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BRE Test Report

Testing MVHR product for inclusion in the PCDB of the NCM, SAP - Aldes Inspirair Top 450 Premium

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1 Introduction

Aldes requested BRE undertake testing of a MVHR product for inclusion in the PCDB of the NCM, SAP.

The test methodology used for the testing of mechanical ventilation products with heat recovery for domestic applications, is; TESTM:01, *SAP 2012 Test method for centralised mechanical supply and extract ventilation systems with heat recovery used in single dwellings*. Issue 1.0, Dated 31/03/2015. http://www.ncm-pcdb.org.uk/sap/page.jsp?id=24

The product tested was:

Product manufacturer	Aldes
Product name	Inspirair Top 450 Premium
Product serial number	1102347623180012
Date received at BRE	15th August 2023

Figure 1 Label of product tested

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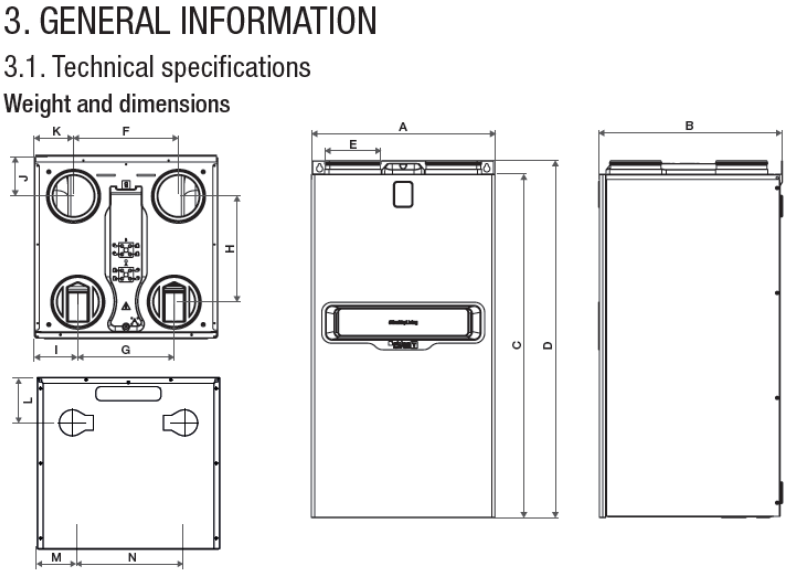
Configuration of MVHR product tested

The product tested had the spigots located on the top side. The spigots were all 160 mm. The general arrangement of the spigots is shown in Figure 2.



	InspirAIR® Top	
	Classic	Premium
A (mm)	560	
B (mm)	560	
C (mm)	1045	
D (mm)	1088	
E (mm)	160	
F (mm)	320	
G (mm)	294	
H (mm)	323	
I (mm)	134	
J (mm)	120	
K (mm)	120	
L (mm)	140	
M (mm)	108	
N (mm)	345	
kg	28	41

Figure 2 General arrangement of spigots on product

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Filters

The filters installed in this product were ISO Coarse 65% in the extract air and ePM1 50% in the supply air stream located immediately before the heat exchanger. The filters can be seen in Figure 3.

Figure 3 Filters installed in product

Access to filters without tools – YES

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Type of fan control

Both the supply fan and the exhaust fan are located after the heat exchanger The fans are controlled independently by a laptop service tool and can be set at 0.01V intervals by the installer. The arrangement of the fans within the product can be seen in Figure 4.

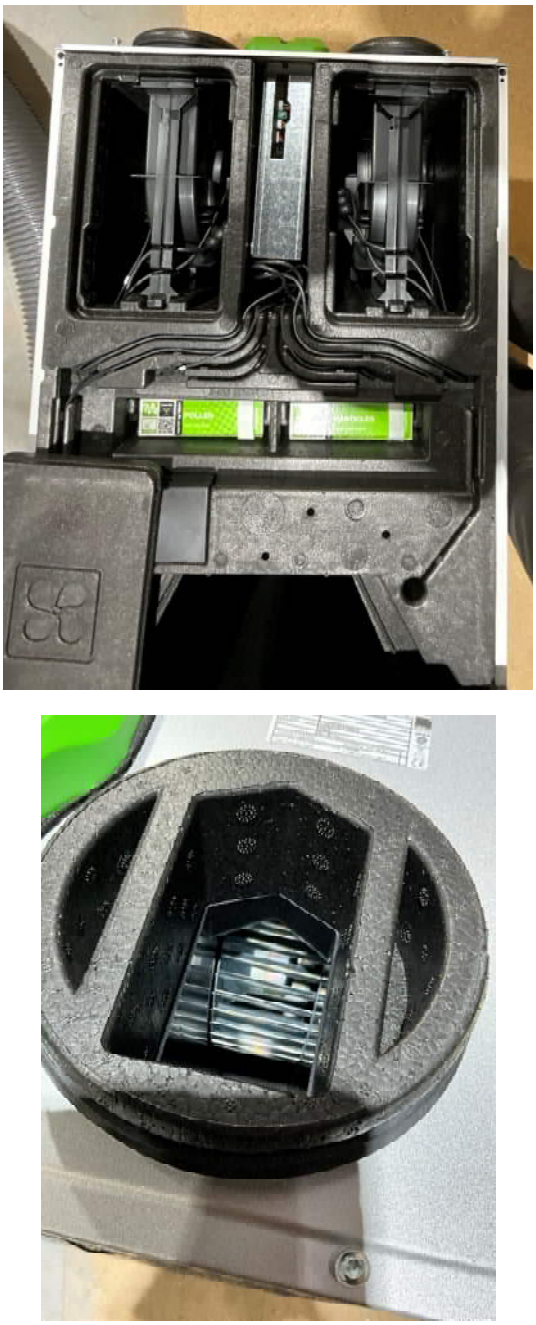

Figure 4 General arrangement of fans in product

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Summer by-pass - type

There is full summer by-pass installed Aldes Inspirair Top 450 Premium. Details of summer by-pass installed can be seen in Figure 5.

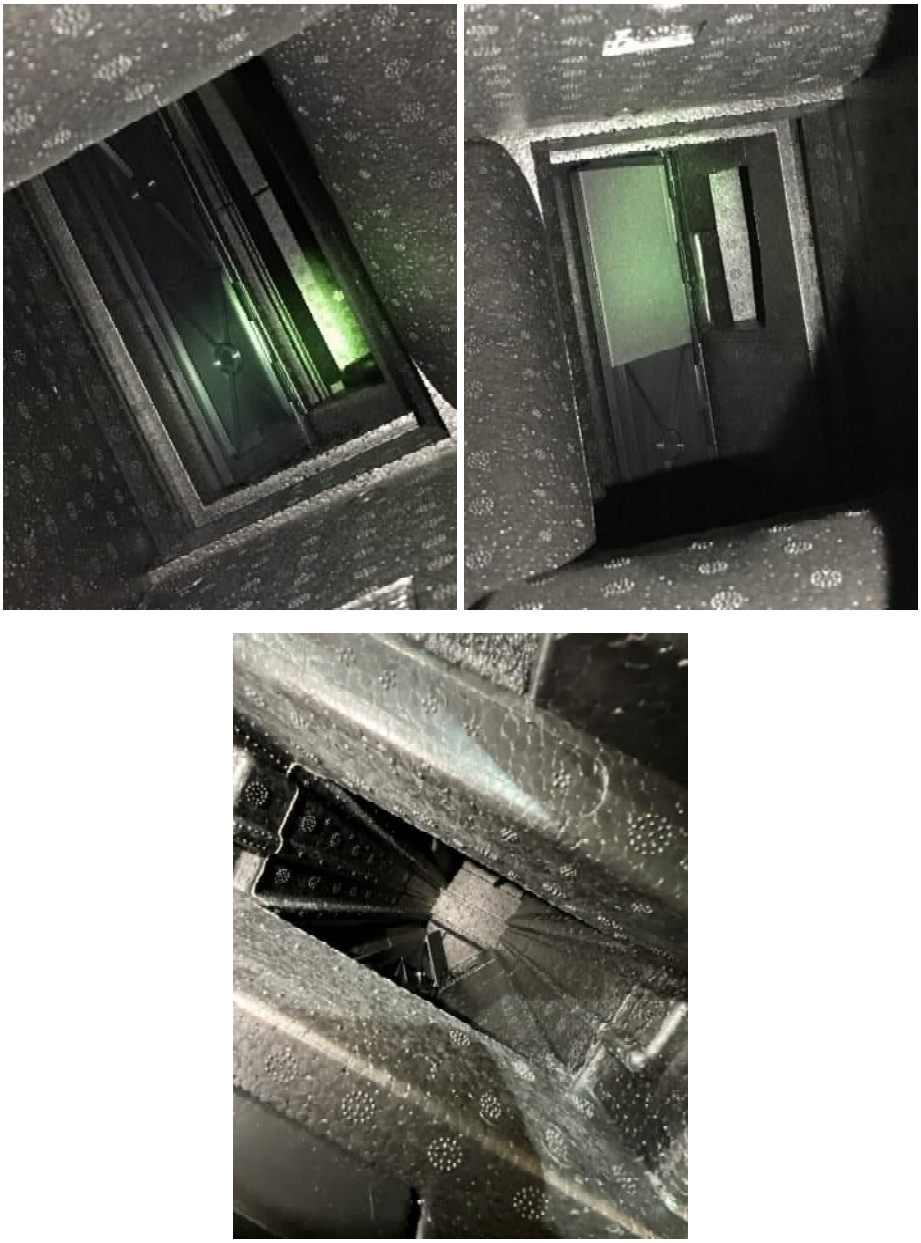

Figure 5 Summer by-pass.

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Heat exchanger

The heat exchanger installed in this product is plastic, counter flow. The heat exchanger type tested is Recair, RU160-500-110, depth 500 mm. Details of heat exchangers installed can be seen in Figure 6.

Figure 6 Heat exchanger installed in the product.

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2 Details of test programme

All testing was undertaken at BRE's HVAC Engineering test laboratory, Building 47, Garston, Watford, UK. All tests were undertaken by Dr M Swainson, Principal Engineer, and Claudiu Manescu, Engineer, HVAC Engineering and Building Diagnostics.

The following tests were undertaken in accordance with the: TESTM:01, *SAP 2012 Test method for centralised mechanical supply and extract ventilation systems with heat recovery used in single dwellings*. Issue 1.0, Dated 31/03/2015. http://www.ncm-pcdb.org.uk/sap/page.jsp?id=24

Determination of leakage - Clause 4.2.1

The external leakage was determined in accordance with BS EN 13141-7:2004 Clause 6.2.1. at + 250 Pa and – 250 Pa only. The leakage rate is expressed as a percentage of the manufacturer's claimed air flow rate at 100 Pa. If the test unit is not designed to operate at above 100 Pa then the leakage rate is expressed as a percentage of the manufacturer's claimed air flow rate at 50 Pa.

The internal leakage was determined in accordance with BS EN 13141-7:2004 Clause 6.2.1. at a pressure of +100 Pa on the exhaust air side only. The leakage rate is expressed as a percentage of the manufacturer's claimed air flow rate at 100 Pa. If the test unit is not designed to operate at above 100 Pa then the leakage rate is expressed as a percentage of the manufacturer's claimed air flow rate at 50 Pa.

Variable	Instrument used for measurement	Calibration
Air flow rate	Brookes 5853E Chell Display CCD100	In-situ cross calibration with nozzle box using Furness FCO560 Calibrator Furness Controls (UKAS)
Duct pressures	Furness Controls FCO332	In-situ 20 point pressure calibration with Furness FCO560 Calibrator Furness Controls (UKAS

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Determination of aerodynamic performance - Clause 4.2.2

The electrical power at a range of air flow rate corresponding to a defined wet room configuration was determined following the method set out in Clause 4.2.2. The configuration of the supply and extract ducts for each wet room configuration was as set out in Clause 4.2.2. Figure 2.

The static pressure at each operating point was measured at a point within 50 mm of the spigot of the test product. This ensured that the true operating point could be transferred to the test for temperature ratio.

Variable	Instrument used for measurement	Calibration
Air flow rate	Hastings LFE LS-8S Chell Display CCD100	In-situ cross calibration with nozzle box using Furness FCO560 Calibrator Furness Controls (UKAS)
Duct pressure	Furness Controls FCO332	In-situ 20 point pressure calibration with Furness FCO560 Calibrator Furness Controls (UKAS)
External plenum pressure	Furness Controls FCO16	BRE calibration Services (UKAS)
Air temperature readings	PT100 1/10th DIN probes	In-situ 8 point temperature calibration with Isotech MilliK with 935-14-112 PRT Isotech (UKAS)
Absorbed electrical power	Yokogawa WT310E	Caltest (UKAS)

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Determination of temperature ratio - Clause 4.3

BRE have a test rig configured to test to EN308:1997. The tests were undertaken in accordance with the requirements of EN308:1997 and the specific procedure for testing fans and ventilation units in: TESTM:01, *SAP 2012 Test method for centralised mechanical supply and extract ventilation systems with heat recovery used in single dwellings*. Issue 1.0, Dated 31/03/2015. http://www.ncm-pcdb.org.uk/sap/page.jsp?id=24

Instruments used in testing:

Variable	Instrument used for measurement	Calibration
Air flow rate	Hastings LFE LS-8S Chell Display CCD100	In-situ cross calibration with nozzle box using Furness FCO560 Calibrator Furness Controls (UKAS)
Air temperature readings	PT100 1/10th DIN probes	In-situ 8 point temperature calibration with Isotech MilliK with 935-14-112 PRT Isotech (UKAS)
Air relative humidity readings	Vaisala HMP110	In-situ 8-point calibration with Michell S8000 Mirror Michell (Traceable NIST)
Duct pressure	Furness Controls FCO332	In-situ 20 point pressure calibration with Furness FCO560 Calibrator Furness Controls (UKAS)
Absorbed electrical power	Yokogawa WT310E	Caltest (UKAS)

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3 Test results

Clause 4.2.1 Determination of leakage

Manufacturer's claimed air flow rate at 100 Pa is 470 m^3/h = 130.5 l/s.

The tests were undertaken on 15th August 2023.

External leakage

Pressure applied (Pa)	Air flow rate (l/s)	Percentage of manufacturer's claimed max air flow rate (%)
+ 250	2.85	2.20%
- 250	2.48	1.90%

Internal leakage

Pressure applied exhaust (Pa)	Pressure applied supply (Pa)	Air flow rate (l/s)	Percentage of manufacturer's claimed max air flow rate (%)
+ 100	0	1.47	1.12%

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Clause 4.2.2 Determination of aerodynamic performance

The tests were undertaken on 28th August 2023.

Variable	Test 1	Test 2	Test 3	Test 4	Test 5
Test point - kitchen plus (№) wet rooms	3	4	5	6	7
Fan speed setting – Supply	1.53V	1.95V	2.47V	2.95V	3.45V
Fan speed setting – Exhaust	1.4V	1.9V	2.33V	2.72V	3.15V
Exhaust air flow rate q_{11} (l/s @ STP)	27.0	33.0	39.0	45.0	51.0
Supply air flow rate q_{22} (l/s @ STP)	27.0	33.0	39.0	45.0	51.0
Static pressure extract air spigot ($_{11}$) (Pa)	-25	-39	-51	-68	-91
Static pressure exhaust air spigot ($_{12}$) (Pa)	5	8	10	13	16
Static pressure fresh air spigot ($_{21}$) (Pa)	-11	-17	-24	-31	-39
Static pressure supply air spigot ($_{22}$) (Pa)	14	19	27	34	44
Measured electrical power (W)	13.01	17.12	22.49	29.46	38.90
Calculated SFP (W/l/s)	**0.48**	**0.52**	**0.58**	**0.65**	**0.76**

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The tests were undertaken on 21st August 2023.

Variable	Test 1	Test 2	Test 3	Test 4	Test 5	Test 6
Test point - kitchen plus (Nº) wet rooms	2	3	4	5	6	7
Fan speed setting – Supply	1.7V	2.3V	2.96V	3.65V	4.45V	5.2V
Fan speed setting – Exhaust	1.6V	2.2V	2.72V	3.35V	3.96V	4.55V
Exhaust air flow rate q_{11} (l/s @ STP)	29.0	37.0	45.0	53.0	61.0	69.0
Supply air flow rate q_{22} (l/s @ STP)	29.0	37.0	45.0	53.0	61.0	69.0
Static pressure extract air spigot ($_{11}$) (Pa)	-38	-50	-74	-95	-127	-160
Static pressure exhaust air spigot ($_{12}$) (Pa)	6	9	13	17	22	27
Static pressure fresh air spigot ($_{21}$) (Pa)	-13	-21	-31	-42	-54	-68
Static pressure supply air spigot ($_{22}$) (Pa)	21	28	40	54	78	98
Measured electrical power (W)	15.13	21.09	30.34	42.80	61.81	87.3
Calculated SFP (W/l/s)	**0.52**	**0.57**	**0.67**	**0.81**	**1.01**	**1.27**

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Clause 4.3 Determination of thermal efficiency

The tests were undertaken on 05th October 2023 and 06th October 2023.

Variable	Test 1	Test 2	Test 3	Test 4	Test 5	Test 6
Test point - kitchen plus (Nº) wet rooms	2	3	4	5	6	7
Extract air temperature t_{11} (°C)	25.0	25.0	25.0	25.1	25.0	25.0
Fresh air temperature t_{21} (°C)	4.9	5.0	4.9	4.9	5.0	4.9
Wet bulb temperature $t_{WB\ 11}$ (%)	12.9	13.0	12.9	12.9	13.2	13.3
Exhaust air temperature t_{12} (°C)	6.8	6.9	7.0	7.1	7.5	7.7
Supply air temperature t_{22} (°C)	23.5	23.5	23.4	23.5	23.3	23.3
Exhaust air flow rate q_{11} (l/s @ STP)	29.0	37.0	45.0	53.0	61.0	69.0
Supply air flow rate q_{22} (l/s @ STP)	29.0	37.0	45.0	53.0	61.0	69.0
Electrical power (W)	15.13	21.09	30.34	42.80	61.81	87.3
Static pressure extract air spigot ($_{11}$) (Pa)	-38	-50	-74	-95	-127	-160
Static pressure exhaust air spigot ($_{12}$) (Pa)	6	9	13	17	22	27
Static pressure fresh air spigot ($_{21}$) (Pa)	-13	-21	-31	-42	-54	-68
Static pressure supply air spigot ($_{22}$) (Pa)	21	28	40	54	78	98
Thermal efficiency (%)	**92.4**	**92.3**	**92.4**	**92.1**	**91.6**	**91.4**

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Results to be used for PCDB

Results of leakage tests

Table Q1

Internal	**Pass**
External	**Pass**

Results for SAP calculations (at minimum flow rate condition)

Table Q2 – Systems with **rigid** ductwork only ***SAP 2005 results***

Exhaust terminal configuration	Fan speed setting	Air flow rate (l/s)	Specific fan power (W/l/s)	Heat exchange efficiency (%)
Kitchen + 3 additional wet rooms	Sup 1.53V Ext 1.4V	**27.0**	**0.48**	**92**
Kitchen + 4 additional wet rooms	Sup 1.95V Ext 1.9V	**33.0**	**0.52**	**92**
Kitchen + 5 additional wet rooms	Sup 2.47V Ext 2.33V	**39.0**	**0.58**	**92**
Kitchen + 6 additional wet rooms	Sup 2.95V Ext 2.72V	**45.0**	**0.65**	**92**
Kitchen + 7 additional wet rooms	Sup 3.45V Ext 3.15V	**51.0**	**0.76**	**92**

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Table Q2 – Systems with **rigid** ductwork only ***SAP 2012 results***

Exhaust terminal configuration	Fan speed setting	Air flow rate (l/s)	Specific fan power (W/l/s)	Heat exchange efficiency (%)
Kitchen + 2 additional wet rooms	Sup 1.7V Ext 1.6V	**29.0**	**0.52**	**92**
Kitchen + 3 additional wet rooms	Sup 2.3V Ext 2.2V	**37.0**	**0.57**	**92**
Kitchen + 4 additional wet rooms	Sup 2.96V Ext 2.72V	**45.0**	**0.67**	**92**
Kitchen + 5 additional wet rooms	Sup 3.65V Ext 3.35V	**53.0**	**0.81**	**92**
Kitchen + 6 additional wet rooms	Sup 4.45V Ext 3.96V	**61.0**	**1.01**	**92**
Kitchen + 7 additional wet rooms	Sup 5.2V Ext 4.55V	**69.0**	**1.27**	**91**

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Report Ends