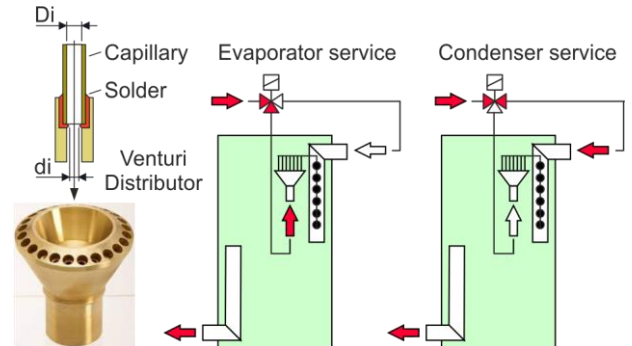


# Capillary and venturi distributor Pressure drop

Occasionally, customers find that the effective pressure drop in the venturi distributor and capillaries is much greater than the calculated value in our applications. Then, of course, the first question is whether we would only calculate the pressure drop in the capillaries and not in the venturi distributor.

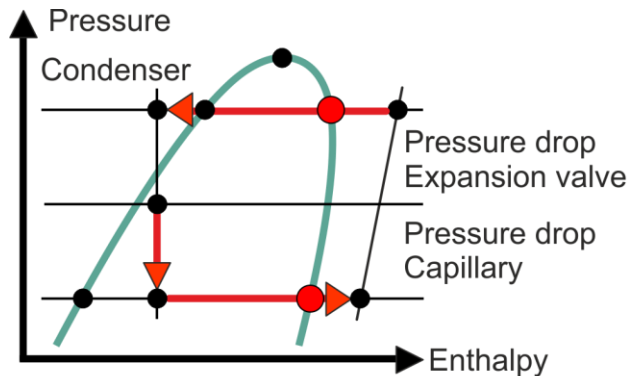
If the distributors used deserve the name venturi, i.e. have curves inside and no rough cross-section transitions and sharp edges, the proportion of the pressure loss is marginal, i.e. totally insignificant. Furthermore, when soldering the capillaries into the distributor, care must of course be taken to ensure that no solder inside the distributor, i.e. at the end of the capillaries, can narrow the cross-section, which then acts like an orifice plate and significantly increases the pressure drop.



## Condenser - Injection Evaporator

In the subcritical area, the pressure difference between the condenser and the injection evaporator must be caused by the expansion valve and the capillaries.

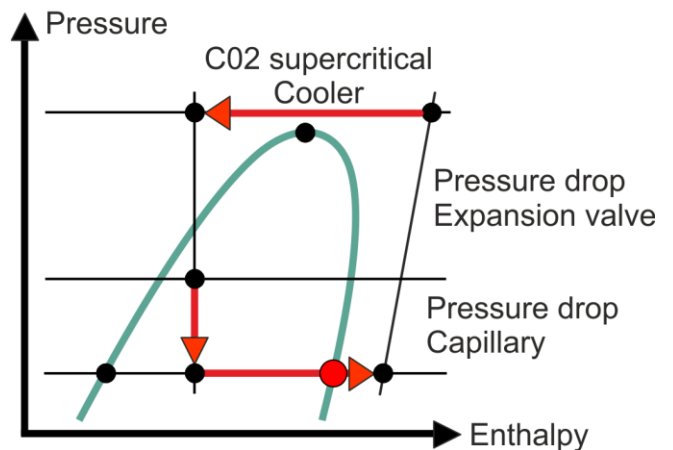
For an even distribution of the refrigerant in all circuits, we recommend a pressure drop in the capillaries between 1 and 5 bar. In some cases, however, you can also go higher, if the pressure difference between condensation and evaporation is very high.



## Condenser - CO2 supercritical cooler

In the supercritical area, the pressure difference between the CO2 cooler and the injection evaporator must be caused by the expansion valve and the capillaries.

For an even distribution of the refrigerant in all circuits, we recommend a pressure drop of > 5 bar, since the pressure difference between CO2 cooler and evaporator is very high, as the pressure at the critical point is 73,773 bar.



## Allow us the following hints, if you do not want any problems:

1. That all capillaries must of course be the same length.
2. That the capillaries must of course have a wall thickness of at least 1 mm.
3. That the venturi distributor must of course be arranged vertically.
4. That the venturi distributor must of course be operated from the bottom up.

**Pressure drop capillaries**

Software by www.zcs.ch



Number of circuits (NC)	Piece	15.000
Length	mm	1500.000
Outside diam.	mm	6.000
Thickness	mm	1.000
Inside diam.	mm	4.000
Roughness	mm	0.002
Mass flow	kg/h	2000.000
Type of cooling oil	---	Oil ISO VG32
Part of cooling oil	%	0.500

Company  
Branch  
Street  
Country / ZIP / City

Phone: xxxxxxxxxx  
Fax: xxxxxxxxxx  
E-Mail  
Homepage

City, 10.2.2022  
With the compliments of

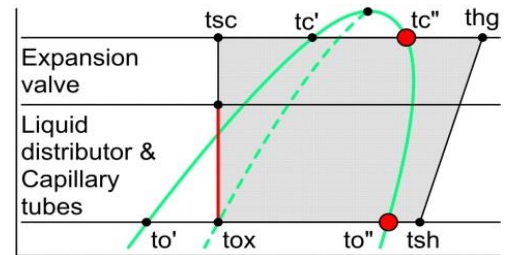
Representative  
Direct dialing  
xxxxxxxxxx

Plant  
Object  
Position

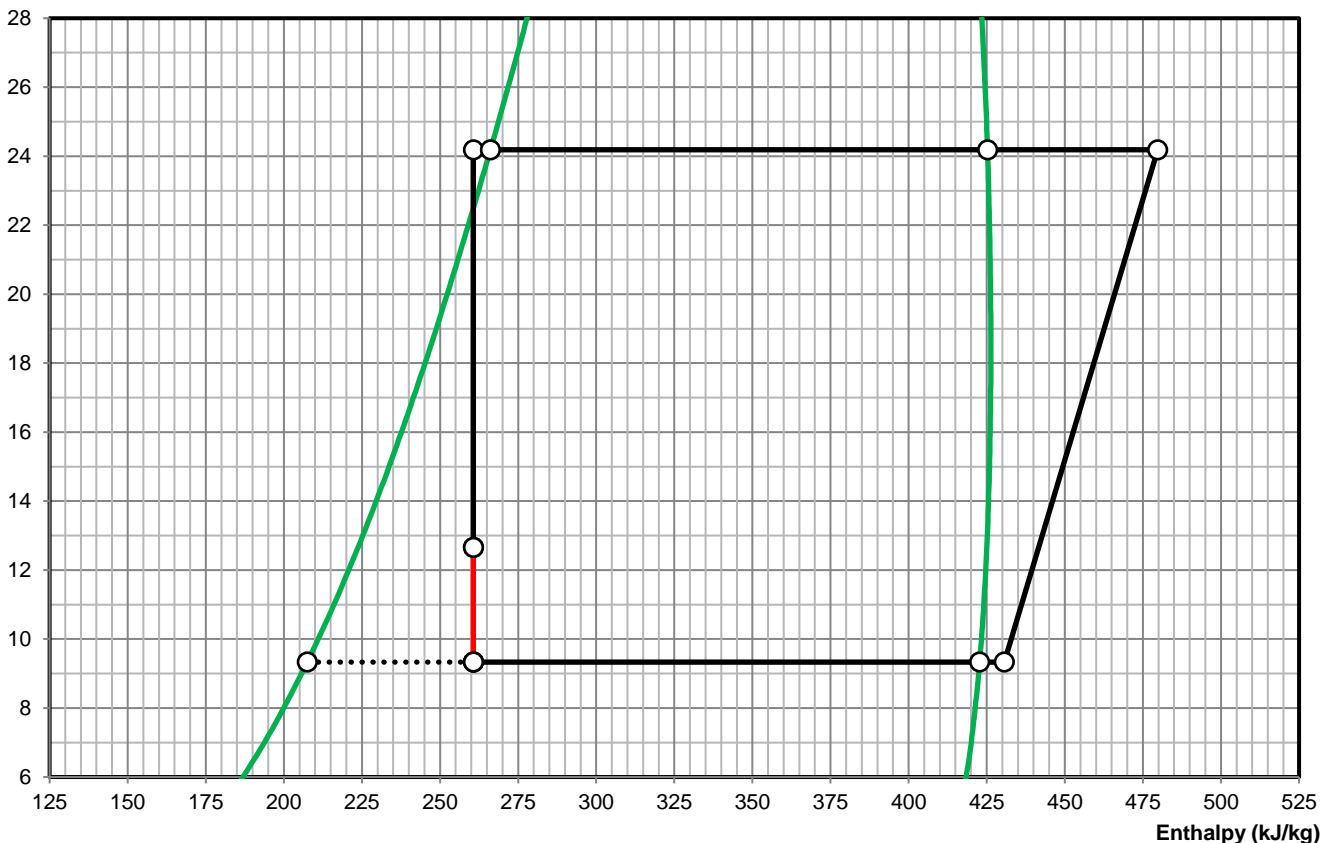
R410A		°C	kJ/kg	---
Hot gas	thg	80.000	479.754	
Condensate	tc"	40.000	425.269	
Condensate	tc'	39.882	266.122	
Subcooling	tsc	37.000	260.653	
Evaporation	to'	4.893	207.499	
Evaporation	tox	4.919	260.653	
Evaporation	to"	5.000	422.727	
Superheating	tsh	12.000	430.663	
Flashgas	x			0.247

Pressure / Capacity	bar	kW
Condenser	pc 24.187	121.723
Evaporator	po 9.331	94.450
Refrig. compressor	dp 14.855	27.273

Pressure drop	bar	%
Pressure drop expansion valve	11.533	77.637
Pressure drop capillaries	3.322	22.363
Total	14.855	100.000



**Pressure (bar)**





**CO2-Cooler (COP = 5.015)**

		Inlet	Outlet	Average
Pressure	bar	90.000	90.000	90.000
Temp.	°C	80.000	30.000	55.000
Density	kg/m3	189.380	744.310	255.550
Enthalpy	kJ/kg	481.590	276.320	429.880
Heat cond.	W/mK	0.030	0.082	0.036
Viscosity	µPas	20.896	61.934	22.109
Capacity	kW			500.000
Mass flow	kg/h	8768.938	8768.938	8768.938
Volume flow	m3/h	46.303	11.781	34.314
Enthalpy difference	kJ/kg			205.270
Temp. diff.	K			50.000
Spec. heat	kJ/kgK			4.105

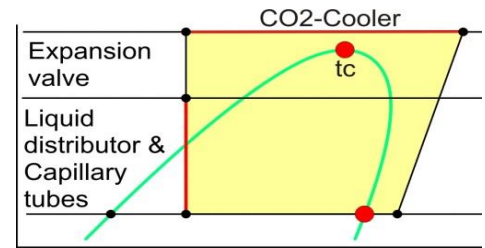
Company  
 Branch  
 Street  
 Country / ZIP / City  
 Phone: xxxxxxxxxx  
 Fax: xxxxxxxxxx  
 E-Mail  
 Homepage  
 City, 10.2.2022  
 With the compliments of

**CO2-Evaporator (COP = 4.015)**

		Inlet	Evaporation	Superheating
Pressure	bar	39.695	39.695	39.695
Temp.	°C	5.000	5.000	12.000
Enthalpy	kJ/kg	276.320	427.483	440.660
Enthalpy difference	kJ/kg			164.340
Capacity	kW			400.303
Flashgas	---	0.297		

Representative  
 Direct dialing  
 xxxxxxxxxx  
 Plant  
 Object  
 Position

Capillary: Number of circuits (NC)	Piece	25.000
Length	mm	1000.000
Outside diam.	mm	6.000
Thickness	mm	1.000
Inside diam.	mm	4.000
Roughness	mm	0.002
Type of cooling oil	---	Oil ISO VG32
Part of cooling oil	%	0.500
Pressure drop capillaries	bar	7.070 (14.054 %)
Cooler - Evaporator	bar	50.305 (100.000 %)



**Pressure (bar)**

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

