Run-Around Coil Heat Recovery Effectiveness

Heat recovered and overall effectiveness of a run-around loop of two coils linked by pumped glycol, from coil UA values, air flows and the liquid flow rate.

Method: Coupled exchangers by ε–NTU

Input parameters

Unit system: SI

Parameter	Value	Unit
Exhaust air flow	14,400	m³/h
Supply (outdoor) air flow	14,400	m³/h
Exhaust air temperature	22.000	°C
Outdoor air temperature	-10.000	°C
Exhaust coil UA	9.0000	kW/K
Supply coil UA	9.0000	kW/K
Liquid capacity rate ṁc_p	4.8000	kW/K

Calculated results

Parameter	Value	Unit
Exhaust coil effectiveness	65.344	%
Supply coil effectiveness	65.344	%
Heat recovered	74.537	kW
Overall effectiveness	48.237	%
Supply air leaving the coil	5.4360	°C

Notes for this case

• Each coil is a counterflow exchanger between air and liquid with ε from the ε–NTU relation. Writing Q = ε₁C_min,1(T_e − T_l,1) for the exhaust coil and Q = ε₂C_min,2(T_l,2 − T_s) for the supply coil, with T_l,2 − T_l,1 = Q/C_l around the loop, gives Q = (T_e − T_s)/[1/(ε₁C_min,1) + 1/(ε₂C_min,2) − 1/C_l]. Overall effectiveness peaks when the liquid capacity rate is close to the air capacity rates; typical loops reach 45–65 %. Air is taken at 1.2 kg/m³ and 1.006 kJ/kg·K, and frost on the exhaust coil limits recovery in cold climates.

Formula and method

$$\dot{Q} = \frac{T_e - T_s}{\frac{1}{\varepsilon_e C_{min,e}} + \frac{1}{\varepsilon_s C_{min,s}} - \frac{1}{C_l}}$$

Variables

$\dot{V}_e$	Exhaust air flow	m³/s
$\dot{V}_s$	Supply (outdoor) air flow	m³/s
T_e	Exhaust air temperature	K
T_s	Outdoor air temperature	K
UA_e	Exhaust coil UA	W/K
UA_s	Supply coil UA	W/K
C_l	Liquid capacity rate ṁc_p	W/K
ε_e	Exhaust coil effectiveness	-
ε_s	Supply coil effectiveness	-

$\dot{Q}$	Heat recovered	W
ε_o	Overall effectiveness	-
$T_{s,out}$	Supply air leaving the coil	K

Method and standards

Run-around loop.

Assumptions and limits

- Counterflow coils; sensible heat only; constant properties.

References

Coupled exchangers by ε–NTU

Report details

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Release checks	3 reference cases of this calculator, computed independently, are checked on every release

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/run-around-coil-effectiveness

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Reopens the calculator with the inputs of this report.