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SAMPLES RECEIVED DATE: 12 September 2005

SAMPLE PLAN: Production Air Duct Material, for use in Recreational Vehicles, sampled by Eric Wangsgaard, TEI-Inspection Services (IS00111)

DATE OF SAMPLING: 16 September 2005

LOCATION OF SAMPLING: Lowell, IN USA

SCOPE / PURPOSE OF TESTING: To perform Listing Compliance Testing for TEI-Listing Services Listing 04103

STANDARD(S) EVALUATED: UL 181 MAY 2004 "Standard for Safety for Factory-Made Air Ducts and Air Connectors" Sections .

TESTING DATE(S): 16 September 2005 – 15 November 2005

PRODUCT DESCRIPTION(S): Polystyrene Core foam board with Aluminum Foil on 42 lbs. Craft Paper bonded on both sides Air Duct Material for use in Recreational Vehicles in Convection Heating systems under 275°F and Air Conditioning systems under 175°F identified: Ultra-Ducts

COMPLIANCE SUMMARY: The Air Duct Material for use in Recreational Vehicles only identified: Ultra-Duct MEETS the requirements of the Sections identified above.

Unless specifically noted, all portions of the following tests were conducted by and/or under the continuous direct supervision of Testing Engineers International, Inc® personnel. The paragraph numbers in the report correspond with the paragraph numbers of the standard(s) above. Paragraphs which do not apply to this particular application or are for laboratory use only have been omitted. No deviations from the standard(s) were made unless specifically noted. If applicable, uncertainty measurements are noted in the applicable test paragraph. This report is the confidential property of the Client and Testing Engineers International, Inc. This report may not be reproduced except in full, without the expressed written consent of Testing Engineers International, Inc. NOTE: The values in this report are the values obtained under standard test conditions and thus may be used for purposes of demonstrating compliance or for comparison with other units tested under the same standard. The results do not indicate the function of the unit under nonstandard or field conditions. This certificate gives the characteristics of the sample(s) submitted for testing only. It does not and may not be used to certify the characteristics of the product, nor to imply that the product in general meets the requirements of any standard, nor its acceptability in the marketplace. © 2005 by Testing Engineers International, Inc®.

Merrill Gee, P.E. – Electrical Laboratory



UL 181
"Standard for Safety for Factory-Made Air Ducts and Air Connectors"

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INTRODUCTION

1.0 SCOPE

1.1 These requirements apply to materials for the fabrication of air duct and air connector systems for use in accordance with the Standards of the National Fire Protection Association for the Installation of Air-Conditioning and Ventilating Systems, NFPA No. 90A, and the Installation of Warm Air Heating and Air-Conditioning Systems, NFPA No. 90B.

1.2 The air ducts and air connectors covered by these requirements include preformed lengths of flexible or rigid ducts, materials in the form of boards for field fabrication of lengths of rigid ducts, and preformed flexible air connectors.

1.3 For the purpose of these requirements, air ducts and air connectors are classified as follows:

Class 0 – Air ducts and air connectors having surface burning characteristics of zero.

Class 1 – Air ducts and air connectors having a flame-spread index of not over 25 without evidence of continued progressive combustion and a smoke-developed index of not over 50.

PERFORMANCE

12.0 TEMPERATURE TEST

12.1 General

12.1.1 Materials for air ducts and air connectors, including any tapes, fabrics, cements, or other materials intended to be used in assembly during installation, shall be resistant to the effects of the temperatures to which they are exposed in the following tests.

12.2 Low temperature

12.2.1 Structural material shall not become deformed or show delamination; tapes, casings, and lining shall remain securely in place; and joints shall not open or show evidence of separation when a sample is subjected to the test described in 12.2.2 – 12.2.4.

RESULTS: i.e. Innovative Energy, Inc.'s Ultra-Ducts meet the requirements for this section. No damage is evident and when visually examined there were no indications of deterioration of Ultra-Duct's wall structure or the tape used when exposed to a temperature of minus 17.8°C (0°F) for a period of 24 hours.

12.3 High temperature

12.3.1 To comply with the requirements of 12.1.1, the exterior and interior surfaces of samples of air duct sections and air connectors are to be simultaneously exposed to air maintained at not less than 51.7°C (125°F) on the exterior and not less than 129.4°C (265°F) on the interior. Any arrangement using samples of air duct sections or air connectors shall be employed. The test arrangement is to provide means for maintaining air at the specified test temperatures in moving contact with the two surfaces of the test samples. As a result of the test described in 12.3.2 – 12.3.4, structural material shall not become deformed or show delamination; tapes, casings, and lining shall remain securely in place; and joints shall not open or show evidence of separation.



RESULTS: *i.e.* Innovative Energy, Inc.'s Ultra-Ducts meet the requirements for this section. No damage is evident and when visually examined there were no indications of deterioration of Ultra-Duct's wall structure or the tape used when exposed to a temperature of 51.7°C (125°F) on the exterior and not less than 129.4°C (265°F) on the interior for a period of 60 days. The duct was tested at 265°F which is Ultra-Ducts maximum allowable interior temperature in accordance with the manufacture's instructions.

13.0 PUNCTURE TEST

13.1 An air duct shall not be punctured when tested in accordance with these requirements.

RESULTS: *i.e.* Innovative Energy, Inc.'s Ultra-Ducts meet the requirements for this section. There was no penetration through the wall of the sample when the plunger head fell from a distance of 20 inches as measured to the top surface of the sample.

18.0 COLLAPSE TEST

18.1 Sections of air ducts and air connectors and the joints between sections, assembled in accordance with the manufacturer's instructions, shall resist collapse, damage, and excessive deformation when subjected to negative pressure of 2-1/2 times the manufacturer's rated negative pressure, and not less than a negative pressure of 1-1/4-inch water column (3.0 Pa).

RESULTS: *i.e.* Innovative Energy, Inc.'s Ultra-Ducts meets the requirements for this section. The Air Duct withstood without collapse, damage, and excessive deformation a negative pressure of 2-1/2 times the manufacturer's rated positive pressure of 0.5" w.c., and 1.25" w. c.. The sample did not rupture, and the joining material remained intact and there was no evidence of other damage.

CONCLUSION

The Air Duct Material for use in Recreational Vehicles only identified: Ultra-Duct MEETS the requirements of the Sections identified above.

END OF REPORT