UKAS TESTING
1262

University of Salford MANCHESTER
Acoustic Testing Laboratory
College of Science & Technology

Out Performs ErP 2018

air HANDLERS

Envirofresh 73 *Quiet*

Low Energy, Air Source, Heat Pump System
Silenced with Acoustic Treatment

BSRIA

About Air Handlers...

Established in 1989 and located in Salford, the company manufactures air handling units for municipal, commercial, health care and industrial use. Our 50,000 square foot purpose built factory is considered one of the most modern air handling manufacturing facilities in the United Kingdom.

The first Envirofresh Heat Pump was commissioned and installed in 1995 and the demand for it has grown from year to year. The wealth of knowledge gained by consistent improvement and research has led to the introduction of the Envirofresh 73 Quiet standard range of low noise breakout and acoustically treated, packaged heat pump air handling units.

Air Handlers is pro-active in understanding the changes to building services low energy specifications and this has led to the development of the Classvent range, specifically designed for schools, colleges and university classrooms. This product was the first ceiling mounted heat recovery unit to incorporate summer boost ventilation, recirculation dampers for start up, fully automated control and connection to BMS control.

Our team of research professionals are committed to developing products with sustainable energy solutions to meet today's demands for reducing ventilation energy consumption.

Accreditation...

The Heat Pump Handling Unit won the Environmental Initiative Product of the Year.

Tested and duty certified by BSRIA - Report No. 53820/1.

Acoustic casework tested and certified by Salford University Acoustic Laboratory - Reports No. 1429 and 2060.

H&V news AWARDS

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Construction Specification...

Location

Envirofresh units can be located in plantrooms or externally to the building.

Casework

The casework of both internal and external Envirofresh units are constructed from an acoustic insulated aluminium Pentapost frame with 50mm double skin panels. The outer skin is Plastisol plastic coated steel, the inner skin is pre-galvanised sheet steel. The panel is insulated with acoustic/thermal insulation composite.

Baseframe

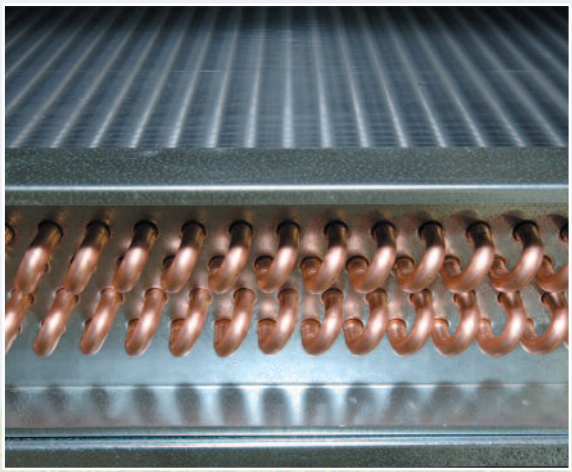
A 100mm high baseframe is provided on all Envirofresh units as standard.

Weatherproofing

For externally mounted Envirofresh units, fresh air and exhaust air louvre cowls are provided on air inlets and outlets, and a pent style roof is fitted to give protection against rain ingress.

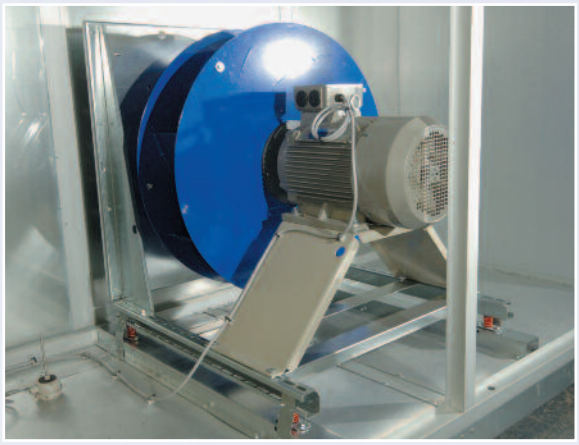
Coils

Condenser and evaporator coils are contained within the Envirofresh unit on slide rails for ease of removal. Standard coil construction is copper tubes and headers with aluminium fins.



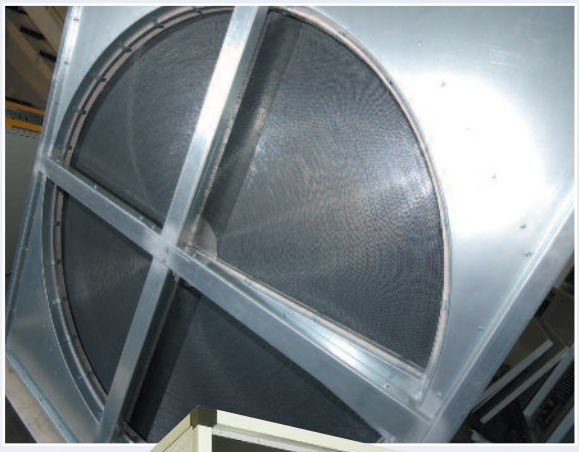
Fans

Envirofresh units incorporate plug type direct driven high efficiency backward curved fans with EC or IE3 complient with ErP 2015 motors suitable for inverter control. The fan/motor sets are isolated from the casework via anti-vibration isolators and a flexible connector.



Heat Recovery Devices

Both thermal wheels and plate exchanger recuperators are used to obtain heat reclaimed energy and are fully complient with Eco Directive 2009/125/EC and LAW (2015 No 469) on January 2016/2018.



Benefits...

Unit Operational Benefits

- Renewable energy source
- BMS controls installed in unit
- Heating and cooling from one source
- Pre-commissioned at factory
- Low noise (no external condensing unit plant)
- No increase in footprint over standard AHU
- Tempered air supply without defrosting
- Room heating and cooling available at reduced volume
- No loss of heating capacity at low ambients
- Reduced site installation time and costs
- Low energy consumption
- 50% less CO2 production than a gas boiler
- Silenced compressors

Digital Scroll Compressor

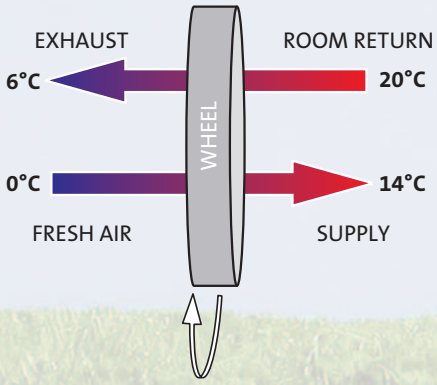
With a full fresh air heat pump system there is a requirement to modulate the capacity from the compressor to avoid cycling.

With a digital scroll compressor the range of modulation goes from 100% down to 30%, which is ideal for full fresh air systems with variable ambient temperatures. Working in conjunction with a 73% recovery wheel results in a compressor only operating at part load.

Concept...

Recovery and Heat Pump

Recovery Wheel

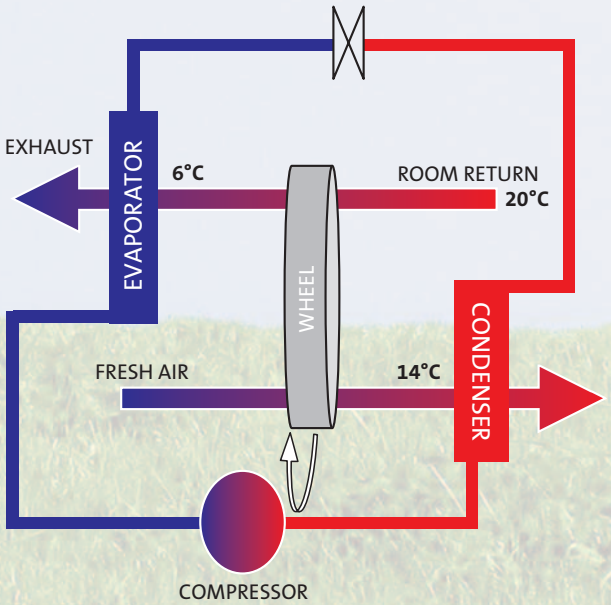


First we recover 73% of the energy from the room exhaust air to the supply air with a rotating wheel.

Then we use a heat pump to extract more heat from the exhaust air.

The energy absorbed from the air is transferred to the refrigerant and then compressed to a high temperature and rejected into the supply air.

Heat Pump (Heating)



Acoustics...

Noise in the community is becoming a major issue, government and local authorities are imposing strict and tough measures on planning consent which is changing the nature of our industry. With this in mind Air Handlers Northern Ltd, have researched products to meet these increased requirements.

Certification...

University of Salford MANCHESTER

Acoustic Testing Laboratory
College of Science & Technology
The University of Salford
Salford, Greater Manchester
M5 4WT, United Kingdom

T: +44 (0) 161 295 4815
F: +44 (0) 161 295 4465
E: d.j.mccaul@salford.ac.uk

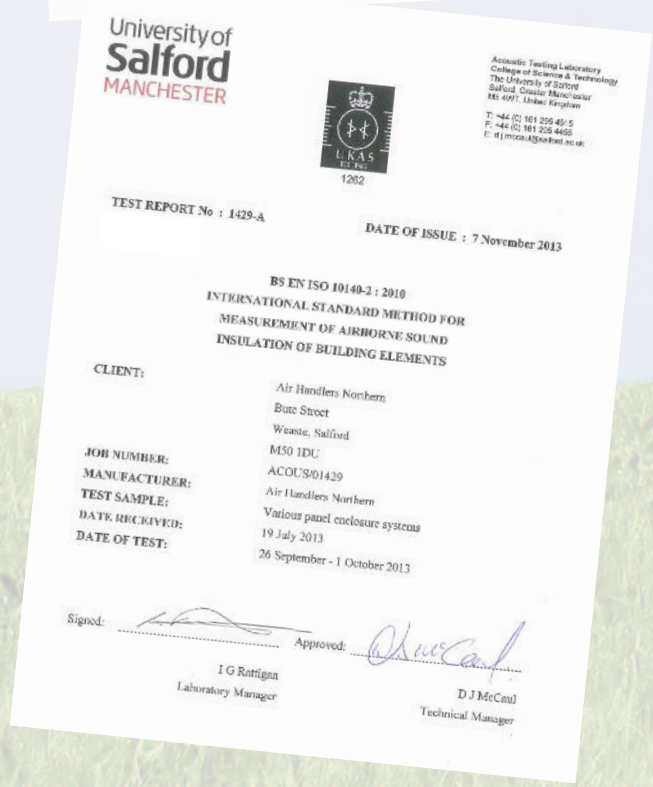
UKAS TESTING 1282

TEST REPORT No : 2060-1 DATE OF ISSUE : 19 February 2015

INTERNATIONAL STANDARD METHOD FOR
MEASUREMENT OF AIRBORNE SOUND
INSULATION OF BUILDING ELEMENTS
BS EN ISO 10140-2 : 2010

CLIENT:	Air Handlers Northern Bute Street Weaste Salford M50 1DU
JOB NUMBER:	ACOUS/02060
TEST SAMPLE:	Various Acoustic Enclosure Panels
MANUFACTURER:	Client
DATE RECEIVED:	5 November 2014
DATE OF TEST:	7 – 9 & 12 January 2015

Signed: I G Rattigan, Laboratory Manager
Approved: C Lomax, Quality Manager



University of Salford MANCHESTER

Acoustic Testing Laboratory
College of Science & Technology
The University of Salford
Salford, Greater Manchester
M5 4WT, United Kingdom

T: +44 (0) 161 295 4815
F: +44 (0) 161 295 4465
E: d.j.mccaul@salford.ac.uk

UKAS TESTING 1282

TEST REPORT No : 1429-A DATE OF ISSUE : 7 November 2013

BS EN ISO 10140-2 : 2010
INTERNATIONAL STANDARD METHOD FOR
MEASUREMENT OF AIRBORNE SOUND
INSULATION OF BUILDING ELEMENTS

CLIENT:	Air Handlers Northern Bute Street Weaste, Salford M50 1DU
JOB NUMBER:	ACOUS/01429
MANUFACTURER:	Air Handlers Northern
TEST SAMPLE:	Various panel enclosure systems
DATE RECEIVED:	19 July 2013
DATE OF TEST:	26 September - 1 October 2013

Signed: I G Rattigan, Laboratory Manager
Approved: D J McCaul, Technical Manager

Casework Breakout...

In partnership with Salford University Acoustic Testing Laboratory a range of composite acoustic panels have been designed and tested.

To obtain the true casework noise breakout the frame and panel assembly has to be tested, with a large enough area sample to give a true representation of an Envirofresh Air Handling Unit Casework.

In practice the framework can leak sound which will flank the panels; therefore the frame must be acoustically insulated to the same standard as the panels.

Testing Standard: BS EN ISO 10140 2:2010 International Standard Method for Measurement of Air Borne Sound.

Salford University Acoustic Test Labs: - Report 1429 & 2060

Assembling test frame and panels

Test set up during testing programme

Air Source Renewable Energy

Casework Sound Reduction Index Options...

Double Skin Panels

FREQ HZ	63	125	250	500	1K	2K	4K	8K
50mm D/Skin FG50	22.5	28	7	30	35	27.5	29	30.1
50mm D/Skin PBFG50	19.6	18.3	33.3	39.8	38.6	36.1	39.3	46.8
50mm D/Skin ASPB50	20.8	21.3	29.6	39	41.4	34.8	32.8	40.2

Triple Skin Panels

FREQ HZ	63	125	250	500	1K	2K	4K	8K
50mm T/Skin PB/TS/ FG50	21.1	21.0	36.3	39.2	41.7	34.7	32.9	40.2
50mm T/Skin AS/TS/ PB50	21.8	23.4	34.4	38.6	41.9	35.1	32.6	39.8

Quadrupal Skin Panels

FREQ HZ	63	125	250	500	1K	2K	4K	8K
50mm Q/Skin AS/QS/ PB50	24.1	36.6	34.7	39.8	40.7	37.8	39.7	43.7

Compressor Section Noise Control

Helmholtz absorber panels fitted to the compressor section reduce the compressor compartment sound pressure level, together with acoustic sound shells on the compressors, which reduce the compressor noise emission.

Vibration control is enhanced by the compressors etc. being mounted on an inertia common base. The whole compressor assembly is isolated from the casework with high deflection anti vibration isolators and refrigerant flexible connections.

The compressor section sound power level can be reduced by as much as 20db utilising all noise control features illustrated.

Compressor Acoustic Shells

Case Study

During 2012, Air Handlers provided Envirofresh low energy heat pump systems to the Dolby screening rooms, Soho, London. The client asked Air Handlers Northern if it was possible to achieve NR25 (including a 5dB uplift for tonal influence).

Air Handlers Northern Acoustics Engineers, who had already reduced the noise level with absorber panels and compressor sound shells, designed an Inertia Base with high deflection spring anti vibration isolators, together with flexible refrigerant connectors, to reduce the 63Hz octave band tonal emission to meet NR25.

The report and graphic analysis shows the effectiveness of the vibration control techniques employed, which had the required low frequency damping to eliminate vibration from the plant.

Munro Acoustics Ltd
Unit 3G1, The Leather Market
11-13 Weston Street
London SE1 3ER

Munro Acoustics Ltd

Dolby Screening Room

Background Noise Assessment

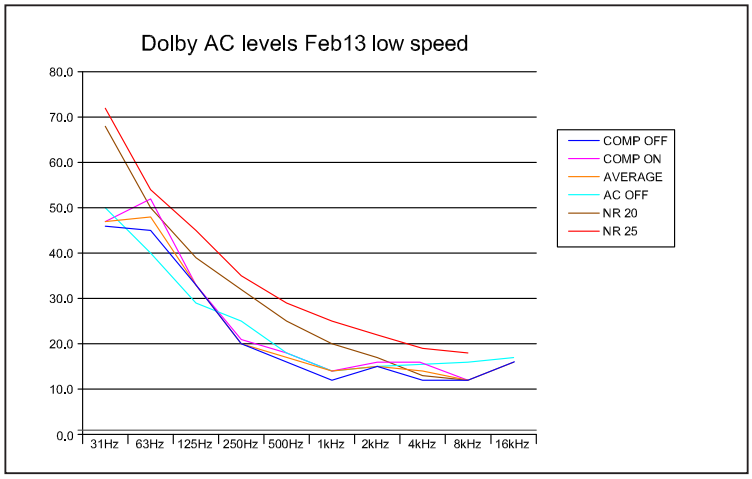
21 June 2013

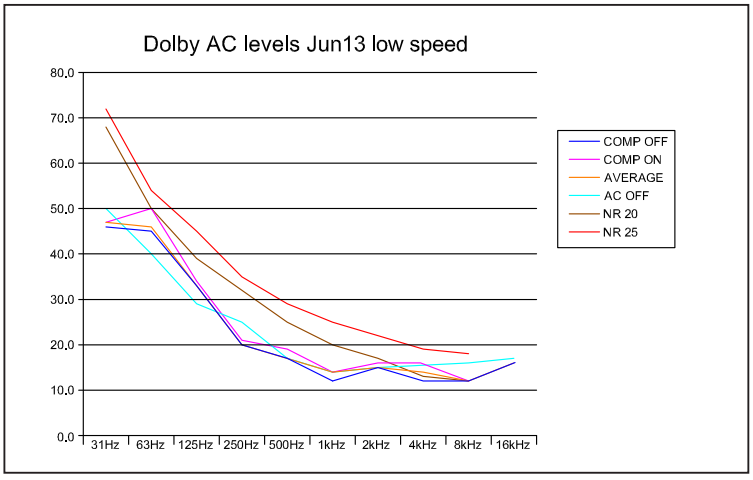
Following our report of 28 February 2013, further work has been done to the air handling unit to reduce the noise output. The compressor has been mounted on anti-vibration mounts with flexible connectors to the pipes.

The background noise level was measured on 17 June 2013 with the plant running on the design airflow. The plant was operated by a representative who installed the unit. A measurement was taken at the central seat position which had previously been observed as the worst point. The improvement (in the 63Hz octave band) seen at this position was then applied to the spatially averaged measurements taken in February to give a comparable result for June.

The graphs below show the measurements before (February) and after (June) the works were carried out.

The peak in the 63Hz band has reduce and now meets NR25 (including for the 5dB) uplift for tonality) and therefore meets the specification.

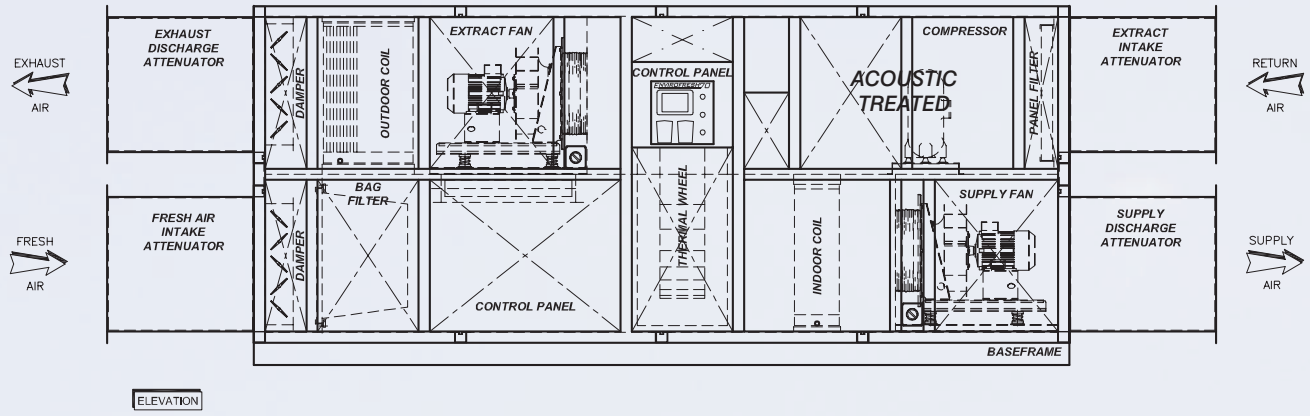




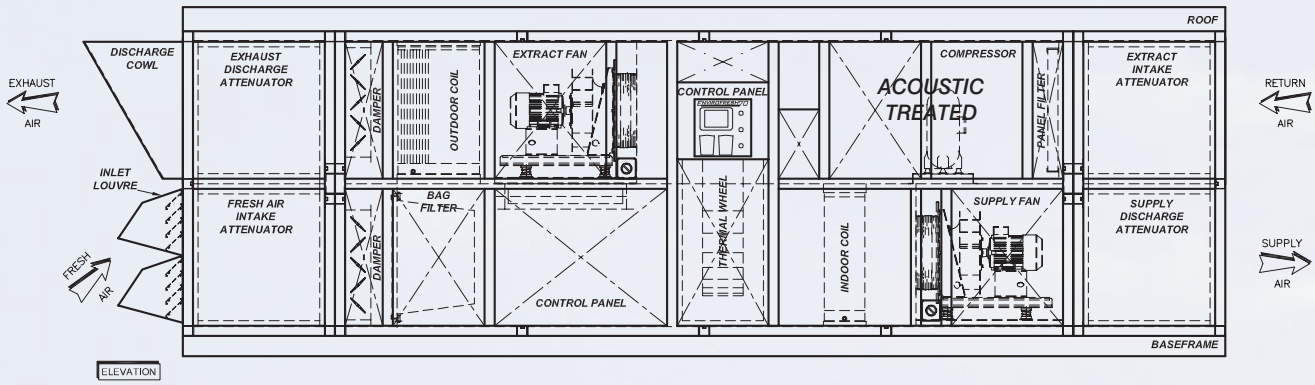
Attenuation...

Matching attenuation can be provided to attenuate the duct borne sound, to prevent flanking; it is recommended that attenuators are in built into the Envirofresh Air Handling Unit Casework, or directly bolted on to the inlets and outlets. The two options are shown below.

ENVIROFRESH WITH BUILT ON DUCT ATTENUATORS



ENVIROFRESH WITH INBUILT ATTENUATORS



Construction

Acoustic absorbent splitters are constructed with a galvanised sheet metal holding frame containing acoustic absorbent material, the face of the material is covered with a lantor face protective scrim, which prevents particle migration.

Should there be possible moisture present, then a melinex protective film can be used to wrap the acoustic absorbent material inside the splitters.

Melinex can reduce the absorption of the splitter, therefore a 30 micron maximum thickness film is used.

Attenuator Performance

With government and local authorities putting noise emissions as a key issue in giving planning consent, particularly in inner city developments. To achieve the strict conditions being given, Air Handlers Northern have developed an Acoustic software selection program which includes atmospheric and room performance characteristics to select the correct attenuators for varying environmental conditions and limits.

Acoustic Absorber Panels...

The use of acoustic absorber panels in fan sections, compressor sections, inlet and discharge plenums have a significant effect on reducing internal sound pressure levels.

Selection Data...

MODEL	ENV800,	ENV1400A,	ENV1400B,	ENV2500A,	ENV2500B,	ENV4000A,	ENV4000B,	ENV5500,	ENV7000,
Volume m3/s (Hi/Lo)	0.55/0.8	1.0/0.7	1.5/1.0	2.0/1.5	2.5/2.0	3.3/2.5	4/3.3	5.0/4.0	7.5/5.0
Comp cooling capacity kW (1)	10.2	12.7	19	25.47	31.7	42	51	64	95.3
Comp cooling EER (1)	4.2	4.2	3.85	4.4	4.35	4.05	4.4	4.35	4.35
Comp heating capacity (2)	5.2	6.5	9.7	13	16.25	21.45	26	32.5	48.7
Comp heating COP (2)	4.7	4.6	3.9	4.77	4.9	4.1	4.77	4.9	4.9
Supply fan motor kW	1.1	1.5	2.2	3	4	5.5	5.5	7.5	15
Extract fan motor kW	1.1	1.5	2.2	3	4	5.5	5.5	7.5	11
Unit SFP (3)	2.1/1.74	1.77/1.6	2.2/1.7	1.63/1.42	1.97/1.65	1.69/1.51	1.93/1.98	1.98/1.67	2.01/1.45
Max Running Current Amps (4)	13	18	21.6	29	37	52	54	70	102
Rec. fuse size amps	20	25	32	50	50	63	63	80	125
Length mm	3400	3500	3500	4000	4000	4600	4600	5000	5500
Width mm	1050	1310	1310	1760	1760	2060	2060	2360	2660
Height (incl. base) mm	1300	1850	1850	2200	2200	2600	2600	3000	3200
R410A refrigerant kg	6.88	8.6	12.9	17.2	21.5	28.38	34.4	43	64.5

(1) Based on 28°C/45%RH ambient, 26°C return, 20°C supply at high volume

(2) Based on 0°C ambient, 20.0°C/40% return, 20°C supply at high volume.

(3) Based on standard unit with external pressures of 300pa supply and 250Pa extract. Includes control power. (60Pa ≈ 0.1SFP)

(4) Based on 400V-3PH-50HZ

Units designed capable of conditions below, at high volume:

Winter: Ambient air -4°C, return air 20°C/40%RH, 20°C supply

Summer : Ambient air 30°C/40%RH, 26°C return, 20°C supply

Selections based on equal volumes

Recovery reduced with lower extract volumes. Extract minimum volume 85% of supply

Correction to achieve 17°C leaving air supply when cooling, 28°C/45% ambient, 26°C return = max vol x 0.75

For displacement systems with 30°C ambient, 30°C return and 19°C supply, correction = max vol x 0.75

Correction to achieve 25°C leaving air supply when heating, -4°C ambient with 20°C return = max vol x 0.7

BSRIA

Test Report No. 53830-1

BSRIA was contacted by Air Handlers Northern Ltd to test an air handling unit (AHU). The unit consisted of a combined air supply and extract system. The tests were conducted during March and April 2010. A range of tests was conducted for a range of outside air conditions including summer, winter and mid-season.

The tests were conducted to determine the capacity and the energy used by the unit during the range of conditions tested.

The construction of the test facility, the instrumentation used, the data collected, analysis and the derived conclusions are presented in this report.

Observations and Conclusions...

A range of tests were completed on the air handling unit at the requested conditions of the client to simulate summer, mid season and winter conditions.

Tests 1 to 5 show that the unit was able to provide the conditioned air at the requested temperature, of 20°C, from an ambient temperature of between 1°C and 30°C at a volume flowrate of 1.0 m^3/s. During the heating tests the thermal wheel was on for heat recovery from the extract air from the simulated building. The thermal wheel was inactive during the two cooling tests.

Test 6 shows that the unit can provide 0.8m^3/s of conditioned air at 26°C to a building at a fresh air inlet temperature of 0°c. The test was conducted to check the winter heating capacity at maximum compressor duty.

BSRIA Test Procedure...

The tests were conducted at the settings requested by the client, to simulate a range of conditions including summer, winter and mid season.

The test data was recorded at 1 minute intervals and averaged over the test period when completed.

The air was supplied to the AHU at the required condition by use of a range of equipment depending on the condition required. The supply conditions were held constant throughout the test period.

Test Conditions

Table 1 Target test conditions

Test number	Test description	Air on temperature	Air supply to building temperature	Air return from building temperature	Airflow volume
-	Units	°C	°C	°C	m^3s^{-1}
1	Cooling 1	24.5	20.0	26.0	1.0
2	Cooling 2	30.0	20.0	26.0	1.0
3	Heating 1	1.0	20.0	20.0	1.0
4	Heating 2	4.0	20.0	20.0	1.0
5	Heating 3	8.0	20.0	20.0	1.0
6	Heating 4	0.0	26.0	20.0	0.8

Table 2 Test 1 - Cooling 1

Date of test	29-Apr-10	
Start time of test	**14:48:30**	
Length of test	**30.0**	**Minutes**
HP Low (gauge)	12.9	Bar
HP High (gauge)	14.0	Bar
LP Low (gauge)	5.2	Bar
LP High (gauge)	7.0	Bar
Compressor percentage	36.0	%
Power to compressor	1.20	kW
Compressor power high	2.72	kW
Compressor power low	0.48	kW
Fresh air temp	24.5	°C
Air onto coil temp	24.2	°C
Air off coil temp	20.2	°C
Air return temp	26.2	°C
Air supply volume	1.00	m^3s^{-1}
Air extract volume	0.97	m^3s^{-1}
Cooling over coil	4.91	kW
Cooling over supply unit	5.3	kW
Supply fan setting	32.6	Hz
Extract fan setting	32.5	Hz

Table 3 Test 2 - Cooling 2

Date of test	29-Apr-10	
Start time of test	**16:26:30**	
Length of test	**30.0**	**Minutes**
HP Low (gauge)	17.6	Bar
HP High (gauge)	17.6	Bar
LP Low (gauge)	5.3	Bar
LP High (gauge)	5.3	Bar
Compressor percentage	100.0	%
Power to compressor	3.00	kW
Compressor power high	3.05	kW
Compressor power low	1.58	kW
Fresh air temp	30.2	°C
Air onto coil temp	30.1	°C
Air off coil temp	20.0	°C
Air return temp	26.3	°C
Air supply volume	0.99	m^3s^{-1}
Air extract volume	1.03	m^3s^{-1}
Cooling over coil	12.27	kW
Cooling over supply unit	12.4	kW
Supply fan setting	32.7	Hz
Extract fan setting	32.6	Hz

Table 4 Test 3 - Heating 1

Date of test	30-Apr-10	
Start time of test	**9:50:00**	
Length of test	**30.0**	**Minutes**
HP Low (gauge)	10.1	Bar
HP High (gauge)	12.0	Bar
LP Low (gauge)	3.6	Bar
LP High (gauge)	4.3	Bar
Compressor percentage	55.0	%
Power to compressor	1.33	kW
Compressor power high	2.23	kW
Compressor power low	0.46	kW
Fresh air temp	0.8	°C
Air onto coil temp	15.1	°C
Air off coil temp	20.0	°C
Air return temp	20.4	°C
Air supply volume	1.03	m^3s^{-1}
Air extract volume	0.99	m^3s^{-1}
Heating over coil	6.18	kW
Heating over supply unit	24.3	kW
Supply fan setting	32.7	Hz
Extract fan setting	32.6	Hz

Table 5 Test 4 - Heating 2

Date of test	30-Apr-10	
Start time of test	**11:02:30**	
Length of test	**30.0**	**Minutes**
HP Low (gauge)	10.0	Bar
HP High (gauge)	11.8	Bar
LP Low (gauge)	3.9	Bar
LP High (gauge)	4.7	Bar
Compressor percentage	43.0	%
Power to compressor	1.14	kW
Compressor power high	2.21	kW
Compressor power low	0.48	kW
Fresh air temp	3.5	°C
Air onto coil temp	16.1	°C
Air off coil temp	20.0	°C
Air return temp	20.4	°C
Air supply volume	1.02	m^3s^{-1}
Air extract volume	1.01	m^3s^{-1}
Heating over coil	4.93	kW
Heating over supply unit	20.7	kW
Supply fan setting	32.7	Hz
Extract fan setting	32.6	Hz

Table 6 Test 5 - Heating 3

Date of test	30-Apr-10	
Start time of test	**12:40:00**	
Length of test	**30.0**	**Minutes**
HP Low (gauge)	9.8	Bar
HP High (gauge)	11.4	Bar
LP Low (gauge)	4.4	Bar
LP High (gauge)	5.3	Bar
Compressor percentage	30.0	%
Power to compressor	0.93	kW
Compressor power high	2.21	kW
Compressor power low	0.48	kW
Fresh air temp	8.2	°C
Air onto coil temp	17.3	°C
Air off coil temp	20.0	°C
Air return temp	19.9	°C
Air supply volume	0.99	m^3s^{-1}
Air extract volume	1.03	m^3s^{-1}
Heating over coil	3.34	kW
Heating over supply unit	14.5	kW
Supply fan setting	32.7	Hz
Extract fan setting	32.6	Hz

Table 7 Test 6 - Heating 4

Date of test	30-Apr-10	
Start time of test	**15:23:30**	
Length of test	**30.0**	**Minutes**
HP Low (gauge)	13.8	Bar
HP High (gauge)	13.8	Bar
LP Low (gauge)	2.9	Bar
LP High (gauge)	2.9	Bar
Compressor percentage	100.0	%
Power to compressor	2.43	kW
Compressor power high	2.46	kW
Compressor power low	2.41	kW
Fresh air temp	-0.3	°C
Air onto coil temp	15.0	°C
Air off coil temp	25.6	°C
Air return temp	20.7	°C
Air supply volume	0.81	m^3s^{-1}
Air extract volume	0.77	m^3s^{-1}
Heating over coil	10.63	kW
Heating over supply unit	25.9	kW
Supply fan setting	27.4	Hz
Extract fan setting	27.9	Hz

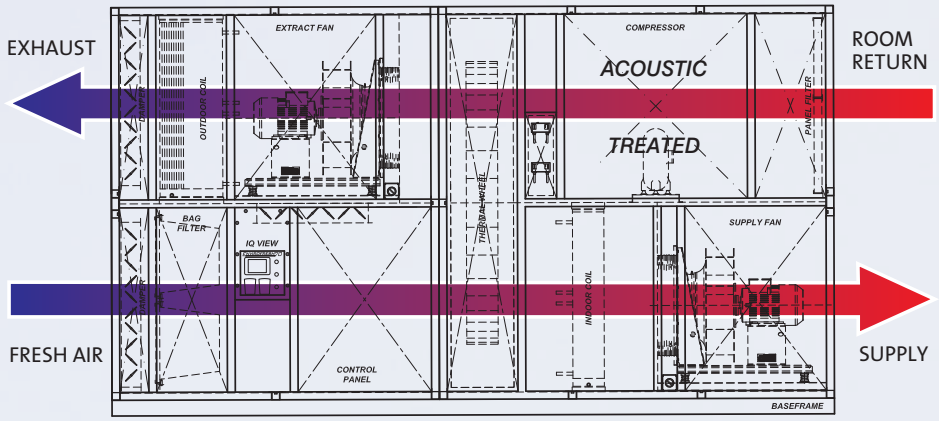
Heating and Cooling Operation...

The Envirofresh is a low energy, air source, heat pump system providing heating and cooling for occupancy fresh air.

The system operates with Variable Air and Refrigerant Volume (VARV).

A heat pump is utilised to provide both heating and cooling. This is possible reversing the direction of the refrigerant in the compressor system. The supply coil changes its mode of operation dependant on the temperature required.

Heating Cycle

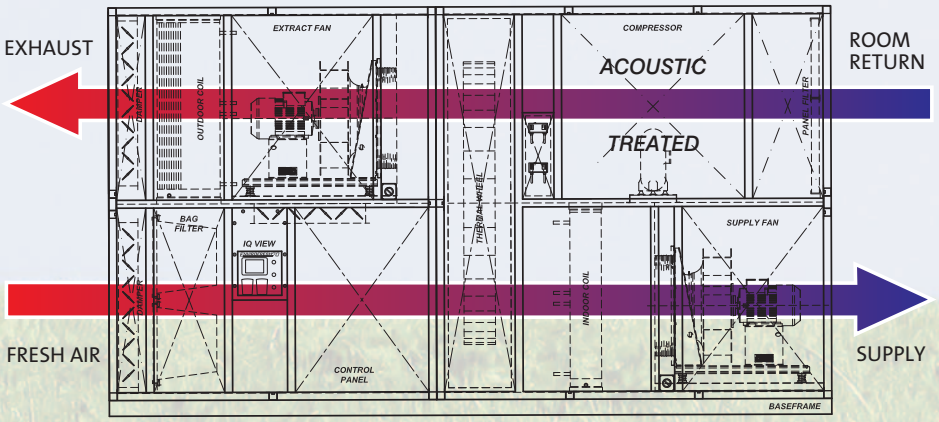


Fresh air enters the Envirofresh unit passing through the thermal wheel which transfers heat energy from the room return air before passing through the supply air coil where the high temperature refrigerant transfers its heat energy to the room supply air.

At the same time the room exhaust air passes through the thermal wheel then onto the exhaust coil, which cools the refrigerant before discharging to the atmosphere.

The heat is then transferred from the refrigerant to the supply coil, which heats the supply air entering the room. The refrigerant then returns back to the exhaust coil, allowing the cycle to begin again.

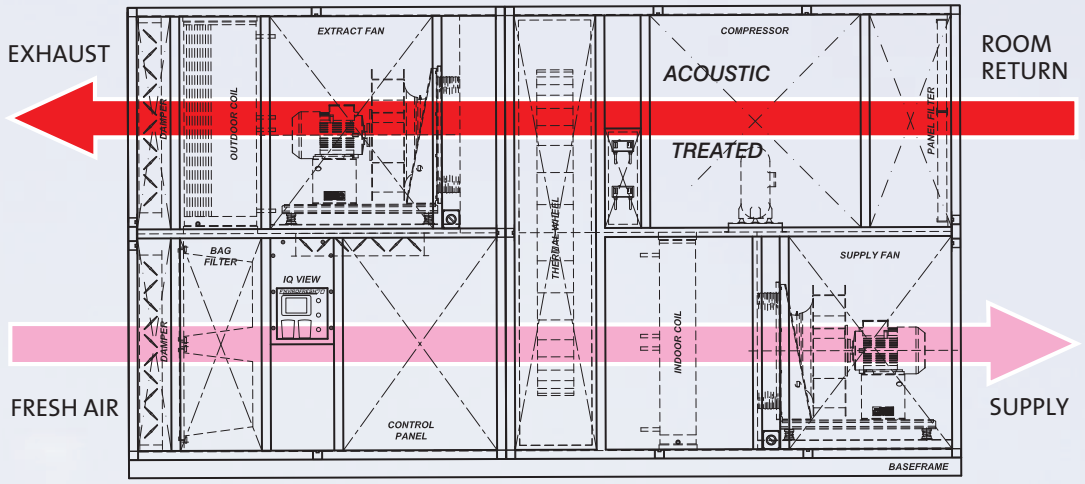
Cooling Cycle



The outside fresh air enters the Envirofresh unit and passes through the thermal wheel to transfer cooling energy from the room return air. If the temperature is lower than the outside ambient air, it then passes through the supply air coil where the lower temperature refrigerant transfers its cooling energy to the supply air, further reducing the entering room air temperature.

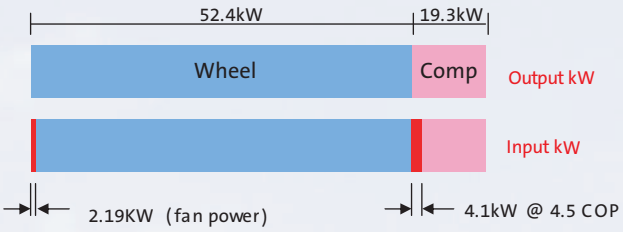
At the same time the room exhaust air passes through the wheel into the exhaust coil, which disapates the hot air to atmosphere.

Free Cooling



When the room is calling for a cooling requirement, and the outside fresh air temperature is lower than the room exhaust air, the Envirofresh Air Handling Unit will utilise the free cooling available to satisfy the cooling demand.

Heating Energy Balance...



71.7kW output for 6.29kW input

Calculate heating capacity for 2.6m³/s unit

Fresh air temp on = -4°C

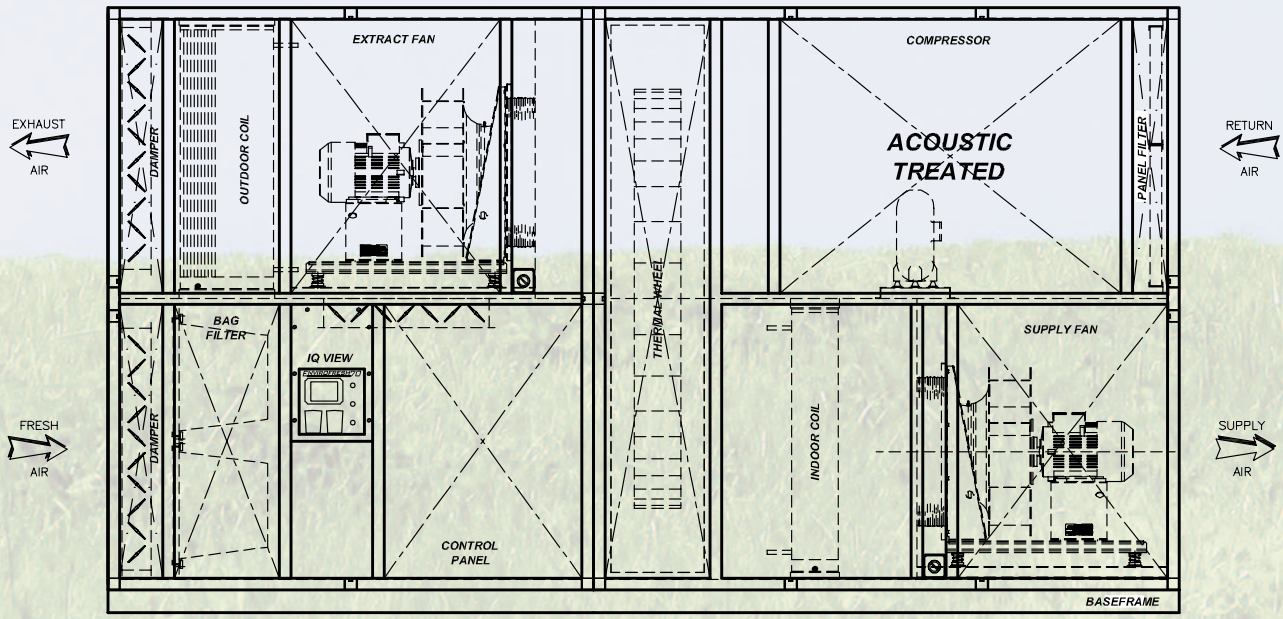
Air temp leaving heat pump coil = 19°C (ignore fan gain)

Room return 20°C

Density = 1.2kg/m³

Required heating capacity = 2.6 x 1.2 x(19+4) = 71.7kW

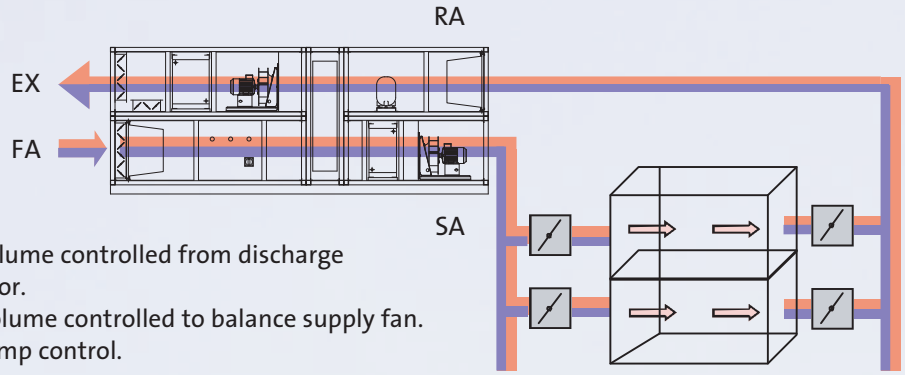
Standard Unit Configuration...



Application and Control Options...

Control Option 1

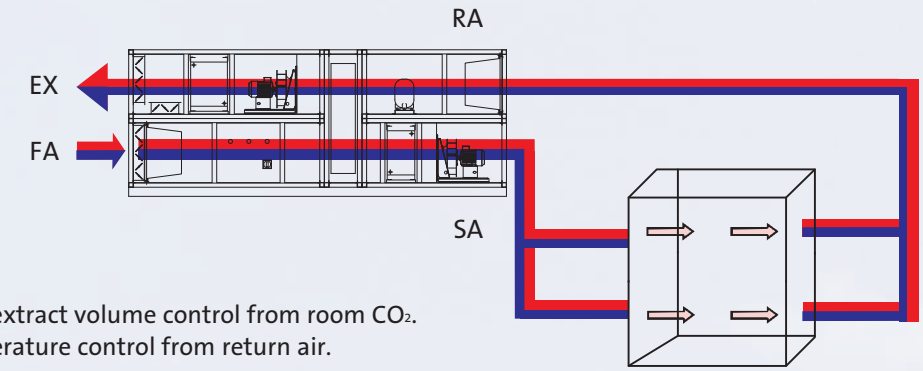
Zone VAV



Supply fan volume controlled from discharge pressure sensor.
Extract fan volume controlled to balance supply fan.
Leaving air temp control.

Control Option 2

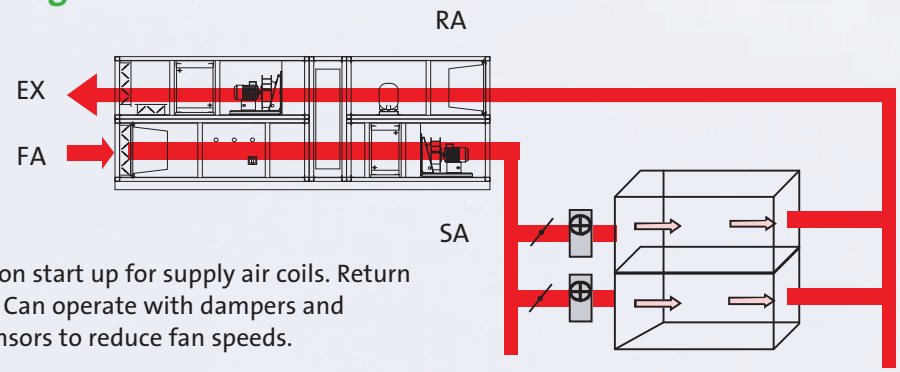
Single Room Control



Supply and extract volume control from room CO_2.
Room temperature control from return air.

Control Option 3

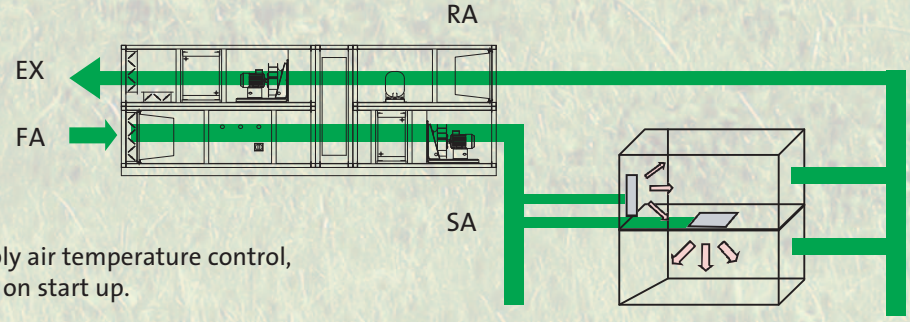
Zone Heating



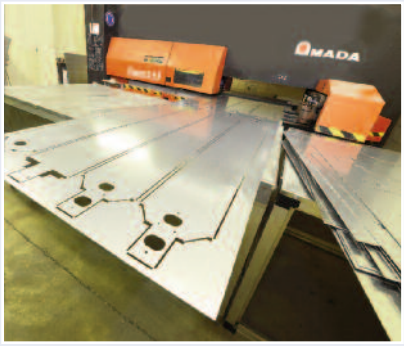
Recirculation on start up for supply air coils. Return temp control. Can operate with dampers and occupancy sensors to reduce fan speeds.

Control Option 4

Tempered Central or Displacement Fresh Air



Leaving supply air temperature control, recirculation on start up.



Options and Accessories...

- Weatherproof Construction
- In-built Attenuators
- Side Intake or Discharge
- Electric Heaters
- Health Care Quality
- DG Series Direct Gas Fired AHU's
- Coastal Application

Selection Software...

- AUTODESK
- AUTOCAD LT
- SOLIDWORKS
- RADAN

Air Handlers have invested in the latest selection and manufacturing software to ensure we offer a quality sales, manufacturing and after sales service.

We pride ourselves on the high level of quality we give our customers on quotation and planning standards

Air Source Renewable Energy

Product Range...

- Single Cased Extract Unit VSI
- Twin Fan Extract Units VTI and ITU
- Classvent Units
- Packaged Void Units PVU
- Vertical Air Handling Units
- AH Series Modular AHU's
- IDG Series Indirect Gas Fired AHU's
- DG Series Direct Gas Fired AHU's
- HOSP Health Care Specification Hygiene AHU's
- AHW Welded Frame and Stainless Units
- TWHR Heat Reclaim AHU's containing Thermal Wheels
- AHR Heat Recovery AHU's containing Recuperators
- Freshcool Cooling only Packaged Units
- Envirofresh Packaged Heat Pump Units
- Attenuators and Anti-vibration Mounts
- Acoustic Enclosures and Screens
- Flat Pack Build and Refurbishment
- Planned Maintenance and Site Repairs
- Airflow/Acoustic/Leakage Performance Testing Facility

Other Associated Literature...

- Sound Advice for Ventilation Plant in Schools.
  By David Pinchbeck
- Air Handling Units Acoustic Insulation Performance test Report
- BSRIA Envirofresh Performance Test Report
- EcoDesign Directive 2016/18

Air Handlers Northern Ltd.
Alfred Procter House
Bute Street, Salford
Manchester M50 1DU

Tel: 0161 745 8888
Fax: 0161 743 9190
Email: sales@airhandlers.net
Web: www.airhandlers.net