Fox Solids Conveying Venturi Eductor/Blower Solutions:

for Pneumatic Conveying of Bulk Solids when Reliability is Critical

Feedback from Fox customers:

"This eductor is in use for 3 shifts and we estimate it runs 5 1/2 days per week. It is used to blow metal chips through a 4" pipe... 175 ft across the roof... The only maintenance this eductor has ever had (in 9 years) was (one adjustment) at start-up.

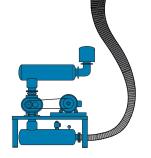
Fox customer in Tennessee, USA - Jan 2002.

"Actually, it wasn't worn out. We assumed it would be because it's transported several million pounds of feedstock. We took it apart ... but we discovered it was still in good shape"
Fox customer in Texas: May 2005.



"It's the best thing that happened on the project. No problems, works good, lasts a long time. Eight minutes per 3000 lb bag (of salt) Thanks."

Fox customer in Ohio. April 2005.



Bulletin 301G - web



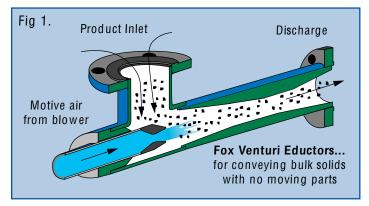
Dover, NJ 07801 USA 973-328 - 1011 Fax 973-328 - 3651 info@foxvalve.com www.foxvalve.com

Fox Venturi Eductors for Conveying Solids with No Moving Parts

- No Maintenance
- No BlowBack
- Minimal Product Degradation
- Easy to Clean (CIP Versions)

Fox Venturi Eductors - What are they?

Fox Venturi Eductors use the positive air pressure from a blower to create suction that is then used to entrain and convey powders, pellets, and bulk solids in a pneumatic conveying system. Because they have no moving parts, they can op-erate entirely maintenance-free.



The eductor acts to compress the air/solids mixture to a pressure adequate to overcome losses in the downstream convey line. The eductor has three connections:

- Motive Air
- · Suction or Product Inlet
- Discharge

How are they used in pneumatic conveying systems?

Fox Venturi Eductors are used to feed bulk solids, such as cement, salt, ash, milk powder, shredded tires, and plastic pellets into positive, dilute-phase conveying systems. They are commonly used to replace rotary airlocks to eliminate blowback, maintenance, wear, and high maintenance costs. They are typically used with convey rates below 10 tons/hr and distances shorter than 400 ft (130 m)

Fox eductors are commonly installed under:

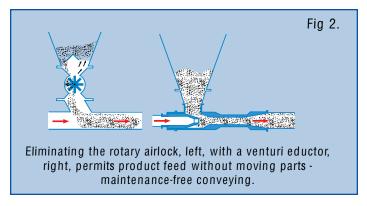
- Dust Collectors/Baghouses
- Screw Feeders
- Weigh belts and Screw Conveyors
- Mixers, Grinders, and Mills
- Bins, Silos, and Bulk-bag unloaders

Who uses them?

Fox Venturi Eductors have been used since 1963 in thousands of installations by hundreds of companies in dozens of countries in dozens of different industries. Our database of eductor installations includes over 4000 different applications representing well over 10,000 installed venturi eductors.

Why are eductors used in pneumatic conveying systems?

• Fox Venturi Eductors have no moving parts. This enables maintenance-free conveying - like those testimonials on front cover. When high reliability is needed in your conveying system, whether handling activated carbon or spices or cement — venturi eductors are the obvious solution.



- No Blowback All rotary airlocks have blowback. If the product conveyed is fine or abrasive, blowback can cause extreme wear problems, high maintenance costs, low flow rates, and a dusty workplace
- Different Eductors for Different Applications -

Over the last 40 years, Fox has developed a wide variety of standard venturi eductors, often maintained as stock items that can ship in 1-2 weeks. In addition to standard carbon steel and stainless eductors. Fox also makes:

- Ceramic & Tool-Steel Lined Eductors
- Sanitary/Hygienic/CIP Eductors (for food & pharma)
- Enlarged Suction Port Eductors

See Page X for photos of these eductor types.

Provided with Matched Blowers

Fox eductors are typically provoded with matched blowers so that we can guarantee meeting the requirements of your applications. We provide sidechannel and pd blowers and any additional accessories required, including hoppers, controls, etc. We have global sources for blowers for shipments to users in Europe, Asia, and elsewhere.

How are they designed? How are they tested? Are they guaranteed to work?

Fox's eductor designs have been exhaustively tested. We have 40+ years of hands-on experience to draw upon. And we have a well-instrumented test lab. This enables Fox to Performance Guarantee every quotation for an integrtaed blower+eductor system we ship.



Fox Venturi Eductors Dover NJ USA info@foxvalve.com

The Ten Most Commonly Asked Questions **About Fox Venturi Eductors**

1) Don't they need evenly metered feed or they'll clog? Wouldn't a full 'head' of product 'overfeed' the eductor?

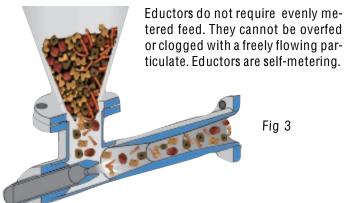


Fig 3

2) Don't eductors need compressed air to work?

No. 98% of all Fox eductors we sell use air at below 12 psig. with about half of them using air at below 4 psig. Only if electricity is free at your plant does it makes sense to consider using air at 60 - 100 psig (3 - 5 barg). Fox can provide a perfectly matched blower that will reduce energy cost 60 -80% from using compressed air.

3) Why Fox? Other companies claim they can make venturi eductors for conveying solids. We evenmade one ourselves that sorta works sometimes. What does Fox know that others don't?

A very great deal. Fox is the only company that sponsored a two year research effort that included hundreds of empirical flow tests with many different products, ranging in bulk densities from 5 to 150 lbs/ft3 conveyed over distances from 50 ft to 200 ft. This data was then collated into algorithms for quickly predicting eductor performance for any pipe geometry with any solid. Couple this with the 4000+ existing applications we have sold to industry since 1963, and we think we have a pretty good knowledge base to work with.

4) What conveying velocity does Fox design around? What controls velocity?

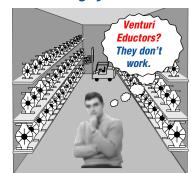
The same as any other pneumatic conveying system. Fragile products can be conveyed slower; cohesive products may be conveyed faster. Fox eductor systems can also include, at surpisingly low added cost, features to allow users to easily adjust/minimize convey velocity as required - very important when conveying fragile materials like warm pellets, snack foods, peanuts, prills, etc. Each eductor is carefully machined to match the Fox blower and to flow the right amount of conveying air into the pneumatic system.

> **Fox Venturi Eductors** info@foxvalve.com



5) If Fox eductors are so great at conveying reliably with no moving parts, how come big system

designers almost never include them, where appropriate, in the plants they design? If the most profitable part of your business was selling rotary airlock spare parts, would you introduce your customers to venturi eductors that just keep working on and on and on?



6) Is there a simple "Rule of Thumb" we can use to predict how much air we need? No. Too many factors are involved in the design of a pneumatic conveying system. To get a guote on the right blower /eductor sub-system guaranteed to meet your specific requirements, just complete the Data Sheet on the last page of this pdf and fax . You'll usually get a quote in 1-2 days.

7) Can we have our material tested? Can we witness these tests? Can you run degradation trials?

Yes to all. Most products already appear on our list of 4000 existing installations, so we do not normally need to run tests to predict flow rates and blower sizing. (See Fox test rig at right.) Predicting degradation with fragile products often does



require testing.

A stainless eductor (316 ss) can work happily at 1100 - 1200° F. For temps up to 1600°, we'd just build it in Inconel.

Fox's Test Lab

9) How does an eductor control the feed rate?

It does not. Eductors cannot be used to regulate convey rates. However, do not interpret this to mean they must have controlled feed or they will clog. Fox eductors sit under wideopen ports below silos, bins, and bulk bags and convey material at their max conveyrate

10) How long does it take to get them?

Fox has a large range of standard eductors ranging from one to six inches (25 - 150 mm) in ss, cs, and ceramic-lined that can all ship in one week. Blowers can ship in 1 week for Rotron blowers and 4-8 weeks (for pd blower packages. Expediting is always an option.

Where Does MY Industry Use Fox Eductors?

Fox eductors are used in almost every industry that requires bulk solids handling. Below is a just a sample from over 4000 installations made since 1963.

Building Products:

Conveying: Phenolic resin and sawdust for chipboard; Gypsum for sheetrock; Pumice powder for grout; Roofing granules;

Cement

Conveying: CKD at up to 800° F; Portland cement at up to 20,000 lbs/hr; Alternate fuel injection (shredded carpets/plastic/tires// paper; biomass, rice hulls.) Kiln spill at 1600° F

Ceramics/Glass:

Conveying: Silica, Glass Frit, Ceramic pellets, Ceramic dust, Mica

Environmental:

Conveying: Activated Carbon, Sodium Bicarbonate, Hydrated Lime, Pulverized Limestone into ducts and stacks; Sorbent injection in fluidized bed boilers for SOx reduction,

Food:

Conveying: Minor ingredients to mixing/batching (salt, sugar, spices, vitamins, flavorings, etc.); Milk powders from spray dryers; Coffee beans from bulk bags; Powdered tea from screeners; Rice; Breakfast cereal from coating reels: Snack food extrudate from extruders; Frozen peas from IQF; Whole peanuts from sorters;

Foundries:

Conveying: Foundry dust from dust collectors; Innoculant to cupolas; Metal grit from grinding stations; Sand and bond

Hygienic/Diapers/Paper:

Conveying: SAP from feeders with uniform flow distribution

Minerals/Mines:

Conveying: Hot copper and nickel alloys at 1000° F from calciners; Mica, talc, quartz, and perlite ore from dust collectors; Copper pellets at 400 lbs/ft3 bulk density;

Plastics:

Conveying: Plastic pellets with reduced angelhair and fines from hundreds of extruders and compounding lines since 1963; 50+ fiberglass filled pellets with Clean-in-place, ceramic-lined wear resistant eductors; Conveying plastic regrind and flakes that jam airlocks in 10 minutes:

Power/Incineration

Conveying: Coal, coke, and alternative fuels; Additives for inhibiting slag build-up on boiler tubes; sorbents for SOx reduction in CFB's: Activated carbon, lime, calcium carbonate, Trona injection for flue gas desulferization (FGD)

But Can Venturi Eductors Convey MY Product?

Let's Start with the letter:

Fox maintains a database of all 4000+ installations made with Fox venturi eductors. Below is a list of those products successfully conveyed with eductors that start with the letter "A." Do you think there's a good chance we've conveyed YOUR product?

Abrasive/Blast Grit Absorbent, SAP polymer **Acid Pellets** Acid Powder, Organic" Acrawax Acrylic Acid/Copolymer Acrylic Flake

Act Carb +Hy'd Lime Activated Carbon **Activated Charcoal**

Additive Adhesive, Dry Adipic Acid Adipic Acid Fines

Aerogel Aerosil

Aggregate/gravel Aggregate Dust

Alamin Alginate Almond Chips Almond Meal Almonds Alum Salt

Alum, Spent (ALOH)

Alumina Alumina Brick, Alumina Catalyst Alumina Dust Alumina Granules Alumina Hydrate Alumina Monohydrate Alumina Silica Powder

Alumina Silicate Alumina Slugs Alumina Sulfate Alumina Trihydrate Alumina/Cerium Powder Aluminium Chips Aluminum Oxide

Aluminum, Shredded Aluminum + Plastic flakes Aluminum Chloride

Aluminum Chlorohydrate Aluminum Dioxide

Aluminum Dross Aluminum Flakes Aluminum Foil trim

Aluminum Hydrate Aluminum Oxide Aluminum Oxide Grit

Aluminum Pellets Aluminum Powder Aluminum Silicate

Aluminum Strips

Aluminum Wire, Chopped"

Amersorb

Ammonium Bicaronate Ammonium Bichromate Ammonium Chloride Ammonium Sulfate Ammonium Triosulfate

Anamol Oxide Anthracite Anthracite Fines Anticaking Agent Anti-perspirant Powder

Apple Bits

Apple Bits + Almonds Apple Crumblets Artificial Sweetener Asbestos Fines Ascorbic Acid

Ash

Ash & Limestone

Ash, Film w/silver at 600°F

Ash + Cement Ash, Flyash at 300° F Ash. Boiler Ash. Bottom Ash, Filter

Ash, Pyrolized Ash, Rice Hull Aspartic Acid Atrazine

Attapulgite Clay, Processed

Please contact us about our specific experience conveying YOUR Product.

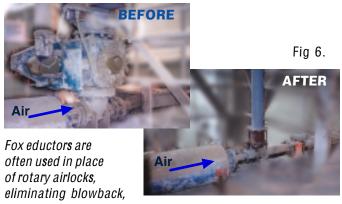


Fox Venturi Eductors Dover NJ USA info@foxvalve.com

Where To Use Eductors in a Pneumatic Conveying System

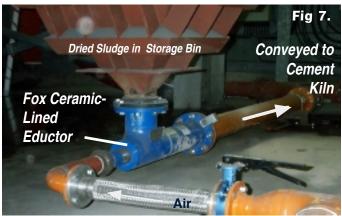
Here are six common applications. There are hundreds more.

Replace Rotary Airlocks



an extra motor, and providing much more reliable conveying.

Conveying to Kilns & Boilers



This Fox eductor is conveying dried sewage sludge to a cement kiln in England using air at 12 psig (0,8 barg)

Under Screw Feeders

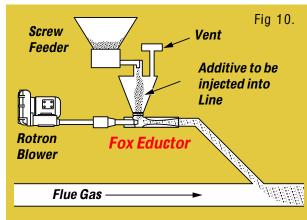


Fox eductors are installed under hundreds of screw feeders. Of course, there is no blowback up into the feeder. Typical applications include combustion and pollution control additives and spices in food production



One pd blower is used to drive five Fox eductors conveying dust from five dust collector outlets. No blowback, no maintenance, and no moving parts.

Pollution Control: FGD; Activated Carbon, etc



Hundreds of Fox eductors are used to convey additives when 24/7 reliability is imperative - eliminating possible use of rotary airlocks.

Conveying HOT Minerals



There is no more reliable way to convey hot cement, minerals, or ash from kilns, reactors, or calciners than using eductors.

What Type of Eductors are Available?

Fox has developed a broad family of eductor designs and styles. Many of these eductor types, which may sound like specials, are in fact maintained in stock and can be shipped in just a few days. For many applications, a perfectly matched side-channel blower can also ship in just a few days

Standard, Off-the Shelf Eductors

Fox maintains large inventories of stock eductors.

- Line Sizes: 1/2" to 6"
- Materials: 304 ss. 316 ss. Carbon Steel
- Sanitary/Hygienic, CIP Eductors: 1" 4"
- Ceramic-Lined Eductors: 1-1/2" 6"
- End Connections : NPT, BSP, Flanged,

Of course, eductors can be ordered in any material such as Inconel, Monel, Hastelloy, ceramic-spray coated, high-release coated, etc.

Fox Ceramic-Lined Venturi Eductors

Highly abrasive products can cause excessive rotary valve wear that can shut down operations. Fox ceramic-lined eductors are to be used with erosive products

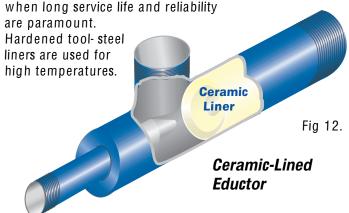


Fig 13.

Cart and Skid-Mounted Eductor Systems

Unlike airlocks and p-d blowers, a complete eductor/Rotron conveying system can be neatly assembled on a small skid. Smaller systems can be cartmounted

mounted and moved to different extruders,

screeners, grinders, or other equipment as needed.

Fox Sanitary Venturi Eductors

In applications that demand food/pharma grade hardware, Fox offers Sanitary Eductors, designed for rapid disassembly in Clean-In-Place (CIP) systems. These eductors are USDA-approved, are built in 304 or 316 ss and have highly polished internals with all welds polished and ground. They are often used by plastic compounders, toner, and pigment producers to avoid cross- contamination by permitting easy CIP after conveying batches of unique products.

Fox has extensive experience in conveying fragile food products **without degradation**. Ask for our Bulletin 350.



Enlarged Suction Port Eductors/ Integral Inlet Transitions

The product inlet to Fox eductors does not need to be round nor small. To facilitate installation below dust collectors, or the handling of irregularly shaped materials, Fox eductors are often supplied with large rectangular openings that match exactly to existing flanges. Enlarged Suction Ports are recommended when handling shredded waste (tires, paper, carpets), chopped cable, fibers, biomass (rice hulls, crushed seeds) or any materials that may bridge above a small opening.





Fox Venturi Eductors

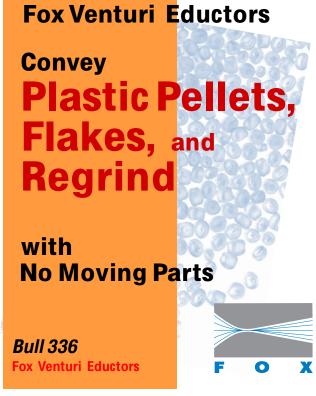
Dover NJ USA Voice - 973 328 1011, Fax - 3651 info@foxvalve.com

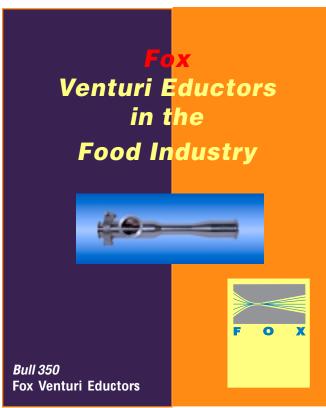
Detailed Info About Venturi Eductor Applications in YOUR Industry

Please request the Fox brochure you need, along with some details of your specific application, and a pdf version can be emailed asap. **Email to: info@foxvalve.com**







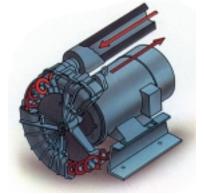


How Much of the Conveying System Can Fox Provide?

Blowers

All eductors require a source of conveying air, which is typically supplied by a blower at below 14 psig. Every year, Fox supplies hundreds of Eductor/Blower subsystems, providing a perfectly matched blower to the required eductor. (For more info on these sub-systems, Request Bulletin 302) Any type, or make of blower can be provided but most fall into the following two categories:

- Rotron blowers output to 6 psig.
- Positive Displacement blowers to 15 psig.



Fox has supplied hundreds of small, quiet, highly reliable Rotron blowers as part of our pneumatic conveying solutions

Fig 16.

• Hoppers, Inlet Funnels, Transitions

Fox can provide custom-fabricated hoppers and transitions. Design options are virtually unlimited and frequently include features such as multiple inlets, vent and access ports, hinged lids, grates, or screens. Special coatings and foodgrade finishes are also available

Diverter Valves:

Fox has supplied many diverter valves to enable our eductor driven convey systems to deliver material to multiple destinations

Slide Gate Valves:

These valves are used to open and close the hopper, bulk bag, or silo atop the eductor.

Cyclones, Dust Collectors

It is very important to use a correctly specified air/solids separator for your eductor system, which Fox can provide.

Controls

Fox can provide the motor controls, level detectors, and other controls.

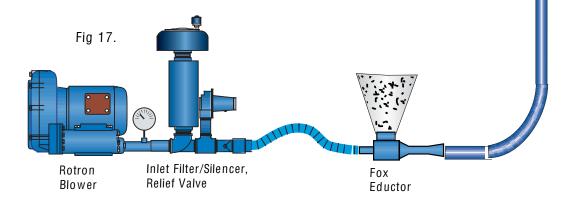
Elbows and Clamps

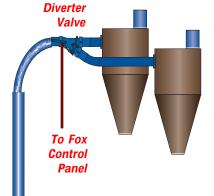
Fox can the wide radius bends and compression couplings needed to install a properly engineered pneumatic convey line. not sup



Fox Venturi Eductors

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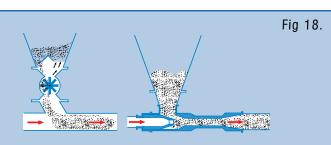




Wide Radius Bend

Give Away the Razors... Sell the Blades ...

Why There's Always a Low Cost Rotary Airlock You Can Buy!



If one sells airlock spares, it's not a good idea to let customers learn about Fox Venturi Eductors. That's why you can **always** find a cheap airlock. This will be only the beginning of your relationship as you replace bearings, seals, rotors, and eventually, the airlock itself. The more abrasive the solid (cement, ash, silica, coke, etc) the more important that airlock sale is, since there will be many, many spare parts to sell later. So, of course, you can always find a cheap airlock to buy!

Venting Blowback from Existing Rotary Airlocks...

Fox Rotary Valve Venting Eductors (RVE's) are used to suck blowback air + suspended solids out of the airlock and pneumatically convey them to the destination of choice: bin or silo located above, or the convey line.

What results can we expect from a retrofit with a Fox RVE Venting Eductor?

It depends on how bad your blowback problem was in the first place. But over the last 25 years, we've seen the following widely varied results:

- Increase in Airlock Feed Rates
- Decreased Wear, Increased Service Life
- Fugitive Dust Eliminated
- Leakage & Waste Eliminated
- Blowback into Screeners Eliminated

Retrofitting/Replacing Existing Rotary Airlocks...

For many reasons, we speak to hundreds of customers anxious to replace their existing rotary airlock with a Fox eductor. The simple answer is that sometimes this is possible, and sometimes this is not.

In this highly competitive sales environment, there is pressure from all parties to reduce costs, particularly if the airlock conveying system was but small component in a larger project. For this reason, the blower and piping are often somewhat undersized, pushing the airlock to the ragged edge of performance and creating the blowback, wear, and failure problems that invite a call to Fox Venturi Eductors.

Replacing an airlock in an existing convey line with a Fox

eductor may require changes to the blower or convey line. Fox engineers will provide all necessary sizing information upon receiving a completed Application Data Sheet.

Engineering a venturi eductor into a system at an early design stage is far easier than retrofitting existing equipment.







Fox Venturi Eductors

Dover NJ USA Voice - 973 328 1011, Fax - 3651 info@foxyalve.com

Additional Technical Literature Available Upon Request

To receive any of the following technical information, please just contact us (email, fax, or phone) and request this literature, along with a brief explanation of your possible application:

Brochures

- Cement Plant Applications Bull. 307
- Food Industry Applications Bull. 350
- Flue Gas Conditioning/Additive Injection into Ducts with Fox Systems - Bull. 305
- Plastics Industry Applications Bull. 336
- Power Industry Applications Bull. 308
- Foundry Applications Bull. 317
- Fox Blower/Eductor Systems using Rotron or PD Blowers - Bulletin 302
- Venting Blowback from Airlocks with Fox RVE Eductors - Bulletin 360
- Slurry Eductors for Liquid/Powders Bull. 106
- Air Ejectors Bull. 251
- Steam Ejectors Bull. 201
- Water Eductors Bull. 101

Published Case Histories/Reprints

- •Ten Years of Maintenance-Free Conveying with Fox eductors at metal processor
- Cement Convey Kiln Spill at 700° C with No moving parts
- Cement Convey waste/alternative fuels into cement kiln with 24/7 reliability
- Power Spent Bed Recirculation, at high temps, at fluidized bed cogen plant
- Power Dried sludge injection at cogen power plant
- Pigment powders at dye mfr.
- Foundry: Spent sand Conveying and dust collector retrofit
- Limestone Dust at Mexican mine
- Convey Dense Metal powders at magnet producer

Case Studies

Fox constantly publishes new Case Studies as our venturi eductors are applied by new customers in new applications conveying new products. Here is just a partial list of case Studies that can be emailed or faxed to you upon request, grouped by industry. Request the Case Study Your need by the Case Study Number:

Food:

- 63 Corn snacks from extruder
- 59 Frozen cranberries
- 55 Puffed rice from reel
- 50 Oat bran from dust coll.
- 49 Ground coffee: screener
- 42 Cereal; package reclaim
- 39 Sugar; bulk bags
- 34 Whey; spray dryers
- 24 Salt flakes; screw feeder
- 17 Minors; spices screw fdr.

Power/Environmental

- 52 Hydrated lime, FGD
- 6 Flyash at 700° F
- 71 Boiler additive injection
- 72 Activated Carbon inj. into ducts
- 27 Pulverized Limestone, screw feeder
- 78 Dried sludge at cogen plant
- 74 Alt fuels; shredded waste

Plastics

- 45 Cryogenic grinding; mill
- 44 Screener overs/unders
- 47 Acrawax feed to line
- 4 Reduce streamers and angelhair

Diapers/ Hygenic

84 SAP/ Absorbant polymer in diaper production

Building Products

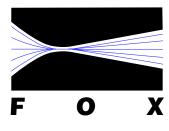
- 79 Pumice/grout from dust collectors
- 83 Ground Cement Boards
- 85 Phenolic Resin at chipboard plants
- 20 Copper pellets, 400 pcf

Minerals/Mines/ Metals

- 20 Copper pellets at 400 pcf
- 70 Copper-based caalcinate @ 700* F
- 81 Shredded Aluminum
- 20 Copper pellets, 400 pcf

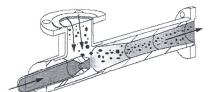
Cement

- 74 Inject alt fuels/waste (shredded tires, carpets) into cement kiln
- 80 CKD @ 700* F
- 77 Dried sludge into kiln



Fox Valve Development Corp. Hamilton Business Park Dover, NJ 07801 973-328-1011 Fax 973.328.3651

email: info@foxvalve.com website: www.foxvalve.com



Fox Venturi Eductors from Fox Valve

Dover, NJ 07801 / www.foxvalve.com

Phone: (973) 328-1011 / Fax (973) 328-3651

E-Mail: info@foxvalve.com

Application Data Sheet for Fox Solids Conveying Eductors

Please provide the requested information so that Fox can prepare a quotation on a performance-guaranteed eductor/blower system.

Company Name:	Contact Name:
Company Address:	
Phone: Fax:	E-Mail:
Material To Be Conveyed:	
Bulk Density:	e: Temp.: °F
Max Allowable Temp. (if temp sensitive):	°F Free Flowing?:
Moisture/Fat Content:	Abrasive Characteristics:
Required Solids Flow Rate: Nominal:	lb/hr Max.: lb/hr
Distance Material is to be Conveyed: Horiz.:	ft. Vert.: ft.
Number of Elbows: 90°: 45°: Other:	
Do you have an existing convey line?: OYes ONo	If so, line size: Sch./ID:
Gravity Feed?: OYes ONo What is eductor fed from?: Should Fox quote hopper or transition?: OYes ONo (If yes, please provide sketch)	
What is eductor conveying <u>into</u> ?:	Pressure Here:
Required Material of Construction: OCarbon Steel	Stainless Steel
Preferred End Connections: (NPT	
Preferred Blower Type: ORegenerative OP-D	Other:
	f yes, blower model: Pessure: Motor HP:
Special Requirements:	

Please provide a sketch of your pneumatic conveying system.