|| नमस्ते ||

BRAYTON CYCLE WITH REGENERATION

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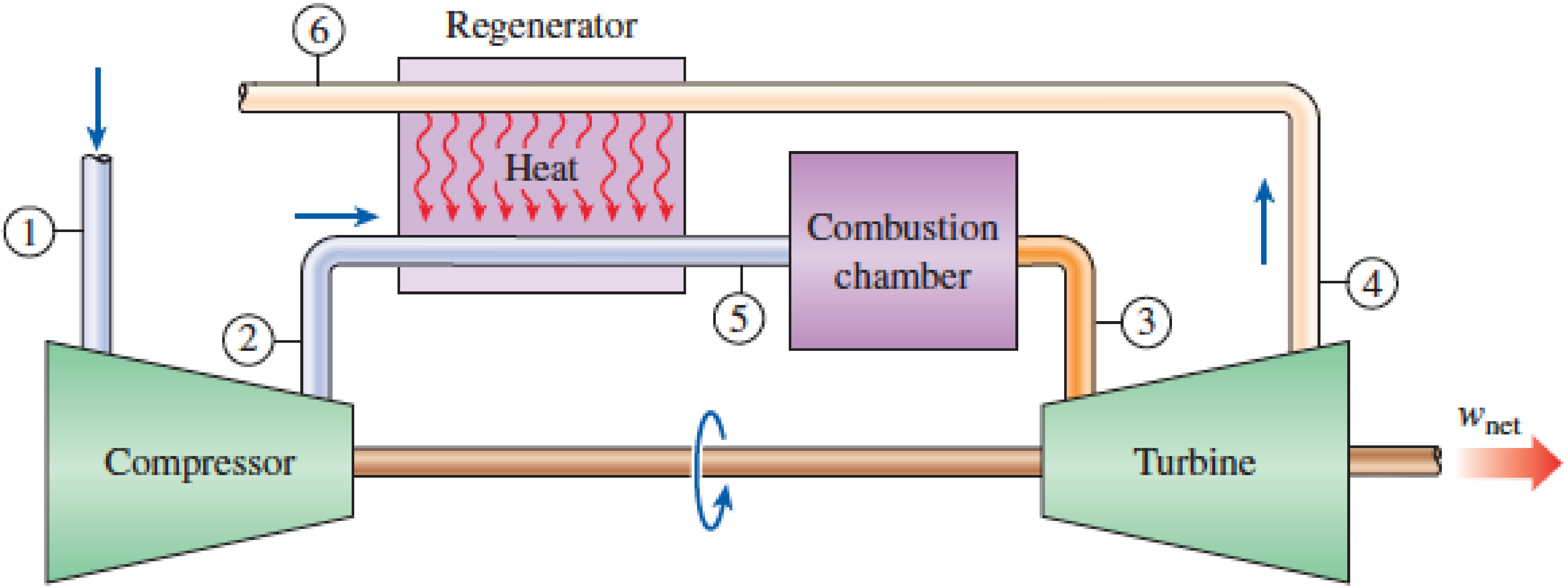
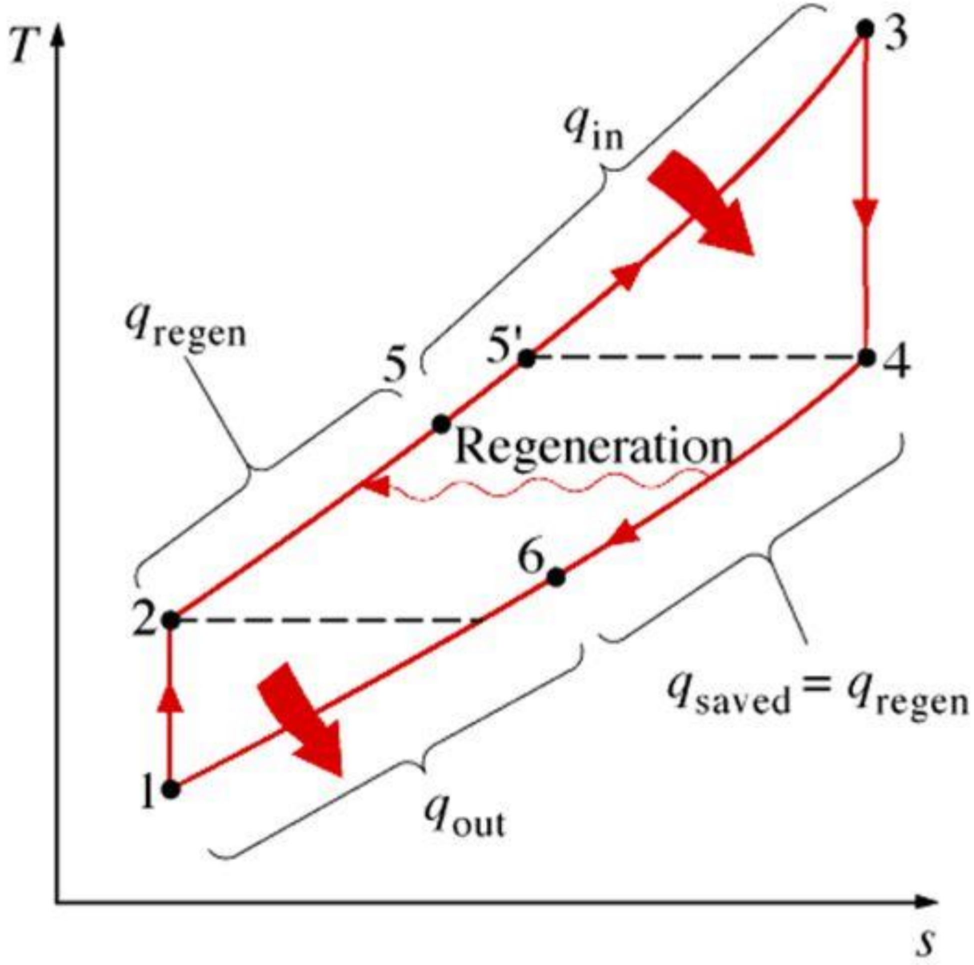


Ts Diagram for Brayton Cycle with Regeneration



Brayton cycle with regeneration

- Regeneration can be carried out by using the hot air exhausting from the turbine to heat up the compressor exit flow.
- The thermal efficiency of the Brayton cycle increases as a part of the heat rejected is re-used.
- Regeneration decreases the heat input (thus fuel) requirements for the same net work output.

- The extent to which a regenerator approaches an ideal regenerator is called the effectiveness, ε and is defined as

$$\varepsilon = q_{regen,act} \,/\, q_{regen,max} = (h_5 - h_2)/(h_4 - h_2)$$

- Under the cold-air-standard assumptions, the thermal efficiency of an ideal Brayton cycle with regeneration is:

$$\eta_{th,regen} = 1 - \left(\frac{T_1}{T_3}\right)(r_p)^{(\gamma-1)/\gamma}$$

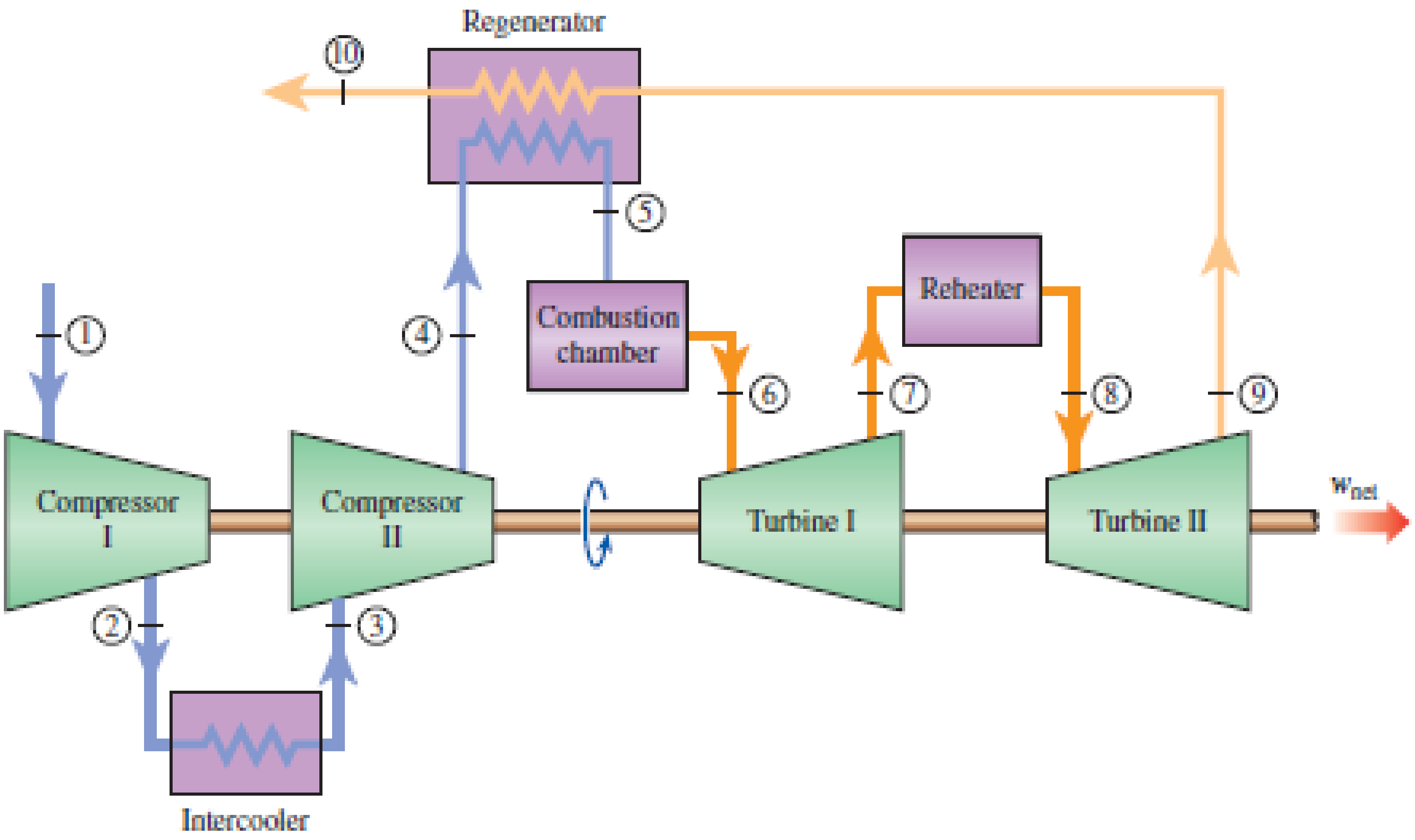
- The thermal efficiency depends upon the temperature as well as the pressure ratio.

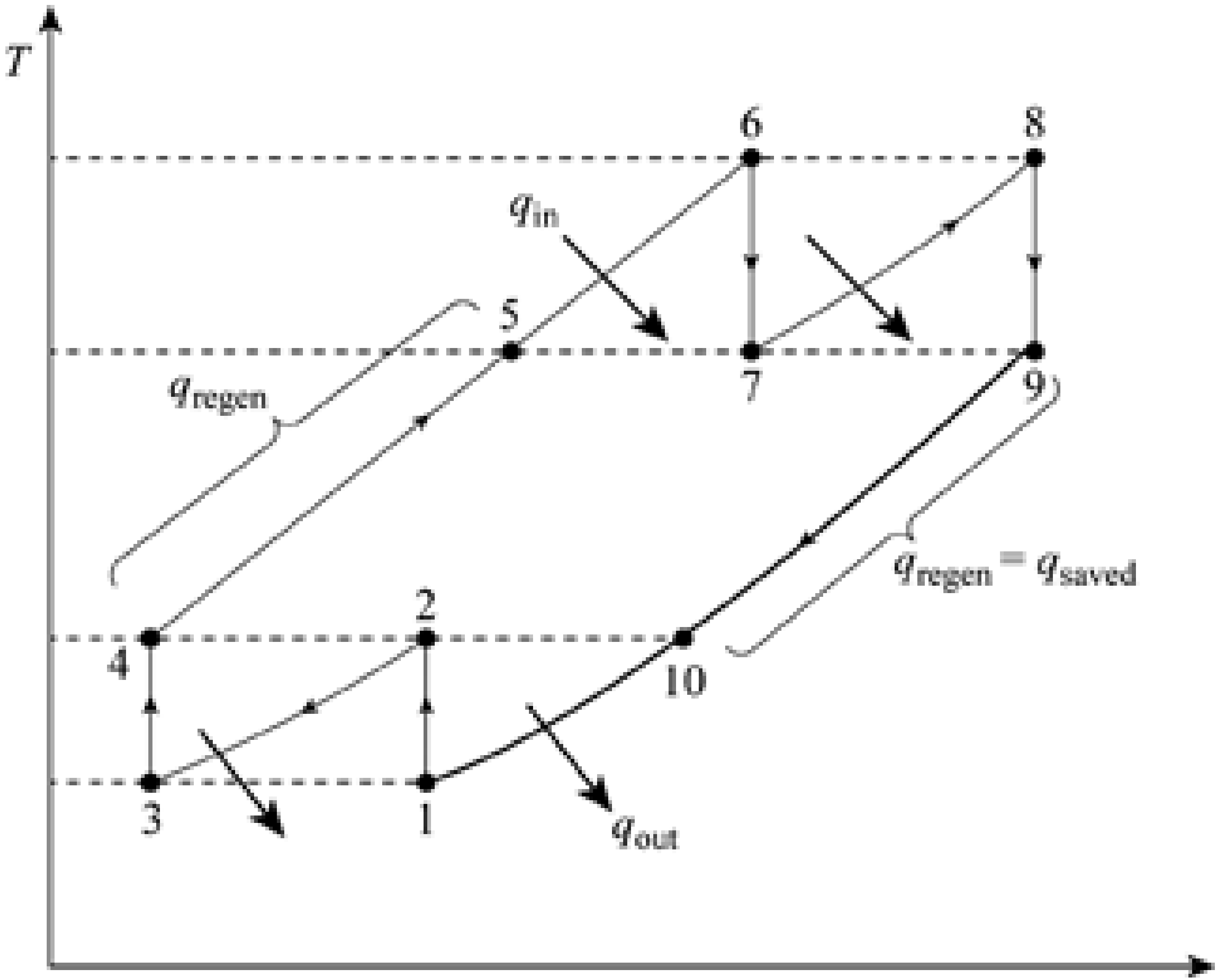
Ideal Brayton Cycle with Intercooling, Reheating and Regeneration

- The net work of a gas-turbine cycle is the difference between the turbine work output and the compressor work input.
- It can be increased by either decreasing the compressor work or increasing the turbine work, or both.
- The work required to compress a gas between two specified pressures can be decreased by carrying out the compression process in stages and cooling the gas in between: multi-stage compression with intercooling.

- **Similarly the work output of a turbine can be increased by: multi-stage expansion with reheating.**
- **As the number of stages of compression and expansion are increased, the process approaches an isothermal process.**
- **A combination of intercooling and reheating can increase the net work output of a Brayton cycle significantly.**

- Intercooling additionally includes the utilization of a heat exchanger. The intercooler is a type of heat exchanger where it is used to cool the compressor gas amid the compression process.
- Reheating in thermodynamic process refers to an approach to build turbine work without variation in the compressor work from which the turbine is developed.
- Regeneration n in thermodynamics process refers to a method where the certain quantity of heat abstracted from the steam is utilized to heat the water. The regeneration process occurs between the stages of turbine and pump respectively. Using regeneration, the efficiencies of thermodynamic cycles can be improved.


Regenerator
10
5
Reheater
1
4
Combustion chamber
6
7
8
9
Compressor I
Compressor II
Turbine I
Turbine II
w_{net}
2
3
Intercooler


T
6
8
q_{in}
5
7
9
q_{regen}
$q_{regen} = q_{saved}$
2
4
10
3
1
q_{out}

- From figures observe that the gas enters the first compressor at constant entropy(process 1-2) to an intermediate pressure and cooled at consistent pressure (process 2-4).
- It is then compacted in the second stage at constant entropy (process 3-4) to the last pressure via intercooler.
- The gas now enters the regenerator (process 4-5), where it is heated at a constant pressure.
- In a perfect regenerator, the gas will leave the regenerator at the temperature of the turbine fumes. The gas enters the main phase of the turbine and extends isentropically (process 6-7) where it enters the reheated (process 7-8).
- It is warmed at consistent pressure, where it enters the second phase of the turbine. The gas leaves the turbine and enters the regenerator for the purpose of cooling at constant pressure (process 9-10-1).
- Now the cycle is completed

Today's Amazing Fact!!

In India Basin Drain Water Rotates Anticlockwise Direction & In Australia Basin Drain Water Rotates Clockwise Direction due to coriolis effect

धन्यवाद

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