Dust Collector Operation

- A fan pushes (positive) or pulls (negative) dust laden air into the collector, contacts an internal target plate baffle, slows down, and dust particles drop out.
- The air is turbulent, begins to rise, carrying finer particles into the filter media area.
- Dust particulate is subsequently captured on the filter media as the air begins to pass through.
- The cleaned air passes through and up inside the media/cage into the clean air plenum, where it is exhausted to atmosphere, back into plant, etc...
- Pulse cleaning of the filters happens simultaneously, dislodging dust to fall down into hopper / silo, etc...

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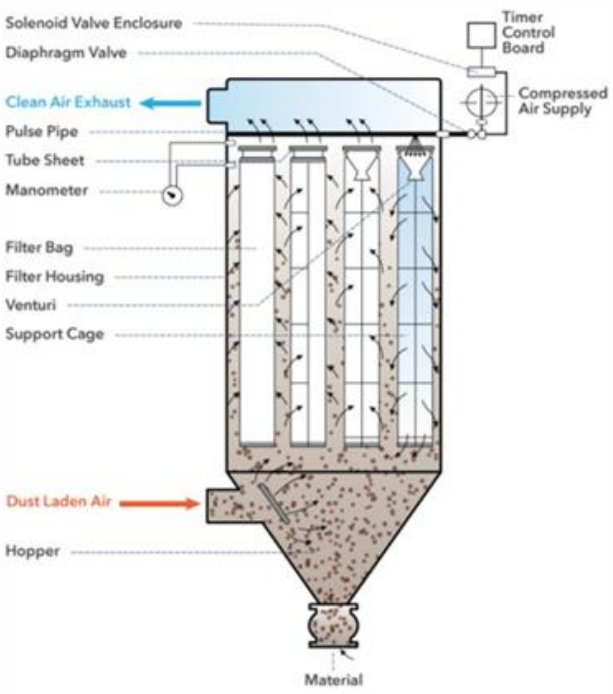

Dust Collector Arrangements

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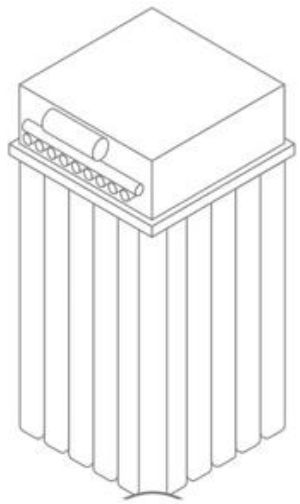
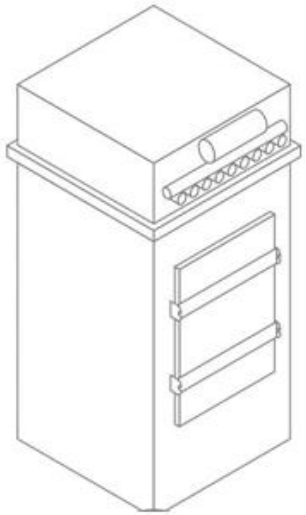
Arrangement 1
CAP & Tubesheet



Arrangement 2
CAP, Tubesheet & DAP



Arrangement 3
CAP, Tubesheet, DAP & Hopper

Design Considerations

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Dust	Application Specifications	Temperature	Pressure	Air to Cloth Ratio	Interstitial Velocity	Filter Types
• Bulk density • Particle size • Loading • Agglomerating • Hygroscopic • Sticky • Abrasive • Corrosive (acidic) • Explosive (Kst, Pmax)	• Silo venting • Filter receiver • Nuisance control • Product reclamation • Support legs • Access platform • Dust collection container	• Degrees F • May affect gasketing, paint finish, filter media, pneumatic tubing, diaphragms, cages, venturis • Insulation	• Operating pressure at inlet or fan (wg, Hg, psig) • Typical drop across filters is 4" - 6"wg	• 5:1 is a general target for baghouses • 3 - 3.5:1 for vertical pleated filters • 2 - 2.5:1 for horizontal cartridges • Amount of filter sq. ft. in relation to airflow	• Upward airflow between filter media • Measured in ft/sec or ft/min • Is can velocity the same? *Can velocity is the vertical gas velocity throughout the housing, above the hopper level but before reaching the bottom of the bags*	• Filter bags • Vertical Pleated filter • Horizontal Cartridge

Filter Type Removal	Filter Efficiency	Construction Material	Location	General Design Standards	Electrical Area Classification	Auxiliary Components
• BBR – side door from dirty air side • TBR – roof doors • TBR – walk-in plenum	• Particulate removal % • Standard or higher • Air permit • HEPA - submicron	• Carbon steel • 304SS • 316SS • Hastelloy • Duplex 2205 • Corten	• Indoors • Outdoors • Elevation • Seismic zone • Wind and snow load • ASCE-7	• QA/QC • AWS D1.1, D1.6 welding • ASME VIII, Div 1 • ANSI	• NEMA-4 • NEMA-4X • NEMA-4/7/9 • ATEX	• Airlock • Fan • Screw conveyor • Slide gate • Level sensor, BBD • Explosion Venting • Vibrator / Fluidizer • Access Ports • Poke hole • Sprinklers

Filter Media Types

Media	Acids	Alkalis	Abrasion	Continuous Temp. (F)	Surges Temp. (F)
Polyester	Good	Good	Excellent	275°F	300°F
Polypropylene	Excellent	Excellent	Good	200°F	200°F
Homopolymer	Excellent	Good	Fair	260°F	284°F
Fiberglass	Excellent	Fair	Poor	500°F	550°F
Aramid	Fair	Fair	Excellent	375°F	425°F
Ryton / PPS	Excellent	Good	Good	375°F	425°F
Felted P84	Good	Fair	Good	420°F	450°F
Teflon (PTFE)	Excellent	Excellent	Poor	450°F	500°F

Typical Surface Treatments:

- ePTFE membrane
- Singed
- Glazed
- Hydro-Oleophobic
- Fire Retardant
- Carbon Impregnated
- Siliconized

Dust Collector Designs

Low-Pressure

CONFIGURATIONS:

- Square or Rectangular flat walled units.

TYPICAL OPERATING RANGE:

- Design Pressure: start at 17" - 20"wg.
- Typical operating pressures = -8" to –15"wg.
- Airflow:
  - Bin vents = ~ 200 acfm
  - Large units = up to 100k+ acfm

FEATURES:

- Top & bottom bag removal
- Single housing, compartmentalized / isolated housings
- For offline maintenance or handling different process streams
- Fabric filter bags or cartridge filters

COMMON MARKETS:

- Food and Grain
- Mining
- Building Products
- Metal processing
- Foundries
- Cement
- Plastics
- Pharmaceuticals

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Dust Collector Designs

High-Pressure

CONFIGURATIONS:

- Cylindrical
- Filter bags or Pleated vertical filters

TYPICAL OPERATING RANGE:

- Pressure:
  - Medium: up to 100"wg (typical)
  - High: ASME code vessels from 15 psig – 300 psig.
- Airflow: up to 25,000-30,000 acfm

COMMON MARKETS:

- Food and Grain
- Plastics
- Central vacuum systems
- Petrochemicals
- Applications where high pressures or easy clean up is required.

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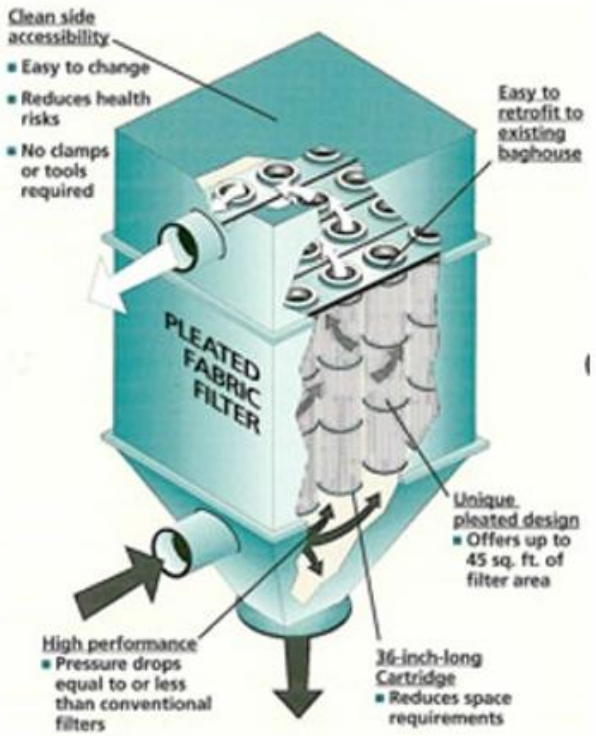
Pleated Cartridge Dust Collectors

- Pulse Jet cleaning - combines the advantages of a fabric filter and a cartridge dust collector.
- Filter area of one 36" long pleated filter (21 sq. ft.) > filter area of one 10 ft. fabric filter bag (15.3 sq. ft).
- 3-4x faster filter changeouts.
- Typical operation at 3:1 to 3.5:1 air-cloth ratio.
- Compatible with different housing and hopper designs.
- Savings achieved via smaller housings, lower pressure drops.
- Configurations: square, rectangular and cylindrical
- Typical operating range:
  - Typical Operating Pressure: Same as other housings in prev. slides
  - Typical Airflow capacity: 200 cfm – 40,000 cfm
- Applications: for smaller footprint / housing requirements.
- Limitations:
  - Interstitial velocity, Temperature
  - Sticky dusts, abrasive dusts, agglomerating / hygroscopic pose issues (build up in the pleats, wear through on peaks)



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CARTRIDGE

Dust Collectors

CONFIGURATIONS:

- Flat wall design, horizontal filters

TYPICAL OPERATING RANGES:

- Typical Pressures: 20"wg to 63"wg
- Typical airflow: 3,600 to 50,000 acfm

APPLICATIONS:

- Chemicals
- Metal working
- Wood working
- Minerals
- Carbon Black
- Plastics
- Electronics
- Food and Beverage

- **Ideal use cases**: Low to moderate dust loading

- **Avoid**:
- Sticky, Abrasive, High moisture, High temp. applications

PRE-CONFIGURED

Cartridge Dust Collectors

Pre- configured, compact units for quick delivery in select applications.

TYPICAL OPERATING RANGES:

- Pressure: +/- 63"wg
- Airflow: 1,400-5,640 acfm

APPLICATIONS:

- Weld Fumes
- Chemicals
- Metal working
- Wood working
- Carbon Black
- Plastics

- Ideal use cases: Small airflow applications, single line use, low dust loading.
- Not recommended for: Sticky, abrasive, high moisture, high temp. applications.

Bin Vents and Cyclone Dust Collectors

Bin Vents

Configuration:

- Flat walled / round units
- Top or bottom filter removal

Operating ranges:

- Pressure: Typical is 17”- 20”wg and can go up to 63”wg
- Airflow: 200 to 3,000 acfm

Typical Applications:

- Pneumatic transport into silos
- Truck or rail loading & unloading
- Mixers, Blenders, Conveyors and other process equipment
- Can also be used as a standalone dust collector (Arr III)

Cyclone Dust Collectors

Can handle:

- High dust loading
- Severe abrasion
- Elevated temperatures and pressures
- Sticky solids

Applications:

- Can be used as a pre-filter to lower loading to a bag house

NFPA Compliance

- Kst – Standardized measure that predicts the potential for explosion of dust (rate of pressure rise).
- Pmax – Max. pressure that can be generated during explosion.
- **ST Classification**
  - **Class St 0:** Non-explosive dust
  - **Class St 1:** Weak explosiveness (0 < Kst ≤ 200 bar·m/s)
  - **Class St 2:** Strong explosiveness (200 < Kst ≤ 300 bar·m/s)
  - **Class St 3:** Very strong explosiveness (Kst > 300 bar·m/s

- Dust Hazard Analysis (accredited lab test)
- Dust collector protection:
  - Passive suppression
  - Flameless venting
  - Rupture panel venting / deflection
  - Chemical suppression
  - Detection and Isolation

NFPA Compliance

Explosion Protection Standards

- **NFPA 68:** Standard on explosion protection by deflagration venting
- **NFPA 69:** Standard on explosion prevention systems
- **NFPA 61:** Standard for the prevention of fire and dust explosions in agricultural and food processing facilities
- **NFPA 664:** Standard for the prevention of fire and dust explosions in wood processing and woodworking facilities
- **NFPA 484:** Standard for combustible metals
- **NFPA 654:** Standard for the prevention of fire and dust explosions from the manufacturing, processing, and handling of combustible particulate solids