



Celotex Corporation
Testing Services

10301 Ninth Street North
St. Petersburg, Florida 33716
(813) 578-4316
Fax (813) 578-4280

THERMAL TESTING LABORATORY REPORT

December 17, 1997

Client: Tenneco Packaging - AVI
1411 Pidco Drive
Plymouth, IN 46563

MTS Job No.: 258218C-1

Metro Dade Notification No.: CAE 97273

Project: Thermal Performance of an Astro-Foil Reflective Insulation
Insulated Simulated Concrete Block Wall Assembly

Introduction:

This report summarizes the results of thermal tests conducted on material submitted to our laboratory on August 26, 1997. Testing was completed on November 18, 1997. The scope of the work was limited to conducting the thermal test ASTM C 236-89, "Standard Test Method for Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box" in the horizontal heat flow direction.

Sample Identification:

Two (2) 48 inch wide rolls of reflective insulation material were supplied by the client and identified as Astro-Foil foil/bubble/bubble/foil reflective insulation. The manufacture of the product was witnessed by J. Bridenstine on July 21, 1997 and documented in a P.E. sealed letter to R&D Services, Incorporated, dated July 23, 1997.

Sample Preparation:

An 8 by 8 foot simulated concrete block wall assembly was fabricated using 5/16 inch thick Astro-Foil reflective insulation, as per the client's request. A nominal 2 x 4 perimeter wood frame was constructed using 1.5 by 3.5 inch studs fastened together with wood screws. Two (2) 3/4 inch plywood sheets were horizontally fastened to the inside of the wood frame with screws to simulate a typical concrete block wall. Six (6) 0.75 by 1.5 inch wood furring strips placed 16 inches on center were attached to the plywood using wood screws. Reflective insulation sections were vertically installed flush with the hot side surface of the furring strip frame using staples to create a 3/4 inch reflective air space. A polystyrene baffle was installed to isolate the 6 by 6 foot metering area. The assembly was completed with two (2) 4 by 8 foot sheets of 1/2 inch gypsum board horizontally placed against the reflective insulation and fastened with wood screws. All butt and perimeter joints were sealed with caulk to prevent air infiltration.

This report is for the information of the client. It may be used in its entirety for the purpose of securing product acceptance from duly constituted approval authorities; however, this report or the name of Celotex Corporation shall not be used in publicity or advertising.

Client: Tenneco Packaging - AVI

MTS Job No.: 258218C-1

Test Program

Thirty (30), type T, 30 gauge, thermocouples were used to measure the temperature of the hot and cold side surfaces. Each were area weighted to account for both the wood furring strip frame and internal cavity areas.

The simulated concrete block wall assembly was tested at a $75^{\circ}\text{F} \pm 2^{\circ}\text{F}$ mean specimen test temperature in controlled laboratory conditions of 70°F and 50% relative humidity. The metering chamber was placed against the gypsum board surface.

Test Results

The following table summarizes the results of the thermal test performed on the Astro-Foil reflective insulation insulated simulated concrete block wall assembly in the horizontal heat flow direction. The systems surface to surface thermal resistance was determined to be $4.8 \text{ h ft}^2 \text{ }^{\circ}\text{F}/\text{Btu}$.

Reflective Insulation Simulated Concrete Block Wall Assembly Guarded Hot Box Test Results

	Horizontal Heat Flow
Hot Air Temperature, °F	100.7
Hot Surface Temperature, °F	95.1
Cold Surface Temperature, °F	54.6
Cold Air Temperature, °F	49.6
Mean Temperature, °F	74.9
Average Power, Watts	89.90
Hot Surface Coefficient, Btu/h ft ² °F	15.21
Cold Surface Coefficient, Btu/h ft ² °F	1.699
Thermal Conductance, Btu/h ft ² °F	0.210
Thermal Resistance, h ft ² °F/Btu	4.8

*R. Ameller
12/19/97*

Tested by: Russell Woltemar
Russell W. Woltemar

Approved by: Stanley D. Gatland II
Stanley D. Gatland II

This report is for the information of the client. It may be used in its entirety for the purpose of securing product acceptance from duly constituted approval authorities; however, this report or the name of Celotex Corporation shall not be used in publicity or advertising.

APPENDIX

MTS JOB NO. 258218C-1

CENTER FOR APPLIED ENGINEERING, INC.
 ASTM C236 – Guarded Hot Box

Client: R & D Services
 MTS Job No.: 258218
 Test Date: 11 – 18 – 97 (Completion)

Average Test Results

	Hot Chamber	Cold Chamber
Surface Temperature, Deg. F	95.1	54.6
Guard Surface Temperature, Deg. F	94.7	55.6
Air Temperature, Deg. F	100.7	49.6
Guard Air Temperature, Deg. F	98.4	50.2
Air Velocity, mph	< 0.5	< 0.5
Surface Coefficient, Btu/(h ft ² Deg. F)	1.521	1.699

Average Power Input = 89.90 Watts
 306.72 Btu/hr

Mean Temperature = 74.9 Deg. F

Thermal Performance Results

Thermal Conductance, C = 0.210 Btu/(h ft² Deg. F)
 Thermal Resistance, R = 4.8 (h ft² Deg. F)/Btu
 Thermal Transmittance, U = 0.167 Btu/(h ft² Deg. F)
 Overall Thermal Resistance, R_u = 6.0 (h ft² Deg. F)/Btu

Guarded Hot Box Dimensions: Metering Area = 6 ft. x 6 ft.
 Guard Area Width = 1 ft.

Test Panel Construction Details:

Test 4

Client: R & D Services

MTS Job No.: 258218

Test Date: 11-18-97 (Completion)

	Time (Hr/Min)	Power (Watts)	Tcs (F)	Tcsg (F)	Tca (F)	Tcag (F)	Ths (F)	Thsg (F)	Tha (F)	Tcsg (F)
1	1257	2.7050	54.7	55.7	49.7	50.3	95.2	94.8	100.8	98.4
2	1307	2.8180	54.6	55.6	49.6	50.3	95.2	94.8	100.8	98.3
3	1317	2.9290	54.6	55.6	49.6	50.1	95.2	94.8	100.7	98.2
4	1327	0.0690	54.7	55.6	49.7	50.4	95.2	94.8	100.8	98.3
5	1337	0.1795	54.7	55.7	49.7	50.4	95.2	94.7	100.8	98.3
6	1347	0.2900	54.7	55.7	49.8	50.3	95.2	94.8	100.8	98.7
7	1357	0.3935	54.7	55.7	49.6	50.4	95.2	94.8	100.7	98.6
8	1407	0.5045	54.7	55.7	49.7	50.3	95.2	94.8	100.8	98.4
9	1417	0.6170	54.7	55.7	49.6	50.3	95.1	94.7	100.8	98.2
10	1427	0.7285	54.7	55.7	49.7	50.2	95.2	94.8	100.8	98.2
11	1437	0.8400	54.7	55.7	49.6	50.3	95.2	94.8	100.8	98.2
12	1447	0.9485	54.6	55.7	49.5	50.2	95.1	94.8	100.7	98.6
13	1457	1.0590	54.6	55.6	49.6	50.4	95.1	94.8	100.8	98.3
14	1507	1.1665	54.6	55.6	49.5	50.2	95.2	94.8	100.8	98.3
15	1517	1.2770	54.6	55.6	49.5	50.1	95.2	94.8	100.8	98.2
16	1527	1.3875	54.6	55.6	49.5	50.2	95.2	94.8	100.8	98.3
17	1537	1.4995	54.6	55.6	49.5	50.1	95.2	94.8	100.7	98.8
18	1547	1.6090	54.6	55.5	49.6	50.2	95.1	94.8	100.8	98.4
19	1557	1.7180	54.6	55.6	49.4	50.3	95.1	94.8	100.7	98.4
20	1607	1.8275	54.5	55.6	49.5	50.2	95.1	94.8	100.7	98.3
21	1617	1.9360	54.5	55.6	49.6	50.2	95.2	94.8	100.7	98.3
22	1627	2.0450	54.5	55.5	49.5	50.1	95.1	94.7	100.8	98.3
23	1637	2.1565	54.5	55.5	49.5	50.2	95.1	94.7	100.7	98.2
24	1647	2.2695	54.5	55.5	49.5	50.1	95.1	94.7	100.7	98.3
25	1657	2.3795	54.5	55.5	49.6	50.3	95.1	94.7	100.7	98.2

98.348

100.76

94.776

95.16

50.244

49.584

55.616

54.612

82.65

(Uncorrected)

	Time (Hr/Min)	Power (Watts)	Tcs (F)	Tcsg (F)	Tca (F)	Tcag (F)	Ths (F)	Thsg (F)	Tha (F)	Tcsg (F)
*	26	2.3795	54.5	55.5	49.6	50.3	95.1	94.7	100.7	98.2
	27	2.4895	54.5	55.5	49.5	50.2	95.1	94.7	100.8	98.2
	28	2.6000	54.5	55.6	49.6	50.3	95.1	94.7	100.6	98.2
	29	2.7075	54.6	55.6	49.5	50.2	95.1	94.7	100.6	98.1
	30	2.8145	54.5	55.6	49.5	50.4	95.1	94.7	100.6	98.7
	31	2.9260	54.6	55.6	49.5	50.3	95.0	94.7	100.6	98.1
	32	0.0650	54.6	55.6	49.6	50.3	95.1	94.7	100.6	98.9
*	33	0.1765	54.5	55.6	49.5	50.3	95.1	94.7	100.7	98.6
*	34	0.2860	54.5	55.6	49.6	50.2	95.0	94.7	100.6	98.3
	35	0.3945	54.5	55.6	49.5	50.2	95.1	94.6	100.7	98.2
	36	0.5050	54.5	55.6	49.5	50.3	95.1	94.6	100.7	98.2
	37	0.6150	54.6	55.6	49.6	50.2	95.0	94.7	100.7	98.1
	38	0.7255	54.6	55.6	49.6	50.2	95.1	94.7	100.8	98.2
	39	0.8385	54.5	55.5	49.5	50.0	95.1	94.6	100.7	98.7
	40	0.9485	54.5	55.6	49.6	50.1	95.1	94.7	100.7	98.7
	41	1.0550	54.6	55.6	49.5	50.2	95.0	94.7	100.8	98.3
	42	1.1635	54.6	55.6	49.5	50.2	95.1	94.7	100.8	98.3
	43	1.2735	54.6	55.6	49.6	50.1	95.1	94.7	100.7	98.3
	44	1.3840	54.6	55.6	49.6	50.2	95.1	94.7	100.7	98.2
	45	1.4960	54.5	55.6	49.6	50.3	95.1	94.6	100.6	98.1
	46	1.6075	54.6	55.6	49.6	50.2	95.1	94.6	100.7	98.2
	47	1.7175	54.6	55.6	49.5	50.3	95.1	94.7	100.7	98.9
	48	1.8280	54.6	55.6	49.5	50.0	95.1	94.7	100.7	98.6
	49	1.9355	54.5	55.6	49.5	50.2	95.1	94.7	100.7	93.4
*	50	2.0460	54.5	55.6	49.5	50.2	95.1	94.7	100.7	93.4
		82.42 (Uncorrected)	54.5	55.6	49.5	50.2	95.1	94.7	100.7	98.4

Average Results	Power (Watts)	Tcs (F)	Tcsg (F)	Tca (F)	Tcag (F)	Ths (F)	Thsg (F)	Tha (F)	Tcsg (F)
	82.53 (Uncorrected)	54.6	55.6	49.6	50.2	95.1	94.7	100.7	98.4

89.90 (Qc = Q*1.0661 + 1.9107)
(Corrected)