Ventilation System Optimization Without Engineering

Luis J. Castano
Applications Engineering Manager
lcastano@iac-intl.com

IEEE East Coast Conference
October 2022

www.iac-intl.com

1

Agenda

- Ventilation Systems
- Baghouses
- Filtration Media
- Installation
- Operation

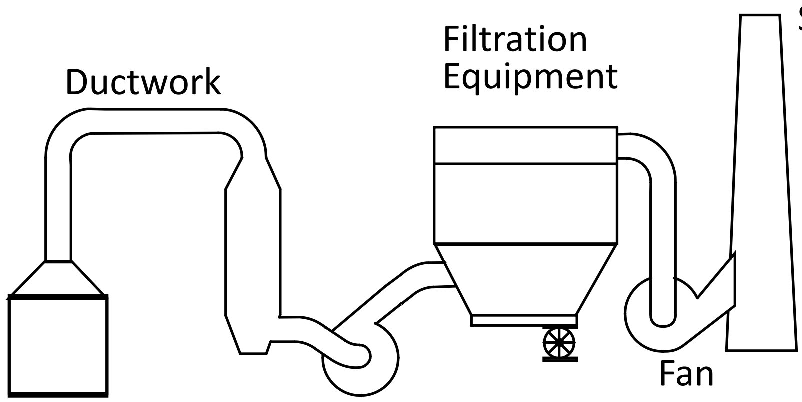
2

Types of Ventilation Systems

- **Process**
  -Kiln
  -Mill
  -Separator
  -Pneumatic Conveying
- **Auxiliary**
  -Belt Transfers
  -Elevators

3

Ventilation System



4

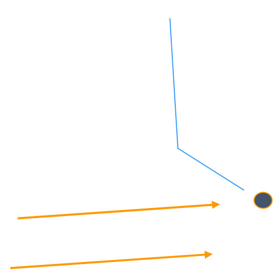
Basic Concepts of Ventilation Systems

- Capture Velocity
- Closed Box

5

Capture Velocity

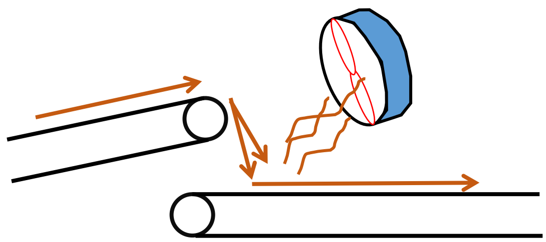
- A Draft of Air Influences Particle Behavior
- This Can Be Used to Address Dust Emissions Problems



6

Capture Velocity

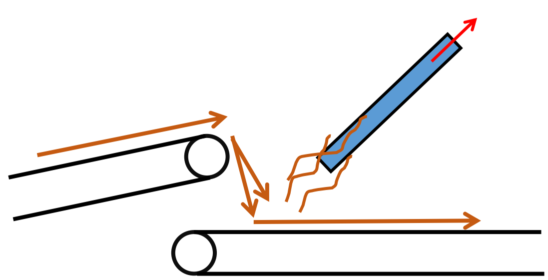
- A Draft of Air Influences Particle Behavior
- This Can Be Used to Address Dust Emissions Problems



7

Capture Velocity

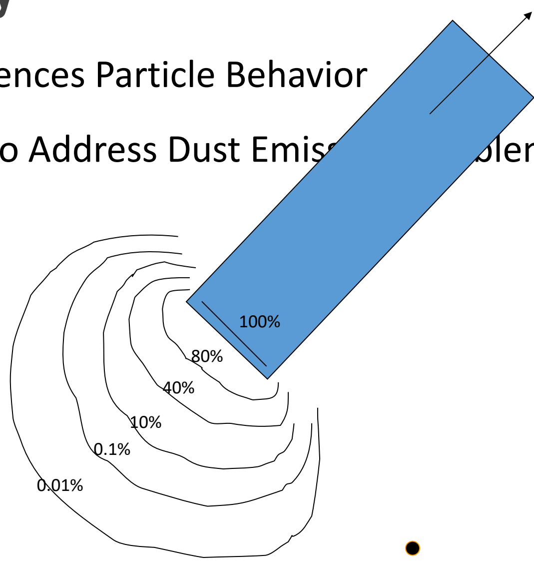
- A Draft of Air Influences Particle Behavior
- This Can Be Used to Address Dust Emissions Problems



8

Capture Velocity

- A Draft of Air Influences Particle Behavior
- This Can Be Used to Address Dust Emis[illegible]blems
- By Itself, NOT A Solution



9

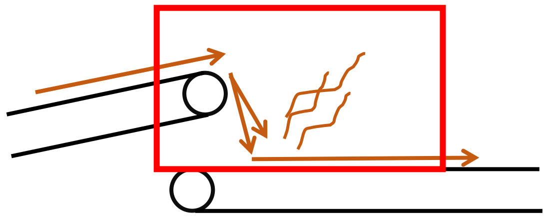
Closed Box Principle

- Dust in a Sealed Box Is NOT a Problem

10

Closed Box Principle

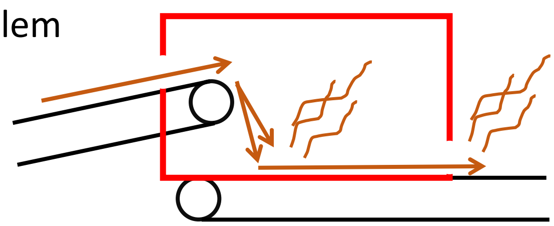
- Dust in a Sealed Box Is NOT a Problem



11

Closed Box Principle

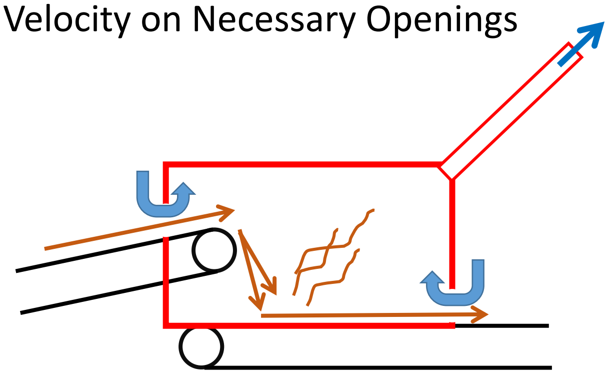
- Dust in a ~~Sealed~~ Box Is NOT a Problem
- Helps, But Does NOT Solve The Problem



12

Ventilation Solution

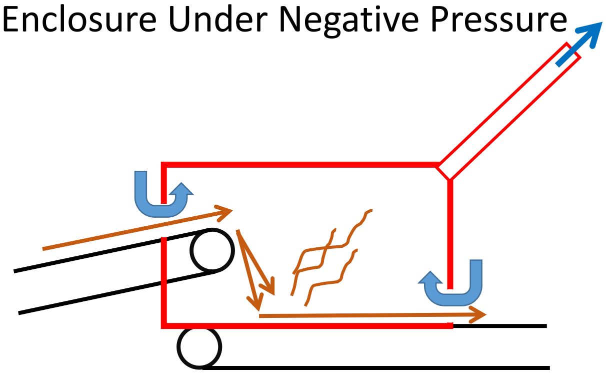
- Enclose as Best Possible
- Apply Capture Velocity on Necessary Openings



13

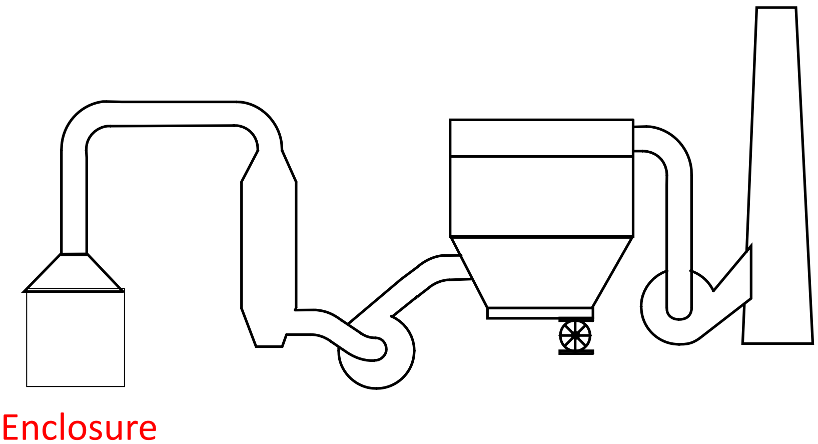
Purpose of Ventilation System

- Is NOT to Suction Dust
- It's to Keep an Enclosure Under Negative Pressure



14

Ventilation System



15

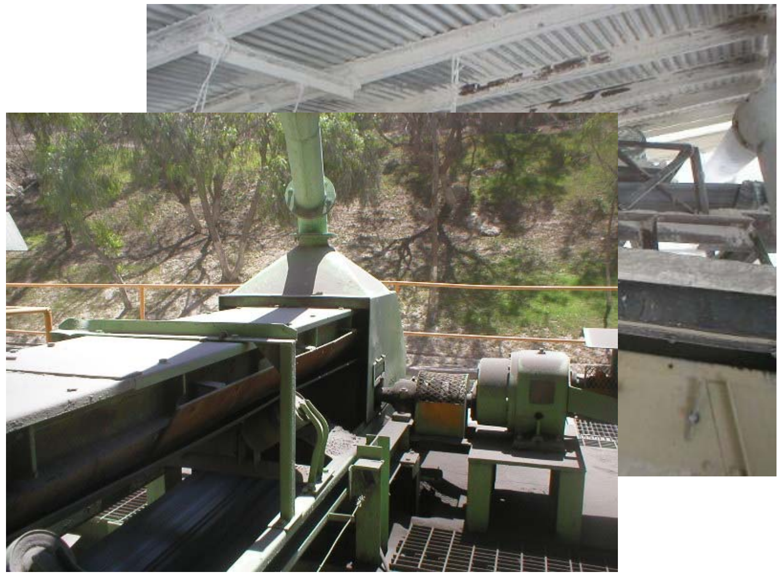
Enclosures

- Bad / Nonexistent

16

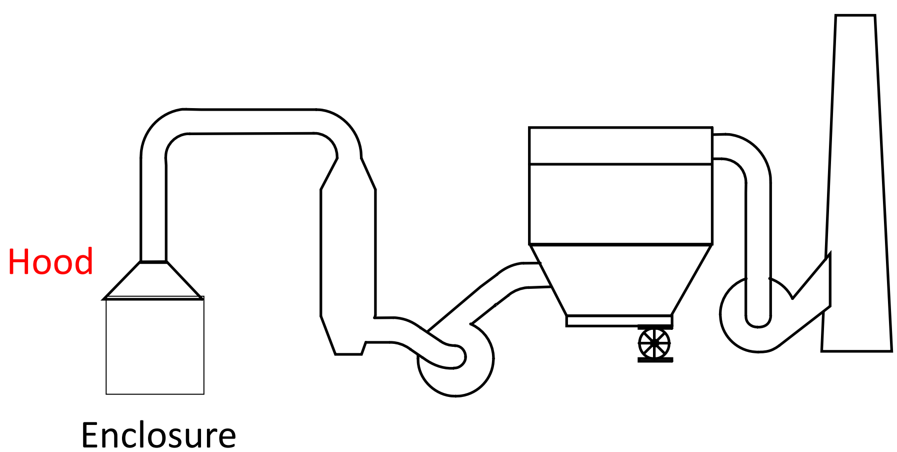
Enclosures

- Bad / Nonexistent
- Good Enclosure



17

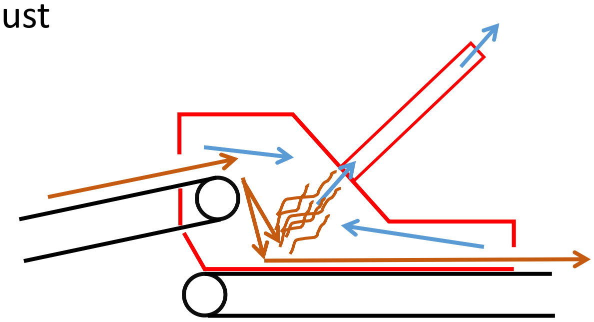
Ventilation System



18

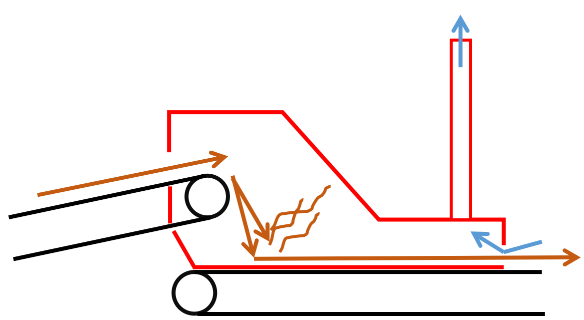
Vent Point Position

- Purpose: Keep Enclosure Under Negative Pressure
- NOT Suction Dust



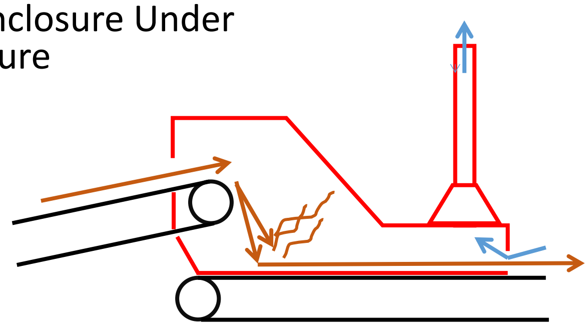
Vent Point Position

- Vent Away From the Cloud of Dust



Vent Point Optimized With Hood

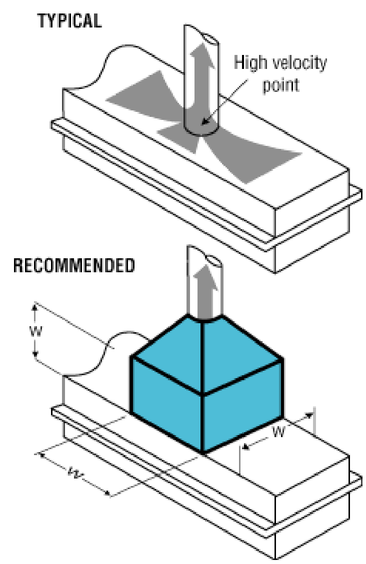
- Minimize Suction of Material
- Still Keeping Enclosure Under Negative Pressure



21

Hoods

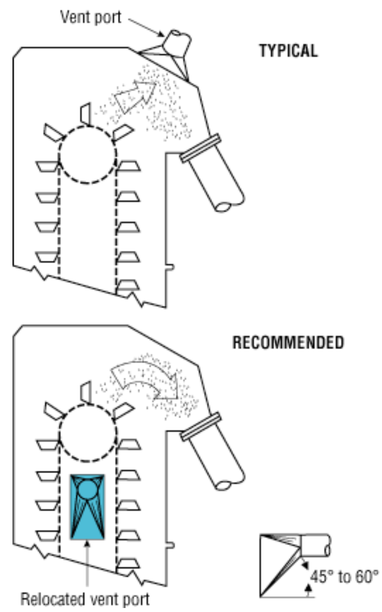
- Minimize Flow Restriction
- Minimize Suction of Material



22

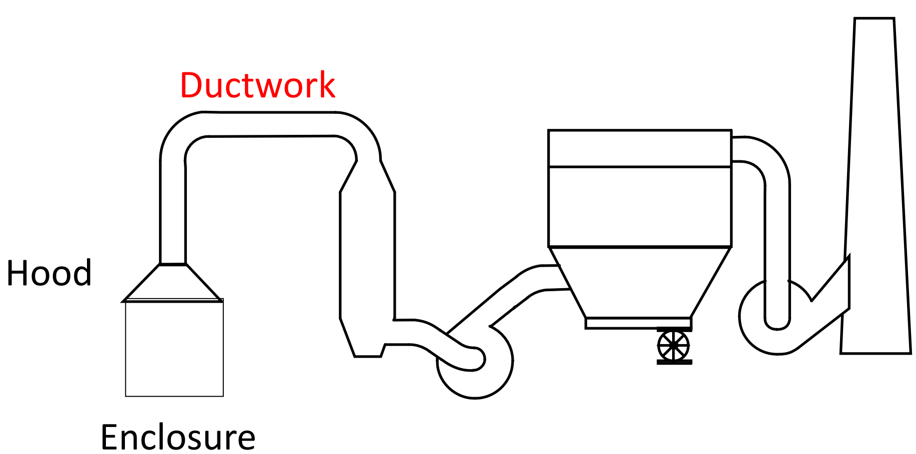
Hoods

- Minimize Flow Restriction
- Minimize Suction of Material



23

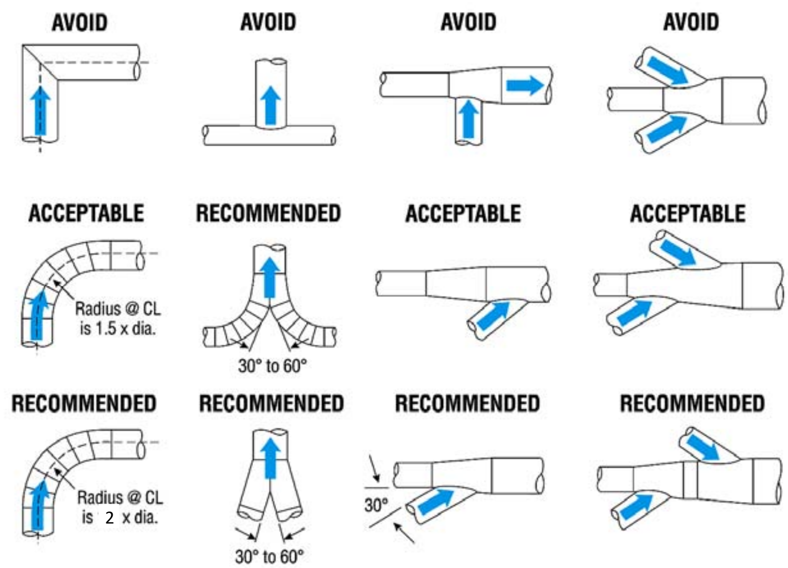
Ventilation System



24

Ductwork

- Design Principles



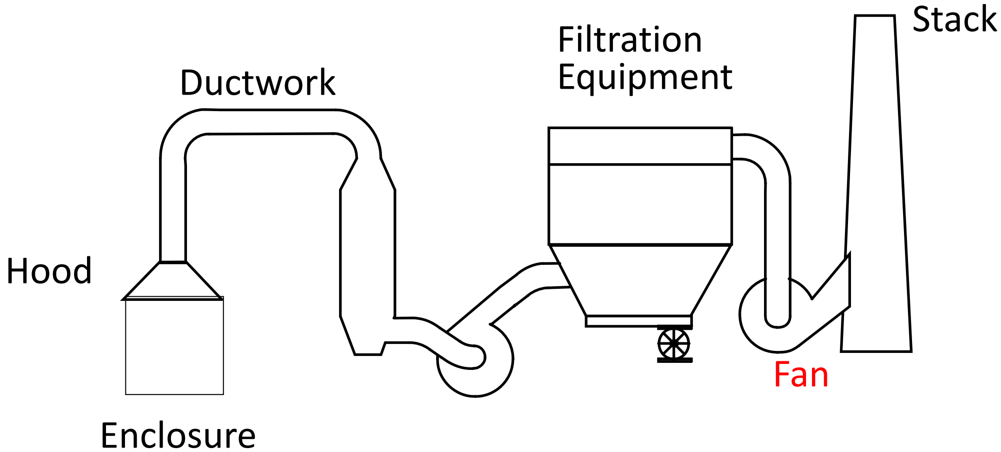
25

Ductwork

- What NOT To Do

26

Ventilation System



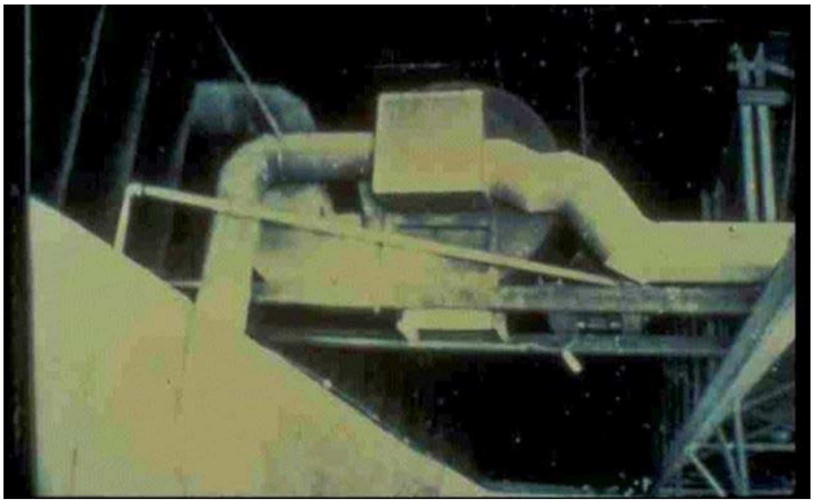
27

Fan Optimization

- Specs Defined Under Ideal Conditions

28

Poor Fan Installation



29

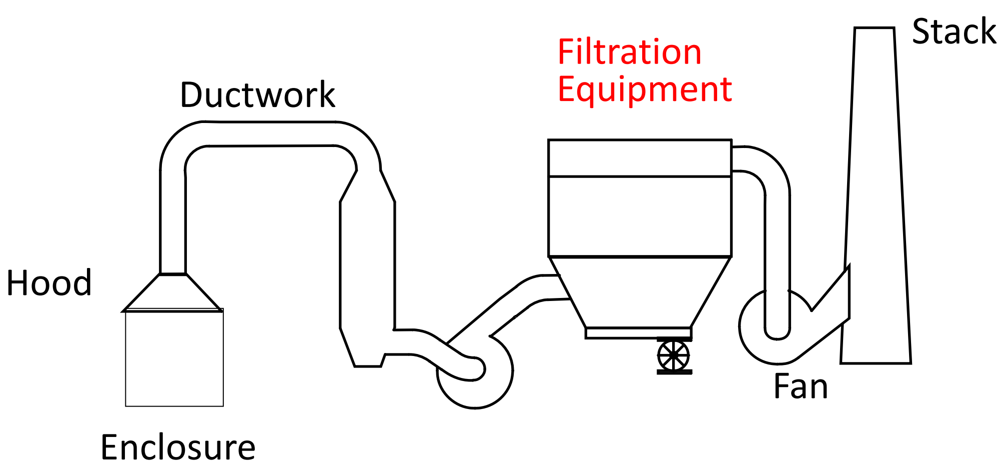
Poor Fan Outlet

30

Excellent Fan Outlet

31

Ventilation System



32

Agenda

- Introduction to IAC
- Ventilation Systems
- Baghouses
- Filtration Media
- Installation
- Operation

33

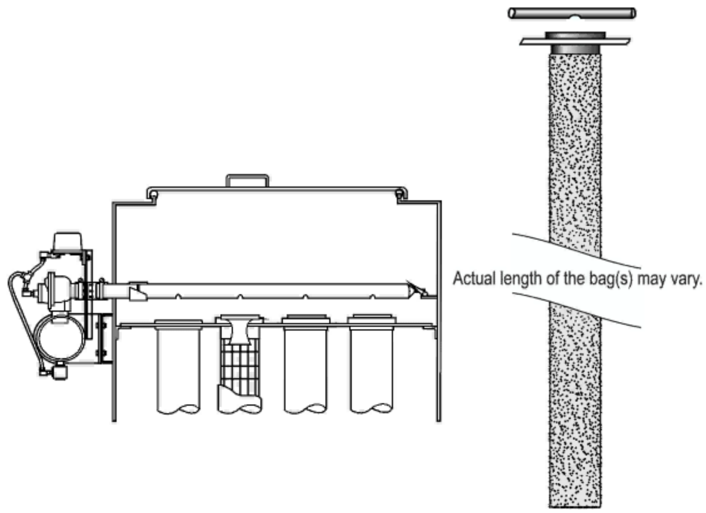
Pulse Jet Baghouses

- On-Line Cleaning
- High Capacity/ Small Size
- Lower Cost
- Harsh on Filter Media

34

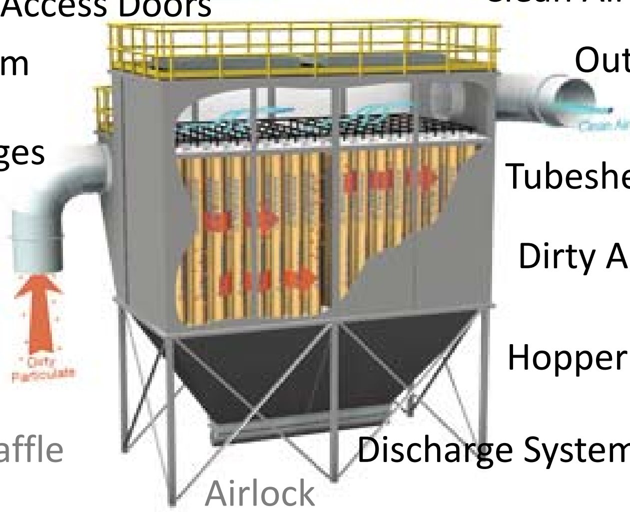
Pulse Jet Baghouses

- On-Line Cleaning
- High Capacity/ Small Size
- Lower Cost
- Harsh on Filter Media



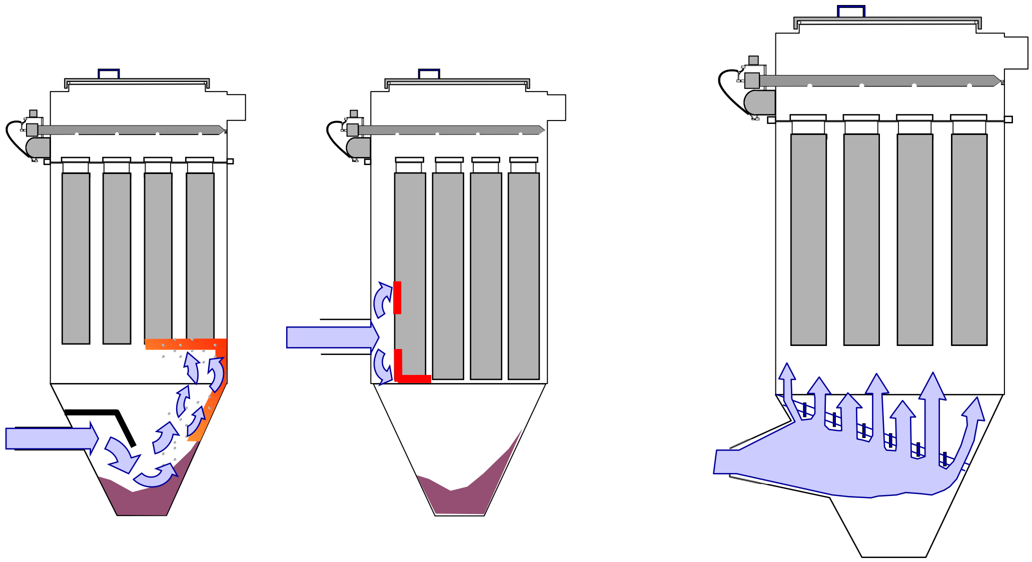
35

Pulse Jet Baghouse Anatomy



36

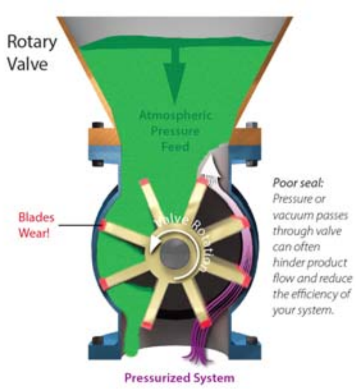
Flow Distribution

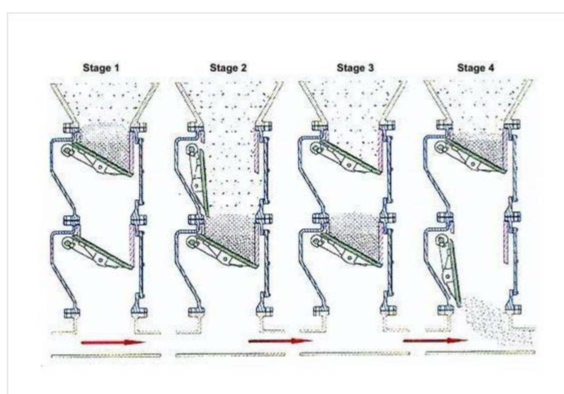


37

Discharge Valves

- Rotary Valve vs Double Tipping Valve

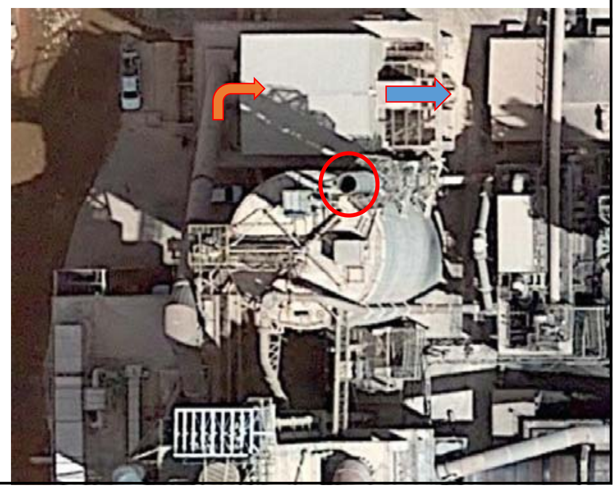




38

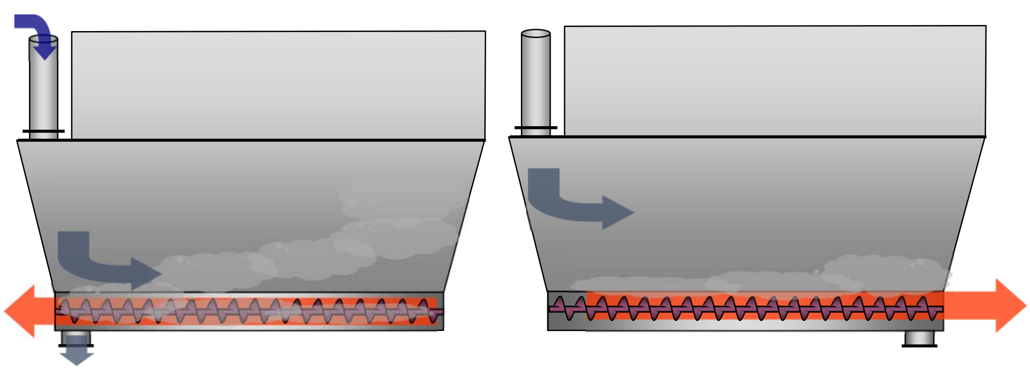
Conceptual Design

- Inlet and Outlet on Opposite Sides



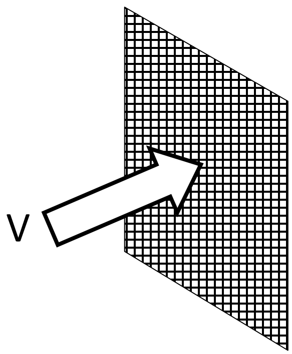
Conceptual Design

- Inlet and Discharge on Opposite Sides



Baghouse Sizing

- Air to Cloth Ratio (ACR)
- Filtration Velocity (FV)



$$ACR = \frac{CFM}{Area}$$

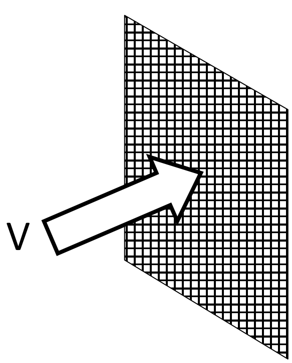
$$ACR = \frac{ft^3}{min \cdot ft^2}$$

$$ACR = \frac{ft}{min}$$

41

Baghouse Sizing

- Air to Cloth Ratio
- Filtration Velocity



$$Process$$
$$FV = 3\ to\ 3.3\ fpm$$

$$Auxiliary$$
$$FV = 4\ to\ 5\ fpm$$

42

Agenda

- Introduction to IAC
- Ventilation Systems
- Baghouses
- Filtration Media
- Installation
- Operation

43

Polyester Felt

- Workhorse of Industry
- 275F Temp Limit
- Inexpensive, Durable
- Subject to Hydrolysis
- Used in Most Low Temp Applications

44

Acrylic Felt

- Solves Hydrolysis
- 265 F Temp Limit
- Resists High Humidity
- More Expensive than Polyes
- Commonly Used in Cement Mill Circuits

45

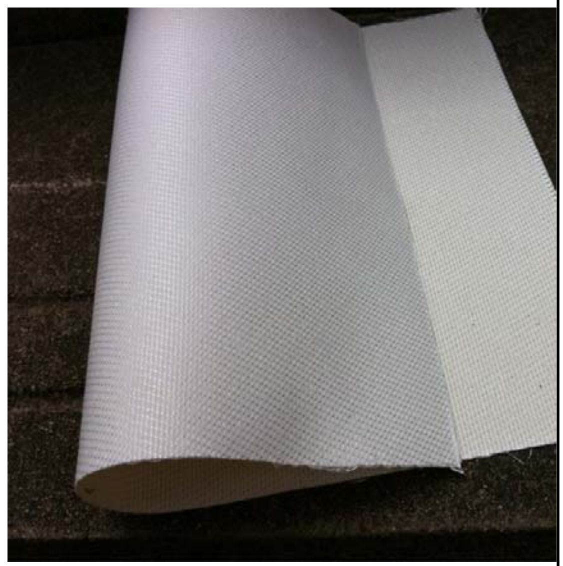
Aramid Felt (Nomex)

- 390 F Temperature Limit
- Subject to Hydrolysis at +300F With High Humidity
- More Expensive than Polyester and Acrylic
- Commonly Used in Clinker Cooler Baghouses

46

Woven Fiberglass

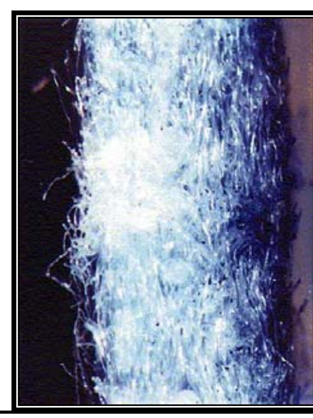
- 500 F Temperature Limit
- Fragile/ Easily Damaged
- Used in Kiln Baghouses
- Usually Laminated with PTFE Membrane

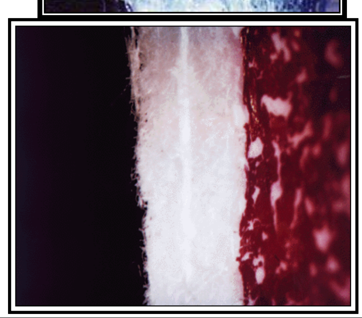


47

PTFE Membrane

- Surface Filtration Principle
- High Efficiency Filtration
- Excellent Dust Release
- Base Fabric Becomes Support Only

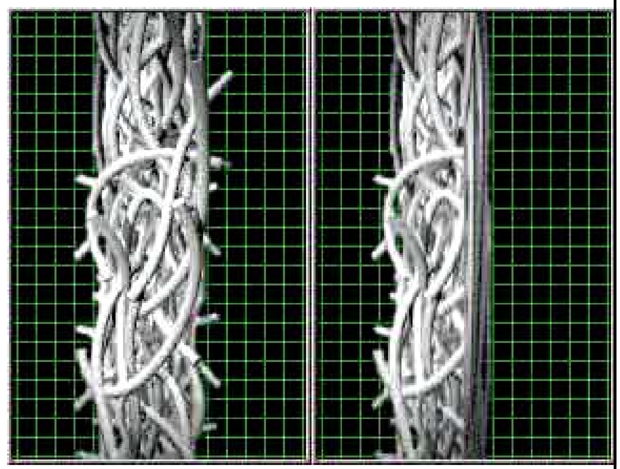




48

PTFE Membrane

- Surface Filtration Principle
- High Efficiency Filtration
- Excellent Dust Release
- Base Fabric Becomes Support Only
- Cannot Handle Oily Flow



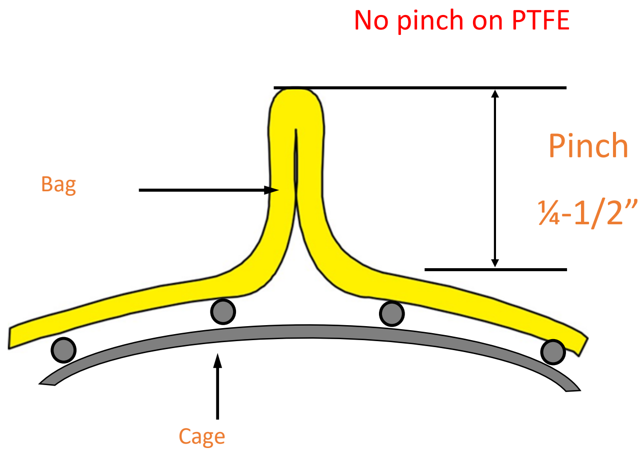
49

Agenda

- Introduction to IAC
- Ventilation Systems
- Baghouses
- Filtration Media
- Installation
- Operation

50

Bags- Verify Pinch



51

Excess Pinch

- Reduces Cleaning Efficiency

52

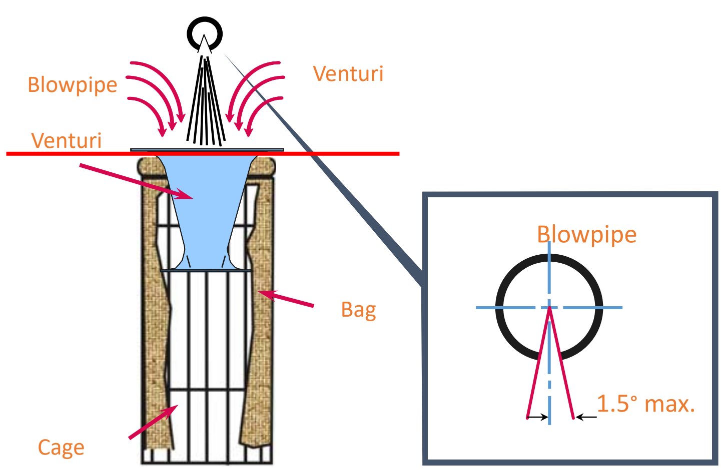
Excess Pinch

- Reduces Cleaning Efficiency
- Creates Failures on Fiberglass

53

Keep Tubesheet Clean

- Avoids Inside Bag Contamination

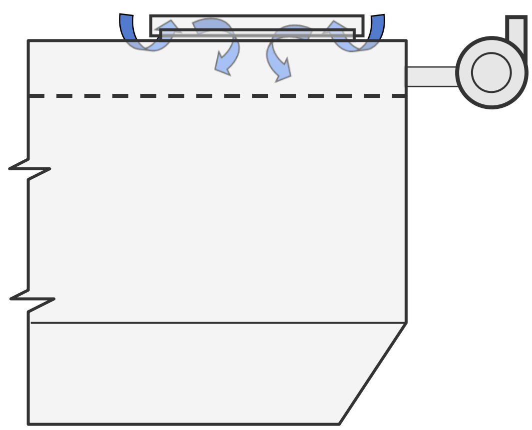


54

Verify Blowpipe Hole Integrity

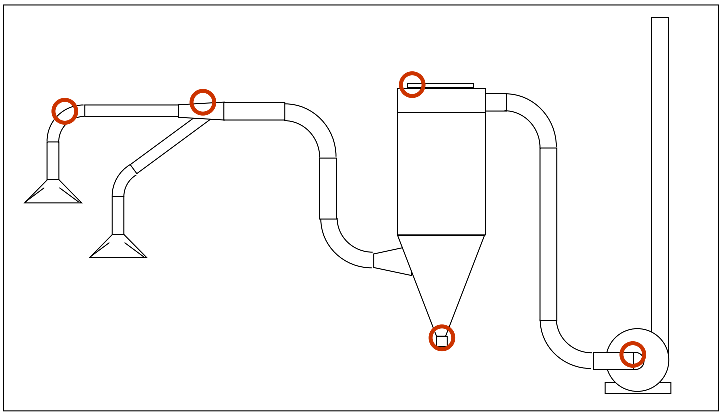
Eliminate Inleakage

- Incoming Ambient Air Reduces Capacity
- Most Common Deficiency
- Particularly Troublesome in High Temperature Systems



Common Inleakage Points

- Ductwork Branching & Elbows
- Baghouse Discharge
- Access Door Seals
- Expansion Joints



57

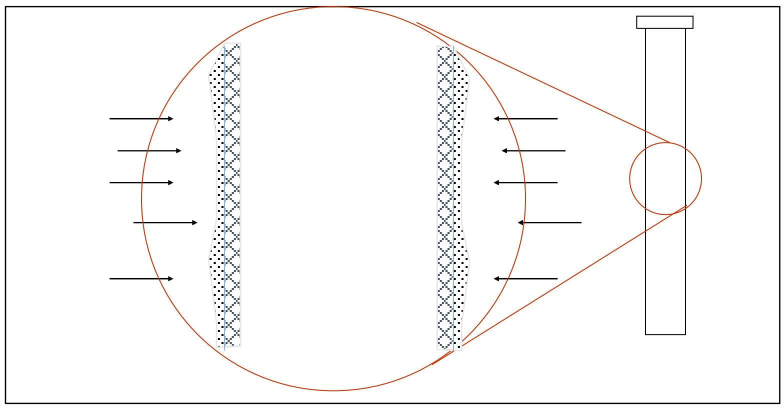
Agenda

- Introduction to IAC
- Ventilation Systems
- Baghouses
- Filtration Media
- Installation
- Operation

58

Dustcake

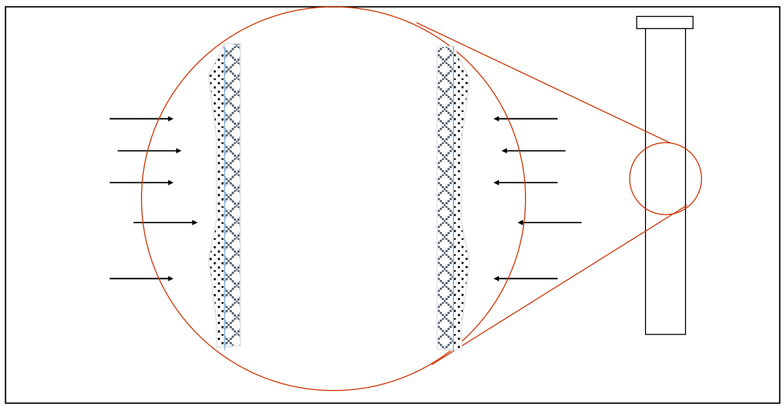
- Filtered Particles on Media
- Part of the System



59

Verify a Good Dustcake

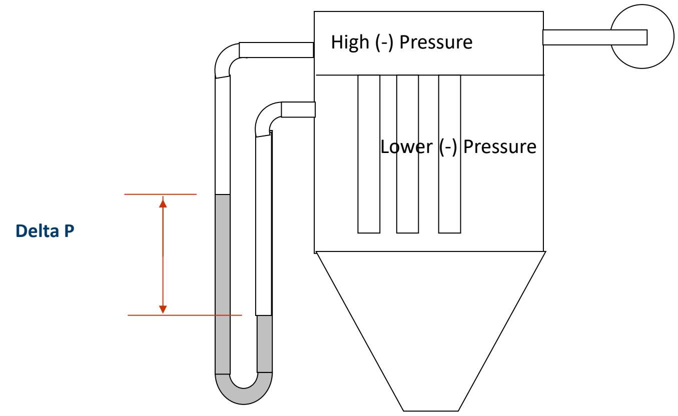
- Differential Pressure



60

Differential Pressure Explained

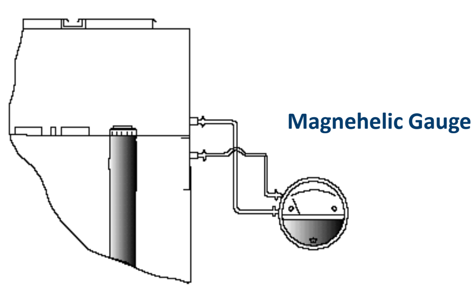
- Difference Between Clean and Dirty Side



61

Differential Pressure

- Operator's Stethoscope
- Indicates a Problem Before it Becomes Disaster
- Good DP is about 4" to 6" w.g.



62

DP Measuring Devices

- Manometer
- Magnehelic
- Photohelic

63

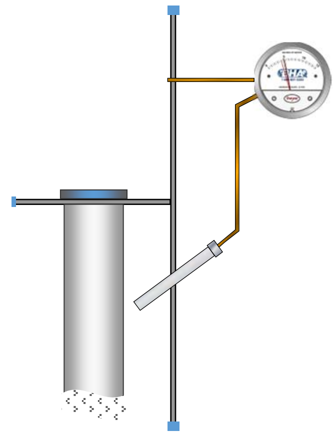
Cleaning Based on DP

- Saves Compressed Air
- Reduces Wear and Tear on Filter Media

64

Cleaning Based on DP

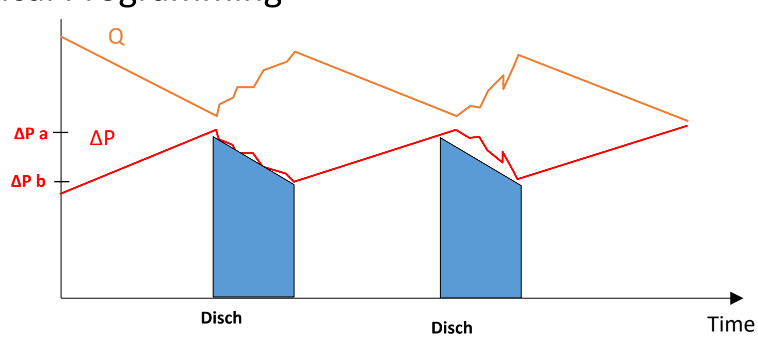
- Saves Compressed Air
- Reduces Wear and Tear on Filter Media
- Accuracy IMPORTANT



65

Cleaning Based on DP

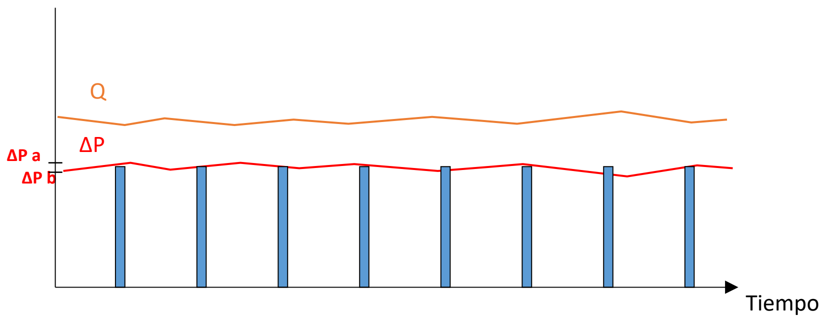
- Saves Compressed Air
- Reduces Wear and Tear on Filter Media
- Typical Programming



66

Cleaning Based on DP

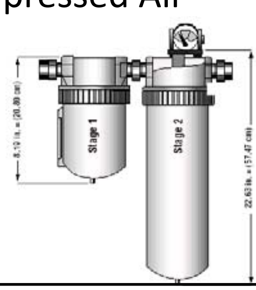
- Saves Compressed Air
- Reduces Wear and Tear on Filter Media
- Recommended Programming

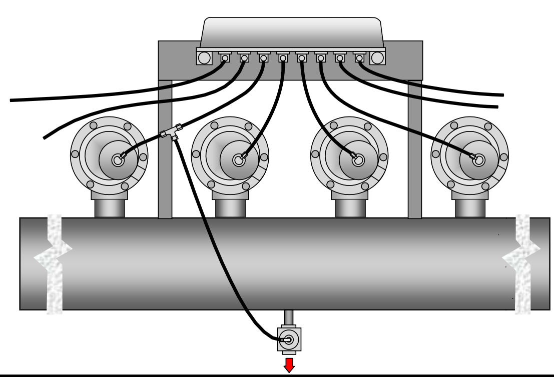


67

Pulse Jet System

- Apply Recommended Pressure and Pulse On-Time
- Typical 80 – 90 psi, 0.1 to 0.2 seconds
- Fiberglass and PTFE Lower
- Clean, Dry Compressed Air

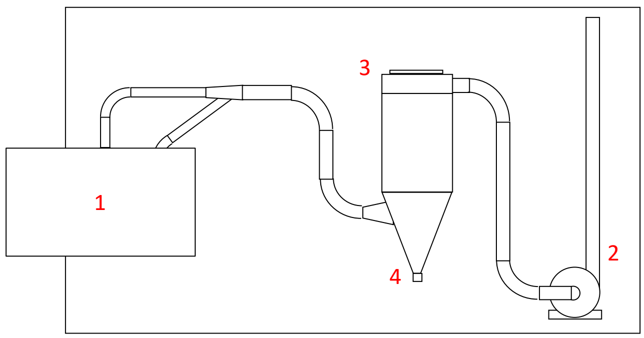




68

Shutdown Procedure

- Turn off Process, Fan Runs to Cool to Ambient Temperature
- Turn off Fan, Pulsing and Discharge Continue Operating
- Verify Hopper is Empty
- Turn off Pulsing and Discharge System



69

Flow Balancing

- Determine Order of Adjustment, Starting at Closest
- Gradually Close Damper Until Slight Pressurization.
- Repeat for Each Vent Point
- Adjust Fan Damper and Verify Flow

70

System Monitoring Basics

- Verify Differential Pressure Daily
- Visual Stack Check
- Verify Pulsing System Operation
- Verify Discharge System Operation
- Modern Controls Inexpensive

71

IAC

(800) 334-7431

Luis J. Castano
lcastano@iac-intl.com

Visit our YouTube channel
https://www.youtube.com/IndustrialAccessoriesCompany

72