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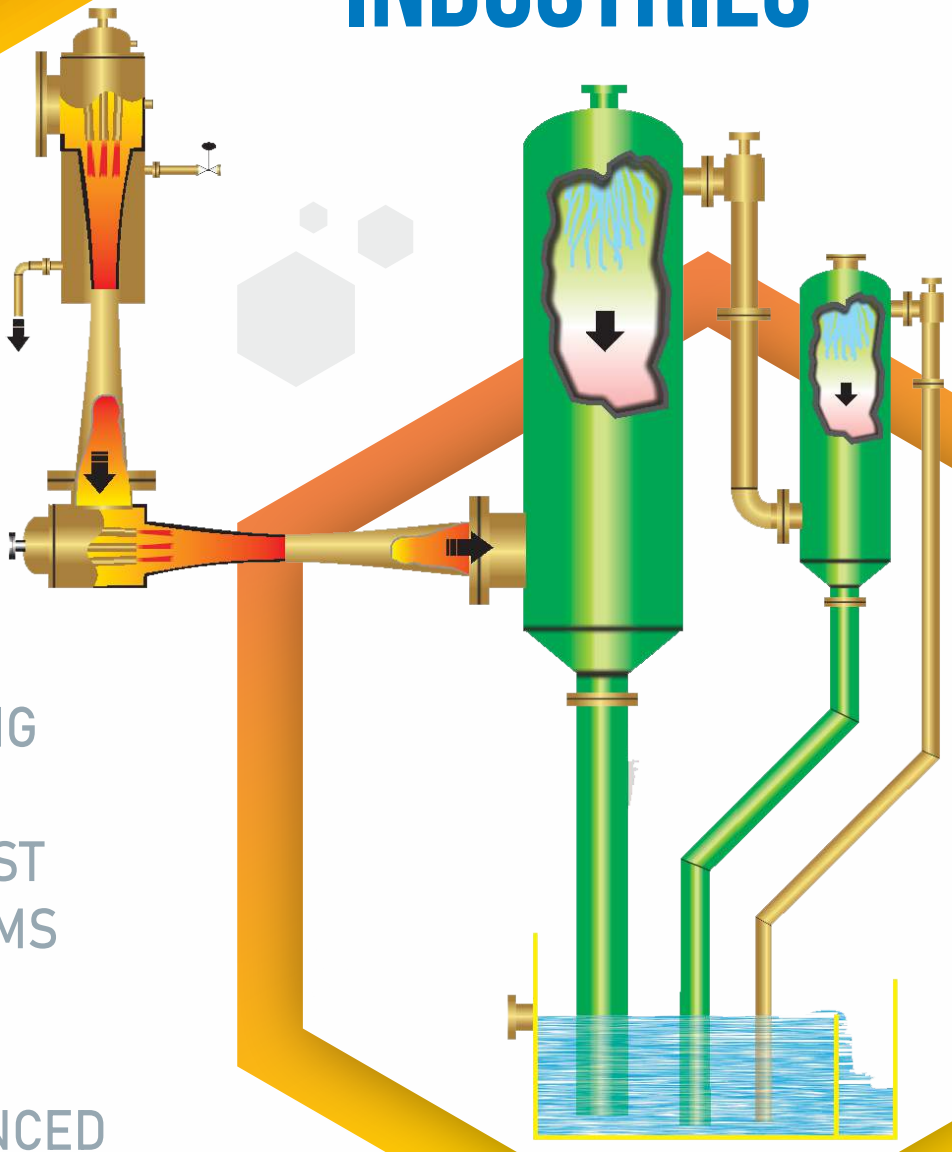
VACUUM SYSTEMS FOR THE EDIBLE OIL INDUSTRIES

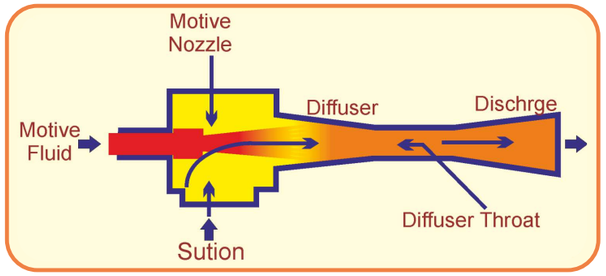


MEEKAJ IS MANUFACTURING AND SUPPLING THE WORLD BEST VACUUM SYSTEMS AS PER THE DESIGN BY MOST EXPERIENCED ENGINEER

VACUUM SYSTEMS FOR THE EDIBLE OIL INDUSTRIES

OPERATION PRINCIPLE AND ARRANGEMENT OF EJECTOR SYSTEM :

Ejector is consisting of mainly mixing chamber, Converging/Diverging nozzle, diffuser (converging inlet, Throat and diverging outlet). In steam jet ejector suction chamber is connected to the vessel or pipeline that is to be evacuated under vacuum. The Gas that is to be induced in to the suction chamber can be any fluid that is compatible with the steam and the components materials of construction.



The Steam nozzle discharges a high velocity jet across the suction chamber. This steam jet creates a vacuum which extracts air or gas from the adjoining vessel. As these gases are entrained in the steam, the mixtures travel through the ejector in to a venture shaped diffuser. In the diffuser, its velocity energy is converted into pressure energy, which helps to discharge the mixer against a predetermined back pressure, either to atmosphere or to a condenser. Since the capacity of a single ejector is fixed by its dimensions,a single unit has practical limits on the total compression and throughout it can deliver. For greater compression, two or more ejectors can be arranged in series.

In a multi-stage system, condensers are typically used between successive ejectors. By condensing the vapors before sending the Steam on to the next stage, the vapor load is reduced. this allows smaller ejectors to be used, and reduces steam consumption.

Ejectors are generally categorized into one of four basic types: single-stage, multi-stage non-condensing, multi-stage condensing and multi-stage with both condensing and non-condensing stages

Pre condensers can be added to reduce the load on the first-stage ejector, and allow for a smaller unit. An after condenser can also be added, to condense vapors from the final stage. Adding an after condenser will not affect overall system performance, but may ease disposal of vapors.

EJECTOR EFFICIENCY :

There are many accepted formulae to express ejector efficiency. Typically, efficiency involves a comparison of energy output to energy input. This ratio is of little value in the selection and design of ejectors. Since ejectors approach a theoretically isentropic process, overall efficiency is expressed as a function of entrainment efficiency. The direct entrainment of a low velocity suction fluid by a motive fluid results in an unavoidable loss of kinetic energy owing to impact and turbulence originally possessed by the motive fluid. this fraction that is successfully transmitted to the mixture through the exchange of momentum is called the entrainment efficiency.

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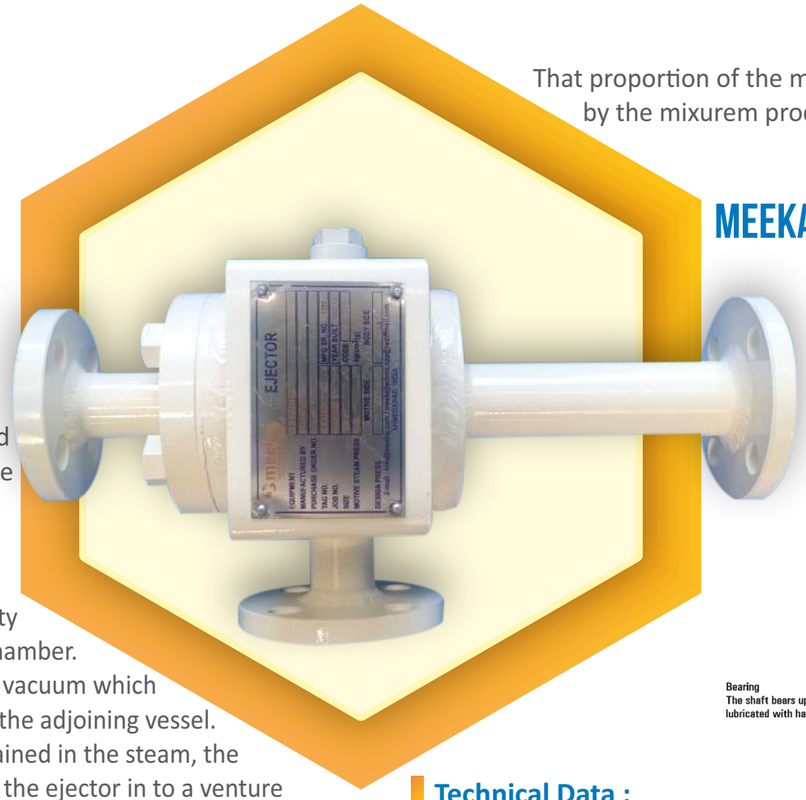
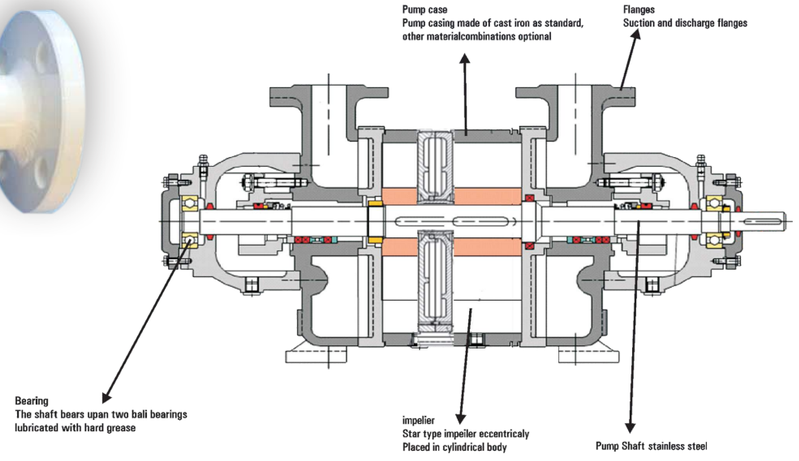


That proportion of the motive fluid energy which is lost is transferred into heat and is absorbed by the mixurem producing therein a corresponding increase in enthalpy

MEEKAJ MAKE HIGH EFFIECENT DOUBLE SYAGE VACUUM PUMP



Technical Data :

Vacuum level : 40 mm Hg (A) at 30°C Seal Water Temp.
Capacity : 49 m3/hr to 1500m3/hr
Power Range : 3.0 to 65 HP
Material of construction :

Single Stage Vacuum pump

Alt. 1 : Complete pump in Cast iron material with En8 Shaft
Alt. 2 : Partially SS 304 or 316 (All contact parts i.e. Control Plate, casing ring, Shift protecting bushes are in SS 304 pr 316 balance parts in cast iron)
Alt. 3 : Complete pump in stainless steel material

Double Stage Vacuum pump

Alt. 1 : Standard Model - Shaft, Impeller in SS and balance parts in cast iron)
Alt. 2 : Partially SS - All contact parts i.e.Control plate, casing, and shaft are in SS 304 or 316 nalance parts in cast iron
Alt. 3 : Complete pump in stainless steel material

Advantages or benefits of Meekaj's liquid ring vacuum pimp :

- Reliable, simple design which involves only one rotation part, which in not subject to more wear
- Can handle condensable vapors or even slugs of liquid entrained in the gas stream without damage to pump or affecting pump performance
- Produces a steady non-pulsating gas flow when it is used as either a vacuum pump or compressor
- Resistant to contaminants entering with the gas stream these will be dilute and washed through the pump by the seal liquid
- Internally no need any lubrication (It is oil Free)
- Rotating metallic parts are non contacting therefore, no inside wearing
- No vibration and low noise level
- Very safe for explosive gases if existing High vacuum system with all ejectors and steam cost is higher than replace the last stage ejector with vacuum pump and save the sream
- Avoid the contamination of the cooling tower water can be provided the water re-circulating arrangement introducing the shell-tube type cooler or plate types heat exchanger

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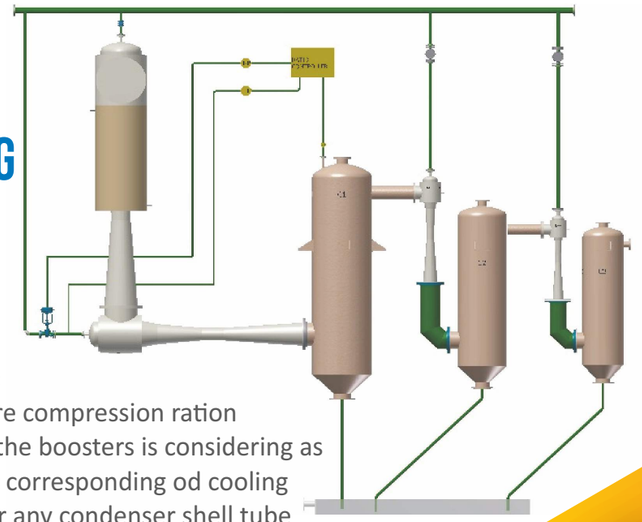
MOTIVE STEAM CONTROLLING IN MULTI STAGE EJECTOR SYSTEM AGAINST LOWER COOLING WATER TEMP



Cooling water is main factor for requirement of the motive steam consumption. Ejector system is designing on the most economical compression ratio (suction pressure/discharge pressure). Lower pressure compression ration means less steam consumption. Suction Pressure of the boosters is considering as per process requirement, while discharge pressure is corresponding od cooling water temp of the condenser. This gives limitation for any condenser shell tube (surface) or direct contact type condensers most of Asian reason min cooling water temp from the cooling water temp is getting around 30 to 40C in the worst weather ejector system is designing for the worst operating condition i.e. highest cooling water temp in the year, min available motive steam and max stripping steam, therefore during the year (specially in winter) if cooling waster temp is getting lower however cannot reduce the steam flow and energy is wasted if chill water is available or want to reduce the motive steam flow during the winter when change the temp to lower. Make the arrangement as shown in fig and regulate the motive steam corresponding to cooling water temp. As shown in fig motive steam control valve is regulating the steam flow of 2nd boosters following the Absolute pressure transmitter reading which is mounted on the condenser.

Multi stage steam jet Ejectors with Liquid ring vacuum pump. Arrangement and advantages :

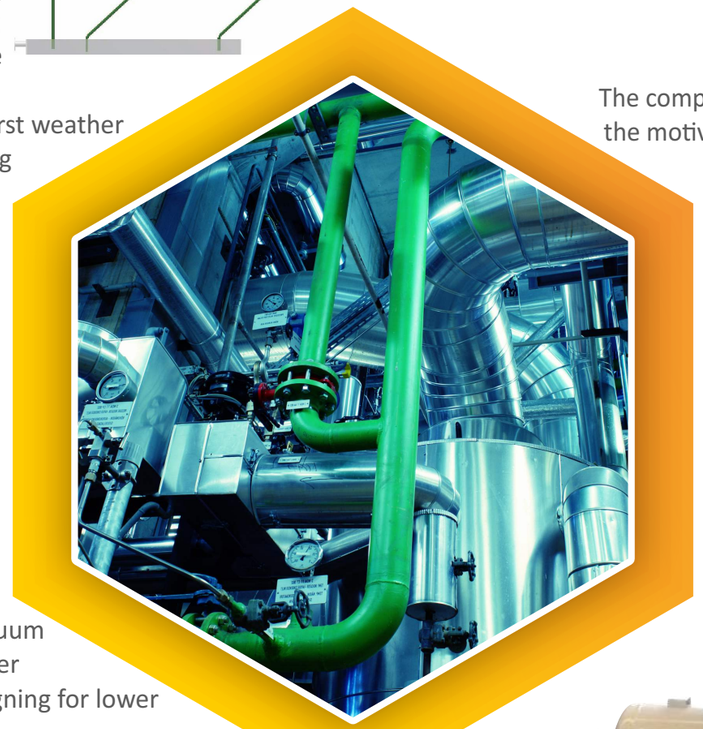
in this system vacuum pump is installing in place of 4st stage ejector or can keep as standby Motive steam is reduce due to non use of 4th stage low HP vacuum pump is sufficient Normally vacuum pump is giving batter vacuum, means lower discharge pressure is achieving at the discharge of 3rd stage ejector so it is designing for lower compression ration around 55torr to 120 torr

instead of 55 to 200torr, it resulted less steam consumption of the 3rd stage.
Start up (Hogger) ejector can be avoided
Cooling tower efficiency is increasing, it resulted more constancy in the vacuum
Operating cost is lesser

Ejector operate optimally under a single set of conditions. Ejector designs can be classified either as critical or non-critical. Critical Design means that the fluid velocity in the diffuse throat is sonic. in non-critical units the fluid velocity is subsonic. A steam ejector is of critical design when the suction pressure is lower than approximately 55% of the discharge pressure. Ejectors designed in the critical range are sensitive to changes in operation can affect ejector performance :

EFFECT OF OPERATIONAL CHANGES ON CRITICAL FLOW EJECTOR PERFORMANCE			
MOTIVE PRESSURE	DISCHARGE PRESSURE	SUCTION PRESSURE	SUCTION CAPACITY
Decrease	Constant	Increase rapidly	Decrease rapidly
Constant	Increase	Increase rapidly	Decrease rapidly
Constant	Constant	Increase	Increase
Constant	Constant	Decrease	Decrease
Increase	Constant	Constant	Decrease gradually
Constant	Decrease	Constant	Unchanged

The basic idea for the design of STEAM JET EJECTORS has to be considered in that wat that the available raw materials and available energy (in which ever form that they take) should be converted with the least possible wasted and therefore the best possible efficiency.



Standard terms for Ejectors

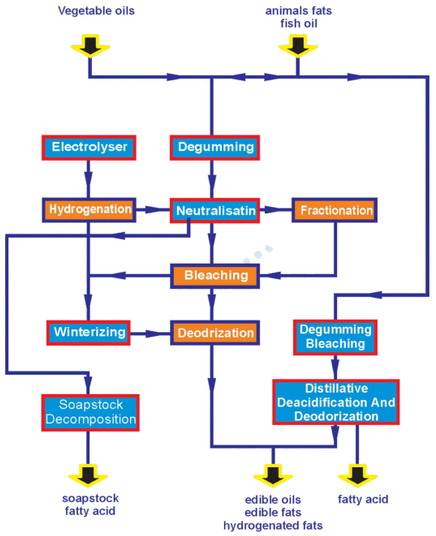
The compression attainable from the suction nozzle to the outlet nozzle is, dependent on the motive pressure, the specific motive steam consumption, and finally and the internal geometry of the ejector.

Vacuum in Deferent Vegetable Oil Processes

Diagram is showing the different process stage in the processing of the edible oil. The Below orange filed process stages, which are carried out under the vacuum

- **Deodorization**
- **Beaching**
- **Fractionation**
- **Hydrogenation**
- **Distillative deacidification with deodorization**

Most of distillation column are operating under 1.5 to 3 torr pressure, it is deciding the according to type of oil, operating temp, design of the column, considering the process stage etc. while bleaching, drying, hydrogenation process doing under 55 to 70 torr pressure



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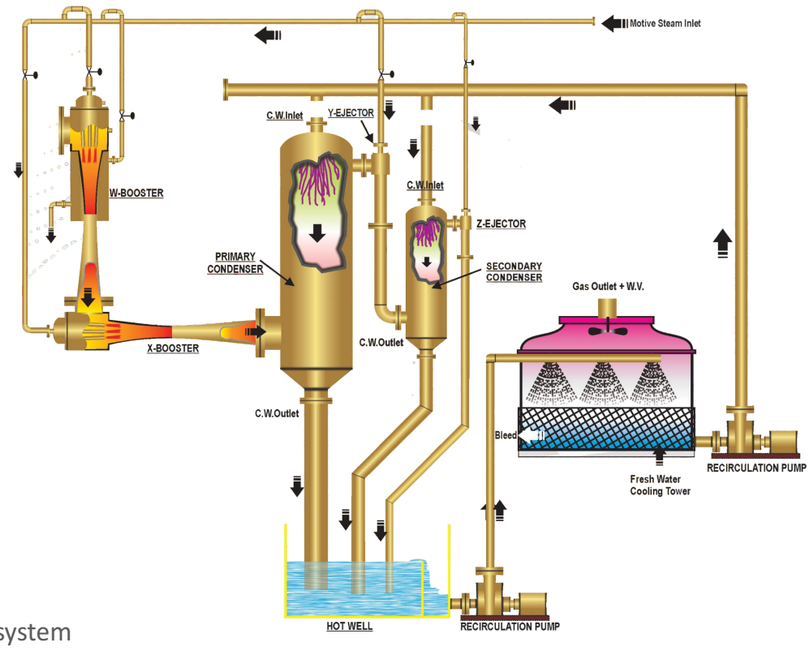
Requirement of the high vacuum multi stage ejector systems are required. it is consist of the steam jet booster, ejector and condenser. Most of condensable vapours including the motive steam of boosters are condense in the inter condensers which reduce the load to followed ejectors, overall which reduce the motive steam requirement.There are many alternates / combination are available in the design of vacuum system according to process limitation and requirement of the vacuum level.

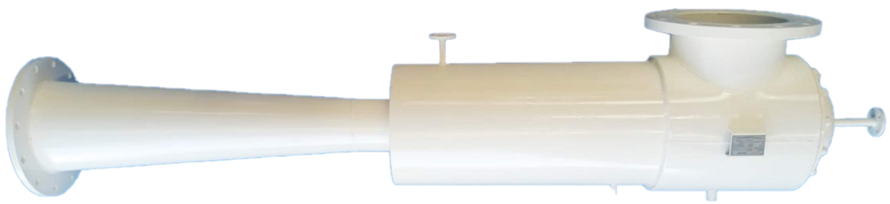
Two stage ejector system with pre condenser for low vacuum or only vacuum pump with pre condenser or single stage ejector and vacuum pump combination, Multi stage steam jet ejector systems with direct contact or surface condensers for high vacuum, multi stage steam jet Ejectors] with Liquid ring vacuum pump.

Multi Stage Steam Jet Ejectors System With Direct Contact Type Condensers

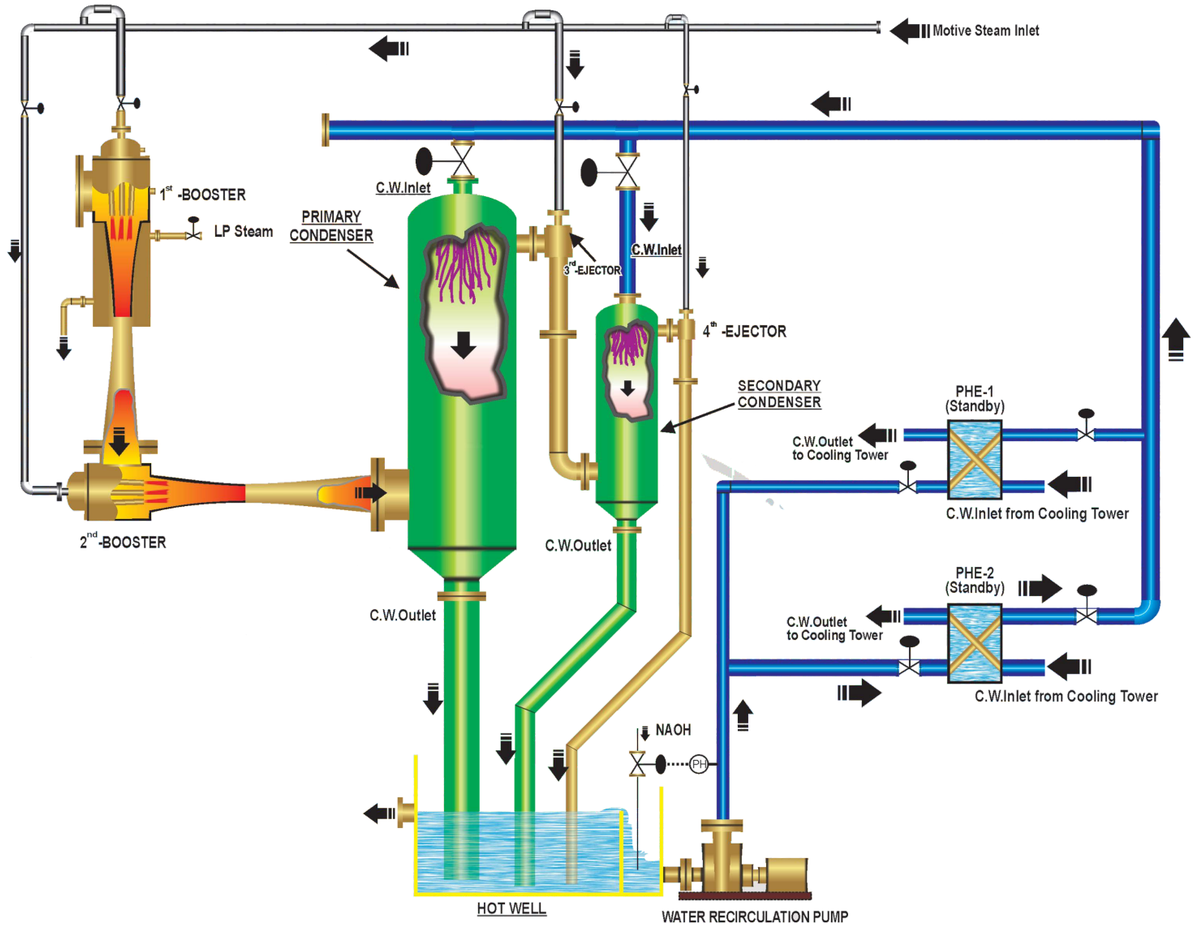


ADVANTAGES :

Maintenance free system
Batter vacuum consistency
Easy to operate
Lowest capital cost



Multi stage steam jet ejector system with closed loop water circulation in condensers (Alkaline system normal cooling water temp)



When the Closed Loop water circulation system is provided as shown in fig and it re-curculating and cool through the plate type heat exchanger the crystallizing fatty acid is despite on plate it resulted exchanger is fouling fastest. To avoid this problem sodium hydroxide solution is added. In this type of system additional condensate of motive steam, striping steam, separate though the special designed Hot-well and removing the additional liquid through over flow nozzle.

Advantages of this system :

- Very Less amount of waste water
- Low maintenance cost
- Low capital cost

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