Heat Recovery Wheel or Plate Exchanger Saving

Supply air temperature and sensible heat recovered by a heat wheel or plate heat exchanger between fresh air and exhaust air, with the energy saved in a year.

Method: Sensible effectiveness definition; ASHRAE psychrometrics

Input parameters

Unit system: SI

Parameter	Value	Unit
Fresh (outdoor) air flow	10,000	m³/h
Atmospheric pressure	101.33	kPa
Outdoor air temperature	40.000	°C
Outdoor air humidity ratio	12.000	g/kg
Exhaust (room) air temperature	24.000	°C
Sensible effectiveness (equal air flows)	70.000	%
Running hours per year at this condition	3,000.0	h

Calculated results

Parameter	Value	Unit
Fresh air temperature after the recovery unit	28.800	°C
Dry air flow	11,059	kg/h
Sensible heat recovered (heating or cooling)	35.380	kW
Energy recovered per year	106,141	kWh

Notes for this case

- Sensible recovery only, equal supply and exhaust flows; an enthalpy wheel also recovers moisture. Fan power for the extra pressure drop is not deducted.

Formula and method

$$T_s = T_o + \varepsilon(T_r - T_o)$$

$$Q_r = \dot{m}_a \lvert h(T_s, W_o) - h(T_o, W_o) \rvert$$

$$E = Q_r t_y$$

Variables

Q	fresh air flow	m³/s
p	atmospheric pressure	Pa
T_o	outdoor temperature	K
W_o	outdoor humidity ratio	kg/kg
T_r	exhaust temperature	K
ε	sensible effectiveness	-
t_y	hours per year	s
h	moist air enthalpy (ASHRAE)	J/kg
T_s	fresh air temperature after recovery	K
$\dot{m}_a$	dry air flow	kg/s
Q_r	heat recovered	W
E	energy per year	J

Method and standards

Sensible effectiveness is the fraction of the possible temperature change achieved; with equal flows the supply leaves at T_o + ε (T_r − T_o). The heat recovered is the dry air flow times the enthalpy change at constant humidity.

Assumptions and limits

- Equal supply and exhaust flows; sensible only. An outdoor humidity ratio above saturation is flagged.

References

• Sensible effectiveness definition
• ASHRAE psychrometrics

Report details

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Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/hvac/loads/heat-recovery-wheel

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.