Federal Council-SIA-SWKI-Bullshit

A Google search with 2 search terms **SIA** and **Freezing** limit yields the following hits:

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Verbund-System-WRG in raumlufttechni- schen Anlagen ...

22.12.2016 — Die Norm **SIA** 382/1 [20] und die SWKI-Richtlinie VA300-01 [21] ...
Einfriergrenze – sobald das Kondensat im der ABL eingefriert würde - eine ...
Du hast diese Seite oft aufgerufen. Letzter Besuch: 3.9.2023

If you then click on the 3 dots at the top right after the homepage, you get:

The Federal Council is the government of the Swiss Confederation and, according to Art. 174 of the Federal Constitution, the highest executive and executive authority of the Confederation. The Federal Council and the federal administration together form the executive branch of Switzerland at the federal level.

Everyone thinks that if the **Federal Council** (administration), the **SIA** (Swiss Association of Engineers and Architects) and the **SWKI** (Planners, Network for Energy, Environment and Building Technology) publish such a paper, it would have its content Accuracy.

Furthermore, the first place to read is:

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Anyone who still has doubts about the correctness of the content of this paper must be totally stupid, everyone thinks so! **Or not?**

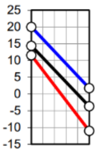
Because the Federal Council doesn't understand anything about thermodynamics, it gives the task to the Federal Office of Energy, which also doesn't know anything about thermodynamics and therefore gives the task to the Lucerne University of Applied Sciences, which also doesn't know anything about thermodynamics and therefore gives the task to the SIA and the SWKI who also do not understand anything about thermodynamics and therefore gave the order to 2 authors who also do not understand anything about thermodynamics and therefore use a horde of so-called engineers, 28 in number, who also do not understand anything about thermodynamics.

Only in this way can such outrageous bullshit, for example, about the freezing limit and flow patterns (laminar, turbulent) come about.

This is what it says on page 24: ***In order to prevent the condensate from freezing in the air cooler, a warm water-glycol mixture is mixed from the return flow into the flow of the air cooler. To do this, the flow temperature at the air cooler must be measured and normally kept above -2°C.***

With this stupid measure, exactly when it is bitterly cold, a large part of the heat recovery energy is prevented. If the exhaust air is relatively dry with 40% humidity, nothing can freeze even at lower temperatures, which is exactly the case in deep winter! In the following example, the freezing point is only -3.33°C and not already -2.00°C.

CC-System in winter			SA-He	RA-Co	Definition
Height over sea level		m			500.000
Pressure		hPa			954.276
Efficiency		%	72.700	58.906	
Capacity sensible		kW	177.247	144.482	
Capacity latent		kW	---	31.813	
Capacity frost		kW	---	0.952	
Capacity total		kW	177.247	177.247	
Surface reserve		%	0.121	0.088	
Present surface		m2	963.224	963.224	
SA-He (ff = 0.00005 m2K/W)			Inlet	Outlet	Definition
Temp.		°C	-11.000	11.537	20.000
Rel. humidity		%	90.000	15.616	40.000
Abs. humidity		g/kg	1.387	1.387	6.145
Volume flow humid		m3/h	22187.121	24094.473	25000.000
Velocity		m/s	1.802	1.957	2.031
Pressure drop		Pa		101.130	
RA-Co (ff = 0.00005 m2K/W)			Inlet	Outlet	Definition
Temp.		°C	20.000	1.739	20.000
Rel. humidity		%	40.000	99.513	40.000
Abs. humidity		g/kg	6.145	4.537	6.145
Volume flow humid		m3/h	25000.000	23382.751	25000.000
Velocity		m/s	2.031	1.899	2.031
Pressure drop wet		Pa		116.753	
25 V% Et.glycol (ff = 0.00005 / 0.00005 m2K/W			SA-He	RA-Co	
Temp.	in	°C	14.390	-3.700	
Temp.	out	°C	-3.700	14.390	
Volume flow		m3/h	9.163	9.166	
Velocity		m/s	1.184	1.184	
Reynolds		---	4933.945	4810.348	
Pressure drop		kPa	193.979	195.214	



Service			Default	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
Air flow		%	100.00	100.00	100.00	100.00	100.00	100.00	100.00
SA: Temp.	**in**	**°C**	-11.00	-10.80	-10.70	-10.60	-10.50	-10.40	-10.30
SA: Rel. humidity	in	%	90.00	90.00	90.00	90.00	90.00	90.00	90.00
SA: Abs. humidity	in	g/kg	1.39	1.41	1.43	1.44	1.45	1.46	1.48
SA: Temp.	out	°C	11.54	11.58	11.60	11.63	11.64	11.64	11.65
SA: Rel. humidity	out	%	15.62	15.85	15.97	16.09	16.22	16.38	16.51
SA: Abs. humidity	out	g/kg	1.39	1.41	1.43	1.44	1.45	1.46	1.48
SA: Volume flow		m3/h	25000.00	25000.00	25000.00	25000.00	25000.00	25000.00	25000.00
SA: Pressure drop		Pa	101.13	101.19	101.21	101.24	101.27	101.29	101.32
SA: Capacity		kW	177.25	**176.04**	**175.41**	**174.85**	**174.18**	**173.33**	**172.67**
SA: Efficiency		**%**	**72.70**	72.67	72.65	72.65	72.61	72.49	72.45
Agent: Temp.	in	°C	14.39	14.41	14.42	14.43	14.44	14.41	14.42
Agent: Temp.	out	°C	-3.70	-3.55	-3.48	-3.42	-3.33	-3.28	-3.20
Agent: Volume flow		m3/h	9.16	9.16	9.16	9.16	9.16	9.16	9.16
Agent: Pressure drop		kPa	389.19	388.33	388.20	388.10	386.74	387.94	387.88
RA: Temp.	in	°C	20.00	20.00	20.00	20.00	20.00	20.00	20.00
RA: Rel. humidity	in	%	40.00	40.00	40.00	40.00	40.00	40.00	40.00
RA: Abs. humidity	in	g/kg	6.15	6.15	6.15	6.15	6.15	6.15	6.15
RA: Temp.	out	°C	1.74	1.83	1.87	1.91	1.93	1.95	1.99
RA: Rel. humidity	out	%	99.51	99.52	99.52	99.52	99.61	99.60	99.59
RA: Abs. humidity	out	g/kg	4.54	4.57	4.58	4.59	4.60	4.61	4.62
RA: Volume flow		m3/h	25000.00	25000.00	25000.00	25000.00	25000.00	25000.00	25000.00
RA: Pressure drop dry		Pa	109.19	109.12	109.09	109.06	109.03	109.02	108.98
RA: Pressure drop wet		Pa	116.75	116.58	116.50	116.42	116.35	116.32	116.24
RA: Efficiency		%	58.91	59.01	59.05	59.12	59.25	59.39	59.44
RA: Frost-Capacity		**kW**	**0.95**	**0.94**	**0.94**	**0.93**	**0.00**	**0.00**	**0.00**
RA: Frost-Capacity		**%**	**0.54**	**0.54**	**0.53**	**0.53**	**0.00**	**0.00**	**0.00**

In addition, there is the fact that only in the last row of pipes less than 1% of the total output occurs as condensate below 0°C and theoretically frost could form. However, since the air speed is 2 m/s, the freezing limit should be even lower. Just look at a river in winter, where only ice forms, where there is, so to speak, no current worth mentioning, i.e. only on the bank in stagnant zones! If the exhaust air still has less than 40% relative humidity, the freezing point drops even further, for example at 20% to -5.26°C. See more on page 3. More than 200 companies are currently working with our software, some of which have passed the type examination at TUEV Süd Munich. The prerequisite for this is that the software and the measurements regarding performance and pressure loss are within 3%.

In spite of this, the so-called leading Swiss manufacturer of air conditioning units is said to list a freezing limit in its offers based on a temperature of -2.00°C of the water-glycol mixture and as the maximum output without a frost bypass. leading? Yes, but only in terms of absolute nonsense!

That's what it says on page 27 & 28: ***The effects of turbulent and laminar flow of the water-glycol mass flow in the heat exchangers on their performance is illustrated in Figure 17 in a very simplified way. Once laminar flow is achieved, performance drops drastically. For this reason, the manufacturers are forced to operate the heat recovery for every water-glycol mass flow in the turbulent range.***

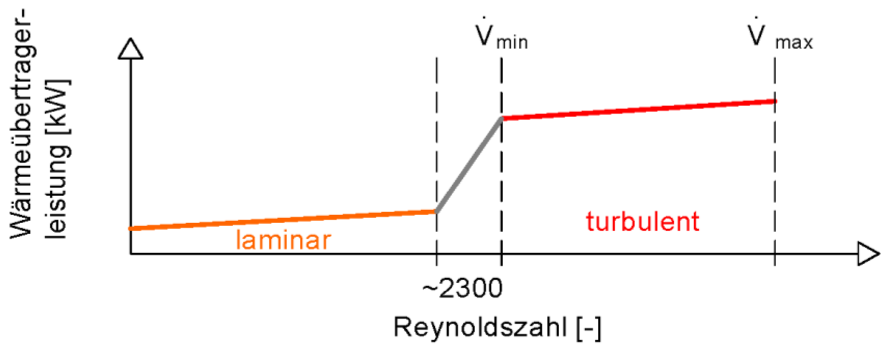


Abbildung 17: Auswirkungen von turbulenter und laminarer Strömung des Wasser-Glykol-Massenstromes im WÜ auf die WÜ Leistung. Für eine optimale Wärmeübertragung muss bei V_{min} eine turbulente Strömung gewährleistet werden.

However, measurements at TUEV Süd Munich have shown that the performance is not drastically reduced in part-load operation, even if the purely theoretical Reynolds number falls below 2300. The power drops linearly to the partial load, so to speak. Why? A laminar flow only exists if there are no disruptive factors, which is not the case with heat exchangers, on the contrary. In the example, the water-glycol mixture in the pipes is deflected 36 times, namely at the back and front in the bends, which ensures a turbulent flow, even below a Reinolds number of 2300! For nominal air quantities, we recommend a pressure loss of 2 bar per heat exchanger, not for reasons of turbulence, but for reasons of high k values, which do not allow for overly large heat exchangers. This **Federal Council SIA SWKI bullshit paper** does not go into further brain-amputated nonsense! It would be better for these idiots to adopt directives and regulations from the EU area than to make themselves look ridiculous with such bullshit!

Reality according to www.zcs.ch contra Federal Council-SIA-SWKI-Bullshit

Return air hunidity	---	Minus 20%	Minus10%	Default	Plus 10%
Return air hunidity	**%**	**20.000**	**30.000**	**40.000**	**50.000**
Temperature efficiency	%	68.350	70.350	72.700	75.300
Heat recovery winter capacity	kW	166.638	171.516	177.247	183.587
Exhaust air frost capacity	kW	0.000	1.266	0.952	0.000
25% Et.Glycol temperature	°C	-5.260	-2.010	-3.330	-4.630
Freezing limit at outside air temperature	°C	-12.500	-8.400	-10.500	-12.600
Heat recovery freezing limit capacity	kW	174.390	155.940	174.180	193.570
Return aur volume flow (20°C/40%)	m3/h	25000.000	25000.000	25000.000	25000.000
Return air temperature	°C	20.000	20.000	20.000	20.000
Return air humidity	%	20.000	30.000	40.000	50.000
Exhaust air temperature	°C	-1.119	0.091	1.739	3.312
Exhaust air humidity	%	83.796	97.507	99.513	100.000
Pressure drop	Pa	105.347	109.665	116.753	125.855
25% Et.Glycol volume flow	m3/h	9.165	9.165	9.165	9.165
Inlet temperature	°C	12.906	13.590	14.390	15.275
Outlet temperature	°C	-4.106	-3.920	-3.700	-3.455
Pressure drop of both heat exchangers	bar	3.923	3.909	3.892	3.873
Outside air volume flow (20°C/40%)	m3/h	25000.000	25000.000	25000.000	25000.000
Outside air temperature	°C	-11.000	-11.000	-11.000	-11.000
Outside air humidity	%	90.000	90.000	90.000	90.000
Supply air temperature	°C	10.189	10.809	11.537	12.343
Supply air humidity	%	17.077	16.387	15.616	14.810
Pressure drop	Pa	100.852	100.979	101.130	101.296

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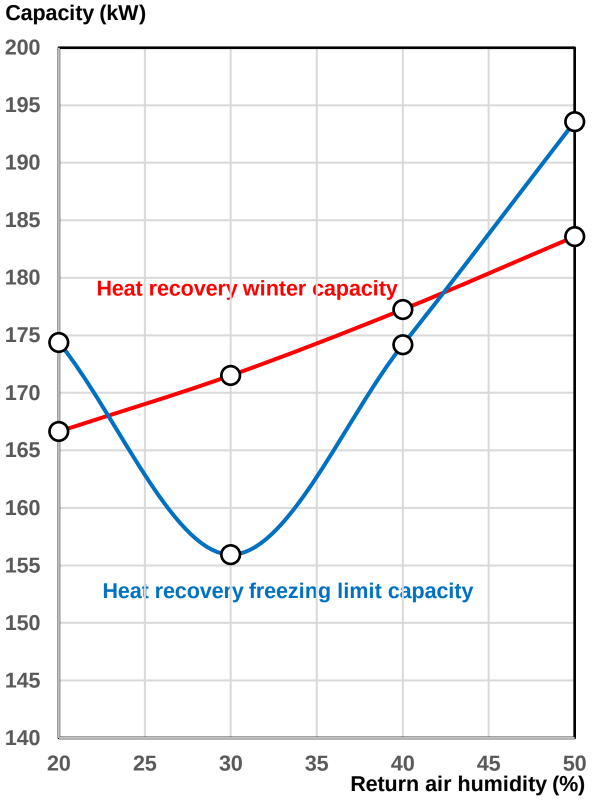
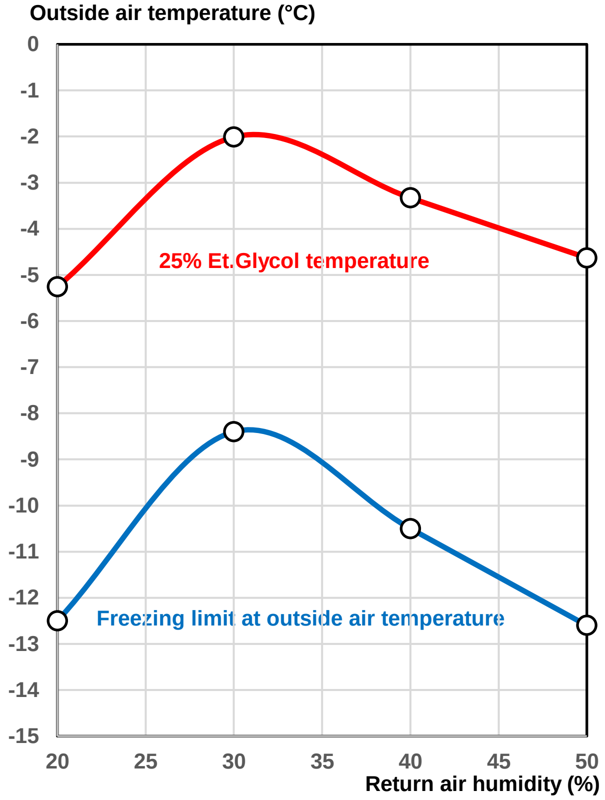




Federal Council-SIA-SWKI-Bullshit

The freezing point is fixed at a glycol temperature of -2°C.
In the example, this results in a freezing limit outside air temperature of -8.4°C.
In the example, this results in a heat recovery freezing limit output of 155.94 kW.

?????

Reality according to www.zcs.ch

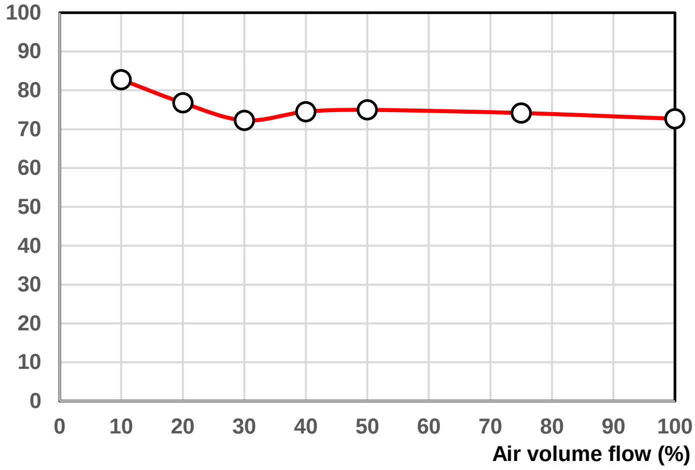
The freezing limit is variable at glycol temperatures, which depend on the exhaust air humidity.
In the example, this results in a freezing limit outside air temperature between -12.6°C and -8.4°C.
In the example, this results in a HR freezing limit output of between 155.94 kW and 193.57 kW.

!!!!!!!

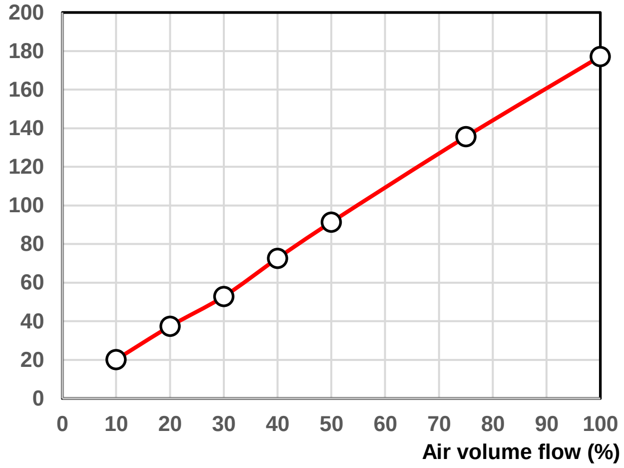
Reality according to www.zcs.ch contra Frderal Council-SIA-SWKI-Bullshit

Air volume flow	**%**	**10.000**	**20.000**	**30.000**	**40.000**	**50.000**	**75.000**	**100.000**
Air volume flow	**m3/h**	**2500.000**	**5000.000**	**7500.000**	**10000.000**	**12500.000**	**18750.000**	**25000.000**
Temperature efficiency	%	82.785	76.800	72.270	74.520	74.980	74.170	72.700
Heat recovery winter capacity	kW	20.184	37.449	52.859	72.674	91.403	135.624	177.247
Exhaust air frost capacity	kW	0.177	0.000	0.000	0.000	0.000	0.746	0.952
25% Et.Glycol temperature inlet	°C	16.008	14.945	14.200	14.558	16.664	14.602	14.390
25% Et.Glycol temperature outlet	°C	-4.588	-4.165	-3.782	-3.985	-3.990	-3.855	-3.700
25% Et.Glycol volume flow	m3/h	0.916	1.833	2.749	3.665	4.582	6.872	9.163
25% Et.Glycol Reynolds supply air	---	493.863	984.453	1473.648	1966.230	2461.567	3699.305	4933.945
25% Et.Glycol Reynolds exhaust air	---	486.225	959.570	1431.879	1914.529	2398.422	3607.425	4810.348

Temperature efficiency (%)

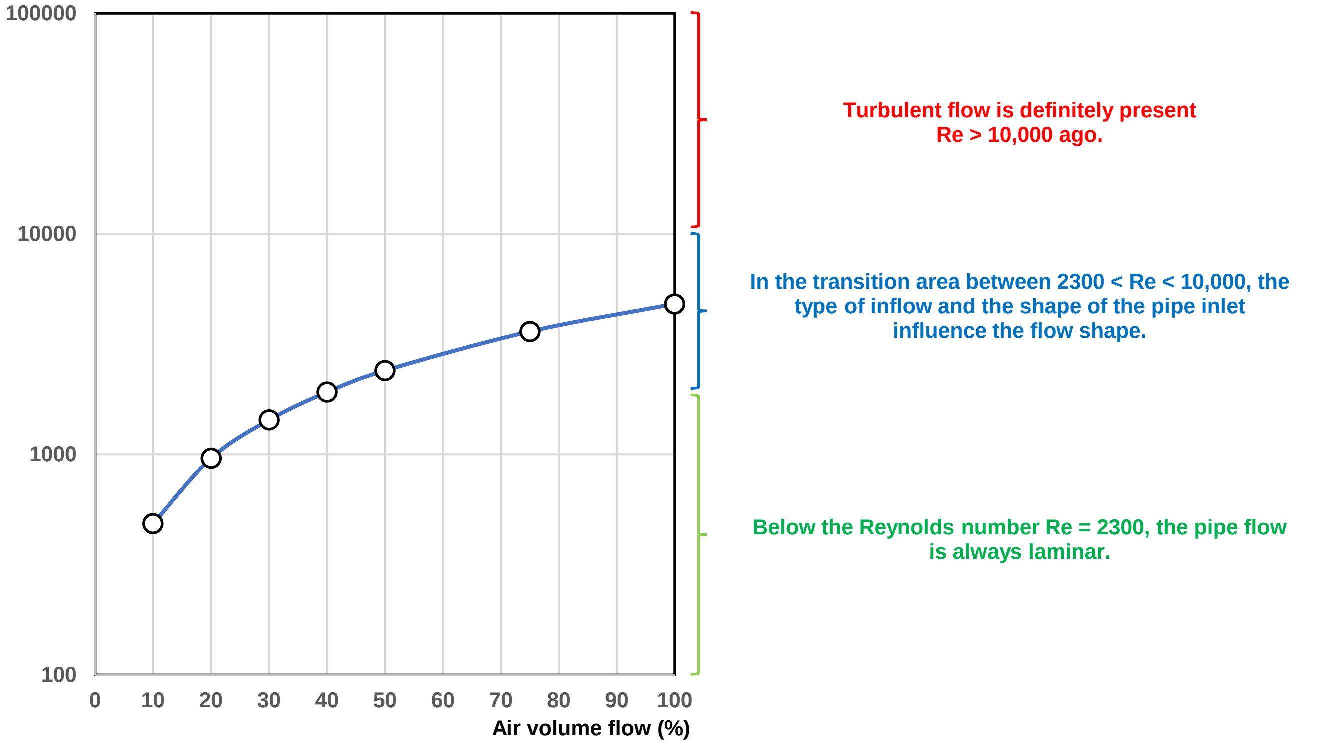


Heat recovery winter capacity (kW)



Reinold's number of 25% et. glycol in the exhaust air (---)

VDI-Wärmeatlas, 12th edition, 2018, G1: Flowed through pipes



Federal Council-SIA-SWKI-Bullshit

Water-glycol mixture: laminar Re<2,300, turbulent Re>10,000.
As soon as laminar flow is achieved, performance decreases drastically!
For this reason, heat recovery is forced to operate in turbulent areas.

?????

Reality according to www.zcs.ch

By definition according to the VDI heat atlas, we never have turbulence with Re>10,000.
By definition according to the VDI heat atlas, we always work in the laminar and transition areas.
Nevertheless, we always have turbulence, because the flow is disturbed by deflections!

!!!!!!!

On page 22 it says: *The optimum water-glycol mass flow must be regulated using the air mass flow. The mass flow in the intermediate circuit depends on the mass flow of the air. If the water-glycol mass flow is too high or too low, or if the heat capacity flows of air and glycol are not identical, then the degree of temperature change is reduced.* ***In order to obtain the optimal efficiency, the following equation must be adhered to.***

$\dot{m}\,WG \cdot cpWG = \dot{m}\,L \cdot cpL$

$\dot{m}\,WG$ Mass flow water-glycol [kg/s]
$cpWG$ Heat capacity water-glycol [J/kgK]

$\dot{m}L$ Mass flow air [kg/s]
cpL Heat capacity air [J/kgK]

CC-System in winter		SA-He	RA-Co	Definition
Height over sea level	m			500.000
Pressure	hPa			954.276
Efficiency	%	72.700	58.906	
Capacity sensible	kW	177.247	144.482	
Capacity latent	kW	---	31.813	
Capacity frost	kW	---	0.952	
Capacity total	kW	177.247	177.247	
Surface reserve	%	0.121	0.088	
Present surface	m2	963.224	963.224	

SA-He (ff = 0.00005 m2K/W)		Inlet	Outlet	Definition
Temp.	°C	-11.000	11.537	20.000
Rel. humidity	%	90.000	15.616	40.000
Abs. humidity	g/kg	1.387	1.387	6.145
Volume flow humid	m3/h	22187.121	24094.473	25000.000
Velocity	m/s	1.802	1.957	2.031
Pressure drop	Pa		101.130	

RA-Co (ff = 0.00005 m2K/W)		Inlet	Outlet	Definition
Temp.	°C	20.000	1.739	20.000
Rel. humidity	%	40.000	99.513	40.000
Abs. humidity	g/kg	6.145	4.537	6.145
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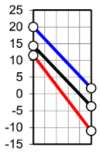
Velocity	m/s	2.031	1.899	2.031
Pressure drop wet	Pa		116.753	

25 V% Et.glycol (ff = 0.00005 / 0.00005 m2K/W			SA-He	RA-Co
Temp.	in	°C	14.390	-3.700
Temp.	out	°C	-3.700	14.390
Volume flow		m3/h	9.163	9.166
Velocity		m/s	1.184	1.184
Reynolds		---	4933.945	4810.348
Pressure drop		kPa	193.979	195.214



Since the calculation of the heat recovery performance for the supply air, the exhaust air and the water-glycol mixture is exactly the same, the heat capacity flows can be easily derived from this.

$$\dot{Q} = \dot{m}cp\Delta t \rightarrow \dot{m}cp = \dot{Q}/\Delta t$$

In the example at the top right, the heat capacity flows are as follows:

Hot air: 177.247/(20.000-1.739)=**9.706** kW/K

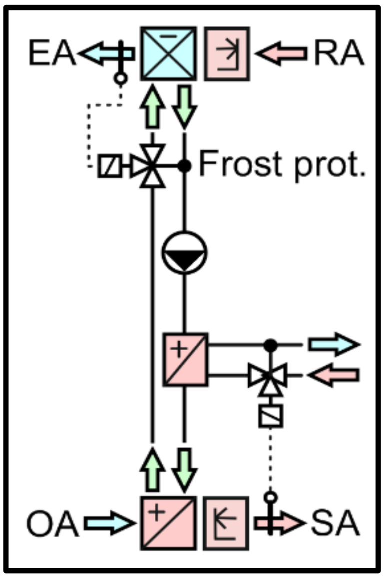
Water-Glycol-Mixture: 177.247/(14.390+3.700)=**9.798** kW/K

Cold air: 177.247/(11,537+11.000)=**7.865** kW/K

Although the quantities of warm air and cold air based on 20°C/40% are exactly the same, the heat capacity flows result in different values with a **deviation of 23.41%**, which is due to the warm air humidity.

In order to keep the freezing limit regarding the outlet temperature of the water-glycol mixture as low as possible (according to page 2 at -3.33°C), the inlet temperature is slightly lowered and the outlet temperature is slightly raised, which can also be seen as a rotation in the temperature diagram at the top right Counterclockwise. The heat capacity flow of the water-glycol mixture therefore has a value that differs from that of the air.

Since this **Federal Council-SIA-SWKI-Bullshit-Paper** also refers to systems with the coupling of heat in winter and cold in summer into the intermediate circuit, where the output in the warm air and in the exhaust air are different, the Claim that all 3 heat capacity flows have to be exactly the same size is therefore completely ridiculous.



So we can confidently come to the conclusion, that there is a significant difference between such luminaries and the Eiffel Tower: In the Eiffel Tower, the biggest rivets are at the bottom!