# Test Report

Intertek Testing Services
ETL SEMKO

ITS Intertek Testing Services
ETL SEMKO

REPORT OF

PERFORMANCE TESTS ON AN ALUMINUM WINDOW

CONDUCTED ON A

3715 mm (147") WIDE X 2000 mm (79-3/4") HIGH
MULTI LITE FIXED WINDOW WALL
2200 SERIES

FOR

UNITED STATES ALUMINUM CORPERATION – TEXAS
COMMERCIAL PRODUCTS GROUP
200 SINGLETON DRIVE
WAXAHACHIE, TEXAS
USA 75165-5094

REPORT PREPARED BY

INTERTEK TESTING SERVICES NA LTD.
WARNOCK HERSEY
211 SCHOOLHOUSE STREET
COQUITLAM, BC
CANADA V3K 4X9

REPORT NUMBER: 481-1840

DATE: APRIL 26, 2001

REVISED: MAY 7, 2001

TABLE OF CONTENTS

## INTRODUCTION

***Revised: May 7, 2001***

Intertek Testing Services N.A. Ltd. has conducted performance tests on a Aluminum Multi Lite Window Wall System. Testing was conducted on April 23 and 24, 2001 at United States Aluminum Corporation – Texas's testing laboratory in Waxahachie Texas. The testing was witnessed by Greg A. Hall and Terry Hopgood representing United States Aluminum Corporation – Texas. All tests were performed in general accordance with the CSA-A440-98 test standard "Windows".

## PRODUCT DESCRIPTION

Designation: 2200 Series

Type (general): Aluminum Multi Lite Window Wall System. The test sample consisted of three panels installed side by side to form two vertical full height split mullions. Each panel had two fixed lites each.

Frame: The aluminum framing system was made up of a three panel system consisting of two fixed lites each. In each panel the head and sill corners were butt jointed and secured using three screws (#10 x 1" HWH SMS). The intermediate horizontal mullion was butt jointed and secured using four screws (#10 x 1" HWH SMS). Nylon end dams (Peterson Mold HD475) were then caulked (Dow Corning 795) on all faces and inserted into all the panel joints to compartmentalize the glazing cavities. The screw splines were sealed to the end dams.

The assembled panels were then snapped together via the split mullions. Vertical end caps (CP100) were caulked (Dow Corning 795) to the top and bottom of each vertical mullion. The system was secured to the test chamber at the head and sill using 3/8" x 3-1/2" stainless steel lag bolts at 75 mm (3") from the corners and at a 500 mm (20") spacing on each panel. The test sample was sealed (Dow Corning 795) to the rough opening using a caulk and rod joint.

Overall Size: 3715 mm (146-1/4") wide x 2000 mm (78-3/4") high.

Panel Size: 1219 mm (48") wide x 2000 mm (78-3/4") high.

Drainage: The glazing cavities were drained using five consecutive 4.7 mm (0.187") diameter weep holes located at 63 mm (2-1/2") from the end of each horizontal pressure plate. Each horizontal pressure plate cap had one 8 mm (0.320") diameter weep hole at mid span to drain water to the exterior.

Glazing Thickness: The glazing units consisted of two 6 mm (1/4") glass panels separated by a 12.7 mm extruded aluminum spacer bar sealed with a hot melt butyl backer.

Glazing Method: The glazing units were exterior dry glazed. They were set on to two 32 mm wide x 100 mm long x 3 mm thick (1-1/4" x 4"x 1/8") glazing blocks located on the sill quarter points of the glass. The jambs had one 32 mm wide x 100 mm long x 3 mm thick (1-1/4" x 4"x 1/8") side blocks located at mid height of the glazing unit. The interior glazing gasket was a soft EPDM vinyl jacketed foam filled type (Tremco NP 420) while the exterior glazing gasket was a dense EPDM type (Tremco NP 420). The gaskets were horizontally butt jointed and caulked (Dow Corning 795) to the frame 51 mm (2") from all corners to both the alumimum and the glass. The horizontal pressure plates were caulked at the ends to the vertical pressure plates. The pressure plates were secured to the mullions using pressure bar bolts (MS 222 at a 55 inch pounds torque) at 34 mm (1-1/2") from the ends and a 230 mm (9") spacing.

Drawings: A full set of drawings stamped "WH" are included in the Appendix II of this report.

## TEST RESULTS

*Revised: May 7, 2001*

### 1. Air Tightness Test

Air Tightness Tests were performed in accordance with ASTM E283-91 "*Standard Test Method for Determining the Rate of Air Leakage through Exterior Windows, Curtain Wall, and Doors under Specified Pressure Differences across the Specimen.*"

A Meriam Instruments Laminar Flow Element (model # 50MC2-2, Serial No. 761930-K1), a Meriam Instruments 0 - 10" calibrated inclined manometer (model # 40HEX35WM, s/n 761930) and a Meriam Instruments 0-4" manometer (model # 40HEX35WM, s/n 175913) were used to measure the volume of air infiltration through the window.

**Air Infiltration**

An air infiltration test was performed using a test pressure of 75 Pa (1.57 psf).

Based on a corrected infiltration rate of 0.70 $m^3/h$ and a crack length of 11.42 m, the air infiltration rate was calculated to be 0.06 $m^3/h$-m. The maximum specified air infiltration rate is 0.25 $m^3/h$-m for a **Fixed** rating.

Based on a corrected infiltration rate of 0.41cfm and an area of 81.38 $ft^2$, the air infiltration rate was calculated to be 0.01 cfm/ $ft^2$.

**Air Exfiltration**

An air exfiltration test was performed using a test pressure of 75 Pa (1.57 psf).

Based on a corrected exfiltration rate of 0.23 $m^3/h$ and a crack length of 11.42 m, the air exfiltration rate was calculated to be 0.02 $m^3/h$-m. The maximum specified air exfiltration rate is 0.25 $m^3/h$-m for a **Fixed** rating.

Based on a corrected infiltration rate of 0.13 cfm and an area of 81.38 $ft^2$, the air infiltration rate was calculated to be 0.002 cfm/ $ft^2$.

**Air Infiltration**

An air infiltration test was performed using a test pressure of 300 Pa (6.24 psf).

Based on a corrected infiltration rate of 0.91 $m^3/h$ and a crack length of 11.42 m, the air infiltration rate was calculated to be 0.08 $m^3/h$-m.

Based on a corrected infiltration rate of 0.54 cfm and an area of 81.38 $ft^2$, the air infiltration rate was calculated to be 0.01 cfm/ $ft^2$.

*Revised: May 7, 2001*

**Table 1**

**AIR TIGHTNESS**

| Window rating | Maximum Air Tightness Rate $(m^3/h)m^{-1}$ |
|---|---|
| Storm | 8.35 (max) |
| | 5.00 (min) |
| A1 | 2.79 |
| A2 | 1.65 |
| A3 | 0.55 |
| Fixed | 0.25 |

## 2. Water Tightness Test

A water resistance test was performed on the sample in accordance with ASTM E547-96 "*Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Cyclic Static Air Pressure Differential.*"

A Meriam Instrument 0 – 10" inclined manometer model # 40HEX35WM was used to measure the pressures. A calibrated water spray assembly was used to deliver the water on the test sample.

The test was performed using a pressure differential of 700 Pa (14.6 psf) and a water spray rate of at least 204 $L/m^2$ per hour (5 US gph). The period consisted of four cycles of five minutes with the pressure applied and one minute with the pressure released.

During the 24 minute test period, no water leakage was observed. The window unit met a level **B-7** rating.

An additional water resistance test was performed on the sample in accordance with ASTM E331-00 "*Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors and Curtain Walls by Uniform Static Air Pressure Differential.*"

The test was performed using a pressure differential of 700 Pa (14.6 psf) and a water spray rate of at least 204 $L/m^2$ per hour (5 US gph). The period consisted of fifteen minutes with the pressure applied.

During the 15 minute test period, no water leakage was observed.

*Revised: May 7, 2001*

Table 2

WATER TIGHTNESS

| Window Rating For Use in Small Buildings | Window Rating For Use in Other Building | Test Pressure Differential (Pa) |
|---|---|---|
| Storm | -- | 0 |
| B1 | B1 | 150 |
| B2 | B2 | 200 |
| B3 | B3 | 250 (300Pa for M98) |
| -- | B4 | 400 |
| -- | B5 | 500 |
| -- | B6 | 600 |
| -- | B7 | 700 |

3. **Wind Load Resistance**

A uniform load test was conducted in accordance with ASTM E-330-97e1 *"Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference."*

Air blowers were used to developed the test pressures. A Meriam Instruments 0-30" manometer (model # 10AA25WM s/n UST 15002) was used to measure pressure and three CDI 0-1" dial indicators (model # 36510C-SB s/n USDI1, USDI2 and USDI3) were used to measure deflections.

The Deflection Test was performed using positive and negative test pressures of 3330 Pa (69.3 psf).

The maximum deflection measured at mid span of the vertical mullions was measure to be 8.64 mm (0.340"). The maximum allowable deflection (L/175) was 11.43 mm (0.45").

The window unit was subjected to a Blow-out test using positive and negative pressures of 5000 Pa (104 psf).

The maximum residual deflection was measured to be 0.89 mm (0.035"). The maximum allowable residual deflection (0.2% of span) was 4.0 mm (0.157").

There was no breakage or permanent deformation which would impair the operation of the window.

The window unit met a level **C-5** Wind Load Rating.

*Revised: May 7, 2001*

Table 3

**WIND LOAD RESISTANCE**

| Window rating | | Test pressure, Pa | |
|---|---|---|---|
| For Use in Small Buildings | For Use in Other Building | Sash Deflection (L/125) | Blowout |
| Storm | -- | -- | 750 |
| C1 | C1 | 500 | 1500 |
| C2 | C2 | 750 | 2000 |
| C3 | C3 | 1200 | 3000 |
| -- | C4 | 1600 | 4000 |
| -- | C5 | 2000 | 5000 |

## TESTING HISTORY

See Appendix I

## CONCLUSIONS

The window unit described herein met the Fixed Air Infiltration, Fixed Air Exfiltration, B-7 Water Tightness, and C-5 Wind Load Resistance requirements of CSA A440-98.

**INTERTEK TESTING SERVICES NA LTD.**
**Warnock Hersey**

Tested by:
Heiko Neugebauer
Technologist, Building Materials

Reviewed by:
Sheldon Warman, P.Eng.
Manager, Building Materials

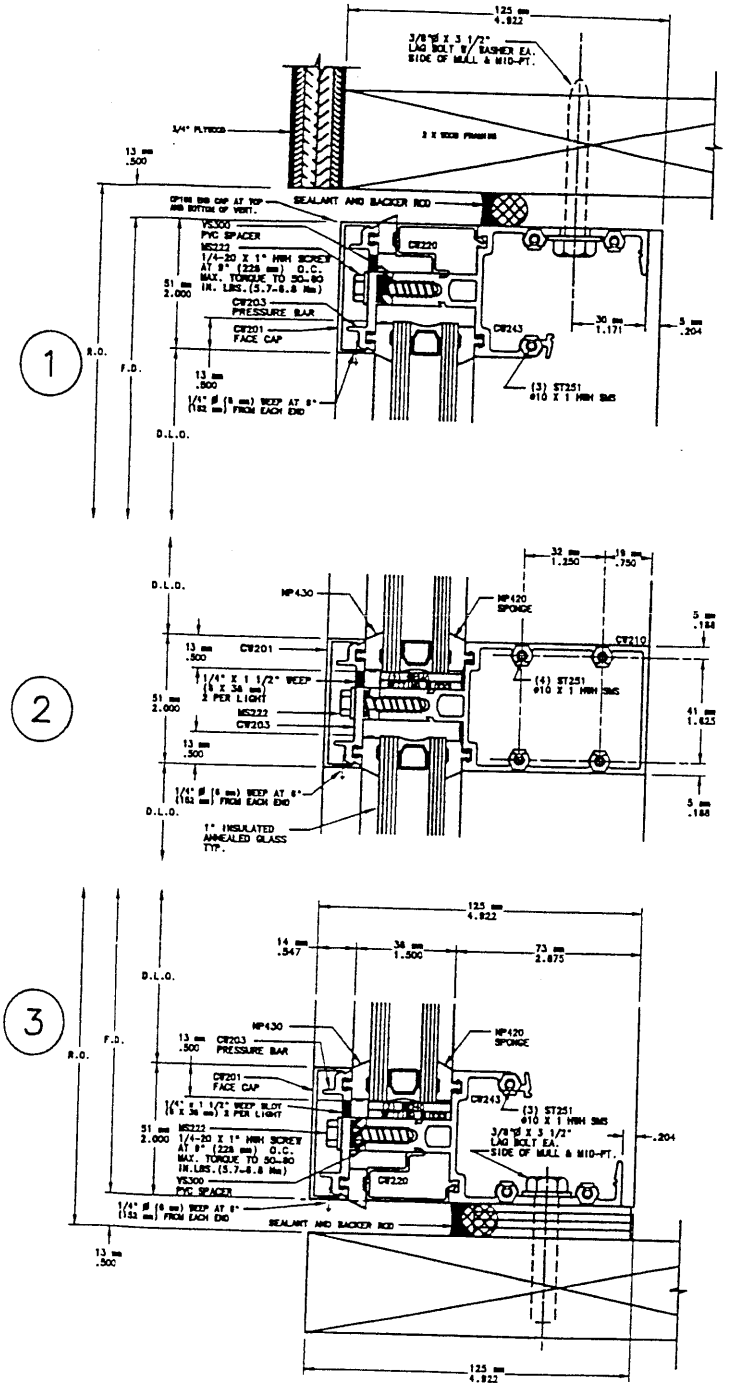
HN/cr

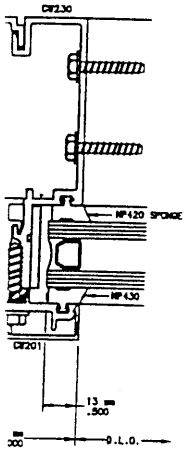
C:\ITS-DATA\480 reports\United States Aluminum\481-1840 US Aluminum 2200 Series1 Rev.doc

## APPENDIX I

**Testing History**

| Date | Test | Event | Modification |
|---|---|---|---|
| 01/04/24 | Water Tightness | Water leakage was observed at the corner of the lower left (viewed from interior) butt joint. | The exterior pressure plate, cap, and perimeter filler were removed to reveal a pin hole in the perimeter caulking under the vertical mullion. More caulking was applied and let cure.<br>The test was repeated. During the 24 minute test period and an additional 15 minute test period, no water leakage was observed. |




## BILL OF MATERIAL

| MFR. | PART # | DESCRIPTION | QTY. | LENGTH |
|---|---|---|---|---|
| | | EXTRUSIONS | | |
| USAC | CW213 | [illegible] | 2 | 78 3/4" |
| USAC | CW230 | VERT. MULL MALE | 2 | 78 3/4" |
| USAC | CW238 | VERT. MULL FEMALE | 2 | 78 3/4" |
| USAC | CW243 | REAR/MULL | 6 | 44" |
| USAC | CW210 | INTERNAL HORIZ. | 3 | 44" |
| USAC | CW220 | PERIMETER FILLER VERT. | 2 | 78 3/4" |
| USAC | CW230 | PERIMETER FILLER HORIZ. | 8 | 45 3/4" |
| USAC | CW201 | FACE CAP VERT. | 4 | 78 3/4" |
| USAC | CW201 | FACE CAP HORIZ. | 8 | 45 15/16" |
| USAC | CW203 | PRESSURE BAR VERT. | 4 | 78 1/2" |
| USAC | CW203 | PRESSURE BAR HORIZ. | 8 | 45 3/4" |
| | | ACCESSORIES | | |
| TREMCO | BE240 | SETTING BLOCKS | 24 | — |
| TREMCO | BE240 | SIDE BLOCKS | 12 | — |
| [illegible] | MS222 | 1/4"-20 X 1" MIN SC | 84 | — |
| [illegible] | ST242 | #10 X 1/2" PH SMS | 12 | — |
| [illegible] | ST251 | #10 X 1" MIN SMS | 24 | — |
| PETERSEN ALUM | HD475 | STYLIZE END DAM | 18 | — |
| MEAC-CA | CP100 | VERT. END CAP | 6 | — |
| TREMCO | MP430 | EXTERIOR GASKET | 80' | — |
| TREMCO | MP420 | INTERIOR GASKET | 80' | — |
| | | 3/8"Ø X 3 1/2" LAG | 18 | — |
| | | 3/8 FLAT WASHER | 18 | — |

## TEST REQUIREMENTS

ALLOWABLE AIR INFILTRATION:
(ASTM E283-91)
0.045 CFM/ft CL = 1.57 psf
(0.25 m³/hr/m CL = 75 Pa)
.06 CFM/SQ.FT. = 6.24 PSF
(0.33 m³/hr/m CL = 300 Pa)

EQUIVALENT TO CSA A440-98 "FIXED"

ALLOWABLE WATER INFILTRATION:
(ASTM E331-93)
NO UNCONTROLLED WATER = 14.62 psf (700 Pa)

EQUIVALENT TO CSA A440-98 "R7"

STRUCTURAL PERFORMANCE:
(ASTM E330-96)
DESIGN = 69.7 psf (3330 Pa)
BLOW-OUT = 104.5 psf (5000 Pa)
MAXIMUM DEFLECTION = L/175

EQUIVALENT TO CSA A440-98 "C5"

| | |
|---|---|
| AREA OF SPECIMEN: | 81.4 ft² (7.56 m²) |
| TOTAL CRACK LENGTH: | 82.3ft (25.1 m) |
| INFILLS: | 25 mm (1") ANNEALED I.G.U. |
| FINISH: | PAINTED |
| STRUCTURAL SILICONE: | — |
| PERIMETER SEAL: | DOW 795 |
| SYSTEM SEAL: | DOW 795 |

NOTES:

1. TEST COMPLETED 4/24/2001 AT U.S. ALUMINUM/TX
2. 1/2" GLASS BITE (TYP.)

UNITED STATES ALUMINUM CORPORATION

CUSTOMER

ARCHITECT

PROJECT
A-440 MOCK-UP
2200 FIXED

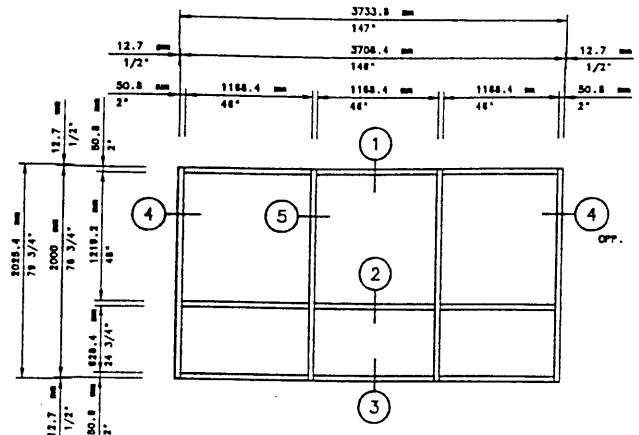
DRAWN BY
DWJ

DATE
4/12/01

DRAWING NO.
M2001-09
PRELIM

SHEET
1
2

10 OF 11



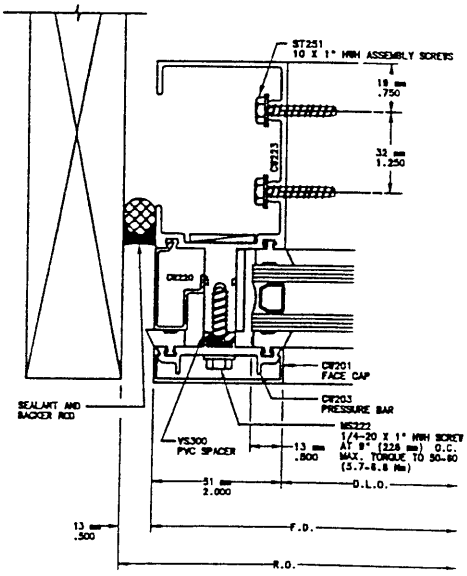

**ELEVATION**

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

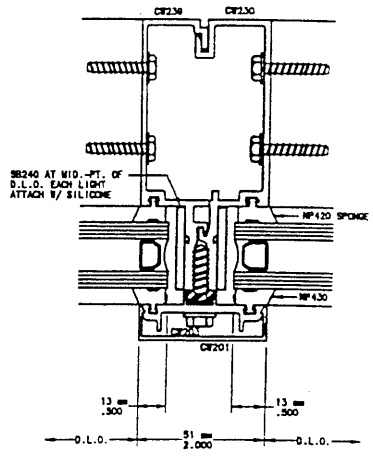
DWG No. 10

MAY 7 2001

APP BY




4




5

[redacted]