

Aeroflex USA

TEST REPORT

SCOPE OF WORK

DUCT INSULATION INSERTION LOSS AND AIRFLOW GENERATED SOUND TESTS

The test specimen was selected and supplied by the client and received at the acoustical lab on May 31, 2023.
The unit appeared to be in good, new condition upon arrival.

MODEL NUMBER

AEROFLEX Breathe-EZ™ Duct Insulation (1" thick)

PROJECT NUMBER

G105445069

REPORT NUMBER

105445069CRT-001

ISSUE DATE

June 12, 2023

REVISED DATE

N/A

TEST DATE

June 9, 2023

DOCUMENT CONTROL NUMBER

DIFF.PKT.2022

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REPORT NUMBER
105445069CRT-001

MODEL NUMBER(s)
AEROFLEX Breathe-EZ™ Duct Insulation (1" thick)

REPORT RENDERED TO:
Aeroflex USA
232 Industrial Park Road
Sweetwater, TN 37874
USA

AUTHORIZATION

The testing performed was authorized by signed quote number Qu-01353267-2.

TEST STANDARDS

ASTM Standard E477-20, entitled "Standard Test Method for Laboratory Measurements of Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers".

In Charge of Testing:



Gerald Gray
Associate Engineer
Acoustical Testing

Reviewer:



Brian Cyr
Engineer
Acoustical Testing

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SAMPLE INFORMATION

REPORT NO. 105445069CRT-001

ITEMS RECEIVED

Item No.	Control No.	Model No.	Description	Received
1	CRT2305311246-001	AEROFLEX Breathe-EZ™ (1")	Duct Insulation	May 31, 2023

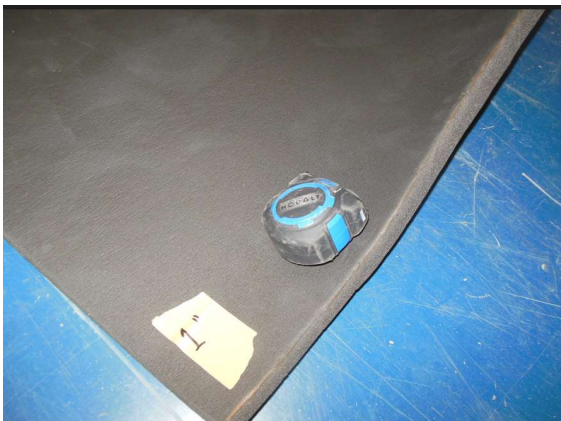
TEST CONDITIONS

Temperature (Deg.F):	74	Humidity (%RH):	36	Barometric Pressre (inHg):	28.56
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DESCRIPTION OF TEST SPECIMEN

The sample consisted of (4) 1 inch thick, 10 foot long, sections of duct insulation installed to create an interior duct size of 24 inches by 24 inches. The duct liner weighed 26 lbs.

SAMPLE PHOTOS



TEST INFORMATION

REPORT NO. 105445069CRT-001

TEST METHODS

The laboratory method used in conducting these tests is in accordance with ASTM Standard E477-20, entitled "Standard Test Method for Laboratory Measurements of Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers".

Sound pressure level data was obtained using a Bruel and Kjaer Pulse Analyzer. The reference sound source used to obtain the generated sound power level was a calibrated Bruel & Kjaer Type 4204, which conforms to the above standard. The Intertek 16,640 cu. ft. (470 cubic meters) reverberation room is qualified in accordance with ANSI S12.51/ISO 3741 for sound measurement from 50 to 10,000 hertz.

The following notes relate to the data submitted in the data pages.

Note: Sound power level data denoted with a double asterisk 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. The generated sound data has been corrected for end reflection.

Note: Sound Power Level data denoted with a single asterisk is near ambient levels and is being corrected.

Note: Insertion loss data denoted with a (>) sign has been corrected to take into consideration the effect of the generated sound pressure level approaching the sound pressure level obtained during the insertion loss portion of the test. In some cases, the insertion loss may be higher than shown.

Note: Insertion loss data denoted with a (>>) sign has reached limitation of the test method, the insertion loss may be higher than shown.

PRECISION AND BIAS

The precision of this test method has been evaluated through round robin testing from 2015 through 2017 with 5 different participating laboratories. The tests were conducted using the 2013 version of the standard. Two different silencer designs were evaluated in the round robin tests.

Because there were not enough participating laboratories to establish repeatability and reproducibility statistics for this round robin. The precision statement is limited to the repeatability standard deviation and reproducibility standard deviation statistics of the measured insertion loss, generated noise and pressure drop for the two tested silencers (Reference Tables 1 – 6 of the test standard). There is no known bias in ASTM E477.

NOTE ABOUT PROGRAM

The results contained herein are for technical evaluation only and are applicable only to the specific specimens referenced herein.

The tests herein reported have not been performed at the request of AMCA International and is not part of the AMCA International Certification Program



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RESULTS OF TESTS - FORWARD FLOW

REPORT NO. 105445069CRT-001

Octave Band Center Frequency, Hz	<u>Insertion Loss</u>				
	<u>0 Flow</u>	<u>Flow 1</u>	<u>Flow 2</u>	<u>Flow 3</u>	<u>Flow 4</u>
		<u>1000</u>	<u>1500</u>	<u>2000</u>	<u>2500</u>
63	2	1	1	1	1 >
125	1	1	1	1	0
250	2	2	2	2	2
500	7	7	7	7	7
1000	15	15	15	15	15
2000	10	10	9	9	9
4000	9	9	9	9	9
8000	7	7	7	7	6

Octave Band Center Frequency, Hz	<u>Generated Sound Power</u>			
	<u>Flow 1</u>	<u>Flow 2</u>	<u>Flow 3</u>	<u>Flow 4</u>
	<u>1000</u>	<u>1500</u>	<u>2000</u>	<u>2500</u>
63	70 **	69 **	70 **	81 **
125	44 **	55 **	62 **	69 **
250	36 **	47 **	55 **	63 **
500	26 **	38 **	46 **	56 **
1000	24 **	29 **	40 **	48 **
2000	19 **	28 **	38 **	45 **
4000	17 **	23 **	34 **	42 **
8000	21 **	21 **	26 **	35 **

1/3 Octave Band Center Frequency, Hz		<u>1/3 Octave</u>			
		<u>Flow 1</u>	<u>Flow 2</u>	<u>Flow 3</u>	<u>Flow 4</u>
		<u>1000</u>	<u>1500</u>	<u>2000</u>	<u>2500</u>
50	8	7	7	7	8 >
63	1	-1	-1	-1	-1
80	1	1	1	1	1
100	1	0	0	0	0
125	1	1	0	1	0
160	1	2	1	1	1
200	2	2	2	1	2
250	2	2	2	2	2
315	3	3	3	3	3
400	5	5	4	4	4
500	7	7	6	6	6
630	15	15	15	15	15
800	15	14	14	14	14
1000	18	18	18	18	18
1250	14	14	14	14	14
1600	10	10	10	10	10
2000	10	10	10	10	10
2500	9	9	9	9	9
3150	8	9	8	8	8
4000	8	9	9	9	9
5000	9	9	9	9	8
6300	8	8	8	7	7
8000	7	7	7	7	7
10000	7	6	6	6	5

1/3 Octave Band Center Frequency, Hz		<u>1/3 Octave</u>			
		<u>Flow 1</u>	<u>Flow 2</u>	<u>Flow 3</u>	<u>Flow 4</u>
		<u>1000</u>	<u>1500</u>	<u>2000</u>	<u>2500</u>
50	70 **	69 **	69 **	80	
63	49 **	51 **	59 **	70 **	
80	49 **	50 **	54 **	63 **	
100	41 **	51 **	58 **	65 **	
125	38 **	50 **	57 **	63 **	
160	39 **	50 **	57 **	64 **	
200	34 **	45 **	52 **	58 **	
250	31 **	42 **	50 **	55 **	
315	27 **	37 **	47 **	59 *	
400	24 **	35 **	43 **	54 **	
500	21 **	32 **	41 **	47 **	
630	18 **	29 **	38 **	46 **	
800	20 **	25 **	36 **	44 **	
1000	17 **	24 **	35 **	44 **	
1250	19 **	24 **	35 **	43 **	
1600	16 **	24 **	34 **	42 **	
2000	14 **	24 **	33 **	40 **	
2500	13 **	23 **	33 **	40 **	
3150	12 **	21 **	32 **	39 **	
4000	12 **	18 **	28 **	37 **	
5000	13 **	15 **	25 **	34 **	
6300	15 **	15 **	23 **	32 **	
8000	16 **	16 **	20 **	29 **	
10000	18 **	18 **	19 **	28 **	

<u>Flow</u>	<u>FPM</u>	<u>Static Pressure</u>	
1	1000	0.02	iwg
2	1500	0.04	iwg
3	2000	0.06	iwg
4	2500	0.08	iwg

Sound power levels are in dB referenced 10-12 Watts.
The Insertion Loss (IL) is in dB.
The Face Velocity is in fpm.



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RESULTS OF TESTS - REVERSE FLOW

REPORT NO. 105445069CRT-001

<u>Octave Band</u> Center Frequency, Hz	<u>Insertion Loss</u>				
	<u>0 Flow</u>	<u>Flow 1</u>	<u>Flow 2</u>	<u>Flow 3</u>	<u>Flow 4</u>
		<u>1000</u>	<u>1500</u>	<u>2000</u>	
63	2	2	2	3	
125	1	1	2	2	
250	2	2	3	3	
500	7	7	8	8	
1000	15	15	15	14	
2000	10	10	10	11	
4000	9	8	8	9	
8000	7	7	7	7	

<u>Octave Band</u> Center Frequency, Hz	<u>Generated Sound Power</u>			
	<u>Flow 1</u>	<u>Flow 2</u>	<u>Flow 3</u>	<u>Flow 4</u>
	<u>1000</u>	<u>1500</u>	<u>2000</u>	
63	70 **	69 **	68 **	
125	42 **	62 **	57 **	
250	31 **	43 **	49 **	
500	23 **	39 **	46 **	
1000	21 **	35 **	42 **	
2000	16 **	32 **	38 **	
4000	17 **	28 **	34 **	
8000	21 **	22 **	26 **	

<u>1/3 Octave</u> Band Center Frequency, Hz		<u>Flow</u>		
		<u>1</u>	<u>2</u>	<u>3</u>
		<u>1000</u>	<u>1500</u>	<u>2000</u>
50	7	8	7	8
63	0	1	1	1
80	0	1	2	2
100	0	1	1	1
125	0	1	1	1
160	1	2	2	2
200	1	2	2	3
250	2	2	2	3
315	3	3	3	5
400	5	5	6	6
500	7	7	8	8
630	15	15	15	15
800	14	14	14	12
1000	18	18	17	15
1250	14	14	14	15
1600	10	10	11	13
2000	10	10	11	12
2500	9	9	9	9
3150	8	8	8	8
4000	8	8	8	9
5000	9	9	9	9
6300	8	8	8	8
8000	7	7	7	7
10000	7	7	6	7

<u>1/3 Octave</u> Band Center Frequency, Hz		<u>Flow</u>		
		<u>1</u>	<u>2</u>	<u>3</u>
		<u>1000</u>	<u>1500</u>	<u>2000</u>
50	70 **	69 **	66 **	
63	49 **	52 **	62 **	
80	52 *	53 *	56 **	
100	39 **	61	54 **	
125	38 **	54 **	52 **	
160	29 **	42 **	50 **	
200	28 **	39 **	46 **	
250	25 **	38 **	44 **	
315	25 **	38 **	43 **	
400	21 **	36 **	42 **	
500	17 **	34 **	41 **	
630	15 **	33 **	40 **	
800	19 **	31 **	38 **	
1000	12 **	30 **	37 **	
1250	12 **	30 **	36 **	
1600	12 **	28 **	34 **	
2000	12 **	27 **	32 **	
2500	11 **	24 **	32 **	
3150	11 **	25 **	30 **	
4000	12 **	24 **	29 **	
5000	13 **	19 **	26 **	
6300	15 **	16 **	23 **	
8000	16 **	16 **	20 **	
10000	18 **	18 **	19 **	

<u>Flow</u>	<u>FPM</u>	<u>Static Pressure</u>	
1	1000	0.02	iwg
2	1500	0.04	iwg
3	2000	0.06	iwg

Sound power levels are in dB referenced 10-12 Watts.
The Insertion Loss (IL) is in dB.
The Face Velocity is in fpm.

EQUIPMENT LIST

REPORT NO. 105445069CRT-001

#	Equipment	Model No	Control No.	Last Cal	Cal Due
1	Microphone/Pre - DF	4942	E550	5/1/2023	5/1/2024
2	Pulse Analyzer	7539	E446	5/1/2023	5/1/2024
3	Reference Sound Source	4204	A230	11/21/2021	11/21/2024
4	Manometer Incline	424-5	F166	3/8/2023	3/8/2024
5	Manometer Incline	424-5	F167	3/8/2023	3/8/2024
6	Microphone Calibrator	4231	A227	5/1/2023	5/1/2024
7	Rotating Microphone Boom	3923	N/A	N/A	N/A
8	Windscreen	UA0237	N/A	N/A	N/A
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

REVISION NOTES

#	Change	Date
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Aeroflex USA

TEST REPORT

SCOPE OF WORK

DUCT INSULATION INSERTION LOSS AND AIRFLOW GENERATED SOUND TESTS

The test specimen was selected and supplied by the client and received at the acoustical lab on May 31, 2023.
The unit appeared to be in good, new condition upon arrival.

MODEL NUMBER

AEROFLEX Breathe-EZ™ Duct Insulation (1-1/2" thick)

PROJECT NUMBER

G105445069

REPORT NUMBER

105445069CRT-002

ISSUE DATE

June 12, 2023

REVISED DATE

N/A

TEST DATE

June 9, 2023

DOCUMENT CONTROL NUMBER

DIFF.PKT.2022

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REPORT NUMBER

105445069CRT-002

MODEL NUMBER(s)

AEROFLEX Breathe-EZ™ Duct Insulation (1-1/2" thick)

REPORT RENDERED TO:

Aeroflex USA
232 Industrial Park Road
Sweetwater, TN 37874
USA

AUTHORIZATION

The testing performed was authorized by signed quote number Qu-01353267-2.

TEST STANDARDS

ASTM Standard E477-20, entitled "Standard Test Method for Laboratory Measurements of Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers".

In Charge of Testing:



Gerald Gray
Associate Engineer
Acoustical Testing

Reviewer:



Brian Cyr
Engineer
Acoustical Testing

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SAMPLE INFORMATION

REPORT NO. 105445069CRT-002

ITEMS RECEIVED

Item No.	Control No.	Model No.	Description	Received
1	CRT2305311246-002	AEROFLEX Breathe-EZ™ (1-1/2")	Duct Insulation	May 31, 2023

TEST CONDITIONS

Temperature (Deg.F):	74	Humidity (%RH):	36	Barometric Pressre (inHg):	28.56
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DESCRIPTION OF TEST SPECIMEN

The sample consisted of (4) 1.5 inch thick, 10 foot long, sections of duct insulation installed to create an interior duct size of 24 inches by 24 inches. The duct liner weighed 32.5 lbs.

SAMPLE PHOTOS



TEST INFORMATION

REPORT NO. 105445069CRT-002

TEST METHODS

The laboratory method used in conducting these tests is in accordance with ASTM Standard E477-20, entitled "Standard Test Method for Laboratory Measurements of Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers".

Sound pressure level data was obtained using a Bruel and Kjaer Pulse Analyzer. The reference sound source used to obtain the generated sound power level was a calibrated Bruel & Kjaer Type 4204, which conforms to the above standard. The Intertek 16,640 cu. ft. (470 cubic meters) reverberation room is qualified in accordance with ANSI S12.51/ISO 3741 for sound measurement from 50 to 10,000 hertz.

The following notes relate to the data submitted in the data pages.

Note: Sound power level data denoted with a double asterisk 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. The generated sound data has been corrected for end reflection.

Note: Sound Power Level data denoted with a single asterisk is near ambient levels and is being corrected.

Note: Insertion loss data denoted with a (>) sign has been corrected to take into consideration the effect of the generated sound pressure level approaching the sound pressure level obtained during the insertion loss portion of the test. In some cases, the insertion loss may be higher than shown.

Note: Insertion loss data denoted with a (>>) sign has reached limitation of the test method, the insertion loss may be higher than shown.

PRECISION AND BIAS

The precision of this test method has been evaluated through round robin testing from 2015 through 2017 with 5 different participating laboratories. The tests were conducted using the 2013 version of the standard. Two different silencer designs were evaluated in the round robin tests.

Because there were not enough participating laboratories to establish repeatability and reproducibility statistics for this round robin. The precision statement is limited to the repeatability standard deviation and reproducibility standard deviation statistics of the measured insertion loss, generated noise and pressure drop for the two tested silencers (Reference Tables 1 – 6 of the test standard). There is no known bias in ASTM E477.

NOTE ABOUT PROGRAM

The results contained herein are for technical evaluation only and are applicable only to the specific specimens referenced herein.

The tests herein reported have not been performed at the request of AMCA International and is not part of the AMCA International Certification Program



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RESULTS OF TESTS - FORWARD FLOW

REPORT NO. 105445069CRT-002

Octave Band Center Frequency, Hz	<u>Insertion Loss</u>				
	<u>0 Flow</u>	<u>Flow 1</u>	<u>Flow 2</u>	<u>Flow 3</u>	<u>Flow 4</u>
		<u>1000</u>	<u>1500</u>	<u>2000</u>	<u>2500</u>
63	3	3	3	3	3
125	1	1	1	1	1
250	4	4	4	4	4
500	16	15	15	15	15
1000	9	9	9	9	9
2000	10	10	10	10	10
4000	11	11	11	11	11
8000	10	10	9	9	9

Octave Band Center Frequency, Hz	<u>Generated Sound Power</u>			
	<u>Flow 1</u>	<u>Flow 2</u>	<u>Flow 3</u>	<u>Flow 4</u>
	<u>1000</u>	<u>1500</u>	<u>2000</u>	<u>2500</u>
63	70 **	69 **	69 **	69 **
125	44 **	56 **	62 **	67 **
250	35 **	47 **	54 **	61 **
500	24 **	35 **	43 **	53 **
1000	23 **	33 **	42 **	48 **
2000	19 **	28 **	37 **	43 **
4000	18 **	21 **	31 **	39 **
8000	21 **	21 **	24 **	31 **

<u>1/3 Octave</u> Band Center Frequency, Hz	<u>Flow</u>				
	<u>Flow 1</u>	<u>Flow 2</u>	<u>Flow 3</u>	<u>Flow 4</u>	
	<u>1000</u>	<u>1500</u>	<u>2000</u>	<u>2500</u>	
50	10	8	8	8	8
63	3	2	2	2	2
80	1	1	1	1	1
100	1	1	0	0	0
125	1	1	1	0	1
160	1	2	2	2	2
200	2	2	2	3	2
250	4	4	4	4	4
315	7	7	7	7	7
400	12	12	12	12	12
500	24	23	23	23	23
630	17	16	16	16	16
800	11	11	10	10	10
1000	9	9	9	9	9
1250	8	9	9	9	9
1600	8	9	8	8	9
2000	11	10	10	10	10
2500	10	10	10	10	10
3150	11	11	11	11	11
4000	10	10	10	10	11
5000	11	11	11	11	11
6300	11	11	11	11	10
8000	9	10	10	10	9
10000	9	9	8	8	8

<u>1/3 Octave</u> Band Center Frequency, Hz	<u>Flow</u>			
	<u>Flow 1</u>	<u>Flow 2</u>	<u>Flow 3</u>	<u>Flow 4</u>
	<u>1000</u>	<u>1500</u>	<u>2000</u>	<u>2500</u>
50	70 **	69 **	69 **	67 **
63	49 **	52 **	58 **	64 **
80	47 **	49 **	53 **	59 **
100	41 **	52 **	58 **	63 **
125	37 **	51 **	57 **	62 **
160	39 **	50 **	57 **	63 **
200	34 **	45 **	51 **	57 **
250	30 **	41 **	49 **	53 **
315	25 **	36 **	47 **	58 **
400	22 **	32 **	40 **	52 **
500	17 **	30 **	38 **	44 **
630	16 **	29 **	37 **	44 **
800	20 **	28 **	37 **	43 **
1000	16 **	29 **	37 **	44 **
1250	16 **	28 **	36 **	42 **
1600	16 **	25 **	33 **	40 **
2000	13 **	23 **	32 **	38 **
2500	12 **	21 **	31 **	37 **
3150	11 **	18 **	29 **	36 **
4000	12 **	14 **	25 **	33 **
5000	16 *	17 **	23 **	31 **
6300	15 **	15 **	20 **	28 **
8000	16 **	16 **	18 **	26 **
10000	18 **	18 **	19 **	24 **

<u>Flow</u>	<u>FPM</u>	<u>Static Pressure</u>	
1	1000	0.02	iwg
2	1500	0.04	iwg
3	2000	0.06	iwg
4	2500	0.08	iwg

Sound power levels are in dB referenced 10-12 Watts.
The Insertion Loss (IL) is in dB.
The Face Velocity is in fpm.

RESULTS OF TESTS - REVERSE FLOW

REPORT NO. 105445069CRT-002

<u>Octave Band</u> <u>Center</u> <u>Frequency, Hz</u>	<u>Insertion Loss</u>			
	<u>0 Flow</u>	<u>Flow 1</u>	<u>Flow 2</u>	<u>Flow 3</u>
		<u>1000</u>	<u>1500</u>	<u>2000</u>
63	3	3	5	5
125	1	2	2	2
250	4	4	5	6
500	16	16	16	16
1000	9	10	11	12
2000	9	10	10	11
4000	11	10	11	11
8000	10	10	10	10

<u>Octave Band</u> <u>Center</u> <u>Frequency, Hz</u>	<u>Generated Sound Power</u>		
	<u>Flow 1</u>	<u>Flow 2</u>	<u>Flow 3</u>
	<u>1000</u>	<u>1500</u>	<u>2000</u>
63	70 **	69 **	68 **
125	41 **	50 **	58 **
250	32 **	42 **	49 **
500	35 **	38 **	46 **
1000	29 **	33 **	42 **
2000	24 **	28 **	38 **
4000	20 **	22 **	33 **
8000	21 **	21 **	26 **

<u>1/3 Octave</u> <u>Band Center</u> <u>Frequency, Hz</u>	<u>Insertion Loss</u>			
	<u>Flow 1</u>	<u>Flow 2</u>	<u>Flow 3</u>	
	<u>1000</u>	<u>1500</u>	<u>2000</u>	
50	9	10	11	10
63	2	3	4	5
80	1	2	2	2
100	1	1	1	1
125	1	1	2	2
160	2	2	3	3
200	2	3	3	4
250	4	4	5	6
315	7	7	8	9
400	12	13	13	13
500	24	24	25	23
630	17	17	18	19
800	11	11	12	14
1000	9	9	10	12
1250	9	9	10	11
1600	8	9	9	10
2000	10	10	11	11
2500	10	10	11	12
3150	11	10	10	11
4000	10	10	10	11
5000	11	11	11	12
6300	11	11	11	11
8000	9	9	9	10
10000	9	9	9	9

<u>1/3 Octave</u> <u>Band Center</u> <u>Frequency, Hz</u>	<u>Generated Sound Power</u>		
	<u>Flow 1</u>	<u>Flow 2</u>	<u>Flow 3</u>
	<u>1000</u>	<u>1500</u>	<u>2000</u>
50	70 **	69 **	66 **
63	49 **	53 **	64 **
80	53 **	49 **	52 **
100	39 **	47 **	56 **
125	37 **	46 **	51 **
160	30 **	41 **	48 **
200	28 **	38 **	46 **
250	28 **	37 **	44 **
315	26 **	35 **	43 **
400	28 **	34 **	43 **
500	31 **	34 **	41 **
630	31 **	32 **	40 **
800	26 **	29 **	38 **
1000	22 **	29 **	38 **
1250	23 **	27 **	36 **
1600	23 **	25 **	35 **
2000	16 **	22 **	33 **
2500	17 **	20 **	31 **
3150	16 **	18 **	30 **
4000	13 **	16 **	28 **
5000	16 **	16 **	26 **
6300	15 **	15 **	23 **
8000	16 **	16 **	20 **
10000	18 **	18 **	19 **

<u>Flow</u>	<u>FPM</u>	<u>Static Pressure</u>	
1	1000	0.02	iwg
2	1500	0.04	iwg
3	2000	0.06	iwg

Sound power levels are in dB referenced 10-12 Watts.
The Insertion Loss (IL) is in dB.
The Face Velocity is in fpm.

EQUIPMENT LIST

REPORT NO. 105445069CRT-002

#	Equipment	Model No	Control No.	Last Cal	Cal Due
1	Microphone/Pre - DF	4942	E550	5/1/2023	5/1/2024
2	Pulse Analyzer	7539	E446	5/1/2023	5/1/2024
3	Reference Sound Source	4204	A230	11/21/2021	11/21/2024
4	Manometer Incline	424-5	F166	3/8/2023	3/8/2024
5	Manometer Incline	424-5	F167	3/8/2023	3/8/2024
6	Microphone Calibrator	4231	A227	5/1/2023	5/1/2024
7	Rotating Microphone Boom	3923	N/A	N/A	N/A
8	Windscreen	UA0237	N/A	N/A	N/A
9					
10					
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18					
19					
20					

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Aeroflex USA

TEST REPORT

SCOPE OF WORK

DUCT INSULATION INSERTION LOSS AND AIRFLOW GENERATED SOUND TESTS

The test specimen was selected and supplied by the client and received at the acoustical lab on May 31, 2023.
The unit appeared to be in good, new condition upon arrival.

MODEL NUMBER

AEROFLEX Breathe-EZ™ Duct Insulation (2" thick)

PROJECT NUMBER

G105445069

REPORT NUMBER

105445069CRT-003

ISSUE DATE

June 12, 2023

REVISED DATE

N/A

TEST DATE

June 9, 2023

DOCUMENT CONTROL NUMBER

DIFF.PKT.2022

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REPORT NUMBER
105445069CRT-003

MODEL NUMBER(s)
AEROFLEX Breathe-EZ™ Duct Insulation (2" thick)

REPORT RENDERED TO:
Aeroflex USA
232 Industrial Park Road
Sweetwater, TN 37874
USA

AUTHORIZATION

The testing performed was authorized by signed quote number Qu-01353267-2.

TEST STANDARDS

ASTM Standard E477-20, entitled "Standard Test Method for Laboratory Measurements of Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers".

In Charge of Testing:



Gerald Gray
Associate Engineer
Acoustical Testing

Reviewer:



Brian Cyr
Engineer
Acoustical Testing

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SAMPLE INFORMATION

REPORT NO. 105445069CRT-003

ITEMS RECEIVED

Item No.	Control No.	Model No.	Description	Received
1	CRT2305311246-003	AEROFLEX Breathe-EZ™ (2")	Duct Insulation	May 31, 2023

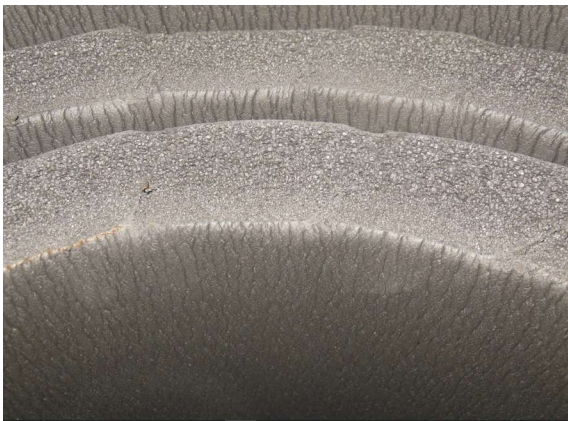
TEST CONDITIONS

Temperature (Deg.F):	74	Humidity (%RH):	36	Barometric Pressre (inHg):	28.56
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DESCRIPTION OF TEST SPECIMEN

The sample consisted of (4) 2 inch thick, 10 foot long, sections of duct insulation installed to create an interior duct size of 24 inches by 24 inches. The duct liner weighed 47 lbs.

SAMPLE PHOTOS



TEST INFORMATION

REPORT NO. 105445069CRT-003

TEST METHODS

The laboratory method used in conducting these tests is in accordance with ASTM Standard E477-20, entitled "Standard Test Method for Laboratory Measurements of Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers".

Sound pressure level data was obtained using a Bruel and Kjaer Pulse Analyzer. The reference sound source used to obtain the generated sound power level was a calibrated Bruel & Kjaer Type 4204, which conforms to the above standard. The Intertek 16,640 cu. ft. (470 cubic meters) reverberation room is qualified in accordance with ANSI S12.51/ISO 3741 for sound measurement from 50 to 10,000 hertz.

The following notes relate to the data submitted in the data pages.

Note: Sound power level data denoted with a double asterisk 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. The generated sound data has been corrected for end reflection.

Note: Sound Power Level data denoted with a single asterisk is near ambient levels and is being corrected.

Note: Insertion loss data denoted with a (>) sign has been corrected to take into consideration the effect of the generated sound pressure level approaching the sound pressure level obtained during the insertion loss portion of the test. In some cases, the insertion loss may be higher than shown.

Note: Insertion loss data denoted with a (>>) sign has reached limitation of the test method, the insertion loss may be higher than shown.

PRECISION AND BIAS

The precision of this test method has been evaluated through round robin testing from 2015 through 2017 with 5 different participating laboratories. The tests were conducted using the 2013 version of the standard. Two different silencer designs were evaluated in the round robin tests.

Because there were not enough participating laboratories to establish repeatability and reproducibility statistics for this round robin. The precision statement is limited to the repeatability standard deviation and reproducibility standard deviation statistics of the measured insertion loss, generated noise and pressure drop for the two tested silencers (Reference Tables 1 – 6 of the test standard). There is no known bias in ASTM E477.

NOTE ABOUT PROGRAM

The results contained herein are for technical evaluation only and are applicable only to the specific specimens referenced herein.

The tests herein reported have not been performed at the request of AMCA International and is not part of the AMCA International Certification Program



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3933 US RT 11
Cortland, NY 13045
Telephone: (607) 753-6711
www.intertek.com

RESULTS OF TESTS - FORWARD FLOW

REPORT NO. 105445069CRT-003

Octave Band Center Frequency, Hz	<u>Insertion Loss</u>				
	<u>0 Flow</u>	<u>Flow 1</u>	<u>Flow 2</u>	<u>Flow 3</u>	<u>Flow 4</u>
		<u>1000</u>	<u>1500</u>	<u>2000</u>	<u>2500</u>
63	5	4	4	3	4
125	1	1	1	1	1
250	3	3	3	3	3
500	13	13	13	13	13
1000	10	10	10	9	9
2000	11	11	11	11	11
4000	11	11	11	11	11
8000	9	9	9	8	8

Octave Band Center Frequency, Hz	<u>Generated Sound Power</u>			
	<u>Flow 1</u>	<u>Flow 2</u>	<u>Flow 3</u>	<u>Flow 4</u>
	<u>1000</u>	<u>1500</u>	<u>2000</u>	<u>2500</u>
63	65 **	65 **	69 **	74 **
125	45 **	56 **	62 **	68 **
250	36 **	46 **	55 **	62 **
500	25 **	35 **	44 **	53 **
1000	22 **	33 **	42 **	48 **
2000	18 **	27 **	37 **	43 **
4000	17 **	20 **	32 **	39 **
8000	21 **	21 **	24 **	32 **

1/3 Octave Band Center Frequency, Hz	<u>Flow</u>				
	<u>Flow 1</u>	<u>Flow 2</u>	<u>Flow 3</u>	<u>Flow 4</u>	
	<u>1000</u>	<u>1500</u>	<u>2000</u>	<u>2500</u>	
50	4	3	1	2	
63	12	11	11	10	
80	3	3	3	3	
100	1	1	0	0	
125	1	1	1	0	
160	2	2	2	2	
200	2	2	2	2	
250	3	3	3	3	
315	6	6	6	5	
400	10	10	9	9	
500	19	19	19	19	
630	15	15	14	14	
800	10	9	9	9	
1000	10	10	9	10	
1250	9	9	9	10	
1600	9	10	10	10	
2000	13	13	12	12	
2500	12	12	12	12	
3150	12	12	12	12	
4000	10	10	10	10	
5000	11	11	11	11	
6300	10	10	10	9	
8000	9	9	9	8	
10000	9	8	8	7	

1/3 Octave Band Center Frequency, Hz	<u>Flow</u>			
	<u>Flow 1</u>	<u>Flow 2</u>	<u>Flow 3</u>	<u>Flow 4</u>
	<u>1000</u>	<u>1500</u>	<u>2000</u>	<u>2500</u>
50	65 **	65 **	68 *	73 **
63	52 **	53 **	61 **	68 **
80	48 **	49 **	52 **	58 **
100	42 **	52 **	58 **	63 **
125	39 **	51 **	58 **	62 **
160	39 **	49 **	57 **	64 **
200	34 **	45 **	52 **	58 **
250	30 **	41 **	49 **	54 **
315	26 **	35 **	48 **	58 **
400	23 **	32 **	41 **	52 **
500	18 **	29 **	39 **	44 **
630	17 **	29 **	38 **	44 **
800	20 **	28 **	38 **	44 **
1000	16 **	29 **	38 **	44 **
1250	15 **	26 **	36 **	42 **
1600	13 **	24 **	34 **	40 **
2000	13 **	21 **	31 **	37 **
2500	12 **	20 **	31 **	37 **
3150	12 **	17 **	29 **	35 **
4000	12 **	14 **	26 **	34 **
5000	13 **	14 **	24 **	32 **
6300	15 **	15 **	21 **	30 **
8000	16 **	16 **	18 **	27 **
10000	18 **	18 **	19 **	25 **

<u>Flow</u>	<u>FPM</u>	<u>Static Pressure</u>	
1	1000	0.02	iwg
2	1500	0.04	iwg
3	2000	0.06	iwg
4	2500	0.08	iwg

Sound power levels are in dB referenced 10-12 Watts.
The Insertion Loss (IL) is in dB.
The Face Velocity is in fpm.

RESULTS OF TESTS - REVERSE FLOW

REPORT NO. 105445069CRT-003

<u>Octave Band</u> <u>Center</u> <u>Frequency, Hz</u>	<u>Insertion Loss</u>			
	<u>0 Flow</u>	<u>Flow 1</u>	<u>Flow 2</u>	<u>Flow 3</u>
		<u>1000</u>	<u>1500</u>	<u>2000</u>
63	5	5	5	6
125	1	2	2	2
250	3	4	4	5
500	13	14	14	14
1000	10	10	10	11
2000	11	11	11	12
4000	11	11	10	11
8000	9	9	8	8

<u>Octave Band</u> <u>Center</u> <u>Frequency, Hz</u>	<u>Generated Sound Power</u>		
	<u>Flow 1</u>	<u>Flow 2</u>	<u>Flow 3</u>
	<u>1000</u>	<u>1500</u>	<u>2000</u>
63	70 **	69 **	71 **
125	40 **	52 **	59 **
250	30 **	42 **	52 **
500	23 **	39 **	47 **
1000	21 **	35 **	44 **
2000	16 **	30 **	40 **
4000	17 **	23 **	36 **
8000	21 **	21 **	29 **

<u>1/3 Octave</u> <u>Band Center</u> <u>Frequency, Hz</u>	<u>Flow 1</u>			<u>Flow 2</u>			<u>Flow 3</u>		
	<u>1000</u>	<u>1500</u>	<u>2000</u>	<u>1000</u>	<u>1500</u>	<u>2000</u>	<u>1000</u>	<u>1500</u>	<u>2000</u>
50	3	4	5	6	6	7	7	7	7
63	12	12	13	14	13	14	14	14	14
80	3	4	3	4	3	4	3	4	4
100	1	2	1	1	1	1	1	1	1
125	1	1	1	1	1	1	1	1	1
160	2	2	3	2	2	3	2	3	2
200	2	2	3	3	2	3	3	3	3
250	3	3	4	5	3	4	5	4	5
315	6	6	7	7	6	7	7	6	7
400	10	10	11	11	10	11	11	10	11
500	20	20	20	18	20	20	18	20	18
630	15	16	16	17	15	16	17	15	17
800	10	10	10	12	10	10	12	10	12
1000	10	10	10	11	10	10	11	10	11
1250	9	10	10	11	9	10	11	9	11
1600	9	9	10	10	9	10	10	9	10
2000	13	13	13	14	13	13	14	13	14
2500	11	11	11	12	11	11	12	11	12
3150	12	11	11	11	12	11	11	12	11
4000	10	10	10	10	10	10	10	10	10
5000	11	11	10	10	11	10	10	11	10
6300	10	10	10	9	10	10	9	10	9
8000	9	9	8	8	9	8	8	9	8
10000	8	9	8	8	8	8	8	9	8

<u>1/3 Octave</u> <u>Band Center</u> <u>Frequency, Hz</u>	<u>Flow 1</u>			<u>Flow 2</u>			<u>Flow 3</u>		
	<u>1000</u>	<u>1500</u>	<u>2000</u>	<u>1000</u>	<u>1500</u>	<u>2000</u>	<u>1000</u>	<u>1500</u>	<u>2000</u>
50	70 **	69 **	69 *	70 **	69 **	69 *	70 **	69 **	69 *
63	55 **	57 **	67 *	55 **	57 **	67 *	55 **	57 **	67 *
80	53 **	50 **	56 **	53 **	50 **	56 **	53 **	50 **	56 **
100	39 **	50 **	57 **	39 **	50 **	57 **	39 **	50 **	57 **
125	35 **	46 **	54 **	35 **	46 **	54 **	35 **	46 **	54 **
160	27 **	43 **	50 **	27 **	43 **	50 **	27 **	43 **	50 **
200	26 **	39 **	49 **	26 **	39 **	49 **	26 **	39 **	49 **
250	24 **	37 **	45 **	24 **	37 **	45 **	24 **	37 **	45 **
315	25 **	36 **	45 **	25 **	36 **	45 **	25 **	36 **	45 **
400	21 **	36 **	44 **	21 **	36 **	44 **	21 **	36 **	44 **
500	16 **	34 **	42 **	16 **	34 **	42 **	16 **	34 **	42 **
630	15 **	33 **	41 **	15 **	33 **	41 **	15 **	33 **	41 **
800	20 **	31 **	40 **	20 **	31 **	40 **	20 **	31 **	40 **
1000	13 **	30 **	39 **	13 **	30 **	39 **	13 **	30 **	39 **
1250	12 **	28 **	38 **	12 **	28 **	38 **	12 **	28 **	38 **
1600	12 **	27 **	36 **	12 **	27 **	36 **	12 **	27 **	36 **
2000	12 **	24 **	35 **	12 **	24 **	35 **	12 **	24 **	35 **
2500	11 **	22 **	34 **	11 **	22 **	34 **	11 **	22 **	34 **
3150	11 **	20 **	32 **	11 **	20 **	32 **	11 **	20 **	32 **
4000	12 **	18 **	31 **	12 **	18 **	31 **	12 **	18 **	31 **
5000	13 **	15 **	29 **	13 **	15 **	29 **	13 **	15 **	29 **
6300	15 **	15 **	27 **	15 **	15 **	27 **	15 **	15 **	27 **
8000	16 **	16 **	24 **	16 **	16 **	24 **	16 **	16 **	24 **
10000	18 **	18 **	20 **	18 **	18 **	20 **	18 **	18 **	20 **

<u>Flow</u>	<u>FPM</u>	<u>Static Pressure</u>	
1	1000	0.02	iwg
2	1500	0.04	iwg
3	2000	0.06	iwg

Sound power levels are in dB referenced 10-12 Watts.
The Insertion Loss (IL) is in dB.
The Face Velocity is in fpm.

EQUIPMENT LIST

REPORT NO. 105445069CRT-003

#	Equipment	Model No	Control No.	Last Cal	Cal Due
1	Microphone/Pre - DF	4942	E550	5/1/2023	5/1/2024
2	Pulse Analyzer	7539	E446	5/1/2023	5/1/2024
3	Reference Sound Source	4204	A230	11/21/2021	11/21/2024
4	Manometer Incline	424-5	F166	3/8/2023	3/8/2024
5	Manometer Incline	424-5	F167	3/8/2023	3/8/2024
6	Microphone Calibrator	4231	A227	5/1/2023	5/1/2024
7	Rotating Microphone Boom	3923	N/A	N/A	N/A
8	Windscreen	UA0237	N/A	N/A	N/A
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