UNIQUE SYSTEMS®
INCORPORATED
ONE SADDLE ROAD - CEDAR KNOLLS, NEW JERSEY 07927-1998
Phone 973-455-0440 Fax 973-455-7214

HEAT EXCHANGE INSTITUTE HEI INCORPORATED MEMBER

EJECTOR PROCESS VACUUM SYSTEMS

INTRODUCTION

TWIN 62C23C EJECTOR VACUUM SYSTEM

MODEL # 15B11 EJECTOR VACUUM SYSTEM

Founded in 1973 by Olof A. Eriksen as a precision machine shop manufacturing close-tolerance steam turbine & compressor parts, Unique Systems soon began manufacturing ejector vacuum system components & assemblies for our largest customer, the Elliott Company, an industry leader in Turbomachinery & Ejector Vacuum Technology.

In 1985 we acquired the Elliott® Vacuum Equipment product lines, including ejectors, condensers, deaerating feedwater heaters, scrub coolers, grease extractors and other ancillary products. We have over **100 years** of accumulated knowledge and expertise in process vacuum applications. Our files contain engineering & test data, technical & design specifications, microfilm and original mechanical drawings for all former Elliott® vacuum equipment.

Unique Systems is a company with a reputation for its commitment to…

"VIP" SERVICE · YOUR ASSURANCE OF TOTAL SATISFACTION

We are dedicated to offering our customers a combination of **value, integrity, professionalism** & **service** in the design, manufacturing, installation & maintenance of Process Vacuum Systems.

Value in your Process Vacuum System investment is best reflected in our ability to match equipment operating characteristics to your requirements and size the system to minimize your operating costs. Our objective is to optimize the performance of your system by taking into consideration the vacuum pumping task, utilities available, operating conditions, mechanical design requirements, physical restrictions that may impact design configurations, materials of construction and your economic objectives.

Integrity extends beyond providing top-quality equipment. We recognize that you may have "unique" requirements calling for custom solutions. A custom solution may be as simple as providing a system configuration that conforms to your space limitations and may also mean developing a proprietary design to satisfy specific materials handling or operating conditions.

Professionalism is our dedication to engineering excellence, recognizing that your reliance upon our products extends over many years of service. Our engineering staff works with you throughout the project cycle to make certain all requirements are fully understood. We will provide professionally prepared quotations that include delivery costs, utility requirements, physical descriptions, performance criteria and information to help you determine the total ownership cost of the equipment.

The Unique "VIP" Service Advantage

• Value, Integrity, Professionalism & Service •

UNIQUE SYSTEMS®
INCORPORATED
ONE SADDLE ROAD - CEDAR KNOLLS, NEW JERSEY 07927-1998
Phone 973-455-0440 Fax 973-455-7214

EJECTOR PROCESS VACUUM SYSTEMS

Unique Systems is a proud member of the Heat Exchanger Institute (HEI). All our equipment is designed and constructed in full compliance with HEI, ANSI, ASME, ASTM, TEMA and other domestic and international codes & standards, as applicable.

Olof Eriksen with his scale model of "Old Ironsides" (Located at Liberty Science Center, Jersey City, NJ)

Service is more than a word at Unique Systems. We understand the importance of developing an individual relationship with each customer. Our success is directly related to your continued satisfaction, which is why we focus our personal attention on every client.

Unique Systems has dedicated considerable resources in an ongoing effort aimed at improving the design and performance of this technology. We continue to enhance our existing products and develop new ones, such as our Quickcheck® Ejector Steam Chest, to better serve our customers.

Our business philosophy backs our commitment to service. We have structured our business to be flexible, responsive and cost-conscious in the design & manufacturing of systems & parts, and to take all necessary measures to help ensure a high-quality product and delivery on schedule. Our plant houses engineering, machining, fabrication, welding, assembly, testing, sandblasting, painting & packing facilities. We stock most common components for our vacuum system product lines; and, we maintain an extensive raw material inventory at all times. Over the years we have also established strong business relationships and strategic partnerships with a roster of professional manufacturing and installation firms of proven capability.

EXPERIENCE IN APPLICATION

Unique Systems has an enormous amount of technical data – drawings, design & engineering records, proprietary computer programs and a library of research & development information – which dates back as far as the early 1900's. Our design resources range from industry-common to totally obscure vacuum process applications including:

Absorption	Concentration	Evaporation	Molding	Refrigeration
Accumulation	Crystallization	Extraction	Packaging	Scrubbing
Aeration	Deaeration	Filtration	Polymerization	Sterilization
Agitation	Decarbonization	Flashing	Powderization	Stills
Annealing	Degasification	Freeze Drying	Priming	Stripping
Air Removal	Dehydration	Hydrogenation	Processing	Testing
Canning	Deodorization	Impregnation	R & D	Thermocompression
Cooking	Distillation	Lubrication	Reclamation	
Cracking	Drying	Melting	Reduction	
Compression	Evacuation	Mixing	Refining	

Some of the industries which utilize vacuum production are:

- **Aerospace**
- **Chemical**
- **Cogeneration**
- **Consumer Product**
- **Food Manufacturing**
- **Marine**
- **Metal**
- **Pulp & Paper**
- **Plastic**
- **Petroleum**
- **Petrochemical**
- **Pharmaceutical**

The Unique "VIP" Service Advantage

• Value, Integrity, Professionalism & Service •

Let's take a moment and briefly discuss a few of these fascinating areas:

AEROSPACE

The most impressive of all ejector applications – if only because of the enormous size of the units involved – are those in the aerospace industry. Construction of these ejectors requires experience of the highest order. Our application records include ejector systems that simulate an elevation of 80,000 feet and pumps rocket exhaust to atmosphere. Unique's combination of informed technology and fabricating skill brings high altitude down to earth!

CHEMICAL / PHARMACEUTICAL PROCESSES

Our technical records cover a broad range of applications within the Chemical & Pharmaceutical process industries, ranging from vacuum cooling & distillation to the low-temperature drying of heat-sensitive materials. Where chemically-active or corrosive materials must be handled, ejectors can be constructed from almost any machineable material – 304SS, 316SS, Carpenter® 20, Hastelloy®, Monel® 400, titanium or graphite. For example, Carp-20 & Hast-C ejectors are at work in the crystallization of fertilizers.

FOOD INDUSTRY

Scarcely a food is produced these days without the help, somewhere along the line, of the steam jet ejector – the making of sugar & salt, vacuum packing, rice conversion, milk evaporation, fruit juice concentration and freeze drying to name a few. Most interesting is a vegetable oil deodorizing ejector system with a "Swirl Jet" Scrub Cooler. The scrub cooler recovers water-free vegetable oil distillates, eliminating a long-standing problem of condensing water pollution – and the distillate is a valuable by-product.

PETROLEUM REFINING

Crude-oil distillation is one of the key processes in a refinery complex. After atmospheric distillation is complete and the lighter distillates recovered, the "reduced crude" passes to the vacuum distillation tower where additional valuable volatiles are recovered. Unique Systems understands the complex economics involved in this important application. We can provide a system with proper emphasis on utilities and initial cost, yet still meet space limitations. We have an extensive collection of records on refining applications.

VACUUM METALLURGY

The Elliott® reputation in vacuum metallurgy was worldwide. They were part of the earliest evolution of the art, from pilot plants to the first commercial applications, including development of vacuum technology to meet each new generation of metallurgical refinements and equipment. Their "know-how" engineered most of the ejector systems in vacuum metallurgy. Our technical library and files contain the cumulative results of their research and experience. For example, vacuum induction melting requires pressures of 10 microns (0.01 mm) of mercury absolute and lower. To enter this exotic region, where one molecule must travel more than an inch before it hits another, six-stage ejector systems are used. To serve a heavy-duty vacuum induction furnace for melting high alloy steel, a six-stage ejector system was constructed. The system was designed to pump a 25-ton heat down to 5 microns absolute pressure! Our records on vacuum degassing are quite impressive.

EJECTOR PROCESS VACUUM SYSTEMS

APPLICATION DATA REQUIRED FOR SIZING EJECTOR SYSTEMS

Non-Condensing Systems

- Capacity required – Air, gas, water vapor, hydrocarbons, etc.
  Please provide molecular weight of load gases, if known.
- Inlet temperature of load gases at ejector suction.
- Absolute pressure to be maintained at ejector suction.
- Motive fluid, if other than steam. Please specify composition, if known.
- Minimum motive fluid pressure & temperature.
- Maximum motive fluid pressure & temperature.
- Maximum discharge pressure.
- Barometric pressure at site.
- Requirement for stability at shut-off, if any.
- Evacuation requirements, if any.
- Need for special materials of construction.
- Describe process the ejector will be designed to serve.
- Note any mechanical design or space limitations at site location.

Condensing Systems

- The following is in addition to the information listed above:
- Maximum cooling water temperature.
- Type of condensers – Barometric (direct-contact) or surface (shell & tube).
- Requirement for a pre- or aftercondenser.
- Allowable water pressure drop (surface condensers only).
- Specify condenser design requirements (TEMA type, tube size, etc.).

EJECTORS

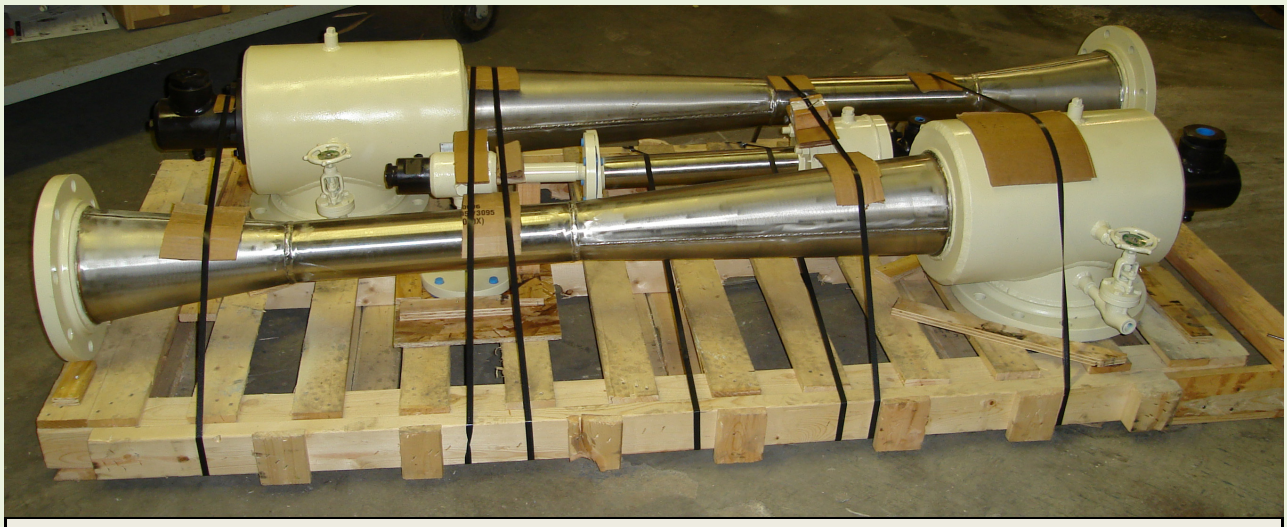
Steam jet ejectors, are the simplest form of vacuum producing pump or compressor. With no moving parts, ejectors are designed to provide many years of **trouble-free operation** with little maintenance. **No lubrication or sealing liquids** are required. They operate on a mass-velocity principle. A motive fluid, steam being the most common, expands through a divergent nozzle, converting its pressure energy into velocity energy. As it passes through the suction chamber, it comes in contact with and entrains the vapors to be evacuated. The steam & vapor mixture then enters the diffuser where velocity energy is converted again to pressure energy at discharge.

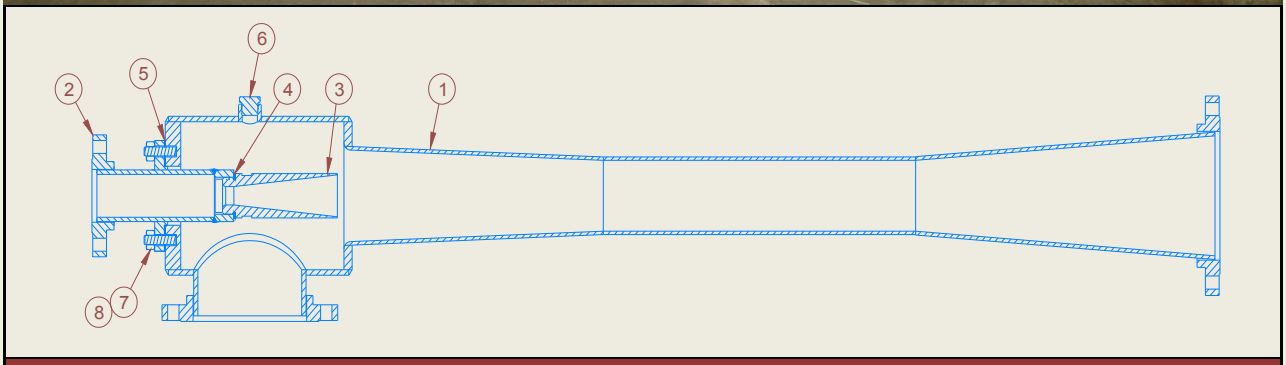
Ejectors are available in **standard or custom designs, single- or multi-stage arrangements** and operate on a **wide variety of motive fluids**, including air, gas/vapor, liquid & steam. Special designs for **high-corrosion & temperature conditions** are also available. Ejectors can be constructed of almost any machineable material ranging from carbon steel thru exotic alloys.

UNIQUE SYSTEMS®
INCORPORATED
ONE SADDLE ROAD - CEDAR KNOLLS, NEW JERSEY 07927-1998
Phone 973-455-0440 Fax 973-455-7214

HEAT EXCHANGE INSTITUTE HEI INCORPORATED MEMBER

EJECTOR PROCESS VACUUM SYSTEMS





CROSS-SECTION OF TYPE "E" STEAM JET EJECTOR			
1	Suction Chamber & Diffuser (Body Weldment)	5	Gasket, Steam Chest
2	Motive Steam Chest	6	Vacuum Gauge Connection (Plugged)
3	Steam Nozzle	7	Threaded Stud
4	Nozzle Spacer	8	Heavy Hex Nut

Unique Systems designs and manufactures its ejectors, including large, complex systems, with care and skill, in compliance with Heat Exchange Institute (HEI) and other applicable standards. Our commitment to continually provide high-quality products was proven with the introduction of our **Quickcheck® Ejector Steam Chest**. On ejector installations where **routine maintenance** and **prevention of "down-time"** are important considerations, users will realize the significant benefits of using this product. Its user-friendly design **permits inspection, maintenance** and prompt return of an ejector to service, **including replacement of the steam nozzle**, if necessary, ***without disassembly!***

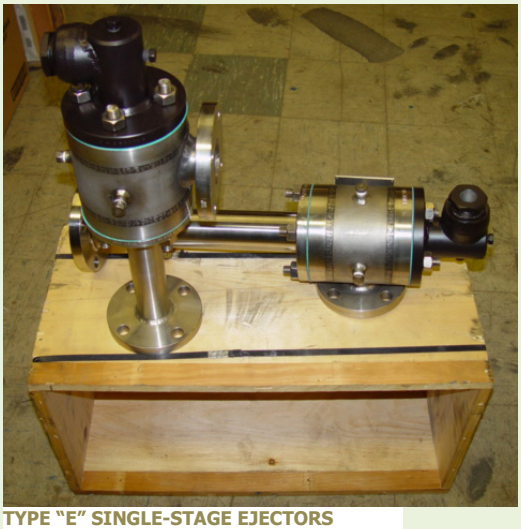
SINGLE-STAGE EJECTORS
[3" (75 mm) Hg Abs - Atmosphere]

Unique single-stage ejectors are made in three distinct types. Type "E" ejectors are suitable for maintaining absolute pressures ranging from 3" of mercury to atmosphere. Type "G" ejectors are for applications which require corrosion resistance. Our P3136-Series ejectors are low-cost units, well-suited for evacuation & priming service where economy and exact performance figures are of little importance.

UNIQUE SYSTEMS®
INCORPORATED
ONE SADDLE ROAD - CEDAR KNOLLS, NEW JERSEY 07927-1998
Phone 973-455-0440 Fax 973-455-7214

HEAT EXCHANGE INSTITUTE HEI INCORPORATED MEMBER

EJECTOR PROCESS VACUUM SYSTEMS



TYPE "E" SINGLE-STAGE EJECTORS

TYPE "E"

Our Type "E" is a highly efficient, single-stage ejector of very careful workmanship, nozzle & diffuser being machined with extreme precision. With its single steam nozzle, the Type "E" ejector is undoubtedly the most simply constructed and most dependable piece of vacuum-producing apparatus available. It will perform continuously and without attention for an indefinite period, depending upon the application.

Absolute pressure down to 3" of mercury can be maintained efficiently with the Type "E".

Standard units can be designed for motive steam up to 600 PSIG & 750ºF. For higher pressures and temperatures, special materials are available. Steam consumption varies from around 30 #/hour upwards.

PERFORMANCE DATA FOR SINGLE-STAGE TYPE "E" & "G" EJECTORS

For preliminary estimate only. Please consult Unique Systems for actual figures relating to your application.

SUCTION PRESSURE In Hg Abs	MAXIMUM RATED CAPACITY (#/HOUR) Based on 70°F Dry Air – 100 PSIG Steam * – Atmospheric Exhaust									POUNDS OF STEAM REQUIRED Per Pound of DAE	
	EJECTOR FRAME SIZE										
	11	15	20								
	21	22	23	31	32	41	42	61	62		
	SUCTION & DISCHARGE CONNECTION SIZES										
	1"	1½"	2"								
	2"	2"	2"	3"	3"	4"	4"	6"	6"	TYPE "E"	TYPE "G"
4	19	46	76	130	185	255	375	560	750	5.61	6.17
5	27	66	105	180	255	350	525	760	1025	4.01	4.41
6	35	82	130	225	320	430	640	950	1360	3.16	3.48
8	47	110	170	300	430	510	850	1275	1810	2.29	2.52
10	59	135	215	375	540	740	1075	1575	2150	1.76	1.94
12	72	165	260	450	650	880	1300	1900	2575	1.48	1.63
14	86	195	305	540	775	1050	1575	2375	3125	1.30	1.43
16	100	230	360	640	910	1250	1850	2700	3725	1.13	1.24
18	115	260	420	750	1175	1475	2200	3150	4350	1.05	1.16
20	135	310	480	880	1225	1700	2550	3700	5100	0.97	1.07

Additional Information:

- Minimum Steam Consumptions (Approx.) – Type "E" (30 #/Hour) & Type "G" (90 #/Hour)
- Sizes 11, 15, 20 & 23 all have threaded connections and are available in Type "E" design only. Flanged connections are available.
- Sizes 31 thru 62 utilize flanged suction & discharge connections.
- Custom configurations, including our patented Quickcheck® design, are available for other conditions in Type "E" design only.

Sample Ejector Frame Selection:
To compress 472 #/hour of 70°F dry air from 6" Hg Abs to atmospheric pressure.

- Maximum capacity at 6" Hg Abs – Size 41 = 430 #/Hour : Size 42 = 640 #/Hour
- Use Ejector Frame Size 42
- Steam Consumptions (Approx.) – Type "E" = 472 x 3.16 = 1,492 #/Hour : Type G = 472 x 3.48 = 1,643 #/Hour

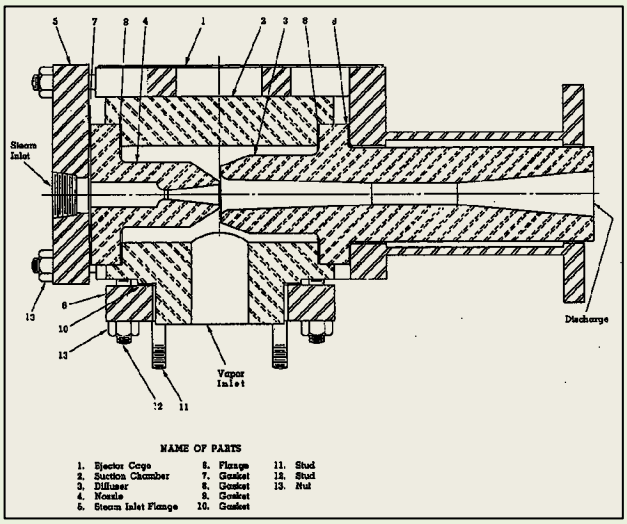
* Please consult Unique Systems for steam pressures other than 100 PSIG.

UNIQUE SYSTEMS®
INCORPORATED
ONE SADDLE ROAD - CEDAR KNOLLS, NEW JERSEY 07927-1998
Phone 973-455-0440 Fax 973-455-7214

HEAT EXCHANGE INSTITUTE HEI INCORPORATED MEMBER

EJECTOR PROCESS VACUUM SYSTEMS

TYPE "G" (GRAPHITE)



Type "G" ejectors are applied when it is necessary to handle the corrosive vapors from most acid & salt solutions. They are resistant to vapors from hydrochloric, sulfuric & acetic acids; but, are not recommended for applications involving strong oxidizing agents, such as nitric or chromic acid.

All internal parts of the Type "G" ejector – suction chamber, nozzle & diffuser – are machined from solid blocks of special high-density graphite. This material, except at very high temperatures, is practically inert. It is also highly resistant to erosion due to the impingement of dry saturated steam. Wet steam will cause some erosion.

The graphite elements are assembled in a steel cage and may be replaced without replacing the steel sleeve. Threaded joints, with the possibility of vapor leakage, are eliminated in favor of gasketed joints in Type "G" ejector design.

Compared with ordinary metal ejectors, the Type "G" demands only a small sacrifice in steam consumption. There is a wide range of sizes available to meet various operating requirements.

"P3136" SERIES

Our P3136-series ejector is a simple, low-priced single-stage unit, suitable for removing large quantities of air or other gases at relatively low vacuum. It is primarily used for applications such as Gland Seal Systems for steam turbines, priming pumps, evacuating tanks, etc. This unit will produce a pressure rise (discharge pressure minus suction pressure) of 3.3" Hg (1.6 PSI) and is available in three standard sizes.

PERFORMANCE DATA FOR "P3136" SERIES EJECTORS
For preliminary estimate only. Please consult Unique Systems for actual figures relating to your application.

EJECTOR FRAME SIZE	CAPACITY(#/HOUR) 70°F DRY AIR	NOMINAL STEAM CONSUMPTION (#/HOUR) 100 PSIG Motive Steam
P3136A500	80	50
P3136A600	160	100
P3136A700	275	175

Additional Information

- Minimum steam pressure is 20 PSIG.
- Please consult Unique Systems for steam pressures other than 100 PSIG.
- Motive steam consumption will be less at higher steam pressures and more at lower pressures.
- Also available using air as a motive fluid. Air consumption is 2x listed steam consumption.
- Custom configurations, including our patented Quickcheck® design, are also available.

UNIQUE SYSTEMS®
INCORPORATED
ONE SADDLE ROAD - CEDAR KNOLLS, NEW JERSEY 07927-1998
Phone 973-455-0440 Fax 973-455-7214

HEAT EXCHANGE INSTITUTE HEI INCORPORATED MEMBER

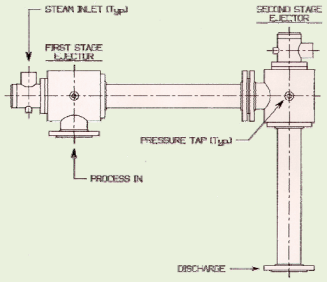
EJECTOR PROCESS VACUUM SYSTEMS

TWO-STAGE EJECTORS
[0.3" (8 mm) Hg Abs - 4.5" (114 mm) Hg Abs]

Unique two-stage ejectors are made in three distinct types. Type "N" ejectors operate without an intercondenser connected between the two stages. Type "B" ejectors use a barometric-type (direct-contact) intercondenser between the stages. Type "C" ejectors use a surface-type (shell & tube) intercondenser between the stages.

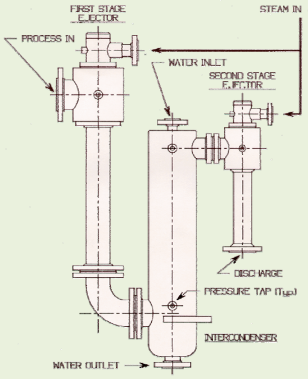
In general, two-stage ejectors are most suitable for maintaining absolute pressures ranging from 0.75" to 4.5" of mercury.

TYPE "N" (NON-CONDENSING)



The Type "N" is a two-stage non-condensing ejector in which the first stage discharges directly into the suction of the second stage. This type of ejector is used where the capacity is small, where steam consumption is not important or where space limitations or lack of water will not permit the use of an intercondenser. It is available in a wide range of sizes and designs, with steam consumptions from 50 #/hour upwards. It can be readily installed directly on any part of the vacuum system.

TYPE "B" (BAROMETRIC INTERCONDENSER)

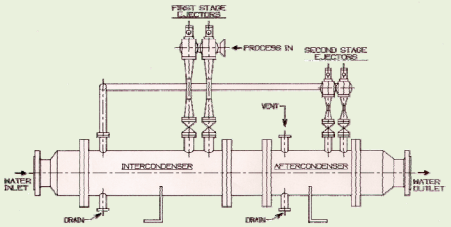


The Type "B" consists of two single-stage ejectors with a counter-current barometric (direct-contact) condenser between stages. It is commonly applied in connection with various industrial processes or on jet or barometric condensers used in power plants. This type of ejector is built in a wide range of sizes, with steam consumption from 40 #/hour up and condensing water requirements from 5 GPM upwards. An aftercondenser of the same type may also be employed.

Compared to the Type-N, the Type-B ejector is used:

- If larger capacities are required.
- If steam consumption must be minimized.

TYPE "C" (SURFACE INTERCONDENSER)



Type "C" ejectors differ from the Type "B" in the use of surface (shell & tube) intercondensers. Type "C" ejectors are built in a wide range of sizes with steam consumption from 40 #/hour up and condensing water requirements from 5 GPM upwards. In addition, many Type "C" installations employ a surface-type aftercondenser.

MULTI-STAGE & BOOSTER EJECTORS

When absolute pressures lower than 1" of mercury must be maintained, it is usually necessary to utilize more than two compression stages. Such units are generally referred to as multi-stage ejectors. Booster stages are ejectors designed to compress relatively large quantities of water vapor or other condensable vapors from a low absolute suction pressure to a discharge pressure such that the mixture may be readily condensed using the available condensing water.

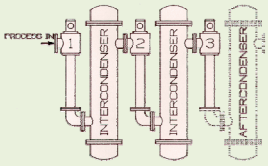
UNIQUE SYSTEMS®
INCORPORATED
ONE SADDLE ROAD - CEDAR KNOLLS, NEW JERSEY 07927-1998
Phone 973-455-0440 Fax 973-455-7214

HEAT EXCHANGE INSTITUTE HEI INCORPORATED MEMBER

EJECTOR PROCESS VACUUM SYSTEMS

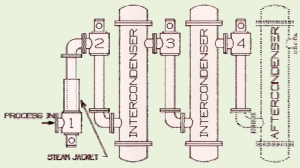
The design of boosters lends themselves to the use of special materials where corrosive gases must be handled. Standard designs are fabricated from steel plate. When a booster must maintain a suction pressure lower than 0.2" (5 mm) of mercury absolute, it is sometimes necessary to enclose the inlet diffuser section, and possibly the steam nozzle, in a steam jacket to prevent the formation of ice particles in the vapor passage.

Condensers of either the barometric (direct-contact) or surface (shell & tube) type can be incorporated into any multi-stage hook-up. Aftercondensers may be employed to recover the heat of the steam, recover condensate, eliminate noise and to prevent the exhaust of steam & process vapors to atmosphere.



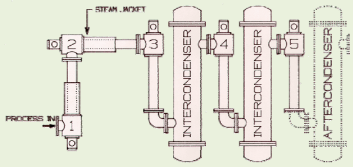
THREE-STAGE EJECTORS
[0.08" (2 mm) Hg Abs - 2" (50 mm) Hg Abs]

Where an absolute pressure between 2" (50 mm) and 0.08" (2.5 mm) of mercury must be maintained, a three-stage ejector is usually applied.



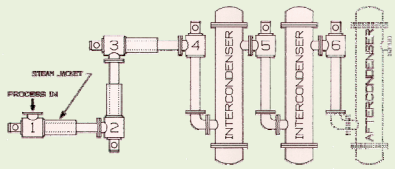
FOUR-STAGE EJECTORS
[0.012" (0.3 mm) Hg Abs - 0.1" (2.5 mm) Hg Abs]

Four-stage ejectors are usually applied where absolute pressures ranging from 0.1" (2.5 mm) and 0.012" (0.3 mm) of mercury are required.



FIVE-STAGE EJECTORS
[0.003" (0.075 mm) Hg Abs - 0.02" (0.5 mm) Hg Abs]

Where an absolute pressure between 0.02" (0.5 mm) and 0.003" (0.075 mm) of mercury must be maintained, a five-stage ejector is usually applied.



SIX-STAGE EJECTORS
[0.004" (0.010 mm) Hg Abs - 0.003" (0.075 mm) Hg Abs]

Six-stage ejectors are usually applied where absolute pressures ranging from 0.003" (0.075 mm) and 0.004" (0.010 mm) of mercury are required.

In each configuration shown above, an aftercondenser, as well as a pre-condenser (not shown), may be employed in certain instances. Second intercondenser is optional when non-condensable load is relatively small. First intercondenser may also be eliminated under certain circumstances, such as a high water temperature or extremely small loads.

CONDENSERS

Condensers are heat exchangers. The two main types used with ejector vacuum systems are the barometric (direct-contact) and the surface (shell & tube) type, both of which may be combined on the same system. Depending upon the application, they may act as pre-condensers, intercondensers & aftercondensers.

UNIQUE SYSTEMS®
INCORPORATED
ONE SADDLE ROAD - CEDAR KNOLLS, NEW JERSEY 07927-1998
Phone 973-455-0440 Fax 973-455-7214

HEAT EXCHANGE INSTITUTE HEI INCORPORATED MEMBER

EJECTOR PROCESS VACUUM SYSTEMS

In ejector systems, condensers are used to accomplish one or more of the following:

- Condensing motive steam & condensable vapors discharged from an ejector stage.
- Lowering steam consumption of the following ejector stage.
- Cooling saturated non-condensable gases prior to their removal by an ejector stage.
- Recovering certain condensable vapors from process applications.

The condensing medium is usually raw water, although process water or other liquids may be used. Maximum temperature of the condensing water should always be specified since high water temperature affects the amount of steam & water required for a specified capacity. Condensing water can be regulated for varying inlet temperatures. Drainage is accomplished by a 34-foot tailpipe (a "barometric leg"), drain trap, condensate pump or other suitable means.

BAROMETRIC (DIRECT-CONTACT) CONDENSERS

The barometric condenser permits the vapor stream to come into "direct contact" with the cooling medium, usually water, at which point condensation occurs. It is the simplest design, lowest cost and easiest form of condenser to maintain. It is also the most efficient design, allowing the greatest amount of vapor condensation to occur, with a lower pressure drop than a surface condenser.

Due to important environmental concerns and restrictions, barometric condensers should only be considered when there is no possibility of releasing contaminants caused by the intermixing of vapors and the cooling medium!

SURFACE (SHELL & TUBE) CONDENSERS

Unlike the barometric-type, application of surface-type condensers utilizes the advantages inherent with a shell & tube design, such as:

- Permits recovery of heat from the propelling steam by using water suitable for boiler feed or process as the condensing medium.
- Prevents contamination of condenser water by the condensable vapors, when the condenser water can be re-used after passing over a cooling tower.
- Permits recovery of valuable condensable vapors in process applications without corruption by steam or other motive fluids from ejectors.

The most common configuration has cooling water flow through the tubes with condensation taking place within the shell. When severe fouling is expected, the configuration is reversed and cooling water flows through the shell-side with condensation occurring within the tubes. The condenser should then be mounted vertically to allow proper drainage of condensate.

UNIQUE SYSTEMS®
INCORPORATED
ONE SADDLE ROAD - CEDAR KNOLLS, NEW JERSEY 07927-1998
Phone 973-455-0440 Fax 973-455-7214

HEAT EXCHANGE INSTITUTE HEI INCORPORATED MEMBER

EJECTOR PROCESS VACUUM SYSTEMS

For most ejector applications, surface condensers are available with either fixed tube sheets or removable tube bundles. A removable bundle permits a more comprehensive cleaning of both shell- & tube-sides. More costly constructions, such as split-ring & pull-through floating head units, are available.

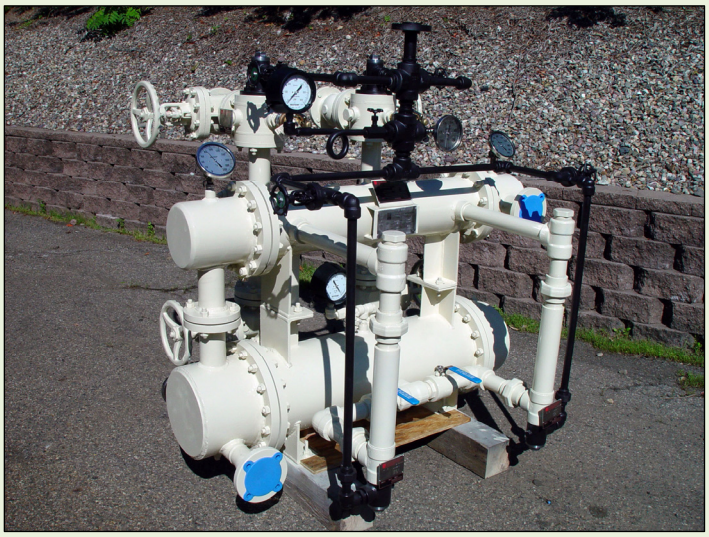
All our surface condensers are designed & constructed in accordance with ASME and TEMA Standards.

PRE-CONDENSERS & AFTERCONDENSERS

Although not required a pre-condenser can substantially lower utility consumption and equipment cost by removing much of the condensable load which would have otherwise been handled by the vacuum equipment. In turn, this reduces the overall size requirements for the vacuum system.

An aftercondenser is used to prevent the discharge of motive fluid and process vapors to atmosphere, eliminate noise, to condense motive steam from the final ejector stage and to recover any remaining non-condensable vapors. The use of an aftercondenser causes no reduction in steam consumption or increase in performance of the ejector stages.

At Unique Systems, we believe in providing our customers with the information required to make the best and most informed choices. It is our goal to provide alternatives to suit your current needs, as well as your needs in the future!



TWIN 32C15C EJECTOR VACUUM SYSTEM

TERMS & DEFINITIONS

The following is a list of helpful terminology, which corresponds with the information contained in this brochure. Due to the wide variety of possible units of measure (UOM), references to specific UOM's have been minimized.

Absolute Pressure: The pressure measured from absolute zero (i.e. from an absolute vacuum).

Booster: An ejector stage designed to compress large quantities of gases from a low absolute suction pressure to a discharge pressure that allows the mixture to be readily condensed using available condensing water.

Capacity: Weight rate of flow of the gas to be handled by the ejector.

Discharge Pressure: Pressure at the discharge flange of an ejector stage. When a unit discharges to atmosphere, discharge pressure will be the summation of the maximum barometric pressure and pressure losses caused by external factors such as the size & length of exhaust steam piping, mufflers, exhaust heads, etc.

Dry Air Equivalent (DAE): Industrial standard for capacity rating of a steam jet ejector is the flow, in pounds per hour, of dry air or equivalent, and is defined as dry air at a temperature of 70°F. One pound per hour of DAE equals one pound per hour of dry air at 70°F. Any gas can be corrected for molecular weight and temperature to be equivalent to dry air at 70°F.

EJECTOR PROCESS VACUUM SYSTEMS

Eductor: An ejector which utilizes pressurized liquid as its motive fluid.

Evacuation: Process of reducing the pressure in a given volume by removing the gas in that volume.

Micron: Unit of measure where 1,000 microns = 1 mm Hg.

Molecular Weight: Sum of the atomic weights of all the atoms in a molecule.

Mol: A mass numerically equal to the molecular weight.

Motive Steam Pressure: Minimum steam pressure existing in the steam chest immediately ahead of the steam nozzle. When stating motive steam pressure, the maximum temperature present should also be given.

Performance Guarantee: Statement indicating the expected performance of an ejector. If weight of gas consists of a mixture of two or more gases, weight & description of component gases should be clearly stated. Only one performance point is guaranteed – others are approximations.

For a single-stage unit, or a multi-stage, non-condensing ejector, this statement should include:

- Weight of Gases to be Compressed
- Suction Pressure
- Maximum Discharge Pressure
- Minimum Motive Steam Pressure
- Steam Consumption

For multi-stage condensing units, the above information should be supplied, plus:

- Maximum Water Temperature
- Water Consumption

Shut-Off Pressure: Absolute suction pressure maintained by the ejector at zero capacity.

Stable Operation: Operation of the ejector without violent fluctuation of the suction pressure.

Stability: A stable ejector is one which will operate over a wide range in capacity and maintain corresponding steady suction pressure, as long as the design motive steam pressure and back pressure conditions are maintained. Should motive steam pressure decrease or the back pressure increase beyond design conditions, a stable ejector will restore the proper suction pressure as soon as design steam conditions or back pressure are again established.

Stage Numbering: The following is an industry-wide system for designating ejector stages & condensers as taken from the Heat Exchange Institute (HEI) *Standards for Steam Jet Vacuum Systems:* "Each ejector stage and condenser has a distinct letter or letters which is a function of its position in the system. Each stage has a single letter designation. The last stage has the letter Z assigned to it. The remaining stages are assigned letters in reverse order (i.e. the stage directly preceding a Z-stage would be a Y-stage). This method is continued for all remaining stages in the system. Intercondensers are assigned the two letters of the stages immediately preceding and following the condenser (i.e. for a condenser between a Y- and Z-stage, the letter designation would be YZ). An aftercondenser is assigned a letter combination ZA. A pre-condenser is assigned a first letter of P followed by the letter designation of the stage following it (i.e. if a pre-condenser is used ahead of a two-stage system, the designation would be PY)."

UNIQUE SYSTEMS®
INCORPORATED
ONE SADDLE ROAD - CEDAR KNOLLS, NEW JERSEY 07927-1998
Phone 973-455-0440 Fax 973-455-7214

HEAT EXCHANGE INSTITUTE HEI INCORPORATED MEMBER

EJECTOR PROCESS VACUUM SYSTEMS

Steam Jet Ejector: A type of compressor which uses a high energy jet of steam to entrain (capture) and compress gases from a vessel where operating pressure below atmospheric pressure must be established or maintained. Ejectors work on a mass-velocity principle, so design is affected by weight of gas to be handled. Capacities are usually stated in pounds per hour of gas at a specified absolute suction pressure.

Suction Pressure: Absolute pressure maintained at the inlet flange of the suction chamber. For extremely low pressure, the measurement is given in microns (1,000 microns = 1 mm Hg). If suction pressure is stated in terms of inches of vacuum, the unit of measurement is usually inches of mercury and should be referred to a 30" barometer.

Suction Temperature: Temperature of the gas at the suction of the ejector.

Thermocompressor: An ejector stage designed to compress large quantities of steam or other vapors. Its purpose is mainly to recover heat in otherwise unusable low pressure steam or other gases.

Torr: Equal to one millimeter of mercury absolute.

Total Steam Consumption: Total weight rate of flow passing through the nozzles of all ejector stages at specified conditions of steam pressure & temperature.

Total Water Consumption: Total rate of flow passing through the ejector condensers at specified inlet temperature.

"Our customers are the best customers in the world!"

www.uniquesystems.com

The Unique "VIP" Service Advantage
• Value, Integrity, Professionalism & Service •