Liquid Line Subcooling Needed Against Lift and Pressure Drop

Liquid line pressure loss from friction and lift, the subcooling needed to stop flash gas at the expansion valve, and the margin over actual.

Method: ASHRAE Handbook—Refrigeration (2018); ch. 1 (refrigerant piping: liquid lines, subcooling against static and friction losses)

Input parameters

Unit system: SI

Parameter	Value	Unit
Friction and accessory pressure drop	30.000	kPa
Vertical lift (liquid rising)	8.0000	m
Liquid density	1,150.0	kg/m³
Saturation temperature slope, in K per kPa (K/psi ÷ 6.895), from tables	0.030000	
Actual subcooling at condenser outlet	5.0000	K

Calculated results

Parameter	Value	Unit
Total pressure loss	120.22	kPa
Subcooling required	3.6066	K
Margin	1.3934	K

Notes for this case

- The slope dT_sat/dp at condensing pressure comes from the refrigerant's tables (about 0.03 K/kPa for R134a and 0.02 K/kPa for R410A at 40 °C).

Formula and method

$$\Delta p = \Delta p_f + \rho_l g H, \quad \Delta T_{req} = \Delta p \frac{dT_{sat}}{dp}$$

Variables

Δp_f	Friction and accessory pressure drop	Pa
H	Vertical lift (liquid rising)	m
ρ_l	Liquid density	kg/m³
dT_{sat}/dp	Saturation temperature slope (K per kPa, from tables)	-
ΔT_{sc}	Actual subcooling at condenser outlet	K
Δp	Total pressure loss	Pa
ΔT_{req}	Subcooling required	K
$\Delta T_{sc} - \Delta T_{req}$	Margin	K

Method and standards

Static and friction loss against saturation slope.

Assumptions and limits

- Linear saturation curve over the drop. The slope is entered in K per kPa in every unit system (a slope in K/psi divided by 6.895).

References

- ASHRAE Handbook—Refrigeration (2018)

- ch. 1 (refrigerant piping: liquid lines, subcooling against static and friction losses)

Report details

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Release checks	2 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/hvac/refrigeration/liquid-line-subcooling

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.