CHEM

Ejectors & Vacuum Systems







Vacuum ■ Evaporation ■ Crystallization ■ Heat Transfer Technologies

CHEM

Customized Engineering Solutions

Ejector Applications

- High vacuum distillation
- Deodourization
- Cooling of liquid & solids
- Vacuum metallurgy
- Evaporation
- Distillation
- Crystallization
- Deaeration
- Drying of solids
- Filtration

Industries

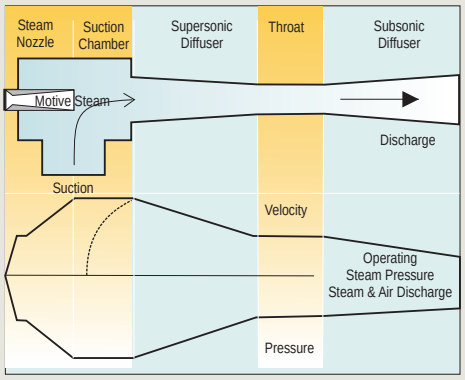
- Chemical
- Petrochemicals
- Heavy chemicals
- Food
- Edible oil refining
- Pesticides
- Refinery
- Fertilizer
- Water treatment
- Heat recovery
- Steel degassing
- Pulp and paper
- Essential oils & flavouring
- Synthetic yarn
- Power
- Desalination

Materials of Construction

- Carbon steels
- Stainless steels
- Duplex steels
- Inconel
- Monel
- Hastelloy
- Impervious graphite
- Teflon lined
- Rubber lined
- Polypropylene
- High density polyethylene
- Titanium
- Polyesters and other exotic materials, special alloys and elastomers.

Introduction

The ejectors which are distinguished from other types of compressors as having no moving parts, work on the principle of converting the pressure energy of a motivating fluid to velocity energy in order to entrain the suction fluid. Vacuum is created, air or gas is entrained and mixture of gas and steam enters the venturi diffuser where its velocity energy is converted into pressure energy, sufficient to discharge against a predetermined back pressure.



Advantages

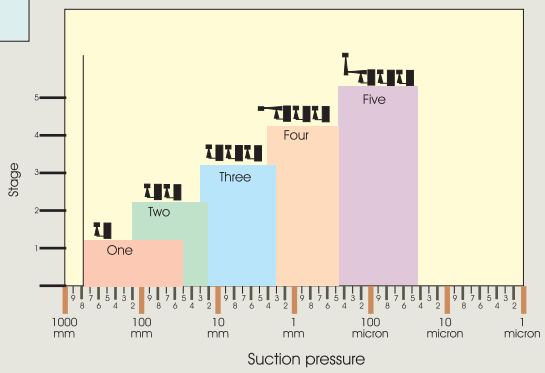
The principal advantages of steam-jet ejectors over other types of vacuum producing units are :

- Low capital costs
- No moving parts hence maintenance free
- Compact construction hence easy installation
- Reliable operation and long working life
- Corrosion/erosion resistant as it can be constructed in a wide range of materials
- High vacuum performance at high suction loads
- Can be installed at remote or inaccessible locations

Staging of Ejectors

The graph shows the relative suction pressure capabilities of CHEM steam-jet ejectors from singlestage through five stage. In some cases units overlap. When this occurs, CHEM engineers should be consulted for their recommendations which are based on their extensive experience in various applications. CHEM offers a size ideally suited for individual requirements. New designs provide far greater capacities than available before and the smallest unit covers a range which previously required two or more ejectors.

Lower suction pressures can be obtained by the staging of ejectors. Ejectors can be divided into



condensing and non-condensing units.

The usual method adopted for staging is to use a vapour condenser between the stages. The size and type of condenser used is a function of the air-vapour ratios, cooling water temperatures and utility costs.

Non-condensing Jets

Non-condensing type has the first stage ejector discharging directly into the suction of the second stage ejector without employing condensers. The non-condensing design has the advantage of lower purchase and installation costs. In corrosive environments non-condensing ejectors are significantly more reliable than the condensing systems. Motive steam requirements for non-condensible ejectors are much higher than motive steam requirements for multi-stage ejectors.

Condensing Multi-stage Vacuum Systems

Multi-stage vacuum systems employ intercondensers between ejector stages to condense steam and vapour of preceeding stages, and cooling air and non-condensible vapour to reduce load to succeeding stages. The intercondensers may be direct contact type or surface type arranged barometrically or at a low level. Ejector system with direct contact type condenser is considerably cheaper than a system with surface condenser. Vacuum system with surface condenser is suitable where the cooling water is not to be contaminated with process vapour.

There are two basic types of condensers : surface and direct-contact. Their advantages and characteristics are:

Surface Condensers

- Steam & vapour condensate is recovered.
- Process product may be recovered as condensate.
- No contamination of cooling water eliminates water treatment
- Vacuum surges will be less likely to carry water back to the process
- Less head room required

Surface condensers are constructed with either fixed or removable tube bundles. Condensers with fixed tube bundles have the limitation of being cleaned on the tube side only whereas condensers with removable bundles may also be cleaned on the shell side.

In general mixing condensers makes more efficient use of cooling water and requires lesser cooling water pressure.

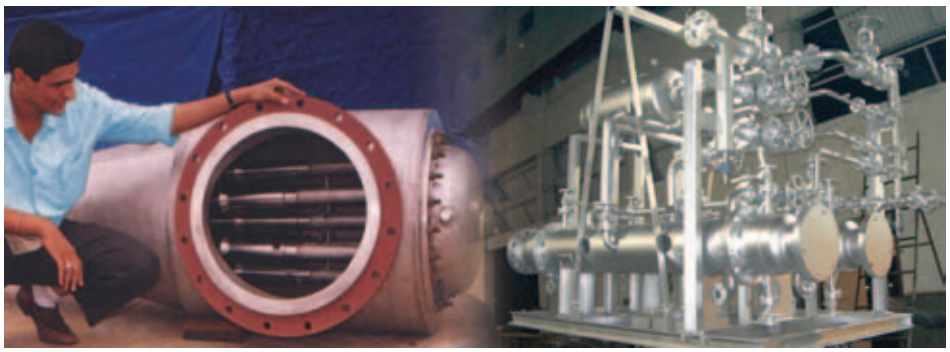
Direct Contact Condenser

Countercurrent Barometric Design

- Lower capital costs
- Lower installation costs
- Smaller terminal difference allows operating at lower absolute pressure, hence less water required for a given vacuum condition
- Less floor area required
- No fouling, hence little or no maintenance required
- Can be fabricated with corrosion resistant materials, rubber or any other suitable lining
- Open barometric discharge provides safe operation without an atmospheric relief valve

Efficient Operation

Efficient operation is an important evaluation criteria because controlling energy consumption and waste production is always a priority for a customer. CHEM continues to make progress towards improving ejector operating efficiencies so that less motive consumption is required. Condensation efficiency and hydraulic performance in the inter and after condensers associated with the ejector system remain our priority. For any application there are evaluation options - it is possible to design the ejector system for low capital cost, but high operating cost, or conversely, for low operating cost, but higher capital cost, or anywhere in between these two extremes. We at CHEM can review the options with you.



PRODUCT RANGE

VACUUM

Steam Jet Ejectors
Multi Stage Vacuum Systems
Liquid Jet Ejectors
Liquid Ring Vacuum Pumps
Air Extraction Systems
Ring Jets : Steam Jet Ejector-Liquid Ring
Vacuum Pump Combination Systems
Eductors/Jet Mixers/Jet Heaters

THERMOCOMPRESSORS

STEAM JET REFRIGERATION SYSTEMS

EVAPORATION

Multiple Effect Evaporation Plants with Thermal/Mechanical Vapour Recompression

Forced Circulation
Falling Film
Natural Circulation
Rising Film
Combination Types

CRYSTALLIZERS

Adiabetic Vacuum
Evaporative Forced
Draft Tube Baffle Type
Spray Evaporator Crystallizer
Oslo Type

HEAT TRANSFER

Surface Condensers
Heat Exchangers

ZERO LIQUID EFFLUENT DISCHARGE SYSTEMS

CAUSTIC CONCENTRATION SYSTEMS

SALT RECOVERY PLANTS

PRESSURE VESSELS

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