



REPORT

ETL TESTING LABORATORIES, INC.

INDUSTRIAL PARK

CORTLAND, NEW YORK 13045

Order No. 47103K

Date: June 16, 1988

REPORT NO. 485562

**TEST OF PRESSURE LOSS VERSUS AIRFLOW
AND GENERATED SOUND LEVELS ON
THREE SHEET METAL
AIR TURNING DEVICES
SINGLE WALL VANE AND E-Z RAIL II**

**Rendered To
SHEET METAL CONNECTORS, INC.**

INTRODUCTION

This report gives the results of pressure loss and generated sound levels versus airflow on three air turning devices. In addition generated sound levels versus airflow was determined for three bare mitered elbows. The elbows were supplied by ETL Testing Laboratories while the turning vanes were selected and supplied by the client and were received in May, 1988.

AUTHORIZATION

Purchase Order No. 7681 and note of 5/24/88 from Mr. Jim Myers.

TEST METHOD

The elbow/elbow-turning vanes were set up and connected with suitable ductwork to ETL's 12,000 CFM variable speed blower with the air volume being measured by a calibrated sharp edged orifice metering station. The pressure drop across the orifice was measured employing Dwyer Inclined Manometer Model 200, range 0-2" W.G. The blower discharge ductwork is acoustically lined (approximately 100 ft of duct) to insure quiet air being delivered to the system plenum. From the lined plenum, the discharge duct with appropriate flow straightener ran the forty feet to our 470 m³ reverberation room. The static pressure upstream of the elbow was measured with a pitot tube at the duct centerline.

The laboratory method used in conducting the sound tests is in accordance with ANSI S1.31, "American National Standard Precision Methods for the Determination of Sound Power Levels of Broad-Band Noise Sources in Reverberation Rooms".

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TEST METHOD (Cont'd)

The reference sound source used for this test was calibrated ILG Fan Serial No. 17-05-066A which conforms to the above standard. Data was obtained on a Bruel & Kjaer Digital Frequency Analyzer Type 2131 and processed in a Hewlett Packard 9825B Computer.

TEST PROCEDURES

Generated sound and airflow versus static pressure were conducted on each specimen tested. The duct test velocities employed were 1000 - 1500 - 2000 - 2500 and 3000 FPM as directed by the client.

DESCRIPTION OF TEST SPECIMEN

- A) 24 x 24 inch bare elbow.
- B) 24 x 24 inch elbow with 10 Snaplock Vanes on E-Z Rail II runners. Vane radius 4-1/2 inch, vane spacing 3-1/4 inches, 10 vanes in total.
- C) 24 x 12 inch bare elbow.
- D) 24 x 12 inch elbow with 10 Snaplock Vanes on E-Z Rail II runners. Vane radius 4-1/2 inch, vane spacing 3-1/4 inches, 10 Vanes in total.
- E) 12 x 24 inch bare elbow.
- F) 12 x 24 inch elbow with 5 Snaplock Vanes on E-Z Rail II runners. Vane radius 4-1/2 inch, vane spacing 3-1/4 inches, 5 vanes in total.



RESULTS OF TESTS

<u>Test Specimen</u>	<u>Generated Sound Power Level</u>						
	<u>dB re 10⁻¹² Watt</u>						
	<u>Octave Band Center Frequency - Hz</u>						
	<u>125</u>	<u>250</u>	<u>500</u>	<u>1000</u>	<u>2000</u>	<u>4000</u>	<u>8000</u>
<u>Test Run #1: Velocity = 1000 FPM</u>							
A	48	42	40	36	28	(23)	(29)
B	48	42	37	33	25	(23)	(29)
C	44	(35)	(31)	(24)	(20)	(22)	(29)
D	(45)	40	37	34	25	(22)	(29)
E	48	39	34	27	(20)	(22)	(29)
F	(46)	40	37	31	(22)	(22)	(29)
<u>Test Run #2: Velocity = 1500 FPM</u>							
A	60	52	50	48	41	35	(30)
B	62	54	51	48	41	36	(30)
C	55	49	44	40	33	26	(29)
D	52	50	48	46	40	34	(29)
E	58	50	45	40	34	(27)	(29)
F	52	49	49	46	38	31	(29)
<u>Test Run #3: Velocity = 2000 FPM</u>							
A	67	61	57	55	50	45	37
B	62	60	59	56	51	46	39
C	62	56	51	48	42	36	(30)
D	59	57	56	54	50	46	36
E	66	59	54	49	44	39	33
F	59	56	57	54	48	43	36
<u>Test Run #4: Velocity = 2500 FPM</u>							
A	73	67	63	60	56	52	46
B	68	66	64	62	57	54	49
C	68	63	58	54	49	44	40
D	65	63	61	60	57	54	46
E	73	66	60	56	51	47	42
F	64	61	63	61	54	51	46



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<u>Test Specimen</u>	<u>Generated Sound Power Level</u>						
	<u>dB re 10⁻¹² Watt</u>						
	<u>Octave Band Center Frequency - Hz</u>						
	<u>125</u>	<u>250</u>	<u>500</u>	<u>1000</u>	<u>2000</u>	<u>4000</u>	<u>8000</u>
	<u>Test Run #5: Velocity = 3000 FPM</u>						
A	A & B not run at 3000 FPM - CFM is above						
B	system limit.						
C	74	69	64	60	55	50	45
D	70	68	66	64	62	61	54
E	79	71	66	61	57	53	51
F	67	66	67	65	60	58	57

Note:

Sound power levels in parentheses have reached ambient levels in the test room or are determined by instrument limitations. Actual levels are less than or equal to the levels indicated.

ACOTXT



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Single Thickness

Turning Vane Pressure Loss

Duct System: 24" X 24"

Date of Test: June 8, 1988

Vane Description: R = 4-1/2" S = 3-1/4"

Temperature: Dry Bulb 72.9°F
Wet Bulb 54.9°F

Number and Type of Vanes: 10 Snaplock Vanes

Barometer: 28.58" Hg

Type of Runners: E-Z Rail II

Upstream Pitot Tube Location "A"

Orifice Metering Station:

Distance Feet: 5'

Duct Diameter 36"

Downstream Pitot Tube Location "B"

Orifice Diameter 25.2"

Distance Feet: 10'

<u>Duct Measurement</u>		<u>Corrected Pressure Drop</u>	<u>Straight Duct Pressure Loss per 100 ft.</u>	<u>Calculations</u>	
<u>Duct Temperature °F</u>	<u>Pressure Drop "H2O A to B</u>			<u>Pressure Loss per Fitting</u>	<u>Air Velocity</u>
76.8	0.023	0.0237	0.0488	0.0164	1007
78.2	0.052	0.0536	0.1087	0.0373	1504
79.8	0.092	0.0949	0.1920	0.0661	1998
80.7	0.143	0.1475	0.2972	0.1029	2486



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6.

Single Thickness

Turning Vane Pressure Loss

Duct System: 24" X 12"

Date of Test: June 10, 1988

Vane Description: R = 4-1/2" S = 3-1/4"

Temperature: Dry Bulb 70.8°F
Wet Bulb 54.0°F

Number and Type of Vanes: 10 Snaplock Vanes

Barometer: 28.91" Hg

Type of Runners: E-Z Rail II

Upstream Pitot Tube Location "A"

Orifice Metering Station:

Distance Feet: 2.5

Duct Diameter 36"

Downstream Pitot Tube Location "B"

Orifice Diameter 25.2"

Distance Feet: 5

<u>Duct Measurement</u>		<u>Corrected Pressure Drop</u>	<u>Straight Duct Pressure Loss per 100 ft.</u>	<u>Calculations</u>	
<u>Duct Temperature °F</u>	<u>Pressure Drop "H2O A to B</u>			<u>Pressure Loss per Fitting</u>	<u>Air Velocity</u>
73.9	0.020	0.0250	0.0707	0.0152	1012
74.1	0.045	0.0461	0.1578	0.0343	1512
74.2	0.080	0.0819	0.2770	0.0611	2010
74.6	0.120	0.1229	0.4322	0.0905	1507
74.9	0.168	0.1721	0.6200	0.1256	3002



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7.

Single Thickness

Turning Vane Pressure Loss

Duct System: 12" X 24"

Date of Test: June 10, 1988

Vane Description: R = 4-1/2" S = 3-1/4"

Temperature: Dry Bulb 70.8°F
Wet Bulb 54.0°F

Number and Type of Vanes: 5 Snaplock Vanes

Barometer: 28.91" Hg

Type of Runners: E-Z Rail II

Upstream Pitot Tube Location "A"

Orifice Metering Station:

Distance Feet: 2.5

Duct Diameter 36"

Downstream Pitot Tube Location "B"

Orifice Diameter 25.2"

Distance Feet: 5

<u>Duct Measurement</u>		<u>Corrected Pressure Drop</u>	<u>Straight Duct Pressure Loss per 100 ft.</u>	<u>Calculations</u>	
<u>Duct Temperature °F</u>	<u>Pressure Drop "H2O A to B</u>			<u>Pressure Loss per Fitting</u>	<u>Air Velocity</u>
75.2	0.025	0.0256	0.0707	0.0203	1013
75.1	0.055	0.0564	0.1578	0.0446	1512
75.2	0.090	0.0922	0.2770	0.0714	2011
75.4	0.140	0.1435	0.4322	0.1111	2508
75.3	0.200	0.2050	0.6200	0.1585	3004

CONCLUSION

The test method employed for this test has no pass-fail criteria, therefore, the evaluation of the test results is left to the discretion of the client.

Report Approved by:

Norman H. Bay
Norman H. Bay, Manager
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