Architectural Testing

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

Rendered to:
US ALUMINUM INC., DIVISION OF CR LAURANCE CO., INC.

SERIES/MODEL:
FT451 Storefront (Interior Set)

Report Number:	**C2658.01-201-45**
Report Date:	**01/23/13**
Simulation Date:	**01/23/13**
Report Retention Date:	**01/23/17**

849 Western Avenue North
St. Paul, MN 55117
phone: 651-636-3835
fax: 651-636-3843
www.archtest.com

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

Rendered to:
US ALUMINUM INC., DIVISION OF CR LAURANCE CO., INC.
200 Singleton Drive
Waxahachie, Texas 75165

Report Number:	C2658.01-201-45
Simulation Date:	01/23/13
Report Date:	01/23/13
Report Retention Date:	01/23/17

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:	27.0

Simulations Specimen Description:

Series/Model:	FT451 Storefront (Interior Set)
Type:	Glazed Wall System , Window Wall
Frame Material:	AU Thermally Improved
Sash Material:	NA Not Applicable
Standard Size:	2000mm x 2000mm

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Technical Interpretations and Modeling Assumptions:

1) Thermal slot conductivity was calculated using equations from Therm 6.3/Window 6.3 Manual, section 8.9.4.

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. 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	0.005592	0.009002	0.012198
SHGC1	0.890495	0.789648	0.695120
VT0	0.000000	0.000000	0.000000
VT1	0.884903	0.780646	0.682922

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.

Product Line	*Report Number*
-----	-----

Spacer Option Description

	Sealant		
Spacer Type	*Primary*	*Secondary*	*Desiccant*
Aluminum Box Spacer A1-D	Butyl Rubber	Butyl Rubber	Yes

Grid Option Description

Grid Size	*Grid Type*	*Grid Pattern*
None	-	-

Reinforcement Option Description

Location	*Material*
None	-

Gas Filling Technique Description

Fill Type	*Method*
48.5% Argon	Single Probe
62.5% Argon	Single Probe
65.0% Argon	Single Probe
67% Argon	Single Probe
73.8% Argon	Single Probe
74.6% Argon	Single Probe
76% Argon	Single Probe
83% Argon	Single Probe
85.7% Argon	Single Probe
86% Argon	Single Probe
88.6% Argon	Single Probe
90.6% Krypton	Unspecified
84.5% Xenon	Dual Probe
94.6% Xenon	Unspecified

Edge-of-Glass Construction

Interior Condition	EPDM
Exterior Condition	EPDM

Weatherstripping

Type	*Quantity*	*Location*
None	-	-

Frame/Sash Materials Finish

Interior	Painted Aluminum
Exterior	Painted Aluminum

NFRC 100/200/500 Summary Sheet
FT451 Storefront (Interior Set)

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*	1/4" Clear / 1/4" Clear, COG U-Factor = 0.4800, COG Temperature = 43.7°F											
	0.225	0.500	0.225					OT		CL	A1-D	N
	U-Factor		0.54	SHGC (N)				0.63	VT (N)	0.70	CR	27
2*	1/4" Clear / 1/4" Clear, COG U-Factor = 0.4600, COG Temperature = 44.8°F											
	0.225	0.500	0.225					ARG48.5		CL	A1-D	N
	U-Factor		0.53	SHGC (N)				0.63	VT (N)	0.70	CR	27
3	1/4" LOF Activ / 1/4" Clear, COG U-Factor = 0.4400, COG Temperature = 45.8°F											
	0.222	0.500	0.225					XEN84.48		CL	A1-D	N
	U-Factor		0.51	SHGC (N)				0.61	VT (N)	0.65	CR	27
4	1/4" AFG P630 / 1/4" Clear, COG U-Factor = 0.4200, COG Temperature = 46.8°F											
	0.222	0.500	0.225					ARG76.09	0.652(#2)	GY	A1-D	N
	U-Factor		0.49	SHGC (N)				0.24	VT (N)	0.21	CR	27
5	1/4" AFG GP120 / 1/4" Clear, COG U-Factor = 0.4000, COG Temperature = 47.9°F											
	0.220	0.500	0.225					ARG85.82	0.566(#2)	GY	A1-D	N
	U-Factor		0.48	SHGC (N)				0.24	VT (N)	0.18	CR	28
6	1/4" AFG B720 / 1/4" Clear, COG U-Factor = 0.3800, COG Temperature = 48.9°F											
	0.226	0.500	0.225					ARG83.03	0.471(#2)	AZ	A1-D	N
	U-Factor		0.46	SHGC (N)				0.16	VT (N)	0.14	CR	28
7	1/4" AFG GP108 / 1/4" Clear, COG U-Factor = 0.3600, COG Temperature = 50.0°F											
	0.220	0.500	0.225					ARG88.65	0.395(#2)	GY	A1-D	N
	U-Factor		0.44	SHGC (N)				0.13	VT (N)	0.06	CR	28
8	1/4" Rezikool / 1/4" Clear, COG U-Factor = 0.3400, COG Temperature = 51.0°F											
	0.232	0.500	0.225					ARG87.42	0.318(#2)	CL	A1-D	N
	U-Factor		0.43	SHGC (N)				0.42	VT (N)	0.50	CR	28
9	1/4" PPG Sungate 500 / 1/4" Clear, COG U-Factor = 0.3200, COG Temperature = 52.0°F											
	0.223	0.500	0.225					ARG64.98	0.215(#2)	CL	A1-D	N
	U-Factor		0.41	SHGC (N)				0.55	VT (N)	0.65	CR	28
10	1/4" LOF Solar E / 1/4" Clear, COG U-Factor = 0.3000, COG Temperature = 53.1°F											
	0.233	0.500	0.225					ARG74.7	0.166(#2)	CL	A1-D	N
	U-Factor		0.40	SHGC (N)				0.40	VT (N)	0.47	CR	28

* Please note that these options cannot be certified per NFRC 100/200/500-2010.

NFRC 100/200/500 Summary Sheet
FT451 Storefront (Interior Set)

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	1/4" PPG Sungate 100 / 1/4" Clear, COG U-Factor = 0.2800, COG Temperature = 54.1°F											
	0.223	0.500	0.225					ARG60.79	0.087(#2)	CL	A1-D	N
	U-Factor		**0.38**	**SHGC (N)**				**0.49**	**VT (N)**	**0.67**	**CR**	**28**
12	1/4" Solarban 60 / 1/4" Clear, COG U-Factor = 0.2600, COG Temperature = 55.2°F											
	0.223	0.500	0.225					ARG62.42	0.035(#2)	CL	A1-D	N
	U-Factor		**0.36**	**SHGC (N)**				**0.34**	**VT (N)**	**0.62**	**CR**	**28**
13	1/4" Solarban 60 / 1/4" Solarban 60, COG U-Factor = 0.2400, COG Temperature = 56.3°F											
	0.223	0.500	0.223					ARG86.02	0.035(#2) / 0.035(#3)	CL	A1-D	N
	U-Factor		**0.35**	**SHGC (N)**				**0.32**	**VT (N)**	**0.55**	**CR**	**28**
14*	1/4" Solarban 70XL-Strph / 1/4" Solarban 70XL-Strph, COG U-Factor = 0.2200, COG Temperature = 57.3°F											
	0.223	0.500	0.223					XEN81.67	0.018(#2) / 0.018(#3)	CL	A1-D	N
	U-Factor		**0.33**	**SHGC (N)**				**0.23**	**VT (N)**	**0.46**	**CR**	**29**
15*	1/4" Solarban 70XL-Strph / 1/4" Solarban 70XL-Strph, COG U-Factor = 0.2000, COG Temperature = 58.4°F											
	0.223	0.500	0.223					XEN94.6	0.018(#2) / 0.018(#3)	CL	A1-D	N
	U-Factor		**0.31**	**SHGC (N)**				**0.23**	**VT (N)**	**0.46**	**CR**	**29**

* Please note that these options cannot be certified per NFRC 100/200/500-2010.

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 by: Heather Duneman

Heather M. Duneman
Senior Simulation Technician
Simulator-In-Responsible-Charge

REVIEWED BY:

Digitally Signed by: Michael Resech

Michael P. Resech
Senior Project Manager

HMD:hmd
C2658.01-201-45

Attachments (pages): This report is complete only when all attachments listed are included.

Appendix A: Drawings and Bills of Material (11)

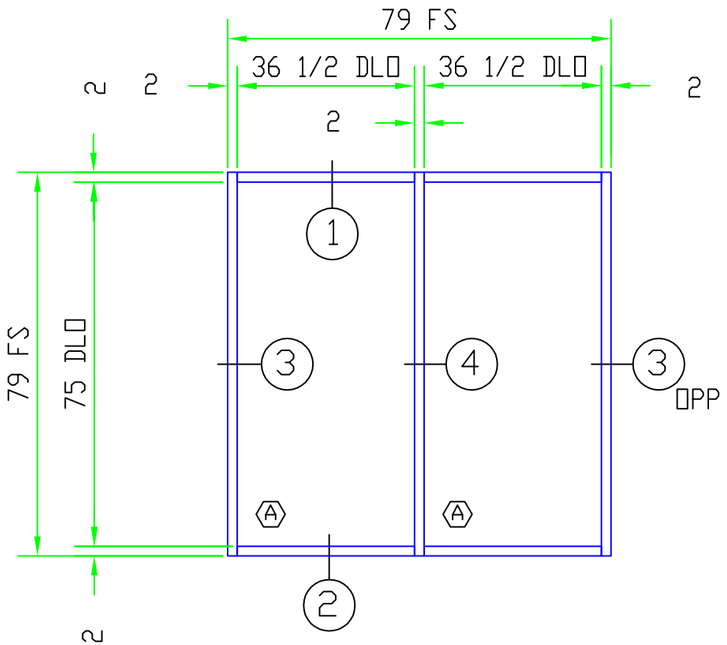
Revision Log

Rev. #	Date	Page(s)	Revision(s)
01-R0	1/23/2013	All	Original Report Issue.

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

Appendix A

C2658.01-201-45



A

QTY = 1

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Report #: C2658.01-201-45
Date: 1/23/13
Verified by: Heather Linneman

SYMBOL KEY			
SYMBOL	DESCRIPTION	QTY	COMMENTS
A	37.375 X 75.875	2	1 INS = INSULATED GLASS

REV	REV_DESCRIPTION	DATE	XXX
SYM	REVISION	DATE	BY

2100 E. 38TH STREET VERNON, CA 90058
PHONE: (323) 588-1281 FAX: (323) 232-2523

DIVISION UNITED STATES ALUMINUM

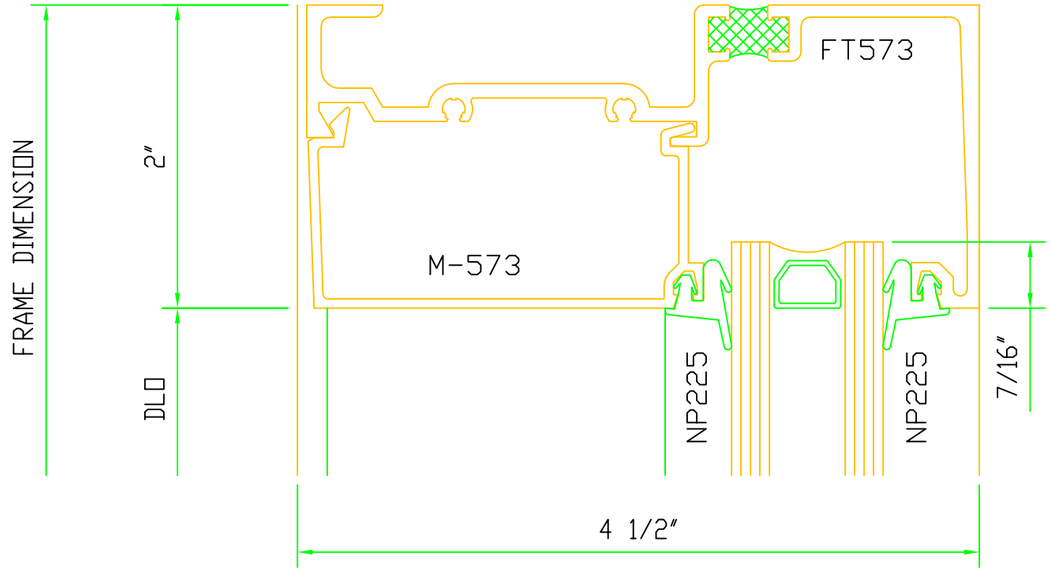
DRWN BY: DCW
DATE: 08.17.12
SCALE: 3/8"=1"

THERMAL_TEST_NFRC_AAMA_1503
SERIES_FT451-INSIDE_SET

DWG NO.
MU2012-013-01

MU2012-013-02

1



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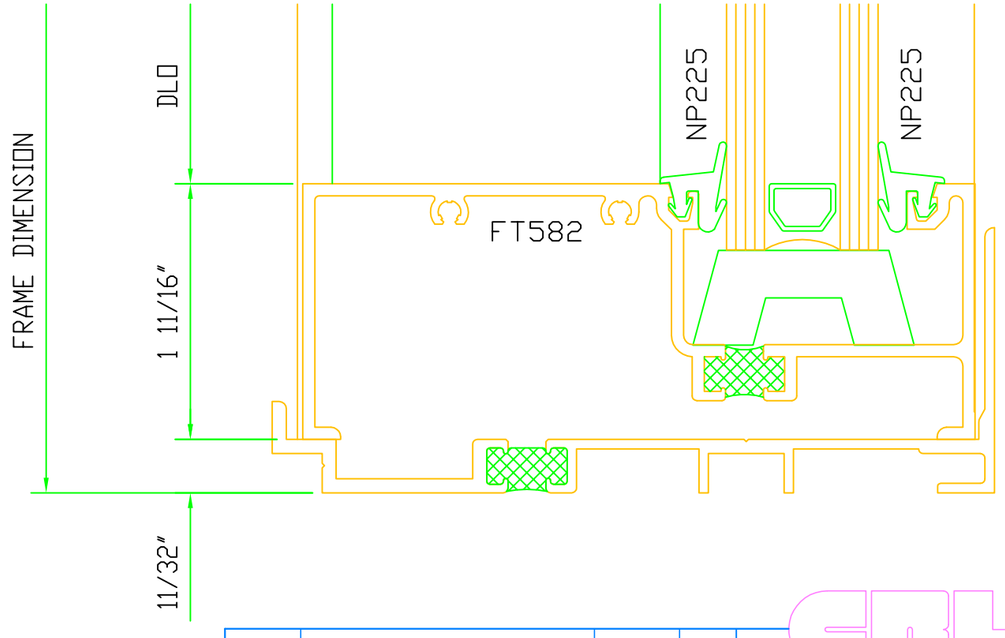

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Report #: C2658.01-201-45
Date: 1/23/13
Verified by:

REV	REV_DESCRIPTION	DATE	XXX
SYM	REVISION	DATE	BY

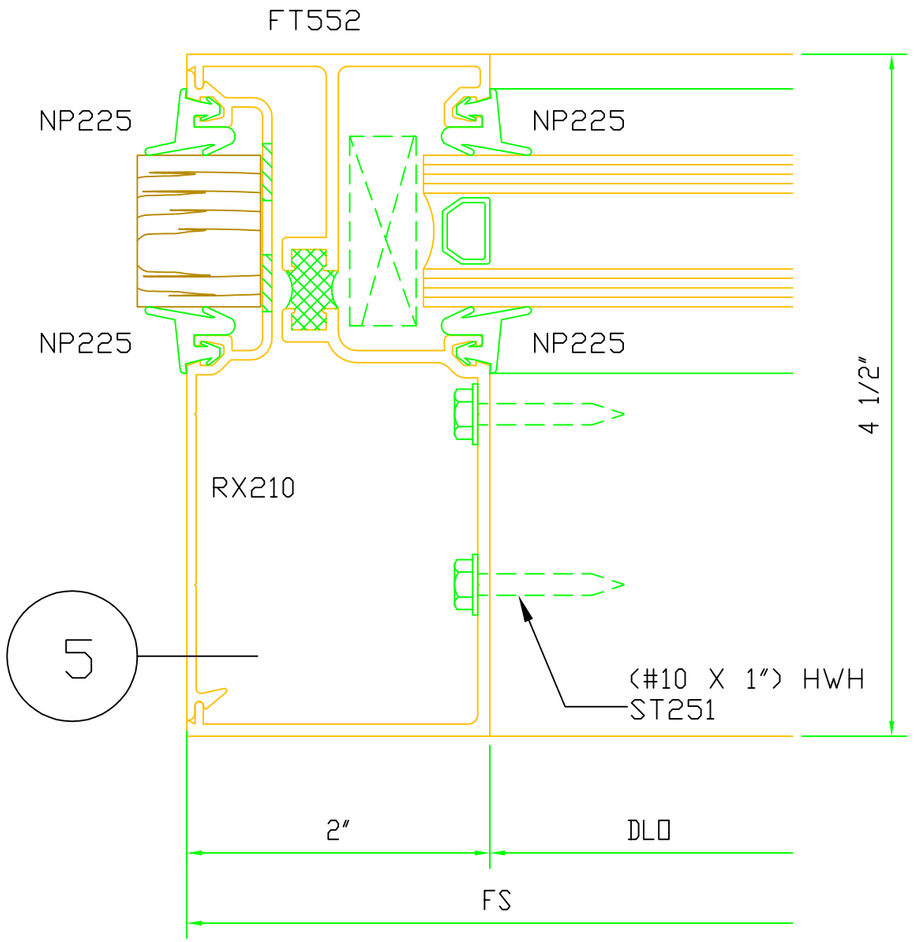
CRL
2100 E. 38TH STREET VERNON, CA 90058
PHONE: (323) 588-1281 FAX: (323) 232-2523
DIVISION UNITED STATES ALUMINUM

DRWN BY: DCW
DATE: 08.17.12
SCALE: FULL

THERMAL_TEST_NFRC_AAMA_1503
SERIES_FT451-INSIDE_SET

DWG NO.
MU2012-013-02

MU2012-013-03



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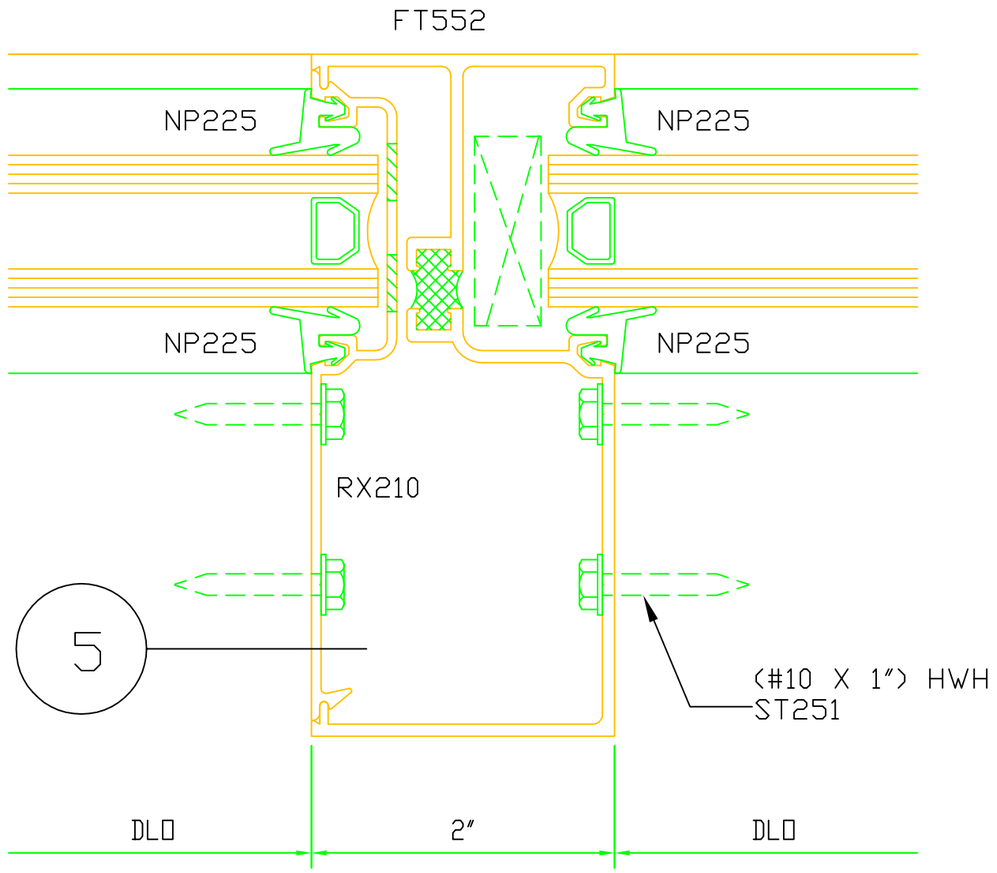

4

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Date: 1/23/13
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REV	REV_DESCRIPTION	DATE	XXX
SYM	REVISION	DATE	BY

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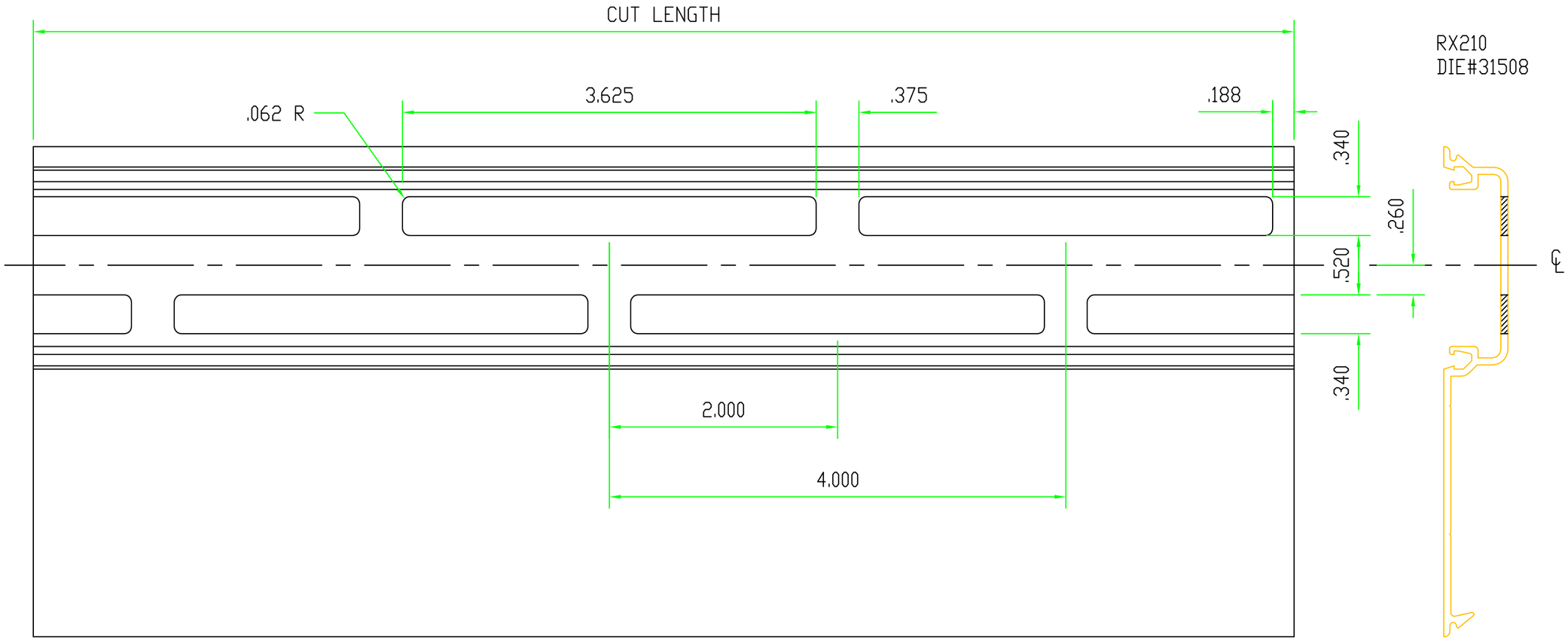
DIVISION UNITED STATES ALUMINUM

DRWN BY: DCW	THERMAL_TEST_NFRC_AAMA_1503	DWG NO.
DATE: 08.17.12	SERIES_FT451-INSIDE_SET	MU2012-013-03
SCALE: FULL		

MU2012-013-04



5 TYPICAL FILLER THERMAL SLOTS

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REV	REV_DESCRIPTION	DATE	XXX
SYM	REVISION	DATE	BY

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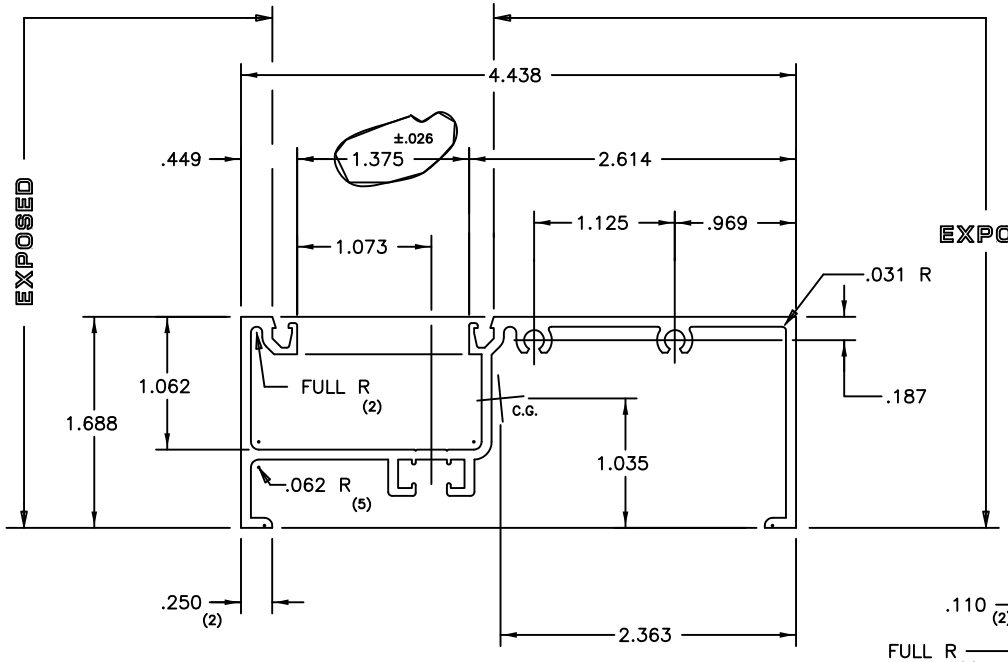
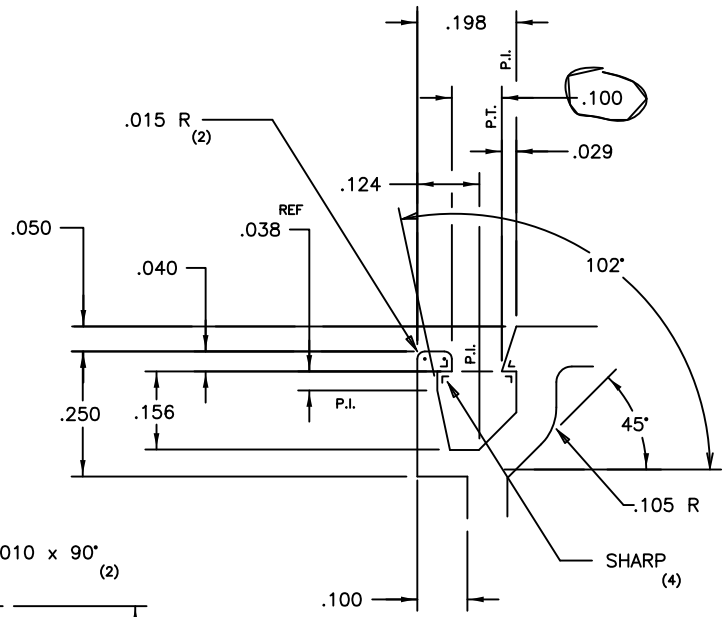
DRWN BY: DCW
DATE: 08.17.12
SCALE: FULL

THERMAL_TEST_NFRC_AAMA_1503
SERIES_FT451-INSIDE_SET

DWG NO.
MU2012-013-04

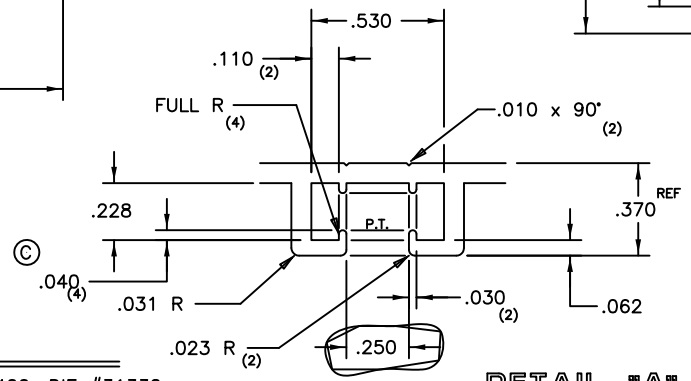
B	SCREWRACE DETAIL REVISED	MM	10/27 93	U.S. ALUMINUM CORP.		T-31362 | C
C	.040 WAS .023, RECALC'D	RT / GH	10/28 97	SILL – INSIDE GLAZE	MAMO	6/21/93
				FF582	FULL SIZE	





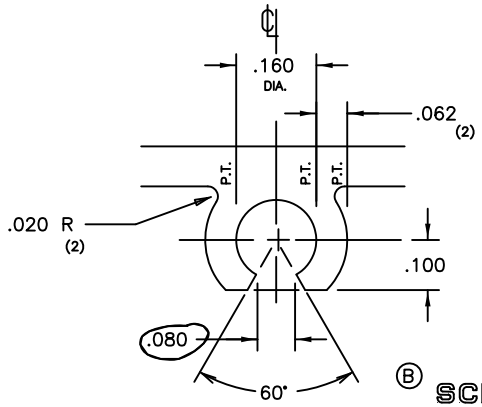
GASKET POCKET DETAIL

SCALE: 4X SIZE (2 PLACES)



DETAIL "A"

SCALE: 2X SIZE



Ⓑ SCREW RACE DETAIL

SCALE: 4X SIZE (2 PLACES)

NOTES:

1. MATES W/FF400, DIE #31332
2. PAINT PERIMETER: 6.043"
3. Ⓒ THERMO DETAIL AREA: .132; "AA"
4. DEBRIDGE WITH A .218 x .015 MAX PENETRATION INTO THERMO MATERIAL.
5. F & D PART NO. IS FT582

SECTION PROPERTIES:

Ixx = 2.195 in^4
Sxx = 0.929 in^3
Iyy = 0.270 in^4
Syy = 0.261 in^3

10x1 1/2 W/P 10x1 1/4 DIE NO STEP

☒ CA
☒ TX

.080

.918 Ⓒ	P-21774	1 / W/P 31362
1.102 Ⓒ	4.800	10x31362
23.515 Ⓒ	SOLID	12x7 1/2 31362
21	8" = 59	T-31362 | C

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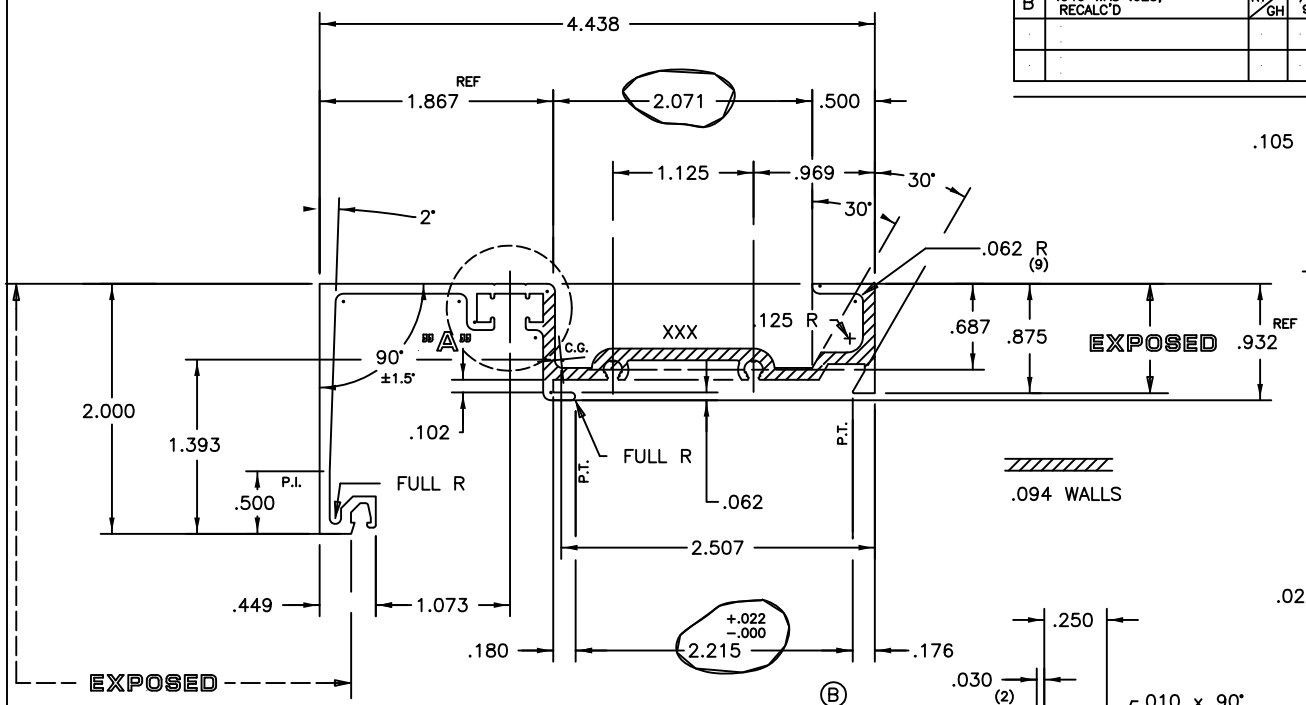
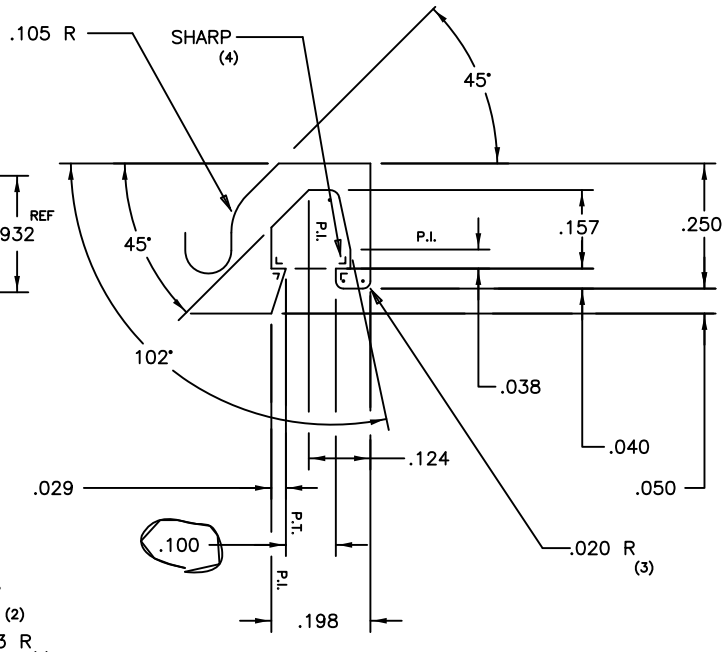
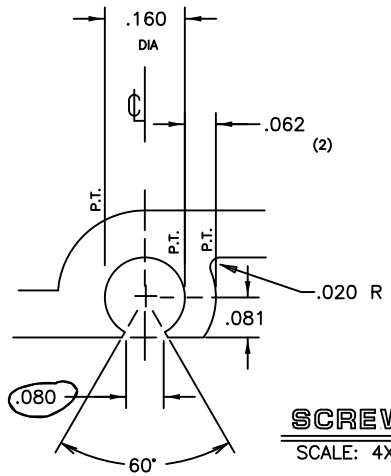
B	.040 WAS .023, RECALC'D	RT/GH	10/30 97	U.S. ALUMINUM CORP.		T-31788 | B
				HEAD – 1"	MAMO	8/3/93
				FF573	FULL SIZE	





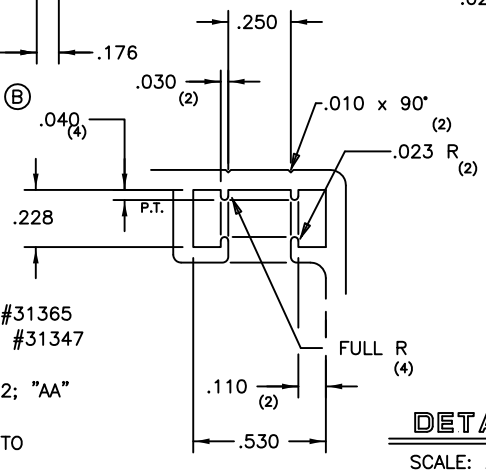
GASKET POCKET DETAIL

SCALE: 4X SIZE



SCREW RACE DETAIL

SCALE: 4X SIZE (2 PLACES)



DETAIL "A"

SCALE: 2X SIZE

NOTES:

1. SNAP–FITS W/M–573; DIE #31365
   ASSEMBLES W/HC201; DIE #31347
2. PAINT PERIMETER: 3.188"
3. (B) THERMO DETAIL AREA: .132; "AA"
4. DEBRIDGE WITH A .218 x
   .015 MAX PENETRATION INTO
   THERMO MATERIAL.
5. XXX INDICATES I.D. MARK FOR IEC–TX
6. F & D PART NO. IS FT573

SECTION PROPERTIES:

Ixx = 2.259 in^4
Sxx = 0.901 in^3
Iyy = 0.242 in^4
Syy = 0.174 in^3

10x1 1/2 W/P 10x1 1/4 DIE NO STEP

.080

	.930 (B)		1 / W/P 31788
	1.116 (B)	5.000	10x31359
	21.321 (B)	SOLID	12x7 1/2 31359
	19	8" = 61	T-31788 | B

Architectural Testing

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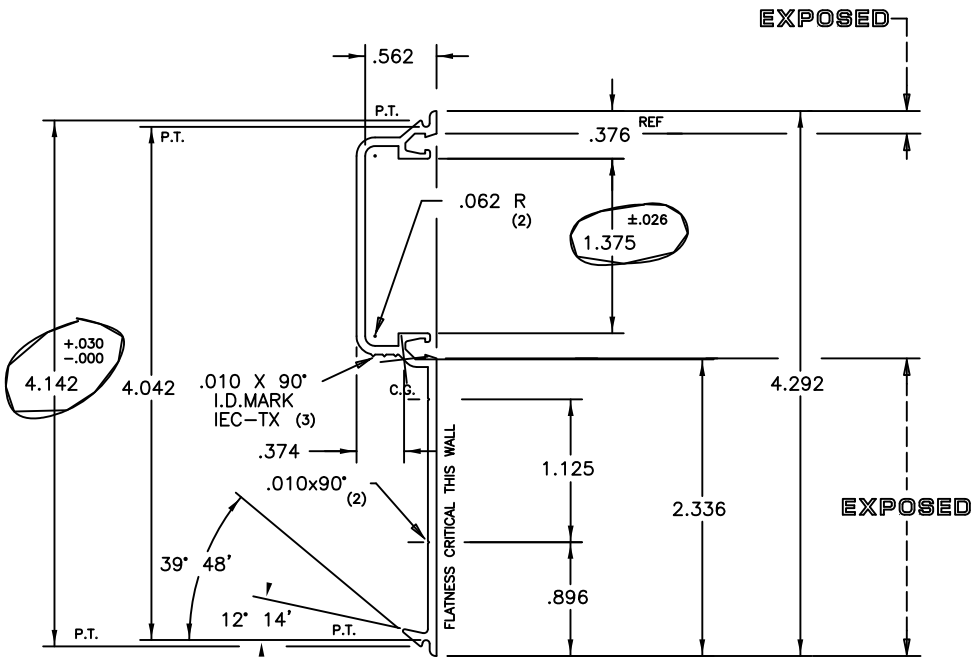
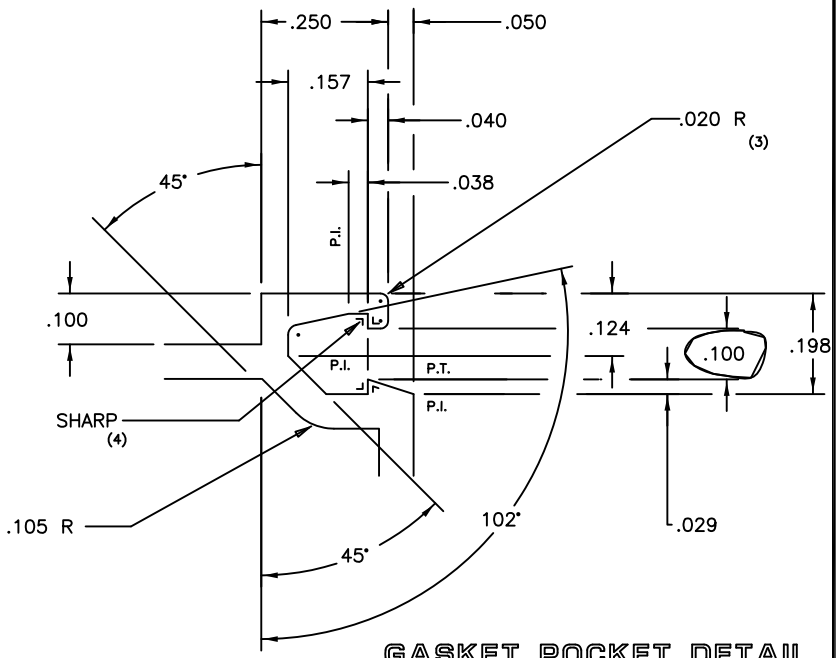
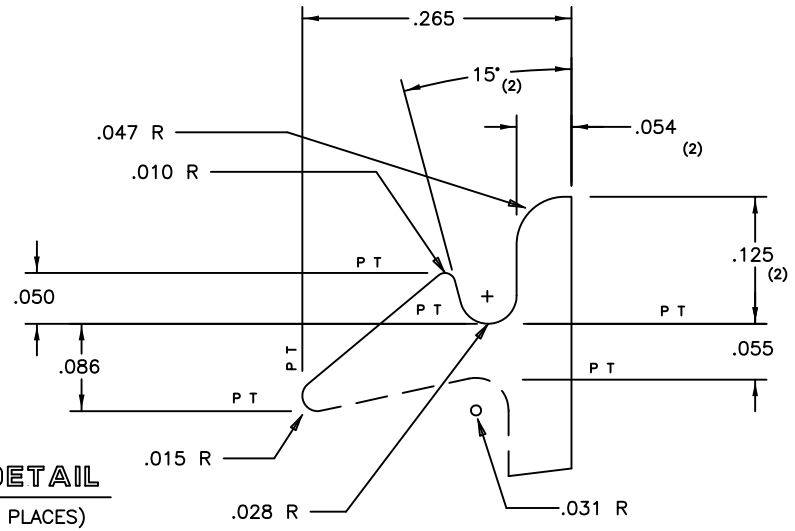




GASKET POCKET DETAIL

SCALE: 4X SIZE (2 PLACES)



SNAP DETAIL

SCALE: 8X (2 PLACES)

PRODUCT:

PROJECT:

NOTES:

1. SNAP–FITS W/FF552; DIE # 31507
   W/FF551; DIE # 31512

2. PAINT PERIMETER: 2.522"

SECTION PROPERTIES:

Ixx = 0.643 in^4
Sxx = 0.275 in^3
Iyy = 0.023 in^4
Syy = 0.061 in^3

SYM	REVISION	BY	DATE

CUSTOMER U.S. ALUMINUM CORP. DIE NO. T–31508

PART NAME INSERT DRAWN MAMO DATE 11/18/94

PART NO. RF210 SCALE FULL SIZE CHKD. APP.

STANDARD TOLERANCES FOR EXTRUDED SHAPES APPLY UNLESS SPECIFICALLY SHOWN OTHERWISE

☐ CA
☐ TX

International Extrusion Corporation
202 SINGLETON DRIVE (972) 937–7032 WAXAHACHIE TEXAS 75165

UNLESS OTHERWISE NOTED, ALL CORNERS ARE .015 R, AND TYPICAL WALL THICKNESS IS .068

EST. AREA:	.397	US–NO.	P–24052	PORTS	
EST. WT/FT:	.476	CIRCLE SIZE	4.292 IN.	BACKER	
EST. PERI:	12.268	CLASS.	SOLID	BOLSTER.	
FACTOR :	26	ER– " =		DIE NO.	T–31508

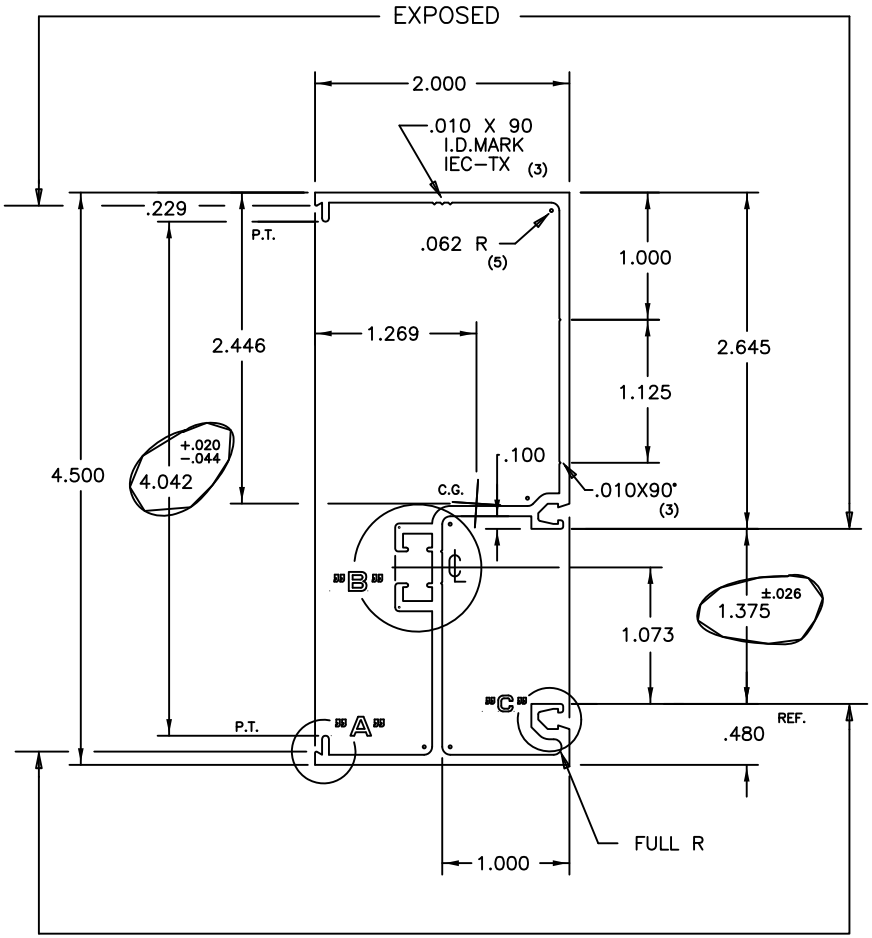
Architectural Testing

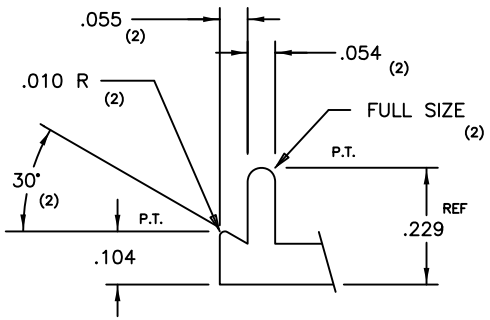
Report #: C2658.01-201-45

Date: 1/23/13

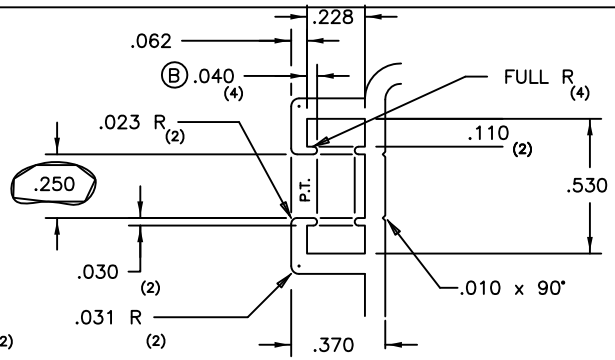
Verified by: Heather Linneman

B	.040 WAS .023, RECALC'D	RT/GH	10/30 97	U.S. ALUMINUM CORP.		T-31507 B
				VERT MULL	MAMO	11/18/94
				FF552	FULL SIZE	

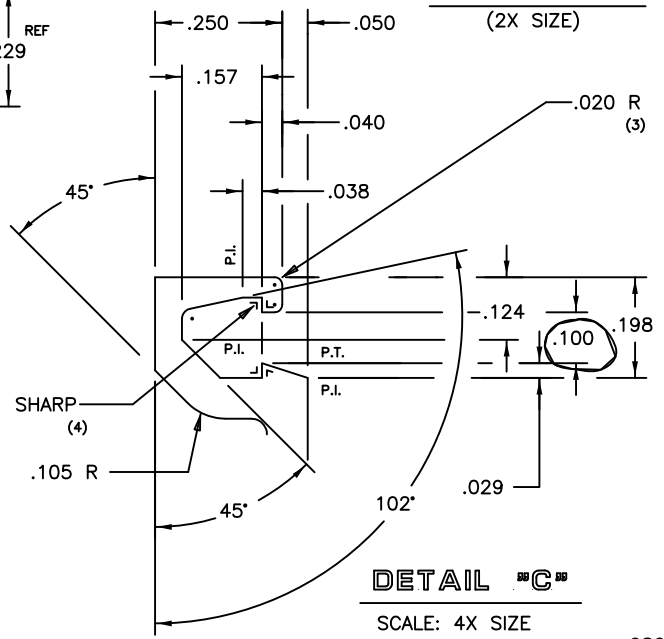




DETAIL "A"
(4x SIZE)



DETAIL "B"
(2X SIZE)



DETAIL "C"
SCALE: 4X SIZE

NOTES:

1. SNAP-FITS W/RF210; DIE #31508
   W/RF110; DIE #31509
   W/PF100; DIE #31510
2. PAINT PERIMETER: 6.758"
3. (B) THERMO POCKET AREA: .132; "AA"
4. F & D PART NO. IS FT552

SECTION PROPERTIES:

$I_{xx} = 2.408_{IN}^4$
$S_{xx} = 0.984_{IN}^3$
$I_{yy} = 0.311_{IN}^4$
$S_{yy} = 0.245_{IN}^3$

.080

.897 (B)		P-24046	1 WP31507
1.076 (B)		4.915	10 X 31507
23.378 (B)		SOLID	31355
22	8	60	T-31507 B

FF451

Architectural Testing

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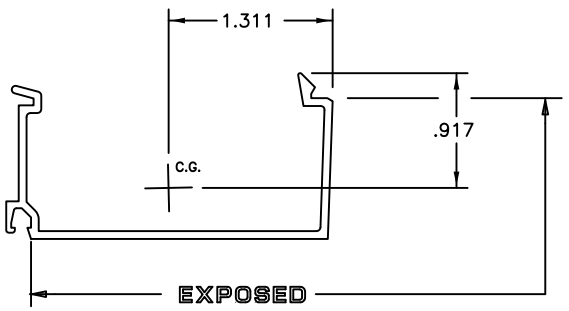
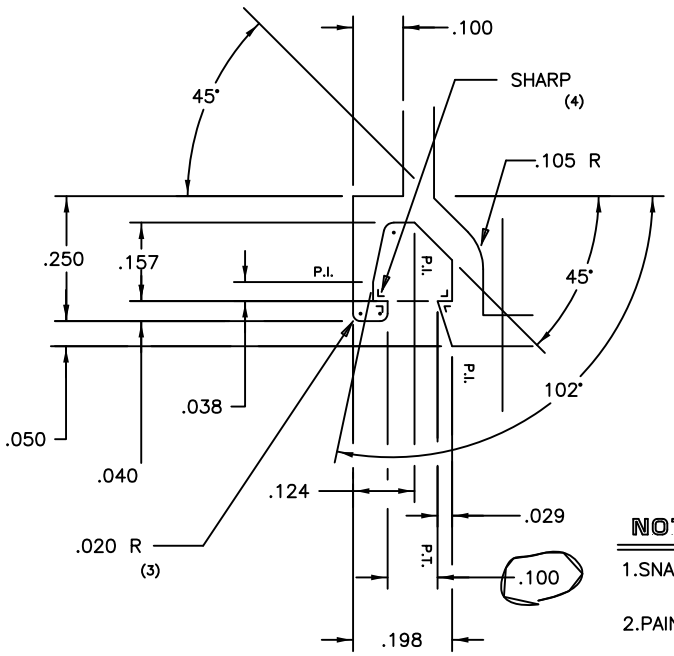
Verified by: Heather Dinsman

U.S. ALUMINUM CORP.		T-31365
INT GLS STOP	MAMO	6/21/93
M-573	2x SIZE	

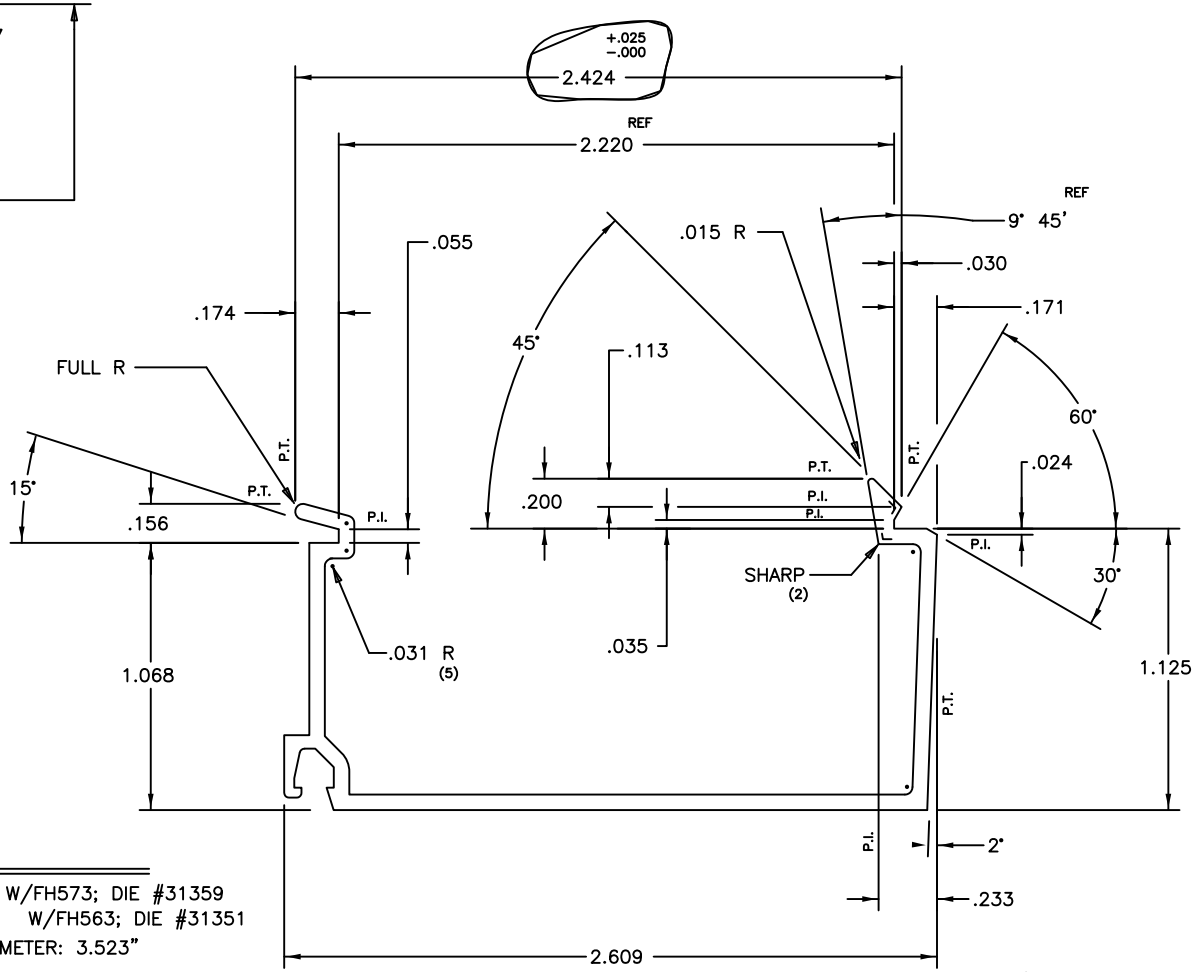


ACTUAL SIZE



GASKET POCKET DETAIL

SCALE: 4X SIZE



9x1 1/4 DIE NO STEP

.062

NOTES:

1. SNAP-FITS W/FH573; DIE #31359
   W/FH563; DIE #31351
2. PAINT PERIMETER: 3.523"

SECTION PROPERTIES:

Ixx = 0.355 in^4
Sxx = 0.271 in^3
Iyy = 0.066 in^4
Syy = 0.072 in^3

.346	P-21780	
.415	3.500	
11.203	SOLID	
27		T-31365

Architectural Testing

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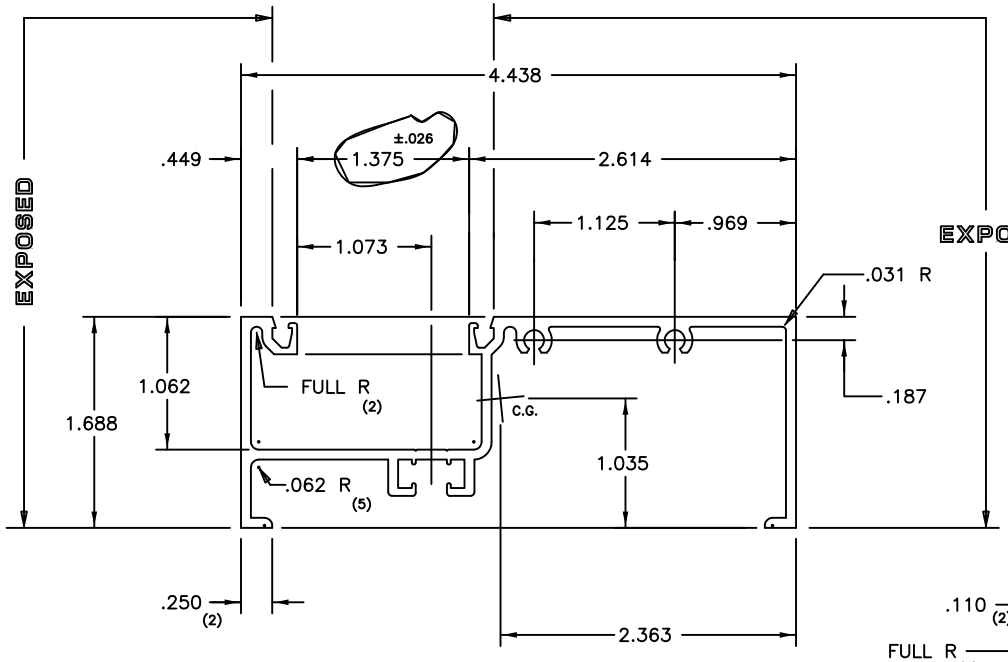
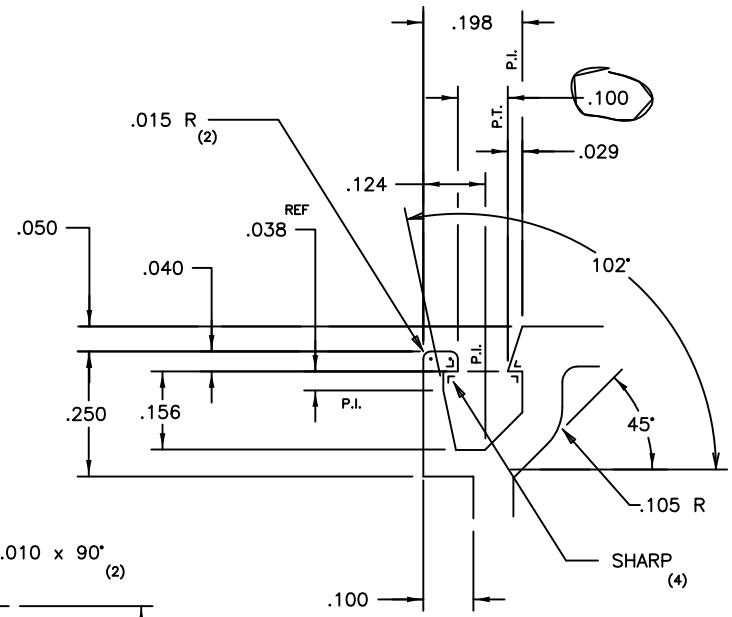
Verified by: Heather Bineman

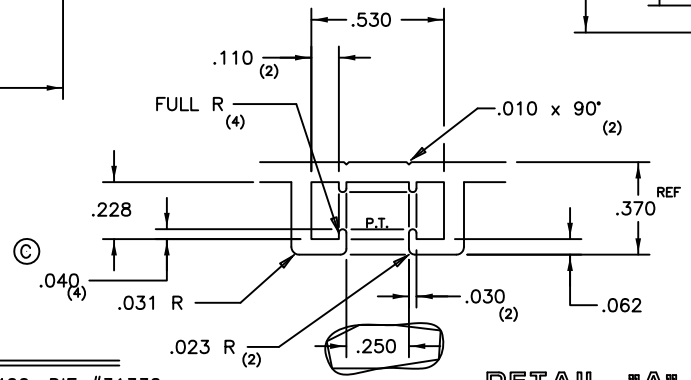
B	SCREWRACE DETAIL REVISED	MM	10/27 93	U.S. ALUMINUM CORP.		T-31362 | C
C	.040 WAS .023, RECALC'D	RT / GH	10/28 97	SILL – INSIDE GLAZE	MAMO	6/21/93
				FF582	FULL SIZE	





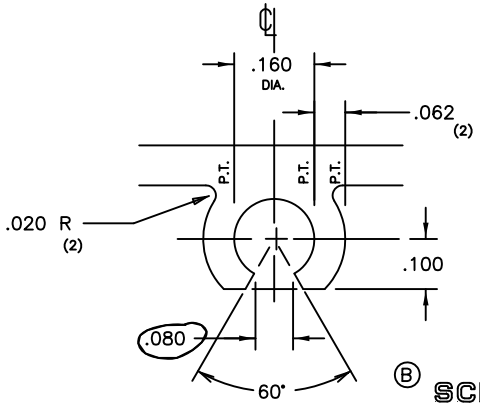
GASKET POCKET DETAIL

SCALE: 4X SIZE (2 PLACES)



DETAIL "A"

SCALE: 2X SIZE



Ⓑ SCREW RACE DETAIL

SCALE: 4X SIZE (2 PLACES)

NOTES:

1. MATES W/FF400, DIE #31332
2. PAINT PERIMETER: 6.043"
3. Ⓒ THERMO DETAIL AREA: .132; "AA"
4. DEBRIDGE WITH A .218 x .015 MAX PENETRATION INTO THERMO MATERIAL.
5. F & D PART NO. IS FT582

SECTION PROPERTIES:

Ixx = 2.195 in^4
Sxx = 0.929 in^3
Iyy = 0.270 in^4
Syy = 0.261 in^3

10x1 1/2 W/P 10x1 1/4 DIE NO STEP

☒ CA
☒ TX

.080

.918 Ⓒ	P-21774	1 / W/P 31362
1.102 Ⓒ	4.800	10x31362
23.515 Ⓒ	SOLID	12x7 1/2 31362
21	8" = 59	T-31362 | C

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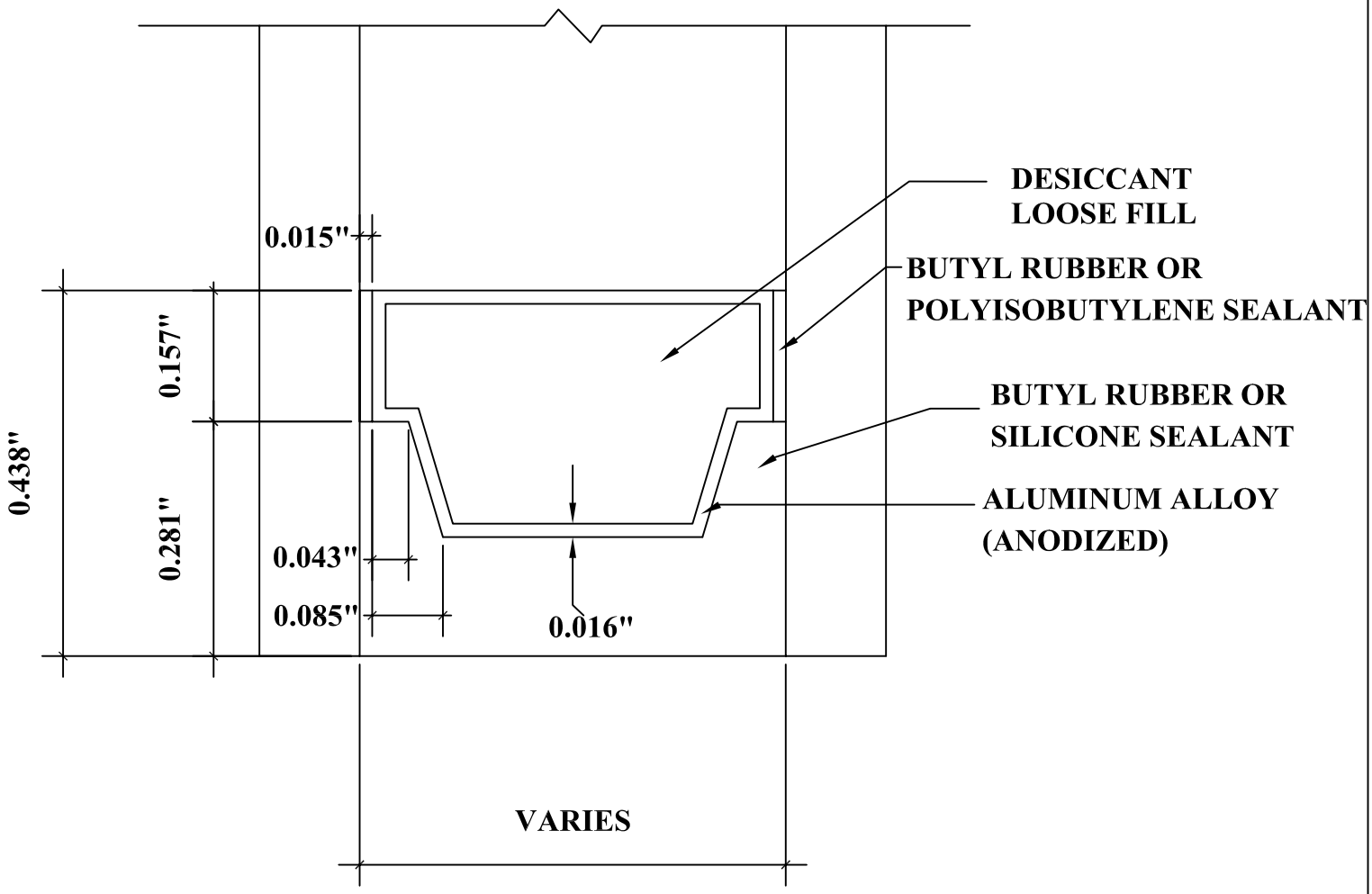

DETAIL FOR THERMAL MODELING OF
ALUMINUM SPACER (A1-D)

Architectural Testing

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Verified by: