SPARRELL ENGINEERING RESEARCH CORPORATION
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April 4, 1988

ASTRO VALCOUR INC.
11756 S. Austin Avenue
Alsip, IL 60482

Attention: Mr. Mark J. Mayronne

Reference: Purchase Order No. 23974

Gentlemen:

In accordance with your instructions, we have determined the thermal resistance of a sample of "Foil/Bubble/Foil" reflective insulation installed in a studded wall. Tests were performed at two temperature gradients, and with three heat flow directions, horizontal, vertical up and vertical down. These tests were performed using the test method of ASTM C236 and conducted using personnel, procedures, and test equipment as approved under the U. S. Department of Commerce NVLAP Accreditation Program.

The sample was installed in a 36" X 36" test module whose dimensions correspond to the frontal dimensions of the meter box. This module consists of two 36" square, 1/2" thick plywood separated by pine studs (2 X 4) located on 16" centers to simulate a standard studded wall. Two full cavities plus one partial one results. (see the enclosed sketch, Figure No. 1. The other module sides consist of 1 X 3 pine trim stock. The sample was installed midway between the two plywood faces and was stapled (from the hot side) using 1" strip tabs of the test material bent upwards. The finished assembly with the hot side plywood face removed is shown in the enclosed photo.

The test module was installed in the aperture of a test frame whose outer dimensions are 67" X 67" and correspond to the outer dimensions of the guard and meter boxes. The 36" X 36" aperture aligns in the instrument with the facial gasket of the meter box. The test frame itself is an insulated structure, 8" thick, with 1 X 6 pine forming the outer edge and the edge towards the aperture. The faces of the test frame are 1/4" Luan and the inside filled with fiberglass insulation.

The test frame containing the mounted test module is installed in the instrument as shown in the sketch of Figure No. 2. Thermocouples, 5 distributed in each location, hot side air, hot side cavity (inside plywood), cold side cavity (inside plywood), and cold side air, are used to measure temperatures. Two additional thermocouples are

attached to the exterior of the plywood, one centered over a cavity, and one centered over a stud. All thermocouples are 28 gauge Type T.

The temperature of the refrigerated coolant supplied to the cold box, and the power supplied to the meter box were adjusted to provide the desired air temperature difference and the average temperature. For each test, at least 24 hours elapsed and then readings were taken at several hour intervals to insure thermal equilibrium test conditions.

From the power dissipated in the meter box and the temperatures as measured, the cavity and the air to air thermal resistances were determined. These values as well as others determined are presented in the enclosed tables. It should be noted that these R values are for a system, including the studs. The effect of the studs is to lower the true value for the reflective insulation alone.

We appreciate the opportunity to perform these measurements for you, and we look forward to being of service to you again in the future.

Very truly yours,
SPARRELL ENGINEERING RESEARCH CORPORATION

James K. Sparrell
President

JKS/eos

cc: Robert Wadsworth, Innovative Energy

# TEST REPORT

ASTRO VALCOUR INC.
11756 S. Austin Avenue
Alsip, IL 60482

April 4, 1988

Attention: Mr. Mark J. Mayronne

Reference: Purchase Order No. 23974

Subject: Thermal Resistance Tests on "Foil/Bubble/Foil"

Test Method: ASTM C236

| Sample orientation | Horizontal | |
|---|---|---|
| Heat flow direction | Up | |
| Nominal air temperature difference, °F | 30 | 45 |
| Hot side air temperature, °F | 89.26 | 97.39 |
| Hot side plywood surface temperature, °F | 87.65 | 94.87 |
| (center of cavity), °F | (88.09) | (95.43) |
| (stud), °F | (87.22) | (94.30) |
| Hot side cavity surface temperature, °F | 85.43 | 91.30 |
| Cold side cavity surface temperature, °F | 64.27 | 59.95 |
| Cold side plywood surface temperature, °F | 62.05 | 55.09 |
| (center of cavity), °F | (61.82) | (54.73) |
| (stud), °F | (62.23) | (55.41) |
| Cold side air temperature, °F | 59.91 | 51.91 |
| Heat flux, Btu/hr-ft$^2$-°F | 4.389 | 6.714 |
| Temperature difference, air to air, °F | 29.35 | 45.48 |
| Average temperature, air to air, °F | 74.59 | 74.65 |
| Conductance, air to air, U, Btu/hr-ft$^2$-°F | 0.150 | 0.148 |
| Resistance, air to air, R, Hr-ft$^2$-°F/Btu | 6.69 | 6.77 |
| Temperature difference, cavity, °F | 21.16 | 31.35 |
| Average temperature, cavity, °F | 74.85 | 75.63 |
| Conductance, cavity, C, Btu/hr-ft$^2$-°F | 0.207 | 0.214 |
| Resistance, cavity, R, Hr-ft$^2$-°F/Btu | 4.82 | 4.67 |
| Hot side air coefficient, h, Btu/hr-ft$^2$-°F | 2.7 | 2.7 |
| Cold side air coefficient, h, Btu/hr-ft$^2$-°F | 2.1 | 2.1 |
| Hot side air velocity, ft/sec | 0.5 | 0.8 |
| Cold side air velocity, ft/sec | 1.1 | 1.1 |

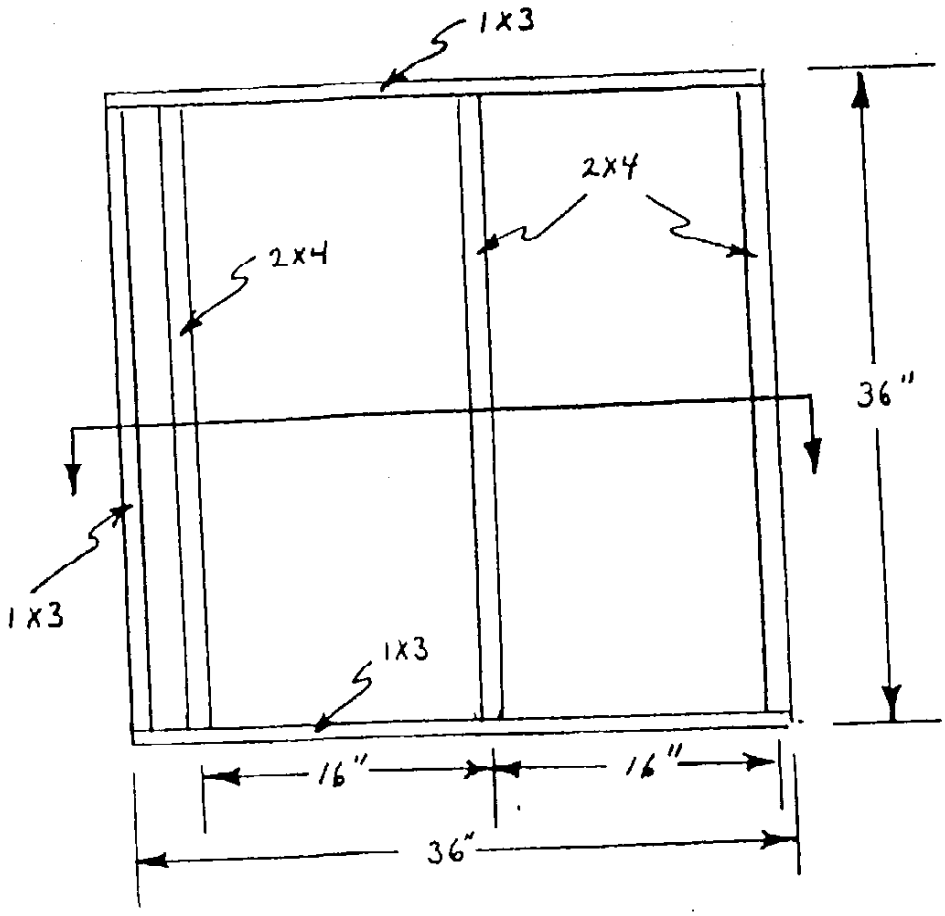
SPARRELL ENGINEERING RESEARCH CORPORATION

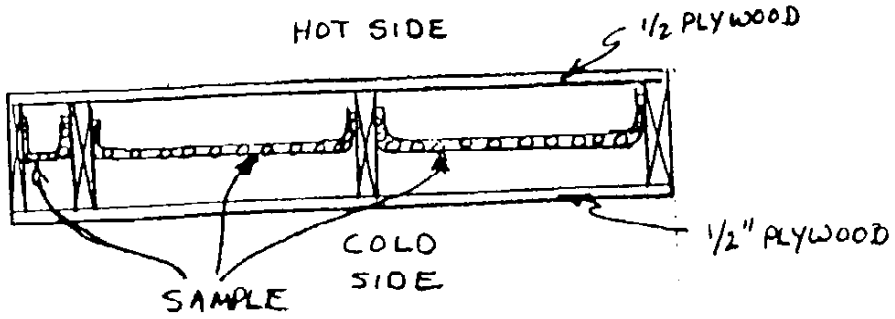
James K. Sparrell

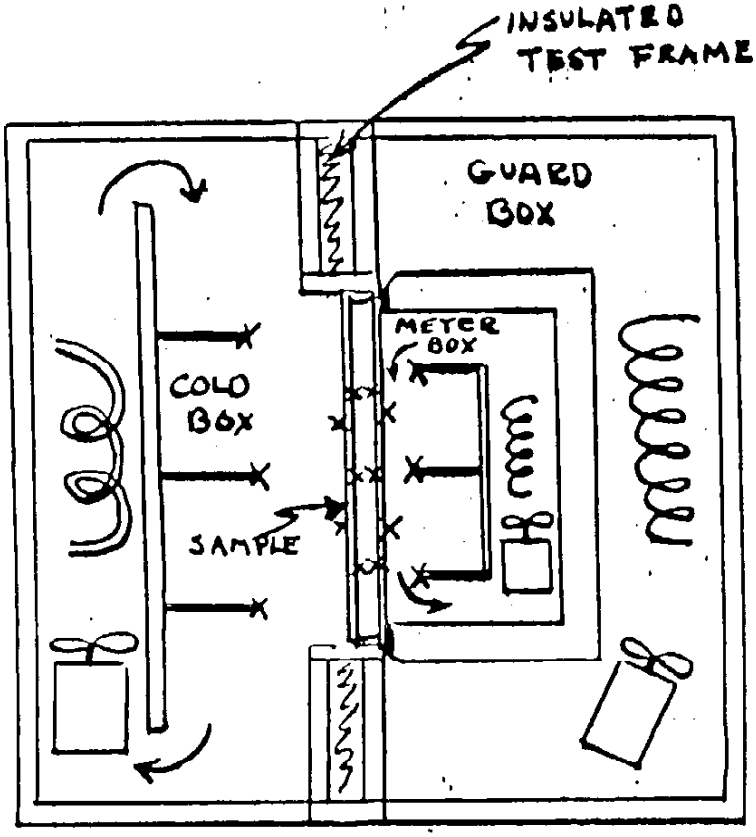
James K. Sparrell
President

FIGURE NO. 1

TEST MODULE WITH SAMPLE INSTALLED






X DENOTES THERMOCOUPLE LOCATIONS

← DENOTES AIR FLOW

ASTM C236 GUARDED HOT BOX

FIGURE 2