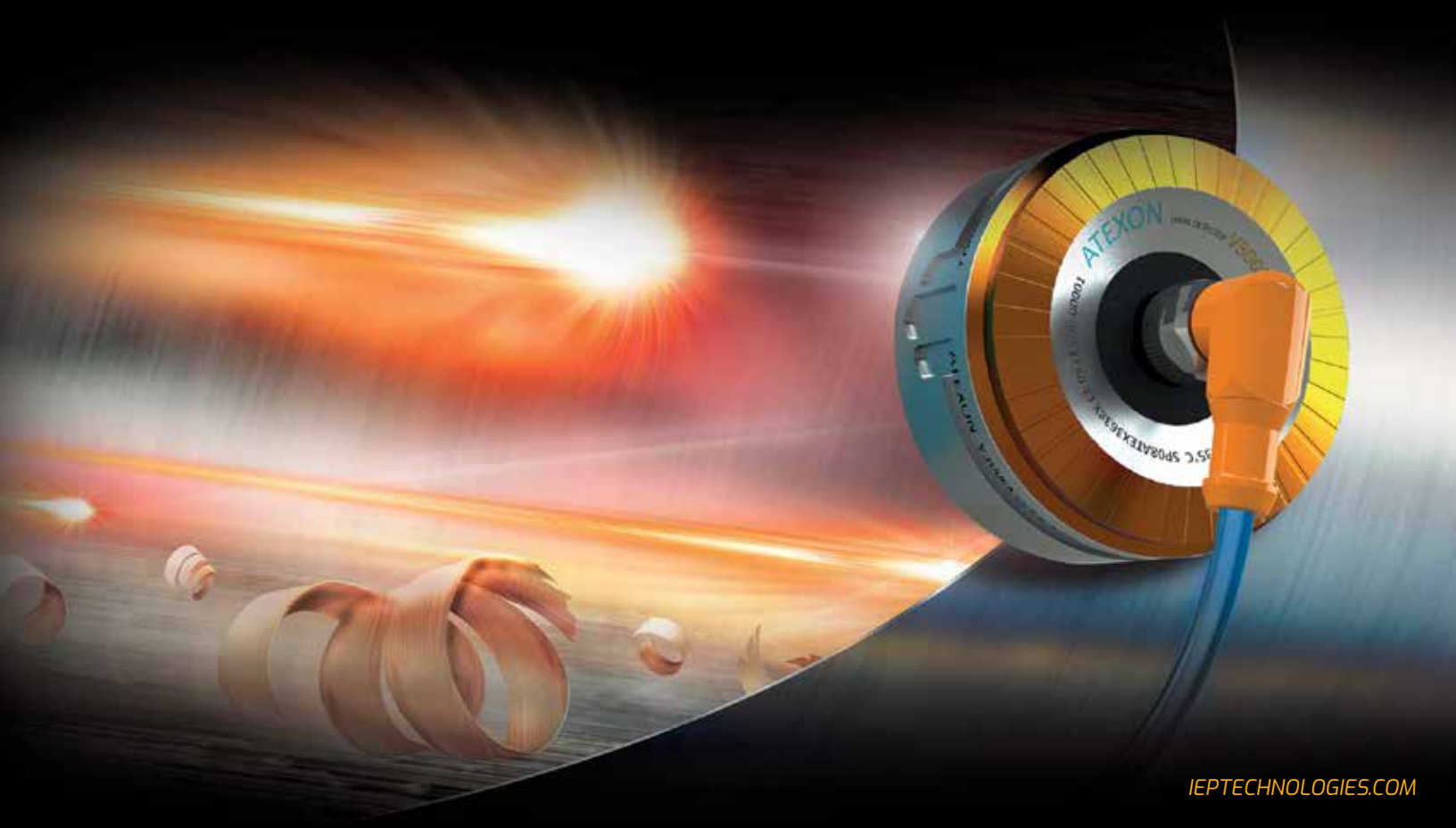




Detecting Sparks Before They Become Explosions

*Atexon® automatic spark detection and extinguishing systems
by IEP Technologies*





Dust Explosion Hazards in an Industrial Process

Combustible dust-air mixtures often occur in pneumatic and mechanical transfer systems handling particulate solids, such as dust collection systems. Vessels receiving this material are at risk of dust explosions. Ignition sources generated in other areas of the process are often carried to these collection areas through the transfer duct, chute or conveyor where they can find the right conditions to initiate an explosion.

A dust explosion can cause a sudden pressure increase of up to 10 bar increase if unmitigated. Such over pressures from dust explosions can rupture filters, the process equipment, as well as put employees' safety at risk. If the pressure wave from an initial explosion is unmitigated it can lift/disturb more dust into the air which if ignited creates a far more devastating secondary explosion.

All organic dust, i.e. dust containing carbon, may be explosive if its particle size is smaller than 0.5 mm.

Elements needed for a dust explosion:

- Combustible dust-air mixture in an enclosed volume
- Oxygen is present in the environment
- An ignition source (e. g. a spark, ember, static electricity)

Characteristics of a dust explosion:

- A flame front which can accelerate up to sonic velocity
- Can cause up to 10 bar increase in pressure.

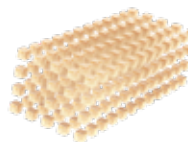
Why does dust explode?

Once ignited a combustible dust-air mixture burns very rapidly due to the large surface area of the dust cloud. The energy is released rapidly as a result of combustion. Temperature can rise to $\sim 1800^{\circ}\text{C}$ and if in an enclosed volume, can cause a high pressure increase according to Charles's thermodynamic law. The pressure increase will discharge from the weakest point of the enclosed volume and often causes an even more dangerous secondary explosion.

The image below shows the surface area of wood and its impact on combustibility.



Chopped wood surface area 0.3 m^2 (3.2 ft^2)



Chopped wood sawed into cubes of 1 cm surface area 5.4 m^2 (58.1 ft^2)



Chopped wood ground into dust surface area $1,080 \text{ m}^2$ ($11,625 \text{ ft}^2$)

Operating principle of a spark detection and extinguishing system

Atexon® spark detection and extinguishing systems by IEP Technologies are designed to protect industrial processes by reducing the risk of ignition sources, such as embers, from reaching protected equipment. The system detects sparks and extinguishes them automatically without interrupting process operations. The small amount of water extinguishant used, approximately five liters, will greatly limit any interruption to filters or other production machines. Once the ignition source has been mitigated, the system automatically resets to normal operations and is ready to extinguish additional ignition sources.



*A typical protected system**

Operation of Atexon® spark detection system

1. The spark detector response time is only a few milliseconds.
2. The extinguishing unit can extinguish detected ignition sources using only a small amount of water.
3. The signal router controls and monitors the extinguishing event.
4. The control panel monitors the status of the system.
5. The siren/ strobe will alarm in the case of an extinguishing event.
6. The fan controller stops the fan in case of overheating or a spark shower.
7. The overheat sensing cable monitors the temperature of the motor cooling fan, the fan bearings and the fan casing.
8. The pressure booster controller supervises the water pump and the heat tracing cables if installed.
9. The pressure booster station ensures the correct delivery pressure and prevents pockets of air in the extinguishing water.

Control Units



AXN18 Control Panel

Atexon® AXN Series Control Panel — Effective protection industrial process lines

The easy-to-use AXN spark and extinguishing series control panel comes equipped with a user-friendly interface, large LCD display, Ethernet-based remote user communication, and enough memory to log thousands of extinguishing events. The AXN control panel series is installed using Furthermore, the use of serial bus communication throughout the ATEXON® spark detection and extinguishing system reduces both cabling to the AXN control panel and associated installation costs.

The AXN18 control panel allows for system expansion up to 18 protection zones, 54 spark detectors, three fan controllers, three pressure booster stations and connections for a multitude of gas, flame, and heat sensors, providing protection for a wide variety of industrial processes.

The AXN18R has an expanded relay bank that provides alarm and trouble notifications to your PLC for each zone in the system.

The AXN4 control panel is available for smaller industrial processes requiring up to four protection zones.



Pressure Booster Controller

Pressure Booster Controller

The pressure booster controller controls the pump and tank system to provide water at a sufficient pressure given the wide range of challenging environments. An integrated heat tracing option provides cost-efficient heating for water pipes in cold conditions without the need for additional thermostats or electrical inputs.

Connections for a wide variety of sensors including:

- Extinguishing water pressures (low and high)
- Double verification of external temperature for heat tracing operations
- Monitoring dry running and running time of the water pump
- Water-flow monitoring and control



TR6-EX Fan Controller

TR6-EX Fan Controller

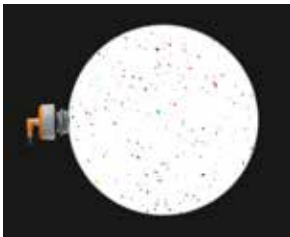
When an alarm is triggered, the TR6-EX fan controller can be configured to stop the production process. Alarm threshold values are easy to set from the user interface of the AXN control panel. A single fan controller can monitor up to six different fans or other process machinery.

The TR6-EX fan controller's integrated overheat detection function, allows for additional protection of equipment. The overheat sensor connections can be used to monitor fans and other electrical devices for overheating. Overheat sensors detect temperature increases from the fan bearings, the motor cooling fans and from the fan perimeter. Monitoring of the fan provides overheat protection and shutdown.

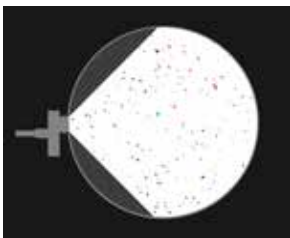
SD300-EX series spark detectors



SD300 - EX Spark Detector



The FOV of the SD300-EX does not
have blind spots



A typical spark detector

Advanced spark detection technology

The Atexon® SD300-EX (standard) and SDF300-EX (daylight insensitive) Spark Detectors by IEP Technologies are designed to detect ignition sources such as sparks, hot particles, and embers, in a conveying path such as a duct, chute, or mechanical conveyor, and signal an Atexon Spark Detection and Extinguishing System to initiate a water spray, helping prevent the ignition source from starting a fire or explosion.

The SD300-EX and SDF300-EX Spark Detectors feature a best-in-class 180-degree field of view (FOV) perpendicular to the direction of material flow, which ensures reliable detection of ignition sources within high-speed material flows without blind spots. The SD300-EX and SDF300-EX Spark Detectors are an excellent choice for facilities across various industries that wish to protect their process lines from potential ignition sources.

When it comes to detecting ignition sources with optimum efficiency, it is crucial to consider all electromagnetic radiation emitted within the target detection area. The Atexon® SD300-EX Spark Detector takes this into account with its extraordinary broad detection spectrum. It can measure visible sparks through material layers and hot particles with the same single detector. A broad detection spectrum coupled with a wide 180-degree viewing angle provides the best available technology for detecting ignition sources in process lines.

Features

- 180-degree field of view
- Multi spectrum detection VIS/NIR/IR
- Flat and well-protected lens structure
- High abrasion resistance
- Stainless steel housing (AISI 316L)
- Multiple mounting options

Product variations

- SD300-EX standard spark detector
- SDF300-EX IR only spark detector - Filters out visible light for locations requiring daylight filtration
- Optional protection tube adapter is available for ATEX zones 20/21

Installation equipment

- Quick-mounting adapter (no need for welding)
- Mounting adapter with air purge functionality
- Straight and angled ATEX-compliant sensor cables



Thread-On Mounting Adapter



Weldable Mounting Adapter



Weldable Mounting Adapter with Air Purge

Extinguishing Units



EXT11-EX Extinguishing Unit



EXT12-EX Extinguishing Unit



EXT22-EX Extinguishing Unit



Insulation jacket of extinguishing unit

Atexon® extinguishing units have been purposely designed for pneumatic transport duct systems operating at very high speeds.

Atexon® extinguishing units help prevent dust explosions and fires by automatically extinguishing detected sparks. The EXT11, EXT12 and EXT22 extinguishing units have been designed for pneumatic transport duct systems moving material at very high speeds. Upon detection, a small amount of water is sprayed into the process, extinguishing the hazard without damaging the protected processing equipment. Extinguishing stops automatically a few seconds after the last spark has been detected.

Features

- Fast acting solenoid valve
- Integrated strainer
- Electronic ball valve position monitoring
- Flow monitoring
- Real-time extinguishing water temperature monitoring.

Nozzles Optimized for Your Individual Process

- Self cleaning spring loaded
- High flow chute nozzles



Self Cleaning Spring Loaded
Stainless Steel Nozzle



Self Cleaning Spring Loaded
Brass Nozzle



High Flow Nozzle



Specialized Water Nozzles

Outdoor installations

A heat-tracing system can be utilized to allow our extinguishing units to be mounted in cold outdoor climate areas. The heat tracing functionality is controlled by a pressure booster controller, which monitors real-time outdoor temperatures using two separate temperature sensors. The supply voltage of the heat tracing is monitored, and all power supply failures trigger an output alarm.

An insulation jacket of the extinguishing unit is also designed to protect the extinguishing unit from the effects of adverse weather conditions.

Protecting dust collection systems

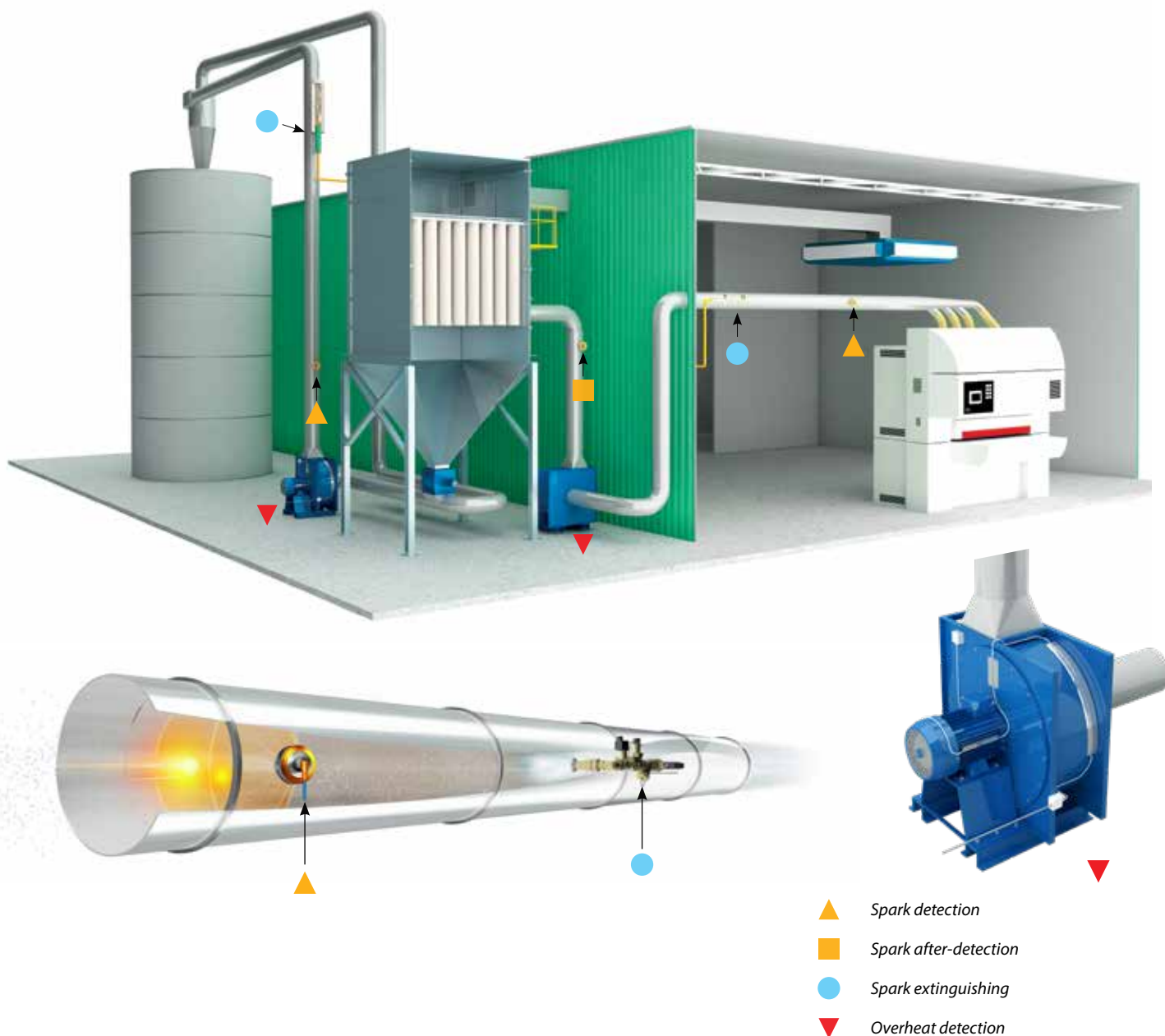
Explosive dust-air mixtures often form inside dust extraction systems. Such mixtures can be ignited by sparks, embers, hot objects or static electricity. Usually these ignition sources are caused by a damaged blade, a wedged foreign object, resin collected on the fan blades or poor machine grounding. In the woodworking industry, many fires are caused by an overheated machine due to bearing failures or blocked ducts in the fan.

A dust explosion and burning material can advance into a dust silo or travel backward through a return air duct into the production area. Dust collection system fires can pose a grave danger to employees and usually cause a lengthy production outage.

Reducing risk factors

A spark detection and extinguishing system is designed to suppress sparks and embers traveling through the protected process duct work, reducing the risk of them reaching interconnected vessels downstream of the protected area. It is important to protect all ducts, as an ignition source does not always reach the filter through the same duct as the explosive mixture of dust.

The Atexon® spark detection and extinguishing system is available with an integrated overhear function that senses the temperature increase of each fan from multiple locations.



Protecting conveyors

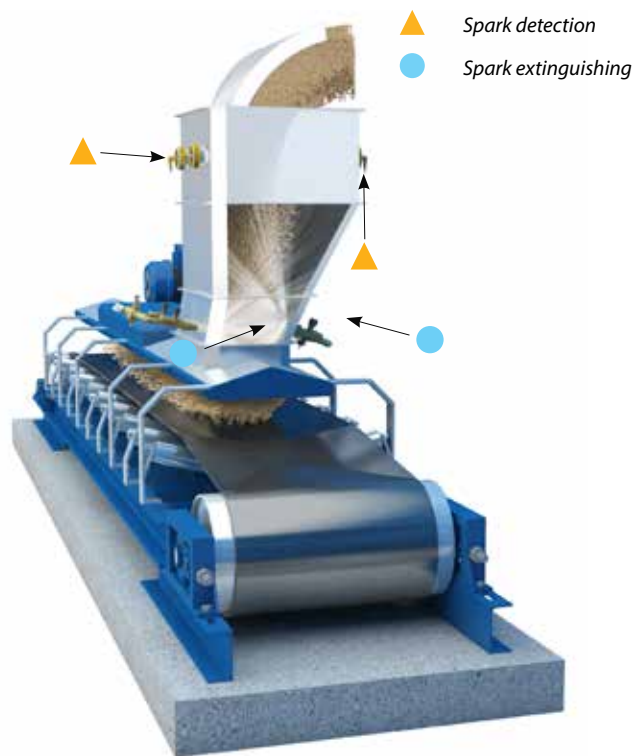
Mechanical movement greater than 1 m/s can cause sparks. A bearing fault or a wedged object inside the conveyor system can cause friction and a rise in temperature, which in turn can cause a spark, leading to a potential fire or dust explosion.

Other risk factors include static electricity, foreign objects inside the conveyor system, and the overheating of electrical motors.

Reducing risk factors

When conveyor systems are being protected, a key objective is to implement both detection and extinguishing at the location where the material is dropped down by gravity and simultaneously mixed with air. This is the point at which the material is at its lowest concentration and radiation from possible ignition sources can most easily pass through the material flow and reach the spark detectors.

The Atexon® spark detection and extinguishing system can be used to protect a wide variety of different conveyor structures. Typical target systems include belt and scraper conveyors and screw feeders.



Protecting bucket elevators

Bucket elevators that transport material to higher levels pose numerous risks that may cause a dust explosion or fire. Typical ignition sources include sparks caused by the displacement of a drive shaft, embers caused by abrasion, bearing failure and hot particles advancing inside the material flow.

Reducing risk factors

Much like with other conveyors, the Atexon® spark detection and extinguishing system is installed in the feeding and discharge chutes where the material is mixed with surrounding air.

The spark detector is designed to detect sparks in milliseconds and immediately trigger the extinguishing unit. The typical duration of the extinguishing event is five seconds. If multiple, consecutive sparks are detected, the system is designed to shut down the elevator.

If the process does not tolerate water, the material flow can be redirected out of the conveyor system during the extinguishing process.



Protecting pellet plants

Pellet manufacturing processes, such as the drying, grinding and pelletizing of material, can pose a significant fire hazard. In addition, these processes generate highly refined combustible dust creating the perfect conditions for an explosion.

A hammer mill grinds the raw material down to the required size for pelletizing. Any foreign objects fed into the hammer mill, such as rocks or pieces of metal, can cause sparks, which in turn can cause a fire or a dust explosion downstream inside a conveyor system or silo.

Elevators that transport the combustible material can also be sources of ignition, for example when a drive shaft becomes misaligned or when a bearing fails.

Pellet mills usually operate at a process temperature of approximately 100°C. However, if the pressed material

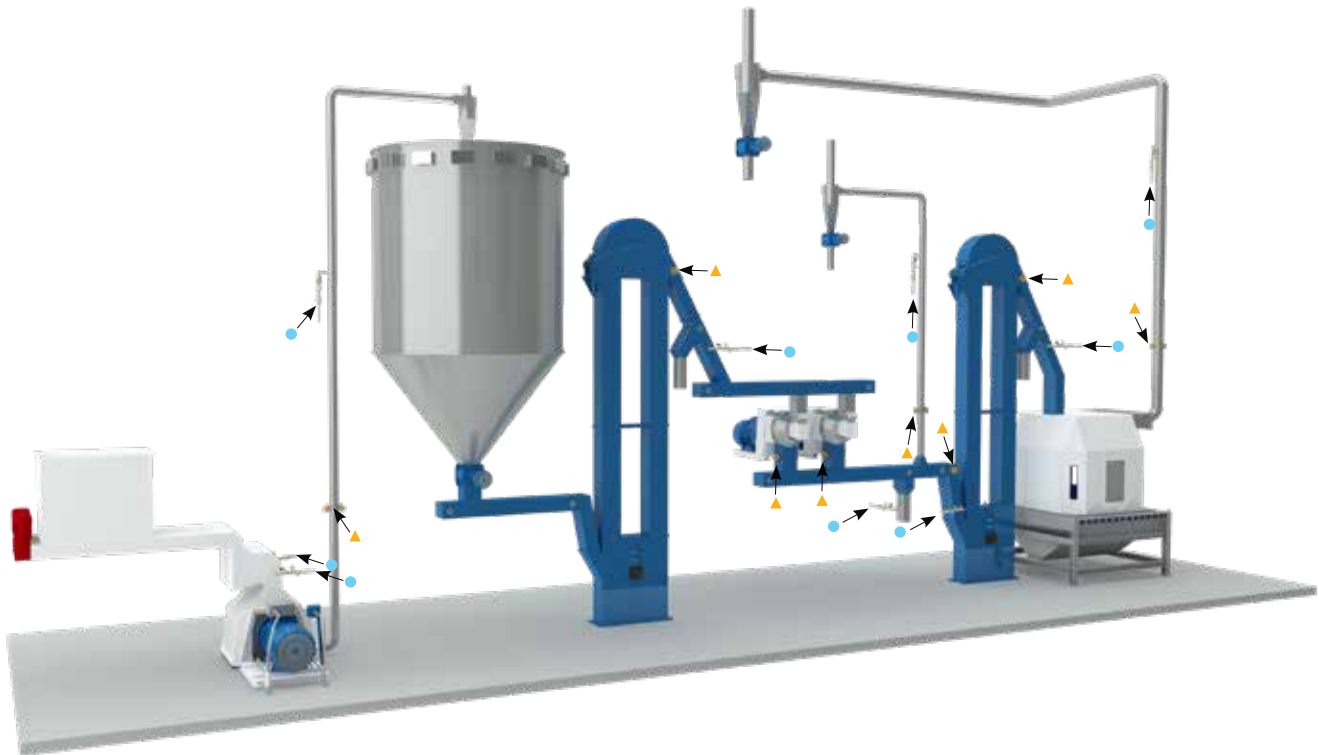
doesn't move out of the press fast enough, this temperature can rise quickly. If ignition sources manage to reach the pellet cooler, the significant airflow it employs provides ample oxygen which helps any fire event to develop.

Reducing risk factors

The Atexon® spark detection and extinguishing systems are designed to mitigate the risk within a variety of areas within the pelletizing process. Water extinguishers cool ignition sources effectively.

All pneumatic transport ducts and humidity removal and cooling ducts can be equipped with a spark detection and extinguishing system.

- ▲ Spark detection
- Spark extinguishing



[illegible]



The Next Step

You can't afford to let a spark threaten your facility. Let us work with you to keep industrial explosions from impacting your bottom line. Call IEP Technologies today.

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