CHAPTER 3

Process Integration

Heat Exchanger Network Design For Maximum Energy Recovery

Divide HEN at pinch and match streams to ensure maximum recovery.

Steps to design HEN for MER

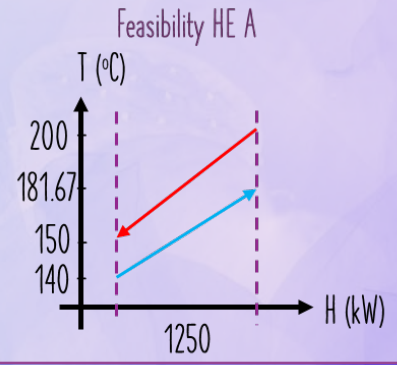
1. Extract and complete stream data
2. Obtain energy targets and pinch point
3. Start at pinch and move away from it
4. Calculate ΔH for each stream
5. Use CP rules to identify feasible matches

Rules for pinch matches

- No exchanger has a $\Delta T \geq \Delta T_{min}$
- No heat transfer across the pinch
- No inappropriate use of utilities
- Violation will increase utility requirements

HE Feasibility check

- Find unknown temperatures
- Draw T-H diagram
- Feasible if:
  - $\Delta T \leq \Delta T_{min}$
  - Hot streams on top
  - Does not cross

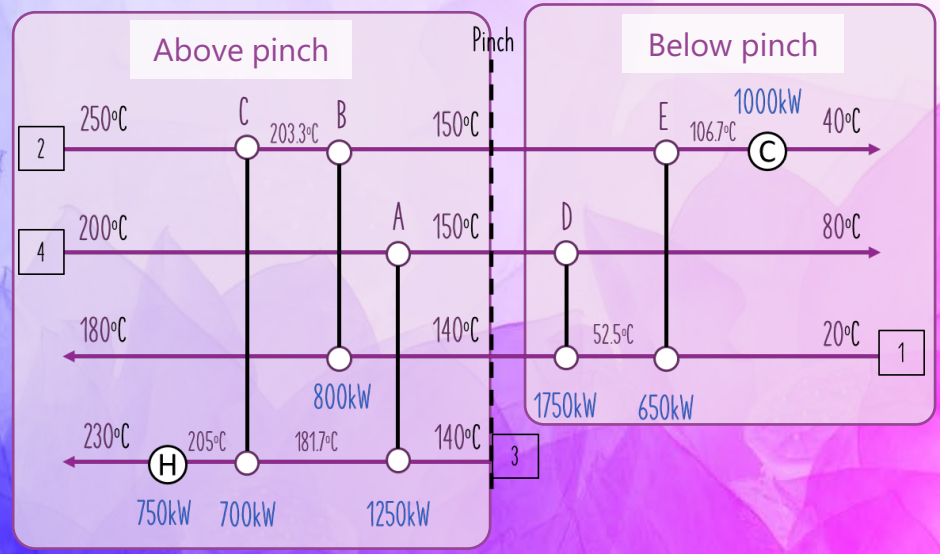


Above the pinch

- No coolers
- $N_{Cold} \geq N_{Hot}$
- $CP_{Cold} \geq CP_{Hot}$

Below the pinch

- No heaters
- $N_{Hot} \geq N_{Cold}$
- $CP_{Hot} \geq CP_{Cold}$

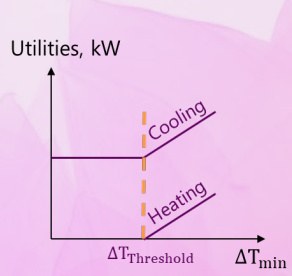


Stream splitting

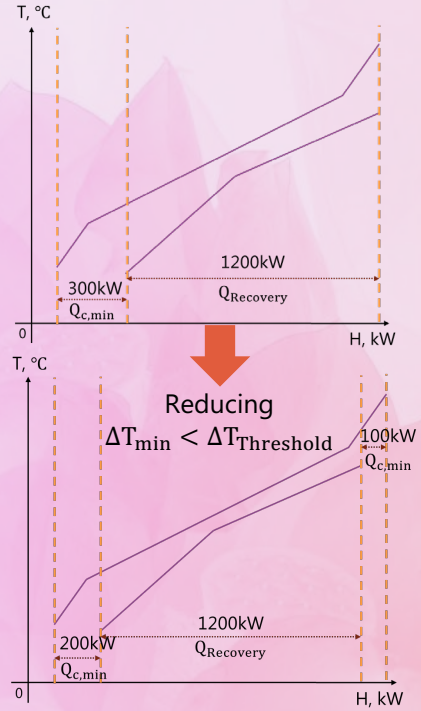
- Streams can be split into parallel branches to ensure feasibility
- Algorithm for splitting similar to CP rules but consider number of streams at pinch
- Splitting provides a degree of freedom

Threshold Problems

- Situation where only one utility is required
- If ΔT_{min} is reduced below the $\Delta T_{Threshold}$, the energy targets do not change
- HEN design starts from the no utility end



Below $\Delta T_{Threshold}$, only constant cooling utility required



Dr Nurul Haiza Sapiee