



HVAC/R Energy Recovery

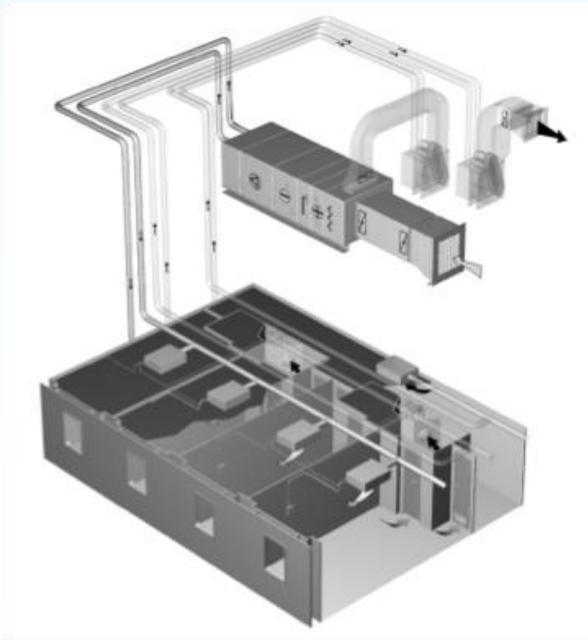
Anders Steen Sørensen
September 2014

Energy Recovery

Traditional marine HVAC system

30-50% return air is mixed into the fresh air

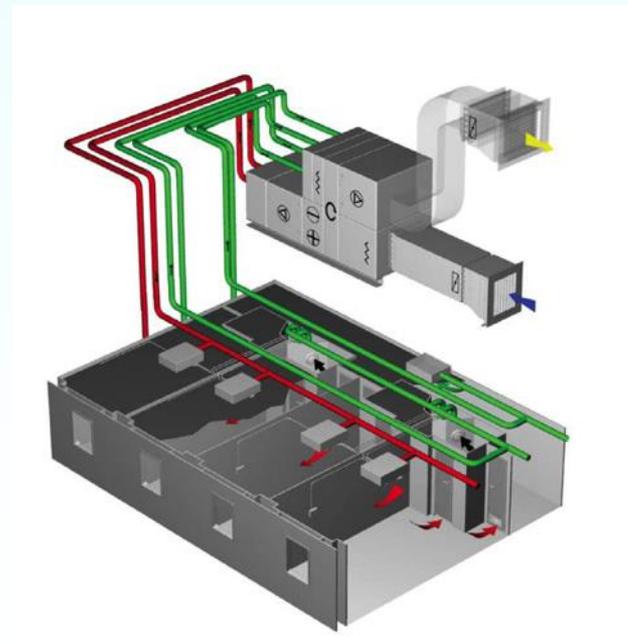
50-70% return air is exhausted to atmosphere



Marine HVAC system with energy recovery

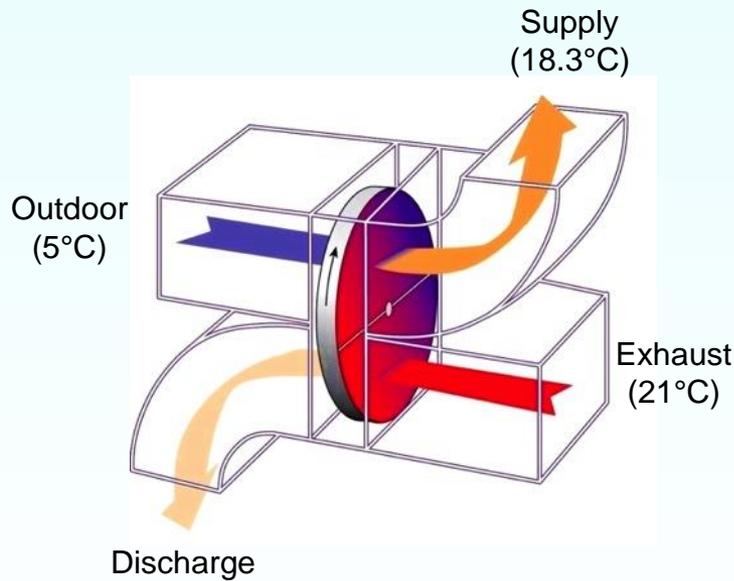
100% return air is passing through a rotary heat exchanger transferring sensible energy (heat) and latent energy (moisture).

Providing significant energy savings and ensures better climate and comfort onboard.



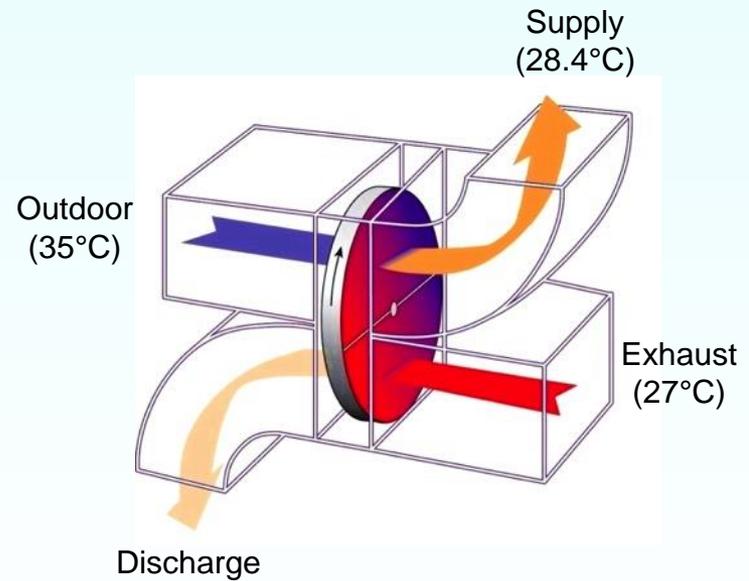
Air-to-air principle of energy transfer

Winter (heating)



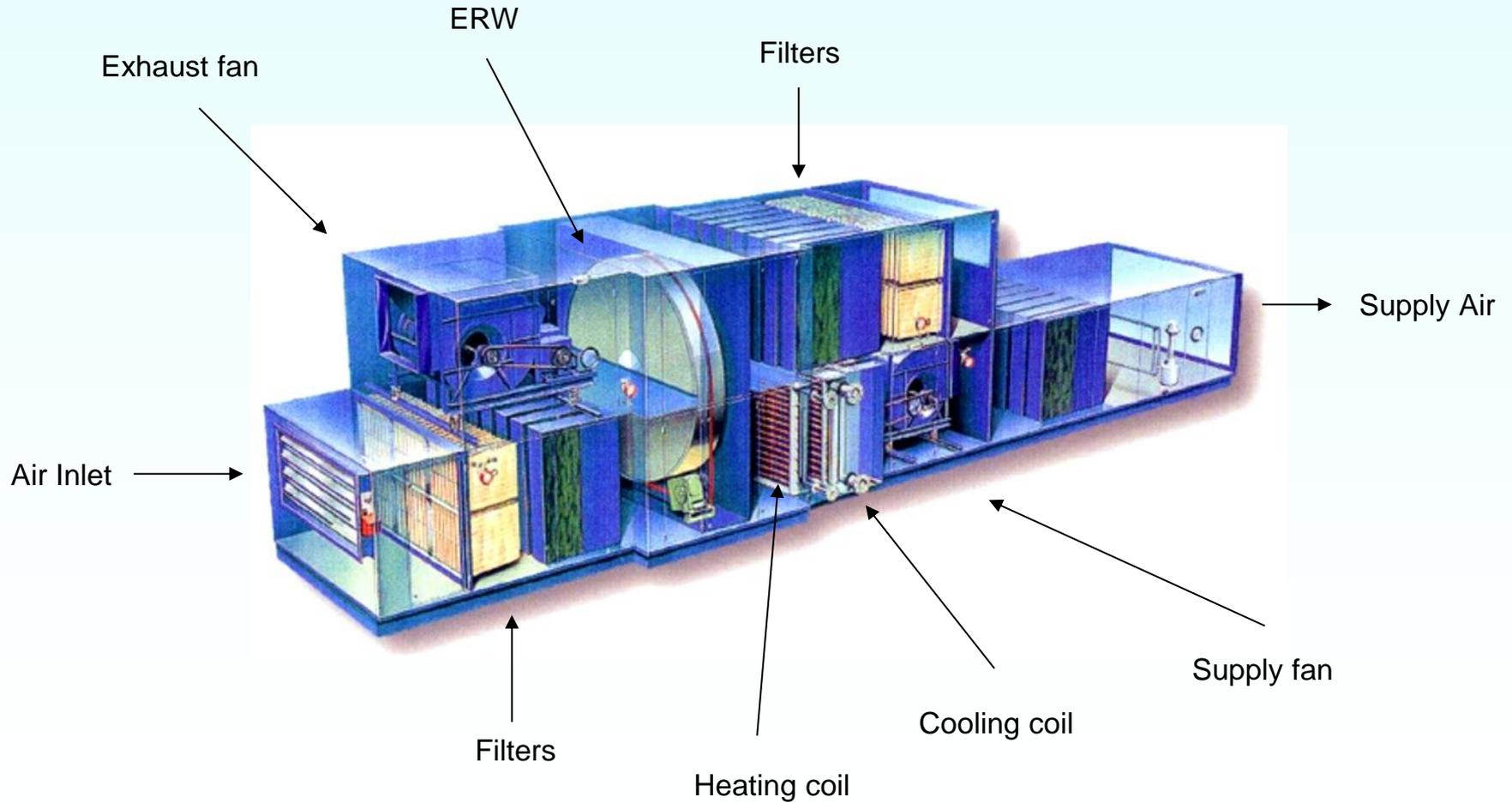
$$\theta = 83.2\%$$

Summer (cooling)



$$\theta = 82.9\%$$

AHU exploded view



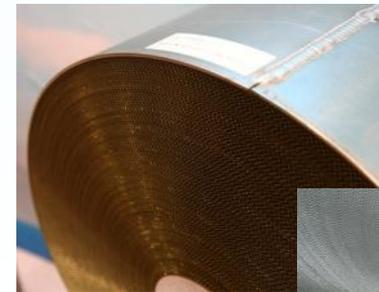
Energy Recovery Wheels

Product Range and main features:

- Rotor sizes ranging from 500 mm to 5000 mm
- Rotor length 200, 240 or 280 mm
- Foil thickness 0.06 mm or 0.1 mm (non-standard thicknesses available)
- Various coatings depending on application
- Casing or “slide-in” construction
- Standard DM design or customs-built to replace any maker

Available coatings:

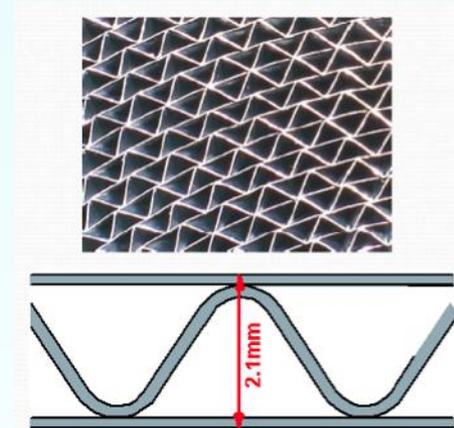
- Standard aluminium (A1)
- Standard aluminium, hygroscopic (AE1)
- Epoxy coated aluminium (AC1)
- Epoxy coated aluminium, hygroscopic (AEC1)
- Molecular sieve coated aluminium (AM1)
- Molecular sieve coated aluminium, epoxy coated (AMC1)



Energy Recovery Wheels

Construction details - rotor element

Normal corrugation height	2.1 mm
Low corrugation height	1.7 mm
Extra low corrugation height	1.4 mm
High corrugation height	2.7 mm

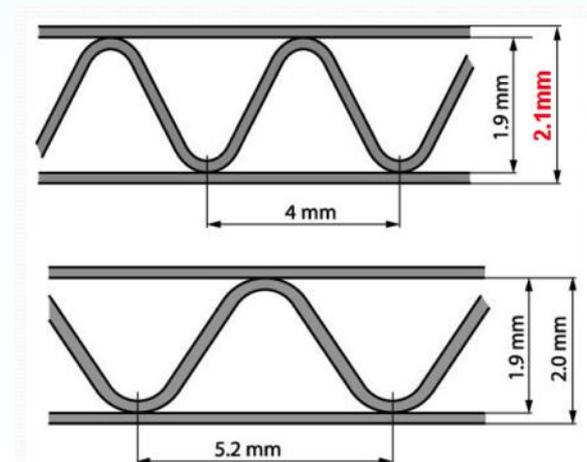


DM Construction:

Corrugation length 4 mm
Separation foil 0.2 mm

Competition:

Corrugation length 5.2 mm
Separation foil 0.1 mm



Molecular sieve coating

Zeolite molecular sieves are crystalline, highly porous materials, which belong to the class of aluminosilicates. These crystals are characterized by a three-dimensional pore system, with pores of precisely defined diameter. By using different ions - Sodium, Potassium, Calcium, etc. the pore size can be adjusted to match the specific intended use.

By using Potassium, a pore diameter of 3 Å is achieved. Water molecules measures app. 2.75 Å and due to the polarity of water molecules they are adsorbed preferentially. The precise pore diameter ensures that no other molecules, for instance VOCs are adsorbed, as they all have significantly larger molecules.

Compared to previous desiccant ERWs this gives:

- Increased efficiency, up to 86%
- Better air quality and comfort due to:
 - Minimum carry over of VOC's
 - Increased humidity in winter conditions

