



Meteorological data

Depending on the data source, the details of the meteorological data are different. We recommend therefore, that you use the data from www.meteonorm.com according to the temperature model of the 10-years extremes. The other two models must be classified under risk management because you can heat too little in winter and too little cool and dehumidify in summer. The following data apply to the Swiss capital Bern at 540 meters above sea level.

Meteorological data from SIA 2028, Edition 2010

Meteorological data from www.meteonorm.com V7.3
Temperature period 2000-2009, Model standard

Meteorological data from www.meteonorm.com V7.3
Temperature period 2000-2009, Model 10 years extreme

Winter	Min. Temperature	°C	-18.3	-7.7	-13.5
Summer	Max. Temperature	°C	35.1	32.4	32.7
	Max. Wet bulb	°C	24.3	23.6	21.5
	Max. Enthalpy	kJ/kg	76.6	73.6	62.8

How to use the Meteonorm software version 7.3 for the software AHH, MDI, DEH & ESH? Example for the capital Bern Switzerland:

Location selection / Available locations / Locations / Print: Bern / Double click on: Bern / Bern go on the left side / Click on the button: Next

Modifications & data import / Nothing to do here / Click on the button: Next

Calculation settings / Select: Meteonorm 7 climate data / Select: Period radiation 1991-2010 / Select: Period temperature 2000-2009

Calculation settings / Click on the Button: Advanced settings

Advanced settings / Select: Temperature model standard (hour)

Advanced settings / Temperature - 10 year monthly extreme values / Select: Extremes averages (default)

Advanced settings / Temperature - 10 year monthly extreme values / Select: Summer period averages (default)

Advanced settings / Temperature - 10 year monthly extreme values / Select: Winter period averages (default)

Advanced settings / Click on the button: Next

Output formats / Custom / User defined / Put in a format name, for instance your company name / Select: Edit or New

Parameters / Output variables / Select: Temperature on the 1st place / Select: Relative humidity on the 2nd place / Delete all other parameters
Units / Temperature: °C / Formatting: Tab / Headers: No header lines / Extension / File extension: dat / Click on the button: Save

Click on the button: Next / The calculation start / Click on the button: Daily temperature / Show the minimal and maximal temperatures

Results and export / Click on the button: Save data for this location

Output directory / Select a directory / Click on the button: Hour / This create two files:

- The file Montemp.prn is not needed
- Rename the file Bern-hour.dat to Bern.dat

Now you can open the file Bern.dat in AHH3 which include AHH, MDI & AHU.

Under MDI you can select the service time and save your project under several extensions:

- Project-Bern.mdd To save your work and open it later again.
- Project-Bern.dat To save and use it under AHH to show in the Mollier and Carrier chart all meteorological data.
- Project-Bern.deh To save and use it under DEH & EAC, software for the economy of air-handling units with heat recovering.
- Project-Bern.esh To save and use it under ESH, software for different applications.

Below you will find meteorological data for 222 locations.

The height, the temperature and the humidity are generated with the software from www.meteonorm.com. The minimal temperature and the maximal temperature are sorted by Excel. The maximal wet bulb and the maximal enthalpy are generated with the software AHH from www.zcs.ch. These two values are important to calculate correct summer conditions, because too many plants were equipped with too small fin coil coolers and must be classified under risk management because you can cool and dehumidify too little.

En example to the calculation of the heat recovery system on find on the pages 5 to 10

Page 5 Mollier-HX-Diagram with air-technical processes, meteorological data and the comfort area.

Page 6 Calculation on Winter with danger of freeze, temperature efficiency 75.45 %, capacity 225.894 kW.

Page 7 Calculation on Winter with bypass and correct pump position, temperature efficiency 61.5 %, capacity 184.094 kW.

Page 8 Calculation on Winter with bypass and not correct pump position, temperature efficiency 57.0 %, capacity 170.621 kW.

The exhaust on cool on 2.0 °C only and the deepest brine temperature of -2.0°C is also respected.

Such absurdly mind-boggling demands rarely appear on the market, naturally stemming only from a fucking **St. Gall bonehead!**

Page 9 Calculation on Summer with adiabatic exhaust cooling, temperature efficiency 75.715 %, capacity 99.456 kW.

Page 10 Calculation concerning DIN EN 308, temperature efficiency 71.068 %, capacity 110.990 kW.

Page 11 Data to the economy for Winter, Summer and concerning DIN EN 308.

Page 12 Characteristic to the temperature efficiency during the heating season.

Page 13 Characteristic to the freezing limit during the heating season. Up on -12°C there is no risk of freezing anymore.

Page 14 Calculation on Winter, the air heater splitting on 2 x 8 tube rows.

Page 15 Calculation on Winter, the air cooler splitting on 2 x 8 tube rows.

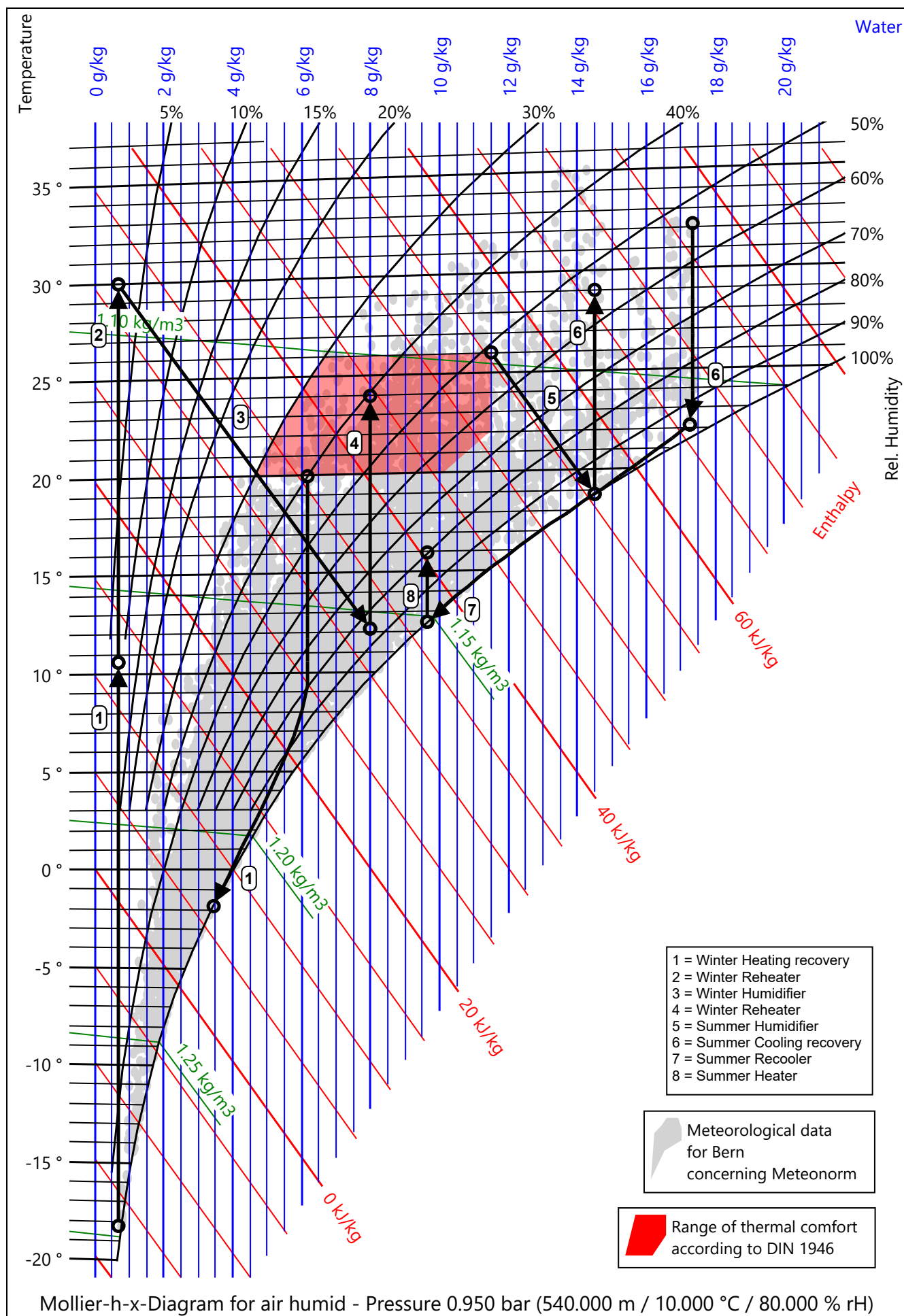


Europe capitals	Capital	Height (m)	Min. Temp. (°C)	Max. Temp. (°C)	Max. Wet bulb (°C)	Max. Enthalpy (kJ/kg)
Albania	Tirana	227	-8.0	41.5	29.7	100.0
Andorra	Andorra la Vella	1021	-13.0	37.2	24.5	80.9
Armenia	Yerevan	990	-21.8	39.4	22.6	72.1
Austria	Vienna	189	-18.7	35.6	26.0	81.7
Azerbaijan	Baku	0	-9.7	39.0	29.2	95.4
Belarus	Minsk	214	-32.4	35.0	24.1	73.8
Belgium	Brussels	58	-14.3	35.9	25.5	78.8
Bosnia & Herzeg.	Sarajevo	529	-24.6	38.6	24.0	75.2
Bulgaria	Sofia	573	-24.5	41.4	24.0	75.5
Croatia	Zagreb	146	-14.4	38.4	26.6	84.1
Cyprus	Nicosia	5	-1.9	41.0	29.8	98.3
Czech Republic	Prague	304	-23.7	38.7	24.8	77.4
Denmark	Copenhagen	13	-15.3	31.4	24.4	73.7
Estonia	Tallinn	31	-31.8	32.2	24.1	72.4
Finland	Helsinki	25	-29.0	31.4	23.7	70.8
France	Paris	38	-12.6	39.7	25.3	77.8
Georgia	Tbilisi	815	-20.6	36.9	25.7	84.8
Germany	Berlin	43	-21.1	39.5	24.9	76.1
Greece	Athens	244	-13.8	41.8	28.2	92.4
Hungary	Budapest	115	-17.6	41.5	26.3	82.3
Iceland	Reykjavik	0	-18.4	25.6	18.7	53.0
Ireland	Dublin	5	-13.7	29.2	21.7	63.2
Italy	Rome	3	-5.8	38.0	26.5	82.5
Kazakhstan	Astana	342	-42.4	40.6	24.3	75.4
Kosovo	Pristina	719	-21.9	41.2	25.1	81.4
Latvia	Riga	14	-28.3	34.0	25.1	76.7
Liechtenstein	Vaduz	460	-16.3	35.0	24.0	74.9
Lithuania	Vilnius	98	-29.6	33.8	24.7	75.7
Luxembourg	Luxembourg	380	-15.8	36.9	23.3	71.6
Macedonia	Skopje	325	-22.5	42.7	26.0	82.6
Malta	Valletta	56	0.4	42.7	28.6	92.9
Moldova	Chisinau	122	-24.3	38.8	25.9	80.6
Monaco	Monaco	68	-4.0	37.0	27.0	85.4
Montenegro	Podgorica	47	-8.4	41.1	27.7	88.3
Netherlands	Amsterdam	0	-17.2	33.9	24.7	74.8
Norway	Oslo	27	-20.9	33.0	21.9	64.3
Poland	Warsaw	127	-25.7	36.9	24.6	75.4
Portugal	Lisbon	18	1.0	40.7	26.5	82.9
Romania	Bucharest	95	-23.4	41.3	26.8	84.8
Russia	Moscow	190	-32.1	37.3	26.0	81.9
San Marino	San Marino	677	-10.4	38.4	24.1	76.5
Serbia	Belgrade	99	-24.5	43.2	27.5	87.9
Slovakia	Bratislava	148	-19.7	38.4	26.0	81.5
Slovenia	Ljubljana	301	-16.1	39.1	25.3	79.4
Spain	Madrid	662	-8.6	41.2	22.9	71.7
Sweden	Stockholm	21	-24.6	40.0	25.4	77.9
Switzerland	Bern	540	-18.3	35.0	24.2	76.4
Turkey	Ankara	872	-21.7	41.4	22.3	70.6
Ukraine	Kyiv	159	-27.0	39.0	26.6	84.2
United Kingdom	London	18	-2.4	37.6	24.8	75.5
Vatican City	Vatikan City	3	-5.8	38.0	26.5	82.5

Germany	City	Height (m)	Min. Temp. (°C)	Max. Temp. (°C)	Max. Wet bulb (°C)	Max. Enthalpy (kJ/kg)
	Berlin	43	-21.1	39.5	24.9	76.1
	Hamburg	1	-20.0	36.6	25.1	76.7
	Munich	529	-23.7	36.4	22.0	67.4
	Cologne	57	-18.8	38.5	25.2	77.5
	Frankfurt	106	-17.2	38.3	25.1	77.3
	Stuttgart	248	-16.9	37.8	24.8	76.8
	Düsseldorf	37	-17.3	36.2	24.9	75.8
	Dortmund	80	-16.2	36.4	24.8	75.8
	Essen	69	-17.0	36.0	25.3	78.0
	Leipzig	143	-22.1	36.1	24.4	74.6
	Bremen	3	-15.9	35.1	23.6	70.5
	Dresden	154	-20.7	37.1	25.8	80.4
	Hanover	184	-33.8	35.5	26.7	84.6
	Nuremberg	281	-19.9	37.4	22.8	69.0
	Duisburg	25	-18.0	36.3	25.6	78.7
	Bochum	100	-16.9	36.0	25.0	76.6
	Wuppertal	238	-18.9	35.7	24.1	73.7
	Bielefeld	109	-20.5	36.4	24.3	74.0
	Bonn	104	-19.1	37.6	24.7	75.4
	Münster	48	-19.0	36.2	25.1	76.8
	Karlsruhe	123	-18.1	39.1	25.7	79.9
	Mannheim	99	-18.5	38.0	26.4	82.7
	Augsburg	485	-24.9	36.2	23.9	74.5
	Wiesbaden	119	-18.6	37.5	24.2	73.7
	Gelsenkirchen	75	-16.9	36.1	24.9	76.1

Switzerland	City	Height (m)	Min. Temp. (°C)	Max. Temp. (°C)	Max. Wet bulb (°C)	Max. Enthalpy (kJ/kg)
	Zurich	413	-16.5	35.4	24.4	76.3
	Geneva	420	-12.5	39.1	24.3	76.0
	Basel	270	-18.4	37.9	24.5	75.7
	Lausanne	526	-12.8	36.4	23.2	72.2
	Bern	540	-18.3	35.0	24.2	76.4
	Winterthur	440	-18.6	36.1	24.2	75.6
	Lucerne	438	-14.7	34.0	23.0	70.8
	St. Gallen	779	-17.7	33.3	22.6	71.3
	Lugano	273	-12.6	36.1	25.3	79.3
	Biel	435	-16.5	37.3	23.9	74.2
	Thun	562	-17.9	35.9	24.1	76.2
	Köniz	582	-19.0	36.2	23.4	73.3
	La Chaux-de-Fonds	994	-24.7	33.5	22.1	70.3
	Fribourg	588	-17.1	37.4	24.6	78.1
	Schaffhausen	402	-15.4	35.2	23.6	73.0
	Vernier	445	-12.9	38.7	24.6	77.3
	Chur	590	-17.2	37.0	23.7	74.3
	Sion	518	-16.6	37.9	23.7	73.8
	Uster	464	-16.7	35.1	23.9	74.5
	Neuchâtel	438	-12.9	37.4	23.8	73.7
Austria	City	Height (m)	Min. Temp. (°C)	Max. Temp. (°C)	Max. Wet bulb (°C)	Max. Enthalpy (kJ/kg)
	Vienna	189	-18.7	35.6	26.0	81.7
	Graz	362	-18.5	38.5	26.3	84.4
	Linz	250	-15.7	35.3	24.7	76.5
	Salzburg	435	-20.2	36.9	25.1	79.3
	Innsbruck	580	-18.8	36.8	24.1	76.1
	Klagenfurt	452	-22.6	37.9	24.7	77.9
	Villach	495	-19.4	37.0	24.7	78.1
	Dornbirn	410	-18.4	37.7	25.5	81.1
	Wiener Neustadt	284	-21.8	38.1	25.2	78.8
	Steyr	309	-19.5	36.2	24.3	75.1
Italy	City	Height (m)	Min. Temp. (°C)	Max. Temp. (°C)	Max. Wet bulb (°C)	Max. Enthalpy (kJ/kg)
	Rome	3	-5.8	38.0	26.5	82.5
	Milan	98	-11.1	39.2	27.8	89.4
	Naples	3	-1.7	42.4	30.6	102.7
	Turin	231	-13.3	35.9	25.9	81.8
	Palermo	1	0.6	41.6	29.9	98.7
	Genoa	0	-3.8	37.1	29.3	95.7
	Bologna	70	-13.2	40.0	25.9	80.4
	Florence	44	-12.1	39.9	29.3	96.4
	Bari	0	-3.3	45.2	28.9	93.8
	Catania	3	-3.9	45.6	31.0	105.0
	Venice	1	-12.1	37.3	26.6	83.0
	Verona	115	-13.6	38.5	28.0	90.5
	Messina	0	0.3	42.2	31.2	105.8
	Padua	14	-11.9	38.1	27.4	86.9
	Trieste	0	-7.5	37.2	27.8	88.5
France	City	Height (m)	Min. Temp. (°C)	Max. Temp. (°C)	Max. Wet bulb (°C)	Max. Enthalpy (kJ/kg)
	Paris	38	-12.6	39.7	25.3	77.8
	Marseille	5	-7.5	37.4	27.3	86.2
	Lyon	180	-12.0	39.5	25.6	79.9
	Toulouse	150	-11.4	39.8	25.1	77.7
	Nice	5	-3.6	37.3	25.4	77.9
	Nantes	27	-11.0	38.2	25.5	78.4
	Strasbourg	140	-18.4	38.2	25.4	78.9
	Montpellier	55	-9.9	37.3	26.2	81.8
	Bordeaux	11	-9.8	39.8	26.7	83.6
	Lille	26	-13.1	35.9	24.8	75.4
	Rennes	49	-11.1	38.5	26.0	80.9
	Reims	100	-13.7	38.3	25.2	77.4
	Le Havre	0	-8.4	35.3	24.9	75.7
	Saint-Etienne	538	-15.7	40.7	24.9	79.4
	Toulon	95	-2.3	35.4	25.6	79.2
Netherlands	City	Height (m)	Min. Temp. (°C)	Max. Temp. (°C)	Max. Wet bulb (°C)	Max. Enthalpy (kJ/kg)
	Amsterdam	0	-17.2	33.9	24.7	74.8
	Rotterdam	0	-15.7	35.1	25.6	78.8
	The Hague	0	-14.3	35.0	25.0	76.3
	Utrecht	0	-16.8	35.3	25.1	76.5
	Eindhoven	16	-19.1	36.7	24.8	75.3
	Tilburg	15	-17.4	36.8	25.4	77.8
	Groningen	0	-18.3	34.5	25.0	76.1

Further capitals	City	Height (m)	Min. Temp. (°C)	Max. Temp. (°C)	Max. Wet bulb (°C)	Max. Enthalpy (kJ/kg)
Arab Emirates	Abu Dhabi	0	3.0	48.1	31.8	109.3
Nigeria	Abuja	534	12.0	42.7	32.3	117.5
Ghana	Accra	22	12.4	37.5	31.1	105.3
Ethiopia	Addis Ababa	2350	2.9	29.4	20.4	71.4
Algeria	Alger	116	-3.0	44.1	29.3	96.7
Jordan	Amman	788	-6.5	43.7	24.0	77.0
Madagascar	Antananarivo	1340	-0.3	33.0	24.8	84.6
Eritrea	Asmara	2340	1.6	35.9	18.4	63.4
Kazakhstan	Astana	342	-42.4	40.6	24.3	75.2
Paraguay	Asunción	91	-0.6	41.2	29.5	97.8
Iraq	Bagdad	33	-11.6	49.5	24.5	74.3
Azerbaijan	Baku	0	-9.7	39.0	29.2	95.4
Thailand	Bangkok	0	14.5	39.3	31.3	106.2
China	Beijing	30	-19.0	41.8	30.0	99.9
Lebanon	Beirut	0	4.0	39.3	29.8	98.5
Colombia	Bogotá	2547	-2.5	28.1	18.4	64.6
Brazil	Brasilia	960	5.5	35.3	26.1	87.6
Congo	Brazzaville	300	9.4	38.1	28.8	95.9
Barbados	Bridgetown	42	17.5	36.2	29.6	97.9
Argentina	Buenos Aires	0	-2.0	38.3	28.7	93.1
Egypt	Cairo	84	-1.6	44.6	29.1	95.4
Australia	Canberra	631	-7.9	40.5	25.4	82.0
Venezuela	Caracas	1051	10.4	36.4	25.0	83.4
Senegal	Dakar	0	10.2	40.9	30.5	102.2
Syria	Damascus	684	-11.2	46.0	24.9	80.3
Bangladesh	Dhaka	15	2.1	40.5	31.5	107.4
Tanzania	Dodoma	1189	5.4	33.5	25.4	86.1
Vietnam	Hanoi	46	4.8	42.1	32.2	112.0
Cuba	Havana	59	4.1	37.2	29.5	97.2
Pakistan	Islamabad	617	-2.5	45.7	30.8	109.5
Indonesia	Jakarta	0	14.3	37.9	29.0	94.3
Israel	Jerusalem	713	-7.3	43.5	25.9	84.8
Afghanistan	Kabul	1800	-14.9	34.5	28.4	107.4
Uganda	Kampala	1189	8.8	31.3	22.6	73.5
Nepal	Kathmandu	1300	-3.2	35.2	23.4	77.7
Sudan	Khartoum	366	8.8	48.2	30.3	104.2
Jamaica	Kingston	16	14.4	38.6	29.6	97.5
Congo	Kinshasa	350	11.9	36.9	28.9	96.7
Malaysia	Kuala Lumpur	152	15.7	37.1	29.9	100.0
Peru	Lima	0	11.2	32.2	25.5	78.4
Philippines	Manila	0	16.4	36.6	29.9	98.9
Mozambique	Maputo	15	5.1	42.1	29.7	98.2
Mexico	Mexico City	2240	-1.0	33.0	18.8	64.2
Somalia	Mogadishu	22	8.2	40.1	29.2	95.7
Uruguay	Montevideo	30	-2.8	38.4	27.6	87.9
Kenya	Nairobi	1691	0.0	36.7	21.7	72.9
Bahamas	Nassau	0	7.4	39.3	30.4	101.4
India	New Delhi	213	0.8	48.6	31.6	109.9
Niger	Niamey	183	9.0	47.0	29.9	100.5
Greenland	Nuuk	0	-28.8	23.5	16.1	45.0
Canada	Ottawa	62	-33.5	36.2	26.9	84.6
Cambodia	Phnom Penh	15	9.2	42.2	31.4	107.2
Mauritius	Port Louis	0	13.2	39.3	29.1	94.8
Haiti	Port-au-Prince	0	12.3	36.8	30.1	99.8
Cape Verde	Praia	0	10.5	35.7	28.4	91.2
South Africa	Pretoria	1402	-2.0	36.5	23.9	80.9
North Korea	Pyongyang	35	-26.1	36.1	28.5	92.2
Ecuador	Quito	2810	0.6	25.9	17.3	61.6
Morocco	Rabat	0	-2.2	45.3	31.0	104.7
Iceland	Reykjavik	0	-18.4	25.6	18.7	53.0
Saudi Arabia	Riyadh	701	-2.7	47.3	22.4	69.9
Puerto Rico	San Juan	19	19.4	34.4	29.0	94.5
El Salvador	San Salvador	680	10.8	38.0	28.1	95.5
Yemen	Sana'a	2260	-2.4	37.2	20.7	72.1
Chile	Santiago	549	-3.8	35.7	21.1	64.1
Dom. Republic	Santo Domingo	30	11.6	37.7	30.7	103.6
South Korea	Seoul	109	-18.6	36.4	28.2	91.3
Singapore	Singapore	30	20.7	36.2	30.4	101.6
Bolivia	La Paz	3620	-12.0	25.2	13.2	50.5
Taiwan	Taipei	419	2.3	35.8	28.6	95.6
Honduras	Tegucigalpa	1000	4.4	36.0	25.1	83.2
Iran	Tehran	1190	-11.8	42.8	26.2	90.3
Japan	Tokyo	16	-3.2	39.5	28.9	93.8
Libya	Tripoli	0	1.3	47.7	29.9	98.9
Tunisia	Tunis	43	-6.9	46.9	29.3	96.2
Laos	Vientiane	152	6.6	41.0	30.5	103.4
United States	Washington	41	-16.1	39.3	28.8	93.7
New Zealand	Wellington	43	-2.9	29.4	22.5	66.4
Cameroon	Yaoundé	731	8.1	33.7	28.5	98.0



CC-System in winter		SA-He	RA-Co	Definition
Height over sea level	m			540.000
Pressure	hPa			949.653
Efficiency	%	75.450	56.540	
Capacity sensible	kW	225.863	170.168	
Capacity latent	kW	---	52.515	
Capacity frost	kW	---	3.440	
Capacity total	kW	225.863	226.123	
Surface reserve	%	0.301	0.188	
Present surface	m2	1834.894	1834.894	



Zeller Consulting Suisse
HVAC solutions
Jurastrasse 35
CH-3063 Ittigen

Phone: +41 79 222 66 42

Fax: Don't exist

info@zcs.ch

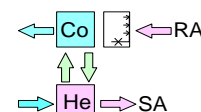
www.zcs.ch

Ittigen, 21.07.2019

With the compliments of

Marin Zeller
Direct dialing
+41 79 222 66 42

Plant
Object
Position



Software by www.zcs.ch

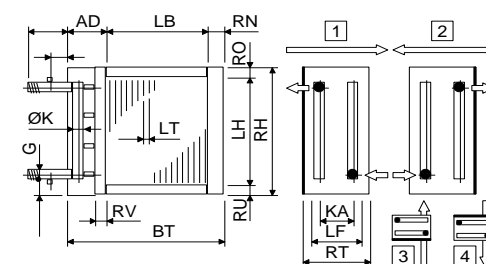
SA-He (ff = 0.00005 m2K/W)		Inlet	Outlet	Definition
Temp.	°C	-18.300	10.597	20.000
Rel. humidity	%	90.000	8.448	40.000
Abs. humidity	g/kg	0.708	0.708	6.175
Volume flow humid	m3/h	21544.775	23987.634	25000.000
Velocity	m/s	1.638	1.824	1.901
Pressure drop	Pa		82.987	

RA-Co (ff = 0.00005 m2K/W)		Inlet	Outlet	Definition
Temp.	°C	20.000	-1.655	20.000
Rel. humidity	%	40.000	100.000	40.000
Abs. humidity	g/kg	6.175	3.508	6.175
Volume flow humid	m3/h	25000.000	23055.055	25000.000
Velocity	m/s	1.901	1.753	1.901
Pressure drop wet	Pa		108.987	

30 V% Et.glycol (ff = 0.00005 / 0.00005 m2K/W)		SA-He	RA-Co	
Temp.	in °C	13.000	-8.100	
Temp.	out °C	-8.100	13.000	
Volume flow	m3/h	10.202	10.217	
Velocity	m/s	1.117	1.119	
Reynolds	---	3454.091	3387.504	
Pressure drop	kPa	188.207	189.756	



Technical data		SA-He	RA-Co	SA-He	RA-Co
Tubes total	Piece	576	576	Tubes:	Cu
Tubes blank	Piece	0	0	Tubes:	smooth
Int. vent./drains	Piece	7	7	Tubes:	in line
Tube rows on the depth	Piece	16	16	Tubes:	circular
Tube rows on the height	Piece	36	36	Collectors:	Cu
Tube coupling in series	Piece	24	24	Collectors:	1.39 m/s
Number of circuits (NC)	Piece	24	24	Connections:	Rg7
Volume	l	190	190	Connections:	1.39 m/s
Weight	kg	746	746	Fins:	Al
Connections	G	2"	2"	Fins:	Wave structure
Frame height	RH mm	1340	1340	Frame:	AlMg3
Frame width	BT mm	3099	3099	Air flow direction:	horizontal
Frame depth	RT mm	620	620	Protection:	without
Finned height	LH mm	1260	1260	Protection:	---
Finned width	LB mm	2900	2900		
Finned depth	LF mm	560	560		
Frame on top	RO mm	40	40		
Frame on bottom	RU mm	40	40		
Frame in front	RV mm	30	30		
Frame on back (~53/53mm)	RN mm	56	56		
Collector-Diameter	K mm	54	54		
Collector covering	AD mm	143	143		
Collector distance	KA mm	542	542		
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	35.000	35.000		
Tube interval on the depth	S2 mm	35.000	35.000		



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

SA-He: 35/35/12-16R-36T-2900A-2.5PA-24C-Cu/Al/AlMg3
RA-Co: 35/35/12-16R-36T-2900A-2.5PA-24C-Cu/Al/AlMg3

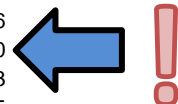
SA-He: EUR 12251.00
RA-Co: EUR 12251.00

CC-System in winter		SA-He	RA-Co	Definition
Height over sea level	m			540.000
Pressure	hPa			949.653
Efficiency	%	61.500	49.329	
Capacity sensible	kW	184.094	148.707	
Capacity latent	kW	---	35.386	
Capacity frost	kW	---	0.000	
Capacity total	kW	184.094	184.093	
Surface reserve	%	0.033	0.025	
Present surface	m2	1834.894	1834.894	

SA-He (ff = 0.00005 m2K/W)		Inlet	Outlet	Definition
Temp.	°C	-18.300	5.255	20.000
Rel. humidity	%	90.000	12.141	40.000
Abs. humidity	g/kg	0.708	0.708	6.175
Volume flow humid	m3/h	21544.775	23535.972	25000.000
Velocity	m/s	1.638	1.789	1.901
Pressure drop	Pa		81.838	

RA-Co (ff = 0.00005 m2K/W)		Inlet	Outlet	Definition
Temp.	°C	20.000	1.107	20.000
Rel. humidity	%	40.000	100.000	40.000
Abs. humidity	g/kg	6.175	4.378	6.175
Volume flow humid	m3/h	25000.000	23321.940	25000.000
Velocity	m/s	1.901	1.773	1.901
Pressure drop wet	Pa		103.691	

30 V% Et.glycol (ff = 0.00005 / 0.00005 m2K/W)		SA-He	RA-Co	
Temp.	in °C	7.409	-9.820	
Temp.	out °C	-9.820	16.636	
Volume flow	m3/h	10.202	6.622	
Velocity	m/s	1.117	0.725	
Reynolds	---	3048.212	2486.774	
Pressure drop	kPa	194.751	86.603	



Zeller Consulting Suisse

HVAC solutions

Jurastrasse 35

CH-3063 Ittigen

Phone: +41 79 222 66 42

Fax: Don't exist

info@zcs.ch

www.zcs.ch

Ittigen, 21.07.2019

With the compliments of

Marin Zeller

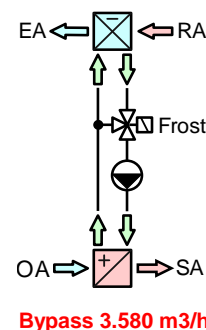
Direct dialing

+41 79 222 66 42

Plant

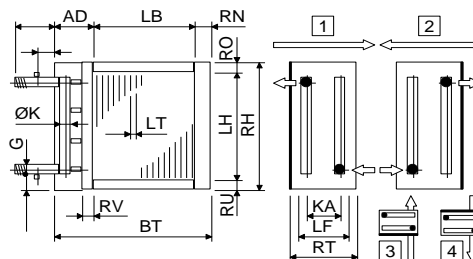
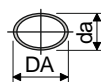
Object

Position



Software by www.zcs.ch

Technical data		SA-He	RA-Co	SA-He	RA-Co
Tubes total	Piece	576	576	Tubes:	Cu
Tubes blank	Piece	0	0	Tubes:	smooth
Int. vent./drains	Piece	7	7	Tubes:	in line
Tube rows on the depth	Piece	16	16	Tubes:	circular
Tube rows on the height	Piece	36	36	Collectors:	Cu
Tube coupling in series	Piece	24	24	Collectors:	1.39 m/s
Number of circuits (NC)	Piece	24	24	Connections:	Rg7
Volume	l	190	190	Connections:	1.39 m/s
Weight	kg	746	746	Fins:	Al
Connections	G	2"	2"	Fins:	Wave structure
Frame height	RH mm	1340	1340	Frame:	AlMg3
Frame width	BT mm	3099	3099	Air flow direction:	horizontal
Frame depth	RT mm	620	620	Protection:	without
Finned height	LH mm	1260	1260	Protection:	---
Finned width	LB mm	2900	2900		
Finned depth	LF mm	560	560		
Frame on top	RO mm	40	40		
Frame on bottom	RU mm	40	40		
Frame in front	RV mm	30	30		
Frame on back (~53/53mm)	RN mm	56	56		
Collector-Diameter	K mm	54	54		
Collector covering	AD mm	143	143		
Collector distance	KA mm	542	542		
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	35.000	35.000		
Tube interval on the depth	S2 mm	35.000	35.000		



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

SA-He: 35/35/12-16R-36T-2900A-2.5PA-24C-Cu/Al/AlMg3

RA-Co: 35/35/12-16R-36T-2900A-2.5PA-24C-Cu/Al/AlMg3

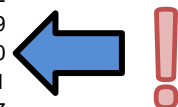
SA-He:	EUR	12251.00
RA-Co:	EUR	12251.00

CC-System in winter		SA-He	RA-Co	Definition
Height over sea level	m			540.000
Pressure	hPa			949.653
Efficiency	%	57.000	46.852	
Capacity sensible	kW	170.621	141.322	
Capacity latent	kW	---	29.299	
Capacity frost	kW	---	0.000	
Capacity total	kW	170.621	170.621	
Surface reserve	%	0.058	0.037	
Present surface	m2	1834.894	1834.894	

SA-He (ff = 0.00005 m2K/W)		Inlet	Outlet	Definition
Temp.	°C	-18.300	3.531	20.000
Rel. humidity	%	90.000	13.694	40.000
Abs. humidity	g/kg	0.708	0.708	6.175
Volume flow humid	m3/h	21544.775	23390.275	25000.000
Velocity	m/s	1.638	1.778	1.901
Pressure drop	Pa		81.469	

RA-Co (ff = 0.00005 m2K/W)		Inlet	Outlet	Definition
Temp.	°C	20.000	2.056	20.000
Rel. humidity	%	40.000	100.000	40.000
Abs. humidity	g/kg	6.175	4.687	6.175
Volume flow humid	m3/h	25000.000	23414.154	25000.000
Velocity	m/s	1.901	1.780	1.901
Pressure drop wet	Pa		101.837	

30 V% Et.glycol (ff = 0.00005 / 0.00005 m2K/W)		SA-He	RA-Co	
Temp.	in °C	13.990	-1.901	
Temp.	out °C	-14.221	13.990	
Volume flow	m3/h	5.771	10.217	
Velocity	m/s	0.632	1.119	
Reynolds	---	1811.819	3846.160	
Pressure drop	kPa	72.105	183.375	



Zeller Consulting Suisse

HVAC solutions

Jurastrasse 35

CH-3063 Ittigen

Phone: +41 79 222 66 42

Fax: Don't exist

info@zcs.ch

www.zcs.ch

Ittigen, 21.07.2019

With the compliments of

Marin Zeller

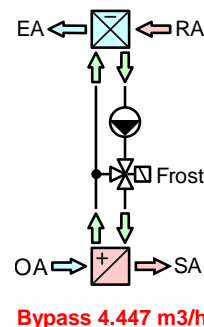
Direct dialing

+41 79 222 66 42

Plant

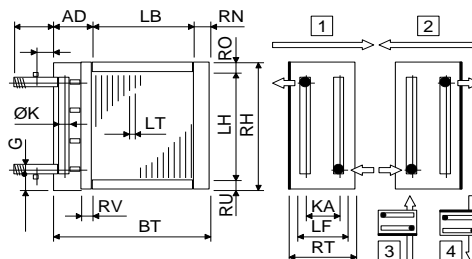
Object

Position



Software by www.zcs.ch

Technical data		SA-He	RA-Co	SA-He	RA-Co
Tubes total	Piece	576	576	Tubes:	Cu
Tubes blank	Piece	0	0	Tubes:	smooth
Int. vent./drains	Piece	7	7	Tubes:	in line
Tube rows on the depth	Piece	16	16	Tubes:	circular
Tube rows on the height	Piece	36	36	Collectors:	Cu
Tube coupling in series	Piece	24	24	Collectors:	0.78 m/s
Number of circuits (NC)	Piece	24	24	Connections:	Rg7
Volume	l	190	190	Connections:	0.78 m/s
Weight	kg	746	746	Connections:	0.78 m/s
Connections	G	---	---	Fin:	Al
Frame height	RH	mm	mm	Fin:	Wave structure
Frame width	BT	mm	mm	Frame:	AlMg3
Frame depth	RT	mm	mm	Frame:	AlMg3
Finned height	LH	mm	mm	Air flow direction:	horizontal
Finned width	LB	mm	mm	Protection:	without
Finned depth	LF	mm	mm	Protection:	---
Frame on top	RO	mm	mm		
Frame on bottom	RU	mm	mm		
Frame in front	RV	mm	mm		
Frame on back (~53/53mm)	RN	mm	mm		
Collector-Diameter	K	mm	mm		
Collector covering	AD	mm	mm		
Collector distance	KA	mm	mm		
Fin spacing	LT	mm	mm		
Fin thickness	LD	mm	mm		
Tube diameter	DA	mm	mm		
Tube diameter	da	mm	mm		
Tube thickness	S	mm	mm		
Tube interval on the height	S1	mm	mm		
Tube interval on the depth	S2	mm	mm		



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

SA-He: 35/35/12-16R-36T-2900A-2.5PA-24C-Cu/Al/AlMg3

RA-Co: 35/35/12-16R-36T-2900A-2.5PA-24C-Cu/Al/AlMg3

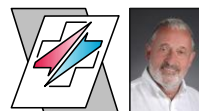
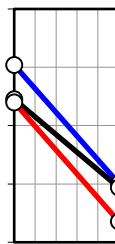
SA-He:	EUR	12251.00
RA-Co:	EUR	12251.00

CC-System in summer		RA-Hy	SA-Co	Definition
Height over sea level	m			540.000
Pressure	hPa			949.653
Efficiency	%	76.075	75.680	
Capacity sensible	kW	81.878	81.878	
Capacity latent	kW	0.000	0.000	
Capacity frost	kW	---	0.000	
Capacity total	kW	81.878	81.878	
Surface reserve	%	0.115	0.191	
Present surface	m2	1834.894	1834.894	

RA-Hy (ff = 0.00005 m2K/W)		Inlet	Outlet	Definition
Temp. (26.000)	°C	18.780	28.989	20.000
Rel. humidity (51.420)	%	100.000	54.208	40.000
Abs. humidity (11.500)	g/kg	14.502	14.502	6.175
Volume flow humid	m3/h	25225.883	26108.026	25000.000
Velocity	m/s	1.918	1.985	1.901
Pressure drop	Pa		97.949	

SA-Co (ff = 0.00005 m2K/W)		Inlet	Outlet	Definition
Temp.	°C	32.200	22.044	20.000
Rel. humidity	%	53.700	97.310	40.000
Abs. humidity	g/kg	17.330	17.330	6.175
Volume flow humid	m3/h	26502.606	25621.147	25000.000
Velocity	m/s	2.015	1.948	1.901
Pressure drop wet	Pa		100.021	37

30 V% Et.glycol (ff = 0.00005 / 0.00005 m2K/W)		RA-Hy	SA-Co	
Temp.	in °C	29.264	21.698	32
Temp.	out °C	21.698	29.264	27
Volume flow	m3/h	10.202	10.207	22
Velocity	m/s	1.117	1.118	17
Reynolds	---	7129.722	6908.121	
Pressure drop	kPa	157.464	158.771	



Zeller Consulting Suisse
HVAC solutions
Jurastrasse 35
CH-3063 Ittigen

Phone: +41 79 222 66 42

Fax: Don't exist

info@zcs.ch

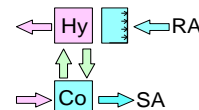
www.zcs.ch

Ittigen, 21.07.2019

With the compliments of

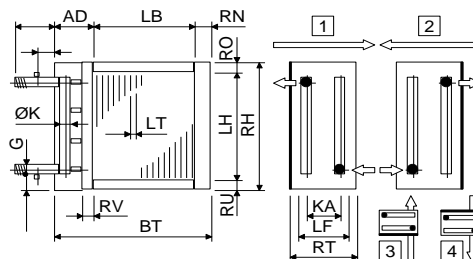
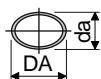
Marin Zeller
Direct dialing
+41 79 222 66 42

Plant
Object
Position



Software by www.zcs.ch

Technical data		RA-Hy	SA-Co	RA-Hy	SA-Co
Tubes total	Piece	576	576	Tubes:	Cu
Tubes blank	Piece	0	0	Tubes:	smooth
Int. vent./drains	Piece	7	7	Tubes:	in line
Tube rows on the depth	Piece	16	16	Tubes:	circular
Tube rows on the height	Piece	36	36	Collectors:	Cu
Tube coupling in series	Piece	24	24	Collectors:	1.39 m/s
Number of circuits (NC)	Piece	24	24	Connections:	Rg7
Volume	l	190	190	Connections:	1.39 m/s
Weight	kg	746	746	Fins:	Al
Connections	G	2"	2"	Fins:	Wave structure
Frame height	RH mm	1340	1340	Frame:	AlMg3
Frame width	BT mm	3099	3099	Air flow direction:	horizontal
Frame depth	RT mm	620	620	Protection:	without
Finned height	LH mm	1260	1260	Protection:	---
Finned width	LB mm	2900	2900		
Finned depth	LF mm	560	560		
Frame on top	RO mm	40	40		
Frame on bottom	RU mm	40	40		
Frame in front	RV mm	30	30		
Frame on back (~56/53mm)	RN mm	56	56		
Collector-Diameter	K mm	54	54		
Collector covering	AD mm	143	143		
Collector distance	KA mm	542	542		
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	35.000	35.000		
Tube interval on the depth	S2 mm	35.000	35.000		



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

RA-Hy: 35/35/12-16R-36T-2900A-2.5PA-24C-Cu/Al/AlMg3
SA-Co: 35/35/12-16R-36T-2900A-2.5PA-24C-Cu/Al/AlMg3

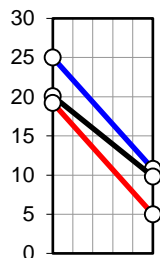
RA-Hy: EUR 12251.00
SA-Co: EUR 12251.00

CC-System (DIN EN 308)		SA-He	RA-Co	Definition
Height over sea level	m			540.000
Pressure	hPa			949.653
Efficiency	%	71.068	71.053	
Capacity sensible	kW	110.990	110.990	
Capacity latent	kW	---	---	
Capacity frost	kW	---	---	
Capacity total	kW	110.990	110.990	
Surface reserve	%	0.091	0.082	
Present surface	m2	1834.894	1834.894	

SA-He (ff = 0.00005 m2K/W)		Inlet	Outlet	Definition
Temp.	°C	5.000	19.214	20.000
Rel. humidity	%	0.000	0.000	40.000
Abs. humidity	g/kg	0.000	0.000	6.175
Volume flow humid	m3/h	23487.737	24687.920	25000.000
Velocity	m/s	1.786	1.877	1.901
Pressure drop	Pa		89.825	

RA-Co (ff = 0.00005 m2K/W)		Inlet	Outlet	Definition
Temp.	°C	25.000	10.789	20.000
Rel. humidity	%	0.000	0.000	40.000
Abs. humidity	g/kg	0.000	0.000	6.175
Volume flow humid	m3/h	25176.530	23976.590	25000.000
Velocity	m/s	1.914	1.823	1.901
Pressure drop	Pa		92.393	

30 V% Et.glycol (ff = 0.00005 / 0.00005 m2K/W)		SA-He	RA-Co	
Temp.	in °C	20.079	9.821	
Temp.	out °C	9.821	20.079	
Volume flow	m3/h	10.244	10.250	
Velocity	m/s	1.122	1.123	
Reynolds	---	5371.179	5168.234	
Pressure drop	kPa	169.448	171.154	



Zeller Consulting Suisse
HVAC solutions
Jurastrasse 35
CH-3063 Ittigen

Phone: +41 79 222 66 42

Fax: Don't exist

info@zcs.ch

www.zcs.ch

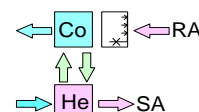
Ittigen, 21.07.2019

With the compliments of

Marin Zeller
Direct dialing

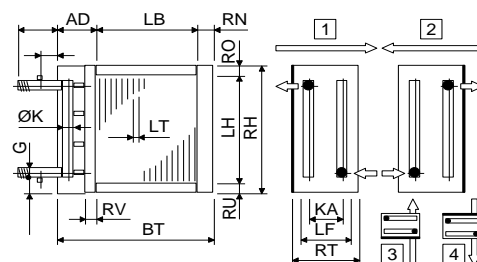
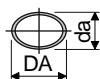
+41 79 222 66 42

Plant
Object
Position



Software by www.zcs.ch

Technical data		SA-He	RA-Co	SA-He	RA-Co
Tubes total	Piece	576	576	Tubes:	Cu
Tubes blank	Piece	0	0	Tubes:	smooth
Int. vent./drains	Piece	7	7	Tubes:	in line
Tube rows on the depth	Piece	16	16	Tubes:	circular
Tube rows on the height	Piece	36	36	Collectors:	Cu
Tube coupling in series	Piece	24	24	Collectors:	1.39 m/s
Number of circuits (NC)	Piece	24	24	Connections:	Rg7
Volume	l	190	190	Connections:	1.39 m/s
Weight	kg	746	746	Fins:	Al
Connections	G	---	2"	Fins:	Wave structure
Frame height	RH	mm	1340	Frame:	AlMg3
Frame width	BT	mm	3099	Air flow direction:	horizontal
Frame depth	RT	mm	620	Protection:	without
Finned height	LH	mm	1260	Protection:	---
Finned width	LB	mm	2900		
Finned depth	LF	mm	560		
Frame on top	RO	mm	40		
Frame on bottom	RU	mm	40		
Frame in front	RV	mm	30		
Frame on back (~53/53mm)	RN	mm	56		
Collector-Diameter	K	mm	54		
Collector covering	AD	mm	143		
Collector distance	KA	mm	542		
Fin spacing	LT	mm	2.500		
Fin thickness	LD	mm	0.200		
Tube diameter	DA	mm	12.400		
Tube diameter	da	mm	12.400		
Tube thickness	S	mm	0.400		
Tube interval on the height	S1	mm	35.000		
Tube interval on the depth	S2	mm	35.000		



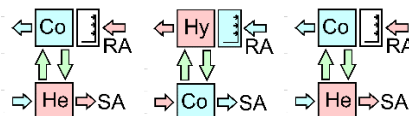
Delivery: 5-6 weeks
Validity: 12 weeks
Condit.: net, prepaid address
Payment: 30 days net

SA-He: 35/35/12-16R-36T-2900A-2.5PA-24C-Cu/Al/AlMg3
RA-Co: 35/35/12-16R-36T-2900A-2.5PA-24C-Cu/Al/AlMg3

SA-He: EUR 12251.00
RA-Co: EUR 12251.00

Economy with CC-System

Base value	Definition
Height over sea level	m 540.000
Pressure	bar 0.950
Volume flow humid at	°C 20.000
Volume flow humid at	% 40.000



CC-System		Winter	Summer	DIN EN 308
Efficiency Supply air	%	75.450	75.680	71.068
Capacity	kW	225.863	81.878	110.990
Surface reserve	%	0.301	0.191	0.091
Present surface	m2	1834.894	1834.894	1834.894

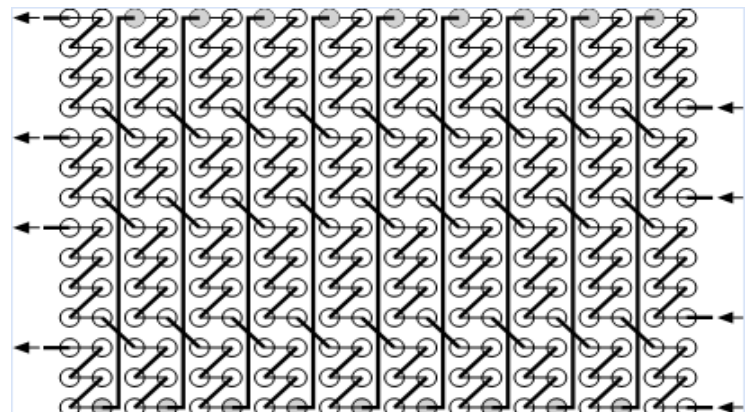
Supply air		Winter	Summer	DIN EN 308
Temp. in	°C	-18.300	32.200	5.000
Temp. out	°C	10.597	22.044	19.214
Volume flow humid	m3/h	25000.000	25000.000	25000.000
Pressure drop	Pa	82.987	100.021	89.825
Fan efficiency	---	0.700	0.700	0.700
Fan power	kW	0.823	0.992	0.891

Return air		Winter	Summer	DIN EN 308
Temp. in	°C	20.000	18.780	25.000
Temp. out	°C	-1.655	28.989	10.789
Volume flow humid	m3/h	25000.000	25000.000	25000.000
Pressure drop	Pa	108.987	97.949	92.393
Fan efficiency	---	0.700	0.700	0.700
Fan power	kW	1.081	0.972	0.917

30 V% Et.glycol (ff = 0.00005 / 0.00005 m2K/W)		Winter	Summer	DIN EN 308
Volume flow	m3/h	10.202	10.207	10.244
Pressure drop Supply air	bar	1.882	1.588	1.694
Pressure drop Return air	bar	1.898	1.575	1.712
Pressure drop Hydraulics	bar	2.000	2.000	2.000
Pressure drop Total	bar	5.780	5.162	5.406
Pump efficiency	---	0.800	0.800	0.800
Pump power	kW	2.047	1.830	1.923

Economy with CC-System		Winter	Summer	DIN EN 308
Gross useful ratio with CC-System	kW	225.863	81.878	110.990
Need of energy with CC-System	kW	3.952	3.794	3.731
Net useful ratio with CC-System	kW	221.911	78.084	107.259
Coefficient of performance (COP)	---	57.153	21.583	29.751
Volume flow humid Total	m3/h	50000.000	50000.000	50000.000
Need of energy with CC-System	kW	3.952	3.794	3.731
Specific CC-System power (SFP)	Ws/m3	284.538	273.142	268.606

Adiabatic return air cooling



Zeller Consulting Suisse
HVAC solutions
Jurastrasse 35
CH-3063 Ittigen

Phone: +41 79 222 66 42

Fax: Don't exist
info@zcs.ch
www.zcs.ch

Ittigen, 21.07.2019
With the compliments of

Marin Zeller
Direct dialing
+41 79 222 66 42

Plant
Object
Position

Software by www.zcs.ch

$$E = \frac{B * C}{D * 3600 * 1000}$$

$$I = \frac{F * G}{H * 3600 * 1000}$$

$$N = K + L + M$$

$$P = \frac{J * N * 100000}{O * 3600 * 1000}$$

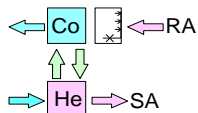
$$Q = E + I + P$$

$$R = A - Q$$

$$S = \frac{A}{Q}$$

$$T = B + F$$

$$U = \frac{Q * 3600 * 1000}{T}$$



Ittigen, 21.07.2019
With the compliments of

Marin Zeller
Direct dialing
+41 79 222 66 42

Plant
Object
Position



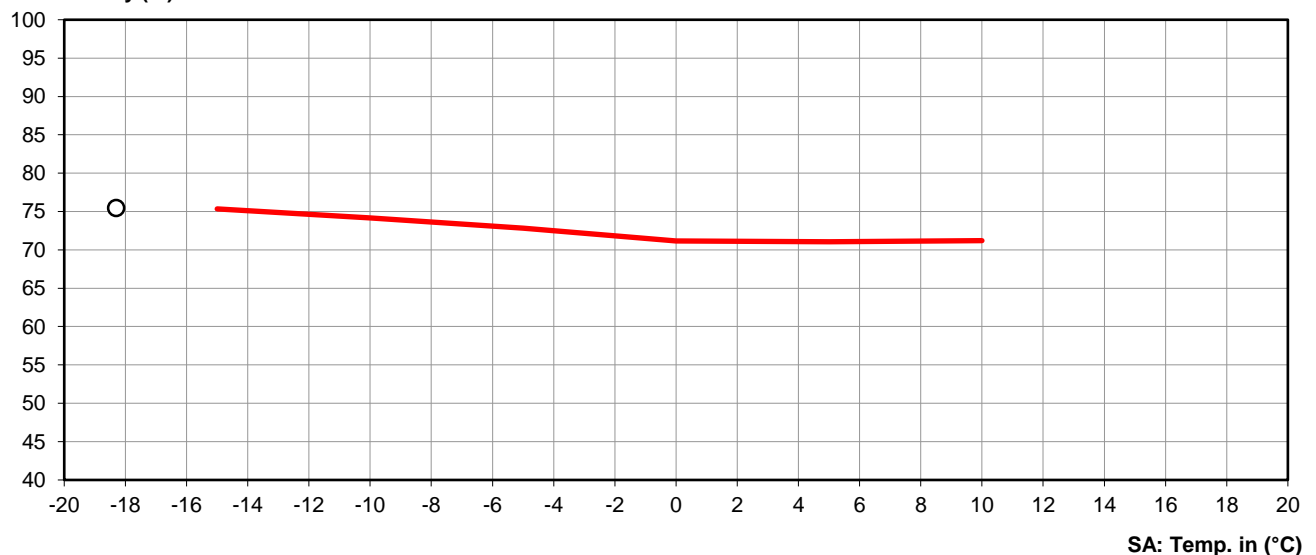
Zeller Consulting Suisse
HVAC solutions
Jurastrasse 35
CH-3063 Ittigen

Phone: +41 79 222 66 42

Fax: Don't exist
info@zcs.ch
www.zcs.ch

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	-18.30	-15.00	-10.00	-5.00	0.00	5.00	10.00
SA: Rel. humidity	in	%	90.00	90.00	90.00	90.00	90.00	90.00	90.00
SA: Abs. humidity	in	g/kg	0.71	0.97	1.53	2.37	3.63	5.19	7.32
SA: Temp.	out	°C	10.60	11.37	12.25	13.20	14.24	15.66	17.12
SA: Rel. humidity	out	%	8.45	10.95	16.30	23.76	33.94	44.25	56.68
SA: Abs. humidity	out	g/kg	0.71	0.97	1.53	2.37	3.63	5.19	7.32
SA: Volume flow	m3/h		25000.00	25000.00	25000.00	25000.00	25000.00	25000.00	25000.00
SA: Pressure drop	Pa		82.99	83.91	85.29	86.74	88.29	90.01	91.85
SA: Capacity	kW		225.86	206.20	174.21	142.74	111.88	84.01	56.36
SA: Efficiency	%		75.45	75.34	74.18	72.82	71.18	71.06	71.21
Agent: Temp.	in	°C	13.00	13.43	13.93	14.52	15.23	16.38	17.59
Agent: Temp.	out	°C	-8.10	-5.81	-2.31	1.23	4.82	8.57	12.36
Agent: Volume flow	m3/h		10.20	10.20	10.20	10.20	10.20	10.20	10.20
Agent: Pressure drop	kPa		377.96	370.91	364.26	357.34	350.48	343.24	336.87
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	6.18	6.18	6.18	6.18	6.18	6.18	6.18
RA: Temp.	out	°C	-1.65	-0.32	1.81	3.95	5.96	9.37	12.87
RA: Rel. humidity	out	%	100.00	100.00	100.00	99.88	99.19	79.30	62.89
RA: Abs. humidity	out	g/kg	3.51	3.93	4.60	5.36	6.13	6.18	6.18
RA: Volume flow	m3/h		25000.00	25000.00	25000.00	25000.00	25000.00	25000.00	25000.00
RA: Pressure drop dry	Pa		99.54	97.89	95.83	93.65	91.53	92.14	92.92
RA: Pressure drop wet	Pa		108.99	106.30	102.34	97.50	91.80	92.14	92.92
RA: Efficiency	%		56.54	58.04	60.64	64.20	70.19	70.88	71.28

SA: Efficiency (%)



Ittigen, 21.07.2019
With the compliments of

Marin Zeller
Direct dialing
+41 79 222 66 42

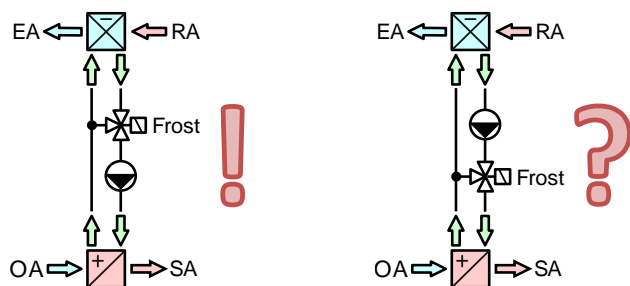
Plant
Object
Position



Zeller Consulting Suisse
HVAC solutions
Jurastrasse 35
CH-3063 Ittigen

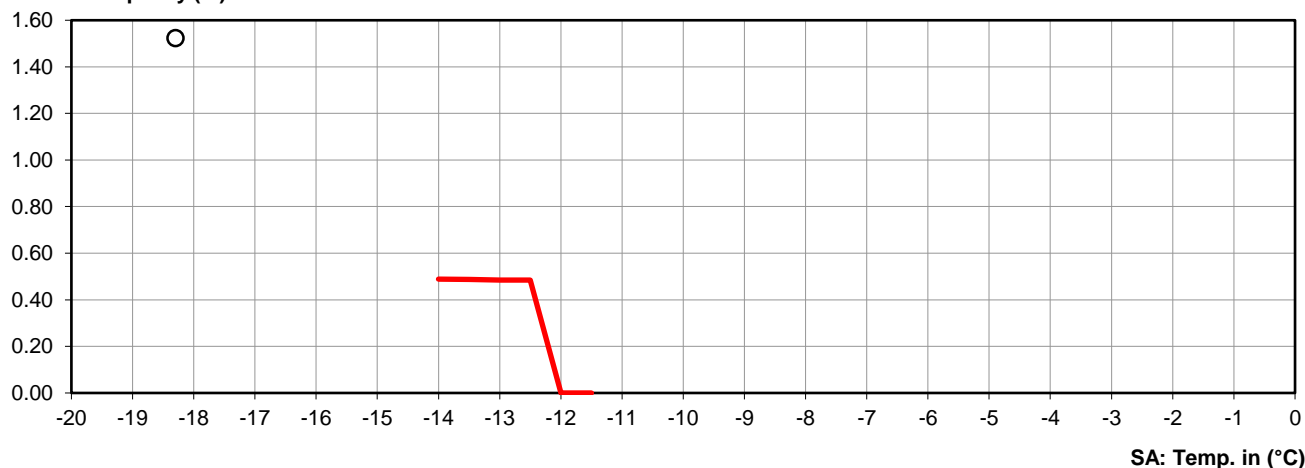
Phone: +41 79 222 66 42

Fax: Don't exist
info@zcs.ch
www.zcs.ch

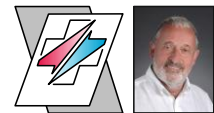
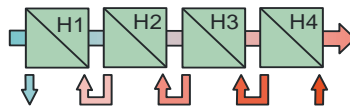


Service			Default	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
Air flow	%		100.00	100.00	100.00	100.00	100.00	100.00	100.00
SA: Temp.	in	°C	-18.30	-14.00	-13.50	-13.00	-12.50	-12.00	-11.50
SA: Rel. humidity	in	%	90.00	90.00	90.00	90.00	90.00	90.00	90.00
SA: Abs. humidity	in	g/kg	0.71	1.06	1.11	1.16	1.22	1.27	1.33
SA: Temp.	out	°C	10.60	11.52	11.63	11.73	11.82	11.88	11.97
SA: Rel. humidity	out	%	8.45	11.89	12.36	12.86	13.38	13.95	14.51
SA: Abs. humidity	out	g/kg	0.71	1.06	1.11	1.16	1.22	1.27	1.33
SA: Volume flow	m3/h		25000.00	25000.00	25000.00	25000.00	25000.00	25000.00	25000.00
SA: Pressure drop	Pa		82.99	84.18	84.32	84.46	84.59	84.73	84.87
SA: Capacity	kW		225.86	199.63	196.58	193.46	190.24	186.84	183.64
SA: Efficiency	%		75.45	75.07	75.02	74.94	74.82	74.62	74.50
Agent: Temp.	in	°C	13.00	13.51	13.57	13.63	13.68	13.71	13.75
Agent: Temp.	out	°C	-8.10	-5.12	-4.77	-4.41	-4.06	-3.72	-3.37
Agent: Volume flow	m3/h		10.20	10.20	10.20	10.20	10.20	10.20	10.20
Agent: Pressure drop	kPa		377.96	369.67	368.88	368.25	367.53	366.95	366.30
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	6.18	6.18	6.18	6.18	6.18	6.18	6.18
RA: Temp.	out	°C	-1.65	0.07	0.29	0.51	0.74	0.91	1.14
RA: Rel. humidity	out	%	100.00	99.67	99.79	99.91	100.00	100.00	100.00
RA: Abs. humidity	out	g/kg	3.51	4.05	4.12	4.19	4.26	4.32	4.39
RA: Volume flow	m3/h		25000.00	25000.00	25000.00	25000.00	25000.00	25000.00	25000.00
RA: Pressure drop dry	Pa		99.54	97.51	97.29	97.08	96.85	96.69	96.47
RA: Pressure drop wet	Pa		108.99	105.60	105.20	104.79	104.37	104.05	103.63
RA: Efficiency	%		56.54	58.60	58.83	59.07	59.28	59.64	59.87
RA: Frost-Capacity	kW		3.44	0.98	0.96	0.94	0.92	0.00	0.00
RA: Frost-Capacity	%		1.52	0.49	0.49	0.48	0.48	0.00	0.00

RA: Frost-Capacity (%)



Definition		
Height over sea level	m	540.00
Pressure	hPa	949.65
Temp.	°C	20.00
Rel. humidity	%	40.00
Air humid	m3/h	25000.00
30 V% Et.glycol	m3/h	10.20



Zeller Consulting Suisse
HVAC solutions
Jurastrasse 35
CH-3063 Ittigen

Phone: +41 79 222 66 42

Fax: Don't exist

info@zcs.ch

www.zcs.ch

Ittigen, 21.7.2019

With the compliments of

Marin Zeller

Direct dialing

+41 79 222 66 42

Plant

Object

Position

software by www.zcs.ch

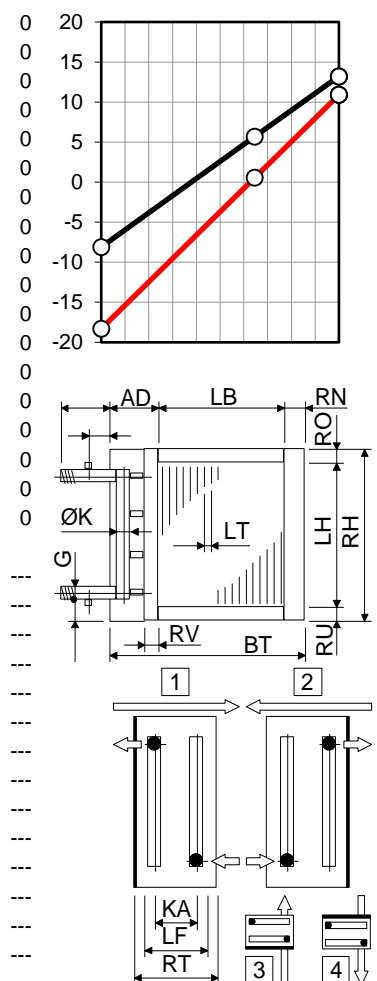
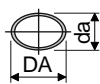
Air humid		Heater 1	Heater 2	Heater 3	Heater 4
Temp. Inlet	°C	-18.30	0.55	10.90	10.90
Rel. humidity Inlet	%	90.00	16.93	8.28	8.28
Temp. Outlet	°C	0.55	10.90	10.90	10.90
Rel. humidity Outlet	%	16.93	8.28	8.28	8.28
Pressure drop	Pa	40.70	43.87	0.00	0.00

30 V% Et.glycol		Heater 1	Heater 2	Heater 3	Heater 4
Temp. Inlet	°C	5.69	13.21	13.21	13.21
Temp. Outlet	°C	-8.10	5.69	13.21	13.21
Pressure drop	kPa	100.60	91.85	0.00	0.00

Heat exchanger		Heater 1	Heater 2	Heater 3	Heater 4
Capacity	kW	147.32	80.91	0.00	0.00
Surface reserve	%	0.28	0.12	0.00	0.00
Present surface	m2	917.45	917.45	0.00	0.00
Required surface	m2	914.87	916.37	0.00	0.00
k-coeff.	W/m2K	22.87	26.58	0.00	0.00
Average temp. diff.	K	7.04	3.32	0.00	0.00

Tubes blank	Piece	0	0	0
Int. vent./drains	Piece	3	3	0
Tube rows on the depth	Piece	8	8	0
Tube rows on the height	Piece	36	36	0
Number of circuits (NC)	Piece	24	24	0
Volume	l	98	98	0
Weight	kg	380	380	0
Connections	G	2"	2"	0
Frame height	RH	1340	1340	0
Frame width	BT	3099	3099	0
Frame depth	RT	340	340	0
Finned height	LH	1260	1260	0
Finned width	LB	2900	2900	0
Frame on top	RO	40	40	0
Frame on bottom	RU	40	40	0
Frame in front	RV	30	30	0
Frame on back (~53/53/0/0)	RN	56	56	0
Collector covering	AD	143	143	0

Tubes	Type	circular	circular	---
Tubes	DA / da	12.40 / 12.40	12.40 / 12.40	---
Tubes	S1 / S2	35.00 / 35.00	35.00 / 35.00	---
Tubes	---	in line	in line	---
Tubes	---	Cu	Cu	---
Tubes	---	smooth	smooth	---
Collector	---	Cu	Cu	---
Connections	---	Rg7	Rg7	---
Fins	LT / LD	2.50 / 0.20	2.50 / 0.20	---
Fins	---	Al	Al	---
Fins	---	Wave structure	Wave structure	---
Frame	---	AlMg3	AlMg3	---
Protection	---	without	without	---
Protection	---	---	---	---
Air flow direction	---	horizontal	horizontal	---



Heater 1: 35/35/12-8R-36T-2900A-2.5PA-24C-Cu/Al/AlMg3

EUR 6343.00

Delivery: 5-6 weeks

Heater 2: 35/35/12-8R-36T-2900A-2.5PA-24C-Cu/Al/AlMg3

EUR 6343.00

Validity: 12 weeks

Heater 3: ---

EUR 0.00

Condit.: net, prepaid address

Heater 4: ---

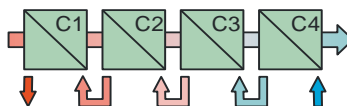
EUR 0.00

Payment: 30 days net

Total

EUR 12686.00

Definition		
Height over sea level	m	540.00
Pressure	hPa	949.65
Temp.	°C	20.00
Rel. humidity	%	40.00
Air humid	m3/h	25000.00
30 V% Et.glycol	m3/h	10.22



Zeller Consulting Suisse
HVAC solutions
Jurastrasse 35
CH-3063 Ittigen

Phone: +41 79 222 66 42

Fax: Don't exist

info@zcs.ch

www.zcs.ch

Ittigen, 21.7.2019

With the compliments of

Marin Zeller

Direct dialing

+41 79 222 66 42

Plant

Object

Position

software by www.zcs.ch

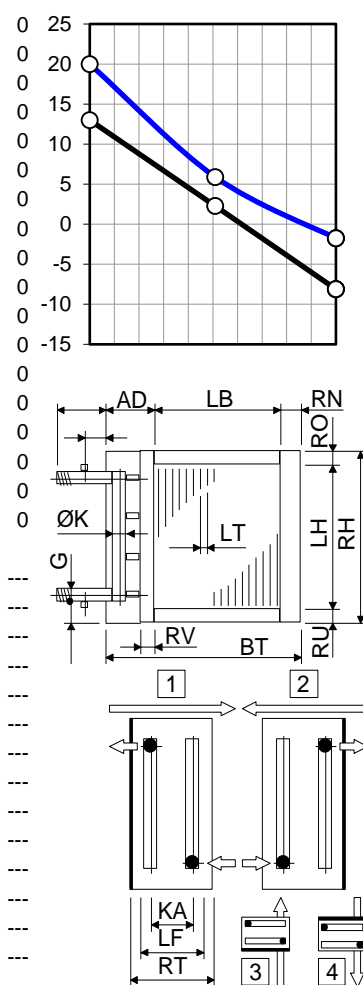
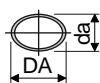
Air humid		Cooler 1	Cooler 2	Cooler 3	Cooler 4
Temp. Inlet	°C	20.00	5.90	-1.75	-1.75
Rel. humidity Inlet	%	40.00	97.07	100.00	100.00
Temp. Outlet	°C	5.90	-1.75	-1.75	-1.75
Rel. humidity Outlet	%	97.07	100.00	100.00	100.00
Pressure drop	Pa	51.16	65.18	0.00	0.00

30 V% Et.glycol		Cooler 1	Cooler 2	Cooler 3	Cooler 4
Temp. Inlet	°C	2.28	-8.12	-8.12	-8.12
Temp. Outlet	°C	13.00	2.28	-8.12	-8.12
Pressure drop	kPa	93.70	101.71	0.00	0.00

Heat exchanger		Cooler 1	Cooler 2	Cooler 3	Cooler 4
Capacity	kW	115.39	111.09	0.00	0.00
Surface reserve	%	0.36	0.23	0.00	0.00
Present surface	m2	982.01	982.01	0.00	0.00
Required surface	m2	978.44	979.72	0.00	0.00
k-coeff.	W/m2K	25.68	24.91	0.00	0.00
Average temp. diff.	K	4.59	4.55	0.00	0.00

Tubes blank	Piece	0	0	0
Int. vent./drains	Piece	3	3	0
Tube rows on the depth	Piece	8	8	0
Tube rows on the height	Piece	36	36	0
Number of circuits (NC)	Piece	24	24	0
Volume	l	98	98	0
Weight	kg	397	397	0
Connections	G	2"	2"	0
Frame height	RH	1340	1340	0
Frame width	BT	3099	3099	0
Frame depth	RT	340	340	0
Finned height	LH	1260	1260	0
Finned width	LB	2900	2900	0
Frame on top	RO	40	40	0
Frame on bottom	RU	40	40	0
Frame in front	RV	30	30	0
Frame on back (~53/53/0/0)	RN	56	56	0
Collector covering	AD	143	143	0

Tubes	Type	circular	circular	---
Tubes	DA / da	12.40 / 12.40	12.40 / 12.40	---
Tubes	S1 / S2	35.00 / 35.00	35.00 / 35.00	---
Tubes	---	in line	in line	---
Tubes	---	Cu	Cu	---
Tubes	---	smooth	smooth	---
Collector	---	Cu	Cu	---
Connections	---	Rg7	Rg7	---
Fins	LT / LD	2.33 / 0.20	2.33 / 0.20	---
Fins	---	Al	Al	---
Fins	---	Wave structure	Wave structure	---
Frame	---	AlMg3	AlMg3	---
Protection	---	without	without	---
Protection	---	---	---	---
Air flow direction	---	horizontal	horizontal	---



Cooler 1: 35/35/12-8R-36T-2900A-2.3PA-24C-Cu/Al/AlMg3

EUR 6532.00

Delivery: 5-6 weeks

Cooler 2: 35/35/12-8R-36T-2900A-2.3PA-24C-Cu/Al/AlMg3

EUR 6532.00

Validity: 12 weeks

Cooler 3: ---

EUR 0.00

Condit.: net, prepaid address

Cooler 4: ---

EUR 0.00

Payment: 30 days net

Total

EUR 13064.00