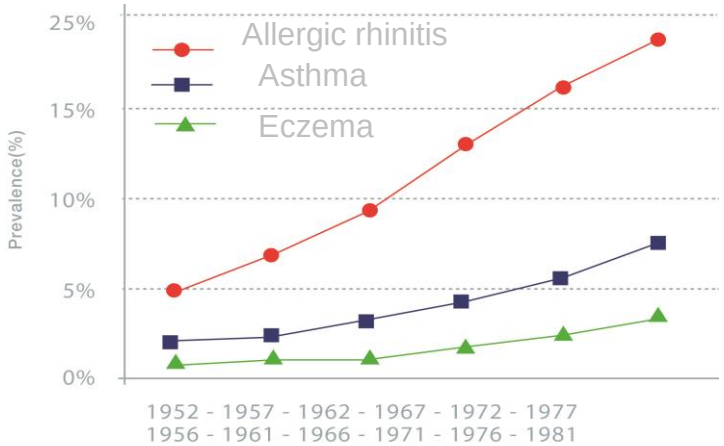
How to improve IAQ
in residential and non-residential buildings

THESAN
The green thinking

IAQ: can be a bigger problem

- Worldwide human beings spend more than 90% of their life in closed environments(1), such as at homes, offices or schools where internal pollutants, like VOC, CO_2 and RH are rising and cause many increasing diseases.



- The Indoor air can be polluted up to 50 % more than the outdoor air and the main reason is the **lack of proper air exchange** due to hyper insulation and the high sealing power of windows and doors in modern, new or renovated buildings(2). Indoor moisture retention and moulds are "collateral" effects of these situations.

(1) European Union – ECA Report no. 23 "Ventilation, Good Indoor Air Quality and Rational Use of Energy" (2) European Union - CAFE Project Data

Why it is necessary to renew the air

Humidity: 2,5-3,0 kg H_20 each person → moulds

Radon → Second main cause of lung cancer

Bacterias → Illnesses

CO_2 → Tiredness; lack of attention

How many air changes: UNI 10339 or ASHRAE 62.1 2007

$$R = \frac{q_v}{V}$$

R = Turnover rate schedule

Q_v = Air flow [m^3/h]

V = Inside volume[m]

1 person 18-20 m^3/h

0,5 volume/h of new air

THESAN AIRCARE ensures a controlled outside air inlet flow with a proper filtration and a controlled direction of the flow inside, providing an Air flow suitable for approx. 30 m^2 or 80 m^3, by using windows of living rooms and bedrooms (residential), windows of hotel rooms, offices and schools / EN 13142

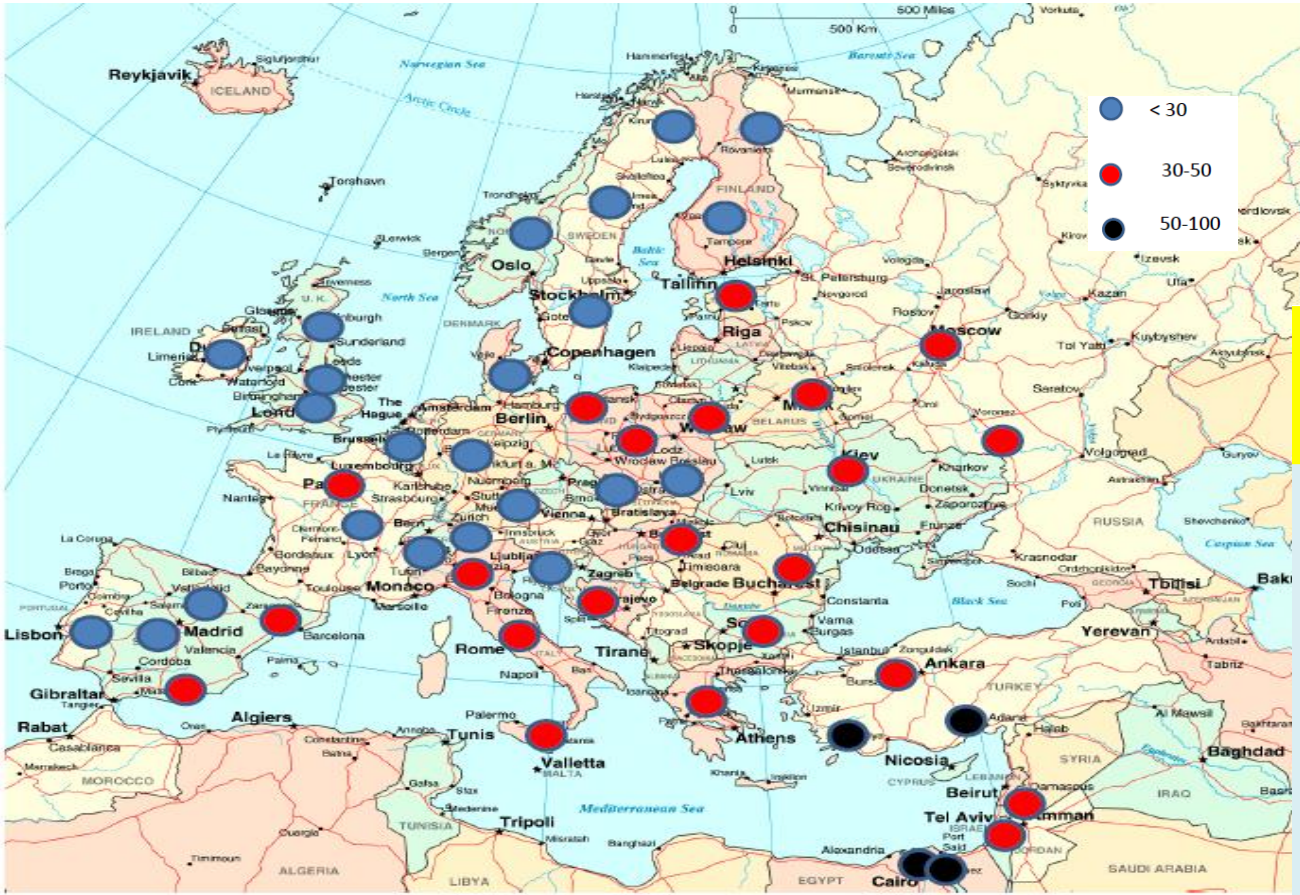
Outdoor AIR pollution is a worldwide problem …

Particulate matter (PM) has the most consistent association with mortality(12) in the environmental pollutant mix. Many studies in Europe and USA involving over 80 mio people, show direct increases of from 0,5 to 1.1% respectively for every 10 mg/m3 in cardiovascular diseases and mortality. China, India, Russia, Mexico suffer same problems.

PM consists of discrete particles with several orders of magnitude:
PM10, or inhalable particles (defined as particulate matter less than 10 μm)
PM2.5, or fine particles (defined as those particles less than 2.5 μm)
PM10-2.5, also known as coarse particles (defined as those particles between 10 and 2.5 μm); and ultrafine particles (UFPs) (defined as those less than 0.1 μm)**.**

Accepted levels of PM10 50 micro grams /m3 for American & European Std (12) Kan et al., 007 Environmental International - Volume 33, Issue 3, 07
(13) APHEA - Air Pollution and Health: a European Approach Accepted levels of PM2,5 15 & 25 for American Std & European Std
(14) Pope – Dockery : Health effects of Fine Particulate *Air Pollution : Lines that connect 2006*

European situation



Bosnia and Herzeg	117
Macedonia	70
Turkey	66
Serbia	43
Romania	42
Latvia	39
Poland	33
Russia	33
Belarus	24
Lithuania	21
Bulgaria	60
Israel	59
Cyprus	53
Greece	44
Italy	37
Malta	35
Croatia	33
Slovenia	30
Spain	29
Czech Republic	29
Portugal	28
Hungary	27
Denmark	27
Slovakia	27
France	27
Belgium	26
Netherlands	26
Austria	25
Sweden	25
Germany	25
Iceland	24
United Kingdom	23
Switzerland	22
Norway	22
San Marino	20
Finland	19
Monaco	18
Luxembourg	18
Ireland	15
Estonia	11

OAQ - Pollution and its effect

Some numbers…

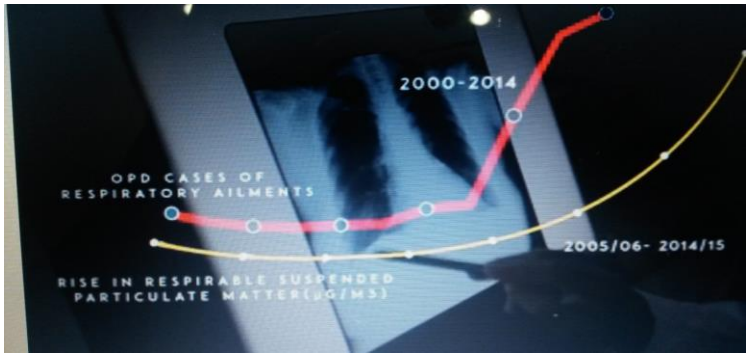
Outdoor air pollution causes **3.7 millions premature deaths** each year in the world [3] ,

3% to 8% of all cases of **asthma** [6], 20% of **lung cancer** [7] (after Tobacco the 2nd main cause is Radon) [5]

4% to 10% of all **COPD cases** (chronic obstructive pulmonary disease) [9]

50% of diseases related to poor air quality are caused by particles from combustion [4] [8] [9]

A study on the pollution in India shows the comparison between the increase of suspended particles and by the of respiratory diseases



(3) WHO - World Health Organization/Pete Guest (4) European Union Envie Report (5) WHO HANDBOOK ON INDOOR RADON – 2009 (6) WHOConvention - ENVIRONMENTAL BURDEN OF DISEASE ASSOCIATED WITH INADEQUATE HOUSING -2011 (7) Indoor Air Proceedings, 2011 Wo et al. (a_357-1) (8) Reference IAIAQ Study – Indoor Air 2011 Conference Proceedings – ref. Jantunen et al (a 383-4) (9) WHO http://www.who.int/quantifying_ehimpacts/publications/ebd5.pdf

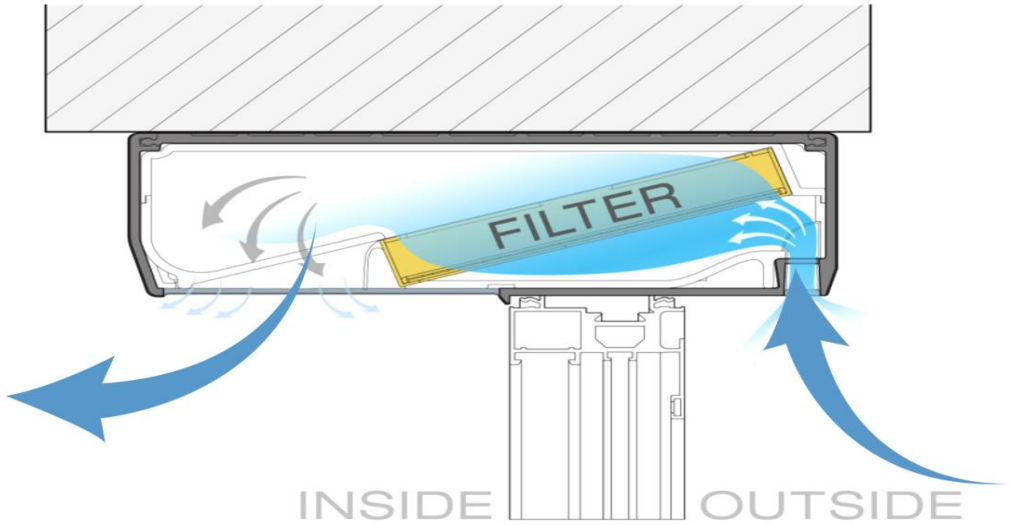
Renewal (+/-) of air and Filtration (+/-)

THESAN AIRCARE ES : filtration AND air exchange

THESAN AIRCARE ensures a controlled outside air inlet flow with a proper filtration and a controlled direction of the flow inside, providing an Air flow suitable for approx. **30 m² or 80 m³**. AF-AFL-AE are single flow, ranging from **15 to 42 m³/h with 5 levels**

Air is filtered by a G4+F9 filter pack (Coarse 45% + ePM1 80% according to EN ISO 16890), capable of trapping up to 99% of fine particulate matter PM10 and PM2,5 and 80% of PM1.

The filter pack is and extractable for easy maintenance and replacement



IAQ and Energy Saving

Roof 15%

Heating system 14%

Walls 25%

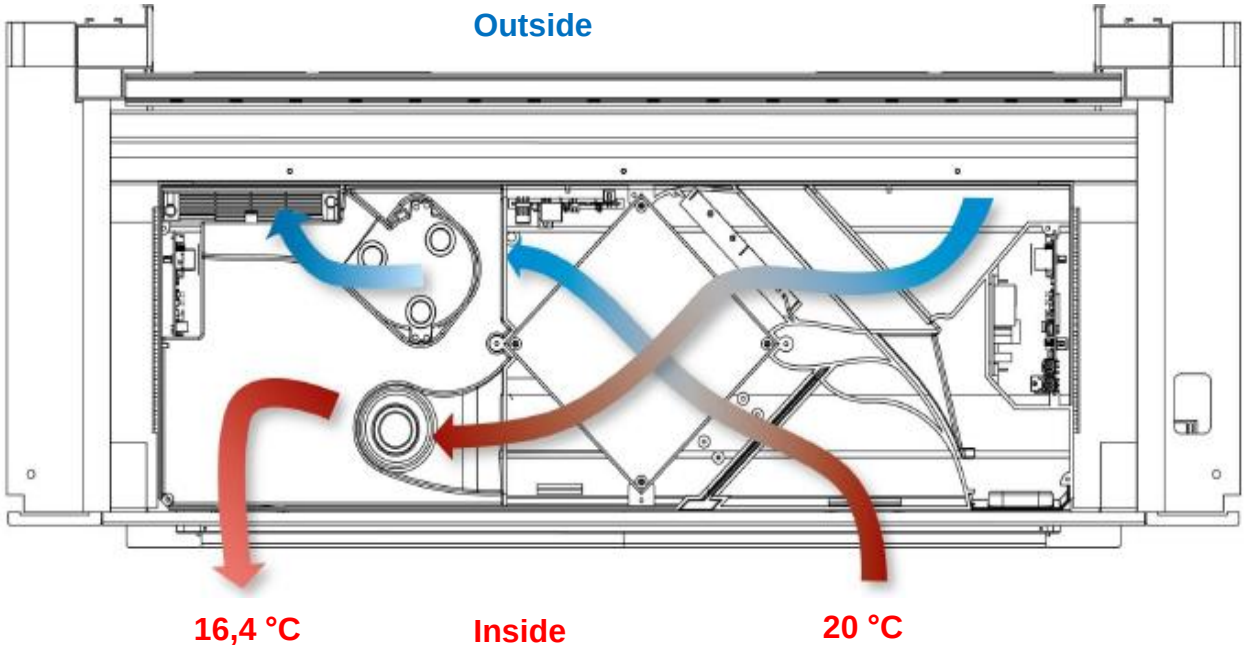
Windows 25%

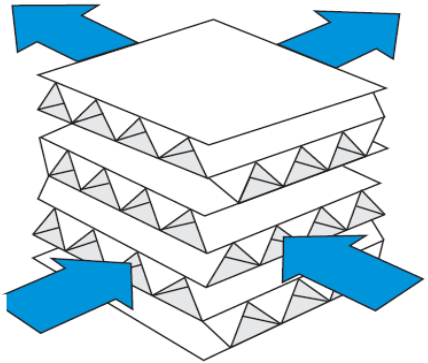
Ventilation 15%

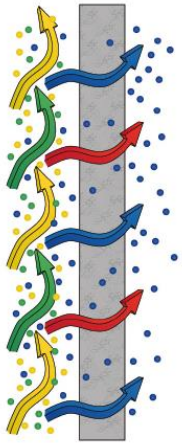
Floor 25%

How to save energy?

Heat Recovery







- Humidity
- Heat
- Odours
- Gases and Pollutants

Due to the «Enthalpy» heat exchanger there is no need to provide water drainage system

THESAN AIRCARE ES: technical data information

Speed	Capacity (l/s)	Sound Power LwA [dB]	Sound Pressure Lp 3meters [dB]	Thermal Efficiency %	Power consumption [W]
1	4.16	37	19	82	4,6
2	5.55	40	22		5,8
3	8.33	45	27	74	10,3
4	9.72	48	30		14,6
5	11.38	51	33	69	20,6

Heat recovered	Up to 82%
Power supply	110-230 / 50-60 Hz
Security class	H
Protection level	IPX4

Operating temperature Range	**Min -20°C Max 50°C**
Ratio	U= 0,30 W/m^{2}K
Noise Reduction	Dnew= 53 dB (shutters opened) Dnew= 55 dB (shutters closed)
Standard filtering pack	Coarse 45% + ePM1 80%

EC 1254/2014 «Electric related Product»:
SEC (Specific Energetic Consumption) / Labelling

SEC-Class - Specific energy consumption SEC	cold: A+ -77	average: A -37	warm: E -14	kWh/(m2*a)

Product information / Product fiche RVU

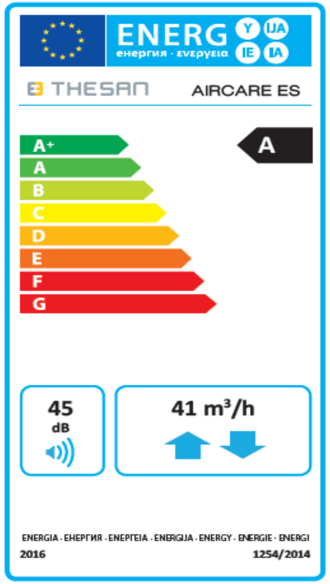
a	Supplier's name	THESAN			
b	Supplier model (code)	1 AIRCARE ES			
c	SEC-Class - Specific energy consumption SEC	cold: A+ -77	average: A -37	warm: E -14	kWh/(m2*a)
d	Typology	✓ RVU / ☐ NRVU	✓ BVU / ☐ UVU		
e	Type of drive installed/ intended to be installed	☐ single speed	☐ 2-speed	✓ multi-speed	
f	Type of heat recovery system	☐ recuperative	✓ regenerative	☐ none	
g	Thermal efficiency of heat recovery η_s / η_s			74 / 70	%
h	Maximum flow rate			40.6	m³/h
i	Electric power input of the fan drive, max flow rate			20.8	W
j	Sound power level decorate installation LWA, ref. flow			45	dB[A]
k	Reference flow rate			28.4	m³/h
l	Reference pressure difference, Pa			0	Pa
m	Specific power input			0,35	W/(m³/h)
n	Control factor and control typology	CTRL 0.65	MISC 1.21	X-Value 2	-
o	Max. internal leakage rate / Max. external leakage rate	2.1% internal	3.3% external		
p	Mixing rate	indoor 0.5%	outdoor 0.3%		
q	Position, description of visual/ acoustically filter warning	Front cover LED			
r	Instructions to install regulated supply/exhaust grilles	/ Not applicable			is cancelled
s	Internet address for pre-/dis-assembly instructions	http://www.thesan.com/catalogo/download/Man_AircareAF_cover.pdf			
t	Airflow sensitivity to pressure variations at -20 Pa and +20 Pa			6.0%	%
u	Indoor / outdoor air tightness			1.6	m³/h
v	The annual electricity consumption per 100 m² floor area AEC	cold 1.1	average 1.1	warm 1.1	kWh/a
z	The annual heating saved AHS	cold 82.5	average 42.2	warm 19.1	kWh/a

THESAN The green thinking

Tabella 1

Classificazione a partire dal 1° gennaio 2016

Classe SEC	SEC in kWh/a.m²
A+ (efficienza massima)	SEC < – 42
A	– 42 ≤ SEC < – 34
B	– 34 ≤ SEC < – 26
C	– 26 ≤ SEC < – 23
D	– 23 ≤ SEC < – 20
E	– 20 ≤ SEC < – 10
F	– 10 ≤ SEC < 0
G (efficienza minima)	0 ≤ SEC



Automatic condensation protection

Aircare ES, thanks to its “enthalpy” heat recovery system, humidity/temperature sensors and an automatic electronic management can operate with outside temperature as low as -15 °C.

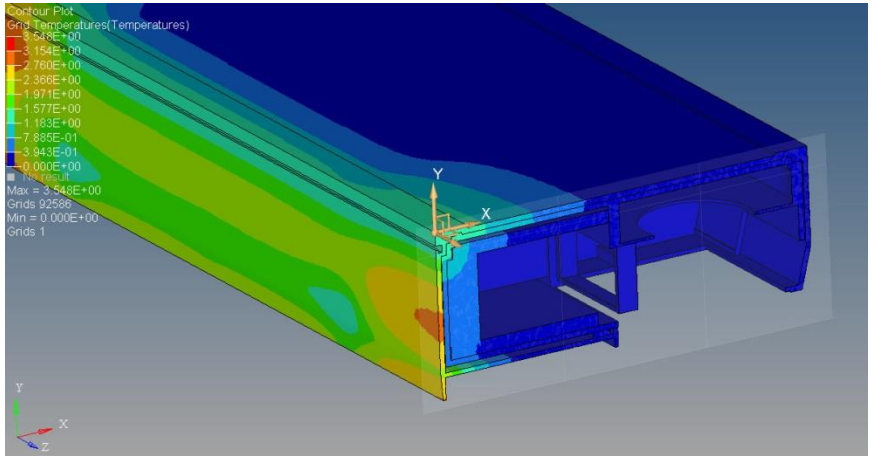
Below -15°C Aircare will work as an extractor.

If Aircare AF is equipped with a resistance, then the outside temperature with which the machine works can be lower then -15°C, as the air will be pre-heated before entering the machine.

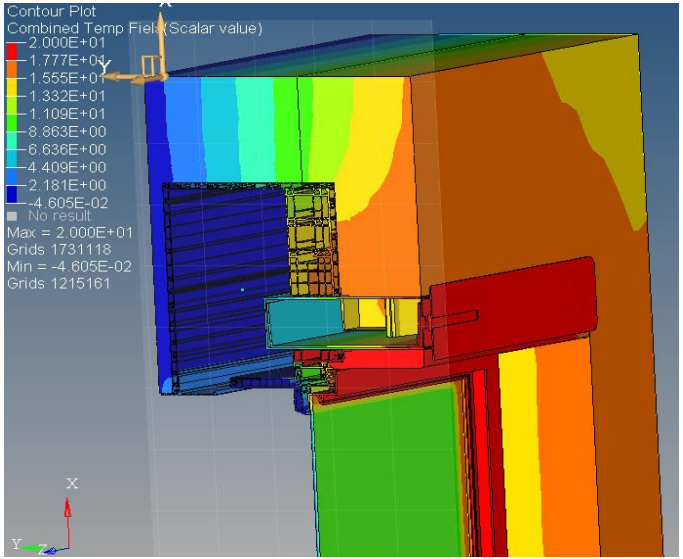
Transmittance

U= 0,30 W/m²K

Heat dispersion for Aircare mounted over the window frame

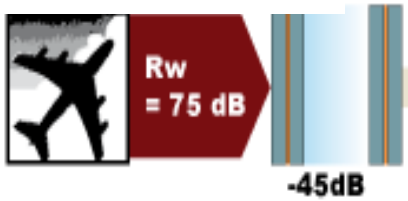


Heat dispersion in a PVC Monoblock



Acoustic values

glass with very high acoustic insulation



glass with high acoustic insulation

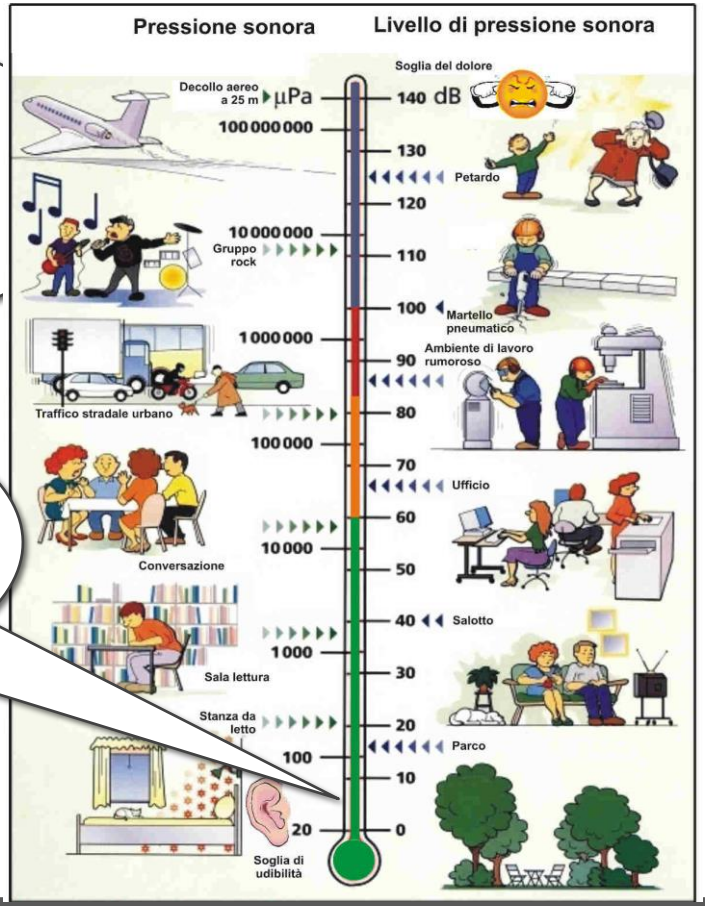
glass with medium acoustic insulation

silent environment

30db

Noise reduction:
D_{new} = 53 dB with shutters open
D_{new} = 55 dB with shutters closed

Sound Pressure Lp: 19 [dB]
Sound Power LwA: 37 [dB]



Many useful functions available with few buttons

«+» turn on the machine / manual increase of speed

«**Pre-Heating**» of inlet: available only for Nordic countries

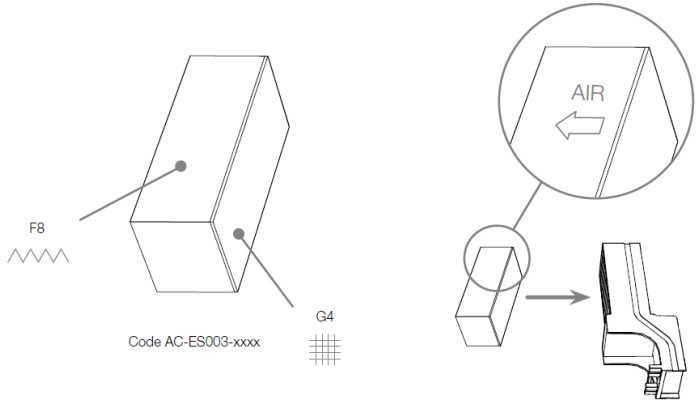
«**Auto**» the machine will work according to the Inside RH and temperature

«Free Cooling» gives the possibility to have fresh filtered air without heating by extruding the inside air

«-» turn off the machine / manual decrease of speed

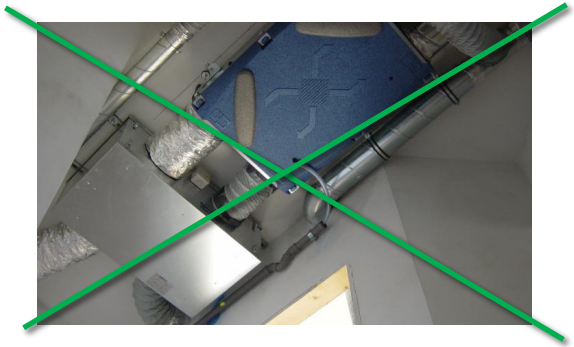
Maintenance

Maintenance is scheduled by the Aircare itself / Alert of checking filter is indicated by flashing led



Fully accessible filters

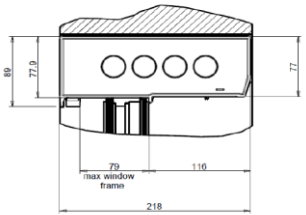
There are no pipes and ducts to check

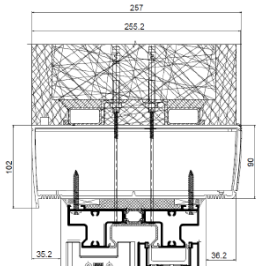


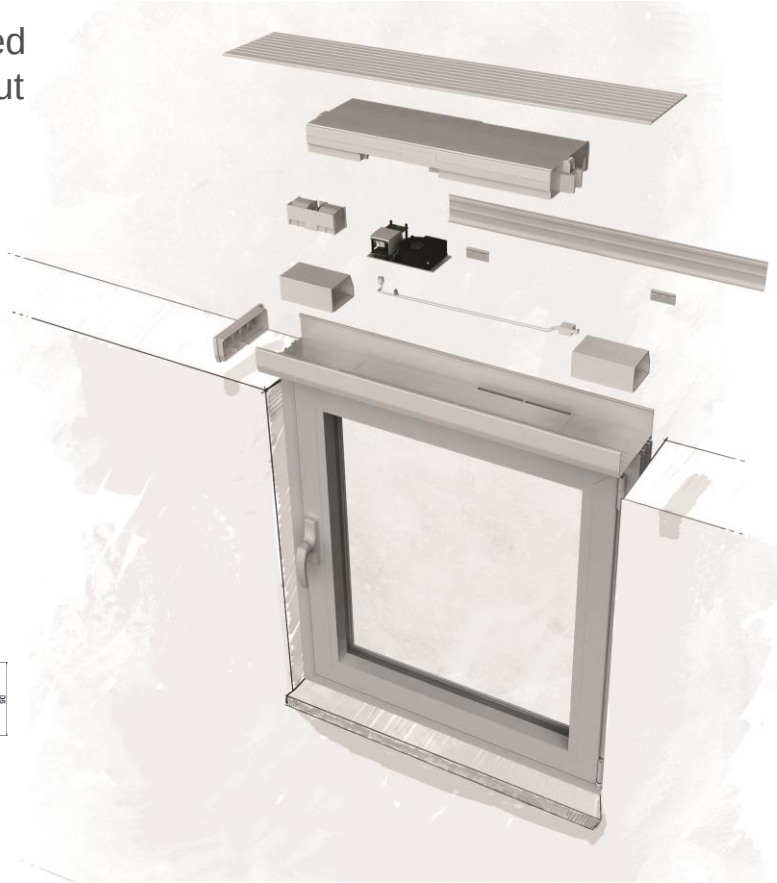
THESAN AIRCARE FOR WINDOW - easy to install, maintain and use

Consisting of a body, which is mounted in the upper part of the window and cut to fit the size of it.

The body hosts the core part of the system, which is quickly mounted on top of the window with reinforcement supports, to be fixed with screws to profiles **with max 80 mm (AF) and 170 mm (AFL-ES) thickness**



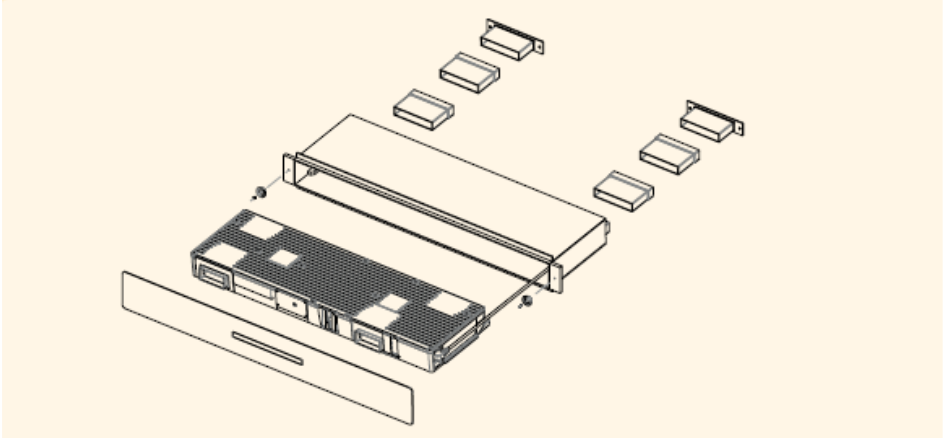


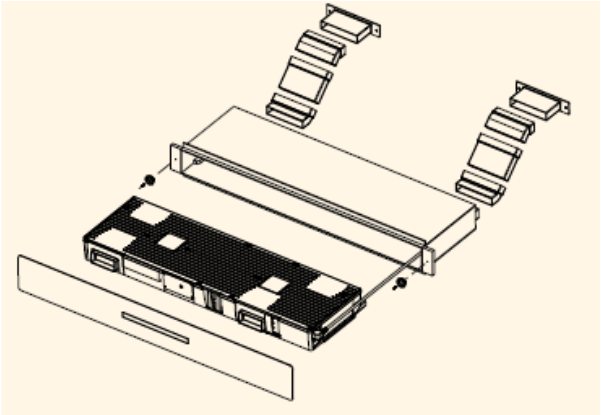


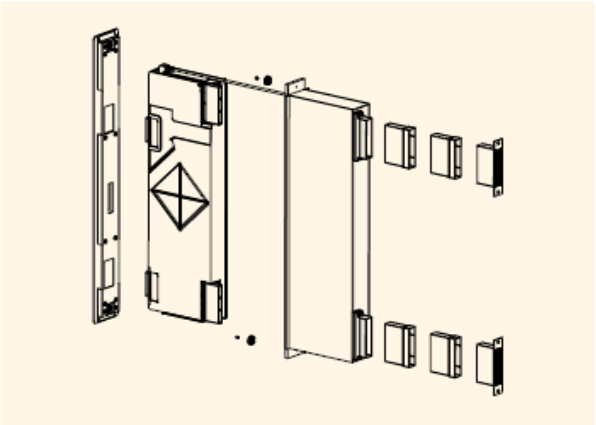
With a simple remote control, everything is easy: **Led lights show immediately what is going on**

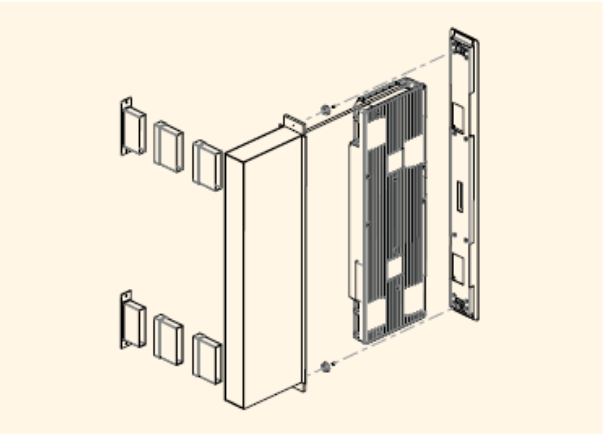
Filters are easy to use, clean and replace by the end user.

Recessed Aircare ES – AF: flexible installation















Aircare ES: wall mounted unit

Aircare ES wall mounted unit – inside / outside views

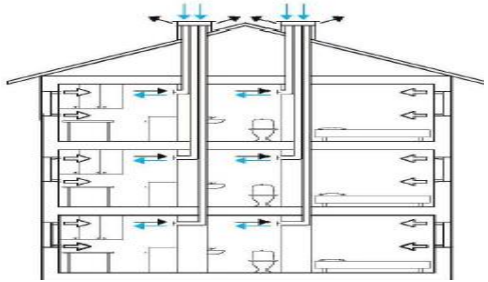
OTHER MV SYSTEMS: Push-Pull - low filtering and lower heat recovery

Reciprocating:

- **NO filtering**
- Much lower heat recovery / Real heat recovery efficiency as low as 30% (and not 90%) due to the relevant flow-rate sensitivity versus differential pressure (between inside and outside)
- High level of outside and inside air mixing
- **Uncontrolled flow-rate direction in windy conditions.**

Other MV Systems: Natural ventilation / Centralised ventilation

Natural Ventilation



By opening windows, air leakages or natural ventilation, but **without filtration and noise protection**.
NO filtering

Centralised MV

- **No possibility to set different speed in different areas**
- Need to regularly sanitise all piping
- Maintenance requires a skilled technician and is expensive
- **Not possible in refurbishment**
- **Filtration level is very poor (mostly G level – course filter)**

Centralised MV: a complicated solution

Centralised MV is suitable for new projects but is hardly suitable for refurbishment. Expensive maintenance (duct cleaning).