



**NFRC U-FACTOR, SHGC, VT, &  
CONDENSATION RESISTANCE  
COMPUTER SIMULATION REPORT**

**Rendered to:  
TUBELITE, INC.**

**SERIES/MODEL:  
SF T14650 Storefront**

**Report Number: B6400.02-116-45**  
**Report Date: 07/13/12**  
**Test Record Retention Date: 01/25/16**

**NFRC U-FACTOR, SHGC, VT, & CONDENSATION RESISTANCE  
COMPUTER SIMULATION REPORT**

Rendered to:  
TUBELITE, INC.  
4878 Mackinaw Trail  
Reed City, MI 49677

Report Number: B6400.02-116-45  
Simulation Date: 01/25/12  
Report Date: 07/13/12  
Test Record Retention Date: 01/25/16

**Project Summary:**

Architectural Testing, Inc. was contracted to perform U-Factor, Solar Heat Gain Coefficient, Visible Transmittance, and Condensation Resistance\* computer simulations in accordance with the National Fenestration Rating Council (NFRC). The products were evaluated in full compliance with NFRC requirements to the standards listed below.

*\*NFRC's Condensation Resistance rating is NOT equivalent to a Condensation Resistance Factor (CRF) determined in accordance with AAMA 1503.*

**Standards:**

*NFRC 100-2010: Procedure for Determining Fenestration Product U-Factors*  
*NFRC 200-2010: Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence*  
*NFRC 500-2010: Procedure for Determining Fenestration Product Condensation Resistance Values*

**Software:**

**Frame and Edge Modeling:** THERM 6.3.45  
**Center-of-Glass Modeling:** WINDOW 6.3.62  
**Total Product Calculations:** WINDOW 6.3.62  
**Spectral Data Library:** 24.0

**Simulations Specimen Description:**

**Series/Model:** SF T14650 Storefront  
**Type:** Glazed Wall System , Window Wall  
**Frame Material:** AP Aluminum w/ Thermal Breaks - Partial  
**Sash Material:** NA Not Applicable  
**Standard Size:** 2000mm x 2000mm

**Modeling Assumptions/Technical Interpretations:**

None

**Specialty Products Table:**

The specialty products method allow the manufacturer to determine the overall product SHGC and VT for any glazing option. The center of glass SHGC and/or VT must be determined using WINDOW 6.3.9. The method gives overall product SHGC and VT indexed on center of glass properties. All values used in the calculations are truncated to six decimal place precision.

	No Dividers	Dividers < 1	Dividers > 1
SHGC0	0.007131	0.010552	0.013759
SHGC1	0.897780	0.796597	0.701733
VT0	0.000000	0.000000	0.000000
VT1	0.890649	0.786045	0.687974

$$SHGC = SHGC0 + SHGCc (SHGC1 - SHGC0)$$

$$VT = VT0 + VTc (VT1 - VT0)$$

**Validation Matrix:**

The following products are part of a validation matrix. Only one is required for validation testing.

<i>Product Line</i>	<i>Report Number</i>
None	-

### Spacer Option Description

<i>Spacer Type</i>	<i>Sealant</i>		<i>Code</i>
	<i>Primary</i>	<i>Secondary</i>	
Aluminum Spacer	Butyl Rubber	Butyl Rubber	Yes

### Grid Option Description

<i>Grid Size</i>	<i>Grid Type</i>	<i>Grid Pattern</i>
None	-	-

### Reinforcement Option Description

<i>Location</i>	<i>Material</i>
None	-

### Gas Filling Technique Description

<i>Fill Type</i>	<i>Method</i>
84.48% Xenon	Dual Probe w/Concentration Sensor
76.09% Argon	Single Probe Timed
85.82% Argon	Single Probe Timed
83.03% Argon	Single Probe Timed
88.65% Argon	Single Probe Timed
87.42% Argon	Single Probe Timed
64.98% Argon	Single Probe Timed
74.70% Argon	Single Probe Timed
60.79% Argon	Single Probe Timed
62.42% Argon	Single Probe Timed
86.02% Argon	Single Probe Timed
81.67% Argon	Single Probe Timed
94.60% Xenon	Evacuated Chamber

### Edge-of-Glass Construction

<i>Interior Condition</i>	Aluminum glazing leg with epdm against glass
<i>Exterior Condition</i>	Aluminum glazing leg with epdm against glass

### Weatherstripping

<i>Type</i>	<i>Quantity</i>	<i>Location</i>
None	-	-

### Frame/Sash Materials Finish

<i>Interior</i>	Painted or Anodized Aluminum
<i>Exterior</i>	Painted or Anodized Aluminum

**NFRC 100/200/500 Summary Sheet  
SF T14650 Storefront**

ID	Pane Thickness 1	Gap Width 1	Pane Thickness 2	Gap Width 2	Pane Thickness 3	Gap Width 3	Pane Thickness 4	Gap Fill	Low-e (Surface#)	Tint	Spacer	Grid Type
	U-Factor			Solar Heat Gain Coefficient (SHGC) Grids (None / <1 / >=1)				Visible Transmittance (VT) Grids (None / <1 / >=1)			Condensation Resistance	
1	COG=0.4400											
	0.222	0.500	0.225					XEN84.48		CL	A1-D	N
	U-Factor 0.59			SHGC (N) 0.62				VT (N) 0.66			CR 38	
2	COG=0.4200											
	0.222	0.500	0.225					ARG76.09	0.652(#2)	GY	A1-D	N
	U-Factor 0.57			SHGC (N) 0.24				VT (N) 0.21			CR 38	
3	COG=0.4000											
	0.220	0.500	0.225					ARG85.82	0.566(#2)	GY	A1-D	N
	U-Factor 0.56			SHGC (N) 0.24				VT (N) 0.18			CR 39	
4	COG=0.3800											
	0.226	0.500	0.225					ARG83.03	0.471(#2)	AZ	A1-D	N
	U-Factor 0.54			SHGC (N) 0.17				VT (N) 0.14			CR 39	
5	COG=0.3600											
	0.220	0.500	0.225					ARG88.65	0.395(#2)	GY	A1-D	N
	U-Factor 0.52			SHGC (N) 0.13				VT (N) 0.06			CR 40	
6	COG=0.3400											
	0.232	0.500	0.225					ARG87.42	0.318(#2)	CL	A1-D	N
	U-Factor 0.51			SHGC (N) 0.42				VT (N) 0.51			CR 41	
7	COG=0.3200											
	0.223	0.500	0.225					ARG64.98	0.215(#2)	CL	A1-D	N
	U-Factor 0.49			SHGC (N) 0.56				VT (N) 0.65			CR 42	
8	COG=0.3000											
	0.233	0.500	0.225					ARG74.7	0.166(#2)	CL	A1-D	N
	U-Factor 0.48			SHGC (N) 0.40				VT (N) 0.48			CR 42	
9	COG=0.2800											
	0.223	0.500	0.225					ARG60.79	0.087(#2)	CL	A1-D	N
	U-Factor 0.46			SHGC (N) 0.49				VT (N) 0.68			CR 42	
10	COG=0.2600											
	0.223	0.500	0.225					ARG62.42	0.035(#2)	CL	A1-D	N
	U-Factor 0.44			SHGC (N) 0.34				VT (N) 0.62			CR 42	

**NFRC 100/200/500 Summary Sheet  
SF T14650 Storefront**

ID	Pane Thickness 1	Gap Width 1	Pane Thickness 2	Gap Width 2	Pane Thickness 3	Gap Width 3	Pane Thickness 4	Gap Fill	Low-e (Surface#)	Tint	Spacer	Grid Type
	U-Factor			Solar Heat Gain Coefficient (SHGC) Grids (None / <1 / >=1)				Visible Transmittance (VT) Grids (None / <1 / >=1)			Condensation Resistance	
11	COG=0.2400											
	0.223	0.500	0.223					ARG86.02	0.035(#2) / 0.035(#3)	CL	A1-D	N
	U-Factor 0.43			SHGC (N) 0.32				VT (N) 0.56			CR 42	
12	COG=0.2200											
	0.223	0.500	0.223					XEN81.67	0.018(#2) / 0.018(#3)	CL	A1-D	N
	U-Factor 0.41			SHGC (N) 0.23				VT (N) 0.46			CR 42	
13	COG=0.2000											
	0.223	0.500	0.223					XEN94.6	0.018(#2) / 0.018(#3)	CL	A1-D	N
	U-Factor 0.40			SHGC (N) 0.23				VT (N) 0.46			CR 42	

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.

Ratings values included in this report are for submittals to an NFRC-licensed IA and are not meant to be used directly for labeling purposes. Only those values identified on a valid Certification Authorization Report (CAR) by an NFRC accredited Inspection Agency (IA) are to be used for labeling purposes. The ratings values were rounded in accordance to NFRC 601, NFRC Unit and Measurement Policy.

Architectural Testing, Inc. is an NFRC accredited simulation laboratory and all simulations were conducted in full compliance with NFRC approved procedures and specifications. The NFRC procedure requires that the computational results be verified through actual test results.

Detailed drawings, simulation data files, a copy of this report, or other pertinent project documentation will be retained by Architectural Testing, Inc. for a period of four 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 test methods. This report does not constitute certification of this product nor an opinion or endorsement by this laboratory. It is the exclusive property of the client so named herein and relates only to the product simulated. This report may not be reproduced, except in full, without the written approval of Architectural Testing, Inc.

For ARCHITECTURAL TESTING, INC.:

SIMULATED BY:



Digitally Signed for: Dale C. White by Kirby M. May

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Dale C. White  
NFRC Certified Simulator

REVIEWED BY:



Digitally Signed for: Kristen Livelsberger by Allison M. Goodyear

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Kristen L. Livelsberger  
Senior Simulation Technician  
Simulator-In-Responsible-Charge

DCW:dcw  
B6400.02-116-45

Attachments (pages):                      This report is complete only when all attachments listed are included.  
Appendix A: Drawings and Bills of Material (12)

### Revision Log

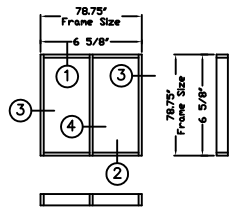
<u>Rev. #</u>	<u>Date</u>	<u>Page(s)</u>	<u>Revision(s)</u>
.02R0	7/13/2012	All	Original report issue to Tubelite, Inc.



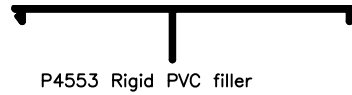
All drawings and Bills of Material used to simulate this product are enclosed in this Appendix

## **Appendix A**

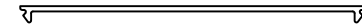
B6400.02-116-45



T-14650 Series Thermal Mock Up

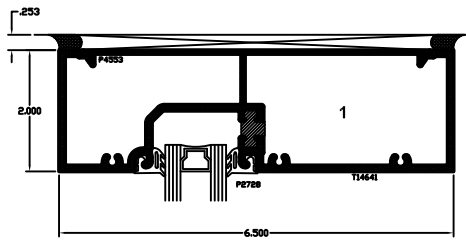


P4553 Rigid PVC filler

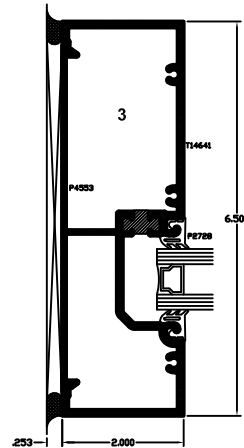


P1148 snap in filler for anchor points

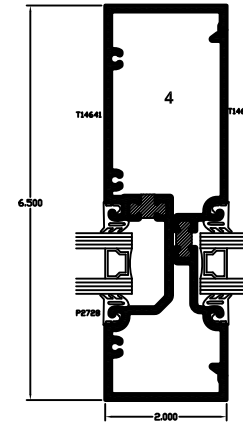
T-14650 Series Mock Up  
SCALE: 1/4" = 1'-0"



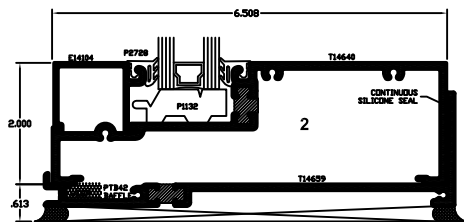
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3



4

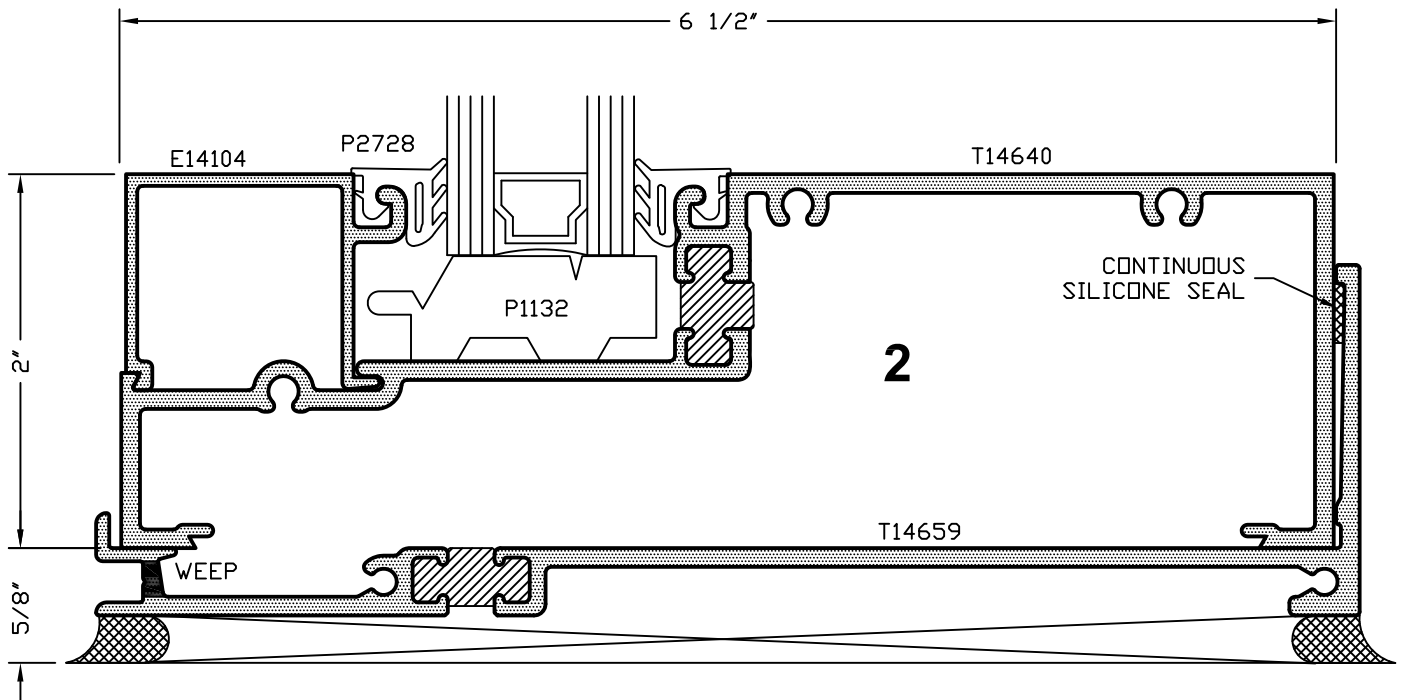


2

ATI	
Report #	B6400
Date	1/2012
Simulator	<i>Blawie</i>

T-14650 Series Mock Up- Thermal Testing

# T14650 Series Deep Flush Glaze Sill Detail

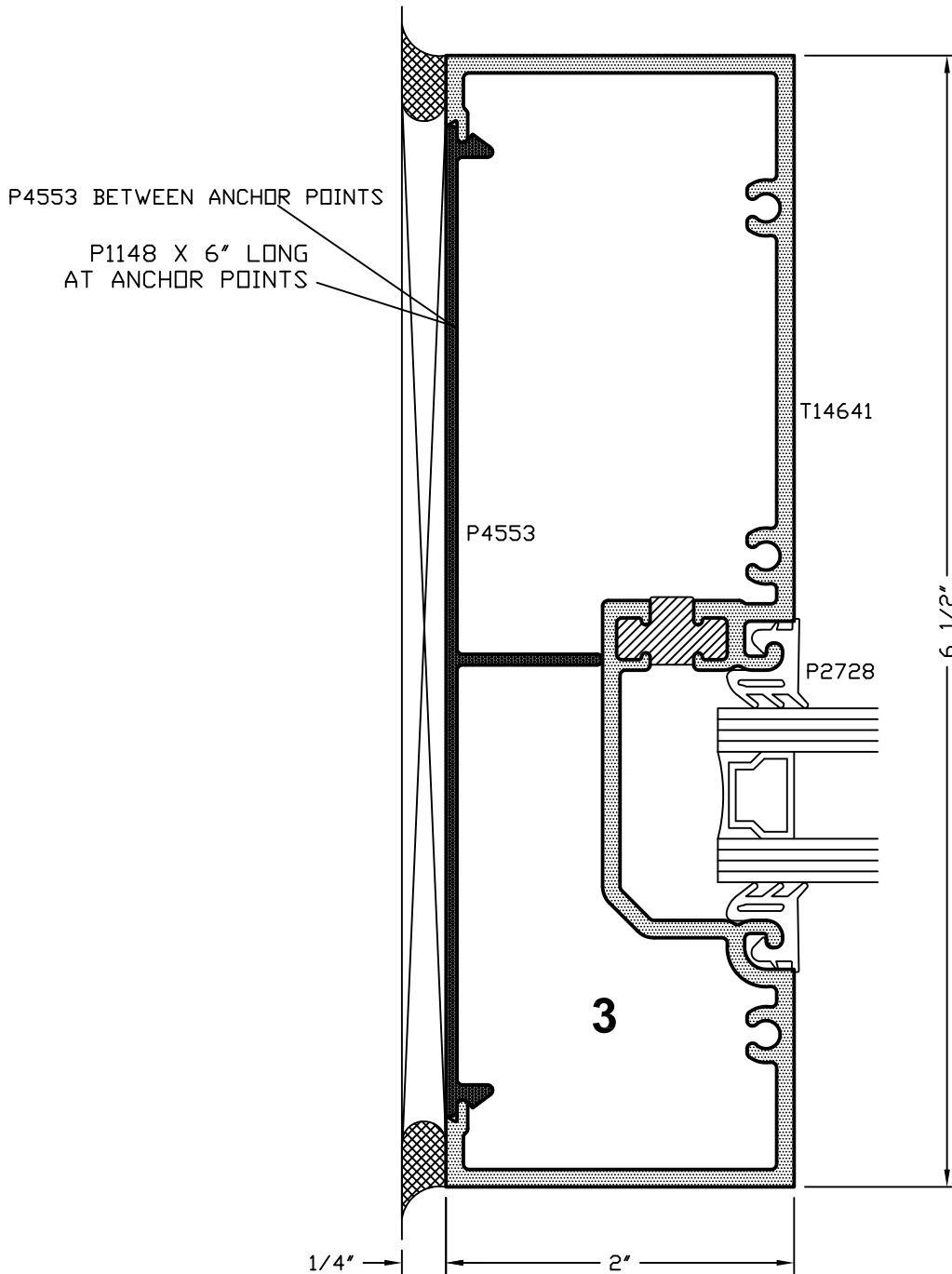


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<b>Report #</b>	<u>B6400</u>
<b>Date</b>	<u>1/2012</u>
<b>Simulator</b>	<u><i>Blaw</i></u>

\*SEALANT, ROD, & ANCHORS NOT BY TUBELITE

**TUBELITE**  
DEPENDABLE  
 LEADERS IN ECO-EFFICIENT STOREFRONT,  
 CURTAINWALL AND ENTRANCE SYSTEMS  
 2012

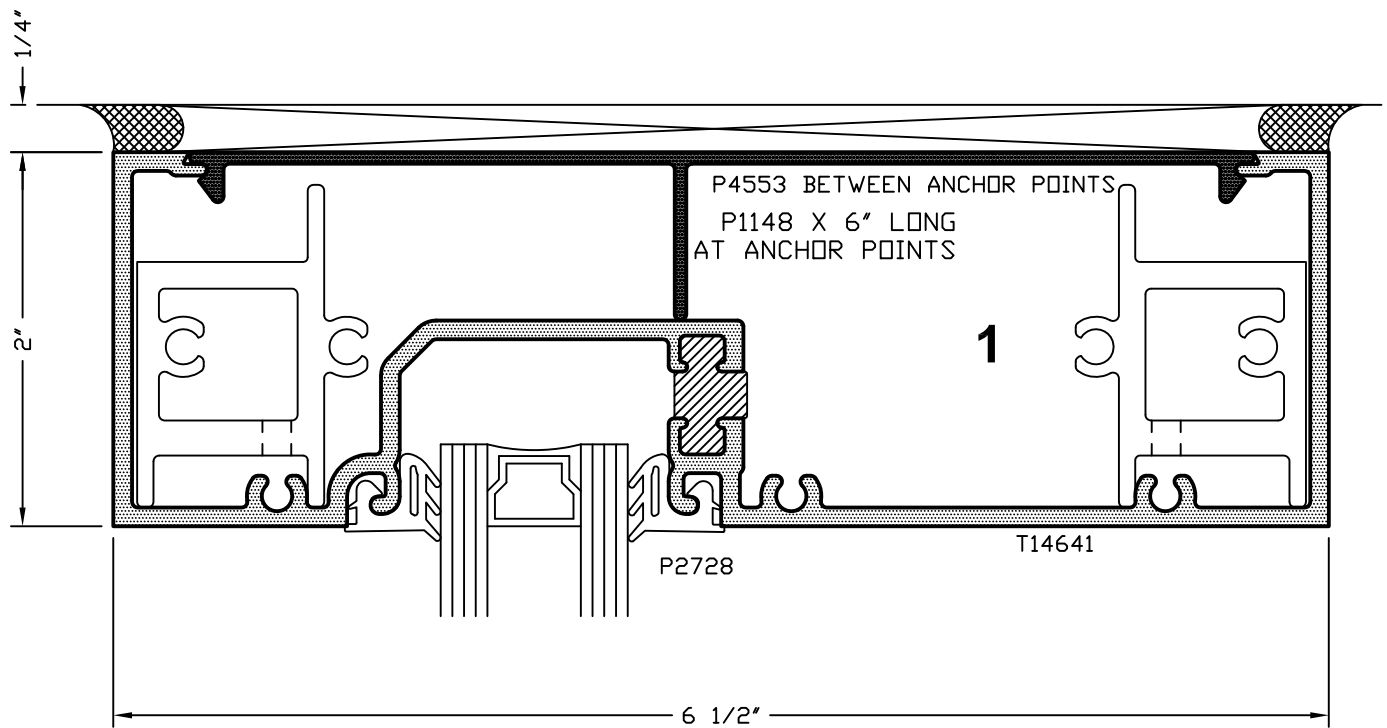
# T14650 Series Deep Flush Glaze Jamb Detail



	<b>ATI</b>
Report #	B6400
Date	1/2012
Simulator	<i>Delia W.</i>

\*SEALANT, ROD, & ANCHORS NOT BY TUBELITE

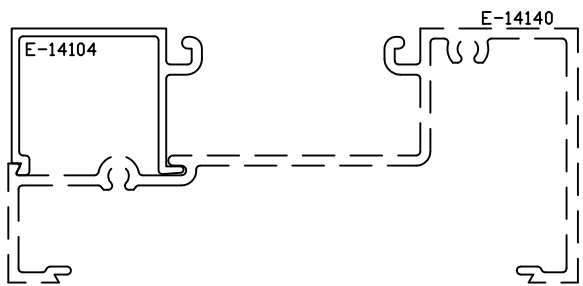
# T14650 Series Deep Flush Glaze Head Member



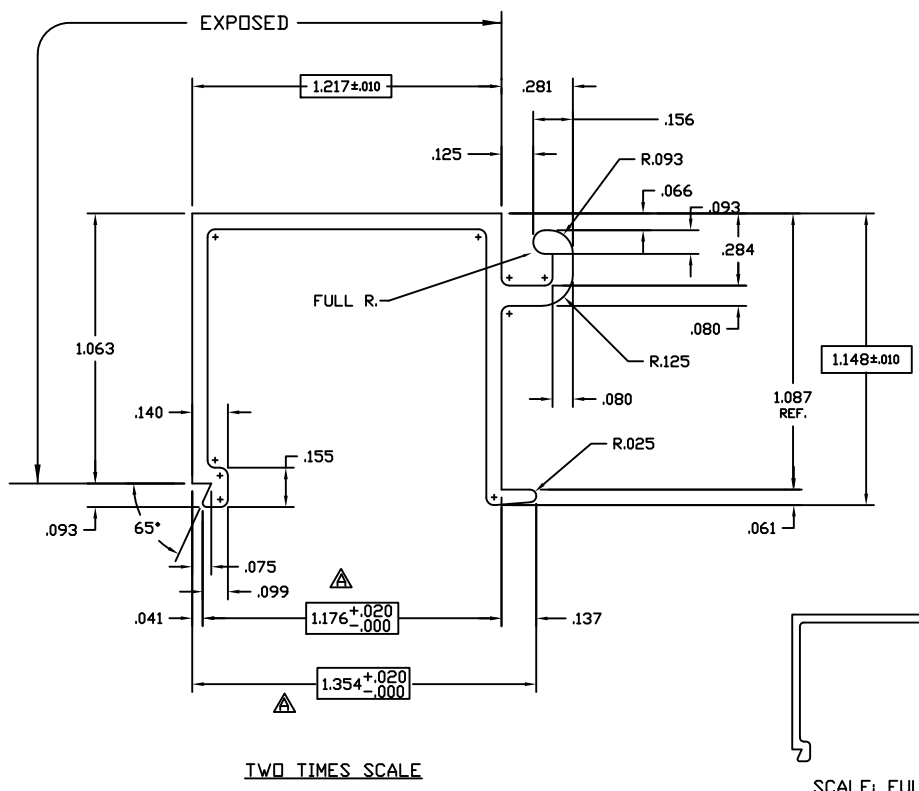
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Report #	B6400
Date	1/2012
Simulator	<i>Del. C. W.</i>

\*SEALANT, ROD, & ANCHORS NOT BY TUBELITE

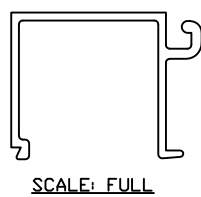
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 2012



**ASSEMBLY**  
NOTE : MATES WITH E-14140 AND E-14103



TWO TIMES SCALE



**ATI**

Report # B6400

Date 1/2012

Simulator *[Signature]*

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ALL UNSPECIFIED RADII .015  
\* INDICATES .031 RADIUS  
 DENOTES CRITICAL DIMENSION  
ALL DIES PROPERTY OF TUBELITE

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DEPENDABLE  
LEADER IN ECO-EFFICIENT STOREFRONT, CURTAINWALL AND ENTRANCE SYSTEMS

3056 WALKER RIDGE NW, SUITE G  
WALKER, MICHIGAN 49544

WALL THK. .060	SECTION CLASS S	MAT'L 6063-T5	RATID 70
PERIMETER (NET TOTAL) 8.270	AREA .264	WGT/FT .310	
FACTOR 27	CIRCLE SIZE 1.784	INFILL VOLUME N/A	

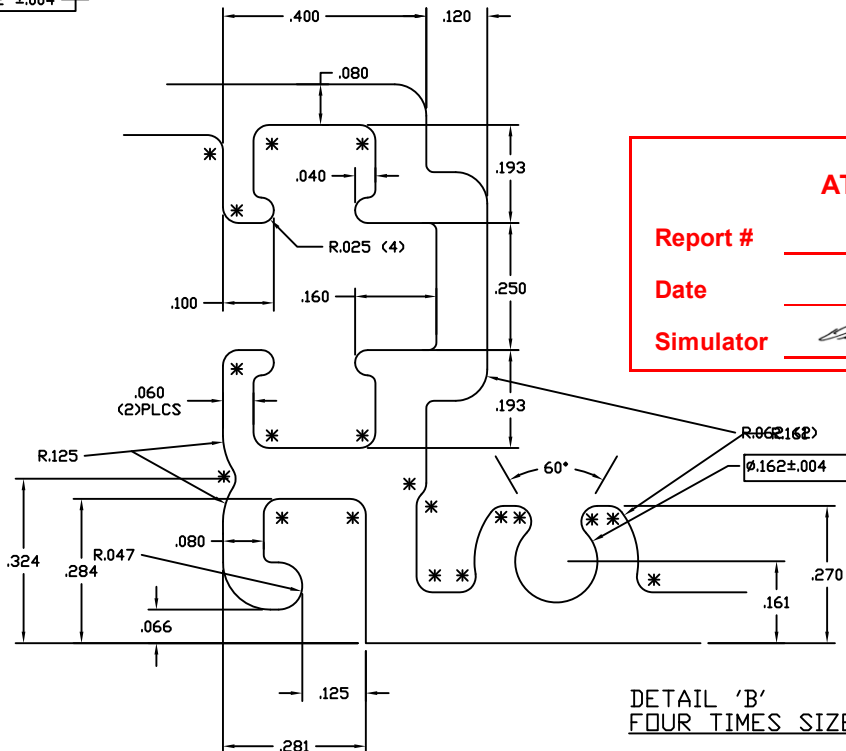
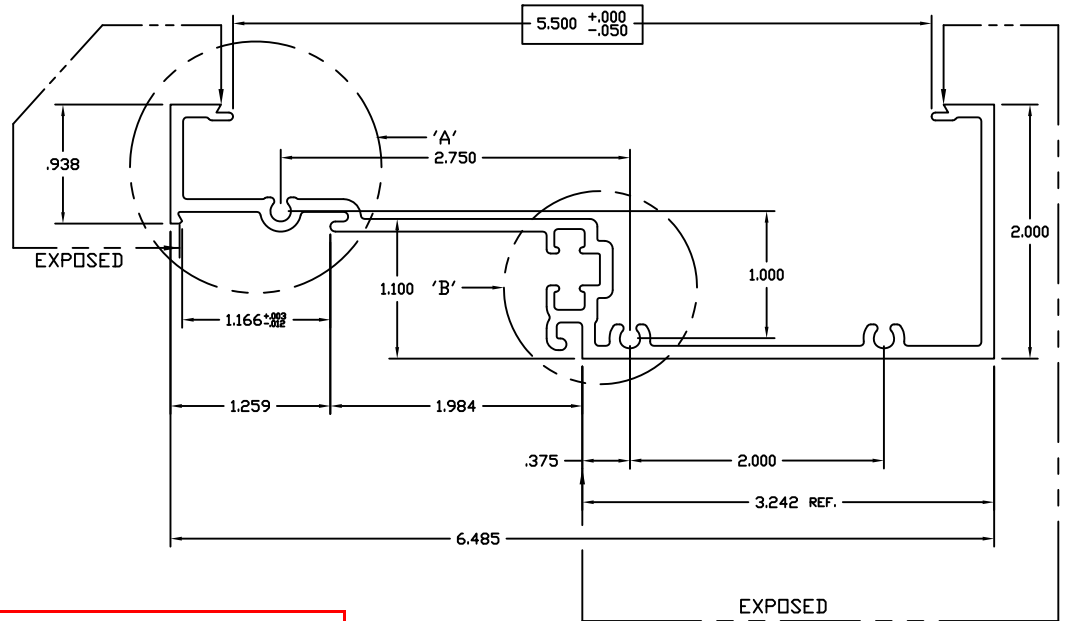
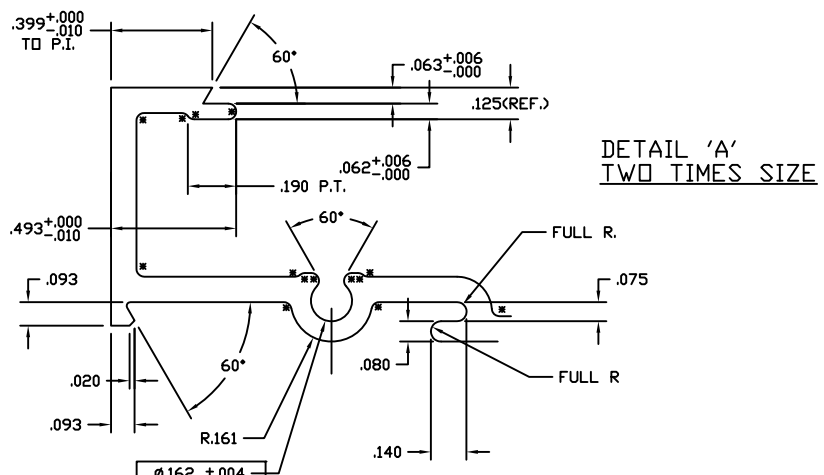
RXX .550	SXX .106	IXX .080	CXX .757
RYX .374	SYX .049	IYX .037	CYX .749

**GLASS STOP FOR 1' GLASS  
E14000 NON THERMAL STOREFRONT**

DRAWN BY KMH	DRWG DATE 03/11/93	APPV'D BY	DATE APPV'D
DWG SCALE NOTED	PRODUCT CODE 190	E14104	REV B

REV	DATE	DESCRIPTION	INTL
4/1/93		RELEASE TO TOOLING	REV
5/18/93		RELEASE TO PRODUCTION	KMH
7/7/93		REVISE EXTR. # WAS E-14003	KMH
A	12/2/97	REVISE TOLERANCES	KMH
B	3/18/98	REV. & REL. TO PROD./TOL. CHANGE NOTED AS	SMF

E14640

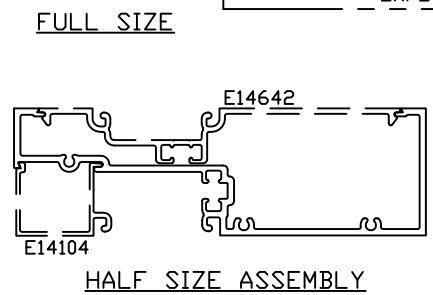


**ATI**

**Report #** B6400

**Date** 1/2012

**Simulator** *Blawie*



SKIP DEBRIDGED

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 ALUMINUM ASSOCIATION STANDARD TOLERANCES APPLY UNLESS NOTED  
 ALL UNSPECIFIED RADII .015  
 \* INDICATES .031 RADIUS  
 DENOTES CRITICAL DIMENSION  
 ALL DIES PROPERTY OF TUBELITE

**TUBELITE**  
 LEADERS IN ECO-FRIENDLY STOREFRONT CURTAINWALL AND ENTRANCE SYSTEMS  
 3056 WALKER RIDGE NW, SUITE G  
 WALKER, MICHIGAN 49544

WALL THK. .100	SECTION CLASS S	MAT'L 6063-T5	RATID 431
PERIMETER (BY DETAIL) 26.850	AREA 1.289	WGT/FT 1.516	
FACTOR 18	CIRCLE SIZE 6.786	INFILL VOL/UM 1.82	

RXX 2.148	SXX 1.699	IXX 5.951	CXX 3.503
RYX .617	SYX .403	IYX .490	CYX 1.217

OPEN BACK SILL/HORIZONTAL 2" X 6 1/2"  
 T14650 STOREFRONT

DRAWN BY SRD	DRVG DATE 02/20/03	APPV'D BY	DATE APPV'D
DWG SCALE NOTED	PRODUCT CODE 180	E14640	REV

ATI

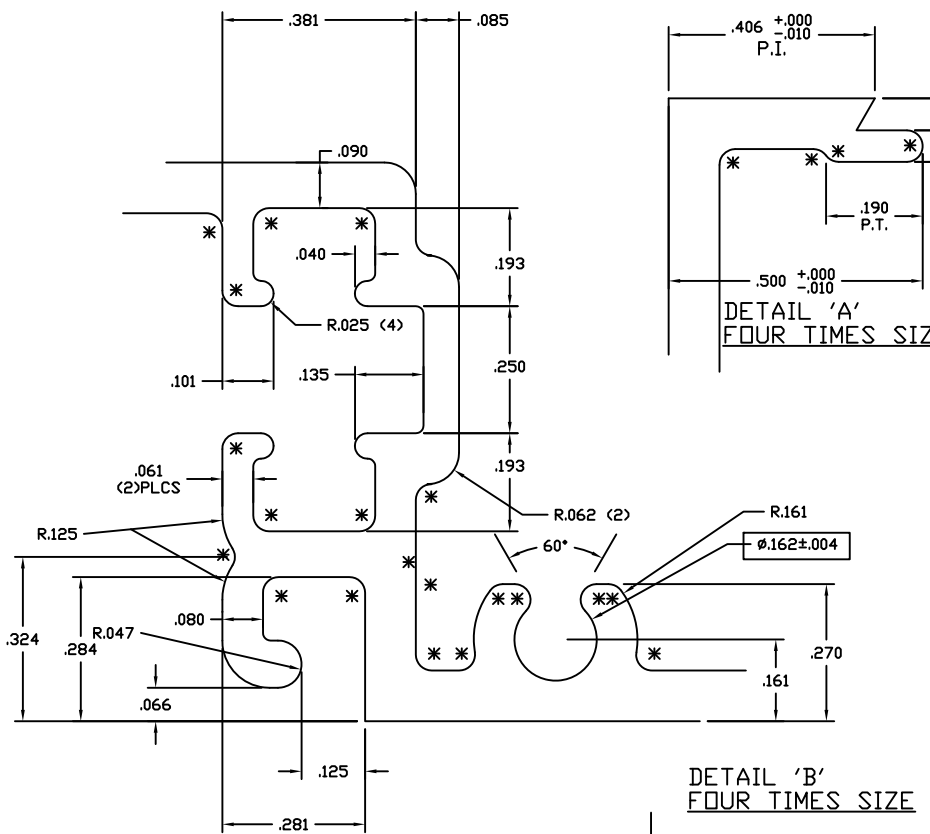
Report # B6400

Date 1/2012

Simulator Blaw

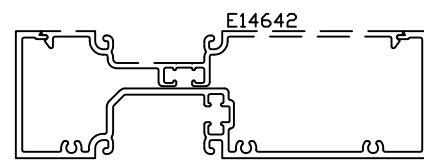
E14641

A

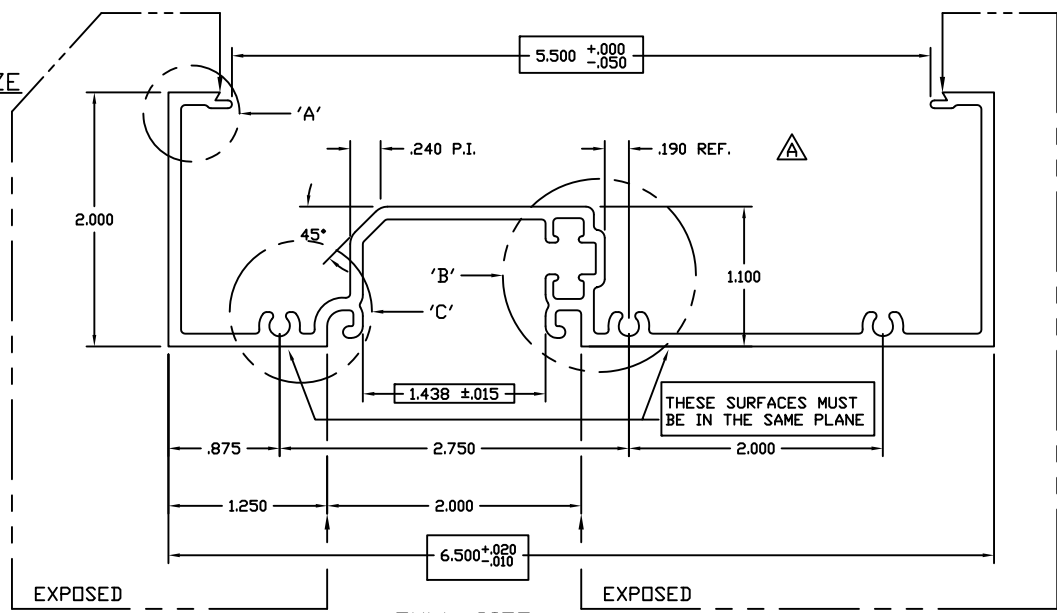


DETAIL 'A'  
FOUR TIMES SIZE

DETAIL 'B'  
FOUR TIMES SIZE



HALF SIZE ASSEMBLY

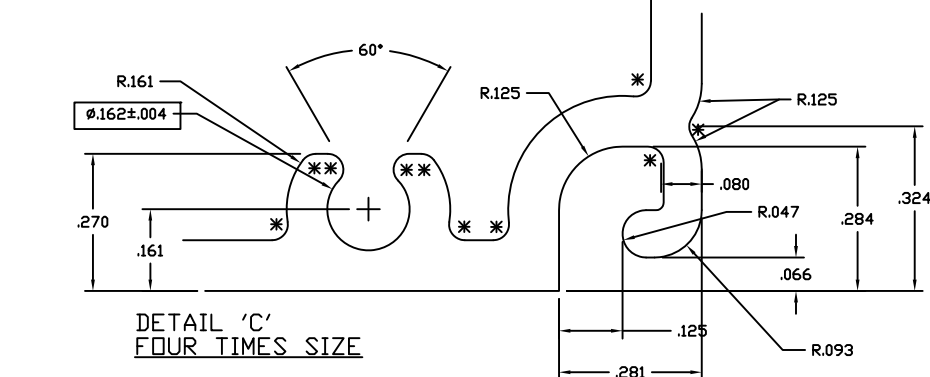


EXPOSED

FULL SIZE

EXPOSED

SKIP DEBRIDGED



DETAIL 'C'  
FOUR TIMES SIZE

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\* INDICATES .031 RADIUS  
□ DENOTES CRITICAL DIMENSION  
ALL DIES PROPERTY OF TUBELITE

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LEADER IN ECO-EFFICIENT STOREFRONT, CURTAINWALL AND ENTRANCE SYSTEMS  
3056 WALKER RIDGE NW, SUITE G  
WALKER, MICHIGAN 49544

WALL THK. .100	SECTION CLASS S	MAT'L 6063-T5	RATID 38:1
PERIMETER (DLT - 1074)	30.603	AREA 1.462	WGT/FT 1.719
FACTOR 18	CIRCLE SIZE 6.801	INFILL VOLUME .182	

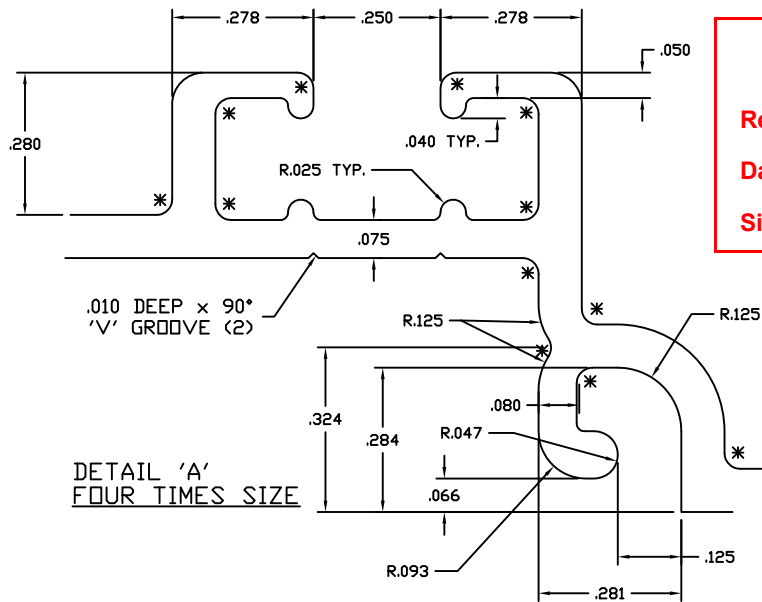
RXX 2.261	SXX 2.218	IXX 7.475	CXX 3.371
RYX .606	SYX .390	IYX .537	CYX 1.379

HEAD/JAMB/VERTICAL 2" X 6 1/2"  
T14650 STOREFRONT

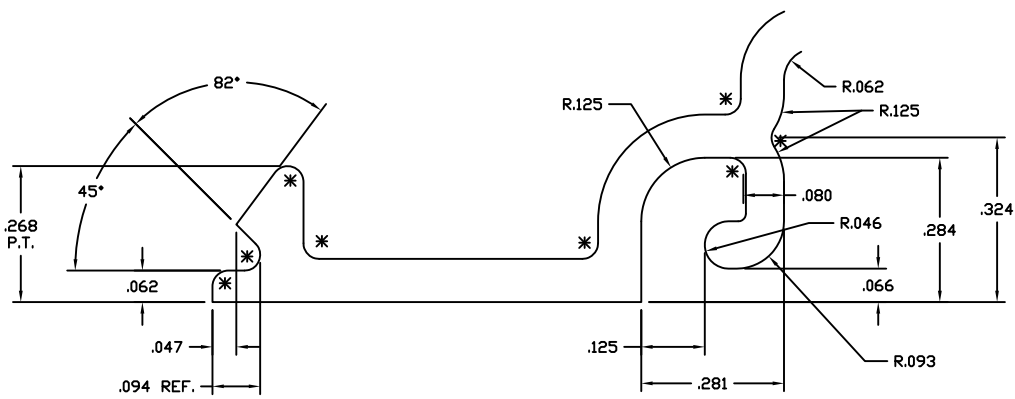
DRAWN BY SRD	DRWG DATE 02/20/03	APPV'D BY	DATE APPV'D
DWG SCALE NOTED	PRODUCT CODE 185	E14641	REV A

REV	DATE	DESCRIPTION	INTL
	02/26/03	RELEASE FOR TOOLING	SRD
	07/07/03	RELEASE FOR PRODUCTION - ER-070301	SRD
A	01/05/05	REVISED PD CAVITY FOR SCREW HEAD CLEARANCE	SRD





DETAIL 'A'  
FOUR TIMES SIZE



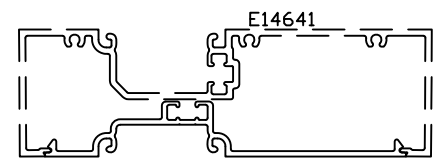
DETAIL 'B'  
FOUR TIMES SIZE

**ATI**

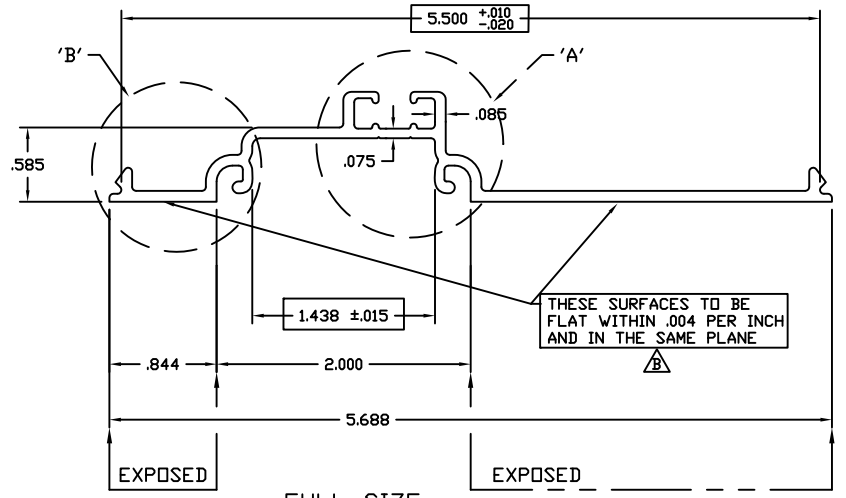
Report # B6400

Date 1/2012

Simulator *[Signature]*



HALF SIZE ASSEMBLY



FULL SIZE

THESE SURFACES TO BE  
FLAT WITHIN .004 PER INCH  
AND IN THE SAME PLANE

▲ LANCED AND SKIP DEBRIDGE

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ALL UNSPECIFIED RADII .015  
\* INDICATES .031 RADIUS  
□ DENOTES CRITICAL DIMENSION  
ALL DIES PROPERTY OF TUBELITE

**TUBELITE**  
LEADERS IN ECO-FRIENDLY STOREFRONT, CURTAINWALL AND ENTRANCE SYSTEMS

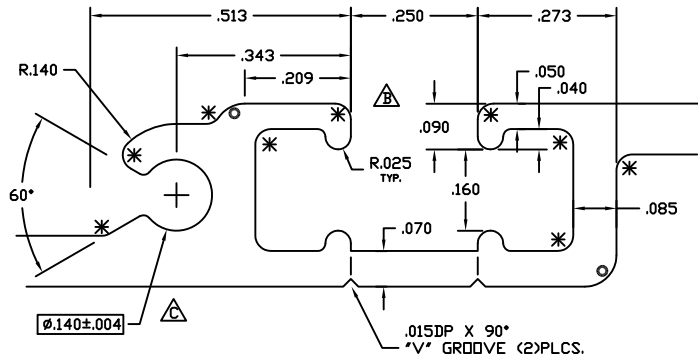
3056 WALKER RIDGE NW, SUITE G  
WALKER, MICHIGAN 49544

WALL THK.	.085	SECTION CLASS	S	MAT'L	6063-T5	RATID	801
PERIMETER (OUT. TOTAL)	16.731	AREA	.689	WGT/FT	.811		
FACTOR	21	CIRCLE SIZE	5.688	INFILL VOLUME	.149		

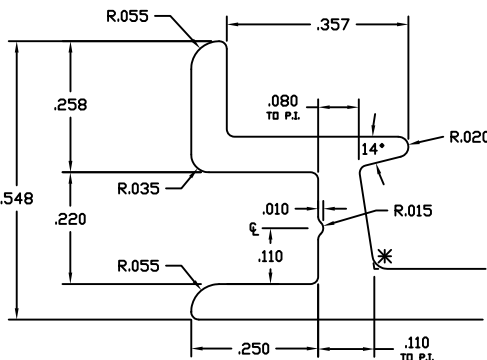
RXX	1.574	SXX	.559	IXX	1.708	CXX	3.056
RYX	.255	SYX	.074	IYX	.045	CYX	.604

SNAP IN FILLER WITH POCKET  
T14650 STOREFRONT

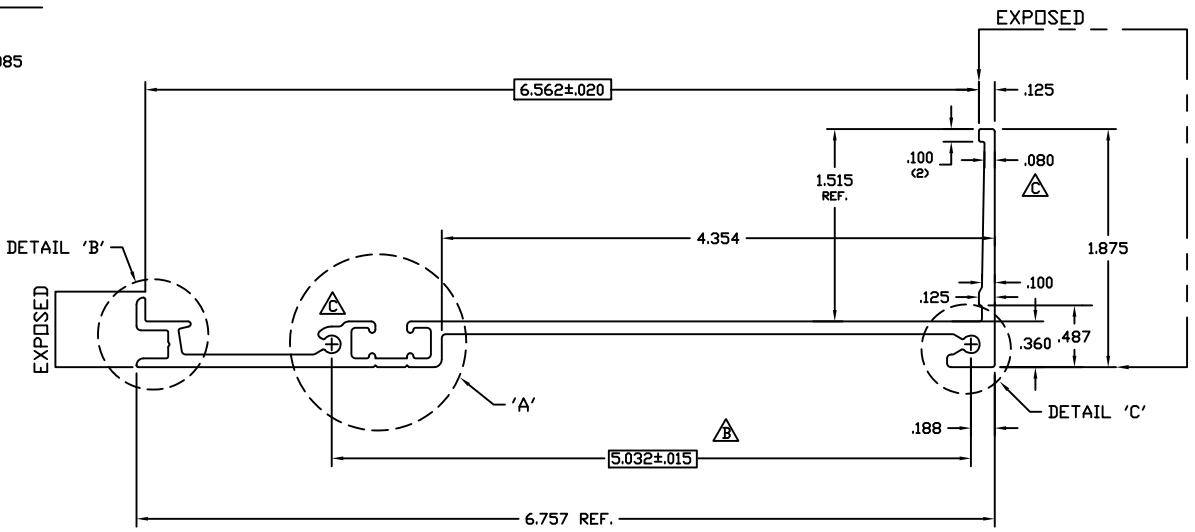
DRAWN BY	SRD	DRVG DATE	02/20/03	APPV'D BY		DATE APPV'D	
DWG SCALE	NOTED	PRODUCT CODE	185	E14642	B		



DETAIL 'A'  
SCALE: 4X



DETAIL "B"  
SCALE: 4X



FULL SIZE

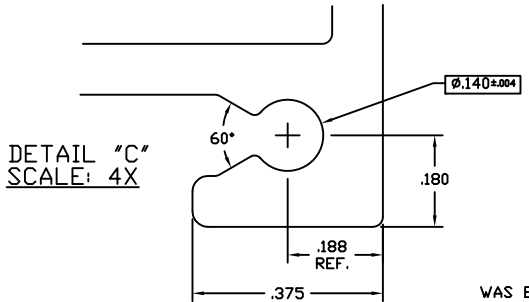
- ▭ INDICATES CRITICAL DIMENSION
- INDICATES .062 RADIUS
- △ LANCED AND FULLY DEBRIDGE

**ATI**

Report # B6400

Date 1/2012

Simulator *[Signature]*



DETAIL "C"  
SCALE: 4X

WAS E908J07

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ALUMINUM ASSOCIATION STANDARD TOLERANCES APPLY UNLESS NOTED

**TUBELITE**  
LEADERS IN ECO-EFFICIENT STOREFRONT CURTAINWALL AND ENTRANCE SYSTEMS

3056 WALKER RIDGE NW, SUITE G  
WALKER, MICHIGAN 49544

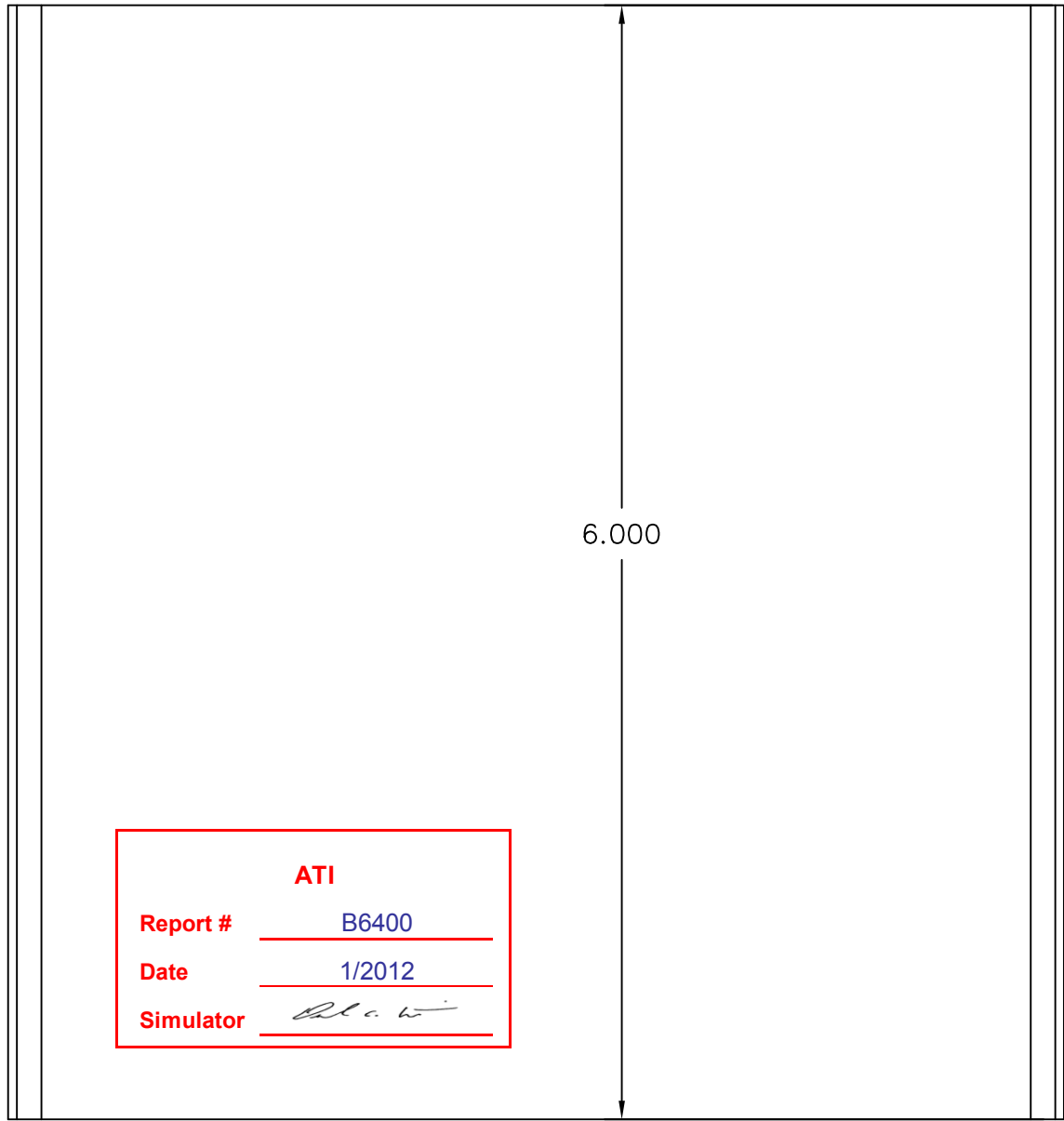
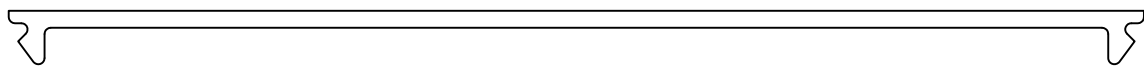
WALL THK. .100	SECTION CLASS S	MAT'L 6063-T5	RATID 55:1
PERIMETER (BLT. TOTAL) 21.404	AREA 1.004	WGT/FT 1.181	
FACTOR 18	CIRCLE SIZE 7.148	INFILL VOLUME .155	

RXX 2.306	SXX 1.401	IXX 5.340	CXX 3.812
RYY .370	SYX .090	IYY .138	CYY 1.526

**THERMAL SILL FLASHING  
T14650 STOREFRONT**

REV	DATE	DESCRIPTION	INTL
	02/26/03	RELEASE FOR TOOLING	SRD
	07/07/03	RELEASE FOR PRODUCTION - ER-070301	SRD
A	03/13/06	REVISED FEATURES IN DETAILS: 'A' AND 'B'	JEM
B	08/10/09	REVISED P&D CAVITY FOR LANCER, ADDED SCREW BOSSES	CRH
C	9/25/09	REVISED DETAIL 'B', ROTATED SCREW BOSS, TAPERED WALL	CRH

DRAWN BY SRD	DRVG DATE 02/20/03	APPV'D BY	DATE APPV'D
DWG SCALE NOTED	PRODUCT CODE 180	E14659	REV C



**ATI**

**Report #**           B6400          

**Date**           1/2012          

**Simulator**           *Bl. W.*          

CUT E14653 TO 6" LONG

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 ALL UNSPECIFIED RADII .015  
 \* INDICATES .031 RADIUS  
 DENOTES CRITICAL DIMENSION

**TUBELITE®**  
 DEPENDABLE  
 LEADERS IN ECO-EFFICIENT STOREFRONT,  
 CURTAINWALL AND ENTRANCE SYSTEMS

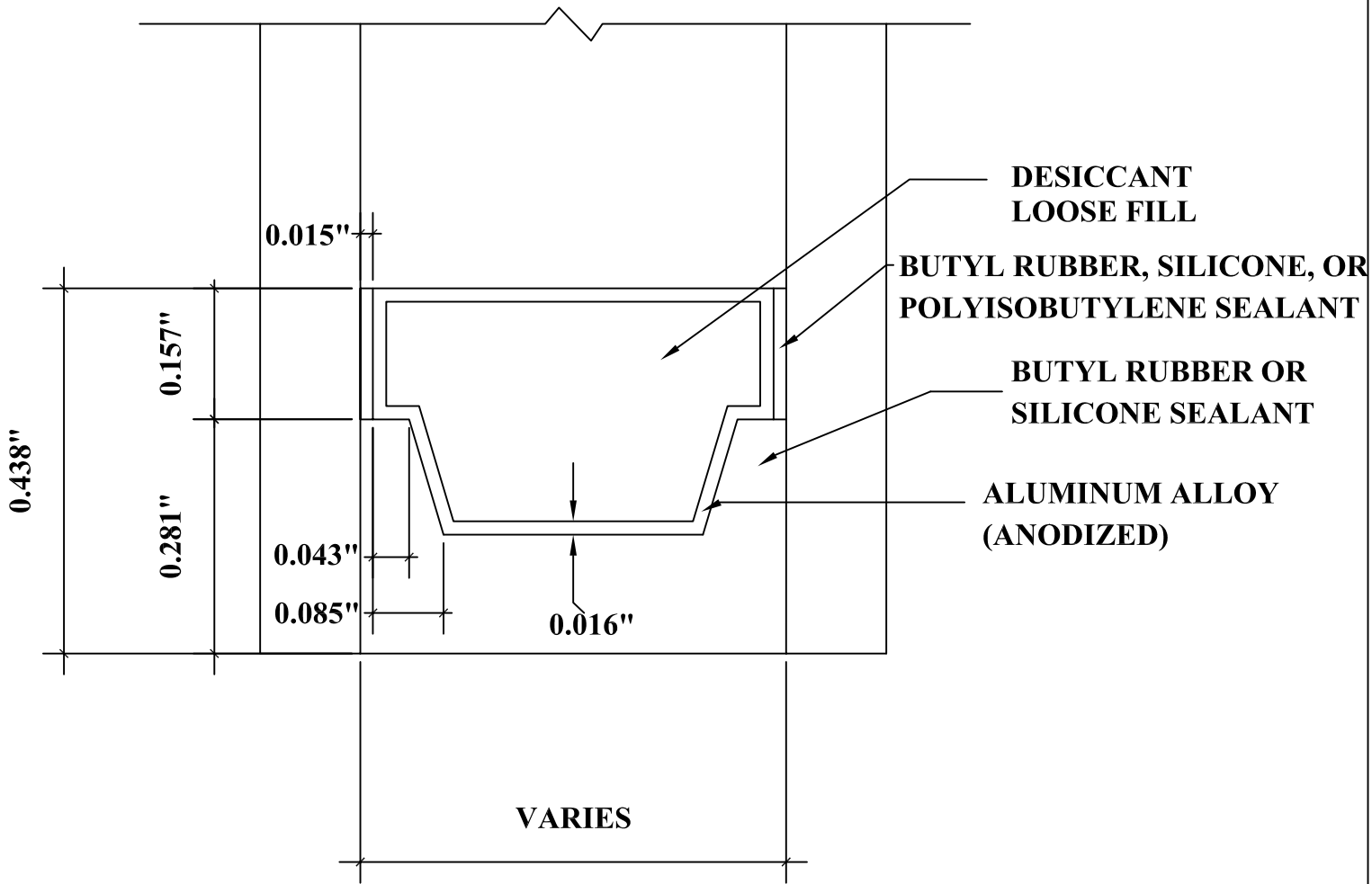
3056 WALKER RIDGE NW, SUITE G  
 WALKER, MICHIGAN 49544

REV	DATE	DESCRIPTION	INTL
	XX/XX/XX	XXXXXXXX	XXX

SNAP-IN ANCHOR SUPPORT  
 FOR 14650 STOREFRONT

DRAWN BY SRD	DRWG DATE 06/04/03	APPV,D BY	DATE APPVD
DRWG SCALE FULL	PRODUCT CODE 185	P1148	REV





DETAIL FOR THERMAL MODELING OF  
ALUMINUM SPACER (A1-D)

	<b>ATI</b>
Report #	<u>B6400</u>
Date	<u>1/2012</u>
Simulator	<u><i>Blaw</i></u>