

**PROJECT:                    ONTARIO INTERNATIONAL AIRPORT  
                                  ONTARIO, CA**

**DATE:                        MAY 9, 1997**

**Air infiltration test per ASTM E283-86**

**Static water penetration test per ASTM E331**

**Dynamic water penetration test per AAMA 501.1**

**Uniform structural load test at design load per ASTM 330**

**Seismic performance at design displacement**

**Seismic performance at 2 x design displacement**

**Uniform structural load test at 1.5 x design overload ASTM E330**



**SMITH-EMERY COMPANY**  
The Full Service Independent Testing Laboratory, Established 1904

781 East Washington Boulevard  
P.O. Box 880550, Hunter's Point Shipyard Bldg. 114  
5427 East La Palma Avenue

- Los Angeles, California 90021
- San Francisco, California 94188
- Anaheim, California 92807
- (213) 749-3411
- (415) 330-3000
- (714) 693-1026
- Fax: (213) 746-7228
- Fax: (415) 330-3030
- Fax: (714) 693-1034

HENSEL PHELPS CONSTRUCTION CO.

File No: 63819

Laboratory No: L-97-581

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MAY 12 1997

May 9, 1997

ONTARIO INTERNATIONAL AIRPORT PROJECT

CLIENT: Hensel Phelps Construction Co. So Cal District  
2415 Campus DR, Suite 100  
Irvine, CA 92715

HPCC Job # 49638

PROJECT: Ontario Airport Mockup A

**REPORT OF TESTS**

Date of Tests: May 9, 1997

Tests Performed by: Dana Nelson.

Description of Mock-up: See as-built drawings.

**PRELOAD (50% of design load)**

Develop a positive pressure on the mockup of 19.25 PSF. Maintain pressure for a period of 10 seconds, then release. (No deflection readings required.)

ACCEPTANCE CRITERIA: NONE

**AIR INFILTRATION TEST**

(Ref: ASTM E 283)

TEST PROCEDURE

Cover and seal the mockup completely with polyethylene sheeting while leaving the chamber uncovered. Develop a positive differential pressure of 6.24 PSF on the chamber. Record the air flow required to maintain this pressure. This number represents the air flow through the chamber. Remove the sheeting and reestablish the positive pressure of 6.24 PSF. Record the air flow required to maintain this pressure. This number is the air flow through the mockup and chamber. The difference between the two recorded air flows is the air flow through the mockup.

ACCEPTANCE CRITERIA:

0.06 CFM per square foot of exterior surface, exclusive of any operating window and door areas. Mockup area = (+) X = SF.

Fixed mockup area = 862 sq. Feet

Total allowable air loss for fixed area = 51.72 CFM

In	Position	Action
	PM	
	GS	
	PE	
	PS	
	OE-1	
	OE-2	
	OE-3	
	AS-1	
	AS-2	
	AS-3	
	COE	
	QCM	
	MEP	
Action		

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Mockup uncovered	38.7 CFM.
<u>Mockup covered</u>	<u>22.0 CFM.</u>
Total air loss through fixed area	16.7 CFM.
<b>Results</b>	<b>Passed</b>

*Roof area = 112.5 sq. Feet*

*Total allowable air loss for fixed area = 6.75 CFM*

Mockup roof area uncovered	52.5 CFM.
<u>Mockup roof area covered</u>	<u>9.5 CFM.</u>
Total air loss through roof area	43.0 CFM.
<b>Results</b>	<b>Failure</b>

**Note** Two additional air tests were performed on the roof area to try and isolate the exact area of the gross infiltration. After these attempts personal from DMJM and Hensel Phelps agreed to try and address this condition on Mockup B Skylight.

## WATER PENETRATION UNDER STATIC PRESSURE

(Ref. ASTM E 331)

### TEST PROCEDURE

Establish a positive test pressure of 15 PSF on the mockup. Apply water to the exterior of the mockup at a rate of 5 gallons per hour per square foot for a period of fifteen minutes while maintaining the differential pressure of 15 PSF. During this period, visually inspect the interior of the mockup for water penetration.

### ACCEPTANCE CRITERIA:

*There shall be no unacceptable water leakage, defined as follows:*

*The occurrence of condensation during water infiltration tests is acceptable. Other water leakage is acceptable only if all of the following conditions are satisfied: (a) the water is contained and drained to the exterior; (b) there would be no staining or other damage to any part of the completed building or its furnishings (c) water leakage is defined as any uncontrolled water that appears on any normally exposed interior surfaces.*

Observations Water was observed penetrating around the top pipe section that penetrated through the wall assemble. Remedial repairs were made in this area.

**Results**      **Passed**

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## WATER PENETRATION UNDER DYNAMIC PRESSURE

(Ref.: AAMA 501.1)

### TEST PROCEDURE

Apply an air stream equivalent to a static differential air pressure of 15 PSF to the mockup. Apply water to the mockup at a rate of five gallons per hour per square foot for a period of fifteen minutes. During this period visually inspect the interior of the mockup for water penetration.

### ACCEPTANCE CRITERIA:

*There shall be no unacceptable water leakage, defined as follows:  
The occurrence of condensation during water infiltration tests is acceptable. Other water leakage is acceptable only if all of the following conditions are satisfied: (a) the water is contained and drained to the exterior; (b) there would be no staining or other damage to any part of the completed building or its furnishings (c) water leakage is defined as any uncontrolled water that appears on any normally exposed interior surfaces.*

Observations Water was observed penetrating around the top pipe section that penetrated through the wall assemble. Remedial repairs were made in this area.

**Results      Passed**

## STRUCTURAL TEST AT 50% & 100% OF INWARD DESIGN PRESSURE

(Ref. ASTM E 330) (Ref section 01430 jobsite specifications)

### TEST PROCEDURE

Apply positive pressure to the mockup of 19.25 PSF and hold for sixty seconds. Release the pressure difference across the mockup. After a recovery period of not less than 1 minute nor more than 5 minutes at zero load, record initial readings. Increase positive pressure to 38.5 PSF and hold for 10 seconds. Record deflection readings. Reduce pressure to zero. After a recovery period of not less than 1 minute nor more than 5 minutes at zero load, record zero load readings to determine permanent deformation.

### ACCEPTANCE CRITERIA:

*Net deflection of framing members shall not exceed 1/200 times span, Span is defined as the distance between anchor centerlines. Where a sealant joint occurs between a framing member and a relatively stiff building element, framing member deflection shall not exceed 1/2 of the nominal joint width, or less if required by sealant manufacturer. Where a framing member runs continuously past a deflecting support, the support deflection shall be added to the member deflections.*

**Results      Passed**

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## STRUCTURAL TEST AT 50% & 100% OF OUTWARD DESIGN PRESSURE (Ref. ASTM E 330) (Ref section 01430 jobsite specifications)

### TEST PROCEDURE

Apply negative pressure to the mockup of 19.25 PSF and hold for sixty seconds. Release the pressure difference across the mockup. After a recovery period of not less than 1 minute nor more than 5 minutes at zero load, record initial readings. Increase negative pressure to 38.5 PSF and hold for 10 seconds. Record deflection readings. Reduce pressure to zero. After a recovery period of not less than 1 minute nor more than 5 minutes at zero load, record zero load readings to determine permanent deformation.

### ACCEPTANCE CRITERIA:

*Net deflection of framing members shall not exceed 1/200 times span, Span is defined as the distance between anchor centerlines. Where a sealant joint occurs between a framing member and a relatively stiff building element, framing member deflection shall not exceed 1/2 of the nominal joint width, or less if required by sealant manufacturer. Where a framing member runs continuously past a deflecting support, the support deflection shall be added to the member deflections*

**Results**      **Passed**

## INTERSTORY DIFFERENTIAL MOVEMENT SEISMIC RACKING AT DESIGN MOVEMENT. (Ref section 01430 jobsite specifications)

### TEST PROCEDURE

Vertical and horizontal ( lateral drift ) Seismic test displacement of 1/2 percent of story height in inches in each direction. Using a hydraulic jack the floor framing will be displaced relative to the roof level framing by    inch (0 x inter-story height) in each direction, (left and right, up and down three cycles in each direction. A plumb bob will be used to measure this displacement.

*Vertical displacement = 3/4"*

*Horizontal displacement = 1/2"*

*Test specimen to be left in maximum open condition at conclusion of test for continuation of testing.*

### ACCEPTANCE CRITERIA:

*There shall be no failure or gross permanent distortion of anchors, frames or glass*

**Results**      **Passed**

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## AIR INFILTRATION TEST

(Ref: ASTM E 283)

### TEST PROCEDURE

Cover and seal the mockup completely with polyethylene sheeting while leaving the chamber uncovered. Develop a positive differential pressure of 6.24 PSF on the chamber. Record the air flow required to maintain this pressure. This number represents the air flow through the chamber. Remove the sheeting and reestablish the positive pressure of 6.24 PSF. Record the air flow required to maintain this pressure. This number is the air flow through the mockup and chamber. The difference between the two recorded air flows is the air flow through the mockup.

### ACCEPTANCE CRITERIA:

*0.06 CFM per square foot of exterior surface, exclusive of any operating window and door areas. Mockup area = ( + ) X = SF.*

*Fixed mockup area = 862 sq. Feet*

*Total air loss for fixed area = 8 CFM water trapped in the system.*

**Results      Passed**

## WATER PENETRATION UNDER STATIC PRESSURE

(Ref. ASTM E 331)

### TEST PROCEDURE

Apply an air stream equivalent to a static differential air pressure of 15 PSF to the mockup. Apply water to the mockup at a rate of five gallons per hour per square foot for a period of fifteen minutes. During this period visually inspect the interior of the mockup for water penetration.

### ACCEPTANCE CRITERIA:

*There shall be no unacceptable water leakage, defined as follows:*

*The occurrence of condensation during water infiltration tests is acceptable. Other water leakage is acceptable only if all of the following conditions are satisfied: (a) the water is contained and drained to the exterior; (b) there would be no staining or other damage to any part of the completed building or its furnishings (c) water leakage is defined as any uncontrolled water that appears on any normally exposed interior surfaces.*

Observations Water was observed penetrating at the sloped glazing intersection to the panel assemble on the return. Remedial repairs were made in this suspect area and an additional water test was performed to verify the repair.

**Results      Passed**

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## WATER PENETRATION UNDER DYNAMIC PRESSURE

(Ref.: AAMA 501.1)

### TEST PROCEDURE

Apply an air stream equivalent to a static differential air pressure of 15 PSF to the mockup. Apply water to the mockup at a rate of five gallons per hour per square foot for a period of fifteen minutes. During this period visually inspect the interior of the mockup for water penetration.

### ACCEPTANCE CRITERIA:

*There shall be no unacceptable water leakage, defined as follows:*

*The occurrence of condensation during water infiltration tests is acceptable. Other water leakage is acceptable only if all of the following conditions are satisfied: (a) the water is contained and drained to the exterior; (b) there would be no staining or other damage to any part of the completed building or its furnishings (c) water leakage is defined as any uncontrolled water that appears on any normally exposed interior surfaces..*

**Results      Passed**

## THERMAL CYCLE

(Ref section 01430 jobsite specifications)

Six complete cycles through 150 degree metal temperature change. Maintain test conditions at each extreme for two hours after equilibrium has been reached. After conclusion of last hot cycle and before wall cools down , apply a negative design load 38.5 PSF for 1 minute and inspect for loss of silicone bond. Maintain load during inspection as determined by test laboratory, but not less than 20 PSF. Maintain 20 degrees for a period of two hours and than maintain 160 degrees for a period of two hours repeat this six times.

Observations After the completion of the thermal cycles a visual inspection was performed in this area for any detrimental affects No visible damage was observed.

**Results      Passed**

## AIR INFILTRATION TEST

(Ref: ASTM E 283)

### TEST PROCEDURE

Cover and seal the mockup completely with polyethylene sheeting while leaving the chamber uncovered. Develop a positive differential pressure of 6.24 PSF on the chamber. Record the air flow required to maintain this pressure. This number represents the air flow through the chamber. Remove the sheeting and reestablish the positive pressure of 6.24 PSF. Record the air flow required to maintain this pressure. This number is the air flow through the mockup and chamber. The difference between the two recorded air flows is the air flow through the mockup.

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## ACCEPTANCE CRITERIA:

*0.06 CFM per square foot of exterior surface, exclusive of any operating window and door areas. Mockup area = ( + ) X = SF.*

*Fixed mockup area = 862 sq. Feet*

*Total air loss for fixed area = 26 CFM.*

**Results        Passed**

## **WATER PENETRATION UNDER STATIC PRESSURE**

### TEST PROCEDURE

Apply an air stream equivalent to a static differential air pressure of 15 PSF to the mockup.

Apply water to the mockup at a rate of five gallons per hour per square foot for a period of fifteen minutes. During this period visually inspect the interior of the mockup for water penetration.

Observations Water penetration appeared in two locations. (1) At the top pipe section that penetrated through the wall assemble. (2) At the horizontal caulking joint between the extruded aluminum panels. Three additional water penetrations tests were performed in order to find exact location of penetrations.

Note: It was determined by personal from DMJM and Hensel Phelps that modifications were to be made in these areas prior to erection at the site.

## ACCEPTANCE CRITERIA:

*There shall be no unacceptable water leakage, defined as follows:*

*The occurrence of condensation during water infiltration tests is acceptable. Other water leakage is acceptable only if all of the following conditions are satisfied: (a) the water is contained and drained to the exterior; (b) there would be no staining or other damage to any part of the completed building or its furnishings (c) water leakage is defined as any uncontrolled water that appears on any normally exposed interior surfaces.*

**Results        Passed**

## **WATER PENETRATION UNDER DYNAMIC PRESSURE**

**(Ref.: AAMA 501.1)**

### TEST PROCEDURE

Apply an air stream equivalent to a static differential air pressure of 15 PSF to the mockup.

Apply water to the mockup at a rate of five gallons per hour per square foot for a period of fifteen minutes. During this period visually inspect the interior of the mockup for water penetration.

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## ACCEPTANCE CRITERIA:

*There shall be no unacceptable water leakage, defined as follows:*

*The occurrence of condensation during water infiltration tests is acceptable. Other water leakage is acceptable only if all of the following conditions are satisfied: (a) the water is contained and drained to the exterior; (b) there would be no staining or other damage to any part of the completed building or its furnishings (c) water leakage is defined as any uncontrolled water that appears on any normally exposed interior surfaces.*

**Results      Passed**

## **STRUCTURAL TEST AT 75% & 150% OF INWARD DESIGN PRESSURE (Ref. ASTM E 330)**

### TEST PROCEDURE

Apply positive pressure to the mockup of 28.8 PSF and hold for sixty seconds. Release the pressure difference across the mockup. After a recovery period of not less than 1 minute nor more than 5 minutes at zero load, record initial readings. Increase positive pressure to 57.75 PSF and hold for 10 seconds. Record deflection readings. Reduce pressure to zero. After a recovery period of not less than 1 minute nor more than 5 minutes at zero load, record zero load readings to determine permanent deformation.

### ACCEPTANCE CRITERIA:

- 1. Net permanent deflection of framing member shall not exceed 1/1000 ? times span.*
- 2. There shall be no glass breakage, permanent damage to framing members, fasteners or anchors, or permanent deformation of framing members.*

**Results      Passed**

## **STRUCTURAL TEST AT 75% & 150% OF OUTWARD DESIGN PRESSURE (Ref. ASTM E 330)**

### TEST PROCEDURE

Apply negative pressure to the mockup of 28.8 PSF and hold for sixty seconds. Release the pressure difference across the mockup. After a recovery period of not less than 1 minute nor more than 5 minutes at zero load, record initial readings. Increase negative pressure to 57.75 PSF and hold for 10 seconds. Record deflection readings. Reduce pressure to zero. After a recovery period of not less than 1 minute nor more than 5 minutes at zero load, record zero load readings to determine permanent deformation.

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ACCEPTANCE CRITERIA:

1. Net permanent deflection of framing member shall not exceed 1/1000 ? times span.
2. There shall be no glass breakage, permanent damage to framing members, fasteners or anchors, or permanent deformation of framing members.

**Results      Passed**

**FOR INFORMATION ONLY**

**INTERSTORY DIFFERENTIAL MOVEMENT SEISMIC RACKING SEISMIC RACKING.**

TEST PROCEDURE

Vertical and horizontal Seismic test displacement at maximum capacity of chamber seismic racking, (left and right, up and down three cycles in each direction. A plumb bob will be used to measure this displacement.

*The mockup was displaced at the upper horizontal seismic level 3.5 inches.*

*The mockup was displaced at the vertical column in the up direction 6 inches.*

ACCEPTANCE CRITERIA:

*There shall be no failure or gross permanent distortion of anchors, frames or glass. Glazing gaskets may disengage. Weather seals may fail.*

**WATER PENETRATION UNDER STATIC PRESSURE**

TEST PROCEDURE

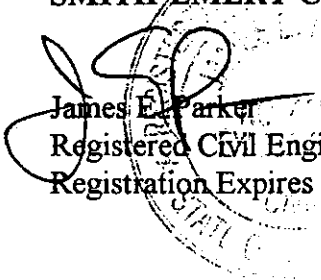
Remove section of primary water seals (caulking, seals ect) apply an air stream equivalent to a static differential air pressure of 15 PSF to the mockup. Apply water to the mockup at a rate of five gallons per hour per square foot for a period of fifteen minutes. During this period visually inspect the interior of the mockup for water penetration.

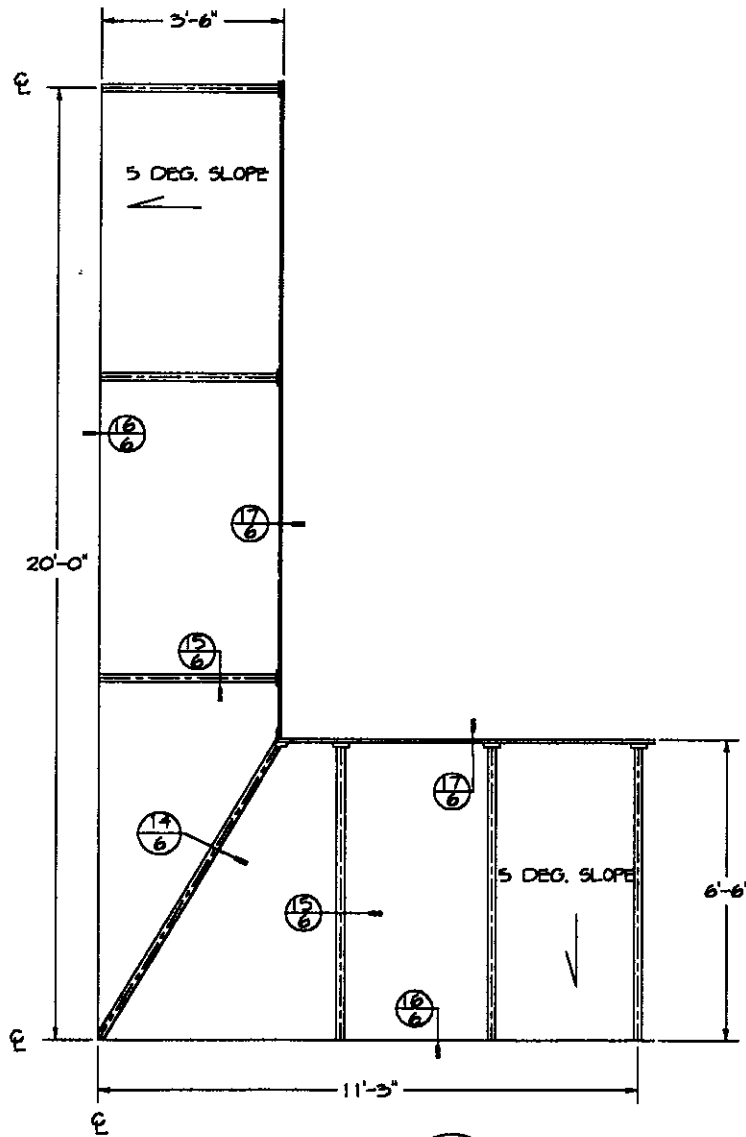
Observation Water appeared in only one area where the primary seals were removed at the second level of the system between panel joints.

ACCEPTANCE CRITERIA: None

Respectfully submitted,  
**SMITH-EMERY COMPANY**

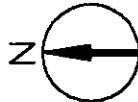
James E. Parker  
Registered Civil Engineer #41507  
Registration Expires 12/31/99





PANELS PLAN

SCALE: 1/2" = 1'-0"



(MOCK-UP A)



1715 West 135th Street  
 Gardena, CA 90249  
 FAX: 213/327-5952  
 Phone: 213/770-0639

# DETAILS

JOB NAME:

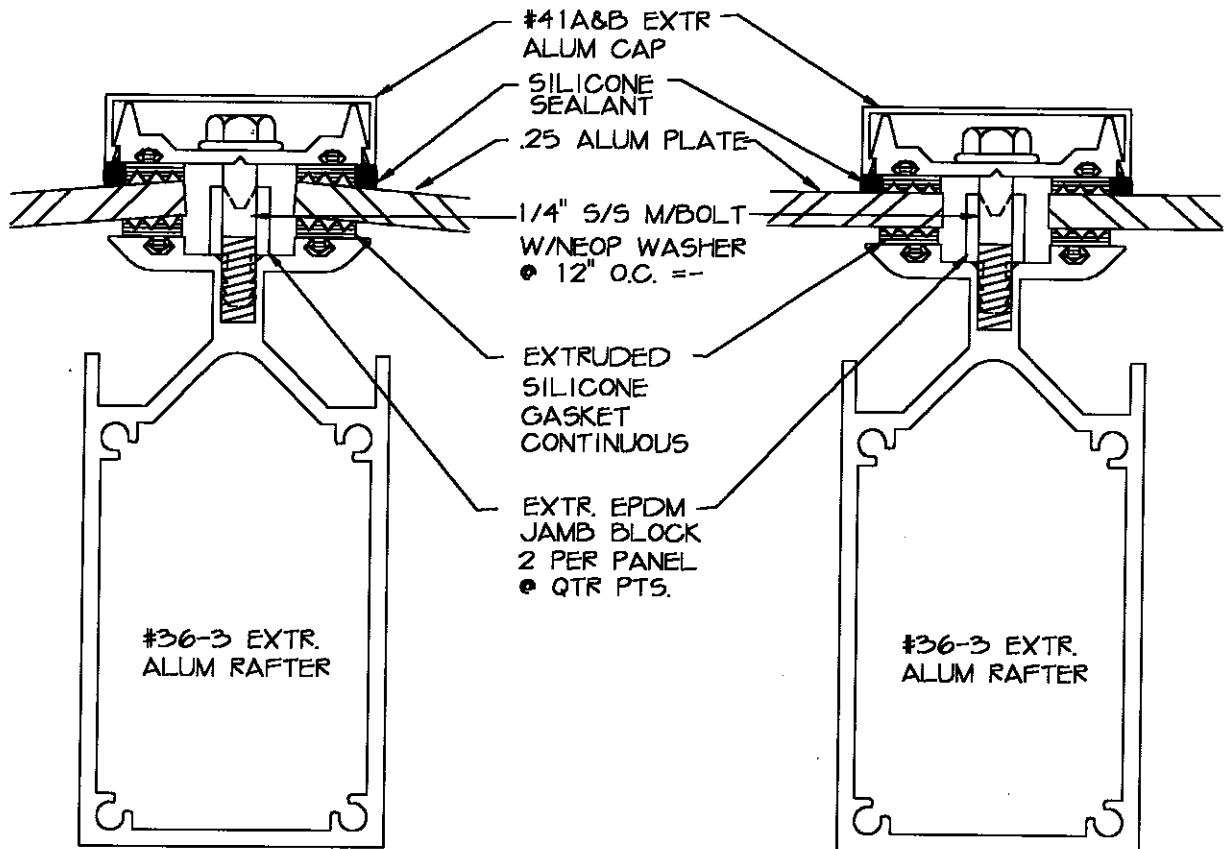
MOCK-UP A  
 ONTARIO INTERNATIONAL  
 AIRPORT

JOB NO:

96819

DATE:

SHEET NO:



HIP RAFTER DETAIL

14

SCALE: FULL

RAFTER DETAIL

15

SCALE: FULL



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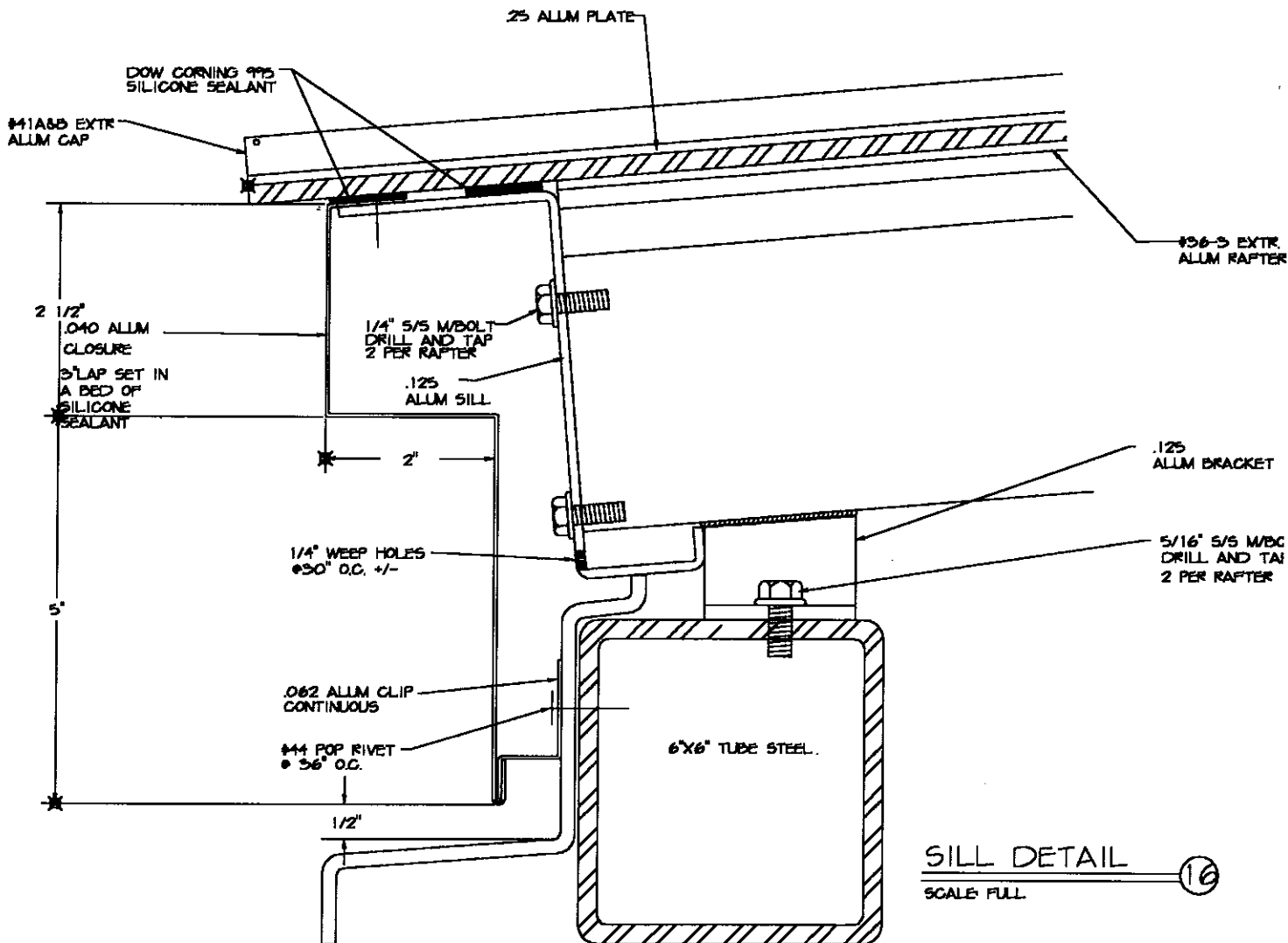
**DETAILS**

JOB NAME: *MOCK-UP A  
 ONTARIO INTERNATIONAL  
 AIRPORT*

JOB NO: *90819*

DATE:

SHEET NO:



1715 West 135th Street  
 Gardena, CA 90249  
 FAX: 213/327-5952  
 Phone: 213/770-0639

# DETAILS

JOB NAME: *MOCK -UP: A*  
*ONTARIO INTERNATIONAL*  
*AIRPORT*

JOB NO: *90819*

DATE:

SHEET NO: