Energy recovery efficiency

The frequently asked question of how the simplest energy recovery system behaves, when the air volumes change and what the optimal intermediate medium quantity is, I will only answer for a certain design point, for which there are already many possibilities. I used the winter case with the same air volumes and a temperature efficiency of 70%, see the **white circle** in the picture on the right.

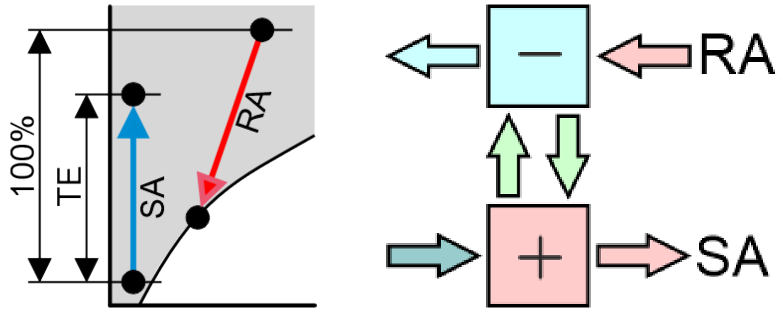
In addition, I used the currently most powerful sinusoidal fin, which can do this with 12 rows of tubes each and therefore does not have to be split according to VDI 6022.

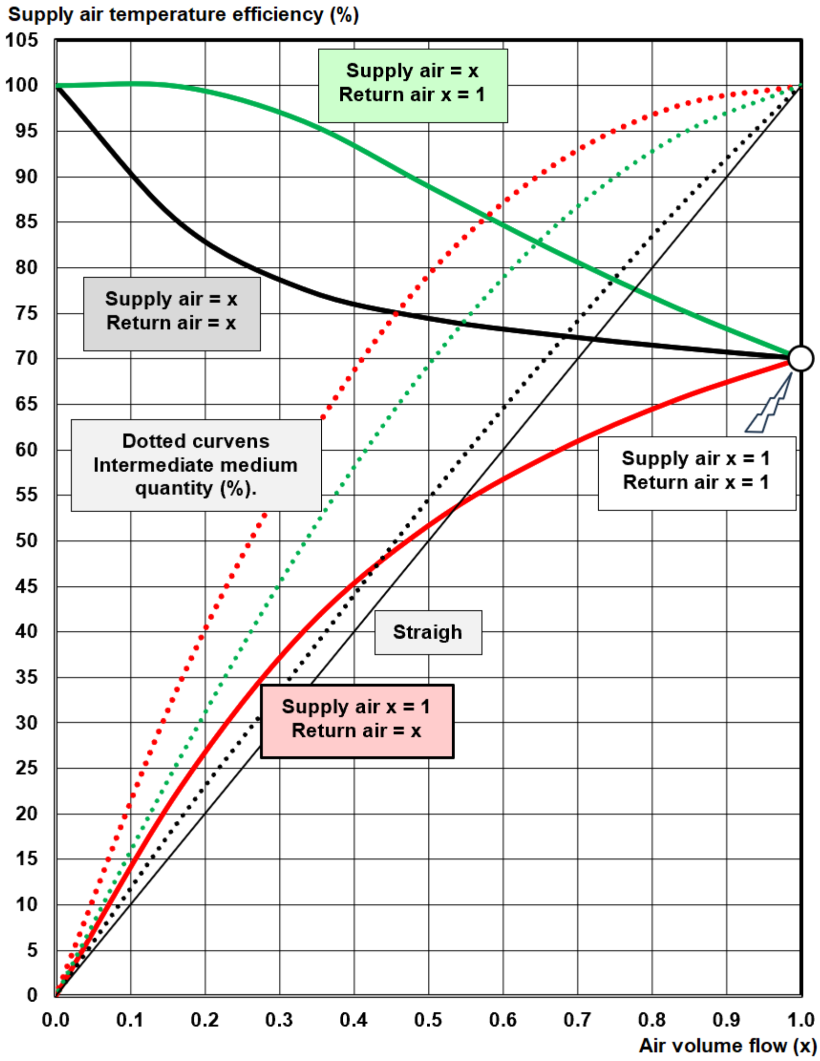
The **black curve** indicates the most common operating case, where both air volumes decrease proportionally to the same extent and thus the temperature efficiency increases. With a good approximation, it can be said, that the intermediate medium quantity also decreases proportionally to the air volume flow and thus does not place great demands on regulation. As an example, this means, that for half the air volume flows, the temperature efficiency increases from 70% to 74%.

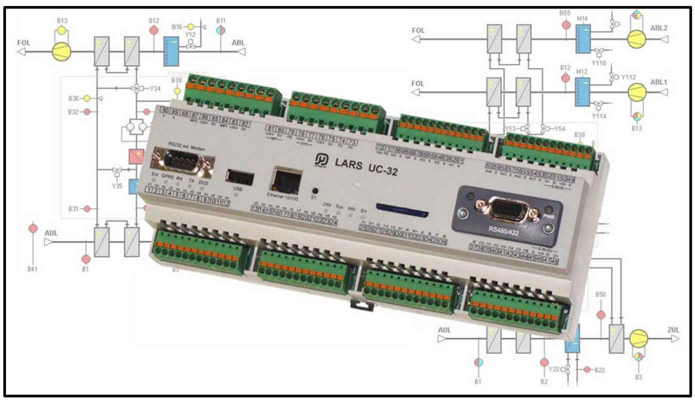
The **red curve** shows the second most common operating case, where the supply air remains constant and the exhaust air is reduced. As an example, this means that for half the exhaust air constriction, the temperature efficiency drops from 70% to 52%. There is no simple relationship to the optimal determination of the intermediate medium quantity, which is why a good controller must periodically determine the optimum temperature efficiency.

The **green curve** indicates the rare operating case, where the supply air is reduced and the exhaust air is constant. As an example, this means that for half the supply air volume flow, the temperature efficiency increases from 70% to 88%. There is no simple relationship to the optimal determination of the intermediate medium quantity, which is why a good controller must periodically determine the optimum temperature efficiency.

Which brings us to the **controller**. This must periodically change the intermediate medium quantity and see, whether the supply air temperature rises or decreases as a result. If the direction of change is known, the intermediate medium quantity must be changed periodically until the optimum in terms of supply air temperature is reached.







CC-System in winter		SA-He	RA-Co	Definition
Height over sea level	m			0.000
Pressure	hPa			1013.250
Efficiency	%	70.000	57.176	
Capacity sensible	kW	224.512	184.454	
Capacity latent	kW	---	38.978	
Capacity frost	kW	---	1.080	
Capacity total	kW	224.512	224.512	
Surface reserve	%	1.368	1.031	
Present surface	m2	1158.612	1158.612	

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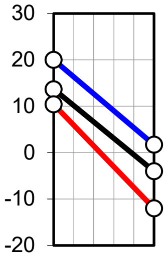
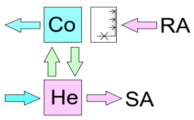
SA-He		Inlet	Outlet	Definition
Temp.	°C	-12.000	10.400	20.000
Rel. humidity	%	90.000	15.381	40.000
Abs. humidity	g/kg	1.193	1.193	5.783
Volume flow humid	m3/h	26529.970	28805.477	30000.000
Velocity	m/s	1.741	1.890	1.969
Pressure drop	Pa		88.177	

RA-Co		Inlet	Outlet	Definition
Temp.	°C	20.000	1.704	20.000
Rel. humidity	%	40.000	99.001	40.000
Abs. humidity	g/kg	5.783	4.237	5.783
Volume flow humid	m3/h	30000.000	28058.449	30000.000
Velocity	m/s	1.969	1.841	1.969
Pressure drop wet	Pa		101.330	

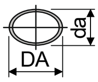


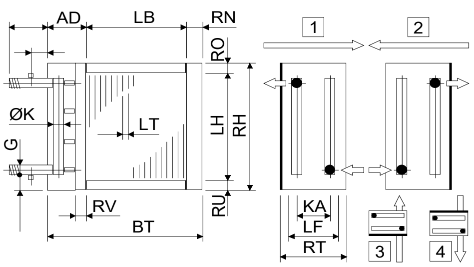


25 V% Et.glycol			SA-He	RA-Co
Temp.	in	°C	13.700	-4.000
Temp.	out	°C	-4.000	13.700
Volume flow		m3/h	11.865	11.869
Velocity		m/s	1.241	1.241
Reynolds		---	5391.114	5252.347
Pressure drop		kPa	196.983	198.245

Software by www.zcs.ch

Technical data			SA-He	RA-Co		SA-He	RA-Co
Tubes total		Piece	792	792	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	66	66	Collectors:	Cu	Cu
Tube coupling in series		Piece	36	36	Collectors:	0.81 m/s	0.81 m/s
Number of circuits (NC)		Piece	22	22	Connections:	Rg7	Rg7
Volume		l	214	214	Connections:	0.81 m/s	0.81 m/s
Weight		kg	599	599	Fins:	Al	Al
Connections	G	---	2 ½"	2 ½"	Fins:	Wave structure	Wave structure
Frame height	RH	mm	2280	2280	Frame:	AISI 304	AISI 304
Frame width	BT	mm	2150	2150	Air flow direction:	horizontal	horizontal
Frame depth	RT	mm	480	480	Protection:	without	without
Finned height	LH	mm	2200	2200	Protection:	---	---
Finned width	LB	mm	1924	1924			
Finned depth	LF	mm	346	346			
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	56	56			
Collector-Diameter	K	mm	76	76			
Covering	AD	mm	170	170			
Collector distance	KA	mm	370	370			
Fin spacing	LT	mm	2.800	2.800			
Fin thickness	LD	mm	0.200	0.200			
Tube diameter	DA	mm	13.100	13.100	Delivery:		5-6 weeks
Tube diameter	da	mm	13.100	13.100	Validity:		12 weeks
Tube thickness	S	mm	0.350	0.350	Condit.:		net, prepaid address
Tube interval on the height	S1	mm	33.333	33.333	Payment:		30 days net
Tube interval on the depth	S2	mm	28.867	28.867			





SA-He: 33/29/13-12R-66T-1924A-2.8PA-22C-Cu/Al/AISI 304 — **SA-He: EUR 10290.00**

RA-Co: 33/29/13-12R-66T-1924A-2.8PA-22C-Cu/Al/AISI 304 — **RA-Co: EUR 10290.00**

1. High-embossed fins, perpendicular to the air direction, are standard and can therefore be found everywhere. They only cause unnecessarily high air-side pressure drops and also high operating costs. The little bit more surface area compared to smooth fins is ridiculous. The cleaning of such fins is a big problem, especially if these fins are much too thin. We recommend a minimum fin thickness of 0.2 mm, which can also be cleaned with Kärcher high-pressure devices.

2. Flat fins, so to speak, are rare and therefore hardly to be found. They only cause small air-side pressure drops and thus also low operating costs. The cleaning of such finss is easy, especially if these fins are thick. We recommend a minimum fin thickness of 0.2 mm, which can also be cleaned with Kärcher high-pressure devices. The power is only slightly lower than with high-embossed fins perpendicular to the air direction.

3. Corrugated fins in the direction of the air are hardly to be found. They only cause small air-side pressure drops and thus also low operating costs. The cleaning of such fins is easy, especially if these fins are thick. We recommend a minimum fin thickness of 0.2 mm, which can also be cleaned with Kärcher high-pressure devices. The performance is much greater than type 1 or 2 fins.