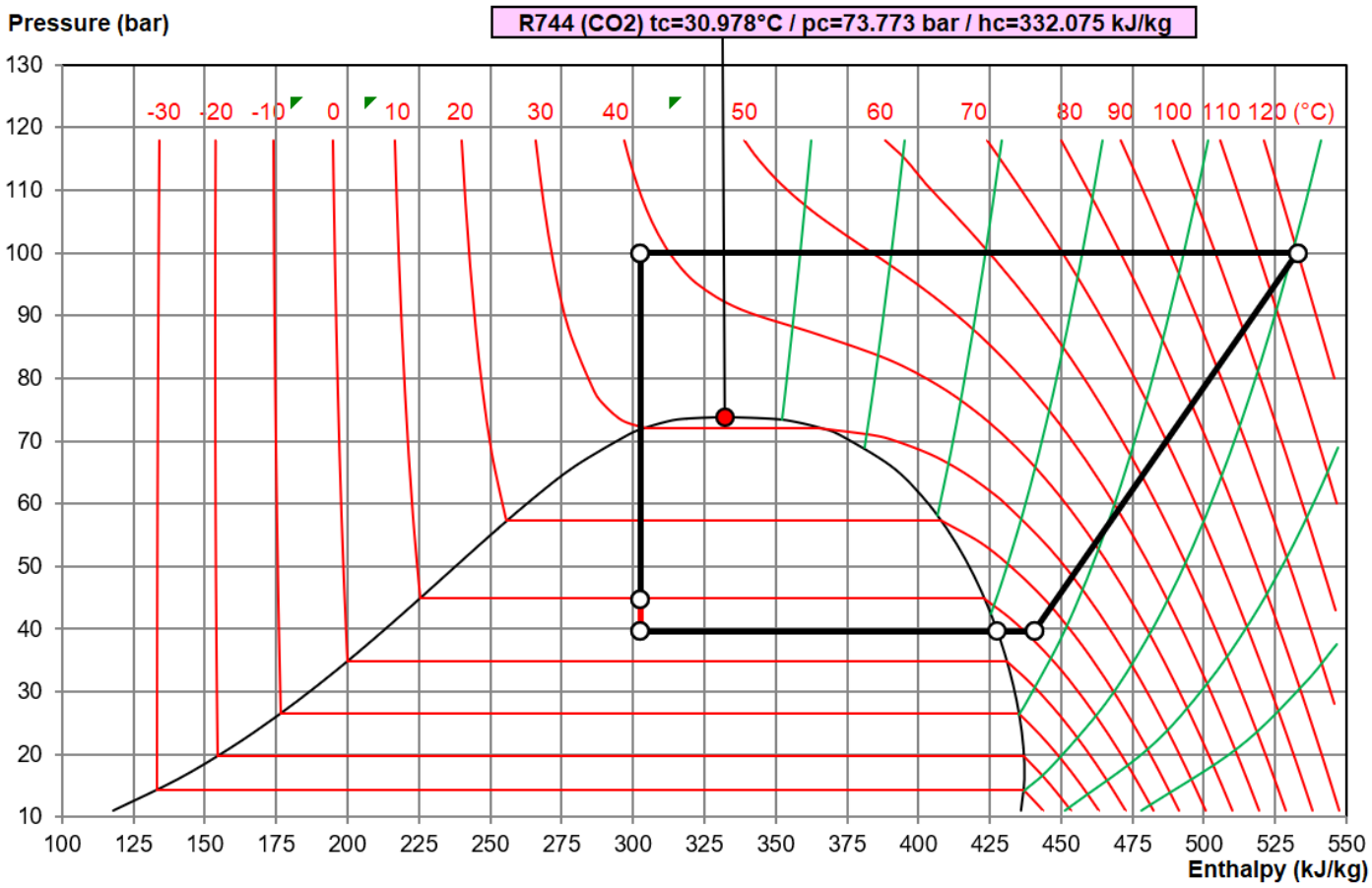
HE-Tubes for CO2-Cooler in the supercritical range

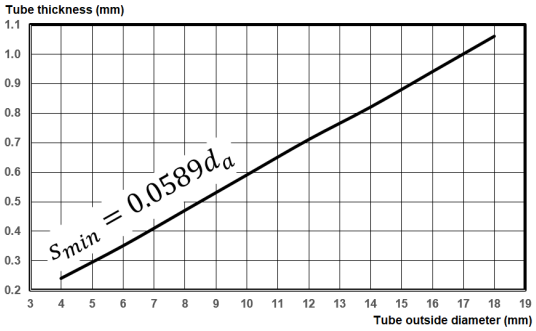
The use of CO2 coolers in the supercritical range places high demands on the producers of finned heat exchangers. At a working pressure of 100 bar, the required test pressure is 130 bar, which is why copper tubes can hardly be used. It looks better for stainless tubes. A typical application for heat pumps in midsummer can be seen in the diagram below.



Online calculator [Arbeitsdruckrechner | Lawton Tubes](#) , temperature 150°C, pressure 136 bar

Copper tubes with an outside diameter of 6.0 mm require a tube thickness of 1.0 mm! These are used as capillaries in injection evaporators, but certainly not as tubes for heat exchangers, which is why copper tubes for CO2 in the supercritical range can definitely be forgotten!

Online calculator [heco - Edelstahl - Rohrauslegung](#)
(Welding factor 0.8), temperature 150°C, pressure 130 bar
Stainless tubes with outside diameter 16.5 mm and a tube thickness of 1.0 mm can be used, for example, for CO2 coolers in the supercritical range. With an outside diameter of 12.4 mm, a tube thickness of 0.73 mm is required. For staggered tubes with 40 x 34.641 x 16.5 x 1.0 mm, you can find the company [www.faco.it](#) with 60 years of experience in Varallo Pombia Italy.



Calculation Example with stainless tubes, staggered tubes 40 x 34.641 x 16.5 x 1.0 mm

CO2-Cooler: 40/35/16-5R-48T-3780A-2.5PA-24C-AISI 304/Al/AISI 304 Software by www.zcs.ch

Capacity	kW	250.000
Surface reserve	%	1.061
Present surface	m2	908.024
Required surface	m2	898.487
k-coeff.	W/m2K	29.513
Average temp. diff.	K	9.428

LOGO

Company
Branch
Street
Country / ZIP / City

Phone: xxxxxxxxxx
Fax: xxxxxxxxxx
E-Mail
Homepage

City, 2.4.2025
With the compliments of

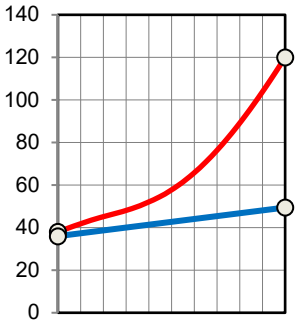
Representative
Direct dialing
xxxxxxxxxx

Plant
Object
Position

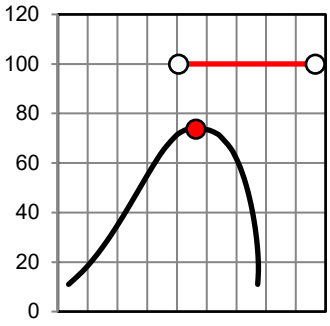
Air humid (ff=0.00005 m2K/W)		Inlet	Outlet	Definition
Height over sea level	m			400.000
Pressure	hPa			965.895
Temp.	°C	36.000	49.442	20.000
Rel. humidity	%	60.000	29.731	40.000
Abs. humidity	g/kg	23.749	23.749	6.070
Density humid	kg/m3	1.073	1.028	1.143
Enthalpy humid	kJ/kg	97.204	111.345	15.179
Volume flow humid	m3/h	60718.008	63358.023	56000.000
Mass flow dry	kg/h	63644.977	63644.977	63644.977
Velocity	m/s	2.324	2.425	2.143
Pressure drop	Pa		78.001	

Carbon dioxide R744 (CO2) supercritical (ff=0.00005 m2K/W)		
Pressure	bar	100.000
Inlet	°C	120.000
Outlet	°C	38.000
Mass flow	kg/h	3908.965
Density in	kg/m3	167.310
Density out	kg/m3	666.790
Volume flow in	m3/h	23.364
Volume flow out	m3/h	5.862
Velocity in	m/s	1.660
Velocity out	m/s	0.417
Pressure drop	kPa	13.578

Temp. (°C)

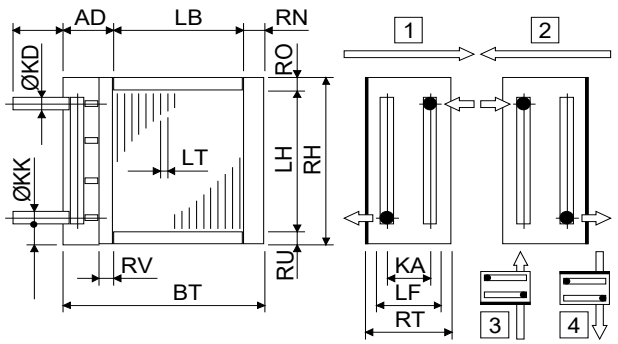


Pressure (bar)



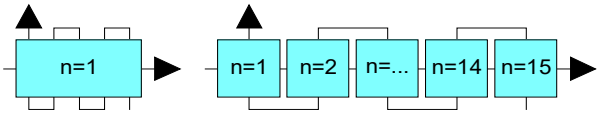
Technical data

Tubes total		Piece	240	Tubes:	smooth	AISI 304
Tubes blank		Piece	0	Tubes:		staggered
Tube rows on the depth		Piece	5	Collectors:	2.9 / 1.2 m/s	AISI 304
Tube rows on the height		Piece	48	Connections:	2.9 / 1.2 m/s	AISI 304
Tube coupling in series		Piece	10	Fins:	ribbed	Al
Number of circuits (NC)		Piece	24	Frame:	2.00 mm	AISI 304
Volume		l	161	Circulations:	1	Default
Weight		kg	671	Protection:		without
Connections	KD/KK	---	60 / 48	Protection:		---
Frame height	RH	mm	2000	Air flow direction:		horizontal
Frame width	BT	mm	4000			
Frame depth	RT	mm	230			
Finned height	LH	mm	1920			
Finned width	LB	mm	3780			
Finned depth	LF	mm	173			
Frame on top	RO	mm	40			
Frame on bottom	RU	mm	40			
Frame in front	RV	mm	30			
Frame on back (~69mm)	RN	mm	69			
Collector-Diameter	K	mm	60 / 48			
Collector covering	AD	mm	151			
Collector distance	KA	mm	139			
Fin spacing	LT	mm	2.500			
Fin thickness	LD	mm	0.200	Delivery:		5-6 weeks
Tube diameter	DA	mm	16.400	Validity:		12 weeks
Tube thickness	S	mm	1.000	Condit.:		net, prepaid address
Tube interval on the height	S1	mm	40.000	Payment:		30 days net
Tube interval on the depth	S2	mm	34.641	**Price net:**	**EUR**	**14122.00**



Carbon dioxide R744 (CO2) - supercritical - 100 bar

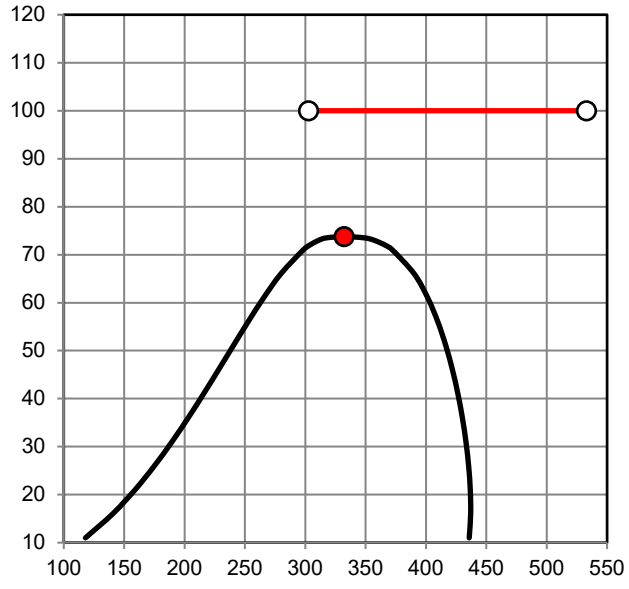
Software by www.zcs.ch



LOGO

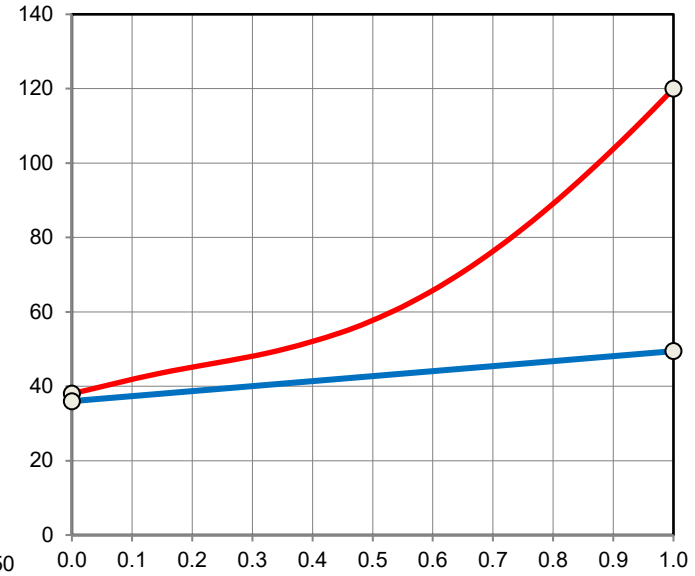
Company
Branch
Street
Country / ZIP / City

Pressure (bar)



Enthalpy (kJ/kg)

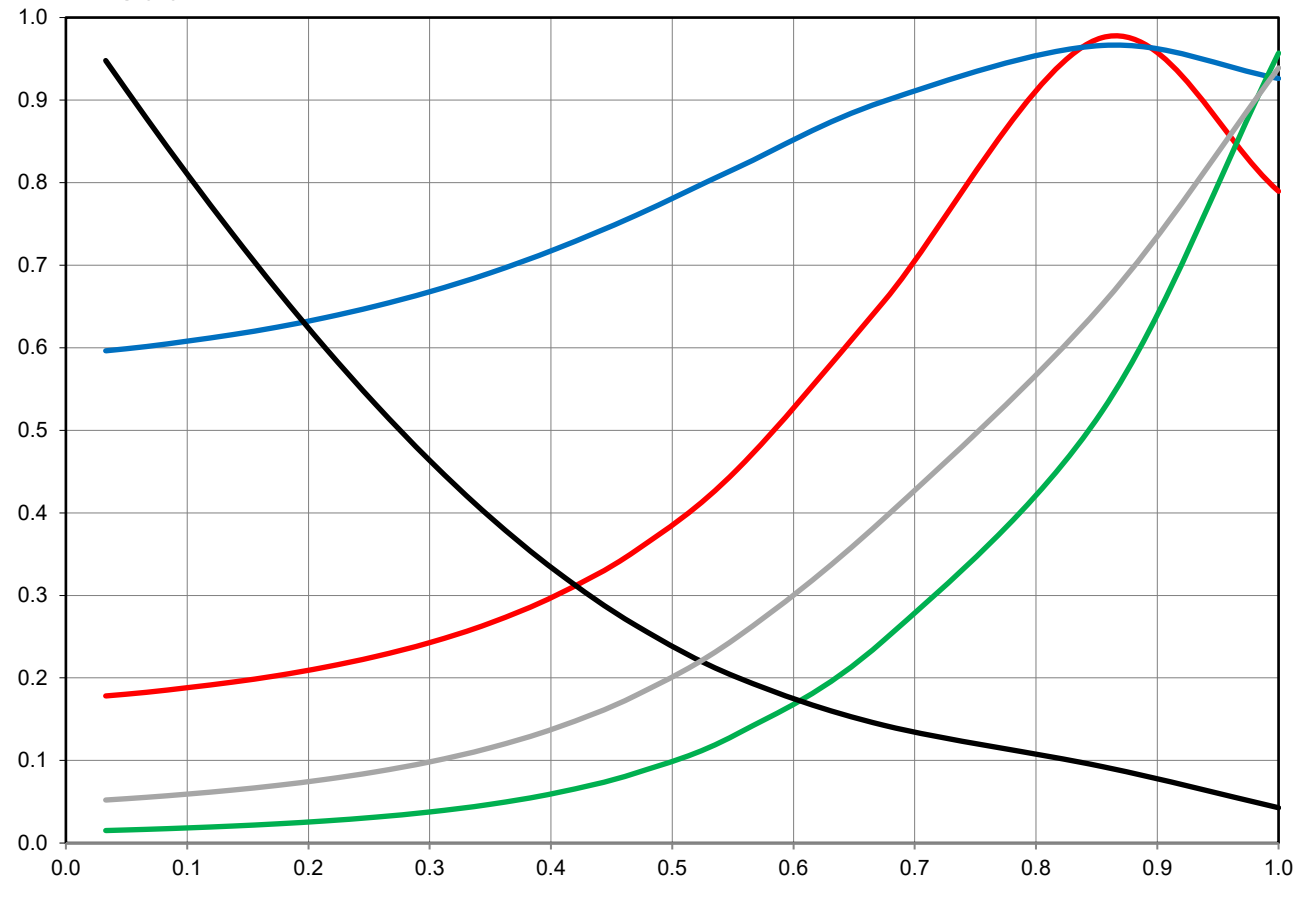
Temp. ((°C)



Finned depth (---)

tc = 30.978 °C
pc = 73.773 bar
hc = 332.075 kJ/kg

Capacity (---)
k-coeff. (---)
Required surface (---)
Average temp. diff. (---)
Pressure drop (---)



Enthalpy (---)

Standard internal coupling		**02-April-2025**
Tube rows on the depth	Piece	5
Tube rows on the height	Piece	48
Number of circuits (NC)	Piece	24
Tube arrangement	---	Staggered
Flow in the tubes	---	Downward
Air flow direction	---	From right
Order number	---	
Tubes total	Piece	240
Tube coupling in series	Piece	10
Blind tubes	Piece	0
SIC version:	**25.1.1.0**	

Zeller Consulting Suisse

HVAC Solutions

Jurastrasse 35

CH-3063 Ittigen

+41 (0)79 222 66 42

info@zcs.ch

www.zcs.ch