

REPORT REF: 20523R04KDmdw

MECHANICAL SERVICES PLANT NOISE IMPACT ASSESSMENT

THAMES TOWER, READING





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Monday, 09 November 2015

Ref: 20523L03KDmdw

Mr. Andy Taylor
Bowmer and Kirkland Ltd (South Midlands)
1210 Arlington Business Park
Theale
Reading RG7 4TY

Dear Andy,

Condition 14 – Thames Tower, Reading.

With reference to Condition 14, the noise assessment produced by Environoise (Report No 20523R04KDmdw) concluded that with the specified mitigation fitted to the chiller units, noise emission levels with a 5dB penalty applied in accordance with BS4142:1997 at the nearest noise sensitive receptors would be at least 10dB below background levels.

The predicted noise levels would comply with the criteria set out in Table 2 of report 'Thames Tower, Reading: Noise impact Assessment (dated 19 June 2014) by Ramboll (ref. 33095-AC-R02).

Yours sincerely,

A handwritten signature in black ink, appearing to read 'K Doyle'.

Kevin Doyle AMIOA
Senior Acoustics Consultant
For and behalf of Environoise Consulting Limited

Andy Taylor

From: Andy Taylor
Sent: 09 November 2015 09:35
To: 'john@mydn-a.com'; Chris@mydn-a.com; piotr@mydn-a.com; Derry - Thames Tower; 'Chris Edwards'; Bill Poole; Ian Douglas; Miles Woolley
Cc: com-inbound-thames-tower-reading@procoretech.com
Subject: RE: TT - Acoustic Information

John,

I'm seeking a formal email/letter for the first point from Miles Woolley with specific reference to the Ramboll report (Environoise were emailed this last December as part of the quotation request and subsequently produced their own NIA as necessary).

For the second point I can confirm that the plant shall thereafter only be installed as approved and be retained thereafter, to continue to achieve the levels indicated in the noise impact assessment, in accordance with BS4142:1997.

Regards,
Andy

Andy Taylor
Design Manager
Tel: 0118 965 4028
Mob: 07867 143 750

From: John Duthaler [mailto:john@mydn-a.com]
Sent: 09 November 2015 09:14
To: Andy Taylor; Chris@mydn-a.com; piotr@mydn-a.com; Derry - Thames Tower; 'Chris Edwards'; Bill Poole; Ian Douglas
Cc: com-inbound-thames-tower-reading@procoretech.com
Subject: RE: TT - Acoustic Information

Andy

We can gear up for submission but could you confirm that the document achieves to discharge the specific items outlined in the condition 14:

- The emission levels attain the levels outlined in the submitted document, Thames Tower, Reading: Noise impact Assessment (dated 19 June 2014) by Ramboll (ref. 33095-AC-R02)
- The plant shall thereafter only be installed as approved and be retained thereafter, to continue to achieve the levels indicated in the noise impact assessment, in accordance with BS4142:1997 methodology.

Once this is confirmed, please put together the pack and we would be happy to submit on your behalf.

Regards

John Duthaler
Project Coordinator
john@mydn-a.com
d: +44 (0) 20 8332 3920
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CLIENT: Bowmer and Kirkland Ltd (South Midlands)
1210 Arlington Business Park
Theale
Reading RG7 4TY

Report written and prepared by:

A handwritten signature in black ink, appearing to read 'K Doyle'.

Kevin Doyle AMIOA Senior Acoustics Consultant

Checked by:

A handwritten signature in black ink, appearing to read 'Miles Woolley'.

Miles Woolley MIOA Director & Principal Acoustics Consultant

Date of issue:

Friday, 06 November 2015

Table of Contents

Executive Summary	4
1 Introduction	5
1.2 Site Description.....	5
1.3 Noise Sensitive Receptors.....	6
2 Criteria	7
2.1 BREEAM 2008.....	7
2.2 Pol 08 Assessment Criteria	7
2.3 Local Authority Requirements.....	7
2.4 Plant Noise Impact.....	8
3 Noise Surveys.....	9
3.1 Survey procedure	9
3.2 Weather Conditions	10
3.3 Instrumentation	10
4 Results.....	12
4.1 Background Noise Levels	12
4.2 Commentary on Background Noise Levels.....	12
5 Plant Noise Impact.....	13
5.1 Mechanical Service Plant	13
5.2 Noise Level Predictions	14
5.3 Noise Impact Assessment	15
6 Recommendations.....	16
7 Conclusion.....	18
References	19
Appendix A: Acoustic Terms	20
Appendix B: BREEAM 2008 Credit Requirements.....	21
Appendix C Sound Power Data	22
Appendix D Distance and Barrier Attenuation Calculations	25
Appendix E Noise Calculations	28

Executive Summary

Environoise Consulting Limited has been instructed by Bowmer & Kirkland to assess the level of noise impact as a result of the fixed services plant associated with the Thames Tower development on existing nearby noise sensitive receptors and associated BREEAM credit Pol 08.

Partially attended noise surveys were done between 17.35hrs on Wednesday 8th April 2015 and 09.00hrs on Friday 10th April at two facade locations at two floor levels. An attended measurement was done at a third location between 17.15hrs until 18.15hrs, Thursday 9th April 2015. The results of the survey were found to correlate with previous surveys undertaken for the project by other consultancies.

An assessment of noise impacts from the proposed mechanical service plant was undertaken in accordance with BS4142 1997. The assessment identified mitigation measures would need to be implemented on the proposed chiller units in order to comply with the requirements of Reading Borough Council.

Predicted noise levels would be more than 10dB below the existing background noise level at the NSR with recommended mitigation measures which BS4142 regards as a positive indication that 'complaints are unlikely' and means that BREEAM Pol 08 can be successfully sought.

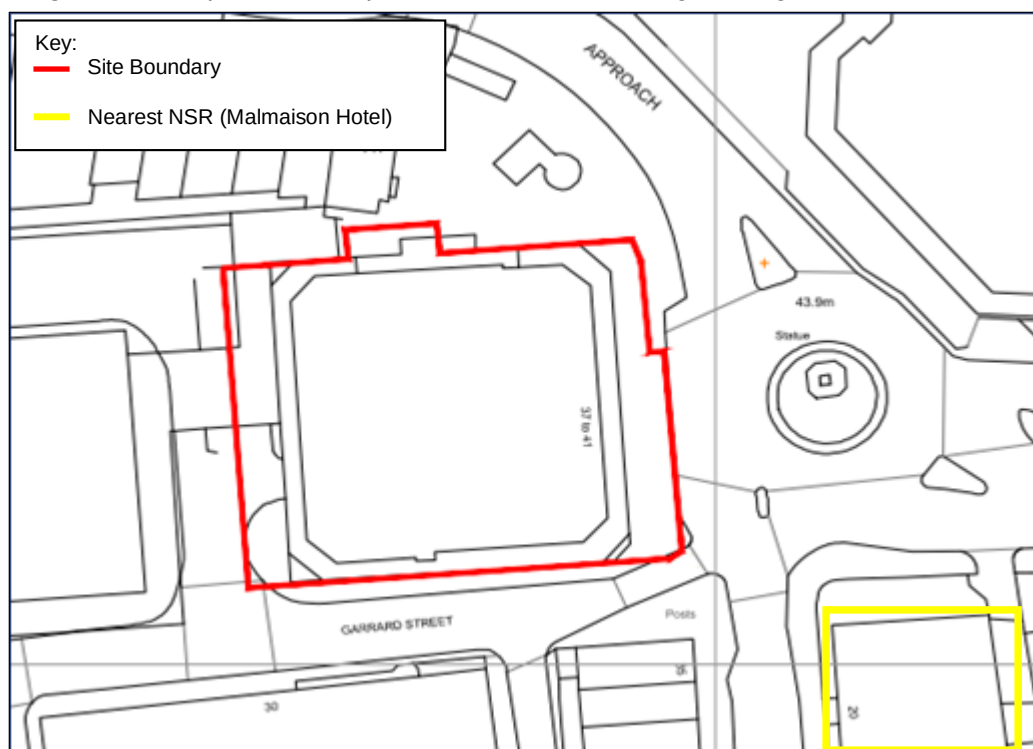
1 Introduction

- 1.1.1 Environoise Consulting Limited has been instructed by Bowmer & Kirkland to assess the level of noise impact as a result of the development (i.e. fixed services plant) on existing nearby noise sensitive receptors.
- 1.1.2 This report considers the existing ambient noise environment and any noise impacts from fixed plant associated with the project.
- 1.1.3 The impact of building services noise on the surrounding noise sensitive properties is considered in terms of BS4142:1997 'Method for rating industrial noise affecting mixed residential and industrial areas'. This British Standard sets out criteria based on the existing background noise level at a receptor for both day and night time periods.

1.2 Site Description

- 1.2.1 Proposals are for the refurbishment of the existing 12 storey 'Thames Tower' office development in Reading with the aim of achieving Building Research Establishment Environmental Assessment (BREEAM) 'Very Good'. The building was constructed in 1974 and closed in September 2010. New proposals include 4 additional floors (16 storeys total) to offer 17 000m² office space to accommodate 1500 No. staff. The proposed development will also offer 750m² reception and cafe/restaurant (A3 units) spaces on the ground floor.
- 1.2.2 Planning Consent was granted by Reading Borough Council on 13th October 2014 with an approximate build programme of 18 months.
- 1.2.3 The site is bounded by Garrard Street to the south, an NCP multi-storey car park to the west, soon to be demolished buildings to the north, with Reading Train Station and Approach Road further north and Forbury Road to the east with Reading Bus Station further east, see Figure 1.1.

Figure 1.1: Proposed development site and surrounding buildings.



1.3 Noise Sensitive Receptors

- 1.3.1 The nearest noise sensitive receptors to the proposed development are residential guestrooms within the Malmaison hotel approximately 30m to the south east of the nearest façade of the proposed development, see Figure 1.1.
- 1.3.2 The Malmaison hotel is 4 storeys high with the nearest residential guest room 9m above ground level. The completed tower would be 55m above ground level when complete which would result in any fixed rooftop plant being a minimum of 64m away when taking into account the height of the complete Thames Tower.

2 Criteria

2.1 BREEAM 2008

- 2.1.1 It is understood that for the Thames Tower project one credit is sought for Pol 8 'Noise attenuation'.
- 2.1.2 The requirements for successful application of Pol 8 are detailed in Appendix B and summarised in section 2.2.

2.2 Pol 08 Assessment Criteria

- 2.2.1 The following is required to demonstrate compliance for one credit
- A noise impact assessment in compliance with BS4142:1997 'Method for rating industrial noise affecting mixed residential and industrial areas has been completed and the following noise levels measured/determined:
 - Existing background noise levels at the nearest or most exposed noise-sensitive development to the proposed development; or at a location where background conditions are similar.
 - The Rating noise level resulting from the proposed noise-source. This can be based upon reference to similar installations or sites, or determined by calculation.
 - Where the Rating level of the noise source(s) from the site/building is equivalent to or less than the background noise level, the credit can be awarded.
 - Where the Rating level of the noise source(s) from the site/building is greater than the background noise level, measures have been installed to attenuate the noise at its source to a level where it will comply with requirement 3.

2.3 Local Authority Requirements

- 2.3.1 We understand¹ that Reading Borough Council requirements for limiting plant noise levels are more onerous than BREEAM Pol 8 requirements provided in section 2.4. The Rating Level from plant must be at least 10dB below the measured background noise level when assessed in accordance with BS4142:1997'.
- 2.3.2 BS4142 was revised in November 2014 after planning consent was granted, however through consultation with Reading Borough Council² it has been confirmed that the local authority requirement would still need to comply with the previous 1997 version as this was the current standard at the time when the criteria was set.

¹ Ramboll Report ref: 33663-AC-R02 dated 23rd June 2014.

² E mail conversation with Rebecca Moon 4th November 2015

2.3.3 Compliance with the Council's requirements will therefore see that the BREEAM Pol 08 credit can be awarded.

2.3.4 As service plant specification is yet to be finalised, limiting plant noise levels have been previously set. These are based on measured background noise levels obtained from a baseline noise survey carried out at the nearby residential receptors and the Local Authority criteria detailed above.

2.4 Plant Noise Impact

2.4.1 BS4142:1997 provides a method of determining the 'likelihood of complaint' due to new industrial noise sources. The basis of the BS4142 standard is a comparison between the background noise level (L_{A90}) in the vicinity of residential locations and the Rating noise level of the industrial noise source under consideration. The Rating Level ($L_{Aeq,T}$) is the specific noise level plus a 5dB penalty added for the characteristic features of the noise.

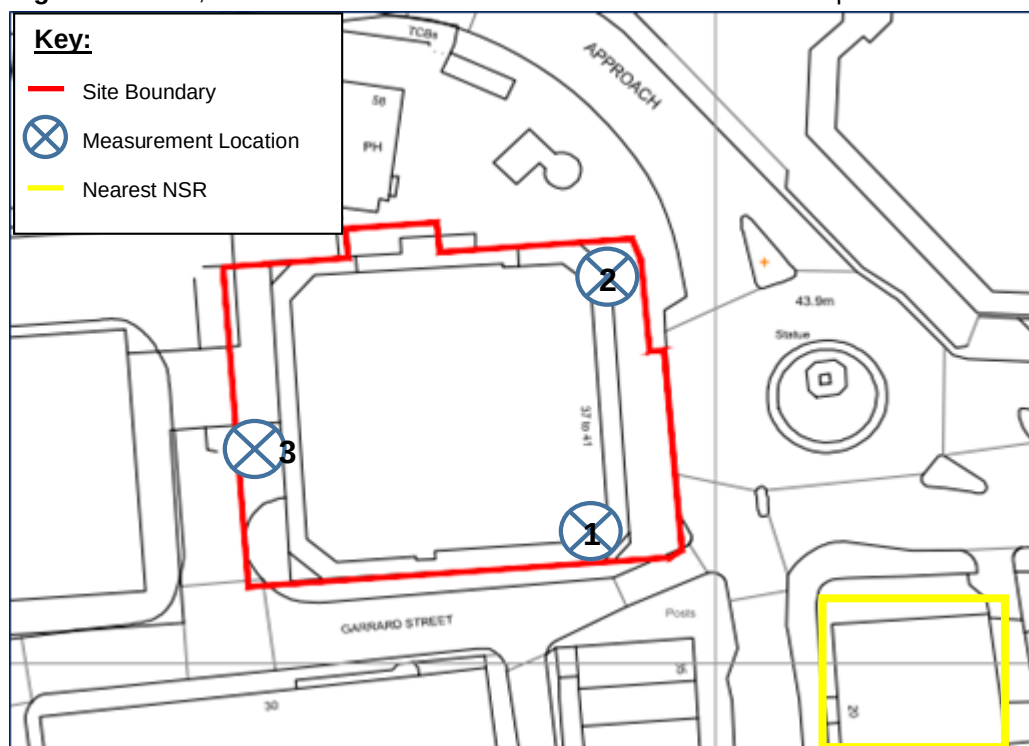
- If the Rating Level of the noise source is more than 10dB(A) below the background noise level this is a positive indication that '**complaints are unlikely**'.
- BS4142 suggests that a Rating Level excess of up to 5dB(A) above the background noise level at the receptor is of '**marginal significance**'.
- If the Rating Level due to the noise source exceeds the background noise level by more than 10dB(A) then the indication is that 'complaints are likely'.

3 Noise Surveys

3.1 Survey procedure

- 3.1.1 The site location, measurement locations and nearest noise sensitive receptor (NSR) properties are shown in Figure 3.1.

Figure 3.1: Site, noise measurement and nearest noise sensitive receptor locations.



- 3.1.2 Noise levels were measured at three locations during the daytime and night-time between Wednesday 8th and Friday 10th April 2015, see Figure 3.1. During attended periods of the noise surveys, notes were taken of the noise climate and weather conditions.
- 3.1.3 Noise measurements were made at the following locations:
- **Locations 1a & 1b:** Noise measurement at 2nd and 7th floor overlooking Forbury Road/ Approach Road.
 - **Locations 2a, 2b:** Noise measurement at 2nd and 7th floor overlooking Garrard Road.
 - **Location 3:** Noise measurement at façade overlooking multi-storey car park.
- 3.1.4 Free-field noise levels were measured at Locations 1a and 2a and 3 using a type 1 sound level meter mounted on a pole fixed to scaffolding approximately 3.5m away from the façade, see Table 3.1 for details.

3.1.5 All noise level measurements were made over contiguous 15 minute periods. Overall A-weighted ambient ($L_{Aeq,15minutes}$) and background ($L_{A90,15minutes}$) noise levels were measured as well as associated linear octave band frequencies.

3.1.6 Noise levels and measurement times are shown in section 4 of this report. All noise surveys were compliant with BS7445-1:2003 'Description and measurement of environmental noise. Guide to quantities and procedures'ⁱⁱ.

3.2 Weather Conditions

3.2.1 Weather conditions were suitable for the noise survey.

Start - 8th April 2015 (17.35hrs)

- 15°C, 40-60% cloud, dry and bright, wind $<1ms^{-1}$

End - 9th April 2015 (09.05hrs)

- 10°C 10-15% cloud, dry and sunny, wind $<1ms^{-1}$

Start - 9th April 2015 (17.35hrs)

- 18°C 10% cloud, dry and bright, wind $1ms^{-1}$

End - 10th April 2015 (09.15hrs)

- 10°C 55% cloud, dry and bright but misty, wind $2-3ms^{-1}$

3.2.2 Weather conditions were suitable for noise measurements during the survey period.

3.3 Instrumentation

3.3.1 The instrumentation used is shown in Table 3.1.

Table 3.1: Instrumentation details for all locations.

Manufacturer	Equipment type	Serial number	Date of Calibration
Rion	NA-28 sound level meter	01070574	25 th June 2014
	NH-23 preamplifier	70591	
	UC-59 Microphone	00380	
	NA-28 sound level meter	00501403	17 th July 2014
	NH-25 preamplifier	01442	
	UC-59 Microphone	01845	
	NC-34 calibrator with ½" adaptor	34904967	15 th July 2014

Calibration

- 3.3.2 The sound level meter was calibrated at the start and end of the noise surveys, there was no recorded drift greater than 0.3dB at 1 kHz. The calibration chain is traceable via to National Standards held at the National Physical Laboratory (NPL).

4 Results

4.1 Background Noise Levels

- 4.1.1 The daytime and night-time A-weighted background (L_{A90}) noise levels obtained from all locations are presented in Table 4.1.

Table 4.1: Measured daytime and night-time background Noise Levels at all locations.

Period	Measurement Location	Background Noise Level range [$L_{A90,(15minutes)}$ (dB)]
(17:50hrs – 23:05hrs) Wednesday		55 - 60
(23:05hrs – 07:00hrs) Wednesday - Thursday	1a	43 - 58
(07:05hrs – 09:05hrs) Thursday		58 - 62
(17:35hrs – 23:05hrs) Wednesday		56 - 61
(23:05hrs – 07:00hrs) Wednesday - Thursday	1b	46 - 61
(07:05hrs – 08:35hrs) Thursday		60 - 63
(16:30hrs – 23:00hrs) Thursday		58 - 63
(23:05hrs – 07:00hrs) Thursday - Friday	2a	46 - 62
(07:00hrs – 09:00hrs) Friday		60 - 66
(18:30hrs – 23:00hrs) Thursday		57 - 61
(23:05hrs – 07:00hrs) Thursday – Friday	2b	51 - 61
(07:00hrs – 09:00hrs) Friday		60 - 63
(17:15hrs – 18:15hrs) Thursday	3	53 - 59

4.2 Commentary on Background Noise Levels

- 4.2.1 The measurement position considered most representative of the nearest noise sensitive receptor (i.e. Malmaison Hotel) is Location 2. Measured background noise levels range between 57dB $L_{A90,15minutes}$ and 66dB $L_{A90,15minutes}$ at Location 2a and 2b during the daytime and 46dB $L_{A90,15minutes}$ to 62dB $L_{A90,15minutes}$ during the night-time.
- 4.2.2 Previously recommended plant noise limits at the nearest receptor (considered to be Malmaison Hotel approximately 30m away to the south-east) of 50dB $L_{Aeq,15minutes}$ and 39dB $L_{Aeq,15minutes}$ have been stipulated during the daytime (07.00hrs – 23.00hrs) and night-time (23.00hrs – 07.00hrs) period respectively.
- 4.2.3 The plant noise limits were based on a lowest measured daytime and night-time background noise level of 60dB and 49dB $L_{A90,15minutes}$. These values correlate with our measured background noise levels as detailed in Table 4.1.

5 Plant Noise Impact

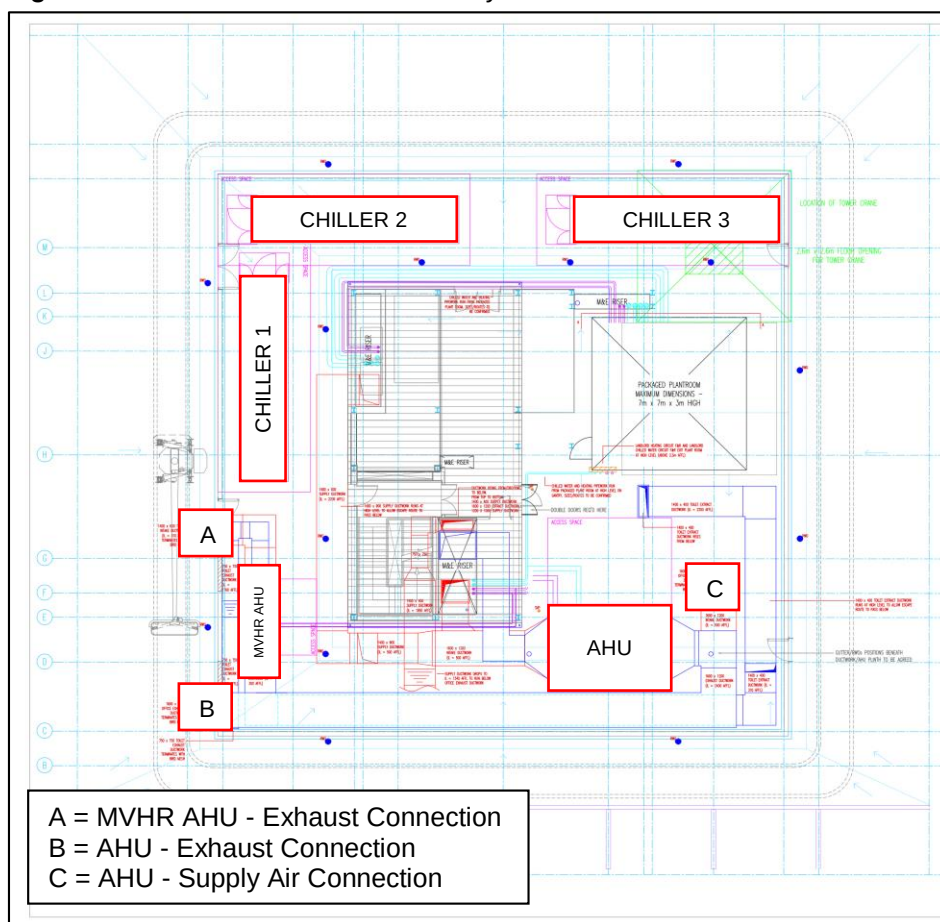
5.1 Mechanical Service Plant

5.1.1 All proposed mechanical service plant is to be installed on the roof of the building, see Table 5.1³ and Figure 5.2.

Table 5.1: Proposed Mechanical Service Plant.

Plant	Manufacturer	Model No.
AHU	FlaktWoods	ACON-01661094 Unit 23
MVHR AHU	FlaktWoods	ACON-01661134 Unit 26
3 No. Chillers	Carrier United Technologies	30XA0902-A Air Cooled Screw Chiller

Figure 5.2: Mechanical Service Plant Layout



³ Based on Drawing 311 SK 004 Rev B, Received via e mail from Bill Poole 26th October 2015.

- 5.1.2 Manufacturer's sound power level data used in the assessment is shown in Table 5.2 with supporting literature in Appendix C.

Table 5.2: Proposed Plant Sound Power Level Data.

Plant Item	Octave Band Centre Frequency L _w (dB)								Sound Power L _{WA} (dB)
	63	125	250	500	1k	2k	4k	8k	
AHU-To surroundings	74	81	69	58	60	61	56	43	69
AHU-Supply air connection	72	87	88	89	83	79	72	67	89
AHU-Exhaust connection	72	87	90	91	85	83	78	75	92
MVHR AHU-To surroundings	63	65	68	53	49	48	42	33	61
MVHR AHU-Exhaust connection	68	67	82	82	81	74	71	69	84
Chiller	Octave Band Data Unavailable								95

5.2 Noise Level Predictions

- 5.2.1 Predictions of plant noise have been done using the following equation:

$$\text{Ambient Noise Level [L}_{\text{Aeq}} \text{ (dB)]} = \text{Sound Power Level [L}_{\text{WA}} \text{ (dB)]} - 20 \log(r) - 8 - A_{\text{bar}}$$

Where; r is the distance from source to receiver.

A_{bar} is barrier attenuation

- 5.2.2 At the NSR the Thames Tower Building would act as a barrier which we have calculated will provide an attenuation (A_{bar}) of between 18dB and 30dB depending upon the plant items location on the roof top and distance to the NSR. Full distance and barrier attenuation calculations are presented in Appendix D.
- 5.2.3 Table 5.3 shows the predicted specific noise level at the nearest NSR with each item of plant ranked from highest contribution to lowest. Details of the calculations are presented in Appendix E.

Table 5.3: Predicted Noise Levels at Nearest NSR

Plant Item	Specific Noise [L _{Aeq,T} (dB)]
Chiller 3	33
Chiller 1	32
Chiller 2	32
AHU Air Supply	30
AHU Exhaust	29
MVHR AHU Exhaust	21
AHU	19
MVHR AHU	0
Total Specific Noise Level at NSR	39

5.3 Noise Impact Assessment

- 5.3.1 Table 5.4 presents an assessment of the daytime (07.00 – 23.00hrs) and night-time (23.00 – 07.00hrs) plant noise impact in accordance with BS4142: 1997 at the NSR. A 5dB rating penalty has been applied to the specific noise level in accordance with BS4142 to account for any distinguishing features or tonality.

Table 5.4 BS4142 Assessment at Nearest NSR

Time Period	Specific Noise Level [$L_{Aeq,T}$ (dB)]	BS4142 Penalty (dB)	Rating Level [$L_{Aeq,T}$ (dB)]	Background Level [L_{A90} (dB)]	Excess over Background Level [L_{A90} (dB)]
Daytime (07:00 – 23:00hrs)	39	+5	44	60	-16
Night-time (23:00 – 07:00hrs)	39	+5	44	49	-5

Daytime

- 5.3.2 The results of the BS4142 assessment shown in Tables 5.4 indicate that the rating level of plant noise at the NSR's during the daytime period will be a minimum of 16dB below the representative background noise level and therefore provides an indication that 'complaints would be unlikely' in accordance with BS4142: 1997.

Night-time

- 5.3.3 During the night-time period, the rating level of plant noise will be 5dB below the representative background noise level. BS4142 would consider this difference to be of 'marginal significance'.
- 5.3.4 Although the predicted rating noise level would comply with requirements set out under BREEAM Pol 08 it would not satisfy the requirements of Reading Borough Council during the night time period (23:00hrs – 07:00hrs) which requires the rating level to be 10dB below background level.
- 5.3.5 Mitigation measures would be required to reduce noise levels to meet the requirements of Reading Borough Council.

6 Recommendations

- 6.1.1 The predicted noise levels presented in Table 5.3 indicate that the noise contribution from the chiller units at the NSR would be the dominant noise source.
- 6.1.1 Manufacturers noise data (presented in Appendix C) indicates that a noise attenuation package⁴ is available which would reduce noise levels down to an ambient noise level of 55dB $L_{Aeq,T}$ at 10m, equivalent to a sound power of 83dB L_{WA} dependent on the size of the chiller⁵.
- 6.1.2 Table 6.1 shows the noise contribution and the predicted rating noise level at the nearest NSR with such treatment to all recommended chillers.

Table 6.1: Predicted Noise Levels at Nearest NSR with Mitigation

Plant	Rating Noise Level [$L_{Aeq,T}$ (dB)] with mitigation
MVHR AHU Exhaust	30
Chiller 2	29
Chiller 3	21
MVHR AHU	21
AHU Exhaust	20
AHU Air Supply	20
Chiller 1	19
AHU	0
Total Rating Noise Level at NSR	34

- 6.1.3 The resultant noise level from the proposed service plant with recommended mitigation measures would be reduced to 34dB $L_{Aeq,T}$ at the NSR.
- 6.1.4 Table 6.2 presents the BS4142 assessment with the mitigation measures on the chiller units in place.

Table 6.2 BS4142 Assessment at Nearest NSR

Time Period	Specific Noise Level [$L_{Aeq,T}$ (dB)]	BS4142 Penalty (dB)	Rating Level [$L_{Aeq,T}$ (dB)]	Background Level [L_{A90} (dB)]	Excess over Background Level [L_{A90} (dB)]
Daytime (07.00 – 23.00hrs)	34	+5	39	60	-21
Night-time (23.00 – 07.00hrs)	34	+5	39	49	-10

⁴ AA203 Attenuation package & base panels – Carrier United Technologies

⁵ This calculation should be accurate providing the chiller has an area of circa 1m².

Daytime

- 6.1.5 The results of the BS4142 assessment shown in Table 6.2 indicate that the rating level of plant noise at the NSR's during the daytime period will be a minimum of 21dB below the representative background noise level and therefore provides an indication that 'complaints would be unlikely' in accordance with BS4142.

Night-time

- 6.1.6 During the night-time period, the rating level of plant noise will be 10dB below the representative background noise level which is a positive indication that 'complaints would be unlikely'.
- 6.1.7 The resultant noise level from the proposed service plant with recommended mitigation measures would be more than 10dB below the representative background noise level during the daytime and night time period and would satisfy both BREEAM Pol 8 and Reading Borough Council requirements.

7 Conclusion

- 7.1.1 An assessment of the proposed plant noise impact at the nearest noise sensitive receptor has been done in accordance with BS4142:1997 based upon manufacturer's sound power noise data
- 7.1.2 The results of the assessment with no mitigation in place indicate that noise levels from the fixed plant would be at least 5dB below the representative background noise levels.
- 7.1.3 The requirements of Reading Borough Council are for the rating noise level from fixed plant to be at least 10dB or more below existing background noise level.
- 7.1.4 The results of the assessment indicate that the noise produced by the chiller units would be the dominant noise source and would require mitigation to meet the requirement of Reading Borough Council.
- 7.1.5 The manufacturers of the chiller unit produce a noise attenuation package which can reduce noise level produced by the chiller units to 55dB L_{AeqT} at 10m.
- 7.1.6 With the attenuation package installed with the chiller units the resultant noise level produced by the proposed fixed plant would be at least 10dB below background noise levels and would comply with the requirements of Reading Borough Council and BREEAM Pol 8.

References

- ⁱ BS4142:1997 Method for rating industrial noise affecting mixed residential and industrial areas, 1997
- ⁱⁱ BS7445-1:2003 'Description and measurement of environmental noise. Guide to quantities and procedures, 2003

Appendix A: Acoustic Terms

Between the quietest audible sound and the loudest tolerable sound there is a million to one ratio in sound pressure (measured in Pascal, Pa). Because of this wide range a noise level scale based on logarithms is used in noise measurement called the decibel (dB) scale. Audibility of sound covers a range of approximately 0 to 140 dB.

The human ear system does not respond uniformly to sound across the detectable frequency range and consequently instrumentation used to measure noise is weighted to represent the performance of the ear. This is known as the 'A weighting' and annotated as dB (A). Table A1 lists the sound pressure level in dB (A) for common situations.

Table A1: Noise levels for common situations.

Typical noise level dB(A)	Example
0	Threshold of hearing
30	Rural area at night, still air
40	Public library, refrigerator humming at 2m
50	Quiet office, no machinery, Boiling kettle at 0.5m
60	Normal conversation
70	Telephone ringing at 2m, Vacuum cleaner at 3m
80	General factory noise level, heavy goods vehicle from pavement
90	Powered lawn motor, operators ear
100	Pneumatic drill at 5m
120	Discotheque – 1m in front of loudspeaker
140	Threshold of pain

The noise levels at a measurement point are rarely steady, even in rural areas, and vary over a range dependent upon the effects of local noise sources. Close to a busy motorway, the noise levels may vary over a range of 5 dB(A), whereas in a suburban area this may increase up to 40 dB(A) and more due to the multitude of noise sources in such areas (cars, dogs, aircraft etc.) and their variable operation. Furthermore, the range of night-time noise levels will often be smaller and the levels significantly reduced compared with daytime levels. When considering environmental noise, it is necessary to consider how to quantify the existing noise (the ambient noise) to account for these second to second variations.

Human subjects are generally only capable of noticing changes in steady levels of no less than 3 dB(A). It is generally accepted that a change of 10 dB(A) in an overall, steady noise level is perceived to the human ear as a doubling (or halving) of the noise level. (These findings do not necessarily apply to transient or non-steady noise sources such as changes in noise due to change in road traffic flow, or intermittent noise sources). The equivalent continuous A-weighted sound pressure level, L_{Aeq} , is the single number that represents the average sound energy measured over that period. The L_{Aeq} is the sound level of a notionally steady sound having the same energy as a fluctuating sound over a specified measurement period. It is commonly used to express the energy value from individual sources that vary in level over their operational cycle.

Appendix B: BREEAM 2008 Credit Requirements

Pol 08 'Noise Attenuation'

Offices (One credit)

Aim

To reduce the likelihood of noise from the new development affecting nearby noise-sensitive buildings.

Assessment Criteria

The following demonstrates compliance:

1. There are, or will be, existing noise-sensitive areas or buildings within 800m radius of the assessed development.

Where there are or will be no noise-sensitive areas or buildings in the locality of the assessed development, the credit can be awarded by default.

2. A noise impact assessment in compliance with BS 4142:1997 has been carried out and the following noise levels measured/determined:

- *a. Existing background noise levels at the nearest or most exposed noise-sensitive development to the proposed development; or at a location where background conditions can be argued to be similar.*
- *b. The rating noise level resulting from the proposed noise-source. This can be based upon reference to similar installations or sites, or determined by calculation.*

The noise impact assessment must be carried out by a suitably qualified acoustic consultant holding a recognised acoustic qualification and membership of an appropriate professional body (see relevant definitions in the additional guidance section).

3. Where the rating level of the noise source(s) from the site/building is equivalent to or less than the background noise level, the credit can be awarded.

4. Where the rating level of the noise source(s) from the site/building is greater than the background noise level measures have been installed to attenuate the noise at its source to a level where it will comply with requirement 3.

Appendix C Sound Power Data

Figure C.1: AHU Sound Power Data

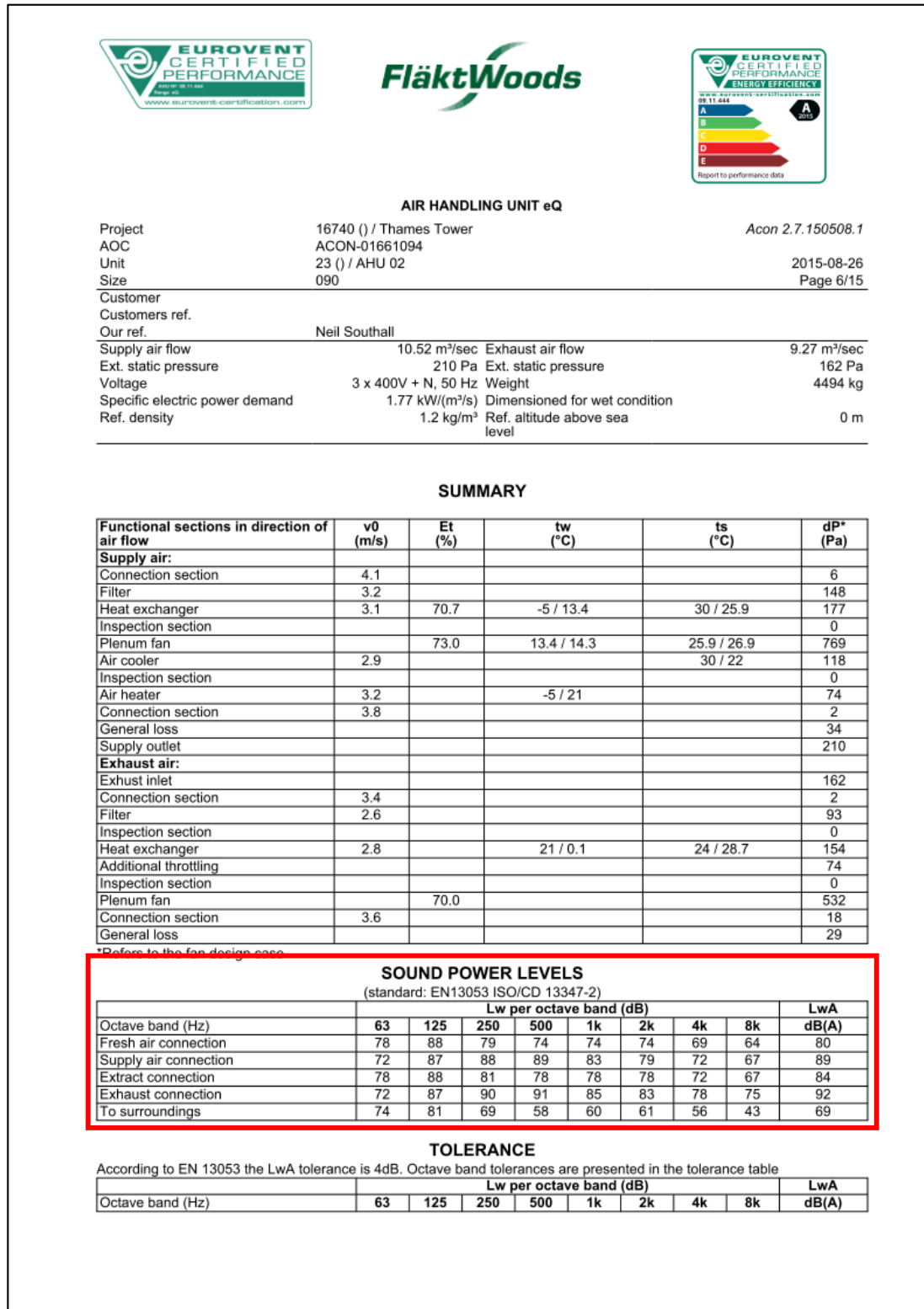


Figure C.2: MVR AHU Sound Power Data

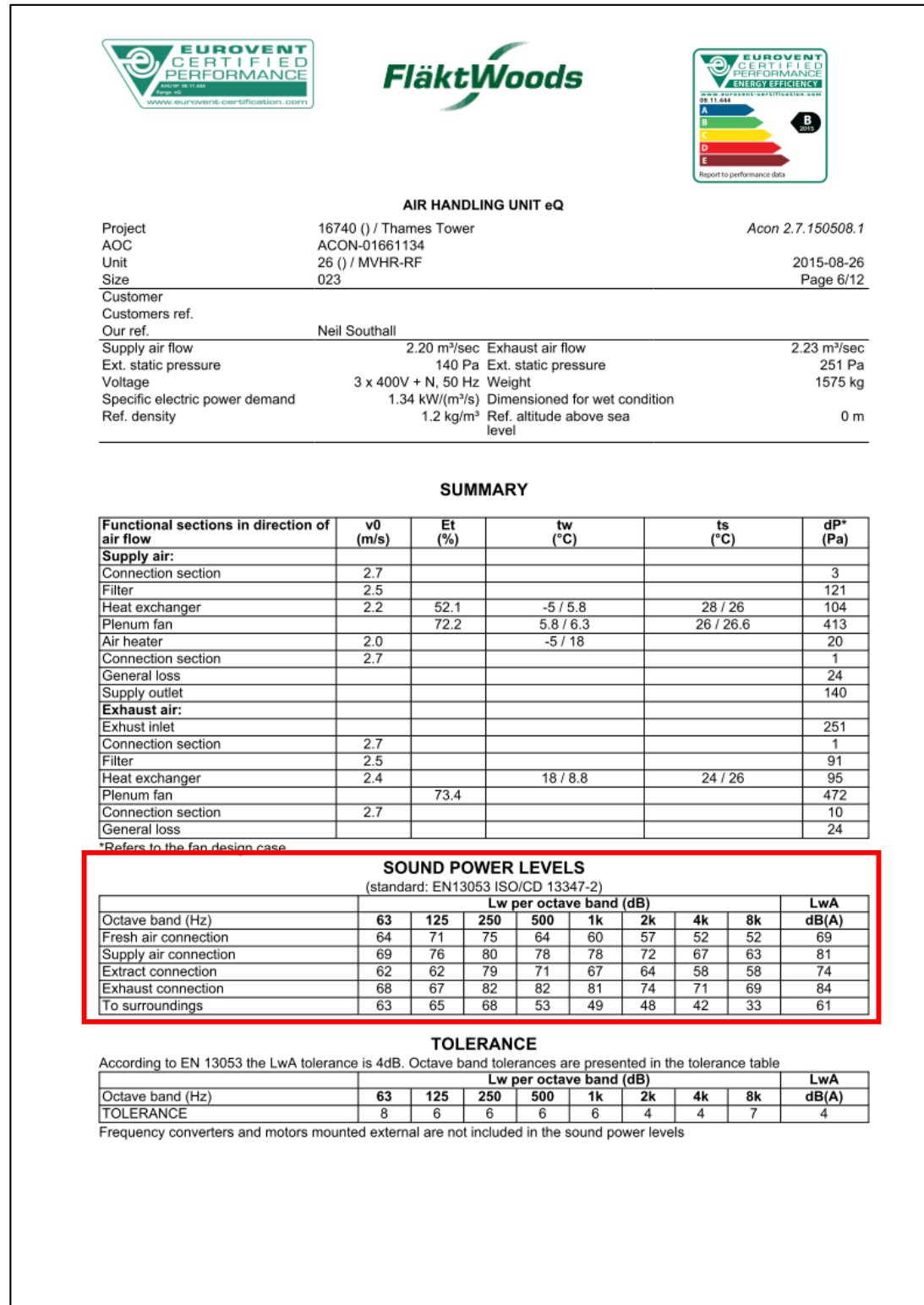
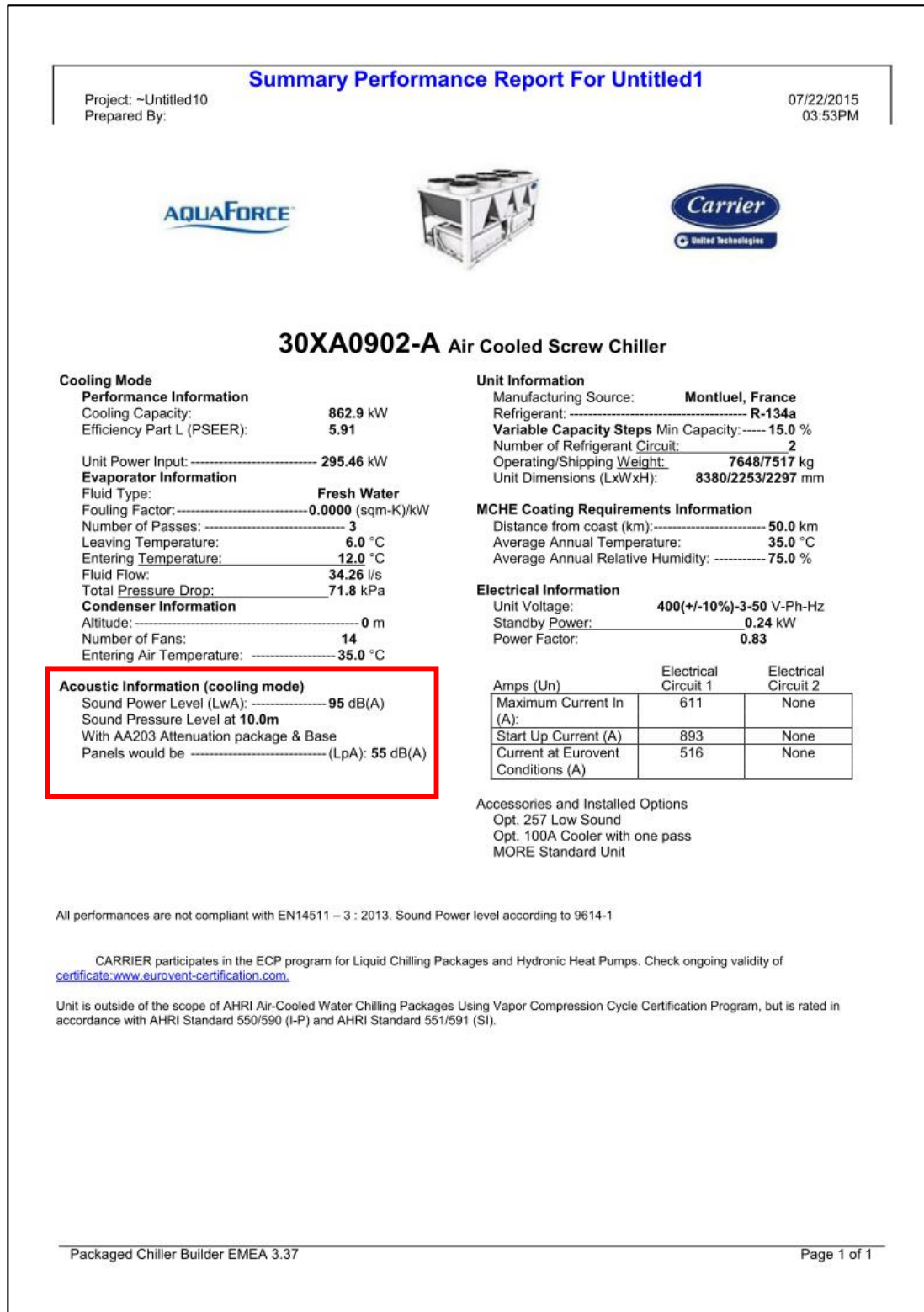
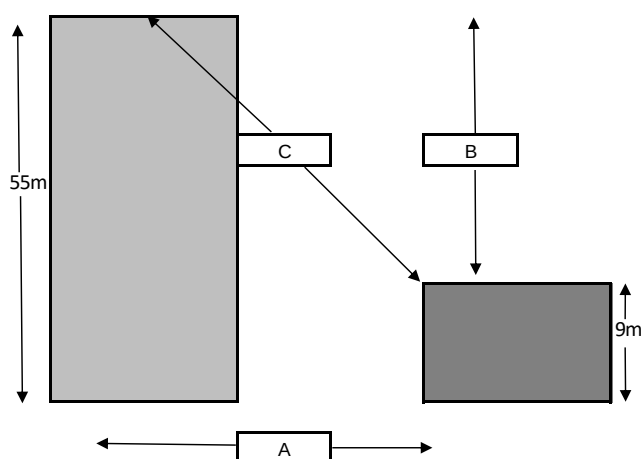


Figure C.2: Chiller Unit Sound Power Data



Appendix D: Distance and Barrier Attenuation Calculations

Figure D1: Distance Calculations



	A (metres)	B (metres)	C (metres)
AHU	32	55	64
AHU Exhaust	57	55	79
AHU Air Supply	40	55	68
MVHR AHU	54	55	77
MVHR AHU Exhaust	60	55	81
Chiller 1	64	55	84
Chiller 2	65	55	85
Chiller 3	54	55	77

Figure D2: Noise Attenuation from Building for AHU

Receiver Height (metres) =	0.01		CRTN Barrier Attenuation SHADOW ZONE CRTN Attenuation = 18 dB
Barrier Height (metres) =	2.00		
Source Height (metres) =	0.01		
Source to Barrier (metres) =	0.01		
Source to Receiver (metres) =	64.00		

Figure D3: Noise Attenuation from Building for AHU Exhaust

Receiver Height (metres) =	0.01		CRTN Barrier Attenuation SHADOW ZONE CRTN Attenuation = 30 dB
Barrier Height (metres) =	27.00		
Source Height (metres) =	0.01		
Source to Barrier (metres) =	0.01		
Source to Receiver (metres) =	79.00		

Figure D4: Noise Attenuation from Building for AHU Air Supply

Receiver Height (metres) =	0.01		CRTN Barrier Attenuation SHADOW ZONE CRTN Attenuation = 28 dB
Barrier Height (metres) =	10.00		
Source Height (metres) =	0.01		
Source to Barrier (metres) =	0.01		
Source to Receiver (metres) =	68.00		

Figure D5: Noise Attenuation from Building for MVHR AHU

Receiver Height (metres) =	0.01		CRTN Barrier Attenuation SHADOW ZONE CRTN Attenuation = 30 dB
Barrier Height (metres) =	24.00		
Source Height (metres) =	0.01		
Source to Barrier (metres) =	0.01		
Source to Receiver (metres) =	77.00		

Figure D6: Noise Attenuation from Building for MVHR AHU Exhaust

Receiver Height (metres) =	0.01		CRTN Barrier Attenuation SHADOW ZONE CRTN Attenuation = 30 dB
Barrier Height (metres) =	30.00		
Source Height (metres) =	0.01		
Source to Barrier (metres) =	0.01		
Source to Receiver (metres) =	81.00		

Figure D7: Noise Attenuation from Building for Chiller 1

Receiver Height (metres) =	0.01		CRTN Barrier Attenuation SHADOW ZONE CRTN Attenuation = 30 dB
Barrier Height (metres) =	34.00		
Source Height (metres) =	0.01		
Source to Barrier (metres) =	0.01		
Source to Receiver (metres) =	84.00		

Figure D8: Noise Attenuation from Building for Chiller 2

Receiver Height (metres) =	0.01		CRTN Barrier Attenuation SHADOW ZONE CRTN Attenuation = 30 dB
Barrier Height (metres) =	35.00		
Source Height (metres) =	0.01		
Source to Barrier (metres) =	0.01		
Source to Receiver (metres) =	85.00		

Figure D9: Noise Attenuation from Building for Chiller 3

Receiver Height (metres) =	0.01		CRTN Barrier Attenuation
Barrier Height (metres) =	24.00		SHADOW ZONE
Source Height (metres) =	0.01		CRTN Attenuation = 30 dB
Source to Barrier (metres) =	0.01		
Source to Receiver (metres) =	77.00		

Appendix E Noise Calculations

Figure E1: Calculations Noise Level at NSR with No Mitigation Measures

Source	Chiller 1								
Distance to Receptor (metres)	84								
	63	125	250	500	1k	2k	4k	8k	dB(A)
Sound Power Level (L_{WA})	95								
Distance Attenuation (dB)	31	31	31	31	31	31	31	31	31
Barrier Attenuation (dB)	30	30	30	30	30	30	30	30	30
Resultant SPL ($L_{Aeq(T)}$)	-61	-61	-61	-61	-61	-61	-61	-61	34

Source	Chiller 2								
Distance to Receptor (metres)	85								
	63	125	250	500	1k	2k	4k	8k	dB(A)
Sound Power Level (L_{WA})	95								
Distance Attenuation (dB)	31	31	31	31	31	31	31	31	31
Barrier Attenuation (dB)	30	30	30	30	30	30	30	30	30
Resultant SPL ($L_{Aeq(T)}$)	-61	-61	-61	-61	-61	-61	-61	-61	34

Source	Chiller 3								
Distance to Receptor (metres)	77								
	63	125	250	500	1k	2k	4k	8k	dB(A)
Sound Power Level (L_{WA})	95								
Distance Attenuation (dB)	30	30	30	30	30	30	30	30	30
Barrier Attenuation (dB)	30	30	30	30	30	30	30	30	30
Resultant SPL ($L_{Aeq(T)}$)	-60	-60	-60	-60	-60	-60	-60	-60	35

Source	AHU								
Distance to Receptor (metres)	64								
	63	125	250	500	1k	2k	4k	8k	dB(A)
Sound Power Level (L_{WA})	74	81	69	58	60	61	56	43	69
Distance Attenuation (dB)	28	28	28	28	28	28	28	28	28
Barrier Attenuation (dB)	18	18	18	18	18	18	18	18	18
Resultant SPL ($L_{Aeq(T)}$)	28	35	23	12	14	15	10	-3	23

Source	AHU Exhaust								
Distance to Receptor (metres)	79								
	63	125	250	500	1k	2k	4k	8k	dB(A)
Sound Power Level (L_{WA})	72	87	90	91	85	83	78	75	92
Distance Attenuation (dB)	30	30	30	30	30	30	30	30	30
Barrier Attenuation (dB)	30	30	30	30	30	30	30	30	30
Resultant SPL ($L_{Aeq(T)}$)	12	27	30	31	25	23	18	15	32

Source	AHU Air Supply								
Distance to Receptor (metres)	68								
	63	125	250	500	1k	2k	4k	8k	dB(A)
Sound Power Level (L_{WA})	72	87	88	89	83	79	72	67	89
Distance Attenuation (dB)	29	29	29	29	29	29	29	29	29
Barrier Attenuation (dB)	28	28	28	28	28	28	28	28	28
Resultant SPL ($L_{Aeq(T)}$)	15	30	31	32	26	22	15	10	32

Source	MVHR AHU								
Distance to Receptor (metres)	77								
	63	125	250	500	1k	2k	4k	8k	dB(A)
Sound Power Level (L_{WA})	63	65	68	53	49	48	42	33	61
Distance Attenuation (dB)	30	30	30	30	30	30	30	30	30
Barrier Attenuation (dB)	30	30	30	30	30	30	30	30	30
Resultant SPL ($L_{Aeq(T)}$)	3	5	8	-7	-11	-12	-18	-27	1

Source	MVHR AHU Exhaust								
Distance to Receptor (metres)	81								
	63	125	250	500	1k	2k	4k	8k	dB(A)
Sound Power Level (L_{WA})	68	67	82	82	81	74	71	69	84
Distance Attenuation (dB)	30	30	30	30	30	30	30	30	30
Barrier Attenuation (dB)	30	30	30	30	30	30	30	30	30
Resultant SPL ($L_{Aeq(T)}$)	8	7	22	22	21	14	11	9	24

Figure E2: Noise Calculations with Proposed Mitigation Measures on Chillers.

Source	Chiller 1									
Distance to Receptor (metres)	84									
	63	125	250	500	1k	2k	4k	8k	dB(A)	
Sound Power Level (L_{WA})										83
Distance Attenuation (dB)	31	31	31	31	31	31	31	31	31	31
Barrier Attenuation (dB)	30	30	30	30	30	30	30	30	30	30
Resultant SPL ($L_{Aeq(T)}$)	-61	-61	-61	-61	-61	-61	-61	-61	-61	22

Source	Chiller 2									
Distance to Receptor (metres)	85									
	63	125	250	500	1k	2k	4k	8k	dB(A)	
Sound Power Level (L_{WA})										83
Distance Attenuation (dB)	31	31	31	31	31	31	31	31	31	31
Barrier Attenuation (dB)	30	30	30	30	30	30	30	30	30	30
Resultant SPL ($L_{Aeq(T)}$)	-61	-61	-61	-61	-61	-61	-61	-61	-61	22

Source	Chiller 3									
Distance to Receptor (metres)	77									
	63	125	250	500	1k	2k	4k	8k	dB(A)	
Sound Power Level (L_{WA})										83
Distance Attenuation (dB)	30	30	30	30	30	30	30	30	30	30
Barrier Attenuation (dB)	30	30	30	30	30	30	30	30	30	30
Resultant SPL ($L_{Aeq(T)}$)	-60	-60	-60	-60	-60	-60	-60	-60	-60	23

Summary Performance Report For Untitled1

Project: ~Untitled10
Prepared By:

07/22/2015
03:53PM



30XA0902-A Air Cooled Screw Chiller

Cooling Mode

Performance Information

Cooling Capacity: **862.9 kW**
Efficiency Part L (PSEER): **5.91**

Unit Power Input: **295.46 kW**

Evaporator Information

Fluid Type: **Fresh Water**
Fouling Factor: **0.0000** (sqm-K)/kW
Number of Passes: **3**
Leaving Temperature: **6.0 °C**
Entering Temperature: **12.0 °C**
Fluid Flow: **34.26 l/s**
Total Pressure Drop: **71.8 kPa**

Condenser Information

Altitude: **0 m**
Number of Fans: **14**
Entering Air Temperature: **35.0 °C**

Acoustic Information (cooling mode)

Sound Power Level (LwA): **95 dB(A)**
Sound Pressure Level at **10.0m**
With AA203 Attenuation package & Base
Panels would be (LpA): **55 dB(A)**

Unit Information

Manufacturing Source: **Montluel, France**
Refrigerant: **R-134a**
Variable Capacity Steps Min Capacity: **15.0 %**
Number of Refrigerant Circuit: **2**
Operating/Shipping Weight: **7648/7517 kg**
Unit Dimensions (LxWxH): **8380/2253/2297 mm**

MCHE Coating Requirements Information

Distance from coast (km): **50.0 km**
Average Annual Temperature: **35.0 °C**
Average Annual Relative Humidity: **75.0 %**

Electrical Information

Unit Voltage: **400(+/-10%)-3-50 V-Ph-Hz**
Standby Power: **0.24 kW**
Power Factor: **0.83**

Amps (Un)	Electrical Circuit 1	Electrical Circuit 2
Maximum Current In (A):	611	None
Start Up Current (A)	893	None
Current at Eurovent Conditions (A)	516	None

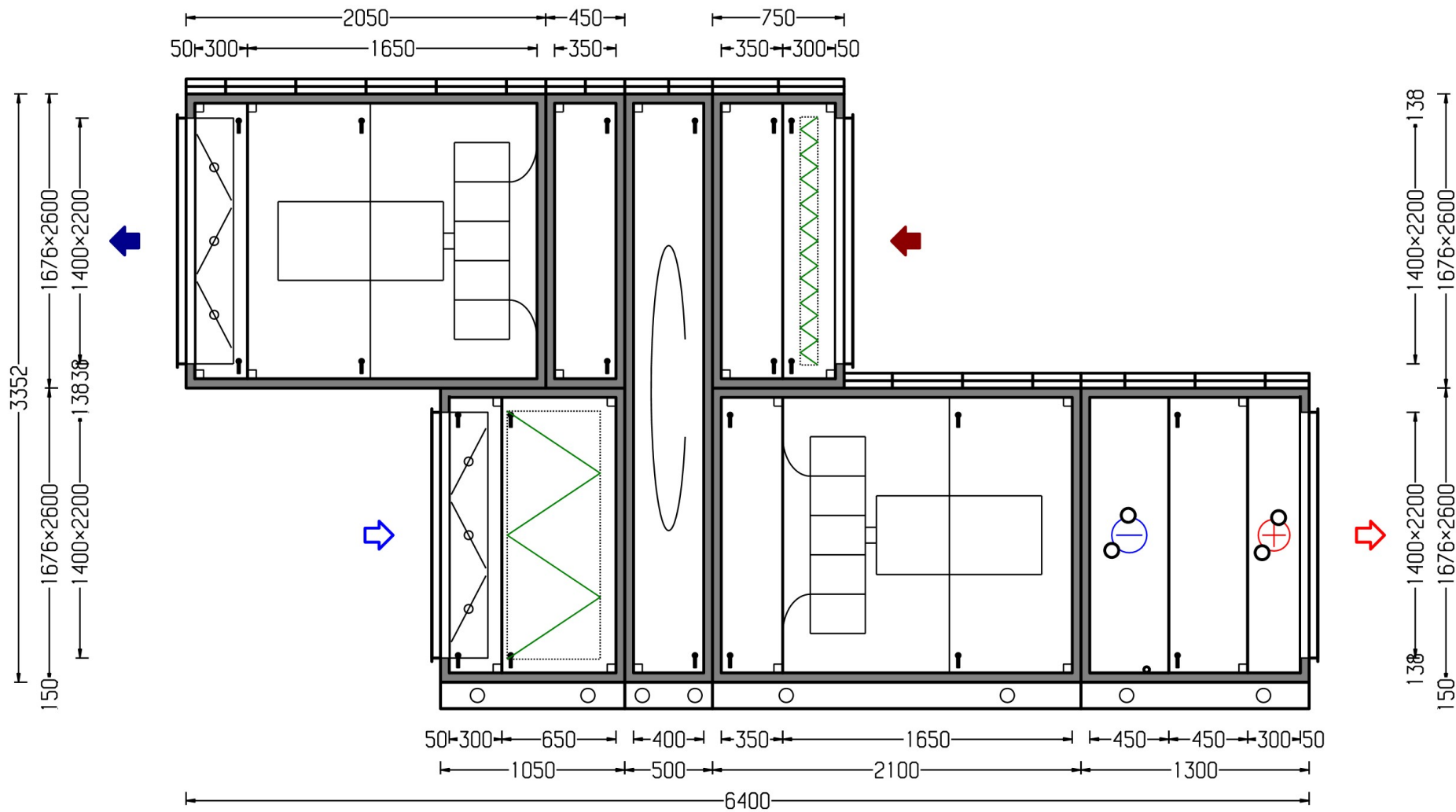
Accessories and Installed Options

Opt. 257 Low Sound
Opt. 100A Cooler with one pass
MORE Standard Unit

All performances are not compliant with EN14511 – 3 : 2013. Sound Power level according to 9614-1

CARRIER participates in the ECP program for Liquid Chilling Packages and Hydronic Heat Pumps. Check ongoing validity of [certificate:www.eurovent-certification.com](http://certificate.www.eurovent-certification.com).

Unit is outside of the scope of AHRI Air-Cooled Water Chilling Packages Using Vapor Compression Cycle Certification Program, but is rated in accordance with AHRI Standard 550/590 (I-P) and AHRI Standard 551/591 (SI).



From Inspection Side

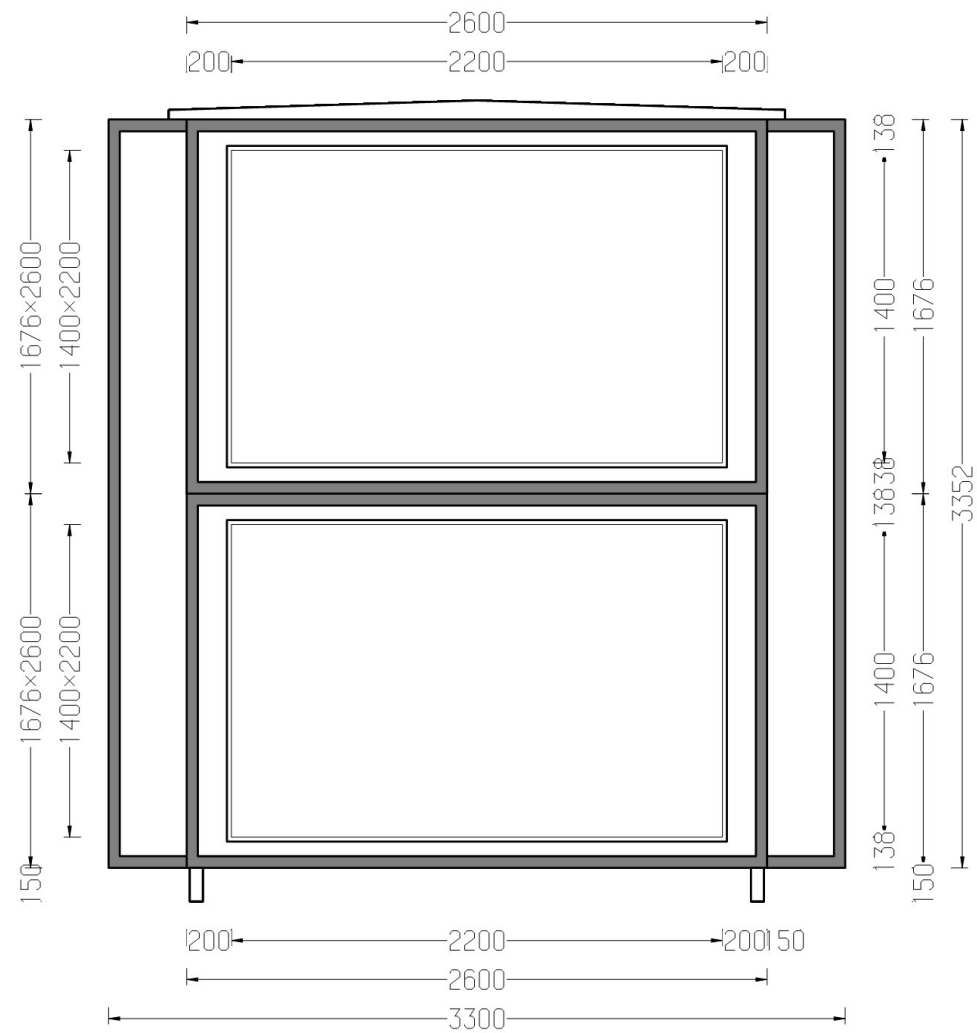
2015-08-26
Acon 2.7.150508.1

Customer id 2459
Project 16740
Unit 23
AOC ACON-01661094

Project name
Unit name
Supply air eQ-090
Exhaust air eQ-090

Thames Tower
AHU 02
10.52 m³/sec
9.27 m³/sec





From Left Hand Side

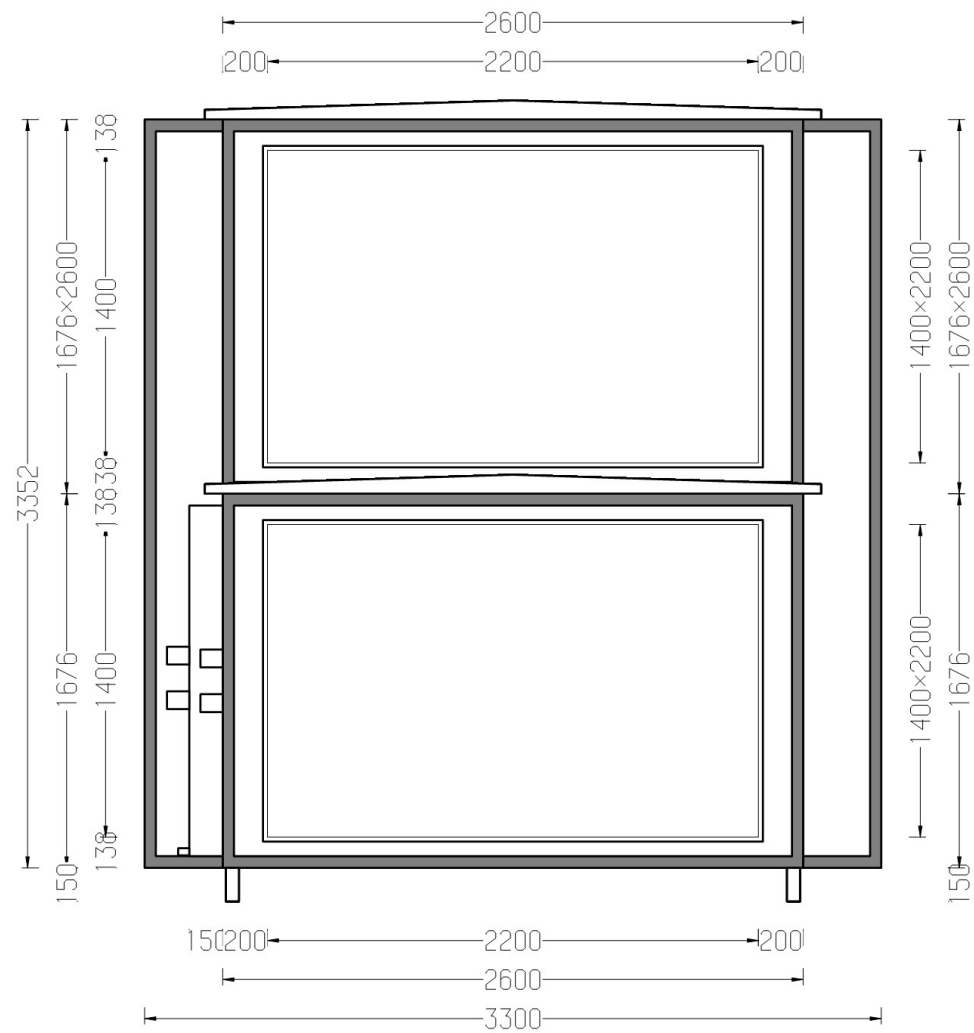
2015-08-26
Acon 2.7.150508.1

Customer id	2459
Project	16740
Unit	23
AOC	ACON-01661094

Project name	
Unit name	
Supply air	eQ-090
Exhaust air	eQ-090

Thames Tower
AHU 02
10.52 m³/sec
9.27 m³/sec





From Right Hand Side

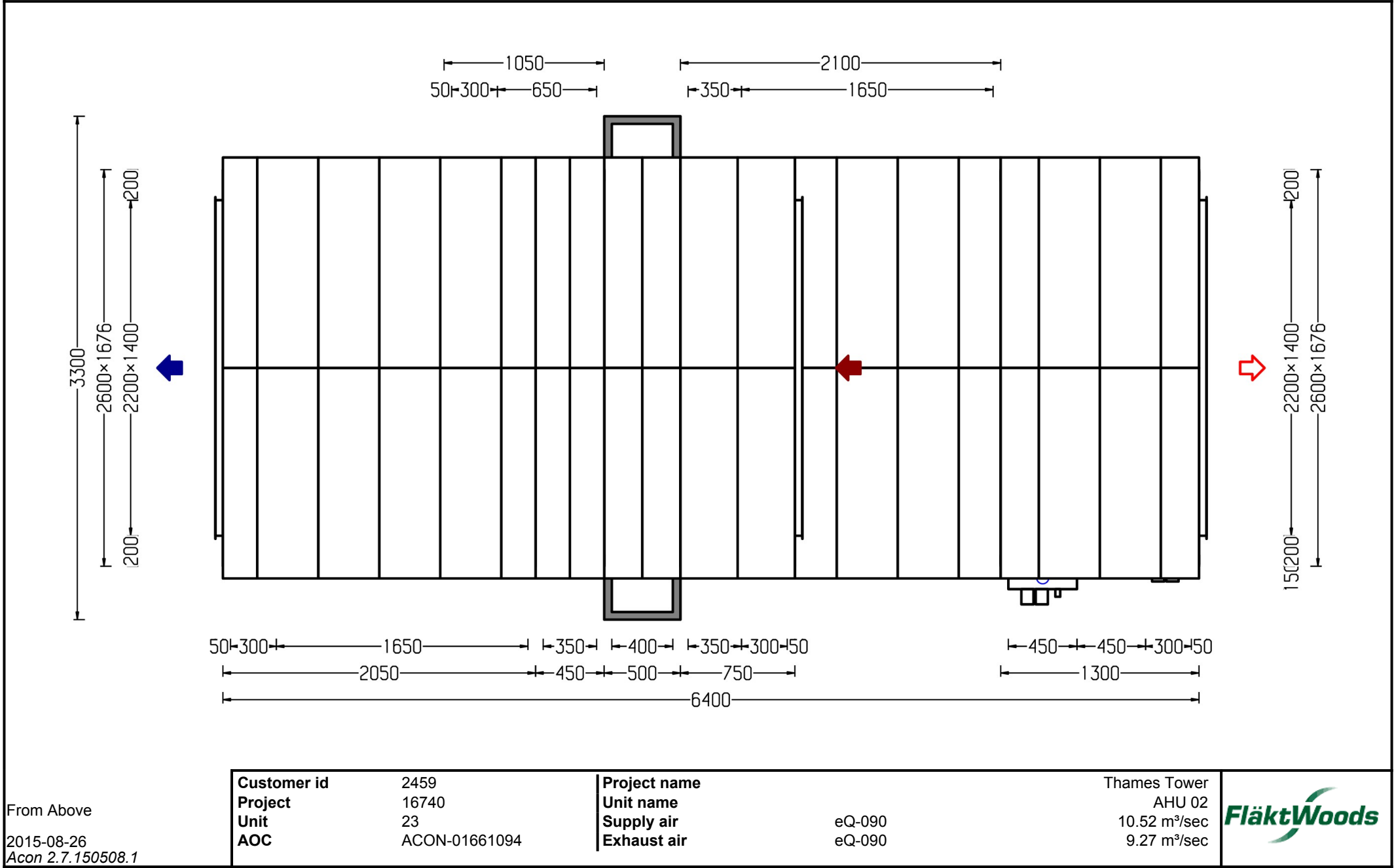
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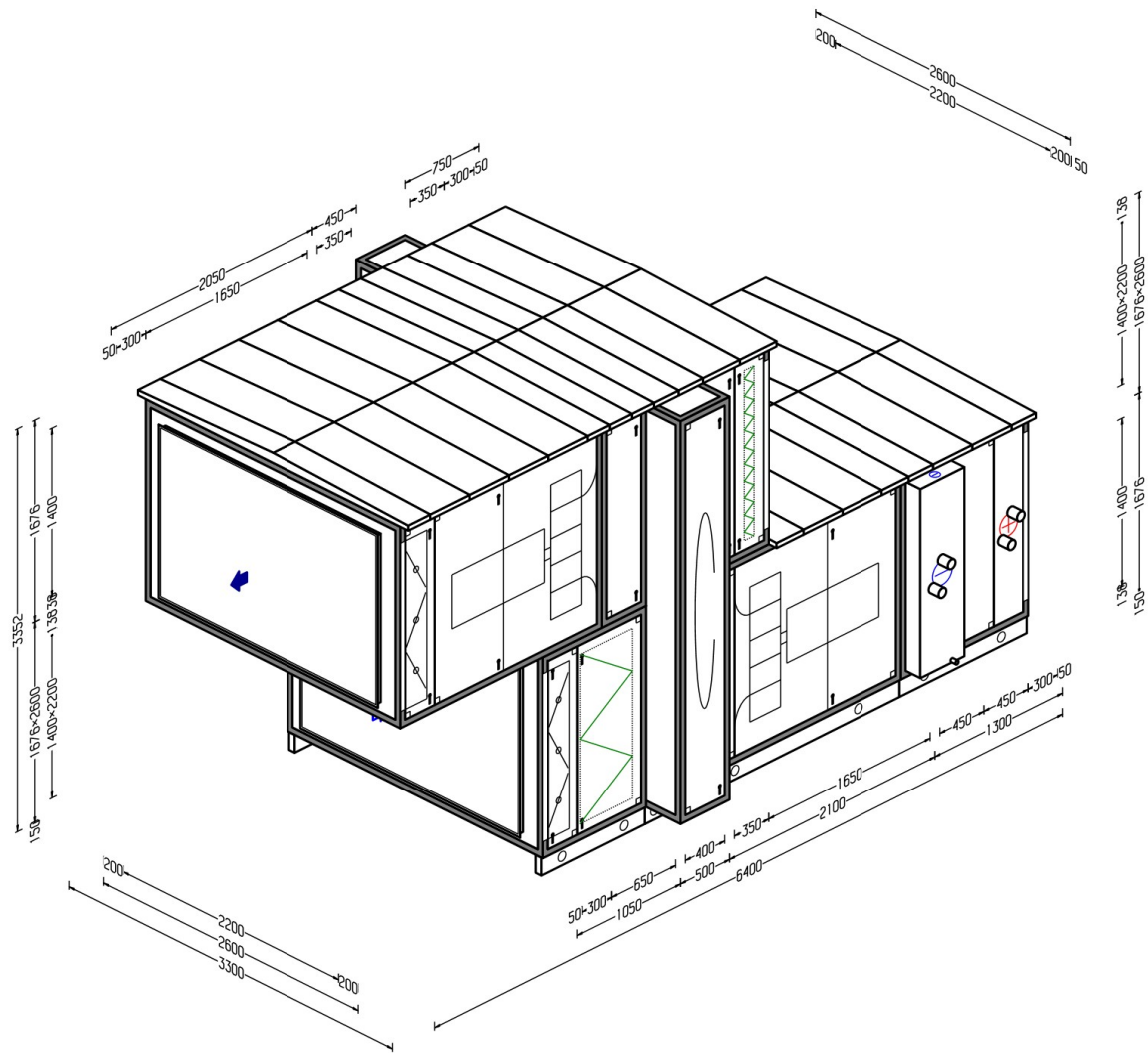
Customer id 2459
Project 16740
Unit 23
AOC ACON-01661094

Project name
Unit name
Supply air eQ-090
Exhaust air eQ-090

Thames Tower
AHU 02
10.52 m³/sec
9.27 m³/sec







Isometric South West
2015-08-26
Acon 2.7.150508.1

Customer id	2459	Project name	Thames Tower	
	16740		AHU 02	
	23		10.52 m³/sec	
	ACON-01661094		9.27 m³/sec	
Unit		Supply air	eQ-090	
AOC		Exhaust air	eQ-090	



AIR HANDLING UNIT eQ

Project 16740 () / Thames Tower Acon 2.7.150508.1
AOC ACON-01661094
Unit 23 () / AHU 02 2015-08-26
Size 090 Page 6/15

Customer
Customers ref.
Our ref. Neil Southall
Supply air flow 10.52 m³/sec Exhaust air flow 9.27 m³/sec
Ext. static pressure 210 Pa Ext. static pressure 162 Pa
Voltage 3 x 400V + N, 50 Hz Weight 4494 kg
Specific electric power demand 1.77 kW/(m³/s) Dimensioned for wet condition
Ref. density 1.2 kg/m³ Ref. altitude above sea level 0 m

SUMMARY

Functional sections in direction of air flow	v0 (m/s)	Et (%)	tw (°C)	ts (°C)	dP* (Pa)
Supply air:					
Connection section	4.1				6
Filter	3.2				148
Heat exchanger	3.1	70.7	-5 / 13.4	30 / 25.9	177
Inspection section					0
Plenum fan		73.0	13.4 / 14.3	25.9 / 26.9	769
Air cooler	2.9			30 / 22	118
Inspection section					0
Air heater	3.2		-5 / 21		74
Connection section	3.8				2
General loss					34
Supply outlet					210
Exhaust air:					
Exhaust inlet					162
Connection section	3.4				2
Filter	2.6				93
Inspection section					0
Heat exchanger	2.8		21 / 0.1	24 / 28.7	154
Additional throttling					74
Inspection section					0
Plenum fan		70.0			532
Connection section	3.6				18
General loss					29

*Refers to the fan design case

SOUND POWER LEVELS

(standard: EN13053 ISO/CD 13347-2)

	Lw per octave band (dB)								LwA
Octave band (Hz)	63	125	250	500	1k	2k	4k	8k	dB(A)
Fresh air connection	78	88	79	74	74	74	69	64	80
Supply air connection	72	87	88	89	83	79	72	67	89
Extract connection	78	88	81	78	78	78	72	67	84
Exhaust connection	72	87	90	91	85	83	78	75	92
To surroundings	74	81	69	58	60	61	56	43	69

TOLERANCE

According to EN 13053 the LwA tolerance is 4dB. Octave band tolerances are presented in the tolerance table

	Lw per octave band (dB)								LwA
Octave band (Hz)	63	125	250	500	1k	2k	4k	8k	dB(A)



AIR HANDLING UNIT eQ

Project	16740 () / Thames Tower	Acon 2.7.150508.1
AOC	ACON-01661094	
Unit	23 () / AHU 02	2015-08-26
Size	090	Page 7/15

Customer		
Customers ref.		
Our ref.	Neil Southall	
Supply air flow	10.52 m³/sec	Exhaust air flow 9.27 m³/sec
Ext. static pressure	210 Pa	Ext. static pressure 162 Pa
Voltage	3 x 400V + N, 50 Hz	Weight 4494 kg
Specific electric power demand	1.77 kW/(m³/s)	Dimensioned for wet condition
Ref. density	1.2 kg/m³	Ref. altitude above sea level 0 m

TOLERANCE	8	6	6	6	6	4	4	7	4
-----------	---	---	---	---	---	---	---	---	---

Frequency converters and motors mounted external are not included in the sound power levels

AIR HANDLING UNIT eQ

Project	16740 () / Thames Tower	Acon 2.7.150508.1
AOC	ACON-01661094	
Unit	23 () / AHU 02	2015-08-26
Size	090	Page 8/15

TECHNICAL SPECIFICATION

(components listed in direction of air flow)

SUPPLY AIR

Intake/ exhaust section (outdoor version, with door)

Unit size: 090

Installation alternative: Fresh air in end, with intake grille and damper

Damper type: with stainless steel CEN 3 damper

Inspection side: right

Pressure drop, dimensioning

6 Pa

Casing end wall

EQVA-090-1-1-11-1-1

Damper

EQAZ-12-220-140-3-2-1-11-2-0-2

Width cm : 220

Height in cm : 140

Tightness class : CEN 3

Connection: flange

Function : Outdoor air

Location: internally end wall

Damper type: 200 mm blade

Material : stainless sheet steel (AISI 304)

Duct connection piece

EQAZ-26-220-140-2-1-1

Width cm : 220

Height in cm : 140

Connection type: flange connection

Material: galvanized sheet steel / AlZn

Empty section

EQTC-090-030-0-0-0-0-0-1-1-2

Unit size : 090

Length: 030

Inspection side : right

Filter

EQPB-090-07-24-4-2-1-1-0-0-8-1

Size: 090

Filter length: Long bag (vertical pockets only)

Filter class: F7

Filter type: glass fibre, standard

Filter frame : plastic

Inspection side: inlet in end wall

Location: negative pressure

Prefilter: without

Drain tray: without

Material: AZ sheet steel

Inspection side: Right

Number of filters

8x592x592, 4x592x287

Pressure drop, start

98 Pa

Pressure drop, dimensioning

148 Pa

Pressure drop, end

198 Pa

Face area

3.6 m²

Face velocity

3.2 m/s

Anti-slip protection

EQAZ-20-090-3-1-1-1

Unit size : 090

Function: Filter, Empty section

Width: 1

Material: aluminium

Version: version 1

AIR HANDLING UNIT eQ

Project	16740 () / Thames Tower	Acon 2.7.150508.1
AOC	ACON-01661094	
Unit	23 () / AHU 02	2015-08-26
Size	090	Page 9/15

REGOTERM rotary heat exchanger

EQRB-090-7-1-1-1-0-1-1-3-1-1-1

Unit size: 090
Rotor type: SEMCO sorption rotor
Output variant: Output variant 5 (1.7)
Drive/Voltage: variable speed,, 1x230V
Motor class: variable speed,
Function lenght: standard (only rotor)
Supply air: lower deck
Delivery: sectoriserad rotor, split casing
Material: galvanized sheet steel/AlZn
Inspection side : right
Version number: rotor drive version 1

	Summer	Winter
Temperature Efficiency	69.0	70.7 %
Capacity reduction	77	360 kW
Humidity efficiency	62.8	67.7 %
Air flow transfer	0.48	0.50 m³/sec
Supply air	Summer	Winter
Pressure drop	177	155 Pa
Air temperature	30 / 25.9	-5 / 13.4 °C
Relative humidity	39.7 / 47	99 / 67.2 %
Exhaust air	Summer	Winter
Pressure drop	154	141 Pa
Air temperature	24 / 28.7	21 / 0.1 °C
Relative humidity	50.2 / 41.4	53.5 / 99.6 %
Additional throttling	74	74 Pa
EN308		
Efficiency calculated in regard to conditions specified by the EN308 standard		70.7 %

Empty section

EQTC-090-035-0-0-0-0-0-1-1-2

Unit size : 090
Length: 035
Inspection side : right

Plenum fan Centriflow Plus

EQLK-090-3-6-1-1-4-1-1-2-1-1-2

Unit size : 090
Fan size : 3
Equipment: normal + pressure tapping for air flow measurement
Anti-vibration mountings : rubber
Position inside the casing : supply air
Outlet direction : forward, towards following function
Material : galvanized sheet steel
Inspection side: right

Dimensioning data

Speed	1001 Rpm
Max speed	1150 Rpm
Fan efficiency	73.0 %
Total efficiency	65.2 %
Pressure rise, dimensioning	769 Pa
Fan shaft power at dim. data	11.4 kW
Grid Power	12.7 kW
Temperature rise	1 °C

SFP Calculation

Grid power according to SFP	11.1 kW
Pressure rise	677 Pa
Speed	954 Rpm

AIR HANDLING UNIT eQ

Project	16740 () / Thames Tower	Acon 2.7.150508.1
AOC	ACON-01661094	
Unit	23 () / AHU 02	2015-08-26
Size	090	Page 10/15

Single-speed motor

APAL-6-01850-2-2-7

Voltage: 380-420 V delta, 660-690 V star
Temperature sensors in stator winding: with thermistor
Design variant: FläktWoods IE2

Efficiency	90.4 %
Speed	987 Rpm
Motor output	18.5 kW
Electric current	36.5 A
Number of Poles	6
Output margin, minimum	20 %

Frequency converter

STRR-1-4-0365-3-0-4-1-01-1

Housing protection: IP66
Efficiency

98.8 %

Motor accessories

APAC-1-1-1-0-1-0365-000-4-0-0

Motor: 1-Speed
Motor control: Mounted frequency converter
Connection accessories: Safety switch
Type: Standard
Power supply: 3x400 VAC

Anti-slip protection

EQAZ-20-090-2-1-1-1

Unit size : 090
Function: Plenum fan (EQLK)
Width: 1
Material: aluminium
Version: version 1

Air cooler for chilled water

EQNN-090-02-2-1-02-01-1-1-1-1

Use as: Cooling Coil
Unit size : 090
Output variant : 2
Design: max. face area
Fin pitch: 2 mm
Fluid circuits : 2
Material, coil : Cu/Al
Droplet eliminator : with, plastic
Material, frame : galvanized sheet steel
Connection side : right
Nom. pipe size
Liquid volume
Pressure drop, dimensioning
Pressure drop
Pressure drop, dry coil
Output
Air temperature
Relative humidity
Face velocity
Water temperature
Water flow
Water velocity
Pressure drop water

80
47.0 l
118 Pa
118 Pa
65 Pa
145 kW
30 / 22 °C
50 / 72.8 %
2.9 m/s
6 / 12 °C
5.75 l/s
1.0 m/s
10.1 kPa

Empty section

EQTC-090-045-0-0-0-0-0-1-1-2

Unit size : 090
Length: 045
Inspection side : right

Anti-slip protection

EQAZ-20-090-3-1-1-1

Unit size : 090

AIR HANDLING UNIT eQ

Project	16740 () / Thames Tower	Acon 2.7.150508.1
AOC	ACON-01661094	
Unit	23 () / AHU 02	2015-08-26
Size	090	Page 11/15

Function: Filter, Empty section
Width: 1
Material: aluminium
Version: version 1

Air heater for hot water

EQEE-090-2-01-1-02-1-1-1-1

Output variant : 2	
Material, coil : Cu/Al	
Fin pitch: 2 mm	
Fluid circuits: 02	
Design: one complete coil	
Material, frame : galvanized sheet steel	
Connection side : right	
Nom. pipe size	80
Liquid volume	44.0 l
Pressure drop, dimensioning	72 Pa
Output	331 kW
Air temperature	-5 / 21 °C
Face velocity	3.0 m/s
Control principle for water heater	flow control
Water temperature	80 / 60 °C
Water flow	4.05 l/s
Water velocity	0.7 m/s
Pressure drop water	4.2 kPa

End connection frame

Pressure drop, dimensioning	2 Pa
Casing end wall	EQVA-090-2-1-11-1-1
Duct connection piece	EQAZ-26-220-140-2-1-1
Width cm : 220	
Height in cm : 140	
Connection type: flange connection	
Material: galvanized sheet steel / AlZn	

EXHAUST AIR

End connection frame

Pressure drop, dimensioning	2 Pa
Casing end wall	EQVA-090-1-1-11-2-1
Duct connection piece	EQAZ-26-220-140-2-1-1
Width cm : 220	
Height in cm : 140	
Connection type: flange connection	
Material: galvanized sheet steel / AlZn	

Filter

EQPA-090-4-2-0-1-2-1

Size: 090	
Filter length: pleated filter	
Filter class: G4	
Filter type: synthetic, cleanable	
Drain tray: without	
Material: Galvanized sheet steel	
Inspection side: Left	
Number of filters	8x592x592, 4x287x592
Pressure drop, start	58 Pa
Pressure drop, dimensioning	93 Pa
Pressure drop, end	128 Pa

AIR HANDLING UNIT eQ

Project	16740 () / Thames Tower	Acon 2.7.150508.1
AOC	ACON-01661094	
Unit	23 () / AHU 02	2015-08-26
Size	090	Page 12/15

Face area	3.6 m ²
Face velocity	2.6 m/s

Empty section

EQTC-090-035-0-0-0-0-0-1-2-2

Unit size : 090
Length: 035
Inspection side : left

Empty section

EQTC-090-035-0-0-0-0-0-1-2-2

Unit size : 090
Length: 035
Inspection side : left

Plenum fan Centriflow Plus

EQLK-090-3-6-1-1-3-1-2-2-1-2-2

Unit size : 090
Fan size : 3
Equipment: normal + pressure tapping for air flow measurement
Anti-vibration mountings : rubber
Position inside the casing : exhaust air
Outlet direction : forward, towards following function
Material : galvanized sheet steel
Inspection side: left

Dimensioning data

Speed	895 Rpm
Max speed	1150 Rpm
Fan efficiency	70.0 %
Total efficiency	62.0 %
Pressure rise, dimensioning	532 Pa
Fan shaft power at dim. data	7.68 kW
Grid Power	8.68 kW
Temperature rise	0.7 °C

SFP Calculation

Grid power according to SFP	7.61 kW
Pressure rise	487 Pa
Speed	847 Rpm

Single-speed motor

APAL-6-01500-2-2-7

Voltage: 380-420 V delta, 660-690 V star
Temperature sensors in stator winding: with thermistor
Design variant: FläktWoods IE2
Efficiency
Speed
Motor output
Electric current
Number of Poles
Output margin, minimum

89.7 %
981 Rpm
15 kW
31.0 A
6
30 %

Frequency converter

STRR-2-4-0310-3-0-4-1-01-1

Housing protection: IP66
Efficiency

98.7 %

Motor accessories

APAC-1-1-1-0-1-0310-000-4-0-0

Motor: 1-Speed
Motor control: Mounted frequency converter
Connection accessories: Safety switch
Type: Standard
Power supply: 3x400 VAC

Anti-slip protection

EQAZ-20-090-2-1-1-1

Unit size : 090
Function: Plenum fan (EQLK)



AIR HANDLING UNIT eQ

Project	16740 () / Thames Tower	Acon 2.7.150508.1
AOC	ACON-01661094	
Unit	23 () / AHU 02	2015-08-26
Size	090	Page 13/15

Width: 1
Material: aluminium
Version: version 1

Intake/ exhaust section (outdoor version, with door)

Unit size: 090
Installation alternative: Damper inside on end wall
Damper type: with stainless steel CEN 3 damper
Inspection side: left
Pressure drop, dimensioning

18 Pa

Empty section

EQTC-090-030-0-0-0-0-1-2-2

Unit size : 090
Length: 030
Inspection side : left

Casing end wall

EQVA-090-2-1-11-2-1

Damper

EQAZ-12-220-140-3-2-4-11-2-0-2

Width cm : 220
Height in cm : 140
Tightness class : CEN 3
Connection: flange
Function : extract air
Location: internally end wall
Damper type: 200 mm blade
Material : stainless sheet steel (AISI 304)

Duct connection piece

EQAZ-26-220-140-2-1-1

Width cm : 220
Height in cm : 140
Connection type: flange connection
Material: galvanized sheet steel / AlZn

AIR HANDLING UNIT eQ

Project	16740 () / Thames Tower	Acon 2.7.150508.1
AOC	ACON-01661094	
Unit	23 () / AHU 02	2015-08-26
Size	090	Page 14/15

BLOCK LIST

	LENGTH (mm)	WIDTH (mm)	HEIGHT (mm)	VOLUME (m³)	WEIGHT (kg)
EQGB-090-105-11-1-1-2-1-2-2-1 Unit casing (frame, module) Material: AlZn sheet steel Thermal insulation: T3 Condensation insulation: TB3 Leakage class: L2 Casing strength: CEN D2 Casing end wall Empty section Filter	1100	2750	1996	6.04	422
EQHB-090-050-11-1-1-2-1-7-2-1 REGOTERM rotary heat exchanger	1200	3555	2025	8.64	1026
EQGB-090-210-11-1-1-2-1-3-2-1 Unit casing (frame, module) Material: AlZn sheet steel Thermal insulation: T3 Condensation insulation: TB3 Leakage class: L2 Casing strength: CEN D2 Empty section Plenum fan Centriflow Plus	2150	2750	2081	12.3	990
EQGB-090-130-11-1-1-2-1-4-2-1 Unit casing (frame, module) Material: AlZn sheet steel Thermal insulation: T3 Condensation insulation: TB3 Leakage class: L2 Casing strength: CEN D2 Air cooler for chilled water Empty section Air heater for hot water Casing end wall	1350	2900	2081	8.15	649
EQGB-090-075-11-1-1-2-1-2-2-1 Unit casing (frame, module) Material: AlZn sheet steel Thermal insulation: T3 Condensation insulation: TB3 Leakage class: L2 Casing strength: CEN D2 Casing end wall Pleated filter Empty section	800	2750	1931	4.25	297
EQGB-090-045-11-1-1-2-1-3-2-1 Unit casing (frame, module) Material: AlZn sheet steel Thermal insulation: T3 Condensation insulation: TB3 Leakage class: L2 Casing strength: CEN D2 Empty section	500	2750	1931	2.66	130
EQGB-090-205-11-1-1-2-1-4-2-1	2100	2750	1931	11.15	979

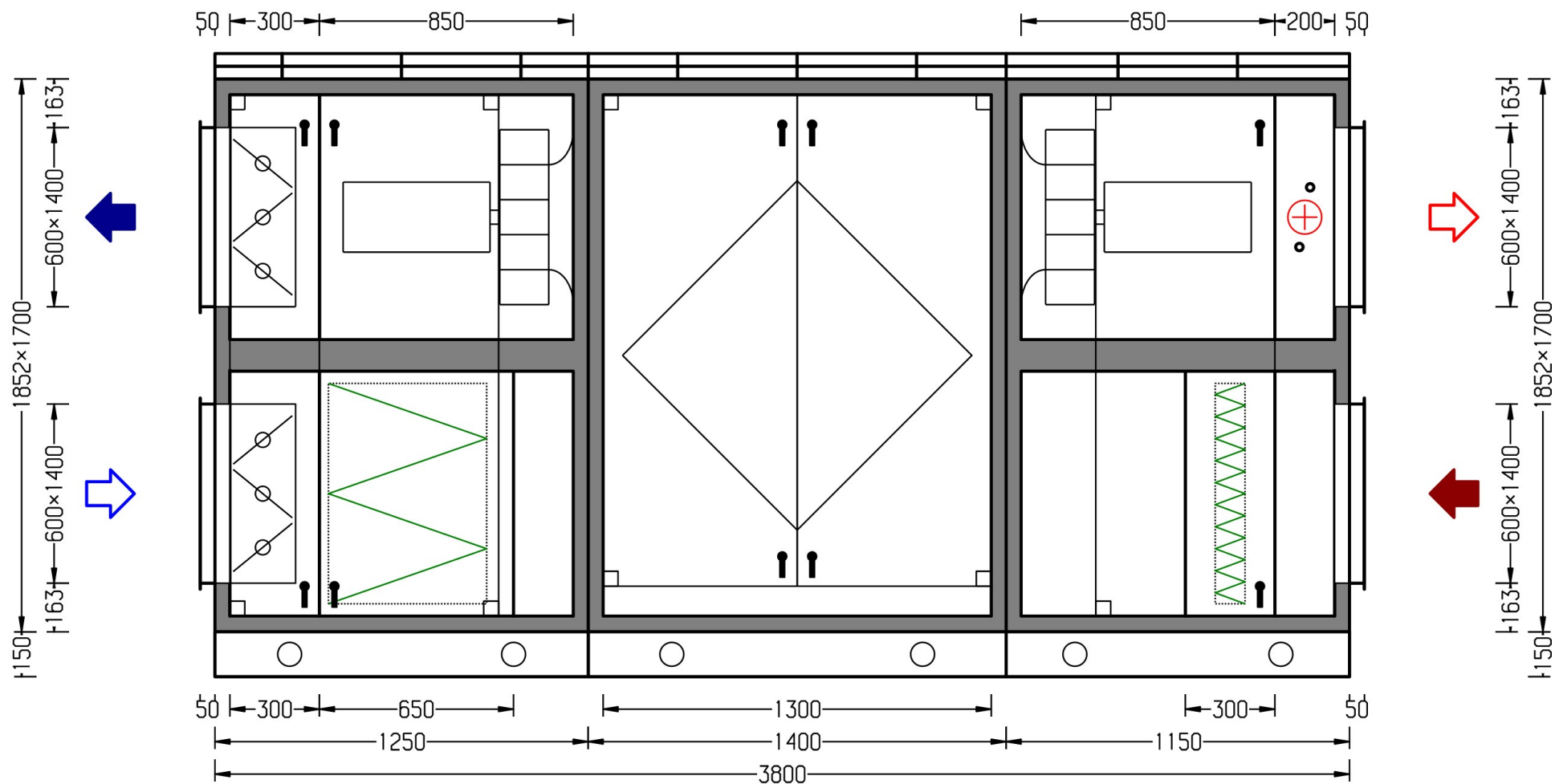


AIR HANDLING UNIT eQ

Project	16740 () / Thames Tower	<i>Acon 2.7.150508.1</i>
AOC	ACON-01661094	
Unit	23 () / AHU 02	2015-08-26
Size	090	Page 15/15

Unit casing (frame, module)
Material: AlZn sheet steel
Thermal insulation: T3
Condensation insulation: TB3
Leakage class: L2
Casing strength: CEN D2
Plenum fan Centriflow Plus
Empty section
Casing end wall

53.18	4494
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From Inspection Side

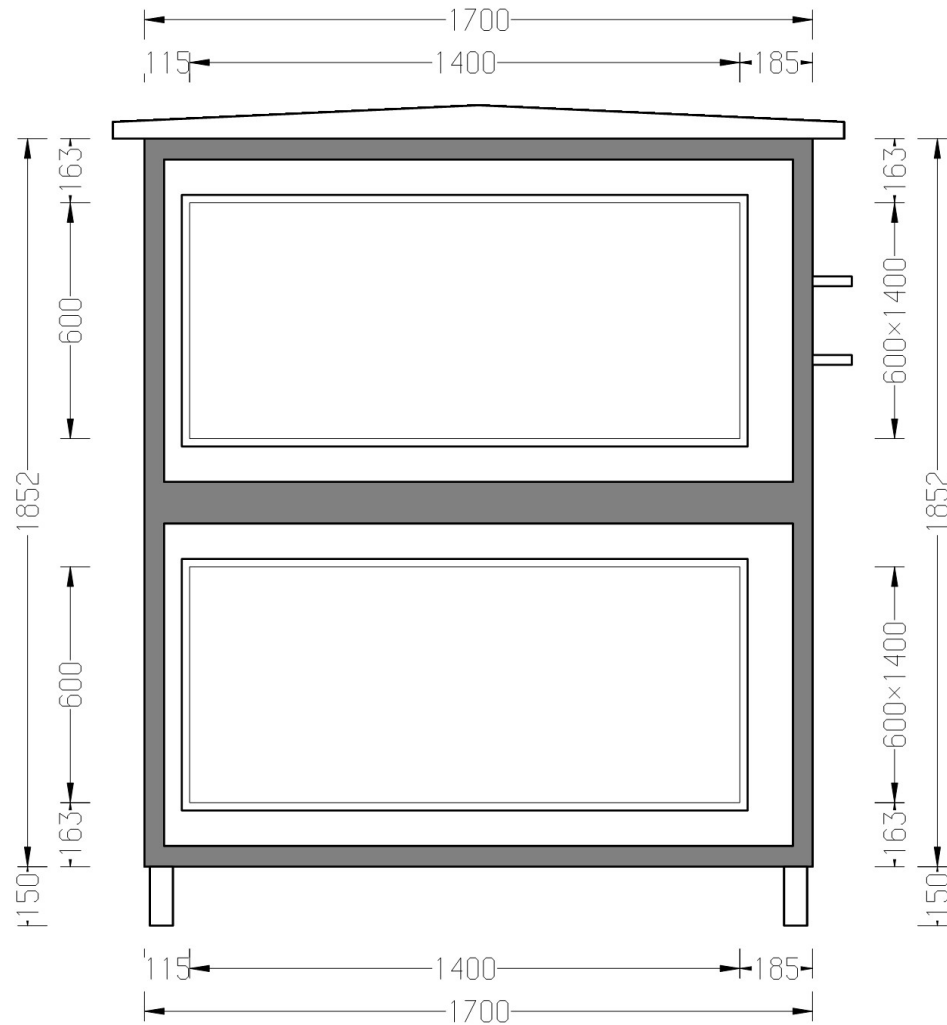
2015-08-26
Acon 2.7.150508.1

Customer id 2459
Project 16740
Unit 26
AOC ACON-01661134

Project name
Unit name
Supply air eQ-023
Exhaust air eQ-023

Thames Tower
MVHR-RF
2.20 m³/sec
2.23 m³/sec





From Left Hand Side

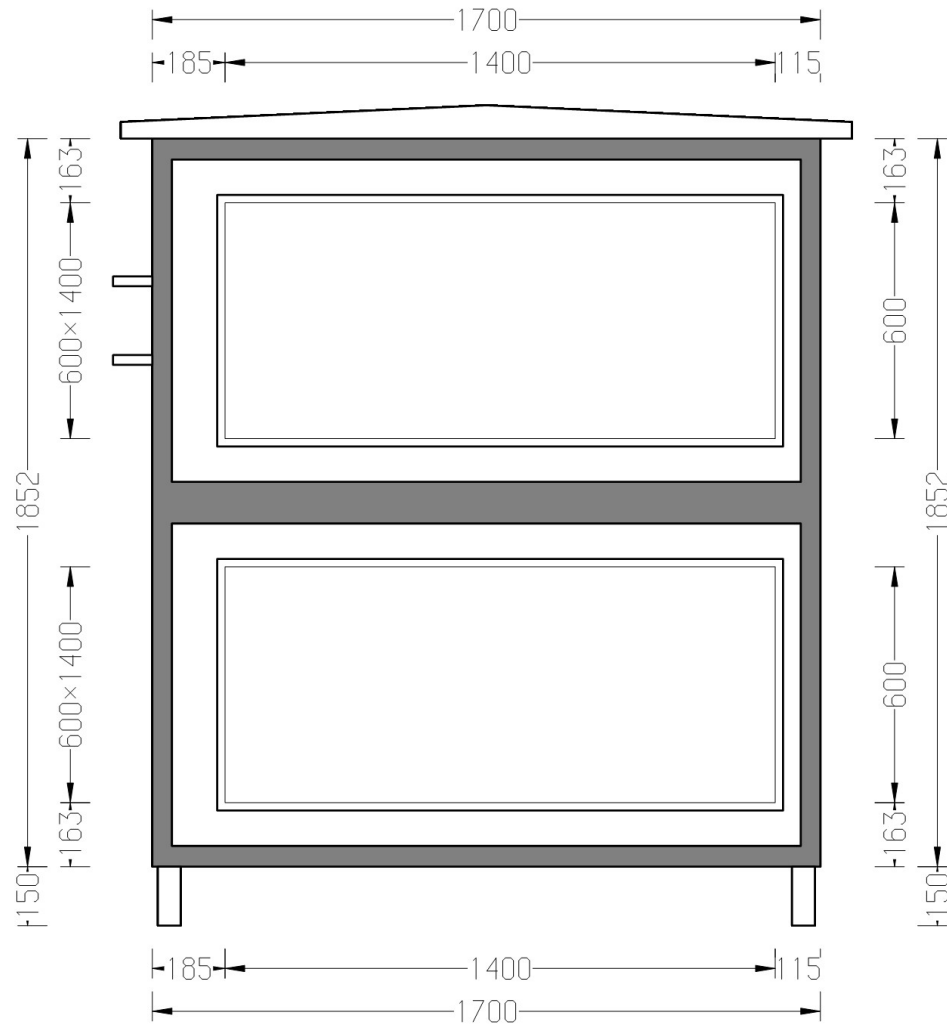
2015-08-26
Acon 2.7.150508.1

Customer id	2459
Project	16740
Unit	26
AOC	ACON-01661134

Project name	
Unit name	
Supply air	eQ-023
Exhaust air	eQ-023

Thames Tower
MVHR-RF
2.20 m³/sec
2.23 m³/sec





From Right Hand Side

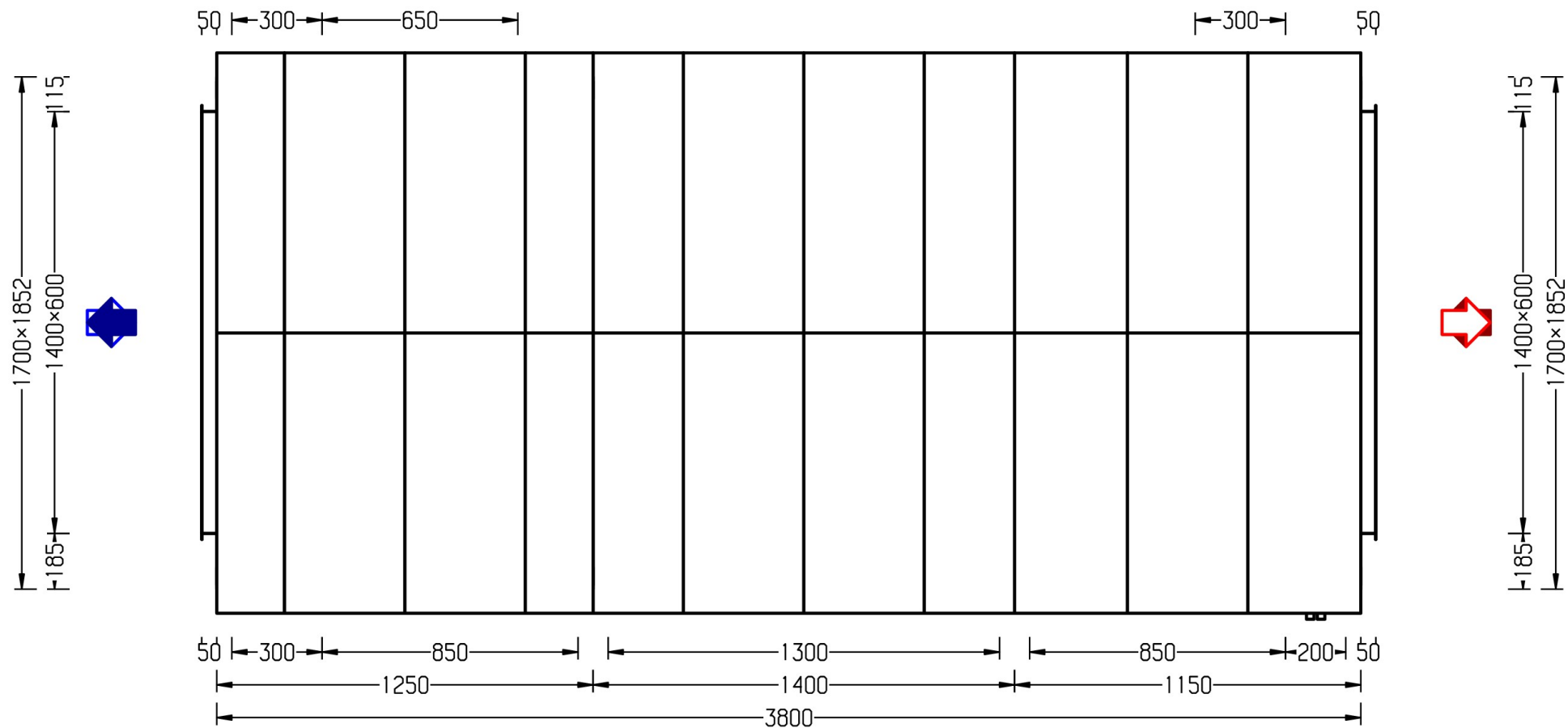
2015-08-26
Acon 2.7.150508.1

Customer id 2459
Project 16740
Unit 26
AOC ACON-01661134

Project name
Unit name
Supply air eQ-023
Exhaust air eQ-023

Thames Tower
MVHR-RF
2.20 m³/sec
2.23 m³/sec





From Above

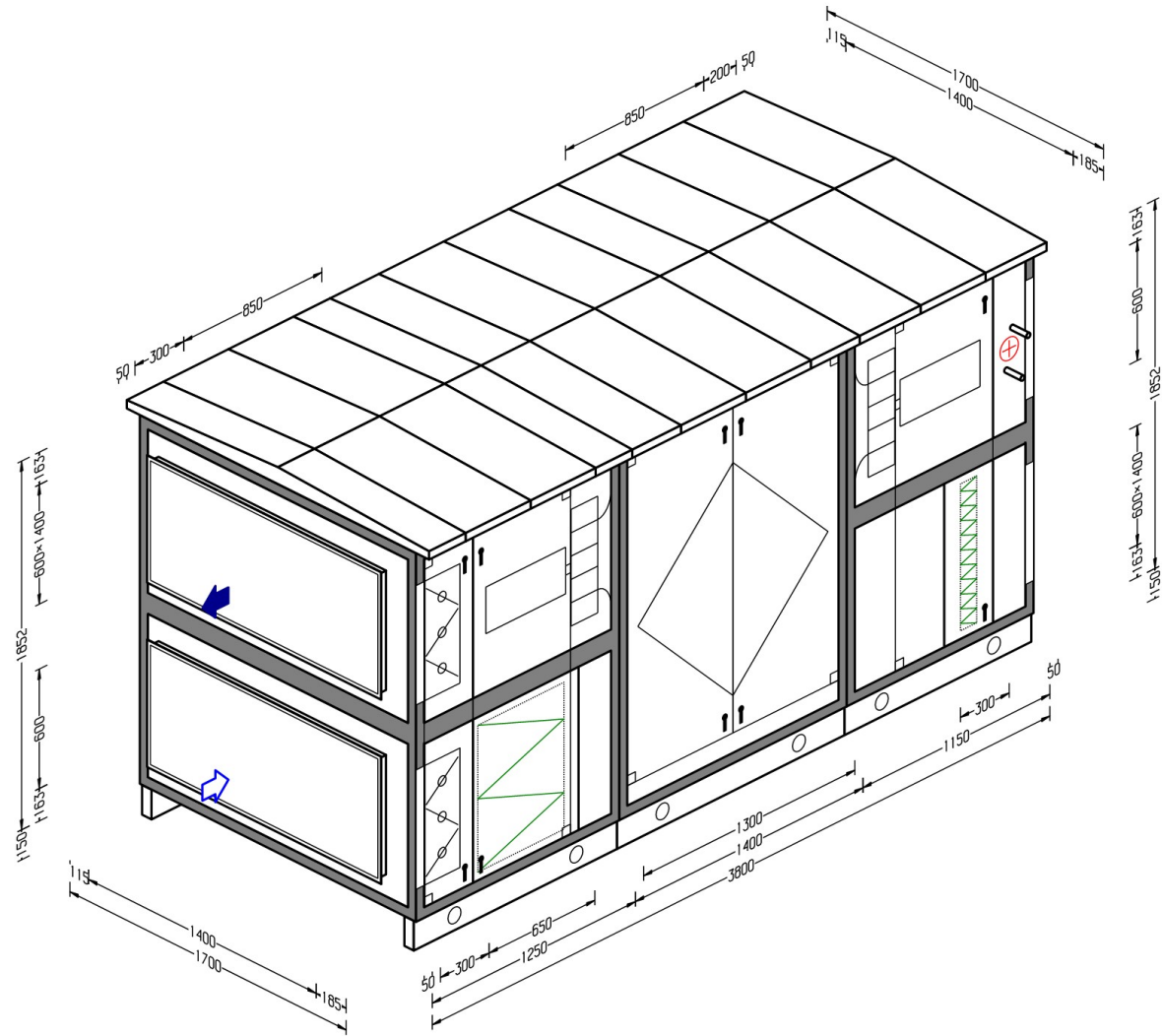
2015-08-26
Acon 2.7.150508.1

Customer id	2459
Project	16740
Unit	26
AOC	ACON-01661134

Project name	
Unit name	
Supply air	eQ-023
Exhaust air	eQ-023

Thames Tower
MVHR-RF
2.20 m³/sec
2.23 m³/sec





Isometric South West

2015-08-26
Acon 2.7.150508.1

Customer id	2459
Project	16740
Unit	26
AOC	ACON-01661134

Project name	
Unit name	
Supply air	eQ-023
Exhaust air	eQ-023

Thames Tower
MVHR-RF
2.20 m³/sec
2.23 m³/sec



AIR HANDLING UNIT eQ

Project 16740 () / Thames Tower Acon 2.7.150508.1
AOC ACON-01661134
Unit 26 () / MVHR-RF 2015-08-26
Size 023 Page 6/12

Customer
Customers ref.
Our ref. Neil Southall
Supply air flow 2.20 m³/sec Exhaust air flow 2.23 m³/sec
Ext. static pressure 140 Pa Ext. static pressure 251 Pa
Voltage 3 x 400V + N, 50 Hz Weight 1575 kg
Specific electric power demand 1.34 kW/(m³/s) Dimensioned for wet condition
Ref. density 1.2 kg/m³ Ref. altitude above sea level 0 m

SUMMARY

Functional sections in direction of air flow	v0 (m/s)	Et (%)	tw (°C)	ts (°C)	dP* (Pa)
Supply air:					
Connection section	2.7				3
Filter	2.5				121
Heat exchanger	2.2	52.1	-5 / 5.8	28 / 26	104
Plenum fan		72.2	5.8 / 6.3	26 / 26.6	413
Air heater	2.0		-5 / 18		20
Connection section	2.7				1
General loss					24
Supply outlet					140
Exhaust air:					
Exhaust inlet					251
Connection section	2.7				1
Filter	2.5				91
Heat exchanger	2.4		18 / 8.8	24 / 26	95
Plenum fan		73.4			472
Connection section	2.7				10
General loss					24

*Refers to the fan design case

SOUND POWER LEVELS

(standard: EN13053 ISO/CD 13347-2)

	Lw per octave band (dB)								LwA
Octave band (Hz)	63	125	250	500	1k	2k	4k	8k	dB(A)
Fresh air connection	64	71	75	64	60	57	52	52	69
Supply air connection	69	76	80	78	78	72	67	63	81
Extract connection	62	62	79	71	67	64	58	58	74
Exhaust connection	68	67	82	82	81	74	71	69	84
To surroundings	63	65	68	53	49	48	42	33	61

TOLERANCE

According to EN 13053 the LwA tolerance is 4dB. Octave band tolerances are presented in the tolerance table

	Lw per octave band (dB)								LwA
Octave band (Hz)	63	125	250	500	1k	2k	4k	8k	dB(A)
TOLERANCE	8	6	6	6	6	4	4	7	4

Frequency converters and motors mounted external are not included in the sound power levels

AIR HANDLING UNIT eQ

Project	16740 () / Thames Tower	Acon 2.7.150508.1
AOC	ACON-01661134	
Unit	26 () / MVHR-RF	2015-08-26
Size	023	Page 7/12

TECHNICAL SPECIFICATION

(components listed in direction of air flow)

SUPPLY AIR

Intake/ exhaust section (outdoor version, with door)

Unit size: 023

Installation alternative: Fresh air in end, with intake grille and damper

Damper type: with galvanized CEN 3 damper

Inspection side: right

Pressure drop, dimensioning

3 Pa

Casing end wall

EQVA-023-1-1-11-1-1

Damper

EQAZ-12-140-060-3-2-1-11-2-0-1

Width cm : 140

Height in cm : 060

Tightness class : CEN 3

Connection: flange

Function : Outdoor air

Location: internally end wall

Damper type: 200 mm blade

Material : galvanized sheet steel

Duct connection piece

EQAZ-26-140-060-2-1-1

Width cm : 140

Height in cm : 60

Connection type: flange connection

Material: galvanized sheet steel / AlZn

Empty section

EQTC-023-030-0-0-0-0-0-1-1-2

Unit size : 023

Length: 030

Inspection side : right

Filter

EQPB-023-07-24-4-2-1-1-0-0-8-1

Size: 023

Filter length: Long bag (vertical pockets only)

Filter class: F7

Filter type: glass fibre, standard

Filter frame : plastic

Inspection side: inlet in end wall

Location: negative pressure

Prefilter: without

Drain tray: without

Material: AZ sheet steel

Inspection side: Right

Number of filters

2x592x592, 1x287x592

Pressure drop, start

71 Pa

Pressure drop, dimensioning

121 Pa

Pressure drop, end

171 Pa

Face area

0.9 m²

Face velocity

2.5 m/s

Plate heat exchanger, RECUTERM

EQRC-023-5-1-1-3-0-0-1-1-1

Unit size : 023

Installation alternative, right-hand/left-hand : 5

Exhaust air direction: upwards

Fin material : aluminium

Design : small plate heat exchanger with by-pass damper

Material : galvanized sheet steel

AIR HANDLING UNIT eQ

Project	16740 () / Thames Tower	Acon 2.7.150508.1
AOC	ACON-01661134	
Unit	26 () / MVHR-RF	2015-08-26
Size	023	Page 8/12

Inspection side: right

Version number: version 1

Performance, unregulated, Winter

Air temperature in	-5	0 °C
Air temperature out	7.4	9.4 °C
Efficiency	54.1	52.1 %

Antifrost control

Temperature efficiency		46.8 %
Capacity reduction		28.7 kW

Temperature efficiency

Cooling recovery		50.2 %
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Supply air

	Summer	Winter
Pressure drop	104	93 Pa
Air temperature	28 / 26	-5 / 5.8 °C
Relative humidity	53.7 / 60.4	99.9 / 43.6 %

Exhaust air

	Summer	Winter
Pressure drop	95	91 Pa
Air temperature	24 / 26	18 / 8.8 °C
Relative humidity	43.4 / 38.5	50 / 83 %

EN308

Efficiency calculated in regard to conditions specified by the EN308 standard		50.4 %
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Plenum fan Centriflow Plus

EQLK-023-2-6-1-1-2-0-1-2-1-1-2

Unit size : 023

Fan size : 2

Equipment: normal + pressure tapping for air flow measurement

Anti-vibration mountings : rubber

Position inside the casing : supply air

Outlet direction : forward, towards following function

Material : galvanized sheet steel

Inspection side: right

Dimensioning data

Speed	1515 Rpm
Max speed	2630 Rpm
Fan efficiency	72.2 %
Total efficiency	58.5 %
Pressure rise, dimensioning	413 Pa
Fan shaft power at dim. data	1.29 kW
Grid Power	1.6 kW
Temperature rise	0.6 °C

SFP Calculation

Grid power according to SFP	1.37 kW
Pressure rise	355 Pa
Speed	1439 Rpm

Centriflow Plus Fan Unit + Motor

AQLK-050-4-00220-10-1-1-1

Single-speed motor

Voltage: 220-240 V delta, 380-420 V star, 220 V delta, 380 V star

Temperature sensors in stator winding: with thermistor

Design variant: FläktWoods IE2

Efficiency	84.3 %
Speed	1450 Rpm
Motor output	2.2 kW
Electric current	4.7 A
Number of Poles	4
Output margin, minimum	30 %

Frequency converter

STRR-1-4-0047-3-0-4-1-01-1

Housing protection: IP66

AIR HANDLING UNIT eQ

Project	16740 () / Thames Tower	Acon 2.7.150508.1
AOC	ACON-01661134	
Unit	26 () / MVHR-RF	2015-08-26
Size	023	Page 9/12

Efficiency 96.2 %

Motor accessories

APAC-1-1-1-0-1-0047-308-4-0-0

Motor: 1-Speed

Motor control: Mounted frequency converter

Connection accessories: Safety switch

Type: Standard

Length: 308

Power supply: 3x400 VAC

Air heater for hot water

EQEE-023-1-01-1-04-1-1-1-1

Output variant : 1

Material, coil : Cu/Al

Fin pitch: 2 mm

Fluid circuits: 04

Design: one complete coil

Material, frame : galvanized sheet steel

Connection side : right

Nom. pipe size

25

Liquid volume

5.0 l

Pressure drop, dimensioning

18 Pa

Output

61.2 kW

Air temperature

-5 / 18 °C

Face velocity

2.0 m/s

Control principle for water heater

flow control

Water temperature

80 / 60 °C

Water flow

0.75 l/s

Water velocity

1.2 m/s

Pressure drop water

12.9 kPa

End connection frame

Pressure drop, dimensioning

1 Pa

Casing end wall

EQVA-023-2-1-11-1-1

Duct connection piece

EQAZ-26-140-060-2-1-1

Width cm : 140

Height in cm : 60

Connection type: flange connection

Material: galvanized sheet steel / AlZn

EXHAUST AIR

End connection frame

Pressure drop, dimensioning

1 Pa

Casing end wall

EQVA-023-1-1-11-2-1

Duct connection piece

EQAZ-26-140-060-2-1-1

Width cm : 140

Height in cm : 60

Connection type: flange connection

Material: galvanized sheet steel / AlZn

Filter

EQPA-023-4-2-0-1-2-1

Size: 023

Filter length: pleated filter

Filter class: G4

Filter type: synthetic, cleanable

Drain tray: without

Material: Galvanized sheet steel

Inspection side: Left

AIR HANDLING UNIT eQ

Project	16740 () / Thames Tower	Acon 2.7.150508.1
AOC	ACON-01661134	
Unit	26 () / MVHR-RF	2015-08-26
Size	023	Page 10/12

Number of filters	2x592x592, 1x287x592
Pressure drop, start	56 Pa
Pressure drop, dimensioning	91 Pa
Pressure drop, end	126 Pa
Face area	0.9 m²
Face velocity	2.5 m/s

Plenum fan Centriflow Plus

EQLK-023-2-6-1-1-2-0-2-2-1-2-2

Unit size : 023
Fan size : 2
Equipment: normal + pressure tapping for air flow measurement
Anti-vibration mountings : rubber
Position inside the casing : exhaust air
Outlet direction : forward, towards following function
Material : galvanized sheet steel
Inspection side: left

Dimensioning data

Speed	1571 Rpm
Max speed	2630 Rpm
Fan efficiency	73.4 %
Total efficiency	59.4 %
Pressure rise, dimensioning	472 Pa
Fan shaft power at dim. data	1.47 kW
Grid Power	1.82 kW
Temperature rise	0.7 °C

SFP Calculation

Grid power according to SFP	1.64 kW
Pressure rise	433 Pa
Speed	1511 Rpm

Centriflow Plus Fan Unit + Motor

AQLK-050-4-00220-10-1-1-1

Single-speed motor

Voltage: 220-240 V delta, 380-420 V star, 220 V delta, 380 V star
Temperature sensors in stator winding: with thermistor
Design variant: FläktWoods IE2

Efficiency	84.3 %
Speed	1450 Rpm
Motor output	2.2 kW
Electric current	4.7 A
Number of Poles	4
Output margin, minimum	30 %

Frequency converter

STRR-2-4-0047-3-0-4-1-01-1

Housing protection: IP66	
Efficiency	96.0 %

Motor accessories

APAC-1-1-1-0-1-0047-308-4-0-0

Motor: 1-Speed
Motor control: Mounted frequency converter
Connection accessories: Safety switch
Type: Standard
Length: 308
Power supply: 3x400 VAC

Intake/ exhaust section (outdoor version, with door)

Unit size: 023
Installation alternative: Damper inside on end wall
Damper type: with galvanized CEN 3 damper
Inspection side: left
Pressure drop, dimensioning

10 Pa



AIR HANDLING UNIT eQ

Project	16740 () / Thames Tower	Acon 2.7.150508.1
AOC	ACON-01661134	
Unit	26 () / MVHR-RF	2015-08-26
Size	023	Page 11/12

Empty section

EQTC-023-030-0-0-0-0-1-2-2

Unit size : 023

Length: 030

Inspection side : left

Casing end wall

EQVA-023-2-1-11-2-1

Damper

EQAZ-12-140-060-3-2-4-11-2-0-1

Width cm : 140

Height in cm : 060

Tightness class : CEN 3

Connection: flange

Function : extract air

Location: internally end wall

Damper type: 200 mm blade

Material : galvanized sheet steel

Duct connection piece

EQAZ-26-140-060-2-1-1

Width cm : 140

Height in cm : 60

Connection type: flange connection

Material: galvanized sheet steel / AlZn

AIR HANDLING UNIT eQ

Project	16740 () / Thames Tower	Acon 2.7.150508.1
AOC	ACON-01661134	
Unit	26 () / MVHR-RF	2015-08-26
Size	023	Page 12/12

BLOCK LIST

	LENGTH (mm)	WIDTH (mm)	HEIGHT (mm)	VOLUME (m³)	WEIGHT (kg)
EQHB-023-125-11-1-1-2-1-2-2-1 Unit casing (frame, unit) Material: AlZn sheet steel Thermal insulation: T3 Condensation insulation: TB3 Leakage class: L2 Casing strength: CEN D2 Casing end wall Empty section Empty section Casing end wall Filter Plenum fan Centriflow Plus	1300	1850	2257	5.43	531
EQHB-023-140-11-1-1-2-1-3-2-1 Unit casing (frame, unit) Material: AlZn sheet steel Thermal insulation: T3 Condensation insulation: TB3 Leakage class: L2 Casing strength: CEN D2 Plate heat exchanger, RECUTERM	1450	1850	2257	6.05	532
EQHB-023-115-11-1-1-2-1-4-2-1 Unit casing (frame, unit) Material: AlZn sheet steel Thermal insulation: T3 Condensation insulation: TB3 Leakage class: L2 Casing strength: CEN D2 Plenum fan Centriflow Plus Pleated filter Air heater for hot water Casing end wall Casing end wall	1200	1850	2257	5.01	512
				16.49	1575