

PULVERIZED COAL SYSTEMS

**Typical
Industries
Served**

Power

Steel / Iron

Cement

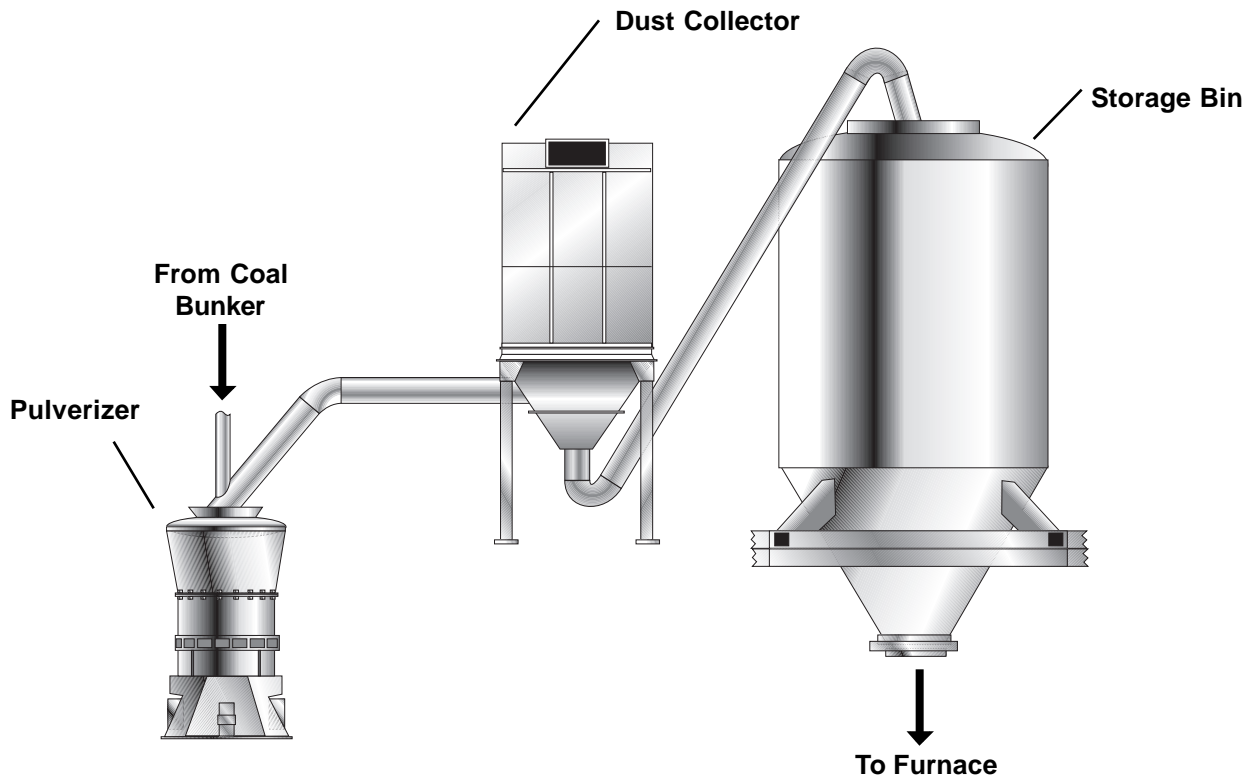


Figure 1: Schematic of a typical coal processing and storage system.

INTRODUCTION

The pulverization of coal to improve burning efficiency and maximize energy output is a method that has been used for more than 75 years. Pulverized coal processing and storage systems are typically found in power generation, steel and iron manufacturing, cogeneration, cement drying, and other industries that employ injection furnaces.

Compliance with the Clean Air Act Amendments (CAAA) of 1990 has moved many facility operators to switch fuels from high-sulfur (bituminous) coal to low-sulfur (sub-bituminous) coal to reduce emissions of sulfur dioxide and nitrogen oxides. Compliance with Phase II of the CAAA is required January 1, 2000.

For all its advantages, the pulverizing process, as well as the conveying and storing of pulverized coal, poses substantial explosion hazards. Many installations include some prevention strategies, such as inerting systems, but these systems only minimize the occurrence of explosions.

The purpose of this application guide is to provide an understanding of the possible explosion hazards and protection solutions for pulverized coal systems. This document is intended to be a guideline and is not applicable to all situations. If you have any questions, please contact the Fike Explosion Protection group or our sales representative in your area.

THE PROBLEM: DEFLAGRATION (EXPLOSION)

Coal has been pulverized (crushed) since 1924 to produce a more efficient fuel. The potential for explosions in pulverized coal processes is well known. Equipment such as crushers, pulverizers, and conveyors all contribute to the creation of dust. When this coal dust is suspended in air (in the pulverizer, conveying lines, bag filters, cyclones, and storage bins) and an ignition occurs, there is the potential for explosion.

The trend to switch to sub-bituminous coal (lower sulfur) addresses the environmental concerns, however the degree of explosion hazard is greatly increased compared to bituminous coal (See Table 1). In steel making, the conversion of using coal in lieu of coke also increases the potential for explosion due to the higher explosibility ratings for coal. (See Table 1).

This application bulletin outlines responsive protection strategies for the primary areas of explosion potential: pulverizing, conveying, and dust collection / storage.

Table One: Coal & Coke explosibility characteristics				
	Bituminous coal	Sub-bituminous coal	Coke	Ref.
Physical characteristics	Moderate dusting, relatively free flowing	Heavy dusting, cohesive, poorly flowing	Not available	1
Auto-ignition time	90 to 120 days	15 to 30 days	Not available	1
Auto-ignition temperature	870° F (466° C)	765° F (407° C)	Not available	1
K_{ST} (Explosibility constant)	129 bar-m/sec	209 bar-m/sec	47 bar-m/sec	2, 3
Dust Hazard Class	St-1	St-2	St-1	3
P_{MAX} (Maximum Explosion Press.)	133 psig (9.2 barg)	104 psig (7.2 barg)	110 psig (7.6 barg)	2, 3

REFERENCES: 1 - *Power Engineering*, August, 1994, "Fire protection considerations when switching fuels", by James B. Biggins; 2 - Determined by ASTM E1226 (ISO 6184/1) test methods at Fike corporation; 3 - NFPA 68

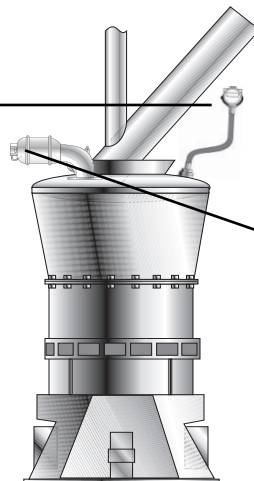
THE SOLUTION: PROTECTING THE PULVERIZER

Explosion venting of the pulverizer is not allowed per NFPA 8503, so this equipment is best protected by either containment (tested to 200 psi), or an Explosion Suppression System. System operation follows these steps:

DETECTION

1) When a deflagration begins, it is preceded by a pressure wave. Patented Fike pressure detectors sense these waves in one millisecond (.001sec.), and instantly send a signal to the control panel.

Note: Most systems require multiple detectors and suppressant containers



CONTROL

2) The control panel receives the signal and issues a command to the suppressant container in less than one millisecond.

SUPPRESSION

3) The suppressant container releases suppressant agent via a dispersion nozzle to suppress the explosion in a matter of milliseconds.

Figure 2: Pulverizer Protected by Explosion Suppression

PROTECTING THE CONVEYING LINES

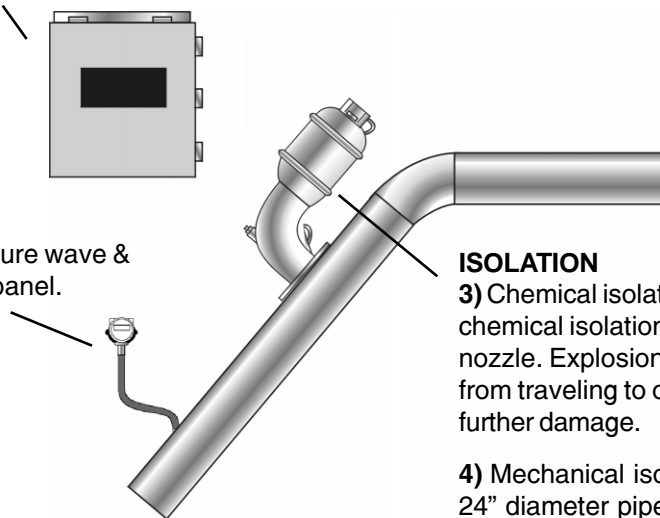
Connected ductwork is best protected by a Chemical Explosion Isolation System.
System operation follows these steps:

CONTROL

2) Control panel receives signal and issues command to suppressant container.

DETECTION

1) Detector senses pressure wave & sends signals to control panel.



ISOLATION

3) Chemical isolation container releases chemical isolation agent via dispersion nozzle. Explosion is isolated and prevented from traveling to other areas and causing further damage.

4) Mechanical isolation is an option for 24" diameter pipes and smaller

Figure 3: Chemical Isolation applied to conveying lines

PROTECTING THE DUST COLLECTOR / COAL STORAGE BIN

Dust collection and storage bins are best protected by either
1) Explosion Vents and/or an 2) Explosion Suppression System.

1) Explosion Vents are designed to open at a predetermined pressure setpoint. This relieves overpressure before destructive levels are reached.

2) Explosion Suppression System.
(Operation described in Figure 2.)

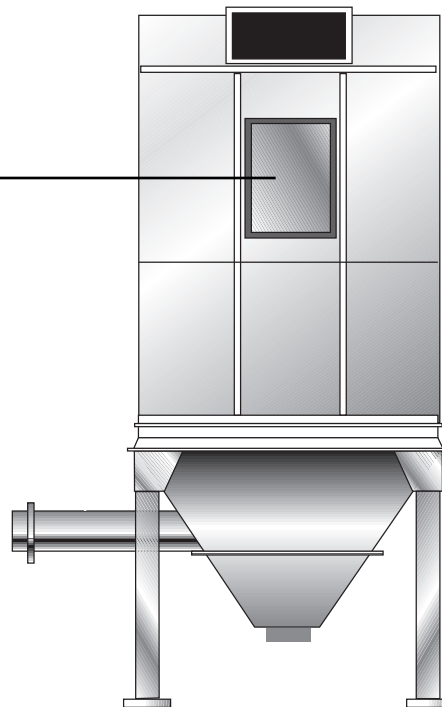


Figure 4: Dust collector protected by Explosion Vents

FIKE'S "TOTAL CONCEPT" APPROACH TO EXPLOSION PROTECTION

Fike's approach provides you with the protection options you need, based upon your specific process requirements, and your protection objectives. Leading the industry in technology, we are continuously pursuing optimization of our protection strategies, and developing new ones to meet our customer's needs. You can be sure of system reliability, compatibility, and effective explosion protection because Fike is the only "single-source" manufacturer in the world that can offer this comprehensive range of products and services.

Explosion Testing - A wide range of bench-scale, and industrial-scale tests to determine explosibility characteristics of process media, and to validate protection strategies

Explosion Venting – Relieves explosion overpressure conditions within process equipment, before destructive levels of pressure can be reached

Explosion Isolation – Mechanical or chemical barriers to prevent the spread of explosions through inter-connecting pipes or ducts

Explosion Suppression – Detects and extinguishes the explosion in its very early stages, before destructive levels of pressure can be reached

Field Service & Customer Training – Isolation and Suppression systems are active strategies that require periodic maintenance and inspection. Fike has the service capability to perform these functions for you, or a training option to qualify and certify your employees

Engineering Workshops And Seminars – An ongoing program to educate engineers, designers, and others in industry who are involved in, or concerned with industrial process safety.

Other Fike products and services of possible interest:

Rupture Disc – A pressure relief device, typically applied to a closed chemical process, will open at a predetermined pressure and temperature to prevent the bursting or explosion of the process

Fire Detection and Suppression Systems – Automatic systems to detect and extinguish fires in controlled environments, or special hazard areas, such as control rooms, auxiliary power station, chemical storage, etc. Typical agents used:

- CO₂
- HFC-227ea
- Water Mist

Detailed information for all these solutions, and locations of our global sales and support organization, are available through our web site at www.fike.com. For your convenience you may call us directly at (816) 229-3405, or e-mail your requests to fmppsales@fike.com.



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