HVAC-Software for planning engineers

If the **software AHH** from www.zcs.ch (4) consisted only of a Mollier-Diagram and cost a lot, we wouldn't buy it either. Then you could have it cheaper, for example from www.unilab.eu (1) with all its flaws. www.i-r-b.de (2) or www.hassler-kaeltetechnik.de (3) are a lot better, but only provide a simple Mollier diagram and that with a limited range.

What the **AHH software** from www.zcs.ch includes, you can read below. As of March 10, 2026, 6,705 AHH licenses were installed worldwide. On the same date, the really absolutely moderate prices for a single license were as follows:

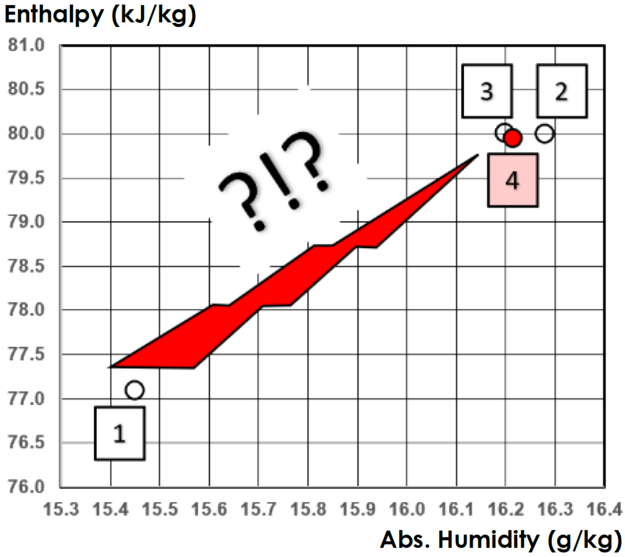
Students	CHF 395.00	or	EUR 452.00
Teacher	CHF 695.00	or	EUR 796.00
Companies	CHF 995.00	or	EUR 1139.00

It should also be noted, that x licenses do not cost x times as much, see downloadable price list.

Furthermore, **network licenses for x clients //** can be procured and installed with us without any problems, which is hardly available elsewhere.

Quality of various software, tested at:
Press. 1,013 bar, temp. 38°C, rel. humidity 39%.

Deviations from www.unilab.eu resulted:
Abs. moisture 0.77 g/kg or **4.75%**
Enthalpy 2.8 kJ/kg or **3.50%**



If you are of the opinion that you have no problem with **errors of 5%,** even in the Mollier-HX-Diagram, you should buy from www.unilab.eu software. However, if you are of the opinion, that you need something more precise and also more applications to carry out HVAC planning, we would like to show you, what the **AHH software** has to offer with an **example** on the following pages.

Example: Well-insulated conference room in Bern (540 meters above sea level) for 50 people

An area of 10 x 10 m = 100 m2, height 3 m, volume = 300 m3, is to be supplied with fresh air. What **cooling loads** in summer and **heating loads** in winter should be planned with? What components does an **air handling unit** have to contain and how much does it cost? What do the processes in the **Mollier-HX-Diagram** look like in summer and winter? What kind of **risk** do you take, if you only assume an outside air of **32°C/40%** in summer, although according to the software used worldwide of www.meteonorm.com there are maximum values of **35°C** in terms of temperature and enthalpy at **32.1°C/54%** of **76.66 kJ/kg**?

Software AHH: 15 applications, one-time costs, unlimited running time

AHH: Mollier- & Psychrometric-Chart, air processes, meteorological Data
DWT: Conversion: Temperature - Relative humidity - Abs. humidity
MDI: Meteorological data interface, service time selection
TEM: Calculation of all mean logarithmic temperature differences
GLY: Brine properties and efficiency comparison for CC-Systems
FRO: Calculation of defrosting time of finned heat exchangers
RFT: Calculation of rib foot temperature in air coolers
REF: Optimize subcritical processes in refrigerant circuits
KES: Calculation of ice storage for cold water production 6/12°C
HDH: Calculation of heating and cooling degree days
MRM: Cooling requirements in midsummer – Meteorol. risk management
CLR: Calculating of the cooling load of rooms
HLR: Calculation of the heating load of rooms
AHU: Neutral air handling unit configurator for projects
GHH: Mollier-Diagram for gas-steam mixtures to condensing the steam

Software AHH-HDH

Heating degree days are a measure of the influence of the weather on a building heating energy needs.

Heating degree days are the difference between the desired room temperature and the outside temperature, if this outside temperature is below a certain heating limit temperature.

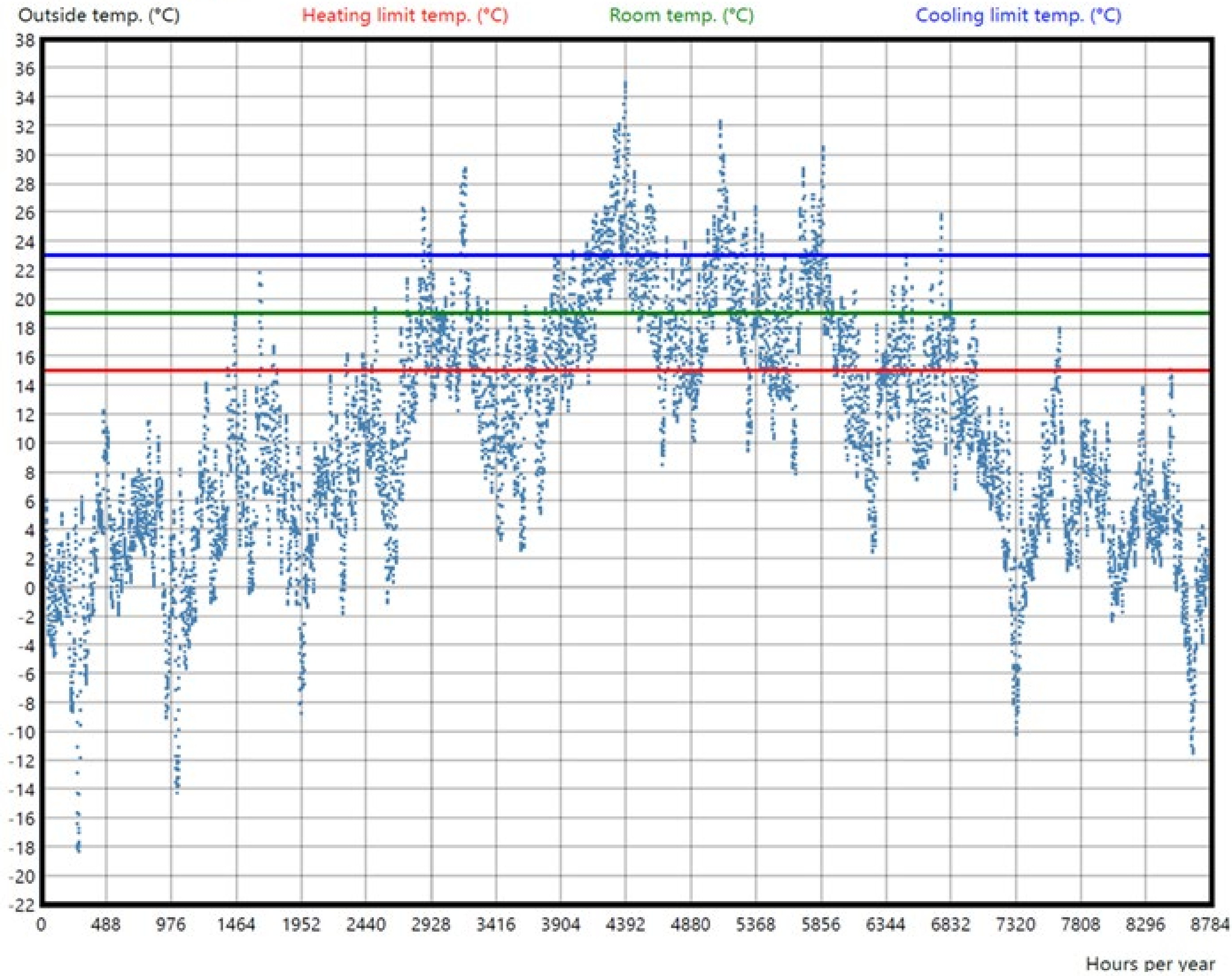
For Bern, this is 3,144 heating degree days according to the following figure.

While the heating oil lobby only talks about heating degree days, in order to be able to sell totally oversized boilers, no one but us talks about the 68 cooling degree days, although it is getting warmer.

In 2025, maximum temperatures of 41.5°C were measured in Grono (Misox) and in Geneva of 39.7°C.

And the extremely clean, frequently used Aare River in Bern reached a fabulous temperature of 22.3°C, which tempted a brain amputee Federal Council (far-right full-post minister) to say: "Thanks to global warming, you no longer have to travel to the Caribbean during the summer holidays".

Location	**Bern**	
Heating limit temp. (°C)	15.00	Recom. 15°C
Room temp. (°C)	19.00	Recom. 19°C
Heating degree hours (Kh)	75461.60	
Heating degree days (Kd)	3144.23	
Cooling limit temp. (°C)	23.00	Recom. 23°C
Cooling degree hours (Kh)	1620.30	
Cooling degree days (Kd)	67.51	



Software AHH-HLR

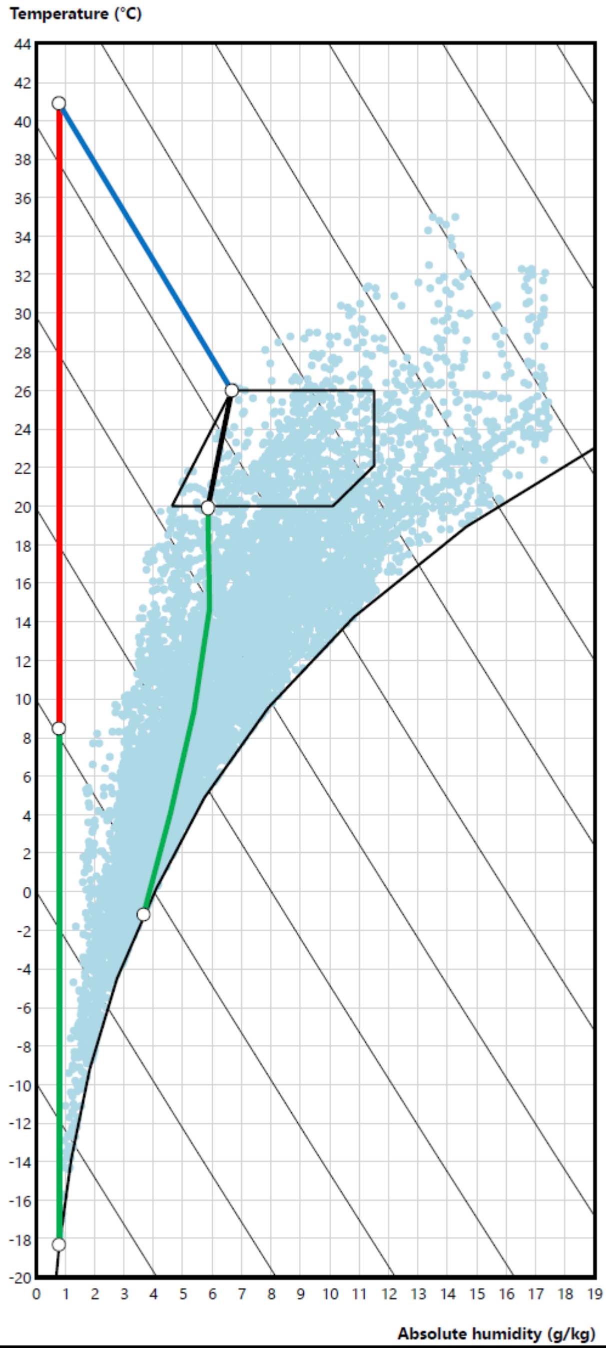
Subsequently, **without meteorological risk management**, based on www.meteonorm.com, the lowest outside temperature of -18.3°C was expected, not for the reason, that such values are to be expected in this century (except for a nuclear winter triggered by Putin), but because anyone who calculates so conservatively, does not want to take any risks at all.

Despite heat recovery with a temperature efficiency of 70%, corresponding to an capacity of 39 kW, a reheater of 48 kW is required, which heats the outside air to 41°C.

Subsequently, the adiabatic humidification of the outside air takes place to 26%C/30%, which is far too much dispensed with. Nasal mucous membranes, like Sahara desert, are then the logical consequence.

In order to keep the **heating load (black)** within the comfort range, an air exchange rate of 16 was required, corresponding to 4,800 m3/h, although guidelines state, that this is sufficient for conference rooms with 8 to 10.

Heatinging load calculation of rooms in winter			
Location			Bern
Height over sea level	H	m	540.000
Air pressure	p	mbar	949.653
Room air temperature	t	°C	26.000
Room humidity	rf	%	30.000
Room humidity	af	g/kg	6.656
Room type			Konferenzraum
Room width	B	m	10.000
Room length	L	m	10.000
Room height	H	m	3.000
Room volume	V	m^3	300.000
Air change rate	n	1/h	16.000
Amount of outside air	Vl	m^3/h	4800.000
Sensible heating load			
Room volume	V	m^3	300.000
Heating demand	---	W/m^3	30.000
Heating demand	---	W	9000.000
Lantent heating load			
Room volume	V	m^3	300.000
Heating demand	---	W/m^3	10.000
Heating demand	---	W	3000.000
Total Heating load			
Heating demand	---	W	12000.000
Exhaust air temperature	t	°C	19.946
Relative exhaust air humidity	rf	%	38.023
Absolute exhaust air humidity	af	g/kg	5.846
Total Heating load			
Sensitive cold loss	Ws	kW	9.000
Latent cold loss	Wl	kW	3.000
Total cold loss	Wt	kW	12.000
Outside Air			
Amount of air	Vl	m^3/h	4050.929
Temperature	t	°C	-18.300
Relative humidity	rf	%	98.000
Absolute humidity	af	g/kg	0.771
Air handling unit to room			
Amount of air	Vl	m^3/h	4800.000
Temperature	t	°C	26.000
Relative humidity	rf	%	30.000
Absolute humidity	af	g/kg	6.656
Recuperator (CC-System, Plate)			
Temperature efficiency		%	70.000
Humidity efficiency		%	0.000
Performance		kW	39.344
Air heater-Performance		kW	47.690
Supply air humidification		kg/h	30.906



Software AHH-HLR

Subsequently, **with meteorological risk management**, i.e. a lowest outside temperature of -11°C, was calculated, not for the reason, that such values will not be undercut in this century, but because those who calculate in this way, will only take a relatively small risk as a result of global warming.

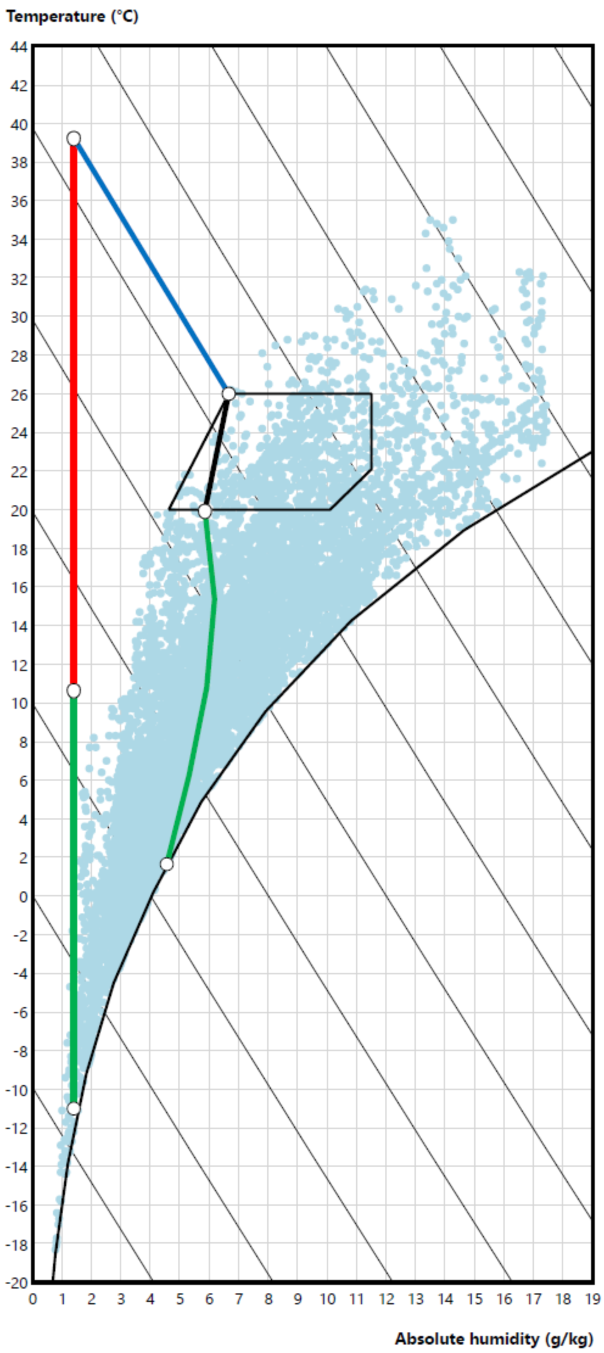
Despite heat recovery with a temperature efficiency of 70%, corresponding to an capacity of 32 kW, a reheater of 42 kW is required, which heats the outside air to 39°C.

Subsequently, the adiabatic humidification of the outside air takes place to 26%C/30%, which is far too much dispensed with. Nasal mucous membranes, like Sahara desert, are then the logical consequence.

In order to keep the heating load (black) within the comfort range, an air exchange rate of 16 was required, corresponding to 4,800 m3/h, although guidelines state that this is sufficient for conference rooms with 8 to 10.

Heatinging load calculation of rooms in winter

Location			Bern
Height over sea level	H	m	540.000
Air pressure	p	mbar	949.653
Room air temperature	t	°C	26.000
Room humidity	rf	%	30.000
Room humidity	af	g/kg	6.656
Room type			Konferenzraum
Room width	B	m	10.000
Room length	L	m	10.000
Room height	H	m	3.000
Room volume	V	m³	300.000
Air change rate	n	1/h	16.000
Amount of outside air	Vl	m³/h	4800.000
Sensible heating load			
Room volume	V	m³	300.000
Heating demand	---	W/m³	30.000
Heating demand	---	W	9000.000
Lantent heating load			
Room volume	V	m³	300.000
Heating demand	---	W/m³	10.000
Heating demand	---	W	3000.000
Total Heating load			
Heating demand	---	W	12000.000
Exhaust air temperature	t	°C	19.946
Relative exhaust air humidity	rf	%	38.023
Absolute exhaust air humidity	af	g/kg	5.846
Total Heating load			
Sensitive cold loss	Ws	kW	9.000
Latent cold loss	Wl	kW	3.000
Total cold loss	Wt	kW	12.000
Outside Air			
Amount of air	Vl	m³/h	4171.128
Temperature	t	°C	-11.000
Relative humidity	rf	%	90.000
Absolute humidity	af	g/kg	1.394
Air handling unit to room			
Amount of air	Vl	m³/h	4800.000
Temperature	t	°C	26.000
Relative humidity	rf	%	30.000
Absolute humidity	af	g/kg	6.656
Recuperator (CC-System, Plate)			
Temperature efficiency		%	70.000
Humidity efficiency		%	0.000
Performance		kW	31.873
Air heater-Performance		kW	42.087
Supply air humidification		kg/h	27.635



Software AHH-CLR

Subsequently, **without meteorological risk management**, based on www.meteonorm.com, the largest enthalpy of 76.66 kJ/kg (32.1°C/54%) was calculated. Despite heat recovery with a temperature efficiency of 70%, corresponding to a capacity of 32 kW, a aftercooler of 87 kW is required. This is followed by an 8 kW reheater, which heats the outside air to 16%C/85%. In order to keep the cooling load (black) within the comfort range, an air exchange rate of 34 was required, corresponding to 10,200 m3/h, although guidelines state that this is sufficient for conference rooms with 8 to 10.

Cooling load calculation of rooms in midsummer			
Location			Bern
Height over sea level	H	m	540.000
Air pressure	p	mbar	949.653
Room air temperature	t	°C	16.000
Room humidity	rf	%	85.000
Room humidity	af	g/kg	10.275
Room air vapor partial pressure	pd	mbar	15.430
Room type			Konferenzraum
Room width	B	m	10.000
Room length	H	m	10.000
Room height	H	m	3.000
Room volume	V	m³	300.000
Air change rate	n	1/h	34.000
Amount of outside air	Vl	m³/h	10200.000
Water pool			Evaporation amount according to VDI 2089
Water pool use			Covered water surface
Evaporation coefficient	ε	g / (mbar m² h)	0.5
Pool width	b	m	1.000
Pool length	l	m	1.000
Water pool surface	A	m²	1.000
Temperature of the water	tw	°C	35.000
Saturation vapor pressure of water	ps	mbar	56.016
Amount of evaporation	W_1	g/h	20.293
Persons			Evaporation amount according to DIN EN ISO 7730
Activity level II			Very light physical activity
Number of people in the room	m	Number	100.000
Evaporative emission per person	W_p	g/h	80.000
Evaporative emission of all persons	W_2	g/h	8000.000
Room			Rough estimate of cooling needs
Room volume	V	m³	300.000
Cooling demand	H_r	W/m³	30.000
Cooling demand	H_1	W	9000.000
Persons			Heat emission according to DIN EN ISO 7730
Activity level III			Light physical activity
Number of people in the room	m	Number	100.000
Heat output per person	H_p	W	231.558
Heat dissipation of all people	H_2	W	23155.758
Total amount of evaporation	W	g/h	8020.293
Amount of outside air	Vl	m³/h	10200.000
Outside air temperature	t	°C	32.100
Relative outside air humidity	rf	%	54.000
Absolute outside air humidity	af	g/kg	17.324
Evaporation per m³	w	g/m3	0.786
Air density	d	kg/m³	1.137
Evaporation per kg	w	g/kg	0.699
Heat of vaporization	Ro	J/kg	2547920.913
Heat emission latent	Wl	kW	5.676
Heat emission sensitive	Ws	kW	32.156
Total heat emission = Cooling load	Wt	kW	37.832
Exhaust air temperature	t	°C	25.832
Relative humidity	rf	%	49.609
Absolute humidity	af	g/kg	10.973
Exhaust air humidification		kg/h	**35.767**
Recuperator (CC-System, Plate)-Temperature efficiency		%	**70.000**
Recuperator (CC-System, Plate)-Humidity efficiency		%	**0.000**
Recuperator (CC-System, Plate)-Performance		kW	**31.740**
Air cooler-Performance		kW	**86.715**
Air heater-Performance		kW	**8.261**

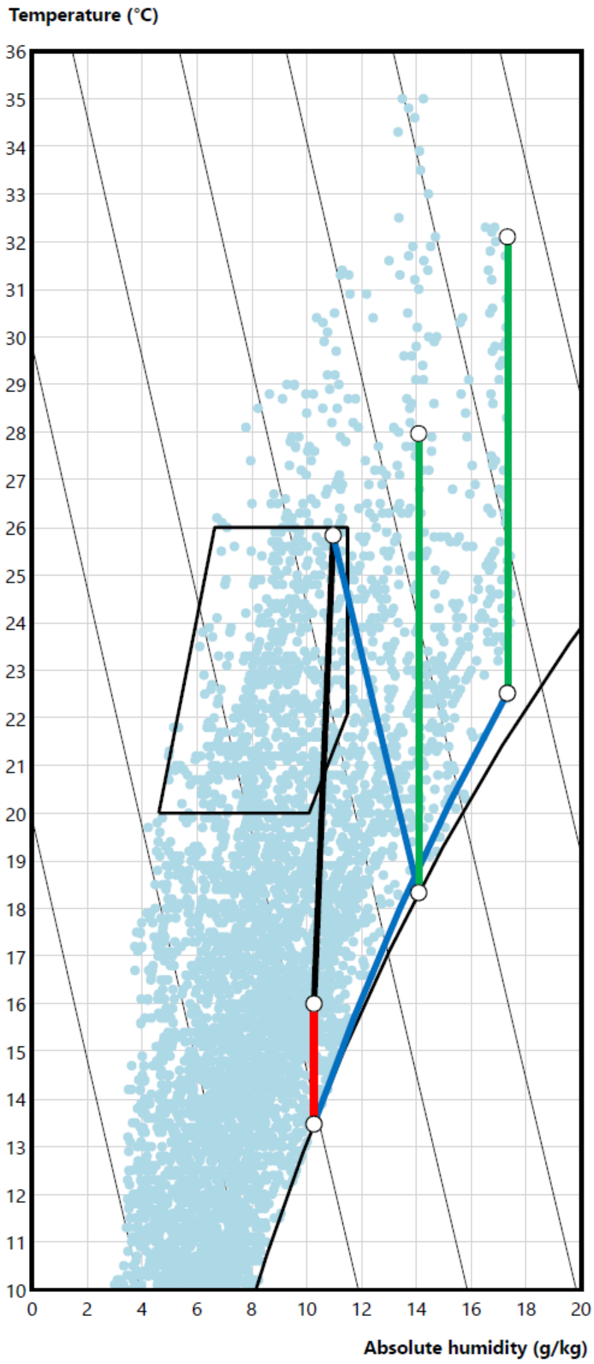
The present method is a simplification and therefore only suitable for long-standing experienced experts on the subject. The guideline VDI 2078 is taken as a basis for the cooling load calculation for planning an air conditioning system. This is issued by the VDI. It contains recommendations and rules and thus represents the state of the art. All parameters that influence the thermal room behavior in any way are taken into account.

$$W_1 = \varepsilon A(p_s - p_d)$$

$$W_2 = mW_p$$

$$H_1 = VH_r$$

$$H_2 = mH_p$$



Software AHH-CLR

Subsequently, **with meteorological risk management**, i.e. 32°C/54%, was expected. Despite heat recovery with a temperature efficiency of 70%, which corresponds to a capacity of 32 kW, an aftercooler of 49 kW is required. This is followed by an 8 kW reheater, which heats the outside air to 16%C/85%. In order to keep the cooling load (black) within the comfort range, an air exchange rate of 34 was required, corresponding to 10,200 m3/h, although guidelines state that this is sufficient for conference rooms with 8 to 10.

Cooling load calculation of rooms in midsummer

Location			Bern
Height over sea level	H	m	540.000
Air pressure	p	mbar	949.653
Room air temperature	t	°C	16.000
Room humidity	rf	%	85.000
Room humidity	af	g/kg	10.275
Room air vapor partial pressure	pd	mbar	15.430
Room type			Konferenzraum
Room width	B	m	10.000
Room length	H	m	10.000
Room height	H	m	3.000
Room volume	V	m³	300.000
Air change rate	n	1/h	34.000
Amount of outside air	Vl	m³/h	10200.000
Water pool			Evaporation amount according to VDI 2089
Water pool use			Covered water surface
Evaporation coefficient	ε	g / (mbar m² h)	0.5
Pool width	b	m	1.000
Pool length	l	m	1.000
Water pool surface	A	m²	1.000
Temperature of the water	tw	°C	35.000
Saturation vapor pressure of water	ps	mbar	56.016
Amount of evaporation	W_1	g/h	20.293
Persons			Evaporation amount according to DIN EN ISO 7730
Activity level II			Very light physical activity
Number of people in the room	m	Number	100.000
Evaporative emission per person	W_p	g/h	80.000
Evaporative emission of all persons	W_2	g/h	8000.000
Room			Rough estimate of cooling needs
Room volume	V	m³	300.000
Cooling demand	H_r	W/m³	30.000
Cooling demand	H_1	W	9000.000
Persons			Heat emission according to DIN EN ISO 7730
Activity level III			Light physical activity
Number of people in the room	m	Number	100.000
Heat output per person	H_p	W	231.558
Heat dissipation of all people	H_2	W	23155.758
Total amount of evaporation	W	g/h	8020.293
Amount of outside air	Vl	m³/h	10200.000
Outside air temperature	t	°C	32.000
Relative outside air humidity	rf	%	40.000
Absolute outside air humidity	af	g/kg	12.667
Evaporation per m³	w	g/m3	0.786
Air density	d	kg/m³	1.137
Evaporation per kg	w	g/kg	0.699
Heat of vaporization	Ro	J/kg	2547920.913
Heat emission latent	Wl	kW	5.676
Heat emission sensitive	Ws	kW	32.156
Total heat emission = Cooling load	Wt	kW	37.832
Exhaust air temperature	t	°C	25.832
Relative humidity	rf	%	49.609
Absolute humidity	af	g/kg	10.973
Exhaust air humidification		kg/h	**35.767**
Recuperator (CC-System, Plate)-Temperature efficiency		%	**70.000**
Recuperator (CC-System, Plate)-Humidity efficiency		%	**0.000**
Recuperator (CC-System, Plate)-Performance		kW	**31.509**
Air cooler-Performance		kW	**48.614**
Air heater-Performance		kW	**8.261**

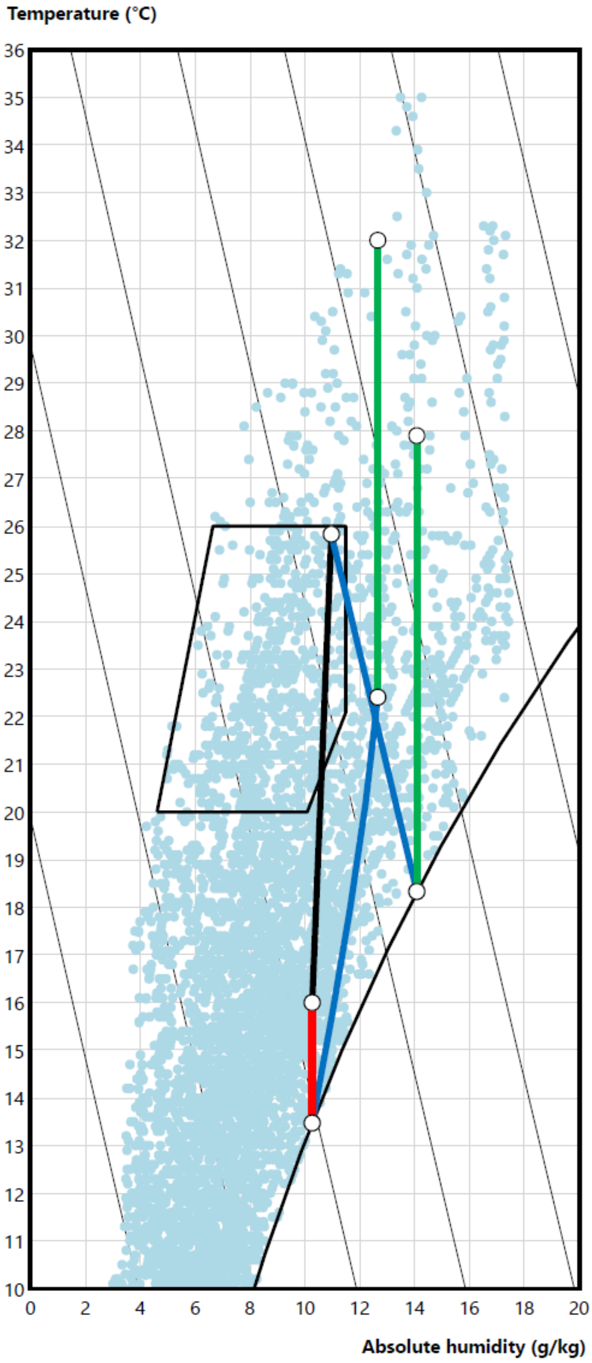
The present method is a simplification and therefore only suitable for long-standing experienced experts on the subject. The guideline VDI 2078 is taken as a basis for the cooling load calculation for planning an air conditioning system. This is issued by the VDI. It contains recommendations and rules and thus represents the state of the art. All parameters that influence the thermal room behavior in any way are taken into account.

$$W_1 = \varepsilon A(p_s - p_d)$$

$$W_2 = mW_p$$

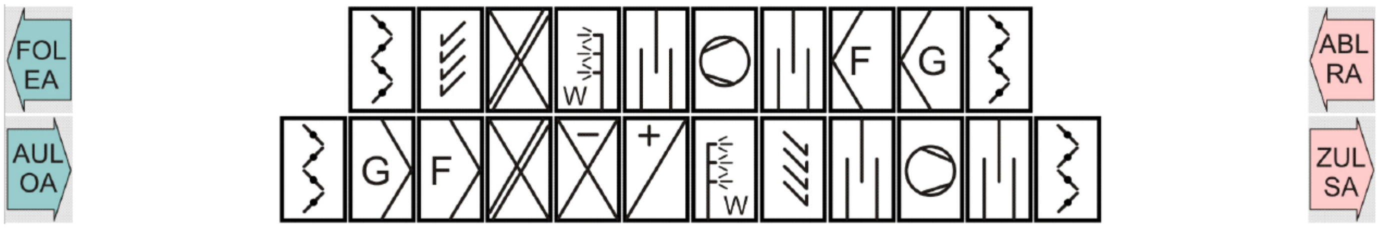
$$H_1 = VH_r$$

$$H_2 = mH_p$$



Software AHH-AHU

Now the air handling unit with all the necessary components has been put together for the larger amount of air required in summer. You have to reckon with a length of 8400 mm, an empty weight of 2430 kg and a price of EUR 48,630. If you want to know more, you start inquiries with several manufacturers of air handling units, whereupon their salespeople are at the door the very next day, even though they are still in the project stage and the realization may take years.

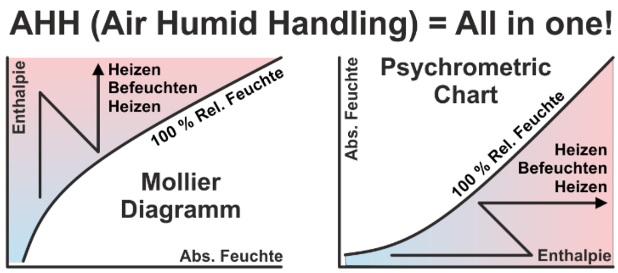


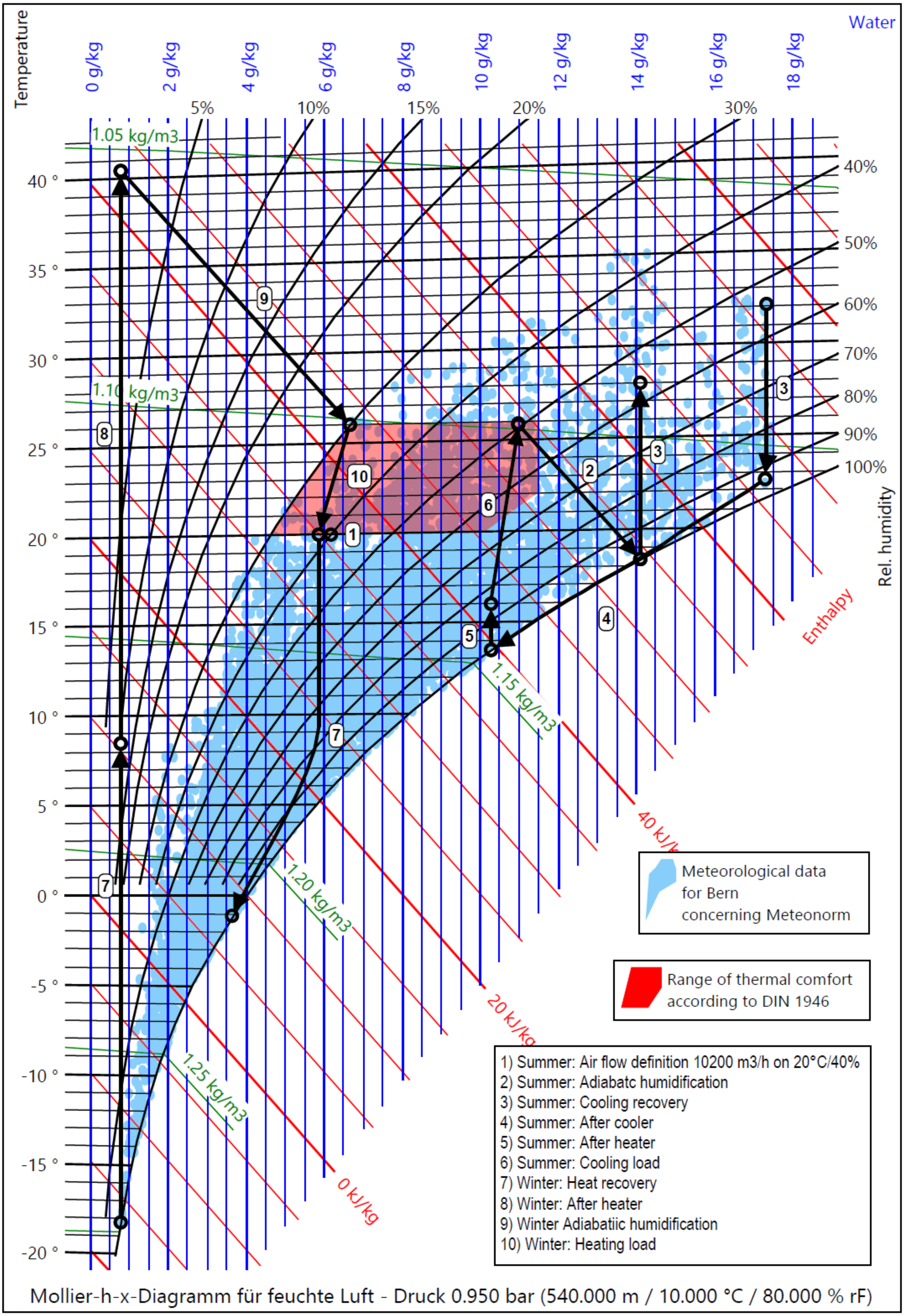
Air-Handling Unit (H x W = 1248 x 1553 mm) Outside air (10200 m³/h - Filter 1.78 m/s)	Length mm	Weight kg	Pressure drop Pa	Price EUR
Outside air			100.00	
Empty part little with flaps	350.00	50.00	24.00	1100.00
Filter G	450.00	60.00	99.00	1100.00
Filter F	650.00	90.00	131.00	1620.00
CC-System	650.00	200.00	111.00	3350.00
Cooler	400.00	130.00	69.00	2140.00
Heater	200.00	80.00	25.00	1290.00
Humidifier water	1300.00	140.00	80.00	3150.00
Droplet separator	150.00	30.00	80.00	690.00
Sound absorber	1300.00	140.00	48.00	3150.00
Fan - Efficiency 70.00 % - Capacity 4.53 kW	1300.00	210.00	80.00	4190.00
Sound absorber	1300.00	140.00	48.00	3150.00
Empty part little with flaps	350.00	50.00	24.00	1100.00
Supply air			200.00	
Total	8400.00	1320.00	1119.00	26030.00

Air-Handling Unit (H x W = 1248 x 1553 mm) Return air (10200 m³/h - Filter 1.78 m/s)	Length mm	Weight kg	Pressure drop Pa	Price EUR
Return air			100.00	
Empty part little with flaps	350.00	50.00	24.00	1100.00
Filter G	450.00	60.00	99.00	1100.00
Filter F	650.00	90.00	131.00	1620.00
Sound absorber	1300.00	140.00	48.00	3150.00
Fan - Efficiency 70.00 % - Capacity 4.15 kW	1300.00	210.00	80.00	4190.00
Sound absorber	1300.00	140.00	48.00	3150.00
Humidifier water	1300.00	140.00	80.00	3150.00
CC-System	650.00	200.00	111.00	3350.00
Droplet separator	150.00	30.00	80.00	690.00
Empty part little with flaps	350.00	50.00	24.00	1100.00
Exhaust air			200.00	
Total	7800.00	1110.00	1025.00	22600.00

Software AHH

Only now is the software AHH, the Mollier-HX diagram or the Psychrometric chart for French, Italians, English, etc. used, see the following pages, where you can see all the processes with data on performance, the comfort range and the meteorological data.





Bern - Technology center west - Conference

1) Point

		Air
Temperature	°C	20.000
Rel. humidity	%	40.000
Abs. humidity	g/kg	6.174
Density humid	kg/m³	1.124
Enthalpy humid	kJ/kg	35.794
Volume flow humid	m³/h	10200.000
Massflow dry	kg/h	11394.999

2) Moistening of air with water

Capacity	kW	0.614
Moistening flow	kg/h	35.508
Moistening temperature	°C	15.000
Moistening enthalpy	kJ/kg	62.302

		Air In	Air Out
Temperature	°C	25.832	18.332
Rel. humidity	%	49.609	100.000
Abs. humidity	g/kg	10.974	14.090
Density humid	kg/m³	1.099	1.125
Enthalpy humid	kJ/kg	53.964	54.158
Volume flow humid	m³/h	10482.301	10269.772
Massflow dry	kg/h	11394.999	11394.999

3) Heat recovery - Circuit connect-system - Surface relation hot/cold 1.000 - Partition of fins (2.5 - 3.5 mm)

Efficiency temperature	%	70.000
Efficiency hygroscopic	%	0.000
Efficiency humid	%	0.000
Capacity	kW	31.509
Mean temp.diff.	K	4.184
Coefficient	kW/K	7.531

		Cold air In	Cold air Out	Hot air In	Hot air Out
Temperature	°C	18.332	27.970	32.100	22.571
Rel. humidity	%	100.000	55.920	54.000	94.135
Abs. humidity	g/kg	14.090	14.090	17.325	17.304
Density humid	kg/m³	1.125	1.089	1.072	1.107
Enthalpy humid	kJ/kg	54.158	64.112	76.659	66.705
Volume flow humid	m³/h	10269.772	10609.313	10809.513	10471.748
Massflow dry	kg/h	11394.999	11394.999	11394.999	11394.999
Condensed water	kg/h		0.000		0.231
Surface temperature	°C				21.002

4) Cooling of air - Partition of fins (2.5 - 3.5 mm)

Capacity	kW	86.210
Mean temp.diff.	K	8.925
Coefficient	kW/K	9.659
Coolant In	°C	6.000
Coolant Out	°C	12.000

		Air In	Air Out
Temperature	°C	22.571	13.460
Rel. humidity	%	94.135	100.000
Abs. humidity	g/kg	17.304	10.266
Density humid	kg/m³	1.107	1.147
Enthalpy humid	kJ/kg	66.706	39.470
Volume flow humid	m³/h	10471.738	10037.414
Massflow dry	kg/h	11394.999	11394.999
Condensed water	kg/h		80.201
Surface temperature	°C		7.940

5) Heating

Capacity	kW	8.245	
Mean temp.diff.	K	27.298	
Coefficient	kW/K	0.302	
Heating medium In	°C	50.000	
Heating medium Out	°C	35.000	
		Air In	Air Out
Temperature	°C	13.460	16.000
Rel. humidity	%	100.000	84.926
Abs. humidity	g/kg	10.266	10.266
Density humid	kg/m³	1.147	1.137
Enthalpy humid	kJ/kg	39.470	42.074
Volume flow humid	m³/h	10037.414	10126.361
Massflow dry	kg/h	11394.999	11394.999

6) Heat load with air

Sensible heat	kW	32.156	
Latent heat	kW	5.676	
Heat Load	kW	37.832	
		Air In	Air Out
Temperature	°C	16.000	25.904
Rel. humidity	%	84.926	49.380
Abs. humidity	g/kg	10.266	10.970
Density humid	kg/m³	1.137	1.099
Enthalpy humid	kJ/kg	42.074	54.026
Volume flow humid	m³/h	10126.361	10484.851
Massflow dry	kg/h	11394.999	11394.999

7) Heat recovery - Circuit connect-system - Surface relation hot/cold 1.000 - Partition of fins (2.5 - 3.5 mm)

Efficiency temperature	%	70.000			
Efficiency hygroscopic	%	0.000			
Efficiency humid	%	0.000			
Capacity	kW	40.178			
Mean temp.diff.	K	14.135			
Coefficient	kW/K	2.842			
		Cold air In	Cold air Out	Hot air In	Hot air Out
Temperature	°C	-18.300	8.472	19.946	-1.120
Rel. humidity	%	98.000	10.607	38.023	98.870
Abs. humidity	g/kg	0.771	0.771	5.846	3.627
Density humid	kg/m³	1.297	1.174	1.124	1.213
Enthalpy humid	kJ/kg	-16.509	10.464	34.907	7.934
Volume flow humid	m³/h	4137.015	4571.595	4796.615	4436.134
Massflow dry	kg/h	5362.353	5362.353	5362.353	5362.353
Condensed water	kg/h		0.000		11.900
Surface temperature	°C				-7.477

Danger of FREEZING!

8) Heating

Capacity	kW	48.108	
Mean temp.diff.	K	16.582	
Coefficient	kW/K	2.901	
Heating medium In	°C	50.000	
Heating medium Out	°C	35.000	
		Air In	Air Out
Temperature	°C	8.472	40.500
Rel. humidity	%	10.607	1.558
Abs. humidity	g/kg	0.771	0.771
Density humid	kg/m³	1.174	1.054
Enthalpy humid	kJ/kg	10.464	42.761
Volume flow humid	m³/h	4571.595	5091.485
Massflow dry	kg/h	5362.353	5362.353

9) Moistening of air with water

Capacity	kW	0.546	
Moistening flow	kg/h	31.556	
Moistening temperature	°C	15.000	
Moistening enthalpy	kJ/kg	62.302	
		Air In	Air Out
Temperature	°C	40.500	25.997
Rel. humidity	%	1.558	30.000
Abs. humidity	g/kg	0.771	6.656
Density humid	kg/m³	1.054	1.101
Enthalpy humid	kJ/kg	42.762	43.128
Volume flow humid	m³/h	5091.543	4901.951
Massflow dry	kg/h	5362.353	5362.353

10) External process

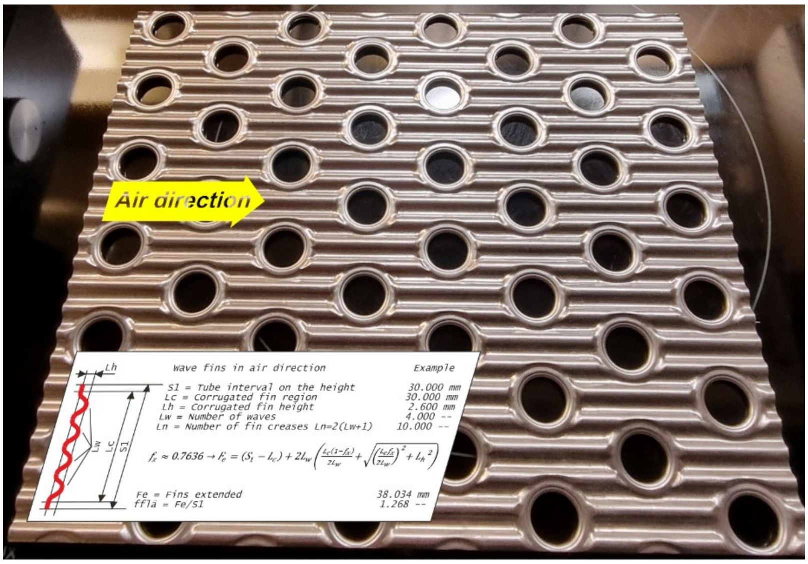
Capacity	kW	12.245	
		Air In	Air Out
Temperature	°C	25.997	19.946
Rel. humidity	%	30.000	38.023
Abs. humidity	g/kg	6.656	5.846
Density humid	kg/m³	1.101	1.124
Enthalpy humid	kJ/kg	43.128	34.907
Volume flow humid	m³/h	4901.951	4796.615
Massflow dry	kg/h	5362.353	5362.353

If a planning engineering office wants to know more about it, you can also purchase software from us for the calculation of heat exchangers and energy recovery systems.

Only then do you have precise information about pressure drops, installation depths, weights and amortization periods of the energy recovery.

For the example at hand, the HES software would be recommended, downloadable under www.zcs.ch. It works as a demo without any restrictions for 30 days and calculates up to 40 different conventional and state-of-the-art geometries in less than 1 second.

State-of-the-art geometry with sinusoidal fins in air direction



Software AHH-MRM

Which would finally bring us to meteorological risk management, if one were to create an absolutely irresponsible plan by standard with an outside air of 32°C/40%.

Instead of 122 kW, a cooler of only 83 kW would have been provided, i.e. a **narrow-gauge cooler**, which would be 32% too small. Then the staff should simply surrender quietly throughout the middle of summer, sweat to themselves, doze off and reduce the output to half, just because an irresponsible planning engineer has built absolute bullshit.

Improvements are then no longer used in the majority of cases, because there is simply not enough space for a cooler with a greater installation depth in the air conditioning unit.

The same planners did not provide a droplet eliminator after the cooler, because they claim, that the drop flight in the air handling unit is only a few centimeters and that all condensate therefore ends up in the drip tray.

Then there are the planners who claim, that an exhaust air handling unit, which is often arranged on the supply air handling unit, is impossible to have a drip tray to adiabatically pre-cool the exhaust air in summer. Then the cold recovery does almost nothing and the aftercooler becomes even bigger, ergo it doesn't get any more stupid!

Then you have to finally change the manufacturer of the air handling units, who insists on such bullshit or even better finally change your profession! How about chimney sweep, for example, which hopefully gets irreversibly stuck in the chimney when it is used for the first time?

Cooling requirements in midsummer - Meteorological risk management

Cooler		Entry after Meteo	Inlet	Outlet	Definition
Location					Bern
Height over sea level	m				540.000
Pressure	hPa				949.653
Temperature	°C	32.100	32.000	13.500	20.000
Rel. humidity	%	54.000	40.000	95.000	40.000
Abs. humidity	g/kg	17.324	12.667	9.770	6.174
Density humid	kg/m³	1.072	1.076	1.147	1.124
Enthalpy humid	J/kg	76.657	64.635	38.258	35.793
Volume flow humid	m³/h	10809.503	10727.266	10030.938	10200.000
Mass flow dry	kg/h	11395.642	11395.642	11395.642	11395.642
Condensate flow	kg/h	86.082	33.018		
Cooling brine	°C	6.000	6.000	12.000	
Capacity sensible	kW	61.167	60.334		
Capacity latent	kW	60.385	23.161		
Frost capacity	kW	0.000	0.000		
Capacity total	kW	121.552	83.496	Indoor climate risk 45.578 % !	
Hours with higher temperatures	h	0.000	14.000		
Hours with higher enthalpies	h	0.000	133.000		

Reheater		Inlet	Outlet	
Temperature	°C	13.500	16.000	
Rel. humidity	%	95.000	80.889	Reheater 8.108 kW
Abs. humidity	g/kg	9.770	9.770	

Heat Load		Inlet	Outlet	
Temperature	°C	16.000	26.000	Capacity sensible 32.441 kW
Rel. humidity	%	80.889	51.433	Capacity latent 13.956 kW
Abs. humidity	g/kg	9.770	11.500	Capacity total 46.397 kW