GE Energy

Pulse-Jet Overview and Common Problems

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Utility Hot Gas Market APC Trends

In the past 5 years, the trend is moving to pulse-jet collectors (approximately 60% of applications):

- Felt used for applications under 400°F (205°C)
- 3:1 - 4:1 air-to-cloth ratio
- 3 – 6 year filter life
- Smaller housing footprint

Municipal Solid Waste Incineration
16 MW – 65,000 ACFM

Coal-fired Industrial Boiler
110,000 ACFM

Utility Boiler
500,000+ ACFM

Hot Gas Pulse Jet Design Trends

	Pulse Pressure	Cage Type	Maximum Length	Fabric Selection	Relative Energy Usage	Issues
Traditional PJ High Pressure / Low Volume	60 - 100 PSI (4.1 – 6.9 Bar)	One-Piece	16 – 19 feet (4.9- 5.8m)	Any	★★★	Housing Footprint
Medium Pressure / Medium Volume	25 – 50 PSI (1.7 – 3.4 Bar)	Multi-Piece	22 – 25 feet (6.7 – 7.6 m)	Felt	★★★	Cage wear; Penthouse restrictions
High Volume / Low Pressure	< 15 PSI < 1 Bar)	Multi-Piece	22 – 27 feet (6.7 – 8.2 m)	Felt	★★★	Cage wear; Penthouse restrictions

Air-to-Cloth Ratios:

3:1 – Fiberglass

3.5:1 – Fiberglass with ePTFE membrane

4:1 - Felt

Fabric Selection Considerations

- Baghouse operating temperature
- Abrasion resistance needed
- Resistance to cleaning energy
- Gas stream chemistry
- Air-to-cloth ratio

Fabric Characteristics & Suitability for Power Generation Applications

	Polypropylene	Polyester	Acrylic	Fiberglass	Aramid	PPS	P84 ***	Teflon® ***
Max. Continuous Operating Temp.	170° F (77° C)	275° F (135° C)	265° F (130° C)	500° F (260° C)	400° F (204° C)	375° F (190° C)	500° F (260° C)	500° F (260° C)
Abrasion	Excellent	Excellent	Good	Fair*	Excellent	Good	Fair	Good
Energy Absorption	Good	Excellent	Good	Fair	Good	Good	Good*	Good
Filtration Properties	Good	Excellent	Good	Fair	Excellent	Excellent	Excellent	Fair
Moist Heat	Excellent	Poor	Excellent	Excellent	Good	Good	Good	Excellent
Alkaline Dust	Excellent	Fair	Fair	Fair	Good	Excellent	Fair	Excellent
Mineral Acids	Excellent	Fair	Good	Poor**	Fair	Excellent	Good	Excellent
Oxygen (>15%)	Excellent	Excellent	Excellent	Excellent	Excellent	Poor	Excellent	Excellent
Relative Cost	$	$	$$	$$$	$$$$	$$$$$$	$$$$$$	$$$$$$$

* Sensitive bag-to-cage fit

** Fair with chemical or acid-resistant finishes

*** Must oversize bag for shrinkage for temperatures above 450°F (232°C)

Commonly Used Filtration Fabrics
Pulse-Jet & Low Pressure - High Volume

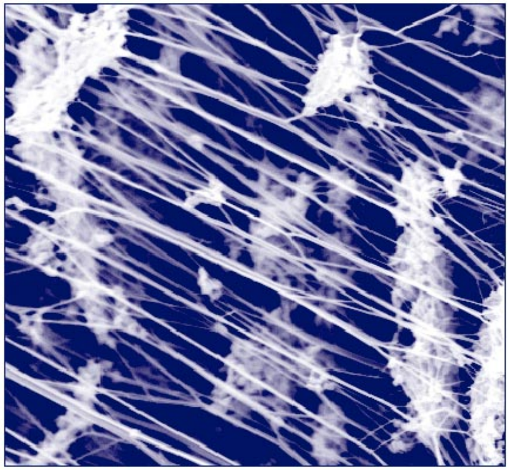
- Woven fiberglass – 25%
- PPS (polyphenylene sulfide) – 60%
- Acrylic – 10%
- Others – 5%
  - P84
  - ePTFE Membrane applied to the above substrates
  - Pleated filter elements (PFEs)

What is ePTFE Membrane?

A microporous membrane laminated to traditional filtration fabrics.

The ePTFE membrane consists of a web of overlapping fibrous strands that form millions of air passages, much smaller than the particulate, for an extremely porous filter surface.

Because the membrane is slick, bag cleaning is more complete and requires less energy.



Microphotograph of membrane

Why is ePTFE Gaining Popularity for Filtration?

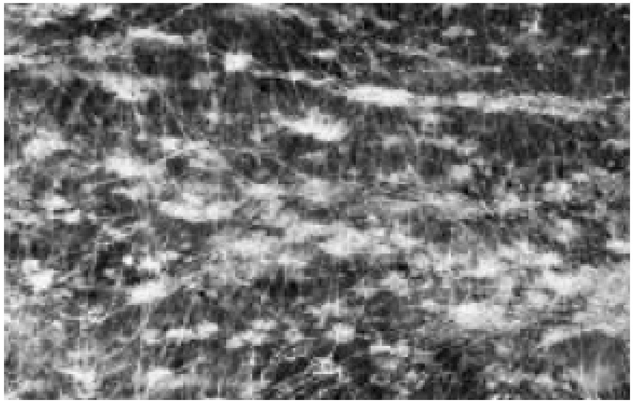
- Enhanced fine particulate collection
- Superior filter clean-down
- Lower differential pressure
- Resistance to moisture in the gas stream
- Longer bag life

ePTFE Membrane vs. Coatings

The difference between coated felt and ePTFE membrane on felt.

Coated Polyester Felt at 1000x

Large pores allow submicron dust to pass through



ePTFE on Polyester Felt at 1000x

ePTFE microporous structure ensures maximum efficiency

Pleated Filter Elements

Increase surface filtration area...
by as much as 2–3 times

Lower differential pressure...
increased airflow

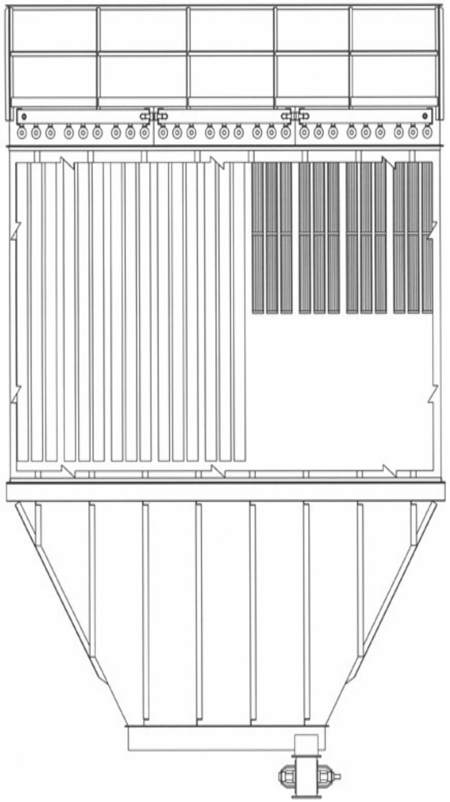
Lower emissions...
double filtration efficiency

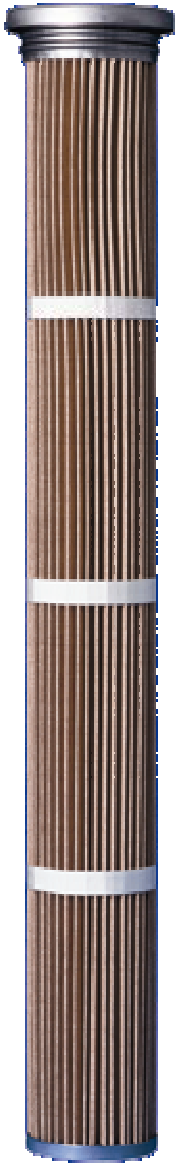
Pleated Filter Technology

Shorter filters are installed out of the inlet gas stream

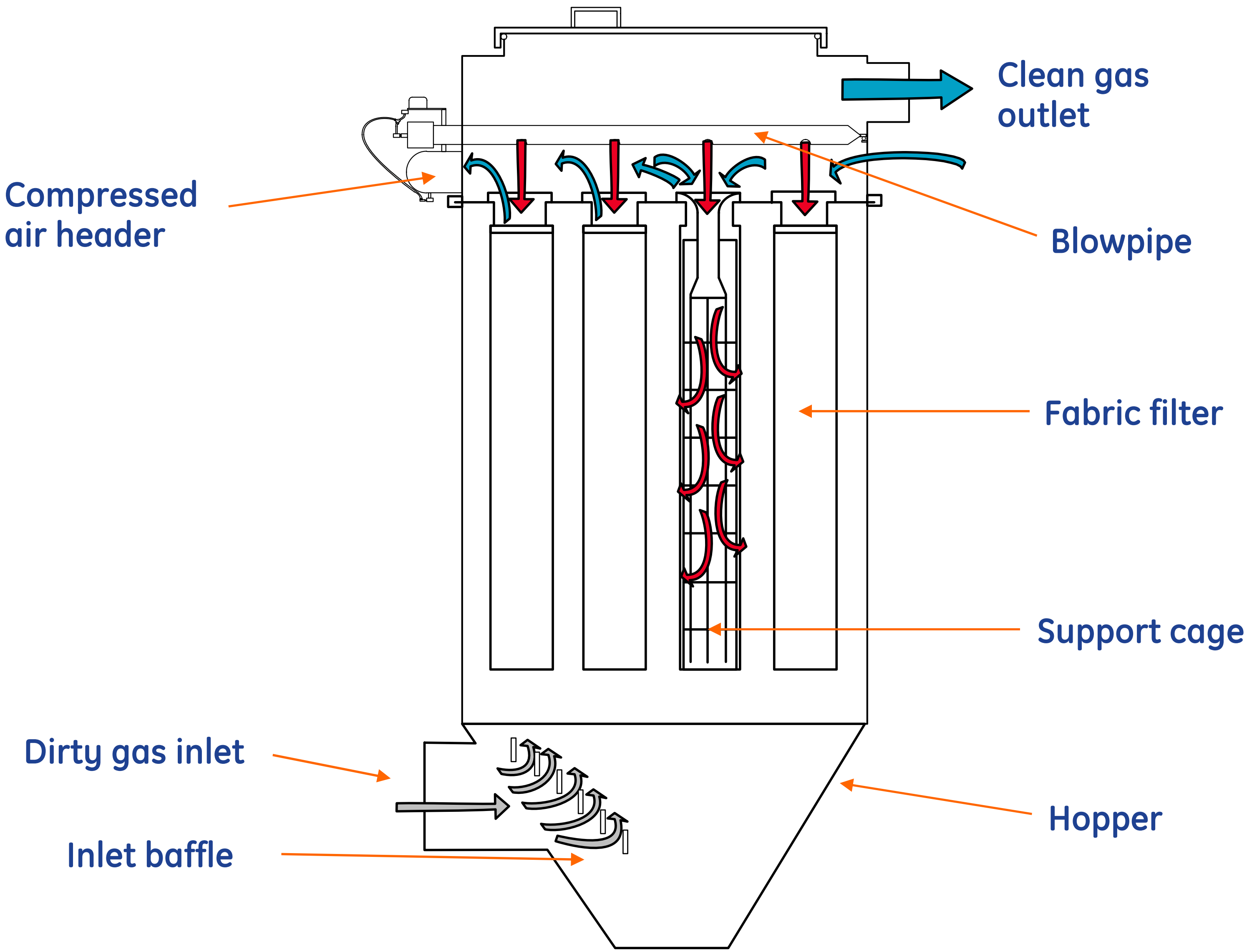
Reduces abrasion to bottom of filters.

Provides for a large drop-out zone.

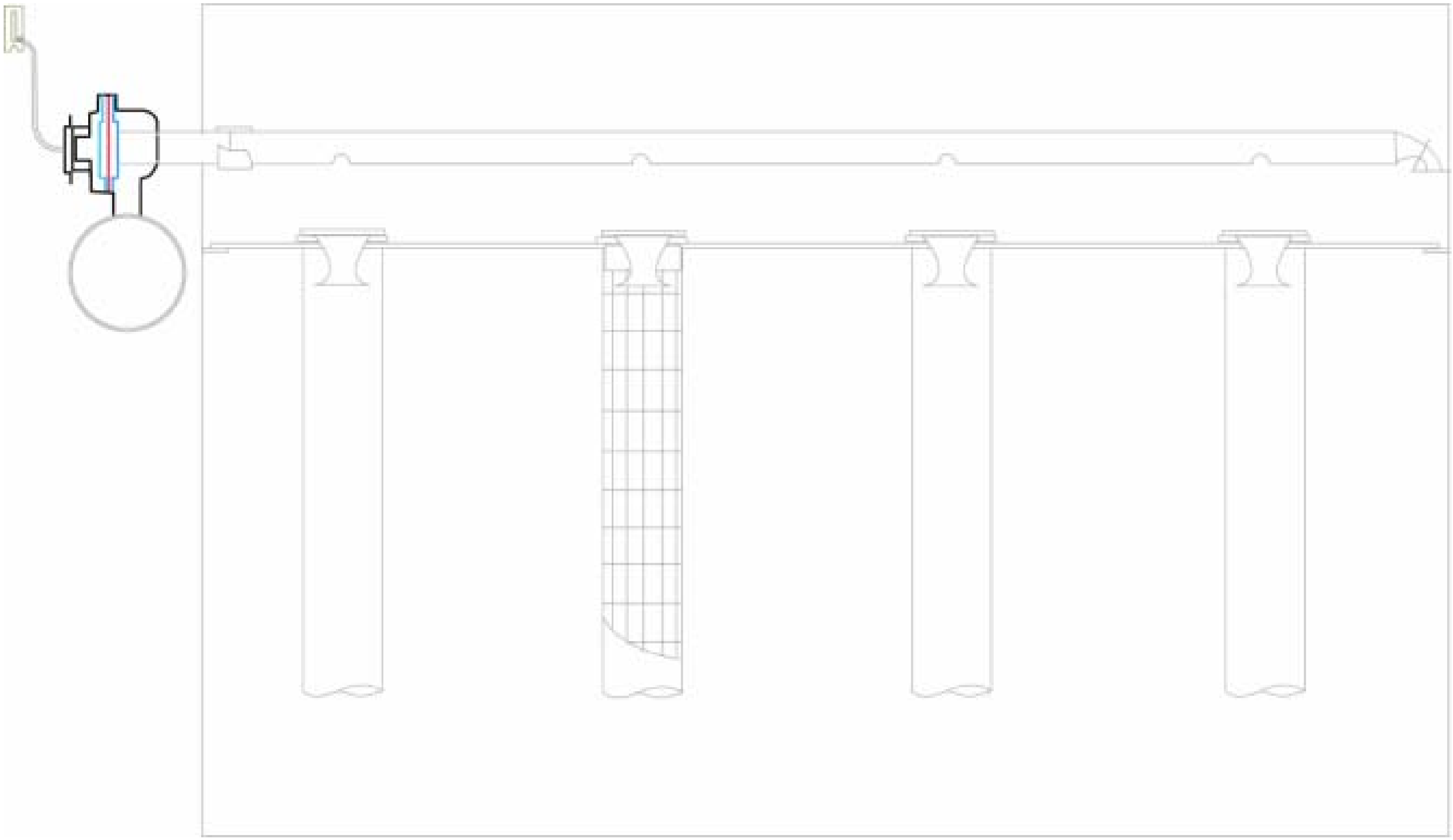




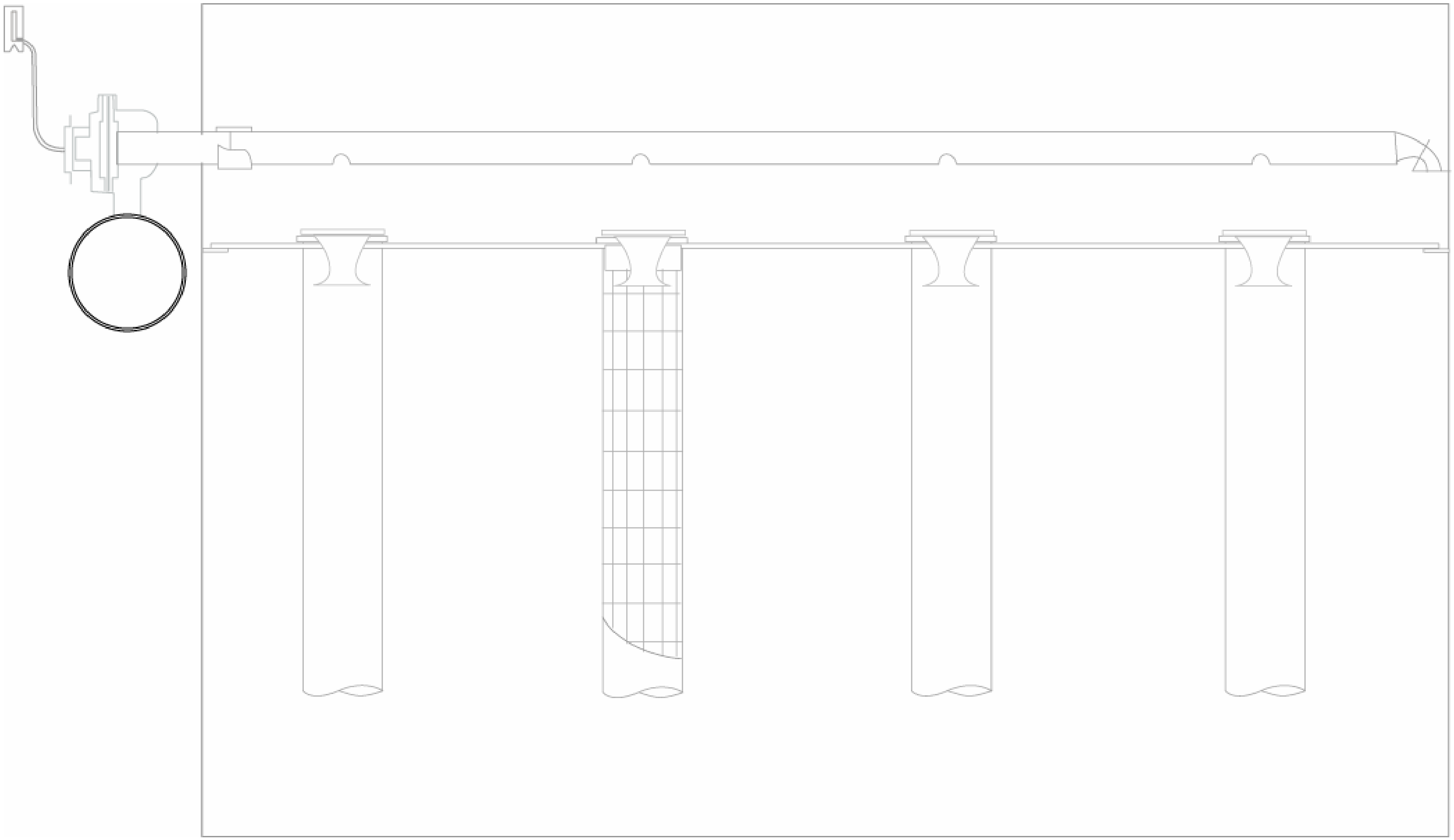
Typical Pulse-Jet Collector



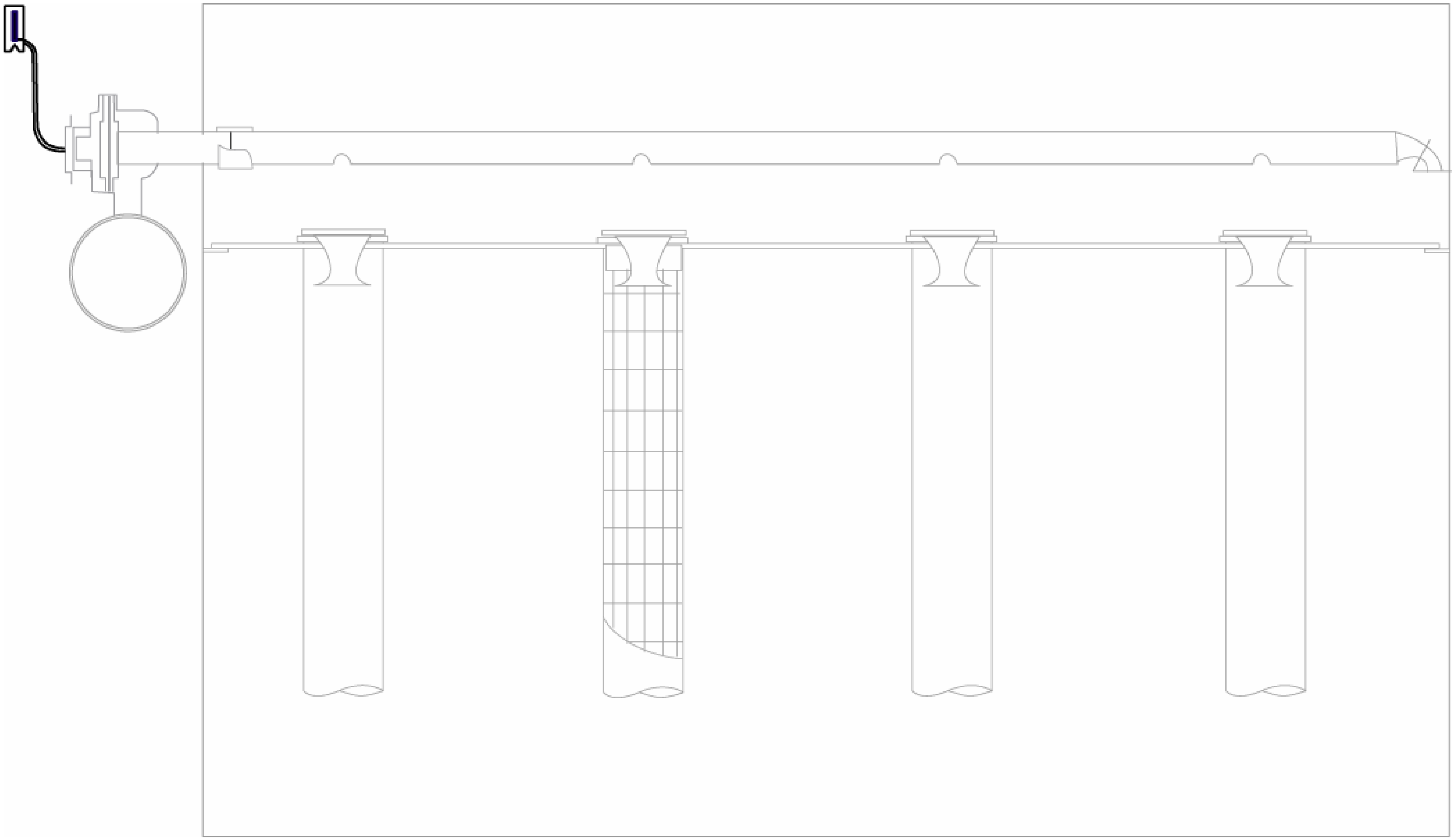
Diaphragm Valve



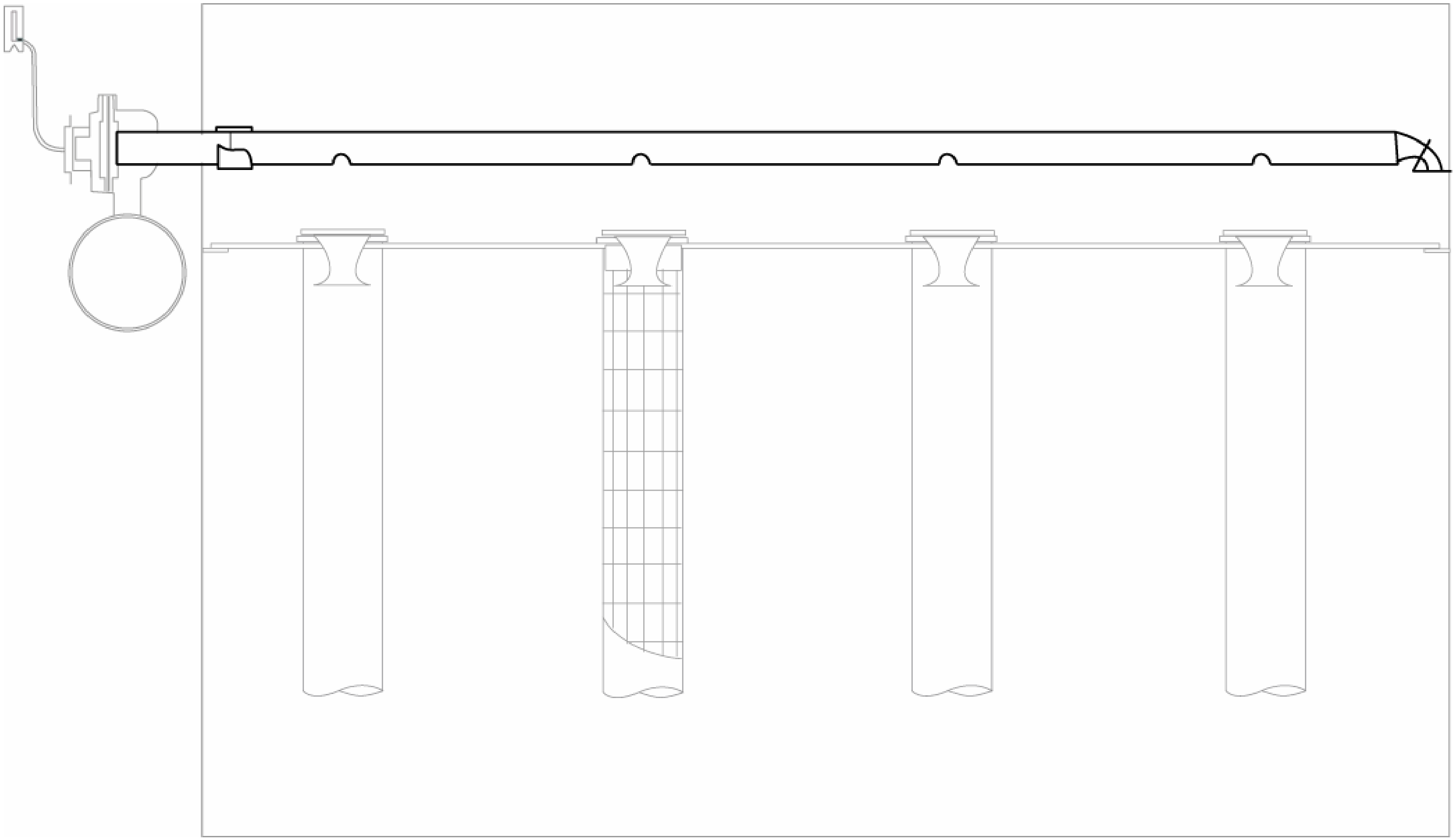
Manifold



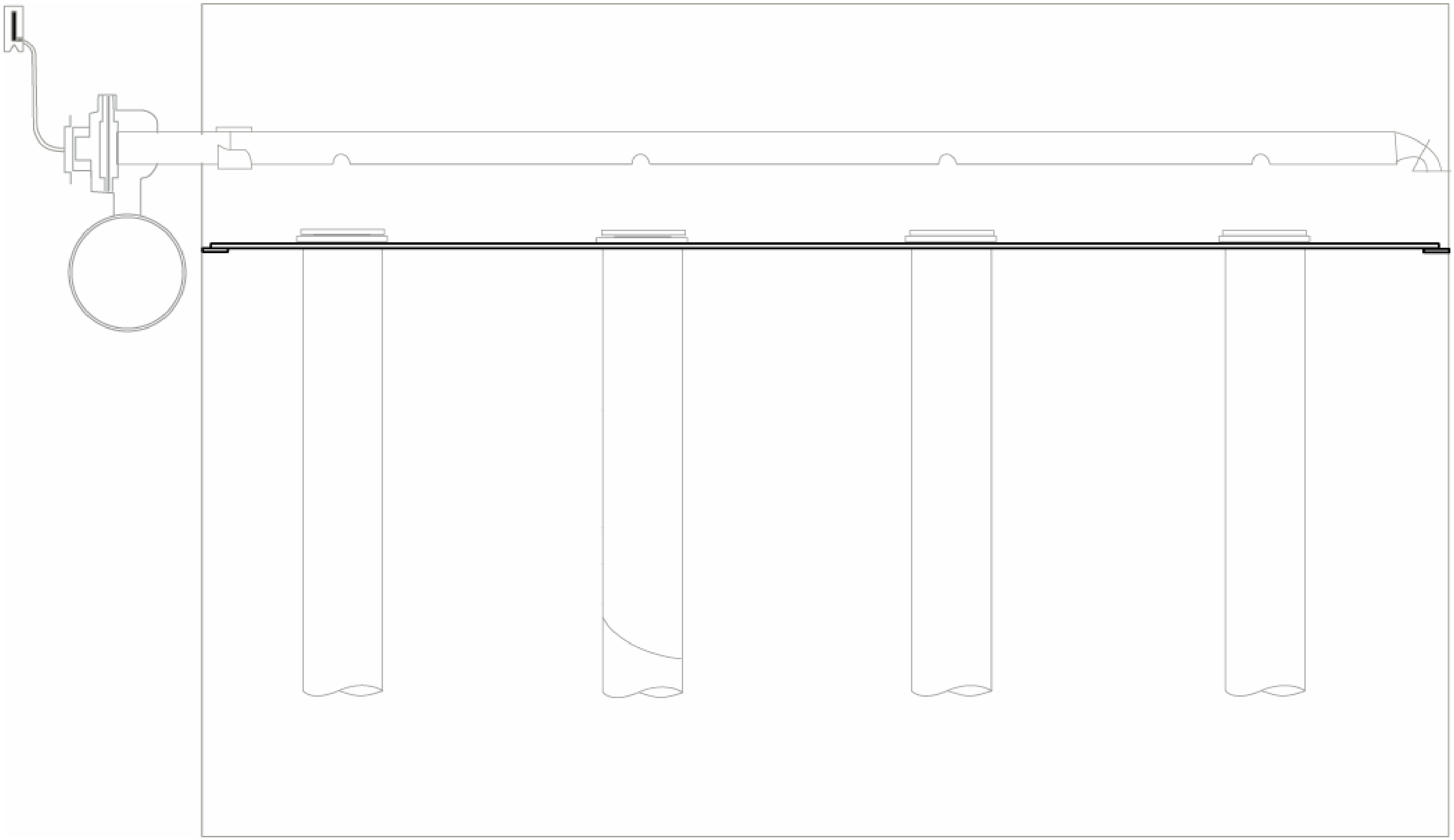
Solenoid Valve/Bleeder Tube



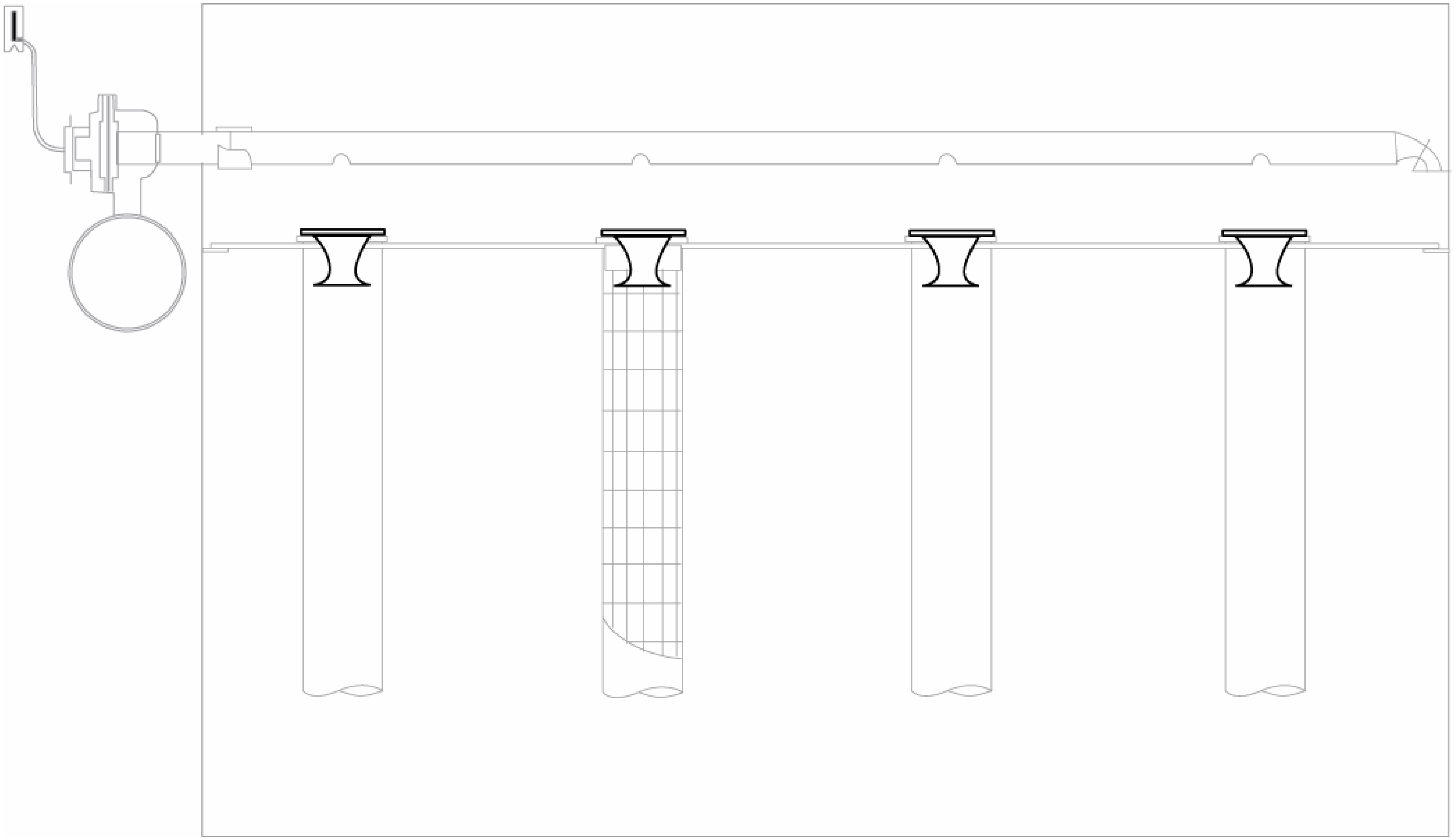
Quick-Release Blowpipe



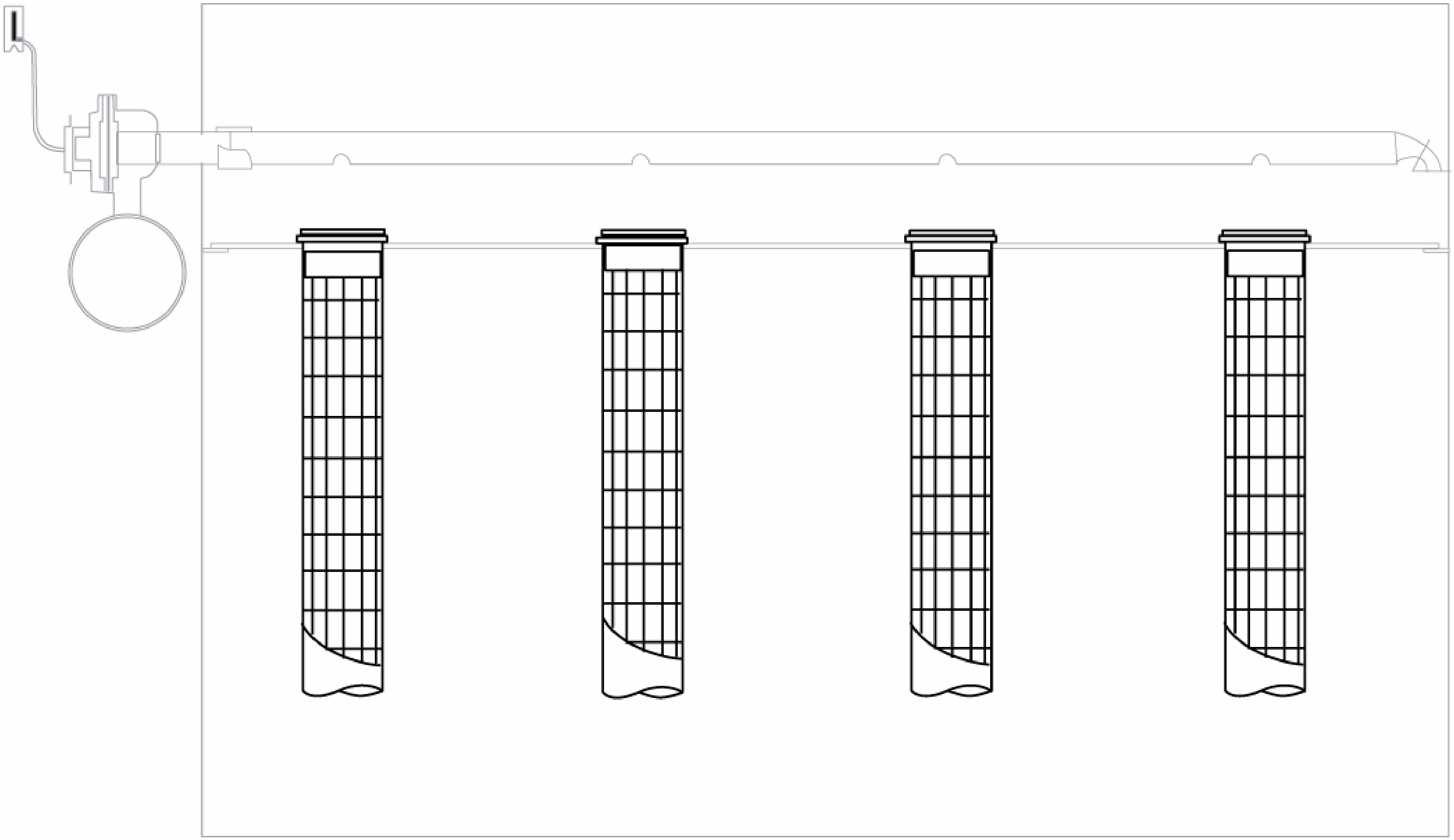
Tubesheet (Cell Plate)



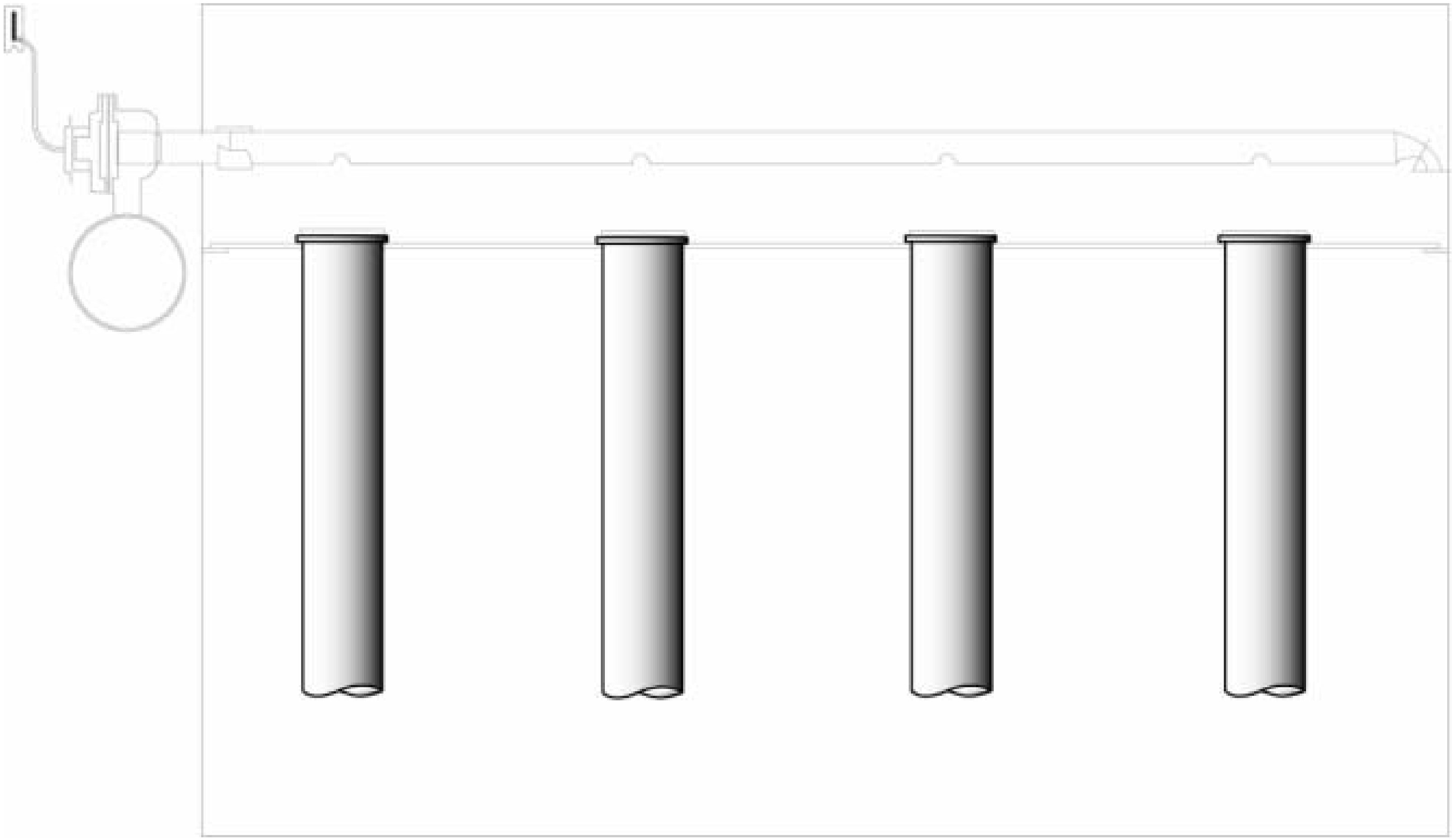
Venturis



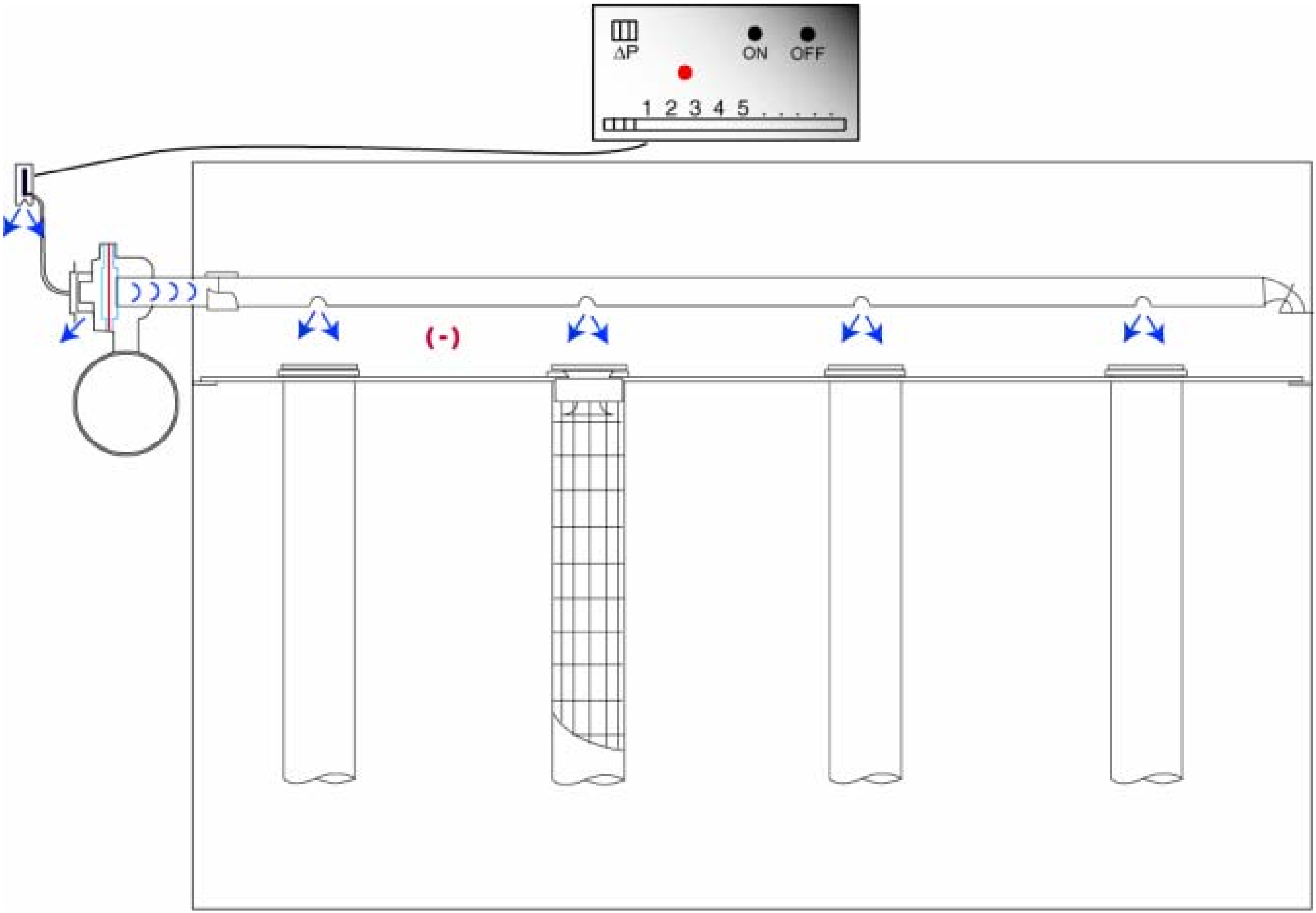
Cages



Bags



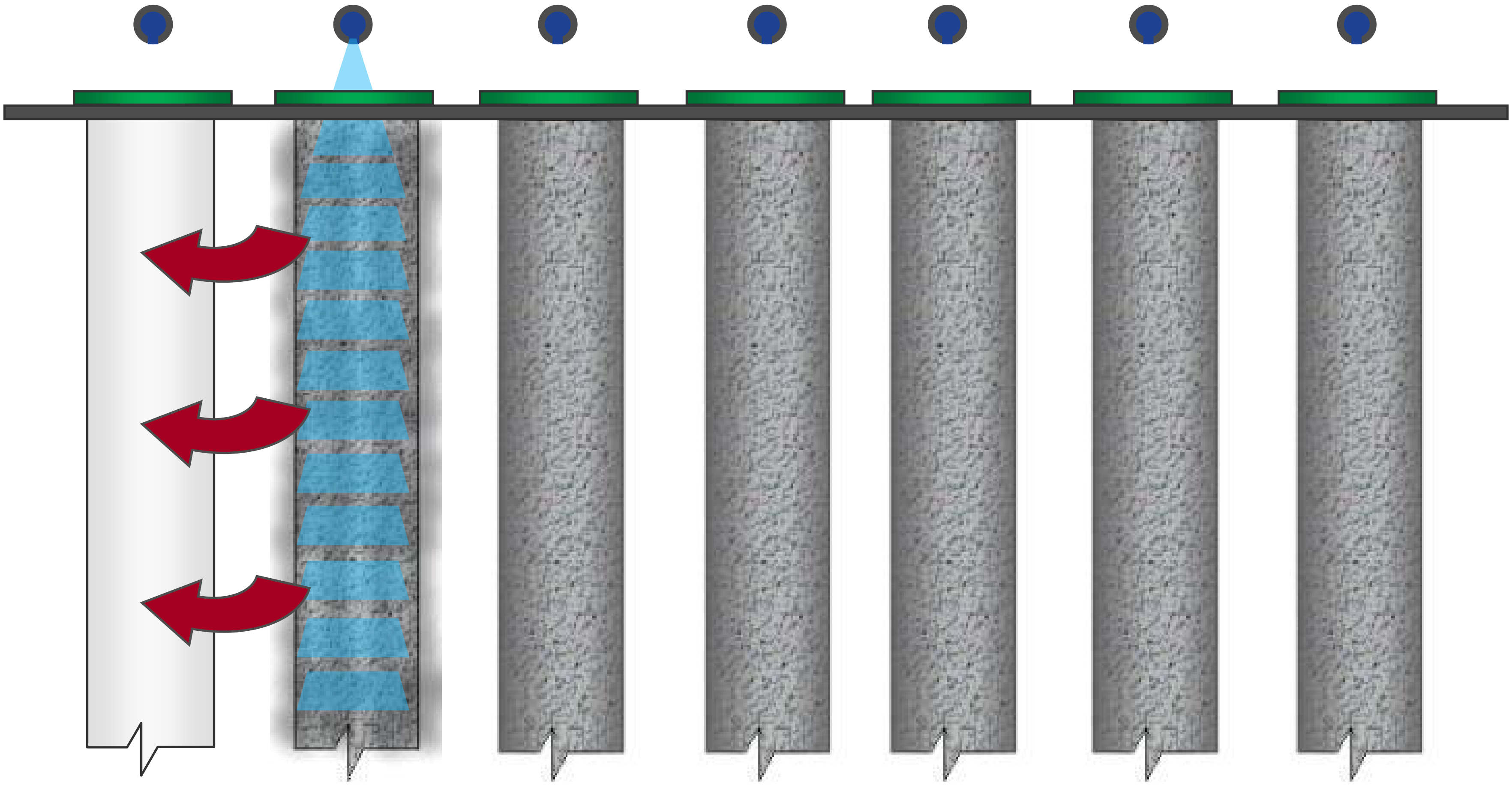
Cross Section of Pulse-Jet Unit



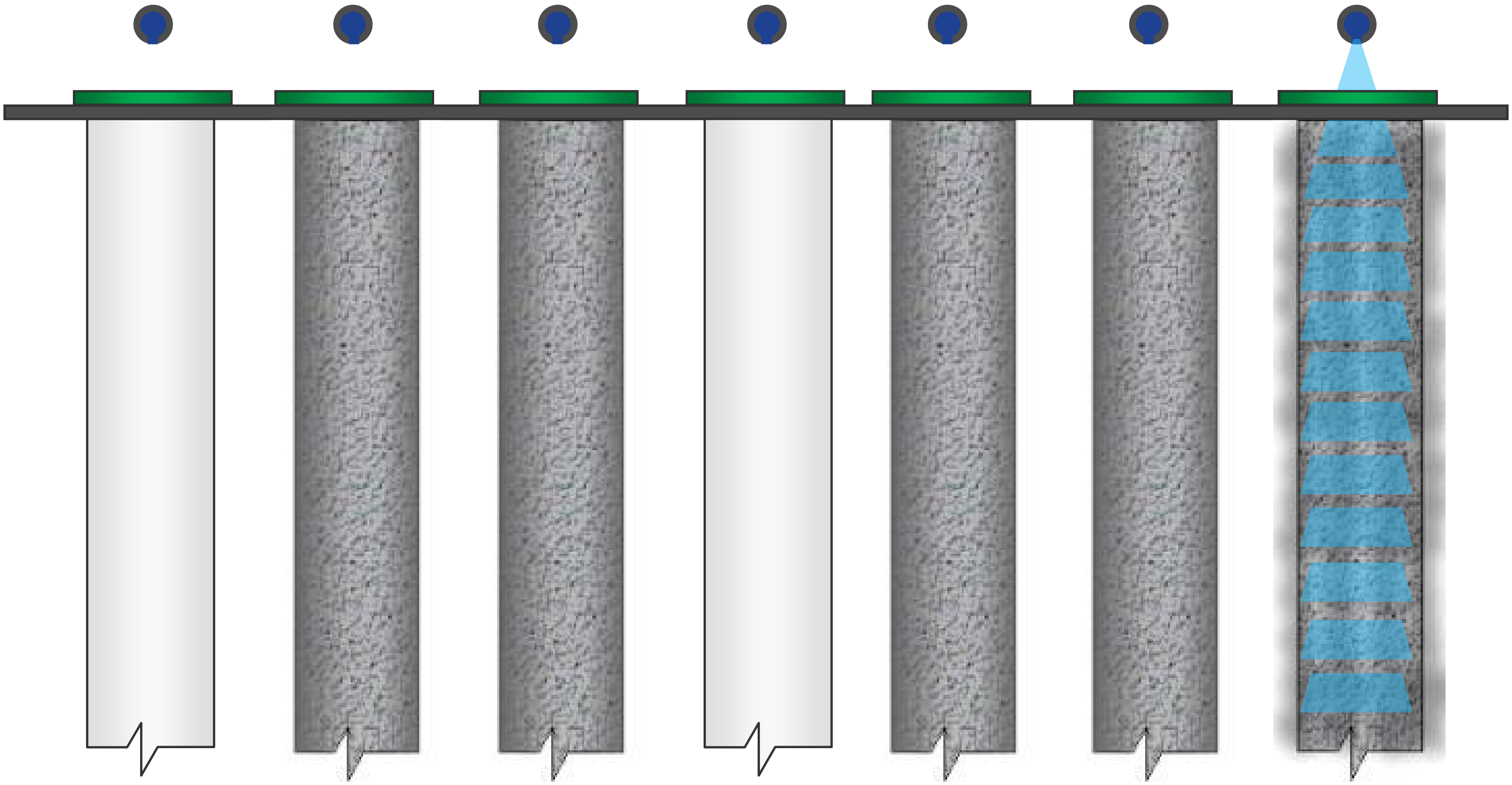
Clean-on-Demand™ System

High-low set points at no greater than 1" apart…
Ideal is no more than 0.5"

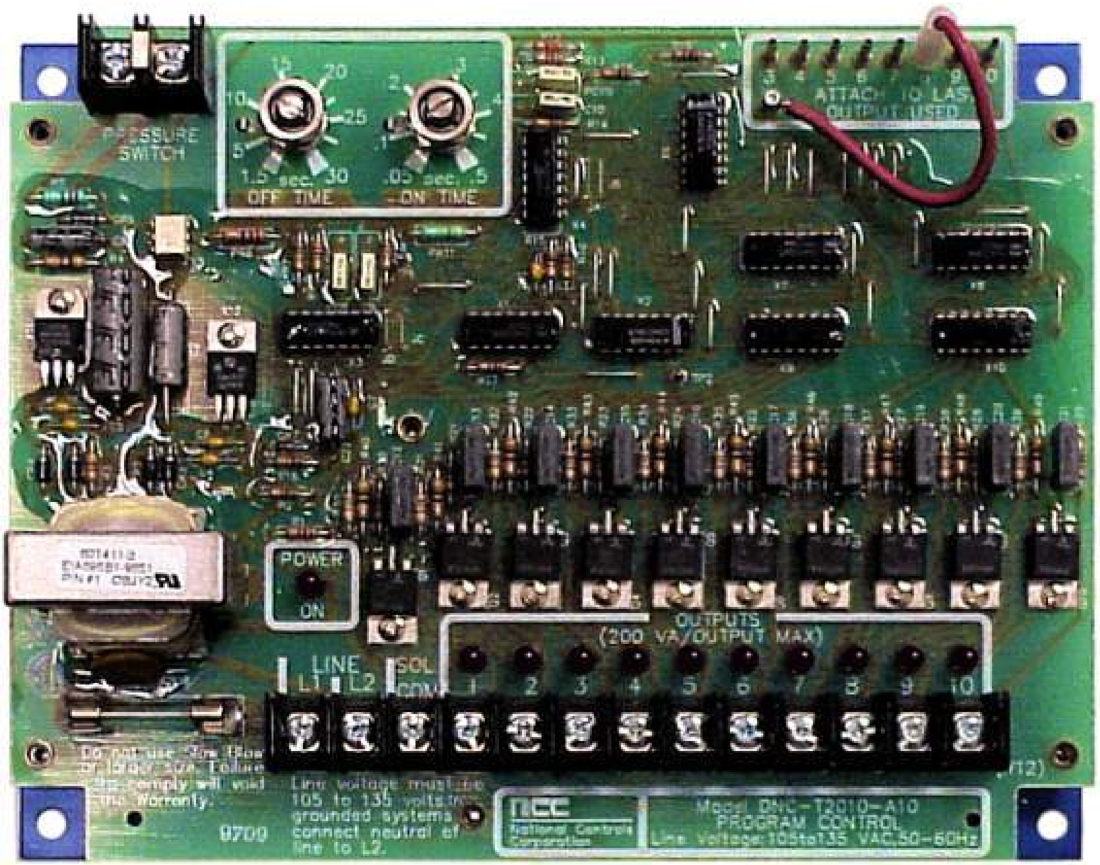
Incorrect Pulse Cleaning Sequence



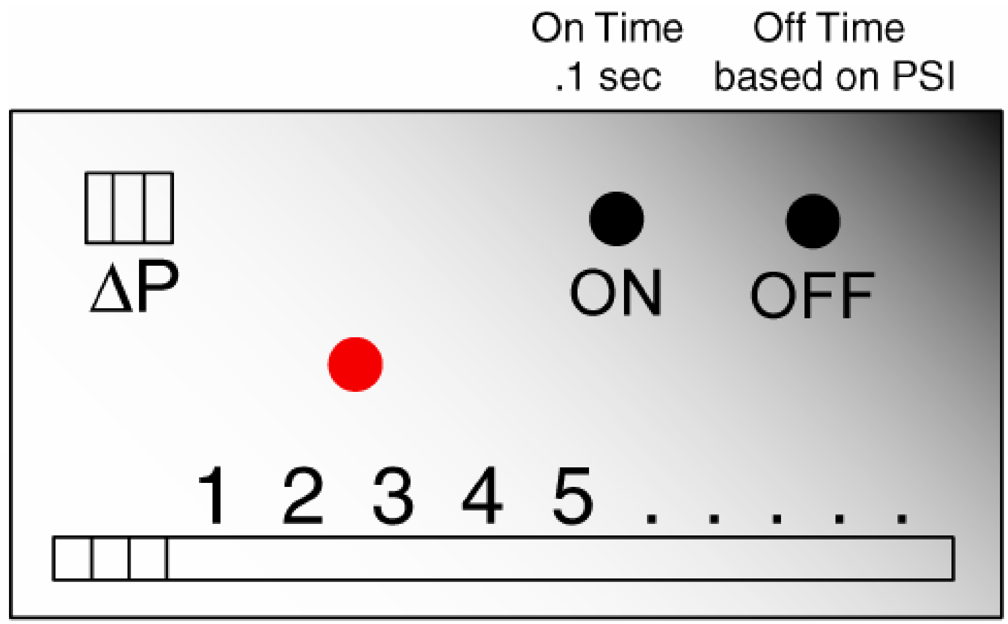
Correct Pulse Cleaning Sequence

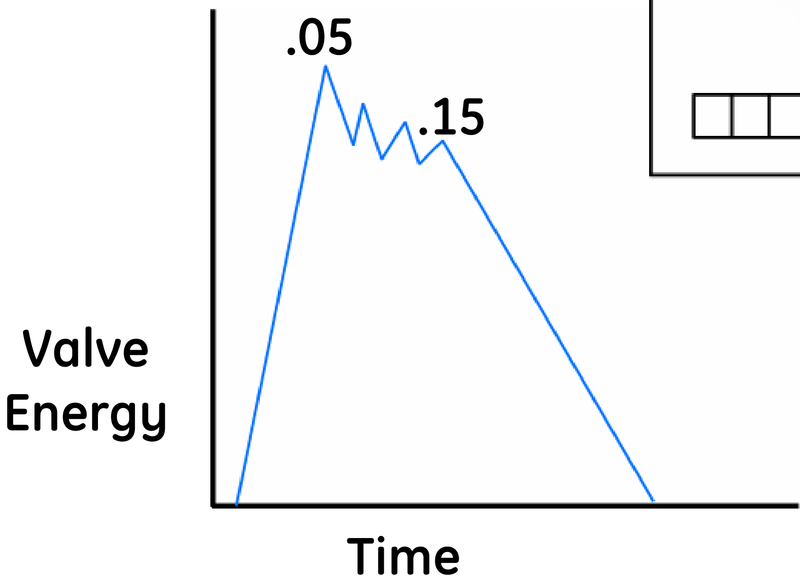


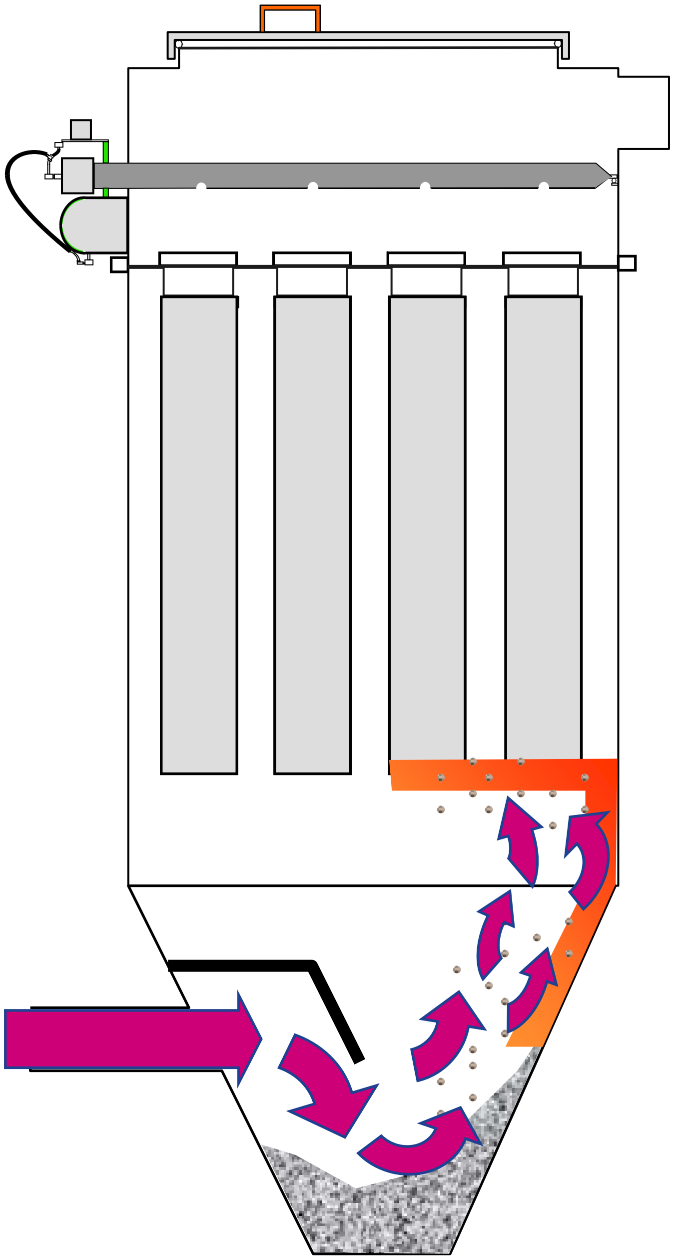
Solid State Timer Board



Pulse Duration







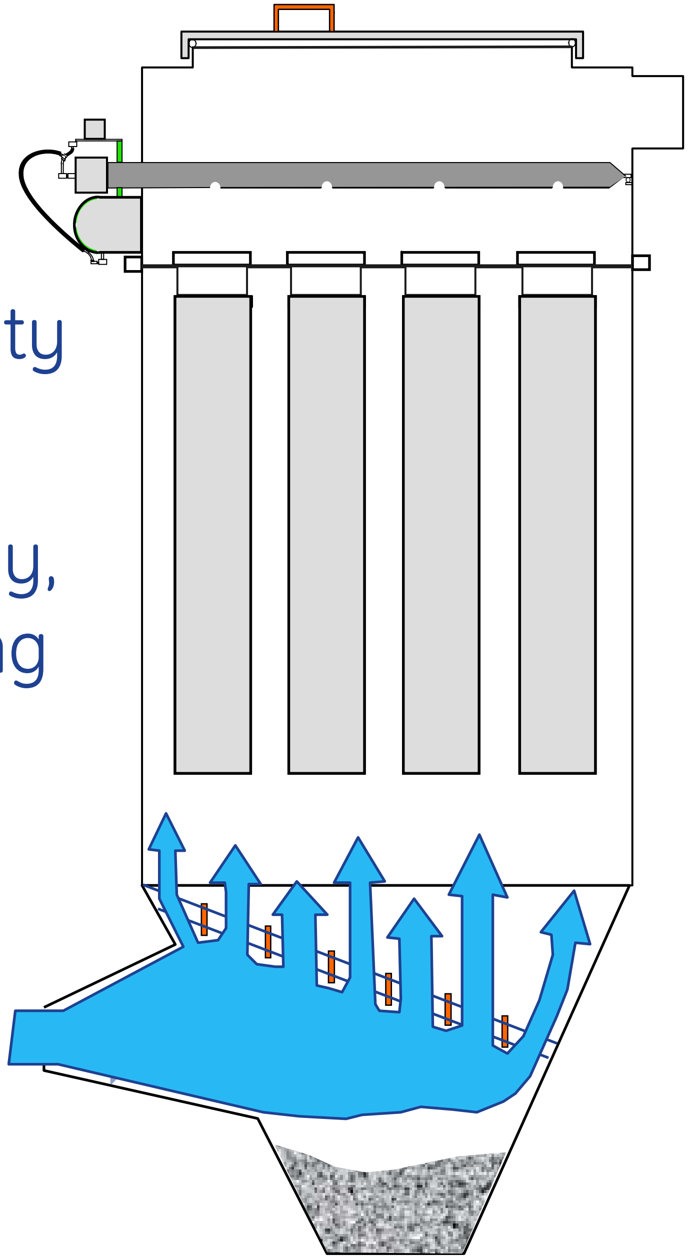
Common Inlet Design

- Inlet baffle directs airflow down into hopper
- Collected material can swirl upward, causing heavier than design grain-loading
- Narrow hoppers and nearby bag bottoms may experience abrasion damage

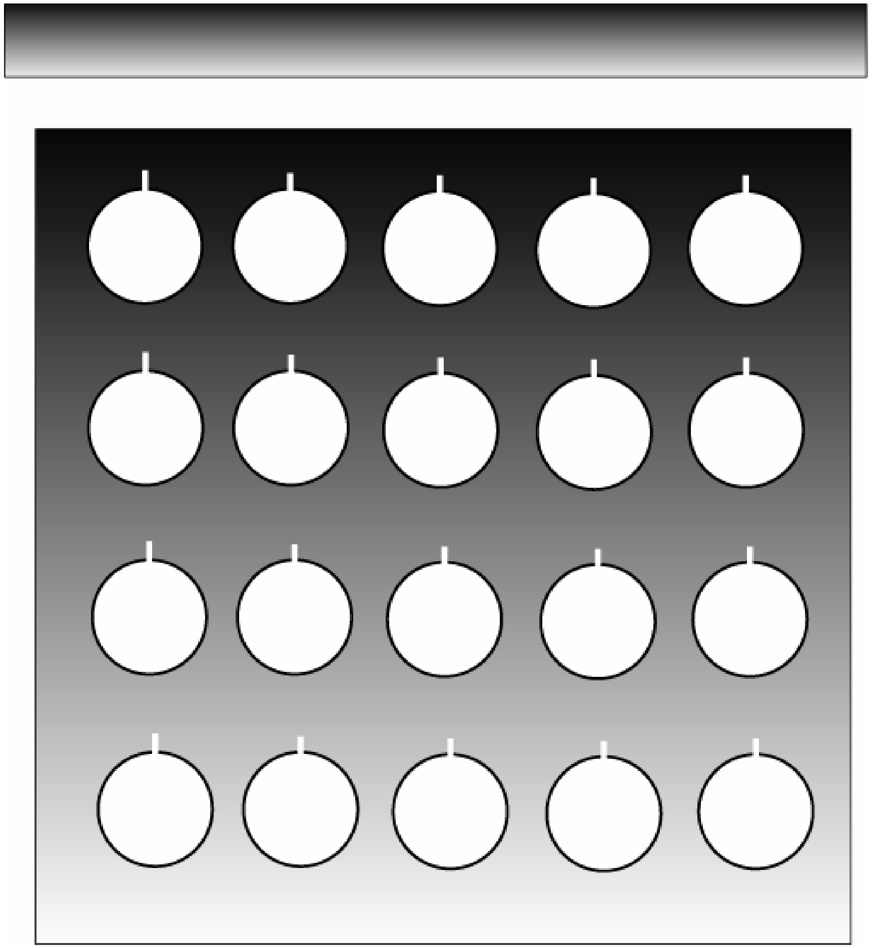
Bottom Bag Abrasion

Improved Design

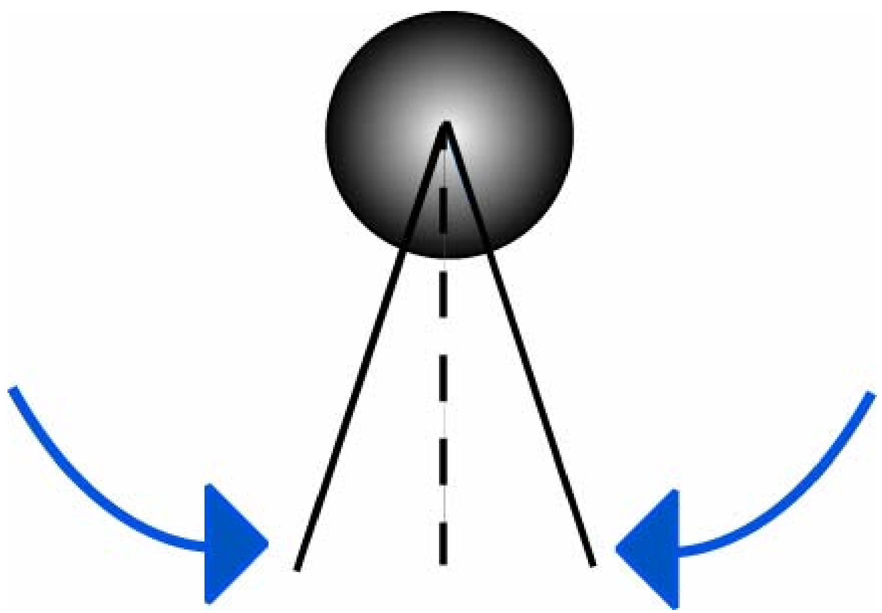
- Enlarged inlet reduces velocity
- "Ladder Vane Baffles" distribute airflow more evenly, reducing uneven grainloading and turbulence
- Inlet baffles are simple and economical to install



Blowpipe Manifold/Bag Seam Alignment

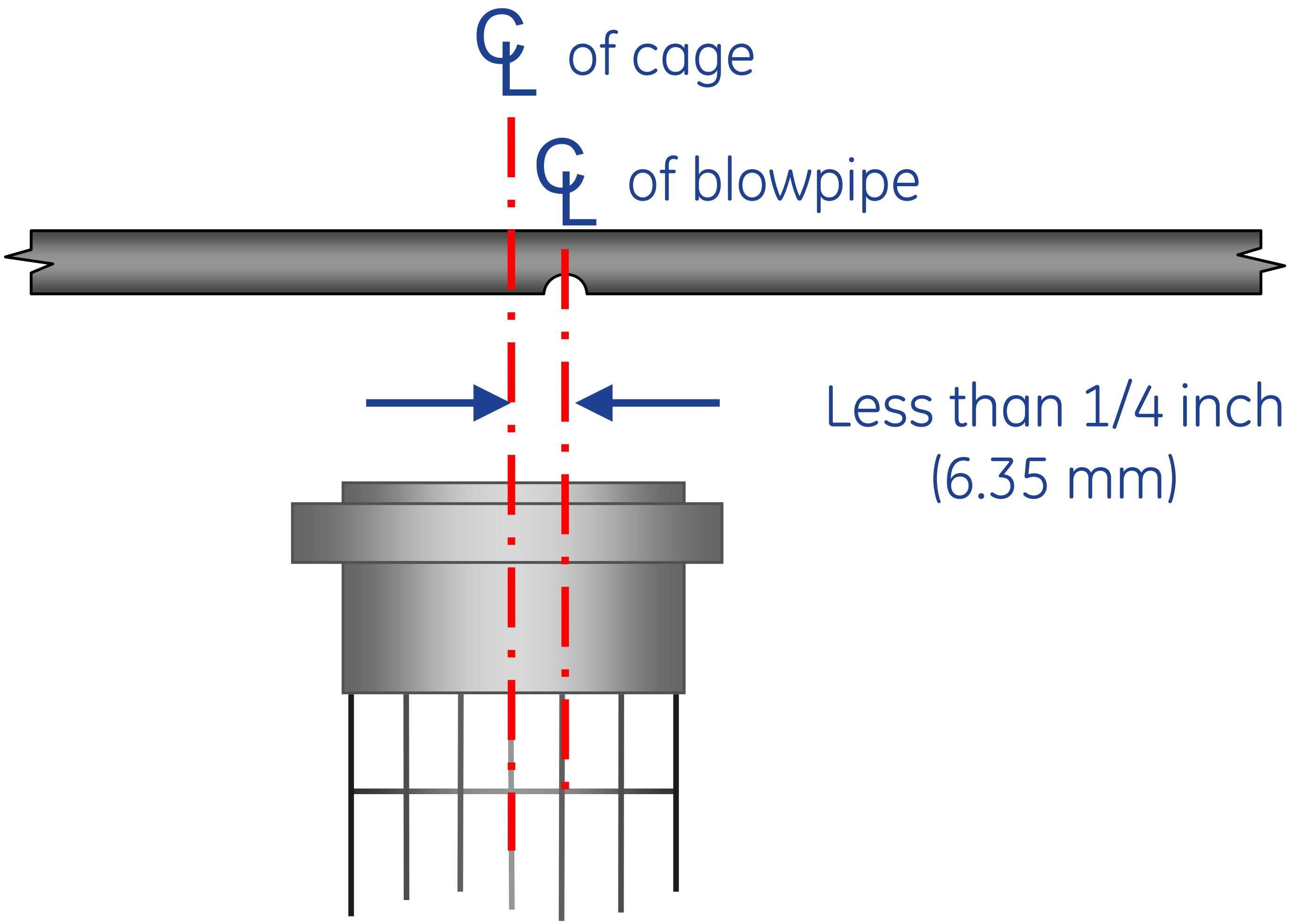


Blowpipe Alignment



2° Allowed

Blowpipe Misalignment



Pulse Abrasion

Six Ways Dust Leaks Into Clean Air Plenum

- Hole in bag
- Snapband
- Leak around a weldment
- Clean too soon
- Not cleaning
- Air leaks at door seal

Inspection and Maintenance Procedures

Daily maintenance

1. Check pressure drop
2. Check cleaning system
3. Check all valves and dampers
4. Check dust removal
5. Check emissions
6. Do a daily walkthrough

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