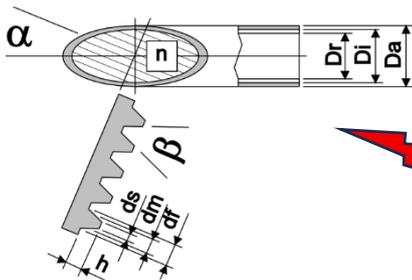




Changeover for refrigerants

How a changeover fin coil heat exchanger for refrigerants must be built correctly in order to function smoothly in different operating modes is of great importance.

Stupid bargain hunters do not use an inlet collector or a changeover valve and certainly not an oil separator and, in the worst case, also use WT tubes with internal grooves, which are pasted with oil within a short time and convert to insulated smooth tubes with reduced capacity, only for the avoidable reason that condensation and hot gas defrosting takes place via the capillaries.



Never!

Connoisseurs of the subject use an inlet collector, a changeover valve, an oil separator, use smooth WT tubes and in this way always have full capacity in evaporation, condensation and short hot gas defrosting times.

An example of how an injection evaporator with hot gas defrost behaves is explained. First, the changeover fin coil heat exchanger is calculated as an injection evaporator, **see page 2**.

Secondly, the fin coil heat exchanger is calculated as a condenser, **see page 3**.

The first mistakes are already made here, because much less capacity is needed at the capacitor, for example, which acknowledges the calculation with a very high area reserve.

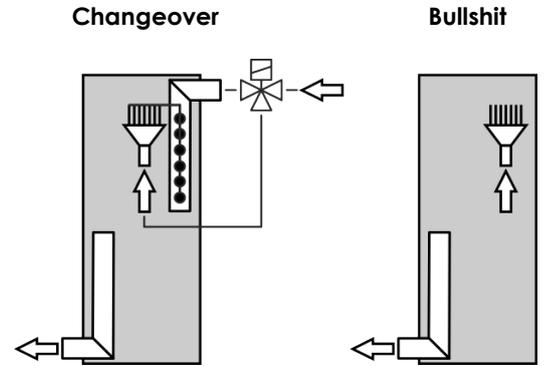
However, a large area reserve never works in operation, as completely different undesirable conditions simply and automatically occur.

The hot gas defrost via the inlet collector is carried out with the entire amount of refrigerant at the lowest pressure drop, **see page 4**.

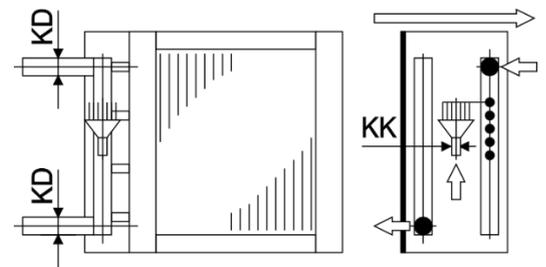
Hot gas defrosting via the capillaries can only be carried out with a reduced amount of refrigerant in the event of a large pressure drop, **see page 5**.

As a result of the high pressure drops via the capillaries, the capacity as a capacitor is reduced from 170 to 130 kW, **see page 6**.

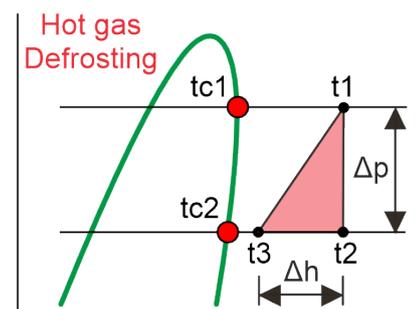
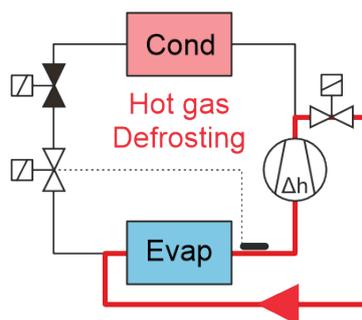
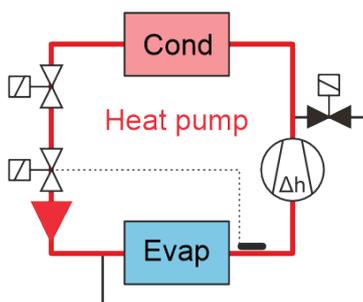
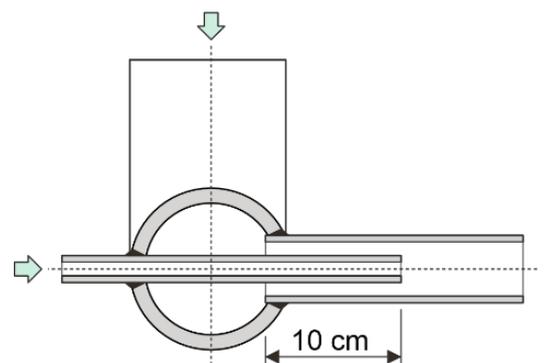
Changeover valve for evaporation via the capillaries for condensation or hot gas defrosting via the inlet collector



Changeover heat exchanger for refrigerant



Capillaries inserted into the WT tubes through the inlet collector





Capacity	kW	124.489	----- sensible:	74.987
Surface reserve	%	2.645	latent:	44.702
Present surface	m ²	189.114	frost:	4.800
Required surface	m ²	184.241	0.5 % Oil ISO VG32	
k-coeff.	W/m ² K	60.998		
Average temp. diff. (100.00 %)	K	11.077		

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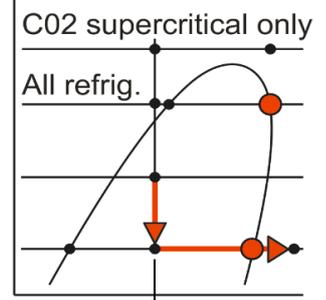
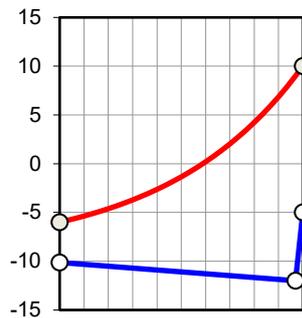
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Plant
Object
Position

Air humid (ff=0.00005 m2K/W)		Inlet	Outlet	Definition
Height over sea level	m			0.000
Pressure	hPa			1013.250
Temp.	°C	10.000	-6.000	20.000
Rel. humidity	%	80.000	100.000	40.000
Abs. humidity	g/kg	6.088	2.262	5.783
Density humid	kg/m ³	1.242	1.319	1.200
Enthalpy humid	kJ/kg	25.398	-0.405	34.801
Volume flow humid	m ³ /h	13529.026	12686.823	14000.000
Mass flow dry	kg/h	16698.932	16698.932	16698.932
Condensate flow	kg/h		63.888	
Surface temperature	°C	-8.778	-9.563	
Velocity	m/s	2.060	1.932	2.132
Pressure drop (dry 48 Pa)	Pa		55.785	

R32 Evaporation 5.433 bar (ff=0.00005 m2K/W)

Condensate"	°C	40.000
Condensate'	°C	40.000
Subcooling	°C	37.000
Evaporation"	°C	-12.000
Superheating	°C	-5.000
Mass flow	kg/h	1794.952
Volume flow	m ³ /h	121.202
Velocity	m/s	11.390
Pressure drop Evaporation	K	1.867
Pressure drop Capillary	bar	4.020

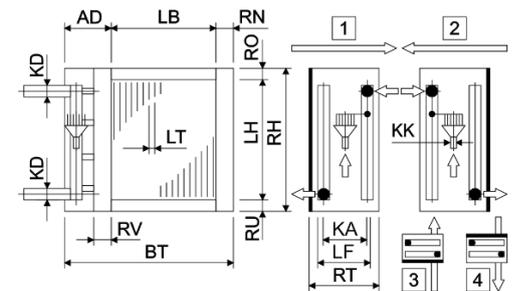


Part of steam on the inject point 26.98 %

Technical data

Tubes total	Piece	480
Tubes blank	Piece	0
Tube rows on the depth	Piece	10
Tube rows on the height	Piece	48
Tube coupling in series	Piece	12
Number of circuits (NC)	Piece	40
Volume	l	63
Weight	kg	170
Cond. connection	KK mm	35
Steam connection	KD mm	76
Frame height	RH mm	1280
Frame width	BT mm	1700
Frame depth	RT mm	300
Finned height	LH mm	1200
Finned width	LB mm	1520
Finned depth	LF mm	217
Frame on top	RO mm	40
Frame on bottom	RU mm	40
Frame in front	RV mm	30
Frame on back (~44mm)	RN mm	44
Covering (~136mm)	AD mm	136
Collector distance	KA mm	195
Fin spacing	LT mm	4.000
Fin thickness	LD mm	0.200
Tube diameter	DA mm	10.400
Tube thickness	S mm	0.350
Tube interval on the height	S1 mm	25.000
Tube interval on the depth	S2 mm	21.651

Tubes:	Cu
Tubes:	smooth
Tubes:	in line
Collectors:	Cu
Connections:	Cu
Finns:	Al
Finns:	smooth
Frame:	2.0 mm AISI 304
Circulations:	1 Default
Capillary:	5.00 x 1.00 x 1400.00 mm
Protection:	without
Protection:	---
Air flow direction:	horizontal



Delivery:	5-6 weeks
Validity:	12 weeks
Condit.:	net, prepaid address
Payment:	30 days net
Price net:	EUR 3729.00



Capacity	kW	168.168
Surface reserve	%	0.617
Present surface	m2	189.114
Required surface	m2	187.955
k-coeff.	W/m2K	44.047
Average temp. diff.	K	20.313

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Air humid (ff=0.00005 m2K/W)		Inlet	Outlet	Definition
Height over sea level	m			0.000
Pressure	hPa			1013.250
Temp. (6.000)	°C	6.000	41.700	20.000
Rel. humidity (80.000)	%	80.000	9.315	40.000
Abs. humidity (4.631)	g/kg	4.631	4.631	5.783
Density humid	kg/m3	1.261	1.118	1.200
Enthalpy humid	kJ/kg	17.667	53.921	34.801
Volume flow humid	m3/h	13306.963	15008.706	14000.000
Mass flow dry	kg/h	16698.932	16698.932	16698.932
Velocity	m/s	2.027	2.286	2.132
Pressure drop (dry 52 Pa)	Pa		51.874	
Evaporation total	kg/h		0.000	

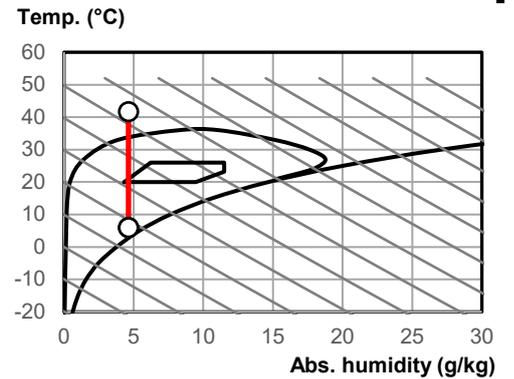
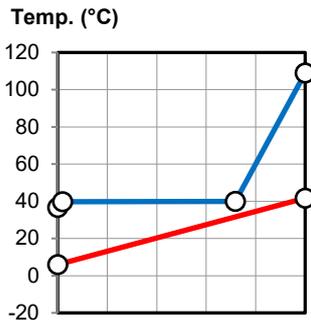
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Plant
Object
Position

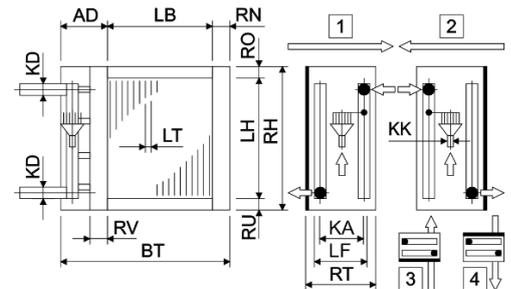
Agent (ff=0.00005 m2K/W)			
R32	%	99.500	
Oil ISO VG32	%	0.500	
Pressure	bar	24.783	
Hot gas	°C	109.000	
Condensation"	°C	40.000	
Condensation'	°C	40.000	
Subcooling	°C	37.000	
Mass flow	kg/h	1794.585	
Volume flow in	m3/h	24.563	
Volume flow out	m3/h	2.010	
Pressure drop (0.275 bar)	K	0.454	



Technical data

Tubes total	Piece	480
Tubes blank	Piece	0
Tube rows on the depth	Piece	10
Tube rows on the height	Piece	48
Tube coupling in series	Piece	12
Number of circuits (NC)	Piece	40
Volume	l	69
Weight	kg	170
Steam connection	KD mm	76
Cond. connection	KK mm	76
Frame height	RH mm	1280
Frame width	BT mm	1700
Frame depth	RT mm	300
Finned height	LH mm	1200
Finned width	LB mm	1520
Finned depth	LF mm	217
Frame on top	RO mm	40
Frame on bottom	RU mm	40
Frame in front	RV mm	30
Frame on back	RN mm	44
Covering	AD mm	136
Collector distance	KA mm	195
Fin spacing	LT mm	4.000
Fin thickness	LD mm	0.200
Tube diameter	DA mm	10.400
Tube thickness	S mm	0.350
Tube interval on the height	S1 mm	25.000
Tube interval on the depth	S2 mm	21.651

Tubes: Cu
Tubes: smooth
Tubes: in line
Collectors: Cu
Connections: Cu
Fins: Al
Fins: smooth
Frame: 2.0 mm AISI 304
Circulations: 1 Standard
Protection: without
Protection: --
Air flow direction: horizontal



Delivery: 5-6 weeks
Validity: 12 weeks
Condit.: net, prepaid address
Payment: 30 days net
Price net: 0 EUR 3729.00

Hot gas defrosting

Software by www.zcs.ch



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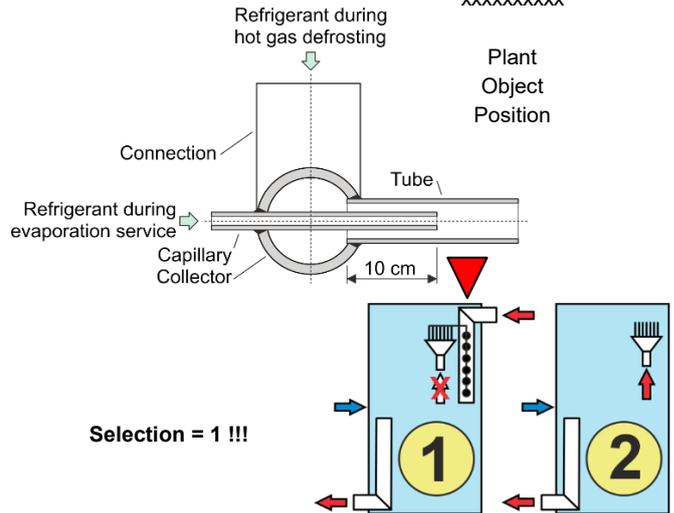
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Plant
Object
Position

Number of circuits (NC)	Piece	40.000
Length	mm	1400.000
Outside diam.	mm	5.000
Thickness	mm	1.000
Inside diam.	mm	3.000
Roughness	mm	0.002
Mass flow	kg/h	1794.952
Type of cooling oil	---	Oil ISO VG32
Part of cooling oil	%	0.500

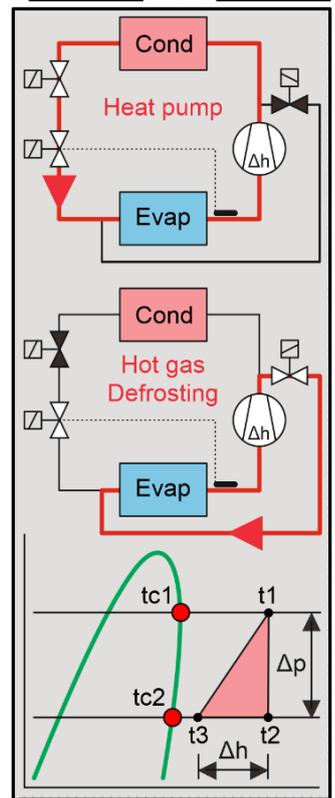
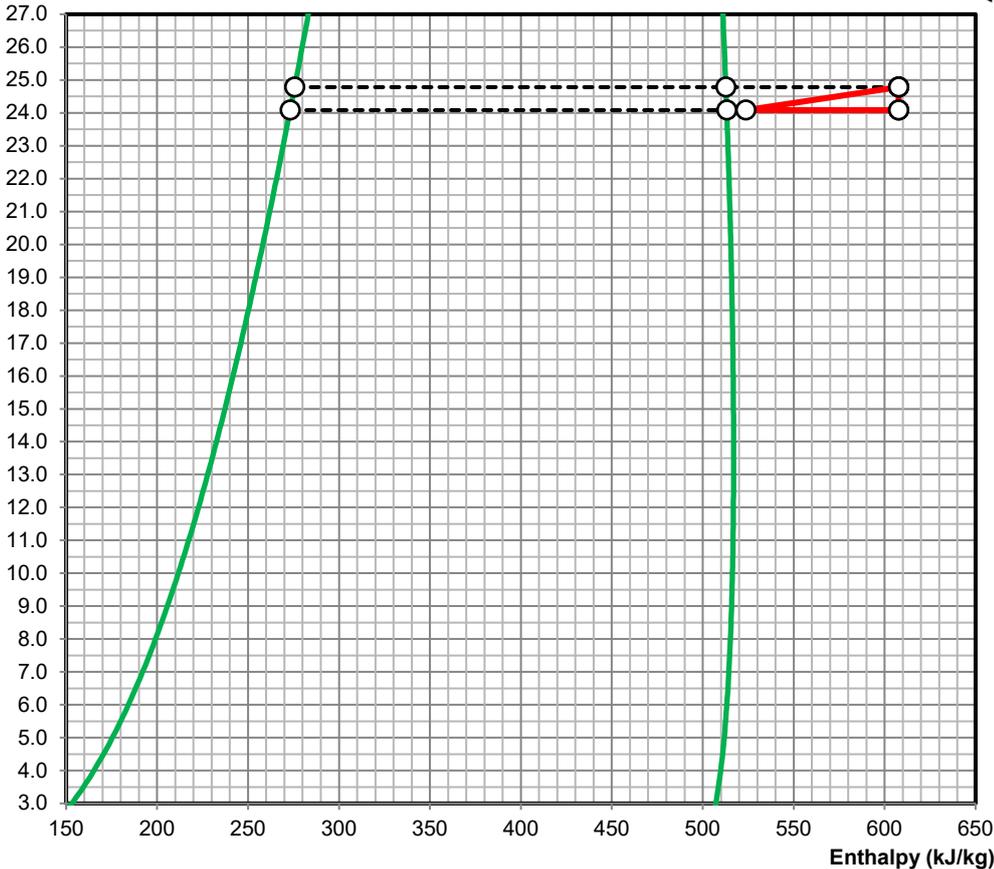
R32

Hot gas	t1	°C	109.000
Hot gas	h1	kJ/kg	607.699
Condensate"	tc1	°C	40.000
Pressure	p1	bar	24.783
Hot gas	t2	°C	108.215
Hot gas	h2	kJ/kg	607.699
Condensate"	tc2	°C	38.829
Pressure	p2	bar	24.083
Refrig. compressor	Qc	kW	41.913
Hot gas	h3	kJ/kg	523.638
Hot gas	t3	°C	44.566
Pressure drop collectors	dp	bar	0.200
Pressure drop valves, pipes	dp	bar	0.500
Pressure drop total	dp	bar	0.700
Frost energy		kWh	4.800
Defr. time		h	0.115
Defr. time		min	6.871



Selection = 1 !!!

Pressure (bar)



Hot gas defrosting

Hot gas defrosting

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Plant
Object
Position

Number of circuits (NC)	Piece	40.000
Length	mm	1400.000
Outside diam.	mm	5.000
Thickness	mm	1.000
Inside diam.	mm	3.000
Roughness	mm	0.002
Mass flow	kg/h	1328.000
Type of cooling oil	---	Oil ISO VG32
Part of cooling oil	%	0.500

R32

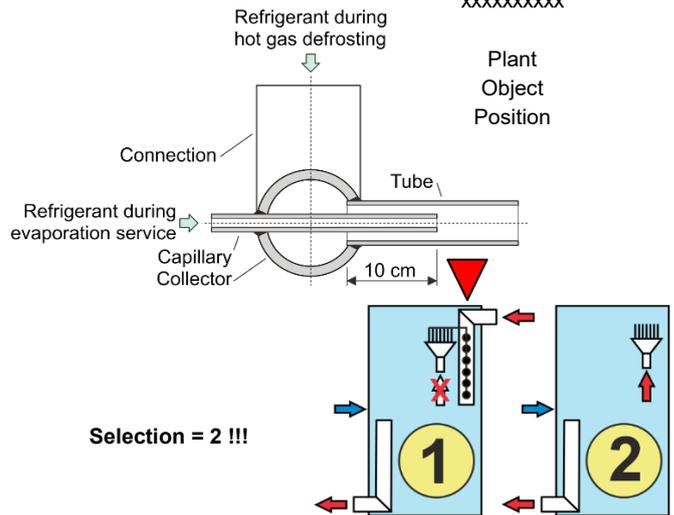
Hot gas	t1	°C	109.000
Hot gas	h1	kJ/kg	607.699
Condensate"	tc1	°C	40.000
Pressure	p1	bar	24.783

Hot gas	t2	°C	103.958
Hot gas	h2	kJ/kg	607.699
Condensate"	tc2	°C	31.972
Pressure	p2	bar	20.279

Refrig. compressor	Qc	kW	30.561
Hot gas	h3	kJ/kg	524.852
Hot gas	t3	°C	37.751

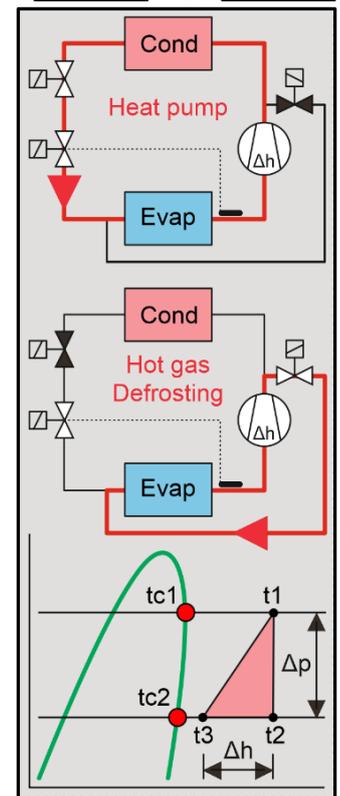
Pressure drop capillaries	dp	bar	4.004
Pressure drop valves, pipes	dp	bar	0.500
Pressure drop total	dp	bar	4.504

Frost energy	kWh	4.800
Defr. time	h	0.157
Defr. time	min	9.424



Selection = 2 !!!

Pressure (bar)



Hot gas defrosting



Capacity	kW	130.789	----- sensible:	130.789
Surface reserve	%	0.174	latent:	0.000
Present surface	m ²	189.114		
Required surface	m ²	188.786		
k-coeff.	W/m ² K	44.054		
Average temp. diff.	K	15.726		

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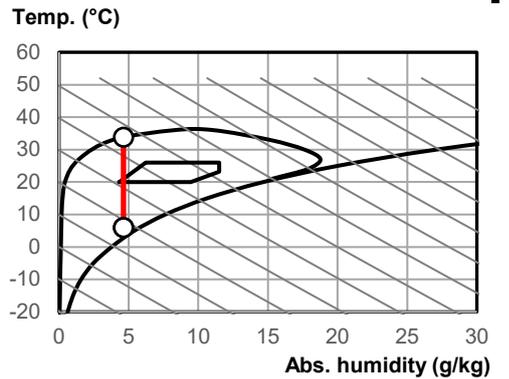
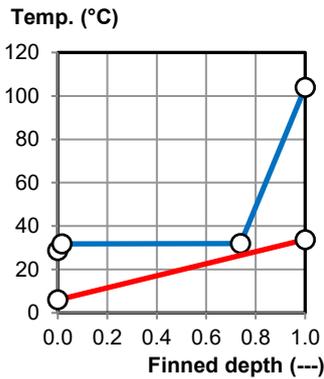
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Plant
Object
Position

Air humid (ff=0.00005 m ² K/W)		Inlet	Outlet	Definition
Height over sea level	m			0.000
Pressure	hPa			1013.250
Temp. (6.000)	°C	6.000	33.770	20.000
Rel. humidity (80.000)	%	80.000	14.309	40.000
Abs. humidity (4.631)	g/kg	4.631	4.631	5.783
Density humid	kg/m ³	1.261	1.147	1.200
Enthalpy humid	kJ/kg	17.667	45.863	34.801
Volume flow humid	m ³ /h	13306.963	14630.700	14000.000
Mass flow dry	kg/h	16698.932	16698.932	16698.932
Velocity	m/s	2.027	2.228	2.132
Pressure drop (dry 76 Pa)	Pa		76.142	
Evaporation total	kg/h		0.000	(15.000 °C)

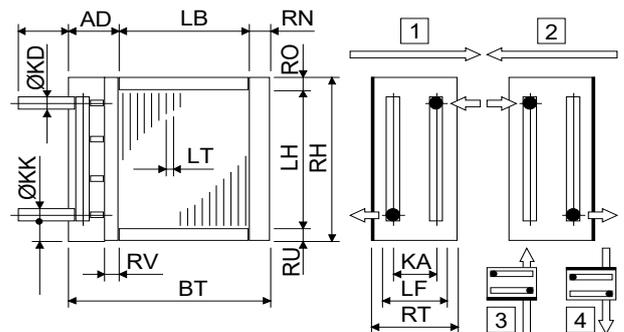
Agent (ff=0.00005 m ² K/W)			
R32	%	100.000	
Oil ISO VG32	%	0.000	
Pressure	bar	20.280	
Hot gas	°C	103.958	
Condensation"	°C	31.972	
Condensation'	°C	31.972	
Subcooling	°C	28.972	
Mass flow	kg/h	1328.100	
Volume flow in	m ³ /h	22.941	
Volume flow out	m ³ /h	1.427	
Pressure drop (0.229 bar)	K	0.441	



Technical data

Tubes total	Piece	480
Tubes blank	Piece	0
Tube rows on the depth	Piece	10
Tube rows on the height	Piece	48
Tube coupling in series	Piece	12
Number of circuits (NC)	Piece	40
Volume	l	60
Weight	kg	160
Steam connection	KD mm	42
Cond. connection	KK mm	35
Frame height	RH mm	1280
Frame width	BT mm	1700
Frame depth	RT mm	270
Finned height	LH mm	1200
Finned width	LB mm	1520
Finned depth	LF mm	217
Frame on top	RO mm	40
Frame on bottom	RU mm	40
Frame in front	RV mm	30
Frame on back (~44mm)	RN mm	44
Covering (~102mm)	AD mm	136
Collector distance	KA mm	195
Fin spacing	LT mm	4.000
Fin thickness	LD mm	0.200
Tube diameter	DA mm	10.400
Tube thickness	S mm	0.350
Tube interval on the height	S1 mm	25.000
Tube interval on the depth	S2 mm	21.651

Tubes:	smooth	Cu
Tubes:	staggered	
Collectors:	6.5 / 0.8 m/s	Cu
Connections:	6.5 / 0.8 m/s	Cu
Fins:	smooth	Al
Frame:	2.0 mm	AISI 304
Circulations:	1	Standard
Air flow direction:		horizontal
Protection:		without
Protection:		---



Delivery:	5-6 weeks
Validity:	12 weeks
Condit.:	net, prepaid address
Payment:	30 days net
Price net:	EUR 3546.00