



Lecture 7

Petrochemicals Engineering

Condensate stabilization





Condensate stabilization concept



Gas condensates are liquid mixtures of high-boiling hydrocarbons of various structures, separated from natural gases during their production at gas condensate fields. When transporting gas through pipelines, the following gas quality conditions should be met:

- i. During transportation, gases should not cause corrosion of pipelines, fittings, instruments, etc.
- ii. The quality of the gas must ensure its transportation in a single-phase state i.e., liquid hydrocarbons, gas condensates and hydrates should not form in the pipelines.

In order for gas condensates to meet the above-mentioned quality conditions during storage or transportation, they must be **stabilized**.

Gas condensate stabilization is the process of “boiling off” light hydrocarbons from the condensate that would otherwise increase the vapor pressure when conditions are fluctuating.



Goals of Gas Condensate Stabilization: Some of the major goals of gas condensate stabilization are the following:

- i. To reduce the vapor pressure of the condensate, thereby lessening evaporation losses during storage or shipment in atmospheric vessels;
- ii. To “sweeten” the condensate (removing the H₂S and CO₂ fractions), in order to meet the required specifications;
- iii. To enable recovery of methane, ethane and liquefied petroleum gas for other purposes.

❖ **Methods of Gas Condensate Stabilization :** The two major methods of gas condensate stabilization are:

- i. Multi-Stage Flash Vaporization
- ii. Distillation



Multi-Stage separation: This is based on the principle of stage-wise pressure reductions and temperature increments, leading to separation of lighter fractions of the gas condensate from the heavier fractions.

- ❖ Stabilization of gas condensates by this method involves decreasing the solubility of low-boiling hydrocarbons in condensates, by increasing temperature and lowering pressure.
- ❖ The choice of the number of stages depends on: the content of low boiling hydrocarbons in the condensate. (the more they are, the more stages are needed) .
- ❖ This is explained by the fact that, as the number of stages increases, the share of separation on each of them decreases.
- ❖ This decrease in the share of separation entails a decrease in the entrainment of the condensate hydrocarbons to the gas phase.
- ❖ During multi-stage separation, the pressure in the subsequent stage is always less than the pressure at the previous stage.



Advantages of Multi-Stage separation: Some of the advantages of this method are:

- i. Simplicity of the models;
- ii. Low metal and energy consumption.

Disadvantages of Multi-Stage separation: Some of the disadvantages of multi-stage separation are:

- i. Loss of light fractions of the condensates;
- ii. Inability to produce liquefied gases that meet standard requirements;
- iii. The collection and utilization of separated gases are associated with high energy costs;
- iv. Poor separation of hydrocarbons.

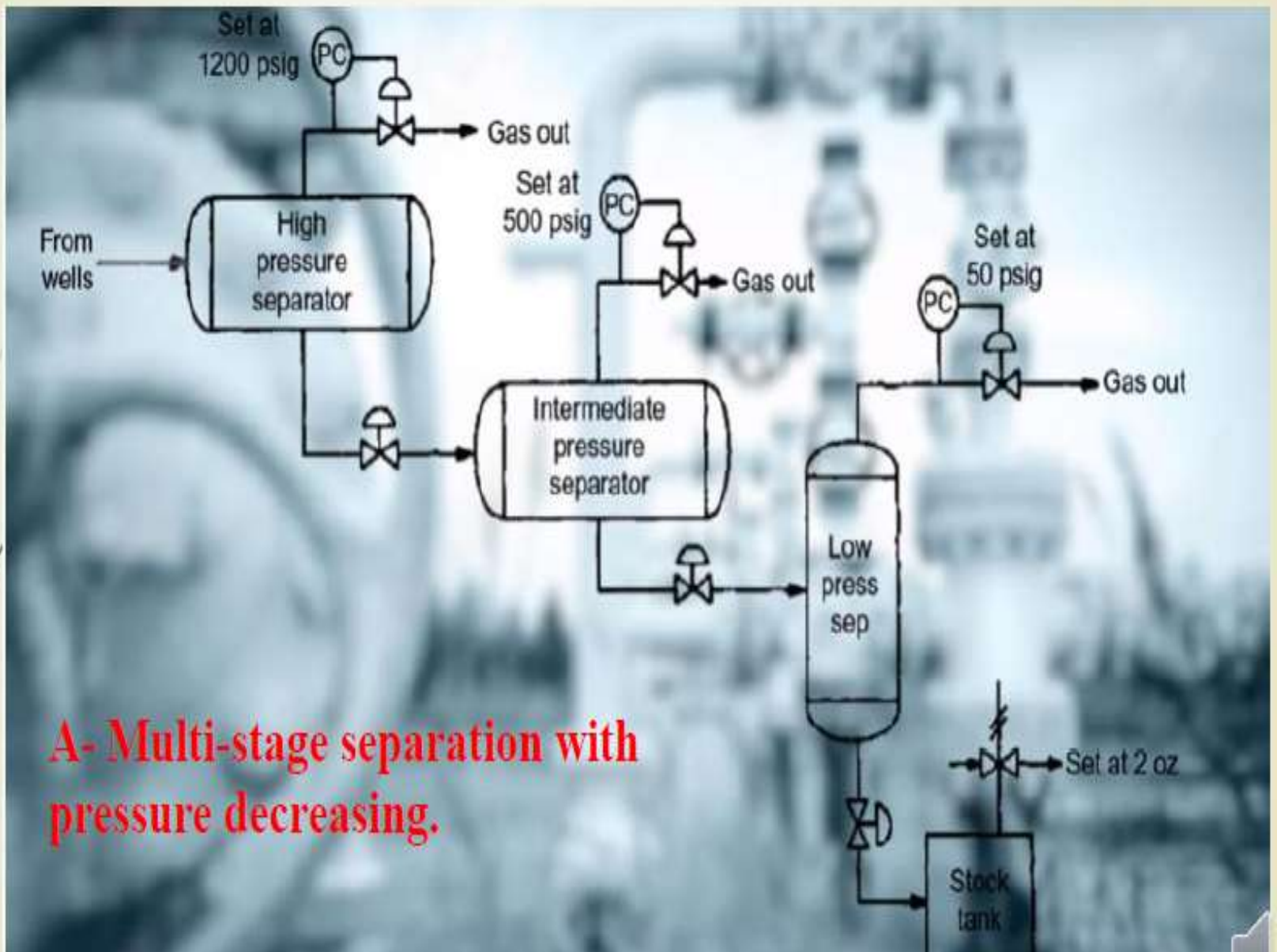
❖ Separation gets better with increase in the number of stages.

Types of distillation methods:

A- **Multi-stage separation with pressure decreasing.**

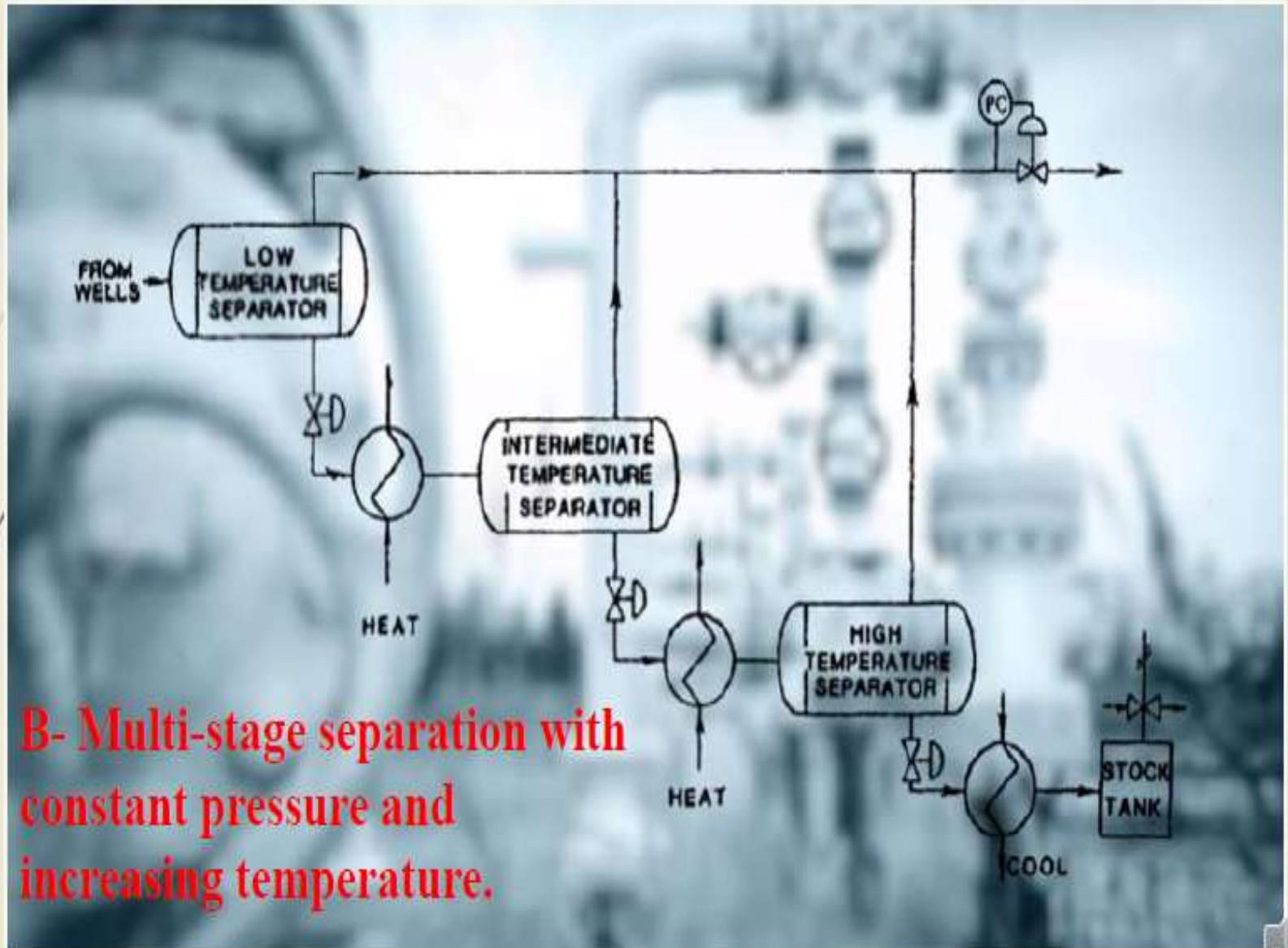
B- **Multi-stage separation with constant pressure and increasing temperature.**





A- Multi-stage separation with pressure decreasing.





B- Multi-stage separation with constant pressure and increasing temperature.



Stabilization of Gas Condensates by Distillation : This is gas condensate stabilization with the use of fractionating or rectification columns. The columns can also be called “condensate stabilizers”. Advantages of Stabilization of Gas Condensates by Distillation.

Some of advantages of this method are the following:

- i. Preliminary separation and deethanization of unstable condensates at high pressures facilitate the utilization of gas streams;
- ii. It is possible to produce liquefied gases that meet standard requirements, without the need for artificial cooling;
- iii. Rational use of the energy of unstable condensates;
- iv. Commercial condensates obtained are characterized by low saturated vapor pressure, which reduces its loss during transportation and storage.

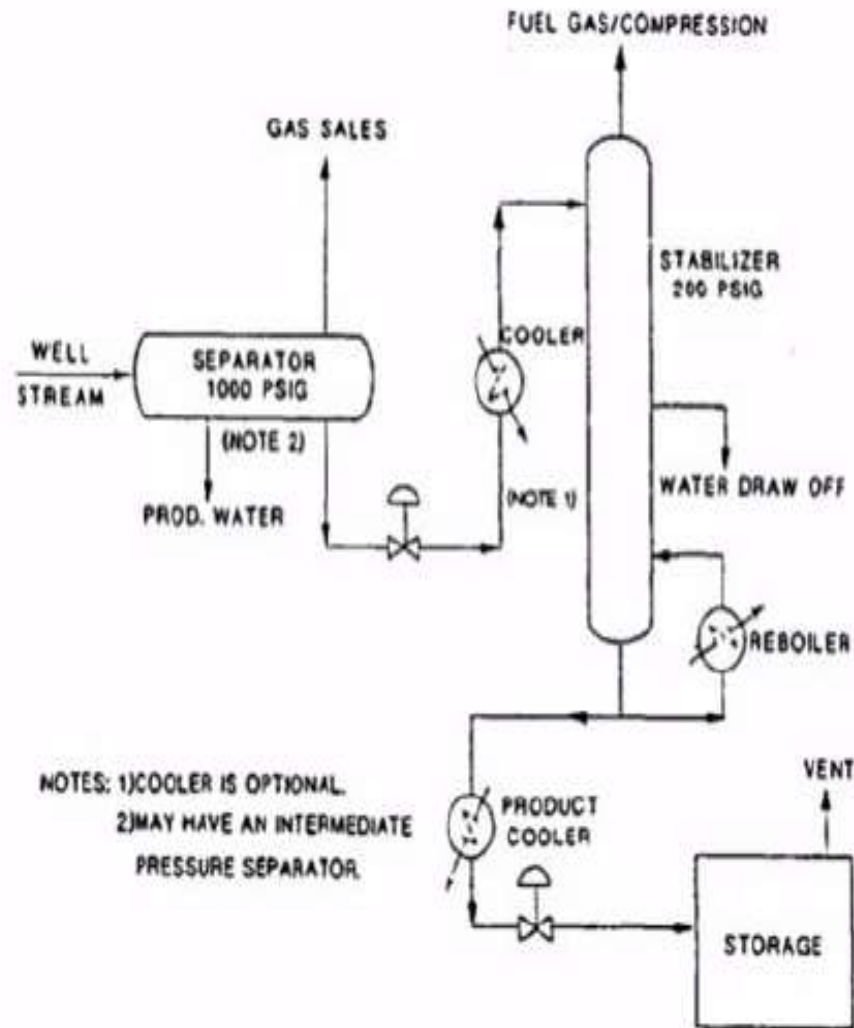
Disadvantages of Stabilization of Gas Condensates by Distillation: The demerits of using the distillation method to stabilize gas condensates are the following:

- i. Complexity of the models;
- ii. High metal and energy consumption.

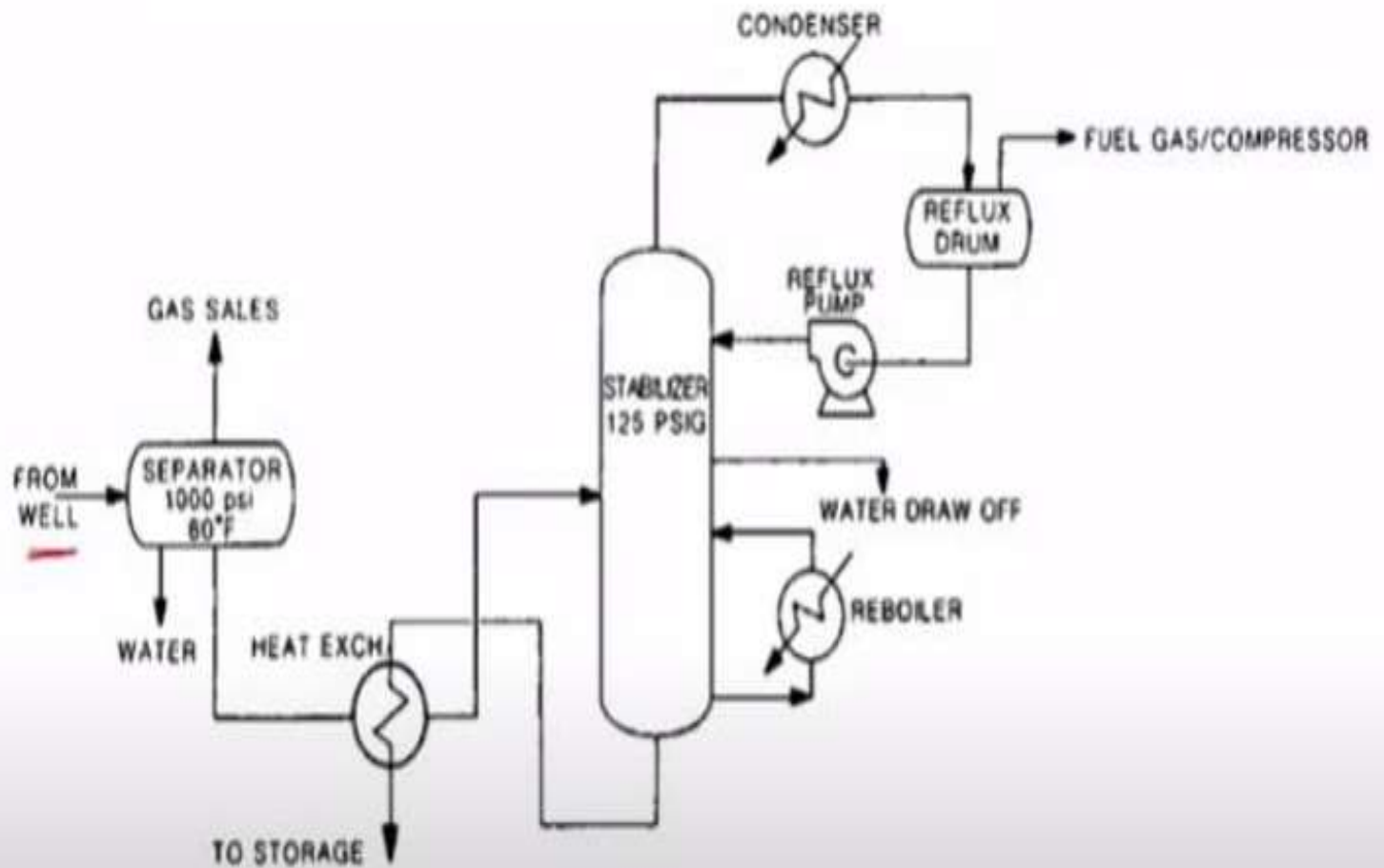
Types of distillation methods: A- **cold feed distillation**, B- **distillation with reflux**



A- Cold feed distillation



B- distillation with reflux





Thank you