

Order No. 3033836

December 13, 2002

**REPORT NO. 3033836-001  
AIR EROSION TEST ON ASTRO-SAFE  
THERMAL DUCT LINER**

**RENDERED TO  
INNOVATIVE ENERGY  
10653 WEST 181 ST AVENUE  
LOWELL, IN 46356**

**INTRODUCTION**

This report gives the results of an Air Erosion Test, which was performed on an L-shaped sheet metal duct lined with Astro-Safe thermal duct liner. The test specimen was selected and supplied by the client and was received at the laboratories on October 20, 2002. The sample appeared to be in new, unused condition upon arrival.

**AUTHORIZATION**

Purchase Order No. 32796 and signed quote.

**GENERAL**

The test was conducted in accordance with UL 181 Standard, "Factory-Made Air Duct Materials and Air Duct Connectors," Section 15, "Erosion Test".

**DESCRIPTION OF TEST SPECIMEN**

The test specimen consisted of one 6 foot length of ductwork upstream, a 90° radius elbow and one 6 foot length of ductwork downstream. All the sheet metal ductwork measured 12 inches square, with an L shaped protective metal nose on the leading edge.

The ductwork was lined with ½ inch thick acoustical and thermal duct liner. The liner material consisted of recycled lofted cotton layered with a pure aluminum radiant barrier facing the airstream. Metal nosing was over the upstream edges and all butt edges were taped with aluminum foil tape. The lining was glued and mechanical fasteners were used with a pin spacing as required by HVAC Duct Construction Standards for air velocity from 2500-6000 FPM. The description of the test specimen was supplied by the client.

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**TEST METHOD**

The air was supplied by a 12,000 cfm Buffalo Forge Blower which was driven by a 40 HP variable speed drive for the purpose of varying the velocity. The fan outlet was covered with a double layer of cheesecloth (14 to 15 square yards per pound and known to the trade as count of 32 by 24 inches).

For the collecting screen a double layer of cheesecloth (the same type as mentioned above) was stretched taut on a frame sized to provide an area greater than five times the inside cross-sectional area of the test specimen. Prior to the installation of the collection screen, air was passed through the test section at a velocity of 6000 fpm for a one-hour period. The collecting screen was then installed at a distance of one foot from the outlet of the test section.

After the collecting screen was set in place and the velocity set at 6000 fpm, the test continued for four hours. The collecting screen was examined for macroscopic particles at the end of each hour by taping the screen with the adhesive side of transparent tape in order to remove any eroded particles. At the end of the four hour period, the test was stopped and the final examination was made.

**TEST REQUIREMENT**

At the end of the test period, there should be no evidence of continued erosion, and the interior surfaces of the sample are not to show evidence of cracking, flaking, peeling or delamination.

**TEST RESULTS** - Test Velocity 6000 fpm

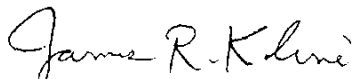
At the end of each test period, there was no evidence of continued erosion, and the interior surfaces of the sample did not show any evidence of cracking, flaking, peeling or delamination.

Date of Test: November 6, 2002

Dry Bulb: 70°F

Relative Humidity: 41%

Report Approved By:

  
James R. Kline, Technician  
Acoustical Testing



Order No. 3033836

December 17, 2002

**REPORT NO. 3033836-002  
AIR EROSION TEST ON ASTRO-SAFE  
THERMAL DUCT LINER**

**RENDERED TO  
INNOVATIVE ENERGY  
10653 WEST 181 ST AVENUE  
LOWELL, IN 46356**

## INTRODUCTION

This report gives the results of an Air Erosion Test, which was performed on an L-shaped sheet metal duct lined with *Astro-Safe thermal duct liner*. The test specimen was selected and supplied by the client and was received at the laboratories on October 20, 2002. The sample appeared to be in new, unused condition upon arrival.

## AUTHORIZATION

Purchase Order No. 32796 and signed quote.

## GENERAL

The test was conducted in accordance with UL 181 Standard, "Factory-Made Air Duct Materials and Air Duct Connectors," Section 15, "Erosion Test".

## DESCRIPTION OF TEST SPECIMEN

The test specimen consisted of one 6 foot length of ductwork upstream, a 90° radius elbow and one 6 foot length of ductwork downstream. All the sheet metal ductwork measured 12 inches square, with an L shaped protective metal nose on the leading edge.

The ductwork was lined with ½ inch thick acoustical and thermal duct liner. The liner material consisted of recycled lofted cotton layered with a pure aluminum radiant barrier facing the airstream. Metal nosing was over the upstream edges and all butt edges were taped with aluminum foil tape. The lining was glued and mechanical fasteners were used with a pin spacing as required by HVAC Duct Construction Standards for air velocity from 0-2500 FPM. The description of the test specimen was supplied by the client.

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**TEST METHOD**

The air was supplied by a 12,000 cfm Buffalo Forge Blower which was driven by a 40 HP variable speed drive for the purpose of varying the velocity. The fan outlet was covered with a double layer of cheesecloth (14 to 15 square yards per pound and known to the trade as count of 32 by 24 inches).

For the collecting screen a double layer of cheesecloth (the same type as mentioned above) was stretched taut on a frame sized to provide an area greater than five times the inside cross-sectional area of the test specimen. Prior to the installation of the collection screen, air was passed through the test section at a velocity of 2500 fpm for a one-hour period. The collecting screen was then installed at a distance of one foot from the outlet of the test section.

After the collecting screen was set in place and the velocity set at 2500 fpm, the test continued for four hours. The collecting screen was examined for macroscopic particles at the end of each hour by taping the screen with the adhesive side of transparent tape in order to remove any eroded particles. At the end of the four hour period, the test was stopped and the final examination was made.

**TEST REQUIREMENT**

At the end of the test period, there should be no evidence of continued erosion, and the interior surfaces of the sample are not to show evidence of cracking, flaking, peeling or delamination.

**TEST RESULTS** - Test Velocity 2500 fpm

At the end of each test period, there was no evidence of continued erosion, and the interior surfaces of the sample did not show any evidence of cracking, flaking, peeling or delamination.

Date of Test: November 7, 2002

Dry Bulb: 71°F

Relative Humidity: 39%

Report Approved By:

James R. Kline, Technician  
Acoustical Testing



Order No. 3033836

December 17, 2002

**REPORT NO. 3033836-003  
AIR EROSION TEST ON ASTRO-SAFE  
THERMAL DUCT LINER**

**RENDERED TO  
INNOVATIVE ENERGY  
10653 WEST 181 ST AVENUE  
LOWELL, IN 46356**

## INTRODUCTION

This report gives the results of an Air Erosion Test, which was performed on an L-shaped sheet metal duct lined with Astro-Safe thermal duct liner. The test specimen was selected and supplied by the client and was received at the laboratories on October 20, 2002. The sample appeared to be in new, unused condition upon arrival.

## AUTHORIZATION

Purchase Order No. 32796 and signed quote.

## GENERAL

The test was conducted in accordance with UL 181 Standard, "Factory-Made Air Duct Materials and Air Duct Connectors," Section 15, "Erosion Test".

## DESCRIPTION OF TEST SPECIMEN

The test specimen consisted of one 6 foot length of ductwork upstream, a 90° radius elbow and one 6 foot length of ductwork downstream. All the sheet metal ductwork measured 12 inches square, with an L shaped protective metal nose on the leading edge.

The ductwork was lined with 1 inch thick acoustical and thermal duct liner. The liner material consisted of recycled lofted cotton layered with a pure aluminum radiant barrier facing the airstream. Metal nosing was over the upstream edges and all butt edges were taped with aluminum foil tape. The lining was glued and mechanical fasteners were used with a pin spacing as required by HVAC Duct Construction Standards for air velocity from 2500-6000 FPM. The description of the test specimen was supplied by the client.

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**TEST METHOD**

The air was supplied by a 12,000 cfm Buffalo Forge Blower which was driven by a 40 HP variable speed drive for the purpose of varying the velocity. The fan outlet was covered with a double layer of cheesecloth (14 to 15 square yards per pound and known to the trade as count of 32 by 24 inches).

For the collecting screen a double layer of cheesecloth (the same type as mentioned above) was stretched taut on a frame sized to provide an area greater than five times the inside cross-sectional area of the test specimen. Prior to the installation of the collection screen, air was passed through the test section at a velocity of 6000 fpm for a one-hour period. The collecting screen was then installed at a distance of one foot from the outlet of the test section.

After the collecting screen was set in place and the velocity set at 6000 fpm, the test continued for four hours. The collecting screen was examined for macroscopic particles at the end of each hour by taping the screen with the adhesive side of transparent tape in order to remove any eroded particles. At the end of the four hour period, the test was stopped and the final examination was made.

**TEST REQUIREMENT**

At the end of the test period, there should be no evidence of continued erosion, and the interior surfaces of the sample are not to show evidence of cracking, flaking, peeling or delamination.

**TEST RESULTS** - Test Velocity 6000 fpm

At the end of each test period, there was no evidence of continued erosion, and the interior surfaces of the sample did not show any evidence of cracking, flaking, peeling or delamination.

Date of Test: November 5, 2002

Dry Bulb: 70°F

Relative Humidity: 40%

Report Approved By:

James R. Kline, Technician  
Acoustical Testing