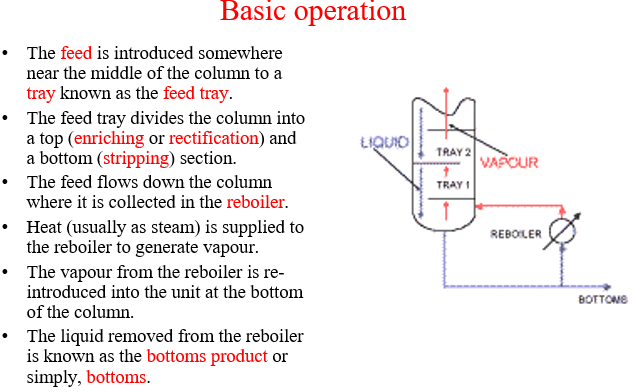
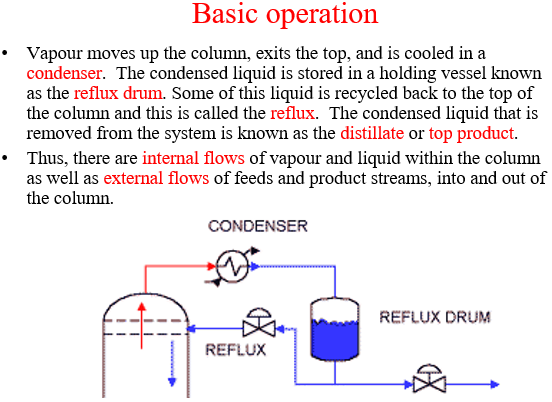
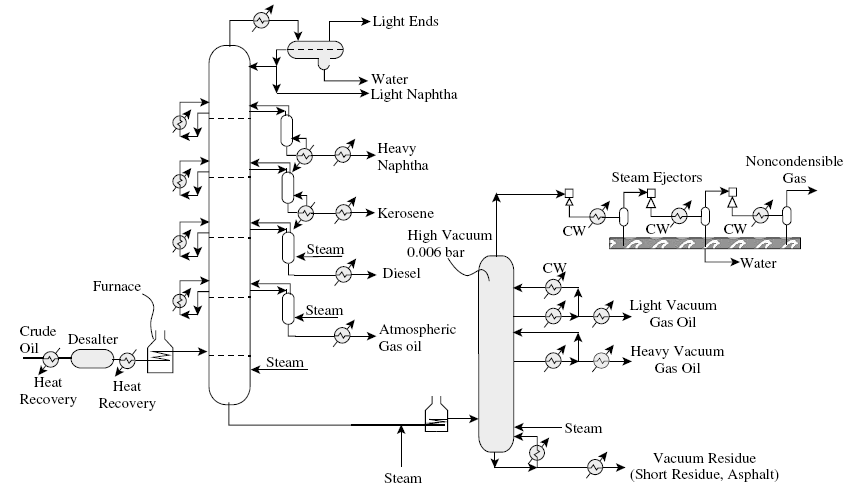
**Distillation Process**

The distillation columns consisting of both **main** and **secondary** crude distillation columns.

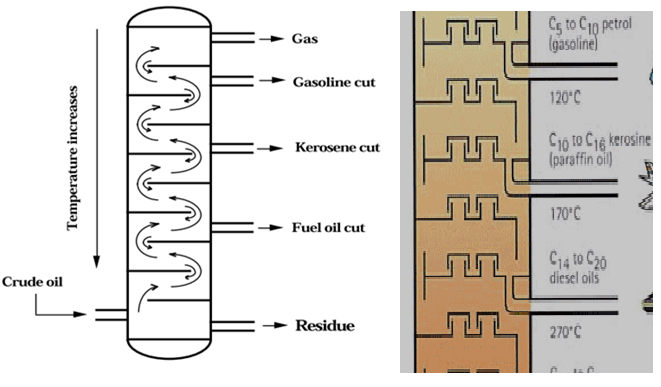




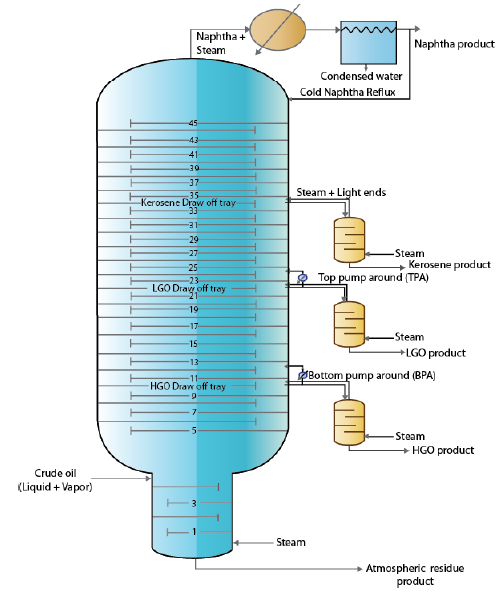


The first and the most fundamental step in the refining process (after the crude oil has been cleaned and any remnants of brine removed) is distillation, which is often referred to as the primary refining process.

* Distillation involves the separation of the different hydrocarbon compounds in a crude oil into a number of different fractions (**cuts**).
* In the atmospheric distillation process , heated crude oil is separated in a distillation column (distillation tower, fractionating tower, atmospheric pipe still) into streams that are then purified, transformed, adapted, and treated in a number of subsequent refining processes, into products for the refinery’s market. *The lighter, more volatile, products separate out higher up the column, whereas the heavier, less volatile, products settle out toward the bottom of the distillation column.*
* The fractions produced in this manner are known as straight run fractions.
* The only condenser in the main column is a partial condenser to facilitate the production of both gas and naptha + water stream.



**Case study:** Distillation unit with 45 tray



**a-** The main column consists of 45 trays and the secondary columns (side strippers) consist of 4 trays each. Three side strippers are used to strip the light ends from kerosene, LGO and HGO products.

**b-** The main column has two sections that are distinguished with respect to a flash zone. The flash zone is where the crude oil partially vaporized is fed to the main column. There are about 4 trays below the flash zone and 41 trays above the flash zone of the main column. The bottom most tray (residue stripping tray) is numbered as 1 and the top tower tray is numbered as 45. Trays 1 to 4 process the atmospheric residue portion of the crude in the section below the flash zone.

**c-**Trays 5 to 10 (6 trays above the flash zone) process the HGO product portion of the crude. From tray 10, HGO draw off product is taken out (as liquid) and enters the HGO side stripper unit. From tray 10 as well, the liquid stream is drawn and sent to tray 12 via a bottom pump around unit that enables cooling of the liquid stream. The steam + light ends from the HGO side stripper enter tray 11 of the main column.

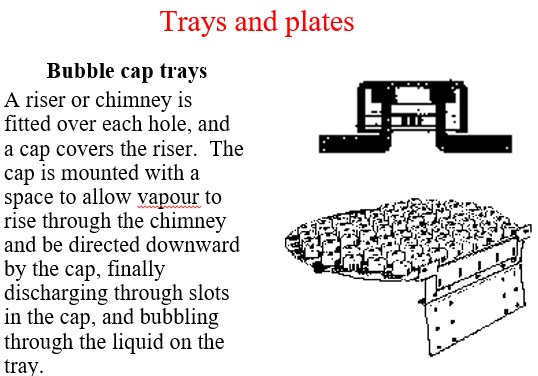
**d-**Trays 13 to 22 (10 trays above the HGO processing zone) process the LGO product portion of the crude. From tray 22, LGO draw off product is taken (as liquid) and sent to the LGO side stripper unit. Also, from tray 22, another liquid stream is taken out and sent to tray 24 via a top pump around unit (TPA) that enables cooling of the liquid stream. The steam + light ends from the LGO side stripper enter tray 23 of the main column.

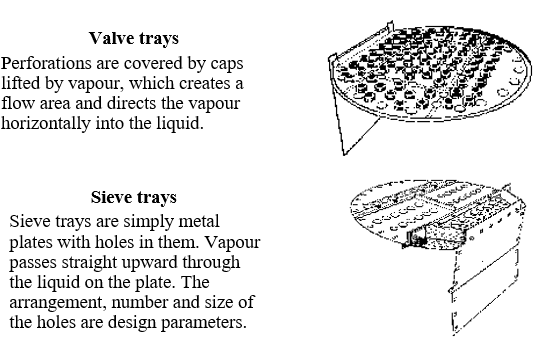
**e-**Trays 24 to 34 (10 trays above the LGO processing zone) process the kerosene product portion of the crude. From tray 34, the kero draw off stream is taken and sent to the kerosene side stripper unit. The steam + light ends of the kerosene side stripper enter tray 35.

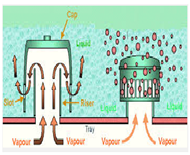
**f-**Trays 34 to 45 (12 trays above the Kerosene processing zone) process the naphtha product portion of the crude.

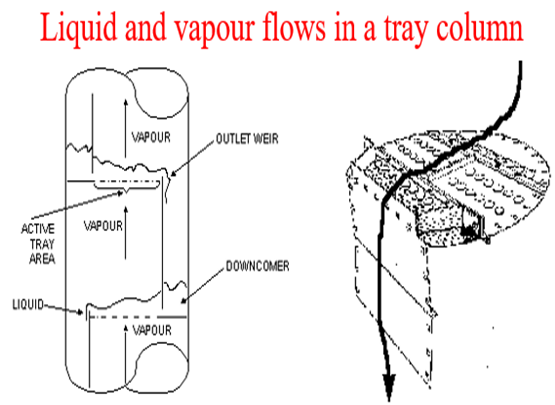
**g-** It is interesting to note that steam enters main column at trays 1, 11, 23, 35 and therefore is present along with the vapor stream along with the hydrocarbons. Therefore, **steam balances throughout the column are very important.**

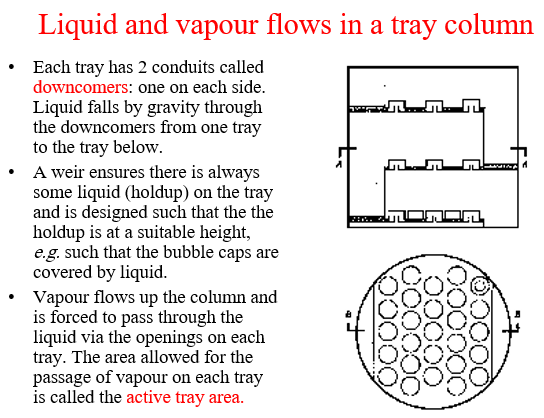
**h-** The cold naphtha stream obtained from the phase separator is sent back to the main column as reflux stream.





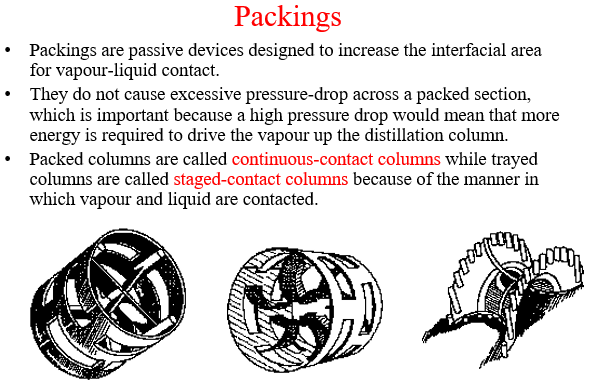






Most of the column uses [packing material](https://en.wikipedia.org/wiki/Packed_bed) for the vapor–liquid contacting because such packing has a lower pressure drop than distillation trays. This packing material can be either [structured sheet metal](https://en.wikipedia.org/wiki/Packed_bed) or randomly dumped packing such as [Raschig rings](https://en.wikipedia.org/wiki/Packed_bed).





**Kinds of Reflux :**

Ways of removing heat are indicated in Fig below , the types of reflux:

**1- Cold Reflux :**is defined as reflux that is supplied at some temperature below the temperature at the top of the tower. Each pound of this reflux removes a quantity of heat equal to the its latent heat and the sensible heat required to raise it temperature from the storage tank temperature to the temperature at the top of the tower



**2- Hot Reflux :**Admitted to the tower at the same temperature . Reflux or over flow from plate to plate in the tower is essentially hot reflux because it is always substantially at its boiling point.

Hot reflux capable of removing only the latent heat because no difference in temperature is involved



**3- Circulating Reflux :**It is not vaporized. It is only able to remove the sensible heat thatis represented by its change in temperature as it circulate. This reflux is withdrawn from thetower as a liquid at a high temperature as a liquid and is returned to the tower after havingbeen cooled.



