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IS YOUR FLAP VALVE IN COMPLIANCE WITH NFPA 69-2014?

Introduction

Dust explosions can occur in dust collectors without warning and with devastating effects. Damage to equipment and facilities, coupled with the lost productivity due to process being shut down could cost millions of dollars. Even worse, employees could sustain serious or fatal injuries.

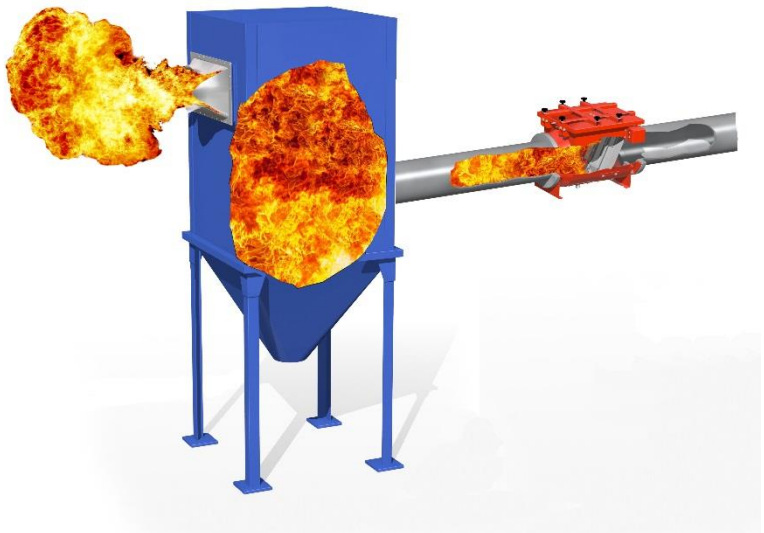
Five elements are required for a dust explosion to occur, all of which are typically present in dust collection equipment.

1) Fuel, which in this case is a combustible dust.
2) Oxygen or another oxidant must be present.
3) The dust must be dispersed at or above the minimum explosible concentration.
4) An ignition source must be present (electrostatic discharge, spark, glowing ember, hot surface, friction heat, flame) with a temperature above the auto ignition temperature of the dust.
5) Confinement, which is provided by the dust collector itself.

A deflagration occurring in a dust collector can also propagate through interconnected ductwork to upstream or downstream equipment and cause subsequent explosions in the adjacent equipment. Testing has shown that subsequent explosions in interconnected vessels are much more severe than the explosion in the original vessel due to pressure piling effects and the high flame speeds travelling through the ducts.

Explosion isolation systems are used to prevent dust explosions from spreading from the primary explosion site to other interconnected processes. According to NFPA 654–2013 Section 7.1.4, where an explosion hazard exists, isolation devices shall be provided to prevent deflagration propagation between pieces of equipment connected by duct work. One method used to provide inlet isolation of dust collectors is the use of flow–actuated flap valves.

Flap valves are suitable as an isolation device on the horizontal inlet ducting upstream of a dust collector. Within the valve, there is a flap blade that rotates on a shaft and allows the valve to open and close. When process air flow is on, the flap blade rotates open.



When process air flow is off, the flap blade rotates closed. During a deflagration, the flap blade relies on the pressure wave developed by the propagating deflagration to rapidly close the flap valve and prevent flame propagation upstream of the protected

vessel. Minimum and maximum mounting distances from the valve to the inlet of the dust collector are determined by the manufacturer and confirmed through independent third-party testing.

The popularity of flow actuated flap valves has been on the rise in recent years due to their low installation, maintenance, and monitoring costs, as well as the fact that they do not require explosion detection devices or control systems.

In order to provide minimum prescriptive guidance on the design and application of this isolation technique, the 2014 edition of NFPA 69 has been revised to include a section on flow actuated flap valves (Section 12.2.3). This new section details flap valve design criteria and system design, application limits, and system certification requirements.

IEP Technologies has released the ProFlapPlusIII flap valve, which was designed specifically to meet the new requirements of NFPA 69-2014. Below are additional details on how the ProFlapPlusIII can help you comply with these new NFPA requirements.

Flap Blade Locking

A locking or latching mechanism is required for the flap blade to prevent it from reopening during a deflagration event. The pressure wave from a deflagration could cause the flap to reopen or bounce as it closes against the valve. If there is flame present in the ductwork or in the dust collector, an unsecured flap blade may allow flame to travel past the flap, and ignite additional material upstream, leading to secondary explosions in other process vessels. The ProFlapPlusIII is equipped with a locking mechanism that locks the flap blade in the closed position during a deflagration, and stops flame from travelling down the ductwork. The locking mechanism also locks the flap blade in the closed position when the process is turned off. During start up, the locking mechanism is energized, releasing the flap blade and allowing the valve to fully open.

Process Interlocks

NFPA 69-2014 states that the flap valve must provide a means to signal an immediate shutdown of the process should the valve close due to a deflagration condition. This is needed in order to ensure that the process does not feed material that could fuel additional explosions and/or post-explosion fires that may exist. The ProFlapPlusIII uses a sensor to monitor the position of the flap blade in order to determine whether a deflagration has occurred. The sensor is typically wired into a PLC or interface panel, which will initiate an immediate shutdown of all process equipment, and turn on notification appliances such as lights, buzzers, or horns if an explosion were to occur.

Continuous Monitoring

While your process is running, there is a possibility that dust accumulations within the valve could prevent the flap blade from fully closing if a deflagration were to occur. When process airflow is on, the flap blade is up in the “open” position. During a deflagration, the flap blade rotates on its shaft to the

"closed" position. Dust accumulations on the bottom of the valve could prevent the proper rotation of the flap blade from the "open" to the "closed" position and allow flame and burning material propagation upstream of the valve, which could fuel secondary explosions. For this reason, NFPA requires that a continuous signal is provided in order ensure that the operation of the valve is not compromised by the accumulation of dust in the interior of the valve. The ProFlapPlusIII is equipped with an accumulation sensor on the bottom of the valve to sense dust deposits. The sensor is typically wired into a PLC or interface panel, which will initiate an immediate shutdown of the process if dust deposits are detected.

The sensor sensitivity is easily adjustable and can sense a wide range of materials and thicknesses. Sensitivity adjustment is an important feature that can be used to eliminate nuisance shut downs of the process, such as when minor material accumulation is detected that will not affect the closure of the flap blade.

Some flow-style flap valves rely on sensing the flap blade position to meet the NFPA continuous accumulation monitoring requirements, but this is does not necessarily make them compliant with NFPA 69-2014.. Sensing of the flap blade position is only an indication of whether the flap blade is open, as should be the case while your processing is running, or closed, which should occur either during a deflagration or whenthe process is not running. It cannot determine if dust accumulation inside the valve will prevent the valve from closing fully or continuously detect for dust accumulations while the process is running. Increasing the inspection frequency also does not qualify as continuous accumulation monitoring, for the simple reason that it is not continuous. By using only a flap blade position sensor, there is a risk of material accumulating inside the valve and affecting its proper operation.

The only alternative to the continuous accumulation monitoring requirements is a documented risk assessment along with an appropriate inspection protocol and frequency that is acceptable to the authority having jurisdiction (AHJ), per NFPA 69-2014 12.2.3.4.5.2. A risk assessment is difficult to provide given the many variations in process operating conditions which include material, particle size, humidity, temperature, and airflow. It also requires an increased inspection frequency in order to ensure there is no dust accumulation within the valve. The inspection requires the owner to shut down the process, access and open the valve, and visually inspect the inside which could be difficult given the physical location of the valve. Also, both the risk assessment and the inspection protocol and frequency must be acceptable to the AHJ, which has usually not been determined at the time the valve is purchased.

System Certification

Per NFPA 69-2014, the isolation system design methodology and application range must be supported by appropriate testing, and certified by a recognized testing organization acceptable to the AHJ. The ProFlapPlusIII has been tested and is certified by a recognized testing organization for the application limits of the valve which include minimum and maximum location distance, Kst values, and air flow requirements.

Of particular interest is the minimum Kst testing requirement. Very often, manufacturers test the maximum limits of the flap valve during certification testing, and pay little attention to the minimum Kst requirement. The problem with this approach is that the flap valve is dependent on the pressure

wave from the deflagration to close the flap blade, under the full range of deflagration conditions. During an explosion, the pressure wave travels faster than the flame and closes the valve before the flame front reaches it. For a low Kst or lean dust/air mixture explosion, there is a risk that the pressure wave is not strong enough to close the flap blade before the flame front reaches it, which would allow the flame to propagate upstream of the valve and potentially cause secondary explosions. That is why both the minimum and maximum tested operational limits of a flap-style valve must be determined and adhered to.

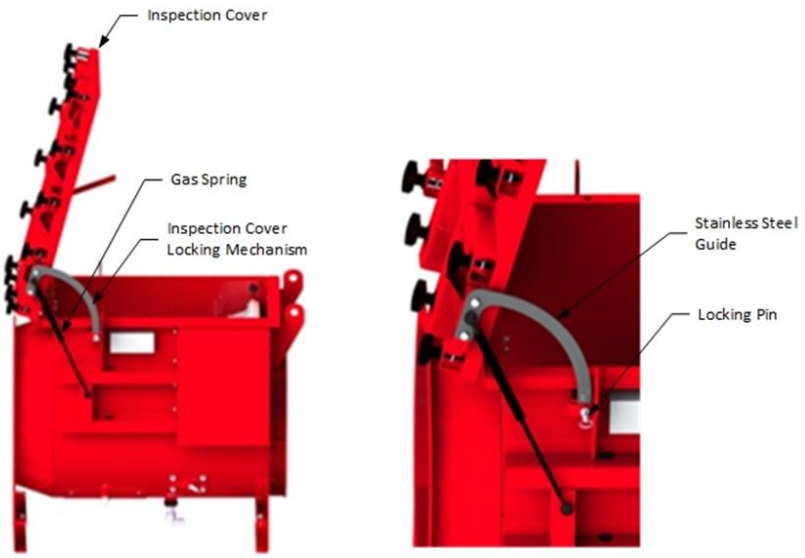
Inspection & Maintenance

NFPA 69-2014 requires that an explosion protection system is inspected and tested every three months. The inspection interval may be increased or decreased based on documented experience or a documented hazard analysis, but only with approval from both the explosion protection system designer and the AHJ.

For inspection and maintenance, the ProFlapPlusIII incorporates a hinged cover for access to the interior of the valve. The cover is easily opened by loosening a set knobs which are retained in the cover and cannot come loose or fall out, important features for valves that are in difficult to access locations. Other style flap valve covers are bolted in place, and require the use of hand tools to loosen the bolts and remove the cover. This could pose a safety hazard for maintenance personnel trying to open the valve in order to access the interior of the valve, especially when the valve is located in a difficult to access location.

Also, the larger size flap valves are more difficult to inspect and service. The larger the valve, the larger and heavier the inspection covers are, which pose additional hazards for maintenance personnel. They are heavy, difficult to remove, and often require multiple personnel to perform the inspection. Two people will be needed to lift or open the covers, and one will need to hold it in place while the other performs the inspection.

The larger-size ProFlapPlusIII eliminates these issues by incorporating a gas spring assisted lifting mechanism, which allows one person to lift the cover easily. It also includes a tether and spring loaded locking mechanism. Once the cover is rotated to the fully open position, it is locked in place, eliminating the risk of the cover inadvertently closing and causing injury to personnel while performing inspections and maintenance. To close the cover, simply release the spring loaded locking mechanism. The gas spring prevents the cover from slamming closed and allows maintenance personnel to gently close it and secure it to the valve body.



The monitoring sensors of the ProFlapPlusIII also make inspection and maintenance of the valve much easier to perform. To inspect the proper closing of the flap blade, the process air conveying fan is shut down. As the process winds down, the flap blade will rotate closed and the deposit sensor will sense the position and provide an indication to the interface panel or PLC. If the interface panel shows an alarm condition, further investigation is required. If the interface panel does not show an alarm, no further action is needed.

The ProFlapPlusIII also incorporates an optional wear and tear sensor which continuously monitors the interior of the valve and provides an indication if excessive wear is present. The sensor will provide a trouble condition, which could be an indication of excessive wear on the interior of the valve and/or the flap blade, which must then be inspected. Without this sensor, it possible for the flap blade to erode from product impingement without warning to the operators, leading to a risk of failure during a deflagration event and subsequent flame progagationand secondary deflagrations upstream of the valve.

Summary

The ProFlapPlusIII is the only flap-style isolation valve that fully complies with the new requirements of NFPA 69-2014 without having to resort to special review and approval by the Authority Having Jurisdiction. It is the only valve that provides continuous monitoring for dust accumulations, flap blade locking, and the process interlock functions required by NFPA 69-2014. It has been designed to allow for safe and easy inspection and maintenance access, and its monitoring sensors provide an indication of any trouble or alarm conditions that could occur during operation. These features, along with the foundation of IEP Technologies' 60 plus years of expertise in explosion protection, make the ProFlapPlusIII the logical choice for passive explosion isolation needs.

Click here for a copy of the ProFlapPlusIII datasheet (MC-582W), or visit our website at www.IEPTechnologies.com.

For additional information please contact Sales@IEPTechnologies.com, or call our main number at (855) 793-8407.