

TECHNICAL NOTE

Project Student Accommodation Development,
Ablett House, Liverpool

Subject Planning Condition 12

Author Simon Webster

Date 3 June 2015

Ref R0834/T05

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15DIS/1571

Planning Condition 12 of the Planning Decision Notice (application ref: 12F/0784 & 12F/2697, 14F/0020, 14F/1027 and 14A/2479) for the student accommodation development at Hatton Gardens, Liverpool, requires that sound insulation measures are incorporated within the building to ensure that adequate protection against external noise ingress is provided. The condition is reproduced below:

12

The student accommodation hereby approved shall be acoustically insulated in accordance with a scheme to be submitted to and approved in writing by the local planning authority (in consultation with the Council's Environmental Health Service), which shall be installed to their satisfaction prior to the first occupation of the student accommodation. For the avoidance of doubt, sound mitigation must take the form of a package of acoustic treatment to all habitable room windows in accordance with the specifications contained within the Noise Insulation Regulations 1975, or double glazing of an equivalent or better acoustic performance, together with the provision of a scheme of acoustically attenuated mechanical ventilation, to remove the need to open windows for rapid ventilation to ensure the same performance criteria can be met, unless otherwise agreed in writing by the Local Planning Authority.

A noise survey was undertaken and a mitigation strategy recommended by Red Acoustics¹ in support of the planning application for the development during October 2012. This included design measures to achieve the following internal noise limits recommended by BS8233:1999:

Living rooms and study bedrooms during daytime (0700hrs to 2300hrs): average level no higher than 40dB $L_{Aeq,16hr}$

Study bedrooms at night (2300hrs to 0700hrs):
average level no higher than 30dB $L_{Aeq,8hr}$
instantaneous levels no higher than 45dB L_{Amax}

The mitigation strategy concluded that a mixture of glazing configurations are to be used throughout the development and the most exposed study bedrooms / common living areas should be provided with acoustically rated background ventilators in order to allow the spaces to be adequately ventilated without the requirement for opening windows, thereby protecting occupants against traffic noise ingress.

The proposed acoustic strategy is shown in Figures 1 to 4 below.

¹ Report ref: R0616-REP01-SJW 'Hatton Gardens, Liverpool - Environmental Noise Study' dated 4 October 2012

Hatton Gardens, Liverpool - Discharge of Planning Condition 12

Figure 1: Proposed noise mitigation strategy - Great Crosshall Street Elevation

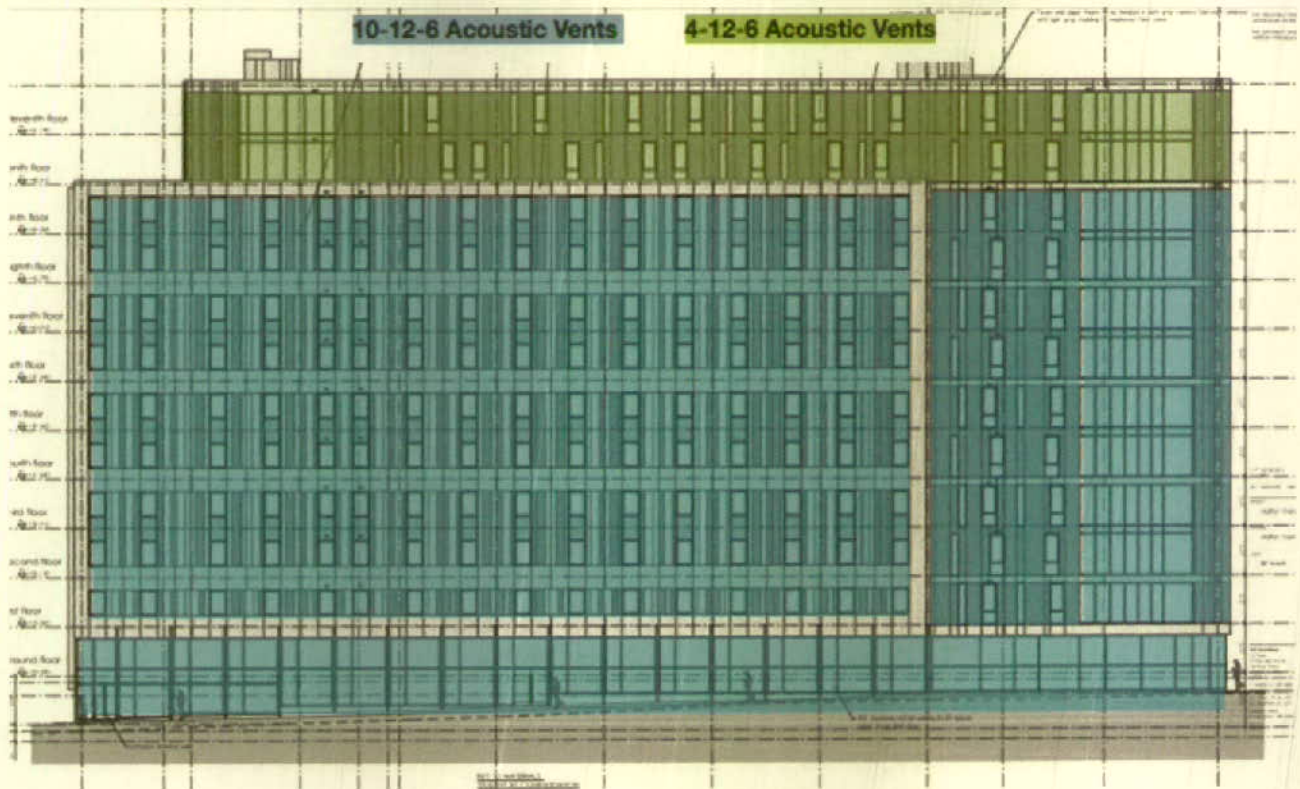


Figure 2: Proposed noise mitigation strategy - Rear Elevation

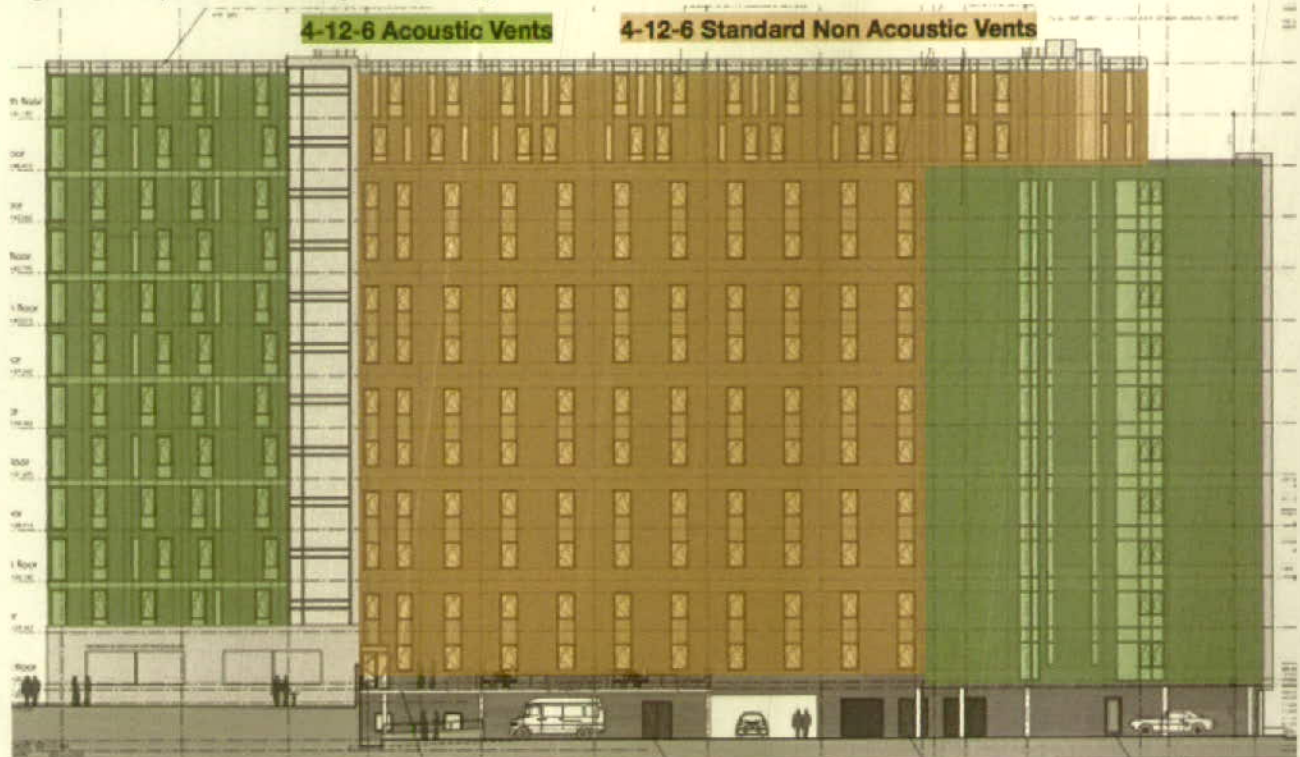
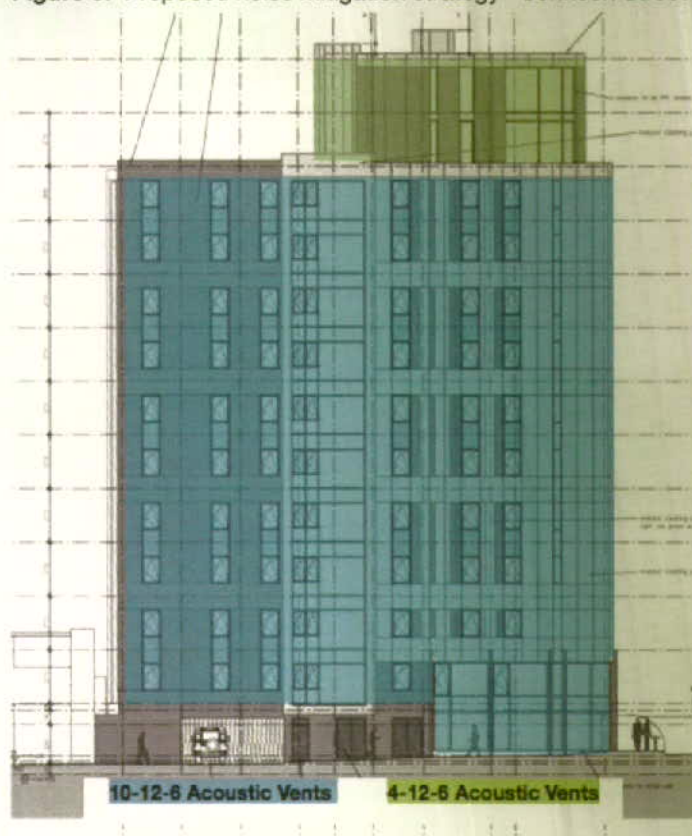


Figure 3: Proposed noise mitigation strategy - Johnson Street Elevation**Figure 4:** Proposed noise mitigation strategy - Hatton Gardens Elevation

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Table 1 below identifies the minimum recommended Sound Reduction Index of the windows and glazing configurations referred to in Figures 1 to 4 against the installed glazing performances as detailed in Figure 5 below. The results clearly indicate that the installed windows are in line with the requirements.

Table 1: Sound Reduction Index of Windows: Proposed vs Installed

Proposed / Installed	Glazing Configuration	Sound Reduction Index (dB) @ Octave Band Centre Frequency (Hz)						Pass ?
		125	250	500	1k	2k	4k	
Proposed Type 1	4mm float / 12mm cavity / 6mm float	23	23	30	41	41	39	
Installed Type 1	4mm float / 16mm cavity / 8mm float	27	24	33	42	42	46	✓
Proposed Type 2	10mm float / 12mm cavity / 6mm float	26	27	34	37	38	38	
Installed Type 2	10mm float / 12mm cavity / 6mm float	30	28	34	41	39	48	✓

Hatton Gardens, Liverpool - Discharge of Planning Condition 12

Figure 5: Installed Glazing Specifications

To:	Mick McCann	From:	Paul Rudge
Company:	Casu Consulto	Order Fax No:	01733 562080
Fax No:	Email	Estimating Fax No:	01227 473445
No. of pages	1	Email:	paul.rudge@saint-gobain.com
		Date:	22.5.15
ESTIMATE Reference:	11486	Subject:	Hatton Gardens Liverpool

The glass specification is:**Type 1 334m²**

Outer Pane: 8mm SGG PLANILUX®

Cavity: 16mm BLACK spacer argon gas 90% filled POLYSULPHIDE SEAL

Inner Pane: 4mm SGG PLANITHERM TOTAL+®

Outer Pane: 8mm SGG SECURIT®

Cavity: 16mm BLACK spacer argon gas 90% filled POLYSULPHIDE SEAL

Inner Pane: 4mm SGG SECURIT PLANITHERM TOTAL+®

Glass	Laboratory	Test Number	R _u	R _g	R _{air}	63Hz	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz
4 (16) 8	CSI	CSI2006052	36	34	31		27	24	33	42	42	46

Type 2 Approx 677m²

Outer Pane: 10mm SGG PLANILUX®

Cavity: 12mm BLACK spacer argon gas 90% filled POLYSULPHIDE SEAL

Inner Pane: 6mm SGG PLANITHERM ULTRA N®

Outer Pane: 10mm SGG SECURIT®

Cavity: 12mm BLACK spacer argon gas 90% filled POLYSULPHIDE SEAL

Inner Pane: 6mm SGG SECURIT PLANITHERM ULTRA N®

Glass	Laboratory	Test Number	R _u	R _g	R _{air}	63Hz	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz
6 (12) 10	CSI	CSI2006032	37	36	34		30	28	34	41	39	48

Spandrel Approx. 322m²

Outer Pane: 6mm SGG SECURIT®

Cavity: 16mm BLACK spacer air filled POLYSULPHIDE SEAL

Inner Pane: 6mm SGG SECURIT EMALIT® STANDARD COLOUR WITH 60MM FOIL BACK FOAM INSULATION

Hatton Gardens, Liverpool - Discharge of Planning Condition 12

It is confirmed that bedrooms identified in Figures 1 to 4 which require acoustically rated vents have been fitted with Simon Ducomax Medio 10 background ventilators achieving the specified level of noise reduction (i.e. 43dB $D_{n,e,w}$ in the open position).

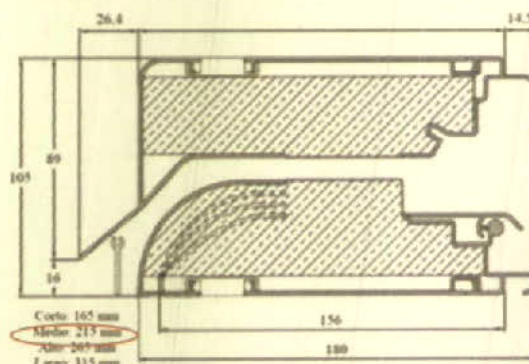


R W Simon Ltd
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Tel 01805 623721

Simon ducomax (ZR) sound absorbing ventilators are designed with three external canopy options - Budgetline, Softline and Louvreline

The Simon ducomax (ZR) is an innovative, trendsetting generation of sound absorbing ventilator that combines both stylish design with outstanding acoustic and airflow performance

Performance/Specification



Geo Opening	Equivalent Area in mm ² @ 1pa per Lin Mtr			
	Corto	Medio	Alto	Largo
10mm	16,543	14,252	15,143	15,143
15mm	26,341	22,523	22,269	22,778
20mm	34,230	32,576	33,467	34,230
25mm	40,720	39,193	37,793	36,775

- Watertightness 650pa
- Knob, cord and rod control options
- RAL colours available
- Self-regulating flap option available
- Thermoplastic components, black or white
- 'Easy clean' inner grille acting as insect screening
- Suitable for aluminium, timber and PVCu frames
- Red/green status indication (closed/open position)

Model	Octave band values in dB						$D_{n,e,w}$ (c/ctr) open
	m3/ph	125	250	500	1000	2000	
Corto 10	67.3	32.8	33.7	39.5	44.4	40	41 (-1;-2)
Corto 15	104.7	30.4	30.8	34.6	40.5	40.1	38 (-0;-2)
Corto 20	137.1	29.4	28.6	32.1	38.7	38.2	36 (-0;-2)
Corto 25	163.1	29	28.4	30.5	37.2	39.9	36 (-1;-3)
Medio 10	56.6	35.1	35.1	42.5	49.3	43.1	44 (-1;-2)
Medio 15	91.4	31.1	33.4	37.2	47.9	45.2	42 (-1;-3)
Medio 20	132.5	30.3	30.5	36.5	43.3	39	39 (-1;-2)
Medio 25	156.6	28.8	28.3	31.6	39.3	41.2	37 (-1;-3)
Alto 10	60.8	34.3	37.5	44.1	51.1	48.7	47 (-1;-3)
Alto 15	90.4	32.1	34.6	41.2	50	47.7	45 (-1;-4)
Alto 20	134.6	29.5	31.3	38	48.5	42.9	41 (-0;-3)
Alto 25	150.5	28.3	28.9	33.9	45.4	40.9	39 (-1;-3)
Largo 10	60.8	35	40.1	49.6	57	52.2	51 (-2;-5)
Largo 15	92.5	32.1	36.5	43.2	53.2	40.9	44 (-2;-3)
Largo 20	137.2	30.2	34.2	42.4	47.4	41.2	44 (-2;-3)
Largo 25	147.6	29.6	31.3	38.3	44.5	39.9	40 (-1;-2)

Our planning stage noise mitigation strategy also concluded the solid (i.e. non-glazed) areas of the external building envelope should provide an airborne sound reduction of at least 55dB R_w .

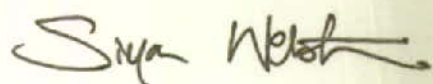
Such areas of the building comprise an inner leaf of 140mm thick solid medium density concrete block and an external leaf of either brick or rainscreen cladding. The external wall construction has been assessed and calculated to meet the target performance. Solid areas of the building envelope are therefore considered to provide suitable protection against noise ingress.

Given the above information, we conclude that the external envelope of the building provides suitable protection against external noise ingress in keeping with the requirements of Condition 12.

Hatton Gardens, Liverpool - Discharge of Planning Condition 12

I look forward to hearing from you.

Yours sincerely,

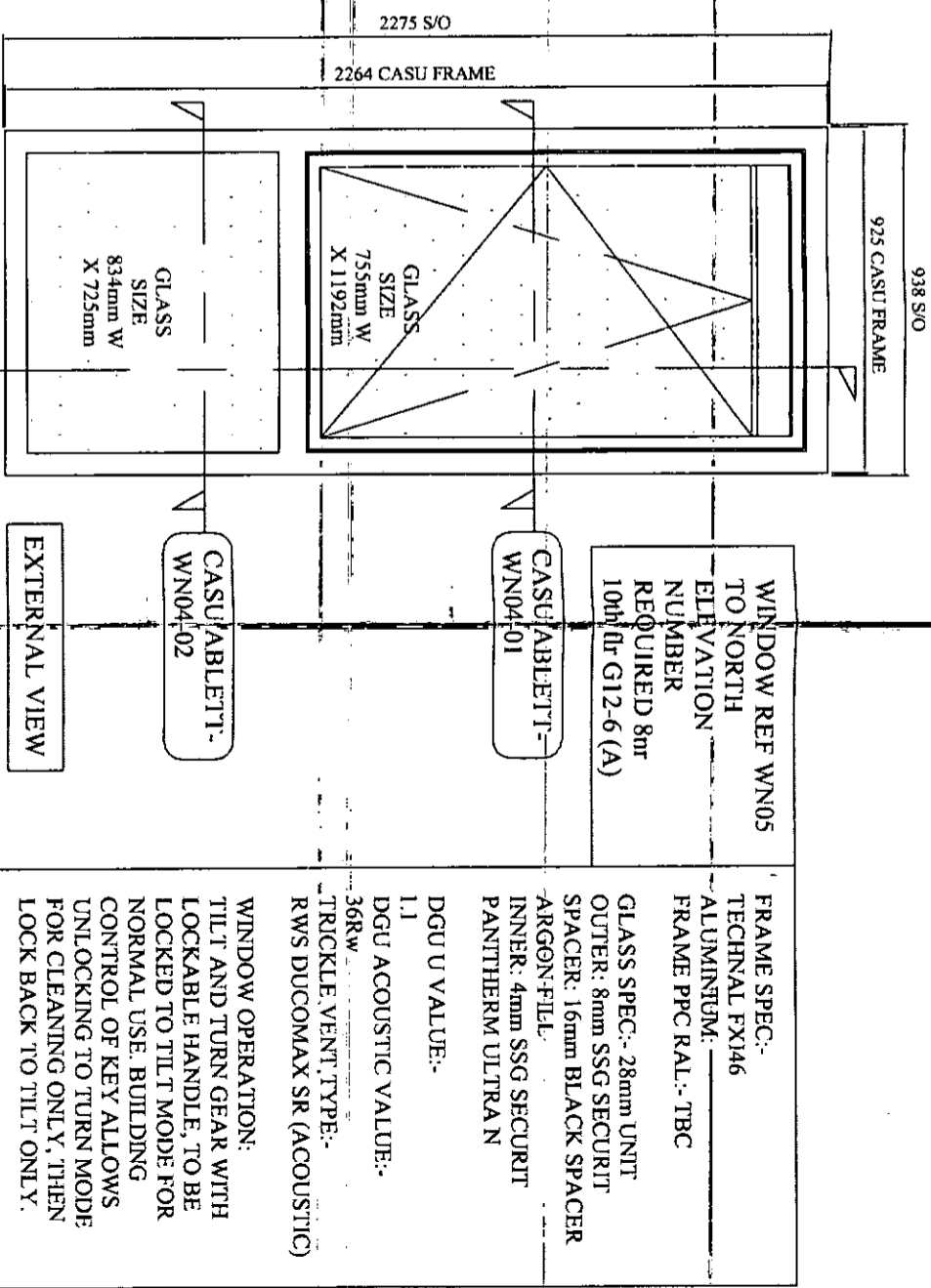


Simon Webster

For and on behalf of Red Acoustics Limited


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m: 07775 850 378



REV.	DESCRIPTION	DATE
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**ISSUE FOR
APPROVAL
FINAL OPENING
SIZE TO BE
CONFIRMED**

			
CASU CONSULT LTD			
TITAN HOUSE			
13 STATION ROAD			
HORSFORTH			
LEEDS			
ENGLAND			
LS18 5PA			
TEL: 0113-2260102			
FAX: 0113-2260103			
<p>THE DRAWING IS THE PROPERTY OF CASU CONSULT LTD LTD. AND MUST NOT BE REPRODUCED OR WHOLELY OR PARTIALLY REPRODUCED WITHOUT THE WRITTEN CONSENT OF THE COMPANY</p>			
PROJECT			
ABLETT-HOUSE			
TITLE WINDOW TYPE: WN05			
TO NORTH ELEVATION			
JOB NO.	SCALE	DATE	DRAWN BY
	A3	17-02-14	JRC
DRAWING NO.			
CASU-ABLETT-WN05-03			
R/V			

Lo-Carbon Sentinel Kinetic® Plus

MVHR Unit

Features & Benefits

- Recognised in SAP Appendix Q
- Ultra quiet
- Horizontal duct option for space-saving installations
- High airflow and ideal for student accommodation clusters
- Unique folding filter for removal when access is restricted
- Integrated digital controller for simple and accurate commissioning
- Lightweight for easy installation
- Plug and play controls; Humidistat, Ventwise, Wireless remote
- BMS connectivity
- LS inputs/(Light Switch)
- Volt-free inputs
- Self diagnosis for simplified fault finding
- Adjustable delay On/delay Off timer
- Summer bypass and frost protection

Increased Performance

The Kinetic Plus benefits from the latest high efficiency, backward curved impeller design, ensuring the lowest possible energy consumption, ultra quiet operation and an exceptional performance range covering small one bed apartments to the largest of houses.

Care Homes & Student Accommodation

The Kinetic Plus is ideal for larger homes and multiple occupancy units such as nursing homes and student accommodation. Capable of 400m³/hr at 150Pa, the unit can extract from up to ten bathrooms and a communal kitchen while still achieving almost 90% heat recovery. The fully automatic capability of the Kinetic range means that adequate ventilation is always achieved.

The Kinetic's BMS capability is also ideal for those commercial applications where landlords or property managers want to monitor and optimise building performance and maintenance. The Kinetic BMS can provide status information and its self diagnostics can report if any fault is found.

Spigot Options

Spigots may be re-positioned to give horizontal connection or a combination of vertical and horizontal connection.

Optional 180mm/200mm spigots can simplify connection in commercial installations where larger diameter duct work has been used.

Quick Change Filter

As many systems are placed within cupboards the unique filter design folds as you remove it to ensure easy access in restricted spaces.

Integral Humidity Sensor

The integral humidity sensor increases speed in proportion to relative humidity levels, saving energy and reducing noise. The sensor also reacts to small but rapid increases in humidity; even if the normal trigger threshold is not reached. This unique feature ensures adequate ventilation, even for the smallest wet room. The night time relative humidity setback feature suppresses nuisance tripping as humidity gradually increases with falling temperature.

Models

	Stock Ref
Kinetic Plus B	443028

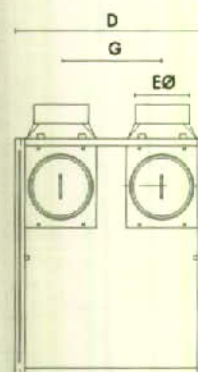
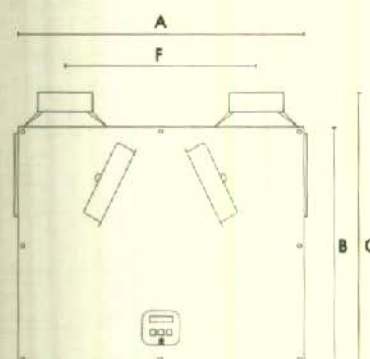
Accessories

Model	Stock Ref
Wired remote controller	443283
Wireless enable kit	441865
Ventwise controller	441780
LED alarm with 15m cable	448356
Opto-coupler	447340
For volt-free bms connection	
Kinetic spare filters 2 pk.	443351
F5 pollen filter	444201
180Mm/200mm spigot kit	446523
(One per pack)	

Dimensions (mm)

A	B	C	D	EØ	F	G
785	635	722	550	150	520	275

Weight: 24kg



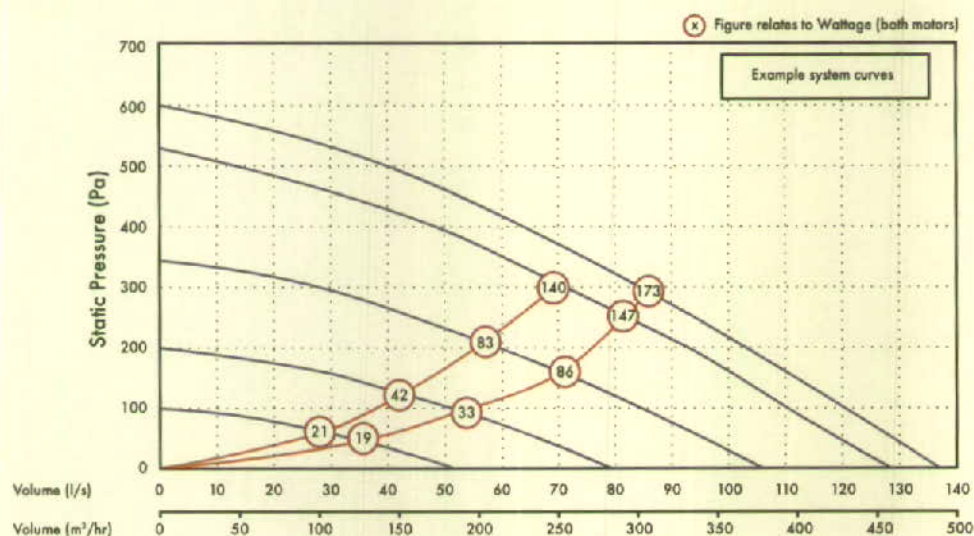
SAP Appendix Q Performance

	Thermal Efficiency %	SFP (W/l/s)
K+1	91	0.51
K+2	91	0.40
K+3	90	0.41
K+4	90	0.45
K+5	90	0.53
K+6	90	0.60
K+7	90	0.70



Performance

Fan speeds are fully adjustable within the performance range



Sound Data

Flow, l/s	Unit setting	Test mode	Octave band, Hz, dB SWL							SPL dB(A) at 3m
			63	125	250	500	1k	2k	4k	
50	20%	Supply	46.5	54.3	46.4	44.8	36.2	28.5	24.5	28.5
		Extract	46	52.2	42.3	38.7	27.6	24.2	24	25
		Breakout	48.5	42.6	43.3	38.9	35.8	29.3	23.8	22.8
78	40%	Supply	50.3	59.1	54.5	56.5	47	39.9	26.3	31.7
		Extract	46.8	51.6	47.8	44.4	32.7	27.4	24.4	28
		Breakout	48.4	51.2	53.4	46	41	34.6	25	30.3
104	60%	Supply	52.4	57.2	60.4	60.9	55.8	50.3	33.1	33.9
		Extract	50	49.8	56.8	52.4	40.2	35.9	33.4	35.2
		Breakout	55	49.6	59.7	54.5	46.9	39.9	33.6	34.9
127	80%	Supply	54.9	60.7	67.4	66.6	61.8	56	39.6	37.7
		Extract	50.4	52	61.2	56.6	45.1	39.6	34.2	40.2
		Breakout	53.5	53.4	60.8	59.1	53	45.3	36	40.1
137	100%	Supply	54.7	61.7	70.5	69.9	62.7	57.5	42.1	38.3
		Extract	54.4	55.1	65.8	57.5	46.9	40.6	33.7	40
		Breakout	56.6	54.6	60.5	60.7	54.7	45.9	36.5	39.6

Lo-Carbon Sentinel® Kinetic Plus

Consultants Specification

Operation

The supply and extract ventilation unit shall be as Sentinel Kinetic Plus as manufactured by Vent-Axia and shall be sized as indicated on the drawings and shall be in accordance with the particular specification.

Supply air to the room shall be pre-heated by the extract air via the integrated composite plastic counterflow heat recovery cell. The Sentinel Kinetic Plus shall automatically vary the ventilation rate via EC/DC motors, as it receives signals from one of the optional interconnected sensors.

When a signal is received, the fans shall either vary their speed proportionally or on a trickle and boost principle.

The unit shall have the facility to commission the supply and extract fans individually via in-built minimum and maximum speed adjustment, or alternative wired remote control unit. The fans themselves shall have independent, infinitely variable speed control.

Unit specification

The unit shall be manufactured with an ABS outer case construction, and incorporate a reversible core to allow for left or right hand mounting.

The unit shall have a high efficiency composite plastic counterflow heat exchanger, supply and extract filters, automatic summer bypass, integral minimum and maximum infinitely variable speed controls with fascia mounted failure indication.

The unit shall have low energy, high efficiency EC/DC fan/motor assemblies with sealed for life bearings. The impellers shall be high efficiency backward curved centrifugal type.

The unit shall have a heat exchanger cell with a thermal efficiency of up to 92% when tested to EN 308. This shall be protected by G3 grade synthetic filters on supply and extract. Complete with a condensate drip tray and drain connection.

The unit shall be constructed with a removable Core allowing full maintenance access. The removable Core shall provide access to the following:

- ✓ Supply and extract filter
- ✓ Heat exchanger
- ✓ Access to the electrical connections

Access shall be provided for wiring termination and setup/ commissioning. The backlit LCD user interface therein may be duplicated for remote mounting if required. Units shall be as manufactured by Vent-Axia Ltd.

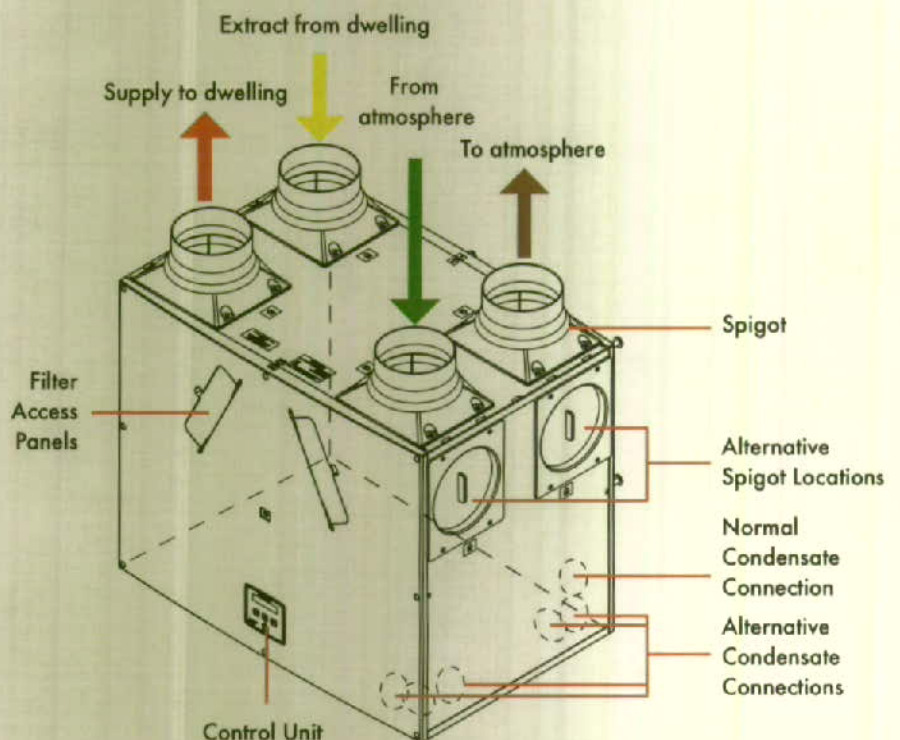
Standard controls

All Sentinel Kinetic units shall incorporate the following functions integrally mounted, pre-wired and factory fitted by the manufacturer:

- ✓ Integral infinitely variable fan speed control on supply and extract
- ✓ Integral min/max ventilation control/set point
- ✓ Integral BMS input/output interfaces - control and status indication
- ✓ Heating interlocks
- ✓ 0-10V proportional speed adjustment
- ✓ Volt free contacts
- ✓ 24V sensor supply
- ✓ Integral on/off or trickle boost function from remote switch, e.g. PIR occupancy detector
- ✓ Fully automatic summer bypass
- ✓ Switched Live input with adjustable 'delay-on' feature
- ✓ Fan failure or component failure indicated via individual fault code display

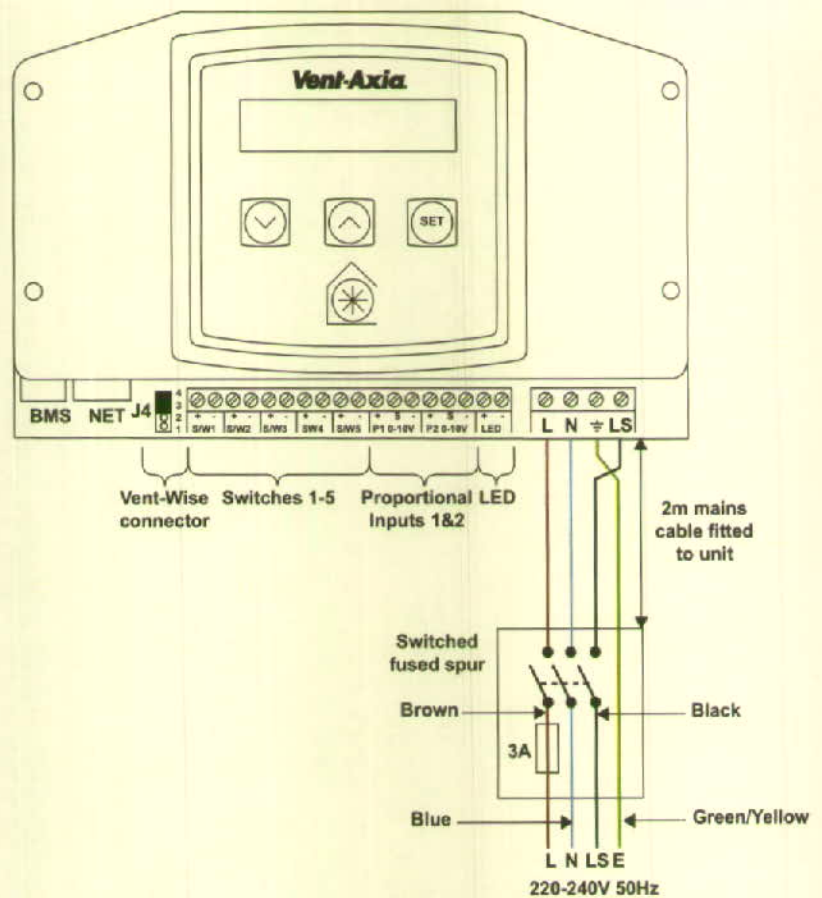
- ✓ Running time counter
- ✓ Control panel PIN number lock
- ✓ Automatic frost protection effective to -20°C
- ✓ The unit shall incorporate an integral humidity sensor with the following features:
 - Ambient Response: Raises the humidity trigger point as dwelling temperature reduces
 - Rapid Response: Monitors the rate of change in humidity and triggers increased airflow even if the humidity trigger threshold is not reached
 - Proportional Response: Incrementally increases the fan speed to reduce noise and reduce energy consumption
- ✓ The unit shall be controlled by the 'Sentinel' control devices (enablers and sensors) as detailed in the schedule or on the drawings.
- ✓ Tool free filter access

Airflow Direction & Condensate Connection (RH Supplied)

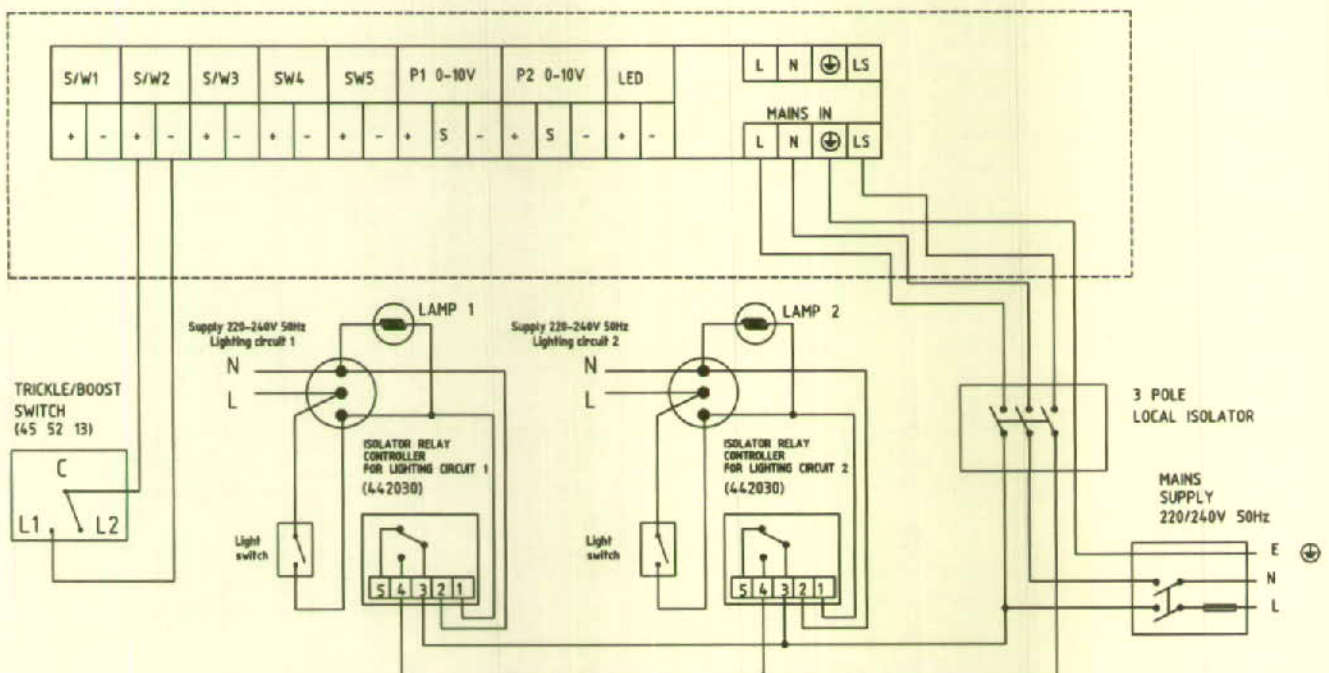


Electrical Connection

Please note: Electrical connection should be carried out by an appropriately qualified person and in accordance with current wiring regulations.



Trickle to Boost by two lighting circuits or Trickle/Boost switch

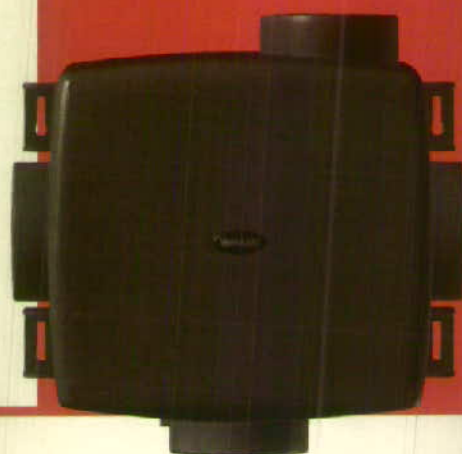


Lo-Carbon Multivent MVDC-MS/MSH

MEV Unit



Vent-Axia
dMEV, MEV & PIV Systems



Features & Benefits

- Reduces your carbon footprint.
- SAP Appendix Q Listed.
- Fitted with four extract 125 or 100mm diameter spigots allowing quick connection to ducts.
- Complies with Building Regulations Part F (System 3)
- Option of wall, ceiling and loft mounting.
- Improved controllability.
- LS Boost connection.
- Fully variable normal and boost speeds.
- Ultra quiet - acoustically lined for low noise levels.
- Integral humidistat (H version)

Models

Model	Stock Ref
MVDC-MS	437634A
MVDC-MSH	443298

SAP Appendix Q Test Results

Exhaust Terminal Configuration	Total Flow Rate (l/s)	Specific Fan Power (W/l/s)
Kitchen + 1 additional wet room	26.5	0.24
Kitchen + 2 additional wet rooms	30.5	0.18
Kitchen + 3 additional wet rooms	41.1	0.21

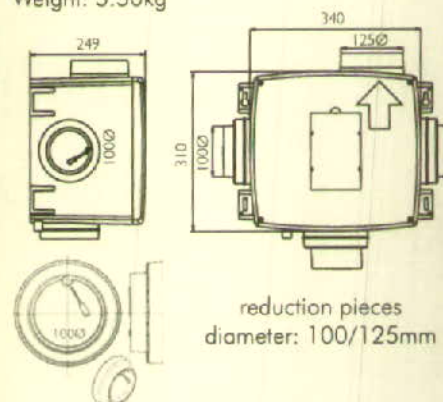
CAS

Sound Levels

Published dB(A) figures are free field sound levels at 3m with spherical propagation at a reference level of 2×10^{-5} Pa. The free field sound power level spectra figures are dB with reference of 10-12 Watts.

Dimensions (mm)

Weight: 5.50kg



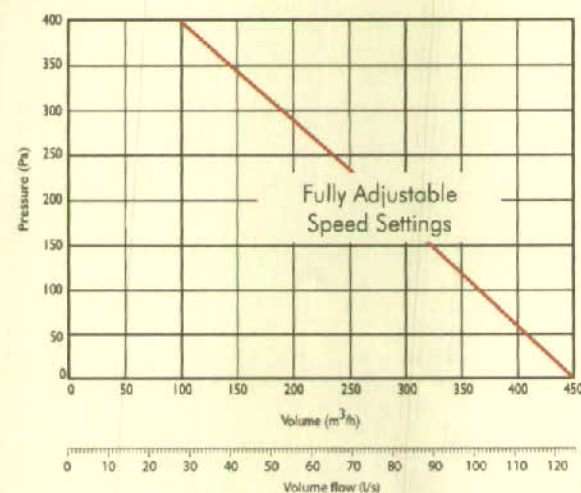
With the growing concerns about over ventilating properties, the Lo-Carbon Multivent MVDC range offers the option of 'Close Control' both in the residential and the commercial sectors. With a DC motor the multi speed Lo-Carbon Multivent is one of the most efficient central extract units in the UK.

The units have 2 fully variable speeds for trickle and boost, with a switched live (LS) activation for the boost speed. An additional third speed (purge) is available using a second switched live connection.

An acoustic lining is included as standard, ensuring minimum noise levels.

The new potentiometer controlled speed selector allows accurate setting of airflow, ensuring exactly the right ventilation rate. This feature also reduces noise, and energy consumption.

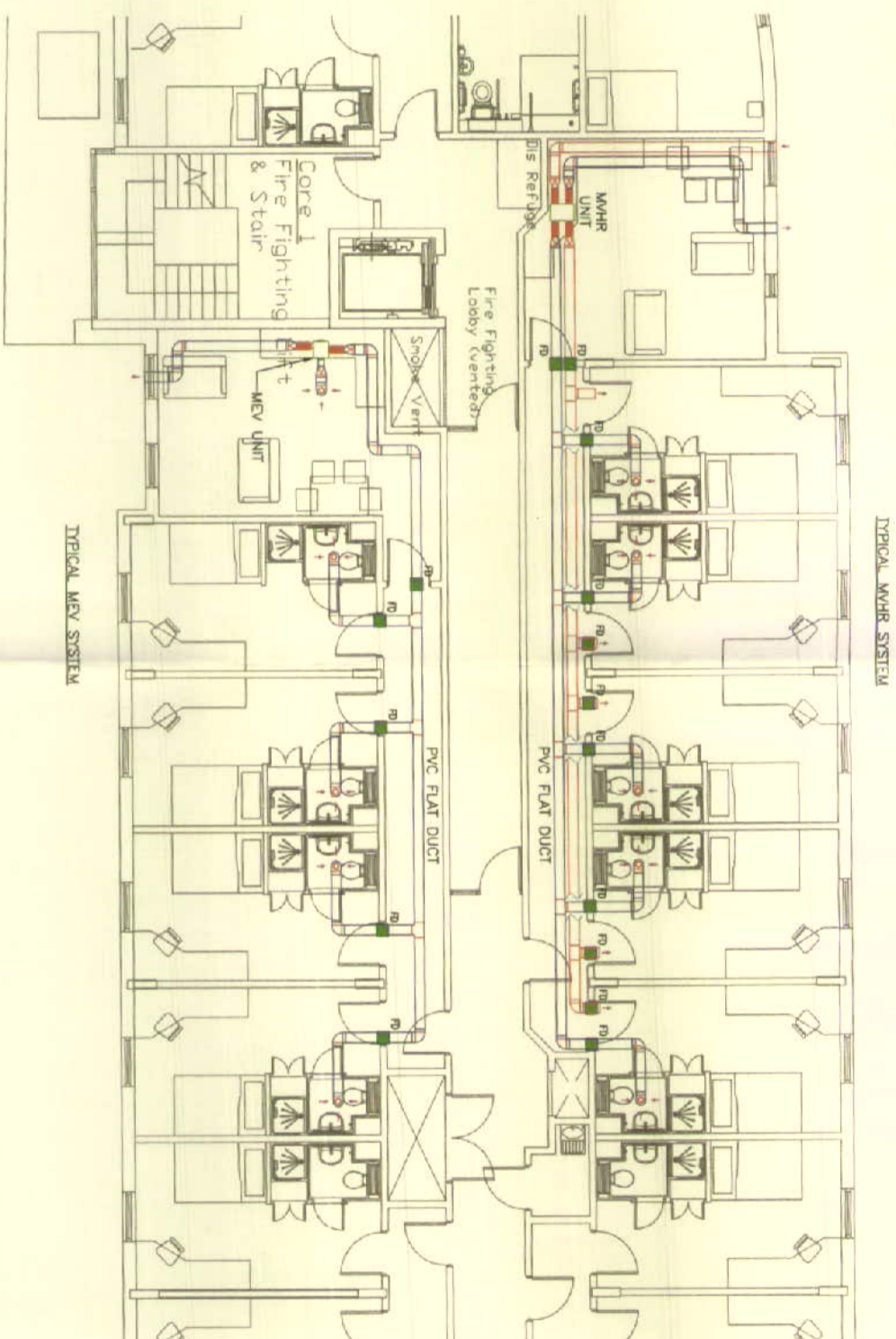
Performance



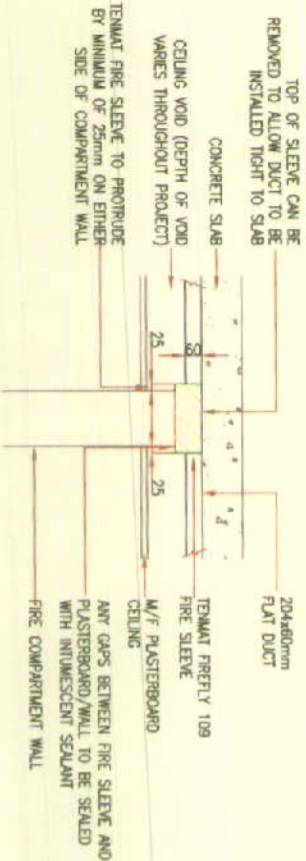
MVDC-MSH features an integral humidistat which triggers the unit to boost when humidity levels in the duct system exceed 70%

Model	Min				Max			
	Casing Breakout dB(A) @ 3m	Inlet Duct dB(A)	FID l/s	Power Watts	Casing Breakout dB(A) @ 3m	Inlet Duct dB(A)	FID l/s	Power Watts
MVDC-MS	19	18	21	6	37	36	123	55
MVDC-MSH	19	18	21	6	37	38	123	55

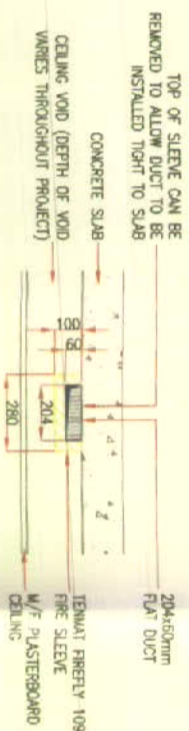
1. WORKING FROM HEIGHT – INSTALLATION OF LIGHT FITTINGS AT CEILING LEVEL – USE OF SAFE WORKING PLATFORMS TO BE USED.
2. WORKING AT HEIGHT – RISK OF TOOLS OR EQUIPMENT BEING DROPPED ONTO OPERATIVES BELOW – RESTRICT ACCESS TO AREAS DIRECTLY BELOW WHERE WORKS ARE BEING CARRIED OUT.
3. INSTALL SERVICES WITHIN CEILING AND CEILING/SERVICE VOIDS – RISK OF FALL, INHALATION OF DUST FIBRES – SUITABLE USE OF SAFE PLATFORMS AND USE ADDITIONAL PPE I.E DUST MASKS, GLOVES ETC.
4. USE OF HAZARDOUS MATERIALS – HAZARDOUS MATERIALS HAVE NOT BEEN SPECIFIED IN THE NEW WORKS. COSHH SHEETS TO BE PROVIDED WHERE APPLICABLE AND SUITABLE PPE TO BE USED BY STAFF.
5. MANUAL HANDLING OF PLANT AND EQUIPMENT – EQUIPMENT IS GENERALLY SMALL ENOUGH TO BE SUITABLE FOR MANUAL HANDLING. MECHANICAL MEANS TO BE USED TO LIFT LARGER ITEMS
6. CUTTING, DRILLING ETC. OF METALWORKS SUCH AS TRAY CONDUIT TRUNKING ETC – NORMAL SAFETY PROCEDURES TO BE USED, PROVIDE PROTECTIVE CLOTHING GOGGLES ETC.
7. CHECK ON SITE ASBESTOS REGISTER FOR POSSIBLE ASBESTOS CONTAMINATION



DETAIL A
FLAT DUCT & FIRE SLEEVE DETAIL
SECTION THROUGH WALL (1:20)



DETAIL B
FLAT DUCT & FIRE SLEEVE DETAIL
SECTION THROUGH DUCT (1:20)



- Legend
- CEILING EXTRACT VALVE WITH ELBOW BEND CONNECTION
 - PVC FLAT DUCT
 - FIRE DAMPER

CLM Notes

Revisions

Rev.	Date	Description	By
01	06-12-22	ISSUED FOR APPROVAL COMMENTS	PM

Stages

PRELIMINARY

Project
HATTON GARDEN
LIVERPOOL

The
TYPICAL CLUSTER VENTILATION
SYSTEMS



R W Simon Ltd
System Works, Hatchmoor Ind Est
Torrington, Devon, EX38 7HP
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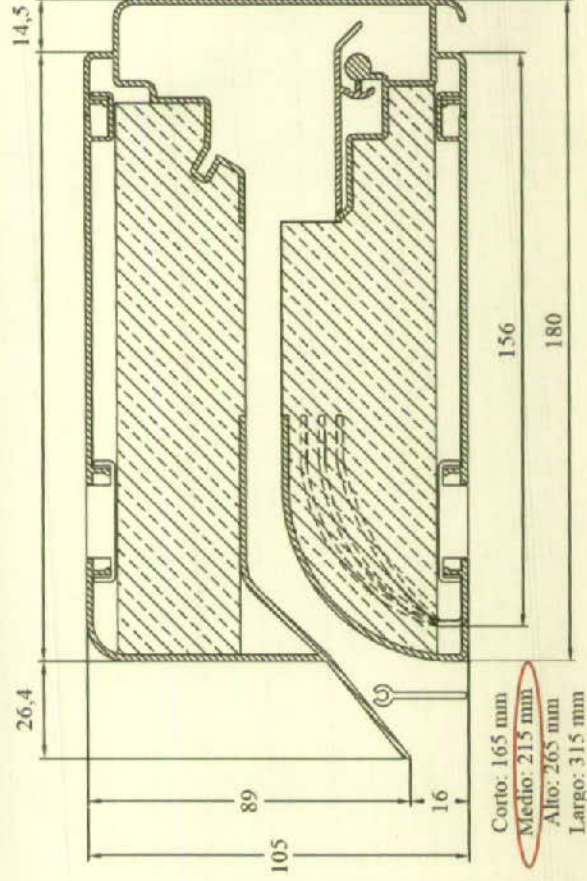
Simon ducomax (ZR) sound absorbing ventilators are designed with three external canopy options - Budgetline, Softline and Louvrelne

The Simon ducomax (ZR) is an innovative, trendsetting generation of sound absorbing ventilator that combines both stylish design with outstanding acoustic and airflow performance

Performance/Specification

Geo Opening	Equivalent Area in mm ² @ 1pa per Lin Mtr		
	Corto	Medio	Largo
10mm	16,543	14,252	15,143
15mm	26,341	22,523	22,269
20mm	34,230	32,576	33,467
25mm	40,720	39,193	37,793

- Watertightness 650pa
- Knob, cord and rod control options
- RAL colours available
- Self-regulating flap option available
- Thermoplastic components, black or white
- 'Easy clean' inner grille acting as insect screening
- Suitable for aluminium, timber and PVCu frames
- Red/green status indication (closed/open position)



Model	Octave band values in dB								Dne,w (c:ctr) open
	m3/ph	125	250	500	1000	2000			
Corto 10	67.3	32.8	33.7	39.5	44.4	40			41 (-1;-2)
Corto 15	104.7	30.4	30.8	34.6	40.5	40.1			38 (-0;-2)
Corto 20	137.1	29.4	28.6	32.1	38.7	38.2			36 (-0;-2)
Corto 25	163.1	29	28.4	30.5	37.2	39.9			36 (-1;-3)
Medio 10	56.6	35.1	35.1	42.5	49.3	43.1			44 (-1;-2) -
Medio 15	91.4	31.1	33.4	37.2	47.9	45.2			42 (-1;-3)
Medio 20	132.5	30.3	30.5	36.5	43.3	39			39 (-1;-2)
Medio 25	156.6	28.8	28.3	31.6	39.3	41.2			37 (-1;-3)
Alto 10	60.8	34.3	37.5	44.1	51.1	48.7			47 (-1;-3)
Alto 15	90.4	32.1	34.6	41.2	50	47.7			45 (-1;-4)
Alto 20	134.6	29.5	31.3	38	48.5	42.9			41 (-0;-3)
Alto 25	150.5	28.3	28.9	33.9	45.4	40.9			39 (-1;-3)
Largo 10	60.8	35	40.1	49.6	57	52.2			51 (-2;-5)
Largo 15	92.5	32.1	36.5	43.2	53.2	40.9			44 (-2;-3)
Largo 20	137.2	30.2	34.2	42.4	47.4	41.2			44 (-2;-3)
Largo 25	147.6	29.6	31.3	38.3	44.5	39.9			40 (-1;-2)

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		Date:	22.5.15
ESTIMATE Reference:	11486	Subject:	Hatton Gardens Liverpool

The glass specification is:

Type 1 334m²

Outer Pane: 8mm SGG PLANILUX[®]

Cavity: 16mm BLACK spacer argon gas 90% filled POLYSULPHIDE SEAL

Inner Pane: 4mm SGG PLANITHERM TOTAL+[®]

Outer Pane: 8mm SGG SECURIT[®]

Cavity: 16mm BLACK spacer argon gas 90% filled POLYSULPHIDE SEAL

Inner Pane: 4mm SGG SECURIT PLANITHERM TOTAL+[®]

Glass	Laboratory	Test Number	R _w	R _a	R _{a,tr}	63Hz	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz
4 (16) 8	CSI	CSI2006052	36	34	31		27	24	33	42	42	46

Type 2 Approx 677m²

Outer Pane: 10mm SGG PLANILUX[®]

Cavity: 12mm BLACK spacer argon gas 90% filled POLYSULPHIDE SEAL

Inner Pane: 6mm SGG PLANITHERM ULTRA N[®]

Outer Pane: 10mm SGG SECURIT[®]

Cavity: 12mm BLACK spacer argon gas 90% filled POLYSULPHIDE SEAL

Inner Pane: 6mm SGG SECURIT PLANITHERM ULTRA N[®]

Glass	Laboratory	Test Number	R _w	R _a	R _{a,tr}	63Hz	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz
6 (12)10	CSI	CSI2006032	37	36	34		30	28	34	41	39	48

Spandrel Approx.322m²

Outer Pane: 6mm SGG SECURIT[®]

Cavity: 16mm BLACK spacer air filled POLYSULPHIDE SEAL

Inner Pane: 6mm SGG SECURIT EMALIT[®] STANDARD COLOUR WITH 60MM FOIL BACK FOAM INSULATION

Regards,
Paul Rudge