

# Energy Recovery Wheels for Energy Efficient Indoor Air Quality (IAQ)



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# What is Indoor Air Quality ?

- **Indoor Air Quality (IAQ)** refers to the **nature of the conditioned (heat / cool) air** that circulates throughout space/area where we work and live i.e. the air we breathe during most of our lives.
- **A Common MYTH** – Air pollution occurs **only outdoors or in industrial environment**.
- **TRUTH!!** – Air inside conditioned space can be substantially **more polluted than outdoor air**.

**On an average, spend approximately 90% of our time indoor**

# Ventilation

## The Solution to Pollution is Dilution

i.e.

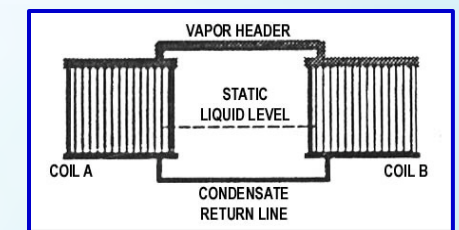
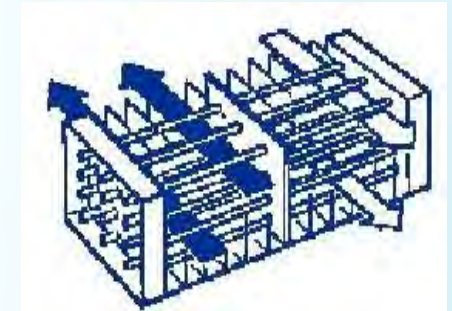
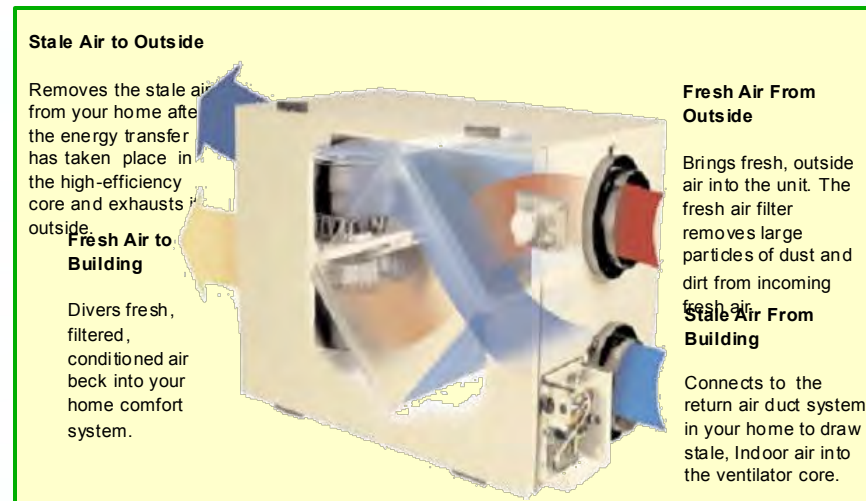
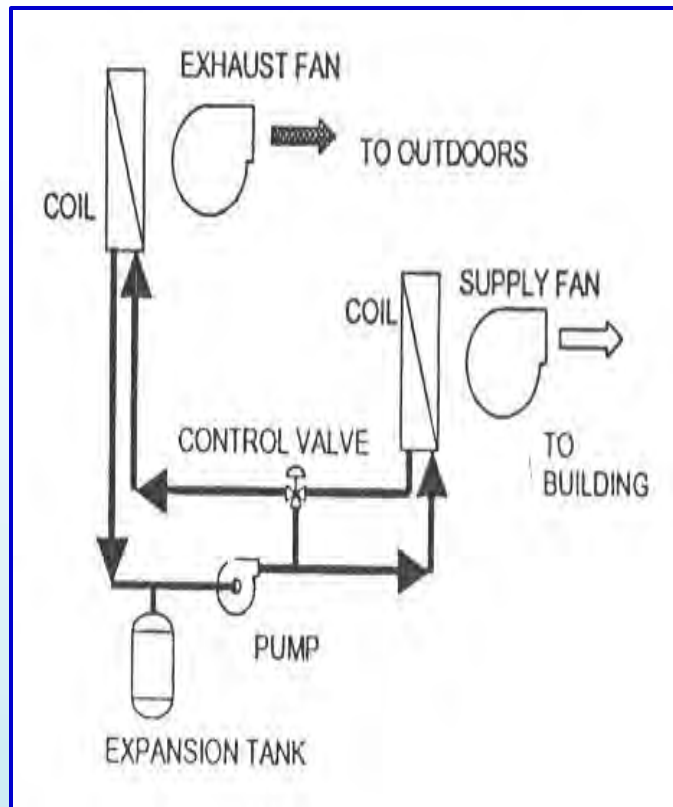
**Bring in Fresh Outdoor Air  
to flush out Stale Indoor Air**

### The Challenge

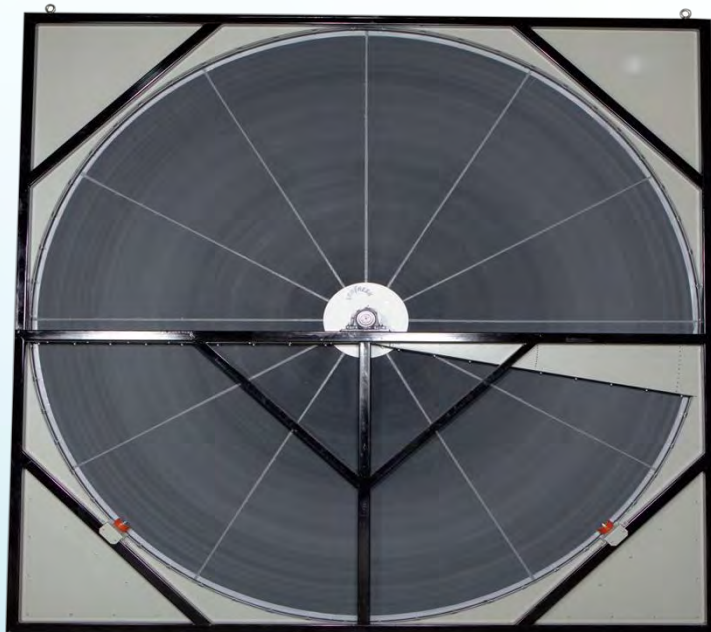
- Improved Indoor Environment
- Higher utility bills
- RH Control

**Energy Recovery  
Devices**

# Heat Exchangers



# Total Energy Recovery Wheels



3Å  
Molecular  
Sieve Coated



# What is Energy Recovery?

- Energy Recovery in Buildings is the **process of recovering the cooling / heating energy from the waste exhaust of the building**. The exhaust air could be mechanically exhausted or getting leaked from the building
- The above is achieved by using **Heat Exchangers** which **exchanges heat** between **Incoming Outdoor Air & Waste Exhaust Air**

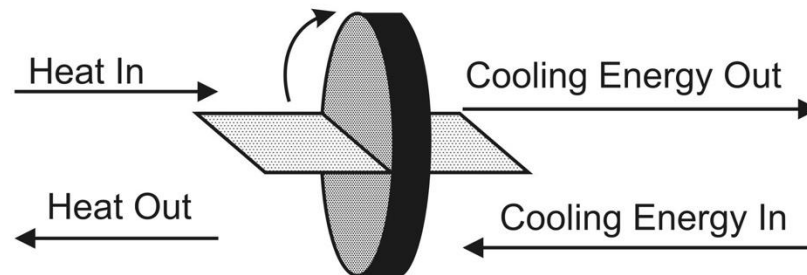
# What is Total Energy Recovery?

$$\text{Total Energy} = \text{Sensible Heat (Temperature)} + \text{Latent Heat (Moisture)}$$

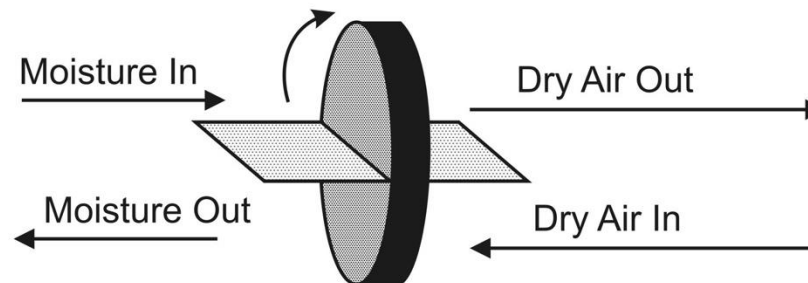
- Can significantly **reduce Energy impact of ventilation**
- As potential first **cost savings** due to reduction in required cooling and heating capacity
- **Improved latent performance** for packaged equipment

# Universal Rules of Total Energy Wheels

**1. Heating/Cooling Energy (e.g. 80%) Is Always Returned To Where It Came From**

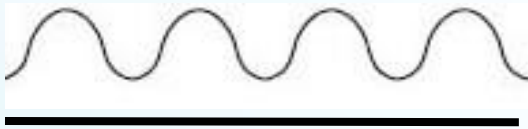


**2. Moisture and Dry Air (e.g. 80%) Is Always Returned To Where It Came From**



# Basic Wheel Construction: Materials

Alternate Layers of Corrugated and Flat Sheets are Bonded and Rolled together to Form A Wheel

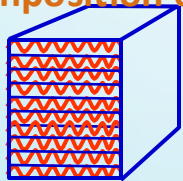


**Energy Recovery Wheel = Substrate + Desiccant Coating**

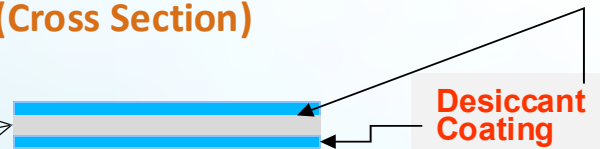
(core material or media)

(Adsorbent)

**Composition of Each Layer (Cross Section)**



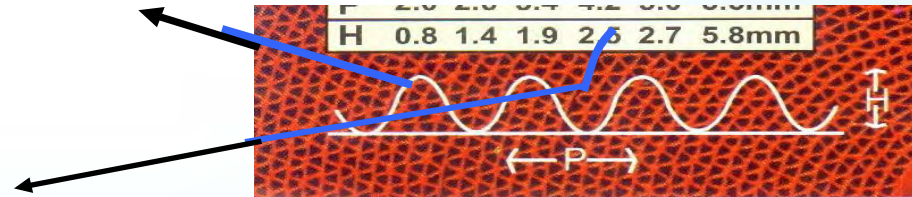
Substrate



Desiccant Coating

## Substrate

1. Thickness (gsm)
2. Specific Heat
3. Specific Gravity



## Flute Geometry

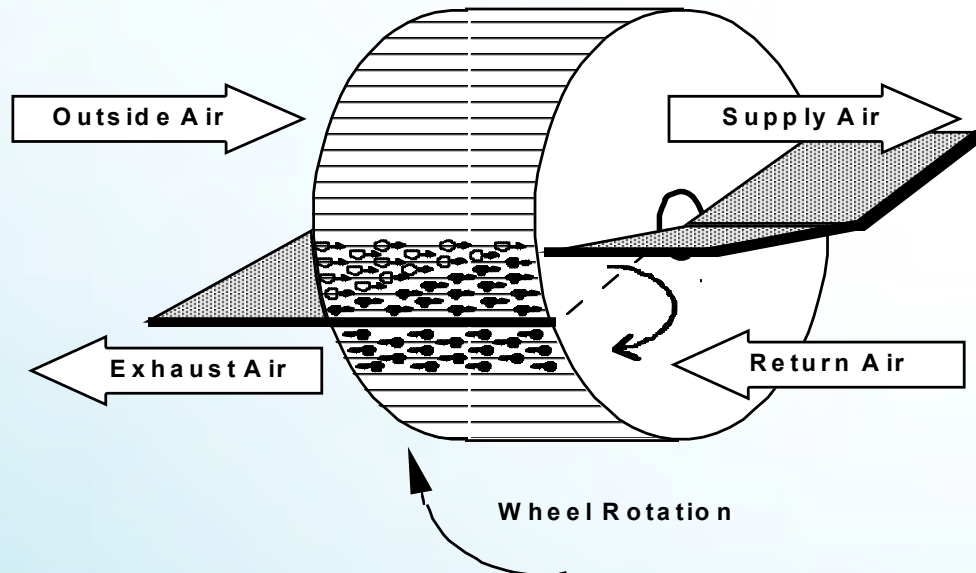
p-pitch  
h-height  
d-depth

## Coating

1. Thickness (gsm)
2. Isotherm
3. Heat of adsorption
4. Heat Capacity

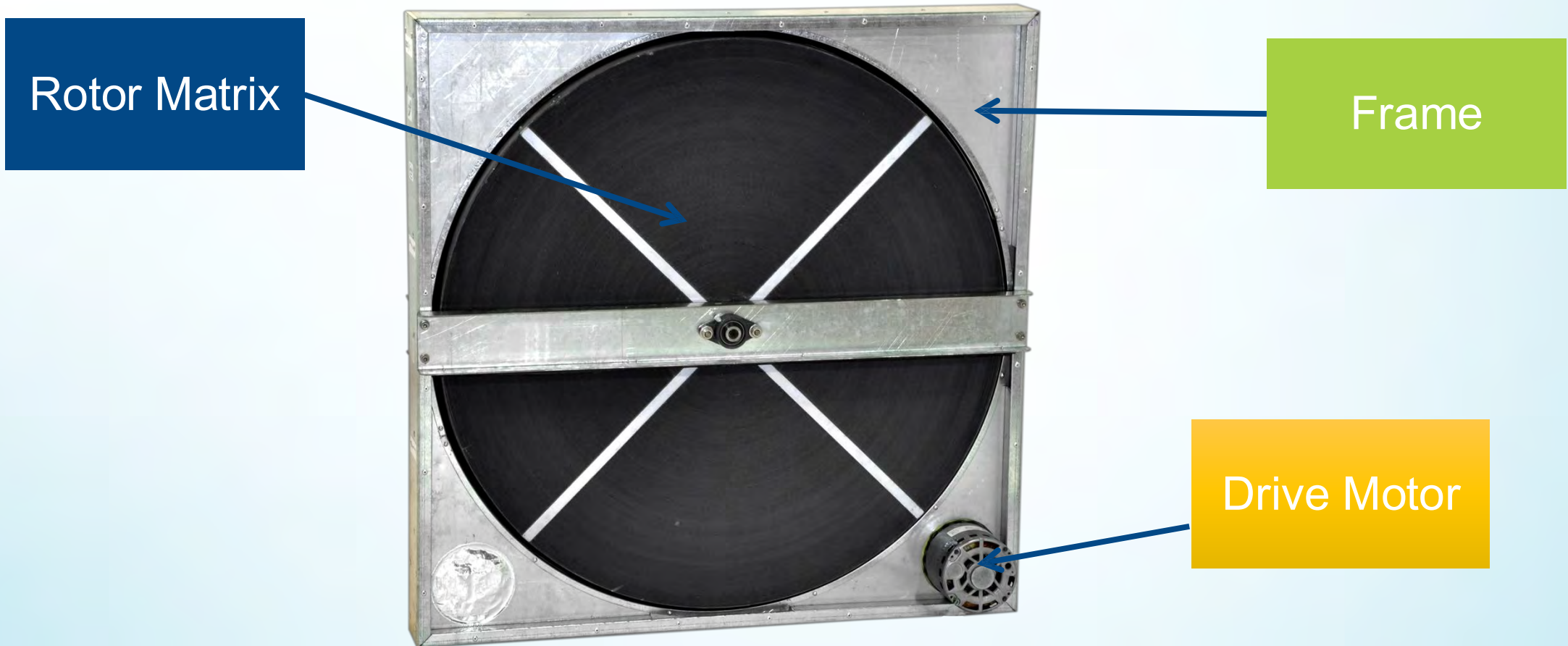
# Illustration of Wheel Purge Section

**Theory of Operation – A specific volume of air is allowed to bypass into exhaust air stream, minimizing carryover of contaminants from return air.**

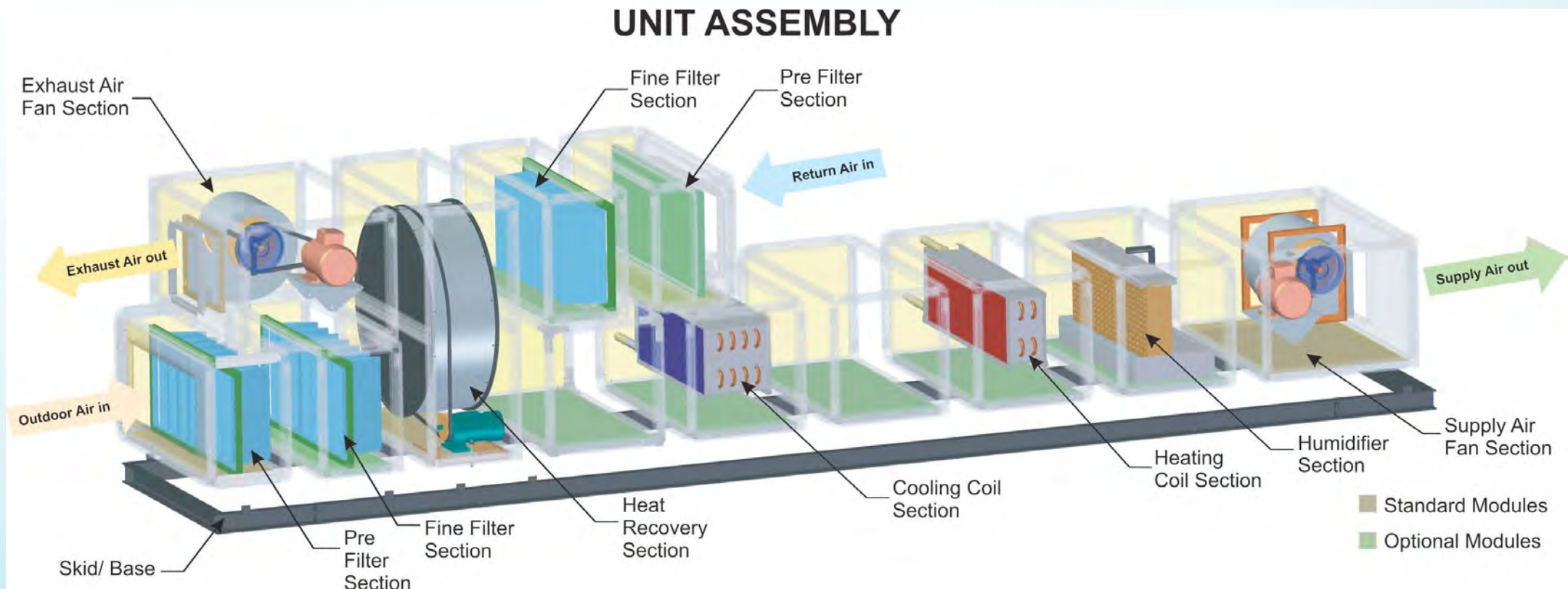


Purge angle is a function of air velocity, and purge volume is a function of wheel volume and rotation speed.

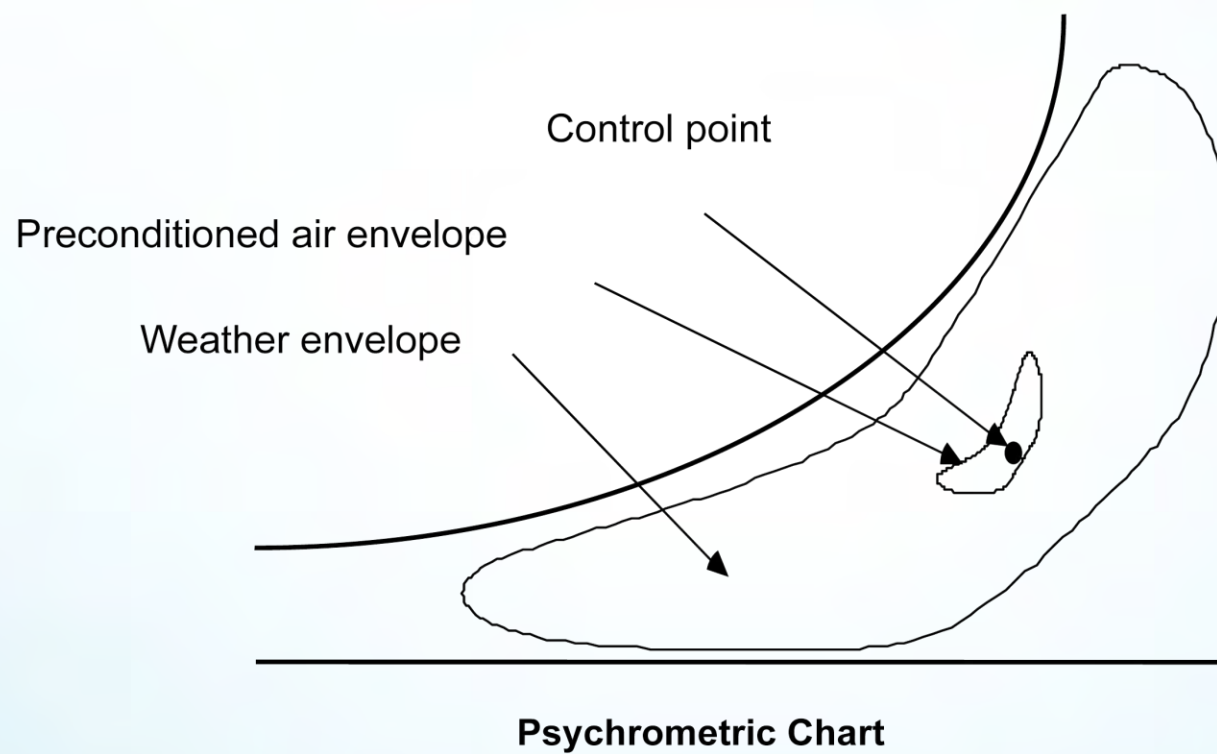
# Energy Recovery Wheel



# Treated Fresh Air Unit Assembly



# What Total Energy Recovery does



# Certified Performance Items

The following performance items shall be certified

## Under standard conditions

(20°C, 50% rel. Humidity and 1.013 105 Pa – or 1.20 kg/m<sup>3</sup>)

**Airflow**

**Outdoor Air Correction Factor**

**Pressure drop**

**Exhaust Air Transfer ratio**

## Under “regular” winter conditions for all RHEs

**Temperature efficiency**

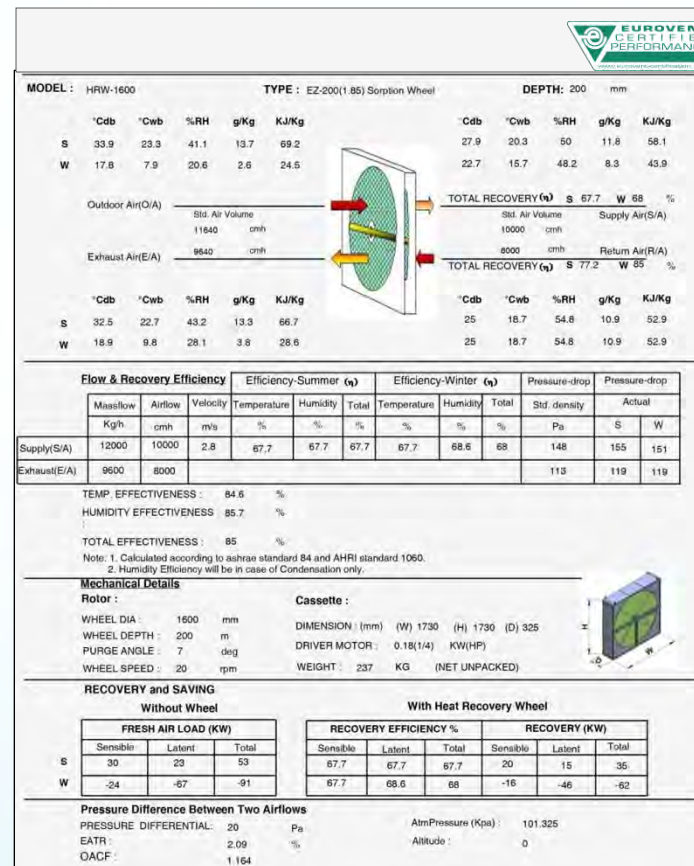
**Humidity efficiency**

## Under “regular” summer conditions for Enthlapy and Sorption RHEs

**Temperature efficiency**

**Humidity efficiency**

# Certified Performance Items



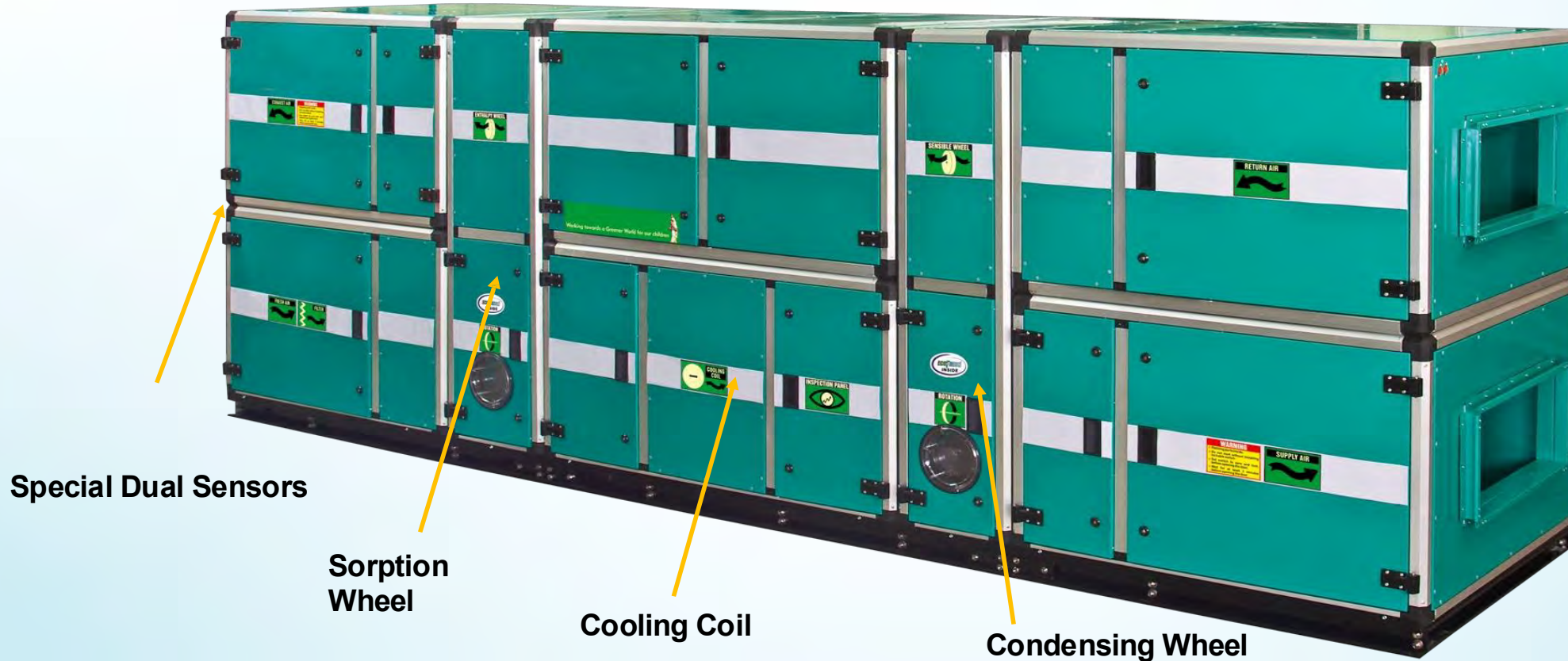
# Certifications



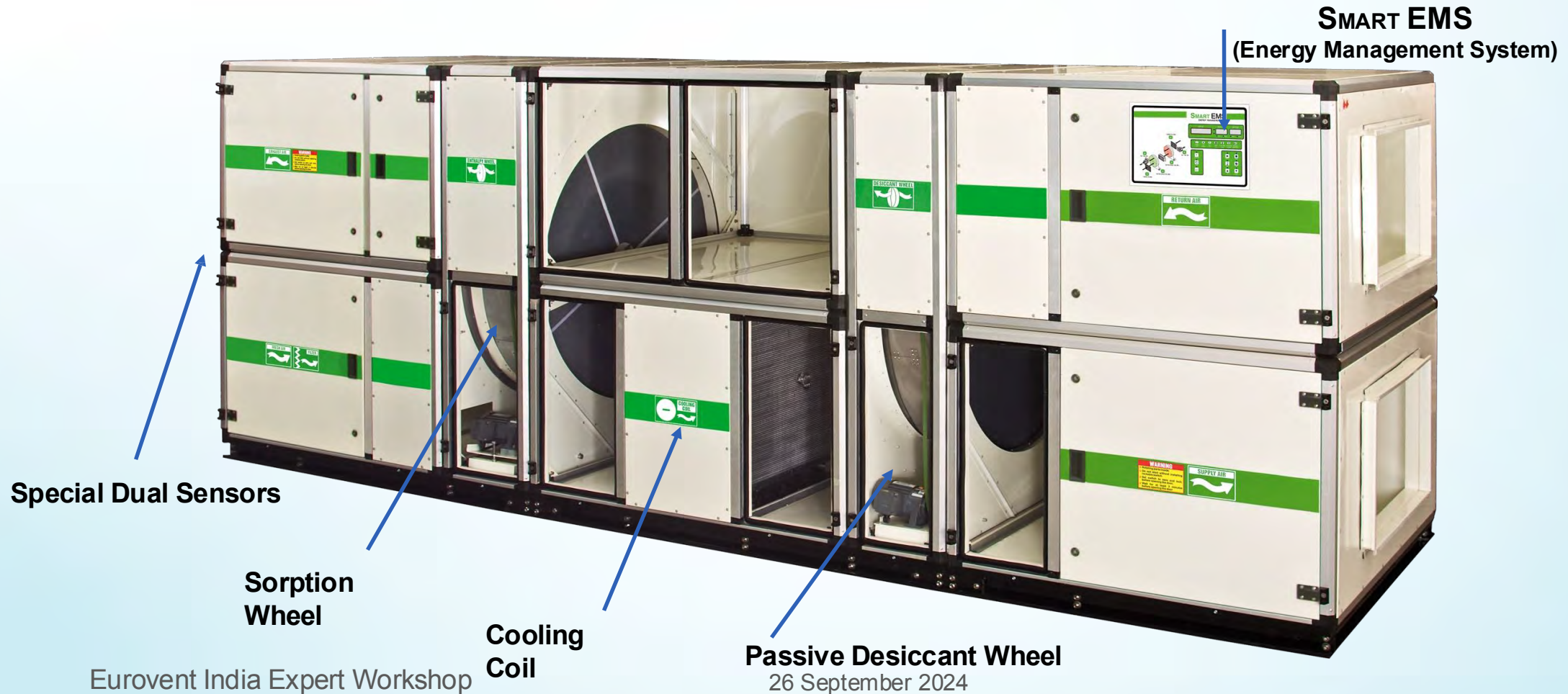
**RoHS**  
compliant



# DOAS Dual Wheel Concept



# DOAS Dual Wheel Concept



# Thank You!

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