SAMWON ENGINEERING CO., LTD.

EJECTOR

- STEAM EJECTOR
- WATERJET EJECTOR
- SUMP EDUCTOR
- TANK MIXING EDUCTOR
- TANK MIXING EDUCTOR

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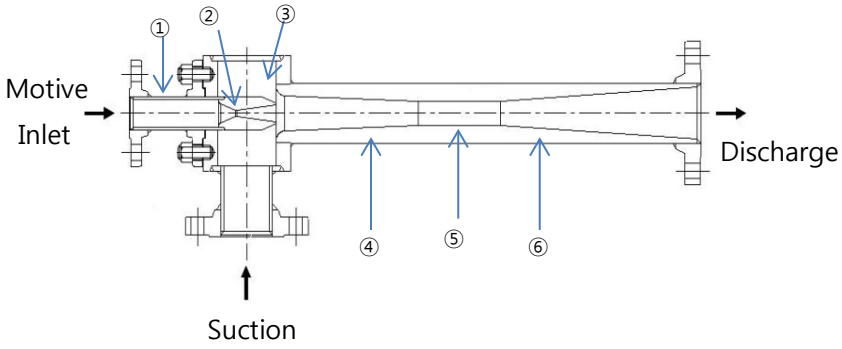
EJECTOR

What is EJECTOR?

An ejector is a device in which a high-velocity jet of fluid mixer with a second fluid stream. the mixture is discharged into a region at a pressure higher than the source of the second fluid. the ejector pumps the second fluid from on place to another.

1) Ejectors consist

1. Motive fluid chest
2. Converging/Diverging nozzle
3. Mixing chamber
4. Converging Inlet diffuser
5. Diverging outlet diffuser
6. Diffuser throat



2) Operating principle

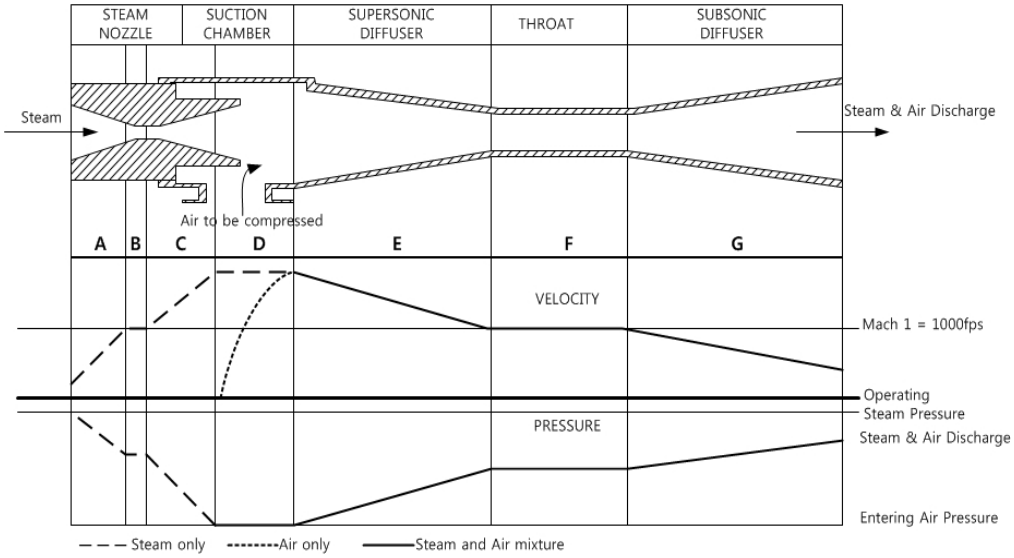
Ejector is that the pressure energy in the motive fluid(1) is converted to velocity energy by an adiabatic expansion in the converging/diverging nozzle(2). the nozzle exit velocity is normally in the supersonic range of 900 to 1200 m/second when using steam as the motive fluid. (velocities may vary depending on molecular weight, temperature, and pressure of the motive fluid.)

This high-velocity(cone shaped) jet enters the mixing chamber(3) and entrains the suction fluid being pumped.

The mixture attains a velocity of approximately 600 to 900 m/second.

The mixed motive fluid and suction fluid then enter the Converging inlet diffuser(4) where a portion of the velocity energy is converted to pressure energy. the mixture is then compressed in the diverging outlet(5) section of the Diffuser to attain the final discharge pressure, normally 5 to 15 times the suction pressure. there is a corresponding rise in mixture temperature as this compression occurs.

3) Basic structure & Flow model of ejector



4) Benefits of EJECTOR

- Ejectors can be operated with many different motive fluids
  - steam, air, organic vapor and other gases.
- Can handle corrosive and slugging liquids, solid and abrasive suction fluids without damage
- Made of any material
  - CS, SS, Ni Alloy, Ti, Teflon, Graphite etc.
- Simple, rugged, reliable and trouble-free.
- No moving parts, no lubrication, no vibration, no bearing or seal problems.
  - Available with flanged or weld end connections.
- No limit to the capacity
  - Single stage is used for low vacuum, and multistage ejectors with inter condensers are used for high vacuum.

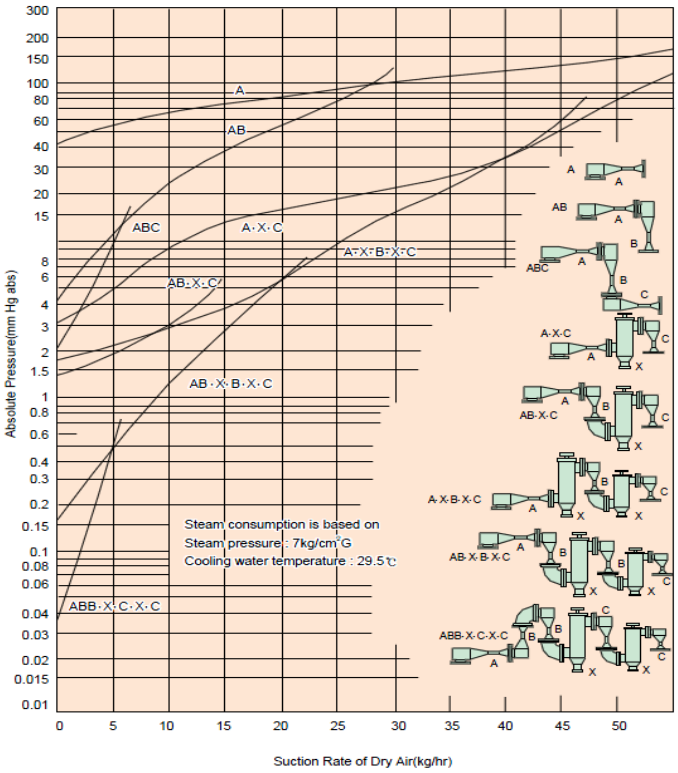
These fluids Do These jobs

	Load materials				
	Water vapor, steam	Air	Gas, vapor	Liquid	Solids
Steam	Refrigeration, Stripping, Drying, Compressor	Vacuum, Compressor	Vacuum, Compressor	Pump, Heater, Injector	Refrigeration, Stripping, Drying, Compressor
Air		Vacuum, Compressor	Vacuum, Compressor	Sampling, Mixing	Conveyor
Gas vapor		"BTU controller", Vacuum	Compressor, Vacuum	Sampling, Mixing	Conveyor
Liquid	Vacuum, Compressor	Vacuum, Pump priming	Vacuum	Pump mixing	Conveyor, mixing

1. STEAM JET EJECTOR

Steam has special properties, including its heating ability, and is often available at one or more pressure levels throughout a processing plant. thus, steam is the most versatile of the motive fluids and is used to pump all types of gases, liquids, and granular solids.

-Steam ejector system



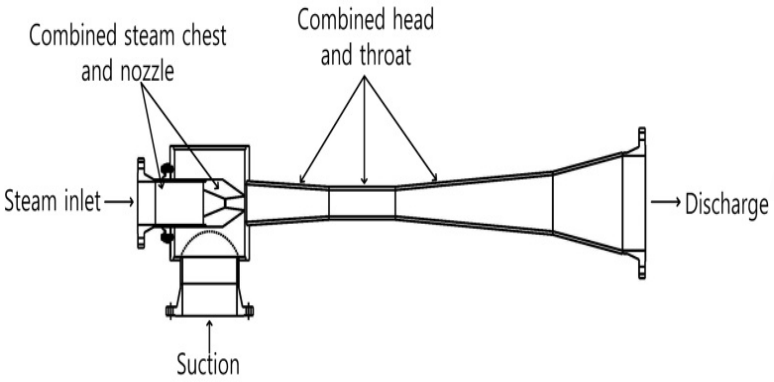
For greater ratios of compression than can be attained in a single ejector stage, two or more stages can be arranged to operate in series. This assembly constitutes a multi-stage ejector.

An ejector stage is inherently a constant capacity device. The capacity is a function of the physical proportions of the diffuser.

To obtain variation in capacity, two or more ejectors, either single or multi-stage, can be arranged to operate in parallel, each series constituting an element of a multiple element ejector,

This arrangement permits the operation required capacity, as each element is capable of completely compressing a portion of the total capacity.

2. TVR(thermal vapor recompressor)



This device often operates at pressures above atmospheric pressure. it uses high pressure steam to pick up low pressure steam and deliver it at a pressure sufficiently high that it condenses and yields useful heat to some process. the device recovers heat which might otherwise be lose, thus reducing the quantity of expensive high pressure steam consumed.

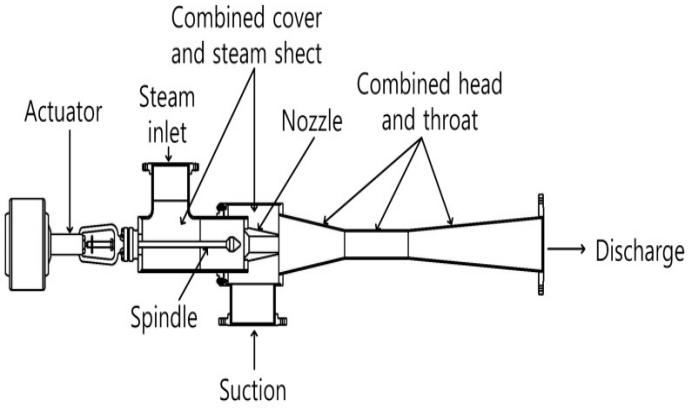


Figure is more complex, using an actuator to position a spindle in the nozzle for capacity control. The construction appears to be suitable for higher pressures.

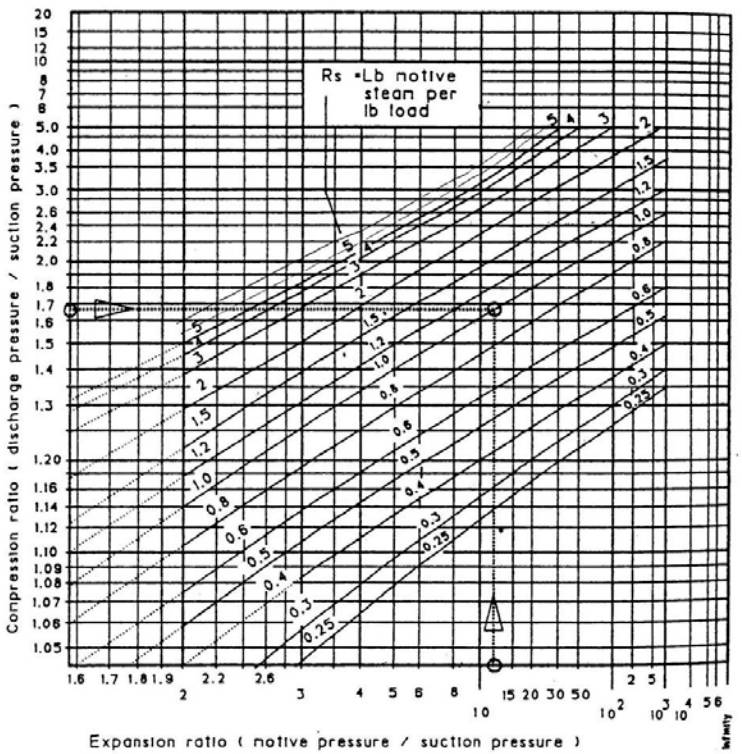


Table is extremely useful for estimating the design-point performance of steam-jet compressors. It is generally accurate to within 20 percent over the range of compression ratios up to 5, expansion ratios up to 1000, and motive/load ratios from 0.25 to 5. It is useful for screening proposed applications for general feasibility and for rough estimates of the economics of feasible applications. Amore detailed calculation may then be made to fine-tune the estimate and size the equipment.

3. WATER JET EDUCTOR

The water jet eductor is a type of ejector which untilizes the kinetic energy of a pressurized liquid to entrain another liquid, mix the two, and discharge the mixture against a counter pressure. Ejectors of this type are used throughout industry for pumping and mixing operations.

In most cases, liquid jet pumps are operated with water as motive medium. Depending on application and material, it is also possible to use other liquids.

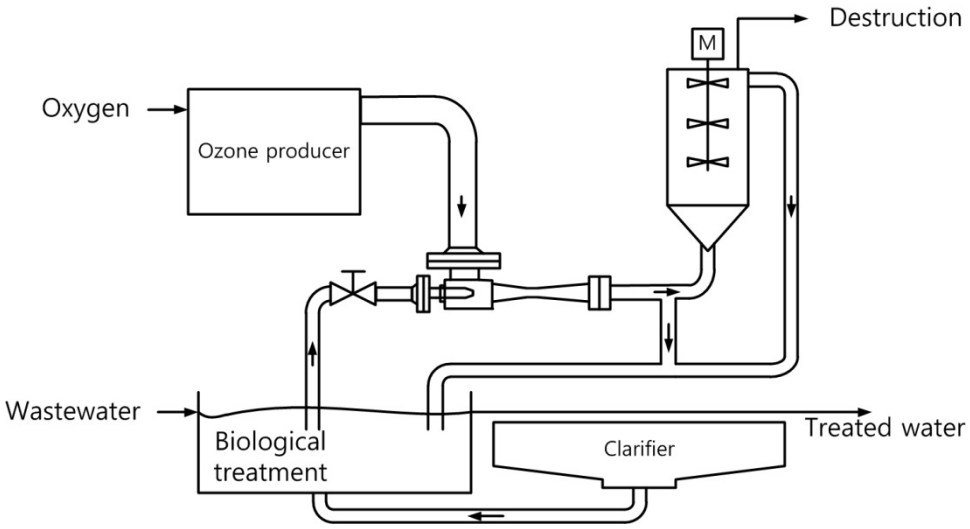
- Materials

CS, SS, Ni Alloy, Ti, Teflon, PVC

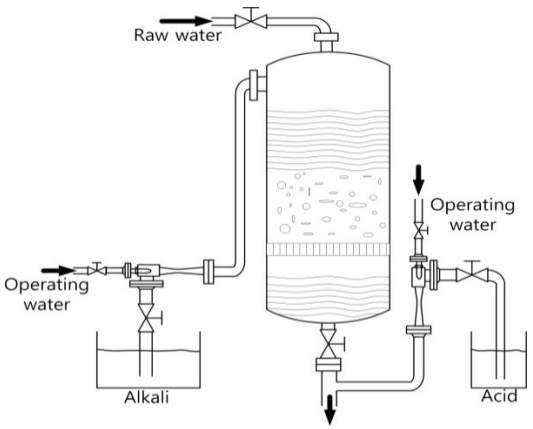
Using the PVC material offer resistance to many corrosive media.

PVE ejectors are not recommended, however, for acetone, ketones, ether, esters, aromatic hydrocarbons or chlorinated hydrocarbons.

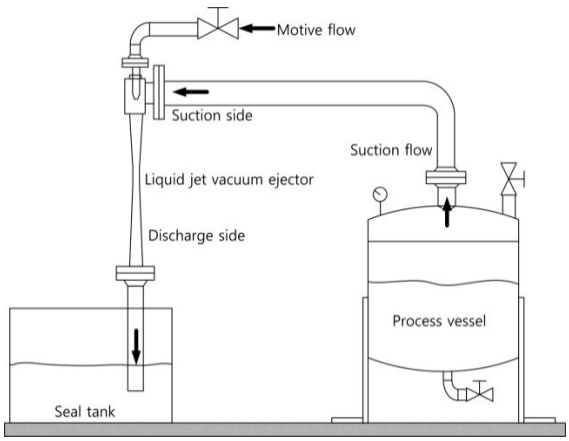
- Installation



Ozone system



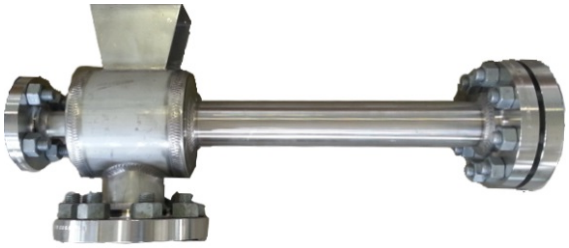
ION exchanger filter process



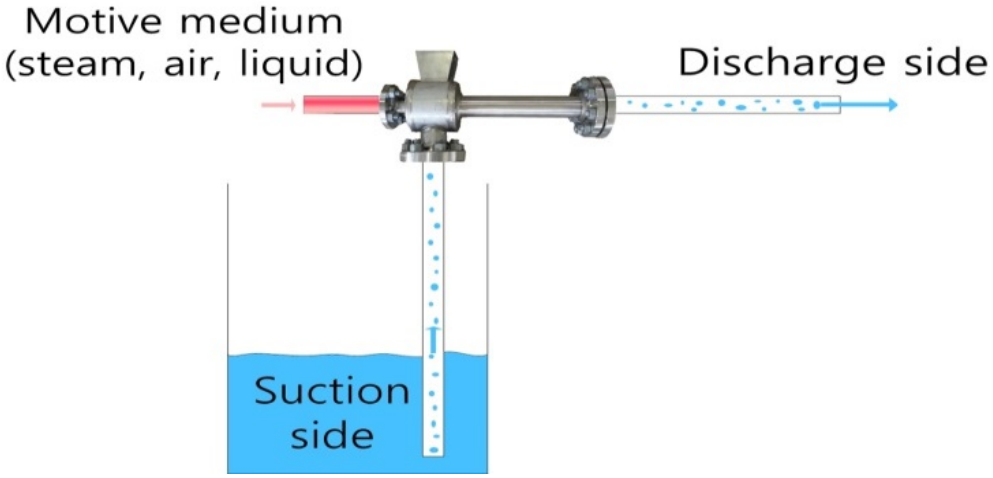
ION exchanger filter process

4. Sump eductor

Water jet eductors are used to pump out sumps(pits, tanks, etc.) where liquid accumulates slowly but must be evacuated when it reaches a predetermined level.
The jet action of the motive fluid creates a vacuum in the eductor and entrains the suction fluid, discharging both fluids under pressure. as the suction fluid is thus pumped out, the sump level drops to a point where the snap-acting valve shuts off. no further pumping action takes place until the sump again fills to the operating level.



Size eductor(inch)	Suction capacity(kg/h)
25A (1″)	1000~2000
40A (1-1/2″)	3000~4000
50A (2″)	5000~6000
80A (3″)	15000~

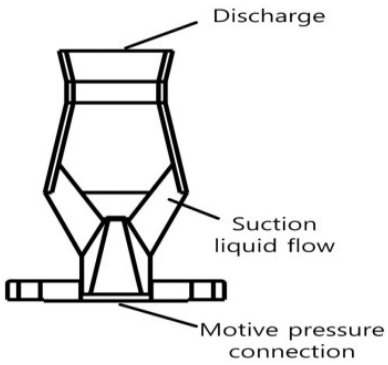


5. Tank mixing eductor

ejductor are used to agitate liquid, dissolve powdered solids in liquid, and to mix two or more liquids intimately within a tank or other vessel without the use of baffles or moving parts inside the tank. these units take the place of mechanical agitators.

A liquid flow is taken from the tank and supplied to the liquid jet mixing nozzle via a centrifugal pump.

Inside the motive nozzle pressure energy is converted to kinetic energy. Under pressure is generated at the motive nozzle outlet thereby sucking in liquid from the immediate vicinity. The suction flow is vigorously intermixed with the motive flow in the adjoining mixing passage and accelerated by impulse exchange. The drag effect of the exiting mixed flow strengthens the mixing effect.

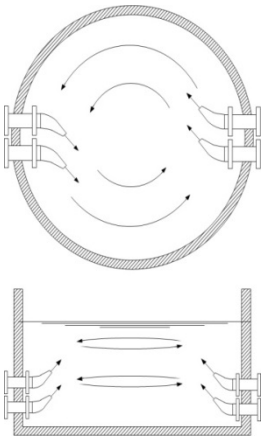


- Motive pressure connection
  -> Air, gas or liquid
- Suction liquid flow
  > Liquid in tank
- Discharge
  -> Liquid in tank and motive fluid mixing and circulation.

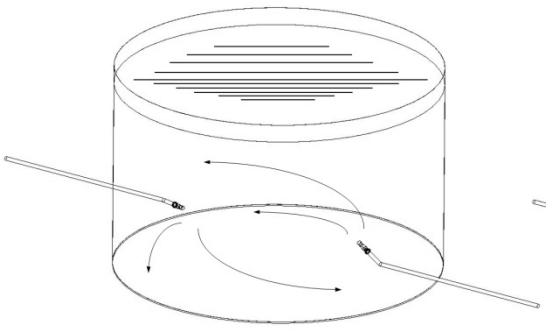
Size (inch)	Flow rate (m3/hr)	Length (mm)	Size (inch)	Flow rate (m3/hr)	Length (mm)
1″	3 ~ 8	200	4″	50 ~ 120	450
1-1/2″	5 ~ 12	280	6″	100 ~200	680
2″	10 ~ 20	280	8″	180 ~ 550	890
3″	15 ~ 60	450	10″	500 ~ 850	1100

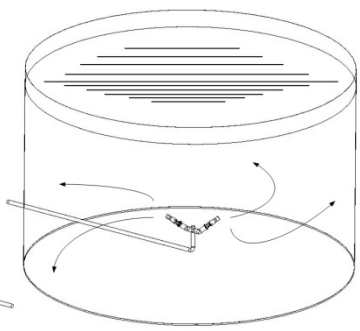
- Tank mixing nozzle

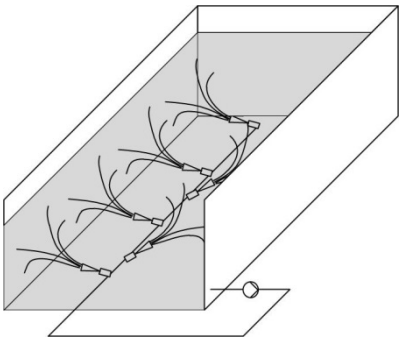
liquid jet mixing nozzles create special mixing systems which can be applied for continuous as well as discontinuous mixing duties. They can be used as a complete replacement for mechanical agitators and in many cases surpass their mixing results.



Installation example in a tank







6. EJECTOR APPLICATIONS

- Steam jet ejector Applications

Steam power plants

- Vacuum pump for surface

Paper

- Thermo Compressor

Steel industry

Degassing unit for RH, DH, TD, LD

Petrochemical

- Distillation, deodorization plants

Ship building

- Crude oil stripping pump

Food

- Vacuum dryer, For flash cooling, evaporators, degassing, and deodorizing

Pharmaceutical

- Frozen dryer

LPG terminal

- Jet condenser

Synthetic fiber

- Polymerization of polyester fiber

- Liquid jet ejector Applications

Water treatment

- dilution of lyes and acids

Sea-water evaporators

- conveying concentrated sea-water (brine)

Foodstuffs and chemical industry

- pumping and mixing of diverse liquids

Hydroelectric power stations

- emergency drainage of pump pits

Ship-building

- Inside the ship: pumping and cargo out bilges, chain lockers, holds ballast tanks

Synthetic fertilizer plants (UREA plants)

- pumping "carbamate"-solution back to the Urea-reactor