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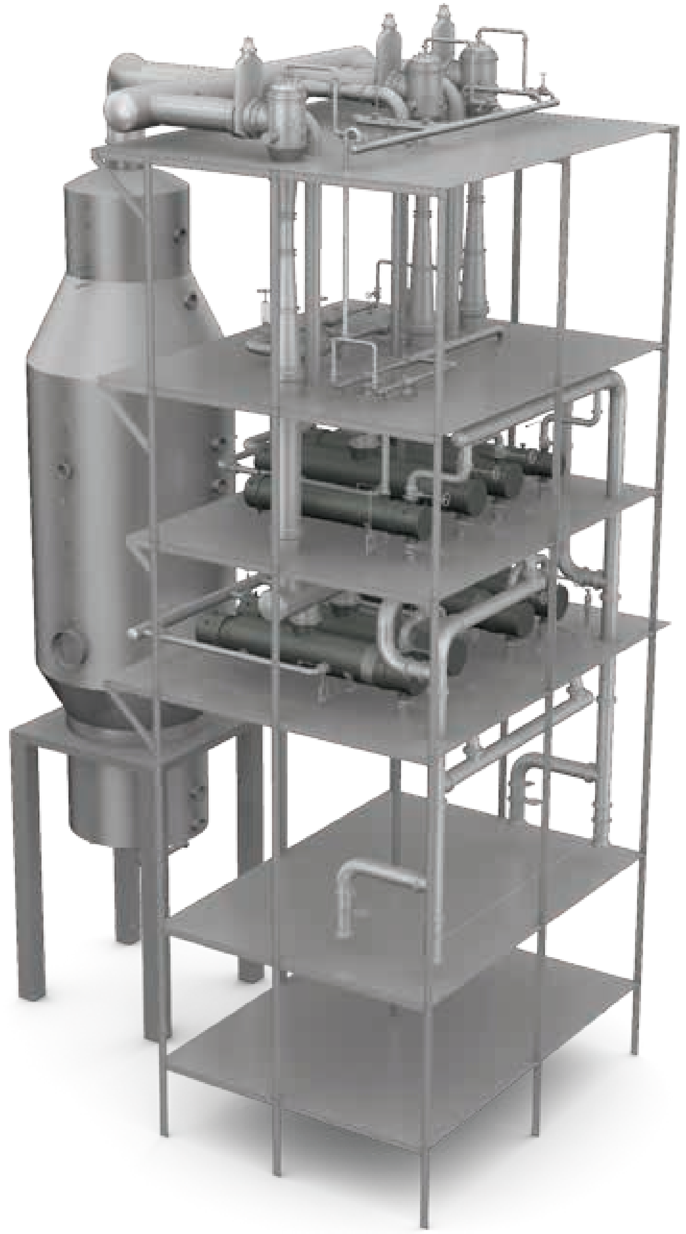
STEAM EJECTOR SYSTEMS FOR THE PROCESS INDUSTRIES

EDWARDS



EDWARDS THE PARTNER OF CHOICE

Edwards is a world leader in the design, technology and manufacture of vacuum equipment with over 95 years' history and more than 75 years' manufacturing experience.

Edwards believes in delivering results that bring value to our customers by using our breadth of industry experience to identify and apply solutions to your problems. Using the most innovative and up-to-date modelling techniques, we can optimise the pumping configuration for customers to provide a system design giving the maximum performance in the most reliable and cost-effective way.

STEAM EJECTOR SYSTEMS

The first steam ejectors were developed in the early 1900's. They were initially used to eject air from condensing plants on turbine systems.

Through the acquisition of Hick Hargreaves in 2001 Edwards have been instrumental in the development of steam ejectors from the original crude single stage devices to the highly efficient multi stage systems of today.

Applications for steam ejectors increased throughout the 20th century and today Edwards has with many years of experience in the design, manufacture and supply of steam ejector systems to many demanding applications in the process industries.

The Custom Engineered Products group which has evolved from Hick, Hargreaves, combines many years of experience in process and mechanical design with project management skills for the supply of individual items of plant or the execution of complete projects including installation and commissioning.

Applications

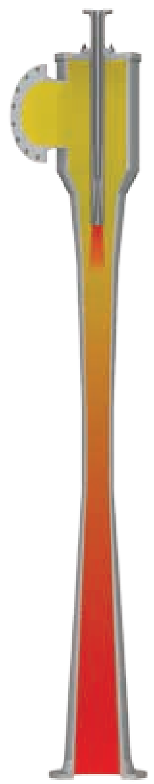
Steam Ejector technology is applied across all sectors of the process industry from huge capacity vacuum distillation units (VDU's) for petrochemical refineries to simple single stage models for reactor evacuation in chemical manufacture.

- Refinery vacuum systems
- Vacuum distillation units
- Flash evaporator for seawater desalination
- Edible oil processing
- Polymerisation
- Crystallisation
- Evaporative cooling
- Dewatering of fuel oils
- Chemical reactor evacuation

Operating Principles

The steam ejector is a simple device consisting of three basic components, a motive steam nozzle, a suction chamber and a mixing diffuser.

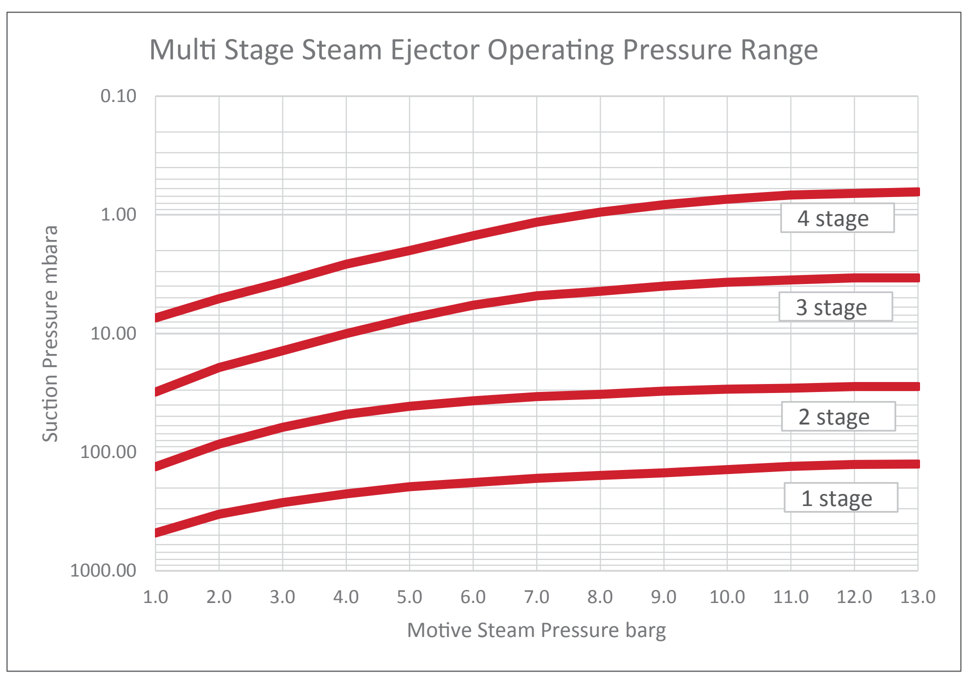
The motive steam enters the ejector through the motive fluid nozzle and is expanded into the mixing diffuser converting pressure energy into velocity energy. The steam entrains the suction gases and the mixture proceeds through the mixing diffuser where some of the velocity energy is reconverted back into pressure energy, enabling the mixture to be discharged at a higher pressure than the suction pressure. The achievable compression ratio is highly dependent upon the quantity of motive steam, therefore the practical compression ratio limit for a single stage unit is defined by economics. Larger capacity ejectors often utilise multiple steam nozzle technology, this has a significant benefit is steam usage when compared with single nozzle units.



Multi Stage Steam Ejector Systems

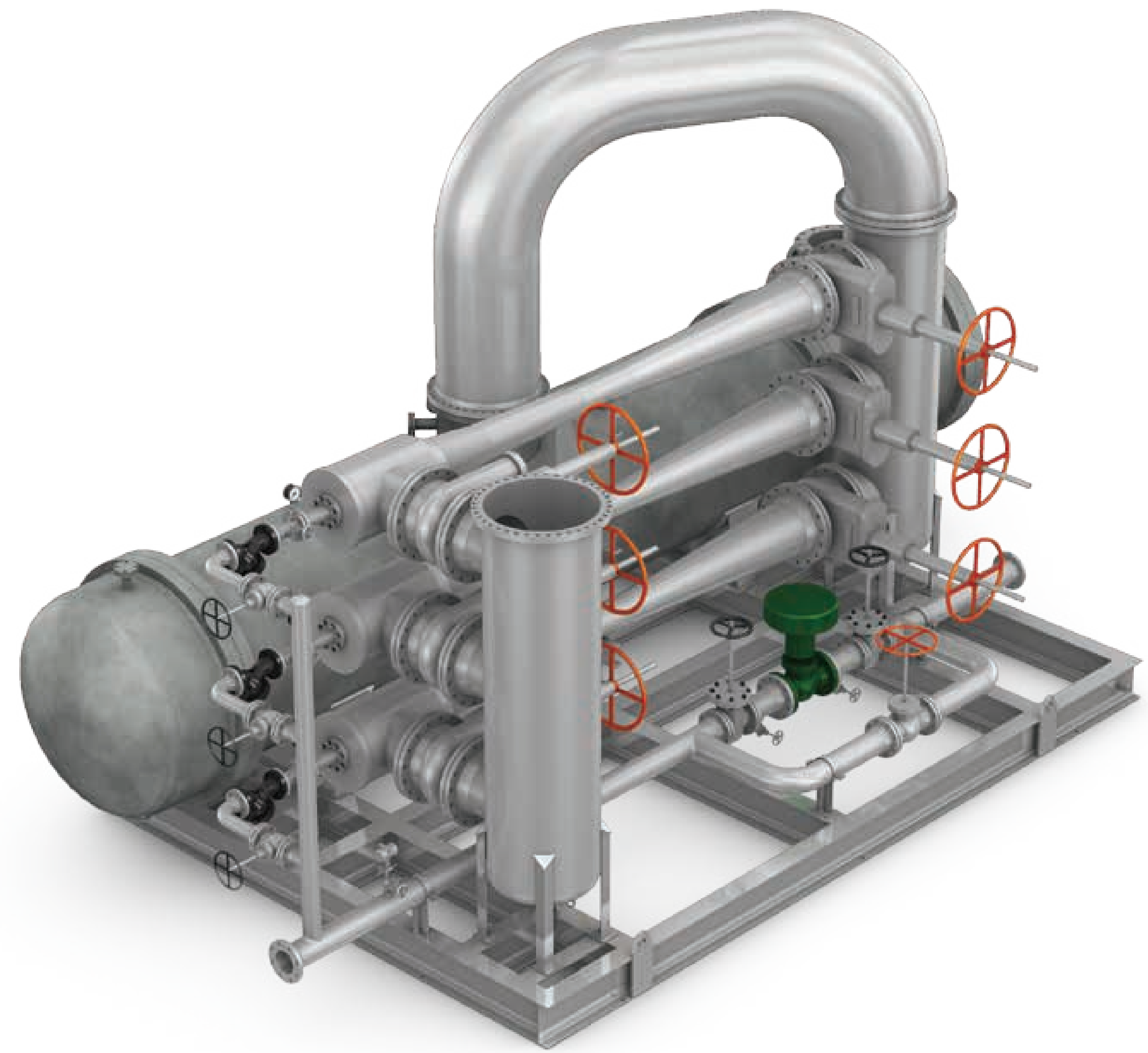
Further efficiency gains can be made by utilising multi stage systems in favour of single stage models, in general it is more efficient in specific energy terms to use multi stage ejectors, this requires the use of inter-condensers to remove the operating steam so that only the incondensable gases pass to the second stage reducing the amount of steam required. The diagram illustrates typical vacuum levels that can be achieved economically for a specific number of stages.

Multi Stage Steam Ejector Performance



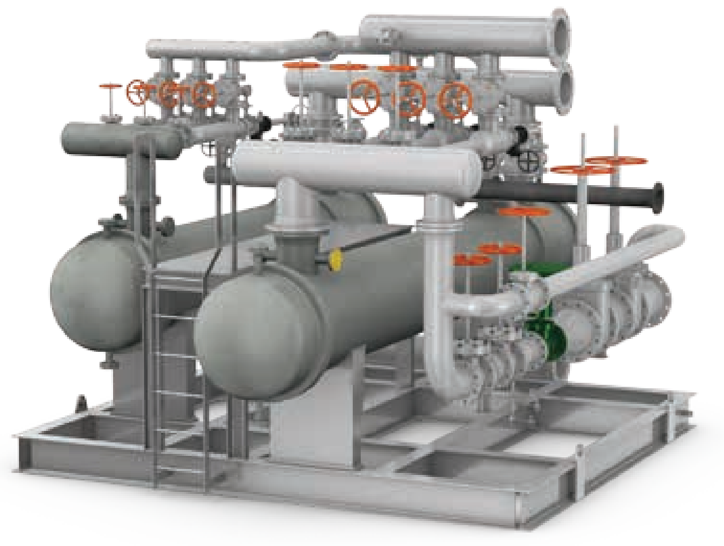
Multi stage steam ejectors enable lower suction pressures to be achieved than can be produced by a single stage unit. The inter-stage condensers economise on the use of motive steam as the operating steam from the upstream stage of the system is condensed leaving only the saturated non condensable gas to be handled by the next stage. Non condensing designs can be considered for some applications where the 1st stage discharges directly into the 2nd stage without a condenser, this increases the load on subsequent stages but reduces the initial cost.

The inter-stage condenser can be either a direct contact or surface type either of which can be positioned at barometric height to enable gravity draining, or at low level which requires a condensate extraction pump to remove the condensed vapours.



Direct contact or jet condenser

These operate by condensing the steam through direct contact with the cooling water, jet condensers typically use less cooling water than surface type but as the condensed vapours are in direct contact with the cooling water the treatment of the resulting effluent must be considered.



Surface condensers

Shell and tube type surface condensers can also be used as inter and after condensers, the key benefit being that as the cooling water is not in contact with the condensate then the potential effluent problem is greatly reduced.

Hybrid Systems

Multi stage systems can be designed utilising a liquid ring pump instead of the final stage ejector, this enables large vapour flows to be handled by the steam ejector system whilst significantly reducing the steam consumption and operating costs.

Steam ejector condenser package

Features and Benefits

- No moving parts – low maintenance regime and spares inventory
- Able to handle high vapour loads without risk of cavitation
- Large internal clearances – low risk of blockage due to fouling
- Tolerant to liquid slugs and process upsets – no requirement for expensive knock out pots
- No suction capacity limitation – eliminates multiple operating trains
- No inlet temperature limitations
- Materials of construction to suit process requirements
- Low capital cost relative to rotating equipment

Capabilities

- In house process design software
- Autodesk Inventor 3D CAD system, HTFS, Finglow
- Collaborative design process ensures optimum system performance
- ISO 9001 QA certification
- Compliant to international standards and design codes
- UK design and project and contract management
- Global procurement to suit specific project requirements

Information required at enquiry stage

- Brief description of the purpose for which the equipment is required
- Suction flow
- Composition and molecular weight
- Suction temperature and pressure
- System volume and evacuation time
- Motive steam normal and minimum pressures available as with maximum temperature if steam is superheated
- Cooling water temperature and pressure
- Installation type barometric or low level
- Preferred condenser type direct or indirect
- Applicable design codes

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