File Note

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Project title	Middlesex Annex Site	Job number	250794-00
cc		File reference	
Prepared by	CB	Date	15 April 2019
Subject	Cooling System Efficiency - Workhouse		

The present file note has been produced with the intent of providing information on the proposed cooling system efficiency that has been designed for the Workhouse. That information is required to discharge the planning Condition 17.

Condition 17 - Prior to works to the listed building being carried out, full details of the TM52 overheating assessment should be provided to demonstrate that the residential units do not overheat without being reliant on mechanical cooling. The applicant should demonstrate that the Mayor's cooling hierarchy has been followed and that overheating risk has been reduced as far as possible, and that active cooling is not proposed unless it can be demonstrated it is required and that all other measures have been considered first. ***Where active cooling is required, details demonstrating the efficiency of the system should be provided to the Council.***

The cooling in the Workhouse apartments is provided by FCU located in the ceiling void of each habitable room (bedroom, kitchen-livingroom). The CHW feeding the FCU is produced by two air cooled chillers located on the New Building's roof. As stated in the Equipment Datasheet submitted for Stage 4 (see Appendix 1) the Chillers have an EER of 3.3 and SEER of 4.99.
Regarding the FCU efficiency the SFP is between 0.13 and 0.21 with only one FCU having an SFP of 0.32 (see Appendix 2).

DOCUMENT CHECKING (not mandatory for File Note)

	Prepared by	Checked by	Approved by
Name	CB	MK	
Signature			

Appendix : Chillers and FCU EDSs

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Equipment Data Sheet
MSA-AIR COOLED CHILLERS

Job Title:	**MSA-Plantroom**			Job Number:	**250794**
Job Stage:	**Stage 4**	Status:	**Stage 4**	Made by:	**VS**
Revision:		Date:	**30/04/2018**	Checked by:	**DB**
Revision Description:					

General Data

Unit Reference	CH/08/01 & 02
Quantity	2
Type	Inverter Screw c/w VVR
Location	Roof plant
System	Chilled water

Performance Data

		Required	Offered
Cooling Capacity	kW	240	
Site Altitude	m		
Chilled Water Flow Rate	kg/s	9.6	
Maximum CHW Flow Rate	kg/s	9.6	
Minimum CHW Flow Rate	kg/s	3.2	
CHW Leaving Temperature	°C	7	
CHW Entering Temperature	°C	13	
Min CHW Leaving Temperature	°C	7	
Max CHW Entering Temperature	°C	26	
Min CHW System Contents	litres	TBC	

		Required	Offered
Refrigerant Type		R134a	
Refrigerant Charge	kg	40	
EER		3.333	
SEER		4.99	
Coefficient of Performance	COP		
Number of Refrigerant Circuits		1	
Number of Control Stages		Stepless	
Min Cooling Capacity Control Step		34%	
Type of Expansion Valve		EEV	
Noise Level (Lp) @3m	dB(A)	63.0	

Evaporator

Number of Evaporators		1	
Pressure Drop	kPa	11.9	
Max Operating Pressure	bar (g)	10.0	
Test Pressure	bar (g)	15.0	
Fouling Factor	m²K/w	0.000	
Water Contents	litres	38	
CHW Antifreeze Solution	%		
Type		Plated heat exchanger	

Shell Material		Alu	
Tube Material		Cu	
Insulation Material		Armaflex	
Insulation Thickness	mm	20	
CHW Connection Type		Victaulic	
CHW Connection Size Ø	mm	114.3	
Drain Connection Ø	mm	25.4	
LP Relief Valve Setting	bar (g)	TBC	

Condenser

Design Air Entering Temperature	°C	35	
Max Air Entering Temperature	°C	45	
Min Air Entering Temperature	°C	-3.3	
Number of Fans		6	
Fan Type		Direct propeller	
Fan Minimum Efficiency	%		
Fan Air Flow Rate	l/s	22664	

Fan External Pressure	Pa	100	
Max Fan Speed	rpm	700	
Fan Size	mm	800	
Method of Head Pressure Control		Inverter	
Type		MCH	
Tube / Fin Material		Alu	
Protective Coating		Blue Acrylic	
HP Relief Valve Setting	bar (g)	TBC	

Compressors

Compressor Type		Inv screw VVR	
Number of Compressors		1	

Compressor Motor Speed	rpm	Variable	
Max Compressor Starts / Hour		3	
Max Allowable Pressure (Ps)	bar (g)		

Unit

Unit Casing Material		RAL 7044	
Unit Casing Finish / Colour		RAL 7044	

Unit Operating Weight	kg	2559	

Dimensional Data

Overall Length	mm	3183	
Overall Width	mm	2258	

Overall Height	mm	2483	

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Equipment Data Sheet
MSA-AIR COOLED CHILLERS

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Revision:		Date:	**30/04/2018**	Checked by:	**DB**
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Electrical Data

		Required	Offered
Main Power Supply	V/Ø/Hz	400/3/50	
Main Power Supply Source			
Auxillary Power Supply	V/Ø/Hz		
Auxillary Power Supply Source		None	
Unit Max Absorbed Power	kW	72.61	
Unit Max Running Current	A	166	
Unit Max Starting Current	A	0	
Unit Upstream Protection Device			
Unit Max In Rush Current	A/5msec		
Unit Max Fault Level	kA 1sec		
Compressor In Rush Current	A/5msec		
Compressor Motor Start Method		Inverter	

		Required	Offered
Compressor Absorbed Power	kW	67.81	
Compressor Motor Rating	kW	75	
Compressor Running Current	A	104	
Compressor Starting Current	A	0	
Condenser Fan Input Power	kW	15.6	
Condenser Fan Motor Rating	kW	4.8	
Crankcase Heater Rating	W	300	
Evaporator Heater Rating	W	300	
Unit IP Rating		IP54	
Local Power Factor Correction		>0.95	
Power Factor		>0.95	

Noise & Vibration Data

	Max Radiated Sound Pressure Level (Lp) dB							
	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
Required	68	65	65	68	63	58	50	43
Offered								

		Required	Offered
Compressor Anti Vibration Mount Type		Required	
Compressor AVM Static Deflection	mm		

		Required	Offered
Unit Anti Vibration Mount Type		Required	
Unit AVM Static Deflection	mm	25	

Access

		Required	Offered
Min Side Clearance	mm	1800	
Min End Clearance	mm	1500	
Min Top Clearance	mm	1500	
Tube Withdrawal Clearance	mm	1000	
Heaviest Component		Compressor	
Weight of Heaviest Component	kg	1000	

		Required	Offered
Largest Component		Compressor	
Length of Largest Component	mm	1200	
Width of Largest Component	mm	400	
Height of Largest Component	mm	400	

Safety & Diagnostics

	Required	Offered
High Refrigerant Pressure Cut Out	✓	
Low Refrigerant Pressure Cut Out	✓	
Low Suction Temperature Cut Out	✓	
Low Oil Pressure Cut Out	✓	
Water Flow Pump Interlock	✓	
Oil Pressure	✓	
Suction Pressure	✓	
Discharge Pressure	✓	

	Required	Offered
Suction Temperature	✓	
Discharge Temperature	✓	
CHW Entering Temperature	✓	
CHW Leaving Temperature	✓	
Nos Compressors Operating	✓	
Compressor Operating Hours	✓	
Fault History	✓	

Control & Monitoring

	Required	Offered
Microprocessor Controls	✓	
Diagnostics	✓	
Master Sequencer Controls		

	Required	Offered
Leaving Chilled Water Control	✓	
Automatic Lead/Lag Compressor Control		
Chiller Flow Proving Switch	✓	

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Equipment Data Sheet
MSA-AIR COOLED CHILLERS

Job Title:	**MSA-Plantroom**			Job Number:	**250794**
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Outputs to BMS

	Required	Offered
Chiller Run Status Volt Free Contact	✓	
Common Alarm Volt Free Contact	✓	
BACnet/Modbus Data link	✓	

Inputs from BMS

	Required	Offered
Chiller Enable/Disable	✓	
Sequencer Enable/Disable		
CHW Temperature Reset (0-10VDC)		
Power Demand Limit Control		

Serial Data Link Protocol	**Required**	
	Offered	

Accessories

	Required	Offered
Compressor Isolating Valves	✓	
Low Ambient Temperature Start	✓	
Condenser Coil Wind Baffles		
Condenser Coil Protection Guards		
Corrosion Resistant Coated Coils	✓	
Special Anti Corrosion Treatment		
Power Supply Isolator	✓	
Compressor Soft Start	✓	
Crankcase Heater Transformer	✓	

	Required	Offered
Low Noise Condenser Fans	✓	
Compressor Attenuator Enclosures		
High Pressure Condenser Fans		
Works Fitted Physical Protection Kit		

Testing

	Required	Offered
Performance Type Tests	✓	
Works Performance Tests	✓	
Site OEM Performance Testing		

Samples

	Required	Offered

Works Performance Tests

	Required	Offered
Chilled Water Flow Rate	✓	
Chilled Water Flow & Return Temperatures	✓	
Evaporator Pressure Drop	✓	
Condenser Coil Air On Temperature	✓	
Condenser Air Off Temperature	✓	
Liquid line Refrigerant Temperature	✓	
Evaporator Refrigerant Pressure	✓	
Condenser Refrigerant Pressure	✓	
Oil Pressure	✓	
Compressor Voltage (each)	✓	
Compressor Running Current (each)	✓	
Voltage (incomimg terminals)	✓	
Running Current (machine)	✓	
Starting Inrush Current	✓	
Total Absorbed Power	✓	
Power Factor	✓	
Operation of All Safety Devices	✓	
Provision of External Interfaces	✓	

	Required	Offered
Full Load Test		
100% Load Test	✓	
Duration of each Load Test (hours)	1	
Measurement Interval (minutes)	10	
Minimum No. of Measurement Intervals	6	
Minimum Load Test		
Minimum Load Test	✓	
Duration of each Load Test (hours)	1	
Measurement Interval (minutes)	15	
Minimum No. of Measurement Intervals	4	
Part Load Test		
90% Load Test		
75% Load Test	✓	
66% Load Test		
50% Load Test	✓	
33% Load Test		
25% Load Test	✓	
Duration of Minimum Load Test (minutes)	60	

Under Capacity Tolerance wrt Design (-%)	0	

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Over Capacity Tolerance wrt Design (+%)	5	☐	Full Noise & Vibration Test	☑ ☐

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Works Performance Tests

1 Carry out performance tests at the manufacturer's works or at an agreed testing facility.

2 Demonstrate:

- a Compliance with the Specification.
- b Thermal performance specified.
- c Operation and control throughout the stated operating range.
- d Noise & vibration performance specified.

3 Provide a complete and precise Test Method Statement. Include method for measuring average condenser air on and off temperatures across coils.

4 Carry out tests in a safe working environment.

5 Provide test instruments necessary to accurately record measurements, attached or adjacent to the machine.

6 Provide copies of the calibration certificates for test instruments before testing..

7 Provide a PC for gathering data to allow instantaneous recordings to be made.

8 Confirm all details of the performance tests with the Tender, including location of test.

9 Simulate design chilled water flow rate, chilled water temperatures, condenser air temperatures and site electrical charateristics at full and part load conditions.

10 Measure and record full and part load test results at specified intervals.

11 Carry out load tests under steady state conditions and specified design conditions.

12 Demonstrate design chilled water leaving temperature is maintained at full and all part load conditions.

13 Demonstrate minimum load tests to manufacturers stated minimum load unless otherwise specified.

14 Demonstrate all safety devices operate correctly at manufactuers' recommended set points on completion of thermal performance tests.

15 Carry out Works Tests to BS EN 14511.

16 Demonstrate design cooling capacity can be achieved with tolerances of -0% and +5%.

17 Noise tests shall be to BS EN ISO 3744:1995 and the Specification.

18 Rectify any defects or items of non compliance with the Specification, retest and redemonstrate at no extra cost.

19 Record test data on manufacturers test sheets demonstrating specified performance.

20 Submit a complete Test Report

Manufacturer

	Preferred	Alternative	Alternative
Manufacturer	Daikin Applied		
Model Reference	EWAD240TZ-XR B1		
Contact Name	Bob Stevens		
Telephone Number	+44 345 5652700		
Fax Number			
E-mail Address	Bob.Stevens@daikinapplied.uk		
Internet Address			

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Additional Information

1 *This equipment data sheet **must** be read in conjunction with all other parts of the Specification, including:*
- *the Technical Introduction*
- *the Materials and Workmanship Specification*
- *the Particular Specification.*

2 *Type test data shall be provided to demonstrate that the equipment performs to the required standards.*

Chillers shall be commissioned by the Specialist

3 *Manufacturer and test in accordance with CIBSE Commissioning Code R.*

4 *All inputs/outputs to be wired to numbered terminals within the control panel.*

All alarm volt free contacts shall be fail safe. Contacts

5 *shall be normally open, closed when healthy, open on alarm or loss of power*

6 *All volt free contacts to be rated at 3A inductive at 230 VAC.*

7 *Selection based upon EN14511-3:2013 Nett Performance*

Comments

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Equipment Data Sheet
MSA-Listed Building FAN COIL UNITS

Job Title:	**MSA-Listed Building**			Job Number:	**250794**
Job Stage:	**Stage 4**	Status:	**Stage 4**	Made by:	**CB**
Revision:		Date:	**30/04/2018**	Checked by:	**VS**
Revision Description:					

General Data

Entering Air Design Conditions:		
Season	Temperature db°C	Temperature wb°C
Summer	24.0	17.0
Winter	22.0	

Cooling Design Conditions:	
Flow Temp. °C	Return Temp. °C
10.0	16.0

Heating Design Conditions:	
Flow Temp. °C	Return Temp. °C
60.0	40.0

Construction Data

Casing Material			
Casing Thickness	mm		
Casing Finish / Colour			
Coil Tube/Fin Material			
Fan Type			
Coil Connection Type			

		Required	Offered
Filter Group & Class			
Filter Test Standard		BSEN 779	
Coil Test Pressure	bar (g)		
Electrical Supply	V/Ø/Hz	240/1/50	

Condensate Tray Material		
Filter Medium		
Access Arrangement		
Inlet Location		
Discharge Location		

Accessories

	Required	Offered
Discharge Plenum (for Highwall series)		
Insulated Drip Tray		
Octopus Box (for Highline Series)		

Controls

	Required	Offered
Wall Mounted Speed Selection Switch	✓	
(for YHMH series)		
Room Temperature Sensor	✓	
Return Air Temperature Sensor	✓	
Temperature Controller	✓	
Controls Enclosure, Fuses, Relays		
Low Voltage Transformer		
Remote Start/Stop Control		
BMS Addressable Controller	✓	
Control Valves & Actuators		

Controls Manufacturer — **Required**

Testing

	Required	Offered
Performance Type Tests	✓	
Works Performance Tests		
Site OEM Performance Tests		

Works Performance Tests

	Required	Offered
Noise Performance Tests	✓	
Duty Performance Tests	✓	

Samples

	Required	Offered
Type Samples		

	Required	Offered
Functional Performance Tests		

Manufacturer

	Preferred	Alternative	Alternative
Manufacturer	Diffusion	Equal or Approved	
Contact Name			
Telephone Number			
Fax Number			
E-mail Address			
Internet Address			

Additional Information

1 *Type test data shall be provided to demonstrate that the equipment performs to the required standards.*

2 *Apartment FCUs to be complete with gravity condensate drain*

4 *All fan coil units shall be provided spare set of filters to the builidng operator prior to building hand over.*

5 *Values in (xx) include the FCU's performance for maximum cooling capacity required*

6 *Discharge in-duct values are giveven "per spigot"*

7 *When attenuation is required it must have the following insertion loss*

Octave Band Frequenchy (Hz)							
63	*125*	*250*	*500*	*1K*	*2K*	*4K*	*8K*
3	*5*	*7*	*11*	*13*	*15*	*8*	*3*

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Equipment Data Sheet
MSA-Listed Building FAN COIL UNITS

Job Title:	**MSA-Listed Building**			Job Number:	**250794**
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	FCU Reference	Location	Quantity	Model Reference	Attenuator	Octopus Box	Fan				Cooling Coil				Heating Coil			Dimensions		
							SFP	Air Flow Rate	Fan Speed	NR	Total Capacity	Sensible Capacity	Flow Rate	Pressure	Total Capacity	Flow Rate	Pressure	Height	Length	Width
							W/l/s	l/s			kW	kW	l/s	ΔPa	kW	l/s	ΔPa	mm	mm	mm
Required	FCU/M03/01	Bed 1	1	H27Aec-WHCH-06/1 * FR+CP	N	N	0.16 (0.17)	66 (75)	uLow (xLow)	25 (27)	0.89 (1.0)	0.79 (0.9)	0.040		0.76	0.009		270	858	882
Offered																				
Required	FCU/M03/02	Bed 2	1	H27Aec-WHCH-06/1 * FR+CP	N	Y (Ø247)	0.16 (0.19)	66 (92)	uLow (Low)	25 (30)	0.89 (1.2)	0.79 (1.1)	0.048		0.67	0.008		270	858	882
Offered																				
Required	FCU/M03/03	Kitchen/Living	1	H27Aec-WHCH-12/2 * FR+CP	N	Y (Ø247)	0.13	158	Low	30	2.1	1.9	0.084		1.28	0.015		270	1233	882
Offered																				
Required	FCU/M04/01	Bed 1	1	H27Aec-WHCH-06/1 * FR+CP	N	N	0.16 (0.20)	66 (108)	uLow (Low+1)	25 (31)	0.89 (1.4)	0.79 (1.3)	0.005		1.17	0.014		270	858	882
Offered																				
Required	FCU/M04/02	Bed 2	1	H27Aec-WHCH-06/1 * FR+CP	N	N	0.16 (0.17)	66 (67)	uLow (xLow)	25 (27)	0.89 (1.0)	0.79 (0.8)	0.040		0.61	0.007		270	858	882
Offered																				
Required	FCU/M04/03	Bed 3	1	H27Aec-WHCH-06/1 * FR+CP	N	N	0.16 (0.19)	66 (83)	uLow (Low)	25 (30)	0.89 (1.1)	0.79 (1.0)	0.044		0.60	0.007		270	858	882
Offered																				
Required	FCU/M04/04	Kitchen/Living	1	H27Aec-WHCH-12/2 * FR+CP	Y	Y (Ø247)	0.16	217	Low+3	30	2.9	2.6	0.116		1.91	0.023		270	1233	1200
Offered																				
Required	FCU/M05/01	Bed 1	1	H27Aec-WHCH-06/1 * FR+CP	N	N	0.16 (0.19)	66 (92)	uLow (Low)	25 (30)	0.89 (1.2)	0.79 (1.1)	0.048		0.6	0.007		270	858	882
Offered																				
Required	FCU/M05/02	Kitchen/Living	1	H27Aec-WHCH-12/2 * FR+CP	N	Y (Ø247)	0.13	175	Low	30	2.3	2.1	0.092		1.48	0.018		270	1233	882
Offered																				
Required	FCU/M06/01	Bed 1	1	H27Aec-WHCH-06/1 * FR+CP	N	N	0.16 (0.19)	66 (83)	uLow (Low)	25 (30)	0.89 (1.1)	0.79 (1.0)	0.044		0.52	0.006		270	858	882
Offered																				
Required	FCU/M06/02	Kitchen/Living	1	H27Aec-WHCH-09/1 * FR+CP	N	Y (Ø247)	0.18	117	Low	30	1.5	1.4	0.060		0.71	0.008		270	1078	882
Offered																				
Required	FCU/M07/01	Bed 1	1	H27Aec-WHCH-06/1 * FR+CP	N	N	0.16 (0.19)	66 (83)	uLow (Low)	25 (30)	0.89 (1.1)	0.79 (1.0)	0.044		0.59	0.007		270	858	882
Offered																				
Required	FCU/M07/02	Bed 2	1	H27Aec-WHCH-06/1 * FR+CP	N	N	0.16 (0.19)	66 (75)	uLow (Low)	25 (30)	0.89 (1.1)	0.79 (0.9)	0.044		0.47	0.006		270	858	882
Offered																				
Required	FCU/M07/03	Kitchen/Living	1	H27Aec-WHCH-13/2 * FR+CP	N	Y (Ø247)	0.13	200	Low	30	2.6	2.4	0.104		1.41	0.017		270	1411	882
Offered																				
Required	FCU/M08/01	Bed 1	1	H17Aec-WHCH-SL09/2 * FR+CS	N	N	0.21	63 (83)	uLow (Low)	25 (30)	0.82 (1.1)	0.75 (1.0)	0.044		0.56	0.007		170	1213	795
Offered																				
Required	FCU/M08/02	Kitchen/Living	1	H17Aec-WHCH-SS17/3 * FR+CS	N	Y (Ø197)	0.20	158	Low	30	2.0	1.9	0.080		1.31	0.016		210	1639	934
Offered																				
Required	FCU/M09/01	Bed 1	1	H17Aec-WHCH-SL09/2 * FR+CS	N	N	0.21	63 (83)	uLow (Low)	25 (30)	0.82 (1.1)	0.75 (1.0)	0.044		0.52	0.006		170	1213	795
Offered																				
Required	FCU/M09/02	Kitchen/Living	1	H17Aec-WHCH-SS17/2 * FR+CS	N	Y (Ø197)	0.21	108	Low	30	1.4	1.3	0.056		0.67	0.008		210	1239	934
Offered																				
Required	FCU/M10/01	Bed 1	1	H17Aec-WHCH-SL09/2 * FR+CS	N	N	0.21	63 (83)	uLow (Low)	25 (30)	0.82 (1.1)	0.75 (1.0)	0.044		0.57	0.007		170	1213	795
Offered																				
Required	FCU/M10/02	Bed 2	1	H17Aec-WHCH-SL09/2 * FR+CS	N	N	0.21	63 (75)	uLow (Low)	25 (30)	0.82 (1.0)	0.75 (0.9)	0.040		0.48	0.006		170	1213	795
Offered																				
Required	FCU/M10/03	Kitchen/Living	1	H17Aec-WHCH-SS17/3 * FR+CS	Y	Y (Ø197)	0.21	175	Low+1	30	2.3	2.1	0.092		1.26	0.015		210	1639	1200
Offered																				
Required	FCU/M11/01	Bed 1	1	HW26Aec-WVCH-06/1	N/A	N/A	0.20 (0.25)	72 (117)	uLow (Low+3)	20 (28)	0.97 (1.5)	0.86 (1.4)	0.056		0.85	0.010		2110	804	275
Offered																				
Required	FCU/M11/02	Bed 2	1	HW26Aec-WVCH-06/1	N/A	N/A	0.20 (0.21)	72 (83)	uLow (xLow+1)	20 (23)	0.97 (1.1)	0.86 (1.0)	0.040		0.42	0.005		2110	804	275
Offered																				
Required	FCU/M11/03	Kitchen	1	H17Aec-WHCH-SL09/2 * FR+CS	N	Y (Ø197)	0.21	83	Low	30	1.2	1.0	0.004		0.28	0.003		211	1026	835
Offered																				
Required	FCU/M11/03	Living	2	H27Aec-WHCH-06/1 * FR+CP	N	Y (Ø247)	0.19	84	Low	30	1.1	1.0	0.044		0.815	0.010		270	858	882
Offered																				
Required	FCU/M12/01	Bed 1	1	H17Aec-WHCH-SL09/2 * FR+CS	N	N	0.21	63 (83)	uLow (Low)	25 (30)	0.82 (1.1)	0.75 (1.0)	0.040		0.43	0.005		170	1213	795
Offered																				
Required	FCU/M12/02	Bed 2	1	H17Aec-WHCH-SL09/2 * FR+CS	N	N	0.21	63 (83)	uLow (Low)	25 (30)	0.82 (1.0)	0.75 (0.9)	0.036		0.43	0.005		170	1213	795
Offered																				
Required	FCU/M12/03	Kitchen/Living	1	HW26Aec-WVCH-09/2	N/A	N/A	0.32	158	Low+3	28	2.1	1.9	0.008		1.06	0.013		211	1024	275
Offered																				
Required	FCU/M13/01	Bed 1	1	H17Aec-WHCH-SL09/2 * FR+CS	N	N	0.21	63 (92)	uLow (Low)	25 (30)	0.82 (1.2)	0.75 (1.1)	0.040		0.55	0.007		170	1213	795
Offered																				
Required	FCU/M13/02	Bed 2	1	H17Aec-WHCH-SL09/2 * FR+CS	N	N	0.21	63 (92)	uLow (Low)	25 (30)	0.82 (1.2)	0.75 (1.1)	0.040		0.46	0.006		170	1213	795
Offered																				
Required	FCU/M13/03	Kitchen	1	H17Aec-WHCH-SL09/2 * FR+CS	N	Y (Ø197)	0.21	83	Low	30	1.2	1.0	0.048		0.38	0.005		211	1026	835
Offered																				
Required	FCU/M13/04	Living	2	H27Aec-WHCH-06/1 * FR+CP	Y	Y (Ø247)	0.2	109	Low	30	1.4	1.3	0.056		1.00	0.012		270	858	1200
Offered																				

FCU Reference	Model Reference	Attenuator	Inlet & Case Radiated Air								Discharge Duct Radiated								Discharge In-duct								
			Free Field / In Duct Sound Power Level @ Lw dB								Free Field / In Duct Sound Power Level @ Lw dB								Free Field / In Duct Sound Power Level @ Lw dB								
			63 Hz	125 Hz	250 Hz	500 Hz	1 Hz	2 Hz	4 Hz	8 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 Hz	2 Hz	4 Hz	8 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 Hz	2 Hz	4 Hz	8 Hz	
FCU/M03/01	H27Aec-WHCH-06/1 * FR+CP	N	41	46	43	42	33	28	19	21	45	45	42	38	36	24	19	23	55	51	44	37	34	21	16	20	Required
																											Offered
FCU/M03/02	H27Aec-WHCH-06/1 * FR+CP	N	41	46	43	42	33	28	19	21	45	45	42	38	36	24	19	23	55	51	44	37	34	21	16	20	Required
																											Offered
FCU/M03/03	H27Aec-WHCH-12/2 * FR+CP	N	46	49	45	42	35	29	22	19	43	42	43	40	35	26	18	15	53	48	45	39	33	23	15	12	Required
																											Offered
FCU/M04/01	H27Aec-WHCH-06/1 * FR+CP	N	41	46	43	42	33	28	19	21	45	45	42	38	36	24	19	23	55	51	44	37	34	21	16	20	Required
																											Offered
FCU/M04/02	H27Aec-WHCH-06/1 * FR+CP	N	41	46	43	42	33	28	19	21	45	45	42	38	36	24	19	23	55	51	44	37	34	21	16	20	Required
																											Offered
FCU/M04/03	H27Aec-WHCH-06/1 * FR+CP	N	41	46	43	42	33	28	19	21	45	45	42	38	36	24	19	23	55	51	44	37	34	21	16	20	Required
																											Offered
FCU/M04/04	H27Aec-WHCH-12/2 * FR+CP	Y	47	53	48	46	40	35	28	21	45	45	46	42	40	31	24	17	55	51	48	41	38	28	21	14	Required
																											Offered
FCU/M05/01	H27Aec-WHCH-06/1 * FR+CP	N	41	46	43	42	33	28	19	21	45	45	42	38	36	24	19	23	55	51	44	37	34	21	16	20	Required
																											Offered
FCU/M05/02	H27Aec-WHCH-12/2 * FR+CP	N	46	49	45	42	35	29	22	19	43	42	43	40	35	26	18	15	53	48	45	39	33	23	15	12	Required
																											Offered
FCU/M06/01	H27Aec-WHCH-06/1 * FR+CP	N	41	46	43	42	33	28	19	21	45	45	42	38	36	24	19	23	55	51	44	37	34	21	16	20	Required
																											Offered
FCU/M06/02	H27Aec-WHCH-09/1 * FR+CP	N	42	52	45	44	41	37	29	22	41	44	45	44	42	33	26	17	51	50	47	43	40	30	23	14	Required
																											Offered
FCU/M07/01	H27Aec-WHCH-06/1 * FR+CP	N	41	46	43	42	33	28	19	21	45	45	42	38	36	24	19	23	55	51	44	37	34	21	16	20	Required
																											Offered
FCU/M07/02	H27Aec-WHCH-06/1 * FR+CP	N	41	46	43	42	33	28	19	21	45	45	42	38	36	24	19	23	55	51	44	37	34	21	16	20	Required
																											Offered
FCU/M07/03	H27Aec-WHCH-13/2 * FR+CP	N	44	51	46	44	39	33	26	21	47	43	44	43	38	29	21	16	55	47	44	40	34	24	16	11	z
																											Offered
FCU/M08/01	H17Aec-WHCH-SL09/2 * FR+CS	N	46	41	39	40	37	27	19	19	45	36	37	39	34	23	13	13	56	42	38	36	29	18	7	7	Required
																											Offered
FCU/M08/02	H17Aec-WHCH-SS17/3 * FR+CS	N	51	46	45	43	37	26	21	21	49	40	44	45	39	31	23	15	61	46	45	43	34	25	17	9	Required
																											Offered
FCU/M09/01	H17Aec-WHCH-SL09/2 * FR+CS	N	46	41	39	40	37	27	19	19	45	36	37	39	34	23	13	13	56	42	38	36	29	18	7	7	Required
																											Offered
FCU/M09/02	H17Aec-WHCH-SS17/2 * FR+CS	N	44	43	43	43	41	32	20	19	51	38	41	44	38	31	22	15	62	44	43	41	33	25	16	9	Required
																											Offered
FCU/M10/01	H17Aec-WHCH-SL09/2 * FR+CS	N	46	41	39	40	37	27	19	19	45	36	37	39	34	23	13	13	56	42	38	36	29	18	7	7	Required
																											Offered
FCU/M10/02	H17Aec-WHCH-SL09/2 * FR+CS	N	46	41	39	40	37	27	19	19	45	36	37	39	34	23	13	13	56	42	38	36	29	18	7	7	Required
																											Offered
FCU/M10/03	H17Aec-WHCH-SS17/3 * FR+CS	Y	52	48	46	44	39	28	22	21	49	42	46	47	42	32	24	16	61	49	47	44	37	26	19	10	Required
																											Offered
FCU/M11/01	HW26Aec-WVCH-06/1	N/A	42	41	31	24	17	15	18	19	42	36	32	25	22	14	18	18	55	44	35	26	22	14	18	18	Required
																											Offered
FCU/M11/02	HW26Aec-WVCH-06/1	N/A	42	41	31	24	17	15	18	19	42	36	32	25	22	14	18	18	55	44	35	26	22	14	18	18	Required
																											Offered
FCU/M11/03	H17Aec-WHCH-SL09/2 * FR+CS	N	46	43	41	42	39	30	20	19	46	36	39	41	37	27	16	14	58	42	40	39	32	22	10	8	Required
																											Offered
FCU/M11/03	H27Aec-WHCH-06/1 * FR+CP	N	43	47	44	43	34	29	21	21	46	46	43	38	37	26	21	24	56	52	45	37	35	23	18	21	Required
																											Offered
FCU/M12/01	H17Aec-WHCH-SL09/2 * FR+CS	N	46	41	39	40	37	27	19	19	45	36	37	39	34	23	13	13	56	42	38	36	29	18	7	7	Required
																											Offered
FCU/M12/02	H17Aec-WHCH-SL09/2 * FR+CS	N	46	41	39	40	37	27	19	19	45	36	37	39	34	23	13	13	56	42	38	36	29	18	7	7	Required
																											Offered
FCU/M12/03	HW26Aec-WVCH-09/2	N/A	44	45	37	28	21	16	19	22	36	42	40	33	27	16	21	21	47	48	43	34	28	16	21	21	Required
																											Offered
FCU/M13/01	H17Aec-WHCH-SL09/2 * FR+CS	N	46	41	39	40	37	27	19	19	45	36	37	39	34	23	13	13	56	42	38	36	29	18	7	7	Required
																											Offered
FCU/M13/02	H17Aec-WHCH-SL09/2 * FR+CS	N	46	41	39	40	37	27	19	19	45	36	37	39	34	23	13	13	56	42	38	36	29	18	7	7	Required
																											Offered
FCU/M13/03	H17Aec-WHCH-SL09/2 * FR+CS	N	46	43	41	42	39	30	20	19	46	36	39	41	37	27	16	14	58	42	40	39	32	22	10	8	Required
																											Offered
FCU/M13/04	H27Aec-WHCH-06/1 * FR+CP	Y	44	49	46	45	37	33	26	21	47	49	46	40	39	29	26	25	57	55	48	39	37	26	23	22	Required
																											Offered