HEH Software (Fin coil heat exchanger)

Fin coil surface

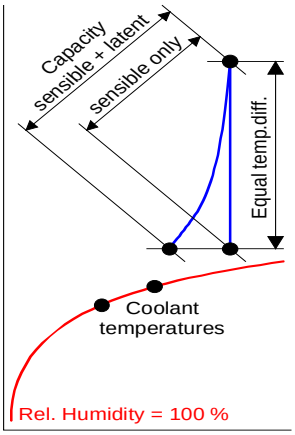
Different manufacturers can offer heat exchangers in terms of price and surface with differences to 50%, although the equation for the required surface is very easily. The problem for the big differences in terms of price and surface is given by 6 influence factors:

$$F = \frac{\dot{Q}}{k \cdot \Delta tm}$$

- Accurate performance calculation, considering the condensation
- Conservative k-value calculation, taking into account the fouling
- Accurate calculation of Δtm, taking into account the pinch point
- Sufficient fin thickness > 0.20 mm for optimum heat conduction
- Optimal contact between the fins and tubes
- Optimal surface ratio Fo/Fi (fins and tubes)

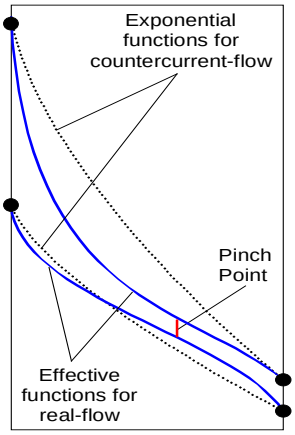
Capacity

For humid air cooling, the opinions about the latent capacity deferred share far apart. Only those which calculated the cooling process with finite elements, can accurately determine, how the cooling process expires. They also play an important role a sufficient fin thickness, a good contact between the fins and tubes and an optimum surface ratio between fins and tubes because that much influence the surface temperature and the creating of condensation. For the humid air and the coolant, during the cooling process, Reynolds go down and Prandtl go up. That's reason the k-value go down. Once formed condensate however, the k-value go up. This can be done only by finite elements taken into account.



Δtm

The beautiful exponential temperature gradients in the chart right must be forgotten, just because at the beginning sensitive capacity exists only and at the end only, latent capacity can be removed. The temperature gradients deform. Since the temperature difference Δtm must understood as surface between the two temperature gradients, this reduced that extreme, well understood in countercurrent-flow too!



Pinch Point

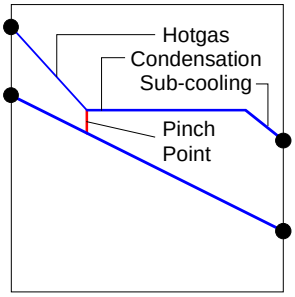
As pinch point means in the thermodynamic process technology the smallest temperature difference between the two media, whether this value between several heat exchangers or inside a heat exchanger occurs. What everyone understands concerning the refrigerant condenser, revealed to the cooler for humid air only, if it anticipates using finite elements.

Fin thickness

When using thick fins, the area is not bigger but the weight and the price rise however. What is also rising, the fin efficiency, which results a better k-value and a lower surface temperature with larger droplet condensation, which is easier to separate.

Contact fins / tubes

If the contact is bad between the fins and tubes, decreases the k-value and the capacity. The surface temperature rises, and it will be less condensed. The drop size is small (aerosol) like fog and can't separated without a combination of demister and drop separator.



Surface ratio Fo/Fi

In times of rising copper prices, some manufacturers came up with the idea of sharing the pipe to double, so only half pipes, instead, suggesting the surface marginal influence, but at the k-value very negative impact, and thus the capacity slackens.

Cooler: 35/35/12-20R-40T-1400A-2.5PA-16C-Cu/Al/AlMg3

Capacity	kW	94.074	------ sensible:	78.826
Surface reserve	%	0.904	latent:	15.249
Present surface	m2	1029.537	frost:	0.000
Required surface	m2	1020.311		
Heat transfer coefficient	W/m2K	24.998	---------- ffi:	5.000E-05
Mean temp. diff. (74.77 %)	K	3.688	ffa:	5.000E-05

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Ittigen, 17.08.2011
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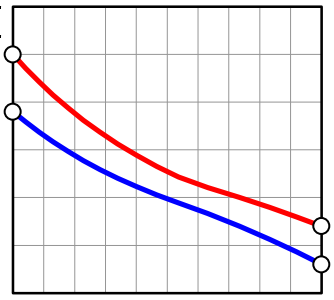
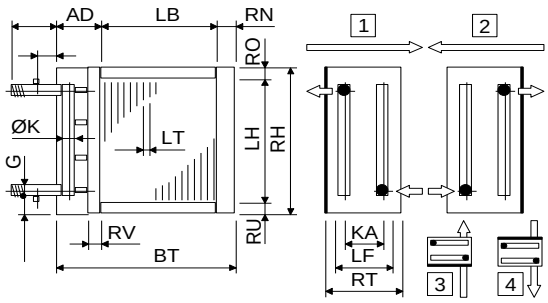
Air humid		Inlet	Outlet	Definition
Height over sea level	m			0.000
Pressure	hPa			1013.250
Temp.	°C	20.000	2.000	20.000
Rel. humidity	%	40.000	100.000	40.000
Abs. humidity	g/kg	5.784	4.373	
Density humid	kg/m3	1.200	1.279	
Enthalpy humid	kJ/kg	34.805	12.964	
Volume flow humid	m3/h	13000.000	12174.390	13000.000
Mass flow dry	kg/h	15506.151	15506.151	
Condensat flow	kg/h		21.877	
Surface temperature	°C	16.558	0.218	
Velocity	m/s	1.842	1.725	
Pressure drop (dry 101 Pa)	Pa		109.414	

25 % Et.glycol		Inlet	Outlet	Medium
Temp.	°C	-2.000	14.000	6.000
Density	kg/m3			1042.210
Heat cont.	kJ/kgK			3.695
Heat cond.	W/mK			0.456
Viscosity	Pas			2.827E-03
Volume flow	m3/h			5.496
Velocity	m/s			0.903
Pressure drop	kPa			133.129



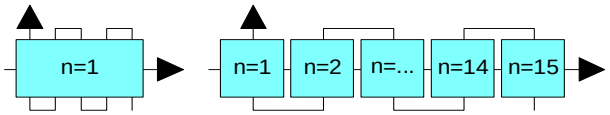
Tecnical datas

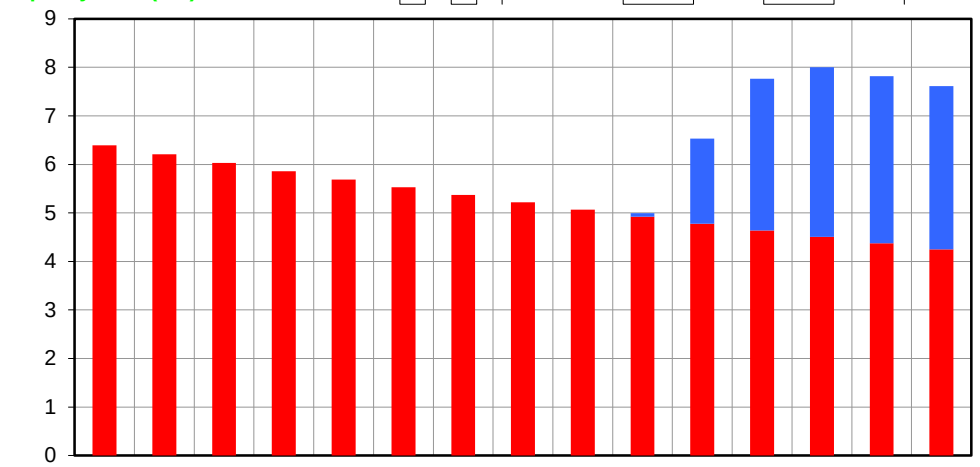
Tubes total		Piece	800	Tubes:	flat	Cu
Tubes blanc		Piece	0		in line	
Internal ventings		Piece	9	Collectors:	1.28 m/s	Cu
Internal drains		Piece	9	Connections:	1.28 m/s	Rg7
Tube rows on the depth		Piece	20	Fins:	flat	Al
Tube rows on the height		Piece	40	Frame:	2.00 mm	AlMg3
Tube coupling in series		Piece	50	Circulations:	1	Default
Number of circuits (NC)		Piece	16	Protection:		without
Volume		l	129			---
Weight		kg	454	El. heat rods:		---
Connections	G	---	1 ½"	Air flow direction:		horizontal
Frame height	RH	mm	1480	Special:		Bottom plate perforated
Frame width	BT	mm	1571			for perfect condensate drain
Frame depth	RT	mm	740			
Finned height	LH	mm	1400			
Finned width	LB	mm	1400			
Finned depth	LF	mm	700			
Frame on top	RO	mm	40			
Frame on bottom	RU	mm	40			
Frame in front	RV	mm	40			
Frame on back (~40mm)	RN	mm	40			
Collector-Diameter	K	mm	42			
Collector covering	AD	mm	131			
Collector distance	KA	mm	670			
Fin spacing	LT	mm	2.500			
Fin thickness	LD	mm	0.200	Delivery:		5-6 weeks
Tube diameter	DA	mm	12.400	Validity:		12 weeks
Tube thickness	S	mm	0.400	Condit.:		net, prepaid adress
Tube intervall on the height	S1	mm	35.000	Payment:		30 days net
Tube intervall on the depth	S2	mm	35.000	**Price net:** Non el. rods	**EUR**	**7085.00**



Tecnical datas

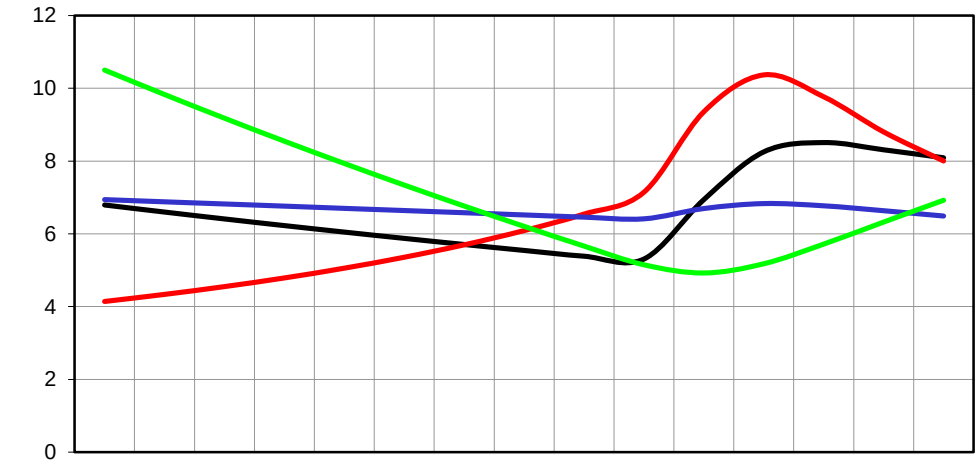
Capacity sensible (kW)
Capacity latent (kW)
Capacity frost (kW)





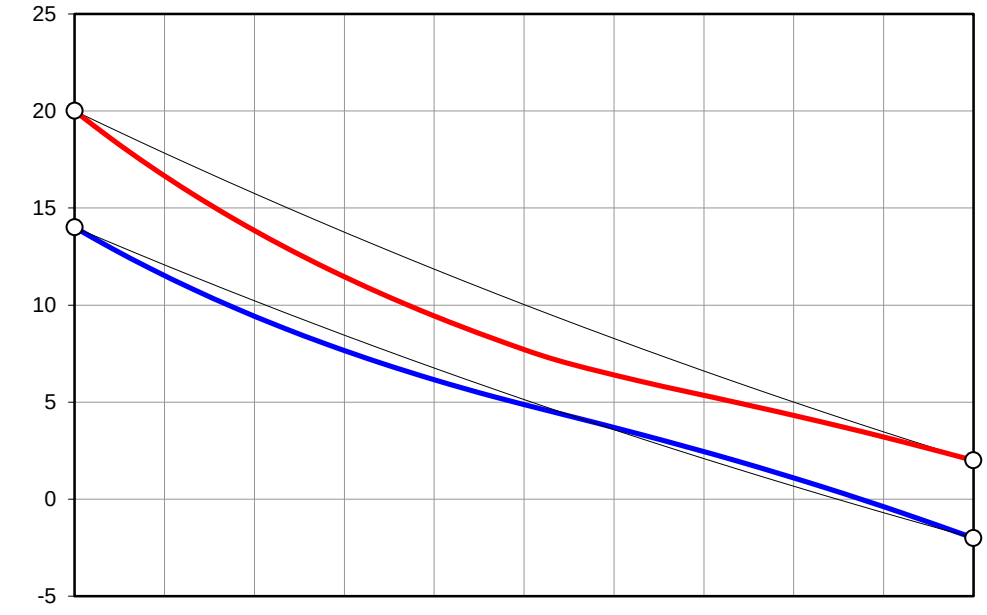
Step (n = 1 to 15)

Capacity (%)
Required surface (%)
Heat transfer coefficient (%)
Mean temp. diff. (%)



Step (n = 1 to 15)

Temp. (°C)



Length (---)

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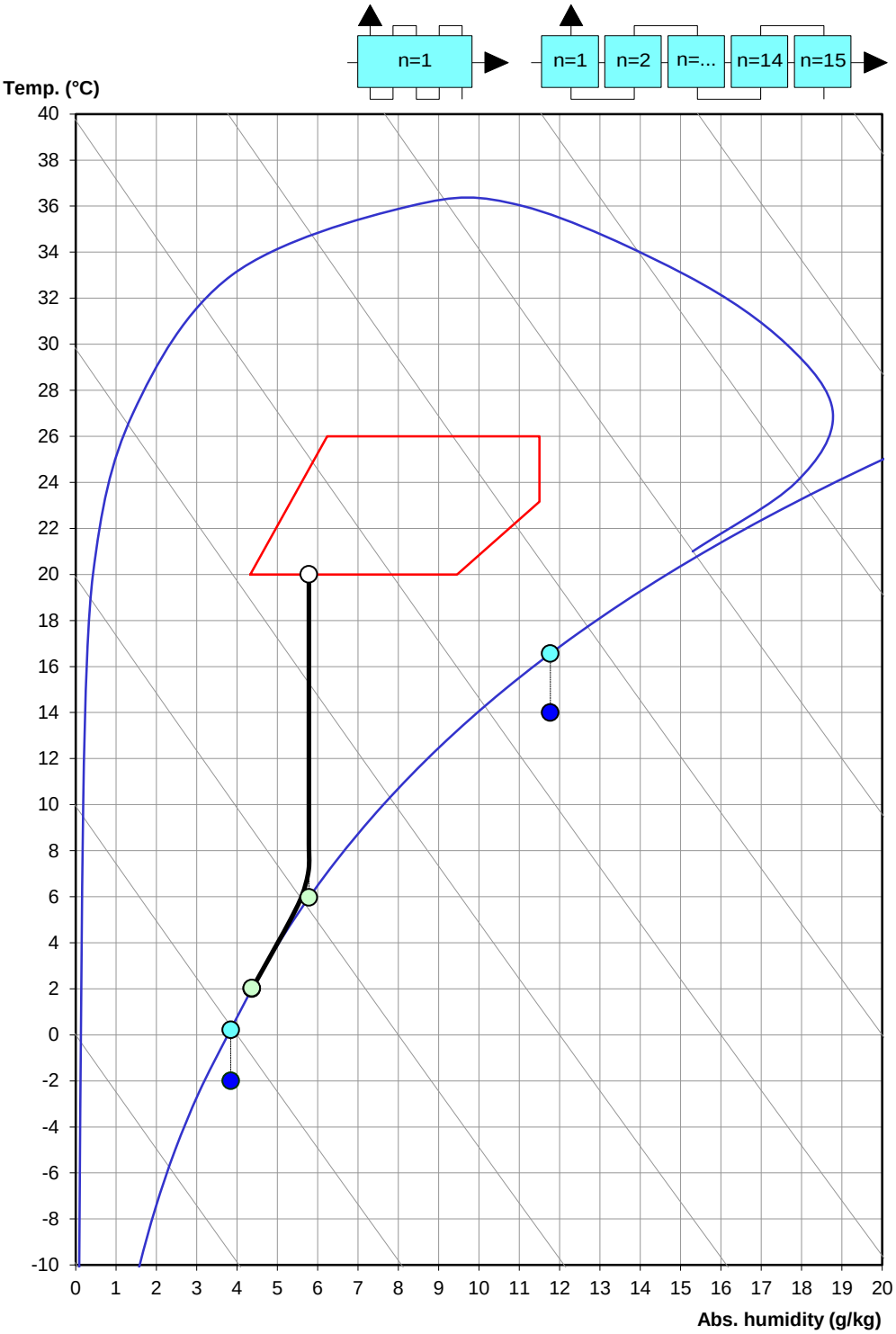
Mollier-t/x-Diagramm for: Air humid



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Cooler			Inlet	Outlet	Indication
Temp.	t	°C	20.000	2.000	○
Abs. humidity	x	g/kg	5.784	4.373	
Dew point temperature	td	°C	5.968	2.030	○
Abs. humidity	xs	g/kg	5.784	4.373	
Surface temperature	ts	°C	16.558	0.218	○
Abs. humidity	xs	g/kg	11.769	3.845	
25 % Et.glycol	ta	°C	14.000	-2.000	○
Abs. humidity	x	g/kg	11.769	3.845	