

# *PART 5*

## ENERGY RELAXED NETWORKS. PINCH METHOD APPROACH

# ENERGY RELAXATION

Energy relaxation is a name coined for the procedure of allowing the energy usage to increase in exchange for at least one of the following effects :

- a) a reduction in area
- b) a reduction in the number of heat exchangers
- c) a reduction in complexity (typically less splitting)

# ENERGY RELAXATION

In the original PDM an energy relaxation procedure was proposed.

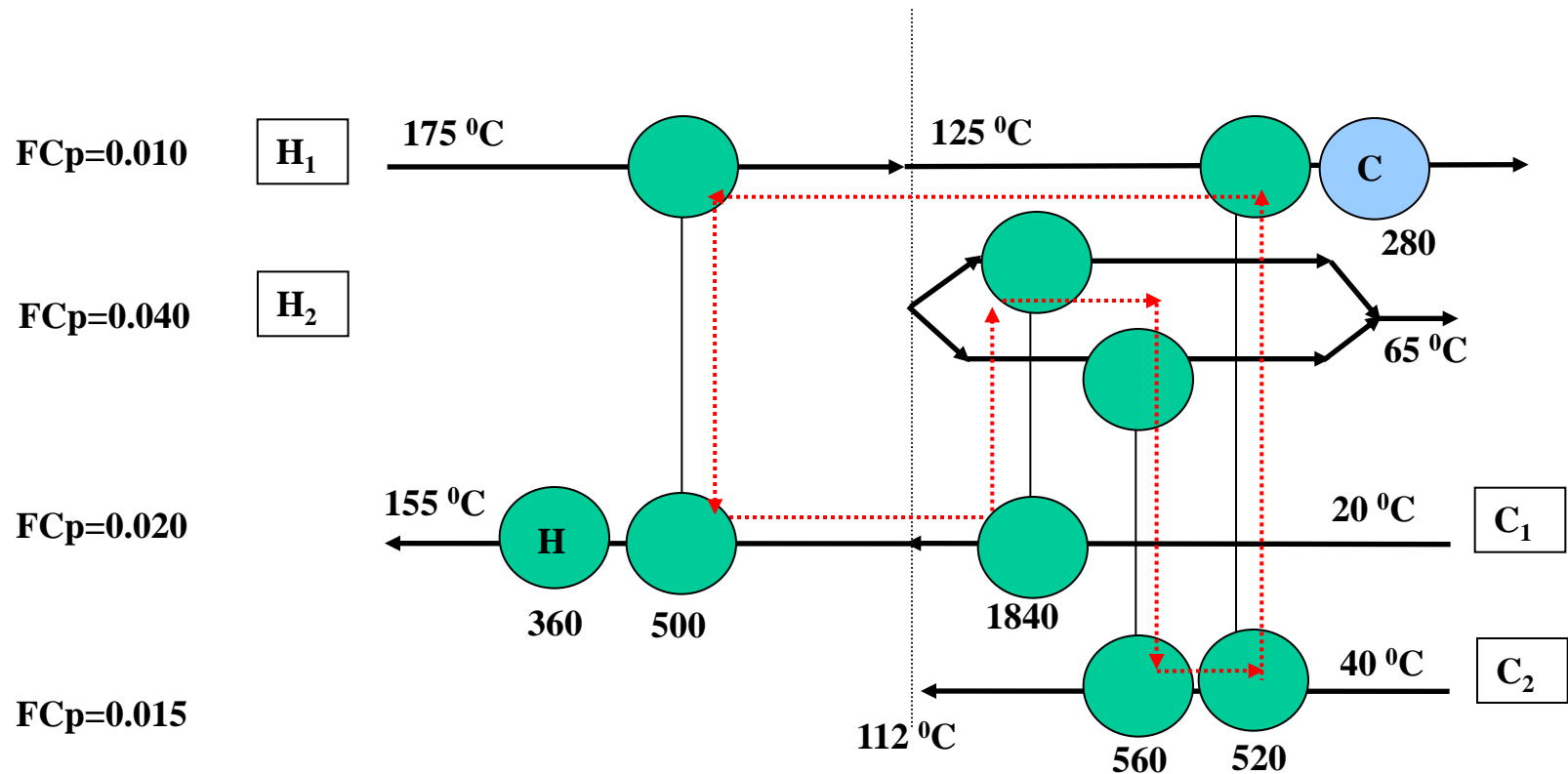
This procedure has as goal to increase heating utility and in exchange reduce the number of units.

# ENERGY RELAXATION

- LOOP: A loop is a circuit through the network that starts at one exchanger and ends in the same exchanger
- PATH: A path is a circuit through the network that starts at a heater and ends at a cooler

# ENERGY RELAXATION

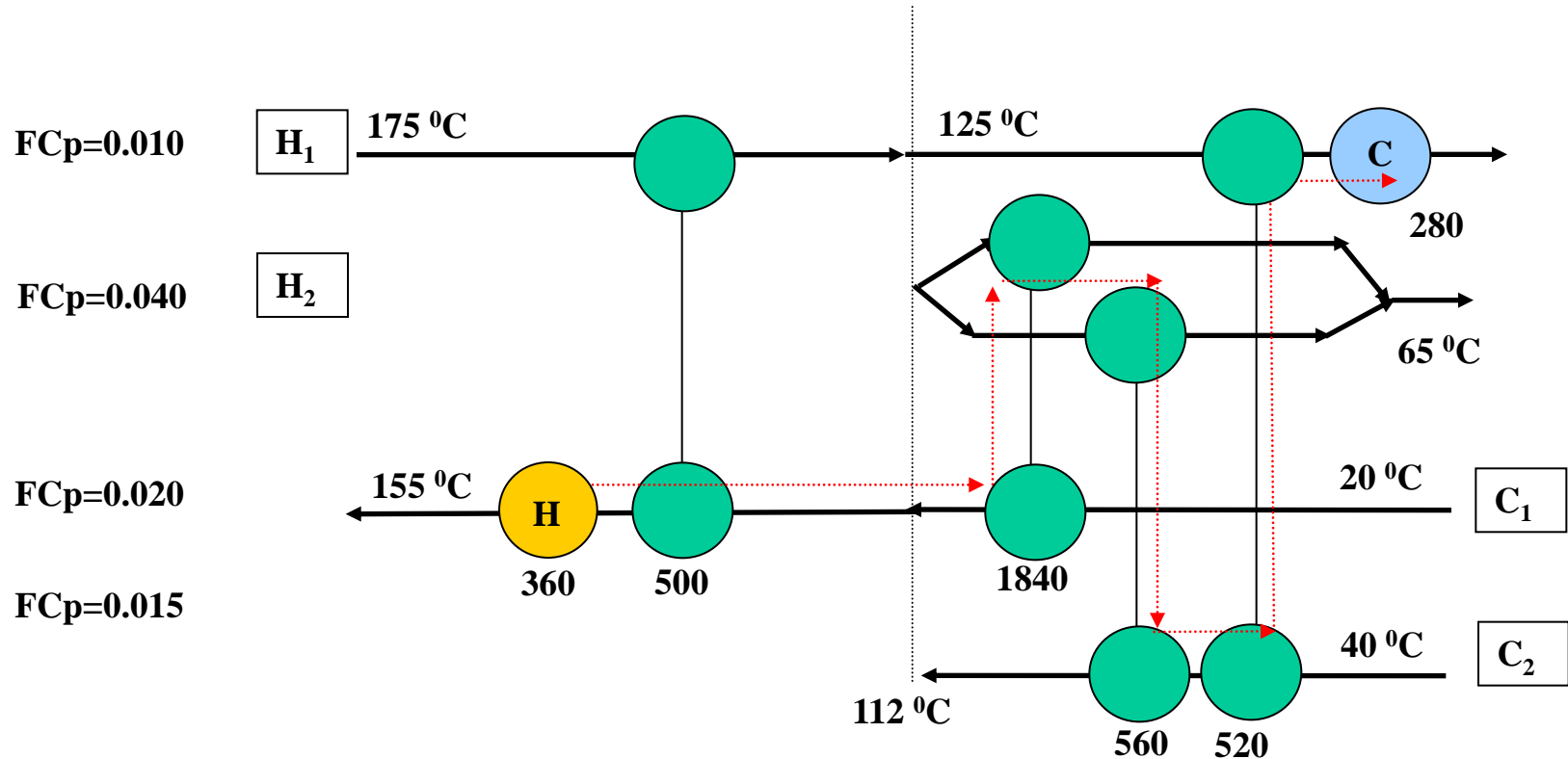
- Illustration of a Loop



(\*) Heat exchanger loads are in kW

# ENERGY RELAXATION

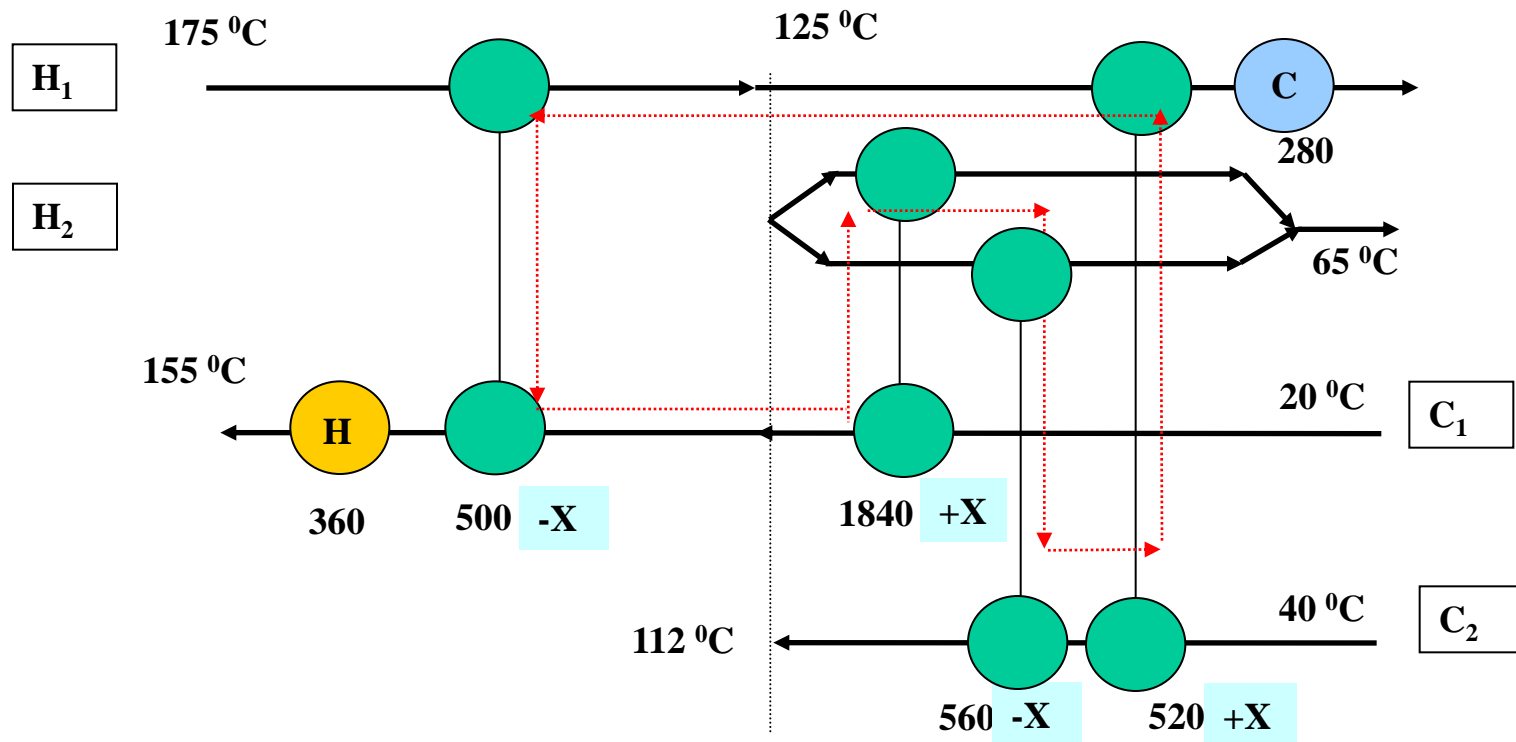
- Illustration of a Path



(\*) Heat exchanger loads are in kW

# ENERGY RELAXATION

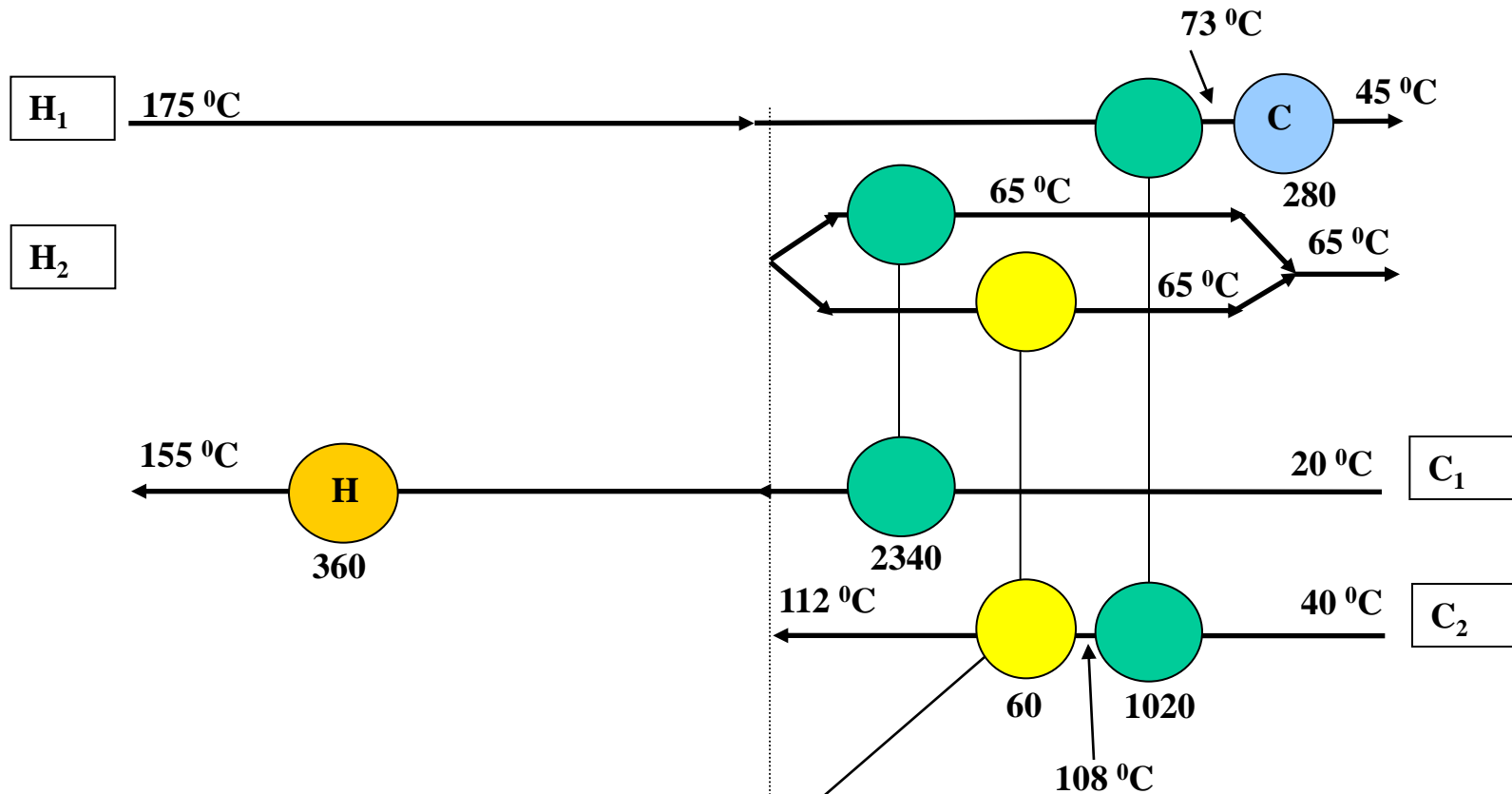
- Procedure : Find a loop and move around heat from exchanger to exchanger until one exchanger is eliminated.



- If one wants to eliminate one exchanger:  $X=500$ . Note that  $X$  could have been negative, but we chose the smallest possible in absolute value.

# ENERGY RELAXATION

- Result: Notice that the result is infeasible!!!

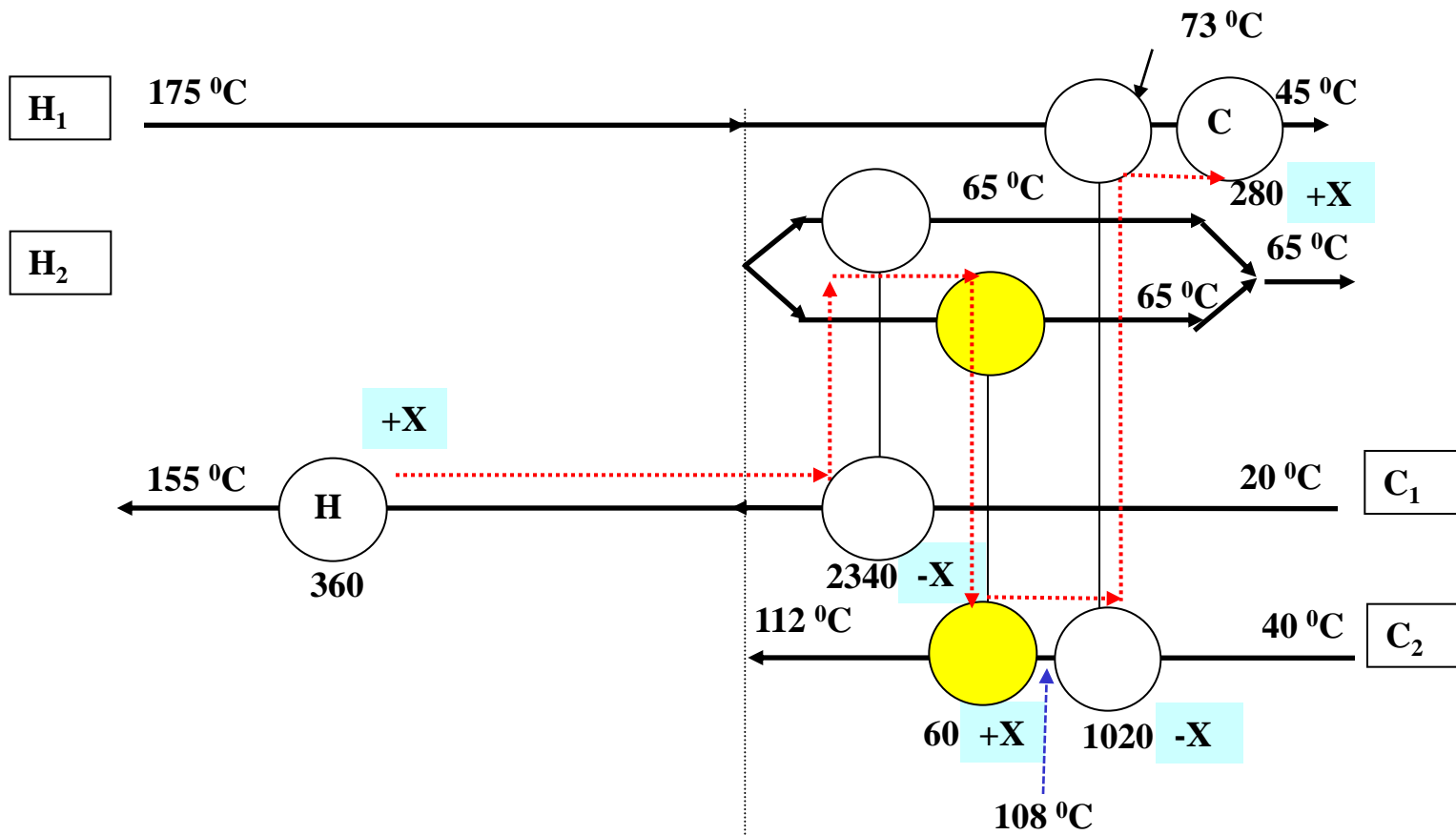


This exchanger is in violation of the minimum approach



# ENERGY RELAXATION

- We use a path to move heat around to restore feasibility



The value of  $X$  needed to restore feasibility is  $X=795$

# ENERGY RELAXATION

- Final Network

