Pulse-Jet Overview and Common Problems
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

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

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

- Dirty gas inlet
- Inlet baffle
- Fabric filter
- Support cage
- Blowpipe
- Clean gas outlet
- Compressed air header
- Hopper
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

![Diagram showing valve energy and time with pulse duration values]

- Pulse Duration
- Time
- Valve Energy
- ΔP
- On Time: 0.1 sec
- Off Time: based on PSI
- Values: 1, 2, 3, 4, 5
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

Less than 1/4 inch (6.35 mm)
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