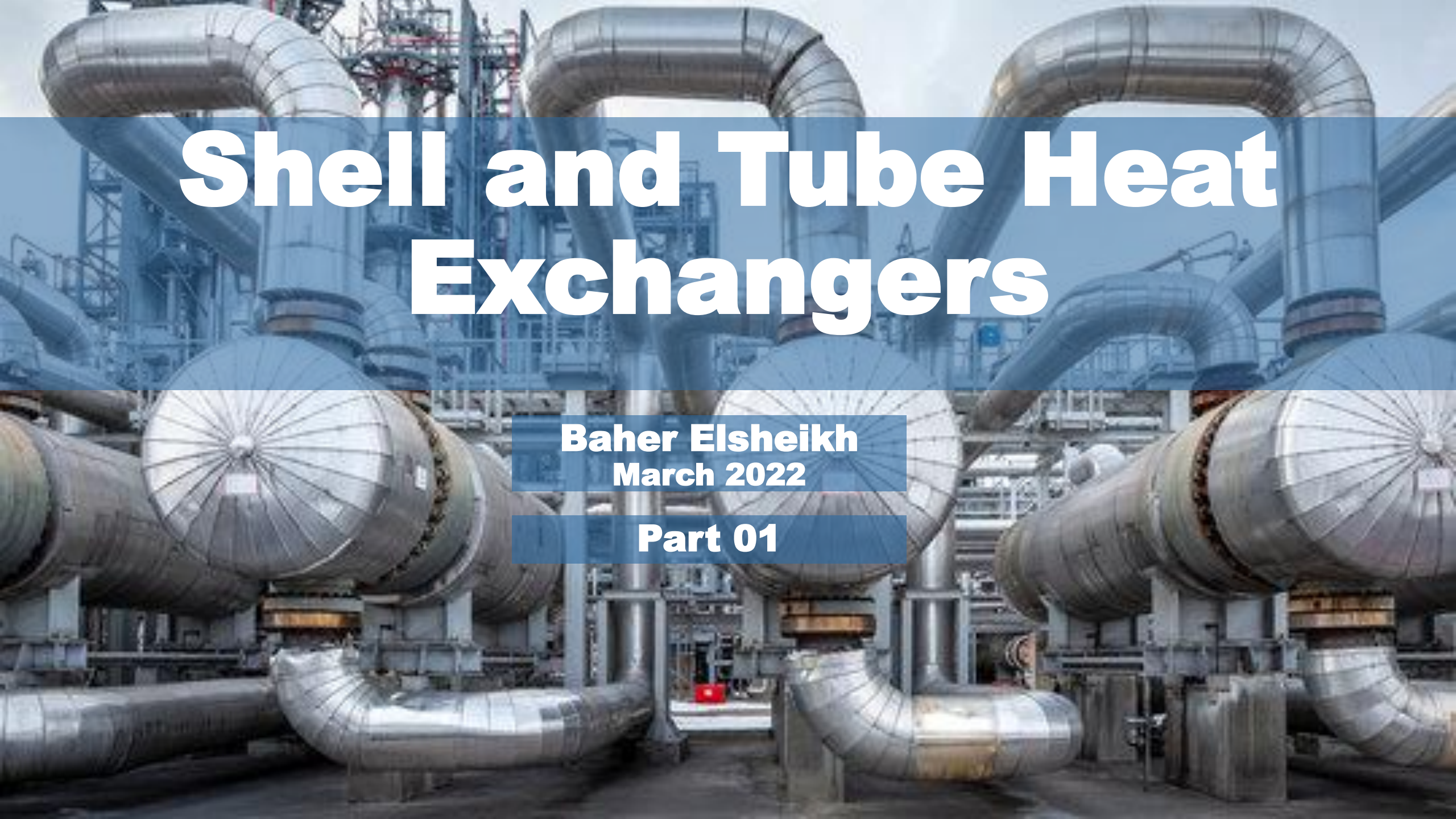


Shell and Tube Heat Exchangers

Baher Elsheikh

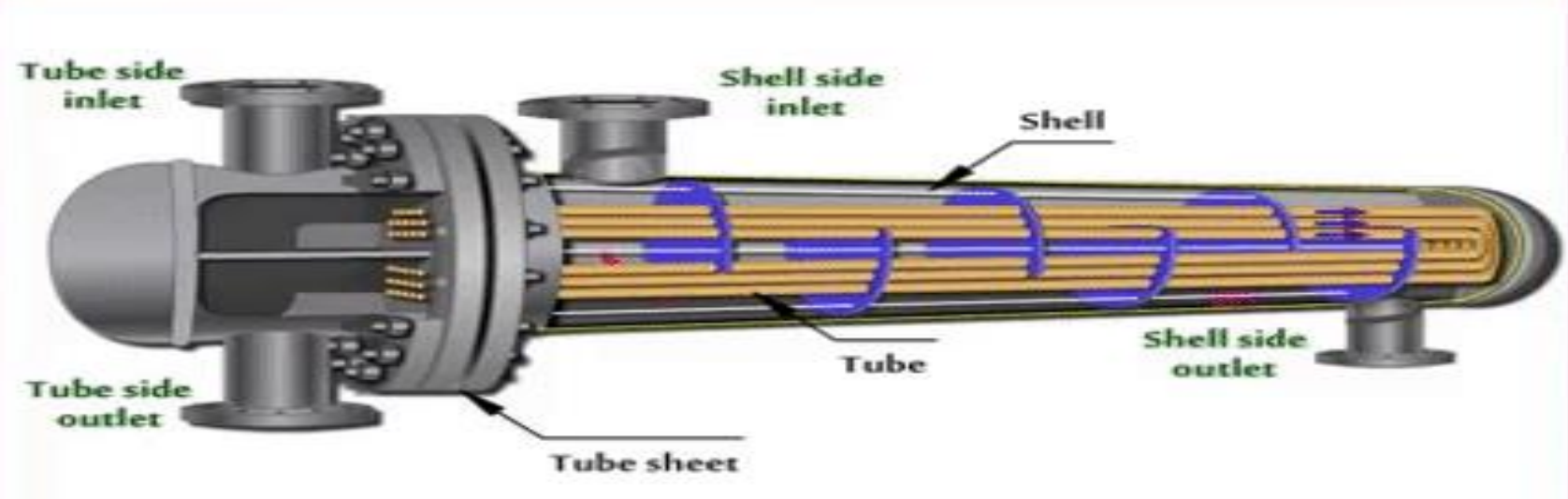
March 2022

Part 01

Introduction to Heat Exchangers

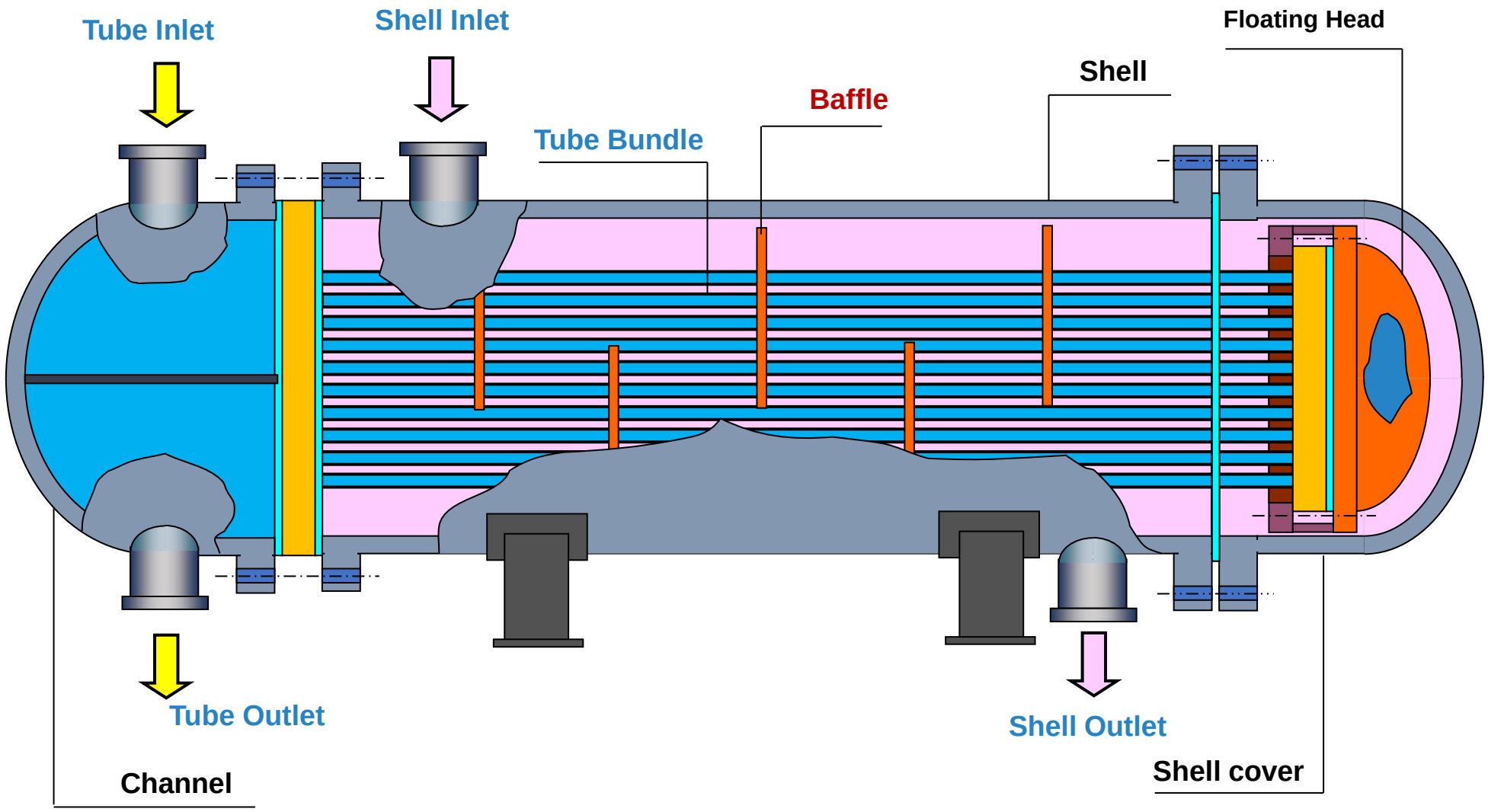
Shell and Tube Heat Exchanger is a type of exchangers used to transfer thermal energy between two fluids. The two fluids are not indirect contact; one pass in the tubes and the other in the shell.

Shell and Tube Heat exchangers are one of the most common equipment found in all oil and gas plants, petrochemical and power plants.



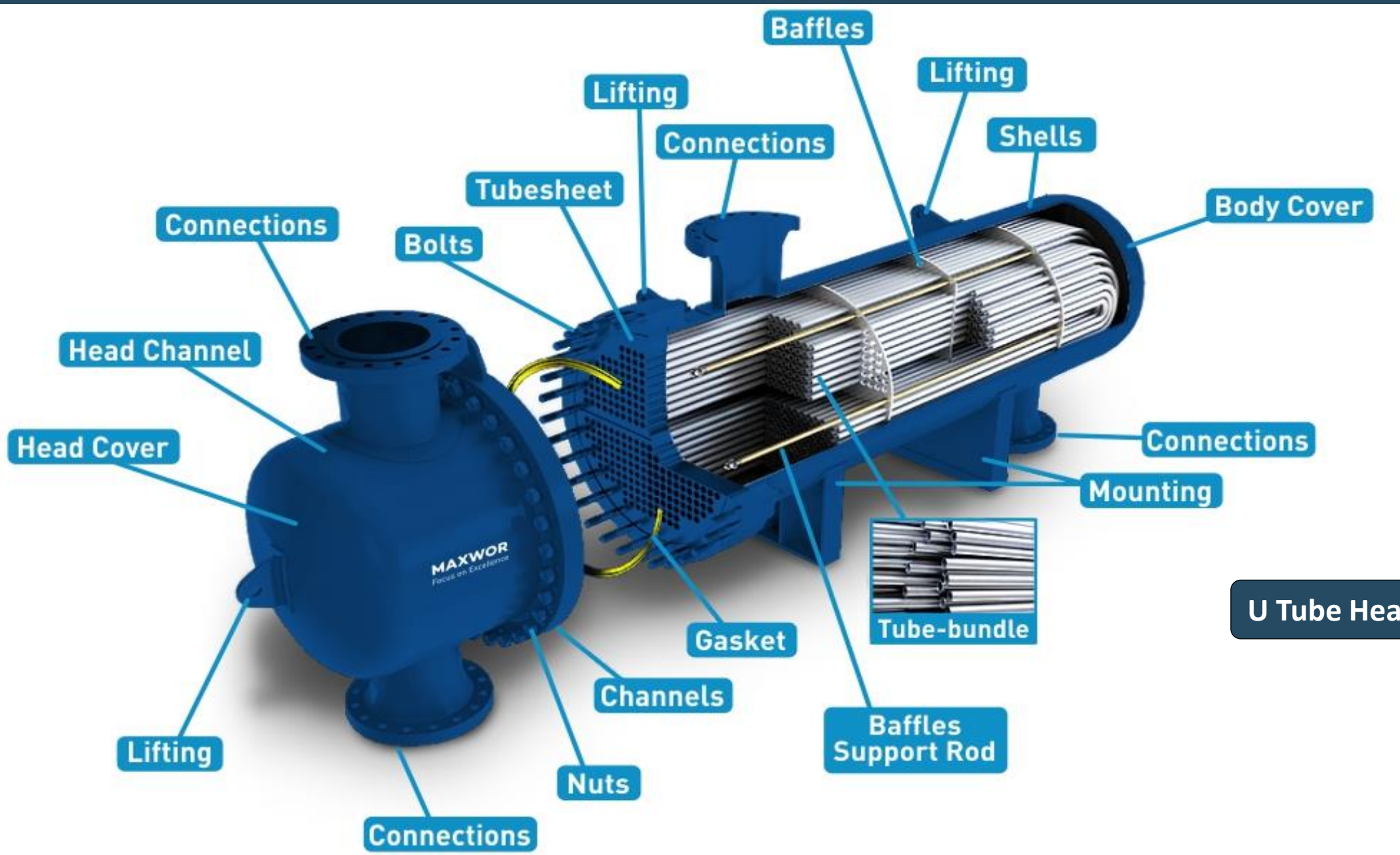
Animation from: gfycat.com

Construction and Main Parts of Shell and Tube Heat Exchanger



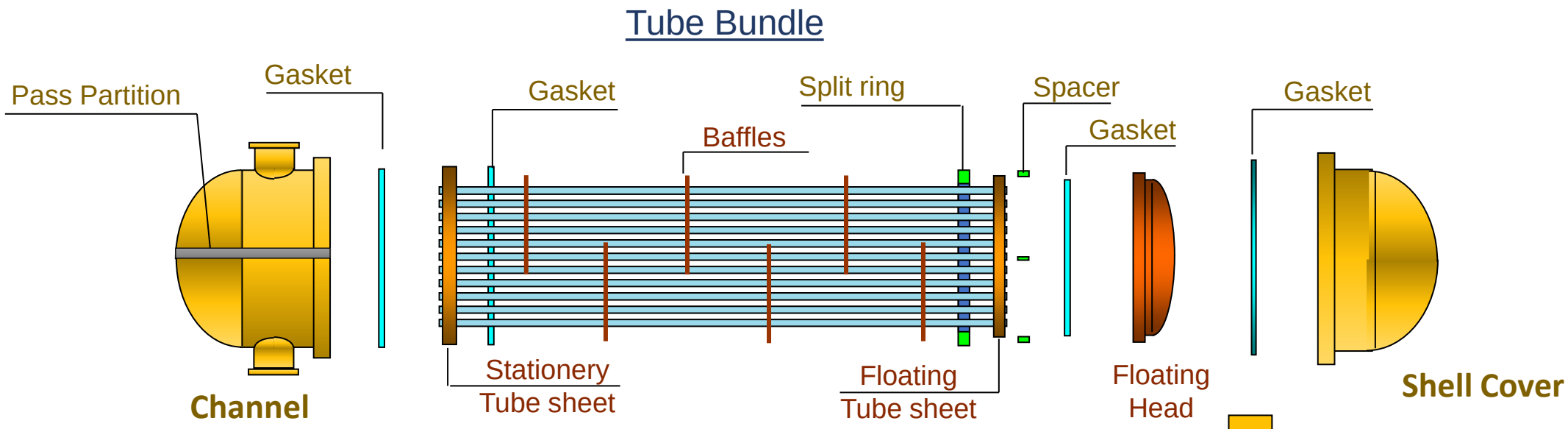
Floating Head Tube Heat Exchangers

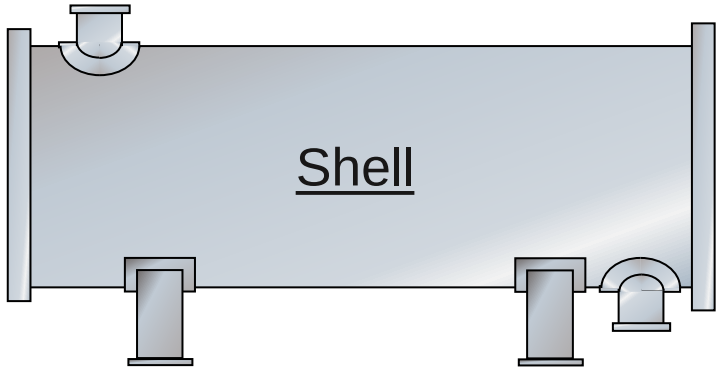
Construction and Main Parts of Shell and Tube Heat Exchanger

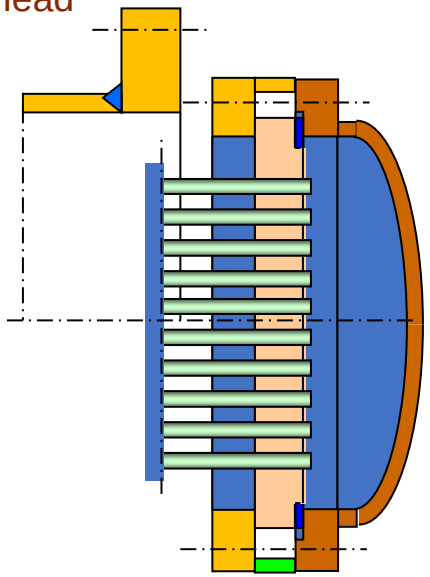


U Tube Heat Exchangers

Construction and Main Parts of Shell and Tube Heat Exchanger

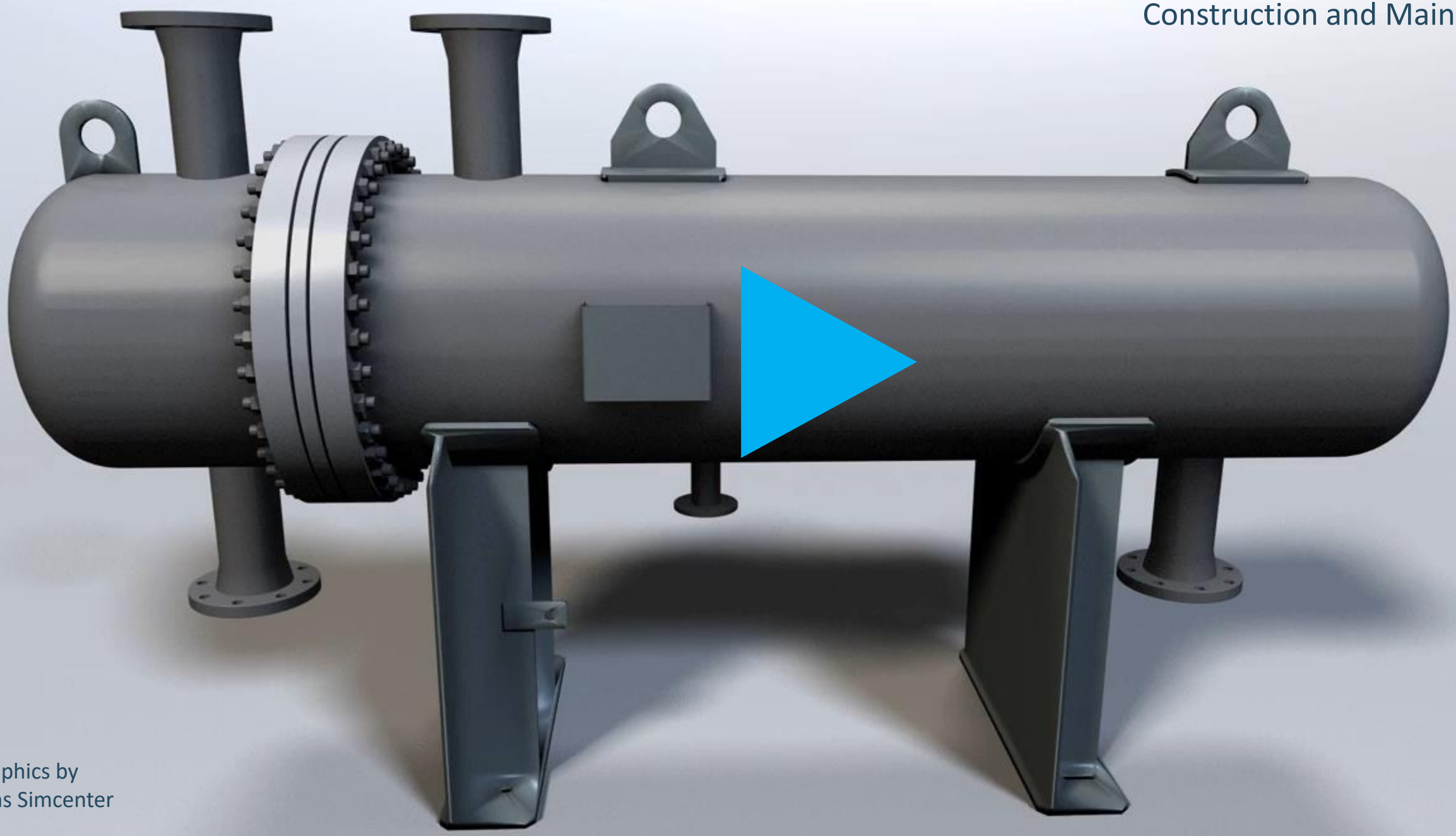






Floating Head Detail

Construction and Main Parts



Graphics by
Siemens Simcenter

Function and Classification

Heat Exchanger: Both sides single phase and process stream

Cooler: One stream process fluid and the other cooling media (water / air)

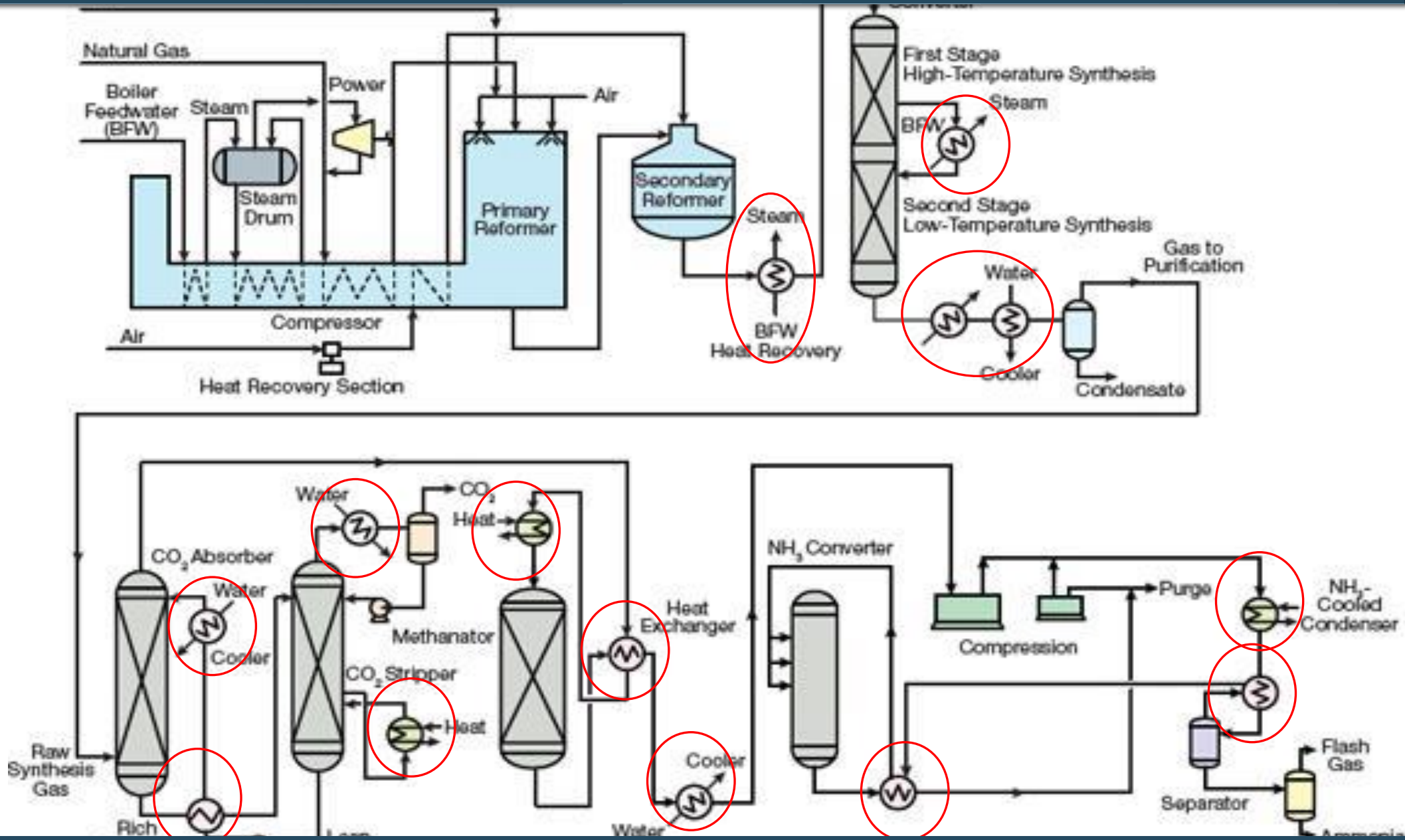
Heater: One stream process fluid and the other heating utility (steam)

Condenser: One stream condensing vapor and the other cooling media (water / air)

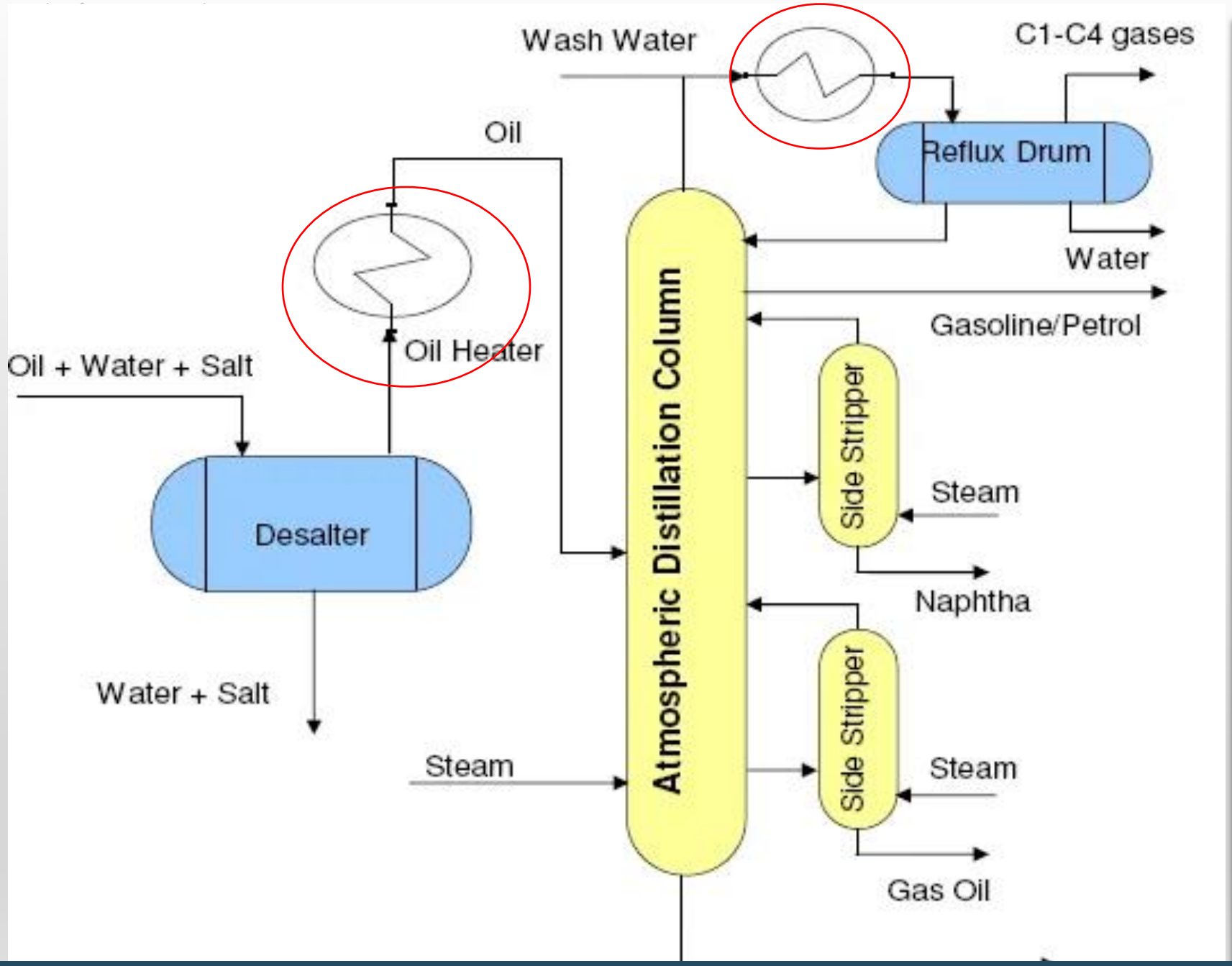
Reboiler: One stream bottom stream from distillation column and the other a hot utility of process stream

Applications in Process Plants

Ammonia Plant

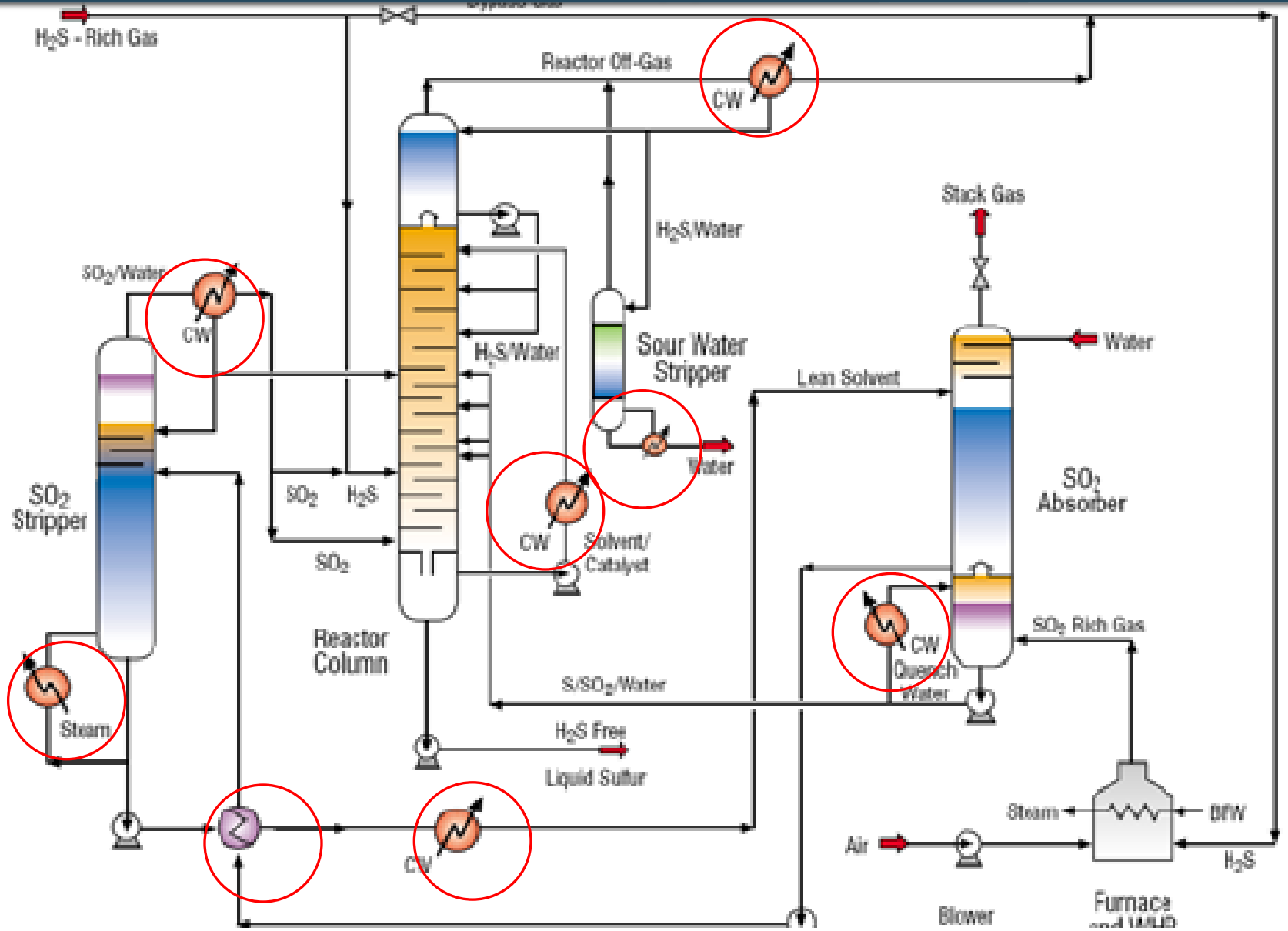


Atmospheric Distillation Unit (ADU)



Applications in Process Plants

Applications in Process Plants



Sulfur Recovery Unit
By KBR

www.researchgate.net

Applications in Process Plants

Kettle Reboiler of Distillation Towers

Distillation set-ups typically use condensers to condense distillate vapors back into liquid

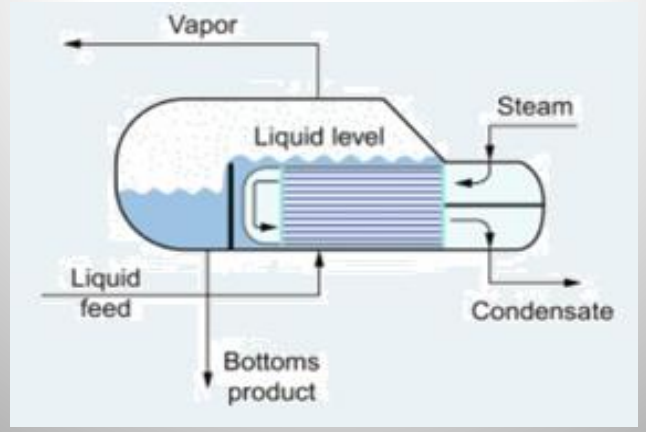
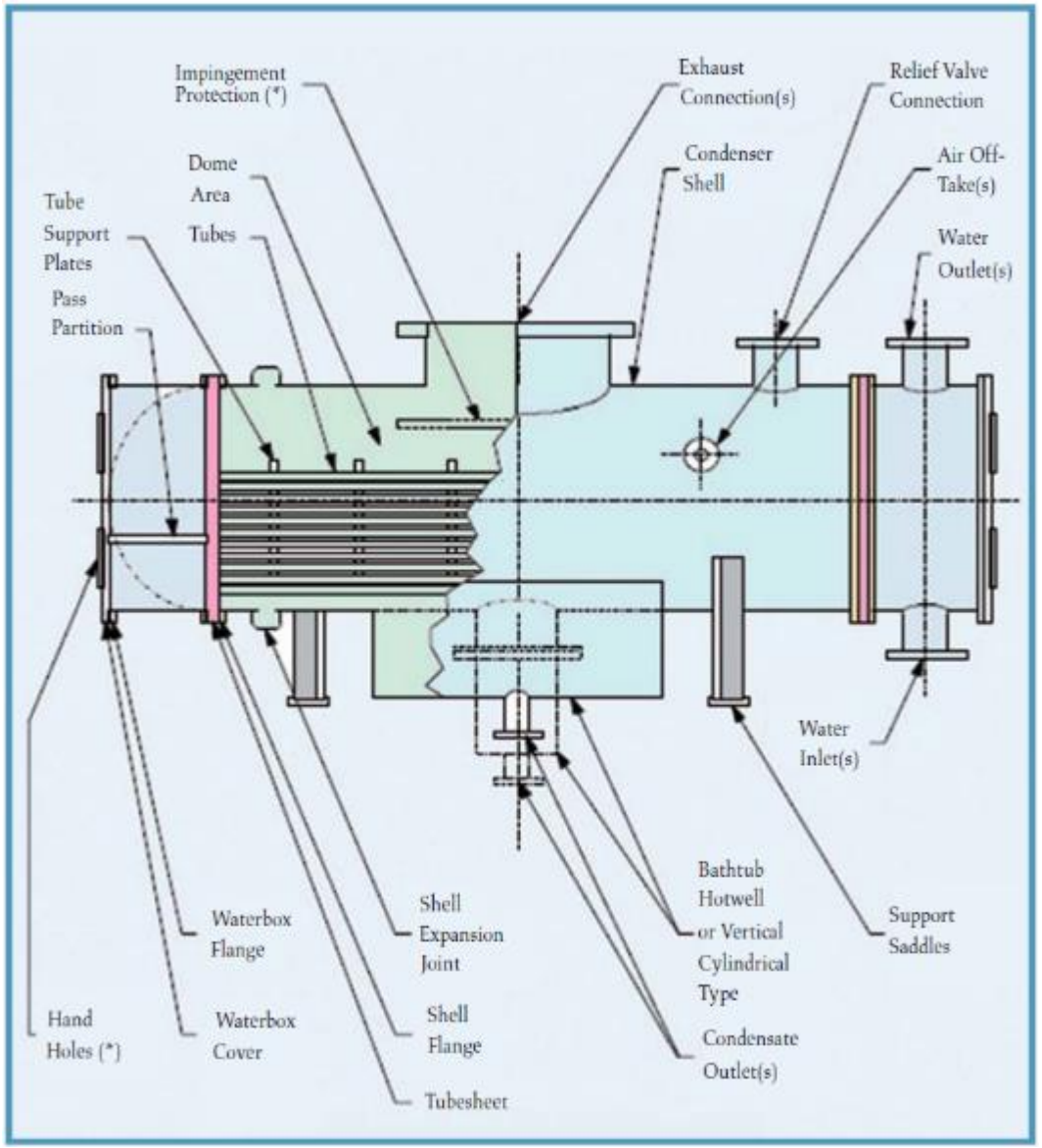


Photo from: www.flickr.com



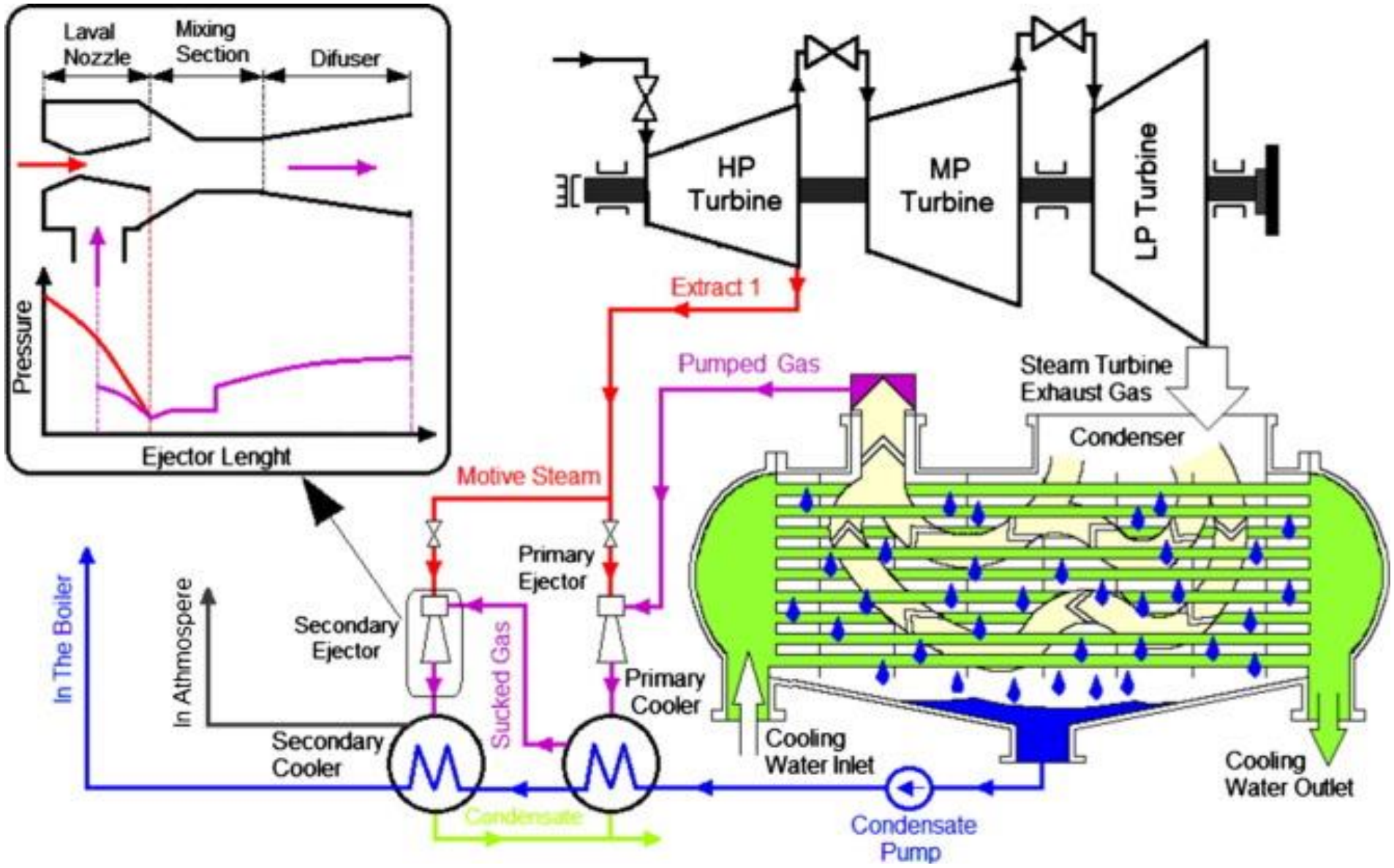
Surface Condenser

The function of a surface condenser is to create the lowest possible turbine or process operating back pressure while condensing steam. The condensate generated is usually recirculated back into the boiler and reused

This condensing effect is a rapid change in state from a gas to a liquid. This change in state results in a great reduction in specific volume and it is this reduction in volume that creates the vacuum in the condenser.

A vacuum venting system is utilized to support the condenser vacuum by continually removing any air entering the system

Steam Turbines
Surface Condenser



www.sciencedirect.com

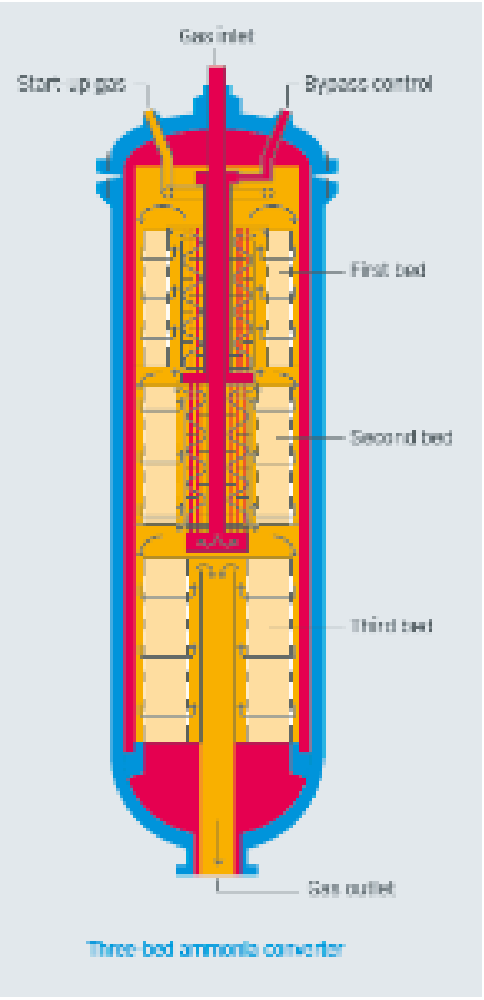
Applications in Process Plants

Centrifugal Compressors

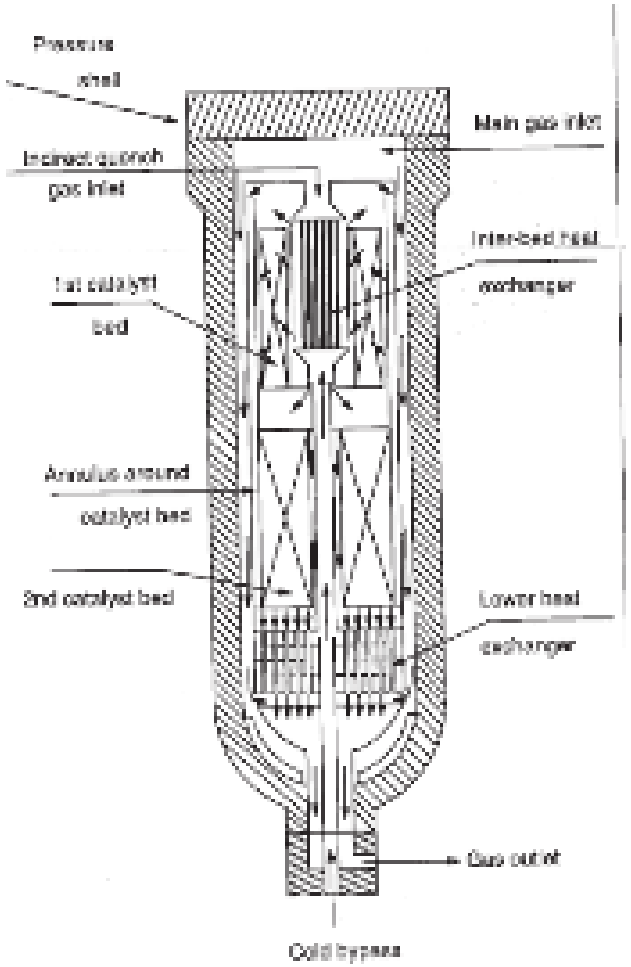
Intercoolers & After Coolers

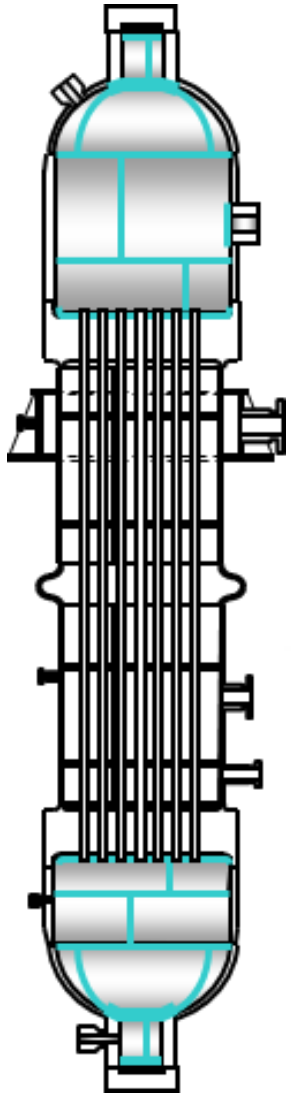
www.ingersollrand.com

Applications in Process Plants

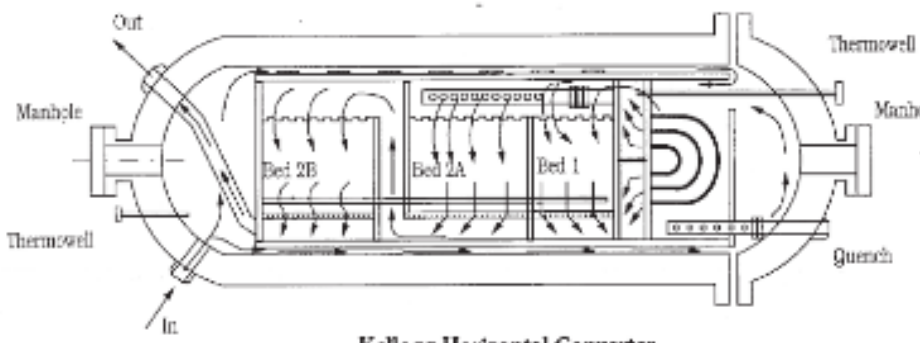


Three bed ammonia converter





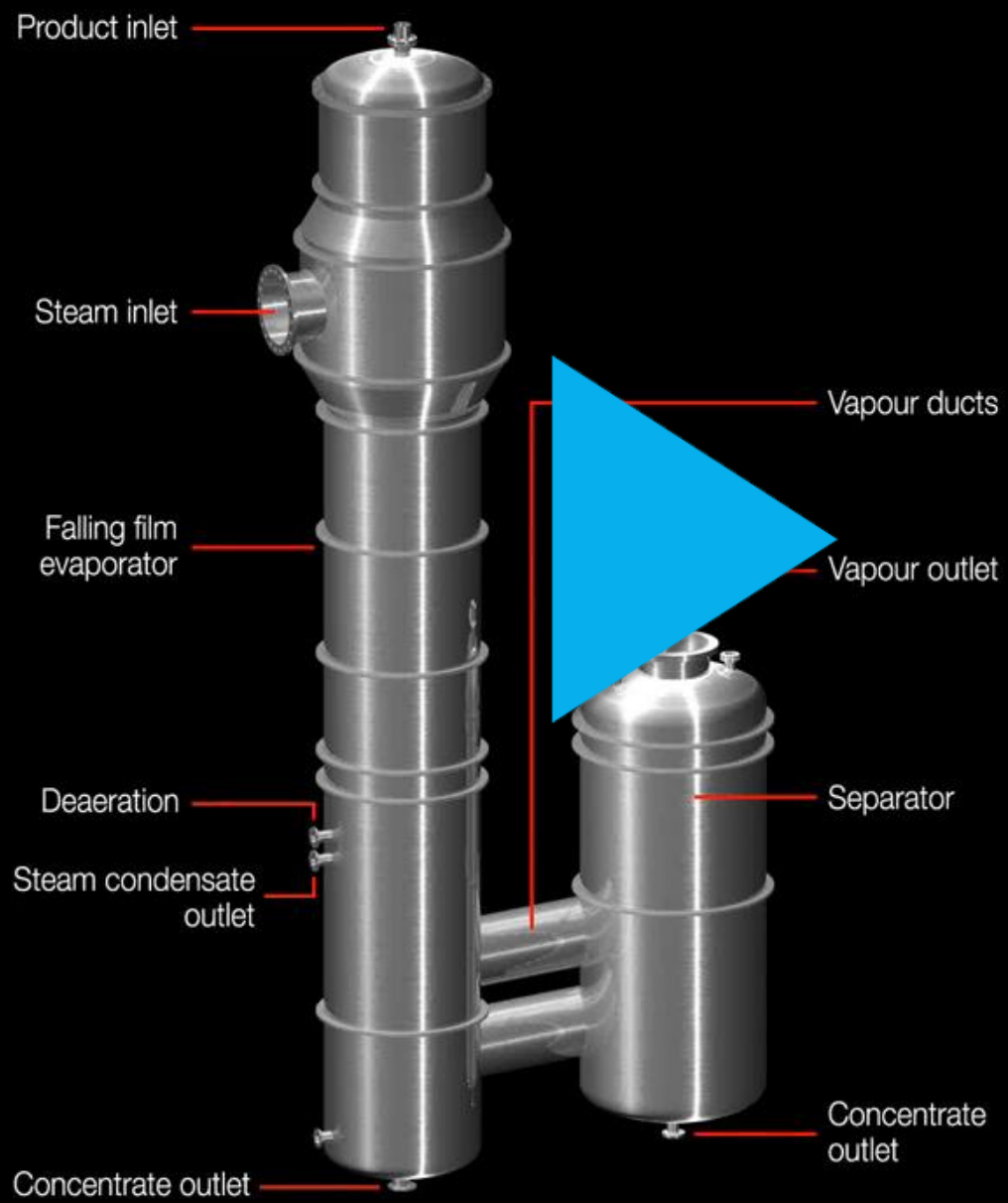
Being part of reactors



Kellogg Horizontal Converter.

Applications in Process Plants

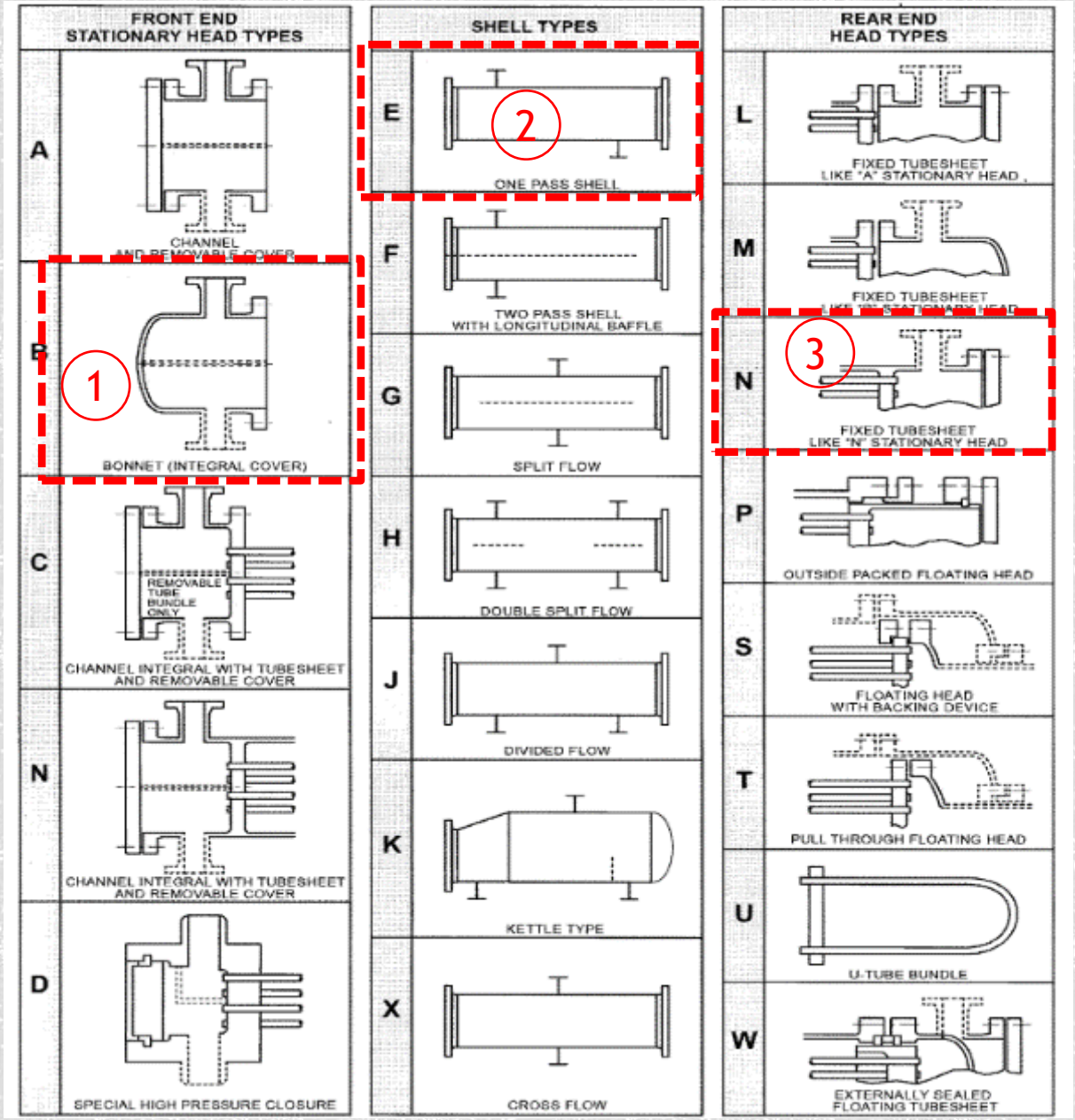
gea.com



Animation: INware, Karlsbad

Falling film evaporator

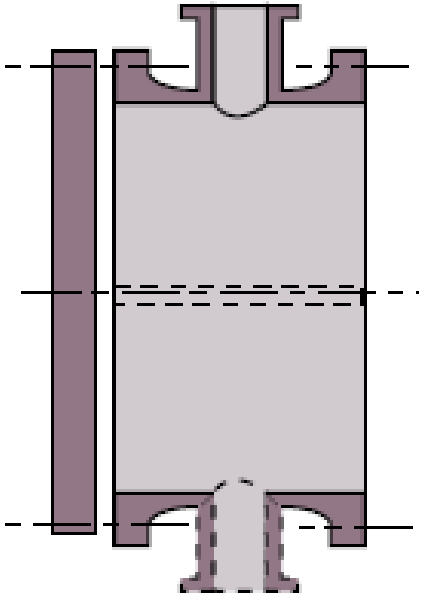
Falling-film evaporators are vertical shell-and-tube heat exchangers that are usually steam-heated on the shell side. The liquid flows downwards along the inner walls of the tubes and is thus partially evaporated



TEMA TYPES

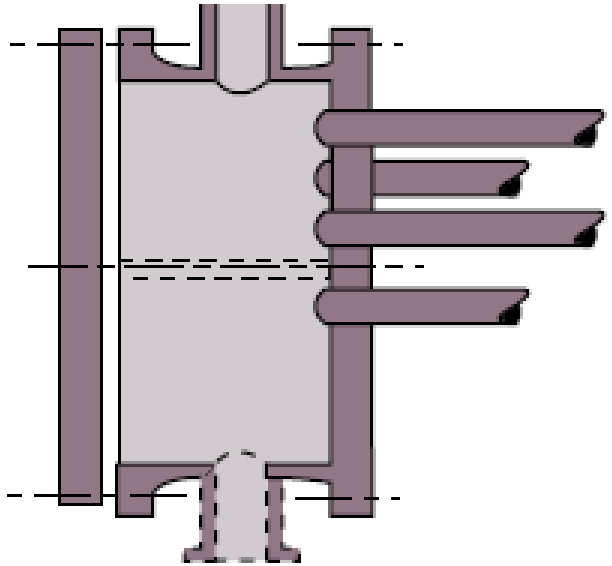
B E N

TEMA FIGURE N-1.2



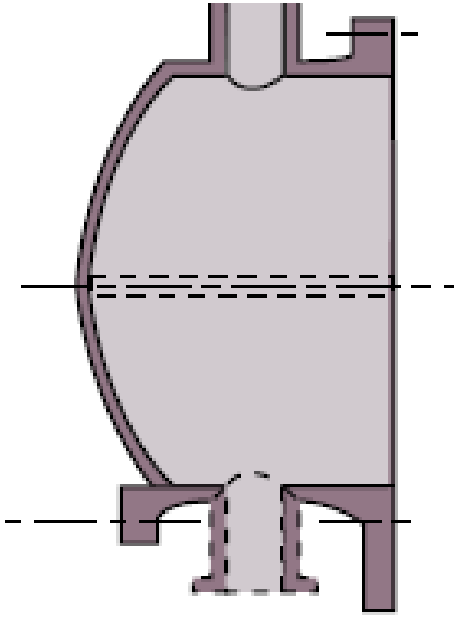
Removable Channel and Cover

A - Type



Integral With Tubesheet
Removable Cover

B - Type

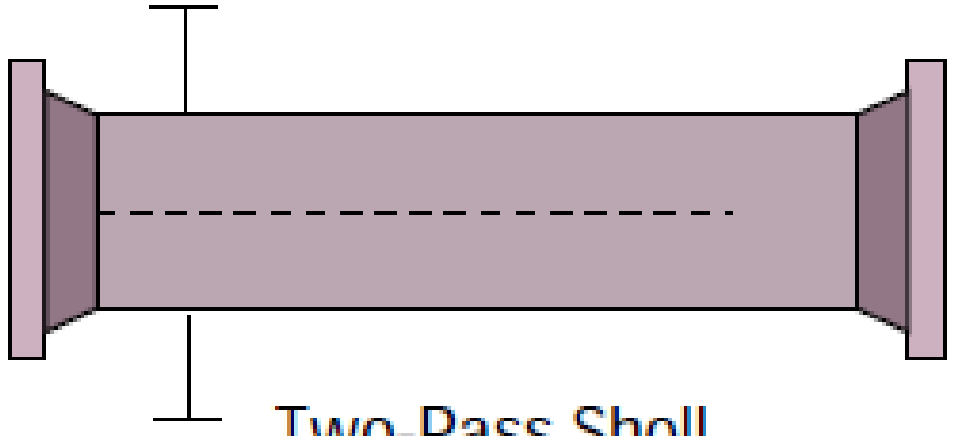


Bonnet (Integral Cover)

C - Type

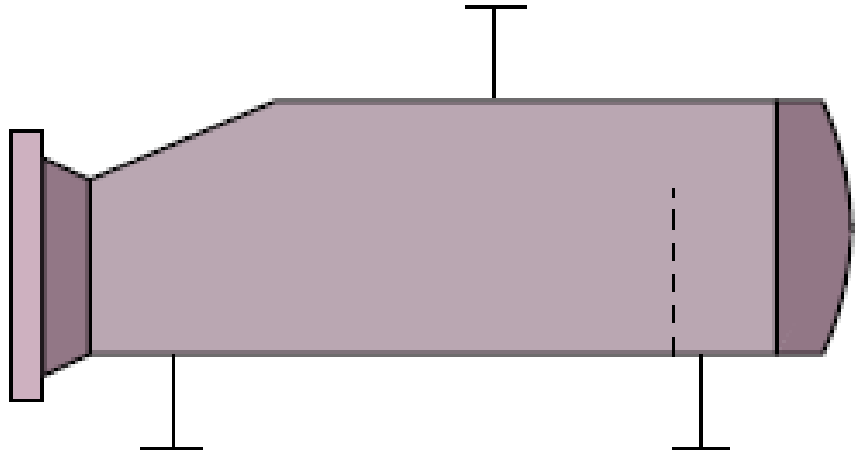
Front Head

Shell Types



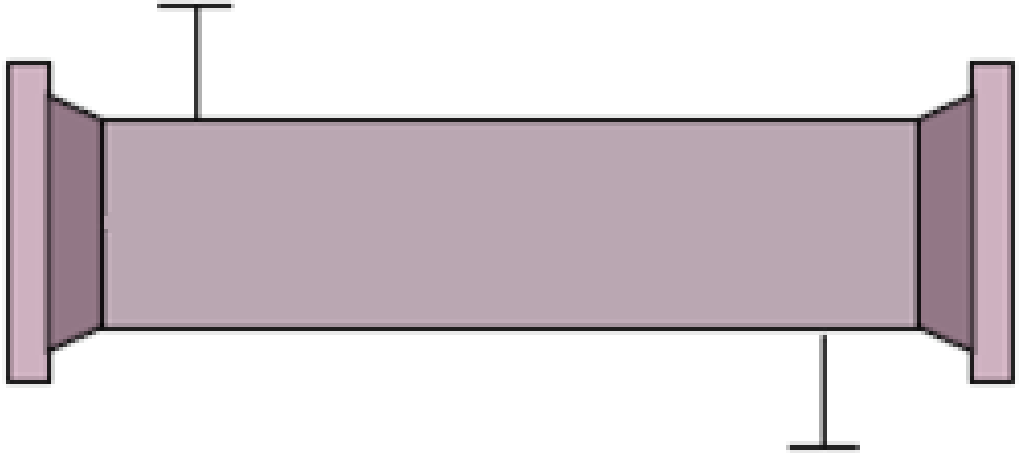
Two-Pass Shell with Longitudinal Baffle

F - Type



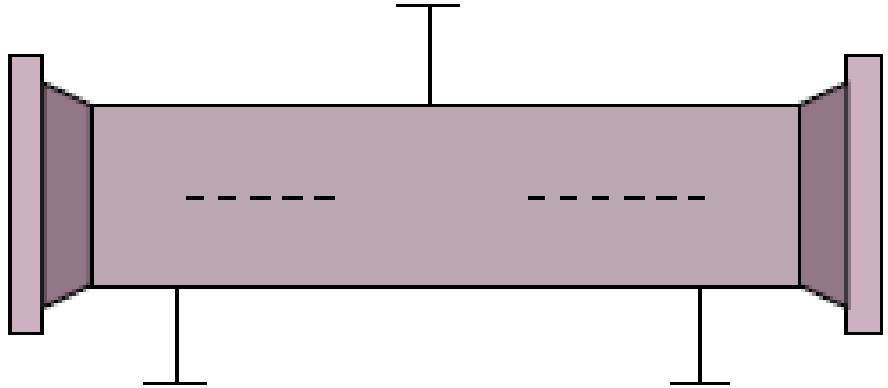
Kettle-Type Reboiler

K - Type



One-Pass Shell

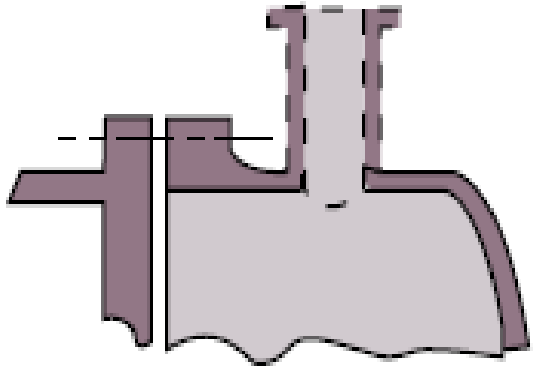
E - Type



Divided Flow

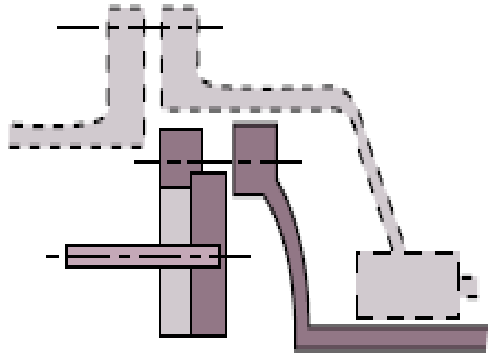
J - Type

Rear End Head Types



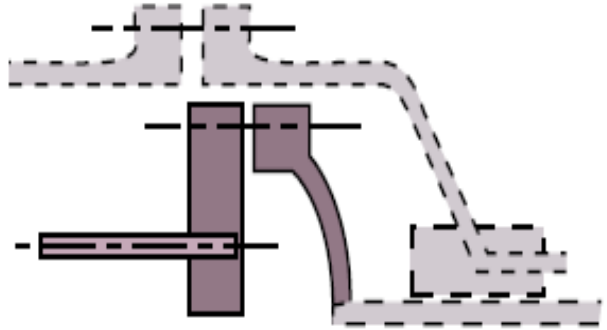
M - Type

Fixed Tubesheet



S - Type

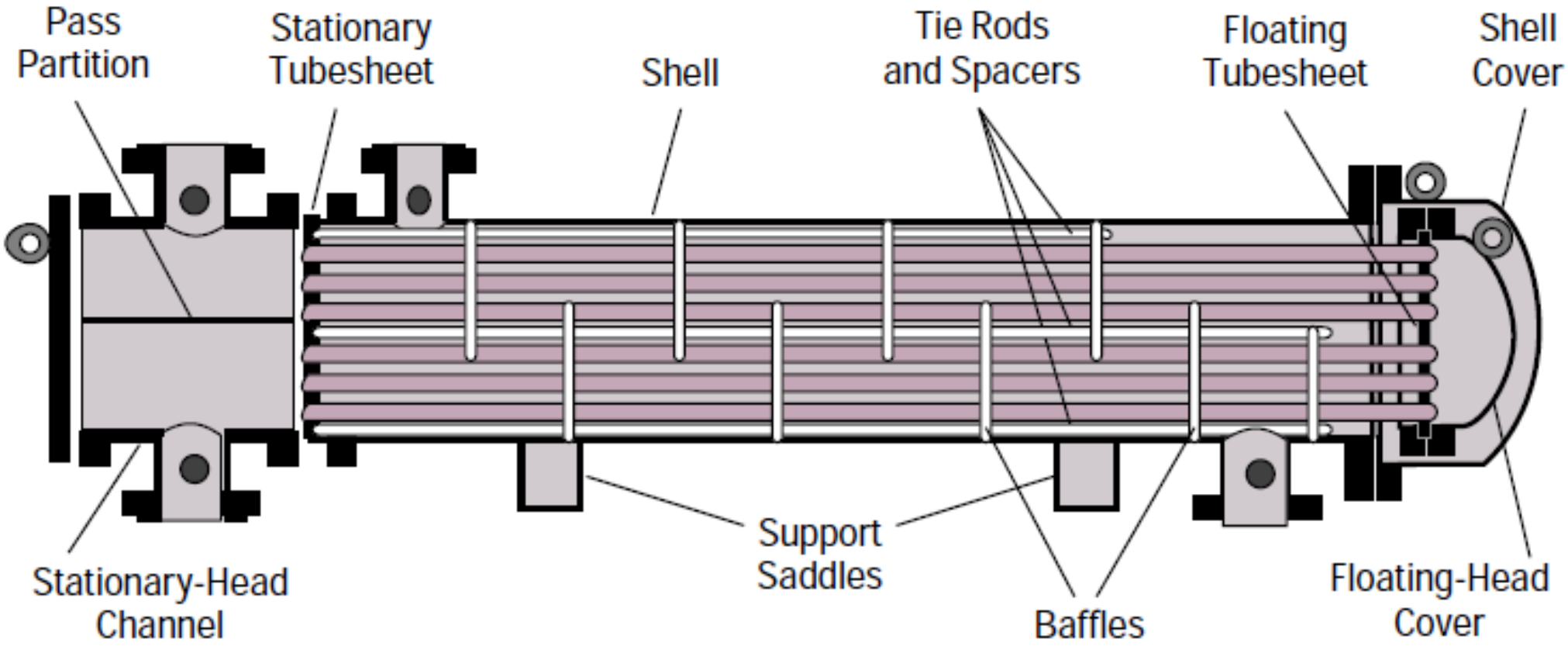
Floating Head



T - Type

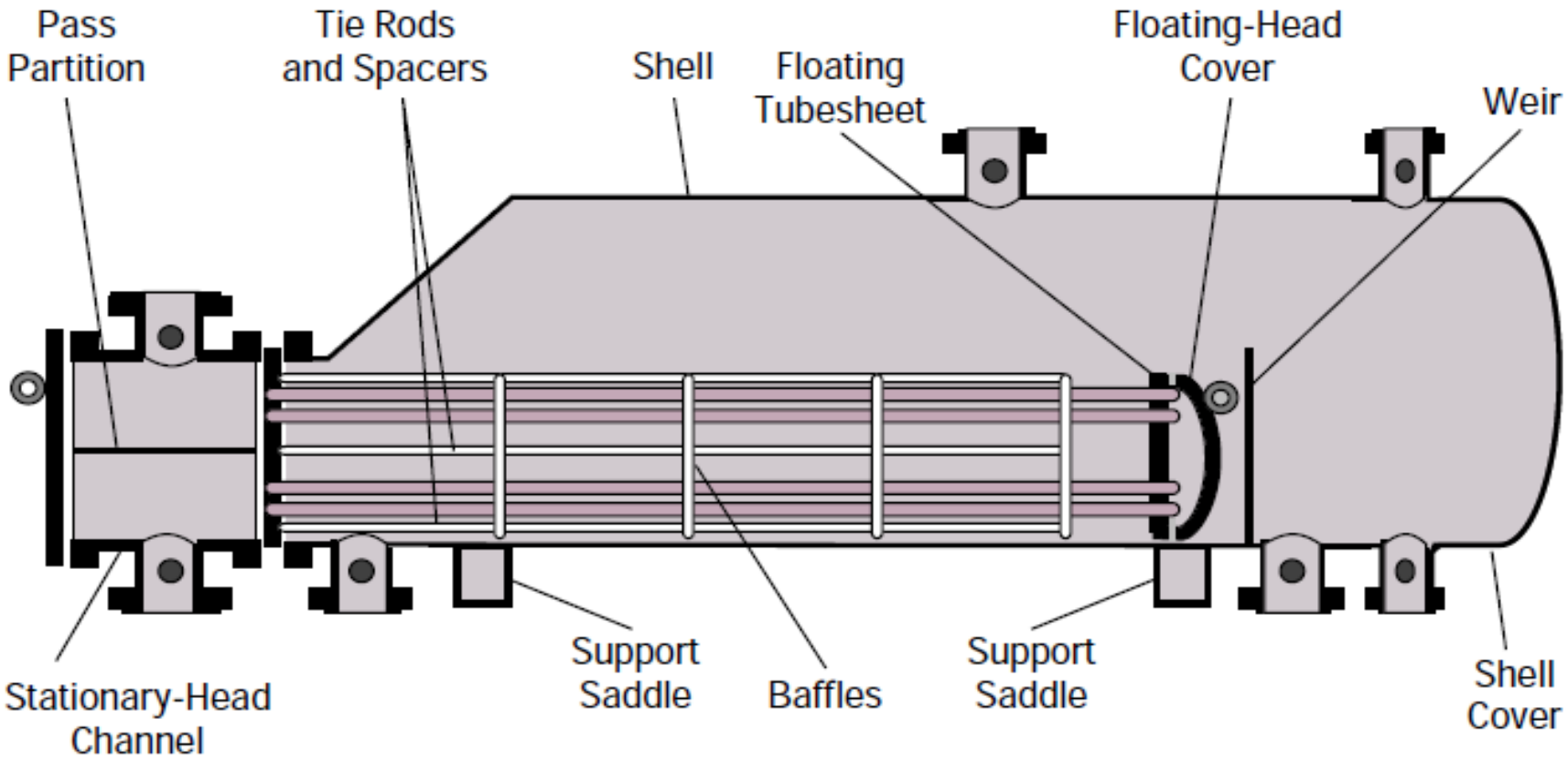
Pull-Through
Floating Head

Example


Pass Partition
Stationary Tubesheet
Shell
Tie Rods and Spacers
Floating Tubesheet
Shell Cover
Stationary-Head Channel
Support Saddles
Baffles
Floating-Head Cover

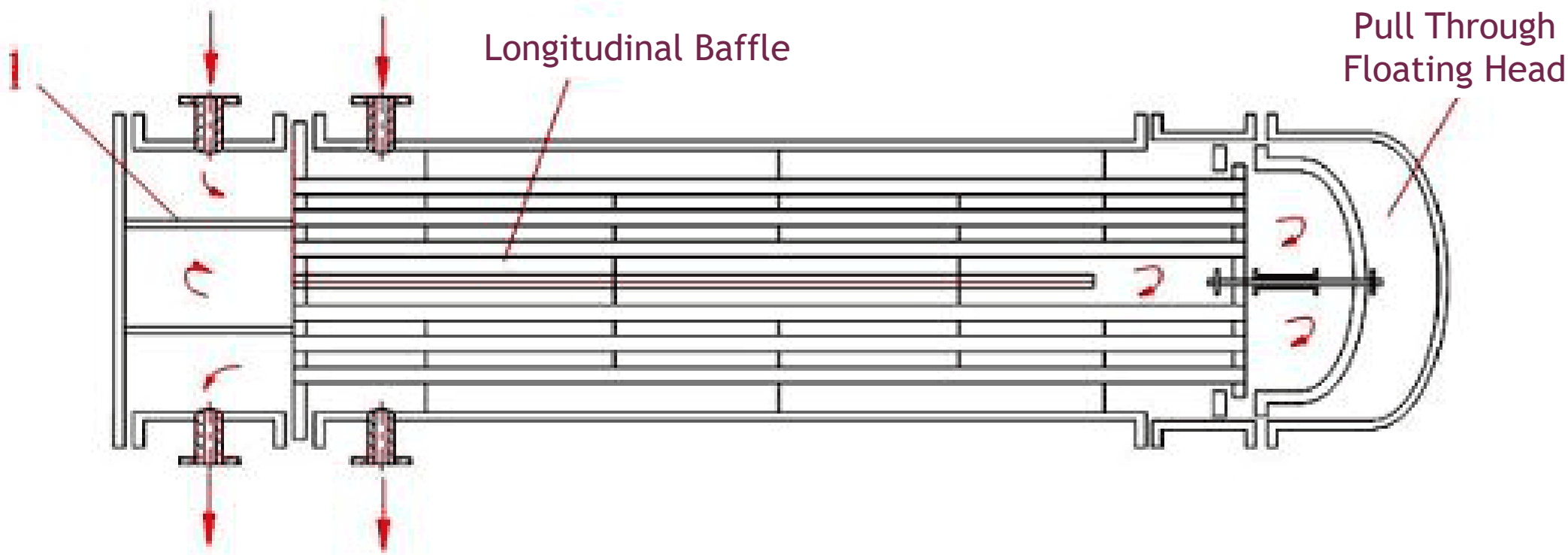
AES

Example


Pass Partition
Tie Rods and Spacers
Shell
Floating Tubesheet
Floating-Head Cover
Weir
Stationary-Head Channel
Support Saddle
Baffles
Support Saddle
Shell Cover

AKT

Multi-Pass Floating Head Heat Exchanger

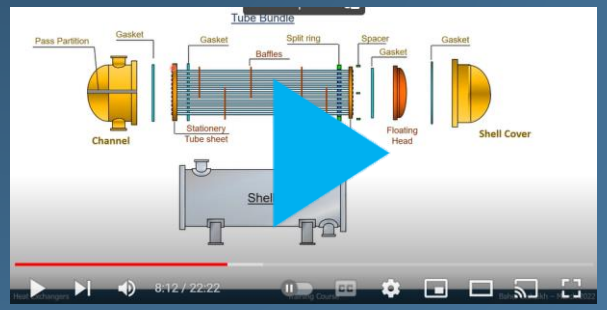


End of Part 1

Thanks

Baher Elsheikh

Watch YouTube video in Arabic



Baher Elsheikh @