REPORT
ETL TESTING LABORATORIES, INC.

INDUSTRIAL PARK CORTLAND, NEW YORK 13045

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REPORT NO. 480837

TEST OF PRESSURE LOSS VERSUS AIRFLOW,
EXIT VELOCITY PROFILE AND GENERATED
SOUND LEVELS ON SIX SHEET METAL
AIR TURNING DEVICES

RENDERED TO

AERO DYNE COMPANY

INTRODUCTION

The report gives the results of pressure loss versus airflow, exit velocity profile and generated sound levels versus airflow on six air turning devices. Of the six air turning devices only one, the 24 x 24 smooth radius rectangular elbow, was entirely supplied by ETL Testing Laboratories. A second 24 x 24 rectangular mitered elbow was supplied by ETL Testing Laboratories but the turning vanes installed in the elbow were supplied by Aero Dyne Company.

The turning vanes were selected and supplied by Aero Dyne Company and were received at the laboratories in April, May and September 1987.

AUTHORIZATION

Letters dated November 2, 1986 and August 31, 1987 from Mr. Gordon Jacobsen of Aero Dyne Company.

TEST METHOD

The elbow/elbow-turning vanes were set up and connected to a 24 x 24 inch square sheet metal duct. The air supply consisted of a 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 a 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 a plenum. From the lined plenum, the discharge duct with appropriate flow straighteners traverses the forty feet to our 470m^3 reverberation room. The elbows under test were placed at the end of this forty foot length of 24 x 24 inch duct. The outlet velocity was measured employing a TSI Air Velocity Meter Model 1650 with ranges of 0-6000 FPM.

TEST METHOD

The upstream static pressure was monitored employing a Dwyer Pitot Tube Model 16-18 placed 2-1/2 equivalent duct diameters upstream of the elbow. The static pressure was measured employing a Dwyer Microtector Model 1430, range 0-2 inches W.G. (accuracy ± 0.0005 in W.G.).

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".

The reference sound source used for this test was a 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 PROCEDURE

Generated sound, airflow versus static pressure and velocity tests were conducted on each specimen tested. The duct test velocities employed were 1000 - 1500 - 2000 and 2500 FPM as directed by the client. Five centerline velocity readings were taken at each test velocity. The center velocity location measurement was used as the baseline to calculate the velocity percentage increase or decrease for the other points. The exit velocities of the four airflows on each specimen were then averaged together.

Description of Test Specimen

A) H-E-P vanes on design centers. Thirteen vanes spaced 2-3/8" on center were installed in a mitered elbow.

B) Two inch radius hollow vanes. Thirteen vanes spaced on 2-1/2 inch centers were installed in a mitered elbow.

C) Two inch radius hollow vanes. Twenty two vanes spaced on 1-1/2 inch centers were installed in a mitered elbow.

D) Four inch radius hollow vanes. Nine vanes spaced on 3-1/2 inch centers were installed in a mitered elbow.

E) Four inch radius single thickness vanes. Ten vanes spaced 3-1/4 inches on center were installed in a mitered elbow.

F) Single width radius elbow without turning vanes. The elbow was 24 inches in width by 24 inches in height with a 24 inch radius (R/W = 1).

RESULTS OF TEST

Test Specimen	Pressure Drop $H2^O$	Generated Sound Power Level dB re 10^{-12} Watt, Octave Band Center Frequency - Hz: 125	250	500	1000	2000	4000	8000
	Test Run #1: Velocity = 1000 FPM							
A	0.027	46	37	35	31	22	(21)	(26)
B	0.070	47	43	43	39	29	(21)	(26)
C	0.035	51	47	42	37	27	(20)	(26)
D	0.029	45	42	42	37	26	(21)	(26)
E	0.025	47	43	41	35	25	(21)	(26)
F	0.050	42	37	37	32	24	(21)	(26)
	Test Run #2: Velocity = 1500 FPM							
A	0.060	53	49	47	44	39	31	(28)
B	0.160	56	52	53	51	44	36	(28)
C	0.075	61	56	53	50	45	35	(27)
D	0.065	56	53	51	50	42	35	29
E	0.055	56	53	53	48	43	33	(27)
F	0.115	53	47	46	43	38	33	(27)
	Test Run #3: Velocity = 2000 FPM							
A	0.105	61	57	54	52	49	47	46
B	0.285	64	59	59	58	53	47	39
C	0.125	65	64	61	58	55	48	40
D	0.115	62	60	59	58	52	46	36
E	0.10	63	61	60	56	53	47	36
F	0.21	58	55	54	51	47	43	37
	Test Run #4: Velocity = 2500 FPM							
A	0.17	66	62	60	57	54	59	58
B	0.43	68	65	64	63	59	53	46
C	0.19	70	69	67	64	62	55	49
D	0.18	67	66	64	63	58	54	45
E	0.15	68	67	66	62	60	56	47
F	0.32	62	62	60	56	53	49	45

See Figure 2 for plot of velocity versus pressure drop.

Note: Sound pressure level data in parenthesis has reached ambient levels in the test room or is determined by instrument limitations. Actual levels are less than or equal to the levels indicated.

Exit Velocity Profile Data

Test Specimen	% of Centerline Velocity 4"	8"	12"	16"	20"
A	97	101	100	99	84
B	105	100	100	100	32
C	89	99	100	102	99
D	95	95	100	104	94
E	83	96	100	103	101
F	97	98	100	96	90

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, Manager
Acoustical Division

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Figure 2