

Industry Focus: Chemicals

Upgrading Dust Collection Systems for NFPA Compliance







This case study details the design and implementation of an NFPA compliant upgrade of client's dust collection systems for explosion and fire safety.

Client Overview

A personal products supplier was required by their insurance provider to upgrade their dust collection systems to make them fire and explosion safe within the parameters set forth by the NFPA. The existing dust collection equipment is located within the plant and did not have any fire or explosion safety devices installed, which endangered both employees and facility. Workers routinely work in the area or walk past the area that this equipment is installed.

Challenges Identified

The client needed an NFPA compliant solution that could be installed without major interruption of their production schedule. The system had to meet not only NFPA approval but also the strict requirements of the insurer (FM Global). Key challenges included:

- Equipment: The solution needed to be FM Global approved and NFPA compliant.
- Space constraints: The proposed solution needed to be installed within the space constraints of the existing equipment which occupies a very limited floor space.
- Maintaining consistency: There were 3 separate dust collectors and client would prefer to have the same equipment installed on all 3 to maintain commonality of spare or replacement parts.
- Installation: The solution needed to be implemented over a long weekend during production shut down.

A Passive Explosion Venting and Isolation System

The proposed solution featured an arrangement of an indoor flameless explosion relief vent along with inlet and discharge duct non-return flap valves to completely contain any explosion incidents within the dust collection room and not allow passage into the process room. The solution also included integration of dust collector fire suppression by integration into the plants' existing fire suppression system.

1. Flameless Explosion Relief Vent

- Function: To allow an explosion inside the dust collector to safely vent within the dust collection room without allowing flame passage.
- Design: A FM Global Approved indoor flameless vent was selected. This vent with flame quench tube to be located on the dirty air plenum on the side of the dust collector
- Benefits: This configuration allows the dust collector to remain inside the building. It allows an explosion to safely vent, while the quench tube rapidly cools and eliminates the resulting fire ball. This also limits the risk of deformation or destruction caused by an explosion.

Solution

2. Inlet and Outlet Ductwork Isolation Valves

- Function: To block a fireball resulting from an internal explosion from travelling down the ductwork into the processing room where plant personnel are present.
- Design: FM Global approved Non-Return Flap Valves (heavy duty check valve) were selected. These devices are activated by the pressure wave created by an explosion. This back flow pressure wave precedes a fire ball and closes the check valve not allowing the fire ball to pass into the duct network.
- Compact footprint: This design was chosen specifically for its minimal footprint. It was installed within the existing duct system.
- Safety Features: The Flap Valves have integrated sensors for flap position and for buildup of material on the flap. Activation of either sensor will send an electronic emergency shut down signal to shut off the dust collector and fan.
- Benefits: This passive design does not rely on high-speed electronics or detection equipment. It utilizes the pressure wave from a resulting explosion to trigger the safety system.

3. Fire Sprinkler System

- Function: To extinguish a fire inside the dust collector.
- Design: A glass thermal element sprinkler head was installed inside the dust collector strategically located between the filter elements. This fusible thermal element will allow water to flood the dust collector if the internal temperature exceeds 170F. A hopper drain will allow the sprinkler water to drain to the floor rather than build up inside the dust collector hopper.
- Benefits: This sprinkler will extinguish a fire resulting from a dust explosion and will also extinguish a deep seated smoldering fire to prevent it from becoming an ignition source to create a dust explosion.

Results

The equipment was installed over a 3-day weekend shut down. The system was tested and approved by the insurance provider and the local Fire Marshall.

Conclusion

- By implementing this passive explosion isolation system, the end user reduced their risk of having a disruption in production or personal injury to employees. Their employees feel safer knowing that a dust collector fire will be extinguished and a dust collector explosion will be safely vented without flame passage into their workspace. The project not only solved a major safety concern but also lowered the end user's insurance premiums.



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