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AirSys Tech Inc.

"The leader in Air Systems that work!"

Commercial & Industrial Ventilation

Dust, Fume & Smoke Collection

Fans & Blowers

Material Handling

Finishing Systems

Engineering, Design & Consulting

Introduction

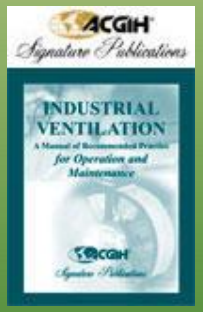
- Dust Collection has been viewed as a necessary evil or a pain in the process flow.
- Explosion reduction was and remains the driving force.
- Health and Safety is rising in importance
- Environmental issues is also becoming more important.
- Process equipment is becoming more sophisticated and needing better dust removal or containment.

Dust Collection Systems

- Sources of Technical Information
- Dust Collection System Components
- Failure Points

Technical Information

- ACGIH (American Conference of Governmental Industrial Hygienists)
  - Industrial Ventilation Handbook



Technical Information

- NFPA (National Fire Protection Association)
  - NFPA 61: Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities.
  - NFPA 654: Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids

Technical Information

- NFPA (National Fire Protection Association)
  - NFPA 652 –Standard on Combustible Dusts (2015)

Technical Information

- SMACNA (Sheet Metal and Air Conditioning Contractor's National Association)
  - Round Industrial Duct Standard
  - Rectangular Industrial Duct Standard
- NIOSH
- GEAPS training data
- FM Global

DUST COLLECTION SYSTEM COMPONENTS

System Components

- There are Really only 5 Components
  - Hood or inlet point
  - Ducting system to carry the dust away
  - The air-material separator
  - The material transfer to bins or disposal
  - Air mover or fan, blower.

Collection Hood Design

- This is the first and most important item in the system.
- They must contain and collect the dust but not too much.
- Main Design Parameters:
  - Is the hood designed for collection or keeping the leg or conveyor under a negative condition?
  - If conveyor enclosure, How wide and how high is the side wall.

Collection Hood Design

- Remember you cannot suck out a match.

- Air is 0.75 lbs/ft³, Grain Dust is approx. 15 lbs/ft³
- Or, 13 times lighter. To influence the trajectory of a dust particle with air alone is difficult at best.

Ducting System

- Ducting system carries the dust to the collector.
- The duct system design provides the right amount of air at the individual hood.
- The balance of the system is critical
- If the design is not correct, the balance becomes impossible.
- Blast gates can only balance out approximately 20% of the difference in the pressure loss.

Ducting System Cont'd

- Elbows should have a centre line radius of 2 times the diameter
- Branch entries should be at 30°
- Branch entries should be horizontal or above
- Entries should be smaller ducts into larger ducts

Dust Air Separator

- Major Types
  - Cyclones
  - Pulse Jet Filters (High Pressure Cleaning)
  - Reverse Air Baghouse
  - Medium Pressure Baghouse

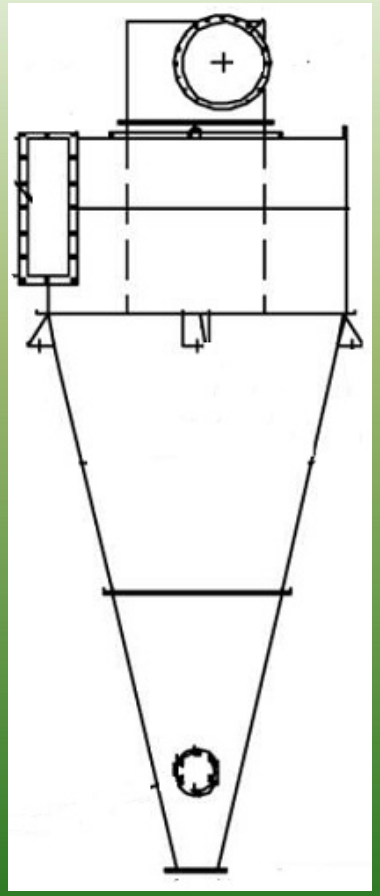
Cyclones

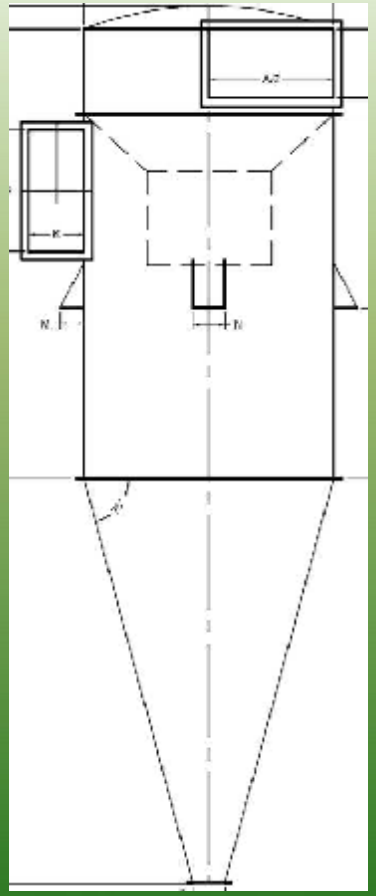
- The mainstay for air material separators in the grain industry
- Efficiency of 98% at about 40 microns (400 mesh)
- Lowest capital cost
- Slightly higher operating cost at start-up

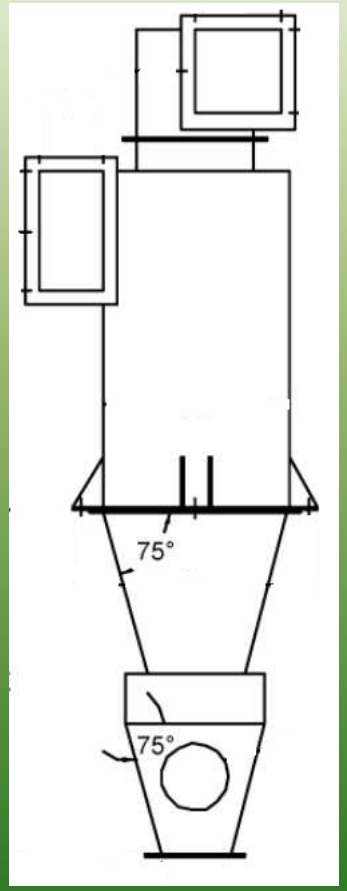
How a Cyclone Works

- Material and air enter tangentially at high velocity
- The material is forced to the wall by the centrifugal forces
- As the material goes down the cyclone cone it accelerates and is held tight to the wall
- When the material reaches the vortex breaker it is flung outwards by the forces
- The air reverses and goes out the top

Cyclone Styles







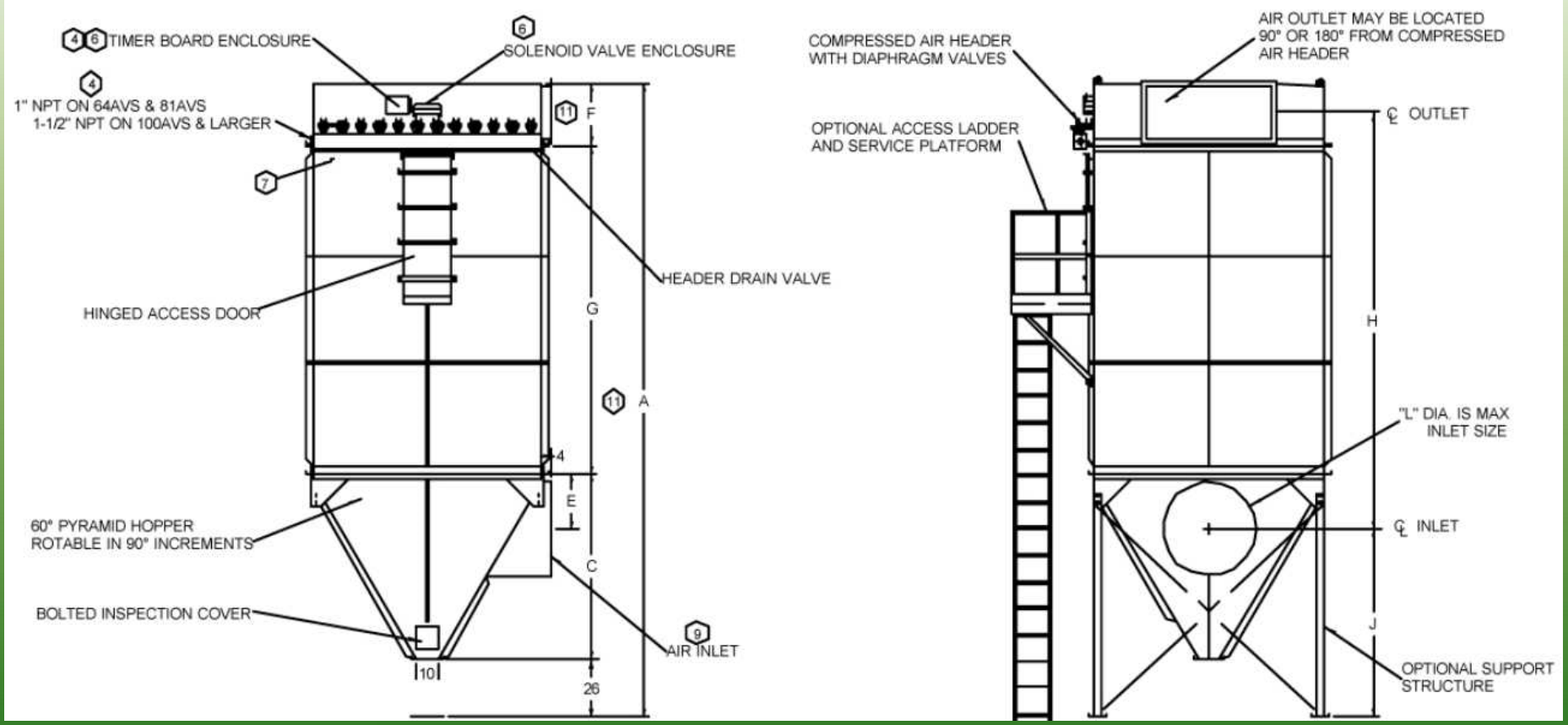
Media Filters

- Media filters used in the grain industry are grouped into three types
  - Low Pressure or Reverse Air
  - Medium Pressure
  - High Pressure
- The efficiency with seasoned media is approximately 99.9% at 0.3 microns

High Pressure Media Filters

- Typically Dust Enters into the hopper
- Can and interstitial velocity becomes critical
- No greater than 200 feet/minute
- Air to Media Ratio of 5 to 1
- Method of material discharge can affect performance, bridging in hopper

High Pressure Media Filter



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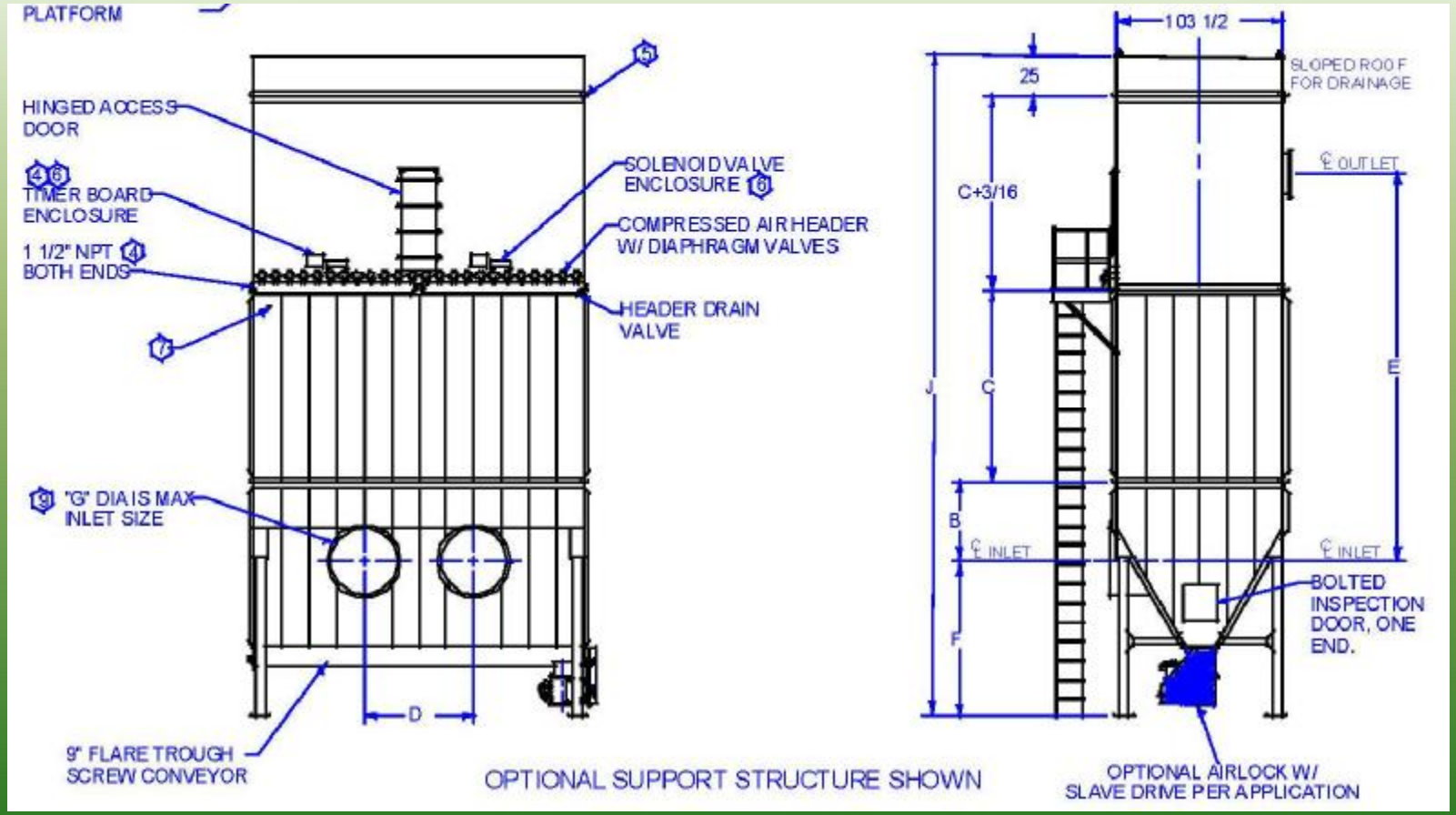
High Pressure Media Filter



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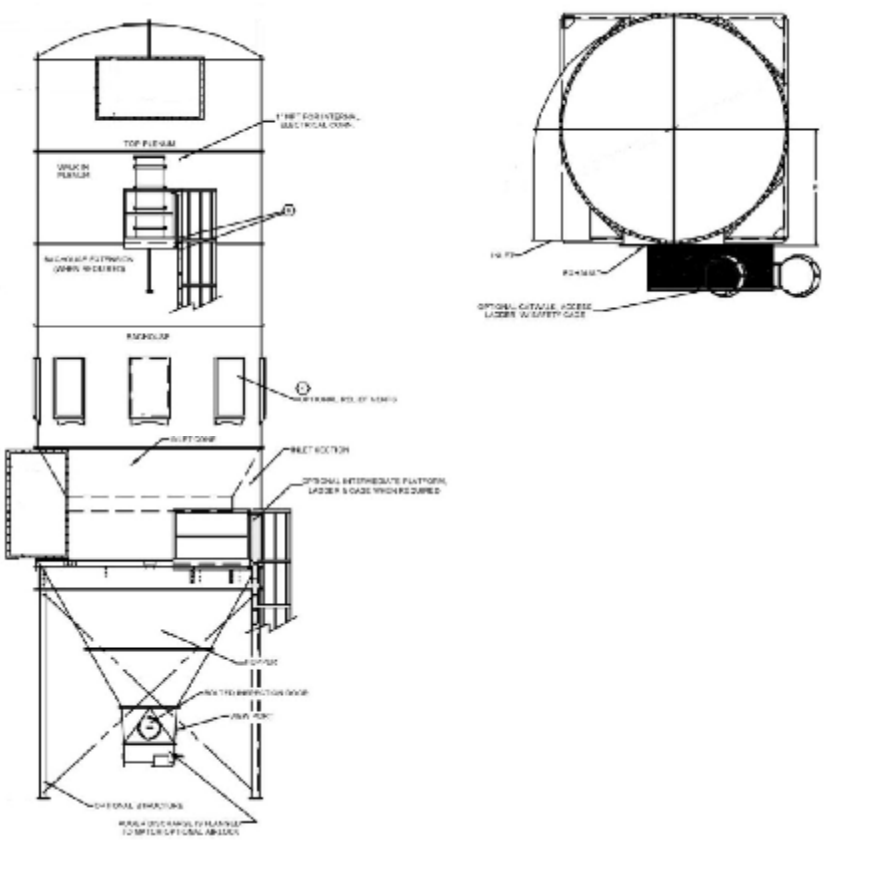
Low & Medium Pressure Media Filters



- Tangential or High Side Inlet
- Explosion Vents
- Walk-in plenum for bag change and cleaning mechanism

Design Consideration

- If all fines, then high side inlet should be considered
- Can velocity must be kept low
- Interstitial velocity below 250 feet per minute
- Unloading should have an auger that feeds an airlock. Helps to prevent bridging.

Dust Discharge Device

- Hopper and Slide Gate
- Rotary Airlock

Air Mover – Fan or Blower

- Dirty Side
  - Radial Blade Centrifugal Fan
  - Common Name LS
  - NFPA requires this fan to be either AMCA A or B non-sparking . Therefore, non-ferrous wheel and rub bars or non-ferrous housing.

Air Mover – Fan or Blower

- Clean Side
  - Backward Inclined (BI)
  - Flat Blade
  - Curved Blade
  - AcoustaFoil (Hollow Curved Blade)

FAILURE POINTS

Cyclone Failures

- Wear out due to seam overlap not in same direction as flow
- Broken cone instead of taper rolls
- Inlet and outlet rotation not the same
- No vortex breaker, thus wear out above airlock
- Air entering cone from hopper or leaky airlock

Hoods and Ducting

- Likely the greatest reason for combustible dust in the space
  - Not enough airflow or air velocity at a hood
  - Hood in wrong location
  - Ducting system not balanced to create the proper airflow

Media Filter

- Air to media ratio to high
- Bags are plugged
- Water vapour in the airstream which turns unto water in the duct or filter resulting in mud cake instead of dust cake. Or, ice on the walls.
- Can and interstitial velocity too high resulting in large volumes of dust in the hopper when unit shutdown and cleaned.

Fans and Blowers

- Wrong material of construction
- Belts slipping or breaking
- Dust on wheel causing out of balance condition
- Vibration cracks causing wheel failure.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THANK YOU FOR YOUR TIME!

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