World's Most Efficient!

Mazda LIMITED

Steam Jet Booster Ejector Vacuum Systems for

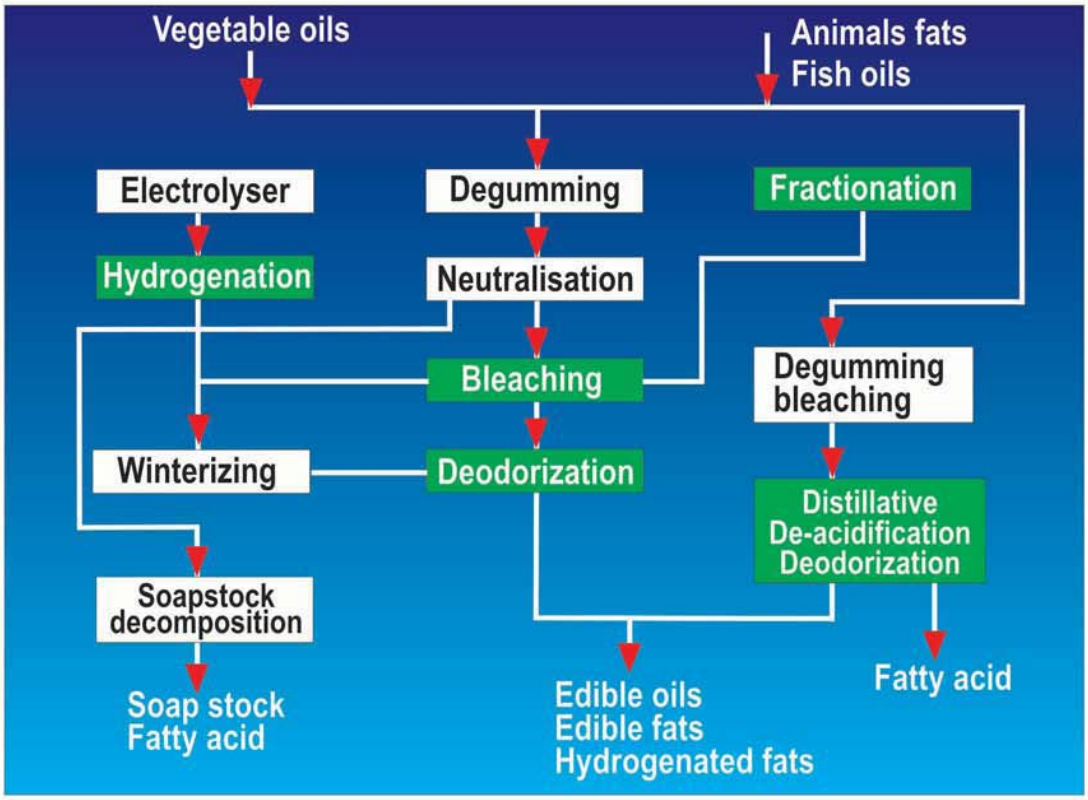
Vegetable Oil

Processing

Vacuum is necessary during various steps of vegetable oil processing. These steps essentially include hydrogenation, fractionation, bleaching, deodorization and de-acidification. Out of all vacuum equipments, **Ejector Vacuum System** has established the superiority and versatility of their use as compared to the mechanical vacuum pump. The most outstanding advantage of the **Steam Jet Ejector** is the total absence of moving parts, which eliminate mechanical breakdown, and assures constant and dependable operation with freedom from repairs. No adjustment or lubrication is required nor are any specially trained operators necessary as their operation is very simple. Over and above this, as **Steam Jet Vacuum System** convey at very high velocity which are many times the speed of sound, they are capable of handling large volume under vacuum thus making them eminently suitable for deodorization application wherein high quantity of open / sparging steam has to be handled.

The figure below shows the various steps where application of vacuum is required in processing of vegetable oil

- *Bleaching / drying*
- *Deodorizing*



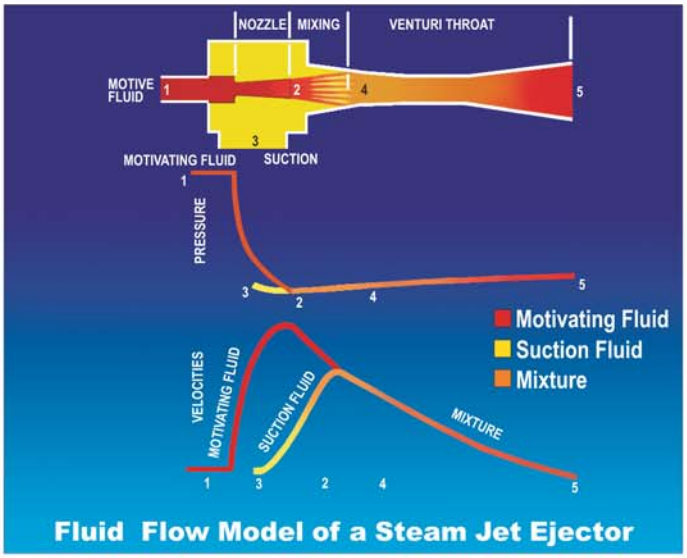


FIGURE-1

*A **Steam Jet Ejector** is simplified type of vacuum pump or compressor, consisting of three basic parts :*

(1)Nozzle
(2)Mixing chamber
(3)Diffuser.

The Nozzle discharges a high velocity Steam Ejector across a suction chamber that is connected to the equipment to be evacuated. The process vapours are entrained by this Steam Jet and carry into a Venturi shape diffuser, which convert the velocity energy of the steam into pressure energy enabling discharge ultimately to atmosphere.

The Ejectors are generally categorized into one of four types:

(1) Single Stage.
(2) Multi-stage condensing.
(3) Multi-stage non-condensing.
(4) Multi-stage with both condensing and non-condensing stages.

Lower suction pressure is obtained by staging of the Ejectors. The number of stages of Ejectors is depended on the suction pressure required. Nominal range of suction pressure for number of Ejector is stated below:

Stages	Nominal range of pressure (in torr)	Nominal range of Vacuum (in mm Hg (v)
Single stage	80 - 300 torr	460 - 680 mm Hg (v)
Second stage	12 - 100 torr	660 - 748 mm Hg (v)
Third stage	4 - 25 torr	735 - 756 mm Hg (v)
Fourth stage	4 - 0.06 torr	756 - 759.4 mm Hg (v)
Fifth stage	0.6 - 0.02 torr	759.4 - 759.98 mm Hg (v)
Sixth stage	0.05 - 0.01 torr	759.95 to 759.99 mm Hg (v)

Effect of Operational change on critical flow Booster / 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 rapidly
Constant	Decrease	Constant	Unchanged

A four stage **Ejector System** is normally used for Continuous Deodorizers where In the nominal operating suction pressure is 1.5- 2.5 torr while a three stage **Ejector System** is used for Batch Deodorizer where a nominal suction pressure is 5 6 torr. However, nowadays, physical refining of some of the oil including rice barn, Soya involves very low operating suction pressure of about 0.5 torr for optimum deodorization which calls for installation of a five stage Ejector System.

Due to high cost of power available from most of the State Electricity Boards, many of the large refineries are installing their own captive power plants. Many a times, low- pressure steam is available as exhaust from the backpressure turbine of their captive power plant. Instead of condensing this waste low-pressure steam and using it as boiler feedwater, the same can be utilized to motivate Ejectors for deodorizers or De-acidifiers.

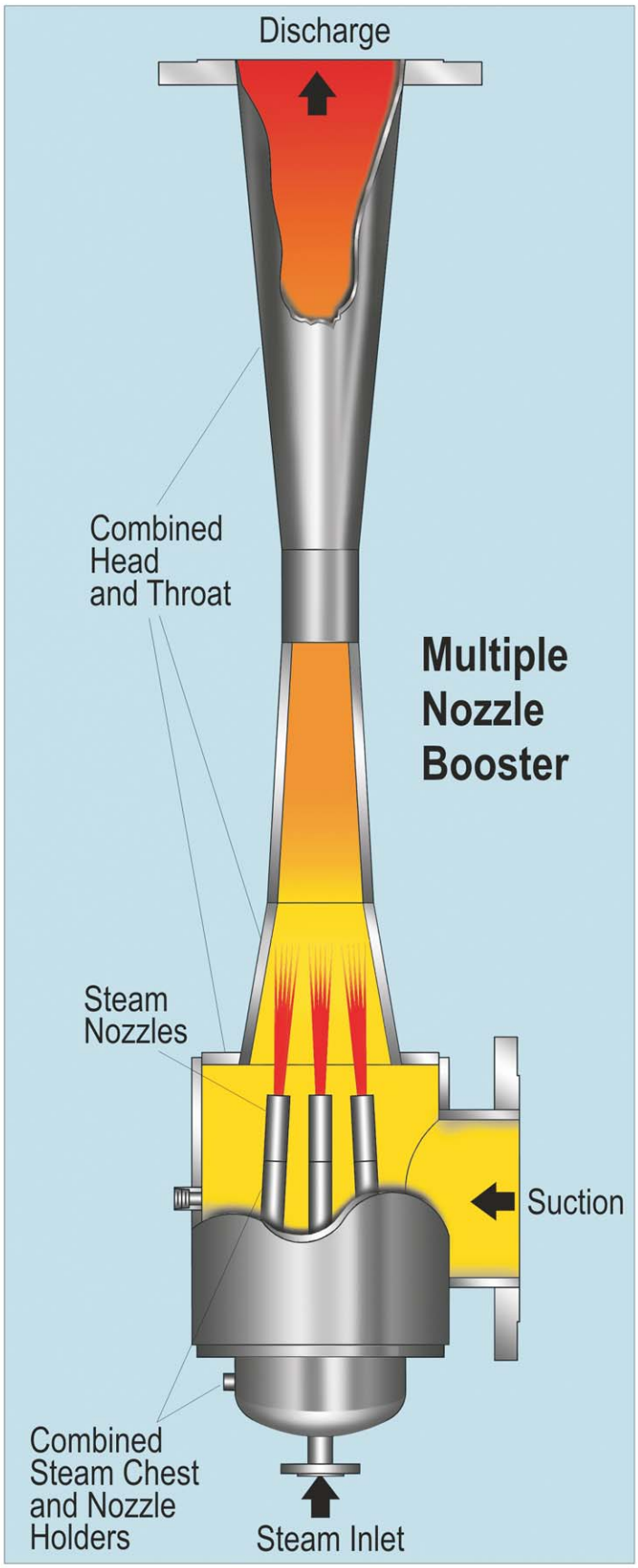
As the cost of this low-pressure waste steam is very less, the running cost of the Plant reduces drastically as the Booster/Ejector Vacuum System utilizes majority of the steam in a refinery.

Boosters and Ejectors have been supplied for as low as **0.5 Kg/cm2 (g)** motive steam pressure and as high as 40 Kg/cm2 (g). Cooling water temperature also plays a very major role for the efficiency of the **Ejector System**. Roughly, for every 2°C, increase in the cooling water inlet temperature of the inter-condenser from 32°C will increase the steam consumption by about 10% and vice versa. Therefore, cooling tower should always be properly maintained.

Also, nowadays, considering high cost of energy, mainly steam, most of the installations have incorporated ***multiple nozzle Boosters*** *which consume about 15 20% lesser steam compared to conventional single nozzle Booster designed for the same motive and suction pressure and capacity.*

Mazda Limited *in India supplies these special multiple nozzle Boosters since last ten years in collaboration with world leaders* ***M/s. Croll-Reynolds USA*** *who have more than eighty years of in-depth experience in this field.*

Mazda *can therefore, claim to be instrumental in improving the efficiency of various refineries and saving India's precious natural resources.*



In an effort to provide its customers with World Class SJAE Systems Croll-Reynolds and Mazda have installed one of the world's largest state-of-the-art-Research and Test facility at its plant in Ahmedabad. With this test facility, Mazda has the ability to simulate operating conditions and analyze all anticipated variables that may be encountered under actual operating conditions.

Some of the critical performance factors that Mazda is able to analyze at the test center include Ejector suction flow capacity, Ejector stability under varying steam and water pressures and temperature conditions.

Croll Reynolds and Mazda guarantees that when the system is operating, it will meet all capacity, steam consumption and power limit specifications according to Heat Exchanger Institute Standards and ASME PTC 24.The center also gives

Mazda the capability to more accurately measure flow generated noise during testing of Ejector discharging to atmosphere.

As a part of the commitment to customer support, pick up and break up pressure records are maintained on every system installation. Record include: system and component specification, detailed list of parts and construction, materials and performance data.

Mazda's Test Centre includes Boilers having a total steam generation capacity of 10,000 Kg/hr at 17.5 Kg/cm2 (g), Cooling Towers of 1200 TR total capacity, Surface Condensers of 300 m2, Control Valves, Condensate Recovery Systems and large capacity Circulation Pumps.

TYPICAL PERFORMANCE CURVE OF 1st AND 2nd STAGE BOOSTER OF FOUR STAGE EJECTOR VACUUM SYSTEM

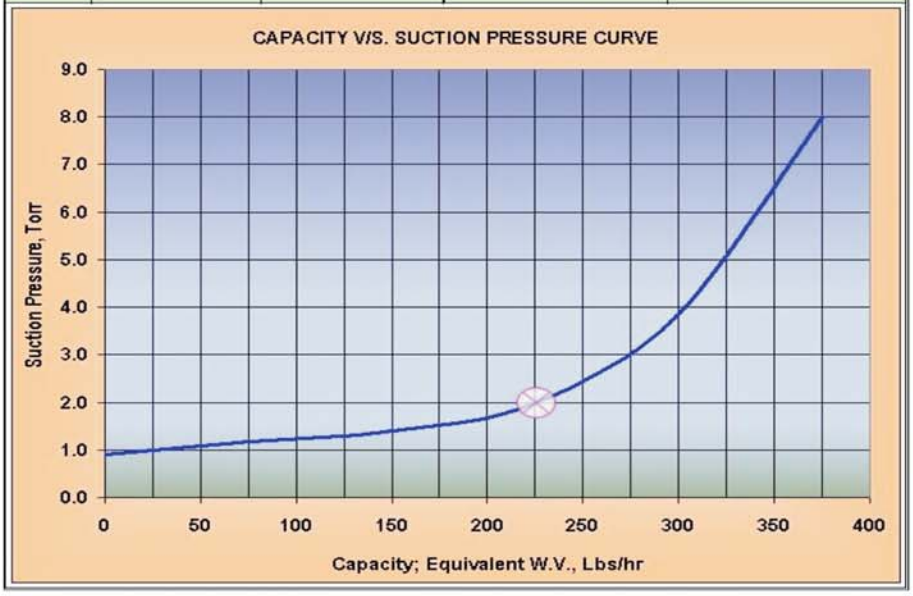
CURVE#
Customer Name :
PO Number :
Project :
Item No :

Equipment Desp. :
Size :
Date of test :

DESIGN CONDITION:
Suction Condition:
Pressure : 2.0 Torr
Temperature : 120 °C
W.V. : 85 Kg/hr
FFA : 2 Kg/hr
Air : 10 Kg/hr
Eq. W.V. : **224 Lbs/hr**
Motive condition : 10 Kg/cm²(g) / Sat.
Discharge condition : 55 Torr

OBSERVATION

SR. NO	MOTIVE PRESS. [KG/CM²(G)]	SUCTION CAPACITY [LBS/HR E.W.V.]	SUC. PRESS. [TORR]	DISCHARGE PRESS. [TORR]
1	10	0	0.9	55
2	10	75	1.3	55
3	10	150	1.6	55
4	10	225	2.0	55
5	10	300	3.7	55
6	10	375	8.0	55



Field Service

Mazda Limited has a steam of trained engineers available at short notice to visit any of the company's or associated company's installations. Although our engineers are generally based in India, they travel world-wide as required. Helpful service can also be obtained through many of our agents and representatives' offices, a number of which, have available field engineering staff. The range of services available include installation advice, pre-commissioning checks, commissioning service, routine-on-stream adjustment, overhauls, inspection and technical reports, etc.

Three large capacity multiple nozzle boosters in series on high vacuum test

Main discharge header has three connections for testing ejectors on different diameter lines.

Two numbers of cooling towers having a total capacity of 1200 TR.

Troubleshooting

Unsatisfactorily performance of an **Ejector System** can be caused by external or internal causes. Unsatisfactory performance can also be classified as sudden or gradual. The gradual loss of vacuum will normally suggest internal erosion or corrosion, whereas a sudden loss of vacuum will normally suggest external causes. Since it is easier to check external Causes of trouble, all possible external causes should be checked first.

External Causes of Trouble:

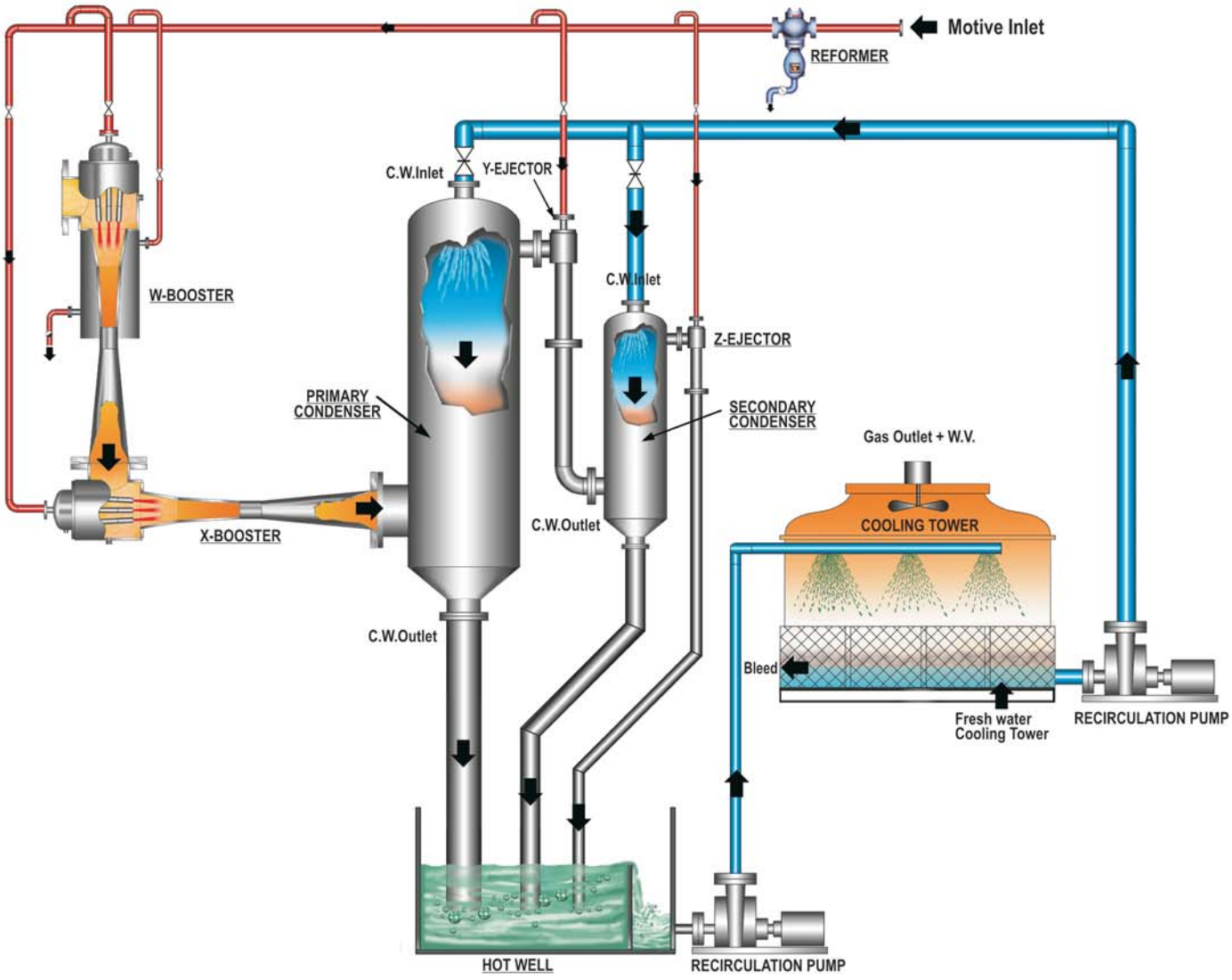
(1) Low steam pressure.
(2) Wet steam.
(3) High water temperature or insufficient water flow.
(4) Entrained air in condenser water.
(5) High discharge pressure
(6) Fluctuating water pressure.
(7) Change in load excessive air leakage.

Let us assume that a multi-stage system has lost vacuum. The possible external causes are quickly checked and are Found trouble-free.
We must now look for internal causes of trouble.

Internal Causes of Trouble:

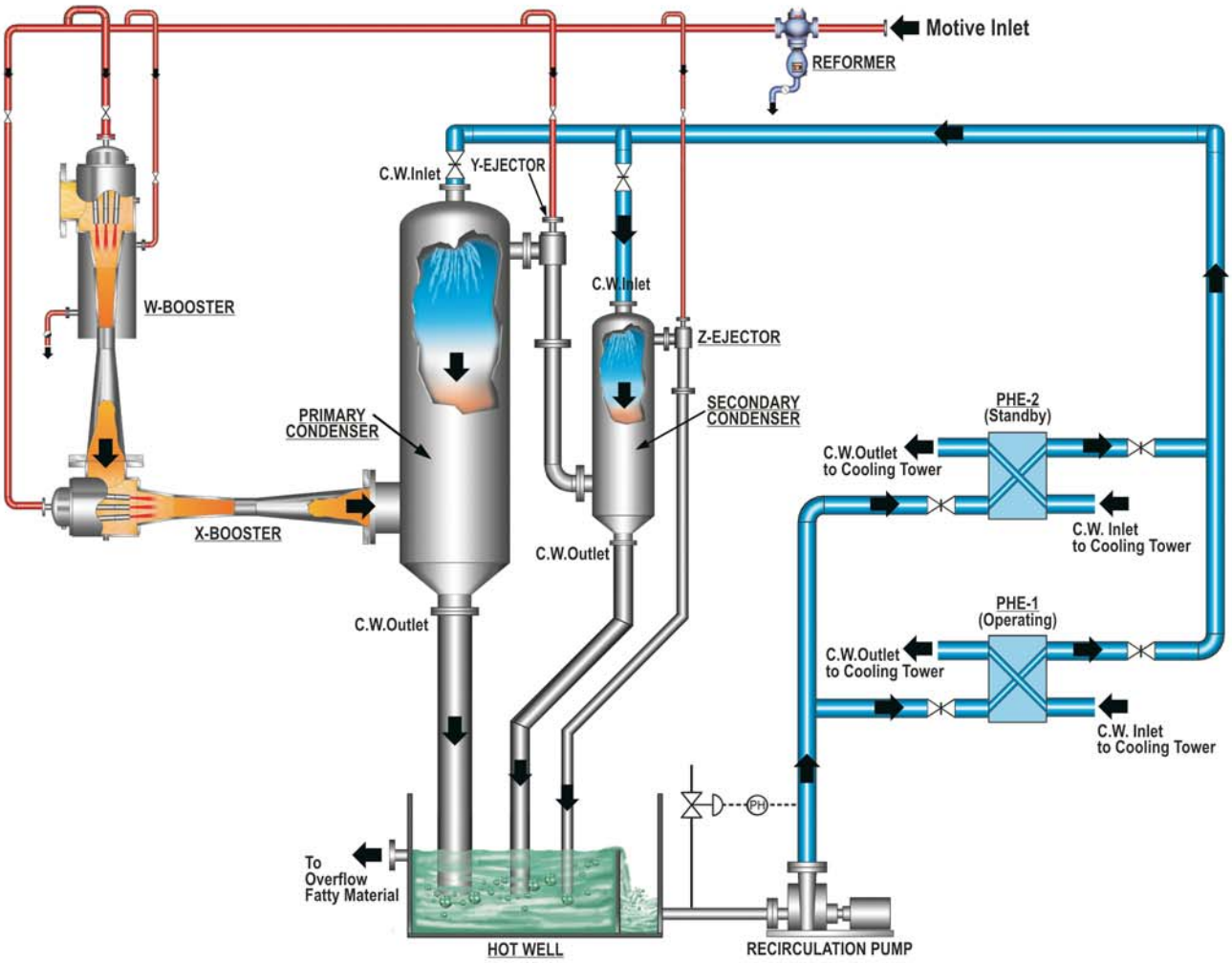
(1) Eroded or corroded parts,particularly nozzles and diffusers.
(2) Clogged nozzles, diffusers and strainers.
(3) Leaks in steam chests.
(4) Clogged or fouled water supply.
(5) Clogged water discharge.
(6) Excessive leakage cracked or worn parts.
(7) Inter-condenser water nozzle eroded.

(1) Multi stage Booster, Ejector Vacuum System with Mixing Condenser and with cooling water re-circulated directly through cooling tower



Advantages	Disadvantages
Lowest capital cost	Cooling water gets polluted
Very little maintenance required	Odour emission takes place
Simple and reliable to operate	Cleaning of cooling tower to be carried out very frequently because of deposition of fatty matter.
Condensers do not get fouled	

(2) Multi stage Booster, Ejector Vacuum System with Mixing Condenser but with cooling water re-circulated indirectly through a PHE (Plate Heat Exchanger)



Advantages	Disadvantages
Keeps the two Water Systems separate i.e. the contaminated cooling water coming out of the direct contact Inter-condenser of the Vacuum Systems and the clean cooling tower water circuit.	Have slightly higher steam consumption
As this contaminated water is saturated,the excess fatty matter gets precipitated and floats on the top in the catch pot which can be collected from the over flow system in the catch pot. The fat so collected is not oxidized and therefore, the foul smell does not emerge into the atmosphere unlike in a cooling tower in a conventional setup where it is sprayed for direct evaporation,which emits sizable amount of undesirable smell to the surroundings.	Therefore, have slightly higher cooling water consumption.
Simple and reliable to operate.	Relatively higher capital cost because of involvement of PHEs.
Mixing Condensers do not get fouled.	Standby PHE has to be installed.
Very little maintenance required as PHEs do not get fouled quickly and can be cleaned easily without stopping the system by installing standby.	Has relatively more space requirement.

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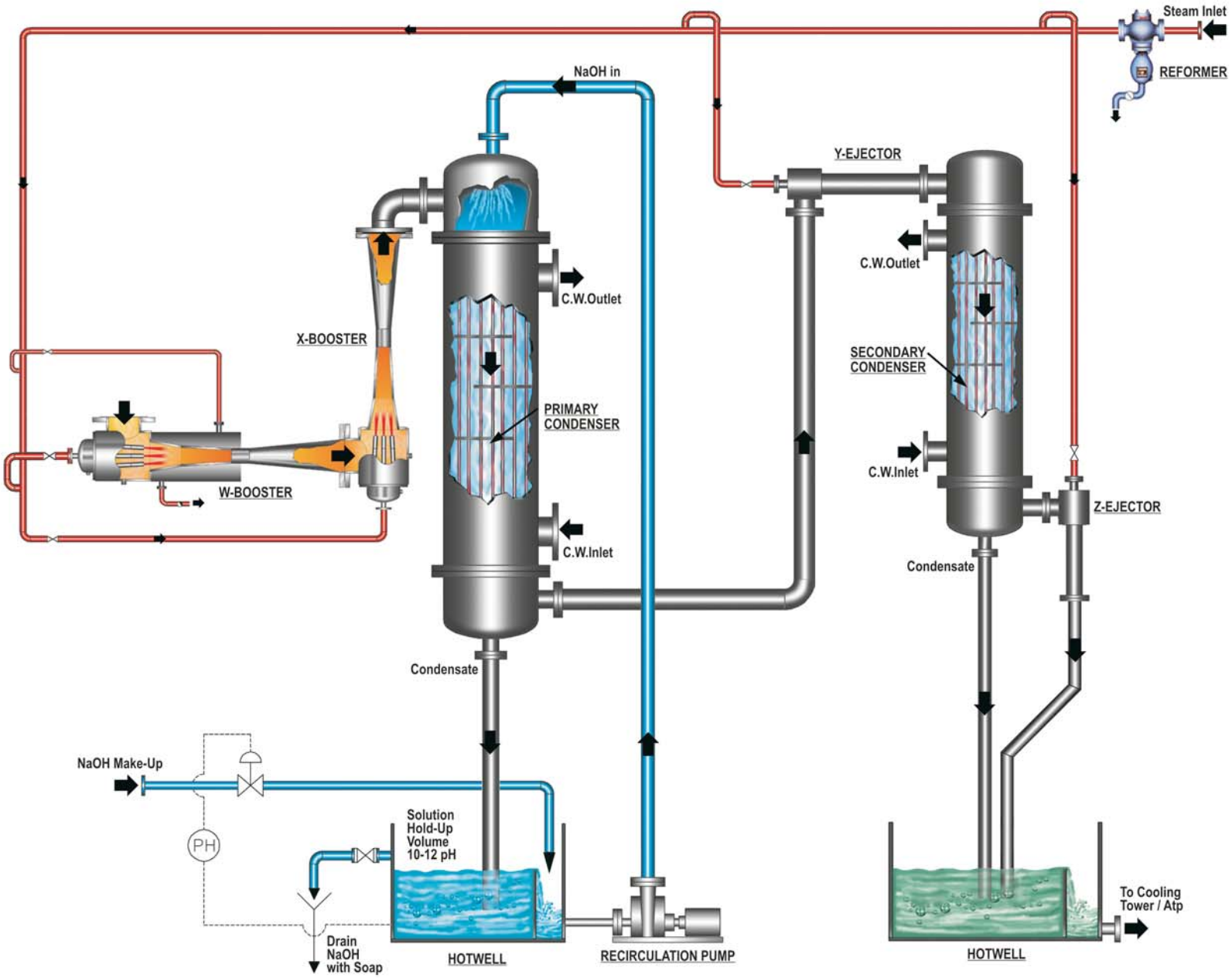
(3) Booster, Ejector and Vacuum Pump Combination System with Shell & Tube Inter-Condensers



Advantages	Disadvantages
Cooling water does not get polluted	Have slightly higher steam consumption.
As the cooling water is clean, the odour causing residue does not contaminate the plant which is one of the most point of concern in Edible Oil Refining plants.	Therefore, have slightly higher cooling water consumption.
Requires relatively very less space.	Relatively higher capital cost because of involvement of PHEs.
	NaOH solution is required
	Very expensive to install.

World's Most Efficient!

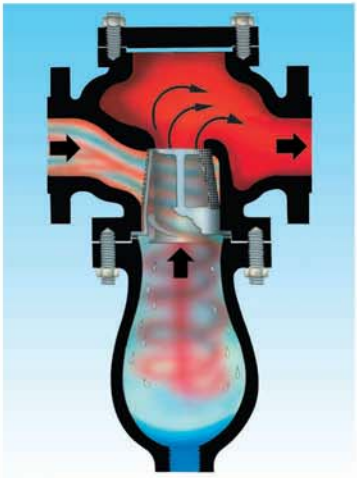
Steam Reformer By MAZDA and C-R

Steam Reformer is new generation equipment which is a combination of steam separator and strainer.

Installation of the Steam Reformer greatly improves the boosters and ejectors performance as it ensures dry and clean steam to the nozzle. Therefore consistent level of vacuum is maintained wich also prevent the nozzles from getting clogged.

Operation and separation efficiency

Reformer filters and separates water particles from flowing stream by employing



the two best methods of separation. A confounded series of vanes and fins change the steam, air or gas flow into a high speed cyclone flow, separating even mist-like condensate with 98% efficiency. The fluid velocity is first maintained but the flow is given a twist so that the heavier water droplets are flung out of suspension by centrifugal force against the sides of the vessel. The flow area is then increased so that the fluid velocity drops to prevent pick-up of separated water

For bleachers & Autoclaves use

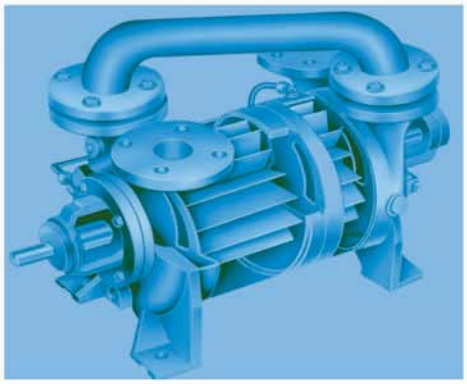
CROLL-REYNOLDS

A NEW GENERATION OF TWO-STAGE WATER RING VACUUM PUMPS

THAT SAVES ENERGY

- **Consistent High Performance**
  Croll-Reynolds two-stage Vacuum Pumps with their rugged cast iron and stainless steel components are the result of an intensive development and testing program. These innovative products incorporate modern engineering principles, based on nearly 75 years of Croll-Reynolds experience in Vacuum technology. All Vacuum Pumps are subjected to 100% performance test prior to shipment.

- **Popular Sizes in Stock**
  Manufactured in India by Mazda, New Generation Liquid Ring



Vacuum Pumps (Model CR-25, CR-27 & CR-210) prompt delivery.

- **Experience**
  Since 1917 Croll-Reynolds has been supplying quality Vacuum equipments for your application. Let CR Engineering team help you select the right Vacuum Pumps for your process needs.

- **Very High Reliability**
  There are no Teflon or rubber balls inside the pumps to deteriorate Vacuum performance. CR pumps require very little maintenance.

- **Extra Deep Stuffing Box**
  Combined with low friction, pure graphite packing gives greater reliability.

- **Exclusive Shaft Sealing Design**

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A few of our Booster Ejector Vacuum Systems working satisfactorily in various prestigious Edible Oil refineries in India are listed as below :

1. Adani Wilmar - 1000 TPD
2. Cargill Foods - 1000 TPD
3. Liberty Oils - 1000 TPD
4. Parakh Foods - 1000 TPD
5. Ruchi Soya - 1000 TPD
6. General Foods - 600 TPD
7. Vimal Oils - 600 TPD

Major Edible Oil OEMs in India who regularly procure systems from us include the following:

1. Alfa Laval (India) Ltd.,
2. De Smet Chemfood Engineering Pvt. Ltd.,
3. LIPICO Technologies (India) Pvt Ltd
4. Glamptech Agro Process Ltd.,
5. Peg Consultants & Engineers Pvt. Ltd.,
6. Veendeep Oiltek Processes Pvt. Ltd.,
7. Muez Hest Process Technologies Pvt. Ltd.,
8. Spec Engineers & Consultants Pvt. Ltd.,
9. Mectech Process Engineers Pvt. Ltd.,
10. Lipid Systems Engineers Pvt. Ltd.,
11. Chemical Construction Co. (P) Ltd.,
12. Mecpro Heavy Engineering Ltd.,
13. Cottor Plants (India) Pvt. Ltd.,
14. Eurrestra Industries Ltd.,
15. Kumar Metal Industries,
16. Troika Processes Pvt. Ltd.,
17. Techno Chem Enterprises,

Our Booster - Ejector Vacuum Systems are regularly exported to various countries around the globe for Edible Oil Refining, through our collaborators M/s. Croll Reynolds Co. Inc., USA which include the following :

1. Brazil
2. S. Africa
3. Kenya
4. Syria
5. China
6. Indonesia
7. Russia
8. Uganda
9. Cyprus
10. Ukraine
11. Malaysia
12. Japan

Major Edible Oil OEMs abroad who regularly procure systems from us through our collaborators M/s. Croll Reynolds Co. Inc., USA include the following :

1. Alfa Laval - Malaysia
2. Alfa Laval - China
3. Alfa Laval - Denmark
4. Alfa Laval - Brazil
5. Alfa Laval- Columbia
6. De Smet - Malaysia
7. De Smet - Brazil
8. Miura Engineering - Japan

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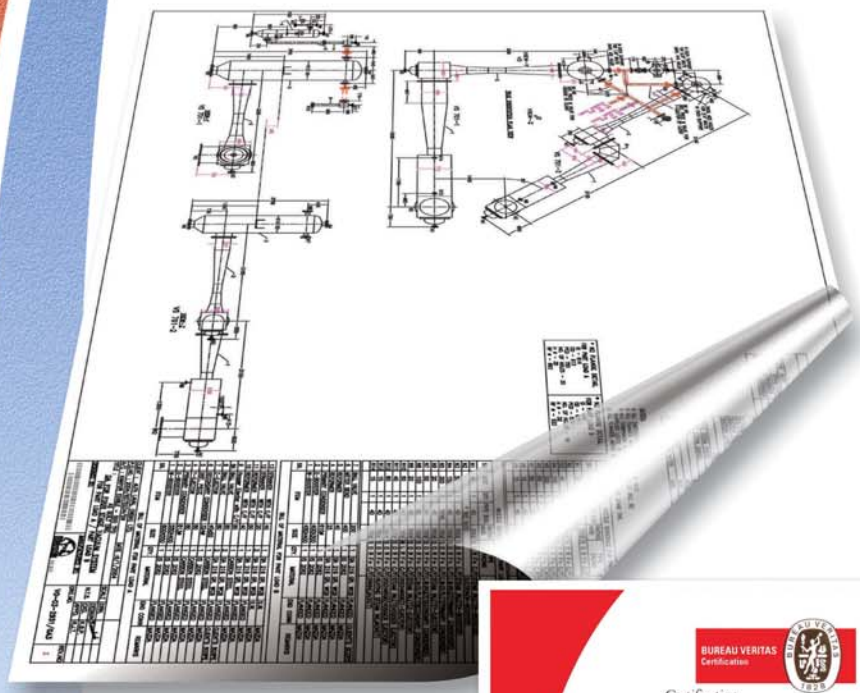


CERTIFICATE OF AUTHORIZATION

The American Society of Mechanical Engineers

This certificate certifies the named company as authorized to use the indicated symbol the American Society of Mechanical Engineers (ASME) for the scope of activity show below in accordance with the applicable rules of the ASME Boiler and Pressure Vess Code. The use of the Code symbol and the authority granted by this Certificate Authorization are subject to the provisions of the agreement set forth in the applicatio Any construction stamped with this symbol shall have been built strictly in accordanc with the provisions of the ASME Boiler and Pressure Vessel Code.

COMPANY:

Mazda Limited
Plot No. 11 and 12
Hitendranagar Sahakari Vasahat Ltd.
N.H. Road, Narode
Ahmedabad, Gujarat 382340
India

SCOPE:

Manufacture of pressure vessels at the above location only

AUTHORIZED: **June 30, 2011**
EXPIRES: **June 27, 2014**
CERTIFICATE NUMBER: **35,184**

Vice President
Conformity Assessment

Director, Accreditation and Certification

BUREAU VERITAS
Certification

Certification
Awarded to
Mazda Limited

Bureau Veritas Certification (India) Private Limited certify that the Management System of the above organisation has been audited and found to be in accordance with the requirements of the standard detailed below

STANDARD
ISO 9001:2008

SCOPE OF SUPPLY

PERMITTED EXCLUSION(S)
NIL

Original Approval Date: **22 December 2010**
Date of New Site Addition **24 November 2011**
Next Recertification Due Before: **22 September 2013**
Subject to the continued satisfactory operation of the organisation's Management System, this certificate is valid until: **21 December 2013**
To check this certificate validity +91 22 6668 0000
please call
Further clarifications regarding the scope of this certificate and the applicability of the Management System requirements may be obtained by consulting the organization.
Certificate Number: **IN211 35024/U/R1**

R. K. SHARMA
Director

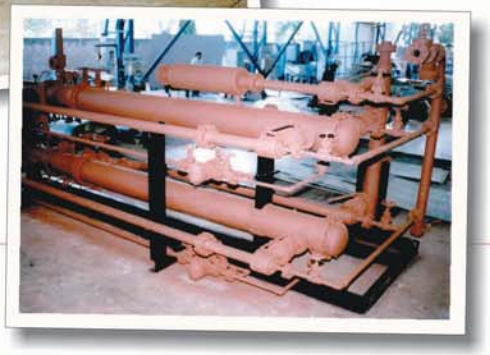
We build more Vacuum Systems for Chemical, Edible Oil and Power plants than anyone else in the world

and

Test them on the world's largest vacuum Test centre

and

Export critical vacuum systems worldwide



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