Anhydro®

IMPROVING SPRAY DRYER PLANT SAFETY

Monitor – Warn – Prevent – Mitigate

SPXFLOW®

PROTECTING YOUR PEOPLE, PLANT AND COMMUNITY

Because of the volatile nature of certain organic powders in relation to ignition sources, modern spray drying plants must consider several safety issues. For example, each plant requires a unique design to ensure higher rates of safety. Additionally, the supplier, customer and local authorities must work together to evaluate and ensure all safety requirements are met to protect personnel, equipment, and the environment.

Risk Ranges for Pressure Induced Dust Explosion

There are several areas of legislation which apply to spray dryer plant manufacturers:

- The Machine Directive 2006/42/EC gives safety precautions relating to mechanical construction of the plant.
- ATEX Directive 94/9/EC Annex 1 describes equipment safety classification zones. All products supplied into potentially explosive atmospheres within the EU must comply. Each area of the spray dryer is classified to determine where there is the highest risk of explosion.
- VDI 2263 (re-issued in December 2011) and the corresponding EN 14491 describe the safety evaluation required when constructing a spray dryer and the ATEX zones in the various parts of the plant.

Based on the assessment of materials, processes and applications, each spray dryer is individually designed to resist the required maximum pressure while providing adequate explosion suppression or relief areas to safe zones with rupture discs on the drying chamber.

The good news is that existing or even aging spray drying plants can be upgraded to comply with the latest safety guidelines. All SPX FLOW equipment deployed in the European Union which is used in potentially explosive atmospheres are ATEX certified.

POWDER CLASSI FICATION (PRESSURE RISE VELOCITY)		
CLASS 1	**CLASS 2**	**CLASS 3**
Kst range: 1 – 199 bar m/s Low risk	Kst range: 200 – 299 bar m/s Medium risk	Kst range: > 300 bar m/s High risk

Industrial powders are classified into low, medium and high risk categories.

MINIMISING RISK OF DUST EXPLOSION

Without a comprehensive plant safety program in place, a powder explosion has catastrophic effects. Modern safety programmes integrate systems and procedures for monitoring, warning, preventing and mitigating safety breaches. SPX FLOW solutions address each of these critical areas to eliminate potential hazards through the following:

Visual Cameras

Monitor nozzle atomisation and enables early action to avoid unnecessary shutdowns.

CO Detection Systems

Monitor for presence of excess CO and warn of potential fire or explosions.

Suppression Systems

Reduce risk of post-deflagration thermal events in plants with high Kst values by applying chemical suppressants.

Explosion Membranes

Reduce risk of post-deflagration thermal events in plants with high Kst values by rupture disk technology for chambers and filters.

Reinforce aging chambers to support explosion membranes

Some adjustments may help prevent explosions by CO detection system and Visual Camera. Others will help mitigate problems by monitoring chamber outlet temperature to shut down the plant at pre-set alarm or to activate fire extinguishing functionality.

Fire Extinguishing Systems

Mitigate disasters by shutting down a plant or activating water when a process reaches a certain temperature.

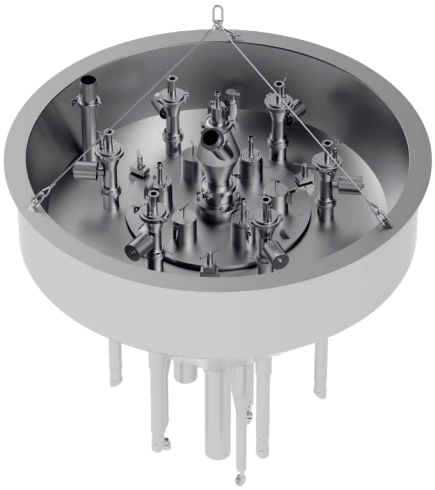
ATEX Regulation

Standard zoning for the best explosion protection.

MONITORING NOZZLE PERFORMANCE

Video Monitoring System

Spray nozzle malfunctions could be an indicator of potential danger. If a nozzle is leaking or powder has built up on it, you should identify the cause and correct the situation ASAP. SPX FLOW offers video monitoring systems that provide 24/7 surveillance for these scenarios.



Our solution is simple - we position multiple cameras inside of your air distributor that provide constant surveillance of the spray zone. This enables operators to monitor nozzle atomization. The operator can even change the view of the control room with a keyboard. And, if maintenance or replacement is necessary, operators can separate it from its support easily. For newer dryers, SPX FLOW also offers side-mounted cameras for even more control.

In addition to the operational safety value, monitoring nozzle performance with our Anhydro camera systems improves uptime and overall drying efficiency.

Visual nozzle camera survey system monitor

- Incorrect spraying nozzle function
- Leaking of nozzle
- Powder built up on nozzle

Benefits

- Operational safety
- Increases production uptime
- Improves dryer efficiency

DETECTING AND WARNING OF GAS LEAKS

CO Detection System

Inspecting dryer exhaust for carbon monoxide enables early warning of smouldering fires. An extremely sensitive measuring system is required to detect small smouldering fires at an early stage. SPX FLOW offers a complete Gas Analyser System for monitoring Delta CO concentration from inlet to outlet of the spray dryer air system in ranges 0-10 ppm with continuous survey. Our system provides the following capabilities:

- Continuous sampling of air inlets and outlets
- Continuous monitoring of Delta CO concentration
- Escalating alarms and mitigation measures

Our CO detection system continuously measures, monitors and trends data via a PC and enables operators to interface with the controls via the plant SCADA. If the difference between inlet CO and outlet CO-level is too great, the system sends a warning. If nothing changes, it escalates to an alarm level and if there is still no change, it shuts the process or triggers the fire extinguishing system.

The Anhydro CO-Detection System consists of the following:

- CO gas analyser
- Exhaust air pump
- Inlet air pump
- Sample probe inlet
- D check option-leak check and outlet air
- Control panel

Benefits

- Low-cost detection system
- Easy installation and maintenance
- Quick and reliable measurement
- Automatic alarm systems

DETECTING AND MANAGING THREATENING PRESSURE CHANGES

The explosion suppression system detects a starting explosion, and, based on pressure increase, injects a fire extinguishing agent from several High-Rate Discharge (HRD) containers installed though-out the plant. This system consists of:

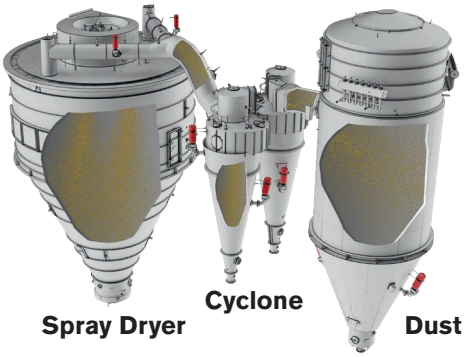
- Control unit
- Multi-sensors/pressure sensors
- Suppression containers

Suppression Systems

Explosion suppression systems monitor pressure increases and pending explosions. If prevention is ineffective, the system mitigates with fire-extinguishing agents from a High-Rate Discharge (HRD) containers installed throughout the plant. A system consists of:

- Control unit
- Multi-sensors/pressure sensors
- Suppression containers

Spray Drying Process – Normal Operations

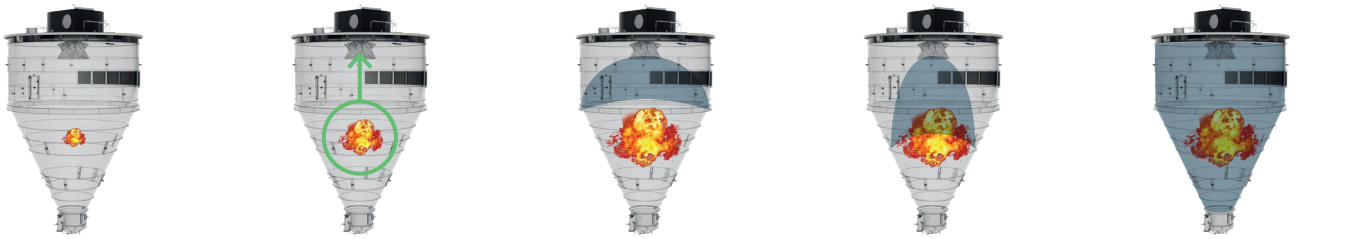


Spray Dryer **Cyclone** **Dust Collector**

Benefits

- System protects the equipment from damages due to explosion
- Early detection and quick response
- Suppression systems provide fast, on-site protection at the earliest stage of an explosion.
- Safe and easy to use – suppression systems activate automatically, they are safe and easy to use
- Pre-engineered and tested to ensure success

Supression



Ignition
Time = 0 ms
Pressure = 0 bar

Pressure rise
Time = 20 ms
Pressure = 0.035 bar

Open of the HRD-supressor
Time = 30 ms
Pressure = 0.1 bar

Suppressant contain the fireball
Time = 50 ms
Pressure = 0.2 bar

Explosion supressed
Time = 75 ms
Pressure = 0.25 bar

UPFITTING AGING DRYING CHAMBERS FOR SAFETY

Explosion Membranes

Maintaining sustainable chamber pressure is important to avoid explosions. To enable this, SPX FLOW safety specialists upgrade your spray drying chamber with rings that burst to vent pressure whenever the pressure inside a component exceeds a certain value. The standard opening pressure is 0.1 bar.

PSR Pressure Shock Resistance Improvement

Some older chambers lack the shock resistance threshold to support explosion membranes - which are critical to reducing downtime and avoiding permanent damage in the event of an explosion.

SPX FLOW has the experience and experts necessary to evaluate and calculate chamber pressure shock resistance to determine what type of reinforcement is needed.

The project scope includes reinforcing chambers to min. +0.2 barg and installing explosion membranes opening at +0.1 barg (same for bag filter). It may also involve installing collar rings on chamber body and cone, IPE profile beams on chamber roof, vertical stiffeners, and rupture disks.

Reinforcing aging chambers for shock resistance is a low-cost way to dramatically improve safety with ATEX certified technology that requires extremely low maintenance.

Benefits

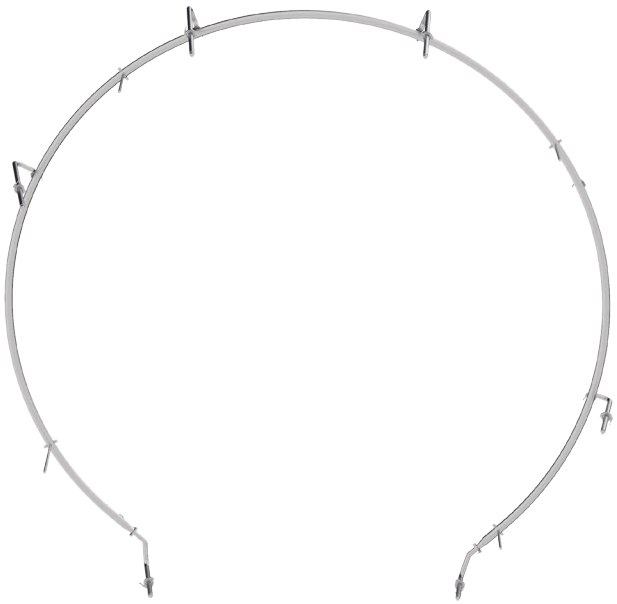
- Reduces risk of post-deflagration thermal events in plants with high Kst values

UPGRADING FOR FIRE PREVENTION AND MITIGATION

Fire Extinguishing Systems

Under certain conditions, fine dry powders can explode. And sparks from moving metal parts, static electricity, overheated product, electrical parts, hot surfaces and smouldering product can ignite fine powders. SPX FLOW has extensive experience equipping plants with systems designed to prevent and mitigate dryer explosions.

In the event of a fire in the chamber, fire ring is activated and water is deployed to extinguish the fire. Based on results from detailed risk assessment, we may recommend changes to nozzles, ring pipes, valves, instruments and controls.



Benefits

- Monitors temperature to shutdown plant or activate water
- Mitigates disaster

WHY PARTNER WITH SPX FLOW?

Years of Experience

- We have been in the spray dryer business since 1948
- Implemented 6,000 different types of spray dryer plants around the world
- Extensive experience rejuvenating spray dryers for safety, efficiency, optimisation, and sustainability
- Developed a proven process for matching strengths to market opportunities
- Long and successful track record in project development and execution

Our Mission

SPX FLOW combines extensive experience and proven technologies to help you capitalise on market trends with:

- Maximum utilisation of your existing assets
- Maximum return on new investments
- Maximum environmental protection

We help you find the best solution for your long-term needs. We work with you to evaluate market opportunities and provide the modernisation, upgrade, or repairs necessary to capitalise on them.

Your Account Team

Your SPX FLOW project manager selects the ideal team for your specific project based on the following criteria:

- Customer support
- Process and design
- Mechanical engineering
- Supply chain optimisation
- Installation and commissioning

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For more information, visit www.spxflow.com.

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