

■ VACUUM SYSTEMS AND EJECTORS

EJECTORS, VACUUM SYSTEMS, HYBRIDS & PACKAGES

Chem Process, designs and manufactures vacuum, evaporation, crystallization, drying, desalination and heat transfer equipment for the process industries and energy sectors. Having decades of experience in the design of steam jet vacuum systems, steam jet heaters, exhausters, compressors, scrubber systems, desuperheaters, thermocompressors, eductors, syphons and ejectors, Chem Process retains experienced design personnel to solve the most challenging process requirements.

Ejector Principle

The ejectors which are distinguished from other types of compressors as having no moving parts, work on the ejector-venturi 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.

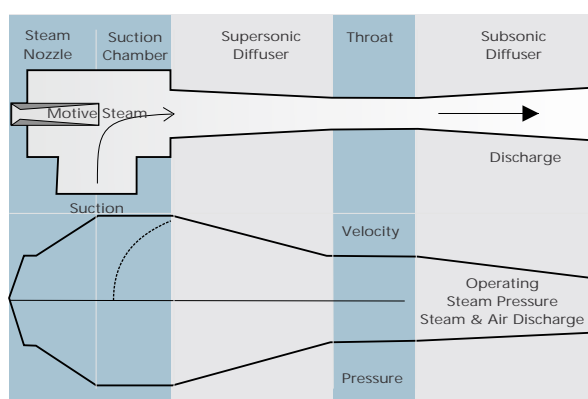
Single Stage Steam Jet Ejectors

Single stage steam jet ejectors handle both condensable and non-condensable gases and vapours and their mixtures and where small amounts of solids or liquids will not cause operating problems.

Multi Stage Steam Jet Ejector Systems

As suction pressure reduces, staging of ejectors is required to achieve economical operation. Depending on the auxiliary equipment used, two and three stage ejectors can be either condensing or non-condensing types, but can also be non-condensing.

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.

Staging of Ejectors

The graph shows the relative suction pressure capabilities of Chem Process steam-jet ejectors from single-stage through six stages. In some cases units overlap, when this occurs, a detailed analysis of initial costs and steam consumption should be made before making a decision as to the type required to meet specific requirements. Chem Process engineers should be consulted for their recommendations, which are based on their expertise and extensive experience of various applications. Chem Process offers an ideally suited size for individual requirements, as new designs provide far greater capacities than available before, and the smallest unit covers a range, which previously required two or more ejectors.

Ejector Advantages

Ejectors can be operated with different motive fluids, viz. steam, air, organic vapour, other gases and their mixtures.

- No moving parts, hence simple, reliable, rugged, trouble-free, simple maintenance requirements
- Low investment costs, low maintenance costs, long life
- Can handle corrosive and slugging liquids, solid and abrasive suction fluids without damage
- Can be manufactured in suitable materials for extremely corrosive flows
- Resistant to pollution by process flows
- Explosion proof construction. Ejectors can be installed indoors or outdoors with versatile mounting design
- Can handle high volumes of suction fluid at low absolute pressures. Chem Process has built multi-stage ejectors to handle volumetric flows upto 40,00,000 m³/hr at 100 microns.
- Absolute suction pressures down to 0.01 mbar

Types of Ejector Systems

- Single stage steam jet ejectors
- Multi-stage steam jet ejector systems
- Multi-stage non-condensing ejector systems
- Multi-stage condensing ejector systems
- Multi-stage non-condensing ejector systems followed by multi-stage condensing ejector systems
- Combination steam ejector and liquid ring vacuum pump systems
- Liquid jet ejectors
- Combination steam jet and liquid jet ejector systems
- Thermocompressors
- Multi-jet barometric condensers
- Multi-jet spray type barometric condensers
- Multi-spray barometric condensers
- Counter current barometric condensers
- Surface condensers



Steam Jet Thermocompressors

A Steam jet thermocompressor is an energy saving device that compresses low pressure steam, often waste steam, to a higher usable pressure.

It offers an advantage over mechanical compressors/blowers due to its smaller size while handling a very large vapour volume under vacuum conditions. Due to its size and absence of mechanical parts, it requires a very low capital investment and a very long maintenance free service with operational safety.

For a given set of operating conditions, a ratio of entrained suction vapour to motive vapour is determined and the amount of motive steam is calculated. The mass and pressure of the motive steam determines the size of the motive steam nozzle.

For applications with varying operating conditions, Chem Process offers a variable nozzle design, to ensure that efficient performance is maintained over the range of desired operation. To achieve variable performance, a steam regulating spindle is fitted to the nozzle and actuated either manually or automatically.

Chem Process has been designing Steam Jet Thermocompressors since decades and each unit is designed specifically to suit a customer's process and mechanical requirements to ensure maximum operating efficiency.

Liquid Jet Ejectors

Liquid jet ejectors are specially designed to operate using water, solvent or any others clear liquid and generate vacuum corresponding to the vapour pressure of the liquid. Liquid jet ejectors are most suitable for low non-condensable and high condensable loads in applications like distillation and evaporation. Liquid jet ejectors are maintenance free, easy to operate and facilitate for low level installation. External heat exchanger can be provided to maintain liquid temperature in accordance with vacuum requirement. For higher vacuum, liquid jet ejector can be utilized along with a steam jet ejector combination system.

Steam Jet-Liquid Jet Ejector Combination Systems

Are ideal to handle small quantities of non-condensable gases and large quantities of condensable vapours on intermittent or batch processes. Low level mounted and energy conserving with effective scrubbing of outlet gases, offers an advantage over other systems in producing vacuum and simultaneously scrubbing entrained gases before discharging to the atmosphere, making it an ideal selection for contaminated and/or corrosive applications.



They are available in multi-element form as a central vacuum source on multi-purpose process applications. Steam jet-liquid jet ejectors are generally used to create vacuum upto 759 mm of Hg in medium sized process vessels. The system is more suitable where low capital investment is preferred. It is generally used for batch plant applications requiring coarse vacuum and low level installations.

Steam Jet-Vacuum Pump Combination Systems

This system is installed at low levels, and is specially designed to take care of the energy consumption, while pulling high vacuum in various applications, in all processing industries.

Chem Process steam jet-vacuum pump combination systems, offer the highest possible thermal efficiencies to the industries. Chem Process has also developed steam jet- vacuum pump combination systems with closed loop seal water re-cycle system for vacuum pumps for the total reduction of effluent.

As per the suction pressure requirement, the first stage ejector compresses the process vapour to the designed inter-stage pressure which may be selected between 8-14 mbar.

The vacuum pump is designed and selected to operate at optimum inter-stage pressure.

Performance Testing

Chem Process has a full fledged test facility to simulate actual operating conditions and is equipped to test all ranges of ejectors i.e. from small ejectors to large capacity multi nozzle boosters.

Each and every Chem Process ejector and vacuum system are performance tested in accordance with HEI/ASME PTC code 24 for vacuum systems, and are checked to establish ejector suction capacity in relation to suction pressure, compression ratio, motive steam consumption and ejector stability.

Materials of Construction

- Polyesters and other exotic
- Alloy 20
- Carbon steels materials, special alloys
- Hastelloys
- Duplex steels and elastomers
- Rubber lined
- High density polyethylene
- Stainless steel
- Impervious graphite
- Polypropylene
- Inconels
- Teflon lined
- Monel
- Titanium

Applications

Chem Process steam-jet ejectors are widely used to create sub-atmospheric pressures for various process applications including:

- Chemical Process
- Metal Refining
- Distillation
- Refinery
- Ethylene Glycol
- Perfume Concentration
- Edible Oil Refining
- Water Treatment
- Pesticides & Fertilizers
- Steel Degassing
- Essential Oils & Flavouring
- Marine
- Petrochemical Refining
- Flash Cooling
- Power
- Food
- Pulp & Paper
- Freeze Drying
- Geothermal
- Heat Recovery
- Synthetic Yarn & Textiles
- Heavy Chemicals
- Vacuum Packaging

PRODUCT RANGE

EJECTORS AND VACUUM SYSTEMS

- Steam Jet Ejectors
- Liquid Jet Ejectors
- Thermocompressors
- Liquid Ring Vacuum Pumps
- Ring Jets
- Eductors
- Jet Heaters
- Jet Mixers
- Silencers
- Hybrid Systems

EVAPORATORS WITH TVR/MVR

- Single and Multi Stage Flash
- Forced Circulation
- Natural Circulation
- Falling Film
- Rising Film
- Combination Type
- Multi-Effect Distillation

- Scraped Surface Type
- Horizontal Wetted

CRYSTALLIZERS AND DRYERS

- Adiabatic Vacuum
- Evaporative Forced
- Draft Tube Baffle Type
- Spray Evaporator
- Oslo Type
- Agitated Thin Film Dryers : ATFD
- Flash Dryers
- Fluid Bed Dryers

PROCESS PLANTS/ TURNKEY PROJECTS

- Zero Liquid Effluent Discharge Plants
- Ethylene Glycol Vacuum Systems
- Caustic Concentration Systems
- Salt Recovery Plants
- Desalination Plants
- Venturi Scrubbers

- Milk Condensing & Khoa Cooling Equipment
- Distillery Spent Wash Treatment
- Food & Beverage
- Distillation
- Gas Scrubbing System

POWER PLANT EQUIPMENT

- Steam Surface Condensers
- Air Extraction Systems
- Gland Steam Condensers
- Condensing Packages
- Feed Water Heaters - LP & HP

SPECIALIZED EQUIPMENT FABRICATION

- Heat Exchangers
- Oil Coolers
- Reactors & Columns
- Pressure Vessels
- Media Filters
- Re-Boilers
- Skids & Packaged Plants

CHEM

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