AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL, INC.

International Headquarters
30 West University Drive
Arlington Heights, Illinois
60004-1893 USA

Phone: +1 847-394-0150
Fax: +1 847-253-0088
E-Mail: jparent@amca.org
Website: www.amca.org

Test No. 33024-S1

May 18, 2016

TO: Dae Ryun Ind Ltd
115 Wanjusandan 7-ro
Bongdong-eup, Wanju-gun, Jeon-Buk, CA REPUBLIC OF KOREA 55318

ATTN: Song Eun Jung
drair@daum.net

SUBJECT: CONTRACT TESTING
MODEL No. DR-AF #2DD

Attached are the test results of the subject model performed on March 23, 2016.

If you should have any questions concerning these data, please let us know.

Sincerely,
AIR MOVEMENT AND CONTROL
ASSOCIATION INTERNATIONAL, INC.

Josh Parent
Laboratory Manager

Attachment

Korea Testing Certification
82, Pyeongtaekhang-ro 156 beon-gil, Poseung-eup, Pyeongtaek-si, Gyeonggi-do, Korea

Test Number
33024-S1

Test Method per ANSI / AMCA Standard 300-14, Figure 2 Setup, Installation Type B

Test Information

Client:	Daeryun Ind. LTD
Test Purpose:	Contract Test
Date of Test:	2016-03-23
Personnel:	KTC_HONG
Witness(es):	None

Test Unit

Manufacturer:	Daeryun Ind. LTD
Type:	DWDI Centrifugal
Trade Name:	DR-AF Series
Model Number:	DR-AF #2DD
Nominal Size:	304 mm
Number of Blades:	20
Blade Setting:	-
Number of Stator Vanes:	-
Measured Impeller Diameter:	304 mm
Measured Inlet Area:	0.080 m²
Measured Outlet Area:	0.134 m²

Test Configuration

Setup:	ANSI / AMCA Standard 300-14, Figure 2 (Inlet Sound)
Installation Type:	B (Unducted Inlet, Ducted Outlet)

Comments

Pre-Test & Post-Test Background Sound Pressures, L_{pb} (dB)

	One-Third Octave band Center Frequency (50 Hz - 630 Hz)											
	50 Hz	63 Hz	80 Hz	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz
L_{pb_PRE}	49.4	48.9	47.2	43.3	40.7	40.0	40.0	36.4	34.3	34.4	31.3	25.1
L_{pb_POST}	50.5	47.3	47.6	42.8	40.1	39.2	40.9	36.1	33.4	34.1	31.0	24.8
Difference	1.1	-1.6	0.4	-0.5	-0.6	-0.8	0.9	-0.3	-0.9	-0.3	-0.3	-0.3

	One-Third Octave band Center Frequency (800 Hz - 10 kHz)											
	800 Hz	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.5 kHz	3.15 kHz	4 kHz	5 kHz	6.3 kHz	8 kHz	10 kHz
L_{pb_PRE}	23.2	19.4	16.1	13.3	9.7	7.1	6.8	7.7	9.8	8.2	10.4	10.4
L_{pb_POST}	22.6	20.6	17.1	12.7	8.8	7.2	6.8	7.3	9.8	8.1	9.8	10.0
Difference	-0.6	1.2	1.0	-0.6	-0.9	0.1	0.0	-0.4	0.0	-0.1	-0.6	-0.4

Korea Testing Certification
82, Pyeongtaekhang-ro 156 beon-gil, Poseung-eup, Pyeongtaek-si, Gyeonggi-do, Korea

Test Number
33024-S1

Test Method per ANSI / AMCA Standard 300-14, Figure 2 Setup, Installation Type B

Reference Sound Source

One-Third Octave band Center Frequency (50 Hz - 630 Hz)

	50 Hz	63 Hz	80 Hz	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz
L_{pqm} (dB)	61.5	59.6	58.9	57.8	59.7	61.1	63.4	64.3	64.4	63.8	64.4	65.0
L_{pb} (dB)	49.4	48.9	47.2	43.3	40.7	40.0	40.0	36.4	34.3	34.4	31.3	25.1
L_{pqm} - L_{pb} (dB)	12.1	10.7	11.7	14.5	19.0	21.1	23.4	27.9	30.1	29.4	33.1	39.9
L_{pq} (dB)	61.2	59.2	58.6	57.6	59.6	61.1	63.4	64.3	64.4	63.8	64.4	65.0
L_{Wr} (dB)	78.8	79.8	78.3	80.2	78.9	79.5	80.1	80.0	79.9	80.1	80.3	80.9
L_{Wr} - L_{pq} (dB)	17.6	20.6	19.7	22.6	19.3	18.4	16.7	15.7	15.5	16.3	15.9	15.9
Background:	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good

One-Third Octave band Center Frequency (800 Hz - 10 kHz)

	800 Hz	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.5 kHz	3.15 kHz	4 kHz	5 kHz	6.3 kHz	8 kHz	10 kHz
L_{pqm} (dB)	66.6	67.4	68.4	68.3	67.8	65.3	63.8	62.4	60.2	57.9	54.4	51.5
L_{pb} (dB)	23.2	19.4	16.1	13.3	9.7	7.1	6.8	7.7	9.8	8.2	10.4	10.4
L_{pqm} - L_{pb} (dB)	43.4	48.0	52.3	55.0	58.1	58.2	57.0	54.7	50.4	49.7	44.0	41.1
L_{pq} (dB)	66.6	67.4	68.4	68.3	67.8	65.3	63.8	62.4	60.2	57.9	54.4	51.5
L_{Wr} (dB)	83.0	83.7	84.9	85.4	86.0	84.5	83.2	83.3	82.7	81.8	80.3	78.4
L_{Wr} - L_{pq} (dB)	16.4	16.3	16.5	17.1	18.2	19.2	19.4	20.9	22.5	23.9	25.9	26.9
Background:	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good

Korea Testing Certification
82, Pyeongtaekhang-ro 156 beon-gil, Poseung-eup, Pyeongtaek-si, Gyeonggi-do, Korea

Test Number
33024-S1

Test Method per ANSI / AMCA Standard 300-14, Figure 2 Setup, Installation Type B

Determination 1 - One-Third Octave Band Analysis

Fan Inlet Test Conditions:

p_b (kPa)	t_{d0} (°C)	t_{w0} (°C)	t_{d1} (°C)	P_{s1} (Pa)	ρ (kg/m³)	N (rpm)
102.28	11.7	7.9	11.7	149	1.25	1799

Test Conditions Converted to Standard Air:

P_s (Pa)	Q (m³/s)
143	0.903

One-Third Octave band Center Frequency (50 Hz - 630 Hz)

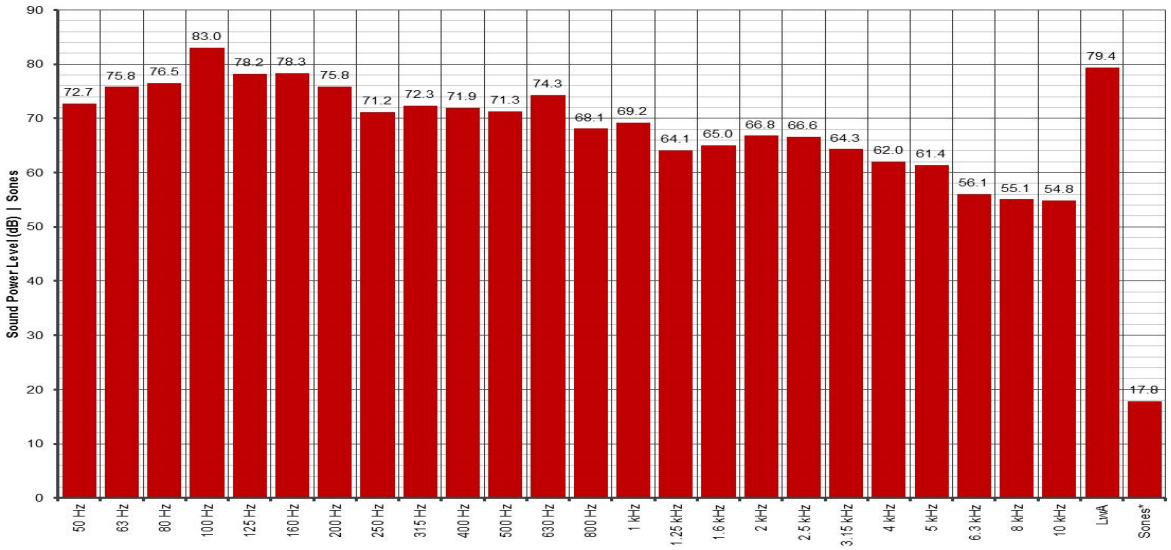
	50 Hz	63 Hz	80 Hz	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz
L_{pm} (dB)	56.3	55.8	57.0	60.5	59.0	59.9	59.1	55.5	56.8	55.6	55.4	58.4
L_{pb} (dB)	49.9	46.8	43.4	37.1	34.7	31.9	28.2	28.2	25.7	25.9	23.2	20.5
L_{pm} - L_{pb} (dB)	6.4	9.0	13.6	23.4	24.3	28.0	30.9	27.3	31.1	29.7	32.2	37.9
L_p (dB)	55.2	55.2	56.8	60.5	59.0	59.9	59.1	55.5	56.8	55.6	55.4	58.4
L_{Wr} - L_{pq} (dB)	17.6	20.6	19.7	22.6	19.3	18.4	16.7	15.7	15.5	16.3	15.9	15.9
E (dB)	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
L_{Wm} (dB)	**72.7**	**75.8**	**76.5**	**83.0**	**78.2**	**78.3**	**75.8**	**71.2**	**72.3**	**71.9**	**71.3**	**74.3**
Background:	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good
s	1.47	2.16	2.62	4.85	3.96	4.55	4.16	3.34	3.76	3.92	4.04	5.14

One-Third Octave band Center Frequency (800 Hz - 10 kHz)

	800 Hz	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.5 kHz	3.15 kHz	4 kHz	5 kHz	6.3 kHz	8 kHz	10 kHz
L_{pm} (dB)	51.7	52.9	47.6	47.9	48.6	47.4	44.9	41.1	38.9	32.2	29.2	28.0
L_{pb} (dB)	20.3	19.0	15.9	12.1	8.5	7.1	6.8	7.3	9.8	8.1	9.7	10.0
L_{pm} - L_{pb} (dB)	31.4	33.9	31.7	35.8	40.1	40.3	38.1	33.8	29.1	24.1	19.5	18.0
L_p (dB)	51.7	52.9	47.6	47.9	48.6	47.4	44.9	41.1	38.9	32.2	29.2	27.9
L_{Wr} - L_{pq} (dB)	16.4	16.3	16.5	17.1	18.2	19.2	19.4	20.9	22.5	23.9	25.9	26.9
E (dB)	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
L_{Wm} (dB)	**68.1**	**69.2**	**64.1**	**65.0**	**66.8**	**66.6**	**64.3**	**62.0**	**61.4**	**56.1**	**55.1**	**54.8**
Background:	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good
s	3.72	4.24	3.32	3.70	4.39	4.63	4.26	3.95	4.07	3.12	3.11	2.82

LwA	Sones*
79.4	**17.8**

Determination 1 Results



* Sone calculation based on a hemispherical free field at 1.524 m.

Korea Testing Certification
82, Pyeongtaekhang-ro 156 beon-gil, Poseung-eup, Pyeongtaek-si, Gyeonggi-do, Korea

Test Number
33024-S1

Test Method per ANSI / AMCA Standard 300-14, Figure 2 Setup, Installation Type B

Determination 2 - One-Third Octave Band Analysis

Fan Inlet Test Conditions:

p_b (kPa)	t_{d0} (°C)	t_{w0} (°C)	t_{d1} (°C)	P_{s1} (Pa)	ρ (kg/m³)	N (rpm)
102.28	11.7	7.9	11.7	197	1.25	1799

Test Conditions Converted to Standard Air:

P_s (Pa)	Q (m³/s)
190	0.833

One-Third Octave band Center Frequency (50 Hz - 630 Hz)

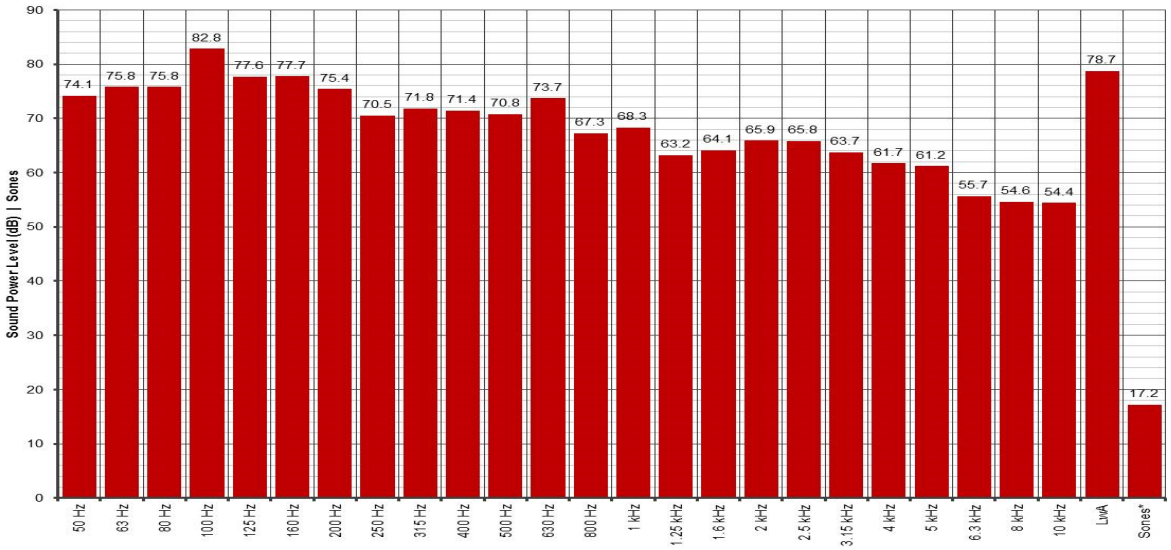
	50 Hz	63 Hz	80 Hz	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz
L_{pm} (dB)	57.4	55.8	56.3	60.3	58.4	59.3	58.7	54.8	56.3	55.1	54.9	57.8
L_{pb} (dB)	49.9	46.8	43.4	37.1	34.7	31.9	28.2	28.2	25.7	25.9	23.2	20.5
L_{pm} - L_{pb} (dB)	7.5	9.0	12.9	23.2	23.7	27.4	30.5	26.6	30.6	29.2	31.7	37.3
L_p (dB)	56.5	55.2	56.1	60.3	58.4	59.3	58.7	54.8	56.3	55.1	54.9	57.8
L_{Wr} - L_{pq} (dB)	17.6	20.6	19.7	22.6	19.3	18.4	16.7	15.7	15.5	16.3	15.9	15.9
E (dB)	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
L_{Wm} (dB)	**74.1**	**75.8**	**75.8**	**82.8**	**77.6**	**77.7**	**75.4**	**70.5**	**71.8**	**71.4**	**70.8**	**73.7**
Background:	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good
s	1.64	2.16	2.49	4.78	3.76	4.37	4.07	3.20	3.66	3.78	3.89	4.96

One-Third Octave band Center Frequency (800 Hz - 10 kHz)

	800 Hz	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.5 kHz	3.15 kHz	4 kHz	5 kHz	6.3 kHz	8 kHz	10 kHz
L_{pm} (dB)	50.9	52.0	46.7	47.0	47.7	46.6	44.3	40.8	38.7	31.8	28.8	27.6
L_{pb} (dB)	20.3	19.0	15.9	12.1	8.5	7.1	6.8	7.3	9.8	8.1	9.7	10.0
L_{pm} - L_{pb} (dB)	30.6	33.0	30.8	34.9	39.2	39.5	37.5	33.5	28.9	23.7	19.1	17.6
L_p (dB)	50.9	52.0	46.7	47.0	47.7	46.6	44.3	40.8	38.7	31.8	28.7	27.5
L_{Wr} - L_{pq} (dB)	16.4	16.3	16.5	17.1	18.2	19.2	19.4	20.9	22.5	23.9	25.9	26.9
E (dB)	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
L_{Wm} (dB)	**67.3**	**68.3**	**63.2**	**64.1**	**65.9**	**65.8**	**63.7**	**61.7**	**61.2**	**55.7**	**54.6**	**54.4**
Background:	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good
s	3.56	4.04	3.14	3.52	4.18	4.39	4.14	3.86	4.01	3.04	3.03	2.76

LwA	Sones*
78.7	**17.2**

Determination 2 Results



* Sone calculation based on a hemispherical free field at 1.524 m.

Korea Testing Certification
82, Pyeongtaekhang-ro 156 beon-gil, Poseung-eup, Pyeongtaek-si, Gyeonggi-do, Korea

Test Number
33024-S1

Test Method per ANSI / AMCA Standard 300-14, Figure 2 Setup, Installation Type B

Determination 3 - One-Third Octave Band Analysis

Fan Inlet Test Conditions:

p_b (kPa)	t_{d0} (°C)	t_{w0} (°C)	t_{d1} (°C)	P_{s1} (Pa)	ρ (kg/m³)	N (rpm)
102.28	11.7	7.9	11.7	227	1.25	1799

Test Conditions Converted to Standard Air:

P_s (Pa)	Q (m³/s)
218	0.793

One-Third Octave band Center Frequency (50 Hz - 630 Hz)

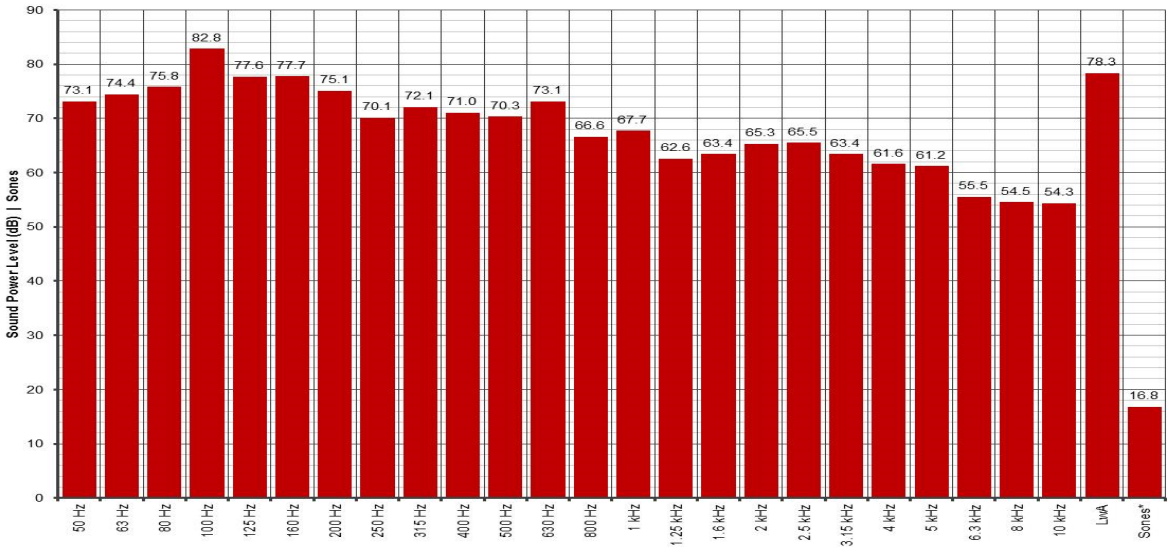
	50 Hz	63 Hz	80 Hz	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz
L_{pm} (dB)	56.6	54.6	56.3	60.3	58.4	59.3	58.4	54.4	56.6	54.7	54.4	57.2
L_{pb} (dB)	49.9	46.8	43.4	37.1	34.7	31.9	28.2	28.2	25.7	25.9	23.2	20.5
L_{pm} - L_{pb} (dB)	6.7	7.8	12.9	23.2	23.7	27.4	30.2	26.2	30.9	28.8	31.2	36.7
L_p (dB)	55.6	53.8	56.1	60.3	58.4	59.3	58.4	54.4	56.6	54.7	54.4	57.2
L_{Wr} - L_{pq} (dB)	17.6	20.6	19.7	22.6	19.3	18.4	16.7	15.7	15.5	16.3	15.9	15.9
E (dB)	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
L_{Wm} (dB)	**73.1**	**74.4**	**75.8**	**82.8**	**77.6**	**77.7**	**75.1**	**70.1**	**72.1**	**71.0**	**70.3**	**73.1**
Background:	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good
s	1.52	1.95	2.49	4.78	3.76	4.37	3.98	3.12	3.72	3.70	3.76	4.78

One-Third Octave band Center Frequency (800 Hz - 10 kHz)

	800 Hz	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.5 kHz	3.15 kHz	4 kHz	5 kHz	6.3 kHz	8 kHz	10 kHz
L_{pm} (dB)	50.2	51.4	46.1	46.3	47.1	46.3	44.0	40.7	38.7	31.6	28.7	27.5
L_{pb} (dB)	20.3	19.0	15.9	12.1	8.5	7.1	6.8	7.3	9.8	8.1	9.7	10.0
L_{pm} - L_{pb} (dB)	29.9	32.4	30.2	34.2	38.6	39.2	37.2	33.4	28.9	23.5	19.0	17.5
L_p (dB)	50.2	51.4	46.1	46.3	47.1	46.3	44.0	40.7	38.7	31.6	28.6	27.4
L_{Wr} - L_{pq} (dB)	16.4	16.3	16.5	17.1	18.2	19.2	19.4	20.9	22.5	23.9	25.9	26.9
E (dB)	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
L_{Wm} (dB)	**66.6**	**67.7**	**62.6**	**63.4**	**65.3**	**65.5**	**63.4**	**61.6**	**61.2**	**55.5**	**54.5**	**54.3**
Background:	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good
s	3.42	3.86	3.02	3.38	4.04	4.30	4.07	3.83	4.01	3.00	3.01	2.74

LwA	Sones*
78.3	**16.8**

Determination 3 Results



* Sone calculation based on a hemispherical free field at 1.524 m.

Korea Testing Certification
82, Pyeongtaekhang-ro 156 beon-gil, Poseung-eup, Pyeongtaek-si, Gyeonggi-do, Korea

Test Number
33024-S1

Test Method per ANSI / AMCA Standard 300-14, Figure 2 Setup, Installation Type B

Determination 4 - One-Third Octave Band Analysis

Fan Inlet Test Conditions:

p_b (kPa)	t_{d0} (°C)	t_{w0} (°C)	t_{d1} (°C)	P_{s1} (Pa)	ρ (kg/m³)	N (rpm)
102.28	11.7	7.9	11.7	316	1.25	1799

Test Conditions Converted to Standard Air:

P_s (Pa)	Q (m³/s)
304	0.673

One-Third Octave band Center Frequency (50 Hz - 630 Hz)

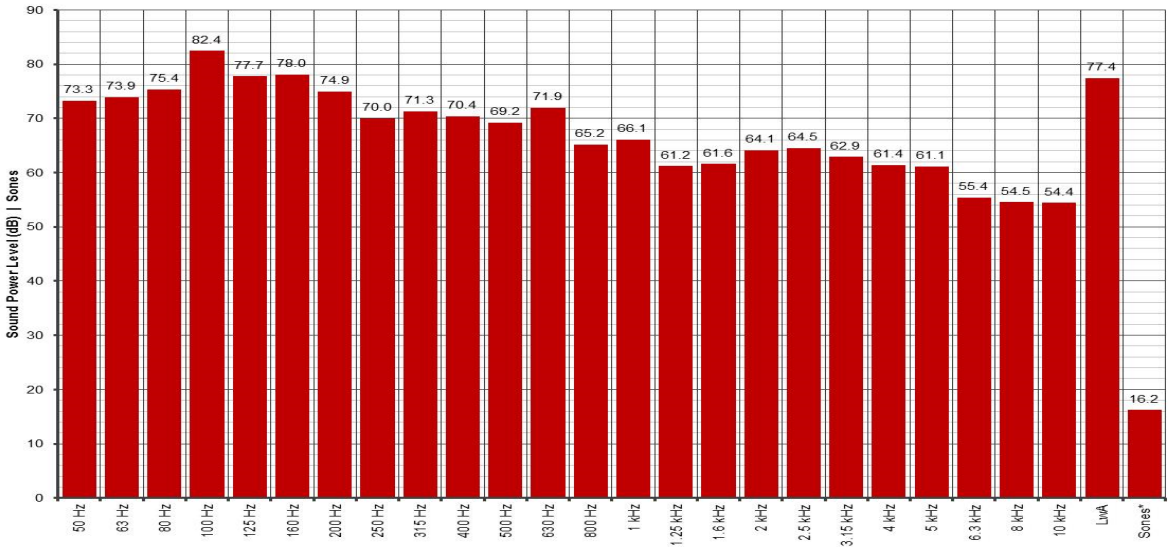
	50 Hz	63 Hz	80 Hz	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz
L_{pm} (dB)	56.7	54.2	55.9	59.9	58.5	59.6	58.2	54.3	55.8	54.1	53.3	56.0
L_{pb} (dB)	49.9	46.8	43.4	37.1	34.7	31.9	28.2	28.2	25.7	25.9	23.2	20.5
L_{pm} - L_{pb} (dB)	6.8	7.4	12.5	22.8	23.8	27.7	30.0	26.1	30.1	28.2	30.1	35.5
L_p (dB)	55.7	53.3	55.6	59.9	58.5	59.6	58.2	54.3	55.8	54.1	53.3	56.0
L_{Wr} - L_{pq} (dB)	17.6	20.6	19.7	22.6	19.3	18.4	16.7	15.7	15.5	16.3	15.9	15.9
E (dB)	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
L_{Wm} (dB)	**73.3**	**73.9**	**75.4**	**82.4**	**77.7**	**78.0**	**74.9**	**70.0**	**71.3**	**70.4**	**69.2**	**71.9**
Background:	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good
s	1.53	1.88	2.41	4.64	3.80	4.46	3.92	3.10	3.56	3.58	3.54	4.42

One-Third Octave band Center Frequency (800 Hz - 10 kHz)

	800 Hz	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.5 kHz	3.15 kHz	4 kHz	5 kHz	6.3 kHz	8 kHz	10 kHz
L_{pm} (dB)	48.8	49.8	44.7	44.5	45.9	45.3	43.5	40.5	38.6	31.5	28.7	27.6
L_{pb} (dB)	20.3	19.0	15.9	12.1	8.5	7.1	6.8	7.3	9.8	8.1	9.7	10.0
L_{pm} - L_{pb} (dB)	28.5	30.8	28.8	32.4	37.4	38.2	36.7	33.2	28.8	23.4	19.0	17.6
L_p (dB)	48.8	49.8	44.7	44.5	45.9	45.3	43.5	40.5	38.6	31.5	28.6	27.5
L_{Wr} - L_{pq} (dB)	16.4	16.3	16.5	17.1	18.2	19.2	19.4	20.9	22.5	23.9	25.9	26.9
E (dB)	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
L_{Wm} (dB)	**65.2**	**66.1**	**61.2**	**61.6**	**64.1**	**64.5**	**62.9**	**61.4**	**61.1**	**55.4**	**54.5**	**54.4**
Background:	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good
s	3.14	3.52	2.79	3.02	3.72	4.10	3.92	3.78	3.98	2.98	3.01	2.76

LwA	Sones*
77.4	**16.2**

Determination 4 Results



* Sone calculation based on a hemispherical free field at 1.524 m.

Korea Testing Certification
82, Pyeongtaekhang-ro 156 beon-gil, Poseung-eup, Pyeongtaek-si, Gyeonggi-do, Korea

Test Number
33024-S1

Test Method per ANSI / AMCA Standard 300-14, Figure 2 Setup, Installation Type B

Determination 5 - One-Third Octave Band Analysis

Fan Inlet Test Conditions:

p_b (kPa)	t_{d0} (°C)	t_{w0} (°C)	t_{d1} (°C)	P_{s1} (Pa)	ρ (kg/m³)	N (rpm)
102.28	11.7	7.9	11.7	378	1.25	1799

Test Conditions Converted to Standard Air:

P_s (Pa)	Q (m³/s)
363	0.573

One-Third Octave band Center Frequency (50 Hz - 630 Hz)

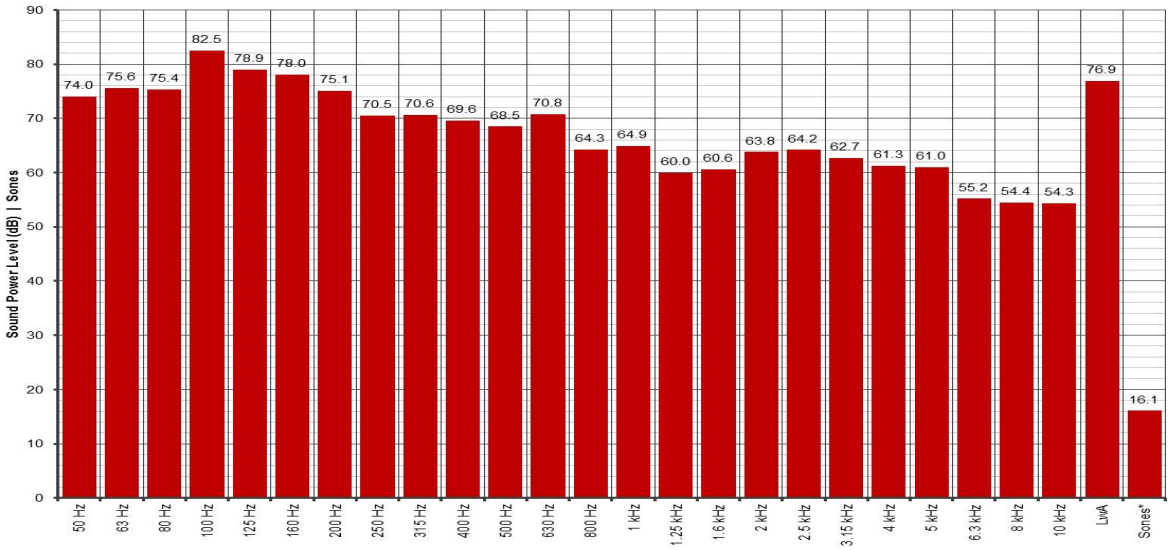
	50 Hz	63 Hz	80 Hz	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz
L_{pm} (dB)	57.3	55.6	55.9	60.0	59.7	59.6	58.4	54.8	55.1	53.3	52.6	54.9
L_{pb} (dB)	49.9	46.8	43.4	37.1	34.7	31.9	28.2	28.2	25.7	25.9	23.2	20.5
L_{pm} - L_{pb} (dB)	7.4	8.8	12.5	22.9	25.0	27.7	30.2	26.6	29.4	27.4	29.4	34.4
L_p (dB)	56.4	55.0	55.6	60.0	59.7	59.6	58.4	54.8	55.1	53.3	52.6	54.9
L_{Wr} - L_{pq} (dB)	17.6	20.6	19.7	22.6	19.3	18.4	16.7	15.7	15.5	16.3	15.9	15.9
E (dB)	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
L_{Wm} (dB)	**74.0**	**75.6**	**75.4**	**82.5**	**78.9**	**78.0**	**75.1**	**70.5**	**70.6**	**69.6**	**68.5**	**70.8**
Background:	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good
s	1.62	2.12	2.41	4.67	4.15	4.46	3.98	3.20	3.42	3.42	3.40	4.16

One-Third Octave band Center Frequency (800 Hz - 10 kHz)

	800 Hz	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.5 kHz	3.15 kHz	4 kHz	5 kHz	6.3 kHz	8 kHz	10 kHz
L_{pm} (dB)	47.9	48.6	43.5	43.5	45.6	45.0	43.3	40.4	38.5	31.3	28.6	27.5
L_{pb} (dB)	20.3	19.0	15.9	12.1	8.5	7.1	6.8	7.3	9.8	8.1	9.7	10.0
L_{pm} - L_{pb} (dB)	27.6	29.6	27.6	31.4	37.1	37.9	36.5	33.1	28.7	23.2	18.9	17.5
L_p (dB)	47.9	48.6	43.5	43.5	45.6	45.0	43.3	40.4	38.5	31.3	28.5	27.4
L_{Wr} - L_{pq} (dB)	16.4	16.3	16.5	17.1	18.2	19.2	19.4	20.9	22.5	23.9	25.9	26.9
E (dB)	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
L_{Wm} (dB)	**64.3**	**64.9**	**60.0**	**60.6**	**63.8**	**64.2**	**62.7**	**61.3**	**61.0**	**55.2**	**54.4**	**54.3**
Background:	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good
s	2.97	3.28	2.60	2.86	3.66	4.01	3.86	3.76	3.95	2.95	2.99	2.74

LwA	Sones*
76.9	**16.1**

Determination 5 Results



* Sone calculation based on a hemispherical free field at 1.524 m.

Korea Testing Certification
82, Pyeongtaekhang-ro 156 beon-gil, Poseung-eup, Pyeongtaek-si, Gyeonggi-do, Korea

Test Number
33024-S1

Test Method per ANSI / AMCA Standard 300-14, Figure 2 Setup, Installation Type B

Determination 6 - One-Third Octave Band Analysis

Fan Inlet Test Conditions:

p_b (kPa)	t_{d0} (°C)	t_{w0} (°C)	t_{d1} (°C)	P_{s1} (Pa)	ρ (kg/m³)	N (rpm)
102.28	11.7	7.9	11.7	443	1.25	1799

Test Conditions Converted to Standard Air:

P_s (Pa)	Q (m³/s)
426	0.453

One-Third Octave band Center Frequency (50 Hz - 630 Hz)

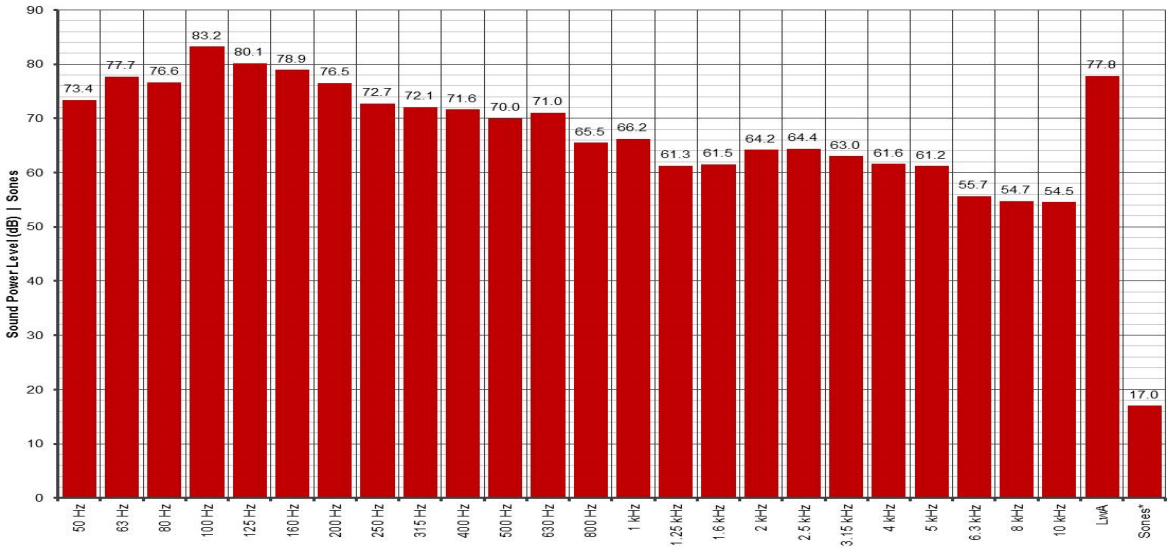
	50 Hz	63 Hz	80 Hz	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz
L_{pm} (dB)	56.8	57.5	57.1	60.7	60.9	60.5	59.8	57.0	56.6	55.3	54.1	55.1
L_{pb} (dB)	49.9	46.8	43.4	37.1	34.7	31.9	28.2	28.2	25.7	25.9	23.2	20.5
L_{pm} - L_{pb} (dB)	6.9	10.7	13.7	23.6	26.2	28.6	31.6	28.8	30.9	29.4	30.9	34.6
L_p (dB)	55.8	57.1	56.9	60.7	60.9	60.5	59.8	57.0	56.6	55.3	54.1	55.1
L_{Wr} - L_{pq} (dB)	17.6	20.6	19.7	22.6	19.3	18.4	16.7	15.7	15.5	16.3	15.9	15.9
E (dB)	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
L_{Wm} (dB)	**73.4**	**77.7**	**76.6**	**83.2**	**80.1**	**78.9**	**76.5**	**72.7**	**72.1**	**71.6**	**70.0**	**71.0**
Background:	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good
s	1.55	2.48	2.64	4.93	4.53	4.73	4.31	3.64	3.72	3.83	3.70	4.20

One-Third Octave band Center Frequency (800 Hz - 10 kHz)

	800 Hz	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.5 kHz	3.15 kHz	4 kHz	5 kHz	6.3 kHz	8 kHz	10 kHz
L_{pm} (dB)	49.1	49.9	44.8	44.4	46.0	45.2	43.6	40.7	38.7	31.8	28.9	27.7
L_{pb} (dB)	20.3	19.0	15.9	12.1	8.5	7.1	6.8	7.3	9.8	8.1	9.7	10.0
L_{pm} - L_{pb} (dB)	28.8	30.9	28.9	32.3	37.5	38.1	36.8	33.4	28.9	23.7	19.2	17.7
L_p (dB)	49.1	49.9	44.8	44.4	46.0	45.2	43.6	40.7	38.7	31.8	28.8	27.6
L_{Wr} - L_{pq} (dB)	16.4	16.3	16.5	17.1	18.2	19.2	19.4	20.9	22.5	23.9	25.9	26.9
E (dB)	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
L_{Wm} (dB)	**65.5**	**66.2**	**61.3**	**61.5**	**64.2**	**64.4**	**63.0**	**61.6**	**61.2**	**55.7**	**54.7**	**54.5**
Background:	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good
s	3.20	3.54	2.81	3.00	3.74	4.07	3.95	3.83	4.01	3.04	3.05	2.77

LwA	Sones*
77.8	**17.0**

Determination 6 Results



* Sone calculation based on a hemispherical free field at 1.524 m.

Korea Testing Certification
82, Pyeongtaekhang-ro 156 beon-gil, Poseung-eup, Pyeongtaek-si, Gyeonggi-do, Korea

Test Number
33024-S1

Test Method per ANSI / AMCA Standard 300-14, Figure 2 Setup, Installation Type B

Determination 1 - Full Octave Band Analysis

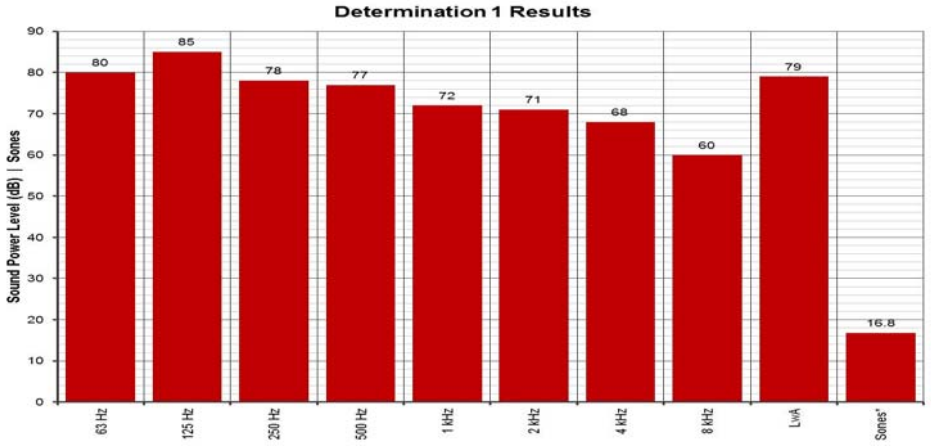
Fan Inlet Test Conditions:

p_b (kPa)	t_{d0} (°C)	t_{w0} (°C)	t_{d1} (°C)	P_{s1} (Pa)	ρ (kg/m³)	N (rpm)
102.28	11.7	7.9	11.7	149	1.25	1799

Test Conditions Converted to Standard Air:

P_s (Pa)	Q (m³/s)
143	0.903

	Full Octave band Center Frequency									
	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	L_{wA}	Sones*
L_{Wm} (dB)	**80**	**85**	**78**	**77**	**72**	**71**	**68**	**60**	**79**	
s	2.9	6.5	5.2	5.8	5.2	5.6	5.5	4.2		**16.8**



* Sone calculation based on a hemispherical free field at 1.524 m.

Determination 2 - Full Octave Band Analysis

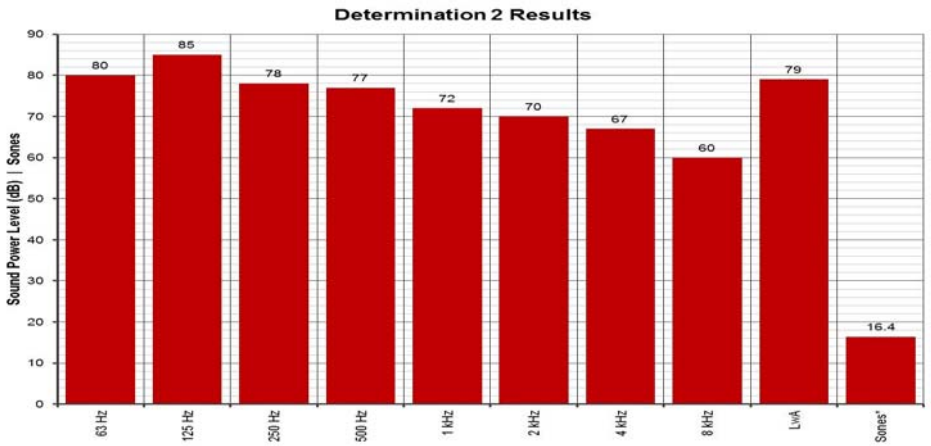
Fan Inlet Test Conditions:

p_b (kPa)	t_{d0} (°C)	t_{w0} (°C)	t_{d1} (°C)	P_{s1} (Pa)	ρ (kg/m³)	N (rpm)
102.28	11.7	7.9	11.7	197	1.25	1799

Test Conditions Converted to Standard Air:

P_s (Pa)	Q (m³/s)
190	0.833

	Full Octave band Center Frequency									
	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	L_{wA}	Sones*
L_{Wm} (dB)	**80**	**85**	**78**	**77**	**72**	**70**	**67**	**60**	**79**	
s	2.9	6.4	5.0	5.6	4.9	5.4	5.4	4.1		**16.4**



* Sone calculation based on a hemispherical free field at 1.524 m.

Korea Testing Certification
82, Pyeongtaekhang-ro 156 beon-gil, Poseung-eup, Pyeongtaek-si, Gyeonggi-do, Korea

Test Number
33024-S1

Test Method per ANSI / AMCA Standard 300-14, Figure 2 Setup, Installation Type B

Determination 3 - Full Octave Band Analysis

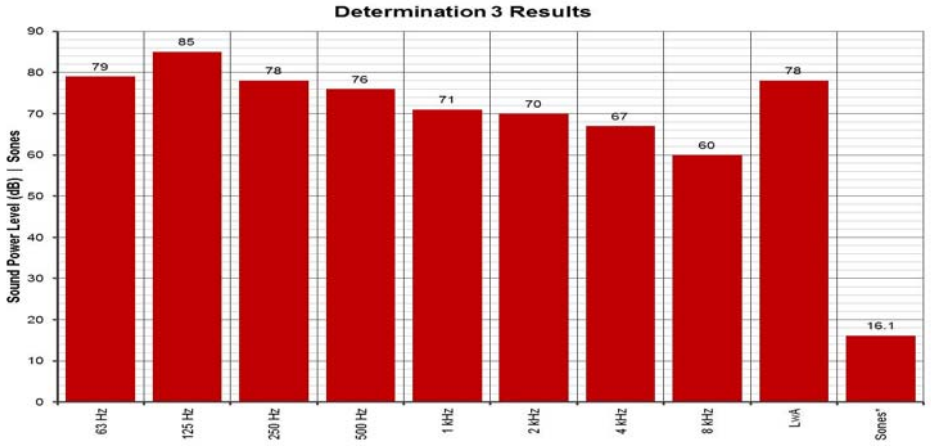
Fan Inlet Test Conditions:

p_b (kPa)	t_{d0} (°C)	t_{w0} (°C)	t_{d1} (°C)	P_{s1} (Pa)	ρ (kg/m³)	N (rpm)
102.28	11.7	7.9	11.7	227	1.25	1799

Test Conditions Converted to Standard Air:

P_s (Pa)	Q (m³/s)
218	0.793

	Full Octave band Center Frequency									
	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	L_{wA}	Sones*
L_{Wm} (dB)	**79**	**85**	**78**	**76**	**71**	**70**	**67**	**60**	**78**	
s	2.8	6.4	5.0	5.5	4.7	5.2	5.3	4.1		**16.1**



* Sone calculation based on a hemispherical free field at 1.524 m.

Determination 4 - Full Octave Band Analysis

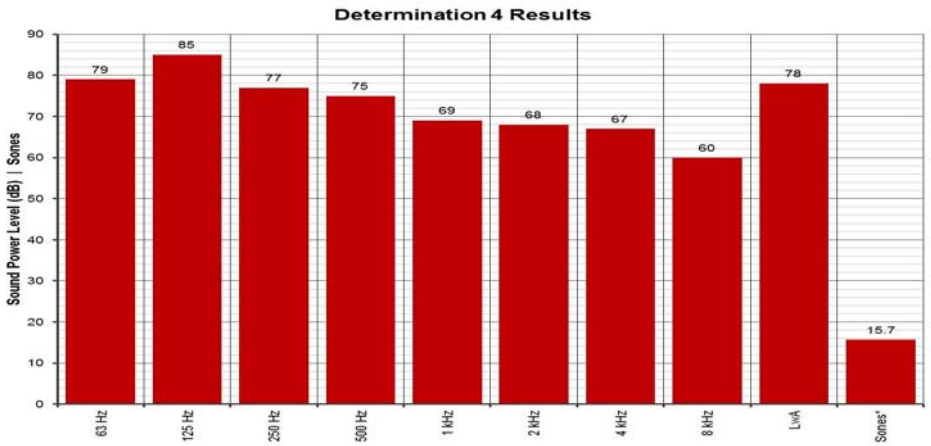
Fan Inlet Test Conditions:

p_b (kPa)	t_{d0} (°C)	t_{w0} (°C)	t_{d1} (°C)	P_{s1} (Pa)	ρ (kg/m³)	N (rpm)
102.28	11.7	7.9	11.7	316	1.25	1799

Test Conditions Converted to Standard Air:

P_s (Pa)	Q (m³/s)
304	0.673

	Full Octave band Center Frequency									
	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	L_{wA}	Sones*
L_{Wm} (dB)	**79**	**85**	**77**	**75**	**69**	**68**	**67**	**60**	**78**	
s	2.7	6.3	4.9	5.2	4.3	4.9	5.2	4.1		**15.7**



* Sone calculation based on a hemispherical free field at 1.524 m.

Korea Testing Certification
82, Pyeongtaekhang-ro 156 beon-gil, Poseung-eup, Pyeongtaek-si, Gyeonggi-do, Korea

Test Number
33024-S1

Test Method per ANSI / AMCA Standard 300-14, Figure 2 Setup, Installation Type B

Determination 5 - Full Octave Band Analysis

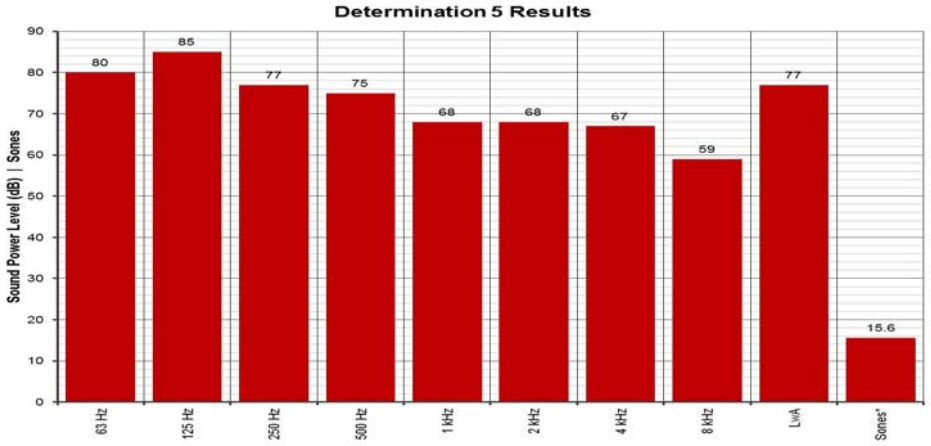
Fan Inlet Test Conditions:

p_b (kPa)	t_{d0} (°C)	t_{w0} (°C)	t_{d1} (°C)	P_{s1} (Pa)	ρ (kg/m³)	N (rpm)
102.28	11.7	7.9	11.7	378	1.25	1799

Test Conditions Converted to Standard Air:

P_s (Pa)	Q (m³/s)
363	0.573

	Full Octave band Center Frequency									
	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	L_{wA}	Sones*
L_{Wm} (dB)	**80**	**85**	**77**	**75**	**68**	**68**	**67**	**59**	**77**	
s	2.9	6.4	4.9	4.9	4.0	4.7	5.2	4.1		**15.6**



* Sone calculation based on a hemispherical free field at 1.524 m.

Determination 6 - Full Octave Band Analysis

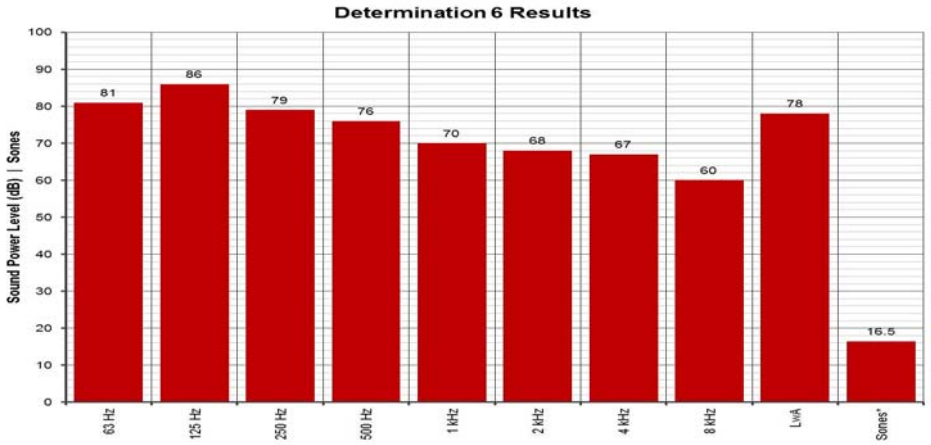
Fan Inlet Test Conditions:

p_b (kPa)	t_{d0} (°C)	t_{w0} (°C)	t_{d1} (°C)	P_{s1} (Pa)	ρ (kg/m³)	N (rpm)
102.28	11.7	7.9	11.7	443	1.25	1799

Test Conditions Converted to Standard Air:

P_s (Pa)	Q (m³/s)
426	0.453

	Full Octave band Center Frequency									
	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	L_{wA}	Sones*
L_{Wm} (dB)	**81**	**86**	**79**	**76**	**70**	**68**	**67**	**60**	**78**	
s	3.1	6.8	5.4	5.3	4.3	4.8	5.3	4.2		**16.5**



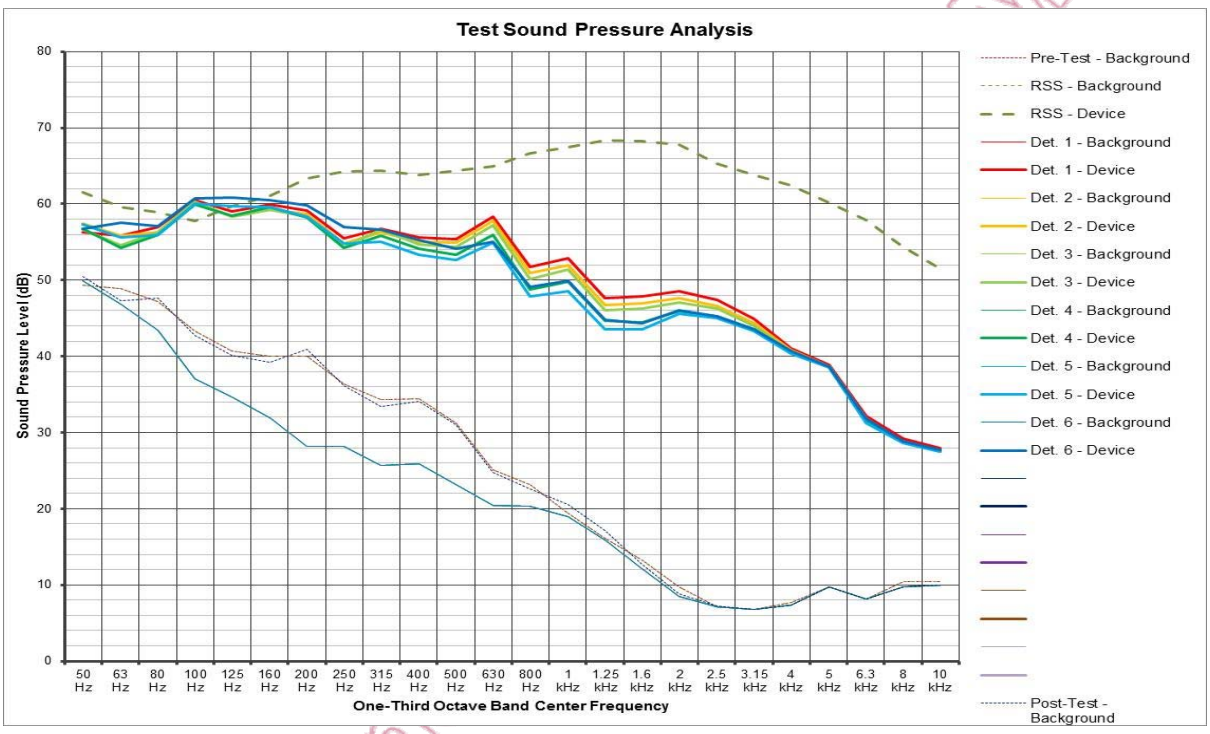
* Sone calculation based on a hemispherical free field at 1.524 m.

Korea Testing Certification
82, Pyeongtaekhang-ro 156 beon-gil, Poseung-eup, Pyeongtaek-si, Gyeonggi-do, Korea

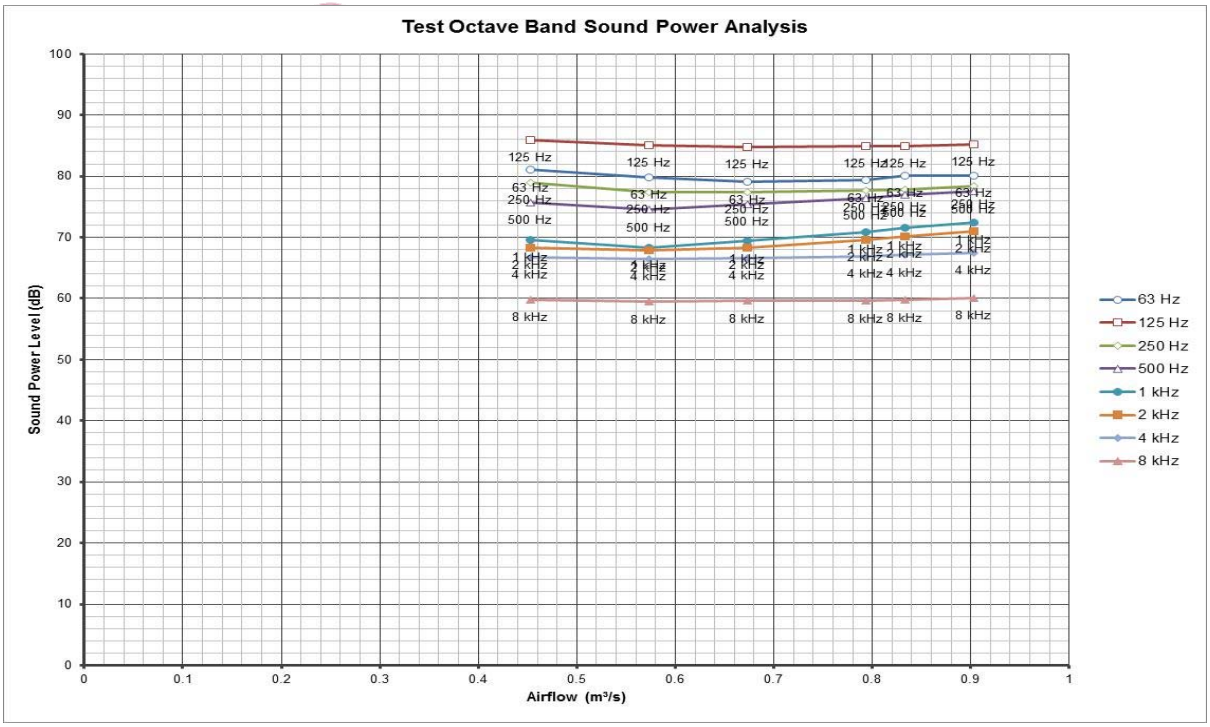
Test Number
33024-S1

Test Method per ANSI / AMCA Standard 300-14, Figure 2 Setup, Installation Type B

Test Sound Pressure Analysis



Test Octave Band Sound Power Analysis



Korea Testing Certification
82, Pyeongtaekhang-ro 156 beon-gil, Poseung-eup, Pyeongtaek-si, Gyeonggi-do, Korea

Test Number
33024-S1

Test Method per ANSI / AMCA Standard 300-14, Figure 2 Setup, Installation Type B

KTC INSTRUMENT LIST

Test Number: 33024-S1 Date: 23-Mar-16 Technician KTC_HONG

The following instrument, calibrated as applicable per the test standard were used for this test

Facility: KTC R 1240 Standard : AMCA 300-14 Figure : Figure 12

Pressure

Barometer

	Asset	Manufacturer	Model	Facility	Plane	Serial Number	Scale Range	Last Calibration	Next Calibration
■	3093-3	YOKOGAWA	UNE31-SHS2		0	6818BA030		2015-05-28	2016-05-28

Pressure Meter

	Asset	Manufacturer	Model	Facility	Plane	Serial Number	Scale Range	Last Calibration	Next Calibration
■	3093-33	YOKOGAWA	EJA110A	KTC R 1240	7	91G740641	-300-300 mmWg.	2015-05-28	2016-05-28
■	3093-34	YOKOGAWA	EJA110A	KTC R 1240	5	91G740640	0 - 300 mmWg.	2015-05-28	2016-05-28
□	3093-25	YOKOGAWA	EJA110A	KTC C 1260	7	91HC23940	-300 - 700 mmWg.	2015-05-28	2016-05-28
□	3093-26	YOKOGAWA	EJA110A	KTC C 1260	5	91J208748	0 - 300 mmWg.	2015-05-28	2016-05-28
□	3093-18	YOKOGAWA	EJA110A	KTC L 1560	8	91HA27332	-700 - 300 mmWg.	2015-05-28	2016-05-28
□	3093-19	YOKOGAWA	EJA110A	KTC L 1560	5	91J208747	0 - 300 mmWg.	2015-05-28	2016-05-28

Temperature

RTD

	Asset	Manufacturer	Model	Facility	Plane	Serial Number	Scale Range	Last Calibration	Next Calibration
■	3093-31	YAMARI	PT 100	KTC R 1240	5	1570329	-40-250 Celsius	2015-05-28	2016-05-28
□	3434-1	YAMARI	PT 100	KTC C 1260	5	1570318	-40-250 Celsius	2015-05-28	2016-05-28
□	3093-20	YAMARI	PT 100	KTC L 1560	2	1570328	-40-250 Celsius	2015-05-28	2016-05-28
□	3093-22	YAMARI	PT 100	KTC L 1560	8	646062	-40-250 Celsius	2015-05-28	2016-05-28
□	3093-27	YAMARI	PT 100	KTC L 1560	5	1570317	-40-250 Celsius	2015-05-28	2016-05-28
■	4375-1	YAMARI	PT 100	-	0	837680	-40-250 Celsius	2015-05-28	2016-05-28
■	4375-2	YAMARI	PT 100	-	0	837681	-40-250 Celsius	2015-05-28	2016-05-28

Torque

Torque

	Asset	Manufacturer	Model	Facility	Plane	Serial Number	Scale Range	Last Calibration	Next Calibration
□	3093-06	ONNOSOKKI	SS-201	-	-	2010359	0- 200 Nm	2016-03-01	2016-04-01
□	3093-09	ONNOSOKKI	SS-501	-	-	5010499	0 - 500 Nm	2016-03-01	2016-04-01
□	3093-12	ONNOSOKKI	SS-102	-	-	1020158	0- 1000 Nm	2016-03-01	2016-04-01
■	3336-01	ONNOSOKKI	SS-500	-	-	74302009	0 - 500 Nm	2016-03-01	2016-04-01
□	3338-01	ONNOSOKKI	SS-102	-	-	N/A	0 - 100 Nm	2016-03-01	2016-04-01

Torque Arm

	Asset	Manufacturer	Model	Facility	Plane	Serial Number	Scale Range	Last Calibration	Next Calibration
□	3421	KBR	N/A	-		N/A	-	2014-07-01	2016-07-01

Weights

	Asset	Manufacturer	Model	Facility	Plane	Serial Number	Scale Range	Last Calibration	Next Calibration
□	4835	SATORIUS	MSE70200S	-		32602042	0-70.2 kG	2015-03-06	2016-03-06

Power

	Asset	Manufacturer	Model	Facility	Plane	Serial Number	Scale Range	Last Calibration	Next Calibration
□	3387	HIOKI	3169-20	-		3890	-	2015-05-29	2016-05-29

Speed

Speed

	Asset	Manufacturer	Model	Facility	Plane	Serial Number	Scale Range	Last Calibration	Next Calibration
□	3093-07	ONNOSOKKI	MP-981	-	-	00303009	0-6000 r/min	2016-03-01	2016-04-01
□	3093-10	ONNOSOKKI	MP-981	-	-	00303101	0-6000 r/min	2016-03-01	2016-04-01
□	3093-13	ONNOSOKKI	MP-981	-	-	10304670	0-6000 r/min	2016-03-01	2016-04-01
■	3336-02	ONNOSOKKI	MP-981	-	-	N/A	0-6000 r/min	2016-03-01	2016-04-01
□	3308-02	ONNOSOKKI	MP-981	-	-	N/A	0-6000 r/min	2016-03-01	2016-04-01
□	3337	B&K	4912	-	-	Y0425N		2015-05-28	2016-05-28

Sound

Sound Pressure Level

	Asset	Manufacturer	Model	Facility	Plane	Serial Number	Scale Range	Last Calibration	Next Calibration
■	3218-3	B&K	4228	-	-	2484517	-	2015-08-17	2016-08-17
■	3218-5	B&K	4942	-	-	2518399	-	2015-08-22	2016-08-22

Sound Power level

	Asset	Manufacturer	Model	Facility	Plane	Serial Number	Scale Range	Last Calibration	Next Calibration
■	3218-1	B&K	4204	-	-	250111093	-	2013-01-31	2016-01-31