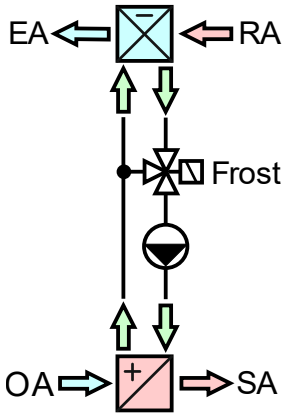
Quo Vadis
Energy recovery

Most frequent calls for proposals for the capital city of Bern
Outside air in winter: -11°C/90%
Outdoor air in summer: 32°C/40%

Are you on the safe side?
The www.meteonorm.com can provide information on this.

Meteonorm standard
In Bern, it is never colder than -7.8°C/100%.
In Bern it is only 9 hours warmer than 32°C/40% (maximum 32.2°C/45%).

Meteonorm extreme
In Bern it is only 53 hours colder than -11°C/100% (minimum -17.9°C/100%).
In Bern it is only 33 hours warmer than 32°C/40% (maximum 35.2°C/36%).



Recommendation
The extreme values in winter can be forgotten as a result of global warming. The extreme values in summer must be taken seriously as a result of global warming. One hears again and again of complaints, that the coolers were designed too tightly and therefore the comfort range in terms of maximum temperature of 26°C and absolute humidity of 11.5 g/kg was massively exceeded. We therefore recommend the following values for tenders:

Outside air in winter: -11°C/90%
Outside air in summer: 35°C/40%

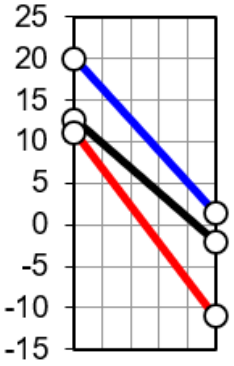
Lowest intermediate medium temperature in winter
There are actually extremely questionable clubs like SIA and SWKI, which write, that you should never go below -2°C. Such bullshit. You give away heat energy exactly, when you need it most. If the exhaust air has little moisture, nothing can freeze and if it has a little more moisture, the bypass opens a little and only for a few hours a year.

Too large intermediate medium circulating quantity
A direct consequence is too much intermediate medium circulation and disturbed temperature curves throughout the year, which reduce the mean logarithmic temperature differences, which can only be compensated with larger heat exchangers, if you want to have the same energy recovery over the whole year, that you would easily achieve with undisturbed temperature profiles.

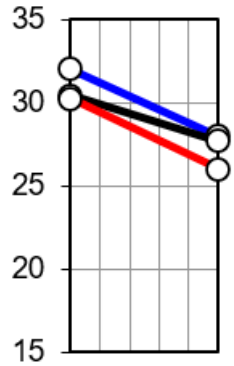
Intermediate carrier medium
There is nothing more idiotic, than using aqueous solutions with ethylene glycol in normal cases or propylene glycol in the food sector. You might as well throw your finances right out the window. Planning engineers, who are not totally stupid, generally use Temper, which is also approved in the food industry and is biodegradable in contrast to glycols.

Adiabatic exhaust air cooling in summer
Far too many planning engineers do not want adiabatic exhaust air cooling in summer and thus prevent the recovery of cooling energy, which, as is well known, costs much more than thermal energy. The reason given far too often is, that the exhaust air handling uits is arranged on top of the supply air handling units and that the drip tray would only cause problems. One can only recommend getting offers for air handling units, that have such peanuts under control without any problems.

Winter, intermediate medium inlet -2°C



Summer, without adiabatic exhaust air cooling, average log. temperature difference strives towards zero



Comparison of performance with different intermediate carrier medium in winter

Intermediate carrier medium	---	25% Pr.Glycol	25% Et.Glycol	Temper-20
Medium inlet	°C	-2.000	-2.000	-5.300
Medium outlet	°C	12.200	12.600	15.430
Medium volume flow	m3/h	10.551	11.061	8.336
Medium pressure drop total	bar	3.568	3.430	3.691
Temperature efficiency	%	68.45	71.150	74.275
HR system capacity	kW	166.068	172.620	180.204

Comparison of performance with different intermediate medium in summer

Adiabatic exhaust air cooling	---	no	no	no	yes
Intermediate carrier medium	---	25% Pr.Glycol	25% Et.Glycol	Temper-20	Temper-20
Medium inlet	°C	30.427	30.416	30.982	29.746
Medium outlet	°C	27.686	27.702	27.080	21.136
Medium volume flow	m3/h	10.551	11.061	8.336	8.336
Medium pressure drop total	bar	2.915	2.938	3.208	3.258
Temperature efficiency	%	67.213	67.469	71.574	71.569
HR system capacity	kW	32.247	32.370	34.339	75.644

Profitability per year (100.00 % air à 4000 h, 66.67% air à 2000 h, 33.33 % air à 1000 h)

Adiabatic exhaust air cooling	---	no	no	no	yes
Intermediate carrier medium	---	25% Pr.Glycol	25% Et.Glycol	Temper-20	Temper-20
Total energy demand/year	MWh	676.46	673.82	668.44	613.93
Heat recovery	MWh	323.02	335.11	348.04	348.04
Cold recovery	MWh	12.83	12.83	12.83	28.74
2 Fans, 1 Pump	MWh	-22.83	-23.14	-20.72	-20.72
Net benefits per year	MWh	313.01	324.79	340.15	356.06
Net benefits per year	%	46.27	48.20	50.89	58.00
Total energy demand/year	EUR	47'744.68	47'538.80	47'058.01	42'697.41
Heat recovery	EUR	19'381.00	20'107.00	20'883.00	20'883.00
Cold recovery	EUR	1'026.00	1'026.00	1'026.00	2'299.00
2 Fans, 1 Pump	EUR	-2'283.00	-2'314.00	-2'072.00	-2'072.00
Net benefits per year	EUR	18'124.00	18'819.00	19'837.00	21'110.00
Net benefits per year	%	37.96	39.59	42.15	49.44
Temperature efficiency (TWG)	%	68.45	71.15	74.28	74.28
Annual utilization rate (JNG)	%	67.28	69.92	73.36	73.36
El.thermal reinforces factor (ETV)	%	17.69	18.10	21.00	21.00
Costs without HR-System	EUR	75'000.00	75'000.00	75'000.00	75'000.00
Costs with HR-System	EUR	122'000.00	126'000.00	130'000.00	135'000.00
Cost overrun	EUR	47'000.00	51'000.00	55'000.00	60'000.00
Amortisation (BEP)	Years	3.00	3.16	3.24	3.34

Summary

Anyone who now believes, that in the future the low-viscosity biodegradable Temper will be used instead of the highly viscous non-biodegradable glycols, that the exhaust air will be adiabatically pre-cooled in summer and that the cooler will be large enough, has not taken into account, ***how sluggish certain planning engineers are, just because they prefer to stick to the usual in their inertia.***

Detailed data

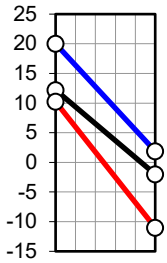
Pages 03-05: 25% Pr.Glycol, ***without*** adiabatic exhaust air cooling in summer
Pages 06-08: 25% Et.Glycol, ***without*** adiabatic exhaust air cooling in summer
Pages 09-11: Temper-20, ***without*** adiabatic exhaust air cooling in summer
Pages 12-14: Temper-20, ***with*** adiabatic exhaust air cooling in summer

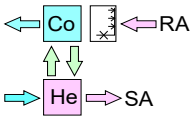
CC-System in winter		SA-He	RA-Co	Definition
Height over sea level	m			540.000
Pressure	hPa			949.653
Efficiency	%	68.450	58.413	
Capacity sensible	kW	166.068	136.892	
Capacity latent	kW	---	29.176	
Capacity frost	kW	---	0.000	
Capacity total	kW	166.068	166.067	
Surface reserve	%	0.042	0.002	
Present surface	m2	975.526	975.526	

SA-He		Inlet	Outlet	Definition
Temp.	°C	-11.000	10.220	20.000
Rel. humidity	%	90.000	17.042	40.000
Abs. humidity	g/kg	1.394	1.394	6.175
Volume flow humid	m3/h	22186.296	23982.077	25000.000
Velocity	m/s	1.779	1.923	2.005
Pressure drop	Pa		98.102	

RA-Co		Inlet	Outlet	Definition
Temp.	°C	20.000	1.892	20.000
Rel. humidity	%	40.000	99.983	40.000
Abs. humidity	g/kg	6.175	4.631	6.175
Volume flow humid	m3/h	24000.000	22462.238	24000.000
Velocity	m/s	1.925	1.801	1.925
Pressure drop wet	Pa		106.616	

25 V% Pr.glycol			SA-He	RA-Co
Temp.	in	°C	12.200	-2.000
Temp.	out	°C	-2.000	12.200
Volume flow		m3/h	10.551	10.554
Velocity		m/s	1.156	1.156
Reynolds		---	3177.871	3082.512
Pressure drop		kPa	177.649	179.153





Company
Branch
Street
Country / ZIP / City

Phone: xxxxxxxxxx
Fax: xxxxxxxxxx
E-Mail
Homepage

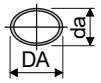
City, 10.12.2024
With the compliments of

Representative
Direct dialing
xxxxxxxxxx

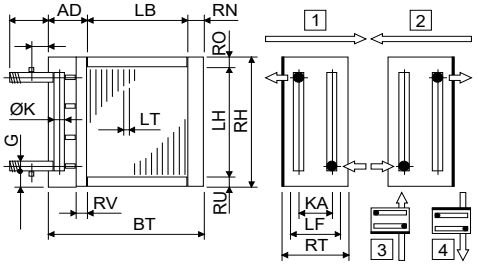
Plant
Object
Position

Software by www.zcs.ch

Technical data			SA-He	RA-Co
Tubes total		Piece	768	768
Tubes blank		Piece	0	0
Int. vent./drains		Piece	5	5
Tube rows on the depth		Piece	12	12
Tube rows on the height		Piece	64	64
Tube coupling in series		Piece	32	32
Number of circuits (NC)		Piece	24	24
Volume		l	164	164
Weight		kg	517	517
Connections	G	---	2"	2"
Frame height	RH	mm	1980	1980
Frame width	BT	mm	2000	2000
Frame depth	RT	mm	400	400
Finned height	LH	mm	1920	1920
Finned width	LB	mm	1804	1804
Finned depth	LF	mm	312	312
Frame on top	RO	mm	30	30
Frame on bottom	RU	mm	30	30
Frame in front	RV	mm	30	30
Frame on back (~53/53mm)	RN	mm	53	53
Collector-Diameter	K	mm	54	54
Collector covering	AD	mm	143	143
Collector distance	KA	mm	321	321
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	0.400	0.400
Tube interval on the height	S1	mm	30.000	30.000
Tube interval on the depth	S2	mm	25.981	25.981



Tubes:	Cu	Tubes:	Cu
Tubes:	smooth	Tubes:	smooth
Tubes:	staggered	Tubes:	staggered
Tubes:	circular	Tubes:	circular
Collectors:	Cu	Collectors:	Cu
Collectors:	1.43 m/s	Collectors:	1.44 m/s
Connections:	Rg7	Connections:	Rg7
Connections:	1.43 m/s	Connections:	1.44 m/s
Fins:	Al	Fins:	Al
Fins:	Wave structure	Fins:	Wave structure
Frame:	AISI 304	Frame:	AISI 304
Air flow direction:	horizontal	Air flow direction:	horizontal
Protection:	without	Protection:	without
Protection:	---	Protection:	---



Delivery:	5-6 weeks		
Validity:	12 weeks		
Condit.:	net, prepaid address		
Payment:	30 days net		
SA-He:	**EUR**	**9294.00**	
RA-Co:	**EUR**	**9294.00**	

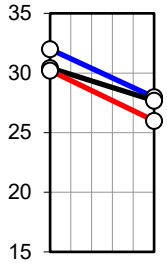
SA-He: 30/26/12-12R-64T-1804A-2.5PA-24C-Cu/Al/AISI 304
RA-Co: 30/26/12-12R-64T-1804A-2.5PA-24C-Cu/Al/AISI 304

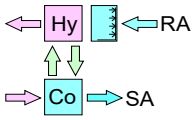
CC-System in summer		RA-Hy	SA-Co	Definition
Height over sea level	m			540.000
Pressure	hPa			949.653
Efficiency	%	70.168	67.213	
Capacity sensible	kW	32.247	32.247	
Capacity latent	kW	0.000	0.000	
Capacity frost	kW	---	0.000	
Capacity total	kW	32.247	32.247	
Surface reserve	%	0.117	0.147	
Present surface	m2	975.526	975.526	

RA-Hy		Inlet	Outlet	Definition
Temp.	°C	26.000	30.210	20.000
Rel. humidity	%	51.420	40.264	40.000
Abs. humidity	g/kg	11.500	11.500	6.175
Volume flow humid	m3/h	24698.725	25046.310	24000.000
Velocity	m/s	1.981	2.009	1.925
Pressure drop	Pa		104.417	

SA-Co		Inlet	Outlet	Definition
Temp.	°C	32.000	27.967	20.000
Rel. humidity	%	40.000	50.395	40.000
Abs. humidity	g/kg	12.671	12.671	6.175
Volume flow humid	m3/h	26292.318	25944.858	25000.000
Velocity	m/s	2.109	2.081	2.005
Pressure drop wet	Pa		113.397	

25 V% Pr.glycol			RA-Hy	SA-Co
Temp.	in	°C	30.427	27.686
Temp.	out	°C	27.686	30.427
Volume flow		m3/h	10.551	10.552
Velocity		m/s	1.156	1.156
Reynolds		---	7417.081	7338.043
Pressure drop		kPa	145.558	145.914





LOGO

Company
Branch
Street
Country / ZIP / City

Phone: xxxxxxxxxx
Fax: xxxxxxxxxx
E-Mail
Homepage

City, 10.12.2024
With the compliments of

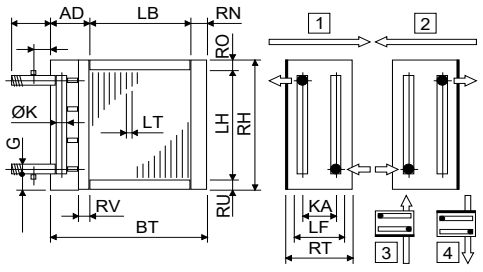
Representative
Direct dialing
xxxxxxxxxx

Plant
Object
Position

Software by www.zcs.ch

Technical data			RA-Hy	SA-Co
Tubes total		Piece	768	768
Tubes blank		Piece	0	0
Int. vent./drains		Piece	5	5
Tube rows on the depth		Piece	12	12
Tube rows on the height		Piece	64	64
Tube coupling in series		Piece	32	32
Number of circuits (NC)		Piece	24	24
Volume		l	164	164
Weight		kg	517	517
Connections	G	---	2"	2"
Frame height	RH	mm	1980	1980
Frame width	BT	mm	2000	2000
Frame depth	RT	mm	400	400
Finned height	LH	mm	1920	1920
Finned width	LB	mm	1804	1804
Finned depth	LF	mm	312	312
Frame on top	RO	mm	30	30
Frame on bottom	RU	mm	30	30
Frame in front	RV	mm	30	30
Frame on back (~53/53mm)	RN	mm	53	53
Collector-Diameter	K	mm	54	54
Collector covering	AD	mm	143	143
Collector distance	KA	mm	321	321
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	0.400	0.400
Tube interval on the height	S1	mm	30.000	30.000
Tube interval on the depth	S2	mm	25.981	25.981

		RA-Hy	SA-Co
Tubes:		Cu	Cu
Tubes:		smooth	smooth
Tubes:		staggered	staggered
Tubes:		circular	circular
Collectors:		Cu	Cu
Collectors:		1.43 m/s	1.43 m/s
Connections:		Rg7	Rg7
Connections:		1.43 m/s	1.43 m/s
Fins:		Al	Al
Fins:		Wave structure	Wave structure
Frame:		AISI 304	AISI 304
Air flow direction:		horizontal	horizontal
Protection:		without	without
Protection:		---	---



Delivery:		5-6 weeks
Validity:		12 weeks
Condit.:		net, prepaid address
Payment:		30 days net

RA-Hy: 30/26/12-12R-64T-1804A-2.5PA-24C-Cu/Al/AISI 304	**RA-Hy:**	**EUR**	**9294.00**
SA-Co: 30/26/12-12R-64T-1804A-2.5PA-24C-Cu/Al/AISI 304	**SA-Co:**	**EUR**	**9294.00**

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	11.3	18.3	21.1	34.5	3.2	91.9	67.01	156.10	22.11
2	-3.3	78.4	12.8	24.5	21.2	35.0	5.8	86.8	65.80	126.43	17.91
3	-1.4	79.2	13.5	27.9	21.3	35.4	6.8	85.0	65.47	116.78	16.54
4	-0.2	78.5	13.9	29.7	21.4	35.9	7.5	83.8	65.30	110.89	15.71
5	0.8	76.3	14.3	30.5	21.5	36.3	8.1	82.8	65.18	105.91	15.00
6	1.6	79.2	14.6	32.8	21.6	36.7	8.6	82.1	65.08	102.17	14.47
7	2.4	77.1	15.0	33.0	21.7	37.2	9.1	81.5	65.01	98.75	13.99
8	3.0	77.3	15.2	34.0	21.8	37.6	9.5	81.1	64.97	96.03	13.60
9	3.6	76.2	15.5	34.3	21.9	38.1	9.9	80.7	64.93	93.53	13.25
10	4.2	75.3	15.8	34.7	22.0	38.5	10.3	80.5	64.89	91.24	12.93
11	4.7	75.9	16.0	35.8	22.2	39.0	10.6	80.1	64.85	88.94	12.60
12	5.3	73.8	16.3	35.5	22.3	39.4	11.0	79.7	64.83	86.66	12.28
13	5.9	75.2	16.6	37.1	22.4	39.9	11.4	79.2	64.79	84.04	11.91
14	6.5	72.4	16.9	36.6	22.5	40.3	11.8	78.6	64.76	81.31	11.52
15	7.1	73.7	17.1	38.1	22.6	40.7	12.2	78.0	64.73	78.95	11.18
16	7.7	72.1	17.4	38.2	22.7	41.2	12.6	77.4	64.72	76.60	10.85
17	8.3	73.0	17.7	39.7	22.8	41.6	13.1	76.6	64.70	73.81	10.46
18	9.0	73.9	18.0	41.2	22.9	42.1	13.6	75.5	64.70	71.02	10.06
19	9.6	73.3	18.3	41.9	23.0	42.5	14.0	74.5	64.70	68.23	9.67
20	10.3	71.7	18.6	41.9	23.1	43.0	14.5	73.6	64.70	65.68	9.30
21	10.9	72.5	18.9	43.4	23.2	43.4	14.9	72.7	64.69	63.04	8.93
22	11.5	68.9	19.2	42.3	23.3	43.9	15.4	71.7	64.71	60.25	8.53
23	12.3	68.7	19.4	43.4	23.4	44.3	15.9	70.5	64.71	56.46	8.00
24	13.1	69.7	19.3	45.3	23.5	44.7	16.5	69.1	64.69	49.26	6.98
25	13.7	67.7	19.1	45.1	23.6	45.2	17.0	68.2	64.70	42.95	6.09
26	14.3	69.5	19.0	47.3	23.8	45.6	17.4	67.5	64.68	37.29	5.28
27	14.9	71.2	18.9	49.6	23.9	46.1	17.9	66.6	64.66	31.12	4.41
28	15.5	71.6	18.7	50.9	24.0	46.5	18.3	65.9	64.66	25.39	3.60
29	16.1	71.0	18.6	51.5	24.1	47.0	18.7	65.1	64.65	19.44	2.75
30	16.7	67.3	18.4	49.9	24.2	47.4	19.2	64.3	64.67	13.38	1.90
31	17.4	64.6	18.3	49.0	24.3	47.9	19.6	63.5	64.69	7.30	1.03
32	18.0	64.9	18.1	50.2	24.4	48.3	20.1	62.7	64.68	1.18	0.17
33	18.6	63.9	18.6	50.6	24.5	48.8	20.6	61.9	64.68	5.17	0.73
34	19.3	64.2	19.3	52.1	24.6	49.2	21.0	61.0	64.66	11.63	1.65
35	20.1	64.5	20.1	53.9	24.7	49.6	21.6	59.8	64.64	19.22	2.72
36	21.0	60.2	21.0	51.8	24.8	50.1	22.3	58.4	64.67	27.51	3.90
37	22.0	62.1	22.0	55.5	24.9	50.5	23.0	56.8	64.62	36.58	5.18
38	23.2	60.1	23.2	56.0	25.0	51.0	23.8	54.8	64.62	47.29	6.70
39	24.8	56.4	24.8	55.7	25.1	51.4	24.9	52.1	64.61	61.05	8.65
40	28.3	50.1	26.3	56.2	25.2	51.9	27.3	45.9	64.58	90.53	12.83

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

LOGO

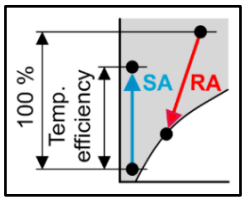
Company
Branch
Street
Country / ZIP / City

Phone: xxxxxxxxxx
Fax: xxxxxxxxxx
E-Mail
Homepage

City, 10.12.2024
With the compliments of

Representative
Direct dialing
xxxxxxxxxx

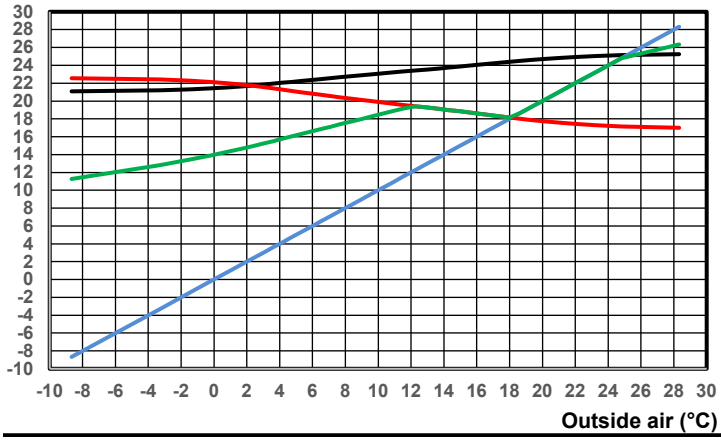
Plant
Object
Position



Software by www.zcs.ch

EU: Energy recovery: Heat energy	MWh	323.02	EUR	19381.00	(60.00 EUR/MWh)
EU: Energy recovery: Cold energy	MWh	12.83	EUR	1026.00	(80.00 EUR/MWh)
EU: 2 Fan + Glycol pump	MWh	-22.83	EUR	-2283.00	(100.00 EUR/MWh)
EU: Energy recovery: Net useful ratio / Year	MWh	313.01	EUR	18124.00	(57.90 EUR/MWh)
EU: Need of energy total / Year	MWh	676.46	EUR	47744.68	(70.58 EUR/MWh)
EU: Net useful ratio / Year	%	46.27	%	37.96	TWG = 68.45%
CH: Guidelines from associations such as SIA and SWKI: TWG>70.00% & JNG>75.00% & ETV>15.00					JNG = 67.28%
					ETV = 17.69

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



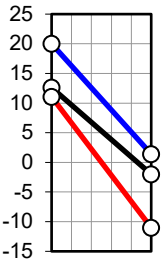
Station		Bern (CH)
Height over sea level	m	540.00
Pressure	hPa	949.65
Outside air	m3/h	0.00
Return air	m3/h	0.00
Adiabatic return air cooling	h/a	0.00
Service at 100% Air flow	h/a	5666.65
Capital interest	%	1.00
Energy increase	%	1.00
Inflation	%	1.00
Support costs	%	5.00
Costs without CC-System	EUR	75000.00
Costs with CC-System	EUR	122000.00
Additional costs	EUR	47000.00
BEP (Break even point) after	Years	3.00

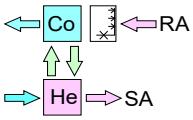
CC-System in winter		SA-He	RA-Co	Definition
Height over sea level	m			540.000
Pressure	hPa			949.653
Efficiency	%	71.150	59.964	
Capacity sensible	kW	172.620	140.485	
Capacity latent	kW	---	32.135	
Capacity frost	kW	---	0.000	
Capacity total	kW	172.620	172.620	
Surface reserve	%	0.129	0.104	
Present surface	m2	975.526	975.526	

SA-He		Inlet	Outlet	Definition
Temp.	°C	-11.000	11.057	20.000
Rel. humidity	%	90.000	16.120	40.000
Abs. humidity	g/kg	1.394	1.394	6.175
Volume flow humid	m3/h	22186.296	24052.911	25000.000
Velocity	m/s	1.779	1.929	2.005
Pressure drop	Pa		98.270	

RA-Co		Inlet	Outlet	Definition
Temp.	°C	20.000	1.411	20.000
Rel. humidity	%	40.000	100.000	40.000
Abs. humidity	g/kg	6.175	4.475	6.175
Volume flow humid	m3/h	24000.000	22417.374	24000.000
Velocity	m/s	1.925	1.798	1.925
Pressure drop wet	Pa		107.460	

25 V% Et.glycol			SA-He	RA-Co
Temp.	in	°C	12.600	-2.000
Temp.	out	°C	-2.000	12.600
Volume flow		m3/h	11.061	11.064
Velocity		m/s	1.211	1.212
Reynolds		---	4863.851	4756.663
Pressure drop		kPa	170.978	172.008





LOGO

Company
Branch
Street
Country / ZIP / City

Phone: xxxxxxxxxx
Fax: xxxxxxxxxx
E-Mail
Homepage

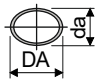
City, 10.12.2024
With the compliments of

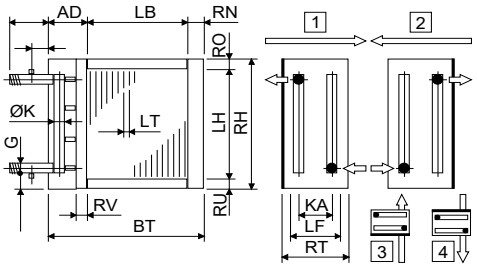
Representative
Direct dialing
xxxxxxxxxx

Plant
Object
Position

Software by www.zcs.ch

Technical data			SA-He	RA-Co		SA-He	RA-Co
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:	0.75 m/s	0.75 m/s
Number of circuits (NC)		Piece	24	24	Connections:	Rg7	Rg7
Volume		l	172	172	Connections:	0.75 m/s	0.75 m/s
Weight		kg	532	532	Fins:	Al	Al
Connections	G	---	2 ½"	2 ½"	Fins:	Wave structure	Wave structure
Frame height	RH	mm	1980	1980	Frame:	AISI 304	AISI 304
Frame width	BT	mm	2023	2023	Air flow direction:	horizontal	horizontal
Frame depth	RT	mm	450	450	Protection:	without	without
Finned height	LH	mm	1920	1920	Protection:	---	---
Finned width	LB	mm	1804	1804			
Finned depth	LF	mm	312	312			
Frame on top	RO	mm	30	30			
Frame on bottom	RU	mm	30	30			
Frame in front	RV	mm	30	30			
Frame on back (~53/53mm)	RN	mm	53	53			
Collector-Diameter	K	mm	76	76			
Collector covering	AD	mm	166	166			
Collector distance	KA	mm	343	343			
Fin spacing	LT	mm	2.500	2.500			
Fin thickness	LD	mm	0.200	0.200			
Tube diameter	DA	mm	12.400	12.400	Delivery:		5-6 weeks
Tube diameter	da	mm	12.400	12.400	Validity:		12 weeks
Tube thickness	S	mm	0.400	0.400	Condit.:		net, prepaid address
Tube interval on the height	S1	mm	30.000	30.000	Payment:		30 days net
Tube interval on the depth	S2	mm	25.981	25.981			





SA-He: 30/26/12-12R-64T-1804A-2.5PA-24C-Cu/Al/AISI 304 **SA-He:** **EUR** **9531.00**

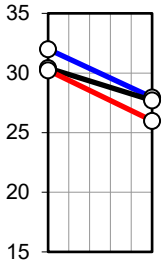
RA-Co: 30/26/12-12R-64T-1804A-2.5PA-24C-Cu/Al/AISI 304 **RA-Co:** **EUR** **9531.00**

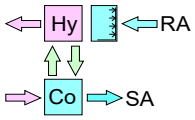
CC-System in summer		RA-Hy	SA-Co	Definition
Height over sea level	m			540.000
Pressure	hPa			949.653
Efficiency	%	70.435	67.469	
Capacity sensible	kW	32.370	32.370	
Capacity latent	kW	0.000	0.000	
Capacity frost	kW	---	0.000	
Capacity total	kW	32.370	32.370	
Surface reserve	%	0.034	0.022	
Present surface	m2	975.526	975.526	

RA-Hy		Inlet	Outlet	Definition
Temp.	°C	26.000	30.226	20.000
Rel. humidity	%	51.420	40.227	40.000
Abs. humidity	g/kg	11.500	11.500	6.175
Volume flow humid	m3/h	24698.725	25047.633	24000.000
Velocity	m/s	1.981	2.009	1.925
Pressure drop	Pa		104.421	

SA-Co		Inlet	Outlet	Definition
Temp.	°C	32.000	27.952	20.000
Rel. humidity	%	40.000	50.440	40.000
Abs. humidity	g/kg	12.671	12.671	6.175
Volume flow humid	m3/h	26292.318	25943.535	25000.000
Velocity	m/s	2.109	2.081	2.005
Pressure drop wet	Pa		113.393	

25 V% Et.glycol			RA-Hy	SA-Co
Temp.	in	°C	30.416	27.702
Temp.	out	°C	27.702	30.416
Volume flow		m3/h	11.061	11.062
Velocity		m/s	1.211	1.212
Reynolds		---	9731.194	9643.605
Pressure drop		kPa	146.722	147.051





Company
Branch
Street
Country / ZIP / City

Phone: xxxxxxxxxx
Fax: xxxxxxxxxx
E-Mail
Homepage

City, 10.12.2024
With the compliments of

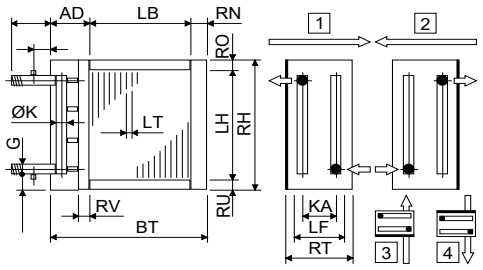
Representative
Direct dialing
xxxxxxxxxx

Plant
Object
Position

Software by www.zcs.ch

Technical data			RA-Hy	SA-Co
Tubes total		Piece	768	768
Tubes blank		Piece	0	0
Int. vent./drains		Piece	5	5
Tube rows on the depth		Piece	12	12
Tube rows on the height		Piece	64	64
Tube coupling in series		Piece	32	32
Number of circuits (NC)		Piece	24	24
Volume		l	172	172
Weight		kg	532	532
Connections	G	---	2 ½"	2 ½"
Frame height	RH	mm	1980	1980
Frame width	BT	mm	2023	2023
Frame depth	RT	mm	450	450
Finned height	LH	mm	1920	1920
Finned width	LB	mm	1804	1804
Finned depth	LF	mm	312	312
Frame on top	RO	mm	30	30
Frame on bottom	RU	mm	30	30
Frame in front	RV	mm	30	30
Frame on back (~53/53mm)	RN	mm	53	53
Collector-Diameter	K	mm	76	76
Collector covering	AD	mm	166	166
Collector distance	KA	mm	343	343
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	0.400	0.400
Tube interval on the height	S1	mm	30.000	30.000
Tube interval on the depth	S2	mm	25.981	25.981

Tubes:	Cu	Cu	
Tubes:	smooth	smooth	
Tubes:	staggered	staggered	
Tubes:	circular	circular	
Collectors:	Cu	Cu	
Collectors:	0.75 m/s	0.75 m/s	
Connections:	Rg7	Rg7	
Connections:	0.75 m/s	0.75 m/s	
Fins:	Al	Al	
Fins:	Wave structure	Wave structure	
Frame:	AISI 304	AISI 304	
Air flow direction:	horizontal	horizontal	
Protection:	without	without	
Protection:	---	---	



Delivery:		5-6 weeks
Validity:		12 weeks
Condit.:		net, prepaid address
Payment:		30 days net
RA-Hy:	**EUR**	**9531.00**
SA-Co:	**EUR**	**9531.00**

RA-Hy: 30/26/12-12R-64T-1804A-2.5PA-24C-Cu/Al/AISI 304

SA-Co: 30/26/12-12R-64T-1804A-2.5PA-24C-Cu/Al/AISI 304

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	12.2	17.2	21.1	34.5	2.6	93.5	70.00	163.06	23.10
2	-3.3	78.4	13.5	23.4	21.2	35.0	5.3	88.5	68.70	131.99	18.70
3	-1.4	79.2	14.1	26.7	21.3	35.4	6.3	86.7	68.33	121.87	17.27
4	-0.2	78.5	14.5	28.5	21.4	35.9	7.0	85.6	68.14	115.72	16.39
5	0.8	76.3	14.9	29.3	21.5	36.3	7.6	84.6	67.99	110.49	15.65
6	1.6	79.2	15.2	31.7	21.6	36.7	8.2	83.9	67.89	106.58	15.10
7	2.4	77.1	15.5	31.9	21.7	37.2	8.6	83.3	67.81	103.01	14.59
8	3.0	77.3	15.8	32.9	21.8	37.6	9.1	82.9	67.75	100.15	14.19
9	3.6	76.2	16.0	33.2	21.9	38.1	9.5	82.6	67.70	97.52	13.82
10	4.2	75.3	16.3	33.6	22.0	38.5	9.8	82.2	67.67	95.14	13.48
11	4.7	75.9	16.5	34.7	22.2	39.0	10.2	81.9	67.62	92.74	13.14
12	5.3	73.8	16.8	34.5	22.3	39.4	10.6	81.7	67.58	90.34	12.80
13	5.9	75.2	17.0	36.1	22.4	39.9	11.0	81.1	67.52	87.59	12.41
14	6.5	72.4	17.3	35.7	22.5	40.3	11.4	80.5	67.49	84.74	12.00
15	7.1	73.7	17.5	37.1	22.6	40.7	11.8	80.0	67.45	82.26	11.65
16	7.7	72.1	17.8	37.2	22.7	41.2	12.2	79.4	67.43	79.80	11.31
17	8.3	73.0	18.1	38.7	22.8	41.6	12.7	78.5	67.40	76.88	10.89
18	9.0	73.9	18.4	40.2	22.9	42.1	13.2	77.4	67.38	73.97	10.48
19	9.6	73.3	18.6	41.0	23.0	42.5	13.7	76.3	67.38	71.06	10.07
20	10.3	71.7	18.9	41.0	23.1	43.0	14.1	75.3	67.39	68.40	9.69
21	10.9	72.5	19.2	42.5	23.2	43.4	14.6	74.3	67.38	65.66	9.30
22	11.5	68.9	19.5	41.4	23.3	43.9	15.1	73.2	67.40	62.75	8.89
23	12.3	68.7	19.4	42.6	23.4	44.3	15.6	71.9	67.39	56.46	8.00
24	13.1	69.7	19.3	44.6	23.5	44.7	16.2	70.4	67.38	49.26	6.98
25	13.7	67.7	19.1	44.3	23.6	45.2	16.7	69.4	67.38	42.95	6.09
26	14.3	69.5	19.0	46.5	23.8	45.6	17.1	68.6	67.37	37.29	5.28
27	14.9	71.2	18.9	48.8	23.9	46.1	17.6	67.7	67.35	31.12	4.41
28	15.5	71.6	18.7	50.2	24.0	46.5	18.0	66.9	67.33	25.39	3.60
29	16.1	71.0	18.6	50.8	24.1	47.0	18.5	66.0	67.33	19.44	2.75
30	16.7	67.3	18.4	49.3	24.2	47.4	19.0	65.2	67.35	13.38	1.90
31	17.4	64.6	18.3	48.4	24.3	47.9	19.4	64.3	67.37	7.30	1.03
32	18.0	64.9	18.1	49.7	24.4	48.3	19.9	63.4	67.36	1.18	0.17
33	18.6	63.9	18.6	50.1	24.5	48.8	20.4	62.5	67.36	5.17	0.73
34	19.3	64.2	19.3	51.6	24.6	49.2	20.9	61.6	67.34	11.63	1.65
35	20.1	64.5	20.1	53.5	24.7	49.6	21.5	60.3	67.32	19.22	2.72
36	21.0	60.2	21.0	51.5	24.8	50.1	22.2	58.8	67.35	27.51	3.90
37	22.0	62.1	22.0	55.2	24.9	50.5	22.9	57.1	67.30	36.58	5.18
38	23.2	60.1	23.2	55.8	25.0	51.0	23.8	55.0	67.29	47.29	6.70
39	24.8	56.4	24.8	55.7	25.1	51.4	24.9	52.2	67.28	61.05	8.65
40	28.3	50.1	26.3	56.5	25.2	51.9	27.4	45.7	67.24	90.53	12.83

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

EU: Energy recovery: Heat energy	MWh	335.11	EUR	20107.00	(60.00 EUR/MWh)
EU: Energy recovery: Cold energy	MWh	12.83	EUR	1026.00	(80.00 EUR/MWh)
EU: 2 Fan + Glycol pump	MWh	-23.14	EUR	-2314.00	(100.00 EUR/MWh)
EU: Energy recovery: Net useful ratio / Year	MWh	324.79	EUR	18819.00	(57.94 EUR/MWh)
EU: Need of energy total / Year	MWh	673.82	EUR	47538.80	(70.55 EUR/MWh)
EU: Net useful ratio / Year	%	48.20	%	39.59	TWG = 71.15%
CH: Guidelines from associations such as SIA and SWKI: TWG>70.00% & JNG>75.00% & ETV>15.00					JNG = 69.92%
					ETV = 18.10

LOGO

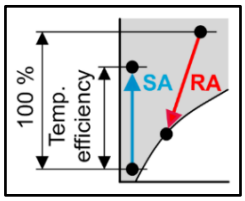
Company
Branch
Street
Country / ZIP / City

Phone: xxxxxxxxxx
Fax: xxxxxxxxxx
E-Mail
Homepage

City, 10.12.2024
With the compliments of

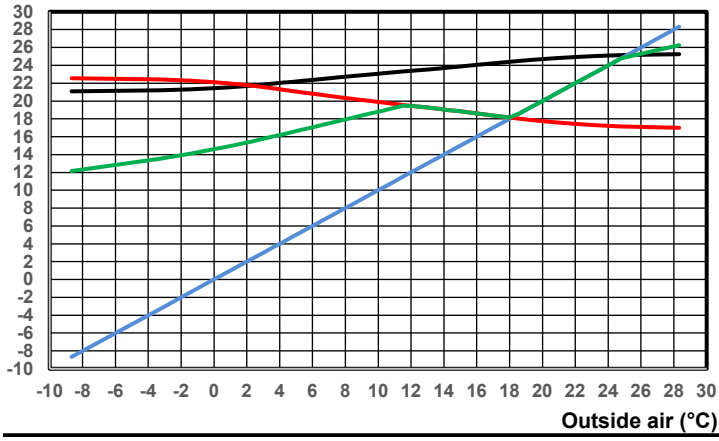
Representative
Direct dialing
xxxxxxxxxx

Plant
Object
Position



Software by www.zcs.ch

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



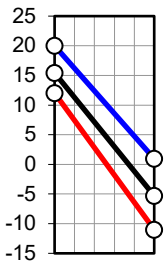
Station		Bern (CH)
Height over sea level	m	540.00
Pressure	hPa	949.65
Outside air	m3/h	0.00
Return air	m3/h	0.00
Adiabatic return air cooling	h/a	0.00
Service at 100% Air flow	h/a	5666.65
Capital interest	%	1.00
Energy increase	%	1.00
Inflation	%	1.00
Support costs	%	5.00
Costs without CC-System	EUR	75000.00
Costs with CC-System	EUR	126000.00
Additional costs	EUR	51000.00
BEP (Break even point) after	Years	3.16

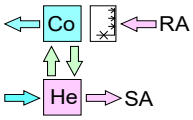
CC-System in winter		SA-He	RA-Co	Definition
Height over sea level	m			540.000
Pressure	hPa			949.653
Efficiency	%	74.275	61.418	
Capacity sensible	kW	180.204	143.848	
Capacity latent	kW	---	35.226	
Capacity frost	kW	---	1.131	
Capacity total	kW	180.204	180.204	
Surface reserve	%	0.011	0.058	
Present surface	m2	975.526	975.526	

SA-He		Inlet	Outlet	Definition
Temp.	°C	-11.000	12.025	20.000
Rel. humidity	%	90.000	15.122	40.000
Abs. humidity	g/kg	1.394	1.394	6.175
Volume flow humid	m3/h	22186.296	24134.896	25000.000
Velocity	m/s	1.779	1.936	2.005
Pressure drop	Pa		98.464	

RA-Co		Inlet	Outlet	Definition
Temp.	°C	20.000	0.960	20.000
Rel. humidity	%	40.000	99.534	40.000
Abs. humidity	g/kg	6.175	4.311	6.175
Volume flow humid	m3/h	24000.000	22374.737	24000.000
Velocity	m/s	1.925	1.794	1.925
Pressure drop wet	Pa		108.348	

Temper -20			SA-He	RA-Co
Temp.	in	°C	15.430	-5.300
Temp.	out	°C	-5.300	15.430
Volume flow		m3/h	8.336	8.339
Velocity		m/s	1.095	1.096
Reynolds		---	5127.557	5011.471
Pressure drop		kPa	184.033	185.095





LOGO

Company
Branch
Street
Country / ZIP / City

Phone: xxxxxxxxxx
Fax: xxxxxxxxxx
E-Mail
Homepage

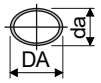
City, 10.12.2024
With the compliments of

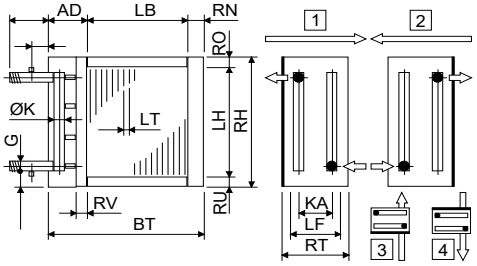
Representative
Direct dialing
xxxxxxxxxx

Plant
Object
Position

Software by www.zcs.ch

Technical data			SA-He	RA-Co		SA-He	RA-Co
Tubes total		Piece	768	768	Tubes:	Cu	Cu
Tubes blank		Piece	8	8	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	38	38	Collectors:	1.13 m/s	1.13 m/s
Number of circuits (NC)		Piece	20	20	Connections:	Rg7	Rg7
Volume		l	164	164	Connections:	1.13 m/s	1.13 m/s
Weight		kg	517	517	Fins:	Al	Al
Connections	G	---	2"	2"	Fins:	Wave structure	Wave structure
Frame height	RH	mm	1980	1980	Frame:	AISI 304	AISI 304
Frame width	BT	mm	2000	2000	Air flow direction:	horizontal	horizontal
Frame depth	RT	mm	400	400	Protection:	without	without
Finned height	LH	mm	1920	1920	Protection:	---	---
Finned width	LB	mm	1804	1804			
Finned depth	LF	mm	312	312			
Frame on top	RO	mm	30	30			
Frame on bottom	RU	mm	30	30			
Frame in front	RV	mm	30	30			
Frame on back (~53/53mm)	RN	mm	53	53			
Collector-Diameter	K	mm	54	54			
Collector covering	AD	mm	143	143			
Collector distance	KA	mm	321	321			
Fin spacing	LT	mm	2.500	2.500			
Fin thickness	LD	mm	0.200	0.200			
Tube diameter	DA	mm	12.400	12.400	Delivery:		5-6 weeks
Tube diameter	da	mm	12.400	12.400	Validity:		12 weeks
Tube thickness	S	mm	0.400	0.400	Condit.:		net, prepaid address
Tube interval on the height	S1	mm	30.000	30.000	Payment:		30 days net
Tube interval on the depth	S2	mm	25.981	25.981			





SA-He: 30/26/12-12R-64T-1804A-2.5PA-20C-Cu/Al/AISI 304 **SA-He:** **EUR** **9274.00**

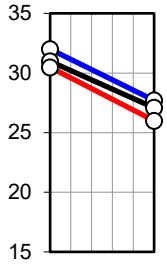
RA-Co: 30/26/12-12R-64T-1804A-2.5PA-20C-Cu/Al/AISI 304 **RA-Co:** **EUR** **9274.00**

CC-System in summer		RA-Hy	SA-Co	Definition
Height over sea level	m			540.000
Pressure	hPa			949.653
Efficiency	%	74.720	71.574	
Capacity sensible	kW	34.339	34.339	
Capacity latent	kW	0.000	0.000	
Capacity frost	kW	---	0.000	
Capacity total	kW	34.339	34.339	
Surface reserve	%	0.023	0.091	
Present surface	m2	975.526	975.526	

RA-Hy		Inlet	Outlet	Definition
Temp.	°C	26.000	30.483	20.000
Rel. humidity	%	51.420	39.641	40.000
Abs. humidity	g/kg	11.500	11.500	6.175
Volume flow humid	m3/h	24698.725	25068.859	24000.000
Velocity	m/s	1.981	2.010	1.925
Pressure drop	Pa		104.480	

SA-Co		Inlet	Outlet	Definition
Temp.	°C	32.000	27.706	20.000
Rel. humidity	%	40.000	51.168	40.000
Abs. humidity	g/kg	12.671	12.671	6.175
Volume flow humid	m3/h	26292.318	25922.311	25000.000
Velocity	m/s	2.109	2.079	2.005
Pressure drop wet	Pa		113.342	

Temper -20			RA-Hy	SA-Co
Temp.	in	°C	30.982	27.080
Temp.	out	°C	27.080	30.982
Volume flow		m3/h	8.336	8.336
Velocity		m/s	1.095	1.096
Reynolds		---	9755.005	9727.602
Pressure drop		kPa	160.321	160.438



LOGO

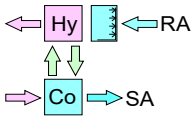
Company
Branch
Street
Country / ZIP / City

Phone: xxxxxxxxxx
Fax: xxxxxxxxxx
E-Mail
Homepage

City, 10.12.2024
With the compliments of

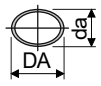
Representative
Direct dialing
xxxxxxxxxx

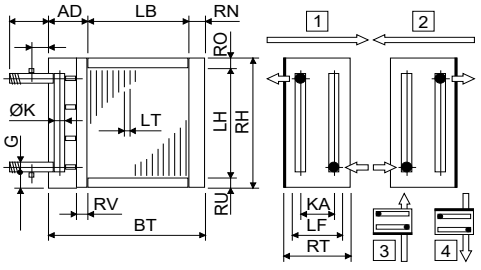
Plant
Object
Position



Software by www.zcs.ch

Technical data			RA-Hy	SA-Co		RA-Hy	SA-Co
Tubes total		Piece	768	768	Tubes:	Cu	Cu
Tubes blank		Piece	8	8	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	38	38	Collectors:	1.13 m/s	1.13 m/s
Number of circuits (NC)		Piece	20	20	Connections:	Rg7	Rg7
Volume		l	164	164	Connections:	1.13 m/s	1.13 m/s
Weight		kg	517	517	Fins:	Al	Al
Connections	G	---	2"	2"	Fins:	Wave structure	Wave structure
Frame height	RH	mm	1980	1980	Frame:	AISI 304	AISI 304
Frame width	BT	mm	2000	2000	Air flow direction:	horizontal	horizontal
Frame depth	RT	mm	400	400	Protection:	without	without
Finned height	LH	mm	1920	1920	Protection:	---	---
Finned width	LB	mm	1804	1804			
Finned depth	LF	mm	312	312			
Frame on top	RO	mm	30	30			
Frame on bottom	RU	mm	30	30			
Frame in front	RV	mm	30	30			
Frame on back (~53/53mm)	RN	mm	53	53			
Collector-Diameter	K	mm	54	54			
Collector covering	AD	mm	143	143			
Collector distance	KA	mm	321	321			
Fin spacing	LT	mm	2.500	2.500			
Fin thickness	LD	mm	0.200	0.200			
Tube diameter	DA	mm	12.400	12.400	Delivery:		5-6 weeks
Tube diameter	da	mm	12.400	12.400	Validity:		12 weeks
Tube thickness	S	mm	0.400	0.400	Condit.:		net, prepaid address
Tube interval on the height	S1	mm	30.000	30.000	Payment:		30 days net
Tube interval on the depth	S2	mm	25.981	25.981			





RA-Hy: 30/26/12-12R-64T-1804A-2.5PA-20C-Cu/Al/AISI 304 **RA-Hy:** **EUR** **9274.00**

SA-Co: 30/26/12-12R-64T-1804A-2.5PA-20C-Cu/Al/AISI 304 **SA-Co:** **EUR** **9274.00**

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	13.1	16.2	21.1	34.5	1.9	95.2	73.19	170.50	24.15
2	-3.3	78.4	14.3	22.3	21.2	35.0	4.7	90.2	71.87	138.09	19.56
3	-1.4	79.2	14.8	25.5	21.3	35.4	5.8	88.4	71.46	127.47	18.06
4	-0.2	78.5	15.2	27.3	21.4	35.9	6.5	87.4	71.26	121.01	17.14
5	0.8	76.3	15.5	28.2	21.5	36.3	7.2	86.4	71.10	115.53	16.37
6	1.6	79.2	15.8	30.4	21.6	36.7	7.7	85.8	70.96	111.40	15.78
7	2.4	77.1	16.1	30.7	21.7	37.2	8.2	85.2	70.88	107.67	15.25
8	3.0	77.3	16.3	31.7	21.8	37.6	8.6	84.9	70.81	104.67	14.83
9	3.6	76.2	16.6	32.1	21.9	38.1	9.0	84.5	70.76	101.93	14.44
10	4.2	75.3	16.8	32.5	22.0	38.5	9.4	84.2	70.71	99.42	14.08
11	4.7	75.9	17.0	33.5	22.2	39.0	9.8	83.9	70.65	96.89	13.73
12	5.3	73.8	17.3	33.4	22.3	39.4	10.2	83.5	70.60	94.38	13.37
13	5.9	75.2	17.5	35.0	22.4	39.9	10.6	83.1	70.54	91.50	12.96
14	6.5	72.4	17.8	34.6	22.5	40.3	11.0	82.5	70.48	88.49	12.54
15	7.1	73.7	18.0	36.1	22.6	40.7	11.4	82.0	70.43	85.90	12.17
16	7.7	72.1	18.2	36.2	22.7	41.2	11.8	81.4	70.39	83.31	11.80
17	8.3	73.0	18.5	37.7	22.8	41.6	12.3	80.6	70.34	80.24	11.37
18	9.0	73.9	18.8	39.2	22.9	42.1	12.8	79.6	70.31	77.19	10.93
19	9.6	73.3	19.0	40.0	23.0	42.5	13.3	78.3	70.31	74.15	10.50
20	10.3	71.7	19.3	40.1	23.1	43.0	13.7	77.3	70.32	71.38	10.11
21	10.9	72.5	19.6	41.6	23.2	43.4	14.2	76.1	70.31	68.52	9.71
22	11.5	68.9	19.6	40.6	23.3	43.9	14.7	74.9	70.32	63.39	8.98
23	12.3	68.7	19.4	41.7	23.4	44.3	15.3	73.4	70.32	56.46	8.00
24	13.1	69.7	19.3	43.7	23.5	44.7	15.9	71.9	70.30	49.26	6.98
25	13.7	67.7	19.1	43.5	23.6	45.2	16.4	70.7	70.31	42.95	6.09
26	14.3	69.5	19.0	45.8	23.8	45.6	16.8	69.9	70.29	37.29	5.28
27	14.9	71.2	18.9	48.1	23.9	46.1	17.3	68.8	70.27	31.12	4.41
28	15.5	71.6	18.7	49.4	24.0	46.5	17.8	68.0	70.26	25.39	3.60
29	16.1	71.0	18.6	50.1	24.1	47.0	18.3	67.1	70.25	19.44	2.75
30	16.7	67.3	18.4	48.7	24.2	47.4	18.7	66.1	70.27	13.38	1.90
31	17.4	64.6	18.3	47.8	24.3	47.9	19.2	65.1	70.29	7.30	1.03
32	18.0	64.9	18.1	49.2	24.4	48.3	19.7	64.2	70.28	1.18	0.17
33	18.6	63.9	18.6	49.6	24.5	48.8	20.2	63.2	70.28	5.17	0.73
34	19.3	64.2	19.3	51.2	24.6	49.2	20.7	62.2	70.26	11.63	1.65
35	20.1	64.5	20.1	53.0	24.7	49.6	21.4	60.8	70.24	19.22	2.72
36	21.0	60.2	21.0	51.2	24.8	50.1	22.0	59.2	70.26	27.51	3.90
37	22.0	62.1	22.0	54.9	24.9	50.5	22.8	57.4	70.21	36.58	5.18
38	23.2	60.1	23.2	55.7	25.0	51.0	23.7	55.2	70.20	47.29	6.70
39	24.8	56.4	24.8	55.6	25.1	51.4	24.9	52.2	70.19	61.05	8.65
40	28.3	50.1	26.2	56.8	25.2	51.9	27.5	45.4	70.15	90.53	12.83

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

EU: Energy recovery: Heat energy	MWh	348.04	EUR	20883.00	(60.00 EUR/MWh)
EU: Energy recovery: Cold energy	MWh	12.83	EUR	1026.00	(80.00 EUR/MWh)
EU: 2 Fan + Glycol pump	MWh	-20.72	EUR	-2072.00	(100.00 EUR/MWh)
EU: Energy recovery: Net useful ratio / Year	MWh	340.15	EUR	19837.00	(58.32 EUR/MWh)
EU: Need of energy total / Year	MWh	668.44	EUR	47058.01	(70.40 EUR/MWh)
EU: Net useful ratio / Year	%	50.89	%	42.15	TWG = 74.28%
CH: Guidelines from associations such as SIA and SWKI: TWG>70.00% & JNG>75.00% & ETV>15.00					JNG = 73.36%
					ETV = 21.00

LOGO

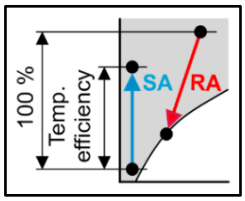
Company
Branch
Street
Country / ZIP / City

Phone: xxxxxxxxxx
Fax: xxxxxxxxxx
E-Mail
Homepage

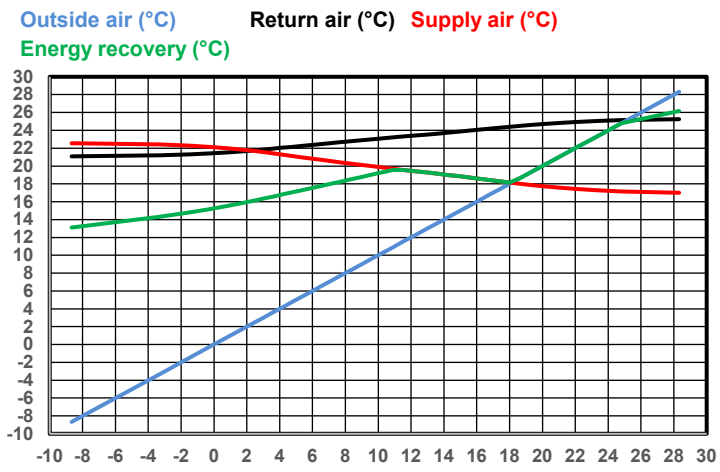
City, 10.12.2024
With the compliments of

Representative
Direct dialing
xxxxxxxxxx

Plant
Object
Position



Software by www.zcs.ch



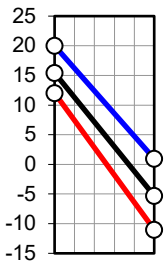
Station		Bern (CH)
Height over sea level	m	540.00
Pressure	hPa	949.65
Outside air	m3/h	0.00
Return air	m3/h	0.00
Adiabatic return air cooling	h/a	0.00
Service at 100% Air flow	h/a	5666.65
Capital interest	%	1.00
Energy increase	%	1.00
Inflation	%	1.00
Support costs	%	5.00
Costs without CC-System	EUR	75000.00
Costs with CC-System	EUR	130000.00
Additional costs	EUR	55000.00
BEP (Break even point) after	Years	3.24

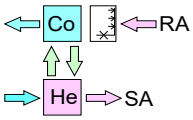
CC-System in winter		SA-He	RA-Co	Definition
Height over sea level	m			540.000
Pressure	hPa			949.653
Efficiency	%	74.275	61.418	
Capacity sensible	kW	180.204	143.848	
Capacity latent	kW	---	35.226	
Capacity frost	kW	---	1.131	
Capacity total	kW	180.204	180.204	
Surface reserve	%	0.011	0.058	
Present surface	m2	975.526	975.526	

SA-He		Inlet	Outlet	Definition
Temp.	°C	-11.000	12.025	20.000
Rel. humidity	%	90.000	15.122	40.000
Abs. humidity	g/kg	1.394	1.394	6.175
Volume flow humid	m3/h	22186.296	24134.896	25000.000
Velocity	m/s	1.779	1.936	2.005
Pressure drop	Pa		98.464	

RA-Co		Inlet	Outlet	Definition
Temp.	°C	20.000	0.960	20.000
Rel. humidity	%	40.000	99.534	40.000
Abs. humidity	g/kg	6.175	4.311	6.175
Volume flow humid	m3/h	24000.000	22374.737	24000.000
Velocity	m/s	1.925	1.794	1.925
Pressure drop wet	Pa		108.348	

Temper -20			SA-He	RA-Co
Temp.	in	°C	15.430	-5.300
Temp.	out	°C	-5.300	15.430
Volume flow		m3/h	8.336	8.339
Velocity		m/s	1.095	1.096
Reynolds		---	5127.557	5011.471
Pressure drop		kPa	184.033	185.095





LOGO

Company
Branch
Street
Country / ZIP / City

Phone: xxxxxxxxxx
Fax: xxxxxxxxxx
E-Mail
Homepage

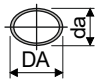
City, 10.12.2024
With the compliments of

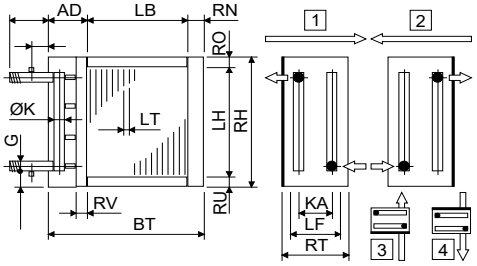
Representative
Direct dialing
xxxxxxxxxx

Plant
Object
Position

Software by www.zcs.ch

Technical data			SA-He	RA-Co		SA-He	RA-Co
Tubes total		Piece	768	768	Tubes:	Cu	Cu
Tubes blank		Piece	8	8	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	38	38	Collectors:	1.13 m/s	1.13 m/s
Number of circuits (NC)		Piece	20	20	Connections:	Rg7	Rg7
Volume		l	164	164	Connections:	1.13 m/s	1.13 m/s
Weight		kg	517	517	Fins:	Al	Al
Connections	G	---	2"	2"	Fins:	Wave structure	Wave structure
Frame height	RH	mm	1980	1980	Frame:	AISI 304	AISI 304
Frame width	BT	mm	2000	2000	Air flow direction:	horizontal	horizontal
Frame depth	RT	mm	400	400	Protection:	without	without
Finned height	LH	mm	1920	1920	Protection:	---	---
Finned width	LB	mm	1804	1804			
Finned depth	LF	mm	312	312			
Frame on top	RO	mm	30	30			
Frame on bottom	RU	mm	30	30			
Frame in front	RV	mm	30	30			
Frame on back (~53/53mm)	RN	mm	53	53			
Collector-Diameter	K	mm	54	54			
Collector covering	AD	mm	143	143			
Collector distance	KA	mm	321	321			
Fin spacing	LT	mm	2.500	2.500			
Fin thickness	LD	mm	0.200	0.200			
Tube diameter	DA	mm	12.400	12.400	Delivery:		5-6 weeks
Tube diameter	da	mm	12.400	12.400	Validity:		12 weeks
Tube thickness	S	mm	0.400	0.400	Condit.:		net, prepaid address
Tube interval on the height	S1	mm	30.000	30.000	Payment:		30 days net
Tube interval on the depth	S2	mm	25.981	25.981			





SA-He: 30/26/12-12R-64T-1804A-2.5PA-20C-Cu/Al/AISI 304 **SA-He:** **EUR** **9274.00**

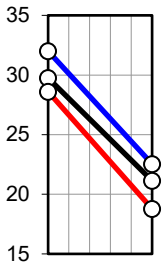
RA-Co: 30/26/12-12R-64T-1804A-2.5PA-20C-Cu/Al/AISI 304 **RA-Co:** **EUR** **9274.00**

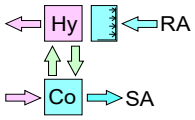
CC-System in summer		RA-Hy	SA-Co	Definition
Height over sea level	m			540.000
Pressure	hPa			949.653
Efficiency	%	74.320	71.569	
Capacity sensible	kW	75.644	75.644	
Capacity latent	kW	0.000	0.000	
Capacity frost	kW	---	0.000	
Capacity total	kW	75.644	75.644	
Surface reserve	%	0.097	0.121	
Present surface	m2	975.526	975.526	

RA-Hy		Inlet	Outlet	Definition
Temp. (26.000)	°C	18.780	28.605	20.000
Rel. humidity (51.420)	%	100.000	55.425	40.000
Abs. humidity (11.500)	g/kg	14.502	14.502	6.175
Volume flow humid	m3/h	24216.847	25031.839	24000.000
Velocity	m/s	1.942	2.007	1.925
Pressure drop	Pa		103.161	

SA-Co		Inlet	Outlet	Definition
Temp.	°C	32.000	22.539	20.000
Rel. humidity	%	40.000	69.551	40.000
Abs. humidity	g/kg	12.671	12.671	6.175
Volume flow humid	m3/h	26292.318	25477.149	25000.000
Velocity	m/s	2.109	2.043	2.005
Pressure drop wet	Pa		112.271	

Temper -20			RA-Hy	SA-Co
Temp.	in	°C	29.746	21.136
Temp.	out	°C	21.136	29.746
Volume flow		m3/h	8.336	8.337
Velocity		m/s	1.095	1.096
Reynolds		---	9096.483	9034.070
Pressure drop		kPa	162.765	163.051





LOGO

Company
Branch
Street
Country / ZIP / City

Phone: xxxxxxxxxx
Fax: xxxxxxxxxx
E-Mail
Homepage

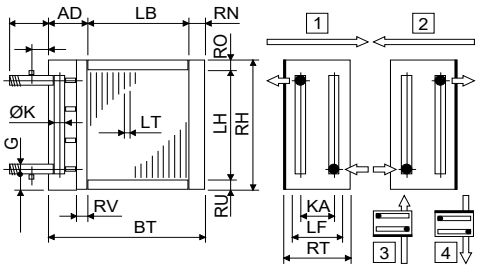
City, 10.12.2024
With the compliments of

Representative
Direct dialing
xxxxxxxxxx

Plant
Object
Position

Software by www.zcs.ch

Technical data			RA-Hy	SA-Co		RA-Hy	SA-Co
Tubes total		Piece	768	768	Tubes:	Cu	Cu
Tubes blank		Piece	8	8	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	38	38	Collectors:	1.13 m/s	1.13 m/s
Number of circuits (NC)		Piece	20	20	Connections:	Rg7	Rg7
Volume		l	164	164	Connections:	1.13 m/s	1.13 m/s
Weight		kg	517	517	Fins:	Al	Al
Connections	G	---	2"	2"	Fins:	Wave structure	Wave structure
Frame height	RH	mm	1980	1980	Frame:	AISI 304	AISI 304
Frame width	BT	mm	2000	2000	Air flow direction:	horizontal	horizontal
Frame depth	RT	mm	400	400	Protection:	without	without
Finned height	LH	mm	1920	1920	Protection:	---	---
Finned width	LB	mm	1804	1804			
Finned depth	LF	mm	312	312			
Frame on top	RO	mm	30	30			
Frame on bottom	RU	mm	30	30			
Frame in front	RV	mm	30	30			
Frame on back (~53/53mm)	RN	mm	53	53			
Collector-Diameter	K	mm	54	54			
Collector covering	AD	mm	143	143			
Collector distance	KA	mm	321	321			
Fin spacing	LT	mm	2.500	2.500			
Fin thickness	LD	mm	0.200	0.200			
Tube diameter	DA	mm	12.400	12.400	Delivery:		5-6 weeks
Tube diameter	da	mm	12.400	12.400	Validity:		12 weeks
Tube thickness	S	mm	0.400	0.400	Condit.:		net, prepaid address
Tube interval on the height	S1	mm	30.000	30.000	Payment:		30 days net
Tube interval on the depth	S2	mm	25.981	25.981			



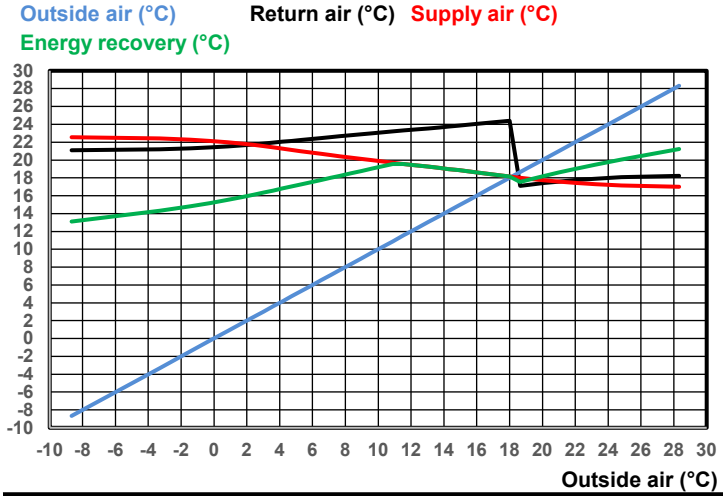
RA-Hy: 30/26/12-12R-64T-1804A-2.5PA-20C-Cu/Al/AISI 304	**RA-Hy:**	**EUR**	**9274.00**
SA-Co: 30/26/12-12R-64T-1804A-2.5PA-20C-Cu/Al/AISI 304	**SA-Co:**	**EUR**	**9274.00**

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	13.1	16.2	21.1	34.5	1.9	95.2	73.19	170.50	24.15
2	-3.3	78.4	14.3	22.3	21.2	35.0	4.7	90.2	71.87	138.09	19.56
3	-1.4	79.2	14.8	25.5	21.3	35.4	5.8	88.4	71.46	127.47	18.06
4	-0.2	78.5	15.2	27.3	21.4	35.9	6.5	87.4	71.26	121.01	17.14
5	0.8	76.3	15.5	28.2	21.5	36.3	7.2	86.4	71.10	115.53	16.37
6	1.6	79.2	15.8	30.4	21.6	36.7	7.7	85.8	70.96	111.40	15.78
7	2.4	77.1	16.1	30.7	21.7	37.2	8.2	85.2	70.88	107.67	15.25
8	3.0	77.3	16.3	31.7	21.8	37.6	8.6	84.9	70.81	104.67	14.83
9	3.6	76.2	16.6	32.1	21.9	38.1	9.0	84.5	70.76	101.93	14.44
10	4.2	75.3	16.8	32.5	22.0	38.5	9.4	84.2	70.71	99.42	14.08
11	4.7	75.9	17.0	33.5	22.2	39.0	9.8	83.9	70.65	96.89	13.73
12	5.3	73.8	17.3	33.4	22.3	39.4	10.2	83.5	70.60	94.38	13.37
13	5.9	75.2	17.5	35.0	22.4	39.9	10.6	83.1	70.54	91.50	12.96
14	6.5	72.4	17.8	34.6	22.5	40.3	11.0	82.5	70.48	88.49	12.54
15	7.1	73.7	18.0	36.1	22.6	40.7	11.4	82.0	70.43	85.90	12.17
16	7.7	72.1	18.2	36.2	22.7	41.2	11.8	81.4	70.39	83.31	11.80
17	8.3	73.0	18.5	37.7	22.8	41.6	12.3	80.6	70.34	80.24	11.37
18	9.0	73.9	18.8	39.2	22.9	42.1	12.8	79.6	70.31	77.19	10.93
19	9.6	73.3	19.0	40.0	23.0	42.5	13.3	78.3	70.31	74.15	10.50
20	10.3	71.7	19.3	40.1	23.1	43.0	13.7	77.3	70.32	71.38	10.11
21	10.9	72.5	19.6	41.6	23.2	43.4	14.2	76.1	70.31	68.52	9.71
22	11.5	68.9	19.6	40.6	23.3	43.9	14.7	74.9	70.32	63.39	8.98
23	12.3	68.7	19.4	41.7	23.4	44.3	15.3	73.4	70.32	56.46	8.00
24	13.1	69.7	19.3	43.7	23.5	44.7	15.9	71.9	70.30	49.26	6.98
25	13.7	67.7	19.1	43.5	23.6	45.2	16.4	70.7	70.31	42.95	6.09
26	14.3	69.5	19.0	45.8	23.8	45.6	16.8	69.9	70.29	37.29	5.28
27	14.9	71.2	18.9	48.1	23.9	46.1	17.3	68.8	70.27	31.12	4.41
28	15.5	71.6	18.7	49.4	24.0	46.5	17.8	68.0	70.26	25.39	3.60
29	16.1	71.0	18.6	50.1	24.1	47.0	18.3	67.1	70.25	19.44	2.75
30	16.7	67.3	18.4	48.7	24.2	47.4	18.7	66.1	70.27	13.38	1.90
31	17.4	64.6	18.3	47.8	24.3	47.9	19.2	65.1	70.29	7.30	1.03
32	18.0	64.9	18.1	49.2	24.4	48.3	19.7	64.2	70.28	1.18	0.17
33	18.6	63.9	17.6	68.4	17.1	100.0	18.2	93.2	70.41	8.65	1.23
34	19.3	64.2	17.9	70.3	17.3	100.0	18.8	91.0	70.39	11.62	1.65
35	20.1	64.5	18.2	72.7	17.4	100.0	19.4	88.4	70.37	15.15	2.15
36	21.0	60.2	18.6	69.9	17.6	100.0	20.1	85.5	70.39	19.28	2.73
37	22.0	62.1	19.0	74.8	17.7	100.0	20.9	82.4	70.34	23.95	3.39
38	23.2	60.1	19.5	75.5	17.9	100.0	21.8	78.7	70.33	29.77	4.22
39	24.8	56.4	20.1	75.2	18.1	100.0	23.0	73.9	70.32	37.73	5.35
40	28.3	50.1	21.2	76.4	18.2	100.0	25.6	63.8	70.28	56.70	8.03

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

EU: Energy recovery: Heat energy	MWh	348.04	EUR	20883.00	(60.00 EUR/MWh)
EU: Energy recovery: Cold energy	MWh	28.74	EUR	2299.00	(80.00 EUR/MWh)
EU: 2 Fan + Glycol pump	MWh	-20.72	EUR	-2072.00	(100.00 EUR/MWh)
EU: Energy recovery: Net useful ratio / Year	MWh	356.06	EUR	21110.00	(59.29 EUR/MWh)
EU: Need of energy total / Year	MWh	613.93	EUR	42697.41	(69.55 EUR/MWh)
EU: Net useful ratio / Year	%	58.00	%	49.44	TWG = 74.28%
CH: Guidelines from associations such as SIA and SWKI: TWG>70.00% & JNG>75.00% & ETV>15.00					JNG = 73.36%
					ETV = 21.00



Station		Bern (CH)
Height over sea level	m	540.00
Pressure	hPa	949.65
Outside air	m3/h	0.00
Return air	m3/h	0.00
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	75000.00
Costs with CC-System	EUR	135000.00
Additional costs	EUR	60000.00
BEP (Break even point) after	Years	3.34

LOGO

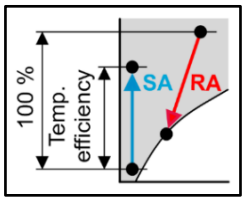
Company
Branch
Street
Country / ZIP / City

Phone: xxxxxxxxxx
Fax: xxxxxxxxxx
E-Mail
Homepage

City, 10.12.2024
With the compliments of

Representative
Direct dialing
xxxxxxxxxx

Plant
Object
Position



Software by www.zcs.ch