

# SOUTHWEST RESEARCH INSTITUTE®

6220 CULEBRA RD. 78238-5166 • P.O. DRAWER 28510 78228-0510 • SAN ANTONIO, TEXAS, USA • (210) 684-5111 • WWW.SWRI.ORG

CHEMISTRY AND CHEMICAL ENGINEERING DIVISION  
FIRE TECHNOLOGY DEPARTMENT  
WWW.FIRE.SWRI.ORG  
FAX (210) 522-3377



Registered to  
ISO 9001:2008

## EVALUATION OF THE EXTERNAL FIRE RESISTANCE CHARACTERISTICS OF ROOF COVERING SYSTEMS IN GENERAL ACCORDANCE WITH ASTM E 108-10a, *STANDARD TEST METHODS FOR FIRE TESTS OF ROOF COVERINGS*: CLASS A

**SAMPLE ID:** *AATIS/FR Panel*

**FINAL REPORT**  
Consisting of 27 Pages

**SwRI® Project No. 01.15677.01.001**  
**Test Date: August 26, 2010**  
**Report Date: September 14, 2010**

**Prepared for:**

**M N Chai Corporation Co., Ltd.**  
**95/397-8 Rama 3 Road, Soi 52**  
**Chongnonsee, Yannawa**  
**Bangkok, THAILAND, 10120**

Prepared By:

JMS  
Handwritten signature of David Hintz in blue ink.

David Hintz  
Engineer  
Fire Resistance Section

Approved By:

Handwritten signature of Barry L. Badders in blue ink.

Barry L. Badders, P.E.  
Manager  
Fire Resistance Section

This report is for the information of the client. This report shall not be reproduced except in full, without the written approval of SwRI.  
Neither this report nor the name of the Institute shall be used in publicity or advertising.



HOUSTON, TEXAS (713) 977-1377 • WASHINGTON, DC (301) 881-0226

## 1.0 INTRODUCTION

This report presents the results of an investigation of the external fire resistance characteristics of *M N Chai Corporation Co., Ltd.'s, AATIS/FR Panel* as a roof covering system in general accordance with Class A test requirements of ASTM E 108, *Standard Test Methods for Fire Tests of Roof Coverings*. The objective of this standard is to measure the relative fire resistance characteristics of roof coverings under a simulated fire originating outside the building. This standard is used to measure and describe the properties of materials, products, or assemblies in response to heat and flame under controlled laboratory conditions and should not be used to describe or appraise the fire hazard or fire risk of materials, products, or assemblies under actual fire conditions. However, results of this test may be used as elements of a fire risk assessment that takes into account all of the factors, pertinent to an assessment of the fire hazard of a particular end use. The results apply specifically to the specimens tested, in the manner tested, and not to the entire production of these or similar materials, nor to the performance when used in combination with other materials.

## 2.0 CLASSIFICATION CRITERIA

Class A tests are applicable to roof coverings that are effective against severe test exposure, afford a high degree of fire protection to the roof deck, do not slip from position, and do not present a flying brand hazard. To be regarded as Class A, a roofing system shall meet the requirements of eight tests: four Burning Brand tests, two Spread of Flame tests, and two Intermittent Flame tests. Each Class A Burning Brand test requires one Class A burning brand to be placed on the test deck. The brand is to be positioned at the location considered most vulnerable to fire penetration. Each Class A Intermittent Flame test requires fifteen 2-min exposures to a  $1400\text{ }^{\circ}\text{F} \pm 50\text{ }^{\circ}\text{F}$  flame with a 2-min interval between each exposure. Each Class A Spread of Flame test requires a single 10-min exposure to a  $1400\text{ }^{\circ}\text{F} \pm 50\text{ }^{\circ}\text{F}$  flame. All tests are performed in the presence of a  $1056 \pm 44\text{-ft/min}$  air velocity.

In order to meet acceptance criteria in accordance with ASTM E 108, a roof covering material shall meet the following conditions when subjected to the particular class of fire tests:

1. At no time during or after the Intermittent Flame, Spread of Flame, or Burning Brand tests shall:
  - Any portion of the roof covering material be blown or fall off the test deck in the form of flaming or glowing brands that continue to glow after reaching the floor,
  - The roof deck be exposed (except for roof coverings restricted to use over noncombustible deck), or
  - Portions of the roof deck fall away in the form of particles that continue to glow after reaching the floor.

2. At no time during the Class A, B, or C Intermittent Flame or Burning Brand tests shall there be sustained flaming of the underside of the deck. If flaming does occur, conduct another series of tests, during which no sustained flaming shall occur.
3. During the Spread of Flame tests, the flaming shall not spread beyond 6 ft (1.8 m) for Class A, 8 ft (2.4 m) for Class B, nor 13 ft (4.0 m, the top of the deck) for Class C. There shall be no significant lateral spread of flame from the path directly exposed to the test flame.

### 3.0 TEST INFORMATION

**Client:** M N Chai Corporation Co., Ltd.

**SwRI Project No.:** 01.15677.01.001

#### Test Specimen

Identification: *AATIS/FR Panel*, manufactured by M N Chai Corporation Co., Ltd.

Date Received: August 19, 2010

Description: The *AATIS FR Panel* is a 4-mm thick panel with 0.5-mm aluminum skins, and a 3-mm thick FR magnesium hydroxide with polyurethane core. The panel was constructed over two layers of 15-mm thick gypsum wall board sandwiching 50-mm of Rockwool insulation.

Construction Details: In ascending order, the *AATIS/FR Panel* roof system consisted of:

1. 15-mm thick gypsum wall board.
2. 50-mm thick Rockwool insulation (130 kg/m<sup>3</sup>).
3. 15-mm thick gypsum wall board.
4. 4-mm thick *AATIS/FR Panel* secured to 6-ga perimeter steel framing with #10 self drilling screws.

Surveillance: N/A

Color: Silver/Copper

Storage Conditions: Ambient conditions

Exposure: N/A

#### Test Details

Test Date: August 26, 2010

Test Location: Southwest Research Institute's (SwRI's) Fire Technology Department in San Antonio, Texas

Witnesses: Mr. Pramoch Chai – representing Mae Num Metal Supply Co., Ltd.  
Mr. Somporn Chanatavaraluk – representing M N Chai Corporation Co., Ltd.

Calibration Details: See Appendix A

Tests Conducted: ASTM E 108, Class A

Slope: 5:12

Observations: Selected photos taken during the test are presented in Appendix B. Observations made during each test can be found in Appendix C. Client-provided drawings of the assembly can be found in Appendix D.

Other Details: The Spread of Flame and Burning Brand tests were conducted in general accordance with the standard because the ambient temperature was greater than the allowed maximum.

#### **4.0 RESULTS**

M N Chai Corporation Co., Ltd.'s, *AATIS/FR Panel* roof covering system met the Class A Test requirements of ASTM E 108.

#### **5.0 CONCLUSION**

SwRI's Fire Technology Department performed testing in general accordance with ASTM E 108 for M N Chai Corporation Co., Ltd., on August 26, 2010. Mr. Pramoch Chai representing Mae Num Metal Supply Co., Ltd., and Mr. Somporn Chanatavaraluk of M N Chai Corporation Co., Ltd., were present to witness the testing. Based on the test results and the classification criteria, the *AATIS/FR Panel* roof covering system, used by M N Chai Corporation Co., Ltd., and described herein met the ASTM E 108 Class A requirements for roof coverings.

**APPENDIX A**  
**CALIBRATION DETAILS**  
**(Consisting of 1 Page)**

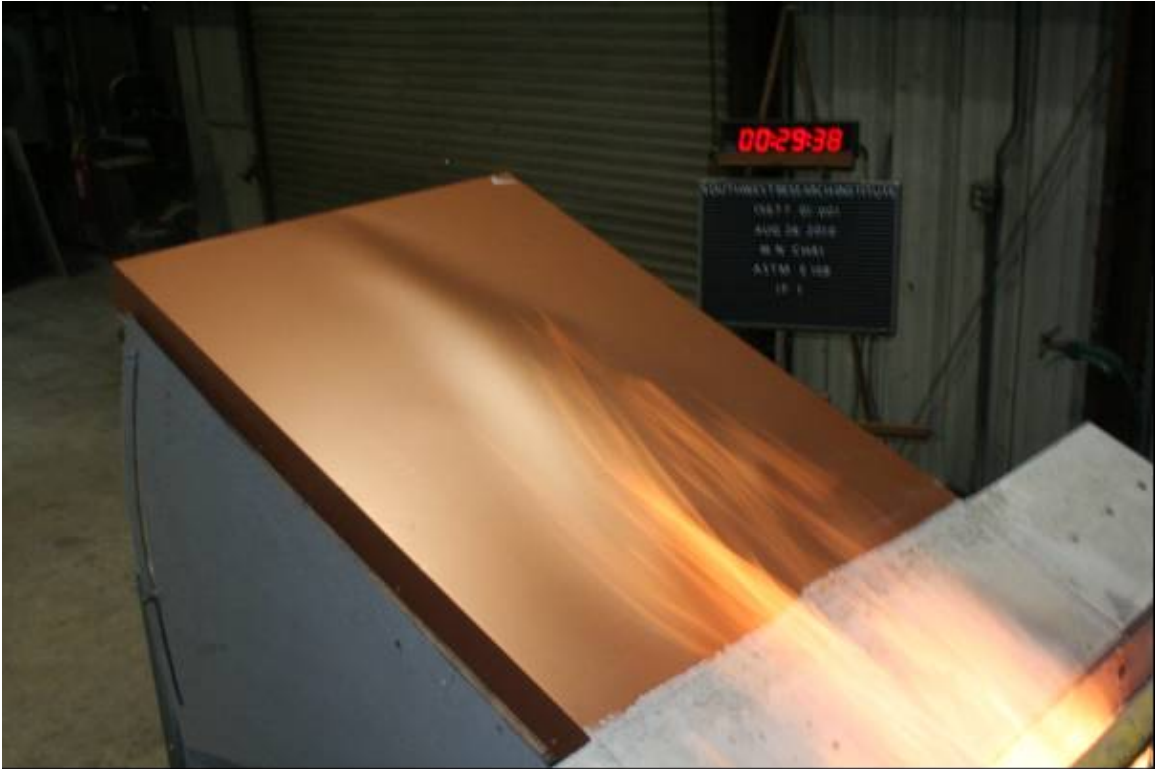
**Calibration Data**

**Calibration Date: August 26, 2010**

---

|                         |               |        |          |
|-------------------------|---------------|--------|----------|
| Air Velocity (ft/min):  | Right         | 1013   |          |
|                         | Center        | 1061   |          |
|                         | Left          | 1046   |          |
| Flame Temperature (°F): | 2-min Average | 1405.4 | (763 °C) |

**APPENDIX B**  
**SELECTED TEST PHOTOGRAPHS**  
**(Consisting of 6 Pages)**



**Figure B-1. Test ID IF-1. Top Side of Test Sample at 29 min 38 s.**



**Figure B-2. Test ID IF-1. Underside of Test Sample at End of Test.**





**Figure B-3. Test ID IF-2. Underside of Test Sample at End of Test.**



**Figure B-4. Test ID SoF-1. Test Sample at End of Fire Exposure.**



**Figure B-5. Test ID SoF-2. Test Sample at End of Test.**



**Figure B-6. Test ID BB-1. Typical Brand Placement.**



**Figure B-7. Test ID BB-1. Underside of Test Sample at End of Test.**



**Figure B-8. Test ID BB-2. Underside of Test Sample at End of Test.**



**Figure B-9. Test ID BB-3. Top Side of Test Sample at End of Test.**



**Figure B-10. Test ID BB-3. Underside of Test Sample at End of Test.**



**Figure B-11. Test ID BB-4. Underside of Test Sample at End of Test.**

**APPENDIX C**  
**TEST OBSERVATIONS**  
**(Consisting of 8 Pages)**

**Class A Intermittent Flame Test**  
**August 26, 2010**

Test ID No.: IF 1 of 2  
 Specimen ID: AATIS/FR Panel  
 Ambient Air Temperature: 82.9 °F (28.3 °C)  
 Deck EMC: N/A  
 Slope: 5:12

| <b>TIME<br/>MIN:S</b> | <b>OBSERVATIONS</b>   |
|-----------------------|---|
| 00:00                 | Start of test; cycle #1 start.  |
| 02:00                 | Cycle #1 complete. Upward bowing of top metal skin of panel. After burner is turned off; bowing decreases.        |
| 04:00                 | Cycle #2 start. Bowing returns after ignition of burner. The bowing reaches further back near back edge of panel. |
| 06:00                 | Cycle #2 complete. No change.   |
| 08:00                 | Cycle #3 start.   |
| 10:00                 | Cycle #3 complete. Bowing reaches back edge of test deck.   |
| 12:00                 | Cycle #4 start.   |
| 14:00                 | Cycle #4 complete. No change.   |
| 16:00                 | Cycle #5 start.   |
| 18:00                 | Cycle #5 complete. No change.   |
| 20:00                 | Cycle #6 start.   |
| 22:00                 | Cycle #6 complete. Bowing in metal skin remains in metal skin after burner has been turned off.                   |
| 24:00                 | Cycle #7 start.   |
| 26:00                 | Cycle #7 complete. No change.   |
| 28:00                 | Cycle #8 start.   |
| 30:00                 | Cycle #8 complete. No change.   |
| 32:00                 | Cycle #9 start.   |
| 34:00                 | Cycle #9 complete. Bowing remains in top skin of deck. No changes visible on underside of deck.                   |
| 36:00                 | Cycle #10 start.  |
| 38:00                 | Cycle #10 complete. No change.  |
| 40:00                 | Cycle #11 start.  |
| 42:00                 | Cycle #11 complete. Tar drip heavier through seam.  |
| 44:00                 | Cycle #12 start.  |
| 46:00                 | Cycle #12 complete. No change.  |
| 48:00                 | Cycle #13 start.  |
| 50:00                 | Cycle #13 complete. No change.  |
| 52:00                 | Cycle #14 start.  |
| 54:00                 | Cycle #14 complete. No change.  |
| 56:00                 | Cycle #15 start.  |
| 58:00                 | Cycle #15 complete. No change. Test stopped. No failure conditions present. <b>PASS.</b>                          |

**Class A Intermittent Flame Test**  
**August 26, 2010**

Test ID No.: IF 2 of 2  
Specimen ID: AATIS/FR Panel  
Ambient Air Temperature: 86.9 °F (33.9 °C)  
Deck EMC: 7.8%  
Slope: 5:12

| <b>TIME<br/>MIN:S</b> | <b>OBSERVATIONS</b>   |
|-----------------------|---|
| 00:00                 | Start of test; cycle #1 start.  |
| 02:00                 | Cycle #1 complete. Upward bowing of top metal skin of panel. After burner is turned off bowing decreases. |
| 04:00                 | Cycle #2 start.   |
| 06:00                 | Cycle #2 complete. No change.   |
| 08:00                 | Cycle #3 start.   |
| 10:00                 | Cycle #3 complete. No change.   |
| 12:00                 | Cycle #4 start.   |
| 14:00                 | Cycle #4 complete. Bowing in panel is the same.   |
| 16:00                 | Cycle #5 start.   |
| 18:00                 | Cycle #5 complete. No change.   |
| 20:00                 | Cycle #6 start.   |
| 22:00                 | Cycle #6 complete. Bowing in metal skin remains the same.   |
| 24:00                 | Cycle #7 start.   |
| 26:00                 | Cycle #7 complete. No change.   |
| 28:00                 | Cycle #8 start.   |
| 30:00                 | Cycle #8 complete. No change.   |
| 32:00                 | Cycle #9 start.   |
| 34:00                 | Cycle #9 complete. No visible changes to underside of deck.   |
| 36:00                 | Cycle #10 start.  |
| 38:00                 | Cycle #10 complete. No change.  |
| 40:00                 | Cycle #11 start.  |
| 42:00                 | Cycle #11 complete. No change.  |
| 44:00                 | Cycle #12 start.  |
| 46:00                 | Cycle #12 complete. No change.  |
| 48:00                 | Cycle #13 start.  |
| 50:00                 | Cycle #13 complete. No change.  |
| 52:00                 | Cycle #14 start.  |
| 54:00                 | Cycle #14 complete. No change.  |
| 56:00                 | Cycle #15 start.  |
| 58:00                 | Cycle #15 complete. No change. Test stopped. No failure conditions present. <b>PASS.</b>                  |



**Class A Spread of Flame Test  
August 26, 2010**

Test ID No.: SoF 1 of 2  
 Specimen ID: *AATIS/FR Panel*  
 Ambient Air Temperature: 91.5 °F (33.1 °C)

| <b>TIME<br/>MIN:S</b> | <b>OBSERVATIONS</b>  |
|-----------------------|--|
| 00:00                 | Start of test; burner on.  |
| 01:05                 | Bowing of top skin of panel becoming visible.                          |
| 01:20                 | Bowing in panel skin reaches approximately 1 ft 6 in.                  |
| 05:00                 | Bowing in panel skin reaches approximately 2 ft 6 in.                  |
| 06:50                 | Small area of discoloration visible at front edge of panel.            |
| 10:00                 | Test stopped. No ignition of exposed surface at any point. <b>PASS</b> |

**Flame-Spread Distance and Time.**

| <b>Distance</b>         | 1 ft | 2 ft | 3 ft | 4 ft | 5 ft | 6 ft | 7 ft | 8 ft |
|-------------------------|------|------|------|------|------|------|------|------|
| <b>Time<br/>(min:s)</b> | -    | -    | -    | -    | -    | -    | -    | -    |

**Class A Spread of Flame Test  
August 26, 2010**

Test ID No.: SoF 2 of 2  
 Specimen ID: AATIS/FR Panel  
 Ambient Air Temperature: 90.7 °F (32.6 °C)

| TIME<br>MIN:S | OBSERVATIONS  |
|---------------|---|
| 00:00         | Start of test; burner on.   |
| 04:11         | Bowing of panel skin in first 3 ft of deck.                             |
| 06:40         | No changes to panel bowing.   |
| 09:00         | No flaming on exposed face of panel. No changes.                        |
| 10:00         | Test terminated. No ignition of panel surface at any point. <b>PASS</b> |

**Flame-Spread Distance and Time.**

| Distance        | 1 ft | 2 ft | 3 ft | 4 ft | 5 ft | 6 ft | 7 ft | 8 ft |
|-----------------|------|------|------|------|------|------|------|------|
| Time<br>(min:s) | -    | -    | -    | -    | -    | -    | -    | -    |

**Class A Burning Brand Test  
August 26, 2010**

Test ID No.: BB 1 of 4  
Specimen ID: *AATIS/FR Panel*  
Ambient Air Temperature: 93.1 °F (33.9 °C)  
Deck EMC: N/A  
Brand Weight: 1929 g (4.25 lb)

| <b>TIME<br/>MIN:S</b> | <b>OBSERVATIONS</b>  |
|-----------------------|--|
| 00:00                 | Brand placed on deck.  |
| 00:40                 | Panel skin below brand bowing upward.  |
| 02:20                 | Front section of brand collapses, scattering embers in front of brand.                                 |
| 02:50                 | Flames from brand receding from back edge of deck.   |
| 05:40                 | Brand 50% consumed. Discoloration behind brand almost reaches back edge of deck.                       |
| 06:15                 | Visual inspection shows no apparent breach of metal skin.  |
| 07:40                 | Brand 75% consumed.  |
| 11:30                 | No changes to bowing in metal skin or discoloration behind brand.                                      |
| 16:11                 | Small embers remain from brand.  |
| 25:00                 | Flaming from brand and glowing embers completely extinguished. No visual changes to underside of deck. |
| 29:00                 | Test terminated. <b>PASS</b>   |

**Class A Burning Brand Test**  
**August 26, 2010**

Test ID No.: BB 2 of 4  
Specimen ID: *AATIS/FR Panel*  
Ambient Air Temperature: 91.6 °F (33.1 °C)  
Deck EMC: N/A  
Brand Weight: 1958 g (4.32 lb)

| <b>TIME<br/>MIN:S</b> | <b>OBSERVATIONS</b>   |
|-----------------------|---|
| 00:00                 | Brand placed on deck.   |
| 02:40                 | Front section of brand collapses, scattering embers in front of brand.                                      |
| 06:00                 | Flames reaching back edge of deck begin receding.   |
| 08:11                 | Brand 50% consumed.   |
| 12:40                 | Brand almost entirely consumed. Embers remain on top side of deck. No visible changes to underside of deck. |
| 19:30                 | No visible changes to underside of deck.  |
| 25:00                 | All embers on top side of deck extinguished. No changes to underside of deck.                               |
| 27:00                 | Test terminated. <b>PASS</b>  |

**Class A Burning Brand Test**  
**August 26, 2010**

Test ID No.: BB 3 of 4  
Specimen ID: *AATIS/FR Panel*  
Ambient Air Temperature: 93.3 °F (34.1 °C)  
Deck EMC: N/A  
Brand Weight: 1954 g (4.31 lb)

| <b>TIME<br/>MIN:S</b> | <b>OBSERVATIONS</b>  |
|-----------------------|--|
| 00:00                 | Brand placed on deck.  |
| 03:00                 | Bowing in deck under brand location.   |
| 03:38                 | Front part of brand collapses, scattering embers on front area of deck. Embers remain on deck. |
| 06:11                 | Flaming recedes from back edge of deck.  |
| 07:26                 | Brand 50% consumed. No changes to underside of deck.   |
| 13:00                 | Flaming from brand ceases. Embers remain on top surface of deck.                               |
| 18:45                 | No visible changes to underside of deck.   |
| 24:25                 | All embers on top surface of deck extinguished. No changes to underside of deck.               |
| 27:00                 | Test terminated. <b>PASS</b>   |

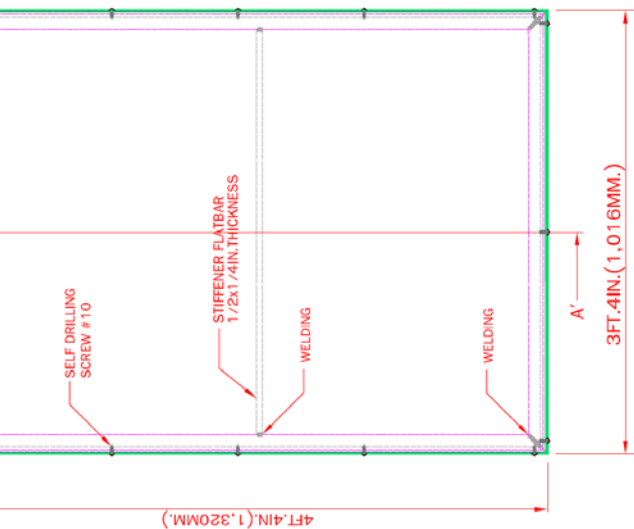
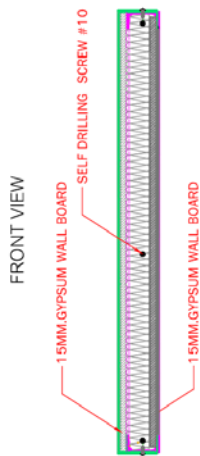
**Class A Burning Brand Test**  
**August 26, 2010**

Test ID No.: BB 4 of 4  
Specimen ID: *AATIS/FR Panel*  
Ambient Air Temperature: 91.2 °F (32.9 °C)  
Deck EMC: N/A  
Brand Weight: 1923 g (4.24 lb)

| <b>TIME<br/>MIN:S</b> | <b>OBSERVATIONS</b>   |
|-----------------------|---|
| 00:00                 | Brand placed on deck.   |
| 01:00                 | Bowing in deck under brand location.  |
| 02:45                 | Front part of brand collapses, scattering embers on front area of deck. Embers remain on deck.                  |
| 05:00                 | Flaming recedes from back edge of deck.   |
| 09:00                 | Brand 75% consumed. Small flames remain at brand location. No changes to underside of deck.                     |
| 13:11                 | Flaming out on top surface of deck. Same embers remain on top surface. No visible changes to underside of deck. |
| 21:20                 | Small ember remains on top surface of deck. No changes to underside of deck.                                    |
| 29:00                 | Test terminated. <b>PASS</b>  |

**APPENDIX D**  
**CLIENT-PROVIDED DRAWINGS**  
**(Consisting of 4 Pages)**

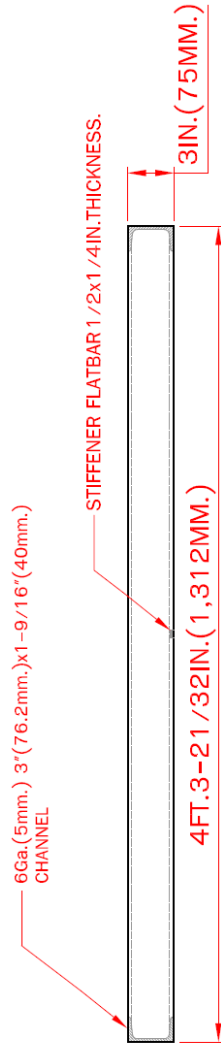
ROOF ASSEMBLING AATIS/FR PANEL INTO STEEL SUPPORT FRAME FOR ASTM E108



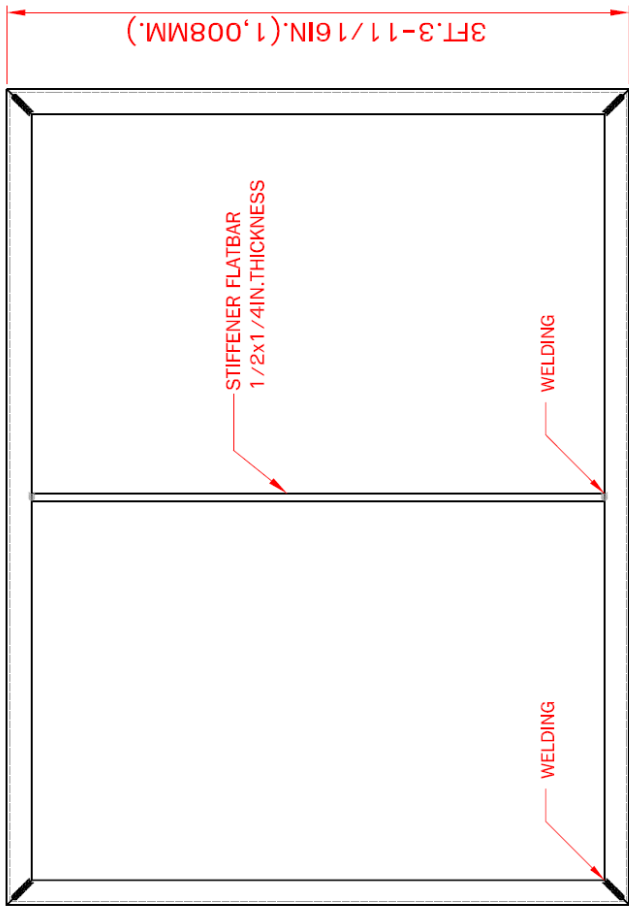


CHANNEL STEEL STUD SUPPORT FRAME FOR ROOF ASSEMBLING ASTM E108

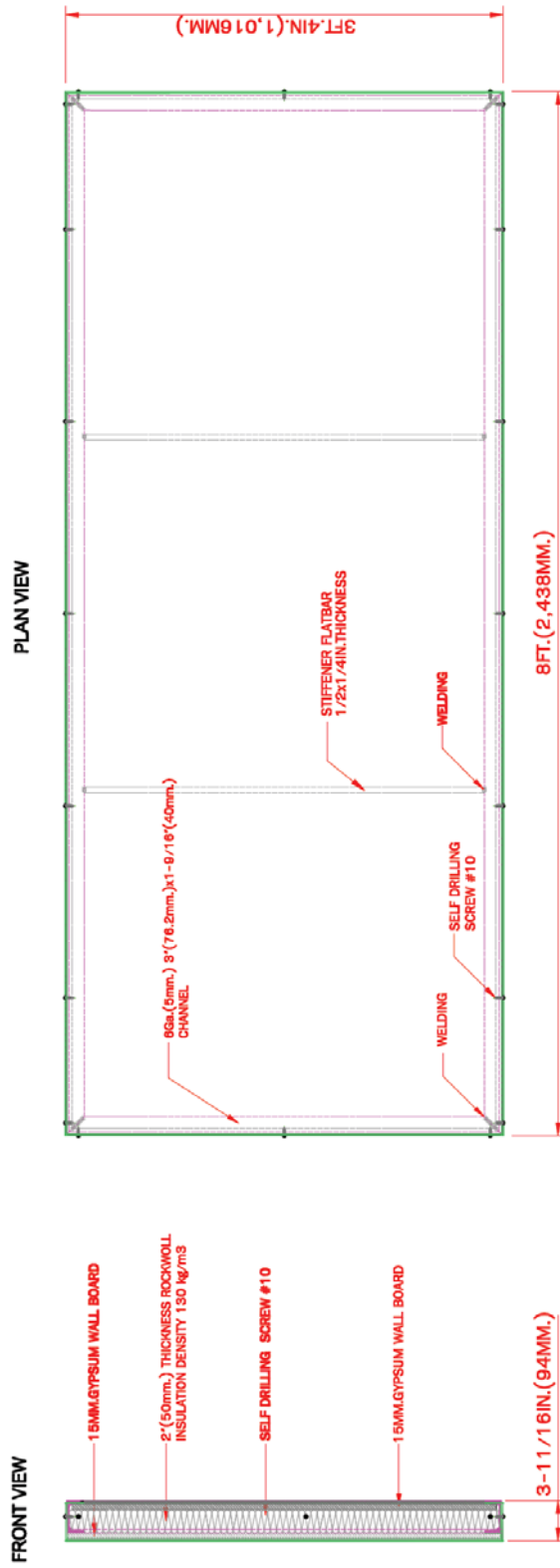
SIDE VIEW



PLAN VIEW

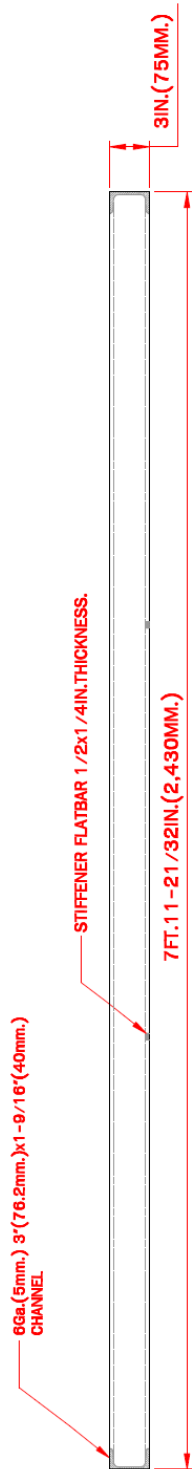


ROOF ASSEMBLING AATIS/FR PANEL INTO STEEL SUPPORT FRAME FOR ASTM E108



### CHANNEL STEEL STUD SUPPORT FRAME FOR ROOF ASSEMBLING ASTM E108

SIDE VIEW



PLAN VIEW

