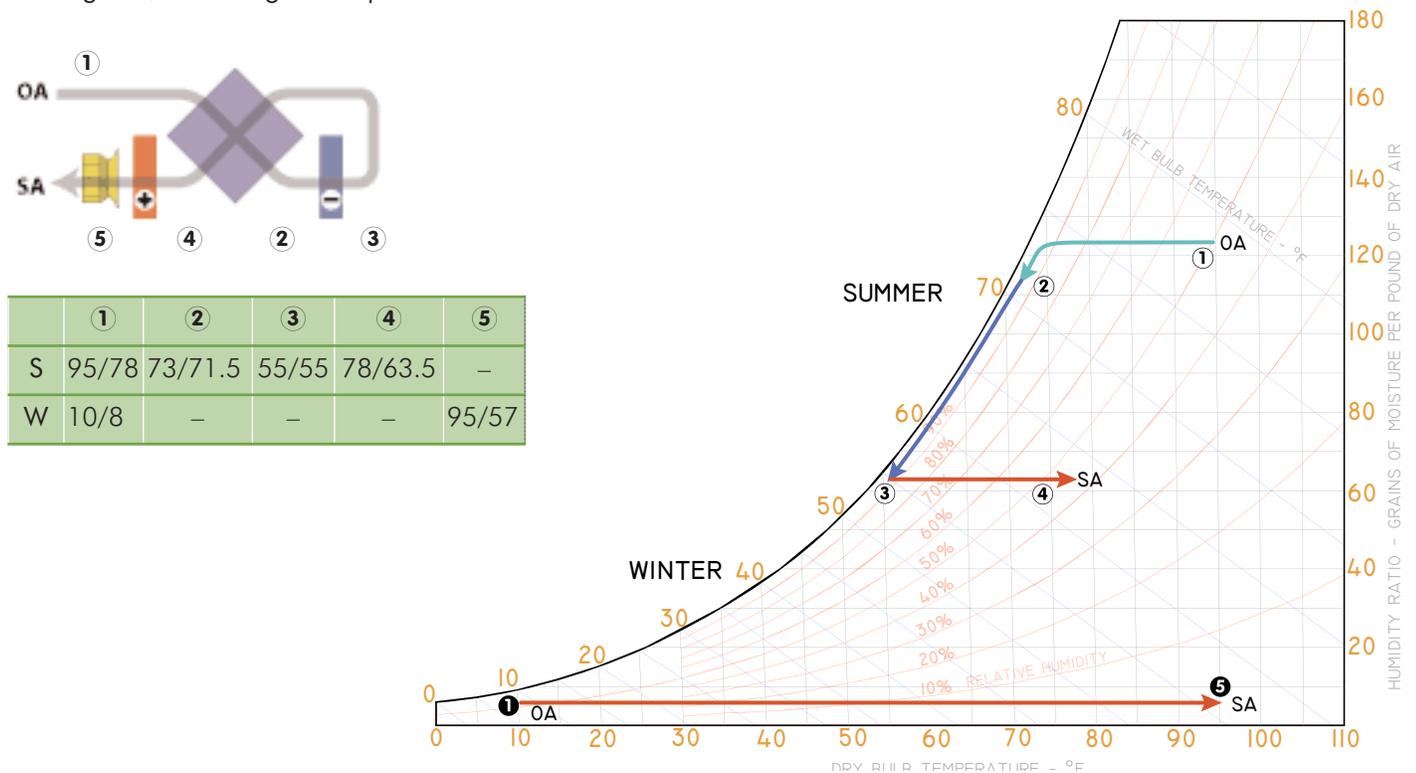


# Process Sheet

## Make-up air unit with a fixed plate with cooling and heating

This page shows a psychrometric process for a typical 100% outdoor air energy recovery unit under standard design conditions. The numbers indicate different stages in the process where there is a transformation of the incoming air condition. The energy saving is compared to the energy needed to achieve the same supply conditions with a basic heating and/or cooling makeup air unit.



### Process Calculation (per 1000 cfm)

#### Summer Operation

Plate effectiveness 65%

In this type of unit the outdoor air passes twice through the fixed plate. The heat exchange occurs between the incoming warm air and the cool air leaving the cooling coil. On the first pass, the fixed plate pre-conditions the air reaching the cooling coil by cooling it, thereby requiring less mechanical cooling. In the second pass the cooled air is reheated by absorbing heat from the incoming air stream. The air temperature after reheat may actually be higher than required by the design conditions. In this case a bypass on the fixed plate is needed to keep the desired set point.

- ①-② pre-cool section  
 $Q_t = 4.5 \times 1000 \times (41.4 - 34.9) = 29.25 \text{ mbh (2.4 tons)}$
- ②-③ mechanical cooling section  
 $Q_t = 4.5 \times 1000 \times (34.9 - 23.2) = 52.65 \text{ mbh (4.4 tons)}$
- ③-④ free reheat  
 $Q_s = 1.08 \times 1000 \times (78 - 55) = 24.8 \text{ mbh}$

#### Winter Operation

The fixed plate has no effect in the winter and the unit is equivalent to a standard make-up air with heating.

- ①-② mechanical heating  
 $Q_s = 1.08 \times 1000 \times (95 - 10) = 91.8 \text{ mbh}$

#### Savings gained by energy recovery

cooling : 2.4 tons/1000 cfm  
 reheat : 16.2 mbh/1000 cfm

#### Energy required without energy recovery

cooling : 6.8 tons/1000 cfm  
 reheat : 16.2 mbh/1000 cfm