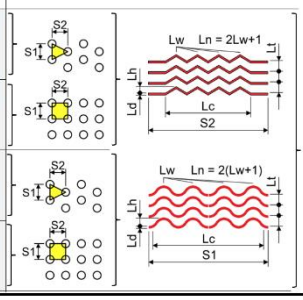
Software for AHU producers
Finned heat exchangers (DLL, GUI)

If you are completely convinced, that you are on the right track with your suppliers for finned heat exchangers, you can save yourself the trouble of reading on. There are countless different geometries for finned heat exchangers. Some are expensive, others produce too much airside pressure drop, which is out of the question for complying with the maximum prescribed pressure drops on the air conditioning unit, the SFP (Specific Fan Power). Below we give an example of a CCSD type heat recovery system, where we have chosen the company **g** with sinusoidal fins in the air direction as the most cost-effective solution.

CC-System: Comparison of different calculations — Software by www.zcs.ch

No	Selection	S1	S2	DA	da	S	T	F	Ld	Lh	Lc	Lw	Ln	P	W	V	RT	LT	Air	Agent	T/C
---	---	mm	mm	mm	mm	mm	---	---	mm	mm	mm	Piece	Piece	EUR	kg	l	mm	mm	Pa	kPa	---
1	Roller	40.000	35.000	15.400	15.400	0.350	1	1	0.200	0.500	33.000	3	7	21914	1371	540	1260	2.6	247	307.42	28.10
2	BTN	37.500	32.476	13.100	13.100	0.350	1	1	0.200	1.200	30.476	4	9	20910	1289	420	1180	2.7	372	277.14	25.16
3		32.000	27.713	12.400	12.400	0.350	1	1	0.200	1.000	25.713	3	7								
4		30.000	25.981	12.400	12.400	0.350	1	1	0.200	1.000	23.981	3	7								
5	Roller	25.000	21.651	10.400	10.400	0.350	1	1	0.200	0.500	19.651	3	7	22057	1112	386	900	2.5	238	359.65	32.72
6	Roller	50.000	50.000	15.400	15.400	0.350	2	1	0.200	0.500	48.000	3	7	26324	1945	494	1860	2.6	219	278.84	25.36
7	Roller	35.000	35.000	12.400	12.400	0.350	2	1	0.200	0.500	33.000	3	7	23237	1450	426	1310	2.6	181	378.35	34.10
8		32.000	32.000	12.400	12.400	0.350	2	1	0.200	1.000	30.000	3	7								
9		30.000	30.000	12.400	12.400	0.350	2	1	0.200	1.000	28.000	3	7								
10		25.000	25.000	10.400	10.400	0.350	2	1	0.200	1.000	23.000	3	7								
11		40.000	34.641	16.400	16.400	0.350	1	2	0.200	2.600	40.000	4	10								
12		35.000	30.311	12.400	12.400	0.350	1	2	0.200	2.600	35.000	4	10								
13	TPS	33.333	28.867	12.400	12.400	0.350	1	2	0.200	2.600	33.333	4	10	18476	1121	344	920	2.5	174	328.72	28.44
14	DBM	30.000	25.981	12.450	12.450	0.350	1	2	0.200	2.600	30.000	4	10	17991	1037	356	800	2.5	180	332.20	30.39
15		25.000	21.651	10.400	10.400	0.350	1	2	0.200	2.600	25.000	4	10								
16		40.000	40.000	16.400	16.400	0.350	2	2	0.200	2.600	40.000	4	10								
17	WTS	35.000	35.000	13.100	13.100	0.350	2	2	0.200	2.600	35.000	4	10	21022	1349	396	1120	2.7	148	260.23	23.57
18		32.000	32.000	12.400	12.400	0.350	2	2	0.200	2.600	32.000	4	10								
19		30.000	30.000	12.400	12.400	0.350	2	2	0.200	2.600	30.000	4	10								
20		25.000	25.000	10.400	10.400	0.350	2	2	0.200	2.600	25.000	4	10								

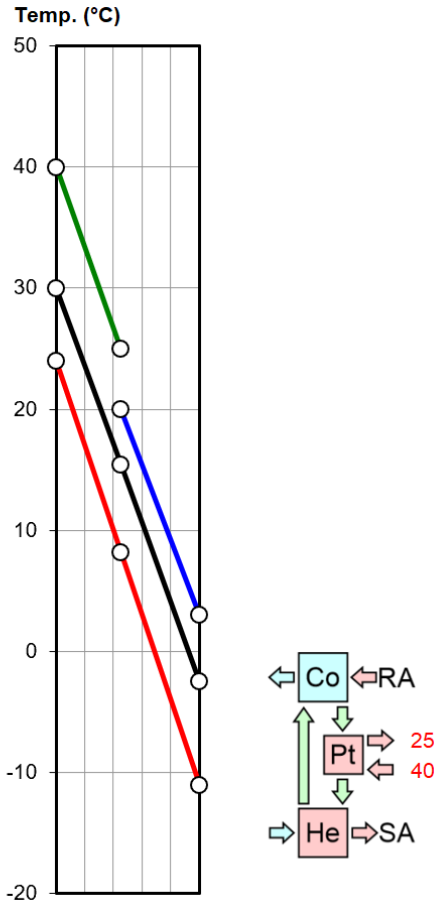


CC-System in winter		SAHe	Pt	RACo	Definition
Height over sea level	m				0.000
Pressure	hPa				1013.250
Capacity	%	100.000	45.154	54.846	
Capacity sensible	kW	292.453	132.055	137.210	
Capacity latent	kW	---	---	23.187	
Capacity frost	kW	---	---	0.000	
Capacity total	kW	292.453	132.055	160.398	
Surface reserve	%	2.683		2.081	
Present surface	m2	1060.384		986.205	

SAHe (ff = 0.00005 m2K/W)		Inlet	Outlet	Definition
Temp.	°C	-11.000	24.000	20.000
Rel. humidity	%	90.000	7.134	40.000
Abs. humidity	g/kg	1.306	1.306	5.784
Volume flow humid	m3/h	22196.994	25160.432	25000.000
Velocity	m/s	1.636	1.854	1.842
Pressure drop	Pa		91.695	

RACo (ff = 0.00005 m2K/W)		Inlet	Outlet	Definition
Temp.	°C	20.000	3.000	20.000
Rel. humidity	%	40.000	98.687	40.000
Abs. humidity	g/kg	5.784	4.635	5.784
Volume flow humid	m3/h	24000.000	22566.897	24000.000
Velocity	m/s	1.769	1.663	1.769
Pressure drop (dry 84 Pa)	Pa		88.803	

25 V% Et.glycol		SAHe	Pt	RACo
Temp. in	°C	30.000	15.472	-2.500
Temp. out	°C	-2.500	30.000	15.472
Volume flow	m3/h	8.386	8.412	8.343
Velocity	m/s	1.074		1.069
Reynolds	---	5878.873		4605.821
Pressure drop	kPa	162.237		169.961

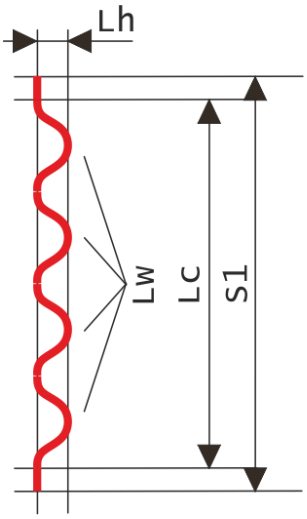


You can see from the table above, that the prices vary up to a factor of 1.463. Now you could argue, that 95% of all finned heat exchangers are purchased from the same supplier, therefore you get very high customer discounts and thus the argument of price is invalid, so to speak. On the other hand, the climate industry is already overjoyed, when a net profit of 5% is achieved at the end of the year. From this point of view, the very high customer discounts granted are highly problematic for manufacturers of finned heat exchangers.

It can be seen from the table above, that the installation depths in the air direction for the finned heat exchangers are different up to a factor of 2.325. In terms of price, it is not only the price of the finned heat exchangers that matters, but also the need for different air conditioner units lengths, or are they free of charge?

It can be seen from the table above, that the airside pressure drops vary by a factor of up to 2.548 and cause enormous operating costs, due to the fan drive power, which is mostly overlooked by technically inexperienced buyers. In this case, the total shitty one is the building owner, which is totally missing the ass of the suppliers of finned heat exchangers and air conditioners.

Last but not least, it should also be mentioned, that if you do not produce optimal heat exchangers and are therefore forced to resort to the help of extremely high customer discounts, this only offers short-term protection. In the medium term, this enormously important air conditioner customer could be lost because it switches to a supplier with optimal finned heat exchangers and will receive similarly high customer discounts there within a short period of time. Many a manufacturer of finned heat exchangers has had to experience this in the most bitter way. In hindsight, the costs for a new production line for optimal finned heat exchangers in the order of 750,000 Euros should have been invested years ago.



Wave fins in air direction — Example

S1 = Tube interval on the height	30.000	mm
Lc = Corrugated fin region	30.000	mm
Lh = Corrugated fin height	2.600	mm
Lw = Number of waves	4.000	--
Ln = Number of fin creases Ln=2(Lw+1)	10.000	--

$$f_x \approx 0.7636 \rightarrow F_e = (S_1 - L_c) + 2L_w \left(\frac{L_c(1-f_x)}{2L_w} + \sqrt{\left(\frac{L_c f_x}{2L_w}\right)^2 + {L_h}^2} \right)$$

Fe = Fins extended	38.034	mm
fflä = Fe/S1	1.268	--

Especially for heat recovery systems, finned heat exchangers with a large number of tube rows are required, whereby we recommend offset round tubes with a pitch of 30 x 25.981 x 12.4 mm. Oval tubes are not recommended for several reasons:

1. For pressure reasons, oval tubes cannot be used in all refrigeration technology for condensers and injection evaporators.

2. Oval tubes generate less turbulence than round tubes, thus have smaller k-values and therefore require significantly more heat exchange surface. The argument of even less airside pressure drop is marginal.

3. The production of finned heat exchangers with oval tubes is far too costly and time-consuming and never pays off. Only absolute weirdos from outside the industry get lost on this hopeless path.