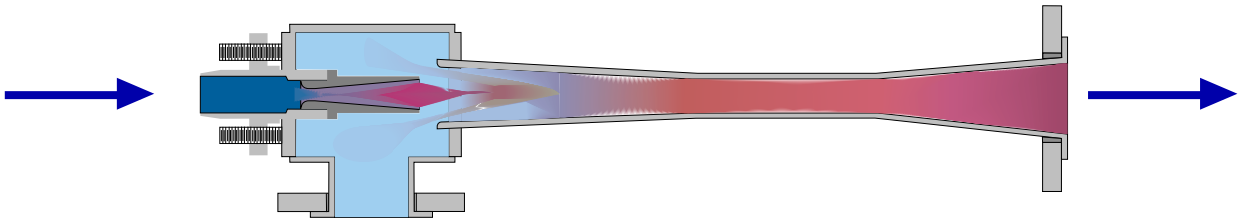
Fox Air Jet Ejectors

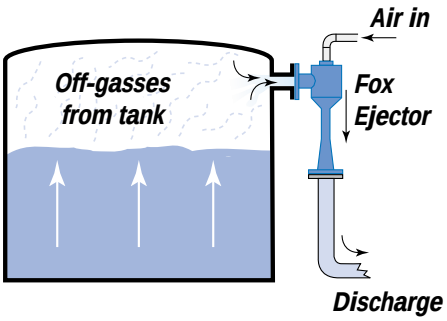


for:

- *Venting Hot,Corrosive, Explosive or Dusty Gasses*
- *Sampling Stack or Process Streams for Analayzers*
- *Mixing or Diluting Gasses*
- *Creating Vacuum to 1 psia*

available in

- *Line Sizes from1/4" to 42"*
- *Materials: Stainless, cs, TFE, Titanium, Monel Inconel, Ceramic-Lined*
- *Stock Units - for Moderate Vacuum;*
- *Custom-Built Ejectors, for Deep Vacuum*



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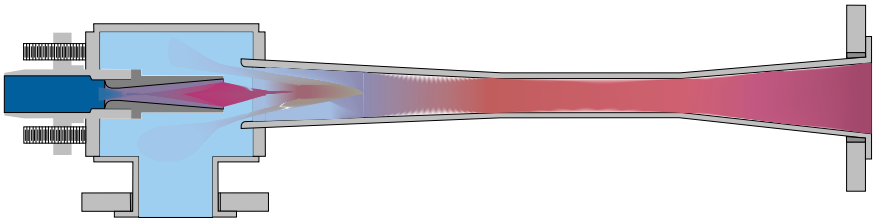
Fox Air Jet Ejectors



The Downloadable version of this Air Ejector brochure contains 8 of 13 pages. To be emailed a complete version within 2- 3 hrs during business hours, please email us at info@foxvalve.com with a brief description of your interest in air ejectors.

Included in Downloadable Version

Table of Contents

- Fox Air Ejectors - Introduction.....Page 3 ✔
- 10 Most Commonly Asked Questions About Air Ejectors.....Page 4 ✔
- Typical Applications.....Page 5 ✔
- You DON'T NEED to Use Compressed Air .....Page 6
- Pump Priming.....Page 7 ✔
- Sampling & Evacuation .....Page 8 ✔
- Gas Blending .....Page 9
- Creating Deep Vacuum.....Page 10
- Approx Dimensions.....Page 11 ✔
- Production Ejectors for OEM's.....Page 12 ✔
- Application Data Sheet .....Page 13 ✔

To receive the complete pdf of this brochure, just email info@foxvalve.com with a brief description of your possible ejector application. You will receive a reply in no more than 2 - 3 hrs druring normal business hours, EST in the USA.

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Fox Air Jet Ejectors

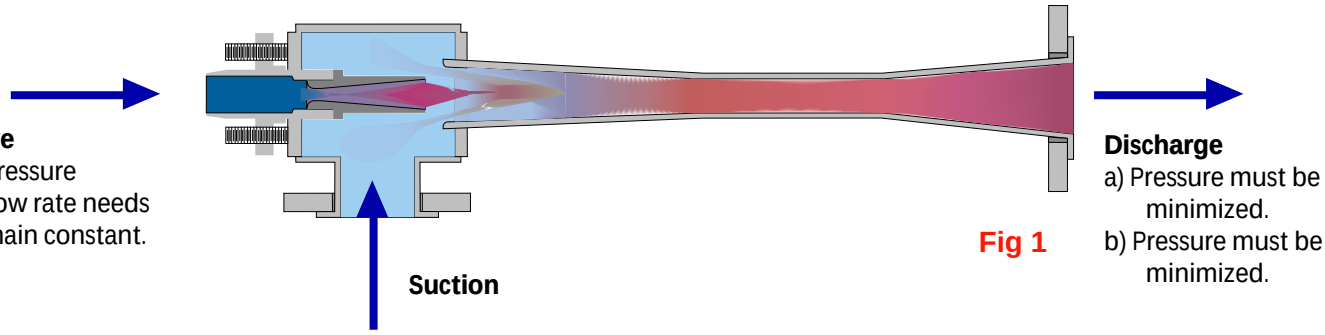


Fig 1

for:

- *Venting Hot,Corrosive, Explosive or Dusty Gasses*
- *Sampling Stack or Process Streams for Analayzers*
- *Mixing or Diluting Gasses*
- *Creating Vacuum to 1 psia*

Fox Venturi ejectors have been used to replace blowers and fans in gas-handling applications since 1961. With no moving parts, Fox ejectors can provide reliable, maintenance-free gas handling or sampling in applications where the alternative of using a blower or fan is both unreliable and unreasonably expensive.

Off-the-Shelf Ejectors to 3"

Fox stocks a range of air ejectors in 1/4" to 3" line sizes (6 - 75 mm) in c-s, ss, and PVC, that can ship in just a few days for handling simple applications. Custom-built air ejectors for creating deeper vacuum, in line sizes up to 42", or in materials like Teflon, monel, titanium,or Hastelloy, can ship in 4 - 8 weeks, depending on complexity.

For a quotation, just complete the attached Application Data Sheet and fax to Fox Valve at 973.328.3651

Fig 2

Manufactured In-House at Fox Valve

Fox manufactures our ejectors in-house, enabling us to provide expedited delivery for standard, specially modified, or custom-built ejectors. It is the integration of engineering expertise AND in-house manufacturing under one roof which makes Fox..

Fox stocks a range of air ejectors in 1/4" to 3" line sizes (6 - 75 mm) in c-s, ss, and PVC, that can ship in just a few days for handling simple applications described. Custom built air ejectors for creating deeper vacuum, in line sizes up to 42", or in materials like Teflon, monel, titanium,or Hastelloy, can ship in 3 - 8 weeks, depending on complexity.

• *No Moving Parts*

Fox Air Jet ejectors have no moving parts. No shafts, no motor starters, no seals, no maintenance. Their rugged construction and simplicity of design enables operation in nasty, corrosive, dusty, or high-temperature environments.

• *Eliminating Blowers or Fans in Corrosive, Explosive, Toxic, or Dusty Gas-Handling Applications*

Ejectors eliminate the need for blowers or fans with XP motors, Teflon-coated blades, or other very expensive blower options that add enormously to cost but still don't protect the blower from intermittant failure.

• *Air Ejectors Don't Need Compressed Air*

The majority of ejector applications we see at Fox do not require use of compressed air at 50-100 psig to accomplish the needed gas handling. Using existing compressed air to drive small ejectors 1" and under. or those that run intermittantly, makes sense. However, continuously operating air ejectors that must vent or exhaust from a process can often be run by a small blower running at 3 - 4 psig, which can, if desired, be located far from the corrosive, explosive, or dusty location of the ejector. Ask Fox.

• *Reliability*

If you need 24/7 reliability, lower installed cost, and reduced maintenance, use ejectors for your demanding gas handling applications.

• *Availability*

Fox stocks a range of standard air ejectors in 1/4" - 3" line sizes.

The 10 Most Commonly Asked Questions About
Air Jet Ejectors

1) What's the deepest vacuum I can pull with an air ejector? Since most users wish to vent or suck vapors, the maximum vacuum level - which is obtained at the no-flow, or shut-off condition - is usually irrelevant. Using air at 80-100 psig, our off-the-shelf ejectors can pull down to about 10 psia. Other, more expensive, custom built ejectors can pull down to about 3 psia. Two stage ejectors can reach 1 psia.

2) Can I use an air ejector to handle dusty or corrosive gasses? No problem. That's the reason ejectors are used - to eliminate use of the very expensive fans or blowers which, despite their high cost, will nevertheless fail often when handling dusty or corrosive vapors. Air ejectors should be used in such applications - particularly if you'd like your process to run reliably without regular equipment failures. Any material of construction can be specified - stainless, TFE, Monel, titanium, ceramic-lined, etc.

3) Must we use air at 60 - 100 psig? Our plant management hates any new equipment that uses compressed air, yet I know that if we try to use a blower to vent these explosive or corrosive or dusty gasses, we'll have no end of blower failures and shutdowns. **So what can we do?** Using plant air is convenient for small ejectors or ejectors that just run intrermittantly. However, for continuous gas venting in a process, its completely unnecessary to use air at 60 - 100 psig when all the ejector needs to do is vent gasses at low pressure and exhaust to a vent or scrubber or duct at pressure. The best solution is buy a matche blower/ejector combination from Fox. A small, quiet Rotron blower running at 2-4 psig provides all the air most air ejectors need. (Note - these are not pd blowers that require silencers, lubrication, etc.) Only the ejector - with no moving parts - sees the dusty, corrosive, or explosive gas and the blower can be located 50 - 100 ft away from areas that require X-Proof or special motors. Since Fox buys over 400 blowers a year, Fox's blower prices may be cheaper than your cost for buying one from your local blower rep - who knows nothing about integrating it with ejectors.

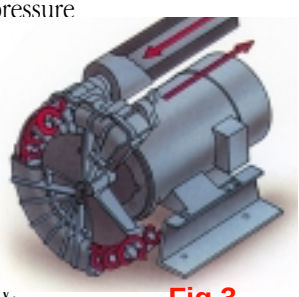


Fig 3

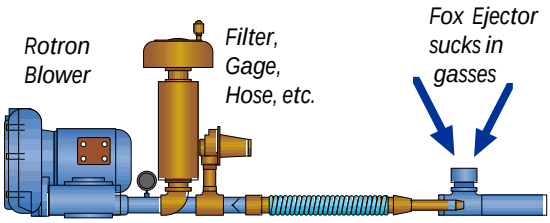


Fig 4

A small , quiet Rotron blower can be provided to drive a Fox air ejector with air at 2 - 4 psig. Most applications do not require air at 50 - 100 psig. Fox can supply the blower & ejectors with all req'd accessories and interface fittings/hose, etc.

4) What gas temperatures can a Fox ejector handle? Plain old stainless is ok for gasses up to about 1000° - 1200° F. Inconel ejectors are good for gasses up to about 1500°F. Other nickel-based alloys can be used up to about 1800°. Above this - inlet gasses must be quenched or cooled before the ejector.

5) We need the ejector to handle a large gas flow rate but, in order to protect process equipment on the suction side, the ejector must be designed so it never pulls a vacuum deeper than 10 inches of water. Can Fox do that? Any ejector that can suck in a large gas flow rate will pull a significant vacuum level if that gas flow rate, or suction load, stops. An ejector cannot be designed with a limited shut-off vacuum level. The solution is a very simple control scheme that diverts some motive flow to the ejector suction port and therefore limits shut-off vacuum level to whatever value is needed to protect your process from implosion.

6) We need to use an ejector to blend two gasses in a precise mixture ratio. Can that be done? Nothing could be easier. (See Page 9) Since the motive flow goes through a sonic choke in the ejector nozzle, the motive flow is held absolutely constant if motive pressure is constant (use a pressure regulator.) If suction inlet pressure is also fixed (such as atmospheric at 14.7 psia), placing a Fox sonic choke on the suction port of the ejector will establish a fixed suction flow rate. Since both flows are fixed, mixture ratio is established. This scheme has no turndown.

7) Can we control the suction flow rate by changing the motive flow with a valve? No. Suction flow rate should be controlled with a valve on the suction line.

8) We need to use as little compressed air as possible. What's the smallest ejector Fox makes? Fox makes a complete line of Mini-Eductors that use as little as 1/4 SCFM of air. They are used in thousands of sampling, analyzer, nd instrumentation systems. Request or download our Mini-Eductor brochure

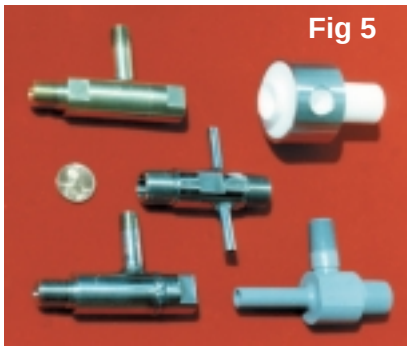


Fig 5

9) Can an ejector suck up water from a sump using compressed air? No. Only eductors driven by steam or water can work. Request or download our Liquid-Eductor brochure

10) How much motive air to I need to drive an air ejector? This all depends on how much work you want the ejector to accomplish, which is defined as ***compresson ratio.*** If all you want the ejector to do is suck gasses at near 0 psig and vent to near 0 psig, your required motive air flow may be only 1/2 or 1/4 your suction flow. However, if you want the ejector to perform some real compression work, the required motive flow can be equal to - or exceed - the suction flow rate. The more compression work you want the ejector to perform, the higher the required mass flow rate must be. See Page 7 to determine compression ratio. If your compression ratio is over 1.3, plan on the required motive flow rate being about equal to the suction flow rate.

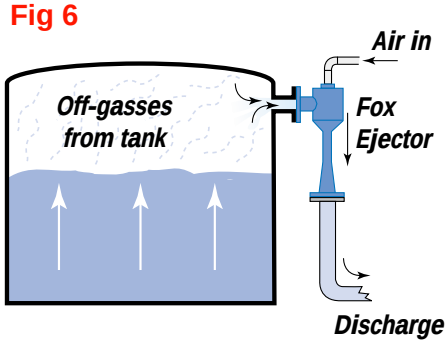
Fox Venturi Eductors
info@foxvalve.com

Typical Applications of Fox Air Jets:

Venting Explosive, Corrosive, or Dusty Gasses

When process tanks, vessels, or chambers are filled with liquids or slurries, hazardous gasses often must be vented during the filling process. Fox ejectors manufactured in Teflon, PVC, 316 ss, titanium, Monel, or Hastelloy can handle just about any caustic, acid, or hazardous gas. High temperatures up to 1800° F can also be handled.

Fig 6



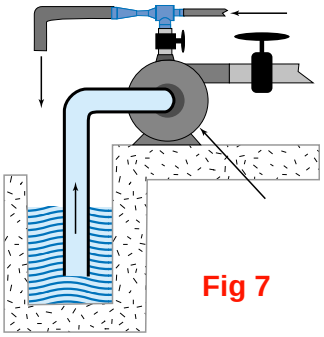


Fig 7

Pump Priming

Fox ejectors are ideal for priming pumps. The ejector is connected to the highest point of the pump and generates sufficient vacuum to draw liquid up to the pump. For more detailed information about this application, see Page 7 .

Fume Removal

Ejectors can be used to handle large gas flow rates, in some fume handling applications - particularly when such fumes are problematic for fans or blowers - such as when dust, explosives, acids, or high temperatures are present.

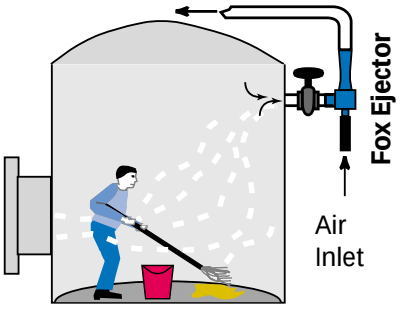
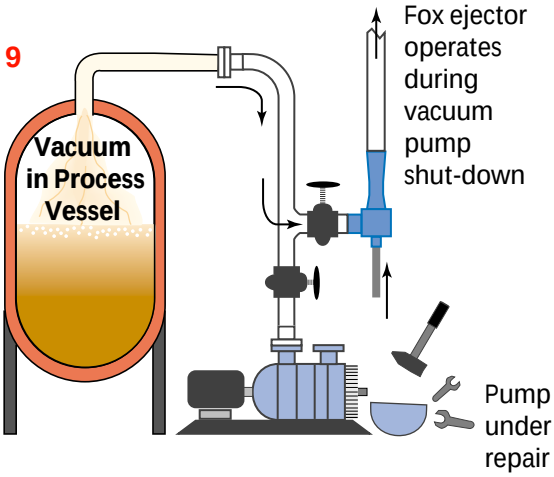


Fig 8

Dangerous fumes and vapors are evacuated from a vessel during a maintenance , cleaning, or inspection.

Fig 9



Back-Up/Emergency Vacuum Source

Fox ejectors are often used as a back-up vacuum source, or emergency vacuum supply, for processes that otherwise rely on mechanical vacuum pumps for process vacuuum. These ejectors get switched into operation if the vacuum pump fails or requires a scheduled maintenance.

Sulfur Pit Venting

Both air and steam ejectors are very successfully used to pump sulfur fumes from pits, and rail/truck unloading. Sulfur fumes need to be removed constantly from the sulfur pit to prevent venting to atmosphere. The heating jacket on the Fox ejector maintains high temperatures within the ejector, preventing solidification of the sulfur and preventing build-up.

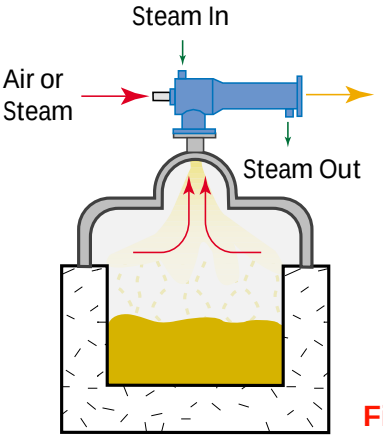


Fig 10

Sulphur pit venting with a steam jacketed Fox air ejector.

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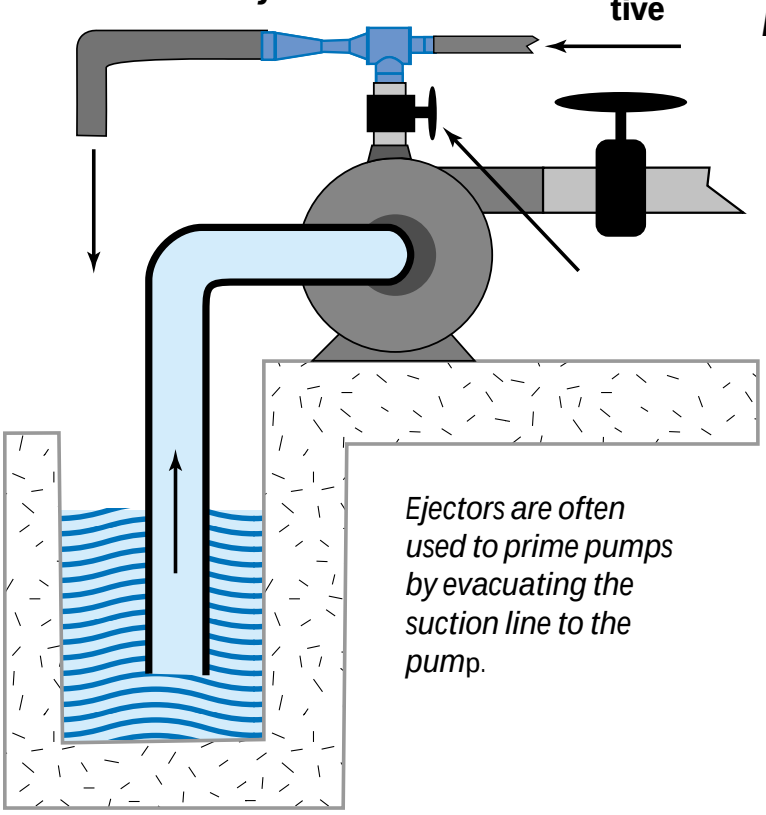
Pump Priming with Fox Air Ejectors

Fox air ejectors are used by the thousands of evacuate vessels, fuel lines, and test chambers. These ejectors are specified by identifying the volume of the vessel or lines to be evacuated, the beginning and final pressures, and the time required to accomplish this evacuation.

Fig 15

Fox Pump Priming Ejector



Ejectors are often used to prime pumps by evacuating the suction line to the pump.

Estimating Evacuation Time:

You can use the charts below to provide a rough guide to the required evacuation time needed for an ejector to evacuate a vessel or volume down to a given final pressure, starting at 14.7 psia = 0 psig.

The times below are used on 10 cubic feet.Multiple time by whatever factor is dictated by your volume.

Evacuation Data
For estimating evacuation time based on 10 ft3 volume.

Time in Seconds to Evacuate 10 Cu. Ft. of Air from 14.7 psia

Final Pressure (PSIA)	Ejector Size 1"	1-1/2"	2"
10	8 sec.	4	2
8	13	6	4
5	21	10	6
2	44	20	11
1	106	50	30

The chart below gives a rough 'capacity factor' which indicates how much faster a larger ejector can evacuate a given volume. For example, a 4" ejector will require 1/16th the time that a 1" ejector needs. It will also require, however, sixteen times as much motive air .

Ejector Size	1"	1-1/2"	2"	2-1/2"	3"	4"	6"
Capacity Factor	1.0	2.25	4	6.25	9	16	36

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Sampling Stack or Process Gasses with Fox Air Ejectors

Literally thousands of Fox air ejectors have been used to sample gasses in analyzer and instrumentation systems. These are usually Fox Mini-Eductors which are stocked in 316 ss, brass, and Teflon. Please request brochure on MINI-EDUCTORS or visit the MINI0EDUCTOR section of our website.

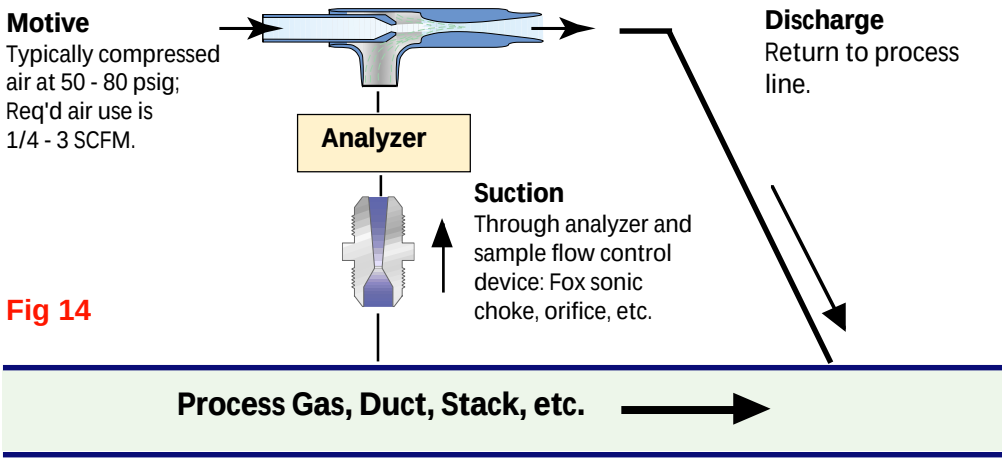

Fig 14

How Big Does Fox Make Them?

Fig 15

This 42" air jet ejector was used to evacuate a chamber. The deep vacuum in the vessel was used to test spacecraft at conditions simulating the vacuum of deep space.

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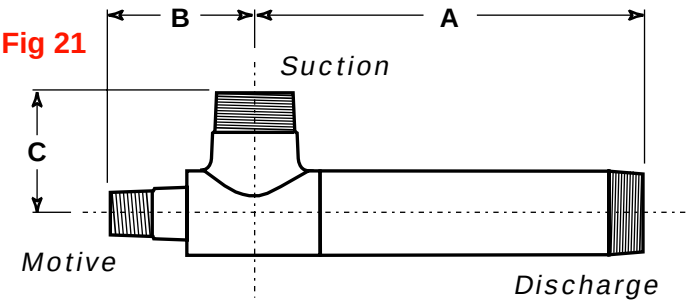
Approximate Dimensions of Stock Fox Air Ejectors (Compression Ratio <1.45)

Fig 21



Typical Dimensions

	A	B	C
1"	7"	2.25"	3"
1-1/2"	10.5"	3.5"	3.75"
2"	14.5"	3"	4.5"
2-1/2"	22"	4.5"	4.5
3"	26"	5"	5
4"	35"	6"	6"
6"	55"	10"	8"

End connections - Standard end connections of stocked air ejectors are male NPT. Flanges can be easily threaded (andback welded), if required0 onto these NPT ends.

How Do Air Ejectors Need to be Installed to Have a Successful Installation

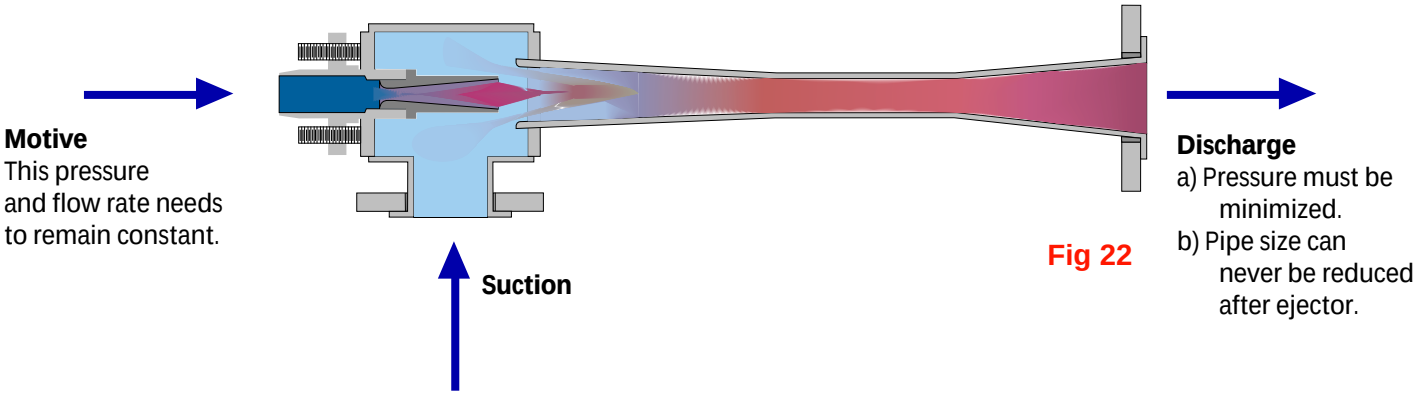


Fig 22

For a successful installation, take care that the Motive, Suction, and Discharge flow rates, pressures, and piping are as you described it on your submitted Application Data Sheet to Fox Valve. Here are some tips:

Motive

- *The motive pressure needs to be constant. This should be fixed by a pressure regulator.*
- *The motive flow rate needs to be constant. Controlling the motive flow rate is not the way to contror reduce suction flow rate.*
- *The motive pressure needs to match the design pressure submitted to Fox Valve. If this pressure is lower than expected, you should have Fox provide a new nozzle designed around this new motive pressure.*

Discharge

- *The discharge pipe size should be the same size, or larger, than the ejector discharge connection.*
- *There should never be any restrictions, orifices, nozzles, or reductions in the downstream line.*

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Development and Production of Air Ejectors for Use in OEM Equipment

Fox Supplies Thousands of Air and Gas Ejectors to OEM's for Use on a Broad Range of Industrial Equipment

Fox has been through the process of taking an initial phone call, or email from a project engineer and taking it through the many stages that lead to the supply of optimized production hardware. Fox has Annual Blanket Orders from many manufacturers for monthly releases of ejectors in quantities ranging from 4 per month to 300/month. Fox excels at thsi process. Thgere is a reason why 'development' is in our company name:

• Quick Supply of First Prototype based on Stock Ejector for Concept Trial

Our first goal is to see if the remachining or modification of a stock ejector can serve as a useful 'proof of concept' or test unit to verify that a Fox ejector can come close yo meeting the requirements within your OEM equipment - such as venting gasses, establishing vacuum, purging lines, recirculating refrigerants. If the application permits modification of a stock unit, shipment can occur in one week.

• Building a Prototype

The next step is the custom manufacture of one or more prototypes with an ejector internal design optimized around your precise requirements. These are machined in-house at Fox Valve and can include whatever end connections, materials of constructions, and special features to make the equipment ideal for incluysion in your system.

• Production Hardware

This is the final product, typically machined at Fox Valve in our CNC lathes. Quantity pricing is significantly lower than the highly engineered prototype. Annual blanket orders, where Fox can schedule a large manufacturing run and ship hardware in monthly releases, maximizes the quantity discount an OEM can obtain.

• Testing

Certain OEM customers require testing of each and every part before shipment. This can include hydrotest, leak test, or a performance test.

About Fox Valve...

Fox Valve Development Corp. was founded in 1961 to build high-performance, custom-engineered venturi controls for aerospace applications, primarily in bipropellant rocket engines. Fox's reputation in the 1960's as venturi specialists with superb in-house manufacturing soon attracted inquiries from diverse industries seeking venturi products tailored to their needs. Our problem-solving skills, familiarity with materials, and manufacturing expertise led Fox into broader range of industrial applications. One by one, standard product lines emerged as we serviced different industries, all based on our one core technology - venturies. These varied product lines have helped Fox grow continuously and rapidly. Our current major product lines include:

- Steam Jet Ejectors & Thermocompressors
- Natural Gas/Vapor Recovery Ejectors
- Solids Conveying Eductors
- Sonic Chokes and Cavitating Venturies
- Mini-Eductors

To Receive a Quotation:

Request and complete our Application Data Sheet.

Additional Technical Literature

The following materials are available upon request:

Bulletins:

- ***051 — General Info - Fox Venturi Products***
- ***101 — Fox Liquid Eductors***
- ***106 — Fox Slurry Eductors***
- ***203 — Steam Jet Ejectors and Vacuum Systems***
- ***205 — Thermocompressors***
- ***206 — Natural Gas/Vapor Recovery Ejectors***
- ***301 — Solids Conveying Venturi Eductors***
- ***302 — Eductor/Blower Combinations***
- ***401 — Mini-Eductors***

F O X

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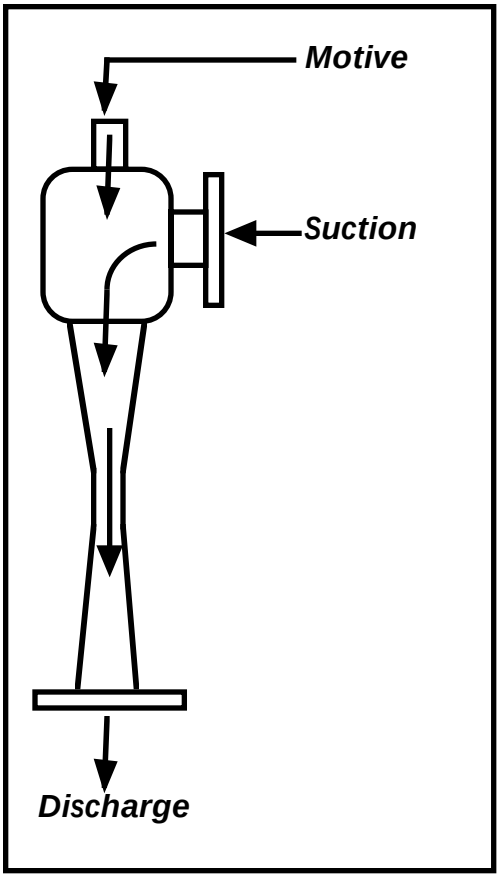

Fox Air, Steam, or Gas Jet Ejectors

for Continuous Venting, Exhausting, or Aspiration of Gasses.

Name: _____

Company: _____

Address: _____

_____

Ph: _____ **Fax:** _____

Motive Gas

Gas Type: _____

Molecular Weight: _____ Temperature: _____

Pressure: _____psig Flow Rate: _____

Suction Gas

Gas: _____

Molecular Weight: _____ Temperature _____

Suction Pressure: _____psia Flow Rate: _____

Discharge Conditions

Pressure: _____ psig, or _____ psia

Why use compress Air?

Do you wish to consider use of a Blower (Air at 3-10 psig) instead of compress air?

☐ Yes ☐ No

Construction/End Connections:

End connections: ☐ Pipe thd. ☐ _____lb. flanged ☐ Other _____

Construction material: ☐ Carbon steel ☐ 304 ss ☐ PVC ☐ Other_____

☐ Teflon (Wetted parts) ☐ Sanitary/CIP

Required Maximum Working Pressure_____

Special Requiremnents: _(Code welding? Hydrotest? etc.) _____

Comments: _____

_____

_____

Data Sheet No. 251 8/2002