Pinch Analysis: Minimum Hot and Cold Utilities (Problem Table)

Minimum hot and cold utility, heat recovery and pinch temperatures for up to two hot and two cold streams by the problem table algorithm at a chosen ΔT_min.

Method: Linnhoff and Flower (1978); AIChE J. 24: 633 (problem table algorithm); Kemp; ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Hot stream 1 supply	170.00	°C
Hot stream 1 target	60.000	°C
Hot stream 1 heat capacity flow	3.0000	kW/K
Hot stream 2 supply	150.00	°C
Hot stream 2 target	30.000	°C
Hot stream 2 CP (0 = none)	1.5000	kW/K
Cold stream 1 supply	20.000	°C
Cold stream 1 target	135.00	°C
Cold stream 1 CP	2.0000	kW/K
Cold stream 2 supply	80.000	°C
Cold stream 2 target	140.00	°C
Cold stream 2 CP (0 = none)	4.0000	kW/K
Minimum approach	10.000	K

Calculated results

Parameter	Value	Unit
Minimum hot utility	20.000	kW
Minimum cold utility	60.000	kW
Heat recovered	450.00	kW
Pinch temperature, hot side	90.000	°C
Pinch temperature, cold side	80.000	°C

Notes for this case

- Do not transfer heat across the pinch, use no hot utility below it and no cold utility above it.

Formula and method

$$T^* = T - \frac{\Delta T_{min}}{2}\ \text{(hot)},\ T^* = T + \frac{\Delta T_{min}}{2}\ \text{(cold)},\quad \Delta H_i = \left(\sum CP_H - \sum CP_C\right)_i \Delta T_i^*$$

$$Q_{H,min} = -\min_k \sum_{i \le k} \Delta H_i,\quad Q_{C,min} = Q_{H,min} + \sum_i \Delta H_i$$

Variables

$T_{s,H1}$	Hot stream 1 supply	K
$T_{t,H1}$	Hot stream 1 target	K
CP_{H1}	Hot stream 1 heat capacity flow	W/K

$T_{s,H2}$	Hot stream 2 supply	K
$T_{t,H2}$	Hot stream 2 target	K
CP_{H2}	Hot stream 2 CP (0 = none)	W/K
$T_{s,C1}$	Cold stream 1 supply	K
$T_{t,C1}$	Cold stream 1 target	K
CP_{C1}	Cold stream 1 CP	W/K
$T_{s,C2}$	Cold stream 2 supply	K
$T_{t,C2}$	Cold stream 2 target	K
CP_{C2}	Cold stream 2 CP (0 = none)	W/K
ΔT_{min}	Minimum approach	K
$Q_{H,min}$	Minimum hot utility	W
$Q_{C,min}$	Minimum cold utility	W
Q_{rec}	Heat recovered	W
$T_{pinch,hot}$	Pinch temperature, hot side	K
$T_{pinch,cold}$	Pinch temperature, cold side	K

Method and standards

Problem table algorithm.

Assumptions and limits

- Constant CP per stream; up to 2 hot and 2 cold streams.
- Threshold problems (no hot utility, or no cold utility) are named in the note.

References

• Linnhoff and Flower (1978)
• AIChE J. 24: 633 (problem table algorithm); Kemp
• Pinch Analysis and Process Integration
• 2nd ed. (Butterworth-Heinemann, 2007)

Report details

Report reference	FCC-M7V6-D641 (the same inputs always give the same reference)
Generated	17 November 2026, 19:48 UTC
Calculator	Pinch Analysis: Minimum Hot and Cold Utilities (Problem Table)
Method last reviewed	13 November 2026
Software release	FireCAD Calc, release of 17 November 2026
Release checks	3 reference cases of this calculator, computed independently, are checked on every release

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This calculator online

https://calc.firecad.com/chemical/process-heat-exchangers/pinch-problem-table

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Reopens the calculator with the inputs of this report.