Round Filters in Dust Collection
Baghouses and Cartridge Collectors

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Overview

- Pollution Control
- Collectors
- Filters
- Baghouse Conversions
Purpose of Pollution Control
Comply - Collect - Protect

- COMPLY with Regulations
  - EPA and OSHA

- COLLECT Product

- PROTECT Resources
  - Equipment and Occupants
Pollution Control Components

- Pickup Points
- Emission Source
- Ductwork
- Dust Collector
- Removal System
- Air Mover / Fan
- Exhaust / Stack
Pollution Control Components

- Pickup Points
- Ductwork
- Dust Collector
- Removal System
- Air Mover / Fan
- Exhaust / Stack
Pollution Control Components

- Dust Collectors
  - 0.1 to 100 gr/ cfm
- Air Filters
  - 0.001 gr/ cfm
- Source
  - Industrial Ventilation
    - www.ACGIH.org
    - $100

Dust Collector Types
- Electrostatic Precipitators (ESP)
- Wet Collectors
- Dry Centrifugal
- Fabric Collectors
Fabric Collectors

- Baghouse
  - Shaker - Cleans Off Line
  - Reverse Air - Cleans On Line
  - Pulse Jet - Cleans On Line
Fabric Collectors

- Baghouse
  - Shaker - Cleans Off Line
  - Reverse Air - Cleans On Line
  - Pulse Jet - Cleans On Line

- Cartridge Collector
  - Up flow
  - Cross flow / Up flow
  - Down flow / Parallel flow
Pulse Jet Components

- Inlet Distribution
- Hopper
- Housing
- Tubesheet
- Plenum
- Cleaning System
  - Blow Pipe / Others
  - Venturi
Cartridge Collector Components

- Inlet Distribution
- Hopper
- Housing
- Tubesheet
- Plenum
- Cleaning System
Collector Considerations

- Air Properties
  - Air Flow
  - Temperature
  - Moisture
  - Explosivity
  - Chemistry

- Dust Properties
  - Particle Size / Shape
  - Grain Load

- Space Constraints
  - Footprint
  - Height

- Capital Cost

- Operating Costs
  - Media
  - Compressed Air
  - Energy / ΔP

- AIR TO CLOTH
Collector Considerations

- Air Velocity
  - Inlet Velocity
  - Can Velocity
  - Interstitial Velocity
  - Media Velocity
  - Air to Cloth / A:C
    - Bags 4 to 8 fpm
    - Pleated 2 to 6 fpm
Collector Considerations

- Air Velocity
  - Inlet Velocity
  - Can Velocity
  - Interstitial Velocity
  - Media Velocity

Inlet Duct = 12\text{\textdegree} Round = 0.8 SF
Inlet Velocity = 3000 CFM / 0.8 SF = 3750 FPM
Collector Considerations

- Air Velocity
  - Inlet Velocity
  - Can Velocity
  - Interstitial Velocity
  - Media Velocity

Can Velocity = 3000 CFM / 11.1 SF = 270 FPM
Collector Considerations

Air Velocity
- Inlet Velocity
- Can Velocity
- Interstitial Velocity
- Media Velocity

Interstitial Velocity = \frac{3000}{6.2} = 480 \text{ FPM}
Interstitial = 1.8 \times \text{Can Velocity}

Bag Bottom Area
= \text{Qty} \times \pi \times \text{Radius}^2
= 25 \times 3.14 \times (3\text{ft})^2
= 4.9 \text{ Sq Feet}

Interstitial Area
= 11.1 - 4.9 \text{ Sq Feet}
= 6.2 \text{ Sq Feet}
Collector Considerations

Air Velocity
- Inlet Velocity
- Can Velocity
- Interstitial Velocity
- Media Velocity

Bag Area = \( \text{Qty} \times \pi \times \text{Diameter} \times \text{Length} \)
= \( 25 \times 3.14 \times 6^\text{in} \times 120^\text{in} \)
= 393 \text{ Sq Feet}

Media Velocity = \( \frac{3000}{393} \) ≈ 7.6 FPM
Collector Considerations

Air Velocity

- Inlet Velocity    3750 FPM
- Can Velocity      270 FPM
- Interstitial Velocity 480 FPM
- Media Velocity    7.6 FPM
Collector Considerations

- **Baghouses**
  - Can Change
    - Media Type
    - Media Area
    - Filter Type
    - Length
  - Cannot Change
    - Tubesheet Hole

- **Cartridge Collectors**
  - Can Change
    - Media Type
    - Media Area
    - Materials
  - Cannot Change
    - Envelope Size
    - Cap Design
Filter Considerations
Bag Fabric

- Felted Fiber
  - Polypropylene (PP)
  - Polyester (PET)
  - Aramid (Nomex)
  - Polyphenylene Sulfide (PPS)
  - Polyimide (P84)
  - Fiberglass

- Basis Weight: oz / sq yd

- Finish
  - Singed / Glazed
  - Metallized
  - Epitropic
  - HydroOleophobic
  - Membrane

- Support
  - Fiber
  - Scrim
## Filter Considerations
### Fiber Properties

<table>
<thead>
<tr>
<th>Fiber</th>
<th>Available In</th>
<th>Tensile Strength</th>
<th>Abrasion Resistance</th>
<th>Acid Resistance</th>
<th>Alkali Resistance</th>
<th>Supports Combustion</th>
<th>Max. Operating Temp. °F (°C)</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Continuous</td>
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<tr>
<td>Cotton</td>
<td>Woven</td>
<td>Good</td>
<td>Good</td>
<td>Poor</td>
<td>Good</td>
<td>Yes</td>
<td>180 (82)</td>
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<tr>
<td>Polypropylene</td>
<td>Woven, Felted</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Yes</td>
<td>170 (77)</td>
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<tr>
<td>Nylon</td>
<td>Woven</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Poor</td>
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<td>Yes</td>
<td>200 (93)</td>
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<tr>
<td>Wool</td>
<td>Woven, Felted</td>
<td>Poor</td>
<td>Fair</td>
<td>Good</td>
<td>Poor</td>
<td>No</td>
<td>200 (93)</td>
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<tr>
<td>Homopolymer Acrylic</td>
<td>Woven, Felted</td>
<td>Good</td>
<td>Good</td>
<td>Very Good</td>
<td>Fair</td>
<td>Yes</td>
<td>260 (127)</td>
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<tr>
<td>Copolymer Acrylic</td>
<td>Woven, Felted</td>
<td>Average</td>
<td>Fair</td>
<td>Good</td>
<td>Fair</td>
<td>Yes</td>
<td>230 (110)</td>
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<tr>
<td>Polyester</td>
<td>Woven, Felted, Knit, Spun Bonded</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Fair</td>
<td>Fair</td>
<td>Yes</td>
<td>275 (135)</td>
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<tr>
<td>Aramid</td>
<td>Woven, Felted</td>
<td>Very Good</td>
<td>Excellent</td>
<td>Fair</td>
<td>Good</td>
<td>No</td>
<td>375 (191)</td>
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<tr>
<td>Teflon®</td>
<td>Woven, Felted</td>
<td>Average</td>
<td>Fair</td>
<td>Excellent</td>
<td>Excellent</td>
<td>No</td>
<td>450 (232)</td>
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<tr>
<td>Fiberglass</td>
<td>Woven, Felted</td>
<td>Excellent</td>
<td>Fair</td>
<td>Good</td>
<td>Fair</td>
<td>No</td>
<td>500 (260)</td>
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<td>Ryton®</td>
<td>Woven, Felted</td>
<td>Very Good</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Very Good</td>
<td>No</td>
<td>375 (191)</td>
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<tr>
<td>P84®</td>
<td>Felted</td>
<td>Very Good</td>
<td>Excellent</td>
<td>Very Good</td>
<td>Fair</td>
<td>No</td>
<td>500 (260)</td>
</tr>
</tbody>
</table>

Teflon is a trademark of E. I. DuPont Company
Ryton is a trademark of Amoco Fabrics
P-84 is a trademark of Lenzing Corporation
Filter Considerations

Pleated Bag

Fabric
- Spunbond Polyester
  - Epitropic / Metallized
  - HydroOleophobic
  - Membrane
- Pleatable Felts
  - Membrane
- Area
  - Pleat Count / Height
  - Limited Length
  - Felt Thickness

Construction
- Installation
  - Top Load
  - Bottom Load
  - Tubesheet Seal
- Materials
  - Potting Compounds
  - Core
- Retainer
  - Bands
Filter Considerations

Cartridge

Fabric
- Spunbond Polyester
  - Epitropic / Metallized
  - HydroOleophobic
  - Membrane
- Pleatable Felts
  - Membrane
- Area
  - Pleat Count / Height
  - Limited Length
  - Felt Thickness

Construction
- Installation
  - Open / Open
  - Open / Closed
  - Flanged Cap
- Materials
  - Potting Compounds
  - Core
- Retainer
  - Bands
  - Cage
Baghouse Conversion

Original with 3000 CFM
- 25 PET Felt Bags
- 6" OD x 120" OAL
- Fabric 393 SF
- Inlet 3750 CFM
- Interstitial 480 FPM
- Media 7.6 FPM

Problems
- High Pressure Drop
- Bag Wear
Baghouse Conversion

- **Original**
  - 25 Bags
  - 6\(^\prime\) OD x 120\(^\prime\) OAL
  - 393 Sq Feet

- **Pleated Bags**
  - 6\(^\prime\) OD x 72\(^\prime\) OAL
    - 45 Pleats at 1\(^\prime\)
  - 1,078 Sq Feet
    - 175\% more fabric
Baghouse Conversion

- **Original**
  - 25 Bags
  - 6" OD x 120" OAL
  - 393 Sq Feet

- **Pleated Bags**
  - 6" OD x 72" OAL
    - 45 Pleats at 1"
  - 1,078 Sq Feet
    - 175% more fabric

- **Replace all of the bags**
  - Lower Air to Cloth
    - From 7.6 to 2.8 FPM
  - Gain Efficiency
    - Better Media
    - Lower A:C
  - Lower Pressure Drop
    - Better Pulse Cleaning
  - Drop Out Zone Adds 4'
Baghouse Conversion

- Replace 10 and Plug 15
  - Lower Air to Cloth
    - From 7.6 to 7.0 FPM
  - Gain Efficiency
    - Better Media
    - Lower A:C
  - Cut Interstitial Velocity
    - From 480 to 330 FPM
  - Drop Out Zone adds 4'
Questions