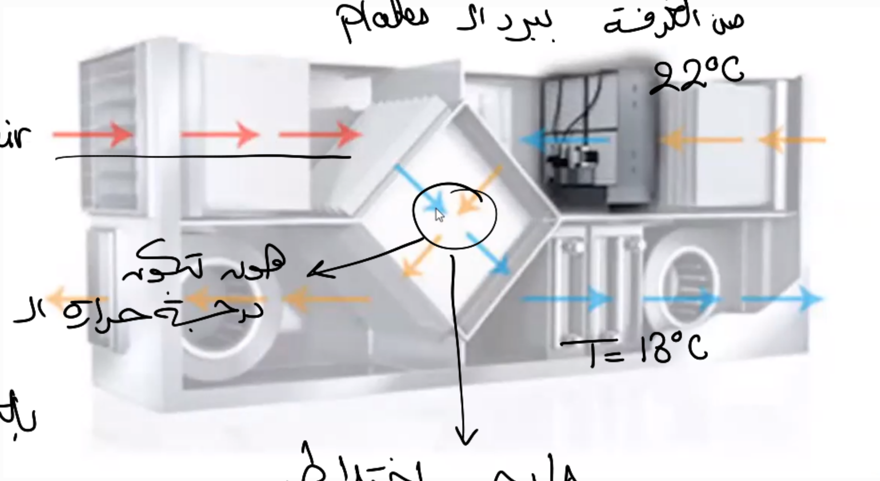
Energy Savings (heat Recovery)

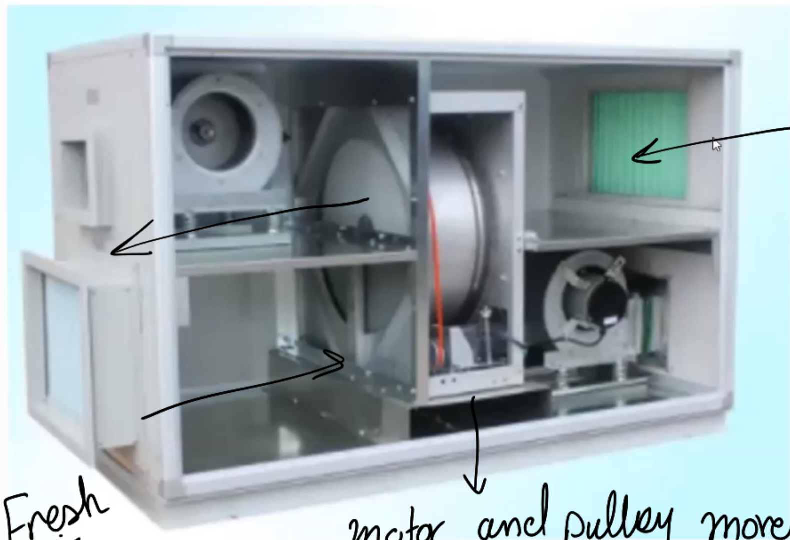
1. Plate heat exchanger
2. Energy wheel
3. Run around coil

} Only for Sensible load

1. Plate heat exchanger (75% sensible load)

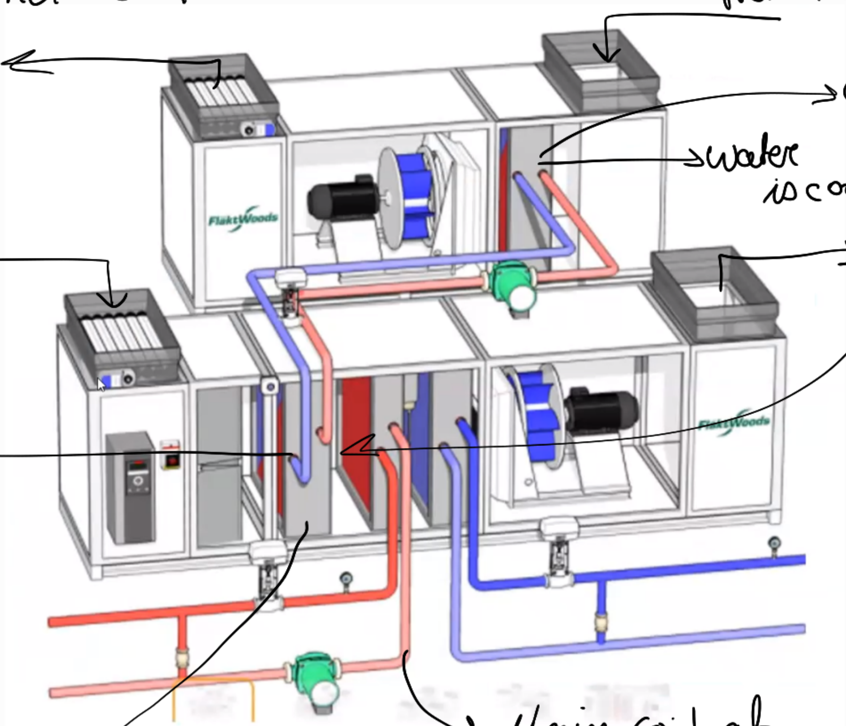


2. Energy wheel



الشي رح يبرد والشي رح يسخن

3. Run around coil



Medium used is water and a pump is used

لما نيجي نحل عليهم اشي مثل ال wheel بكون عندي Q تاع ال cooling coil وعندي $\dot{m}$ وعندي T للهوا الي داخل (fresh air)

بضرب Q بـ 0.75 و بستخدم قانون $Q = \dot{m} C_p \Delta T$

$$0.75 \times Q_{sensible} = (\dot{m}_{fresh})(C_{p\,air})(T_{out} - T_1)$$

$0.75 \times Q_{sensible}$: Q recovery

T_{out}: الي جاي من برا

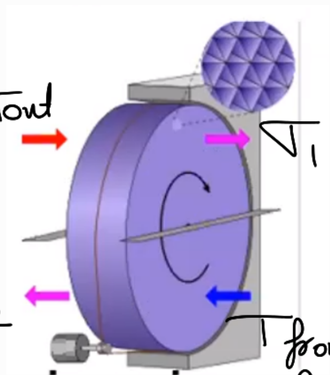
T_1: الي بعد ال Recovery

Also

$$0.75 \times Q_{sensible} = (\dot{m}_{fresh})(C_{p\,air})(T_{Room} - T_2)$$

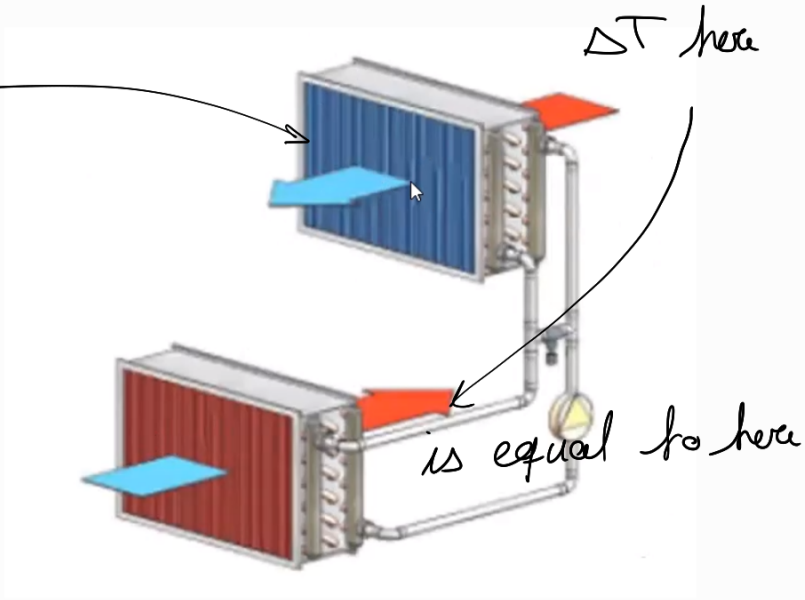
T_{Room}: الي جاي من الغرفة

T_2: بعد ال Recovery من الجهة الثانية

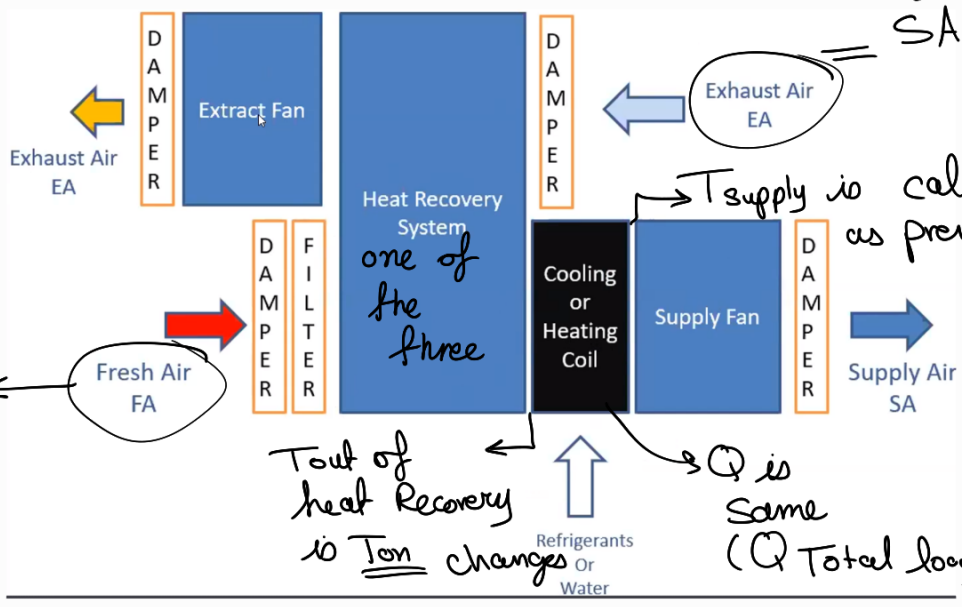


For the run around coil

$\dot{m}_{water} C_{p\,water} \Delta T_{water} = \dot{m}_{air} C_{p\,air} \Delta T_{air}$



- If one of these is added, the air handeling unit is called double deck AHU



- Recovered heat = Q_{Rec} = Capacity of wheel when divided by COP → Gives IO

$COP = \frac{\text{heat saved}}{\text{Electrical saved}}$ → Electrical saved energy

Total cooling load

Given $\underline{\underline{Q}}_{Total} = 1.23 \times \Delta T \times \dot{V}$ (Given; 1.23 → cp; $\dot{V}$ → Supply ↳ For all loads) → $\dot{V} = 3428$

FA = 1240

handling Unit → is for all loads including ventilation

And so $Q_{cooling\ coil} = Q_{Total}$

RA = SA − FA

① Damper

* We Go to psychometric and obtain ω,h by having Tdb, RH

Why do we need a Damper?

1. Control air Quantity

22/50% comfort zone → cooling coil is off + Return damper → All fresh air from Fan

So no treatement is done

② Mixing Box

- we have infos about RA, FA → 4 properties
- Formulas applicable are:

$$\dot{m}_1 h_1 + \dot{m}_2 h_2 = (\dot{m}_1 + \dot{m}_2) h_3$$ → supply air

$$\dot{m}_1 \omega_1 + \dot{m}_2 \omega_2 = (\dot{m}_1 + \dot{m}_2) \omega_3$$

$\dot{m}_1$ ↳ m^3/s ; ω_3 ↳ of supply air

from h, ω → T_{db}, ϕ

③ Cooling coil → only cooling so ω is constant

$Q_{cooling}$ = Total with vent

$$\dot{m} = \frac{SA}{1000} \times 1.2 = kg/s$$

(1.2 → ρ)

- To calculate T_{off} of the cooling coil

Q cooling of All load including ventilation → معروفة

$$Q = \dot{m}\, c_p\, \Delta T$$

c_p → 1.23

$\Delta T = (T_{off} - T_{on})$

T_{off} ↳ T_{supply} ; T_{on} ↳ T_{mixing}

لقينا نقطة T_{on} مع ω على chart عملي خط

مستقيم على فرض انو ω ثابتة وبشوف ϕ, h

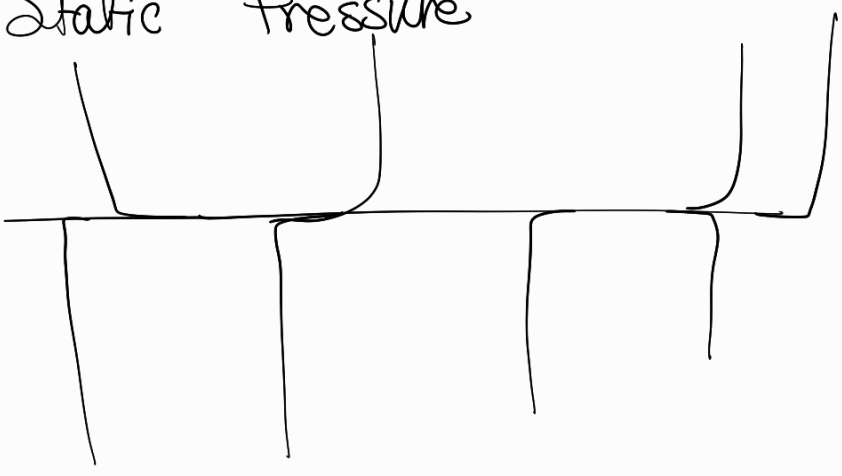
عند الكرانة T_{off}

④ Fan

① Flow rate = Supply flow rate

② Esp = External Static Pressure

Pressure losses ↓ ⇒



- If we only want total fresh air (No Return)

* Air heat Recovery
  Energy wheel is calculated