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25 October, 2017

Refer: 5703-3.1L

Attention: Mr John Brodie **Email: johnbrodie@airius.com.au**

AIRIUS Q SERIES THERMAL EQUALISER SOUND POWER LEVEL COMPARISONS

We are pleased to advise that we have reviewed the acoustical data for Airius Q Series Thermal Equaliser Models Q-50-EC-STD-100-130W and Q-50-P4-STD-120W.

1.0 AIRIUS FANS Q-50-P4, Q-50-EC

The Airius fans circulate air to evenly distribute air throughout a large space. The fans are designed to hang from the ceiling and distribute air from heights as follows:

- Q-50-EC – 5 to 16 metres
- Q-50-P4 – 5 to 16 metres

Tested noise data for the Airius Q-50 Thermal Equalisers have been provided by the manufacturer. The datasheets for the two fans are attached as Appendix A. The calculated sound power levels from linear third octave band sound pressure levels are tabulated as follows:

Table 1 Airius Fans

Fan	RPM	Sound Power Level (dBA)	Airflow L/s
Q-50-EC	413	36	-
Q-50-EC	825	55	-
Q-50-EC	1238	68	-
Q-50-EC	1650	73	637
Q-50-P4	800	57	-
Q-50-P4	1065	62	-
Q-50-P4	1420	70	500

2.0 AUSTRALIAN STANDARD AS2107:2016

2.1 Recommended Internal Noise Levels

Australian Standard AS 2107:2016 *Recommended design sound levels and reverberation times for building interiors* recommend the following internal noise levels for theatres and museums:

Table 2 Recommended Internal Noise Levels

Type of occupancy/activity	Recommended design sound level, L_{Aeq}, dB(A)	
	Satisfactory	Maximum
Public Buildings–		
Art galleries	40	45
Auditoria		
Cabarets and theatre restaurants	35	40
Concert and recital halls	30	35
Drama theatres	25	30
Exhibition areas	40	50
Museums (exhibition spaces)	40	45
Theatres for operetta and musical plays	35	40

2.2 Sound Pressure Levels of Fans – Acoustically Live Room

Given the sound power levels in Table 1 above, the following sound pressure levels are calculated at distances outlined in Table 3 below.

The following calculated noise levels are for a 2000 m^3 room volume with typically hard surface finishes and no soft furnishings to create an acoustically live room.

Table 3 Sound Pressure Level of Fans – Acoustically Live Room

Fan	Sound Pressure Level from Discharge (dBA)			
	5 metres	8 metres	10 metres	16 metres
Q-50-EC				
413 RPM	25	24	24	24
825 RPM	44	43	43	43
1238 RPM	57	56	56	56
1650 RPM	62	61	61	61
Q-50-P4				
800 RPM	46	45	45	45
1065 RPM	51	50	50	50
1420 RPM	59	58	58	58

The above calculated sound pressure levels appear to be suitable for use in museums (40 – 45 dBA) and theatres (35 – 40 dBA) for speeds of 800 RPM or less, when compared against the recommended internal noise levels outlined in Australian Standard AS2107:2016, provided a suitable distance from the fan is maintained.

We recommend that the installation of the fans be assessed on a case by case basis as the acoustic environment and installation may change depending on the use of the space.

2.3 Sound Pressure Levels of Fans – Acoustically Dead Room

Given the sound power levels in Table 1 above, the following sound pressure levels are calculated at distances outlined in Table 4 below.

The following calculated noise levels are for a 2000 m^3 room volume with typically carpet flooring and plenty of soft furnishings to create an acoustically dead room.

Table 4 Sound Pressure Level of Fans – Acoustically Dead Room

Fan	Sound Pressure Level from Discharge (dBA)			
	5 metres	8 metres	10 metres	16 metres
Q-50-EC				
413 RPM	19	17	15	14
825 RPM	38	36	34	33
1238 RPM	51	49	47	46
1650 RPM	56	54	52	51
Q-50-P4				
800 RPM	40	38	36	35
1065 RPM	45	43	41	40
1420 RPM	53	51	49	48

The above calculated sound pressure levels appear to be suitable for use in museums (40 – 45 dBA) and theatres (35 – 40 dBA) for speeds of 800 RPM or less, when compared against the recommended internal noise levels outlined in Australian Standard AS2107:2016, provided a suitable distance from the fan is maintained.

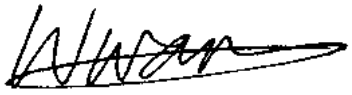
We recommend that the installation of the fans be assessed on a case by case basis as the acoustic environment and installation may change depending on the use of the space.

3.0 CONCLUSION

Day Design was engaged to assess the sound power levels of the Q-50 fans from Airius.

The sound pressure levels of the Q-50 Airius fans have been determined at various distances for comparison against Australian Standard 2107:2016 *Recommended design sound levels and reverberation times for building interiors* to determine suitability.

We recommend that the installation of the fans be assessed on a case by case basis as the acoustic environment may change depending on the use of the space.



William Wang, BE (Mechatronics), MIEAust, MAAS
Senior Acoustical Engineer
for and on behalf of Day Design Pty Ltd

AAAC MEMBERSHIP

Day Design Pty Ltd is a member company of the Association of Australian Acoustical Consultants, and the work herein reported has been performed in accordance with the terms of membership.

The undersigned hereby certifies that this Report has been checked and approved in accordance with our Quality Management System.

Date: 25/10/17

Attachments:

- Appendix A – Airius Fans Q-50-EC, Q-50-P4 Datasheets
- Appendix B – Airius Test Data – Q-50-EC
- Appendix C – Airius Test Data – Q-50-P4

saving you energy

Airius Model Q50 EC Motor Product Information Sheet

Q50 -230V-EC

MODEL Q50 DIMENSIONS

(Free hanging units can be angled up to 90° off vertical)

For horizontal installations Airius recommend the use of the Airius proprietary cradle or a second cable or rod attachment to the discharge end to provide balance

MODEL Q50 PROPERTIES

UNIT SIZE

	Standard
Weight:	7.45 kgs
Height to Rim:	435 mm
Total Height:	550 mm
Diameter:	364 mm

MOTOR

	230V
Watts* (MAX) @ 50 htz:	110
RPM* (MAX) @ 50 htz:	1710
L/S* @ 50 htz (m3/hr):	637 (2,294)
AMPS* @ 50 htz:	.07

*Motor data provided by motor manufacturer and is subject to change at anytime

COVERAGE

- Floor area = 115m²
- Diameter = 12m
- Ceiling Height = 15m

MOTOR

- Single Phase
- 1710 RPM @ 50htz
- EC - Electricity Commutated, 92% efficient motor
- All model Q50 EC motors are sourced from EBM PAPST

OPERATING TEMPERATURES

- Min start temp (approx.) = - 25° C
- Maximum ambient temp = 60° C
- Ambient temperature maximum = 60° C
- Overtemperature protected electronics/motor

NOISE LEVELS

- Sound Power Level 71 dB (A)
- Sound Pressure Level @ 8 mts = 43 dB
- Sound Pressure Level @ 12 mts = 41 dB

Please contact Airius for full Noise Testing Report

INGRESS PROTECTION

- Rated IP44

COLOUR

- Off white as standard
- Can be tailor painted to your colour specifications

ACCESSORIES & OPTIONS

- Airius speed control - Potentiometer to alter 0-10VDC control (EC)
- Building management systems can vary speed of EC based on a 0-10VDC

WARRANTY

- 5 years full manufacturers replacement from date of despatch. Subsequent 5 year 'half new price' rebuild cover

STANDARDS

Product conforming to standards:
EN 60335-1, EN 61800-5-1, EN 60950-1, CE

saving you energy

Airius Model Q50 EC Motor Product Information Sheet

Q50 -230V-EC

MODEL Q50 PLACEMENT

PREPARATION

- *Install electrical circuit(s) and outlet(s) in accordance with national and local electric codes*
- *Outlets should generally be mounted vertically unless a "twist/locking" type is being used*
- *Wall switch may be installed in circuit to disable power and prevent electrical hazards when servicing*
- *Confirm electrical continuity of Airius unit on the ground before permanently mounting in the ceiling*

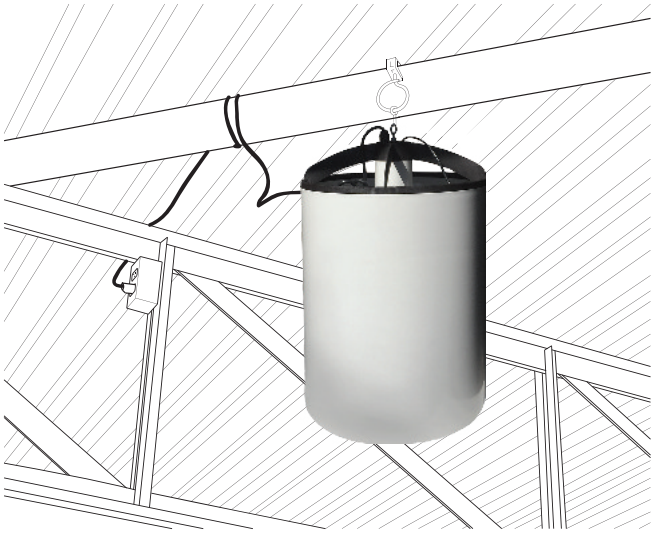
INSTALLATION

- *Hang vertically as high in the ceiling as possible Typically 300 – 450 mm from the roof deck to intake*
- *The Airius unit performs best when air column from the nozzle is unimpeded to the floor*
- *Use professionally installed hardware, capable of supporting a minimum of five times the weight*
- *Hardware to hang the unit includes but is not restricted to: Hooks, chains, cables, carabiners, bridle rings, beam clamps and bolts*
- *Density of the placement is directly related to the effectiveness, performance and savings*
- *Mount out of reach from people and animals*
- *Floor plans, mezzanines, office locations, machinery, people placement, plumbing, lighting, duct work, electrical systems, natural light/air systems, cranes, doors, windows, ventilation and fire suppression systems are all factors in properly locating the Airius system within the ceiling*

NOTE:- *Air Pears must not be installed directly to structure if they are to be angled.In this case a small length of cable or wire must be used between the handle and the structure to reduce compound twisting torque on the handle.*

OPERATION

- *Designed to operate 24 hours-a-day, 7 days-a-week to maintain thermal equalization/humidity equalization*
- *Use optional speed control to fine tune RPM if needed*



MAINTENANCE

- *Frequency of cleaning will vary by application and environment*
- *You may clean the plastic housing with a damp warm cloth, using mild household detergents*
- *Do not use petroleum products, thinners or solvents to clean any part of the Airius unit*
- *If the Airius unit fails, contact manufacturer*

MATERIALS & PROPERTIES

- *Constructed from recyclable materials*
- *The outer shell, stator and fan blades are fire rated 5VA materials*
- *Power cord is a 3 wire 1.02 mm diameter 300VAC rated electrical cord - CE/EU compliance rated as HO5VV*
- *Motor is thermally protected. Shutoff is at 135°C & reset is at 125°C*
- *71dB (A) Sound Power Level*
- *No lubrication required. Bearings are sealed*

PC/ABS

saving you energy

Airius Model Q50 PS4 Motor Product Information Sheet

Q50 -230V-PS4

MODEL Q50 DIMENSIONS

(Free hanging units can be angled up to 90° off vertical)

For horizontal installations Airius recommend the use of the Airius proprietary cradle or a second cable or rod attachment to the discharge end to provide balance

MODEL Q50 PROPERTIES

UNIT SIZE

	Standard
Weight:	7.45 kgs
Height to Rim:	435 mm
Total Height:	550 mm
Diameter:	364 mm

MOTOR

	230V
Watts* (MAX) @ 50 htz:	72
RPM* (MAX) @ 50 htz:	1320
L/S* @ 50 htz (m3/hr):	500 (1,800)
AMPS* @ 50 htz:	.32

*Motor data provided by motor manufacturer and is subject to change at anytime

COVERAGE

- Floor area = 115m²
- Diameter = 12m
- Ceiling Height = 13m

MOTOR

- Single Phase
- 1320 RPM @ 50htz
- EBM Papst PS4 Four Pole Motor

OPERATING TEMPERATURES

- Min start temp (approx.) = - 25° C
- Maximum ambient temp = 50° C
- Overtemperature protected electronics/motor

NOISE LEVELS

- Sound Power Level 0-62 dB (A)
- Sound Pressure Level @ 6 mts = 38 dB
- Sound Pressure Level @ 12 mts = 32 dB

Please contact Airius for full Noise Testing Report

INGRESS PROTECTION

- Rated IP44

COLOUR

- Off white as standard
- Can be tailor painted to your colour specifications

ACCESSORIES & OPTIONS

- Airius Transformer type speed controller 1 and 5 Amp available. 0-100% in 5 steps
- Airius speed control - TRIAC speed control to adjust top end RPM

WARRANTY

- 5 years full manufacturers replacement from date of despatch. Subsequent 5 year 'half new price' rebuild cover

STANDARDS

Product conforming to standards:
EN 60335-1, EN 61800-5-1, EN 60950-1, CE

saving you energy

Airius Model Q50 PS4 Motor Product Information Sheet

Q50 -230V-PS4

MODEL Q50 PLACEMENT

PREPARATION

- *Install electrical circuit(s) and outlet(s) in accordance with national and local electric codes*
- *Outlets should generally be mounted vertically unless a "twist/locking" type is being used*
- *Wall switch may be installed in circuit to disable power and prevent electrical hazards when servicing*
- *Confirm electrical continuity of Airius unit on the ground before permanently mounting in the ceiling*

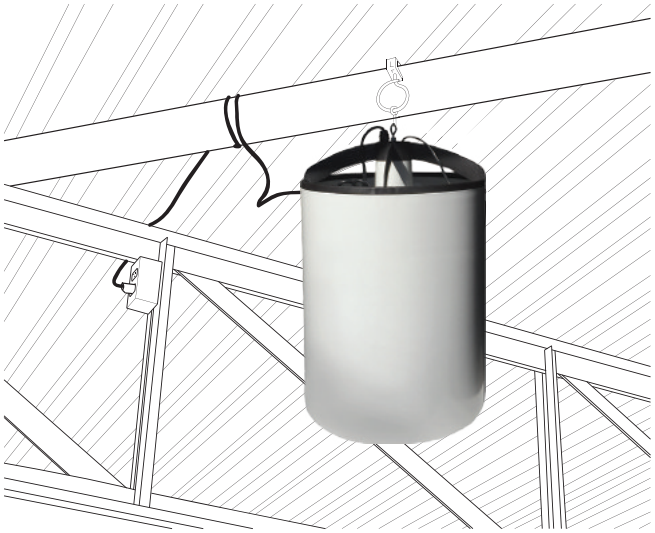
INSTALLATION

- *Hang vertically as high in the ceiling as possible Typically 300 – 450 mm from the roof deck to intake*
- *The Airius unit performs best when air column from the nozzle is unimpeded to the floor*
- *Use professionally installed hardware, capable of supporting a minimum of five times the weight*
- *Hardware to hang the unit includes but is not restricted to: Hooks, chains, cables, carabiners, bridle rings, beam clamps and bolts*
- *Density of the placement is directly related to the effectiveness, performance and savings*
- *Mount out of reach from people and animals*
- *Floor plans, mezzanines, office locations, machinery, people placement, plumbing, lighting, duct work, electrical systems, natural light/air systems, cranes, doors, windows, ventilation and fire suppression systems are all factors in properly locating the Airius system within the ceiling*

NOTE:- *Air Pears must not be installed directly to structure if they are to be angled.In this case a small length of cable or wire must be used between the handle and the structure to reduce compound twisting torque on the handle.*

OPERATION

- *Designed to operate 24 hours-a-day, 7 days-a-week to maintain thermal equalization/humidity equalization*
- *Use optional speed control to fine tune RPM if needed*



MAINTENANCE

- *Frequency of cleaning will vary by application and environment*
- *You may clean the plastic housing with a damp warm cloth, using mild household detergents*
- *Do not use petroleum products, thinners or solvents to clean any part of the Airius unit*
- *If the Airius unit fails, contact manufacturer*

MATERIALS & PROPERTIES

- *Constructed from recyclable materials*
- *The outer shell, stator and fan blades are fire rated 5VA materials*
- *Power cord is a 3 wire 1.02 mm diameter 300VAC rated electrical cord - CE/EU compliance rated as HO5VV*
- *Motor is thermally protected. Shutoff is at 135°C & reset is at 125°C*
- *0-62dB (A) Sound Power Level*
- *No lubrication required. Bearings are sealed*

PC/ABS

Airius Q-50-EC
Noise Data

5703-3
Appendix B

Airius Q-50-EC-STD-100-130W
Novemeber 2016 Latest Q50EC Acoustic testic EBM Papst Sound labs 60 hz
All testing standards as per EBM Papst original acoustic testing report

1650 RPM

1/3 Octave Freq [Hz]	Sound Pressure Lp(A)
100	40.6
125	59.0
160	49.7
200	42.7
250	55.3
315	52.5
400	53.3
500	53.2
630	53.8
800	54.1
1000	55.9
1250	52.4
1600	51.4
2000	50.5
2500	49.2
3150	48.2
4000	48.1
5000	43.7
6300	40.8
8000	37.5
10000	32.4
12500	27.7
16000	32.4
20000	18.1
Overall	**62.7**

1238 RPM

1/3 Octave Freq [Hz]	Sound Pressure Lp(A)
100	52.4
125	39.5
160	37.4
200	41.5
250	42.6
315	47.9
400	47.4
500	49.1
630	46.2
800	48.4
1000	49.5
1250	45.4
1600	44.8
2000	43.5
2500	40.0
3150	39.1
4000	38.7
5000	33.8
6300	30.2
8000	25.6
10000	19.7
12500	19.6
16000	32.1
20000	14.2
Overall	**55.9**

825 RPM

1/3 Octave Freq [Hz]	Sound Pressure Lp(A)
100	30.1
125	34.1
160	28.5
200	29.1
250	35.2
315	39.5
400	38.1
500	39.1
630	37.0
800	38.2
1000	39.1
1250	33.6
1600	30.4
2000	29.1
2500	25.4
3150	23.4
4000	22.3
5000	16.5
6300	11.8
8000	8.9
10000	8.1
12500	8.5
16000	20.5
20000	8.5
Overall	**45.0**

413 RPM

1/3 Octave Freq [Hz]	Sound Pressure Lp(A)
100	28.1
125	30.6
160	21.3
200	16.2
250	22.2
315	23.8
400	22.3
500	19.4
630	18.3
800	17.3
1000	17.8
1250	14.0
1600	9.7
2000	7.4
2500	5.3
3150	5.7
4000	6.2
5000	6.7
6300	7.1
8000	7.4
10000	7.6
12500	7.8
16000	13.2
20000	8.2
Overall	**28.4**

Airius Q-50-EC
Noise Data

5703-3
Appendix B

1/3 Octave Freq [Hz]	Sound Power Lw(A)
100	44.3
125	51.2
160	46.3
200	46.8
250	61.2
315	58.3
400	58.5
500	67.1
630	63.3
800	61.0
1000	62.2
1250	61.0
1600	60.6
2000	61.6
2500	59.3
3150	56.9
4000	54.1
5000	50.9
6300	47.4
8000	42.5
10000	36.4
Overall	**72.8**

1/3 Octave Freq [Hz]	Sound Power Lw(A)
100	38.6
125	34.1
160	37.7
200	46.8
250	50.6
315	54.1
400	54.6
500	65.8
630	55.8
800	55.1
1000	55.8
1250	54.3
1600	53.7
2000	54.2
2500	50.8
3150	48.3
4000	45.3
5000	41.4
6300	36.9
8000	30.9
10000	24.0
Overall	**68.2**

1/3 Octave Freq [Hz]	Sound Power Lw(A)
100	21.5
125	27.8
160	28.6
200	33.1
250	43.5
315	46.5
400	44.2
500	49.1
630	46.0
800	44.6
1000	45.5
1250	42.9
1600	41.0
2000	41.5
2500	37.5
3150	33.6
4000	29.6
5000	24.1
6300	20.6
8000	18.1
10000	16.4
Overall	**55.3**

1/3 Octave Freq [Hz]	Sound Power Lw(A)
100	18.0
125	20.2
160	17.3
200	18.4
250	27.1
315	28.8
400	25.1
500	29.0
630	26.7
800	24.0
1000	23.0
1250	23.9
1600	18.1
2000	17.9
2500	17.6
3150	18.0
4000	18.4
5000	18.4
6300	18.2
8000	17.4
10000	16.2
Overall	**36.4**

Airius Q-50-P4
Noise Data

5703-3
Appendix C

Arius

Q-50-P4-STD-
120

1420 rpm		1065 rpm		800 rpm	
1/3 Octave	**Sound Pressure**	**1/3 Octave**	**Sound Pressure**	**1/3 Octave**	**Sound Pressure**
Freq [Hz]	**Lp(A)**	**Freq [Hz]**	**Lp(A)**	**Freq [Hz]**	**Lp(A)**
100	48.5	100	45.1	100	38.6
125	53.7	125	47.0	125	48.5
160	45.1	160	41.9	160	32.6
200	45.0	200	38.4	200	32.7
250	50.4	250	44.6	250	39.9
315	55.2	315	49.2	315	43.6
400	55.2	400	48.8	400	44.5
500	56.2	500	48.8	500	41.4
630	52.7	630	46.9	630	39.4
800	53.5	800	46.4	800	39.2
1000	55.1	1000	45.9	1000	38.9
1250	49.7	1250	40.8	1250	35.3
1600	46.4	1600	42.2	1600	30.6
2000	46.9	2000	39.5	2000	27.5
2500	47.3	2500	35.2	2500	25.3
3150	46.6	3150	36.3	3150	25.5
4000	45.7	4000	35.1	4000	23.5
5000	39.9	5000	29.2	5000	16.5
6300	38.5	6300	26.2	6300	14.5
8000	33.7	8000	20.7	8000	10.0
10000	29.2	10000	15.7	10000	9.5
12500	24.2	12500	11.9	12500	8.8
16000	19.9	16000	9.9	16000	9.0
20000	14.4	20000	8.8	20000	8.4
Overall	**61.6**	**Overall**	**54.0**	**Overall**	**47.2**

1/3 Octave	Sound Power	1/3 Octave	Sound Power	1/3 Octave	Sound Power
Freq [Hz]	**Lw(A)**	**Freq [Hz]**	**Lw(A)**	**Freq [Hz]**	**Lw(A)**
100	42.1	100	34.1	100	29.2
125	45.6	125	39.4	125	41.1
160	42.9	160	39.0	160	29.7
200	49.0	200	40.8	200	35.3
250	57.2	250	50.9	250	45.3
315	59.2	315	53.0	315	47.1
400	58.2	400	53.2	400	48.7
500	62.8	500	56.0	500	49.6
630	61.4	630	52.9	630	47.5
800	58.7	800	51.3	800	45.5
1000	58.8	1000	51.3	1000	44.8
1250	57.2	1250	49.4	1250	43.3
1600	56.9	1600	49.3	1600	41.2
2000	58.1	2000	49.3	2000	40.0
2500	56.1	2500	45.7	2500	35.7
3150	53.0	3150	42.8	3150	32.0
4000	49.6	4000	39.2	4000	27.7
5000	46.2	5000	35.0	5000	22.9
6300	42.1	6300	29.5	6300	20.0
8000	37.2	8000	23.5	8000	18.1
10000	31.3	10000	19.0	10000	16.7
Overall	**69.7**	**Overall**	**62.4**	**Overall**	**56.5**