LMTD Correction Factor F for a 1-2 Shell and Tube Exchanger

Correction factor F for one shell pass and two (or any even number of) tube passes from the four terminal temperatures (Bowman), with P, R and the corrected LMTD.

Method: R.A. Bowman; A.C. Mueller and W.M. Nagle; ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Hot fluid in	150.00	°C
Hot fluid out	90.000	°C
Cold fluid in	30.000	°C
Cold fluid out	70.000	°C

Calculated results

Parameter	Value	Unit
Thermal effectiveness of the cold side	0.33333	
Capacity ratio	1.5000	
Correction factor	0.91048	
Counterflow LMTD	69.521	K
Corrected mean temperature difference	63.298	K

Formula and method

$$P=\frac{t_2-t_1}{T_1-t_1},\quad R=\frac{T_1-T_2}{t_2-t_1},\quad F=\frac{\sqrt{R^2+1}\,\ln\frac{1-P}{1-RP}}{(R-1)\ln\frac{2-P(R+1-\sqrt{R^2+1})}{2-P(R+1+\sqrt{R^2+1})}}$$

Variables

$T_{h,in}$	Hot fluid in	K
$T_{h,out}$	Hot fluid out	K
$T_{c,in}$	Cold fluid in	K
$T_{c,out}$	Cold fluid out	K
P	Thermal effectiveness of the cold side	-
R	Capacity ratio	-
F	Correction factor	-
$\Delta T_{lm,cf}$	Counterflow LMTD	K
$F\Delta T_{lm}$	Corrected mean temperature difference	K

Method and standards

Bowman's analytic result for one shell pass and an even number of tube passes.

Assumptions and limits

- Constant U and properties. Within 10^{-6} of R = 1 the R = 1 limit form is used, avoiding loss of digits.

References

- R.A. Bowman
- A.C. Mueller and W.M. Nagle
- Trans. ASME 62 (1940) 283; TEMA and Kern
- Process Heat Transfer

Report details

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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/mechanical/heat-transfer/lmtd-correction-factor

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.