

Tikrit University

The College of Petroleum Processes Engineering

Petroleum Systems Control Engineering

Department

Petroleum Refining Processes

Fourth Class

Lecture 9

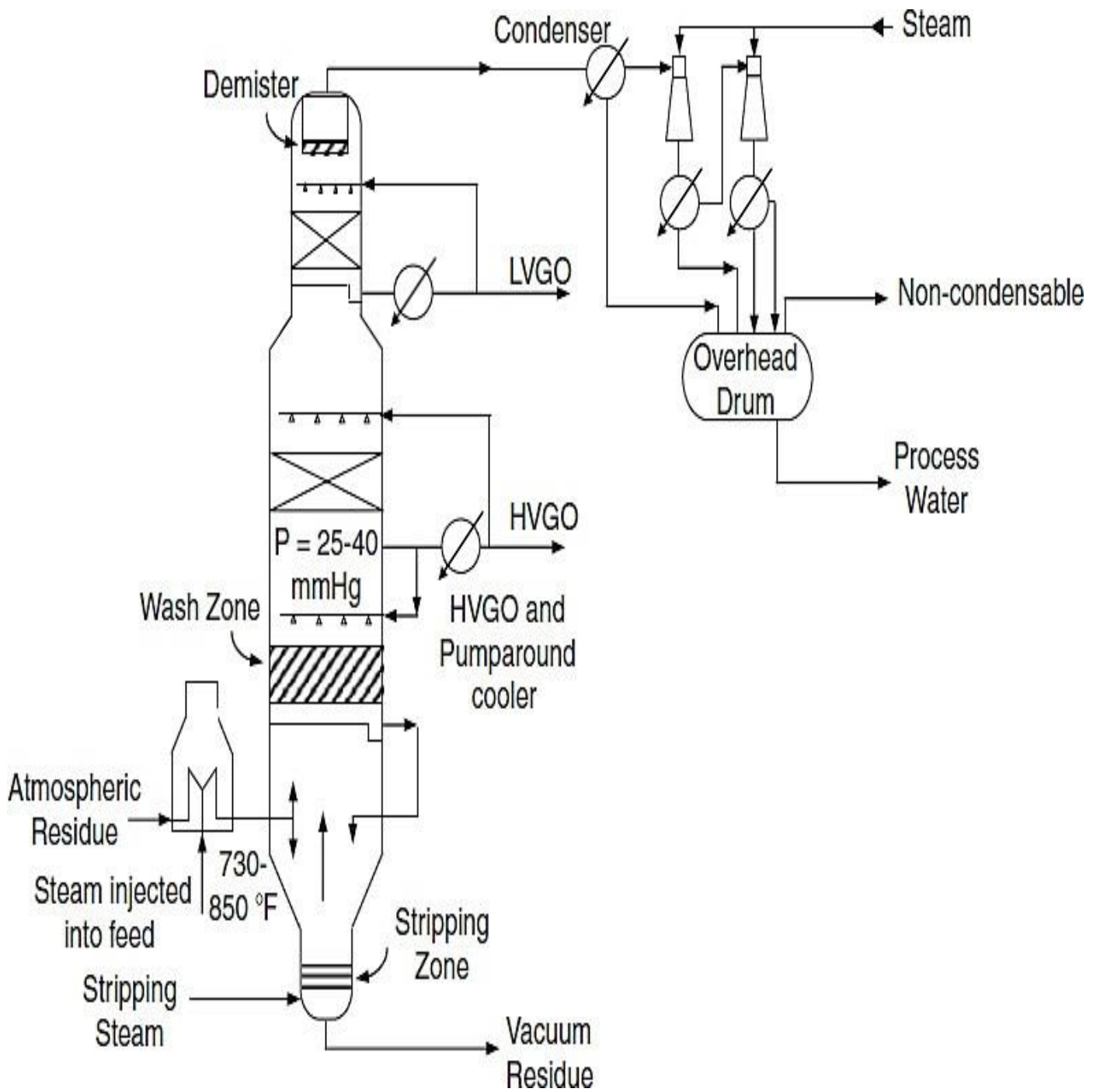
Asst. Teacher: Sundus H. Yousif

Vacuum Distillation of Atmospheric Residue

- ✚ To extract more distillates from the atmospheric residue, the bottom from the atmospheric CDU is sent to the vacuum distillation unit.
- ✚ The vacuum distillates are classified as light vacuum gas oil (LVGO), medium vacuum gas oil (MVGO), and heavy vacuum gas oil (HVGO).
- ✚ The distillation must be performed at absolute pressures as low as 10 to 40 mmHg to limit the operating temperature to less than 370°C.

Major equipment

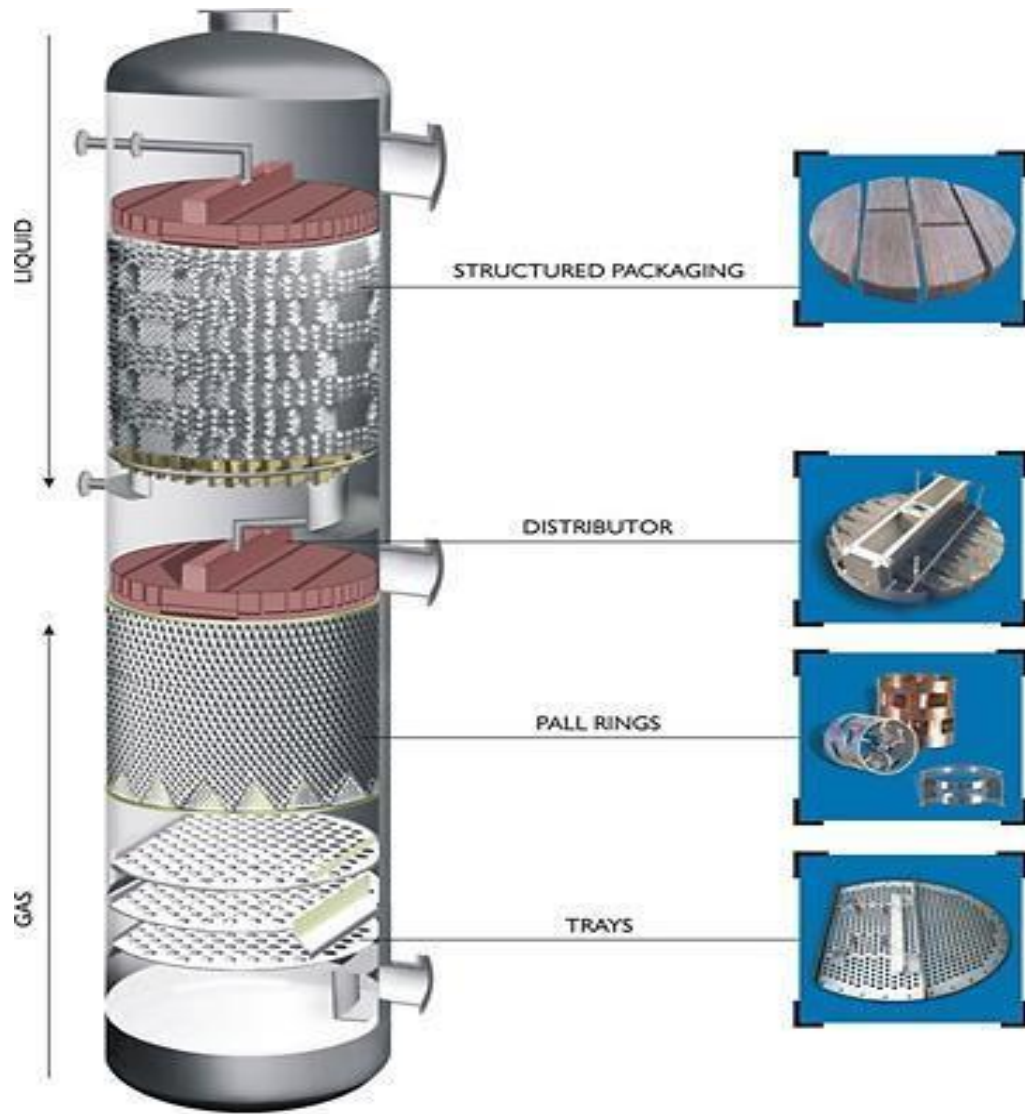
- ✚ Vacuum furnace and vacuum distillation column.
- ✚ Product stripper and products coolers.
- ✚ Overhead ejector system.



Process flow diagram of the vacuum distillation unit.

Vacuum Fractionator

- ✚ The vacuum tower has 4 stripping trays (below the feed) and 6 wash trays (above the feed).
- ✚ The tower has a packed bed (2" metal ball rings) : **packings reduce the pressure drop in the column which is necessary for creating a low vacuum in the lower section of the column and to enhance fractionation and condense the (HVGO) and the wash oil.**
- ✚ This packing material can be either structured sheet metal or randomly dumped packing such as ball rings.
- ✚ **Three chimney trays** for collecting liquid product for withdrawal of LVGO, HVGO.
- ✚ **A demister eliminator** to prevent liquid entrainment with the vapor due to excessive vaporization generated by the vacuum.
- ✚ **Steam injection** to the heater tube passes and the fractionator bottom **which further improves vaporization, minimize thermal cracking and coking.**
- ✚ Heat is removed from the tower by three circulating pumparound systems.
- ✚ Portion of the HVGO is refluxed back to the tower **to provide better fractionation between the HVGO and vacuum residue in the trays 5-10 and improve HVGO end point.**
- ✚ **Larger diameters** are used in the vacuum distillation columns than the atmospheric columns to **control the space velocity of the vapor.**
- ✚ **A wash section** immediately above the flash-zone ensures that the metal content in the lowest side draw is minimized.
- ✚ Heavy distillate from the wash trays is recycled to the heater inlet or withdrawn as metal cut.

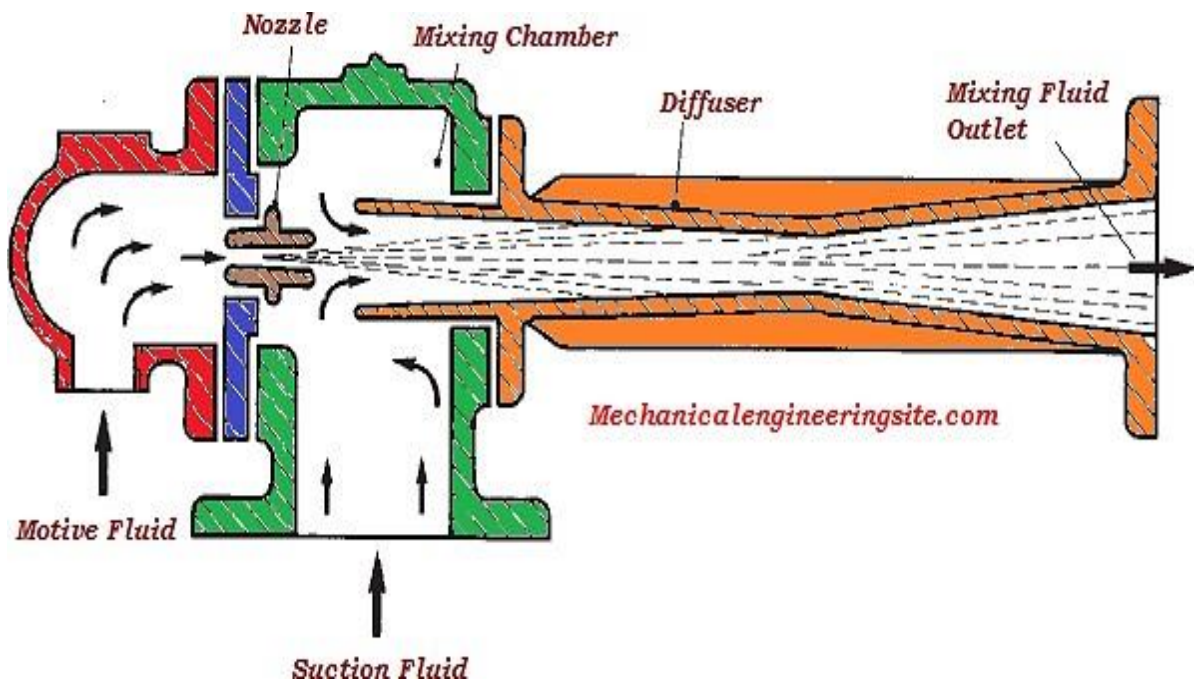


Vacuum generating system

- ✚ The type of **vacuum pump** needed will depend on **the degree of vacuum required, the capacity of the system, and the rate of air in-leakage.**
- ✚ **Steam-jet ejectors** are economic vacuum pumps used particularly in vacuum distillation. They can handle high vapor flow rates and, when several ejectors are used in series, can produce low pressures, down to about 0.1 mmHg (0.13 mbar).

The advantages of ejector:

- ✚ Simple, reliable means of producing vacuum.
- ✚ low installed cost as well.
- ✚ They are commonly found in process plants having available steam.
- ✚ They provide many years of trouble-free operation.



Flow pattern in steam ejector