Solar Collector Pipe and Duct Heat Loss Correction

Modified collector parameters FR(τα) and FRUL that include heat lost from the supply and return pipes or ducts, from their loss coefficient and area.

Input parameters

Unit system: SI

Parameter	Value	Unit
Collector area	20.000	m²
Collector F_R(τα)	70.000	%
Collector F_R U_L	4.5000	W/(m²·K)
Capacitance rate of the collector fluid	1.2540	kW/K
Pipe or duct loss coefficient (on its surface area)	1.2000	W/(m²·K)
Inlet (supply) pipe or duct surface area	5.6549	m²
Outlet (return) pipe or duct surface area	5.6549	m²

Calculated results

Parameter	Value	Unit
Optical factor ratio	0.99462	
Loss coefficient ratio	1.1392	
Modified intercept	69.623	%
Modified slope	5.1265	W/(m²·K)

Notes for this case

- Loss coefficient U_d on the pipe's outer area, with the surroundings at ambient temperature; pipes indoors lose to a warmer space and less.

Formula and method

$$\frac{(\tau\alpha)'}{(\tau\alpha)} = \frac{1}{1+\frac{U_d A_o}{\dot{m}c_p}}, \quad \frac{U'_L}{U_L} = \frac{1-\frac{U_d A_o}{\dot{m}c_p}+\frac{U_d(A_i+A_o)}{A_c F_R U_L}}{1+\frac{U_d A_o}{\dot{m}c_p}}$$

Variables

A_c	Collector area	m²
$F_R(\tau\alpha)$	Collector F_R(τα)	-
$F_R U_L$	Collector F_R U_L	W/(m²·K)
$\dot{m}c_p$	Capacitance rate of the collector fluid	W/K
U_d	Pipe or duct loss coefficient (on its surface area)	W/(m²·K)
A_i	Inlet (supply) pipe or duct surface area	m²
A_o	Outlet (return) pipe or duct surface area	m²
$(\tau\alpha)'/(\tau\alpha)$	Optical factor ratio	-
U'_L/U_L	Loss coefficient ratio	-
$F_R(\tau\alpha)'$	Modified intercept	-
$F_R U'_L$	Modified slope	W/(m²·K)

Method and standards

The equivalent-collector treatment of pipe and duct losses.

Assumptions and limits

- Small temperature change along the pipes; ambient surroundings.

Report details

Report reference	FCC-J8XS-3KAT (the same inputs always give the same reference)
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Calculator	Solar Collector Pipe and Duct Heat Loss Correction
Method last reviewed	17 November 2026
Software release	FireCAD Calc, release of 22 November 2026
Release checks	3 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/environmental/solar-thermal/collector-pipe-loss-correction

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.