

TO: Atlanta Sales, Commercial Field Sales, Regional Managers, Plant Managers, and Account Executives **NUMBER:**

FROM: Richard Roe, Director, Technical Services,
Commercial Roofing Products

DATE: May 13, 2003

SUBJECT: Third-Party LTTR Certification and Quality Control

Atlas Roofing Corporation first published Long-Term Thermal Resistance (LTTR) values for ACFoam-II and ACFoam-III in the spring of 2002, prior to the conversion in Canada from 6-month conditioned R-values to LTTR-values. These values range from 6.0 to 25.0, depending on product thickness, and are determined in accordance with CAN/ULC-770, now included in ASTM C 1289-02, Annex A1. Test samples are third-party selected at the plants by an accredited testing laboratory or by Underwriters Laboratories. ACFoam-II and ACFoam-III are also manufactured according to the requirements established by our FM Approvals and UL Classifications.

Since five Atlas plants are listed in Canada by the Canadian Construction Materials Centre (CCMC), third-party testing was already required of product from each listed plant in order to maintain these listings, which, practically speaking, are necessary for widespread acceptance in the Canadian marketplace. CCMC is part of a federal governmental agency, and its testing protocol stipulates annual certification by the manufacturer and full product testing performed by an approved testing laboratory every third year. CCMC's program is well respected and supported by the construction industry throughout Canada, including the contractor community.

As a result of this experience with CCMC's protocol, Atlas decided last year to expand LTTR testing to include our remaining two polyiso plants, making a total of seven. Our LTTR verification schedule requires full LTTR testing annually in addition to daily QC checks, such as density and initial k-value (thermal conductivity) testing. Atlas believes that this comprehensive approach better ensures the thermal performance expected by building Owners, Architects, Consultants, Contractors, specification writers, and installers of our roof insulation. The following bullet points highlight our QC and LTTR-value verification practice:

- Production from each plant is tested annually, based on the date of the first LTTR test for a given plant.
- The accredited testing laboratory, Bodycote Materials Testing Canada Inc., has the most experience, perhaps in the world, in performing this relatively new LTTR test protocol, having provided repeated LTTR testing services for manufacturers since at least the close of 2000. Bodycote has performed LTTR testing for other PIMA members, as well.

- Test samples are randomly selected by the accredited testing laboratory or, in the U.S., by Underwriters Laboratories. UL selects product for testing, signs each board selected, and issues a letter to Atlas and the testing laboratory to confirm the selection, including such information as site location, dates, location of the UL inspection center, and so on (see attached copy). The signed boards are then shipped to the testing laboratory.
- The laboratory performs the LTTR testing and issues a signed report to Atlas (and to CCMC when required). The report (see attached copy) includes a description of the procedure, the five-year aged thermal resistivity for 4 in., 3 in., 2 in., and 1 in. products, and aged thermal resistivity for 10 years, 15 years, and 20 years at a given thickness (this additional data is requested by Atlas but not required by the LTTR test method). Resistivity values are then converted to LTTR-values for each thickness.
 - o As stated in CAN/ULC-S770, a five-year aged value is equal to a 15-year time weighted average, which is intended for use as the design value.
 - o Third-party test results consistently support Atlas's published LTTR-values.
- QC checks for density, compressive strength, initial k-value, and dimensional stability are performed every day on each product manufactured that day.
- FM Approvals and Underwriters Laboratories audit each of our plants every quarter to ensure that the products are consistently manufactured within the parameters of the FM Approved and UL Classified formulations.

This level of attention to consistent quality is important to help distinguish Atlas Roofing Corporation from the competition. As a result, our customers can be further assured that the thermal and mechanical properties of our polyiso roofing products meet or exceed our published values.

1.0 INTRODUCTION

At the request of Atlas Roofing Corporation Bodycote materials Testing Canada Inc. was retained to evaluate Atlas' 2 inch ACFoam II in accordance with ASTN C1298-02 "Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulate".

Underwriters laboratories Inc. conducted sample selection on December 10, 2002 from Atlas' CampHill, PA plant. The sample selection letter dated January 23, 2003 is presented in Figure 7

Upon receipt, the sample was given the following Bodycote Sample no.:

<u>Client Sample Description</u>	<u>Bodycote Sample No.</u>
Atlas ACFoam II CampHill (Black facers)	02-06-M0259

2.0 PROCEDURE

The sample was evaluated in accordance with ASTM C1289-02 "Standard Specification for Faced Rigid Cellular polyisocyanurate thermal insulation" for:

Long Term thermal Resistance	Annex A1
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In addition, at the request of Atlas roofing Corporation, Bodycote materials Testing Canada inc. was requested to determine the LTTR of the 2 in. product at 10, 15, and 20 years.

The sample was analyzed using the following test equipment:

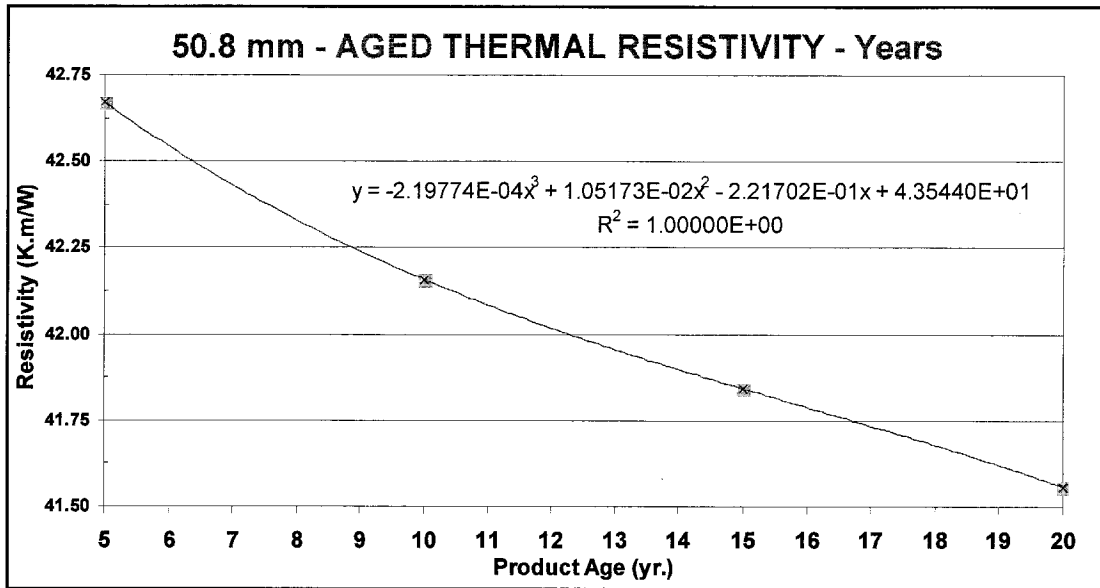
Conditioning room # 3028, asset #A11354,
Mitutoyo 8 in. Digimatic Caliper, asset # B01458,
LaserComp, Model Fox 600, asset # A13785,
Holometrix Model Rapid-K, asset # A04850

3.0 RESULTS

The test results for the ACFoam II, CampHill, PA sample, are summarized in the following Tables and Figures;

Table 1	Thermal Resistance of the Original Product
Table 2	Surface Thickness Measurements
Table 3	Core Thickness Measurements
Table 4	Test Point Days for Thin Surface and Core Layers for Various thicknesses
Table 5	Test Point Days for Thin Surface and Core Layers for Various Years
Table 6	Thermal Resistance of thin slices
Table 7	Thin Slice Aging Factors at Various thicknesses,
Table 8	Thin Slice Aging Factors at Various Years.

Figure 6



4. CONCLUSION

The 5 year aged long-term thermal resistivity values for the Atlas ACFoam II, CampHill, PA, are presented in Table 9.

Table # 9 – 5 YEAR LTTR VALUES FOR ACFOAM II, CAMP HILL, PA				
Product Thickness (mm. / in.)	Thermal Resistivity (K.m/W)	Thermal Resistance (m².°K/W)	Thermal Resistivity (°F.ft².h/Btu.in)	Thermal Resistance (°F.ft².h. / Btu)
101.6 / 4.0	43.819	4.452	6.320	25.280
76.2 / 3.0	43.358	3.304	6.254	18.762
50.8 / 2.0	42.671	2.168	6.155	12.310
25.4 / 1.0	41.559	1.056	5.994	5.994

The thermal resistivity of the product, for any thickness between the values listed in the above Table 9, can be calculated using the following equations:



Northbrook Division
333 Pflingsten Road
Northbrook, IL 60062-2096
www.ul.com

January 23, 2003

Atlas Roofing Corp.
Mr. Richard Roe
Suite 160
1775 The Exchange
Atlanta, GA 30339

Our Reference: R13089/02NK45887

Dear Mr. Roe:

This is in reference to your email requesting that Underwriters Laboratories Inc. (UL) conduct visits to your plants in Diboll, TX and Camp Hill, PA for the purpose of selecting and marking samples for testing at Bodycote Materials Testing, in Mississauga, ON, CANADA.

On December 3, 2002, a representative of UL from our Southern Delta Inspection Center visited your Diboll, TX facility and selected and marked three 2 in. by 4 ft. by 8 ft. pieces of AC Foam II.

On December 10, 2002, a representative of UL from our Pennsylvania Area inspection Center visited your Camp Hill, PA facility and selected and marked three 2 in. by 4 ft. by 8 ft. pieces of AC Foam II.

We have opened a work completed Project 02NK45887, File R13089 with a cost limit of \$600.00 to cover the charges associated with this work. Our Accounting Department has been advised that the work has been completed and to send the appropriate invoices.

If you need any additional information, do not hesitate to contact us.

Sincerely,

Reviewed by:

A handwritten signature in black ink, appearing to read 'Judith G. Marzullo'.

JUDITH G. MARZULLO
Lead Engineering Associate
Fire Protection Division

A handwritten signature in black ink, appearing to read 'Douglas C. Miller'.

DOUGLAS C. MILLER
Engineering Group Leader
Fire Protection Division