

Fluid line

The following table indicates the recommended average cooling capacity for fluid piping and refrigerant charge according to the diameter.

Diameter copper line	Cooling capacity recommended in fluid line				Refrigerant load (g/m)	
	Without subcooling		With subcooling 0°C			
	R-404A / R-452A	R-134a / R-449A	R-404A	R-134a / R-449A	R-449A / R-452A	R-134a / R-449A
1/4"	2	3	4	5	20	25
3/8"	5	7	12	15	50	65
1/2"	10	14	24	30	100	120
5/8"	15	23	40	50	160	200
3/4"	23	35	55	80	240	300
7/8"	32	50	80	120	340	400
1"	43	63	105	150	450	500
1 1/8"	55	80	135	200	550	700
1 3/8"	80	120	200	300	850	1 000
1 5/8"	115	170	280	400	1 200	1 500
2 1/8"	200	300	500	700	2 100	2 500

Equivalent length

The equivalent length of a cooling line is usually between 1.2 and 5 times the actual length depending on the number of elbows and reductions. A rough estimate can be made using the values indicated in the following table:

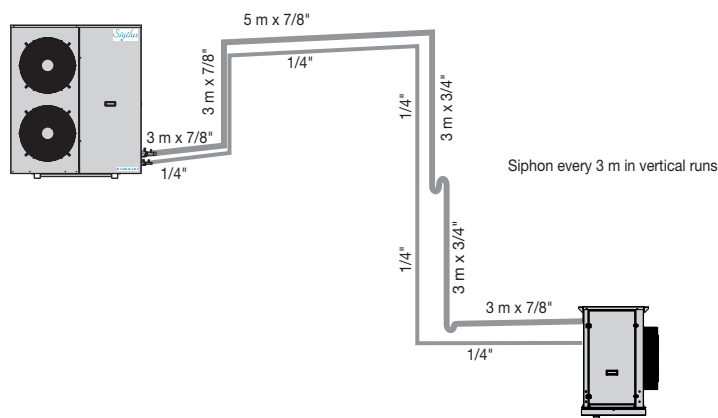
Diameter copper line	Equivalent length (m)						
	Elbow to 90°	T-branch		Reduction	Siphon	Service angular valve	Gate service valve
		Straight flow	Derived flow				
3/8"	0.7	0.3	0.8	0.3	1.1	1.8	0.2
1/2"	0.8	0.3	0.9	0.4	1.2	2.0	0.2
5/8"	0.9	0.4	1.0	0.5	1.4	2.2	0.3
3/4"	1.0	0.4	1.2	0.6	1.6	2.5	0.3
7/8"	1.1	0.5	1.4	0.6	1.8	3.0	0.3
1"	1.2	0.5	1.5	0.7	2.0	3.5	0.3
1 1/8"	1.4	0.6	1.8	0.8	2.3	4.0	0.4
1 3/8"	1.7	0.7	2.2	1.0	2.7	5.0	0.5
1 5/8"	2.0	0.9	2.7	1.2	3.5	6.0	0.6
2 1/8"	2.5	1.1	3.3	1.5	4.3	8.0	0.7

Recommendations

In designing the layout of the refrigerant lines the following practices are recommended:

- Design the layout as straight as possible, with the minimum number of elbows, diversions and valves.
- Install a trap in vertical runs of suction line every 3 meters.
- Install the horizontal sections of the suction line in a downward slope towards the compressor.
- Evaporators refrigeration connections to the intake manifold must always be conducted through the top of the units.

Example - Refrigeration line calculation



Liquid piping selection

Given a given cooling capacity at a given evaporating temperature, the liquid pipe diameter must be selected according to the recommended cooling capacity with a range of $\pm 50\%$.

It is recommended that liquid piping should not be insulated unless it is exposed to direct sunlight or in two-stage compression or vapour injection systems, where the piping should be insulated with a minimum 10 mm thick element to preserve liquid subcooling and prevent surface condensation.

The recommended cooling capacities for liquid lines correspond to flow rates of 1 m/s.

Calculation example

Dimensioning of refrigerant lines according to service to a 1500 W evaporator for low temperature cold rooms at -20 °C with a DT1 of 7 K.

The liquid line is dimensioned based on the recommended cooling capacity, 1/4" piping being admissible.

Initially we take an equivalent length of 1.5 times the actual length. This is: $Leq = 1.5 \times 20 \text{ m} = 30 \text{ m}$.

Admitting in the suction line a pressure drop equivalent to 1K saturation temperature, if we go to the column for 30 m of low temperature pipe (-30 °C evaporation), finding that:

Pipe 3/4" pipe has a recommended maximum power of 1.7 kW, but with a loss of efficiency greater than 15 % (figures in red).

Pipe 7/8" has a minimum power of 1.5 kW, impeding the return of gas in vertical uprights.

7/8" diameter it is recommended for horizontal and descending sections, and 3/4" diameter only in vertical uprights.

We can see that the estimate of the equivalent length is correct:

$Leq = 20 \text{ m} + 3 \times 1.1 \text{ m (elbow)} + 2 \times 1.6 \text{ m (oil trap)} + 2.5 \text{ m (check valve)} = 29 \text{ m}$