CHEMETRON™ Fire Systems

CARDOX

CO_2

Application Bulletin

Carbon Dioxide Fire Suppression —

Blast Furnace Pulverized Coal Injection Systems (and other Coal Storage Systems)

The desire to move away from the production of coke, with its inherent environmental problems, has motivated the use of pulverized coal rather than coke in blast furnace operations.

In this operation, raw coal is stored, then ground and transported to a storage tank, then moved to feed tanks, distributed and injected into the blast furnace through the tuyeres. The drawing accompanying this bulletin illustrates such a system.

This operation is virtually identical to the Coal Grinding, Handling and Storage System as described in Industrial Facilities Bulletin #0785. (Applications Bulletin #0160 describes this application as it is used in the Cement Industry.)

A major difference can be the extensive use of inert gas in some of the process schemes offered. Blast furnace gas (essentially carbon monoxide) is burned, creating an inert gas that is fed into the grinding mill to convey the ground coal through to the collection equipment (cyclone or collector) and then to the pulverized coal bin (silo).

Nitrogen systems have been used to provide a cleaning system for bag filters, if a bag type dust collector is used to capture the pulverized coal. This nitrogen system is available to keep the plant inert when it is out of production, and to provide inert gas to be used in start-up and shut down. While nitrogen can be used to provide part of the inerting done by CO_2 in indirect firing systems, from a purely fire control point of view, carbon dioxide has some significant advantages over nitrogen from a fire protection standpoint. This is discussed in more depth later in this bulletin.

However, many systems use air to convey the coal. An air operated system requires lower capital costs.

The scope of fire protection required is best established following a Fire Risk Analysis, with which Chemetron Fire Systems can be of help.

CHEMETRON™ Fire Systems
A World of Protection

4801 Southwick Drive
Third Floor
Matteson, IL 60443
Telephone: 708/748-1503
Fax: 708/748-2847
email: info@chemetron.com

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Typical Installations

In the pioneering pulverized coal injection system of over 20 years ago, a 6 ton capacity Cardox low pressure CO_2 system was installed to protect the raw coal bunker, pulverizer, fluidized coal tanks, dust collectors and the motor control center.

In a somewhat different arrangement recently made at a Midwest USA mill, the installation of a 6 ton capacity Cardox system was made to protect just the pulverizer, weight feeder, ducts and dust collectors.

On a job in the Far East, CO_2 was used to protect the raw coal bunker, coal feeder, pulverizer, ducts, and filter house, as well as the pulverized coal reservoir and feeder tanks.

It has been noted that the systems we protected have used either pressurized mills or mills operating at a slight negative pressure, for which the CO_2 design varies substantially from one system to another. Consultation with Chemetron ensures that protection planning starts down the right path.

In all designs, there are portions of the PCI system that warrant consideration of CO_2 fire protection. The following application bulletins describe the techniques used in protecting the type hazard representative of the various segments of this process. (These techniques have been used for over 40 years in a wide range of applica tions .)

- Coal Grinding, Handling & Storage Systems, Industrial Facilities Bulletin #0785.
- Coal Storage Silos and Bunkers, Power Generation Bulletin #0040.
- Bag Houses (Bag Type Dust Collectors, Industrial Facilities Bulletin #0790.

Carb on Dioxide vs. Nitro gen

In evaluating inert gases, it is proper to compare nitrogen and carbon dioxide.

While CO_2 and nitrogen are both inert gases, the use of CO_2 for fire suppression for this type of hazard is well established. It is covered by an NFPA Standard (NO. 12, Carbon Dioxide Extinguishing Systems) which recognizes its ability to extinguish fires as may be experienced in coal mills, ducts, cyclones, etc. This Standard establishes system design criteria for many hazards. Hundreds of these systems have been installed, so design techniques are well established. No such standard exists for nitrogen.

Due to the difference in density between CO_2 vapor and air, it is substantially easier to control fires in stored coal by pushing CO_2 vapor through the coal with a continuous discharge in the event of spontaneous ignition of the coal. The discharge of CO_2 into this atmosphere creates an interface between the CO_2 and entrapped air; this interface rises to engulf the burning coal. Such is not the case with nitrogen, which has essentially the same density as air. Introducing nitrogen into the coal requires multiple injection points to ensure the inert gas envelops the burning coal mass within the silo.

CO_2 equipment is also approved by recognized authorities as are system control schemes. No such approvals have been obtained for nitrogen.

Other Applications

Other coal-use systems such as the production of hot metal from direct reduction iron in a melter-gasifier could also present problems in coal silos and feeders. Therefore, fire protection should be evaluated in these facilities as well.

Chemetron Fire Systems' Applications Engineering group is available to consult on requirements for specific installations of any type.

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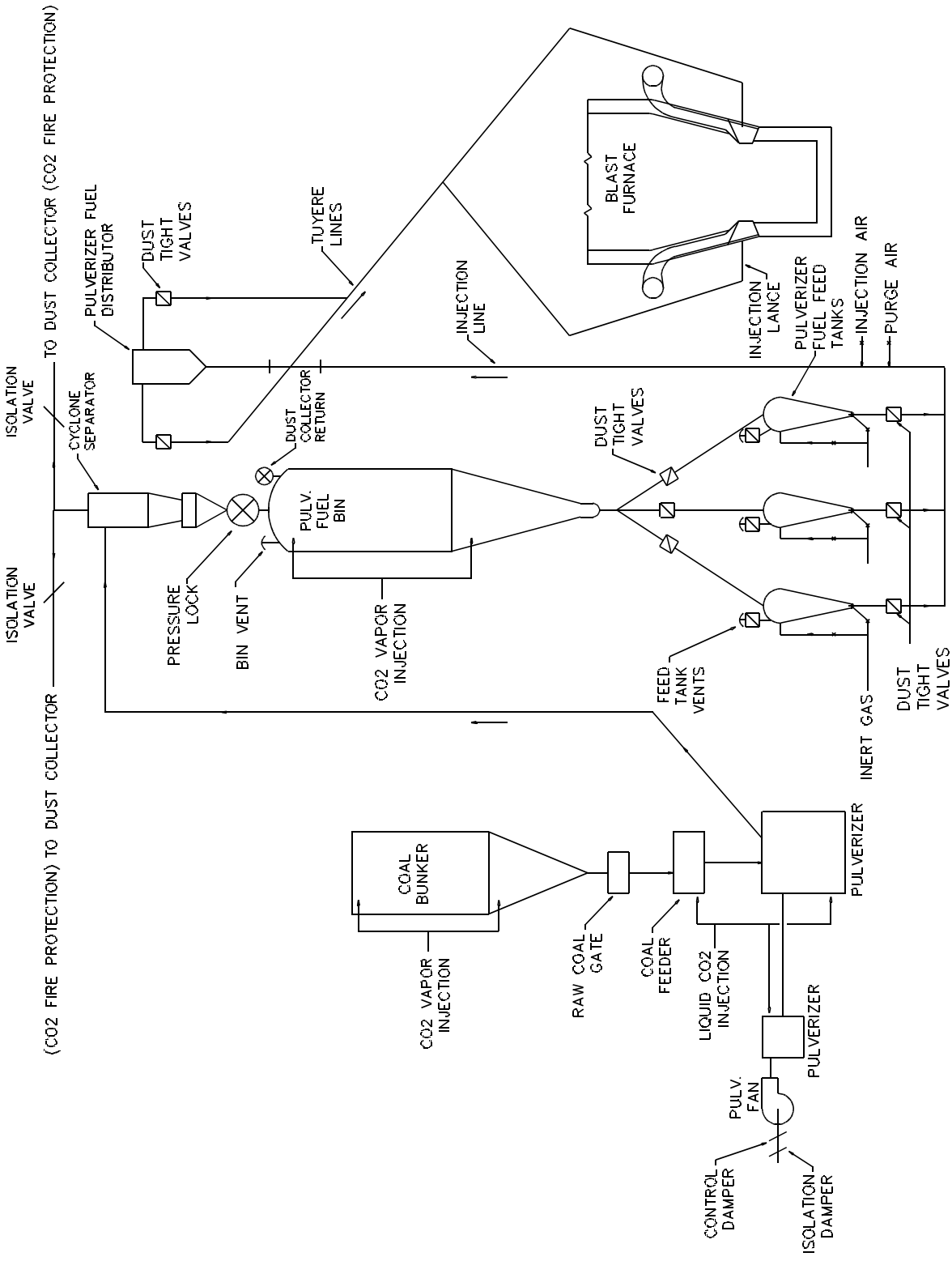

Blast Furnace Pulverized Fuel Injection System

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