

Energy recovery wheels for energy efficient 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, we spend approximately 90% of our time indoors

Ventilation

The Solution to Pollution is Dilution

i.e.

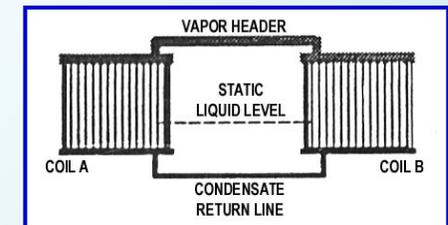
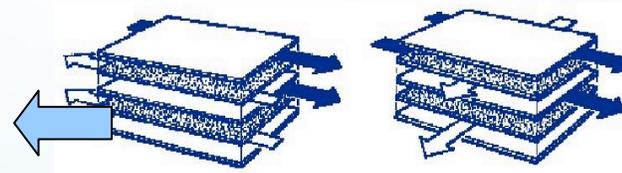
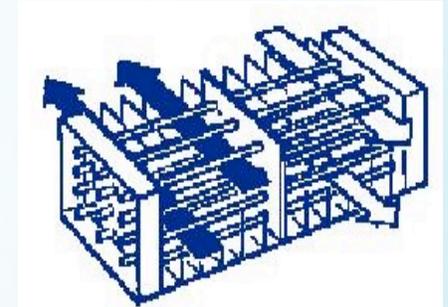
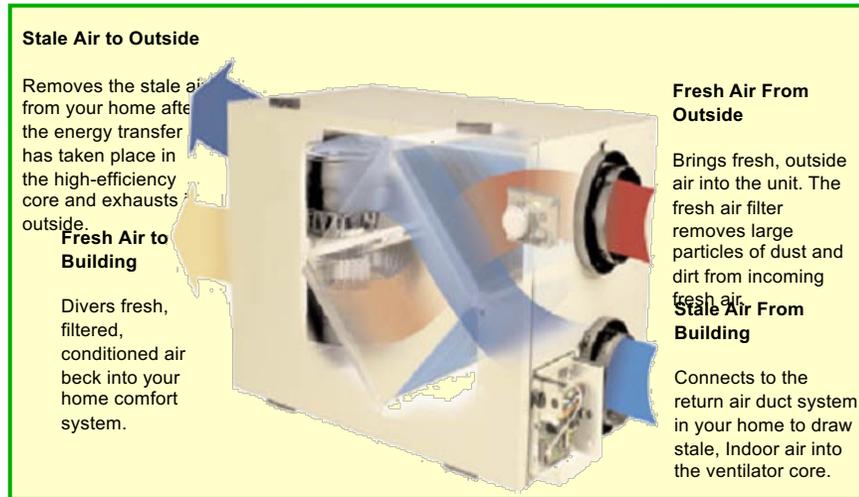
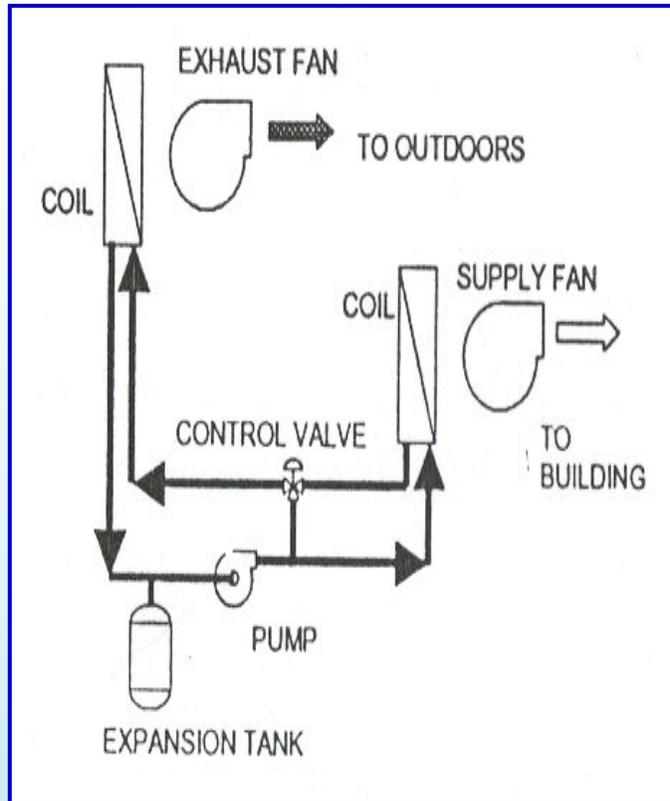
**Bring in fresh Outdoor Air
to flush out stale Indoor Air**

The challenge

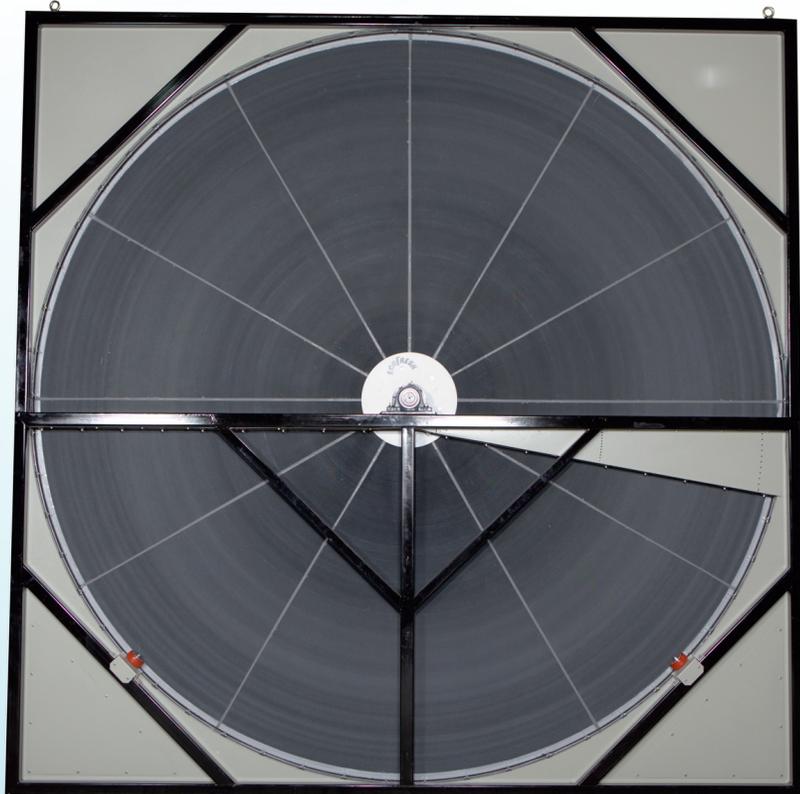
- **Improved indoor environment**
- **Higher utility bills**
- **RH control**

**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**

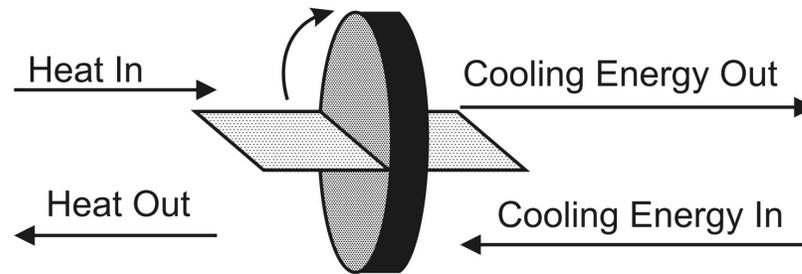
What is Total Energy Recovery?

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

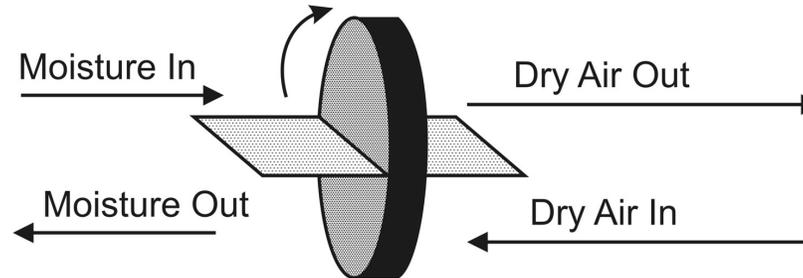
- Can significantly **reduce Energy impact of ventilation**
- As potential first **cost savings** due to reduction in required cooling and heating capacity
- **Improved latent performance** for packaged equipment

Universal Rules of Total Energy Wheels

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

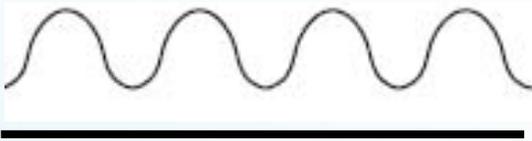


2. Moisture and Dry Air (e.g. 80%) Is Always Returned To Where It Came From



Basic Wheel Construction: Materials

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



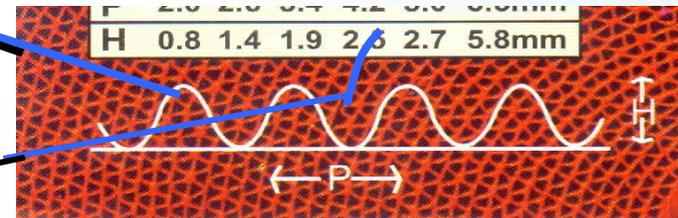
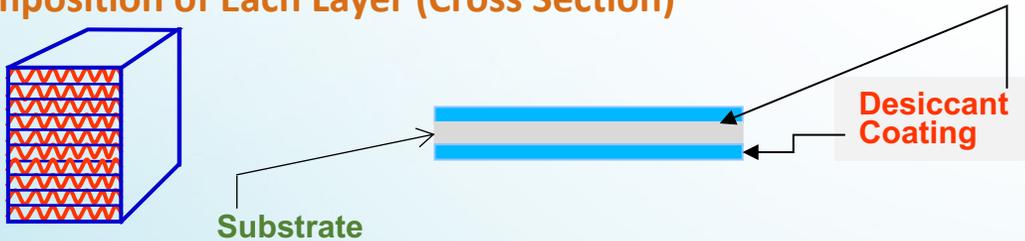
Substrate

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

Energy Recovery Wheel = Substrate + Desiccant Coating

(core material or media) (Adsorbent)

Composition of Each Layer (Cross Section)



Flute Geometry

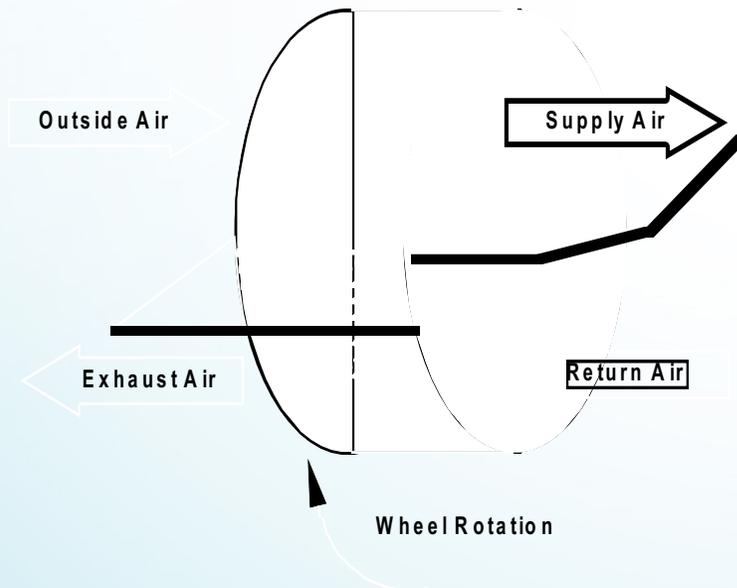
p-pitch
h-height
d-depth

Coating

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

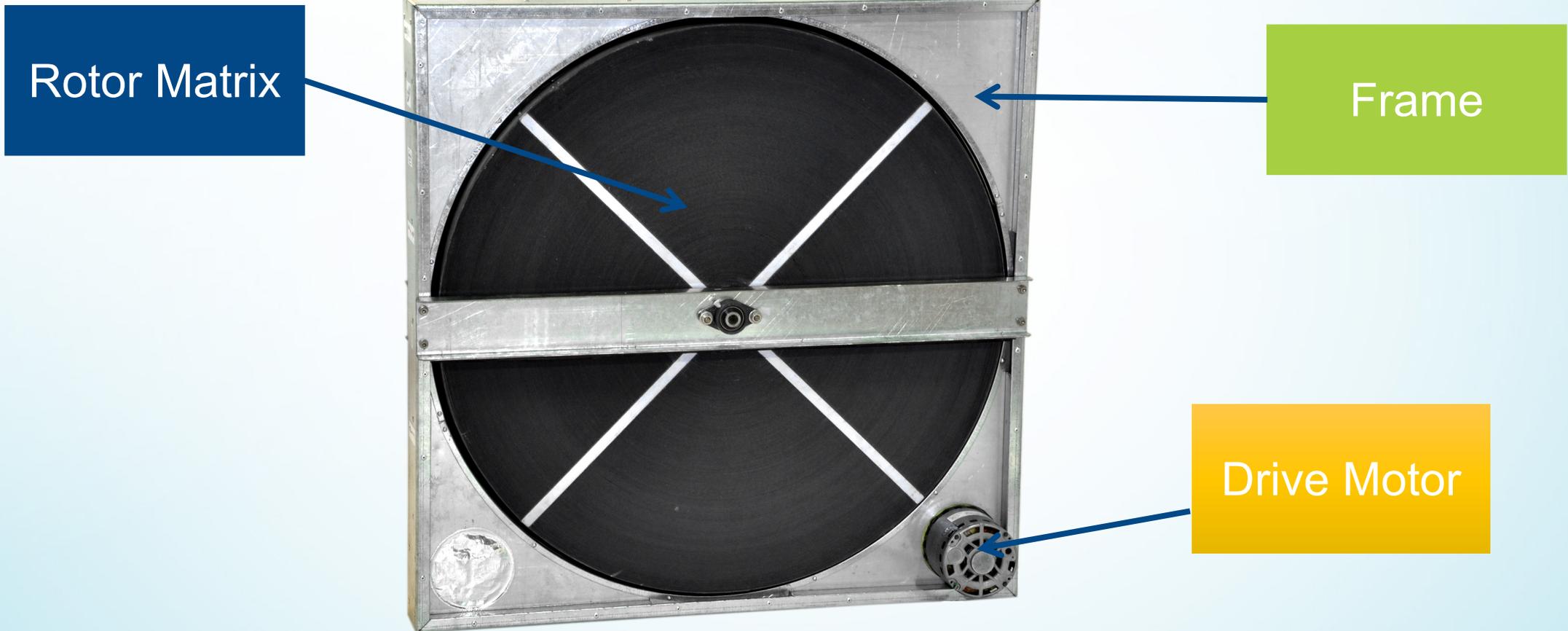
Illustration of Wheel Purge Section

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

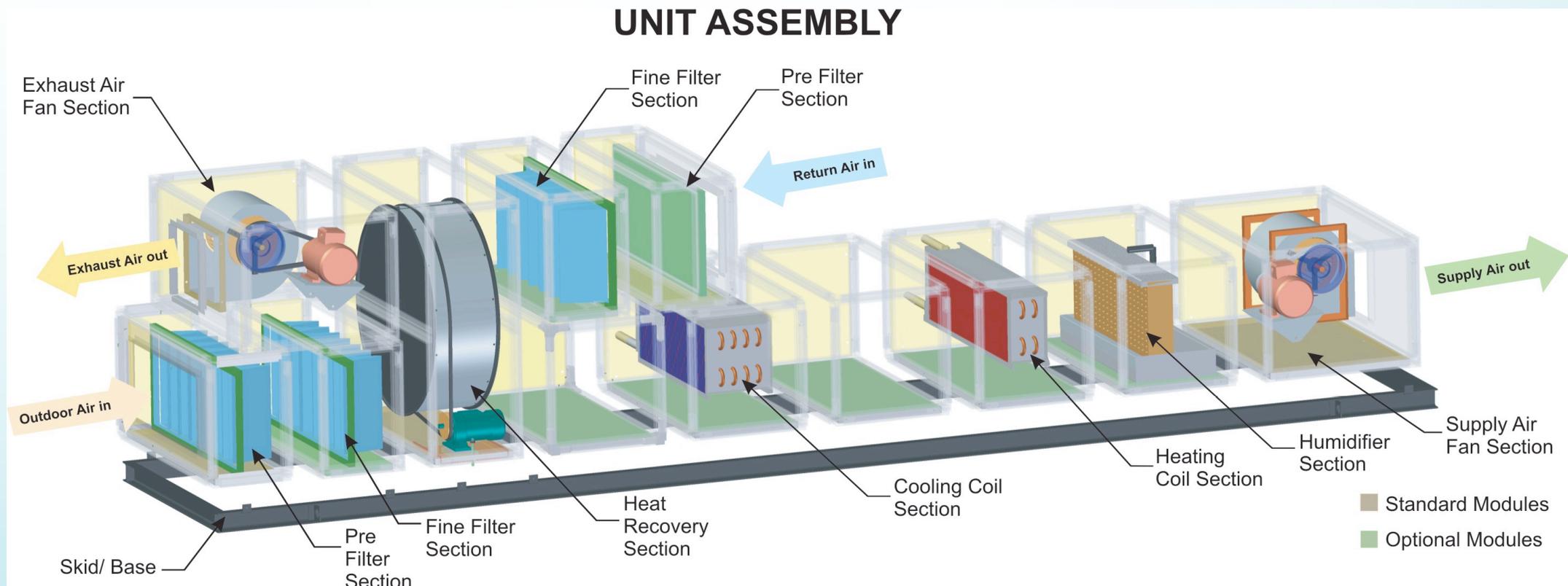


Purge angle is a function of air velocity, and purge volume is a function of wheel volume and rotation speed.

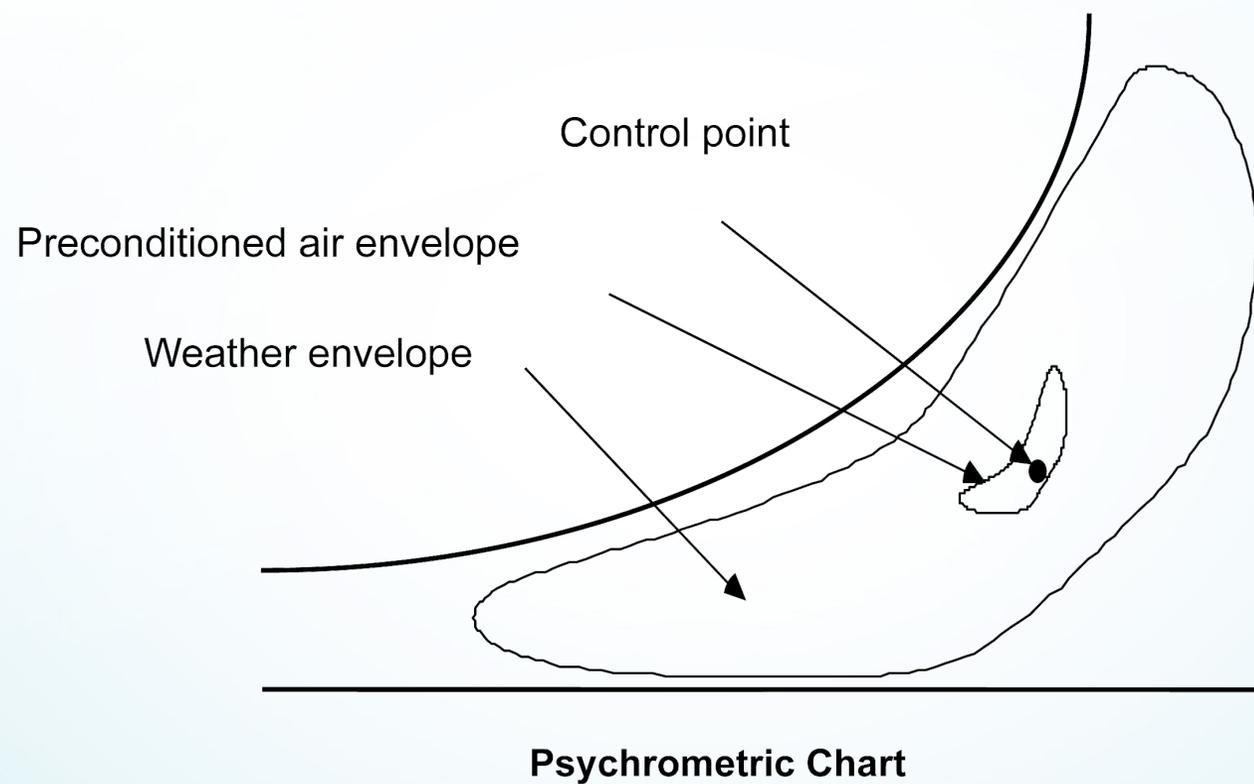
Energy Recovery Wheel



Treated Fresh Air Unit Assembly



What Total Energy Recovery does



Certified Performance Items

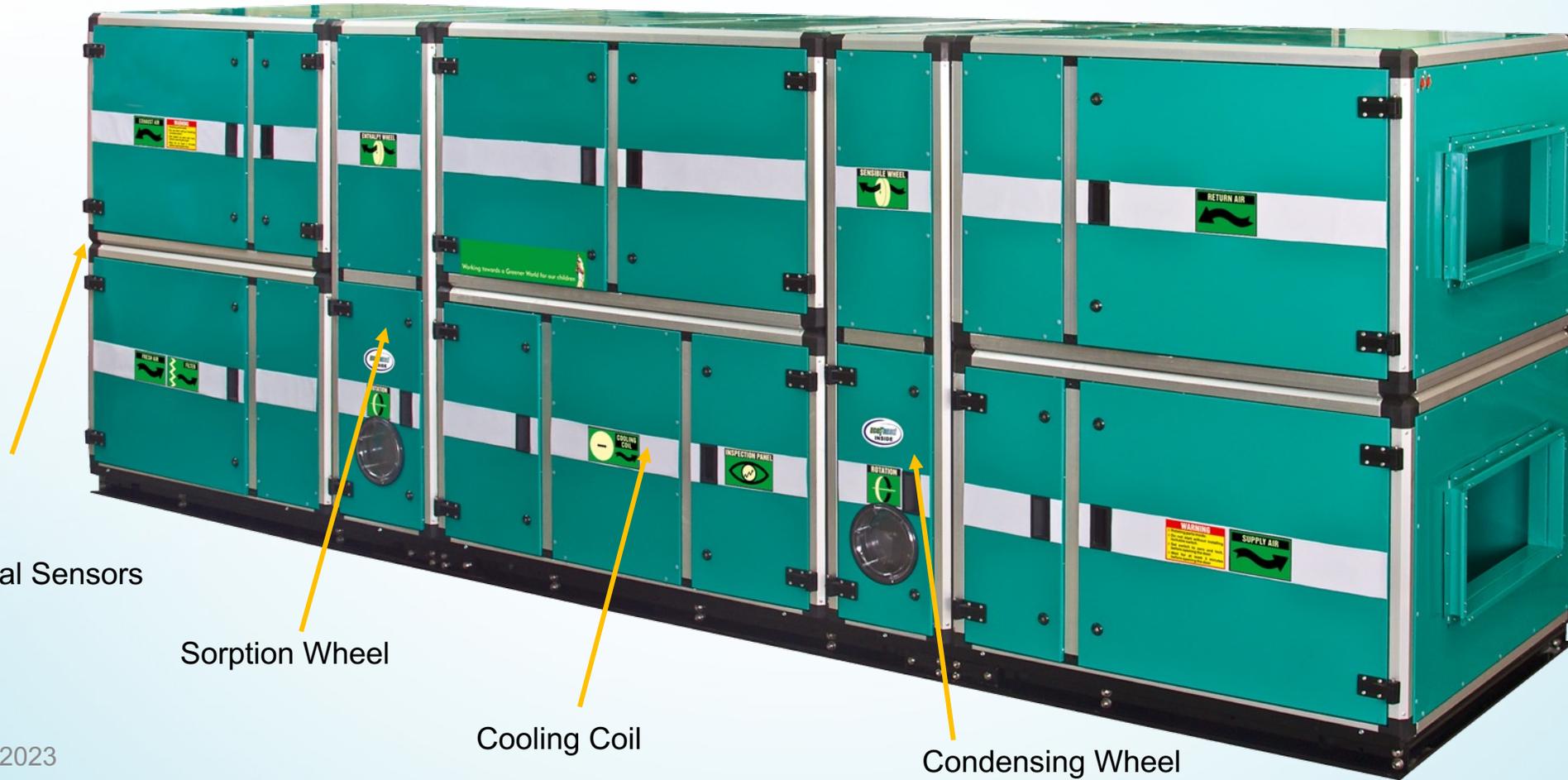
The following performance items shall be certified

Under standard conditions (20°C, 50% rel. Humidity and 1.013 105 Pa – or 1.20 kg/m3)	
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

Certifications



DOAS Dual Wheel Concept



Special Dual Sensors

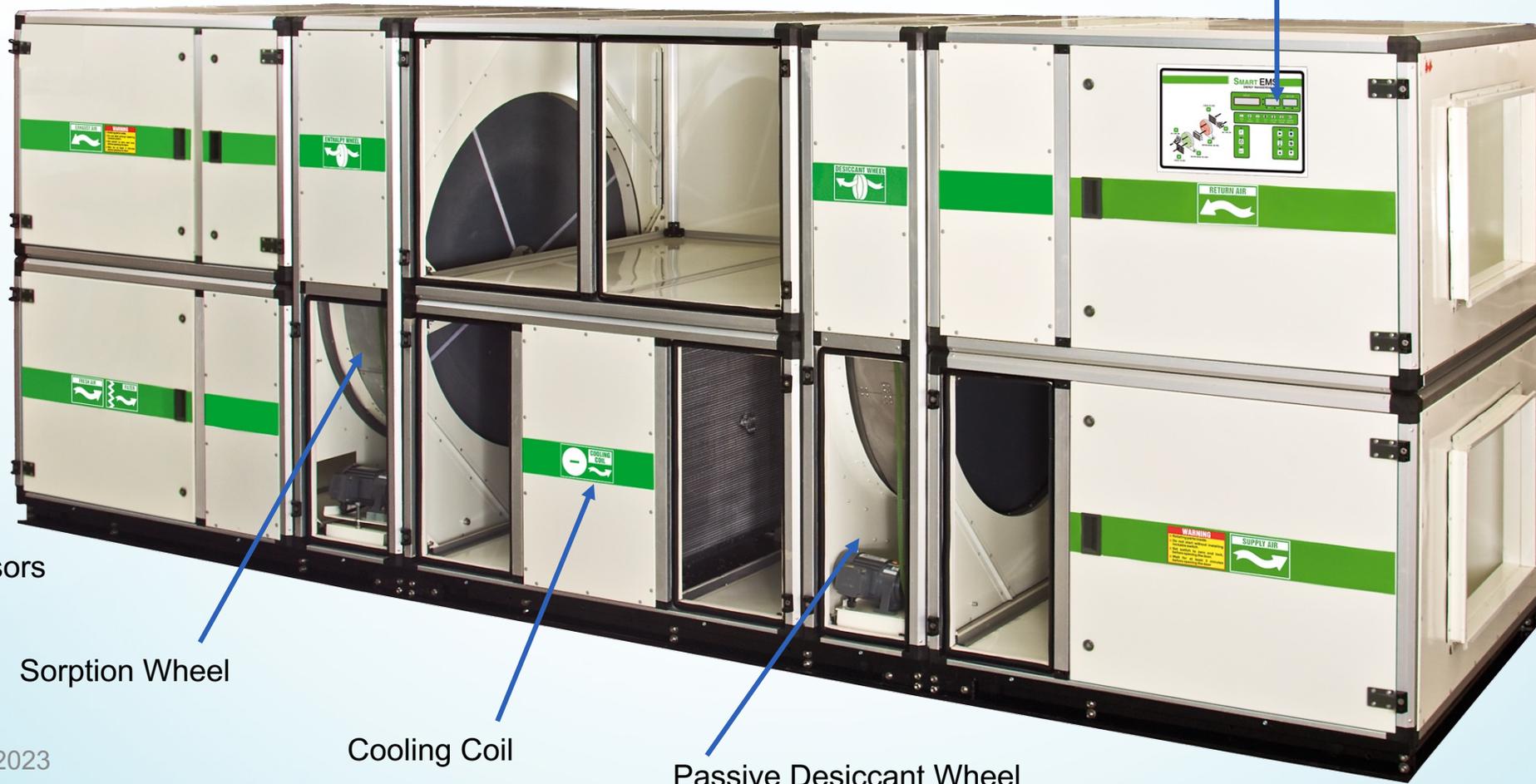
Sorption Wheel

Cooling Coil

Condensing Wheel

DOAS Dual Wheel Concept

SMART EMS
(Energy Management System)



Special Dual Sensors

Sorption Wheel

Cooling Coil

Passive Desiccant Wheel