

Force Engineering & Testing, Inc.

19530 Ramblewood Drive
Humble, Texas 77338
Phone: (281) 540-6603
Fax: (281) 540-9966
www.forceengineeringtesting.com

Project Number : 528-0252T-13A, B

Test Report Date : January 16, 2014

Test Material : SLC1500 Snap Lock with Fastener Flange 24 Ga.

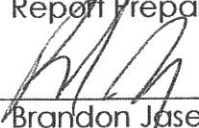
Test Procedures : TAS 125-03
UL 580-06 / UL 1897-04

Test Location : Force Engineering & Testing Inc.
19530 Ramblewood Drive
Humble, Texas 77338

SLC 1500 Panel

(Over 15/32" Plywood)

Report Prepared by:


Brandon Jasek, P.E.
Lab Manager

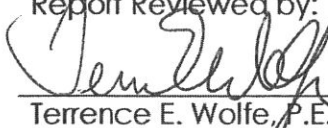


ACCREDITED
LABORATORY

ACCREDITED TL-417

MIAMI-DADE COUNTY
APPROVED

Report Reviewed by:


Terrence E. Wolfe, P.E.
Director of Operations

ACCREDITED
LABORATORY



TEXAS DEPARTMENT
OF TRANSPORTATION

ACCREDITED LABORATORY

Project Number : 528-0252T-13A, B

GENERAL:

The subject of this report is a fastener flange roof panel attaching to plywood decking.

The object of this investigation was to establish by test, the max uplift pressure for the roof panel described in this report. The test assembly and test were completed under the observation of a licensed professional.

TEST DATE:

December 16-17, 2013

TEST ASSEMBLY:

Manufacturer: Zimmerman Metals, Inc.
201 East 58th Avenue
Denver, Colorado

Panel: SLC 1500 panel with fastener flange, 24 Ga. 50 ksi Steel, 14" nominal coverage, 1 ½" tall snap lock seam w/ slotted fastener flange with ½"x 3/16" slots at 3 7/8" O.C.

Panel Properties: $F_y = 51.7$ ksi Steel, 0.022" Coated thickness per ASTM E 8 (See Appendix)

Panel Seam: Snap Lock

Panel Rollformer: Zimmerman Metals, Inc.

Panel Fastener: (1) #10-8 x 1" Pancake Type A

Fastener Spacing Test A: 11 5/8" O.C. (every third slot)
Test B: 3 7/8" O.C. (every slot)

Panel Length: 9'-11"

Substrate: (1) layer of Tamko TW Metal & Tile Underlayment applied to 15/32" 4-Ply B-C Group 1 Exterior Plywood. The plywood was attached to the SYP 2x10 wood framing @ 6" O.C. interior/exterior with (1) 8D 2-1/2" Hot Galv. Ring Shank Patio/Deck Nails. 2x10 wood framing spaced at 24" O.C.

TESTING APPARATUS:

UL 580 Chamber

Project Number : 528-0252T-13A, B

PROCEDURE:

1. The roof assembly was subjected to all five phases of the Class 30, Class 60 & Class 90. At the end of each phase the test specimen was inspected.
2. Throughout the test, observations were made of the control of positive and negative pressures and of the condition of the top surface and the under side of the test assembly.
3. The action of the roof assembly during the application of the steady pressures in Phases I, II, IV, and V was a bowing up between screw attachments.
4. The action of the test assembly during the oscillating phase of each test (Phase III) was a rising and settling of the members.
5. After the Class 90 phase, the positive pressure was set at 9.3 inches of water and remained constant; the negative pressure was increased by increments of 15 psf until the panel assembly failed.

RESULTS/CONCLUSIONS:

Test A:

The maximum sustained combined test pressure was 142.0 psf and the ultimate failure test pressure was 157.0 psf. The failure mode was the fastener flange tore around the fastener heads causing the panel to pull over the fasteners.

Test B:

The maximum sustained combined test pressure was 202.0 psf. The ultimate failure test pressure was 217.0 psf. The failure mode was the panel seams disengaged.

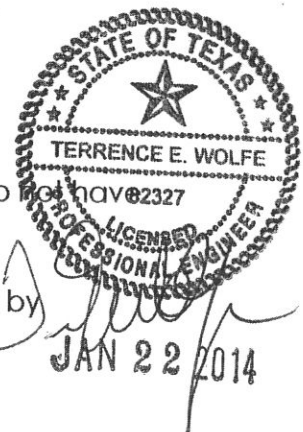
Note: During this test, tape and plastic were used to seal against air leakage. The tape and plastic had no restrictive influence on the test.

Force Engineering &
Testing, Inc.
State of Texas
Reg. # F-4611

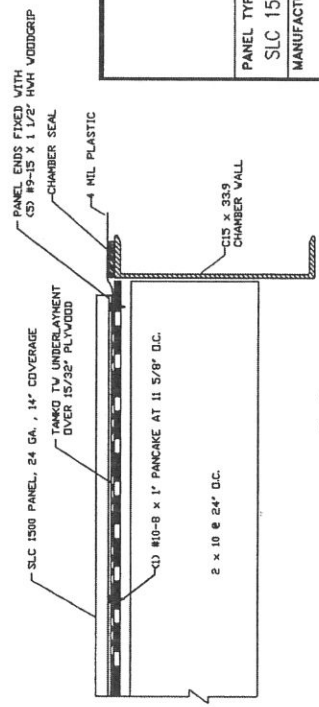
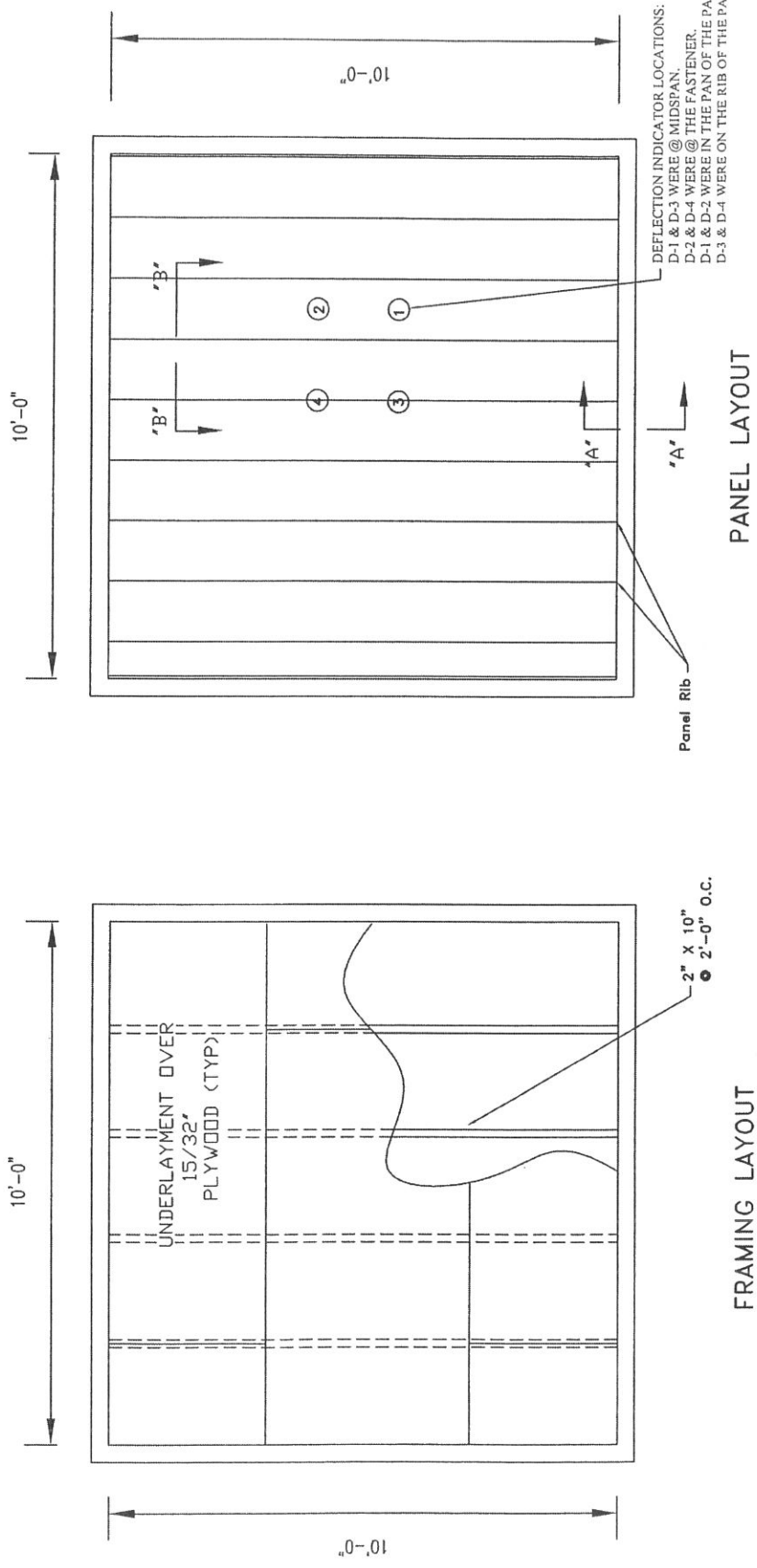
STATEMENT OF INDEPENDENCE:

Force Engineering & Testing, Inc. or any persons employed by them do not have any financial interest in Zimmerman Metals, Inc.

Force Engineering & Testing, Inc. is not owned, operated or controlled by Zimmerman Metals, Inc.



Appendix



 Force Engineering & Testing Inc. 1750 Alameda Drive Southfield, Michigan 48034 Phone: (313) 544-6600 Fax: (313) 544-9966	TEST:	BY:	DESCRIPTION:	DATE:
PANEL TYPE: SLC 1500 PANEL, 24 GA, 14" COVERAGE				DATE:
MANUFACTURER: ZIMMERMAN METALS, INC.				CLIP TYPE: NA
				CLIP FASTENER:
				SPAN: 11 5/8" O.C.
				MAX. PRESSURE:
				QUOTE NUMBER: 528-0252T-13A
				TEST PROTOCOL: UL 580/1897

UL 580 DEFLECTION READINGS

Test Date: 12/16/2013
Project Number: 528-0252T-13A
Panel Description: 24 Ga. SLC 1500 14" nominal coverage
Panel Fasteners: (1) #10-8 x 1" Pancake Type A at every third slot (11 5/8" O.C.)
Panel Clip: NA
Substrate: Tamko TW Underlayment over 15/32" 4-ply plywood

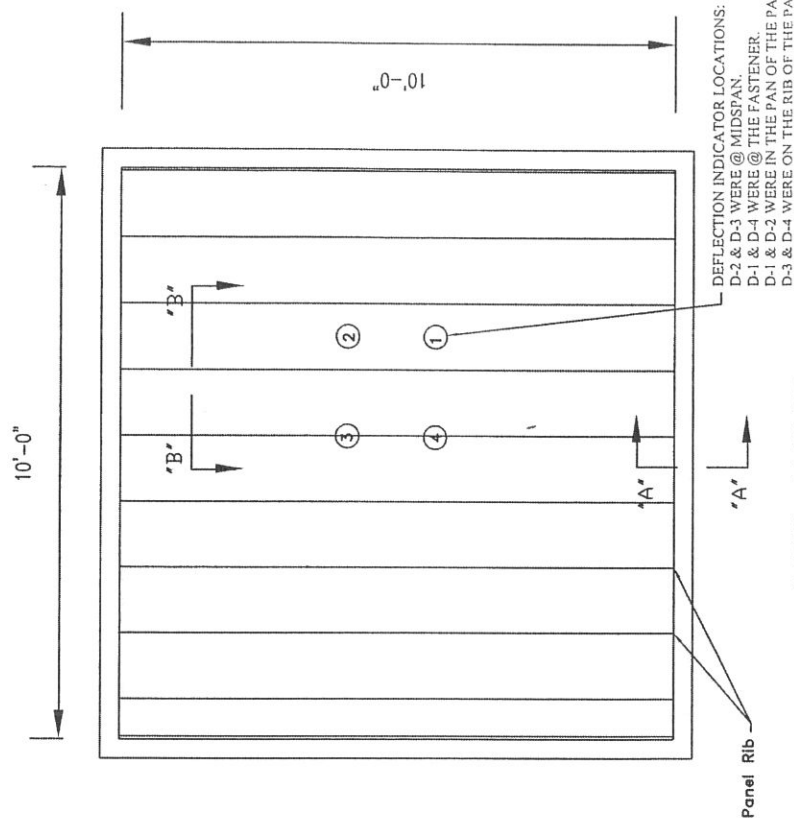
Static Pressure Inches Of H ₂ O (Neg./Pos.)	Deflection (inches)			
	D-1: Pan Mid	D-2: Pan Fast	D-3: Rib Mid	D-4: Rib Fast
CLASS 30				
0	0.0000	0.0000	0.0000	0.0000
-3.1 / +0	0.7500	0.6875	0.0625	0.0625
-3.1 / +2.7	1.1250	1.0625	0.1875	0.0625
-5.3 / +2.7	1.2500	1.1875	0.3125	0.0625
-4.7 / +0	1.1250	1.0625	0.2500	0.0000
-4.7 / +4.0	1.4375	1.3125	0.3125	0.0625
0	0.1250	0.1250	0.1250	0.0625
CLASS 60				
0	0.0000	0.0000	0.0000	NA
-6.2 / +0	1.1250	1.0000	0.1250	NA
-6.2 / +5.3	1.5000	1.4375	0.2500	NA
-10.7 / +5.3	1.7500	1.7500	0.3750	NA
-7.8 / +0	1.5625	1.5000	0.2500	NA
-7.8 / +6.7	1.8125	1.6875	0.3125	NA
0	0.1250	0.1875	0.0625	NA
CLASS 90				
0	0.0000	0.0000	0.0000	NA
-9.3 / +0	1.5000	1.5000	0.2500	NA
-9.3 / +8.0	2.0000	1.9375	0.4375	NA
-9.3 / +8.0	2.0000	2.0000	0.4375	NA
-10.9 / +0	1.8125	1.8125	0.3125	NA
-10.9 / +9.3	2.2500	2.1875	0.4375	NA
0	0.2500	0.0625	0.0625	NA

UL 1897

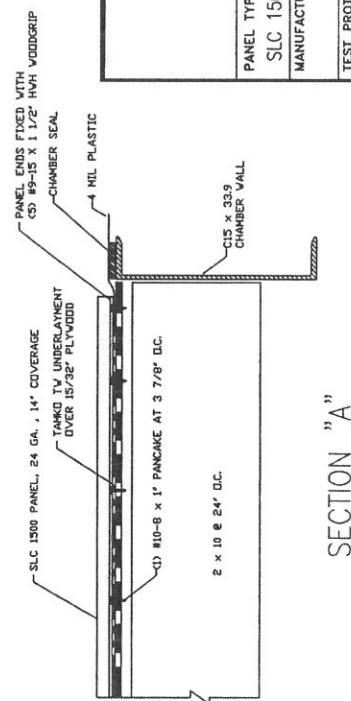
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FAILURE MODE: Panel slot tore at fasteners

MAX PRESSURE: 142 psf



PANEL LAYOUT



 <p>Force Engineering & Testing Inc. 1550 Raintreewood Drive Lewisville, Texas 75118 Phone: (202) 340-6600 Fax: (202) 340-9960</p>	TEST:	BY:	DESCRIPTION:	DATE:
<p>PANEL TYPE: SLC 1500 PANEL, 24 GA. 14" COVERAGE</p> <p>MANUFACTURER: ZIMMERMAN METALS, INC.</p>				
TEST PROTOCOL: UL 580/1897		<p>CLIP TYPE: NA</p> <p>DATE:</p> <p>CLIP FASTENER:</p> <p>SPAN: 3 7/8" O.C.</p> <p>MAX. PRESSURE:</p>		
QUOTE NUMBER: 528-0252T-13B				

UL 580 DEFLECTION READINGS

Test Date: 12/17/2013
 Project Number: 528-0252T-13B
 Panel Description: 24 Ga. SLC 1500 14" nominal coverage
 Panel Fasteners: (1) #10-8 x 1" Pancake Type A at every slot (3 7/8" O.C.)
 Panel Clip: NA
 Substrate: Tamko TW Underlayment over 15/32" 4-ply plywood

Static Pressure Inches Of H ₂ O (Neg./Pos.)	Deflection (inches)			
	D-1: Pan Fas	D-2: Pan Mid	D-3: Rib Mid	D-4: Rib Fast
CLASS 30				
0	0.0000	0.0000	0.0000	0.0000
-3.1 / +0	0.6875	0.6875	0.0625	0.0000
-3.1 / +2.7	1.0625	1.1250	0.1250	0.0000
-5.3 / +2.7	1.1250	1.1875	0.1875	0.0000
-4.7 / +0	1.0000	1.0625	0.1250	0.0000
-4.7 / +4.0	1.3125	1.3750	0.1875	0.0625
0	0.5625	0.5000	0.0625	0.0625
CLASS 60				
0	0.0000	0.0000	0.0000	0.0000
-6.2 / +0	0.6250	0.6875	0.1250	0.0625
-6.2 / +5.3	1.0000	1.1250	0.1875	0.0625
-10.7 / +5.3	1.1875	1.3125	0.2500	0.0625
-7.8 / +0	0.9375	1.0625	0.1250	0.0625
-7.8 / +6.7	1.1875	1.3750	0.1875	0.1250
0	0.5625	0.5000	0.0000	0.1250
CLASS 90				
0	0.0000	0.0000	0.0000	0.0000
-9.3 / +0	1.4375	1.5000	0.1250	0.0000
-9.3 / +8.0	1.9375	1.8750	0.1875	0.1250
-9.3 / +8.0	1.9375	2.0000	0.1875	0.1250
-10.9 / +0	1.7500	1.8125	0.1250	0.1875
-10.9 / +9.3	2.1250	2.1875	0.1875	0.1875
0	0.0625	0.1250	0.0625	0.2500

UL 1897

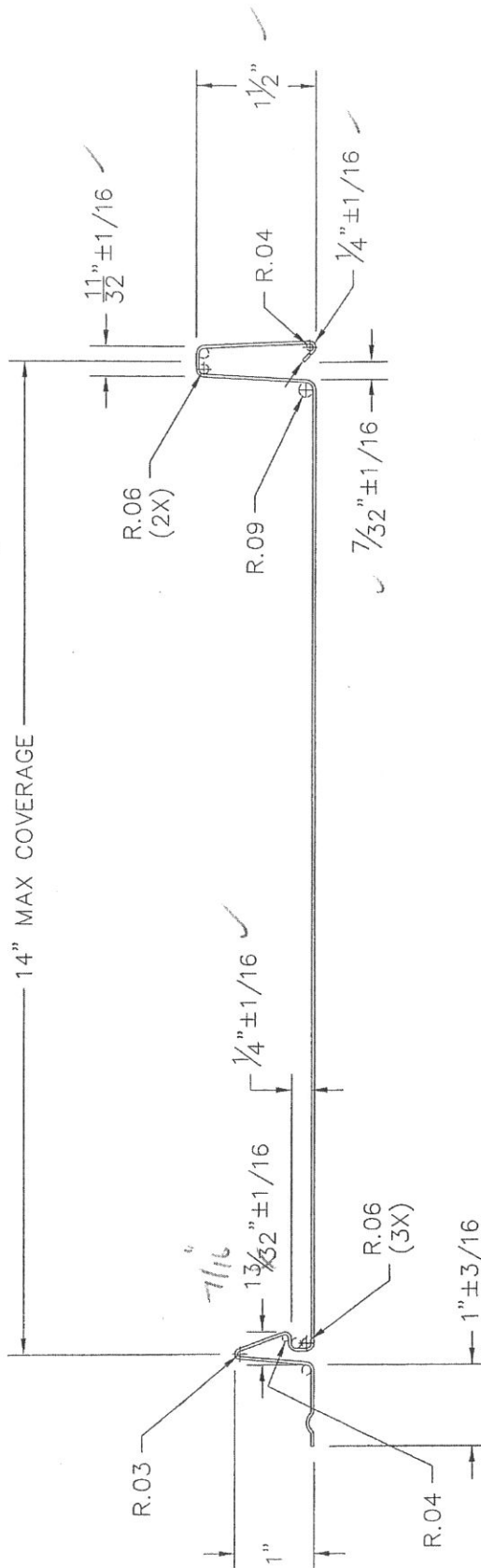
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FAILURE MODE: Panel seam disengaged

MAX PRESSURE: 202 psf

MODEL SLC-1500

24 GA MIN, GRADE "D", 50 KSI MIN. YIELD



ZIMMERMAN METALS INC.
201 E 58th AVE.
DENVER, CO 80216
(303) 294-0180

TITLE	1.5" CONVERTABLE	3/4" ANGLE PROJ.
	SNAP LOCK PROFILE	BREAK ALL UNMARKED CORNERS
MACH. MOD. NO.	CRPM	PROPRIETARY INFORMATION NOTICE THIS DOCUMENT CONTAINS PROPRIETARY & CONFIDENTIAL INFORMATION WHICH SHALL NOT BE REPRODUCED, TRANSFERRED TO OTHER DOCUMENTS, DISCLOSED TO OTHERS, OR USED FOR OTHER PURPOSES WITHOUT PRIOR WRITTEN PERMISSION OF ZIMMERMAN METALS INC. OF DENVER CO.
DRAWING NO.	SLC-1500-UL	SCALE: 100% SCALE DWG
SHEET / OF		DRAWN BY: CEL
NOTES:	ALL DIMENSIONS ±10% U.N.O.	DATE: 12/06/13
MAT'L:	STEEL, 24 GAGE MIN	APPROV BY: DATE:

NOTE: ALL RADII ARE INSIDE

COMMERCIAL ROOF PANEL AVAILABLE PROFILES

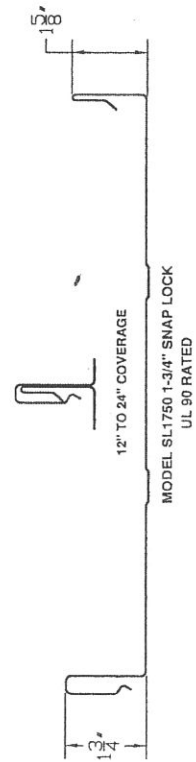
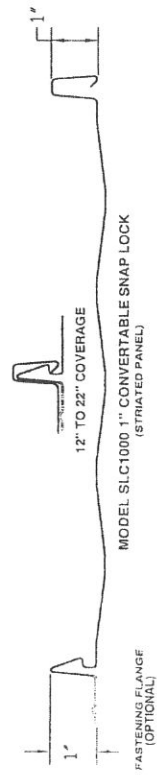
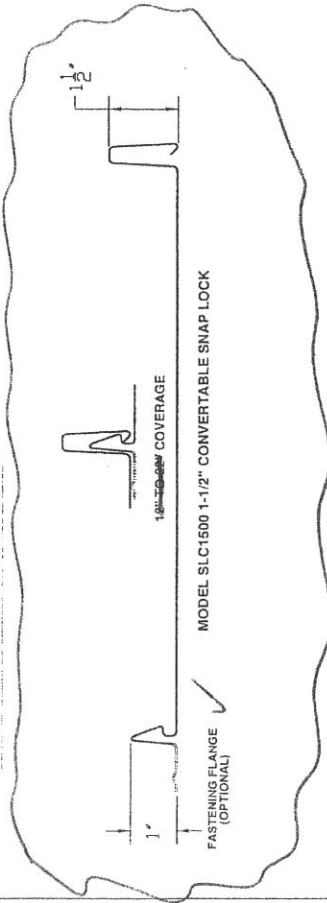


Zimmerman Metals Inc.

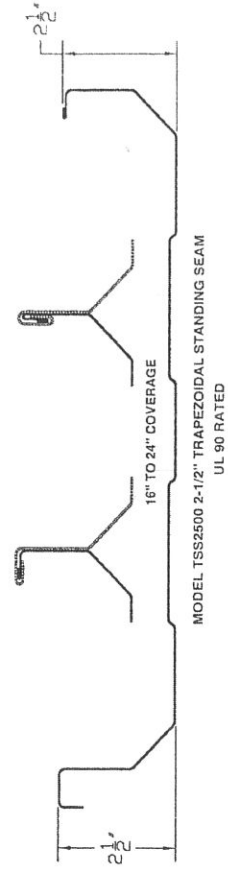
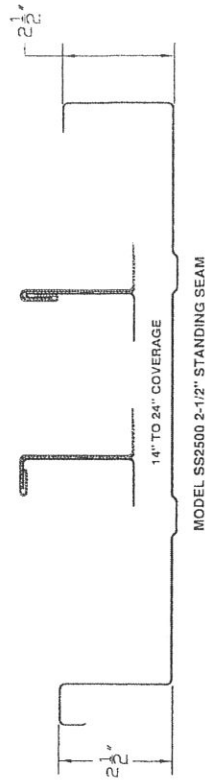
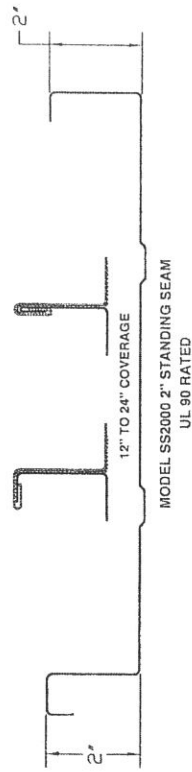
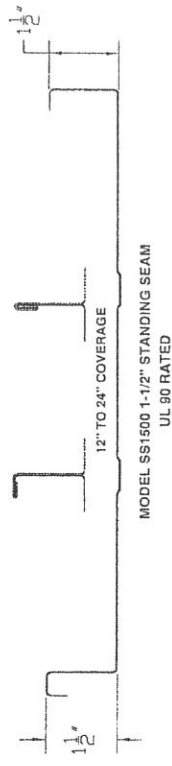
Over 70 Years of Quality Workmanship and Service

201 East 58th Avenue, Denver, Colo. 80216 / 303-294-0180 / FAX 303-292-5013

SNAP LOCK PROFILES:



STANDING SEAM PROFILES:



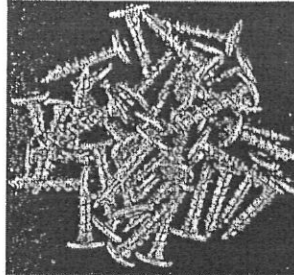
ALL PANELS CAN BE FORMED SMOOTH, WITH RIBS OR WITH STRIATIONS

smpclips@yahoo.com
SCHULMEISTER METAL PRODUCTS INC.
Your Personal Roofing Supplier

SMP ECONO ZINC PLATED PANCAKE SCREW - MTW

With low profile pancake head for installing standing seam panels and concealed panel clips into wood substrates. Yellow or silver zinc plating for light corrosion protection. #10-8 Yellow zinc 1" with TP-17 cutpoint and #2 Phillips/#2 square drive.

Packages 250 pcs/bag.

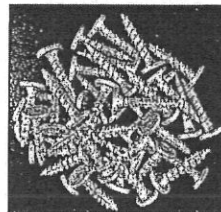


Available Sizes		Qty/Box
#10 x 1"	TP17	5,000
#10 x 1-1/2"	SP	2,500
#10 x 2"	SP	2,000
#12-8 x 1"	SP	4,000
#12-8 x 1-1/2"	SP	2,000
#12-8 x 2"	SP	1,500

SMP

SMP PAN CLIP COATED LONGLIFE DADE PANCAKE SCREW-MTW

#10-9 with low profile pancake head for installing standing seam panels and concealed panel clips into wood substrates. Special 1000 hour tested coating with Dade County approval for corrosion protection. TP-17 cutpoint and #2 Phillips/#2 Square Drive. Packages 250 pcs/bag.



Available Sizes		Qty/Box
#10 x 1"	TP17	3,000
#10 x 1-1/2"	TP17	2,500
#10 x 2"	TP17	2,000

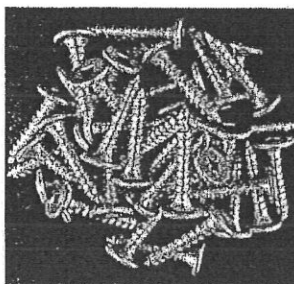
Dimension	Pull Out SPF	Pull Out Plywood	Pull Out OSB	DADE #
TDia.:204	1": 665	1/2": 478	7/16": 293	Shear: 1428
HDia.:447	Pine: 952			Tensile: 1981
Pullover>	26GA:778	24GA: 1128	22GA: 1512	Torsional:66 inlbs

**MIAMI-DADE COUNTY
APPROVED**

SMP PANCLIPS 304 STAINLESS STEEL PANCAKE SCREW - MTW

With low profile pancake head for installing standing seam panels and concealed panel clips into wood substrates. Suggested for installation of aluminum panels, stainless steel panel clips and in coastal areas. Full 304 stainless steel fastener, #2 square drive sizes have a Dade County Listing/Approval and 20 year corrosion warranty.

Packages 250 pcs/bag.



Available Sizes		Qty/Box
#10 x 1"	SQ2 SP	3,000
#10 x 1-1/2"	SQ2 SP	2,500
#10 x 1"	PH2 SP	5,000
#10 x 2"	PH2 SP	2,000
#12 x 1-1/4"	T25SP	3,500B
#12 x 2"	T25 TP17	1,500B
#12 x 3"	T25 TP17	1,500B

**MIAMI-DADE COUNTY
APPROVED**

Tell Mike what your panel machine manufacturer is.

**Call Mike
Your Roofing Specialist
770-363-6465**

TAMKO® TW METAL AND TILE

Underlayment

PRODUCT DATA

IMPORTANT: This product features a skid resistant and tear resistant surface. This feature does not serve as a substitute for following all proper fall protection procedures in accordance with OSHA regulatory requirements - including the use of personal fall protection devices when working on a roof. **Applicator safety is of utmost importance.**

DESCRIPTION

TAMKO® TW Metal and Tile Underlayment is a flexible, fiberglass reinforced, self-adhering rubberized asphalt sheet membrane with a polymer film on the surface and a removable treated release film on the adhesive side.

USES

TAMKO TW Metal and Tile Underlayment is well-suited for use as an underlayment where prevention of water penetration is required prior to installation of a metal roof system or a mechanically fastened tile roof system*. TW Metal and Tile Underlayment also provides secondary protection against water penetration after installation of the roof system. When fasteners penetrate the TW Metal and Tile Underlayment membrane during installation of a metal roof system, the metal roof system manufacturer's recommendations must be followed for watertight integrity at the fastener penetrations.

*Before installing TW Metal and Tile Underlayment under copper roofing, a design professional must be consulted to analyze the interaction of the building, roof deck, and roof assembly with regards to adequate temperature resistance.

ADVANTAGES

- Textured surface provides skid resistance.
- Strong fiberglass reinforcement for added stability during installation.
- Split treated release film for easier installation.
- Adheres to plywood, OSB, exterior gypsum sheathing, DensGlass®, DensGlass Gold®, felt-faced and foil-faced polyisocyanurate foam insulation, metal, cast-in-place concrete, or pre-cast concrete surfaces.
- Meets ASTM D 1970 for nail sealability of self-adhering roofing underlayments.
- High temperature resistance up to 250°F.
- Can be left exposed for up to 120 days before application of finished roof.
- ICC-ES ESR-1252
- Florida Building Code Approval # FL 1478

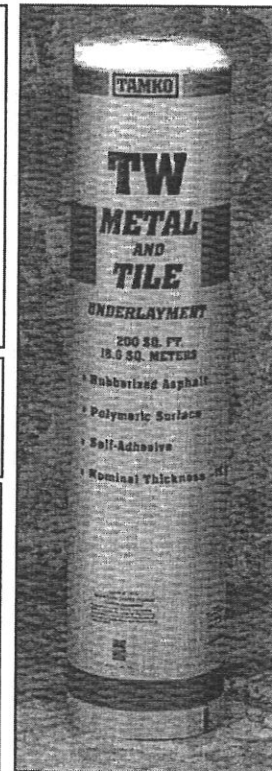
LIMITATIONS

- Membrane must not be applied to damp, frosty or contaminated surfaces.
- Membrane must not come into contact with products containing coal-tar pitch.
- Must be applied at temperatures of 40°F and higher.

PRODUCT DATA**

Roll Size	2 square (200 sq. ft.) <i>The coverage before overlaps as required by the instructions.</i>
Roll Coverage	179.82 sq. ft. (16.71 square meters) <i>When applied according to instructions (excluding side lap).</i>
Roll Dimensions	39-3/8" x 61'
Thickness	75 mil
Rolls Per 37" x 47" Pallet	20 rolls

**All values stated as nominal.



TYPICAL PHYSICAL PROPERTIES

Property	Test Method	Typical Value
Adhesion to Plywood at 75°F	ASTM D 1970	15 lbf/ft width (min.)
Moisture Vapor Permeability	ASTM E 96 (BW)	0.05 perms (max.)
Air Permeance ($\Delta P = 75$ Pa)	ASTM E 2178	<0.0005 L/s-m ² (<0.0001 CFM/ft ²)
Maximum Load	ASTM D 1970	30 lbf/in.
Elongation Modified Bitumen Portion	ASTM D 1970	40%
Low Temp. Flexibility	ASTM D 1970	-20°F

TAMKO® TW METAL AND TILE

Underlayment

APPLICATION INSTRUCTIONS

THESE ARE THE APPLICATION INSTRUCTIONS FOR TAMKO METAL AND TILE UNDERLAYMENT. TAMKO BUILDING PRODUCTS, INC. SHALL NOT BE RESPONSIBLE FOR LEAKS OR OTHER ROOFING PROBLEMS RESULTING FROM IMPROPER APPLICATION. FAILURE TO PROPERLY APPLY THIS PRODUCT ACCORDING TO THESE INSTRUCTIONS COULD RESULT IN UNSAFE CONDITIONS AND COULD ADVERSELY AFFECT COVERAGE OF THE LIMITED WARRANTY.

SAFETY PRECAUTION

Personal fall protection devices must always be used when applying TAMKO TW METAL AND TILE UNDERLAYMENT. Moisture, frost or debris will decrease the traction while walking on TAMKO TW METAL AND TILE UNDERLAYMENT. PLEASE EXERCISE CAUTION DURING INSTALLATION.

SURFACE PREPARATION

To begin, remove any dust, dirt, loose nails or other protrusions from the deck of new roofs. Remove all shingles, roofing felt, nails, or other existing roofing materials and debris from the deck of existing roofs. Sweep thoroughly to remove any dust and dirt. For best application, apply TAMKO® TW Metal and Tile Underlayment only in fair weather and when air, substrate, and membrane temperatures are above 40°F. Priming is generally not required for surfaces that are smooth, clean, and dry. In any case where adhesion is found to be marginal, prime with TAMKO® TWP-1 or TWP-2 primers at the designated coverage rates. Priming is always required when adhering to concrete.

FOR ROOF DECKS

Apply TAMKO TW Metal and Tile Underlayment from low to high point in shingle fashion as shown below, so that laps will shed water. Overlap edge seams 4". End seams must be overlapped 6" and staggered. Where necessary, the membrane may be unrolled and cut into 10- to 15-foot lengths. Align the membrane on the lower edge of the roof. Remove the release film from the membrane then press the membrane into place. Roll lower edges firmly with a roofing seam roller; "Broom in" the installed membrane using an industrial flat broom or squeegee. Bear down on the installed membrane with the broom or squeegee to insure total, even adherence to the substrate. Care should be taken not to damage the surface when brooming.

FOR VALLEYS AND RIDGES

Where necessary, the membrane may be unrolled and cut into 4- to 6-foot lengths. Peel the release film and center sheet over valley or ridge. Drape and press sheet into place, working from the center of the valley or ridge outward in each direction. For valleys, apply the membrane starting at the lowest point and work upward. Overlap all sheets a minimum of 6 inches. The TW Metal and Tile Underlayment must be used on "closed valley" applications only. TW Metal and Tile Underlayment must not be left permanently exposed to the weather. It must be covered by roofing materials.

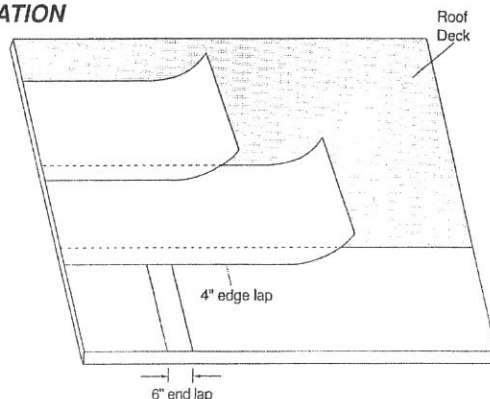
APPLICATION WITH ROLL LENGTH PARALLEL TO THE ROOF SLOPE

TAMKO TW Metal and Tile Underlayment may be applied with the long dimension of the roll running parallel to the roof slope in situations where the roof slope equals or exceeds 21 inches per foot. In these applications, side laps must be a minimum of 4" wide and formed so the smooth film selvage along one side of the roll is covered by the adjacent roll of TW Metal and Tile Underlayment. All side and end laps must be rolled with a roofing seam roller in addition to brooming the entire surface.

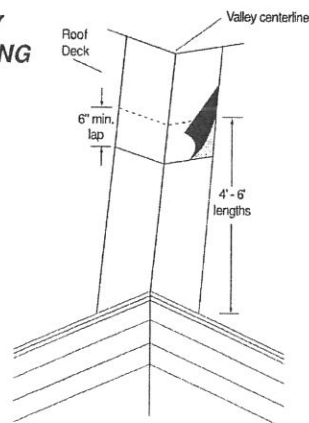
VENTILATION

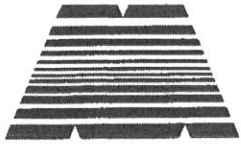
A vapor retarding layer may result when TW Metal and Tile Underlayment is installed over an entire roof deck. Design of the entire roof system and the area immediately beneath the roof deck (e.g. attic, plenum, conditioned space) to properly address potential moisture and heat accumulation is the responsibility of a design professional (e.g. architect, engineer) and the building owner. Specific ventilation requirements expressed in applicable building codes or necessitated by the roof covering may apply and should be considered.

TW METAL AND TILE UNDERLAYMENT FIELD APPLICATION



VALLEY FLASHING DETAIL





METALLURGICAL ENGINEERING SERVICES, INC.

Consulting • Failure Analysis • Laboratory Testing

January 13, 2014

REPORT OF: Tensile Test

REPORT TO: Force Engineering & Testing, Inc.
Gianna Willits
19530 Ramblewood Drive
Humble, Texas 77338

DATE APPROVED: January 10, 2014

IDENTIFICATION: 1 ea. Metal Roof Panel identified as:
A) 528-0252T-13A; Zimmerman Metals, Inc.; 1.5" Nail Strip
Panel

PROCEDURES:

Tensile testing was performed per ASTM E 8-11 on the submitted sample using a Satec Systems Model Apex 22EMF, S/N: 1017, calibration due 5/2/14.


RESULTS: *Tensile Test* - 2" Gage Length, 0.2% Offset

SQR Dimensions Inches				Ultimate Strength		Yield Strength		Elong
ID	Width	Thickness	Area, in ²	Load, Lbs	PSI	Load, Lbs	PSI	%
A	0.4925	0.0220	0.0108	639	59,200	559	51,700	24.4

These results and opinions are based on the tests performed and are subject to change upon the receipt of new or additional information.

Respectfully submitted,

METALLURGICAL ENGINEERING SERVICES, INC.
Firm Registration No. F-2674


Daniel A. Stolk, PE
President


Karen Goldstein
Quality Assurance Assistant

Purchase Order No. 528-0252T-13A

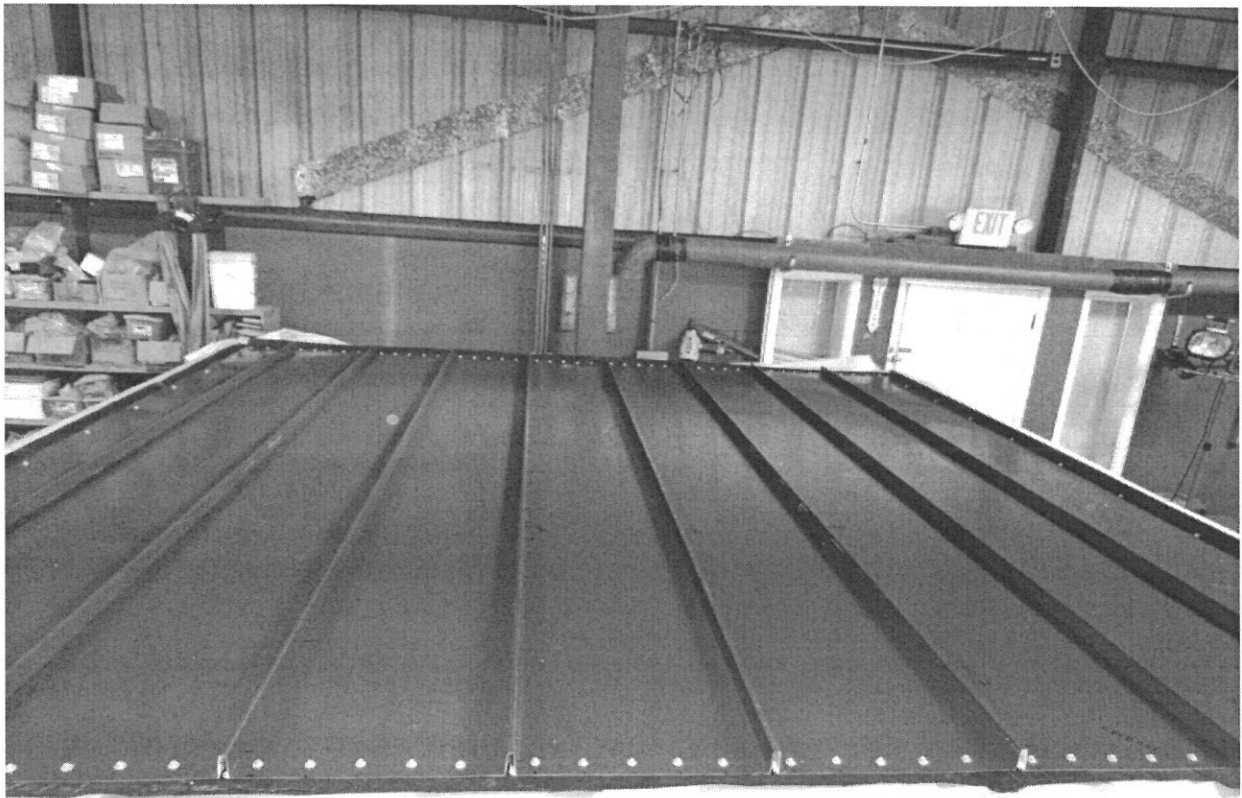
Lab No. 29093-A
Page 1 of 1

NOTE: Submitted material will be retained for 30 days unless otherwise notified in writing.
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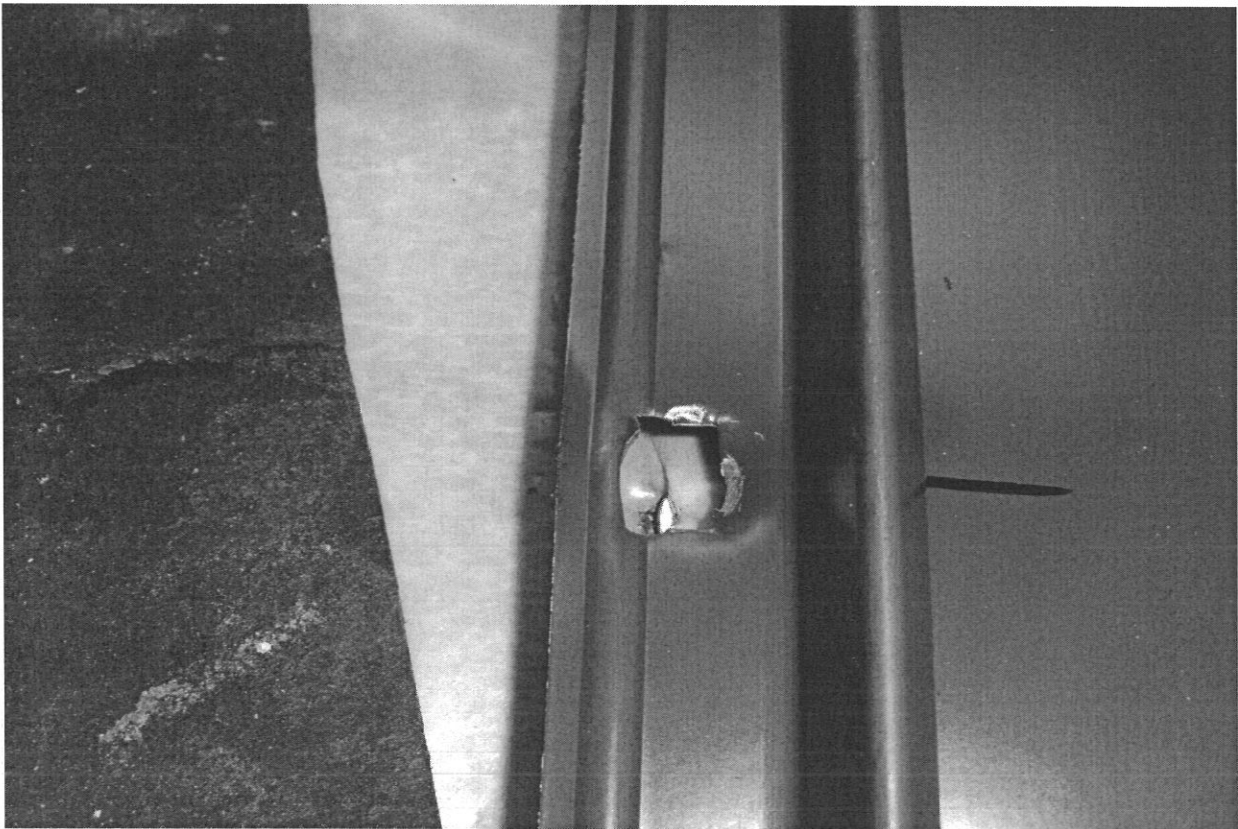
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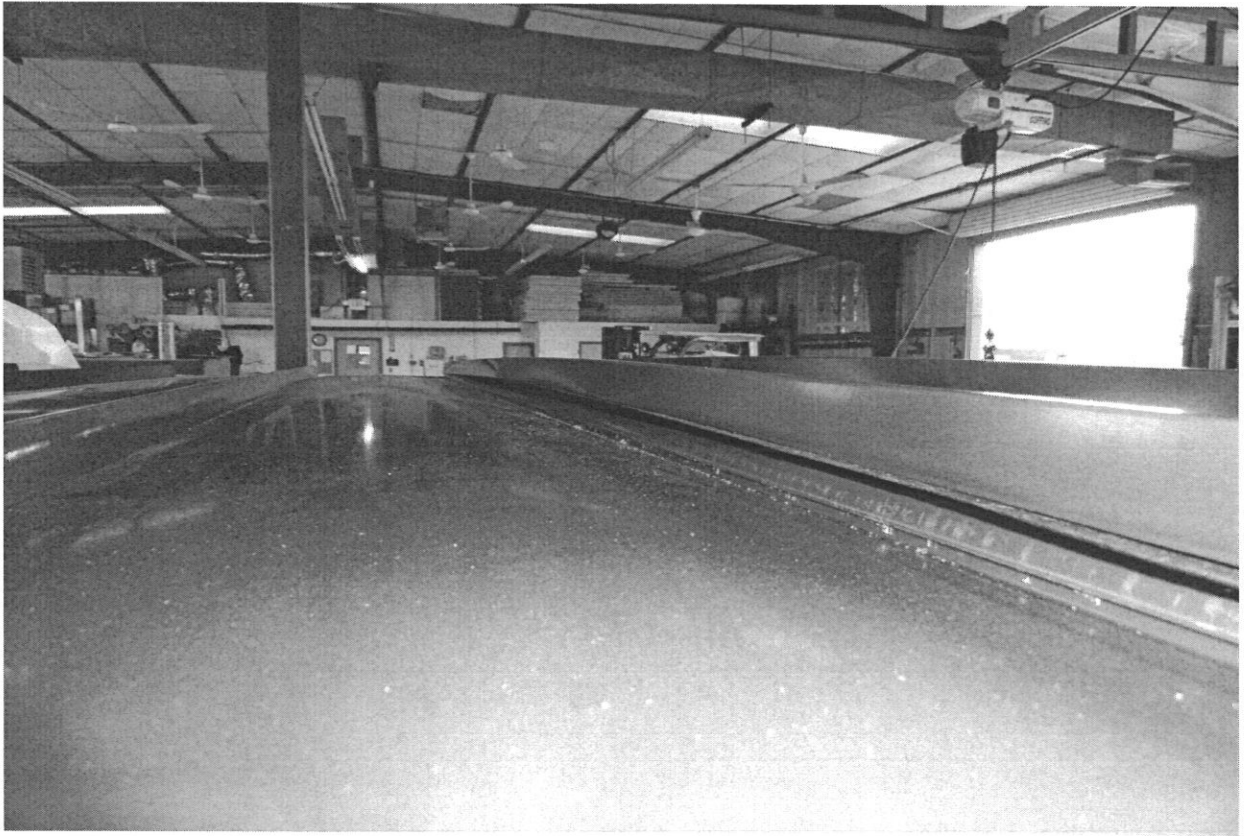
Photos



TYPICAL PANEL ASSEMBLY BEFORE TESTING



TEST A FAILURE, FASTENER FLANGE TORE AROUND FASTENER HEAD



TEST B FAILURE, PANEL SEAMS DISENGAGED