is certified according to DS EN ISO 9001.

3.2 Tests of the product
Processes and routines are established to secure the quality of the delivered material. During production the spacers are continuously monitored through systematic and random checks. Data will be available for a period of 5 years.

3.3 Quality agreement
ROLLTECH A/S fulfil the requirements of EN 1279 - 6 annex A. Specific quality agreement can be made to reduce inspection and test of the incoming material according to EN1279-6 part 5.2.6.

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4.0 Customer focus and warranty

On all spacers ROLLTECH offers a 5 years' product warranty. The warranty covers free exchange of spacers in case of a defect. The spacers must have been stored, installed and used according to present norms and technical standards. Special solutions and **usage** that **are not standardized** will need prior approval in writing from ROLLTECH in order to be covered. Related to temperature standardized condition for IG is -30° to 80°C.

4.1 Storage and use

To secure the performance of the spacers, the stock conditions must be acceptable. Broken packaging, humidity and variation in temperature will have an effect on the spacer in general. Make sure the spacer is conditioned at room temperature before use.

Preferred conditions will be a room temperature over 15°C and humidity RH of minimum 45%
Avoid having an environment with a high concentration of dust.

General handling and attention according to safety data sheet for the spacer. Use gloves when handling the spacer/frames and make sure there is exhausting when cutting the spacer.

It is recommended to check out and control all the specific points above.

4.2 Adhesion check

When preparing samples for adhesion test according to EN1279-6 F3.2.2 make sure the spacer backside is covered and in full contact with the sealant (no air bubbles). When pulling the samples make sure to support the spacer fully inside to avoid deformation. If the spacer deforms the adhesion test will be affected. Written procedure can be delivered up on request. Curing time according to instruction from sealant manufacturer.

4.3 Pressure

Deformation by pressure such as wind load and weight load by horizontal installation can be provided.

4.4 System performance

The user (here the IG producer) must secure the whole system consisting of spacer, connector/corner key, bending machine, desiccant, butyl and sealant works well together in the chosen setup. Focus on compatibility, adhesion, dust and corner quality.

After handling and transport of the frames, it´s important to check if the connector/corner keys are still in the correct position, if not there is a significant risk for desiccant dust inside the IG unit. Foam behind the connector/corner can be used to avoid such problems.

4.5. Cleaning the plastic surface

If for some reason the plastic surface is defiled by dust from other materials it can be cleaned again by the use of water or air. Dust can easily be removed with antistatic loaded compressed air or a moist cloth. Chemicals are not recommended. In case of specific cleaning needs make sure to test compatibility between materials.

4.6 UV stability

The plastic used is an organic material with UV stabilizer in order to minimize the ageing effect caused by sun light.

The material is tested for 3.000 hours according to EN ISO 4892-1 & EN 4892-2 method A, cycle 1. Evaluation is done according to grey scale index.