

## Dust Explosions and Solutions

Dust explosions have been an ever present hazard to industry for hundreds of years. Over the years, many casualties and injuries to personnel could have been prevented by having explosion protection solutions in place. Mec-Tric Control Company and Fike Corporation bring Explosion Protection Products, Dust Testing, Design and System Service together. Through years of extensive research and development, Fike has designed explosion containment systems and pressure relief explosion vents. Fike is also a leader in dust testing with many tests available relating to a substances explosibility characteristics.

Mec-Tric's explosion protection design department is involved with reviewing customers applications and works with Fike to bring a tailor made explosion protection solution to hazardous situations found in the workplace. Oftentimes the solution involves containment of the explosion and/or pressure relief of the vessel. Our explosion protection service department is involved in the commissioning of active explosion protection containment systems as well as the repair and preventative maintenance of the systems. The National Fire Protection Association (NFPA) has instituted many guidelines and standards which are used in industry today. NFPA 61, 68, 69, 484, 654, 664 and 655 all offer guidance for prevention and containment of explosions and fires. OSHA is involved with the compliance of these standards and regulations. For a comprehensive list of compliance requirements of OSHA standards or regulations, refer to Title 29 of the Code of Federal Regulations.

Pressure relief with Explosion Vents.



Fike VMAX ® style Explosion Vent

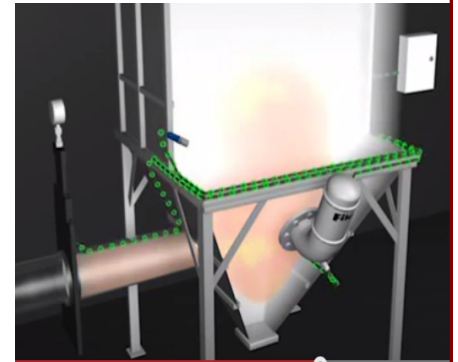
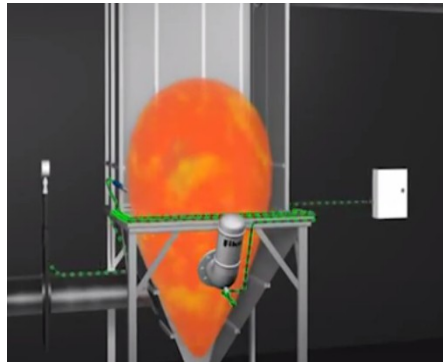


Fike CV-S ® style Explosion Vent



Fike FlameQuench II ® flame arrester

Explosion Containment with vessel explosion suppression and duct explosion isolation.



Fike Pressure detector



Fike Spark IR detector



Fike HRD for suppression (SBC)



HRD Lockout



Fike SRD for isolation (SBC)



Fike EIPV for isolation



Fike EIV for isolation



Fike EPC



Fike Annunciator



Ventex ® for isolation

# Dust Testing



Fike offers the following tests in addition to other tests not shown below.

- Explosibility Screening (20 L and 1 m3)
- Dust Explosibility (20 L and 1 m3) (Kst & Pmax)
- Minimum Explosible Concentration of Dusts (MEC)
- Limiting Oxygen Concentration for Dusts (LOC)
- Minimum Autoignition Temperature: Dust Clouds (MAIT)
- Minimum Ignition Energy for Dusts (MIE) (w/ & w/o Inductance)
- Minimum Dust Layer Ignition Temperature
- Percent Combustible Material (PCM)
- Dust Burn Rate Screen Test (DBR - SCREEN)
- Dust Burn Rate (DBR)
- Particle Size Analysis (PSA)
- Bulk Resistivity Measurement Test
- OSHA/NEP Package Testing
- Dust, Gas and liquid testing available

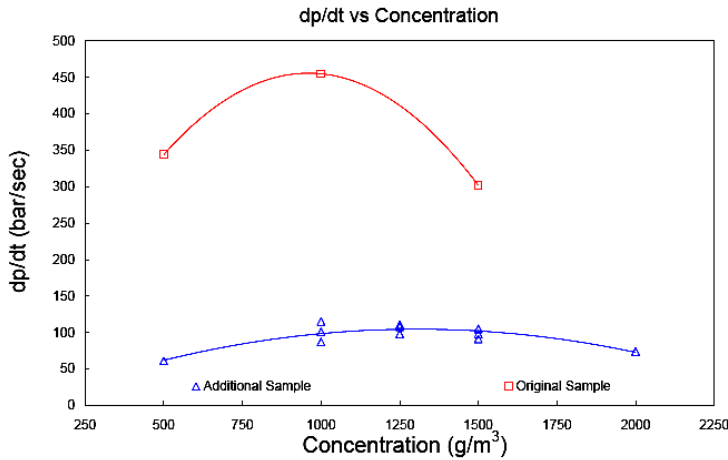
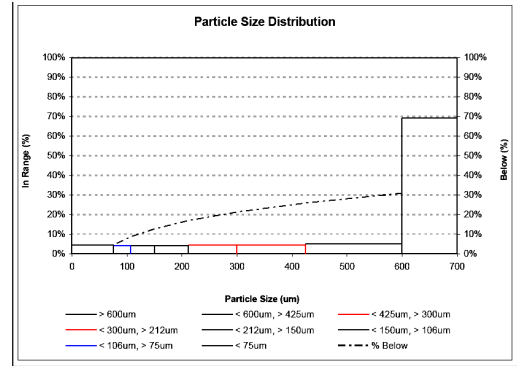


FIGURE 4. EXPLOSION PRESSURE RATE OF RISE MEASURED IN 20L APPARATUS (TRANSDUCER 1)



Result with inductance L = 1 mH

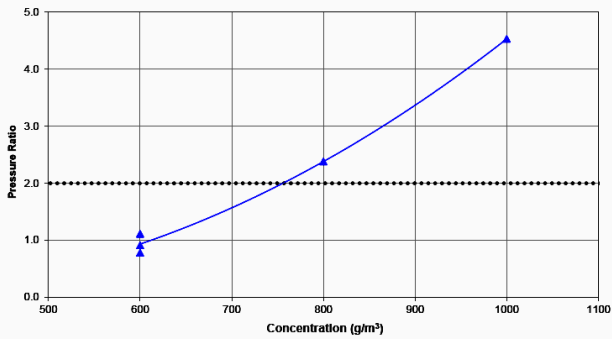
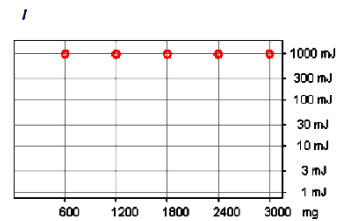


Figure 2: Pressure Ratios vs Concentration

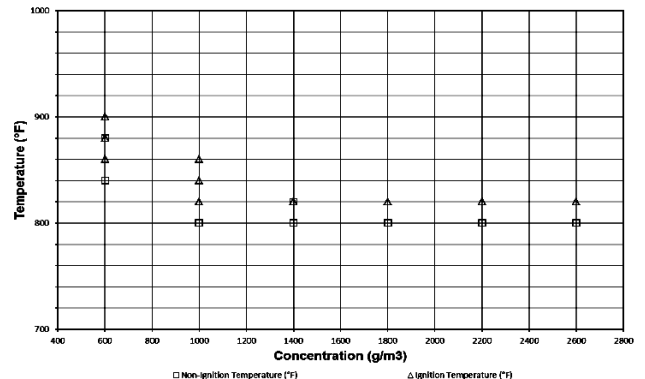


Figure 4 : Ignitability of Dust Cloud by Heat

### Mec-Tric & Fike Explosion Protection Design

- 1. Customer completes Explosion Protection Worksheet for specific vessel type to be protected.
  - 2. Mec-Tric completes preliminary evaluation and design with information provided by customer.
  - 3. If Explosion Vent requirement, Fike Vent Calc computer application utilized for vent size and type determination (NFPA 68, 2013).
  - 4. If Active system, Fike Project computer program utilized along with Fike Iso-calc computer application for isolation calculations.
  - 5. Fike EP designer application used for calculations related to Total Suppressed vessel Pressure (TSP).
- If active system chosen, all design work forwarded to Fike for final review and system engineering drawings.

**Fike** Explosion Protection Worksheet  
**Cyclone Separator**

Project ID: \_\_\_\_\_ Customer \_\_\_\_\_  
Site Location: \_\_\_\_\_ Special Requirements  Yes  No  
City: \_\_\_\_\_ Approvals  None  CFM  
State: \_\_\_\_\_ Hazardous Area  ATEX  Other  
Country: \_\_\_\_\_ Flameless Explosion Venting \_\_\_\_\_  
Explosion Venting, Preferred Vent Model \_\_\_\_\_  
Explosion Suppression  Sanitary  Standard  
Explosion Isolation  Chemical  ENV  Finch Valve  Vertex

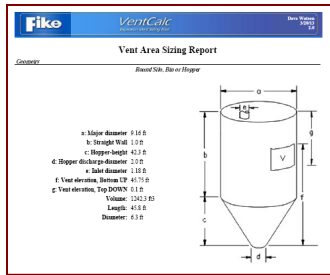
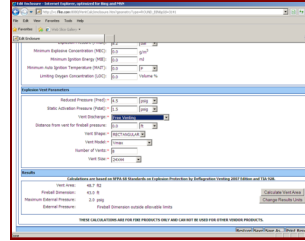
Process  
Positive operating pressure  
Vacuum operating pressure  
Inlet temperature  
Outlet temperature  
Explosion temperature  
Ambient temperature  
Airflow  
Reduced Explosion Pressure (P<sub>red</sub>)  
Inlet type  
Enclosure location  Proofs  Gaskets  
If vent duct is required Length \_\_\_\_\_ Clow City \_\_\_\_\_

Combustible material ( advise if hybrid)  
Name \_\_\_\_\_  
Grain \_\_\_\_\_  
Clow \_\_\_\_\_  
Barb's \_\_\_\_\_  
Inch \_\_\_\_\_  
Lug # \_\_\_\_\_  
Type \_\_\_\_\_  
Unit \_\_\_\_\_

Enclosure  
Tag/D Number \_\_\_\_\_  
Manufacturer \_\_\_\_\_  
Model Number \_\_\_\_\_  
a Hat / Vortex diameter \_\_\_\_\_  
b Hat height \_\_\_\_\_  
c Miter diameter \_\_\_\_\_  
d Straight height \_\_\_\_\_  
e Conical height \_\_\_\_\_  
f Product discharge \_\_\_\_\_  
g Inlet diameter \_\_\_\_\_  
h Exhaust diameter \_\_\_\_\_  
i Free straight wall \_\_\_\_\_  
j Vent elevation \_\_\_\_\_

Comments:

2



3

**Fike** VentCalc  
Vent Area Sizing Report

Project Information  
Project Name: dym cyclones  
ID Number: 00\_26\_13

Enclosure Information  
Type (enclosure): Cyclone Separator  
Manufacturer: Paul Mueller company  
Model: unknown cyclone with conical walls  
Volume: 1242.63  
Length (axial run path): 45.8 ft  
Diameter (effective hydraulic): 6.8 ft

Process  
Maximum Positive Pressure (P<sub>max</sub>): 0.0 psig  
Maximum Vacuum: 0.0 psig  
Air Flow: 27500.0 CFM  
Cyclic / Pulsating Pressure: Positive-Positive  
Maximum Temperature: 145.0 F  
Minimum Temperature: 60.0 F  
Minimum Transport Velocity: 0.0 ft/s

Combustible Material  
Combustible Material Name: Dust-Organic  
Deflagration Index (K<sub>st</sub>): 199.0 bar m/s  
Explosion Pressure (P<sub>max</sub>): 8.2 bar

Explosion Vent Parameters  
Reduced Pressure (P<sub>red</sub>): 11.0 psig  
Static Activation Pressure (P<sub>stat</sub>): 4.5 psig  
Vent Discharge: Free Venting  
Distance from vent for free venting: 0.0 ft  
Vent Shape: RECTANGULAR  
Vent Model: CV  
Number of Vents: 6  
Vent Size: 440x44

Results  
Calculated as based on NFPA 68 Handbook on Explosion Protection by Deflagration Venting 2012 Edition and ISA 109  
Vent Area: 243 m<sup>2</sup>  
Fireball Diameter: Past outside of allowable limits  
Minimum External Pressure: 0.2 bar  
External Pressure: Fireball Dimension outside allowable limits

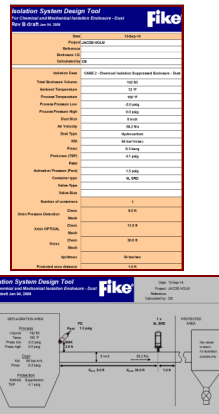
Additional Info: Note: \_\_\_\_\_

3

Excel spreadsheet showing a detailed specification table for a "Round Dust Collector Round Filter".

Unit of Measure:	Imperial	SI
<b>Process</b>		
Manufacturer:	30881	UTR AL 150/21
Model Number:	07272300	
Material:	142.70	4.03 m
Weight:	157.47	4.49 m <sup>3</sup>
Clear Air Flow (CFM):		
V <sub>1</sub> :	34.0	0.97
V <sub>2</sub> :	34.0	0.97
V <sub>3</sub> :	34.0	0.97
V <sub>4</sub> :	34.0	0.97
V <sub>5</sub> :	34.0	0.97
V <sub>6</sub> :	34.0	0.97
Capacity (lb/hr):	110.0	3.1 m <sup>3</sup>
<b>Filter</b>		
Filter:	142.70	4.03 m
Filter Area:	157.47	4.49 m <sup>2</sup>
Filter Efficiency:	99.9%	
Filter Pressure Drop:	1.5 in. H <sub>2</sub> O	
Filter Temperature:	150.0 F	
Filter Humidity:	50.0%	
Filter Material:	PP	
Filter Construction:	袋式过滤器	
Filter Type:	袋式过滤器	
Filter Model:	袋式过滤器	
Filter Part Number:	袋式过滤器	
Filter Weight:	袋式过滤器	
Filter Dimensions:	袋式过滤器	
Filter Installation:	袋式过滤器	
Filter Maintenance:	袋式过滤器	
Filter Replacement:	袋式过滤器	
Filter Life:	袋式过滤器	
Filter Cost:	袋式过滤器	

4



4

Fike Explosion Suppression  
TOTAL SUPPRESSED PRESSURE  
Version 2.14

Process Vessel: 36884  
Total Volume: 142 ft<sup>3</sup> Protected Volume: 107 ft<sup>3</sup>  
Vessel ID: -238 Operating Pressure: 72 psig  
Process Temperature: 100 F Ambient Temperature: 72 F  
Max. Suppressant Throw Distance: 7 ft in. Number of Detectors: 2  
Hazard Type: Hydrocarbon Dust Name: \_\_\_\_\_ K<sub>st</sub>: 84 bar/m/s  
Pact. Pressure Detection Activation Point: 1.5 psig

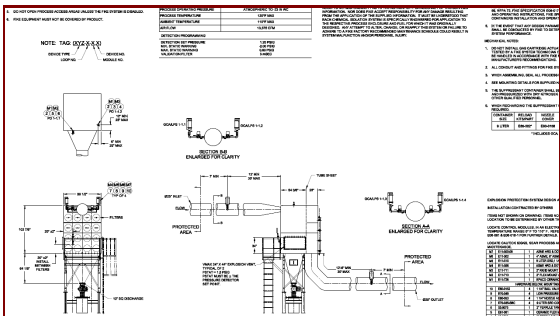
Suppressant Containers:  
 2.5 liter container(s)  
 5 liter container(s)  
 10 liter container(s)  
 20 liter container(s)  
 30 liter container(s)  
 50 liter container(s)

Detector Type:  
 Electronic (Static Set Point)

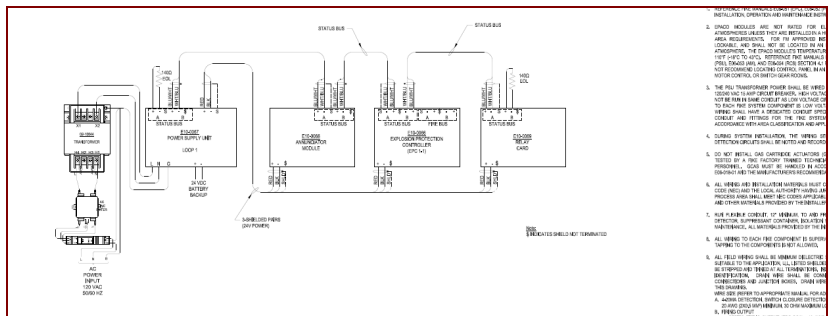
Suppressant Agent:  
 Sodium Bicarbonate  
 Dessikarb  
 Map Suppressant Conc.: 6.6 lbs/m<sup>3</sup>

T.S.P. = 4.5 psig  
Calculate T.S.P.   
PRINT WINDOW   
Quit

4



5



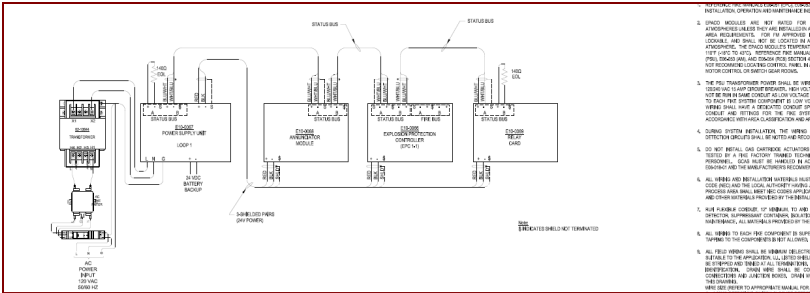
5

3

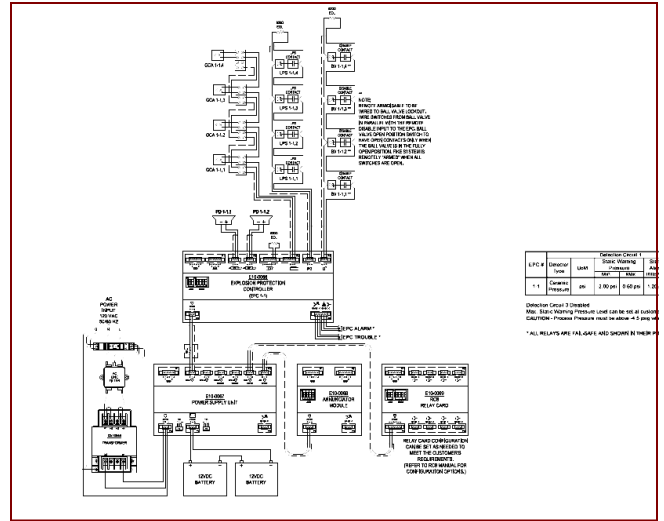


## Mec-Tric Service and Commissioning

Mec-tric's Fike factory trained technicians have many years of training and experience involving explosion protection systems. Our commitment to keeping your systems working is second to none. We are well aware of the impact on factory production of explosion protection systems that are down or in need of service as well as the impact that these systems have on the overall safety of the plant in which they are safeguarding. NFPA 69 provides guidance for active systems. Our technicians provide on call support as well as phone support to keep your explosion protection systems in operation. We stock many parts required to keep the systems in operation as well as Explosion Protection system knowledge and Fike support.



Fike Module Schematic



Fike Wiring Schematic



Fike EP Modules



Fike HRD containers (vessel suppression)



Fike SRD container (duct isolation)



Fike HRD container