

GE Energy

# Pulse-Jet Overview and Common Problems



imagination at work

# 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
<b>Traditional PJ High Pressure / Low Volume</b>	60 - 100 PSI (4.1 - 6.9 Bar)	One-Piece	16 - 19 feet (4.9- 5.8m)	Any		Housing Footprint
<b>Medium Pressure / Medium Volume</b>	25 - 50 PSI (1.7 - 3.4 Bar)	Multi-Piece	22 - 25 feet (6.7 - 7.6 m)	Felt		Cage wear; Penthouse restrictions
<b>High Volume / Low Pressure</b>	< 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)

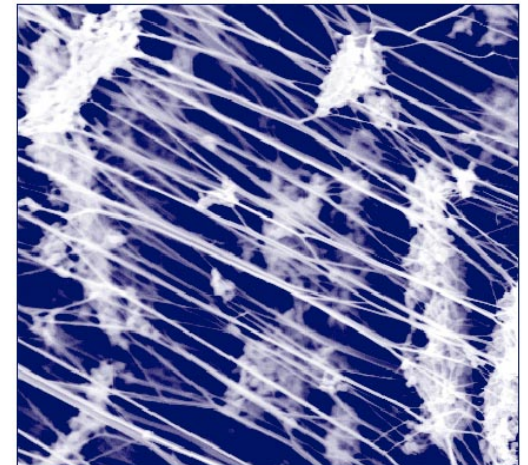
# What is ePTFE Membrane?

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

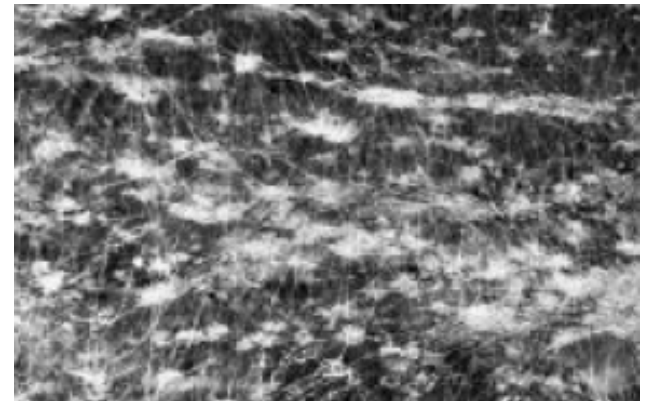


# ePTFE Membrane vs. Coatings

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

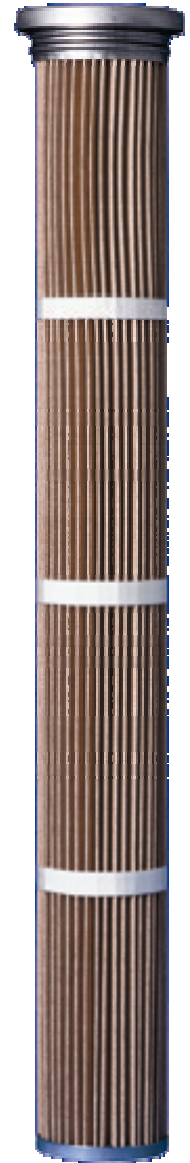
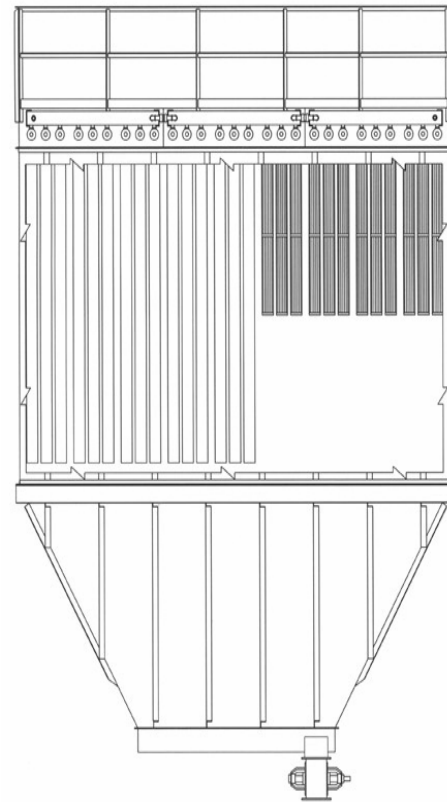


# Pleated Filter Technology

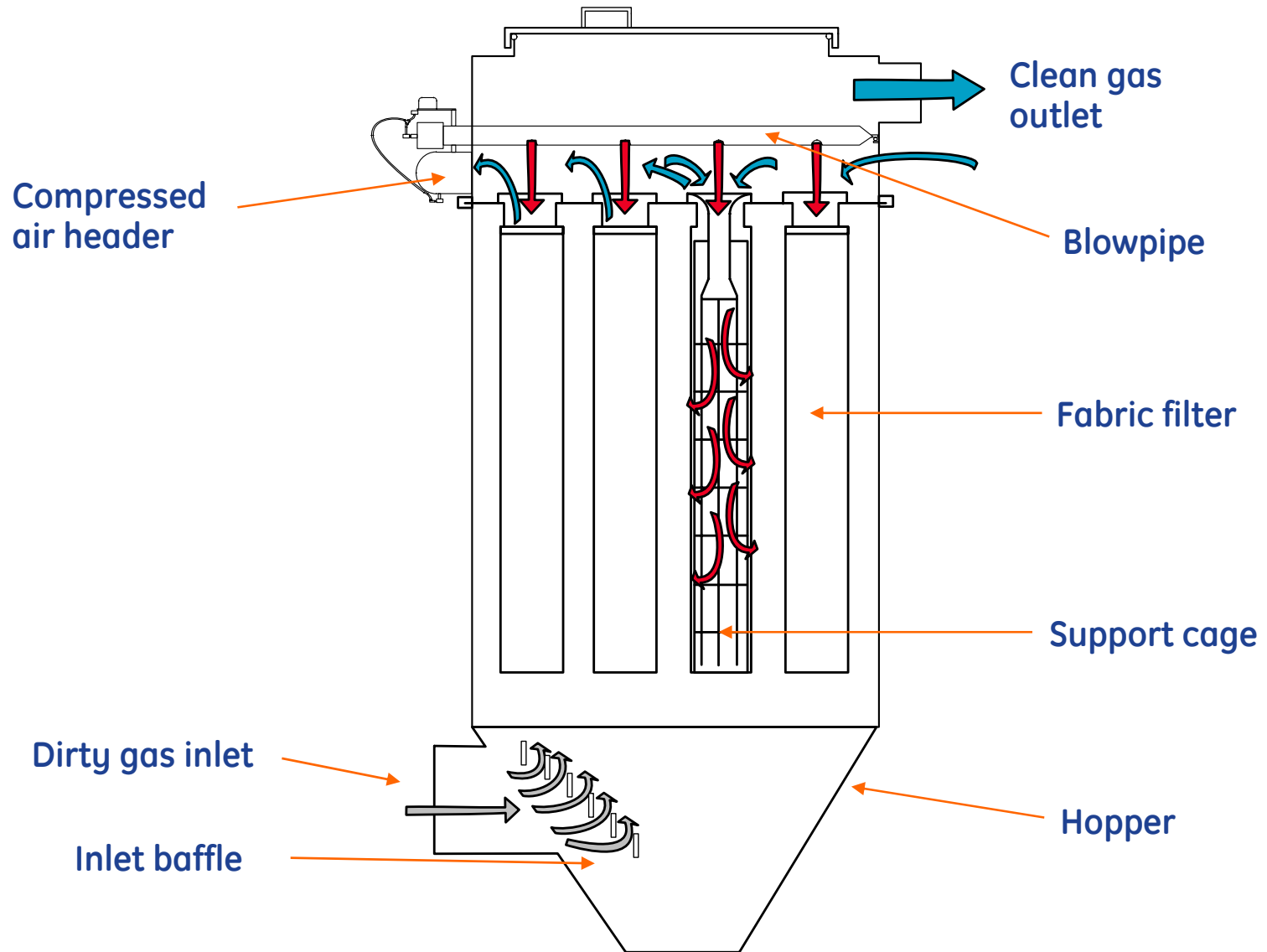
Shorter filters are installed out of the inlet gas stream

Reduces abrasion to bottom of filters.

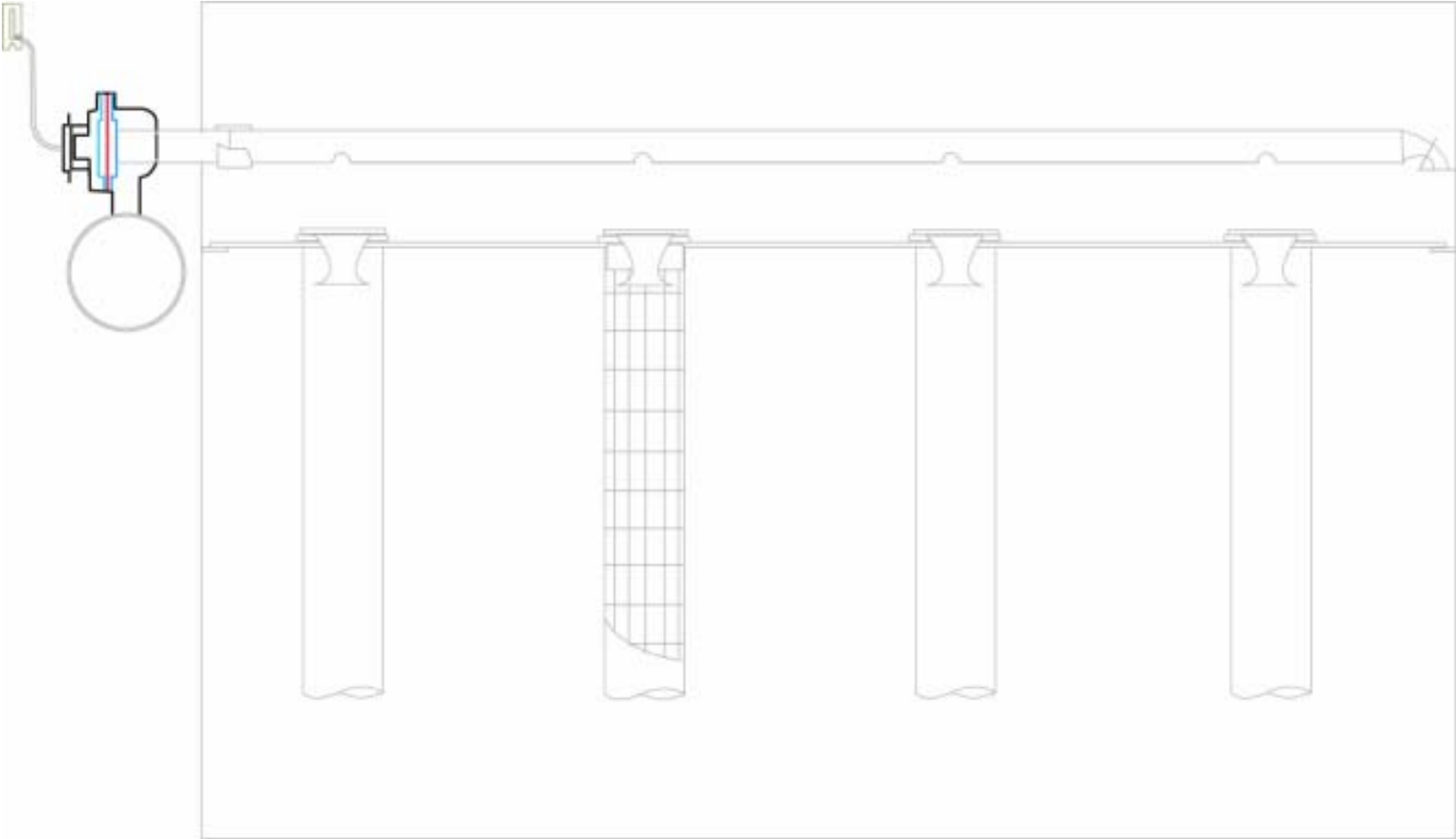
Provides for a large drop-out zone.



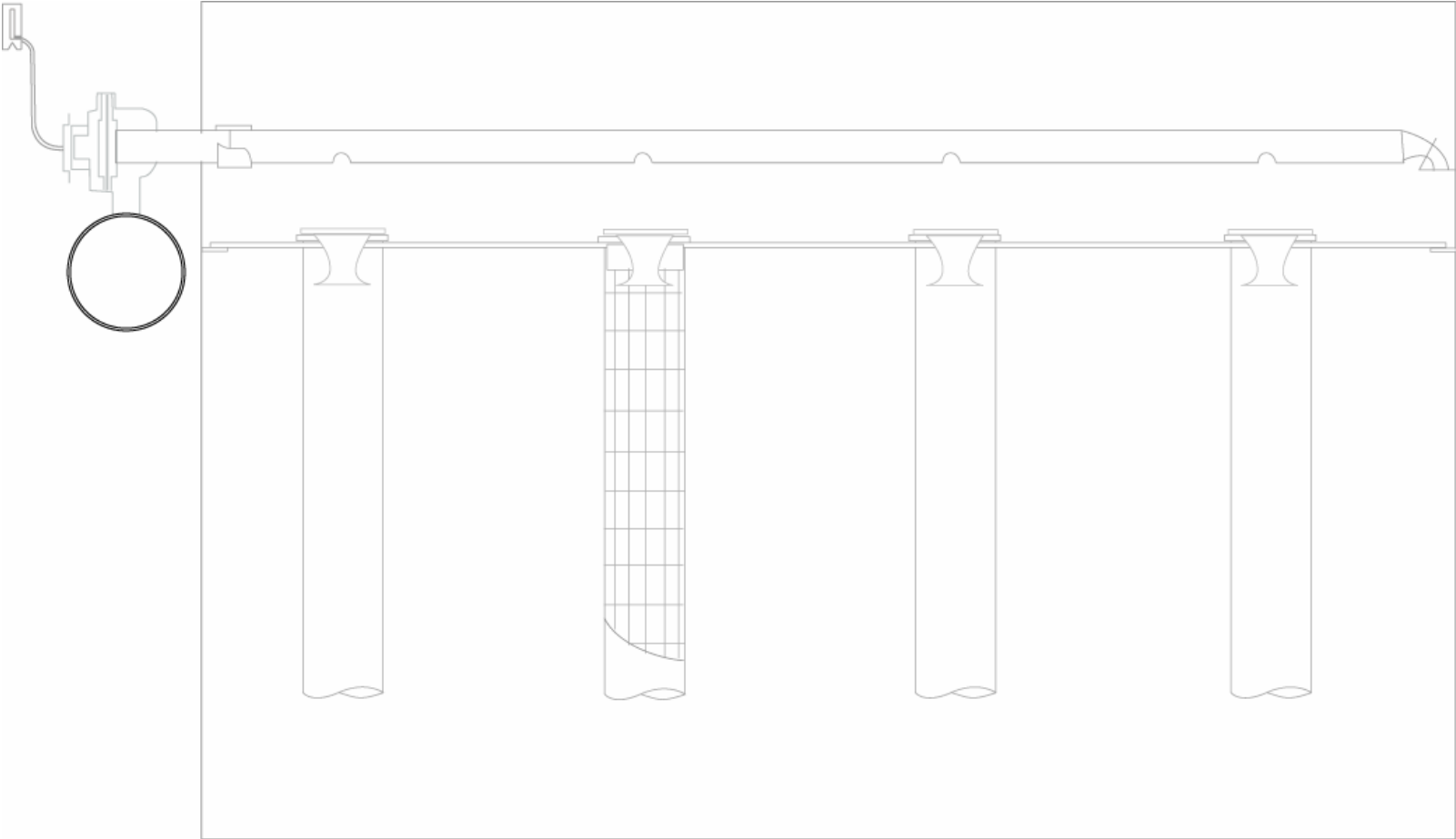
# Typical Pulse-Jet Collector



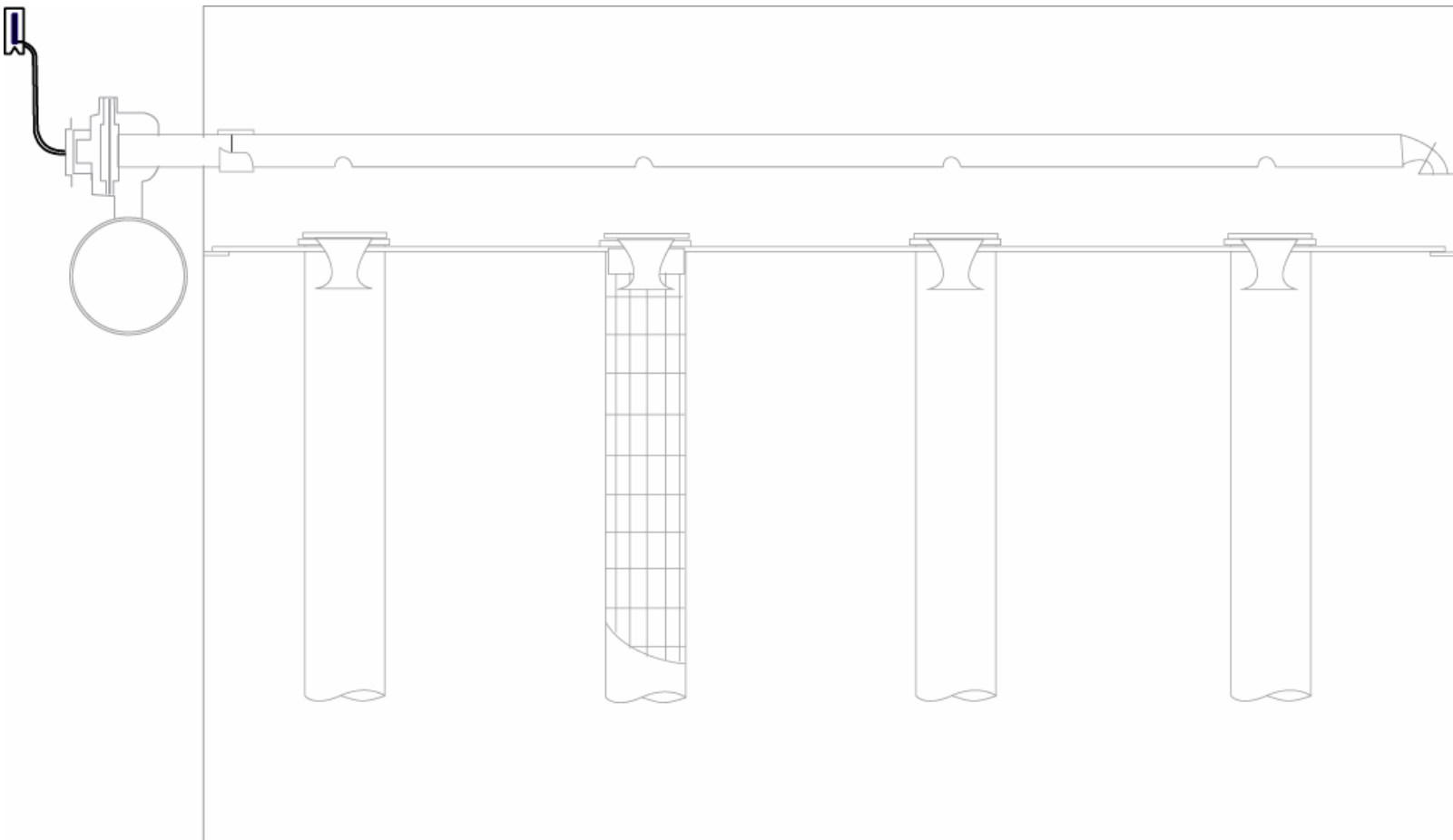
# Diaphragm Valve



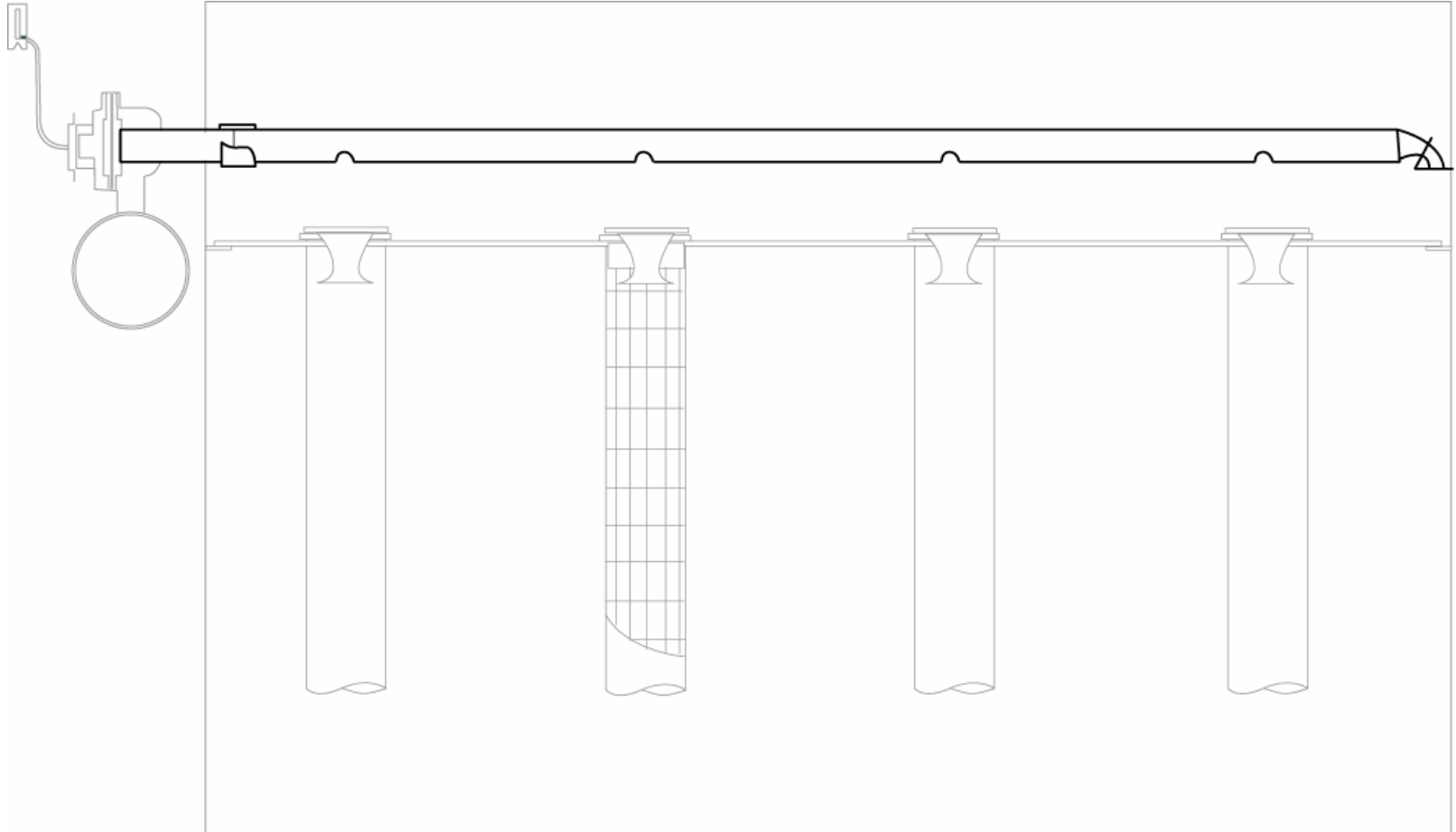
# Manifold



# Solenoid Valve/Bleeder Tube

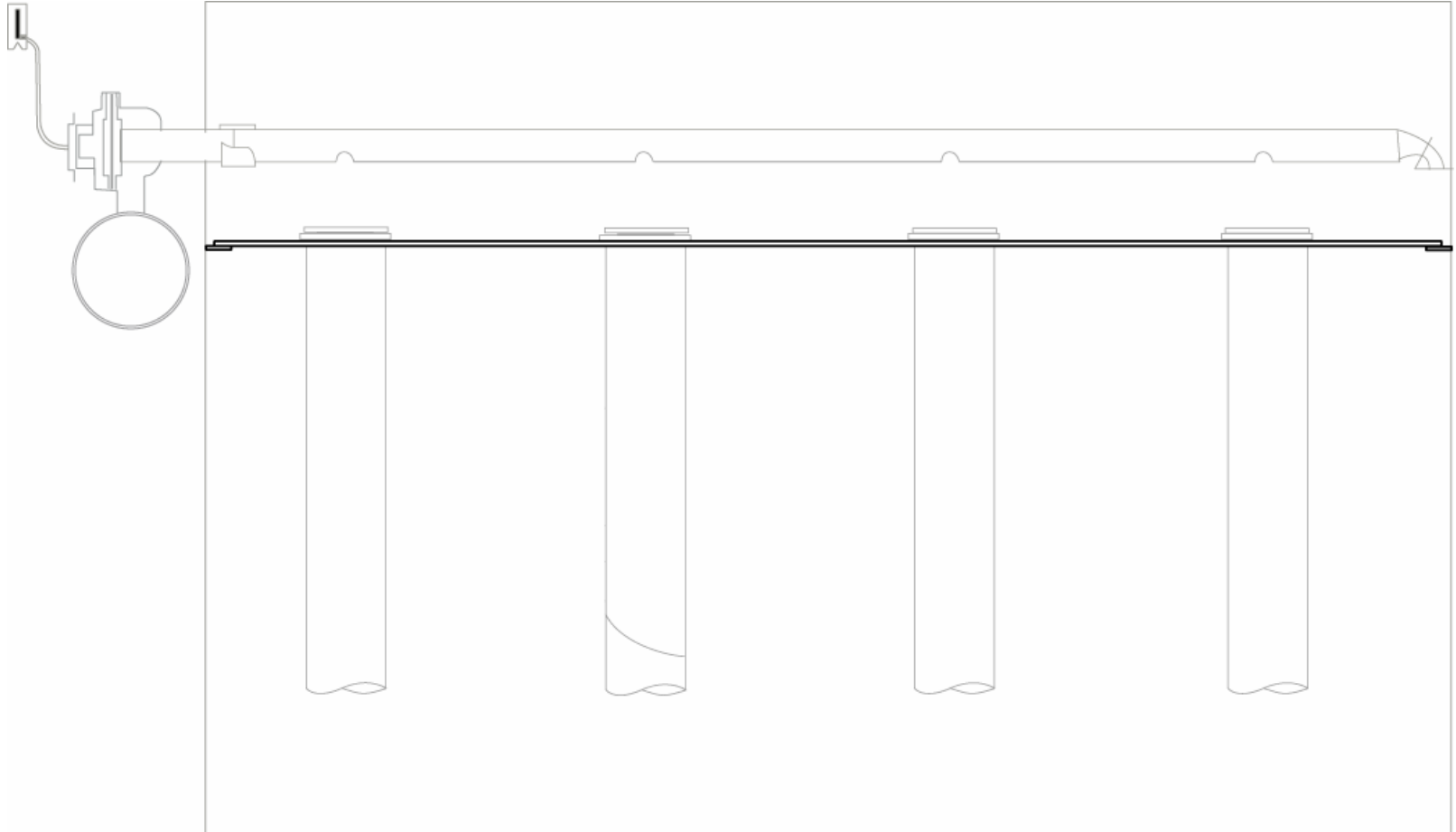


# Quick-Release Blowpipe

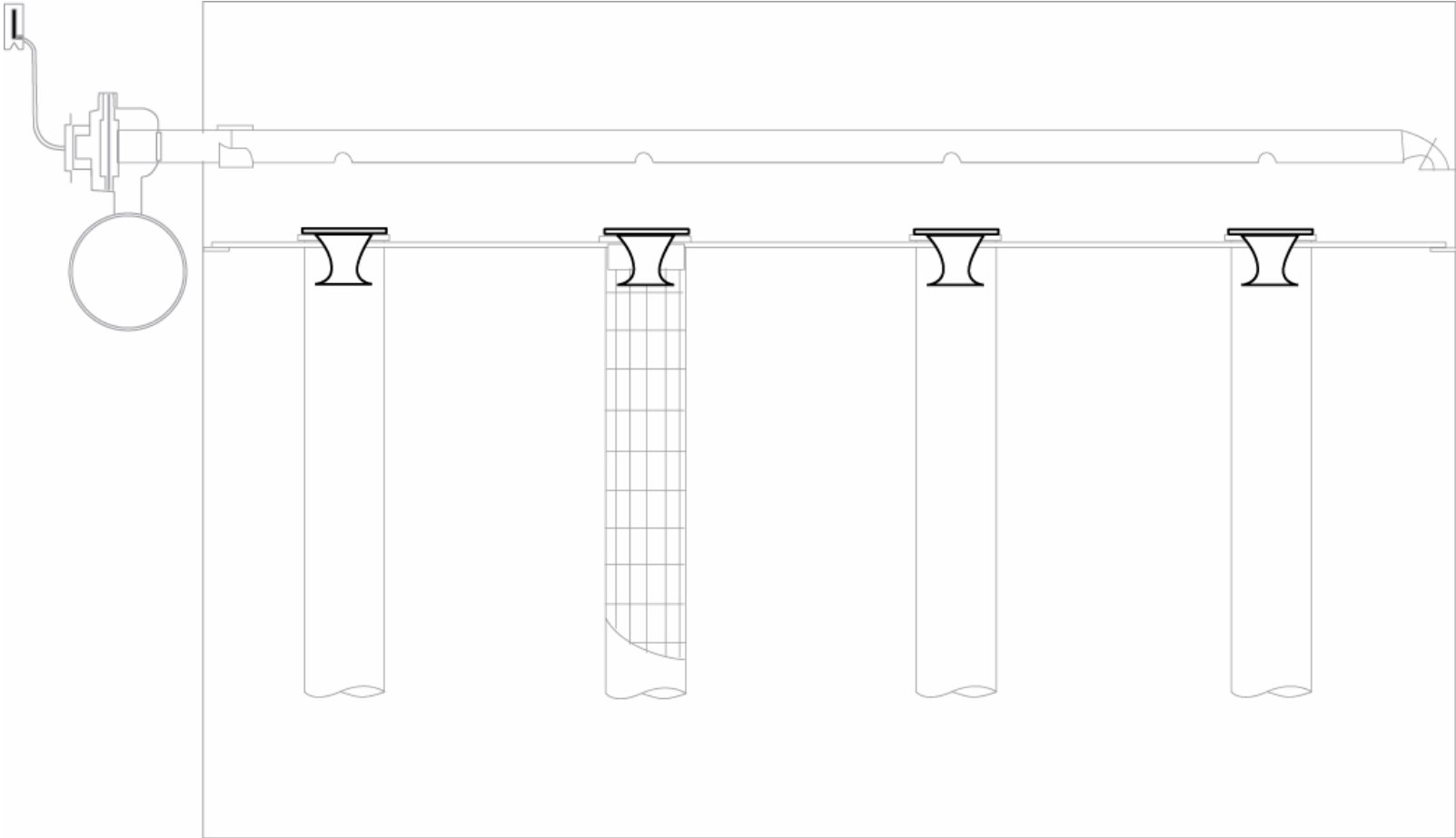




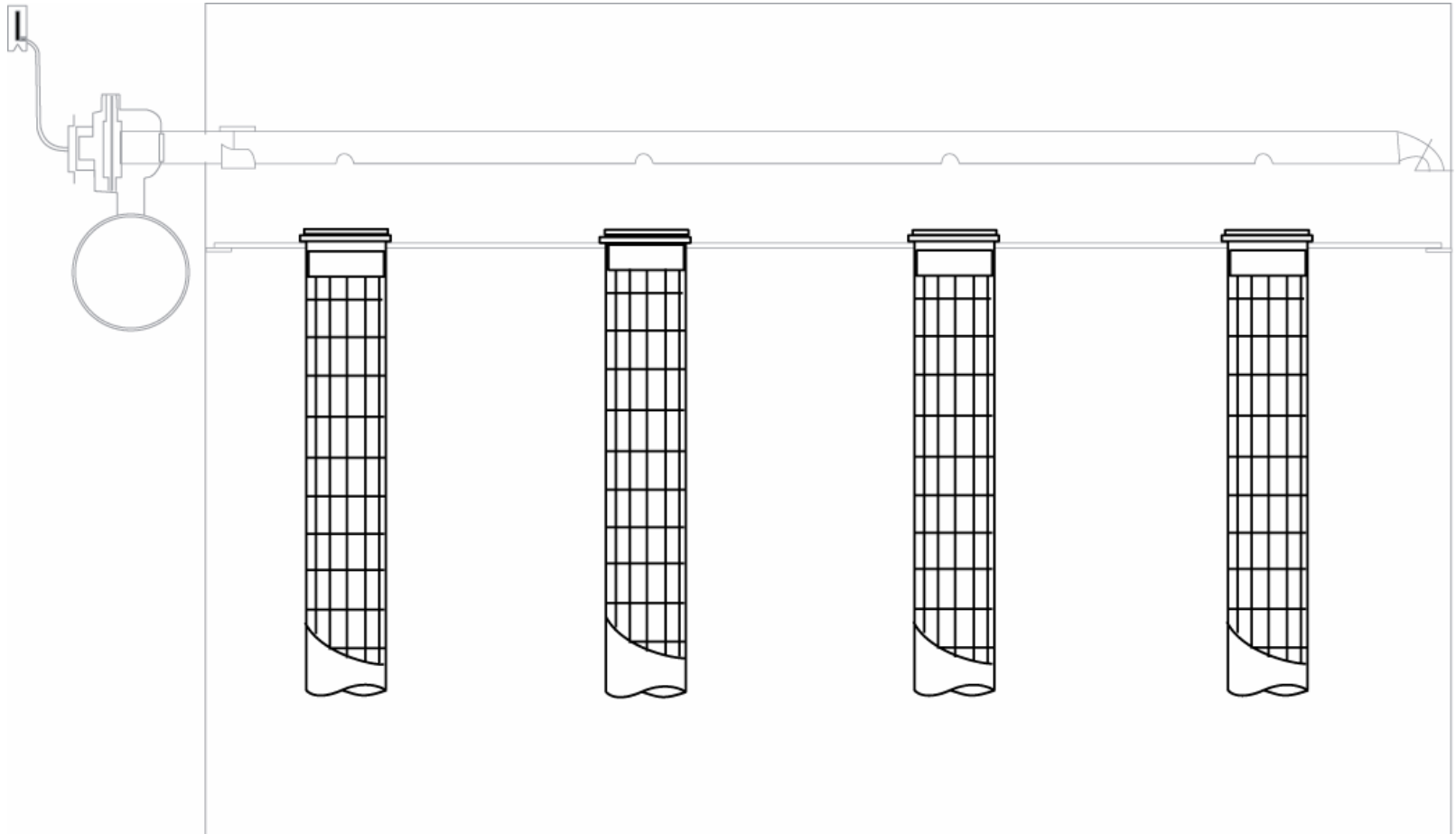
# Tubesheet (Cell Plate)



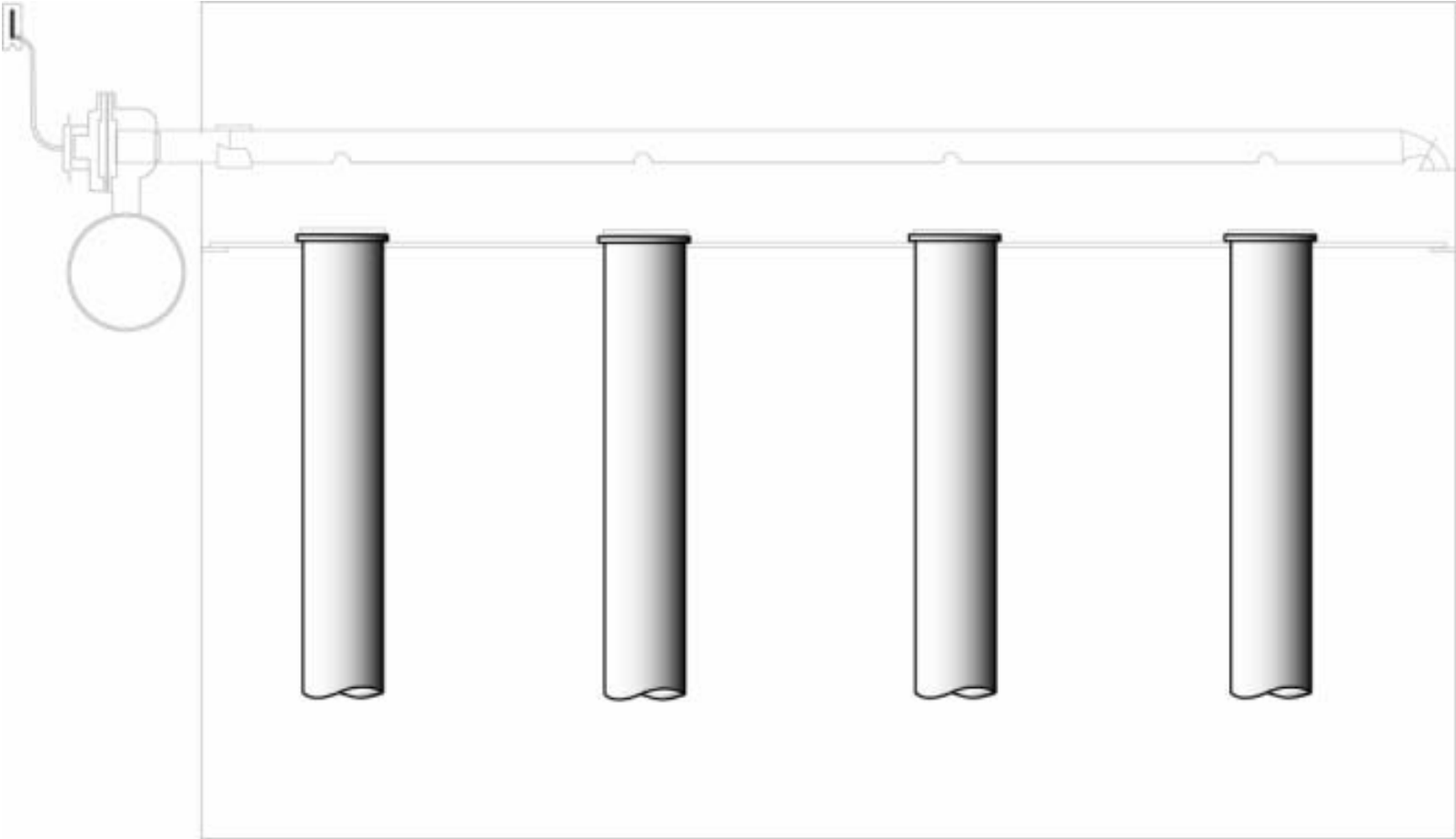
# Venturis



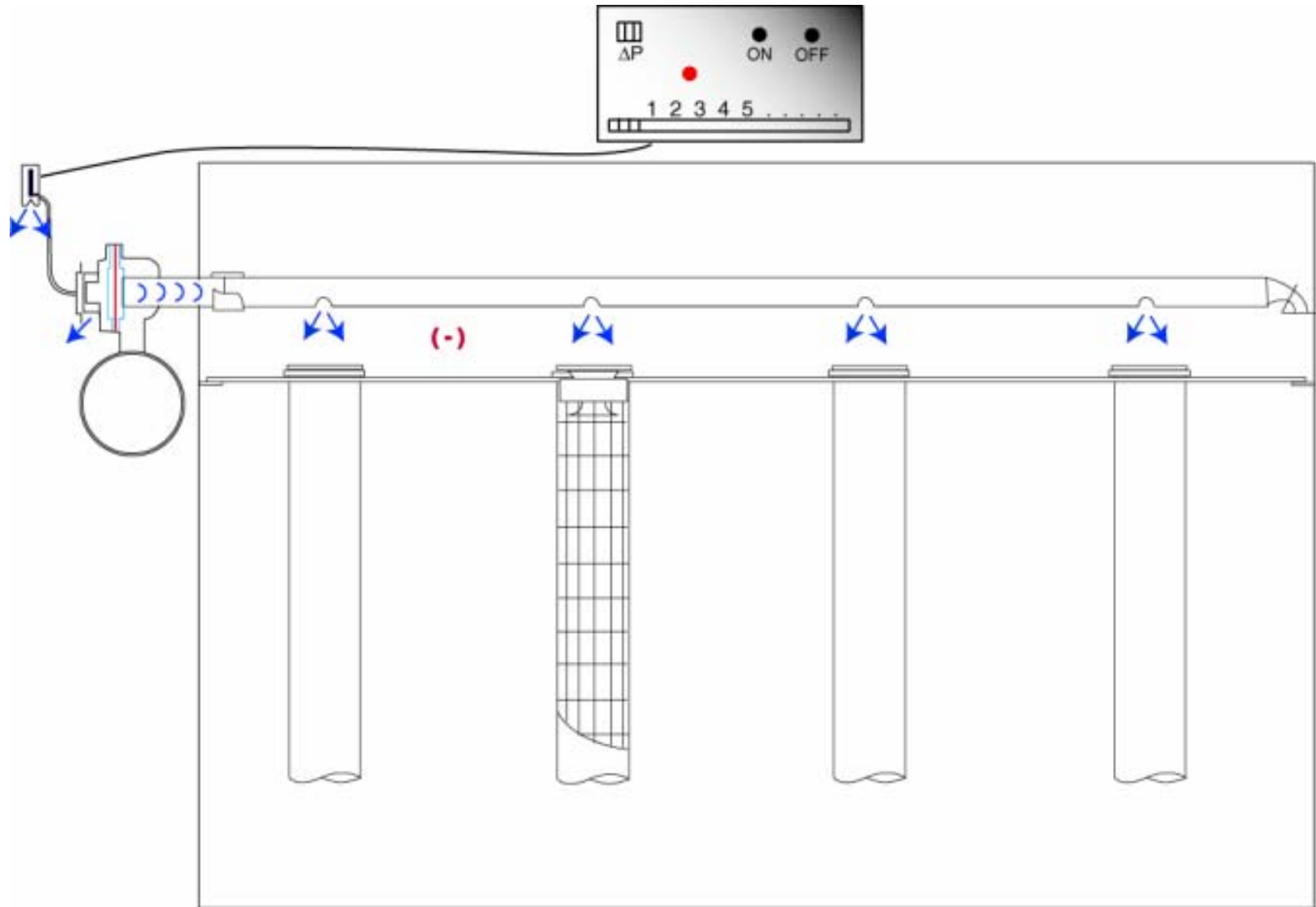
# Cages



# Bags



# Cross Section of Pulse-Jet Unit



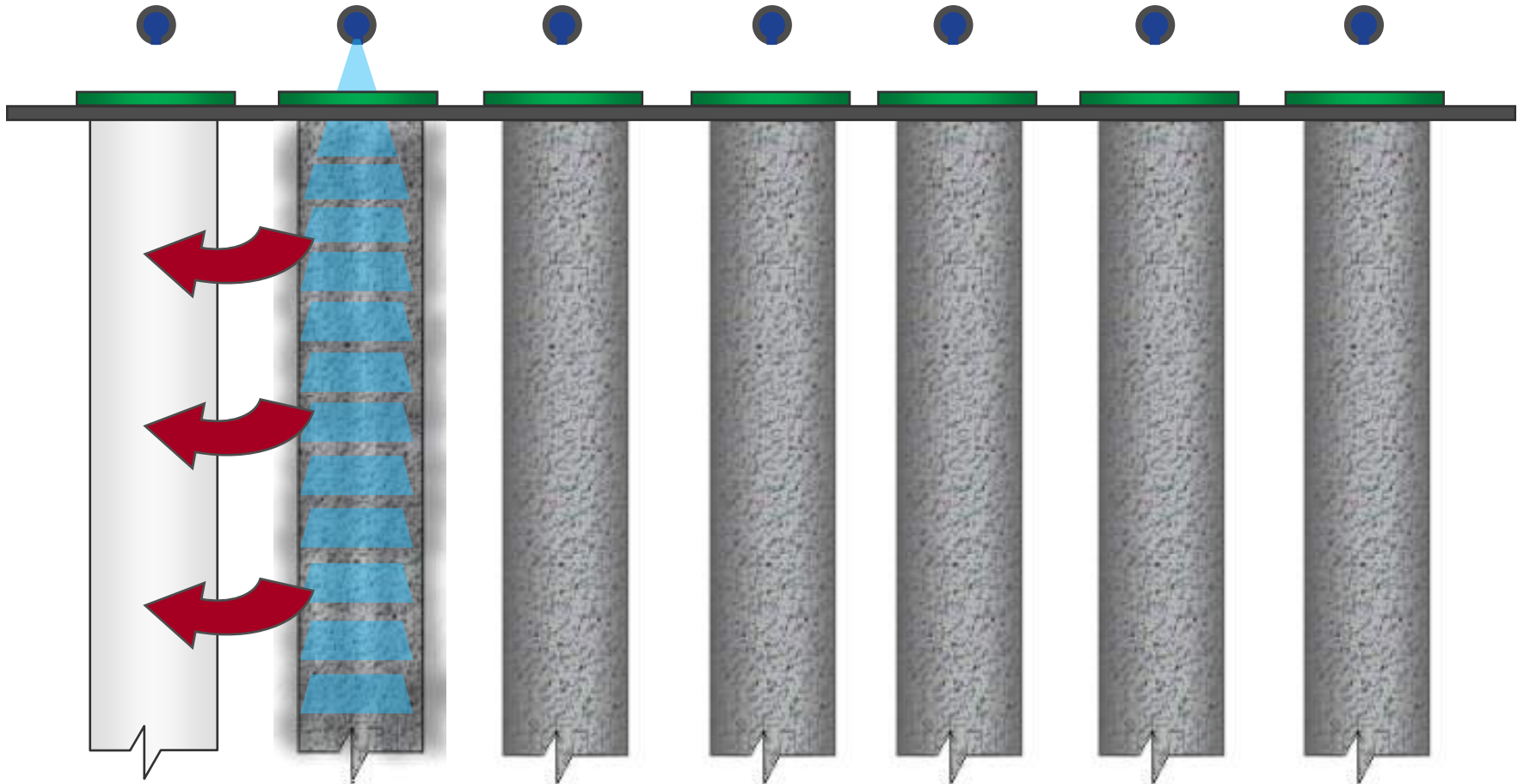
# Clean-on-Demand™ System



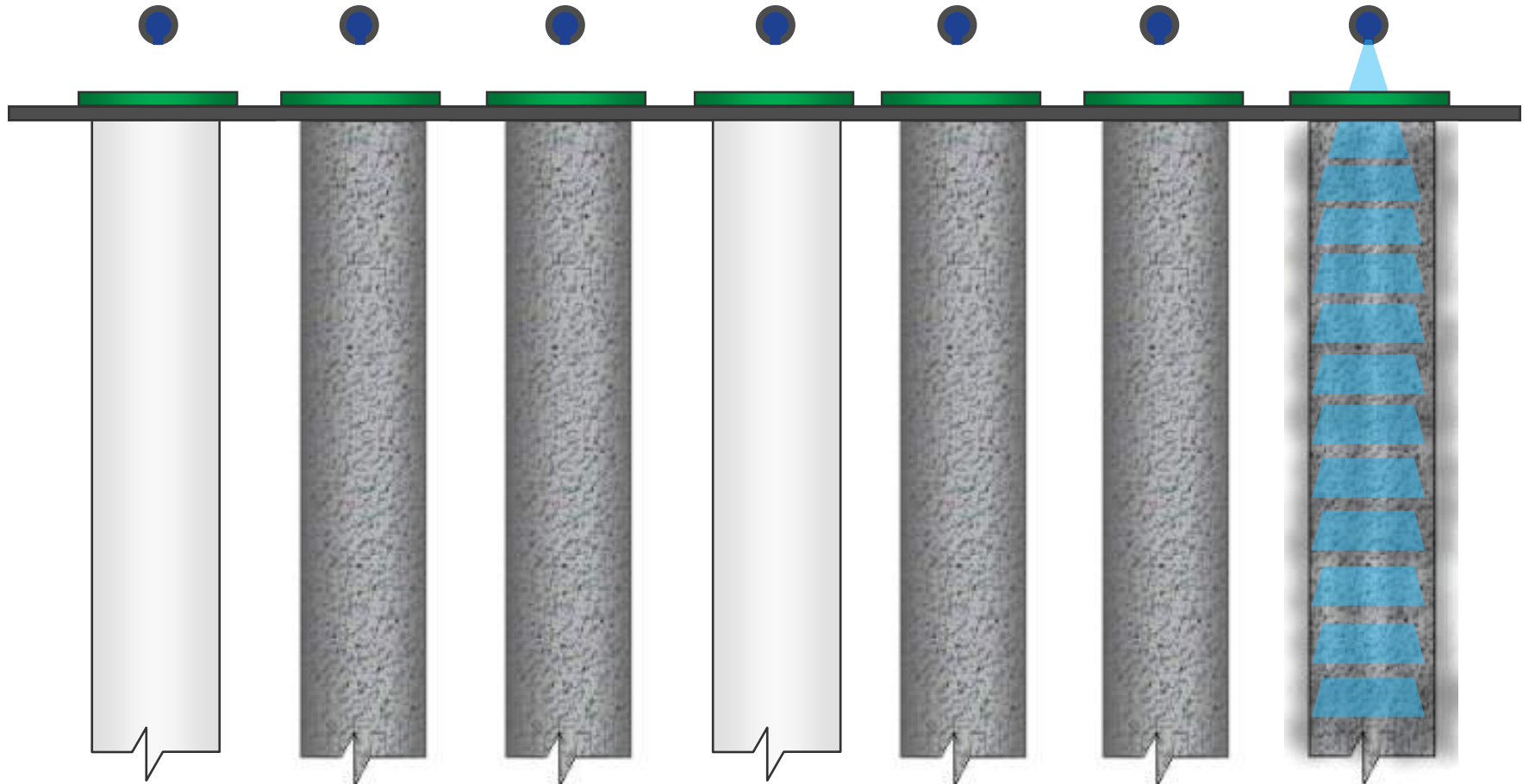
High-low set points at no greater than 1" apart...  
Ideal is no more than 0.5"



# Incorrect Pulse Cleaning Sequence

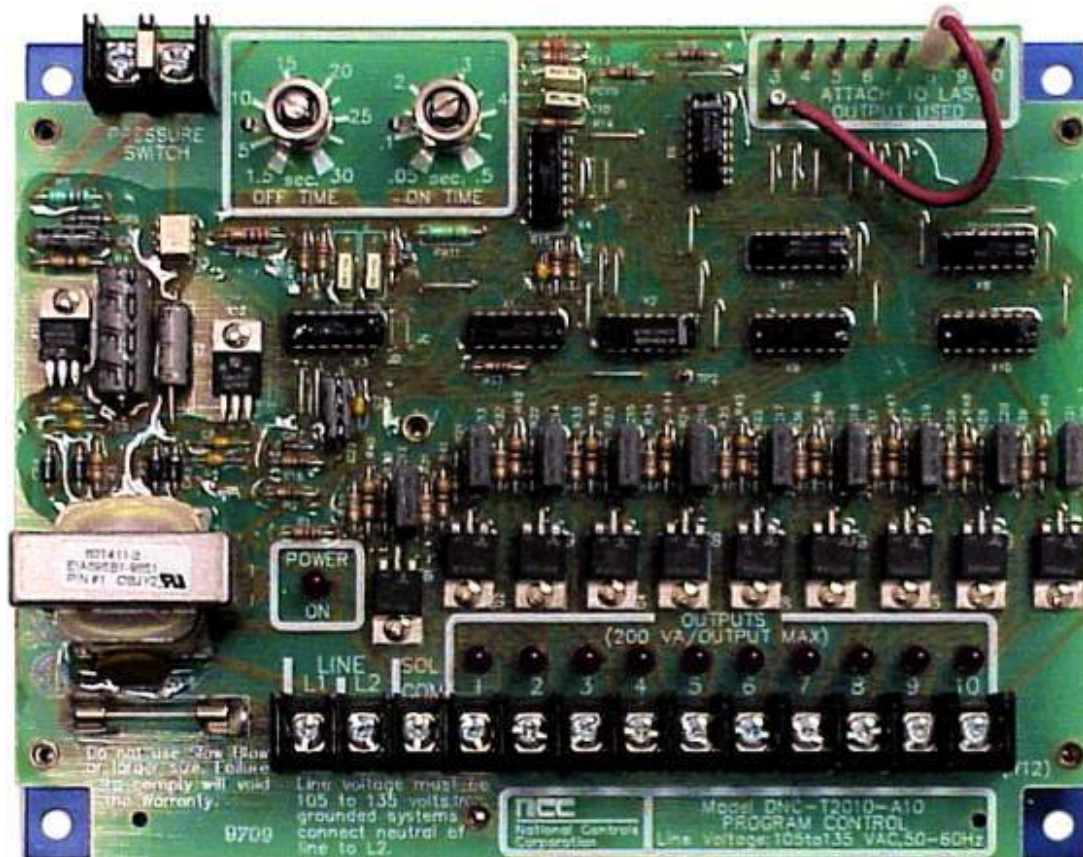


# Correct Pulse Cleaning Sequence



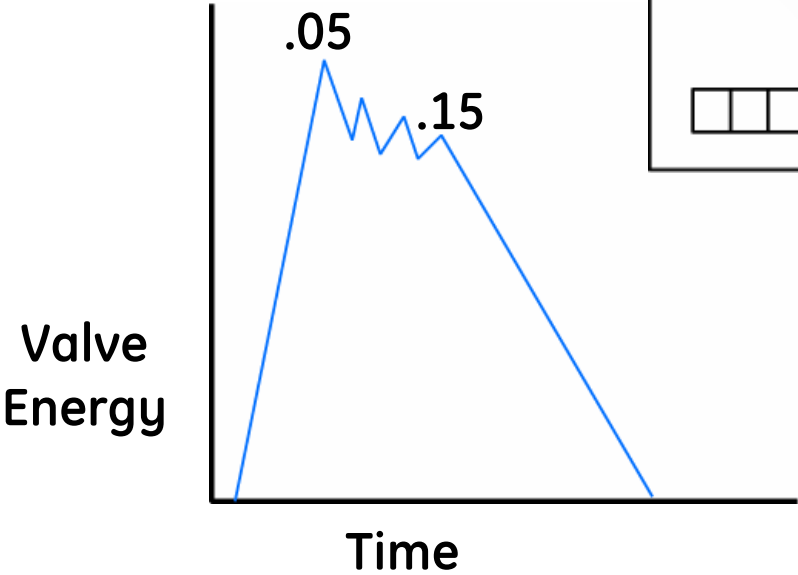
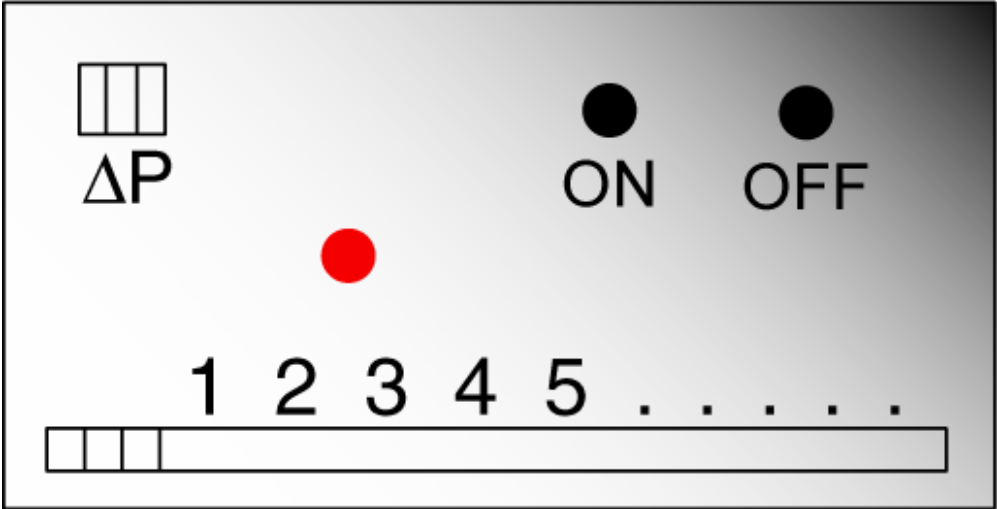


# Solid State Timer Board

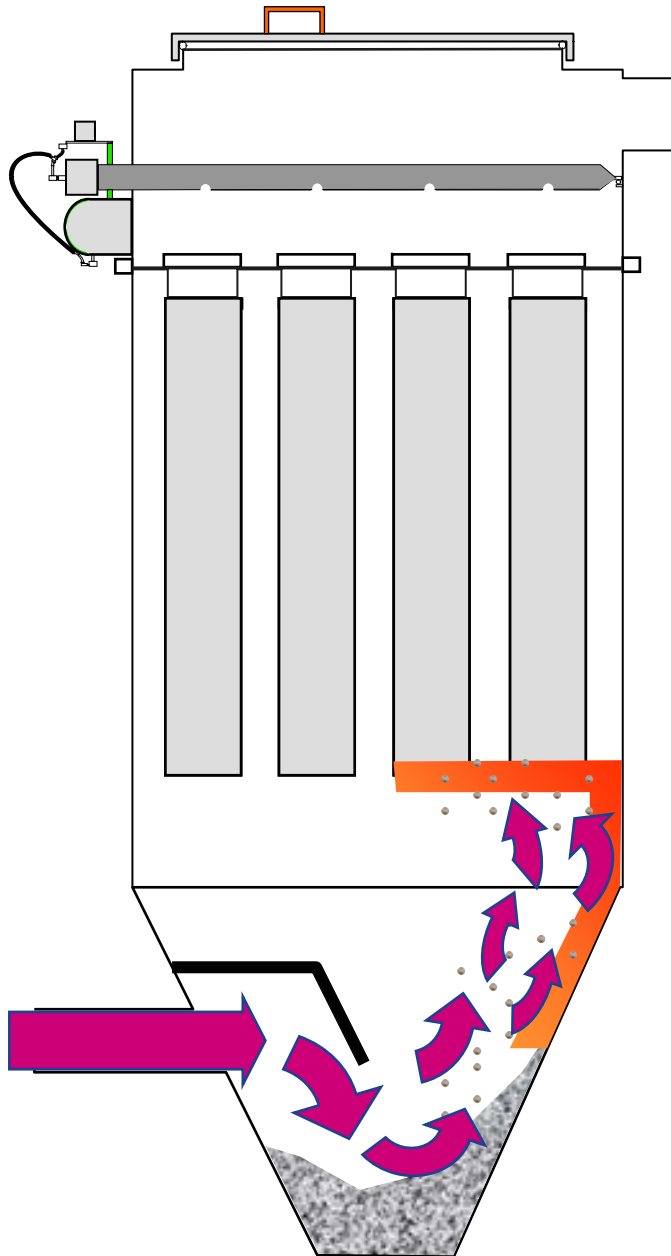


# Pulse Duration

On Time .1 sec  
Off Time based on PSI



# Common Inlet Design



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

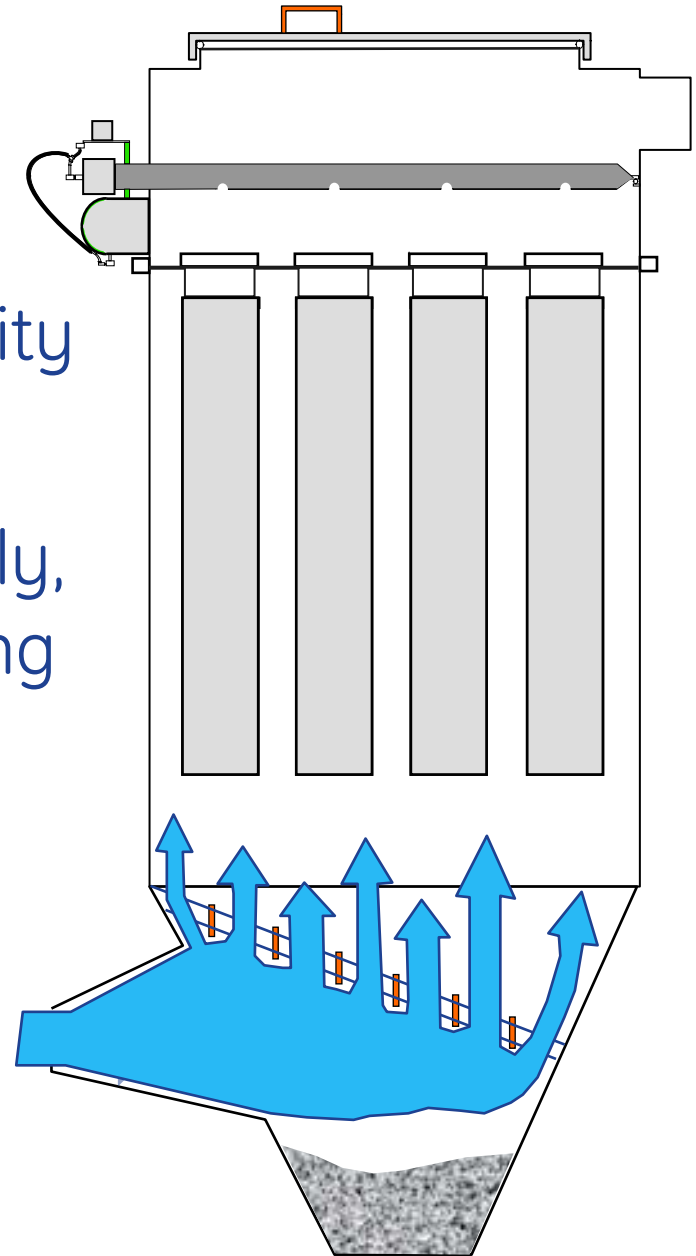
# Bottom Bag Abrasion



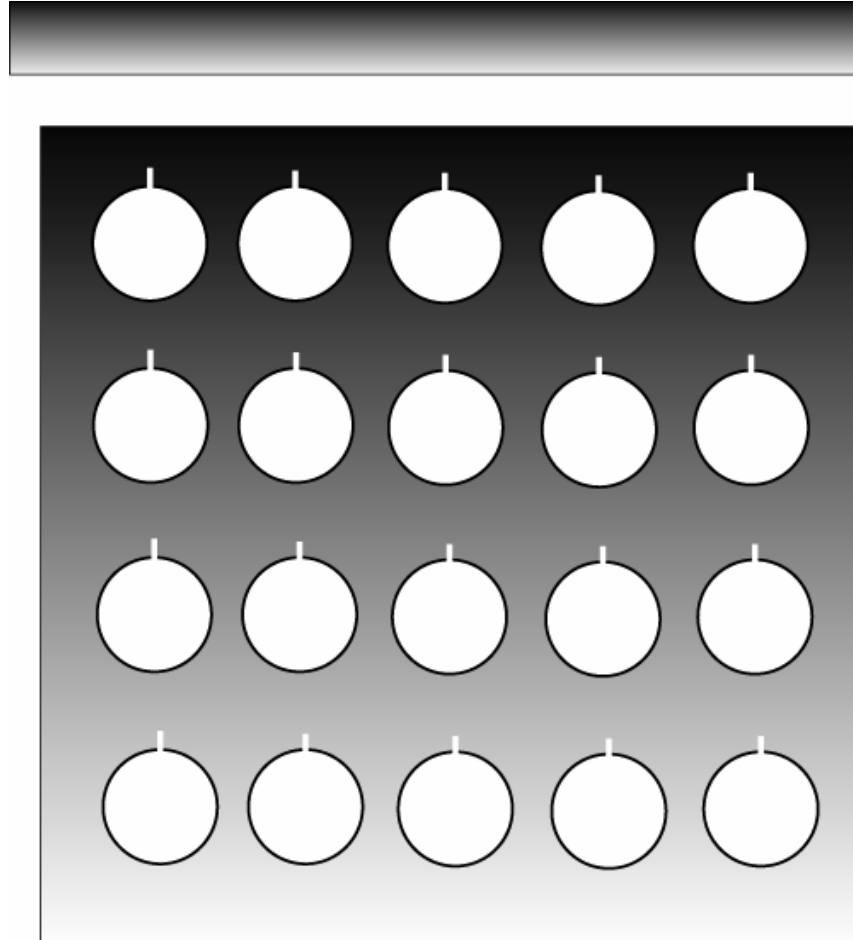
imagination at work

# Improved Design

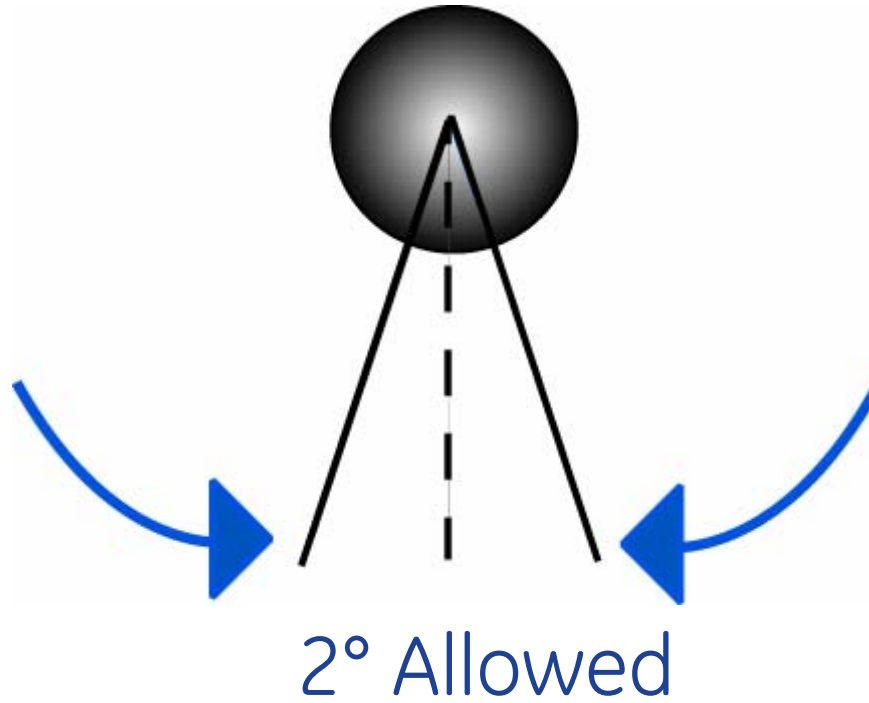
- Enlarged inlet reduces velocity
- “Ladder Vane Baffles” distribute airflow more evenly, reducing uneven grainloading and turbulence
- Inlet baffles are simple and economical to install



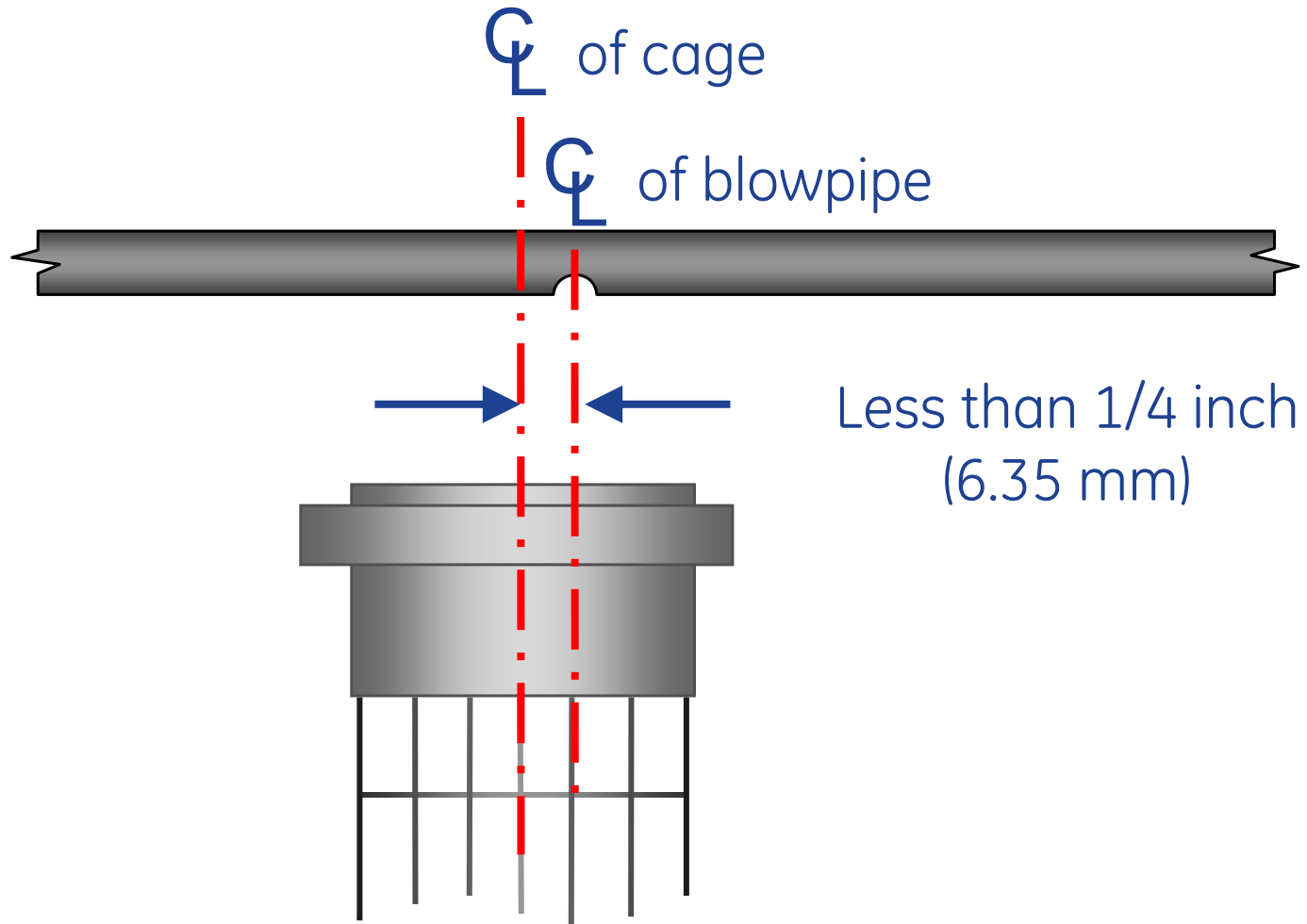
# Blowpipe Manifold/Bag Seam Alignment



# Blowpipe Alignment



# 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

