Salahaddin University - Erbil

College of Agricultural Sciences Engineering

Food Technology Department

Third year

F.P.E. (Practical)

2021-2022

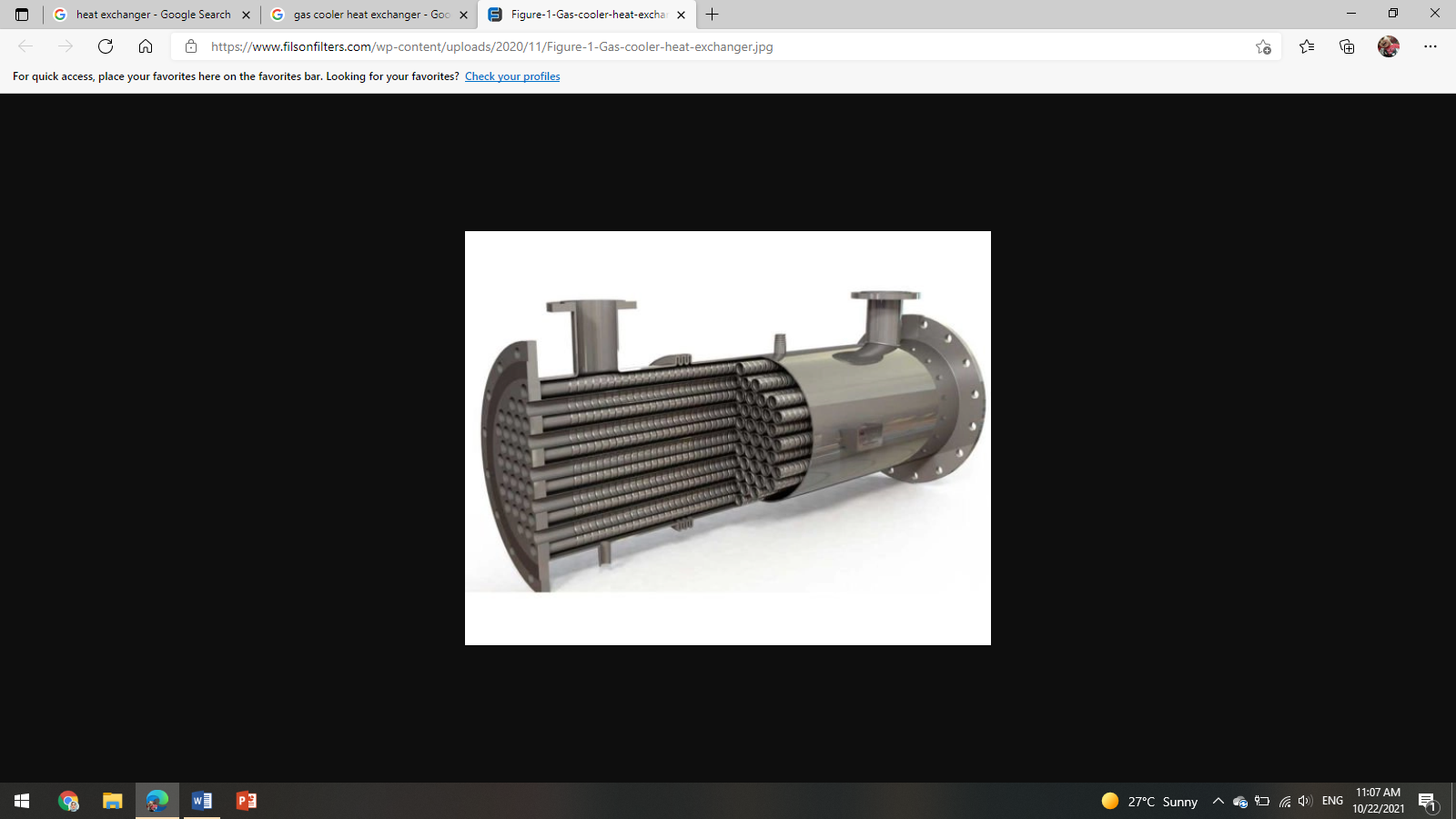
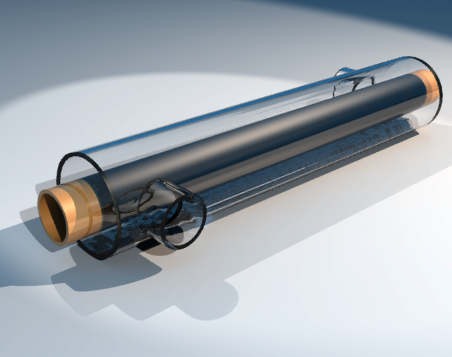
3 Hours

Mrs. Darwin Mohammed

**Lecture 3 \ Heat Exchanger**

**Heat exchanger:**

An equipment that transfers thermal energy from a hot fluid to a colder one(s), with minimum cost and maximum result.[[1]](#footnote-1)



The fluids are separated by the solid walls of the carrier tube so as not to be mixed or being in direct contact.[[2]](#footnote-2)

The exchanged heat in the tubes can be calculated by the following equation:

Q (watt) = U \* A(m2) \* ∆TLM (kelvin)

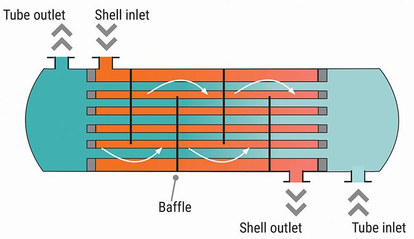
Log mean temperature difference is an equation that shows the logarithmic average of the heat difference between the hot and the cold fluids in a heat exchanger.

Q: Transferred Thermal Energy

U: Heat transfer coefficient

A: surface area of the tube or pipe

∆TLM: Log mean temperature Difference



B

A

The larger log mean temperature difference, the more heat is transferred. The equation for log mean temperature difference is:

∆TLM =

∆TLM: Log mean temperature difference

∆TA: temperature difference at side A

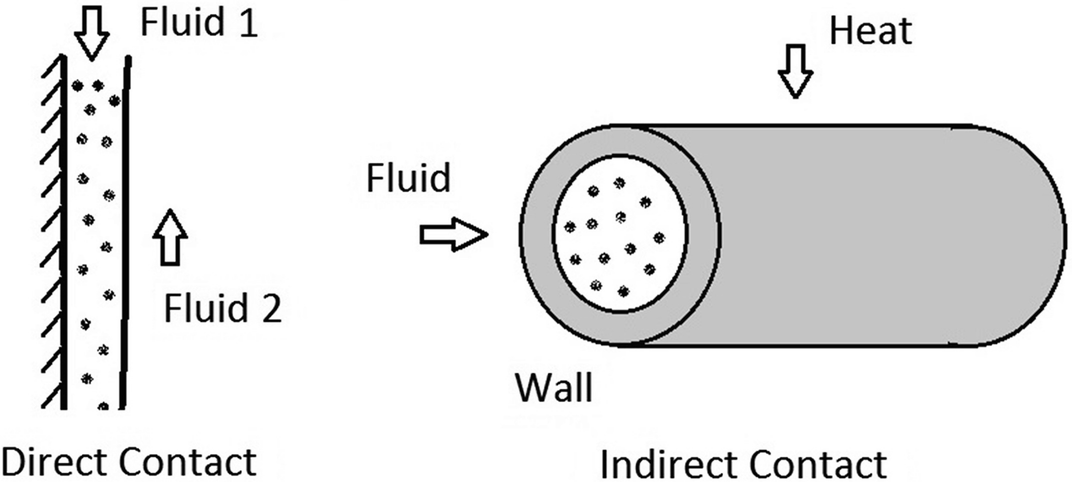
∆TB: temperature difference at side B

**Problem:** A heat exchanger system used to cool down a fluid from 425o Kelvin to 320o Kelvin, using another fluid which enters the system with a temperature of 180o Kelvin and leaves with a temperature of 230o Kelvin. Calculate the transferred thermal energy when you know that the heat transfer surface area is 2.50 m2. Assume the heat transfer coefficient is 4000 .

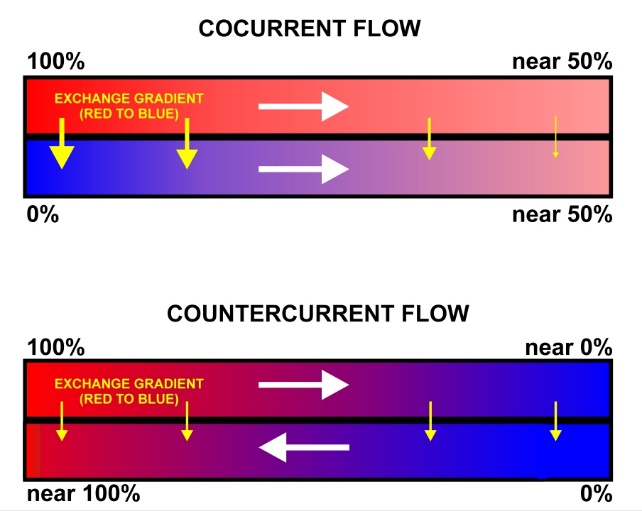
**Types of Heat Exchangers:**

Heat exchangers can be classified according to several properties, characteristics, and designs[[3]](#footnote-3), they are classified according the following points:

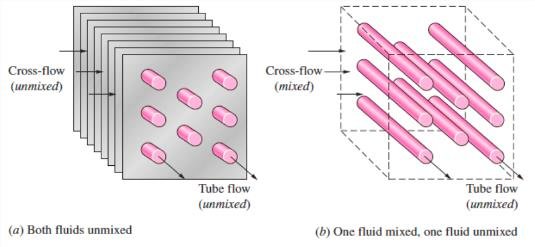
1. Nature of heat exchanging process, into:
   1. Direct contact heat exchangers (open heat exchangers).
   2. Indirect contact heat exchangers.



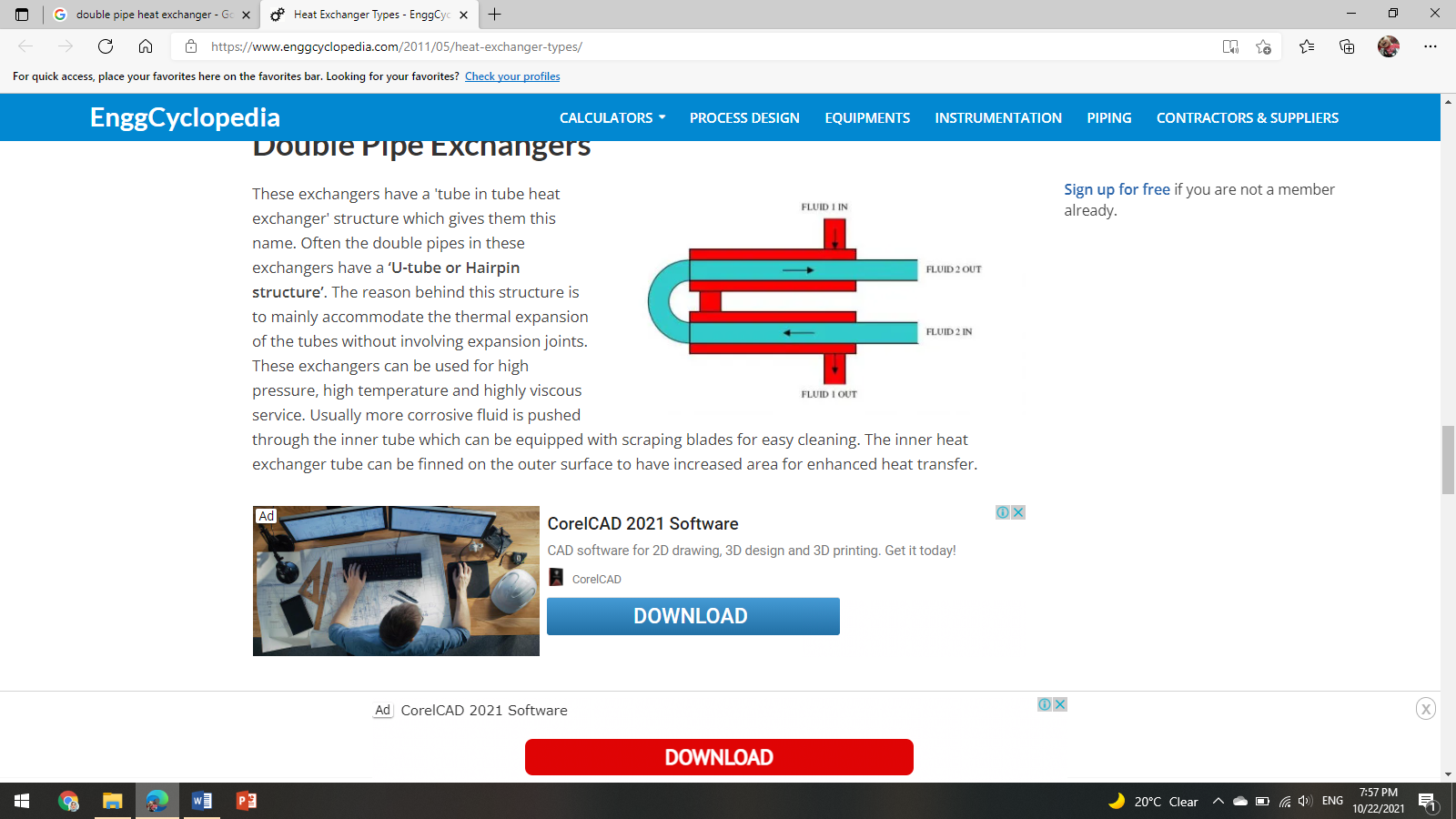
1. Direction of the current flow, into:
   1. Co-current flow (parallel flow).
   2. Countercurrent flow.



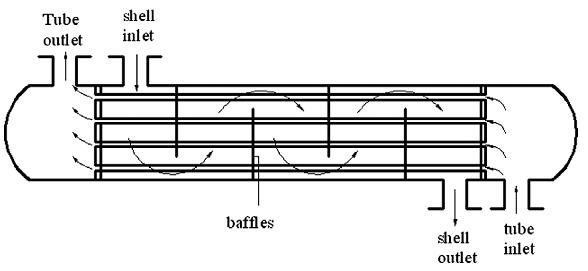
* 1. Cross Flow.



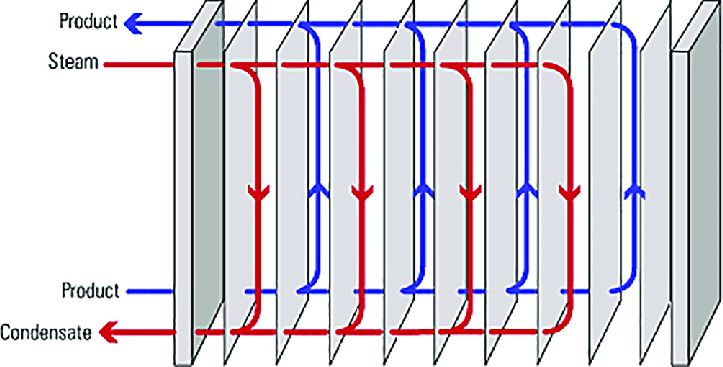
1. Design and construction, into:
   1. Double pipe exchangers.



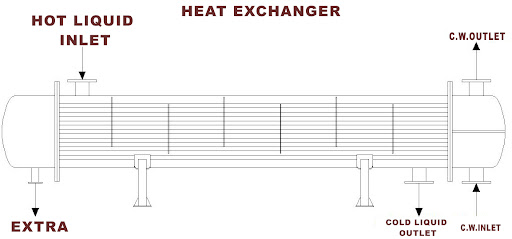
* 1. Shell and tube exchangers.



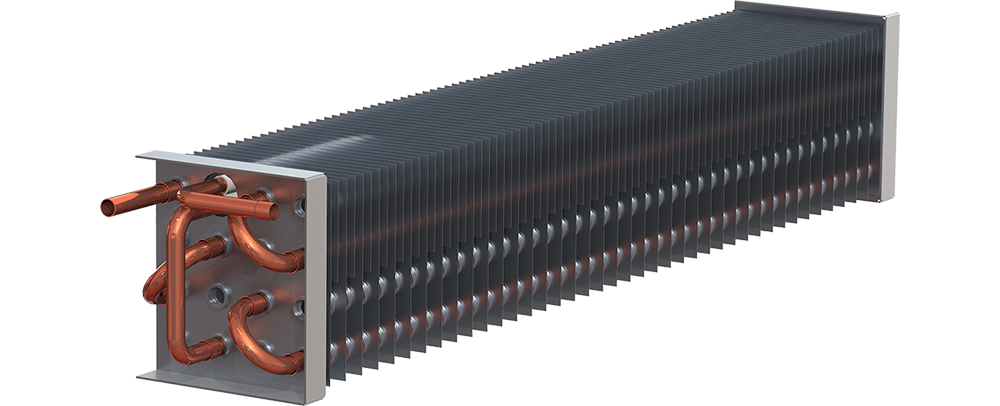
* 1. Plate heat exchangers.



1. Physical state of fluids:
   1. Condensers.



* 1. Evaporators.



1. Al-Sammarraie, A.; Vafai, K. (2017) *Heat transfer augmentation through convergence angles in a pipe,* Numerical Heat Transfer, Part A: Applications. 72 (3): 197–214 [↑](#footnote-ref-1)
2. Kakaç, S., Liu, H. (2002) *Heat Exchangers: Selection, Rating and Thermal Design*, (2nd ed.), CRC Press [↑](#footnote-ref-2)
3. Perry, R., Green, D. (1984). *Perry's Chemical Engineers' Handbook* (6th ed.). McGraw-Hill [↑](#footnote-ref-3)