LAYTON CONSULTING LTD
GLAZING, CLADDING, & SPECIALTY STRUCTURAL ENGINEERING
Suite 233 - 18525 53rd Ave., Surrey, BC, Canada, V3S 7A4

NFRC National Fenestration Rating Council® ACCREDITED

CSA A440.2 SIMULATION REPORT

Project Name: **Acro Aluminum Swing Door Thermal Simulation**

Project Number: 1510-17133

Simulation Date: May 19, 2023

Report Date: May 24, 2023

Revision #: R1 – Updated material properties for the gaskets and insulation based on supplier data. Also updated models based on latest CAD models, and changed the glass and spacer type.

Product Model:

Name/Number	Type
Baywest Swing Door	Single Door
Baywest Swing Door	Double Door

Fenestration Product Supplier:

Acro Aluminum Inc.
5430 275th Street
Langley, BC
V4W 3X7

Attn: Brent Friesen

	Layton Consulting Employee Name	Signature
Simulation by:	Taylor Wight, P.Eng., NFRC Certified Simulator	
Reviewed by:	Tyler Loewen, NFRC Certified Simulator	

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GENERAL NOTES

Disclaimers

- This report shall not be reproduced, neither in part nor in full, without the approval of Layton Consulting Ltd.
- This report relates only to the fenestration products simulated and are based on the CAD files and information provided by the client. Layton Consulting Ltd. does not verify that all the provided information is current and accurate to what is installed.
- Ratings values included in this report are for submittals to an NFRC-licensed IA and are not meant to be used directly for labelling purposes. Only those options identified on a valid Certificate of Authorization (CA) by an NFRC accredited Inspection Agency (IA) are to be used for labelling purposes".
- 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.

Simulation Notes

- Thermal simulations were conducted in full compliance with NFRC test methods (as per ANSI/NFRC 100-2020[E0A0] Procedure for Determining Fenestration Product U-factors).
- The Solar Heat Gain Coefficient (SHGC) and Visible Transmittance (VT) were determined following ANSI/NFRC 200-2020[E0A0].
- Glass layers are generally taken from the latest International Glazing Database (IGDB). If custom glass types were required to be created the glass layer will be noted in the "Insulated Glazing Unit (IGU) Details" section, and additional layer details can be found in the appendix. If layers were created, OPTICS software was used and NFRC 303-2020[E0A0] & NFRC 304-2020[E0A0] were followed to do so.
- The IGU gas fill was assumed to be filled with Argon using the single-probe timed filling technique, to fill the air gap with 90% Argon, and 10% Air.
- Simulation was completed using NFRC approved software – THERM 7.8 and WINDOW 7.8.
- Thermal simulation models may require some minor modifications made by the simulator, relative to the provided drawings, to account for software limitations.
- Rounding is per NFRC 601, NFRC Unit and Measurement Policy.
- Unless otherwise stated, only continuous hardware was modelled.

PRODUCT LINE DESCRIPTION AND MATERIAL PROPERTIES

Table 1: Frame Material Types & Properties Used for Components of the System

Component	Color	Material	λ(W/m·K)
Spacer Type	*	Super Spacer TriSeal	*0.141
Spacer Primary Seal		Polyisobutylene (PIB)	0.2
Spacer Secondary Seal (backfill)		Butyl rubber, (Isobutene), Solid / Hot Melt	0.24
Frame / Sash		Aluminum Alloys (Anodized)	160
Thermal Break(s)		Polyamide 6.6 with 25% Glass Fiber	0.3
Glazing Gaskets	*	Deventer TPE 60	*0.2417
Frame Seal(s) (operable Only)	*	Santoprene 101-55	*0.246
	*	Santoprene 101-80	*0.221
		Silicone	0.35
	*	Deventer TPE 60	*0.2417
Frame Insulation		Polyurethane Foam - Comfort Lock HFO	0.0267

All material properties are taken from NFRC 101-2023, unless otherwise stated in additional footnotes.

** The information sent from the suppliers defining the conductivity is in the appendix of this report.*

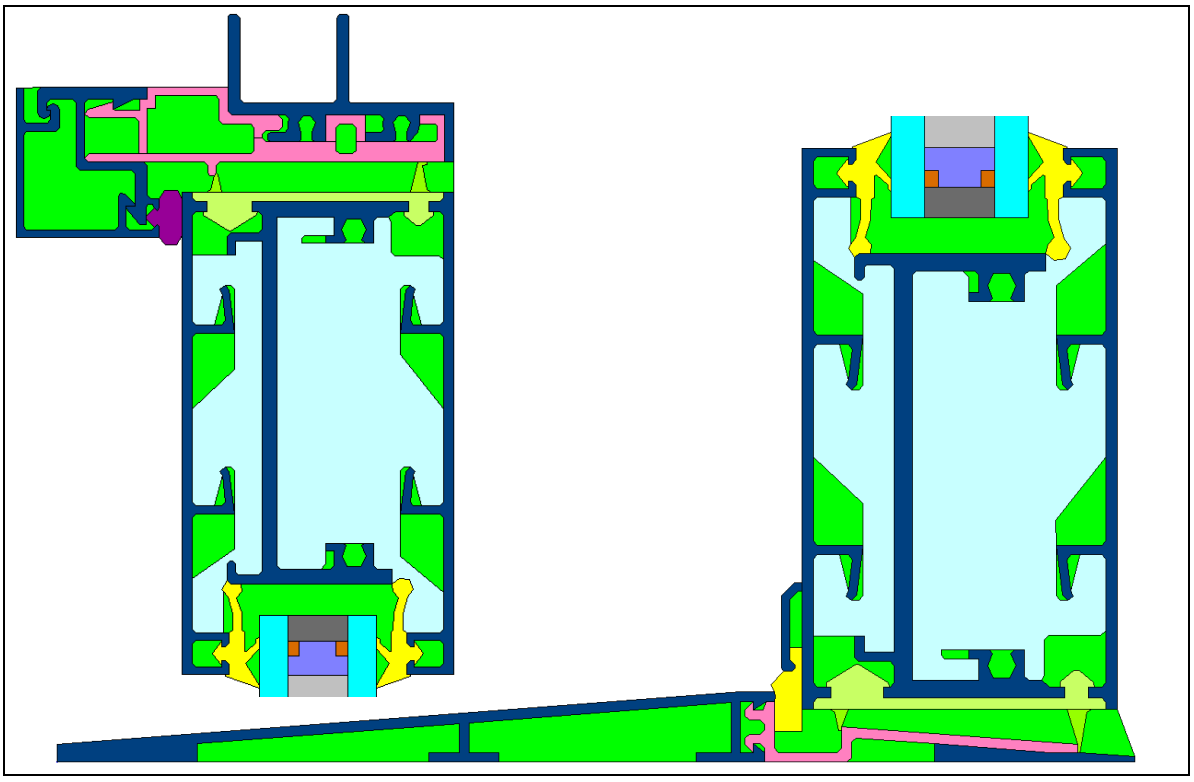


Figure 1: Model of the CW Jamb to Show the Materials of Components Modelled

Insulated Glazing Unit (IGU) Details:

G1: LoE² 272 on 6 mm Clear (Surface #2, ε = 0.042) / 12.7mm Air (10%) - Argon (90%) Mix / Generic Clear Glass (Total Thickness = 24.1mm)

G2: LoE² 272 on 6 mm Clear (Surface #2, ε = 0.042) / 12.7mm Air (10%) - Argon (90%) Mix / i89 on 6mm Clear (Surface #4, ε = 0.149) (Total Thickness = 24.1mm)

RESULTS

Table 2: Thermal Modelling Result

Product Name	Glazing Type	Width x Height (mm)	U-Value (W/m²-K)	U-Value (Btu/h-ft²-°F)	SHGC	VT
Single Door 1-Low-E	G1	960 x 2090	1.76	0.31	0.26	0.46
Single Door 2-Low-E	G2	960 x 2090	1.56	0.27	0.25	0.43
Double Door 1-Low-E	G1	1920 x 2090	1.73	0.30	0.27	0.47
Double Door 2-Low-E	G2	1920 x 2090	1.52	0.27	0.25	0.44

APPENDIX

CERTIFICATE OF ACCREDITATION
NATIONAL FENESTRATION RATING COUNCIL
HEREBY ACKNOWLEDGES THAT
LAYTON CONSULTING LTD.
SURREY, BRITISH COLUMBIA
HAS FULFILLED ALL THE REQUIREMENTS OF THE NFRC LABORATORY ACCREDITATION PROGRAM AND IS GRANTED RECOGNITION FOR ONE YEAR AS AN
NFRC ACCREDITED SIMULATION LABORATORY
ON THE TERMS AND CONDITIONS SET FORTH IN THE LICENSE AGREEMENT.
DECEMBER 2021
Approval Month Year
Dennis Anderson
Program Manager

CERTIFICATE OF ACHIEVEMENT
NATIONAL FENESTRATION RATING COUNCIL
HEREBY ACKNOWLEDGES THAT
TAYLOR WIGHT
HAS FULFILLED ALL THE REQUIREMENTS AND PASSED ALL EXAMINATIONS CONDUCTED BY THE NFRC AND IS GRANTED RECOGNITION FOR THE USE OF WINDOW/THERM AS AN
NFRC CERTIFIED SIMULATOR
MARCH 2019
Date
Kevin S. Louder
Program Manager

Figure 2: NFRC Certification of Laboratory and Simulator – Taylor Wight

IGU Name: G1

	ID	Name	Thick	Surf	Tsol	Tvis	E	Source
Glass 1	2014	LoE272-6.CIG	5.7	2	0.409	0.781	0.042	IGDB v16.4
Gap 1	9	Air (10%) - Argon (90%) Mix	12.7					
Glass 2	103	CLEAR_6.DAT	5.7		0.771	0.884		IGDB v11.4

Overall thickness (mm): 24.12

IGU Name: G2

	ID	Name	Thick	Surf	Tsol	Tvis	E	Source
Glass 1	2014	LoE272-6.CIG	5.7	2	0.409	0.781	0.042	IGDB v16.4
Gap 1	9	Air (10%) - Argon (90%) Mix	12.7					
Glass 2	2162	i89-6.CIG	5.7	4	0.683	0.870	0.149	IGDB v21.0

Overall thickness (mm): 24.06

Centre of Glass U-Factor Results (Frame not included):

Name	# of Layers	Mode	Overall Thickness	Uval	SHGC	Tvis
			mm	W/m2-K		
6mm LoE272 / 12.7mm Arg / 6mm Clear	2	#	24.70	1.405	0.399	0.693
6mm LoE272 / 12.7mm Arg / 6mm i89	2	#	24.70	1.135	0.389	0.682

Figure 3: Additional IGU Details

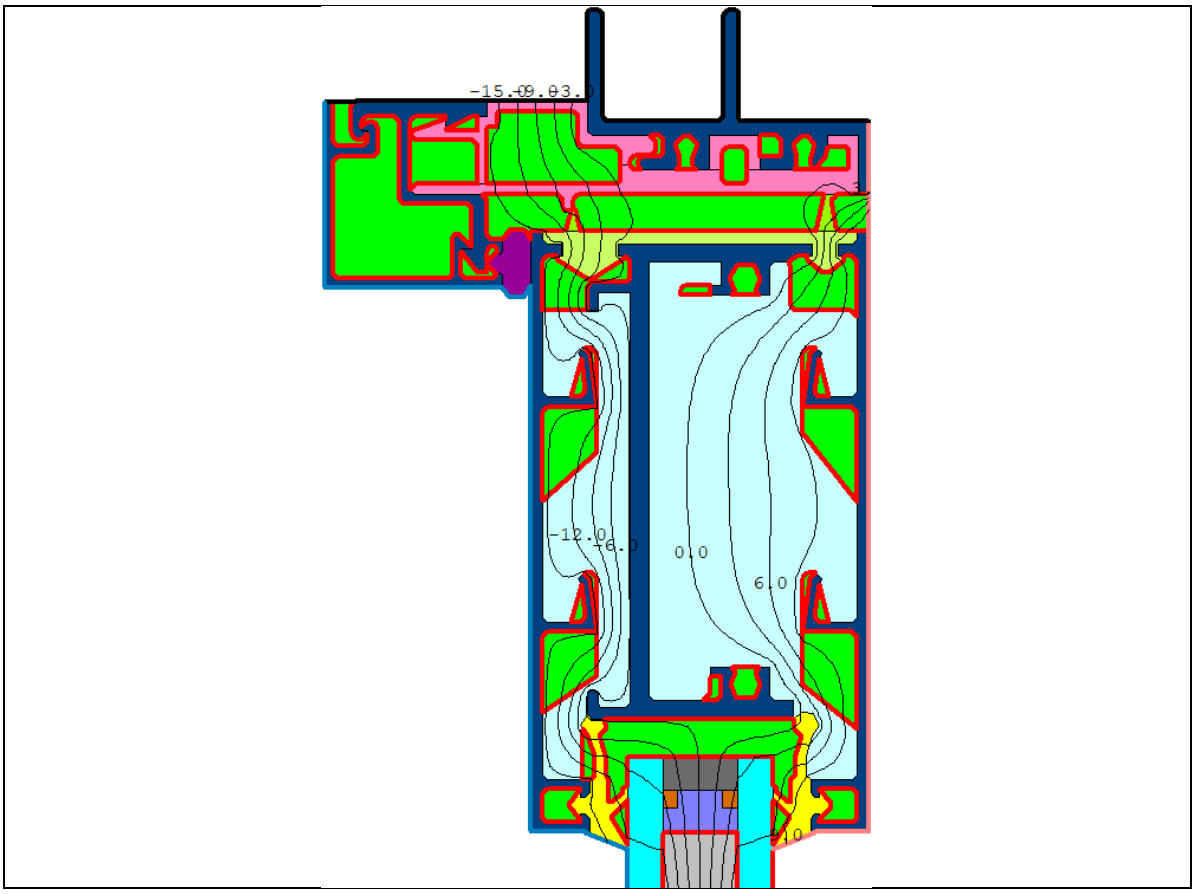


Figure 4: Thermal Modelling Result – Head

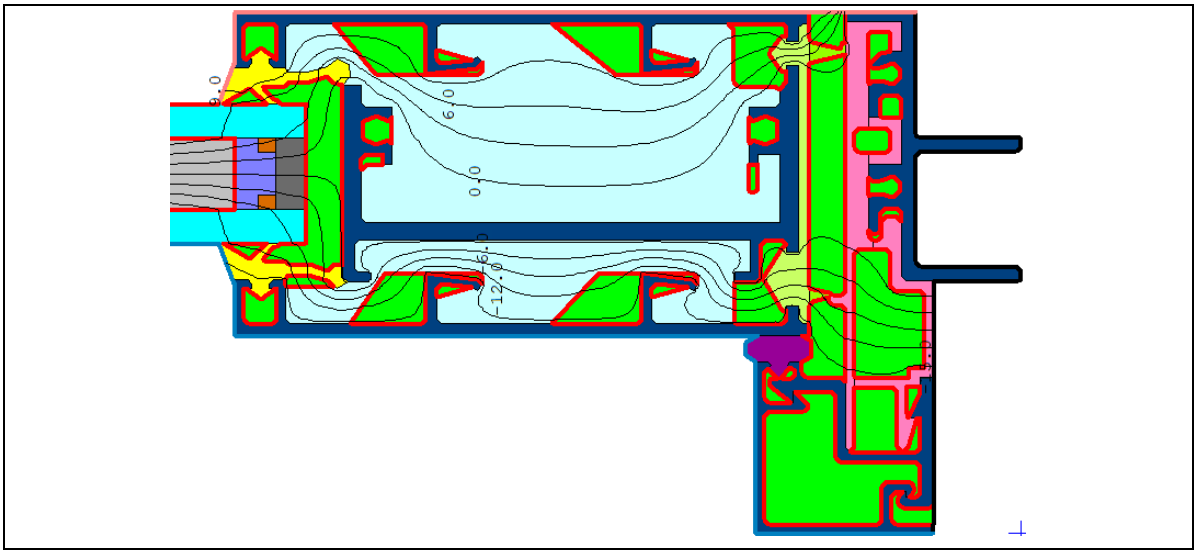


Figure 5: Thermal Modelling Result – Jamb

Figure 6: Thermal Modelling Result – Sill

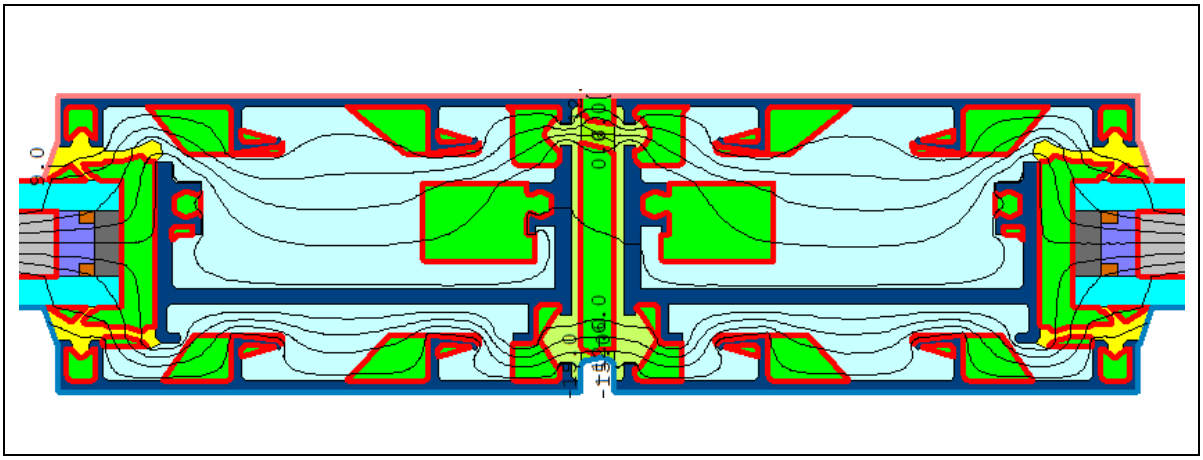


Figure 7: Thermal Modelling Result – VMR

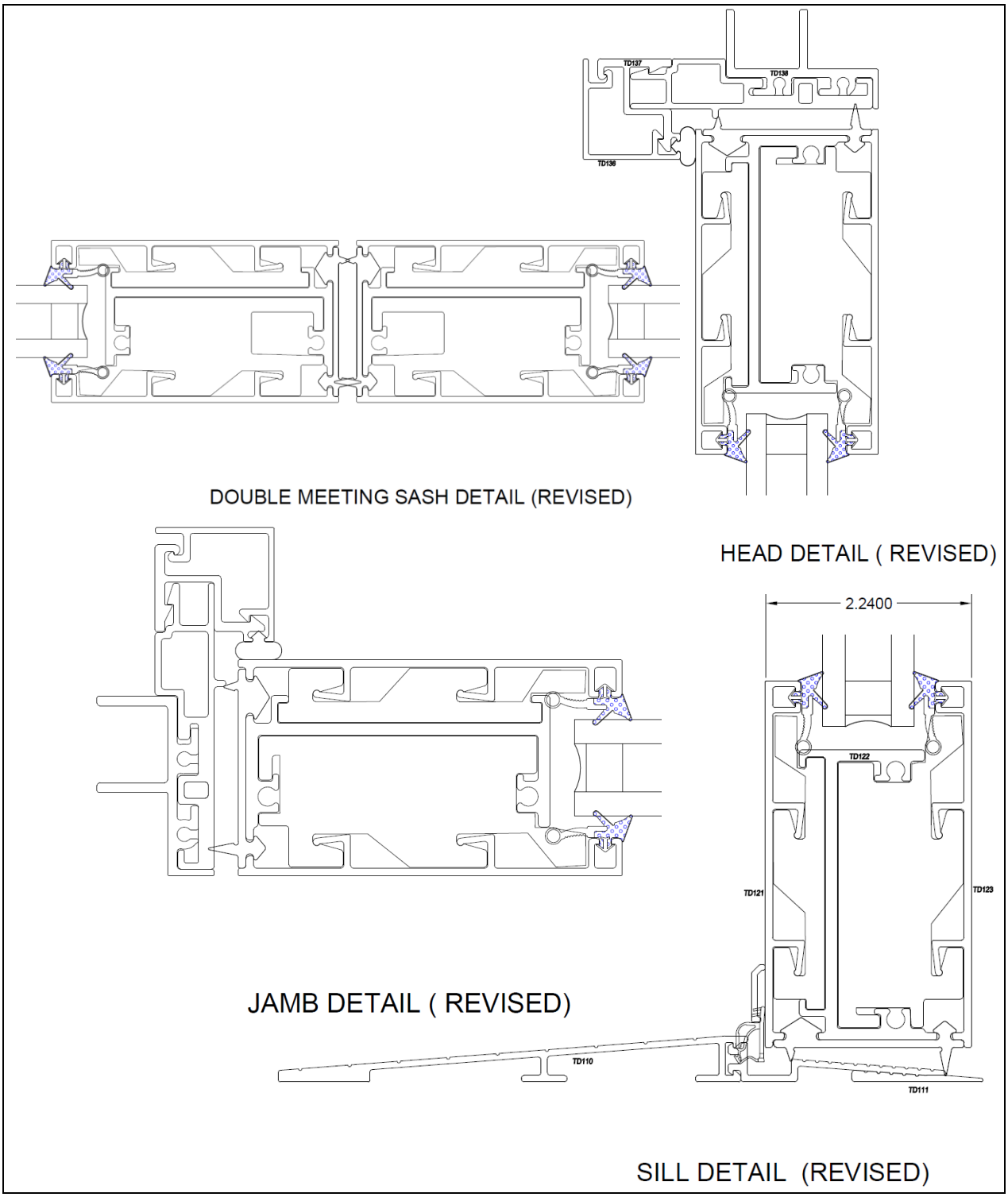


Figure 8: Assembled Profile Drawings

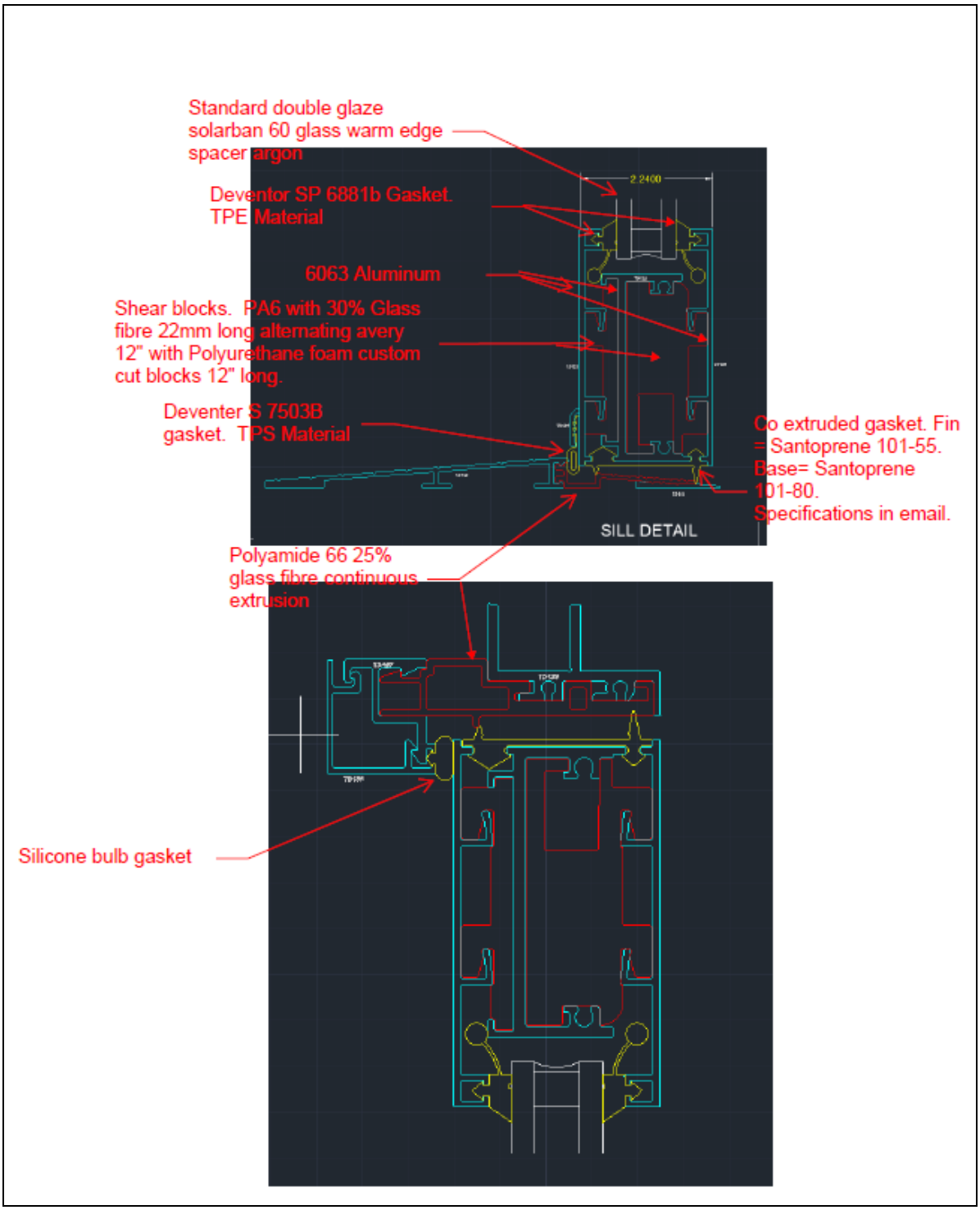


Figure 9: Bill of Materials

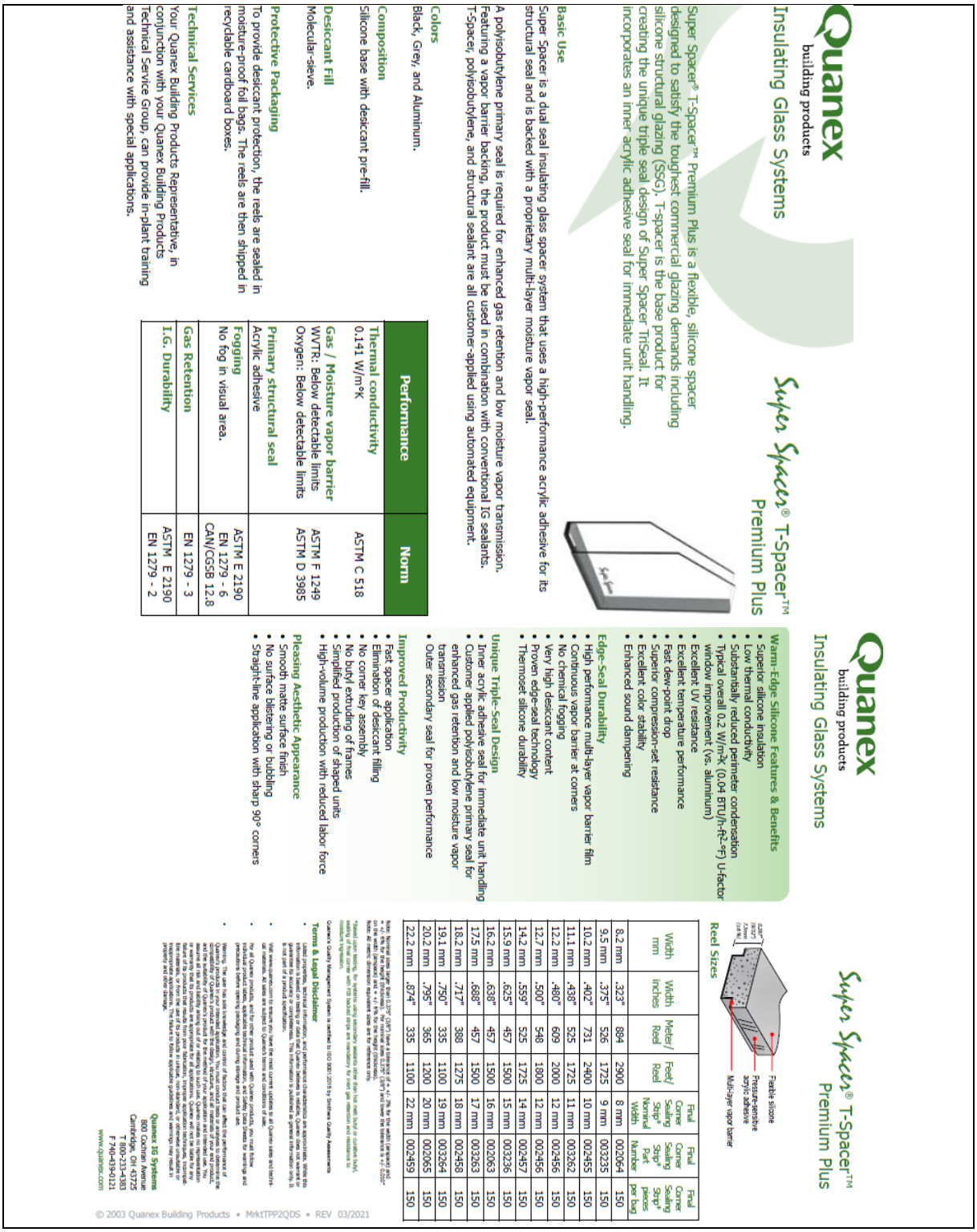


Figure 10: Spacer Details

From: Brent Friesen <brent@baywestglazing.ca>
Sent: Monday, June 5, 2023 6:41 PM
To: Bill Shipman <Bill.Shipman@roto-frank.com>
Cc: Renee Coma <renee.coma@roto-frank.com>
Subject: RE: Specifications on gaskets

Hi Bill,

That is interesting info but it doesn't help my thermal modeler know what thermal resistance TPE has. Do you have any information on thermal resistance of TPE for thermal modelling?

I would still like the cad drawing as well so they can get the shape correct.

Brent Friesen
Owner

Baywest Glazing Systems Inc. (Formerly Clearbrook Glass)
5430 275th Street,
Langley BC, V4W 3X7
Direct: 778-771-1951
Shop: 604-854-1327
brent@baywestglazing.ca
www.baywestglazing.ca

From: Bill Shipman <Bill.Shipman@roto-frank.com>
Sent: Wednesday, June 7, 2023 5:24 AM
To: Brent Friesen
Cc: Renee Coma
Subject: RE: Specifications on gaskets

Hello Brent,

Deventer came back to us with information:

About your question:
You could give the customer the follow information

Lambda Value of the DEVENTER TPE 60 is 0,2417 W/mK
Lambda value of the DEVENTER TPE foam:0,102 W/mK

With these values a customer will be able to calculate on his construction about the thermal resistance.

Figure 11: Deventer Gaskets Material details

From: Brent Friesen [mailto:brent@baywestglazing.ca]
Sent: Wednesday, May 31, 2023 6:41 AM
To: Daniel Bao <daniel.bao@haida.cn>
Subject: Door gaskets add

Hi Daniel,

We are testing our door. We are very happy with your gasket and will make an order soon.
Can you send me the thermal transmittance of Santoprene101-80 and 101-55? Preference would be in W/m*K units. I couldn't find it on the spec sheets you provided.

From: Daniel Bao <daniel.bao@haida.cn>
Sent: Wednesday, May 31, 2023 12:40 AM
To: Brent Friesen
Subject: RE: Door gaskets add

Hi Brent:

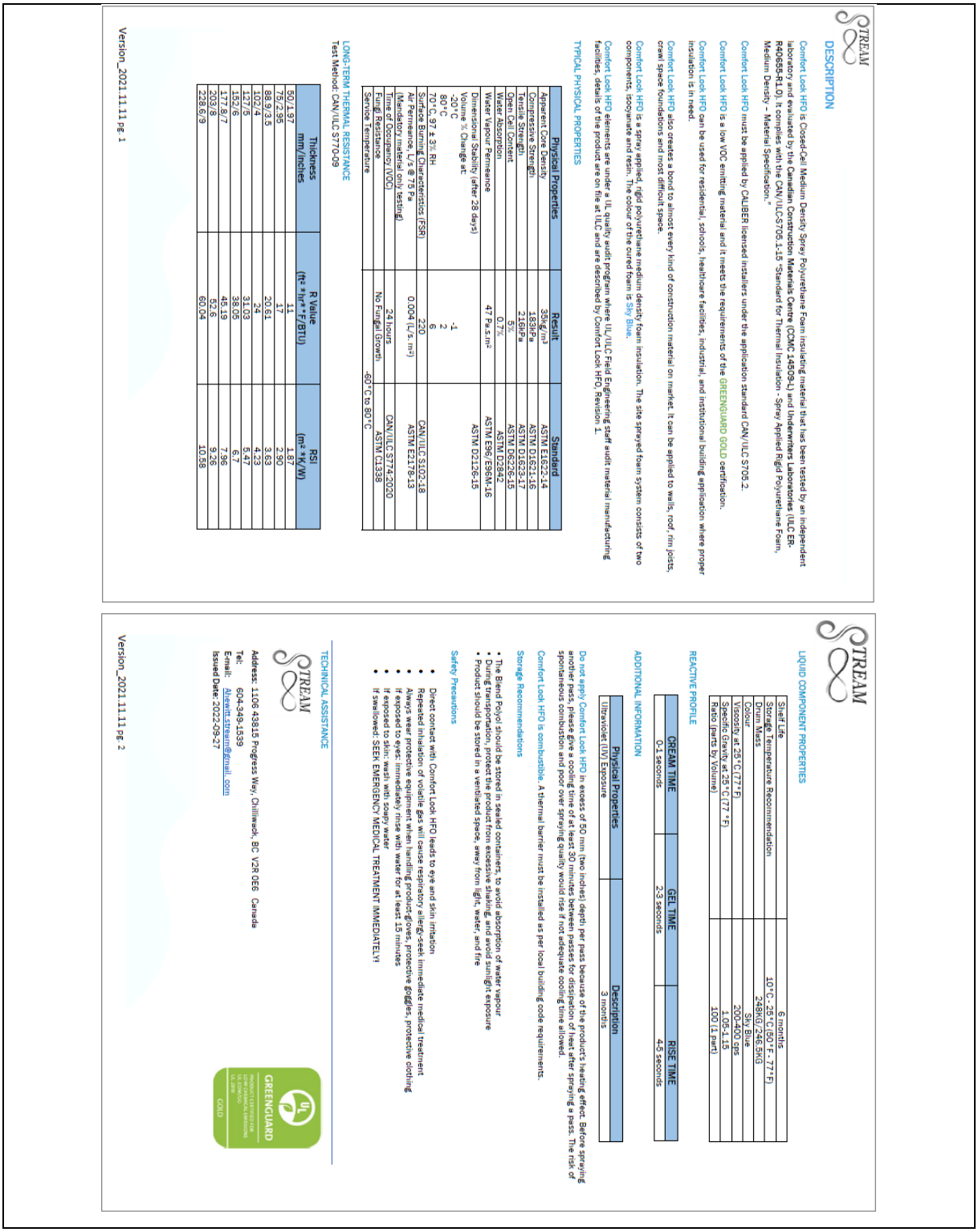
Good morning.
Here is the thermal transmittance given by our supplier:
101-55

Thermal conductivity data		
Temperature (T) °C	Thermal conductivity (k) W/m-°C	Heating/Cooling rate °C/s
265.00	0.183	0.0
247.00	0.186	0.0
229.00	0.190	0.0
210.00	0.192	0.0
192.00	0.194	0.0
174.00	0.198	0.0
156.00	0.201	0.0
138.00	0.202	0.0
120.00	0.227	0.0
101.00	0.232	0.0
83.00	0.239	0.0
65.00	0.246	0.0

101-80

Thermal conductivity data		
Temperature (T) °C	Thermal conductivity (k) W/m-°C	Heating/Cooling rate °C/s
265.00	0.185	0.0
247.00	0.189	0.0
229.00	0.192	0.0
210.00	0.194	0.0
192.00	0.196	0.0
174.00	0.200	0.0
156.00	0.203	0.0
138.00	0.206	0.0
120.00	0.217	0.0
101.00	0.220	0.0
83.00	0.222	0.0
65.00	0.221	0.0

Figure 12: Santoprene Seals Material Details



DESCRIPTION

Comfort Lock HFO is Closed-Cell Medium Density Spray Polyurethane Foam insulating material that has been tested by an independent laboratory and evaluated by the Canadian Construction Materials Centre (CCMC 14509-L) and Underwriters Laboratories (ULC ER-R40655-R1.0). It complies with the CAN/ULC-S705.1-15 "Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density - Material Specification."

Comfort Lock HFO must be applied by CALIBER licensed installers under the application standard CAN/ULC S705.2.

Comfort Lock HFO is a low VOC emitting material and it meets the requirements of the GREENGUARD GOLD certification.

Comfort Lock HFO can be used for residential, schools, healthcare facilities, industrial, and institutional building application where proper insulation is in need.

Comfort Lock HFO also creates a bond to almost every kind of construction material on market. It can be applied to walls, roof, rim joists, crawl space foundations and most difficult space.

Comfort Lock HFO is a spray applied, rigid polyurethane medium density foam insulation. The site sprayed foam system consists of two components, isocyanate and resin. The colour of the cured foam is Sky Blue.

Comfort Lock HFO elements are under a IIL quality audit program where IIL/ULC Field Engineering staff audit material manufacturing facilities, details of the product are on file at ULC and are described by Comfort Lock HFO, Revision 1.

TYPICAL PHYSICAL PROPERTIES

Physical Properties	Result	Standard
Apparent Core Density	35kg/m³	ASTM E1622-14
Compressive Strength	183kPa	ASTM D1621-16
Tensile Strength	216kPa	ASTM D1623-17
Open Cell Content	5%	ASTM D6226-15
Water Absorption	0.7%	ASTM D2842
Water Vapour Permeance	47 Pe.s.m²	ASTM E96/E96M-16
Dimensional Stability (after 28 days)		ASTM D2126-15
Volume % Change at:		
-20°C	-1	
80°C	2	
70°C, 97 ± 3% RH	6	
Surface Burning Characteristics (FSR)	220	CAN/ULC S102-18
Air Permeance, L/s @ 75 Pa (Mandatory material only testing)	0.0004 (L/s. m²)	ASTM E2178-13
Time of Occupancy (VOC)	24 hours	CAN/ULC S774-2020
Fungi Resistance	No Fungal Growth	ASTM C1338
Service Temperature		-60°C to 80°C

LONG-TERM THERMAL RESISTANCE

Test Method: CAN/ULC S770-09

Thickness mm/inches	R Value (ft² *hr* °F/BTU)	RSI (m² *K/W)
50/1.97	11	1.87
76/2.95	17	2.90
88.9/3.5	20.61	3.63
102/4	24	4.23
127/5	31.03	5.47
152/6	38.05	6.7
177.8/7	45.19	7.96
203/8	52.6	9.26
228.6/9	60.04	10.58

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LIQUID COMPONENT PROPERTIES

Shelf Life	6 months
Storage Temperature Recommendation	10°C - 25°C (50°F - 77°F)
Drum Mass	248KG/246.5KG
Colour	Sky Blue
Viscosity at 25°C (77°F)	200-400 cps
Specific Gravity at 25°C (77 °F)	1.08-1.15
Ratio (parts by Volume)	100 (1 part)

REACTIVE PROFILE

CREAM TIME	GEL TIME	RISE TIME
0-1 seconds	2-3 seconds	4-5 seconds

ADDITIONAL INFORMATION

Physical Properties	Description
Ultraviolet (UV) Exposure	3 months

Do not apply Comfort Lock HFO in excess of 50 mm (two inches) depth per pass because of the product's heating effect. Before spraying another pass, please give a cooling time of at least 30 minutes between passes for dissipation of heat after spraying a pass. The risk of spontaneous combustion and poor over spraying quality would rise if not adequate cooling time allowed.

Comfort Lock HFO is combustible. A thermal barrier must be installed as per local building code requirements.

Storage Recommendations

- The Blend Polyol should be stored in sealed containers, to avoid absorption of water vapour
- During transportation, protect the product from excessive shaking and avoid sunlight exposure
- Product should be stored in a ventilated space, away from light, water, and fire

Safety Precautions

- Direct contact with Comfort Lock HFO leads to eye and skin irritation
- Repeated inhalation of volatile gas will cause respiratory allergy-seek immediate medical treatment
- Always wear protective equipment when handling product-gloves, protective goggles, protective clothing
- If exposed to eyes: immediately rinse with water for at least 15 minutes
- If exposed to skin: wash with soapy water
- If swallowed: SEEK EMERGENCY MEDICAL TREATMENT IMMEDIATELY!

TECHNICAL ASSISTANCE

Address: 1106 43815 Progress Way, Chilliwack, BC V2R 0E6 Canada
Tel: 604-349-1539
E-mail: Alexander.stream@gmail.com

Issued Date: 2022-09-27

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Figure 13: Polyurethane Foam (Comfort Lock HFO) Material Details