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**18 – 21 FEBRUARY 2023**  
RIYADH FRONT EXHIBITION AND  
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## Energy Efficient Indoor Air Quality

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Senior Technical Manager

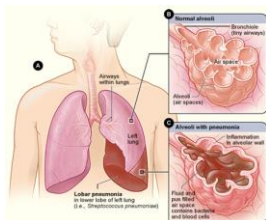


[www.thebig5saudi.com](http://www.thebig5saudi.com)



# Context

Air pollution & Mortality rates



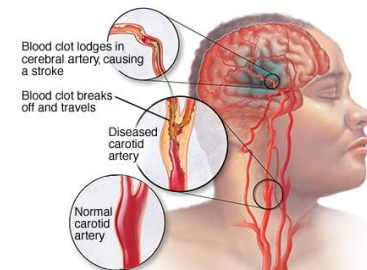
سرطان الرئة  
Lung Cancer  
7%



Pneumonia

التهاب الرئة

21%



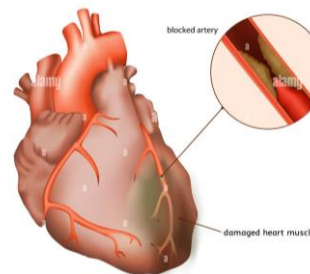
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Stroke

جلطة دماغية

20%

7 Million death per year



Ischaemic heart disease

مرض القلب الإقفاري

34%

COPD  
الإنسداد الرئوي

19%



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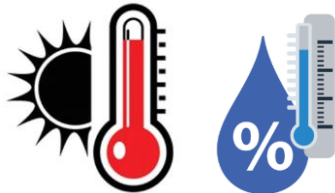
# Context

## Air pollution in GCC



Pollutant	Averaging time	AQG level WHO	UAE	KSA	QATAR	KUWAIT
PM 2.5 ( $\mu\text{g}/\text{m}^3$ )	Annual	5	173	38	93	94
PM 10 ( $\mu\text{g}/\text{m}^3$ )	Annual	15	142	78	88	244
Ozone (O <sub>3</sub> ) ( $\mu\text{g}/\text{m}^3$ )	Peak Season	60	106	42	423	
Nitrogen dioxide (NO <sub>2</sub> ) ( $\mu\text{g}/\text{m}^3$ )	Annual	10	20	40		30
Sulphur dioxide (SO <sub>2</sub> ) ( $\mu\text{g}/\text{m}^3$ )	24 hours	40	141	169		770
Carbon monoxide (CO) (mg/m <sup>3</sup> )	24 hours	4	150	143	123	321

Source: Amoatey et al. 2018



# Context

Indoor Air Quality IAQ



**80 to 95%**  
of time spent Indoor

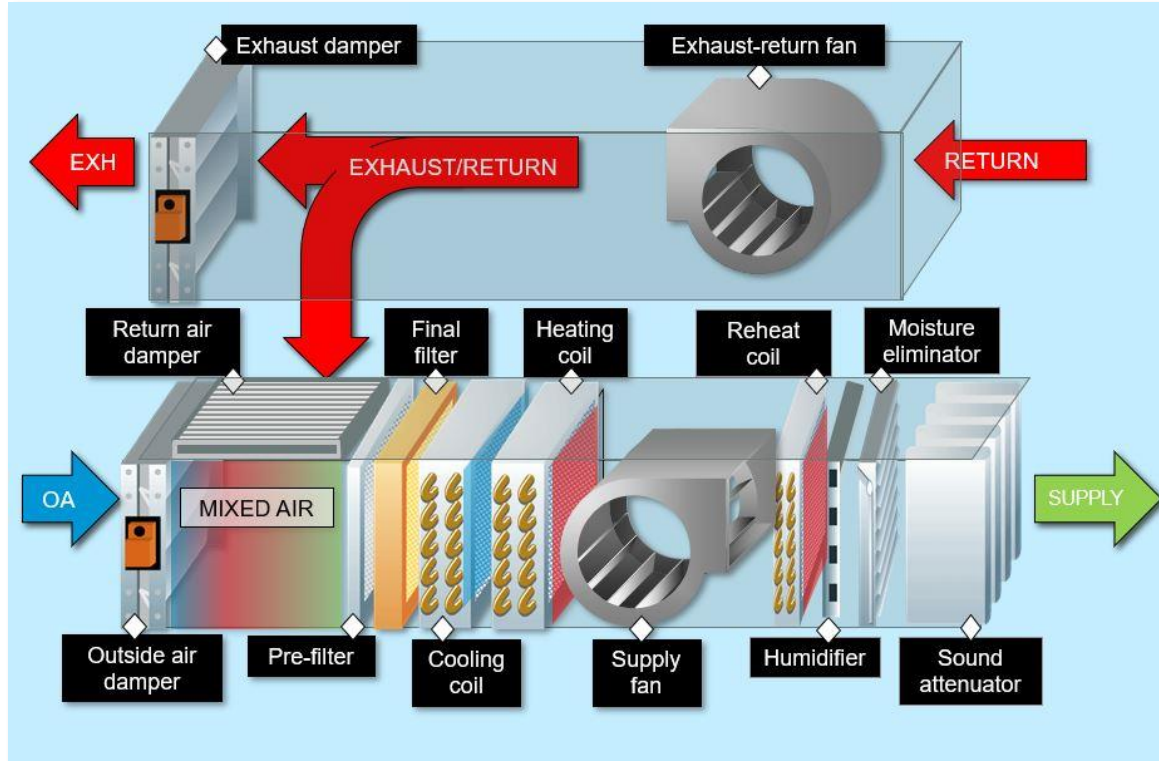


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# Air Handling Unit

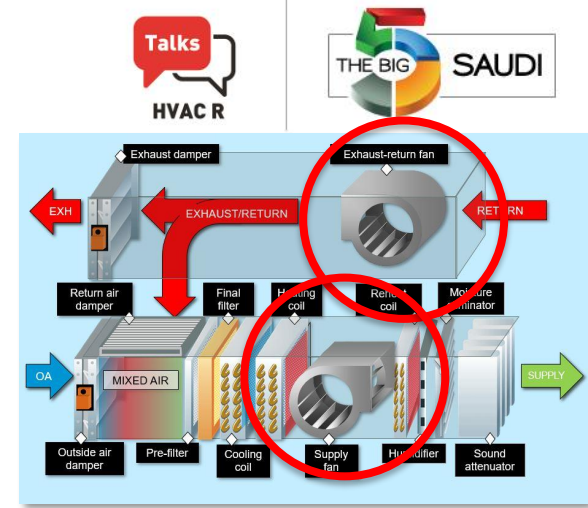
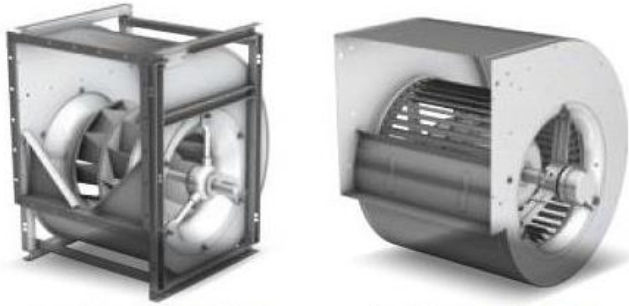
How does it Work?



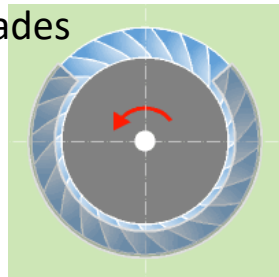
# Air Handling Unit

Components – FAN

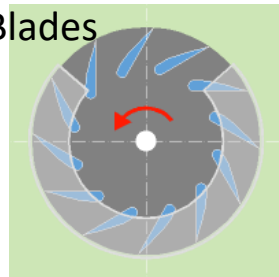
CENTRIFUGAL (with housing)



Forward-Curved  
Blades



Backward-Curved  
Blades



Driven mode : Belt  
and pulley



Plug Fans



EC Fan



# Air Handling Unit

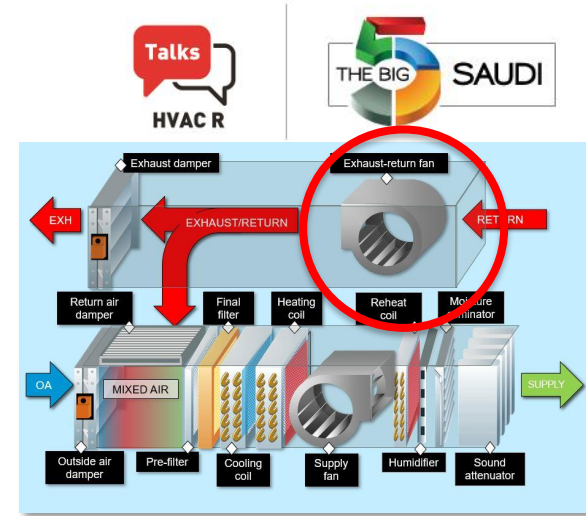
Components – FAN



Dirt



Corrosion



Talks  
HVAC R

THE BIG 5 SAUDI

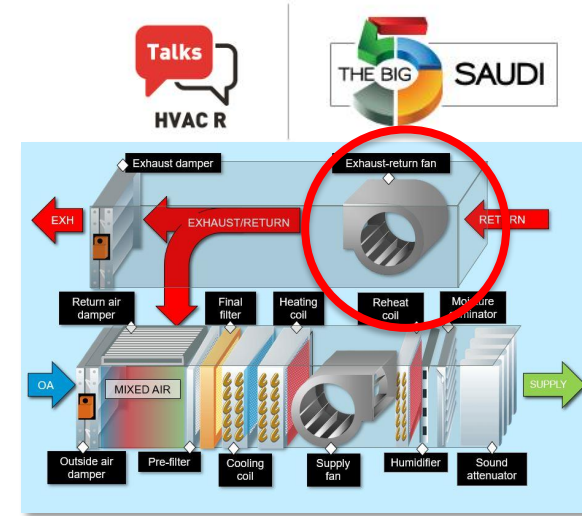
# Air Handling Unit

Components – FAN

Eurovent REC 6-18

Recommended fan and drive type for use in air handling units:

- **Direct driven, free running, backward curved or airfoil fan**
- **AC IE4, EC and PM variable speed motors**
- **Speed of fans needs to be controlled according to the demand**





# Air Handling Unit

## Components – Filters

Soft Bags



Rigid Bags



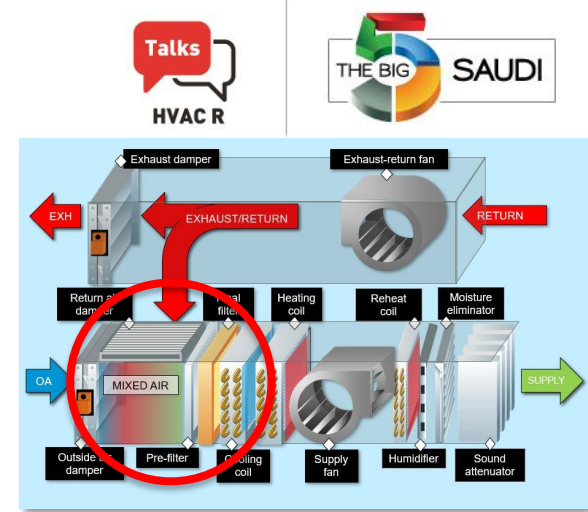
Panels



Sliding Types



Fixed with Springs

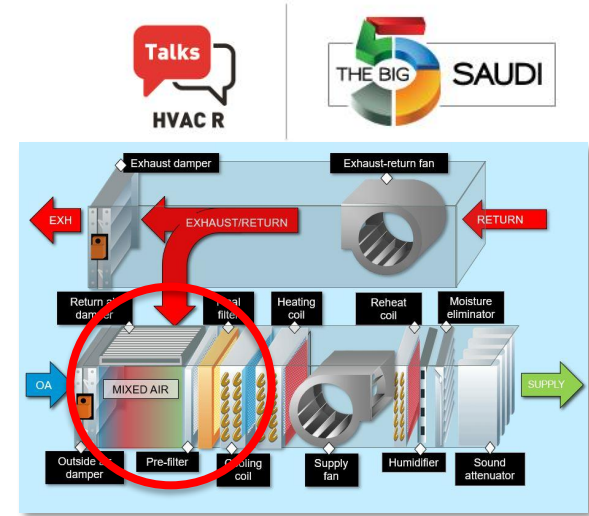


# Air Handling Unit

## Components – Filters



Dirt



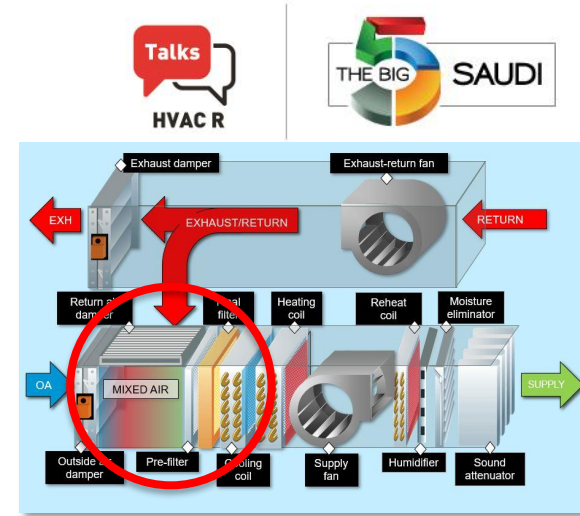
# Air Handling Unit

Components – Filters

## Eurovent REC 6-18

If no ODA and SUP categories are specified, it is recommended to use

- ISO ePM1 50% on the outdoor air inlet (first filtration stage)
- ISO ePM1 80% in the supply air (second filtration stage, if applicable)
- ISO ePM10 50% on the extract air inlet



Outdoor air			Supply air				
			SUP 1* PM <sub>2,5</sub> ≤ 1,25 PM <sub>10</sub> ≤ 3,75	SUP 2* PM <sub>2,5</sub> ≤ 2,5 PM <sub>10</sub> ≤ 7,5	SUP 3** PM <sub>2,5</sub> ≤ 3,75 PM <sub>10</sub> ≤ 11,25	SUP 4 PM <sub>2,5</sub> ≤ 5 PM <sub>10</sub> ≤ 15	SUP 5 PM <sub>2,5</sub> ≤ 7,5 PM <sub>10</sub> ≤ 22,5
Category	PM <sub>2,5</sub>	PM <sub>10</sub>	ePM1	ePM1	ePM <sub>2,5</sub>	ePM <sub>10</sub>	ePM <sub>10</sub>
ODA 1	≤ 5	≤ 15	70%	50%	50%	50%	50%
ODA 2	≤ 7,5	≤ 22,5	90%	70%	70%	80%	50%
ODA 3	>7,5	> 22,5	90%	80%	80%	90%	80%

# Air Handling Unit

How To guarantee Performances?



**What you buy**



**What you may receive**



# Air Handling Unit

## Third Party Certification



### BENEFITS



Fair comparison using a 'Standard' benchmark

Increase Consumer confidence



Ensures performance before purchase!

Eliminates over-sizing due to under performing uncertainty

انتهاء زيادة الاستطاعة التصميمية

Eliminates expensive customer Verification tests

انتهاء تكاليف اختبارات التحقق من صحة جودة الاداء

Avoids excessive system operating costs

تجنب التكاليف العالية بالتشغيل





# Air Handling Unit

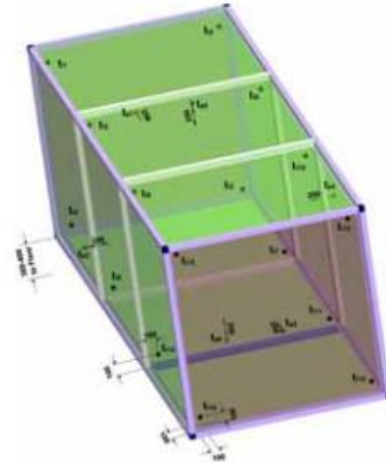
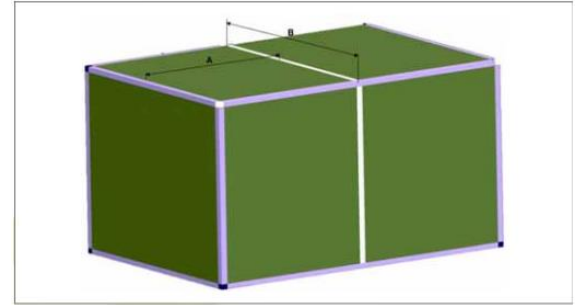
Third Party Certification - Definitions



## Model Box

Construction envelope built according to specifications presented in manufacturer's literature, used to establish according to relevant standards:

- Mechanical performance
- Thermal performance
- Acoustical performance (Only required for EN)



# Air Handling Unit

Third Party Certification - Definitions



## Real Unit

Unit from the range of a specific size, used to establish complete performance for all the available functions of the Air Handling Unit range



# Air Handling Unit

Third Party Certification – What to check?



Model  
Box

Real unit  
testing

Factory  
audit

Software  
check



# Air Handling Unit

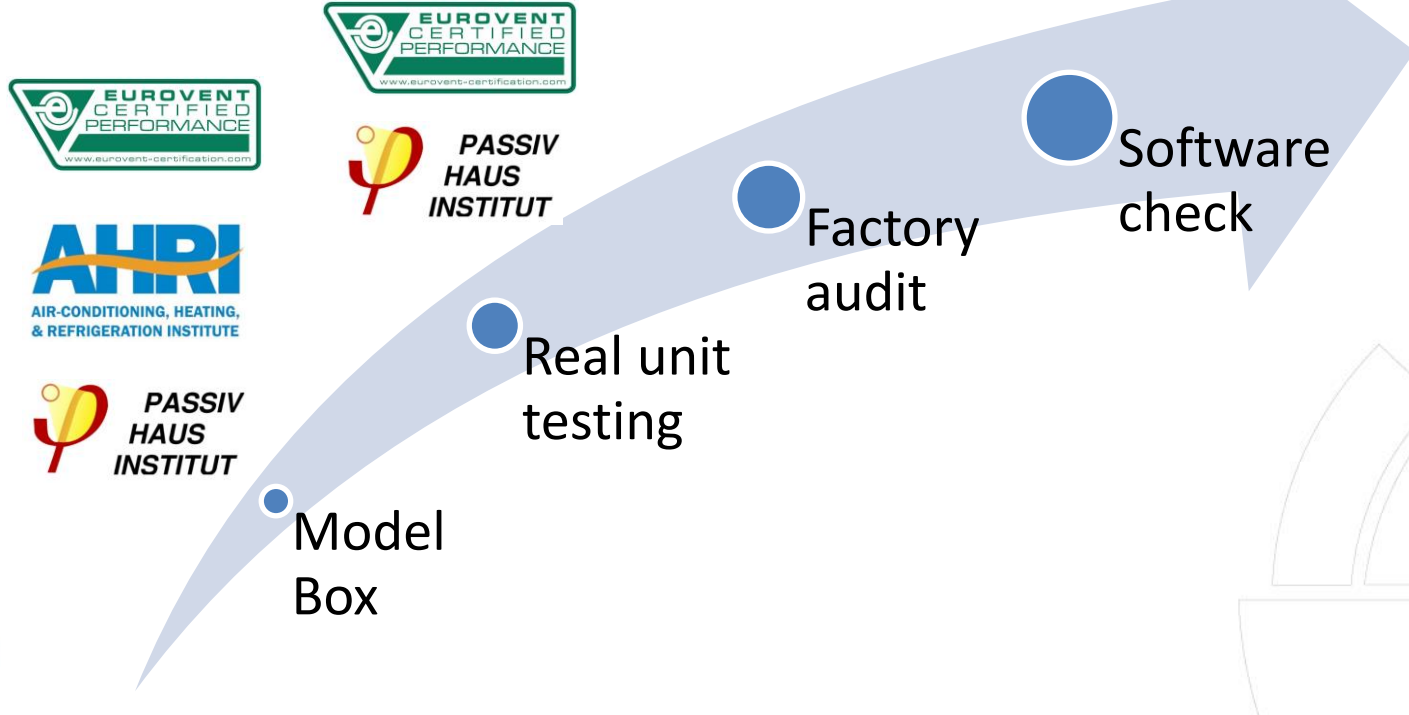
Third Party Certification – Model Box



Casing	ECP	Passivhaus	AHRI
Casing Deflection Rating Class	✓		✓
Casing Air Leakage Class	✓	✓	✓
Thermal Transmittance Class with Leakage	✓		✓ (option)
Thermal Transmittance Class without Leakage			✓ (option)
Thermal Bridging Class	✓		✓ (option)
Acoustic Insulation	✓		
Filter Bypass Leakage	✓		

# Air Handling Unit

Third Party Certification – What to check?





# Air Handling Unit

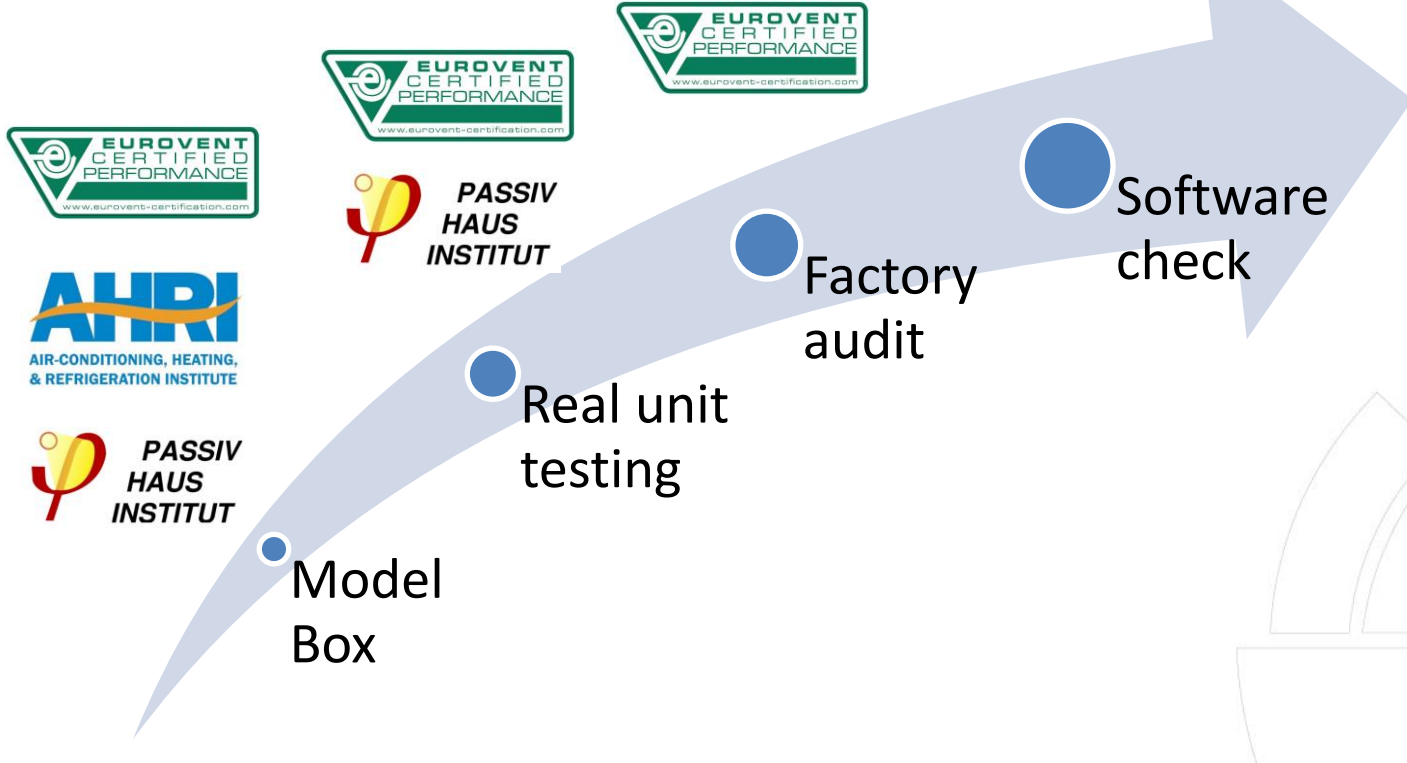
Third Party Certification – Real Unit Testing



Real Unit Performances	ECP	Passivhaus	AHRI
Heat Recovery Rate	✓	✓	N/A
Octave band in-duct sound power level	✓		
Air flow	✓		
Total electrical power consumption of the ventilation apparatus	✓	✓	
Acoustic Performance	✓	✓	
Energy Efficiency	✓	✓	

# Air Handling Unit

Third Party Certification – What to check?



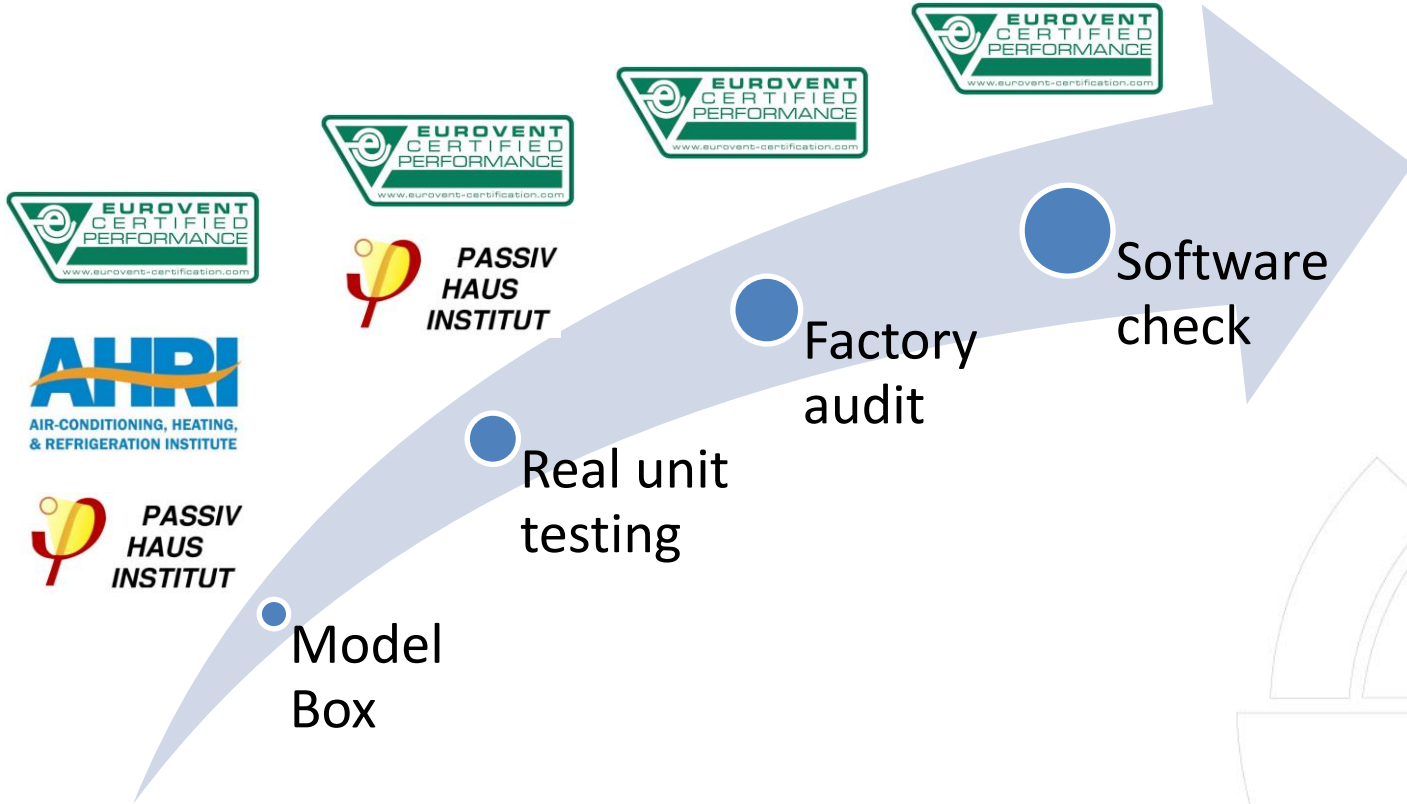
# Air Handling Unit

Third Party Certification – Factory Audit



# Air Handling Unit

Third Party Certification – What to check?



# Air Handling Unit

## Third Party Certification – Software Check



JHU Audit Training 23+24 08-2017

Guidelines for Real Unit Selection

### Methodology

#### 4. Air Flow and way of selecting

- Option 1 : Select and set the conditions component by component
- Option 2 : Select all the components, and then go through each, to set the condition

Option 2

**Methodology**

#### 4. Air Flow and way of selecting

Case Name	Air Velocity	Return Air Velocity	Coil Air Velocity
CASE 110 X 080	2.25 m/s	2.25 m/s	4.17 m/s
CASE 110 X 110	1.51 m/s	1.51 m/s	2.43 m/s
CASE 140 X 110	1.12 m/s	1.12 m/s	1.74 m/s
CASE 140 X 140	0.83 m/s	0.83 m/s	1.23 m/s
CASE 170 X 140	0.66 m/s	0.66 m/s	0.90 m/s
CASE 170 X 170	0.52 m/s	0.52 m/s	0.70 m/s
CASE 200 X 170	0.46 m/s	0.46 m/s	0.60 m/s

**Usual values :**  
From 2000m<sup>3</sup>/h to 8000m<sup>3</sup>/h  
ESP From 200 to 500 Pa

**Suggestions :**  
3000 to 5000 m<sup>3</sup>/h  
300 to 500 Pa (Not below 200 Pa)

### B. Methodology

#### 3. Overview of 11 Points

The following points will be carried out, in different conditions, however it shall be ensured that the unit, physically, is same in terms of dimensions, and components. The manufacturer will send only one unit...

Air Flow & Sound Performances (supply fan only)	95%	97.5%	Nominal	102.5%	105.5%
ESP - External static pressure (Pa)	500	600	600	650	650
Power input @ terminal of motor or VFD (kW)	X<300	X<300	300	X<300	X<300
Fan speed @ working point (rpm)	1267	1268	1268	1267	1267
Cooling Coil (Wet conditions)	Cooling Point 1		Cooling Point 2		
Air Volume flow rate (m <sup>3</sup> /h)	6200		6200		

Air Flow \* 5 + Sound \* 1

Selection is now finished...

**Methodology**

Condition	Front (ft) in. di. of supply	Unit connection size	Front (ft) in. di. of supply
Supply Unit	-	Supply Unit	-
Air volume	7500 m <sup>3</sup> /hr	Air volume	7500 m <sup>3</sup> /hr
Static	150 Pa	Static	400 Pa
External static	-	External static	-
Component type	-	Component type	-
Pressure drop	-	Pressure drop	-

**System \* 1**

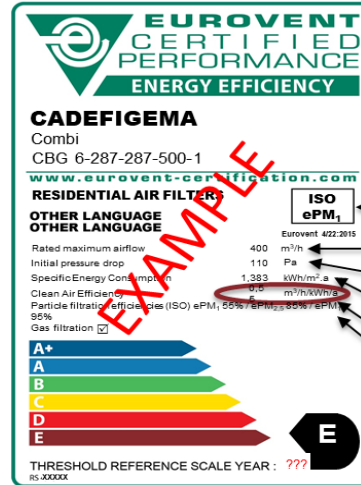


# Air Handling Unit

Third Party Certification – How to verify?



## Air Filters Certification

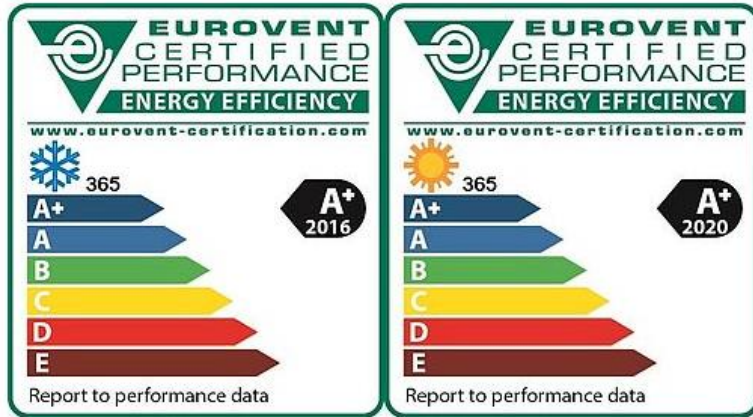


# Air Handling Unit

Third Party Certification - How to verify?



## Energy efficiency



Eurovent label for winter conditions

Eurovent label for summer conditions

CLASS	All Units	Units for full of partial outdoor air at design winter temperature $\leq 9^{\circ}\text{C}$		Fan Efficiency Grade NG <sub>ref-class</sub> [-]
	Velocity	Heat recovery system		
	$v_{\text{class}}$ [m/s]	$\eta_{\text{class}}$ [%]	$\Delta p_{\text{class}}$ [Pa]	
A+ / A+C / A+	1.4	83	250	64
A / A <sub>C</sub> / A <sub>T</sub>	1.6	78	230	62
B / B <sub>C</sub> / B <sub>T</sub>	1.8	73	210	60
C / C <sub>C</sub> / C <sub>T</sub>	2.0	68	190	57
D / D <sub>C</sub> / D <sub>T</sub>	2.2	63	170	52
E / E <sub>C</sub> / E <sub>T</sub>	No calculation required			No requirement

Eurovent winter calculations

CLASS	All Units	Units for full or partial outdoor air at design summer: winter dry bulb temperature $\geq -3^{\circ}\text{C}$ AND dry bulb temperature $\geq 30^{\circ}\text{C}$ OR winter dry bulb temperature $\geq -3^{\circ}\text{C}$ AND dew-point temperature $\geq 17^{\circ}\text{C}$ OR dry bulb temperature $\geq 30^{\circ}\text{C}$ AND dew-point temperature $\geq 17^{\circ}\text{C}$					Fan Efficiency Grade NG <sub>ref-class</sub> [-]
	Velocity	Heat recovery system					
	$v_{\text{class}}$ [m/s]	$\eta_{\text{class-T}}$ [%]	$\Delta p_{\text{class-T}}$ [Pa]	$\eta_{\text{class-H}}$ [%]	$\Delta p_{\text{class-H}}$ [Pa]		
A+	1.4	83	167	81	222	64	
A	1.6	78	160	73	213	62	
B	1.8	73	155	65	207	60	
C	2.0	68	151	58	202	57	
D	2.2	63	147	50	197	52	
E	No calculation required					No requirement	



# THANK YOU

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