



**NFRC U-FACTOR, SHGC / VT
AND CONDENSATION RESISTANCE COMPUTER SIMULATION**

Project:
Fixed Window

Rendered To:
Foshan YT Aluminum CO., Ltd.
No. 3 PanAo Factory, Shi Bei Minxi Village, Shishan Town, Nanhai District
Foshan, Guangdong 528225, China

QCT Report No.:
QCT-SIM-12219.01

Report Date:
March 2, 2023



Report No.: QCT-SIM-12219.01

Simulation Date: 03/02/23

Report Date: 03/02/23

Retention Date: 03/02/28

NFRC THERMAL SIMULATION REPORT

Rendered To:

Foshan YT Aluminum CO., Ltd.
No. 3 PanAo Factory, Shi Bei Minxi Village, Shishan Town, Nanhai District
Foshan, Guangdong 528225, China

Project Name:

Fixed Window

Project Scope:

Quast Consulting and Testing, Inc. (QCT) was contracted by Foshan YT Aluminum CO., Ltd. to conduct U-Factor, Solar Heat Gain Coefficient, Visible Transmittance, and Condensation Resistance computer simulations in accordance with the National Fenestration Rating Council (NFRC) guidelines.

Note 1: The NFRC Condensation Resistance rating is NOT equivalent to a Condensation Resistance Factor (CRF) determined in accordance with AAMA 1503-09.

Note 2: The Condensation Resistance results obtained from this procedure are for controlled laboratory conditions and do not include the effects of air movement through the specimen, solar radiation, and the thermal bridging that may occur due to the specific design and construction of the fenestration system opening.

Standards:

ANSI/NFRC 100-2020:	Procedure for Determining Fenestration Product U-Factors
ANSI/NFRC 200-2020:	Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence
NFRC 500-2017:	Procedure for Determining Fenestration Product Condensation Resistance Values
NFRC 101-2020:	Procedure for Determining Thermophysical Properties of Materials For Use in NFRC-Approved
NFRC 303-2020:	Procedure for Constructing a Laminate in Optics
NFRC 601-2020:	NFRC Unit and Measurement Policy

Software:

Frame and Edge Modeling:	THERM 7.4.4.0
Center-of-Glass Modeling:	WINDOW 7.4.14.0
Total Product Calculations:	WINDOW 7.4.14.0
Laminate Construction:	OPTICS 6.0
Spectral Data Library:	90.0

Description of Simulation Product:

Product Type:	Fixed (4-Sided)
Frame Type:	Aluminum w/ Thermal Breaks
Sash Type:	Not Applicable
Thermal Break:	Polyamide
Model Size:	1200mm x 1500mm (47 in. x 59 in.)



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Material/Finish:	Exterior	Interior		
	Aluminum Alloy (Painted)	Aluminum Alloy (Painted)		
Weatherstripping:	N/A			
Reinforcement:	N/A			
Continuous Hardware:	N/A			
Cavity Fill	Type	Location		
	Polyethylene Foam	All frame enclosed cavities		
Validation Matrix:	Project Number	Product Line		
	N/A			
Edge-of-Glass Material:	Exterior	Interior		
	EPDM Gasket	EPDM Gasket		
Center-of-Glass Gas Fill:	Type & Concentration	Filling Technique		
	Argon 95%	Dual Probe or Evacuated Chamber		
Optics Laminate Make-Up:	ID	Name		
	N/A			
Spacer (s):	Code	Spacer	Primary Sealant	Secondary Sealant
	ZF-D	Super Spacer Premium Plus Enhanced	Butyl Rubber	N/A
Grid (s):	Size	Type	Modeled	Pattern
	N/A			



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 Project Name: Fixed Window
 Manufacturer: Foshan YT Aluminum CO., Ltd.

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NFRC PRODUCT LINE SUMMARY

ID	Description	Glass Thickness	Gap Width	Gap Fill	Emissivity	Tint	Spacer	Divider	U-Factor	No Divider		Divider < 1"		Divider ≥ 1"		CR
										SHGC	VT	SHGC	VT	SHGC	VT	
1	TP1 5mm HighTransmittance LowE ARG 5mm CL	0.197,0.191	0.709	ARG 90	0.147(#2)	CL	ZF-S	N	0.35	0.56	0.65					57
2	TP2 6mm SuperN1 LowE ARG 6mm CL	0.234,0.231	0.591	ARG 90	0.098(#2)	CL	ZF-S	N	0.33	0.51	0.67					57
3	TP3 6mm SuperN1 LowE ARG95 SuperN1 6mm	0.234,0.234	0.591	ARG 90	0.098(#2)0.098(#3)	CL	ZF-S	N	0.31	0.48	0.63					59
4	TP4 6mm Double LowE ARG95 6mm CL	0.232,0.231	0.591	ARG 90	0.048(#2)	CL	ZF-S	N	0.31	0.37	0.63					58
5	TP5 6mm Triple LowE ARG SuperN1 LowE 6mm	0.231,0.234	0.591	ARG 90	0.03(#2)0.098(#3)	CL	ZF-S	N	0.31	0.30	0.54					59
6	TP6 6mm Triple LowE ARG 6mm CL	0.231,0.231	0.591	ARG 90	0.03(#2)	CL	ZF-S	N	0.31	0.29	0.57					58
7	TP7 6mm Triple LowE ARG Triple LowE 6mm	0.231,0.231	0.591	ARG 90	0.03(#2)0.03(#3)	CL	ZF-S	N	0.30	0.28	0.47					59
8	TP8 6mm Triple LowE ARG Double LowE 6mm	0.231,0.232	0.591	ARG 90	0.03(#2)0.048(#3)	CL	ZF-S	N	0.30	0.29	0.51					59
9	TP9 5mm HighT LowE ARG 5mm HighT LowE ARG 5mm CL	0.197,0.197,0.191	0.472,0.472	ARG 90	0.147(#2)0.147(#4)	CL	ZF-S	N	0.22	0.47	0.55					59
10	TP10 6mm SuperN1 LowE ARG 6mm SuperN1 LowE ARG 6mm CL	0.234,0.234,0.231	0.354,0.354	ARG 90	0.098(#2)0.098(#4)	CL	ZF-S	N	0.23	0.42	0.57					59
11	TP11 6mm Triple LowE ARG 6mm Triple LowE ARG 6mm CL	0.231,0.231,0.231	0.354,0.354	ARG 90	0.03(#2)0.03(#4)	CL	ZF-S	N	0.22	0.23	0.42					59



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Technical Notes/Modeling Assumptions:

1. None.

References:

Rating values included in this report are for submittals to an NFRC licensed Inspection Agency (IA) and are not intended to be used directly for labeling purposes. Only those options identified on a valid Certificate of Authorization (CA) by an NFRC accredited IA are to be used for labeling purposes.

Quast Consulting and Testing, Inc. is an NFRC accredited simulation laboratory and all simulations were conducted in full compliance with NFRC approved standards and procedures. The NFRC procedure requires that the computational results be verified through physical testing.

Detailed drawings, simulation data files, a copy of this report and other pertinent project documentation will be retained by Quast Consulting and Testing, Inc. for a period of five years from the original test date. At the end of this retention period, such materials shall be discarded without notice and the service life of this report will expire. Results obtained are simulated values and were secured by using the designated simulation methods. This report does not constitute certification of this product nor an opinion or endorsement by this laboratory. This report is the exclusive property of the client so named herein and represents only the product simulated. This report may not be reproduced, except in full, without the written consent of Quast Consulting and Testing, Inc.

This report is not complete without all attachments:

Appendix A: Drawings (12)

A handwritten signature in black ink, reading 'Sherri Wendt'.

Sherri Wendt
NFRC Simulation Project Manager

A handwritten signature in black ink, reading 'Jeff Zibton'.

Jeff Zibton
Simulator-In-Responsible-Charge



Report No.: QCT-SIM-12219.01

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Revision No.	Date	Description
.01	03/02/23	- Original report issued.



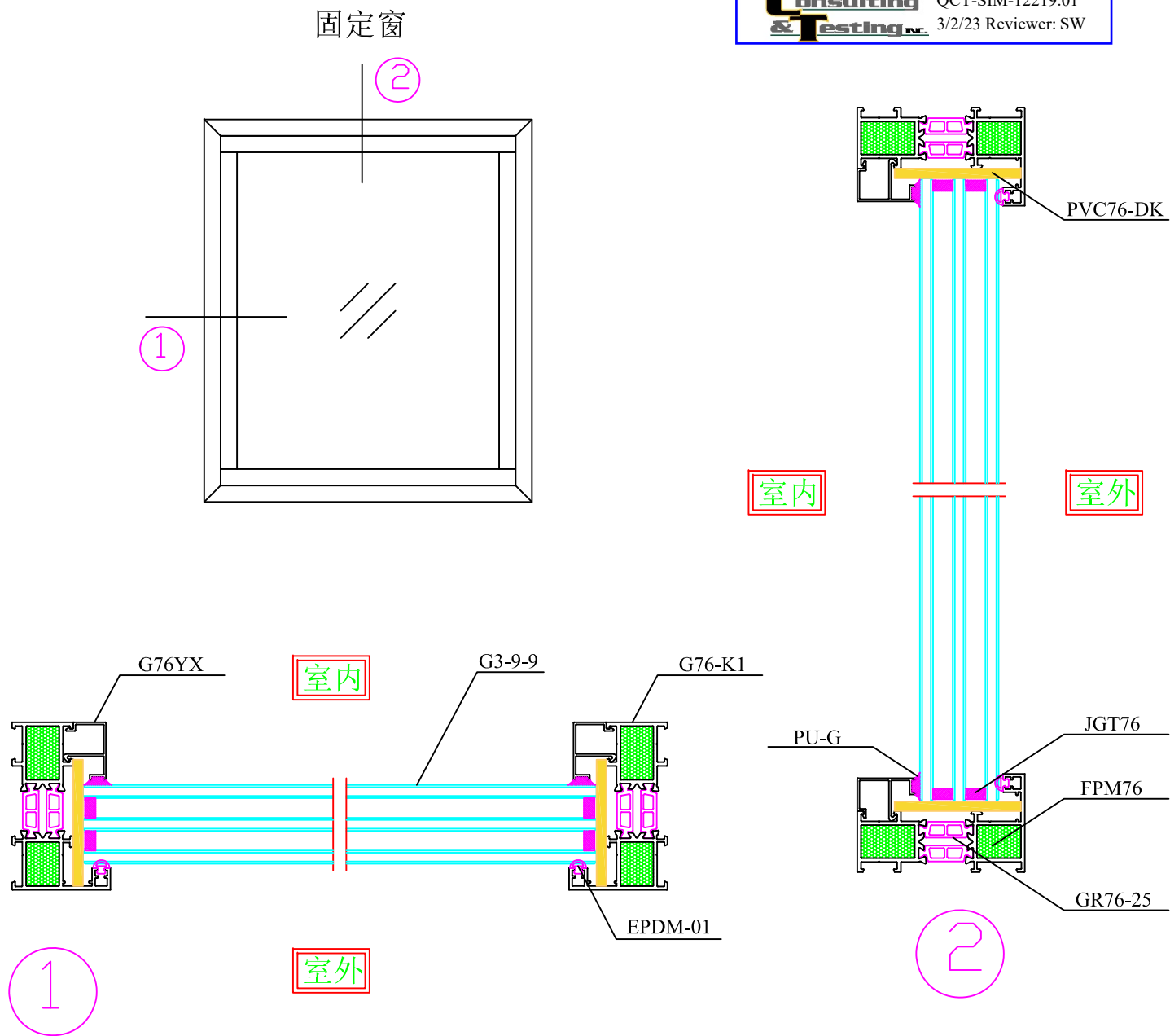
Report No.: QCT-SIM-12219.01

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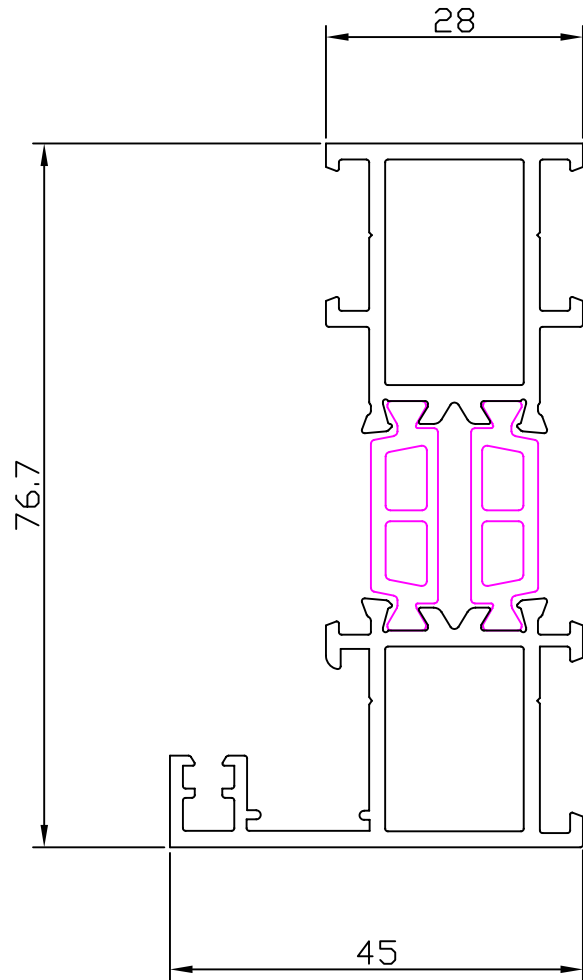
APPENDIX A

固定窗材料清单(Fixed window)

SN	BOM Code	BOM Name	Unit	Quantity
1	G76-K1	窗外框	PC	4
2	G76YX	压线	PC	4
3	G3-9-9	Regal条三层玻璃	PC	1
4	EPDM-01	三元乙丙密封皮条	PC	4
5	GR76-25	隔热条	PC	8
6	FPM76	聚乙烯发泡保温棉	PC	8
7	JGT76	Regal间隔条	PC	8
8	PVC76-DK	气凝胶	PC	4
9	PU-G	“硅宝”胶水	PC	4

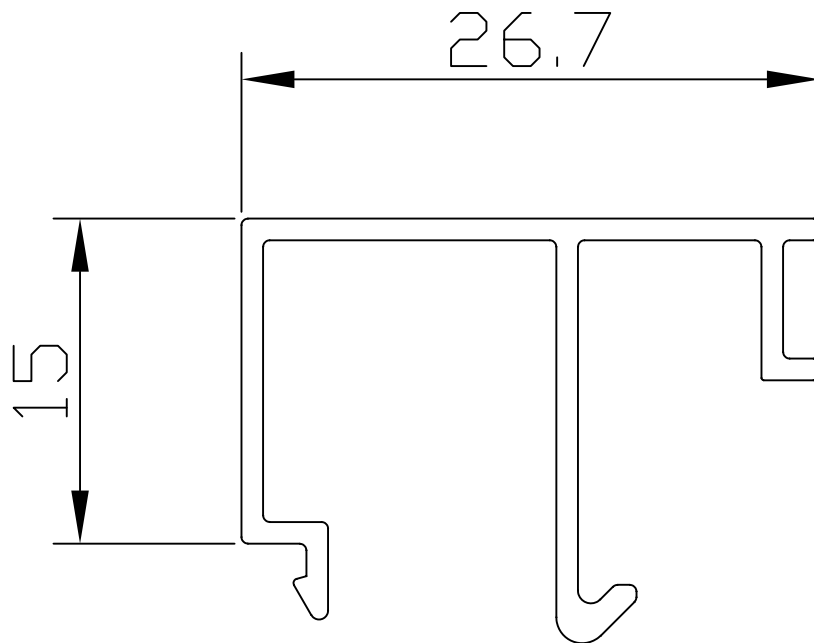


INSIDE



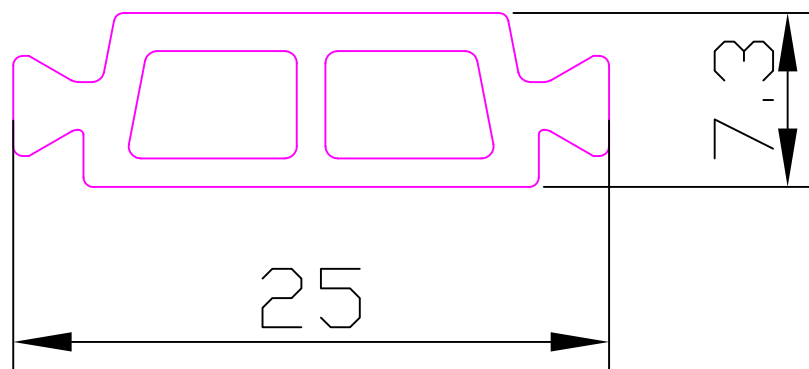
PVC - Rigid

BOM Code	G76-K1
BOM Name	Window frame
比 例	----- 2022 ----- DOORS & WINDOWS SYSTEM SOLUTION SUPPLIER
1 : 1	



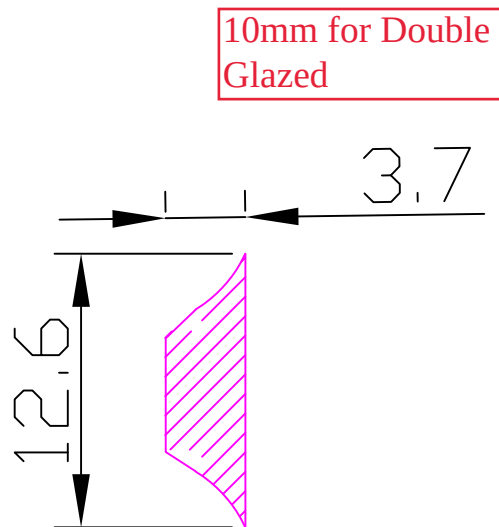
PVC Rigid

BOM Code	G76YX
BOM Name	Crimping
比 例	----- 2022 ----- DOORS & WINDOWS SYSTEM SOLUTION SUPPLIER
1 : 1	

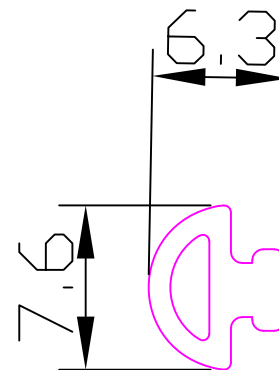


Polyamide 6.6 with 25% glass Fiber

BOM Code	GR76-25
BOM Name	Heat insulation strip
比 例	----- 2022 ----- DOORS & WINDOWS SYSTEM SOLUTION SUPPLIER
1 : 1	



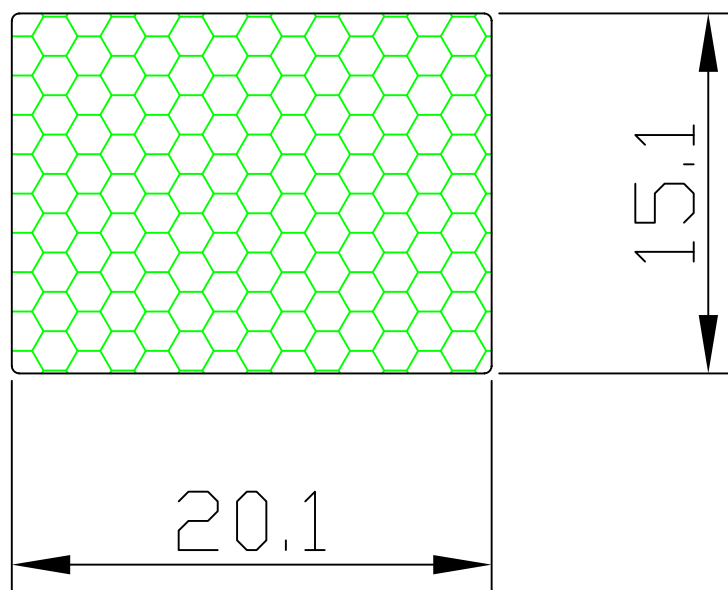
PU-G



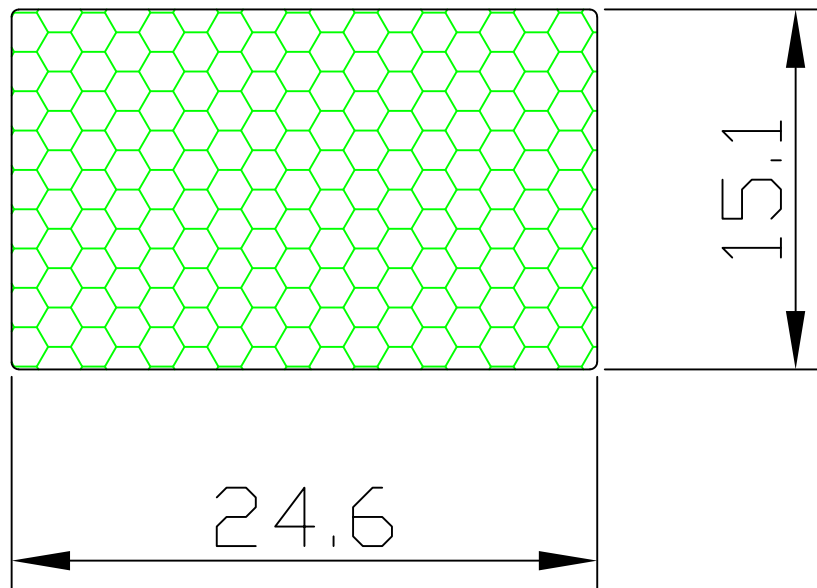
EPDM-01

EPDM

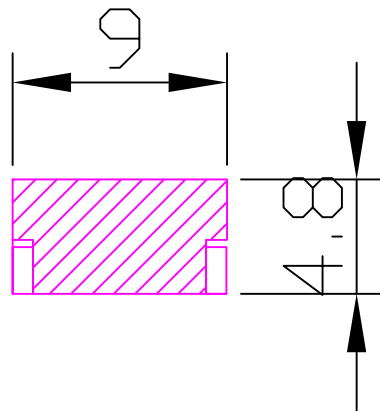
----- 2022 -----



BOM Code	FPM76-002
BOM Name	Polyethylene foam insulation cotton
比 例	----- 2022 ----- DOORS & WINDOWS SYSTEM SOLUTION SUPPLIER
1 : 1	



BOM Code	FPM76-001
BOM Name	Polyethylene foam insulation cotton
比 例	----- 2022 -----
1 : 1	DOORS & WINDOWS SYSTEM SOLUTION SUPPLIER



BOM Code	JGT76-001
BOM Name	Quanex spacer bar
比 例	----- 2022 ----- DOORS & WINDOWS SYSTEM SOLUTION SUPPLIER
1 : 1	

Super Spacer® Premium Plus Enhanced

Super Spacer® Premium Plus is a flexible, silicone foam spacer that provides the maximum in perimeter insulation for sealed glazing units. Desiccant-filled with pre-applied side adhesive, the structural foam product significantly simplifies insulating glass (IG) production.



Basic Use

Super Spacer is a dual seal insulating glass spacer system that uses a high-performance acrylic adhesive for its structural seal and is backed with a proprietary multi-layer moisture vapor seal.

Featuring a vapor barrier backing, the spacer must be used in combination with conventional IG sealants.

Colors

Super Spacer Premium is available in Black, Aluminum, Grey and Almond.

Composition

Silicone foam base with desiccant pre-fill.

Desiccant Fill

3A molecular-sieve; 47% minimum by weight.

Continuous Packaged Length

For regular insulating glass production, Super Spacer Premium Plus is supplied on reels with the continuous packaged length varying depending on the spacer width.

Protective Packaging

To provide desiccant protection, the reels are sealed in moisture-proof foil bags. The reels are then shipped in recyclable cardboard boxes.

Performance	Norm
Thermal conductivity 0.127 W/m°K	ASTM C 518
Gas / Moisture vapor barrier WVTR < 0.020 gm/m ² /day Oxygen < 0.009 cc/m ² /day	ASTM F 1249 ASTM D 3985
Primary structural seal Acrylic adhesive	
Fogging No fog in visual area.	ASTM E 2190 EN 1279 - 6 CAN/CGSB 12.8
Gas Retention Pass with hot-melt butyl or curative butyl	EN 1279 - 3
I.G. Durability Pass with hot-melt butyl or curative butyl	ASTM E 2190 EN 1279 - 2

Super Spacer® Premium Plus Enhanced

Warm-Edge Silicone Foam Features & Benefits

- Superior silicone foam insulation
- Low thermal conductivity
- Substantially reduced perimeter condensation
- Typical overall 0.2 W/m²K (0.04 BTU/h-ft²-°F) U-factor window improvement (vs. aluminum)
- Excellent UV resistance
- Extreme temperature performance
- Fast dew-point drop
- Superior compression-set resistance
- Excellent color stability
- Enhanced sound dampening

Edge-Seal Durability

- Continuous vapor barrier at corners
- No chemical fogging
- High desiccant content
- Same spacer material and edge-seal technology as the proven Premium Plus product.

Unique Dual-Seal Design

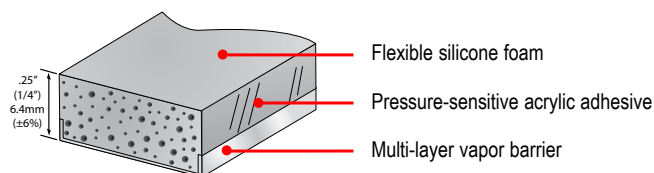
- Outer hot-melt butyl sealant for enhanced gas retention
- Inner structural acrylic side adhesive
- Immediate unit handling
- No cold flow or spacer/seal migration problems

Improved Productivity

- Fast application
- Elimination of desiccant filling
- No corner key assembly
- Simplified production of shaped units
- Limited equipment investment
- High-volume production with reduced labor force

Pleasing Aesthetic Appearance

- Black, Aluminum, Grey or Almond colors
- Smooth matte surface finish
- No surface blistering or bubbling
- Straight-line application with sharp 90° corners



Reel Sizes

Width mm	Width inches	Meter/ Reel	Feet/ Reel	Meter/ Auto Reel	Feet/ Auto Reel
3.2 mm	.125"	457	1500	N/A	N/A
4.8 mm	.188"	457	1500	1372	4500
6.4 mm	.250"	335	1100	1006	3300
7.9 mm	.313"	305	1100	914	3000
9.5 mm	.375"	274	900	823	2700
11.1 mm	.438"	244	800	731	2400
12.7 mm	.500"	213	700	640	2100
14.3 mm	.563"	190	625	571	1875
15.9 mm	.625"	175	575	526	1725
17.5 mm	.688"	152	500	N/A	N/A
19.1 mm	.750"	152	500	457	1500
20 mm*	.787"	122	400	N/A	N/A

* All even metric sizes are not available in North American market.

Note: Nominal sizes larger than 0.375" (3/8") have a tolerance of +/- 3% for the width (airspace) and +/- 6% for the height (thickness).

For nominal sizes 0.375" (3/8") and lower the tolerance is +/- 0.010" on the width (airspace) and +/- 6% for the height (thickness).

Note: All metric dimension equivalent sizes are for reference only.

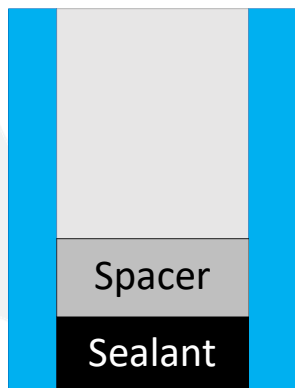
Quanex's Quality Management System is certified to ISO 9001 by Smithers Quality Assessments

Rev. #	Revisions Made	Rev. Date
2	Changed U-value to U-factor per Grant Muller	2/24/17

Quanex IG Systems

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Cambridge, OH 43725
T 800-233-4383
F 740-439-0121
www.quanex.com

Please use the information below when modeling Quanex Super Spacer® for thermal performance.



Modeling Steps (THERM):

1. Sum the sealant depth and the appropriate spacer height;
2. Import a glazing system with the **Spacer Height** set to the sum from step 1;
3. Use the **Rectangle** tool to draw the sealant box:
 - a. Box bottom should be flush with the lower glass edge;
 - b. Box height is according to the actual sealant depth;
4. Use the **Fill Void** tool to create the spacer box; make sure to select the proper material.

Spacer Type	Spacer Height	Material Name in NFRC 101	Listed K _{EFF}
Standard	3/16" [4.8 mm]	Super Spacer Standard (EPDM)	0.179 W/m·K
Premium	3/16" [4.8 mm]	Super Spacer S2 Premium	0.115 W/m·K
Premium Plus	1/4" [6.4 mm]	Super Spacer S2 Premium Plus	0.127 W/m·K
Triseal	0.287" [7.3 mm]	Super Spacer Triseal / T-Spacer	0.141 W/m·K
T-Spacer	0.287" [7.3 mm]	Super Spacer Triseal / T-Spacer	0.141 W/m·K

Notes:

1. All Super Spacers are modeled using the 2-box method, using effective conductivity (K_{EFF}) values for the spacers, and the appropriate conductivity for the sealant. This includes the various T-spacers: the PIB is not drawn separately.
2. Listed K_{EFF} values are taken from NFRC 101, but may not be current. If there is a disparity between the values above and those in NFRC 101, use the NFRC values.
3. By default, Super Spacer is sized in 1/16" increments, but some non-standard sizes are available. Always verify actual size with the IG manufacturer before modeling.
4. Default sealant depths¹ for the rectangular (i.e. not T-spacer/Triseal) spacers are:
 - a. 3/16" for hot melt butyl, a.k.a. "Butyl rubber (isobutene, solid/hot melt)";
 - b. 1/4" for other organic sealants (silicone is not used with rectangular spacers);
 - c. Always verify actual sealant depth with the IG manufacturer before modeling;
5. Default sealant for the T-spacer and Triseal products is 1/4" silicone.¹ However, both the material and depth can vary according to the requirements of individual projects, so always verify both with the IG manufacturer before modeling.

¹ Note that default sealant specifications are for thermal modeling only; they are not recommendations for IG manufacture. For more information, see Quanex technical bulletin RDQ0024: *Secondary Sealant use with Super Spacer Systems*.

For questions regarding this document, please contact:

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