Aggressive exhaust air

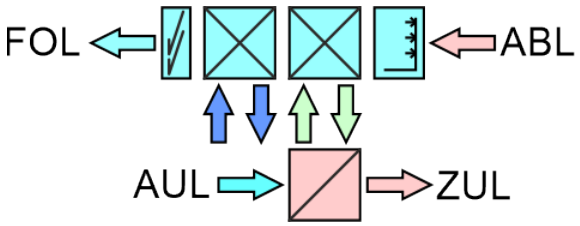
For example, you have 30,000 m3/h of highly aggressive exhaust air of 20°C/40% all year-round and you have to cool it down to such an extent, that the pollutants can be recovered as condensate.

On the other hand, 30,000 m3/h of supply air is required all year-round. Upstream energy recovery is an obvious choice. A downstream cooler is then required, which separates the remaining pollutants as condensate. How far it has to be cooled down depends on the partial pressure of these mostly watery pollutants.

Now the question of suitable heat exchangers in this highly aggressive exhaust air automatically arises.

For example, there are plastic heat exchangers with smooth tubes, which are far too expensive due to the miserable heat transfer rates.

Which brings us to fin coil heat exchangers with a suitable immersion bath coating of www.heresite.com.



Connoisseurs of the air conditioning industry know from experience, what such a year-round energy recovery system in the circular network costs in terms of investment and operation and how quickly it is amortized, always provided, that the exhaust air is not aggressive. It is sufficient, if the heat exchangers consist of copper tubes, aluminum fins and stainless steel frames. However, if there is highly aggressive exhaust air, the heat exchanger can be made of the same materials, but must be coated with Heresite in the immersion bath, which also requires a fin pitch of 4 mm. However, anyone who thinks, that the exhaust air has to be carried out with polypropylene smooth tubes has a price problem. A comparison is offered below.

Designation		**Exhaust Cu/Al**	**Exhaust Heresite**	**Exhaust Poly.-Prop.**
Winter: Temperature Efficiency	%	72.35	72.35	72.35
Winter: Heat recovery	kW	210.64	210.64	210.64
Winter: Pressure loss outside air	Pa	86.00	126.00	160.00
Winter: Pressure loss exhaust air	Pa	103.00	107.00	144.00
Winter: Pressure loss intermediate beam	bar	6.00	6.00	6.00
Recovery: Heat per year	MWh	408.00	408.00	408.00
Recovery: Cooling per year	MWh	34.00	34.00	34.00
Amortization: Energy recovery	years	3.18	4.33	10.54
Investment: 2 heat exchangers	EUR	20'760.00	41'300.00	142'000.00
Investment: Hydraulics & Controller	EUR	20,000.00	20,000.00	20,000.00
Investment: Total energy recovery	EUR	40'760.00	61'300.00	162'000.00

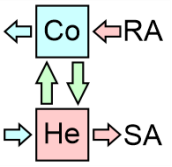
If you want to know more, take a look at the following pages:
Pages 2 to 5 on exhaust air in Cu/Al with fins 2.5 mm / 2.5 mm
Pages 6 to 9 of Exhaust Air in Heresite with Slats 2.5 mm / 4.00 mm
Pages 10 to 13 on exhaust air in polypropylene plain pipes

CC-System in winter		SAHe	RACo	Definition
Height over sea level	m			540.000
Pressure	hPa			949.653
Efficiency	%	72.350	58.725	
Capacity sensible	kW	210.639	172.012	
Capacity latent	kW	0.000	37.563	
Capacity frost	kW	---	1.063	
Capacity total	kW	210.639	210.638	
Surface reserve	%	0.413	0.240	
Present surface	m²	1305.858	1305.858	

SAHe		Inlet	Outlet	Definition
Temp.	°C	-11.000	11.428	20.000
Rel. humidity	%	90.000	15.728	40.000
Abs. humidity	g/kg	1.394	1.394	6.174
Volume flow humid	m³/h	26623.555	28901.272	30000.000
Velocity	m/s	1.750	1.900	1.972
Pressure drop	Pa		85.995	

RACo		Inlet	Outlet	Definition
Temp.	°C	20.000	1.795	20.000
Rel. humidity	%	40.000	99.666	40.000
Abs. humidity	g/kg	6.174	4.584	6.174
Volume flow humid	m³/h	30000.000	28065.843	30000.000
Velocity	m/s	1.972	1.845	1.972
Pressure drop	Pa		102.752	

25 V% Et.glycol			SAHe	RACo
Temp.	in	°C	14.000	-3.260
Temp.	out	°C	-3.260	14.000
Volume flow		m³/h	11.413	11.417
Velocity		m/s	1.229	1.229
Reynolds		---	5101.873	4970.848
Pressure drop		kPa	187.236	188.448



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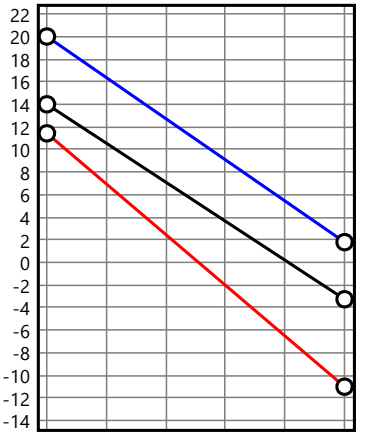
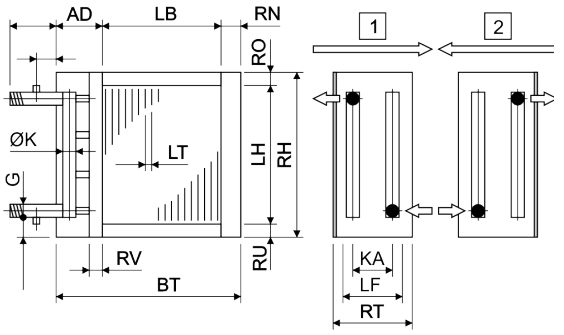
Object
Position

Temperature (°C)



Technical data			SAHe	RACo			
Tubes total		Piece	768	768	Tubes:	Cu	Cu
Tubes blank		Piece	0	0	Tubes:	smooth	smooth
Int. vent./drains		Piece	5	5	Tubes:	staggered	staggered
Tube rows on the depth		Piece	12	12	Tubes:	circular	circular
Tube rows on the height		Piece	64	64	Collectors:	Cu	Cu
Tube coupling in series		Piece	32	32	Collectors:	0.78 m/s	0.78 m/s
Number of circuits (NC)		Piece	24	24	Connections:	Rg7	Rg7
Volume		l	191	191	Connections:	0.78 m/s	0.78 m/s
Weight		kg	623	623	Fins:	Al	Al
Connections	G	---	2 ½"	2 ½"	Fins:	Wave structure	Wave structure
Frame height	RH	mm	2200	2200	Frame:	AISI304	AISI304
Frame width	BT	mm	2200	2200	Frame:	2.00 m/s	2.00 mm
Frame depth	RT	mm	470	470	Protection:	without	without
Finned height	LH	mm	2133	2133	Protection:	---	---
Finned width	LB	mm	1981	1981			
Finned depth	LF	mm	346	346			
Frame on top	RO	mm	33	33			
Frame on bottom	RU	mm	34	34			
Frame in front	RV	mm	30	30			
Frame on back	RN	mm	53	53			
Collector-Diameter	K	mm	76	76			
Collector covering	AD	mm	166	166			
Collector distance	KA	mm	369	369			
Fin spacing	LT	mm	2.500	2.500			
Fin thickness	LD	mm	0.200	0.200			
Tube diameter	DA	mm	12.400	12.400			
Tube diameter	da	mm	12.400	12.400			
Tube thickness	S	mm	0.350	0.350			
Tube interval on the height	S1	mm	33.333	33.333			
Tube interval on the width	S2	mm	28.867	28.867			



SAHe: 33/29/12-12R-64T-1981A-2.5PA-24C-Cu/Al/AISI304 **SAHe:** **EUR** **10380.00**

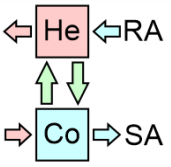
RACo: 33/29/12-12R-64T-1981A-2.5PA-24C-Cu/Al/AISI304 **RACo:** **EUR** **10380.00**

CC-System in summer		RAHe	SACo	Definition
Height over sea level	m			540.000
Pressure	hPa			949.653
Efficiency	%	70.184	69.976	
Capacity sensible	kW	81.224	81.224	
Capacity latent	kW	0.000	0.000	
Capacity frost	kW	---	0.000	
Capacity total	kW	81.224	81.224	
Surface reserve	%	0.002	0.600	
Present surface	m²	1305.858	1305.858	

RAHe		Inlet	Outlet	Definition
Temp.	°C	20.000	28.422	20.000
Rel. humidity	%	100.000	60.420	40.000
Abs. humidity	g/kg	15.667	15.667	6.174
Volume flow humid	m³/h	30453.340	31328.216	30000.000
Velocity	m/s	2.002	2.059	1.972
Pressure drop	Pa		99.264	

SACo		Inlet	Outlet	Definition
Temp.	°C	32.000	23.603	20.000
Rel. humidity	%	54.000	88.056	40.000
Abs. humidity	g/kg	17.224	17.224	6.174
Volume flow humid	m³/h	31777.262	30902.842	30000.000
Velocity	m/s	2.089	2.031	1.972
Pressure drop	Pa		101.208	

25 V% Et.glycol			RAHe	SACo
Temp.	in	°C	29.260	22.655
Temp.	out	°C	22.655	29.260
Volume flow		m³/h	11.413	11.415
Velocity		m/s	1.229	1.229
Reynolds		---	9251.342	9125.856
Pressure drop		kPa	163.961	164.522



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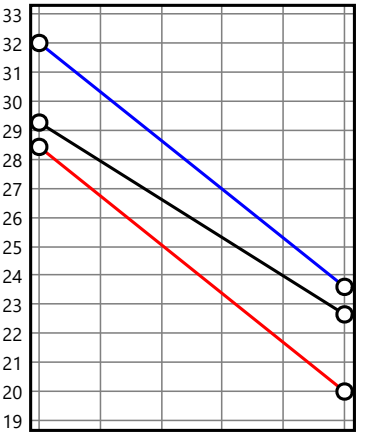
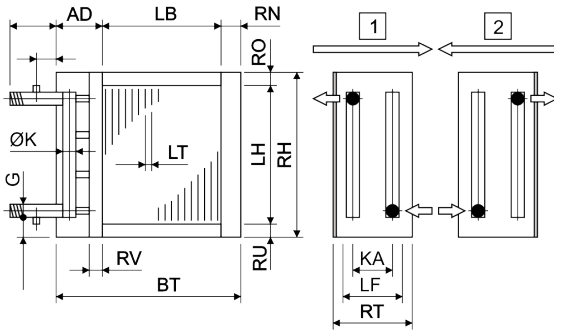
Temperature (°C)



Technical data			SAHe	RACo			
Tubes total		Piece	768	768	Tubes:	Cu	Cu
Tubes blank		Piece	0	0	Tubes:	smooth	smooth
Int. vent./drains		Piece	5	5	Tubes:	staggered	staggered
Tube rows on the depth		Piece	12	12	Tubes:	circular	circular
Tube rows on the height		Piece	64	64	Collectors:	Cu	Cu
Tube coupling in series		Piece	32	32	Collectors:	0.78 m/s	0.78 m/s
Number of circuits (NC)		Piece	24	24	Connections:	Rg7	Rg7
Volume		l	191	191	Connections:	0.78 m/s	0.78 m/s
Weight		kg	623	623	Fins:	Al	Al
Connections	G	---	2 ½"	2 ½"	Fins:	Wave structure	Wave structure
Frame height	RH	mm	2200	2200	Frame:	AISI304	AISI304
Frame width	BT	mm	2200	2200	Frame:	2.00 m/s	2.00 mm
Frame depth	RT	mm	470	470	Protection:	without	without
Finned height	LH	mm	2133	2133	Protection:	---	---
Finned width	LB	mm	1981	1981			
Finned depth	LF	mm	346	346			
Frame on top	RO	mm	33	33			
Frame on bottom	RU	mm	34	34			
Frame in front	RV	mm	30	30			
Frame on back	RN	mm	53	53			
Collector-Diameter	K	mm	76	76			
Collector covering	AD	mm	166	166			
Collector distance	KA	mm	369	369			
Fin spacing	LT	mm	2.500	2.500			
Fin thickness	LD	mm	0.200	0.200			
Tube diameter	DA	mm	12.400	12.400			
Tube diameter	da	mm	12.400	12.400			
Tube thickness	S	mm	0.350	0.350			
Tube interval on the height	S1	mm	33.333	33.333			
Tube interval on the width	S2	mm	28.867	28.867			



RAHe: 33/29/12-12R-64T-1981A-2.5PA-24C-Cu/Al/AISI304 **RAHe:** **EUR** **10380.00**

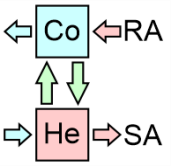
SACo: 33/29/12-12R-64T-1981A-2.5PA-24C-Cu/Al/AISI304 **SACo:** **EUR** **10380.00**

CC-System - (DIN EN 308)		SAHe308	RACo308	Definition
Height over sea level	m			540.000
Pressure	hPa			949.653
Efficiency	%	69.142	69.128	
Capacity sensible	kW	129.579	129.580	
Capacity latent	kW	0.000	0.000	
Capacity frost	kW	---	0.000	
Capacity total	kW	129.579	129.580	
Surface reserve	%	0.000	0.489	
Present surface	m²	1305.858	1305.858	

SAHe		Inlet	Outlet	Definition
Temp.	°C	5.000	18.828	20.000
Rel. humidity	%	0.000	0.000	40.000
Abs. humidity	g/kg	0.000	0.000	6.174
Volume flow humid	m³/h	28185.284	29586.493	30000.000
Velocity	m/s	1.853	1.945	1.972
Pressure drop	Pa		90.706	

RACo		Inlet	Outlet	Definition
Temp.	°C	25.000	11.174	20.000
Rel. humidity	%	0.000	0.000	40.000
Abs. humidity	g/kg	0.000	0.000	6.174
Volume flow humid	m³/h	30211.836	28810.924	30000.000
Velocity	m/s	1.986	1.894	1.972
Pressure drop	Pa		93.356	

25 V% Et.glycol			SAHe308	RACo308
Temp.	in	°C	20.192	9.648
Temp.	out	°C	9.648	20.192
Volume flow		m³/h	11.448	11.452
Velocity		m/s	1.232	1.233
Reynolds		---	6959.807	6771.040
Pressure drop		kPa	175.801	177.012



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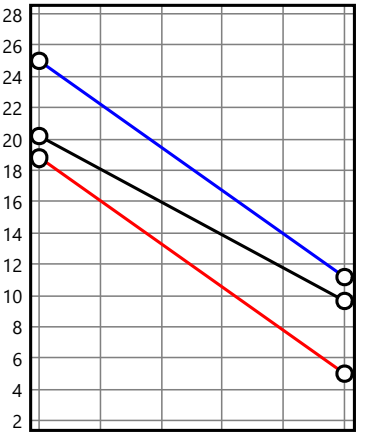
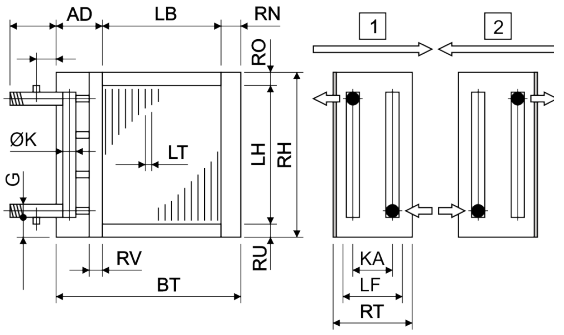
Temperature (°C)



Technical data			SAHe	RACo			
Tubes total		Piece	768	768	Tubes:	Cu	Cu
Tubes blank		Piece	0	0	Tubes:	smooth	smooth
Int. vent./drains		Piece	5	5	Tubes:	staggered	staggered
Tube rows on the depth		Piece	12	12	Tubes:	circular	circular
Tube rows on the height		Piece	64	64	Collectors:	Cu	Cu
Tube coupling in series		Piece	32	32	Collectors:	0.78 m/s	0.78 m/s
Number of circuits (NC)		Piece	24	24	Connections:	Rg7	Rg7
Volume		l	191	191	Connections:	0.78 m/s	0.78 m/s
Weight		kg	623	623	Fins:	Al	Al
Connections	G	---	2 ½"	2 ½"	Fins:	Wave structure	Wave structure
Frame height	RH	mm	2200	2200	Frame:	AISI304	AISI304
Frame width	BT	mm	2200	2200	Frame:	2.00 m/s	2.00 mm
Frame depth	RT	mm	470	470	Protection:	without	without
Finned height	LH	mm	2133	2133	Protection:	---	---
Finned width	LB	mm	1981	1981			
Finned depth	LF	mm	346	346			
Frame on top	RO	mm	33	33			
Frame on bottom	RU	mm	34	34			
Frame in front	RV	mm	30	30			
Frame on back	RN	mm	53	53			
Collector-Diameter	K	mm	76	76			
Collector covering	AD	mm	166	166			
Collector distance	KA	mm	369	369			
Fin spacing	LT	mm	2.500	2.500			
Fin thickness	LD	mm	0.200	0.200			
Tube diameter	DA	mm	12.400	12.400			
Tube diameter	da	mm	12.400	12.400			
Tube thickness	S	mm	0.350	0.350			
Tube interval on the height	S1	mm	33.333	33.333			
Tube interval on the width	S2	mm	28.867	28.867			



SAHe308: 33/29/12-12R-64T-1981A-2.5PA-24C-Cu/Al/AISI304 **SAHe308: EUR 10380.00**

RACo308: 33/29/12-12R-64T-1981A-2.5PA-24C-Cu/Al/AISI304 **RACo308: EUR 10380.00**

Energy recovery / Year (Service at 100% Air flow = 5667 Hours)

No	Outside air °C	Outside air %	CCSB °C	CCSB %	Return air °C	Return air %	Exhaust air °C	Exhaust air %	Efficiency %	Capacity kW	Energy MWh
1	-8.7	84.0	12.5	16.9	21.1	34.5	3.0	92.3	71.0	198.4	28.1
2	-3.3	78.4	13.8	23.0	21.2	35.0	5.6	87.1	69.8	160.9	22.8
3	-1.4	79.2	14.4	26.3	21.3	35.4	6.6	85.3	69.4	148.6	21.1
4	-0.2	78.5	14.8	28.1	21.4	35.9	7.3	84.2	69.3	141.2	20.0
5	0.8	76.3	15.1	28.9	21.5	36.3	7.9	83.2	69.1	134.8	19.1
6	1.6	79.2	15.4	31.2	21.6	36.7	8.4	82.6	69.0	130.1	18.4
7	2.4	77.1	15.7	31.4	21.7	37.2	8.9	82.0	69.0	125.7	17.8
8	3.0	77.3	16.0	32.4	21.8	37.6	9.3	81.6	68.9	122.2	17.3
9	3.6	76.2	16.2	32.8	21.9	38.1	9.7	81.2	68.9	119.0	16.9
10	4.2	75.3	16.5	33.2	22.0	38.5	10.1	81.0	68.8	116.1	16.5
11	4.7	75.9	16.7	34.2	22.2	39.0	10.5	80.7	68.8	113.2	16.0
12	5.3	73.8	17.0	34.1	22.3	39.4	10.8	80.4	68.8	110.3	15.6
13	5.9	75.2	17.2	35.6	22.4	39.9	11.3	79.8	68.7	106.9	15.2
14	6.5	72.4	17.5	35.2	22.5	40.3	11.7	79.2	68.7	103.5	14.7
15	7.1	73.7	17.7	36.7	22.6	40.7	12.1	78.8	68.6	100.5	14.2
16	7.7	72.1	18.0	36.8	22.7	41.2	12.5	78.2	68.6	97.5	13.8
17	8.3	73.0	18.2	38.3	22.8	41.6	12.9	77.3	68.6	93.9	13.3
18	9.0	73.9	18.5	39.8	22.9	42.1	13.4	76.3	68.6	90.3	12.8
19	9.6	73.3	18.8	40.5	23.0	42.5	13.9	75.2	68.6	86.8	12.3
20	10.3	71.7	19.1	40.7	23.1	43.0	14.3	74.3	68.6	83.5	11.8
21	10.9	72.5	19.3	42.1	23.2	43.4	14.8	73.4	68.6	80.2	11.4
22	11.5	68.9	19.6	41.1	23.3	43.9	15.3	72.3	68.6	76.1	10.8
23	12.3	68.7	19.4	42.2	23.4	44.3	15.8	71.0	68.6	67.7	9.6
24	13.1	69.7	19.3	44.2	23.5	44.7	16.4	69.7	68.6	59.1	8.4
25	13.7	67.7	19.1	44.0	23.6	45.2	16.9	68.7	68.6	51.5	7.3
26	14.3	69.5	19.0	46.2	23.8	45.6	17.3	68.0	68.6	44.7	6.3
27	14.9	71.2	18.9	48.5	23.9	46.1	17.7	67.1	68.5	37.3	5.3
28	15.5	71.6	18.7	49.8	24.0	46.5	18.2	66.3	68.5	30.5	4.3
29	16.1	71.0	18.6	50.5	24.1	47.0	18.6	65.5	68.5	23.3	3.3
30	16.7	67.3	18.4	49.0	24.2	47.4	19.1	64.7	68.6	16.1	2.3
31	17.4	64.6	18.3	48.2	24.3	47.9	19.5	63.9	68.6	8.8	1.2
32	18.0	64.9	18.1	49.5	24.4	48.3	20.0	63.0	68.6	1.4	0.2
33	18.6	63.9	17.6	68.3	17.1	100.0	18.2	93.6	68.7	10.1	1.4
34	19.3	64.2	17.9	70.1	17.3	100.0	18.7	91.6	68.7	13.9	2.0
35	20.1	64.5	18.3	72.4	17.4	100.0	19.3	89.1	68.6	17.7	2.5
36	21.0	60.2	18.7	69.6	17.6	100.0	19.9	86.4	68.7	22.6	3.2
37	22.0	62.1	19.1	74.4	17.7	100.0	20.7	83.4	68.6	28.0	4.0
38	23.2	60.1	19.6	75.0	17.9	100.0	21.5	79.9	68.6	34.8	4.9
39	24.8	56.4	20.2	74.6	18.1	100.0	22.7	75.4	68.6	44.2	6.3
40	28.3	50.1	21.4	75.5	18.2	100.0	25.1	65.6	68.6	66.4	9.4

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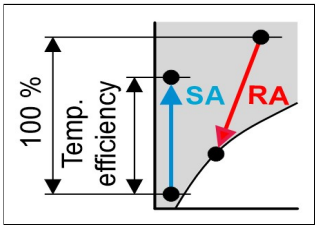
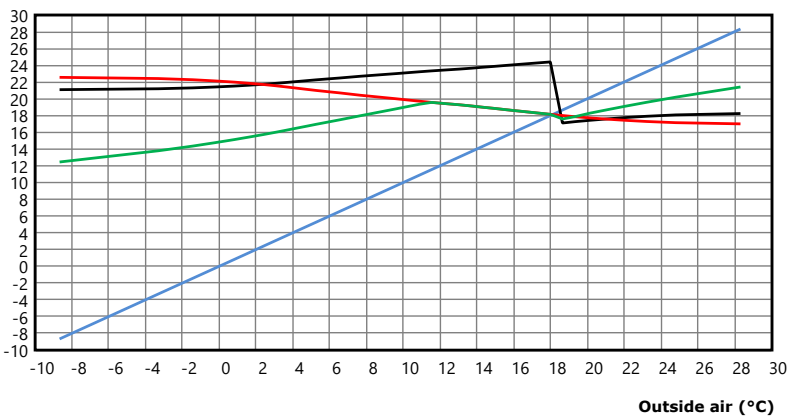
Object
Position



Air (%)	Service (h/a)
100.00	4000
66.67	2000
33.33	1000
▼	▼
100.00	5667

EU: Energy recovery: Heat energy	MWh	408.04	EUR	24482.00	(60.00 EUR/MWh)
EU: Energy recovery: Cold energy	MWh	33.68	EUR	2695.00	(80.00 EUR/MWh)
EU: 2 Fan: Glycol pump	MWh	-25.66	EUR	-2566.00	(100.00 EUR/MWh)
EU: Energy recovery: Net useful ratio / Year	MWh	416.06	EUR	24611.00	(59.15 EUR/MWh)
EU: Need of energy total / Year	MWh	740.87	EUR	51652.32	(69.72 EUR/MWh)
EU: Net useful ratio / Year	%	56.16	%	47.65	TWG = 72.35%
CH: Guidelines from associations such as SIA and SWKI: TWG>70.00% & JNG>75.00% & ETV>15.00					JNG = 71.41%
					ETV = 19.87

Outside air (°C) **Return air (°C)** **Supply air (°C)** **Energy recovery (°C)**



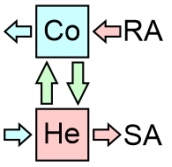
Station		Bern
Height over sea level	m	540.00
Pressure	hPa	949.65
Outside air	m³/h	30000.00
Return air	m³/h	30000.00
Adiabatic return air cooling	h/a	1133.33
Service at 100% Air flow	h/a	5666.67
Capital interest	%	1.00
Energy increase	%	1.00
Inflation	%	1.00
Support costs	%	5.00
Costs without CC-system	EUR	86000.00
Costs with CC-system	EUR	153000.00
Additional costs	EUR	67000.00
BEP (Break even point) after	**Years**	**3.18**

CC-System in winter		SAHe	RACo	Definition
Height over sea level	m			540.000
Pressure	hPa			949.653
Efficiency	%	72.350	57.869	
Capacity sensible	kW	210.639	169.494	
Capacity latent	kW	0.000	38.521	
Capacity frost	kW	---	2.624	
Capacity total	kW	210.639	210.639	
Surface reserve	%	10.886	9.498	
Present surface	m²	1981.529	1130.827	

SAHe		Inlet	Outlet	Definition
Temp.	°C	-11.000	11.428	20.000
Rel. humidity	%	90.000	15.728	40.000
Abs. humidity	g/kg	1.394	1.394	6.174
Volume flow humid	m³/h	26623.555	28901.272	30000.000
Velocity	m/s	1.730	1.878	1.949
Pressure drop	Pa		126.297	

RACo		Inlet	Outlet	Definition
Temp.	°C	20.000	2.061	20.000
Rel. humidity	%	40.000	96.942	40.000
Abs. humidity	g/kg	6.174	4.543	6.174
Volume flow humid	m³/h	30000.000	28091.101	30000.000
Velocity	m/s	1.949	1.825	1.949
Pressure drop	Pa		106.685	

25 V% Et.glycol			SAHe	RACo
Temp.	in	°C	15.000	-7.000
Temp.	out	°C	-7.000	15.000
Volume flow		m³/h	8.958	8.958
Velocity		m/s	0.964	1.006
Reynolds		---	3893.394	4039.748
Pressure drop		kPa	190.796	188.759



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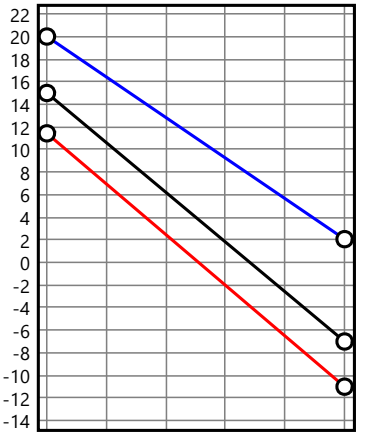
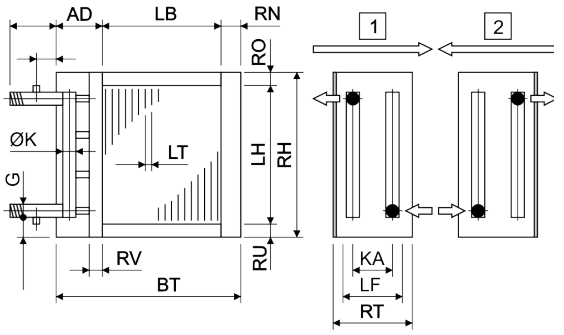
Representative

Plant
Object
Position

Temperature (°C)



Technical data			SAHe	RACo			
Tubes total		Piece	1152	1024	Tubes:	Cu	Cu
Tubes blank		Piece	0	12	Tubes:	smooth	smooth
Int. vent./drains		Piece	8	7	Tubes:	staggered	staggered
Tube rows on the depth		Piece	18	16	Tubes:	circular	circular
Tube rows on the height		Piece	64	64	Collectors:	Cu	Cu
Tube coupling in series		Piece	48	44	Collectors:	1.22 m/s	1.22 m/s
Number of circuits (NC)		Piece	24	23	Connections:	Rg7	Rg7
Volume		l	271	242	Connections:	1.22 m/s	1.22 m/s
Weight		kg	900	723	Fins:	Al	Al
Connections	G	---	2"	2"	Fins:	Wave structure	Wave structure
Frame height	RH	mm	2200	2200	Frame:	AISI304	AISI304
Frame width	BT	mm	2200	2200	Frame:	2.00 m/s	2.00 mm
Frame depth	RT	mm	600	540	Protection:	without	dip coated
Finned height	LH	mm	2133	2133	Protection:	---	76 µ Heresite
Finned width	LB	mm	2004	2004			
Finned depth	LF	mm	520	462			
Frame on top	RO	mm	33	33			
Frame on bottom	RU	mm	34	34			
Frame in front	RV	mm	30	30			
Frame on back	RN	mm	53	53			
Collector-Diameter	K	mm	54	54			
Collector covering	AD	mm	143	143			
Collector distance	KA	mm	520	462			
Fin spacing	LT	mm	2.500	4.000			
Fin thickness	LD	mm	0.200	0.200			
Tube diameter	DA	mm	12.400	12.400			
Tube diameter	da	mm	12.400	12.400			
Tube thickness	S	mm	0.350	0.350			
Tube interval on the height	S1	mm	33.333	33.333			
Tube interval on the width	S2	mm	28.867	28.867			



SAHe: 33/29/12-18R-64T-2004A-2.5PA-24C-Cu/Al/AISI304 **SAHe:** **EUR** **15027.00**

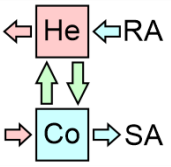
RACo: 33/29/12-16R-64T-2004A-4.0PA-23C-Cu/Al/AISI304 **RACo:** **EUR** **26273.00**

CC-System in summer		RAHe	SACo	Definition
Height over sea level	m			540.000
Pressure	hPa			949.653
Efficiency	%	72.953	72.739	
Capacity sensible	kW	84.430	84.431	
Capacity latent	kW	0.000	0.000	
Capacity frost	kW	---	0.000	
Capacity total	kW	84.430	84.431	
Surface reserve	%	0.005	0.425	
Present surface	m²	1130.827	1981.529	

RAHe		Inlet	Outlet	Definition
Temp.	°C	20.000	28.754	20.000
Rel. humidity	%	100.000	59.269	40.000
Abs. humidity	g/kg	15.667	15.667	6.174
Volume flow humid	m³/h	30453.340	31362.740	30000.000
Velocity	m/s	1.979	2.038	1.949
Pressure drop	Pa		105.648	

SACo		Inlet	Outlet	Definition
Temp.	°C	32.000	23.271	20.000
Rel. humidity	%	54.000	89.830	40.000
Abs. humidity	g/kg	17.224	17.224	6.174
Volume flow humid	m³/h	31777.262	30868.314	30000.000
Velocity	m/s	2.065	2.006	1.949
Pressure drop	Pa		148.557	

25 V% Et.glycol			RAHe	SACo
Temp.	in	°C	30.748	22.002
Temp.	out	°C	22.002	30.748
Volume flow		m³/h	8.958	8.958
Velocity		m/s	1.006	0.964
Reynolds		---	7652.887	7335.836
Pressure drop		kPa	162.850	164.570



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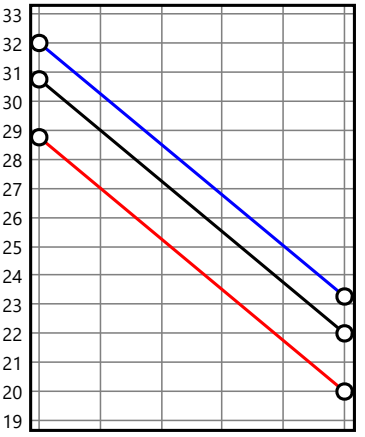
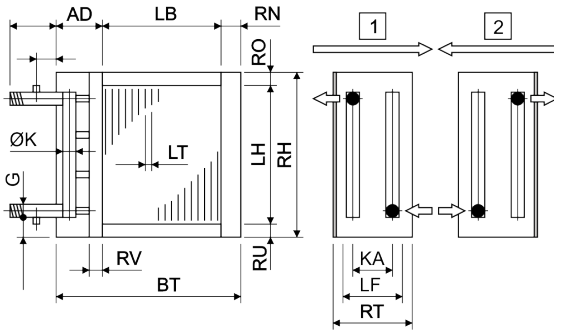
Representative

Plant
Object
Position

Temperature (°C)



Technical data			SAHe	RACo			
Tubes total		Piece	1024	1152	Tubes:	Cu	Cu
Tubes blank		Piece	12	0	Tubes:	smooth	smooth
Int. vent./drains		Piece	7	8	Tubes:	staggered	staggered
Tube rows on the depth		Piece	16	18	Tubes:	circular	circular
Tube rows on the height		Piece	64	64	Collectors:	Cu	Cu
Tube coupling in series		Piece	44	48	Collectors:	1.22 m/s	1.22 m/s
Number of circuits (NC)		Piece	23	24	Connections:	Rg7	Rg7
Volume		l	242	271	Connections:	1.22 m/s	1.22 m/s
Weight		kg	723	900	Fins:	Al	Al
Connections	G	---	2"	2"	Fins:	Wave structure	Wave structure
Frame height	RH	mm	2200	2200	Frame:	AISI304	AISI304
Frame width	BT	mm	2200	2200	Frame:	2.00 m/s	2.00 mm
Frame depth	RT	mm	540	600	Protection:	dip coated	without
Finned height	LH	mm	2133	2133	Protection:	76 µ Heresite	---
Finned width	LB	mm	2004	2004			
Finned depth	LF	mm	462	520			
Frame on top	RO	mm	33	33			
Frame on bottom	RU	mm	34	34			
Frame in front	RV	mm	30	30			
Frame on back	RN	mm	53	53			
Collector-Diameter	K	mm	54	54			
Collector covering	AD	mm	143	143			
Collector distance	KA	mm	462	520			
Fin spacing	LT	mm	4.000	2.500			
Fin thickness	LD	mm	0.200	0.200			
Tube diameter	DA	mm	12.400	12.400			
Tube diameter	da	mm	12.400	12.400			
Tube thickness	S	mm	0.350	0.350			
Tube interval on the height	S1	mm	33.333	33.333			
Tube interval on the width	S2	mm	28.867	28.867			



RAHe: 33/29/12-16R-64T-2004A-4.0PA-23C-Cu/Al/AISI304 **RAHe: EUR 26273.00**

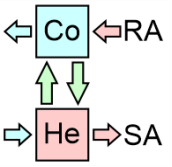
SACo: 33/29/12-18R-64T-2004A-2.5PA-24C-Cu/Al/AISI304 **SACo: EUR 15027.00**

CC-System - (DIN EN 308)		SAHe308	RACo308	Definition
Height over sea level	m			540.000
Pressure	hPa			949.653
Efficiency	%	72.243	72.229	
Capacity sensible	kW	135.391	135.392	
Capacity latent	kW	0.000	0.000	
Capacity frost	kW	---	0.000	
Capacity total	kW	135.391	135.392	
Surface reserve	%	0.003	0.034	
Present surface	m²	1981.529	1130.827	

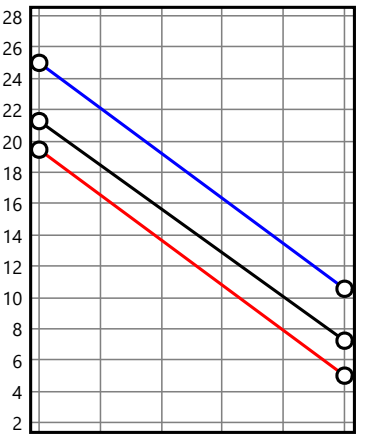
SAHe		Inlet	Outlet	Definition
Temp.	°C	5.000	19.449	20.000
Rel. humidity	%	0.000	0.000	40.000
Abs. humidity	g/kg	0.000	0.000	6.174
Volume flow humid	m³/h	28185.284	29649.326	30000.000
Velocity	m/s	1.831	1.926	1.949
Pressure drop	Pa		133.426	

RACo		Inlet	Outlet	Definition
Temp.	°C	25.000	10.554	20.000
Rel. humidity	%	0.000	0.000	40.000
Abs. humidity	g/kg	0.000	0.000	6.174
Volume flow humid	m³/h	30211.836	28748.073	30000.000
Velocity	m/s	1.963	1.868	1.949
Pressure drop	Pa		99.194	

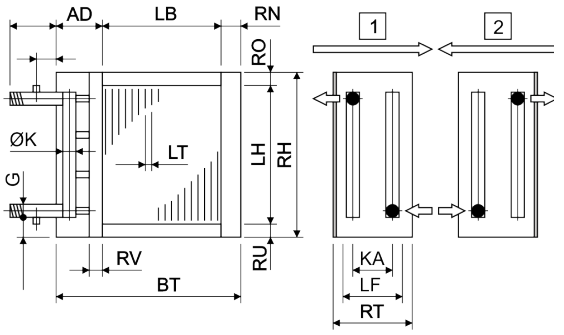
25 V% Et.glycol			SAHe308	RACo308
Temp.	in	°C	21.275	7.235
Temp.	out	°C	7.235	21.275
Volume flow		m³/h	8.985	8.985
Velocity		m/s	0.967	1.009
Reynolds		---	5360.458	5572.565
Pressure drop		kPa	177.555	175.834



Temperature (°C)



Technical data			SAHe	RACo			
Tubes total		Piece	1152	1024	Tubes:	Cu	Cu
Tubes blank		Piece	0	12	Tubes:	smooth	smooth
Int. vent./drains		Piece	8	7	Tubes:	staggered	staggered
Tube rows on the depth		Piece	18	16	Tubes:	circular	circular
Tube rows on the height		Piece	64	64	Collectors:	Cu	Cu
Tube coupling in series		Piece	48	44	Collectors:	1.22 m/s	1.22 m/s
Number of circuits (NC)		Piece	24	23	Connections:	Rg7	Rg7
Volume		l	271	242	Connections:	1.22 m/s	1.22 m/s
Weight		kg	900	723	Fins:	Al	Al
Connections	G	---	2"	2"	Fins:	Wave structure	Wave structure
Frame height	RH	mm	2200	2200	Frame:	AISI304	AISI304
Frame width	BT	mm	2200	2200	Frame:	2.00 m/s	2.00 mm
Frame depth	RT	mm	600	540	Protection:	without	dip coated
Finned height	LH	mm	2133	2133	Protection:	---	76 µ Heresite
Finned width	LB	mm	2004	2004			
Finned depth	LF	mm	520	462			
Frame on top	RO	mm	33	33			
Frame on bottom	RU	mm	34	34			
Frame in front	RV	mm	30	30			
Frame on back	RN	mm	53	53			
Collector-Diameter	K	mm	54	54			
Collector covering	AD	mm	143	143			
Collector distance	KA	mm	520	462			
Fin spacing	LT	mm	2.500	4.000			
Fin thickness	LD	mm	0.200	0.200			
Tube diameter	DA	mm	12.400	12.400			
Tube diameter	da	mm	12.400	12.400			
Tube thickness	S	mm	0.350	0.350			
Tube interval on the height	S1	mm	33.333	33.333			
Tube interval on the width	S2	mm	28.867	28.867			



SAHe308: 33/29/12-18R-64T-2004A-2.5PA-24C-Cu/Al/AISI304 — **SAHe308: EUR 15027.00**

RACo308: 33/29/12-16R-64T-2004A-4.0PA-23C-Cu/Al/AISI304 — **RACo308: EUR 26273.00**

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Plant
Object
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Energy recovery / Year (Service at 100% Air flow = 5667 Hours)

No	Outside air °C	Outside air %	CCSB °C	CCSB %	Return air °C	Return air %	Exhaust air °C	Exhaust air %	Efficiency %	Capacity kW	Energy MWh
1	-8.7	84.0	12.4	16.9	21.1	34.5	3.0	92.2	70.9	198.1	28.1
2	-3.3	78.4	13.8	23.1	21.2	35.0	5.6	87.0	69.7	160.6	22.8
3	-1.4	79.2	14.3	26.4	21.3	35.4	6.6	85.3	69.3	148.4	21.0
4	-0.2	78.5	14.7	28.1	21.4	35.9	7.3	84.1	69.1	140.9	20.0
5	0.8	76.3	15.1	29.0	21.5	36.3	8.0	83.2	69.0	134.6	19.1
6	1.6	79.2	15.4	31.2	21.6	36.7	8.5	82.5	68.9	129.8	18.4
7	2.4	77.1	15.7	31.5	21.7	37.2	8.9	81.9	68.8	125.5	17.8
8	3.0	77.3	16.0	32.5	21.8	37.6	9.4	81.5	68.8	122.0	17.3
9	3.6	76.2	16.2	32.8	21.9	38.1	9.8	81.2	68.7	118.8	16.8
10	4.2	75.3	16.5	33.2	22.0	38.5	10.1	80.9	68.7	115.9	16.4
11	4.7	75.9	16.7	34.3	22.2	39.0	10.5	80.7	68.7	113.0	16.0
12	5.3	73.8	16.9	34.1	22.3	39.4	10.9	80.3	68.6	110.1	15.6
13	5.9	75.2	17.2	35.7	22.4	39.9	11.3	79.8	68.6	106.8	15.1
14	6.5	72.4	17.5	35.3	22.5	40.3	11.7	79.2	68.6	103.3	14.6
15	7.1	73.7	17.7	36.8	22.6	40.7	12.1	78.7	68.5	100.3	14.2
16	7.7	72.1	18.0	36.8	22.7	41.2	12.5	78.1	68.5	97.3	13.8
17	8.3	73.0	18.2	38.3	22.8	41.6	12.9	77.3	68.5	93.7	13.3
18	9.0	73.9	18.5	39.9	22.9	42.1	13.4	76.3	68.5	90.2	12.8
19	9.6	73.3	18.8	40.6	23.0	42.5	13.9	75.2	68.5	86.6	12.3
20	10.3	71.7	19.1	40.7	23.1	43.0	14.3	74.3	68.5	83.4	11.8
21	10.9	72.5	19.3	42.2	23.2	43.4	14.8	73.3	68.5	80.1	11.3
22	11.5	68.9	19.6	41.1	23.3	43.9	15.3	72.3	68.5	76.1	10.8
23	12.3	68.7	19.4	42.3	23.4	44.3	15.8	71.0	68.5	67.7	9.6
24	13.1	69.7	19.3	44.2	23.5	44.7	16.4	69.6	68.5	59.1	8.4
25	13.7	67.7	19.1	44.0	23.6	45.2	16.9	68.7	68.5	51.5	7.3
26	14.3	69.5	19.0	46.2	23.8	45.6	17.3	67.9	68.5	44.7	6.3
27	14.9	71.2	18.9	48.5	23.9	46.1	17.8	67.0	68.4	37.3	5.3
28	15.5	71.6	18.7	49.9	24.0	46.5	18.2	66.3	68.4	30.5	4.3
29	16.1	71.0	18.6	50.6	24.1	47.0	18.6	65.5	68.4	23.3	3.3
30	16.7	67.3	18.4	49.1	24.2	47.4	19.1	64.7	68.4	16.1	2.3
31	17.4	64.6	18.3	48.2	24.3	47.9	19.6	63.8	68.5	8.8	1.2
32	18.0	64.9	18.1	49.5	24.4	48.3	20.0	63.0	68.4	1.4	0.2
33	18.6	63.9	17.6	68.3	17.1	100.0	18.2	93.6	68.6	10.1	1.4
34	19.3	64.2	17.9	70.1	17.3	100.0	18.7	91.6	68.5	13.9	2.0
35	20.1	64.5	18.3	72.4	17.4	100.0	19.3	89.1	68.5	17.7	2.5
36	21.0	60.2	18.7	69.6	17.6	100.0	19.9	86.4	68.5	22.5	3.2
37	22.0	62.1	19.1	74.4	17.7	100.0	20.7	83.4	68.5	28.0	4.0
38	23.2	60.1	19.6	75.0	17.9	100.0	21.5	79.9	68.5	34.8	4.9
39	24.8	56.4	20.2	74.6	18.1	100.0	22.7	75.4	68.5	44.1	6.2
40	28.3	50.1	21.4	75.5	18.2	100.0	25.1	65.7	68.4	66.3	9.4

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Fax: xxxxxxxxxx
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Direct dialing
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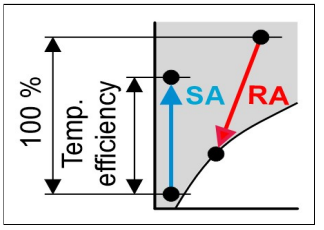
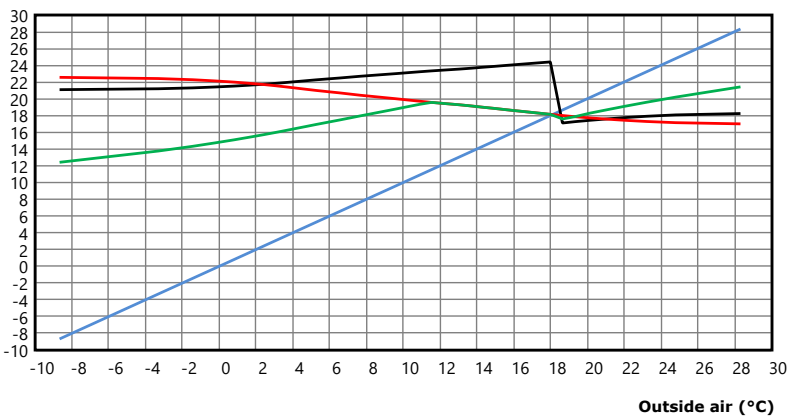
Plant
Object
Position



Air (%)	Service (h/a)
100.00	4000
66.67	2000
33.33	1000
▼	▼
100.00	5667

EU: Energy recovery: Heat energy	MWh	407.45	EUR	24447.00	(60.00 EUR/MWh)
EU: Energy recovery: Cold energy	MWh	33.63	EUR	2691.00	(80.00 EUR/MWh)
EU: 2 Fan: Glycol pump	MWh	-25.93	EUR	-2593.00	(100.00 EUR/MWh)
EU: Energy recovery: Net useful ratio / Year	MWh	415.15	EUR	24545.00	(59.12 EUR/MWh)
EU: Need of energy total / Year	MWh	738.15	EUR	51380.77	(69.61 EUR/MWh)
EU: Net useful ratio / Year	%	56.24	%	47.77	TWG = 72.35%
CH: Guidelines from associations such as SIA and SWKI: TWG>70.00% & JNG>75.00% & ETV>15.00					JNG = 71.25%
					ETV = 19.64

Outside air (°C) **Return air (°C)** **Supply air (°C)** **Energy recovery (°C)**



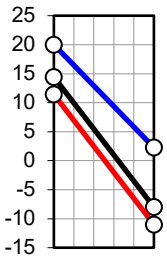
Station		Bern
Height over sea level	m	540.00
Pressure	hPa	949.65
Outside air	m³/h	30000.00
Return air	m³/h	30000.00
Adiabatic return air cooling	h/a	1133.33
Service at 100% Air flow	h/a	5666.67
Capital interest	%	1.00
Energy increase	%	1.00
Inflation	%	1.00
Support costs	%	5.00
Costs without CC-system	EUR	86000.00
Costs with CC-system	EUR	153000.00
Additional costs	EUR	67000.00
BEP (Break even point) after	**Years**	**3.19**

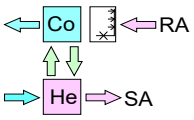
CC-System in winter		SA-He	RA-Co	Definition
Height over sea level	m			540.000
Pressure	hPa			949.653
Efficiency	%	72.350	57.217	
Capacity sensible	kW	210.639	167.541	
Capacity latent	kW	---	41.905	
Capacity frost	kW	---	1.192	
Capacity total	kW	210.639	210.638	
Surface reserve	%	4.107	6.764	
Present surface	m2	2724.108	2421.783	

SA-He		Inlet	Outlet	Definition
Temp.	°C	-11.000	11.429	20.000
Rel. humidity	%	90.000	15.728	40.000
Abs. humidity	g/kg	1.394	1.394	6.174
Volume flow humid	m3/h	26623.555	28901.272	30000.000
Velocity	m/s	1.678	1.821	1.891
Pressure drop	Pa		160.350	

RA-Co		Inlet	Outlet	Definition
Temp.	°C	20.000	2.263	20.000
Rel. humidity	%	40.000	92.566	40.000
Abs. humidity	g/kg	6.174	4.400	6.174
Volume flow humid	m3/h	30000.000	28105.313	30000.000
Velocity	m/s	1.000	0.937	1.000
Pressure drop wet	Pa		144.479	

25 V% Et.glycol			SA-He	RA-Co
Temp.	in	°C	14.429	-8.000
Temp.	out	°C	-8.000	14.429
Volume flow		m3/h	8.789	8.790
Velocity		m/s	0.757	0.264
Reynolds		---	2976.646	1239.802
Pressure drop		kPa	138.786	133.440





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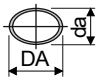
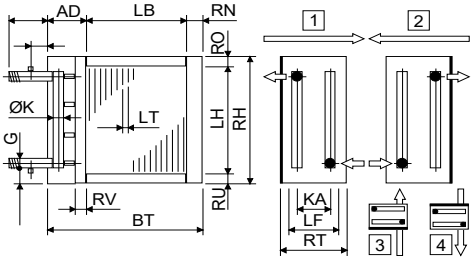
Technical data			SA-He	RA-Co		SA-He	RA-Co
Tubes total		Piece	1440	16800	Tubes:	Cu	PP
Tubes blank		Piece	0	0	Tubes:	smooth	smooth
Int. vent./drains		Piece	11	0	Tubes:	staggered	in line
Tube rows on the depth		Piece	24	210	Tubes:	circular	circular
Tube rows on the height		Piece	60	80	Collectors:	Cu	PP
Tube coupling in series		Piece	48	280	Collectors:	1.20 m/s	1.11 m/s
Number of circuits (NC)		Piece	30	60	Connections:	Rg7	PP
Volume		l	367	7024	Connections:	1.20 m/s	1.11 m/s
Weight		kg	1221	10295	Fins:	Al	PP
Connections	G	---	2"	2"	Fins:	Wave structure	smooth
Frame height	RH	mm	2080	3280	Frame:	AISI 304	AISI 304
Frame width	BT	mm	2400	2800	Air flow direction:	horizontal	horizontal
Frame depth	RT	mm	780	8470	Protection:	without	without
Finned height	LH	mm	2000	3200	Protection:	---	---
Finned width	LB	mm	2204	2604			
Finned depth	LF	mm	693	8400			
Frame on top	RO	mm	40	40			
Frame on bottom	RU	mm	40	40			
Frame in front	RV	mm	30	30			
Frame on back	RN	mm	53	53			
Collector-Diameter	K	mm	54	60			
Covering	AD	mm	143	143			
Collector distance	KA	mm	693	8360			
Fin spacing	LT	mm	2.500	500.000			
Fin thickness	LD	mm	0.200	5.000			
Tube diameter	DA	mm	12.400	16.000	Delivery:		5-6 weeks
Tube diameter	da	mm	12.400	16.000	Validity:		12 weeks
Tube thickness	S	mm	0.350	1.000	Condit.:		net, prepaid address
Tube interval on the height	S1	mm	33.333	40.000	Payment:		30 days net
Tube interval on the depth	S2	mm	28.867	40.000			





SA-He: 33/29/12-24R-60T-2204A-2.5PA-30C-Cu/Al/AISI 304 **SA-He: EUR 20209.00**

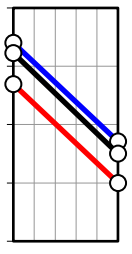
RA-Co: 40/40/16-210R-80T-2604A-500.0PA-60C-PP/PP/AISI 304 **RA-Co: EUR 121734.00**

CC-System in summer		RA-Hy	SA-Co	Definition
Height over sea level	m			540.000
Pressure	hPa			949.653
Efficiency	%	70.600	70.392	
Capacity sensible	kW	81.706	81.707	
Capacity latent	kW	0.000	0.000	
Capacity frost	kW	---	0.000	
Capacity total	kW	81.706	81.707	
Surface reserve	%	0.398	0.109	
Present surface	m2	2421.783	2724.108	

RA-Hy		Inlet	Outlet	Definition
Temp.	°C	20.000	28.472	20.000
Rel. humidity	%	100.000	60.245	40.000
Abs. humidity	g/kg	15.667	15.667	6.174
Volume flow humid	m3/h	30453.340	31333.408	30000.000
Velocity	m/s	1.015	1.045	1.000
Pressure drop	Pa		144.036	

SA-Co		Inlet	Outlet	Definition
Temp.	°C	32.000	23.553	20.000
Rel. humidity	%	54.000	88.320	40.000
Abs. humidity	g/kg	17.224	17.224	6.174
Volume flow humid	m3/h	31777.262	30897.645	30000.000
Velocity	m/s	2.003	1.947	1.891
Pressure drop wet	Pa		188.781	

25 V% Et.glycol			RA-Hy	SA-Co
Temp.	in	°C	31.132	22.508
Temp.	out	°C	22.508	31.132
Volume flow		m3/h	8.789	8.789
Velocity		m/s	0.264	0.757
Reynolds		---	2431.315	5836.878
Pressure drop		kPa	112.114	117.135



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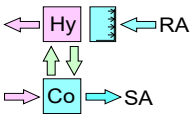

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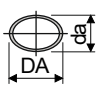
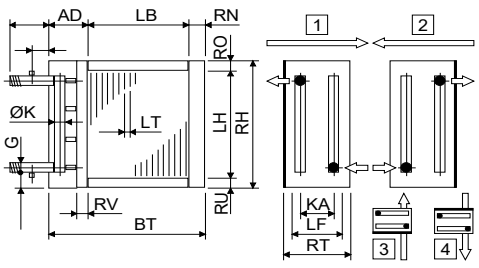
Technical data			RA-Hy	SA-Co		RA-Hy	SA-Co
Tubes total		Piece	16800	1440	Tubes:	PP	Cu
Tubes blank		Piece	0	0	Tubes:	smooth	smooth
Int. vent./drains		Piece	0	11	Tubes:	in line	staggered
Tube rows on the depth		Piece	210	24	Tubes:	circular	circular
Tube rows on the height		Piece	80	60	Collectors:	PP	Cu
Tube coupling in series		Piece	280	48	Collectors:	1.11 m/s	1.20 m/s
Number of circuits (NC)		Piece	60	30	Connections:	PP	Rg7
Volume		l	7024	367	Connections:	1.11 m/s	1.20 m/s
Weight		kg	10295	1221	Fins:	PP	Al
Connections	G	---	2"	2"	Fins:	smooth	Wave structure
Frame height	RH	mm	3280	2080	Frame:	AISI 304	AISI 304
Frame width	BT	mm	2800	2400	Air flow direction:	horizontal	horizontal
Frame depth	RT	mm	8470	780	Protection:	without	without
Finned height	LH	mm	3200	2000	Protection:	---	---
Finned width	LB	mm	2604	2204			
Finned depth	LF	mm	8400	693			
Frame on top	RO	mm	40	40			
Frame on bottom	RU	mm	40	40			
Frame in front	RV	mm	30	30			
Frame on back	RN	mm	53	53			
Collector-Diameter	K	mm	60	54			
Covering	AD	mm	143	143			
Collector distance	KA	mm	8360	693			
Fin spacing	LT	mm	500.000	2.500			
Fin thickness	LD	mm	5.000	0.200			
Tube diameter	DA	mm	16.000	12.400	Delivery:		5-6 weeks
Tube diameter	da	mm	16.000	12.400	Validity:		12 weeks
Tube thickness	S	mm	1.000	0.350	Condit.:		net, prepaid address
Tube interval on the height	S1	mm	40.000	33.333	Payment:		30 days net
Tube interval on the depth	S2	mm	40.000	28.867			





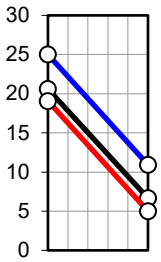
RA-Hy: 40/40/16-210R-80T-2604A-500.0PA-60C-PP/PP/AISI 304	**RA-Hy:**	**EUR**	**121734.00**
SA-Co: 33/29/12-24R-60T-2204A-2.5PA-30C-Cu/Al/AISI 304	**SA-Co:**	**EUR**	**20209.00**

CC-System (DIN EN 308)		SA-He	RA-Co	Definition
Height over sea level	m			540.000
Pressure	hPa			949.653
Efficiency	%	70.350	70.335	
Capacity sensible	kW	131.843	131.843	
Capacity latent	kW	---	---	
Capacity frost	kW	---	---	
Capacity total	kW	131.843	131.843	
Surface reserve	%	0.201	0.475	
Present surface	m2	2724.108	2421.783	

SA-He		Inlet	Outlet	Definition
Temp.	°C	5.000	19.070	20.000
Rel. humidity	%	0.000	0.000	40.000
Abs. humidity	g/kg	0.000	0.000	6.174
Volume flow humid	m3/h	28185.284	29610.963	30000.000
Velocity	m/s	1.776	1.866	1.891
Pressure drop	Pa		169.276	

RA-Co		Inlet	Outlet	Definition
Temp.	°C	25.000	10.933	20.000
Rel. humidity	%	0.000	0.000	40.000
Abs. humidity	g/kg	0.000	0.000	6.174
Volume flow humid	m3/h	30211.836	28786.453	30000.000
Velocity	m/s	1.007	0.960	1.000
Pressure drop	Pa		135.419	

25 V% Et.glycol			SA-He	RA-Co
Temp.	in	°C	20.599	6.661
Temp.	out	°C	6.661	20.599
Volume flow		m3/h	8.816	8.816
Velocity		m/s	0.759	0.265
Reynolds		---	4133.265	1725.447
Pressure drop		kPa	128.022	122.818



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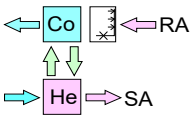

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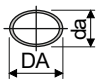
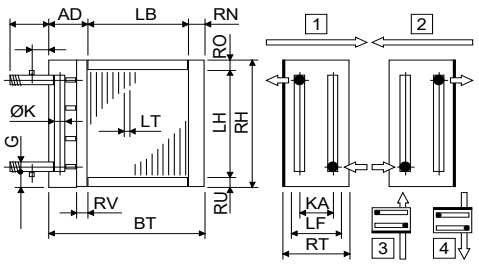
Technical data			SA-He	RA-Co		SA-He	RA-Co
Tubes total		Piece	1440	16800	Tubes:	Cu	PP
Tubes blank		Piece	0	0	Tubes:	smooth	smooth
Int. vent./drains		Piece	11	0	Tubes:	staggered	in line
Tube rows on the depth		Piece	24	210	Tubes:	circular	circular
Tube rows on the height		Piece	60	80	Collectors:	Cu	PP
Tube coupling in series		Piece	48	280	Collectors:	1.20 m/s	1.11 m/s
Number of circuits (NC)		Piece	30	60	Connections:	Rg7	PP
Volume		l	367	7024	Connections:	1.20 m/s	1.11 m/s
Weight		kg	1221	10295	Fins:	Al	PP
Connections	G	---	2"	2"	Fins:	Wave structure	smooth
Frame height	RH	mm	2080	3280	Frame:	AISI 304	AISI 304
Frame width	BT	mm	2400	2800	Air flow direction:	horizontal	horizontal
Frame depth	RT	mm	780	8470	Protection:	without	without
Finned height	LH	mm	2000	3200	Protection:	---	---
Finned width	LB	mm	2204	2604			
Finned depth	LF	mm	693	8400			
Frame on top	RO	mm	40	40			
Frame on bottom	RU	mm	40	40			
Frame in front	RV	mm	30	30			
Frame on back	RN	mm	53	53			
Collector-Diameter	K	mm	54	60			
Covering	AD	mm	143	143			
Collector distance	KA	mm	693	8360			
Fin spacing	LT	mm	2.500	500.000			
Fin thickness	LD	mm	0.200	5.000			
Tube diameter	DA	mm	12.400	16.000	Delivery:		5-6 weeks
Tube diameter	da	mm	12.400	16.000	Validity:		12 weeks
Tube thickness	S	mm	0.350	1.000	Condit.:		net, prepaid address
Tube interval on the height	S1	mm	33.333	40.000	Payment:		30 days net
Tube interval on the depth	S2	mm	28.867	40.000			





SA-He: 33/29/12-24R-60T-2204A-2.5PA-30C-Cu/Al/AISI 304 — **SA-He: EUR 20209.00**

RA-Co: 40/40/16-210R-80T-2604A-500.0PA-60C-PP/PP/AISI 304 — **RA-Co: EUR 121734.00**

Energy recovery / Year (Service at 100% Air flow = 5667 Hours

No	Outside air		CCSB		Return air		Exhaust air		Efficiency	Capacity	Energy
	°C	%	°C	%	°C	%	°C	%	%	kW	MWh
1	-8.7	84.0	12.5	16.9	21.1	34.5	3.0	92.3	76.04	198.50	28.12
2	-3.3	78.4	13.8	23.0	21.2	35.0	5.6	87.1	76.04	160.95	22.80
3	-1.4	79.2	14.4	26.3	21.3	35.4	6.6	85.3	76.04	148.68	21.06
4	-0.2	78.5	14.8	28.1	21.4	35.9	7.3	84.2	76.04	141.20	20.00
5	0.8	76.3	15.1	28.9	21.5	36.3	7.9	83.2	76.04	134.85	19.10
6	1.6	79.2	15.4	31.2	21.6	36.7	8.4	82.6	76.04	130.09	18.43
7	2.4	77.1	15.7	31.4	21.7	37.2	8.9	82.0	76.04	125.75	17.81
8	3.0	77.3	16.0	32.4	21.8	37.6	9.3	81.6	76.04	122.26	17.32
9	3.6	76.2	16.2	32.8	21.9	38.1	9.7	81.3	76.04	119.07	16.87
10	4.2	75.3	16.5	33.2	22.0	38.5	10.1	81.0	76.04	116.17	16.46
11	4.7	75.9	16.7	34.2	22.2	39.0	10.5	80.7	76.04	113.24	16.04
12	5.3	73.8	17.0	34.0	22.3	39.4	10.8	80.4	76.04	110.33	15.63
13	5.9	75.2	17.2	35.6	22.4	39.9	11.3	79.8	76.04	106.98	15.16
14	6.5	72.4	17.5	35.2	22.5	40.3	11.7	79.2	76.04	103.50	14.66
15	7.1	73.7	17.7	36.7	22.6	40.7	12.1	78.8	76.04	100.48	14.23
16	7.7	72.1	18.0	36.8	22.7	41.2	12.5	78.2	76.04	97.48	13.81
17	8.3	73.0	18.3	38.3	22.8	41.6	12.9	77.4	76.04	93.92	13.31
18	9.0	73.9	18.5	39.8	22.9	42.1	13.4	76.3	76.04	90.37	12.80
19	9.6	73.3	18.8	40.5	23.0	42.5	13.9	75.3	76.04	86.81	12.30
20	10.3	71.7	19.1	40.6	23.1	43.0	14.3	74.3	76.04	83.57	11.84
21	10.9	72.5	19.3	42.1	23.2	43.4	14.8	73.4	76.04	80.22	11.36
22	11.5	68.9	19.6	41.1	23.3	43.9	15.3	72.3	76.04	76.07	10.78
23	12.3	68.7	19.4	42.2	23.4	44.3	15.8	71.1	76.04	67.75	9.60
24	13.1	69.7	19.3	44.2	23.5	44.7	16.4	69.7	76.04	59.11	8.37
25	13.7	67.7	19.1	44.0	23.6	45.2	16.9	68.7	76.04	51.54	7.30
26	14.3	69.5	19.0	46.2	23.8	45.6	17.3	68.0	76.04	44.75	6.34
27	14.9	71.2	18.9	48.5	23.9	46.1	17.7	67.1	76.04	37.34	5.29
28	15.5	71.6	18.7	49.8	24.0	46.5	18.2	66.3	76.04	30.47	4.32
29	16.1	71.0	18.6	50.5	24.1	47.0	18.6	65.5	76.04	23.33	3.30
30	16.7	67.3	18.4	49.0	24.2	47.4	19.1	64.7	76.04	16.06	2.28
31	17.4	64.6	18.3	48.2	24.3	47.9	19.5	63.9	76.04	8.76	1.24
32	18.0	64.9	18.1	49.5	24.4	48.3	20.0	63.0	76.04	1.41	0.20
33	18.6	63.9	17.6	68.3	17.1	100.0	18.2	93.6	76.04	10.12	1.43
34	19.3	64.2	17.9	70.1	17.3	100.0	18.7	91.6	76.04	13.95	1.98
35	20.1	64.5	18.3	72.4	17.4	100.0	19.3	89.1	68.66	17.73	2.51
36	21.0	60.2	18.7	69.6	17.6	100.0	19.9	86.4	68.68	22.57	3.20
37	22.0	62.1	19.1	74.4	17.7	100.0	20.7	83.4	68.63	28.04	3.97
38	23.2	60.1	19.6	75.1	17.9	100.0	21.5	79.9	68.62	34.85	4.94
39	24.8	56.4	20.2	74.6	18.1	100.0	22.7	75.3	68.62	44.18	6.26
40	28.3	50.1	21.4	75.6	18.2	100.0	25.1	65.6	68.58	66.39	9.41

Air (%)	Service (h/a)
100.00	4000
66.67	2000
33.33	1000
▼	▼
100.00	5667

LOGO

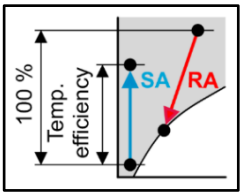
Company
Branch
Street
Country / ZIP / City

Phone: xxxxxxxxxx
Fax: xxxxxxxxxx
E-Mail
Homepage

City, 25.3.2026
With the compliments of

Representative
Direct dialing
xxxxxxxxxx

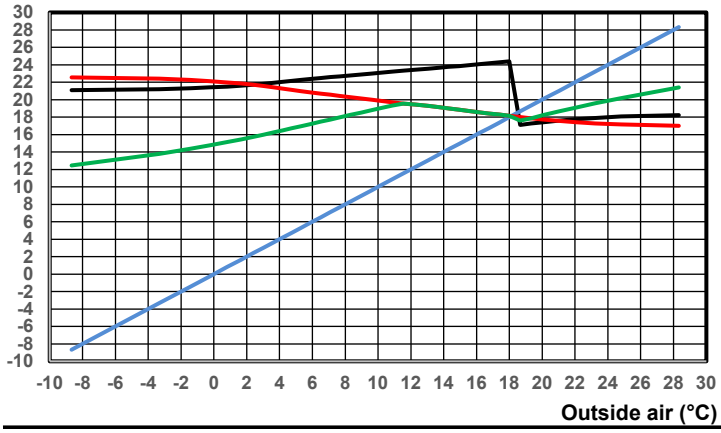
Bern
Inselspital
Bettenhaus



Software by www.zcs.ch

EU: Energy recovery: Heat energy	MWh	408.14	EUR	24489.00	(60.00 EUR/MWh)
EU: Energy recovery: Cold energy	MWh	33.69	EUR	2695.00	(80.00 EUR/MWh)
EU: 2 Fan + Glycol pump	MWh	-42.18	EUR	-4218.00	(100.00 EUR/MWh)
EU: Energy recovery: Net useful ratio / Year	MWh	399.66	EUR	22966.00	(57.46 EUR/MWh)
EU: Need of energy total / Year	MWh	738.69	EUR	51435.06	(69.63 EUR/MWh)
EU: Net useful ratio / Year	%	54.10	%	44.65	TWG = 72.35%
CH: Guidelines from associations such as SIA and SWKI: TWG>70.00% & JNG>75.00% & ETV>15.00					JNG = 68.35%
					ETV = 12.10

Outside air (°C) Return air (°C) Supply air (°C)
Energy recovery (°C)



Station		Bern (CH)
Height over sea level	m	540.00
Pressure	hPa	949.65
Outside air	m3/h	30000.00
Return air	m3/h	30000.00
Adiabatic return air cooling	h/a	1133.33
Service at 100% Air flow	h/a	5666.65
Capital interest	%	1.00
Energy increase	%	1.00
Inflation	%	1.00
Support costs	%	5.00
Costs without CC-System	EUR	86000.00
Costs with CC-System	EUR	248000.00
Additional costs	EUR	162000.00
BEP (Break even point) after	Years	10.54