EXPLOSION PROTECTION

TESTING SERVICES

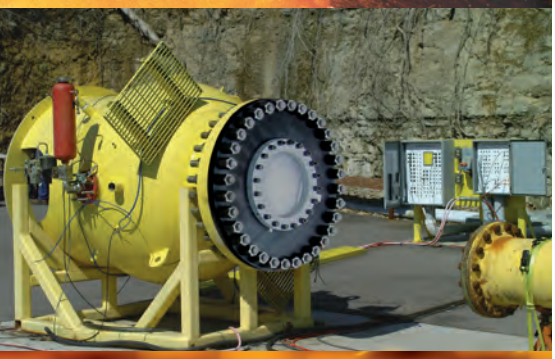
IS YOUR FACILITY

AT RISK FOR A

DUST EXPLOSION?

Fike®

Dust explosions are deadly and commercially devastating. Unfortunately, many of them occur at facilities without a prior explosion incident, providing a false sense of security. The reality is that many facilities have inherent risks that should be addressed to prevent an inevitable catastrophe.



Fike offers a wide range of explosibility tests designed to assist companies in identifying and mitigating costly explosion hazards. Fike's state-of-the-art testing laboratory is staffed with highly trained technicians, engineers, and combustion scientists. To assure proper execution and interpretation of the results, tests are conducted in accordance with ASTM and CEN standards.

WHY TESTING?

Material explosibility testing is vital for safe plant design, safe operating parameters, and safe handling procedures. Fike provides testing in both small- and large-scale explosion test vessels, designed and constructed to provide accurate data that is scalable to industrial equipment volumes:

- **Information regarding explosibility parameters of P_{max} and K_{max}**
- **Explosibility limits of fuel, oxidant, or ignition energy**
- **Performance of many tests at elevated temperatures and/or pressures to simulate customer operating conditions**
- **Verify and document K_{ST} information required to comply with NFPA standards**

Fike's testing facilities accommodate a wide variety of fuels and oxidants, including DEA Schedule 2, 3 and 4 controlled substances.

REMOTE TESTING FACILITY

Fike also operates a unique, large scale testing facility designed and engineered to conduct industrial testing on a magnitude more closely resembling actual applications. Due to this state-of-the-art facility (which features enclosures ranging from 0.5 to 10 cubic meters volume, two full-scale dust collectors and a wide variety of pipeline components), our product validation process is one of the most comprehensive in the industry.

- **Explosibility testing**
- **Explosion isolation**
- **Explosion suppression**
- **Combustion phenomena research**
- **Explosion venting**

Fike®

CUSTOMIZED TESTING

In addition to a wide range of standardized explosion tests, Fike conducts specialized explosion application and equipment tests, specifically designed for a customer's industrial environment. Fike's unique testing capabilities and equipment include:

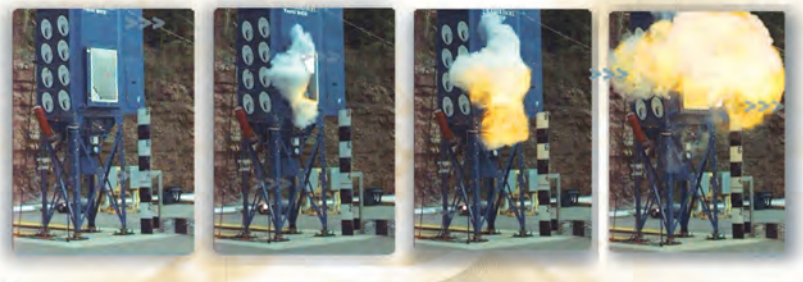
- Interconnected vessel and isolation test equipment
- Equipment designed to accommodate gas/vapor, dust, and hybrid fuels
- Multi-channel high-speed data acquisition systems, instrumentation, and high-speed digital video available for capturing the physical characteristics of each event

Fike's knowledgeable scientists, engineers, and technicians are available to assist in the development and completion of your test plan. When our customers need to test a complicated application regarding their safety and protection equipment, Fike has the facilities and expertise to perform standard and non-standard explosibility tests.

20-Liter Vessel – Used for K_{ST} and P_{MAX} determination

OSHA TESTING

Fike's testing facility also performs tests required by the U.S. Occupational Safety and Health Administration (OSHA). These specific tests can be used to determine whether a particular material possesses combustible properties. If the material is determined to be combustible, further tests are required to verify the specific combustion properties – which in turn will help identify the appropriate level of protection needed for your facility.



EXPLOSION PROTECTION

No business can afford an explosion. We have a team of experienced engineers, application specialists and combustion researchers that work to understand your critical plant operations. We back that up with a variety of products and services to help you prevent explosions, protect property and save lives:

- **Venting** - effective, cost-efficient, ATEX- certified explosion venting solutions.

- **Flameless Venting** - safely and economically protects equipment located inside a facility, without expensive duct work.

- **Explosion Isolation** - detects and mechanically or chemically blocks the flame pathways, preventing the spread of an explosion from one part of the process to another.

- **Explosion Suppression** - detects and chemically suppresses an explosion in its earliest (incipient) stages to prevent the development of destructive pressures or catastrophic explosions.

FIKE IS THE MOST EXPERIENCED, COMPLETE EXPLOSION PROTECTION PROVIDER.

EXPLOSION PROTECTION SERVICES

STANDARD DUST TESTS

TEST	DETERMINES	APPLICATION	ASTM STANDARD	CORRESPONDING CEN STANDARD
Explosibility Screening (20 L and 1 m³)	Potential for combustion.	Screening test to determine if further characterization is needed	E1226 - "Standard Test Method for Explosibility of Dust Clouds"	– — –
Dust Explosibility (20 L and 1 m³)	Maximum pressure, P_{max}; maximum pressure rate-of-pressure-rise, (dp/dt) max; and deflagration index, K_{max}. Measures potential explosion severity of a fuel-air mixture.	Design of explosion protection systems	E1226 - "Standard Test Method for Explosibility of Dust Clouds"	EN14034-1:2004 Dust EN14034-2:2004 Dust
Minimum Explosive Concentration of Dusts (MEC)	Relationship between dust concentration and explosion severity.	Design of explosion prevention systems	E1515 - "Standard Test Method for Minimum Explosible Concentration (MEC) of Combustible Dusts"	EN14034-3:2006
Limiting Oxygen Concentration for Dusts (LOC)	The lowest oxygen concentration in air at which a dust explosion will occur.	Design of explosion prevention systems (specifically inerting systems)	E2931 - "Standard Test Method for Limiting Oxygen (Oxidant) Concentration of Combustible Dust Clouds"	EN14034-4:2006
Minimum Autoignition Temperature: Dust Clouds (MAIT)	Minimum temperature at which a dust cloud will auto ignite when exposed to air heated. Provides a relative measure of dust cloud ignitability.	Analysis and design of explosion prevention and protection systems	E1491 - "Standard Test Method for Minimum Autoignition Temperature (MAIT) of Dust Clouds"	EN50281-2-1
Minimum Ignition Energy for Dusts (MIE)	Lowest spark energy required to initiate a dust explosion. Assesses relative sensitivity of the sample to ignition by electrical sparks.	Analysis and design of fire/explosion prevention and protection systems	E2019 - "Standard Test Method for Minimum Ignition Energy (MIE) of a Dust Cloud in Air"	EN13821:2002
Minimum Dust Layer Ignition Temperature	Lowest surface temperature required to ignite a dust layer. Smoldering dust layers can lead to fires and can provide an ignition source for dust explosions.	Analysis and design of fire/explosion prevention and protection systems	E2021 - "Standard Test Method for Hot-Surface Ignition Temperature of Combustible Dusts"	EN50281-2-1
Percent Combustible Material (PCM)	Percentage of collected sample that is combustible.	OSHA Standard Test #3	– — –	– — –
Dust Burn Rate Screen Test (DBR - SCREEN)	Whether a sample can be classified as not readily combustible solid of Division 4.1.	EPA Method 1030	– — –	– — –
Dust Burn Rate (DBR)	Proper packing group (II, III) of a readily combustible solid within Division 4.1.	EPA Method 1030	– — –	– — –
Particle Size Analysis (PSA)	Laser diffraction analysis determines particle size distribution of test sample along with statistical measurements (mean, median, mode).	– — –	– — –	– — –

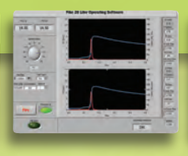
STANDARD LIQUID/GAS TESTS

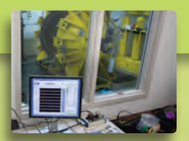
TEST	DETERMINES	APPLICATION	ASTM STANDARD	CORRESPONDING CEN STANDARD
Minimum Autoignition Temperature of Liquids (MAIT)	Minimum temperature at which a liquid will auto ignite when exposed to heat.	Analysis and design of explosion prevention systems	E659 - "Standard Test Method for Autoignition Temperature of Liquid Chemicals"	EN14522:2005
Gas Explosibility	Maximum pressure, P_{max}; maximum pressure rate-of-pressure-rise, (dp/dt) max; and deflagration index, K_{max}. Measures potential explosion severity of a fuel-air mixture.	Design of explosion protection systems	– — –	EN13673-1:2003 EN13673-2:2003
Limits of Flammability: Liquids and Gases	Upper Flammable Limit (UFL) and Lower Flammable Limit (LFL) of liquid or gaseous chemicals at ambient pressure and temperature.	Design of safety systems, process operations and information for publication in Material Safety Data Sheets	E681 - "Standard Test Method for Concentration Limits of Flammability of Chemicals"	EN1839:2003

SPECIAL TESTING SERVICES

TEST	DETERMINES	APPLICATION	ASTM STANDARD	CORRESPONDING CEN STANDARD
Limiting Oxidant Concentration: Gases and Vapors	Limiting oxidant concentration at elevated temperature and pressure.	Design of safety systems, process operations and information for publication in Material Safety Data Sheets	E2079 - "Standard Test Method for Limiting Oxygen (Oxidant) Concentration in Gases and Vapors"	EN14756:2006
Limits of Flammability: Elevated Temperature and Pressure	Upper Flammable Limit (UFL) and Lower Flammable Limit (LFL) of gaseous chemicals in air at elevated pressure and/or temperature pressure (>70°F, 1 atm).	Design of safety systems, process operations and information for publication in Material Safety Data Sheets	E918 - "Standard Practice for Determining Limits of Flammability of Chemicals at Elevated Temperature and Pressure"	– — –
Large Scale Tests	4, 5 and 10m³ vessels: Dust Collectors; Pipelines.	Application development and testing	– — –	– — –
Autigniton Temperature: Elevated Pressure	Autoignition temperature of liquid or gaseous chemicals in air or other oxidant at elevated pressure.	– — –	– — –	– — –
Bulk Resistivity Measurement Test	Electrical resistance of a powder.	– — –	– — –	– — –
Charge Relaxation Test	Measures the tendency of highly resistive powders to generate and retain electrical charge.	– — –	– — –	– — –







SAMPLE PREPARATION

Particle size distribution and moisture content of a dust sample can have a significant impact on its explosive behavior. Nearly all dust samples will contain some amount of fine particles which are more easily ignited. Combustion will also propagate more rapidly through fine particles than larger particles. For this reason, the ASTM standards recommend the testing of particles < 75µm. Dust samples can be tested "as received" provided the particles are small enough to properly disperse in the test apparatus (typically < 425µm). However, if fine particles are seen in the sample, the customer will be notified that the sample should be sieved to extract the smaller particle content for testing.

Fike also conducts a moisture analysis. Typically, the sample will be dried prior to testing if the moisture content is >5%. If this greater moisture content is representative of the process, the sample can be tested as provided, as long as it can be dispersed into a dust cloud within the test apparatus. In order to properly accommodate, prior arrangements should be made for testing samples at higher moisture contents.

CONTACT FIKE

Fike is a global team of experienced professionals dedicated to life and business safety. We work closely with our clients to solve highly complex problems with easy-to-use products and services.

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