



# Enhancing Fire Safety in Industrial Operations Innovations and Best Practices – by Firefly Intelligent System

# Summary of Presentation

1. Fire Risk in Industry Operations and Key factors for fire hazard.
2. A comprehensive fire protection strategy.
  - a) Prediction
  - b) Prevention
  - c) Protection
3. Firefly and ProDetec in Brief
4. Industries we protect
5. Application and Customer Case Study
6. Firefly control system and water system





## Fire Risks



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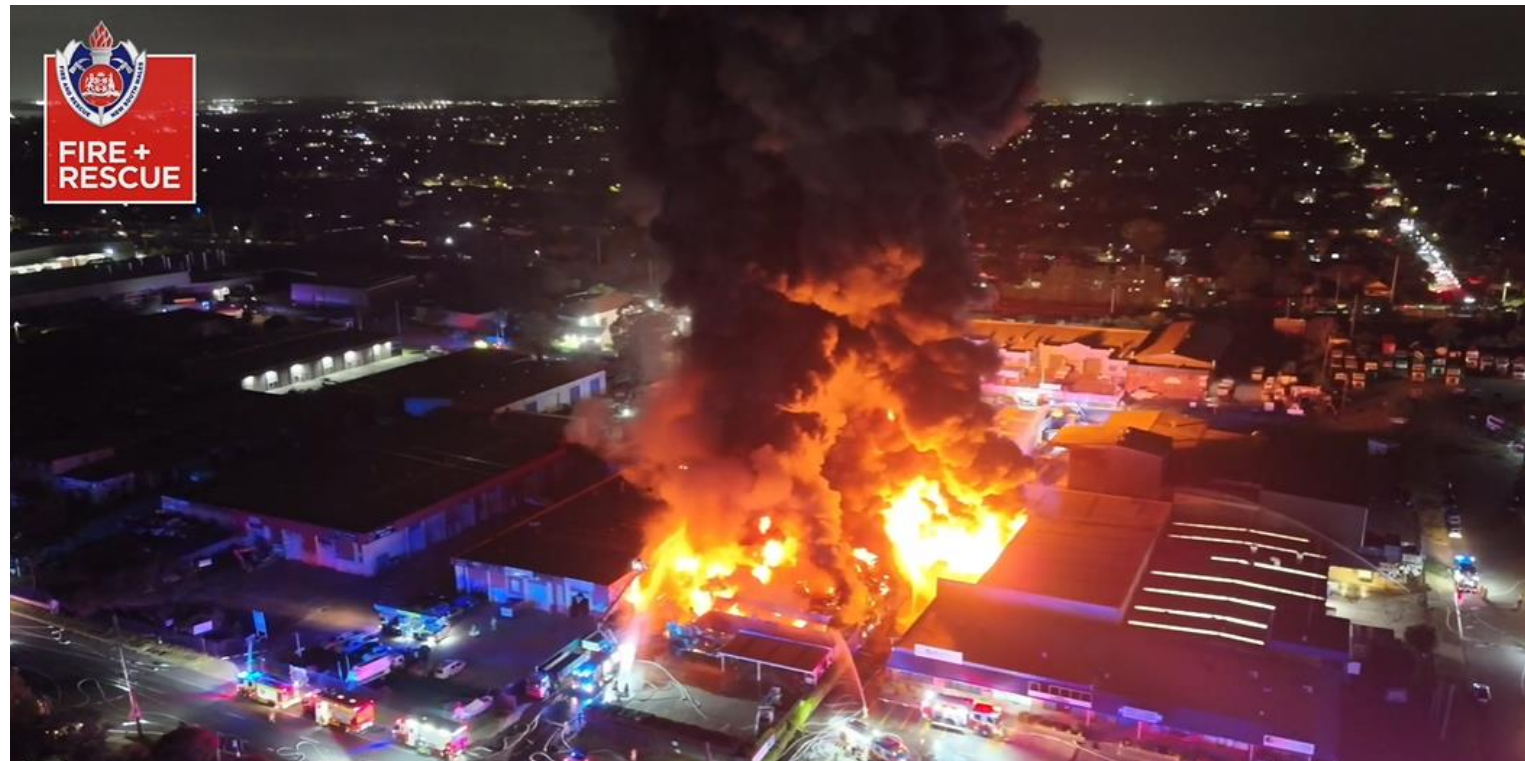
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# The most recent fire incidents in Sydney – a Furniture factory



A furniture factory in Sydney's south-west has been destroyed by a massive blaze. Firefighters battled to prevent the blaze from spreading to surrounding properties.

# The most recent fire incidents in Sydney – a waste facility



More than 200 firefighters have contained a fire that has destroyed a waste facility at North St Marys in Sydney's west.

Still, it is not the large incidents that are most costly for the industry;

The **high frequency of smaller incidents** is even more costly to the industry when adding up the loss in production.



# Fire Risks in Belt Conveyors

- Ignition sources coming with the incoming material
- Friction heat between pulley and belt
- Large number of mechanically moving parts that can break and generate friction
- Large amounts of dry combustible material on the belt
- Fine dust can easily spread and accumulate on bearings, etc.
- A fire can be very difficult to reach
- A fire can spread quickly if not stopped in time!



# Fire Problems in Belt Conveyors



## Södra Cell Mönsterås Bruk, Sweden

“Probable cause of fire: friction and overheating of bearings resulting in hot particles falling down to the material stack”

20 days of loss in production, reached full capacity after 7 months.



## Dong Energy, DK

“One hot conveyor roller drops down and ignites accumulated wood dust, underneath the conveyor belt” - Dong Energy

Fire fighting lasted for 12 days.



## Gypsum Power Plant, US

The fire started in a conveyor carrying wood chips: “there was fire in both of the plant's silos and on three different conveyor belts spreading across hundreds of feet...”



# Fire in the Cooler/Freezer

## June 2013 - Netherlands

On Tuesday 4 June 2013, around 1:30 PM, a fire started in a fridge-freezer unit.

The fire was first thought to be relatively small, but it soon grew into a catastrophic multi-million Euro loss fire incident.

One production hall was lost, two were severely damaged and six production lines suffered heavy smoke and soot damage.



# Fire in the Cooler

August 2020 - Sweden

MSB investigation after the fire at Polarbröd

“The fire was caused by combustible material igniting in the oven, something that has also happened before, but then the staff discovered the fire early and were able to extinguish it.

This time the small fire followed the conveyor belt further into the process”

“It has become clear in the investigation how important it is with technical systems that can detect even small fires at an early stage and extinguish them at an early stage”.

Source:

<https://www.msb.se/sv/aktuellt/nyheter/2021/februari/manga-bidragande-orsaker-bakom-branden-i-polarbrods-fabrik/>



# Fire in the Oven

September 2020 - France



# General Fire Risks With Baking

## Typical Incidents

- Fire in the oven or at the outlet of the oven
  - Bread crumbs, oil and fat can easily be ignited in the oven or at the outlet
- Fire in the extraction ducts from the oven
  - Oil and fat in the extraction ducts from the oven can easily be ignited
- Smoldering or burning products coming out from the oven
  - Damaging the transport belt
  - Starting a fire down streams in the process (e.g. in the cooling section)
- Fire in the Cooler or Freezer
  - Often caused by smoldering or burning products coming out from the oven



# General Fire Risks With Baking

Typical causes:

- Overheated material on the roof/wall of the oven falling down on the products
- Band stop inside the oven, mechanical failure
- Lost of temperature and/or moisture control
- Waste, breadcrumbs and dust under the band inside the oven.
- Oven outlet, dirt, oil and normal oxygen available
- Cooler (fans blowing air in the cooler will accelerate a fire)



# Fire Risks with Different Ovens

## Types of Ovens:

### Convection oven

- Very efficient baking device, increases fire risks due to a lack of humidity control in the product

### Direct gas oven

- Still common oven in the industry, old models increase the risk due to operational and control failures

### Hybrid Ovens

- For specific products and in combination with convection oven. Old models might create fire problems due to operational control failures



Jetdirc convection oven



Direct Gas Fired oven



Hybrid ovens



# Common causes of fires in recycling industries

- Frictional heat inside the machine (shredder, bailer).
- Moving mechanical parts, which wear and generate friction.
- Ignition sources coming into the material being handled.
- Objects, such as stones or pieces of metal, in combination with dust.

## Considerations

- Tough environment.
- There are usually large amounts of dry fuel on the belts.
- Dust spreads and accumulates on surfaces, bearings, etc..
- If a fire breaks out, it is very difficult to fight manually, due to the inaccessibility of the area.



# Bearing Failure in Recycling



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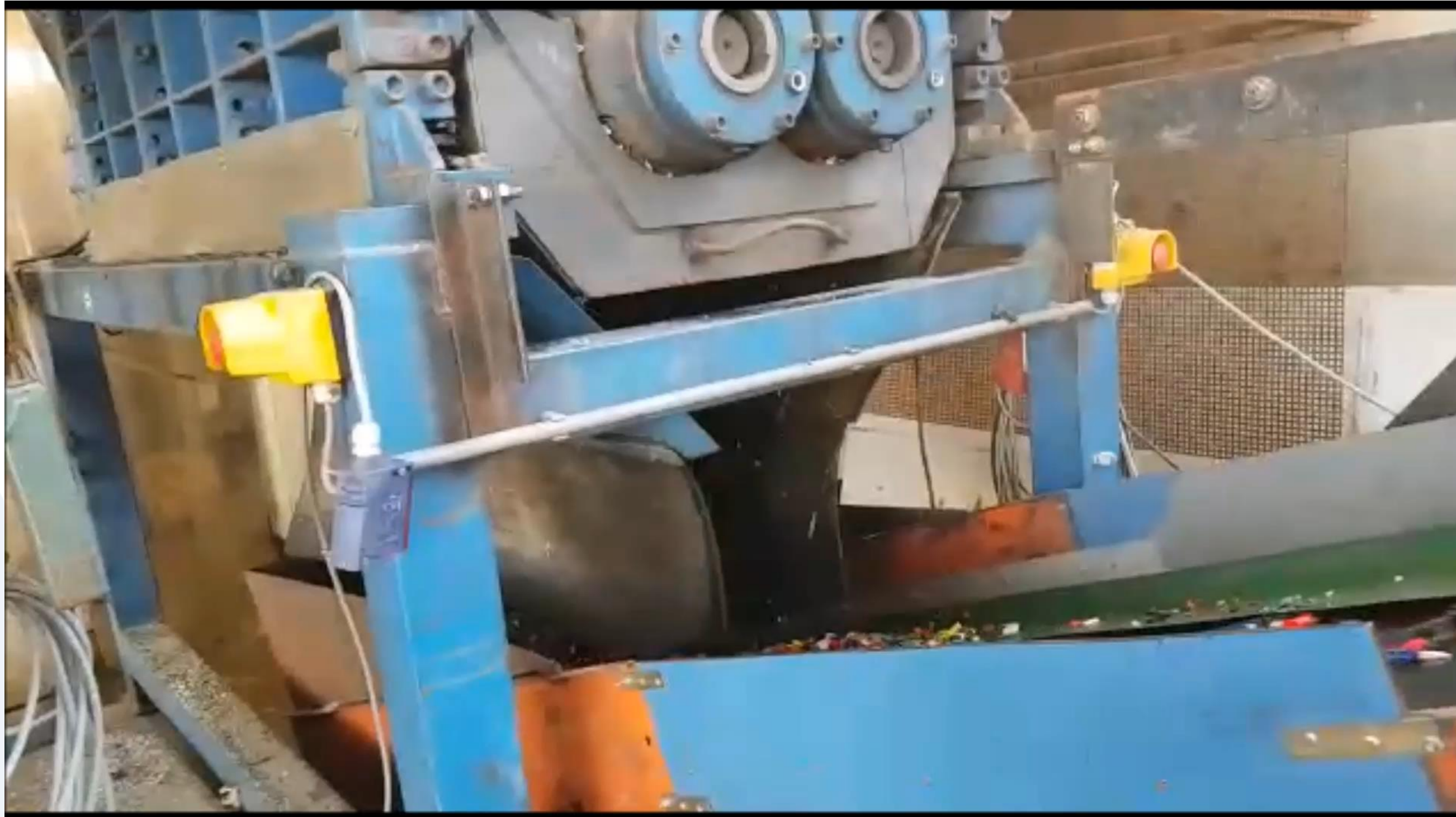


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## Fire in Shredder



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## Explosion in Shredder



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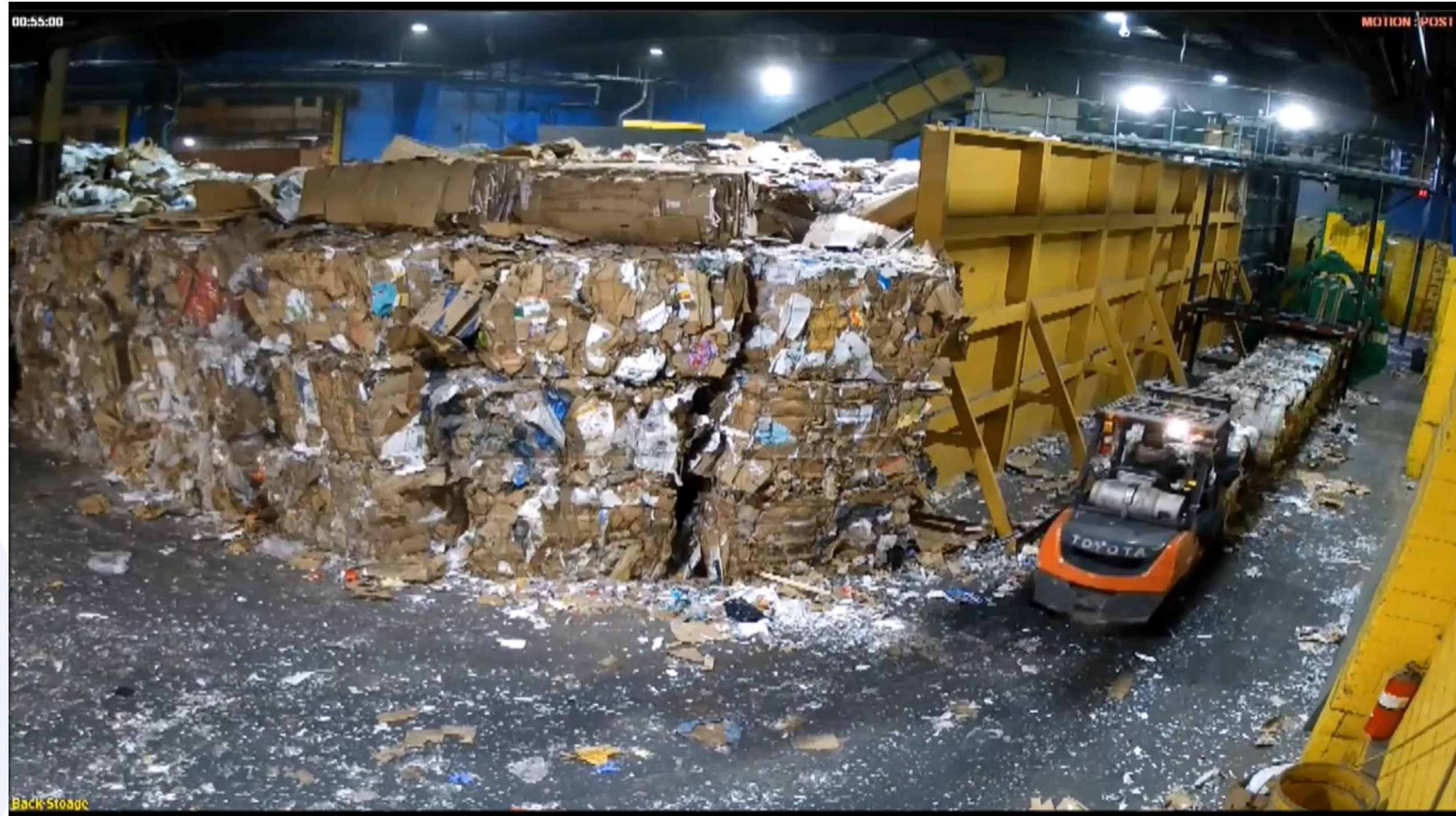


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# Fire in Bailer



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## Fire in a Tissue Machine – Drive Side



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## Fire in a Tissue Machine – Drive Side of Yankee



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## Fire in Embosser



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## Fire Problems are Common in the Woodworking Industry



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# Fire Problems Are Common in a Particle Board Production Plant



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## Fire Problems Are Common in a Particle Board Production Plant



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## Fire Problems Are Common in a Particle Board Production Plant



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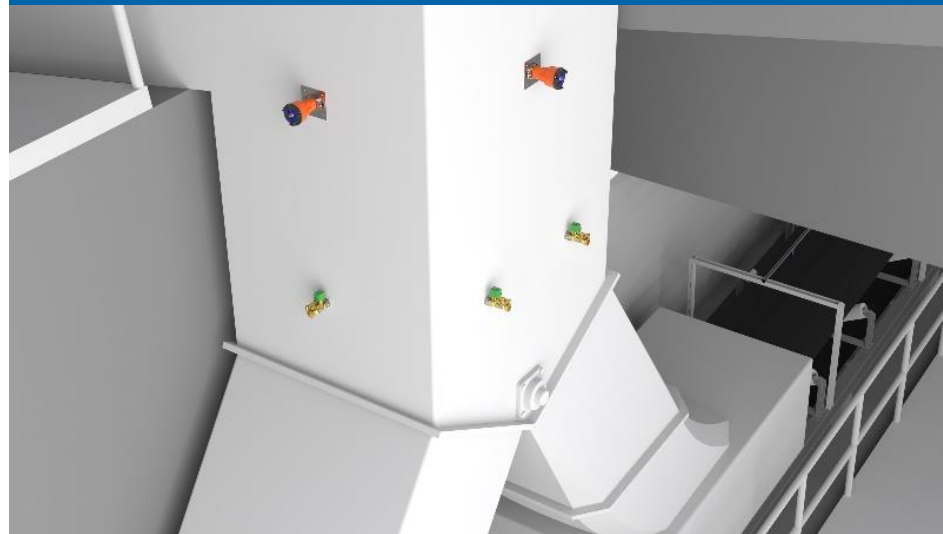
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# Prediction, Preventive and Protective Fire Protection Systems

1969

## Preventive Systems

- Spark Detection Systems
- MGD – Electronic Nose

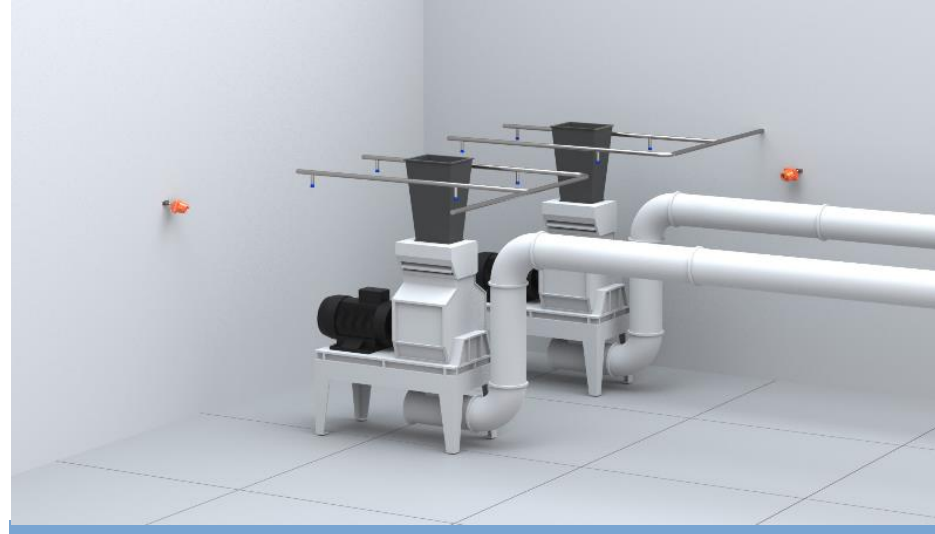


Detection and extinguishing of ignition sources **before** fire or explosion has occurred

1999

## Protective Systems

- Quick Suppression Systems
- Fast Water Mist Systems

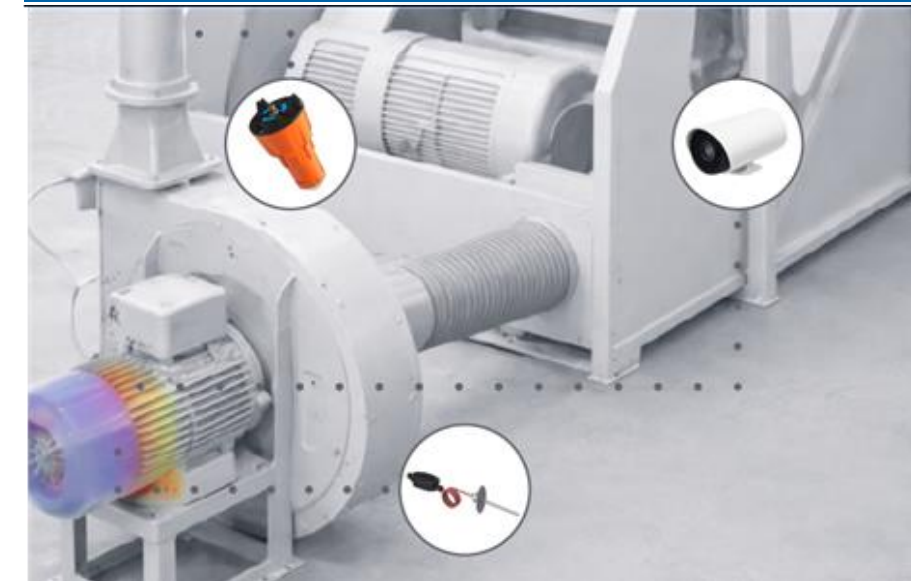


Quick detection and suppression of flames/fires

2026

## Predictive Systems

- Condition Monitoring System



Identification of a problem **before** an ignition source or a fire is generated.



# ProDetec – About Us

- Established in 2003
- Proudly Australian owned
- Supply safety products in Australia and New Zealand since the 1990s
- Established an extensive customer base.
- Comprehensive range of Safety Products
- Exclusive distributor for ALL of our manufacturers
- In-house and on-site service & commissioning capabilities
- Full warranty responsibilities
- Experience with large projects
- Certified to ISO9001:2015



## Firefly in Brief



- Firefly AB – a Swedish company founded in 1973
- Designing and manufacturing high-tech fire protection systems for the process industry
- Leading supplier of Spark detection and Quick suppression systems
- Listed on the NASDAQ First North stock exchange in Stockholm
- Head office in Stockholm, subsidiaries in Poland and Italy and agents/distributors worldwide
- Multiple service centers located in all continents of the world
- Customers in over 80 countries
- More than 13000 protection systems worldwide



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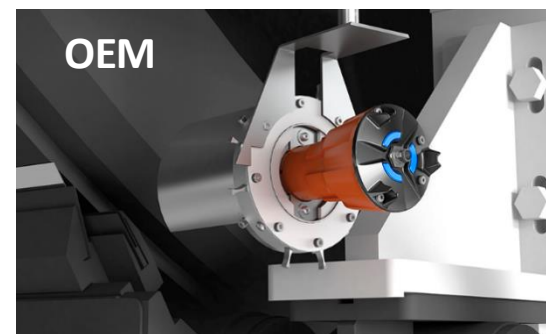
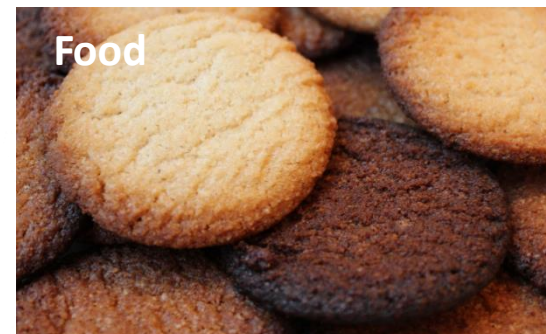
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## Industries We Protect



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## Major customers in Australia and New Zealand



Laminex®



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## Major customers worldwide



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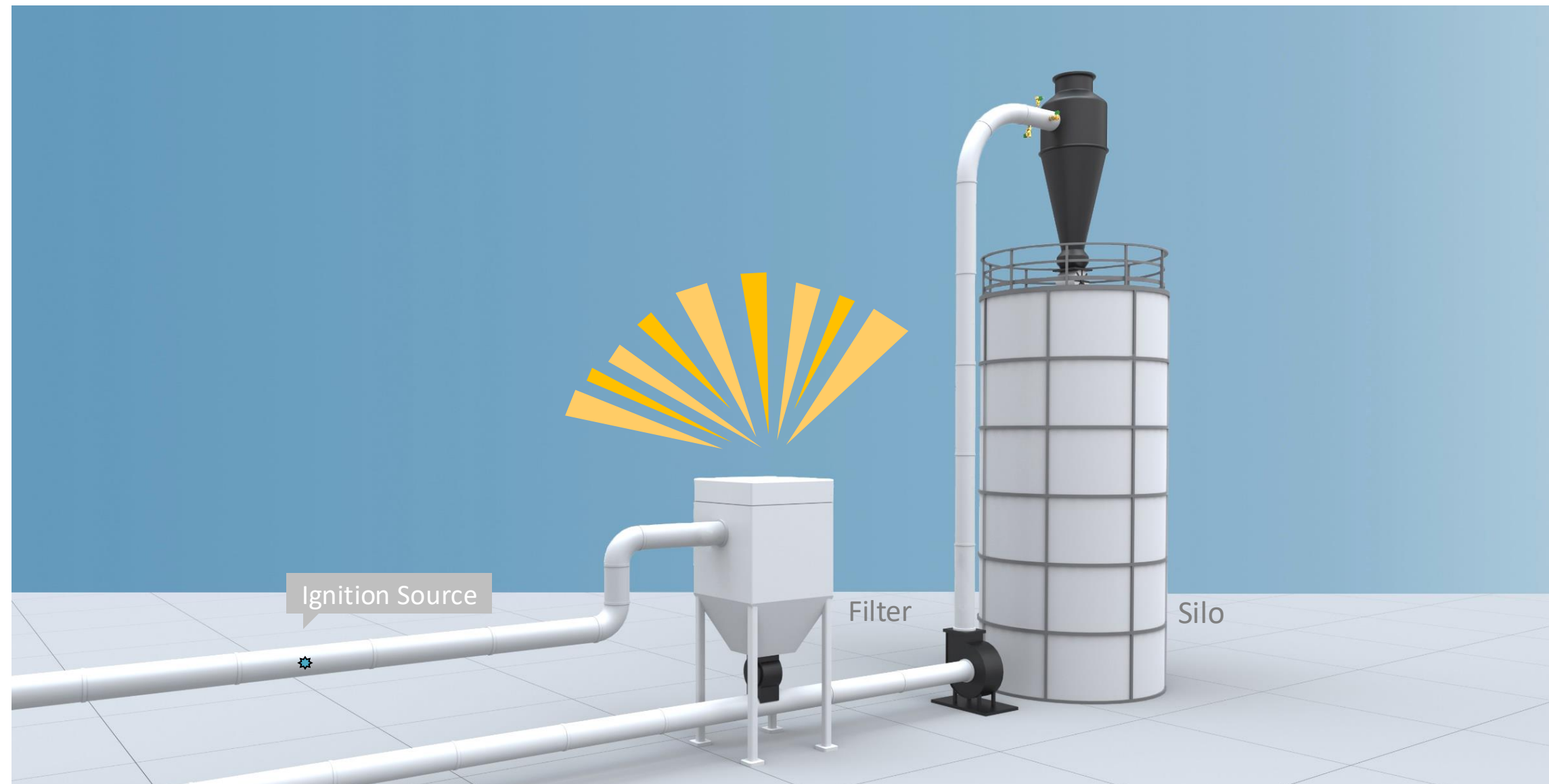


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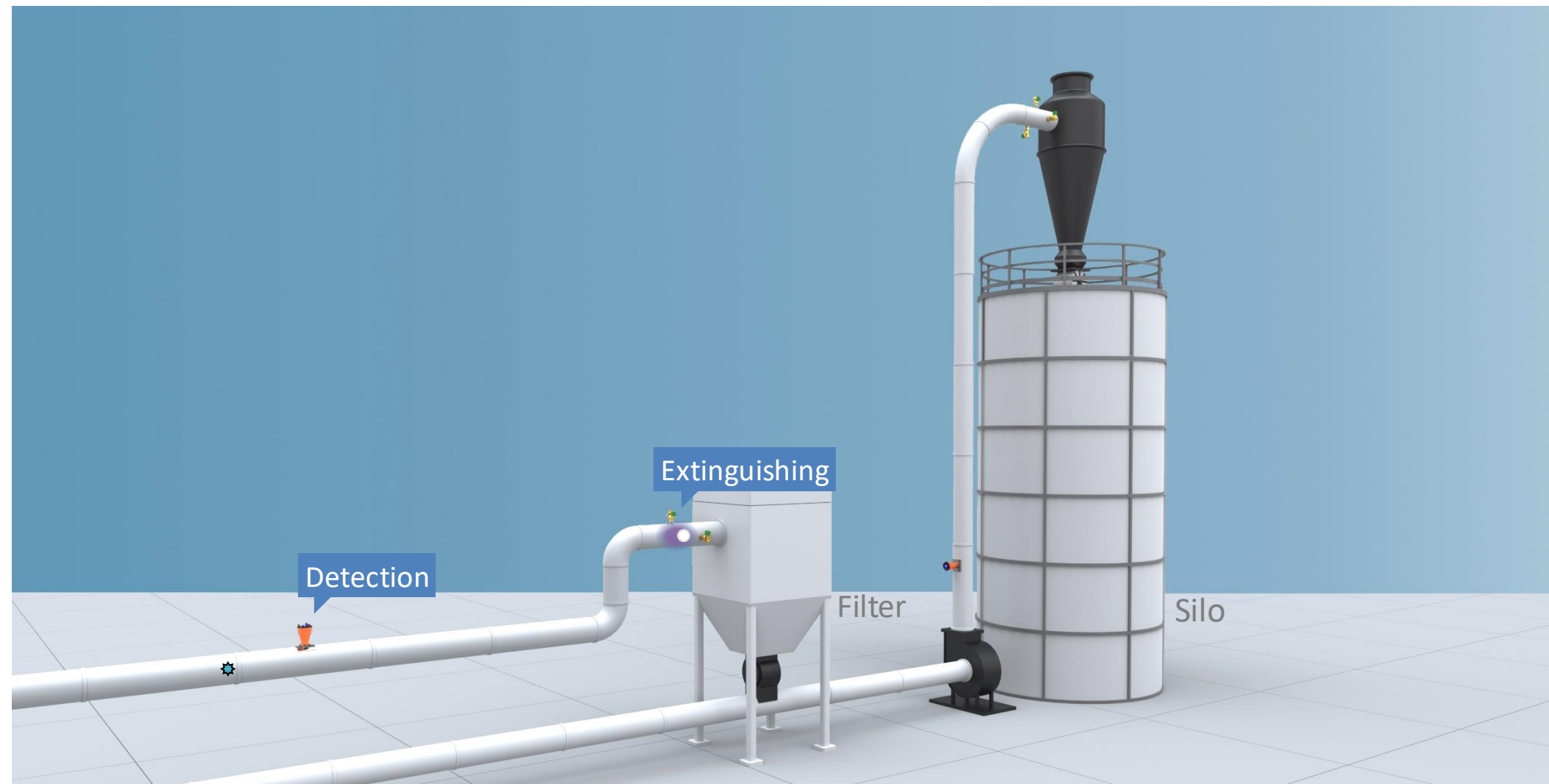


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## EXAMPLE – FILTER WITHOUT PROTECTION



# EXAMPLE – FILTER WITH FIREFLY SPARK DETECTION SYSTEM



# Which Particles are Dangerous?

**A particle is dangerous if it has:**

- ✓ Enough temperature (Above MIT)
- ✓ Enough energy (Above MIE)

= A Possible Ignition Source

See table from NFPA, next page for  
MIT and MIE for different materials



# Which Particles Needs to be Detected?

**TABLE 5-9A. Explosion Characteristics of Various Dusts**

(Compiled from the following reports of the U.S. Department of Interior, Bureau of Mines: RI 5753, The Explosibility of Agricultural Dusts; RI 6516, Explosibility of Metal Powders; RI 5971, Explosibility of Dusts Used in the Plastics Industry; RI 6597, Explosibility of Carbonaceous Dusts; RI 7132, Dust Explosibility of Chemicals, Drugs, Dyes and Pesticides; and RI 7208, Explosibility of Miscellaneous Dusts.)

| Type of Dust                            | Explosi-<br>bility<br>Index | Ignition<br>Sensi-<br>tivity | Explo-<br>sion<br>Severity | Maximum<br>Explosion<br>Pressure<br>psig* | Max Rate<br>of<br>Pressure<br>Rise<br>psi/sec* | Ignition<br>Temperature† |             | Min<br>Cloud<br>Ignition<br>Energy<br>joules | Min<br>Explosion<br>Conc<br>oz/cu ft‡ | Limiting<br>Oxygen<br>Percentage§<br>(Spark<br>Ignition) |
|-----------------------------------------|-----------------------------|------------------------------|----------------------------|-------------------------------------------|------------------------------------------------|--------------------------|-------------|----------------------------------------------|---------------------------------------|----------------------------------------------------------|
|                                         |                             |                              |                            |                                           |                                                | Cloud<br>°C              | Layer<br>°C |                                              |                                       |                                                          |
| Agricultural Dusts                      |                             |                              |                            |                                           |                                                |                          |             |                                              |                                       |                                                          |
| Cellulose                               | 2.8                         | 1.0                          | 2.8                        | 130                                       | 4,500                                          | 480                      | 270         | 0.080                                        | 0.055                                 | C13                                                      |
| Cellulose, alpha                        | >10                         | 2.7                          | 4.0                        | 117                                       | 8,000                                          | 410                      | 300         | 0.040                                        | 0.045                                 | —                                                        |
| Cocoa, natural 19% fat                  | 0.6                         | 0.5                          | 1.1                        | 68                                        | 1,200                                          | 510                      | 240         | 0.10                                         | 0.075                                 | —                                                        |
| Coffee, fully roasted                   | <0.1                        | 0.2                          | 0.1                        | 38                                        | 150                                            | 720                      | 270         | 0.16                                         | 0.085                                 | C17                                                      |
| Corn                                    | 6.9                         | 2.3                          | 3.0                        | 113                                       | 6,000                                          | 400                      | 250         | 0.04                                         | 0.055                                 | —                                                        |
| Cornstarch commercial product           | 9.5                         | 2.8                          | 3.4                        | 106                                       | 7,500                                          | 400                      | —           | 0.04                                         | 0.045                                 | —                                                        |
| Cork dust                               | >10                         | 3.6                          | 3.3                        | 96                                        | 7,500                                          | 460                      | 210         | 0.035                                        | 0.035                                 | —                                                        |
| Cotton linter, raw                      | <0.1                        | <0.1                         | <0.1                       | 73                                        | 400                                            | 520                      | —           | 1.92                                         | 0.50                                  | C21                                                      |
| Cube root, South American               | 6.5                         | 2.7                          | 2.4                        | 69                                        | 2,100                                          | 470                      | 230         | 0.04                                         | 0.04                                  | —                                                        |
| Grain dust, winter wheat, corn,<br>oats | 9.2                         | 2.8                          | 3.3                        | 131                                       | 7,000                                          | 430                      | 230         | 0.03                                         | 0.055                                 | —                                                        |
| Lycopodium                              | 16.4                        | 4.2                          | 3.9                        | 75                                        | 3,100                                          | 480                      | 310         | 0.04                                         | 0.025                                 | C13                                                      |
| Milk, skimmed                           | 1.4                         | 1.6                          | 0.9                        | 95                                        | 2,300                                          | 490                      | 200         | 0.05                                         | 0.05                                  | N15                                                      |
| Rice                                    | 0.3                         | 0.5                          | 0.5                        | 47                                        | 700                                            | 510                      | 450         | 0.10                                         | 0.085                                 | —                                                        |
| Soy flour                               | 0.7                         | 0.6                          | 1.1                        | 94                                        | 800                                            | 550                      | 340         | 0.10                                         | 0.06                                  | C15                                                      |
| Sugar, powdered                         | 9.6                         | 4.0                          | 2.4                        | 109                                       | 5,000                                          | 370                      | 400‡        | 0.03                                         | 0.045                                 | —                                                        |
| Wheat flour                             | 4.1                         | 1.5                          | 2.7                        | 97                                        | 2,800                                          | 440                      | 440         | 0.06                                         | 0.05                                  | —                                                        |
| Wheat starch, edible                    | 17.7                        | 5.2                          | 3.4                        | 100                                       | 6,500                                          | 430                      | —           | 0.025                                        | 0.045                                 | C12                                                      |
| Wood flour, white pine                  | 9.9                         | 3.1                          | 3.2                        | 113                                       | 5,500                                          | 470                      | 260         | 0.040                                        | 0.035                                 | —                                                        |



Note! A particle < 650°C is **black**

Enough temperature  
(MIT for dust cloud): 370-450 °C

Enough temperature  
(MIT for dust layer): 200-340 °C

Enough energy (MIE):  
from 40mJ



# SPARK DETECTION OVERVIEW

## - TRUE IR SPARK/HOT PARTICLE DETECTORS

### HD600

Detects from **600°C**  
For Flu gas monitoring etc

### HD400

Detects from **400°C**  
Protection of filters, cyclones, etc (dust clouds)

### HD400E

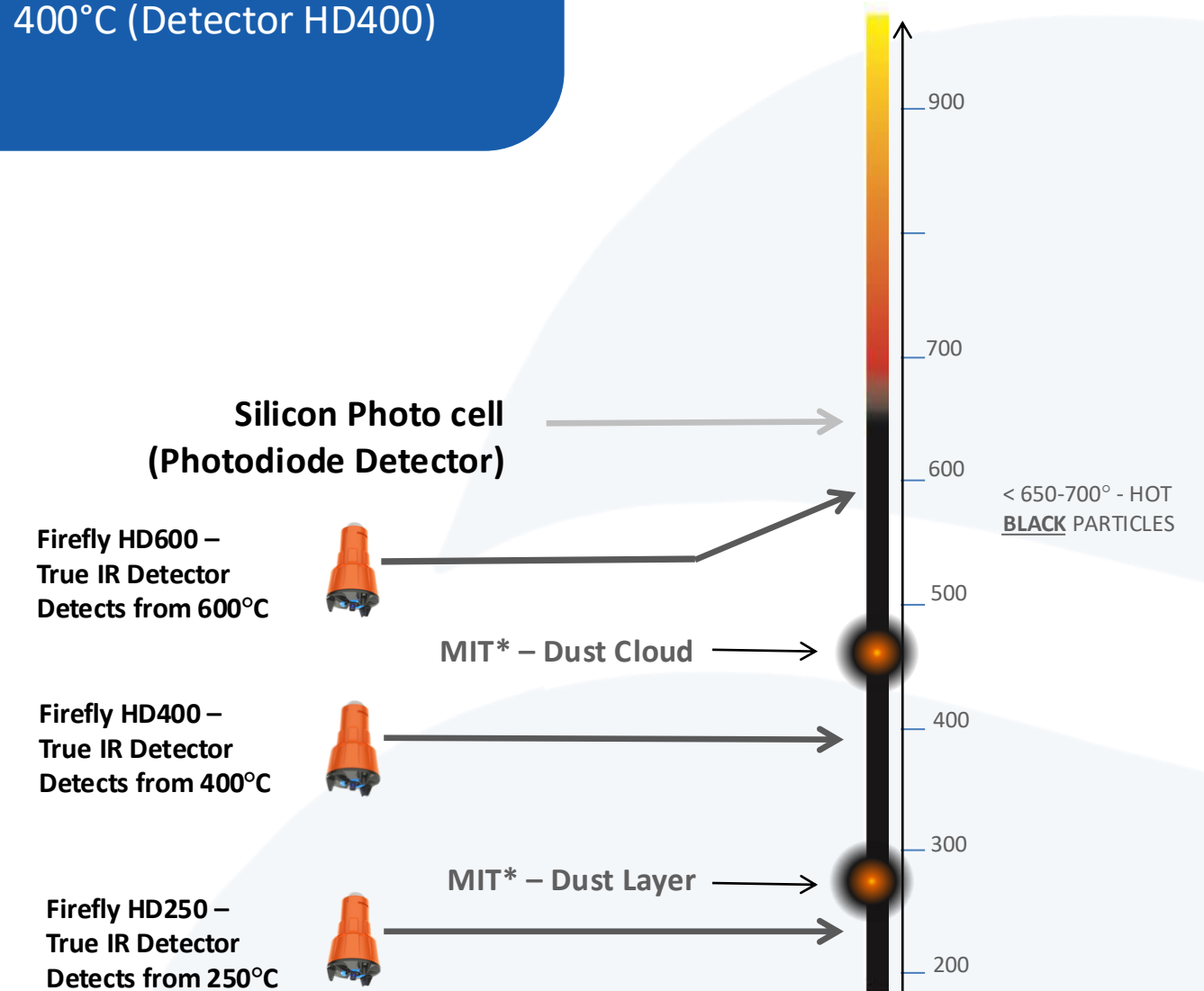
Detects from **400°C**  
Covers extraction ducts up to 1.250mm diameter with one detector (Based on max. material flow: 200g/m<sup>3</sup>)

### HD250

Detects from **250°C**  
Protection of silos, intermediate storage, etc (layers of dust)

FM approval for Superheated Particle and Spark detectors that detect from:

- ✓ 250°C (Detector HD250)
- ✓ 400°C (Detector HD400)



# Video – Short Explanation of Firefly Spark Detection System



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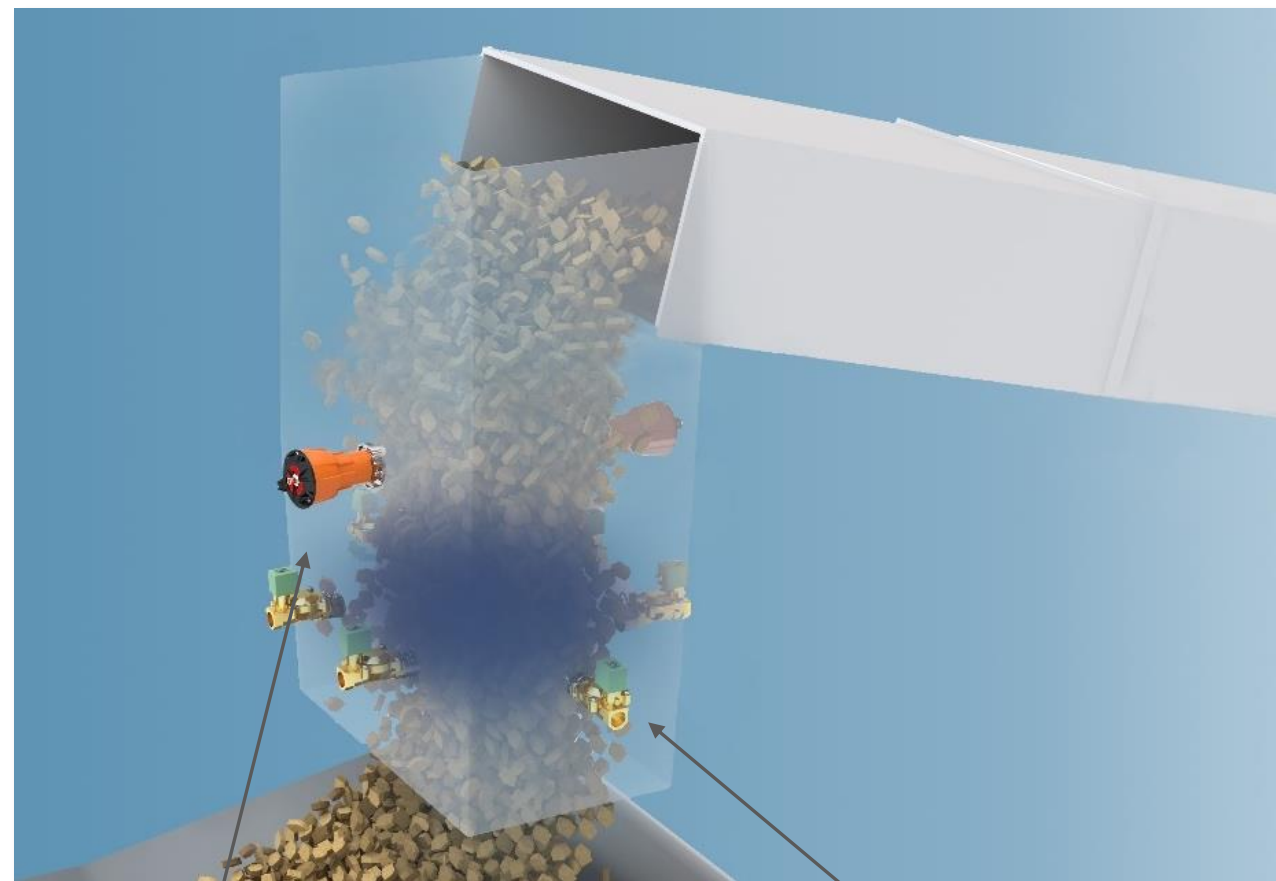
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# The Principle of Firefly Spark Detection System

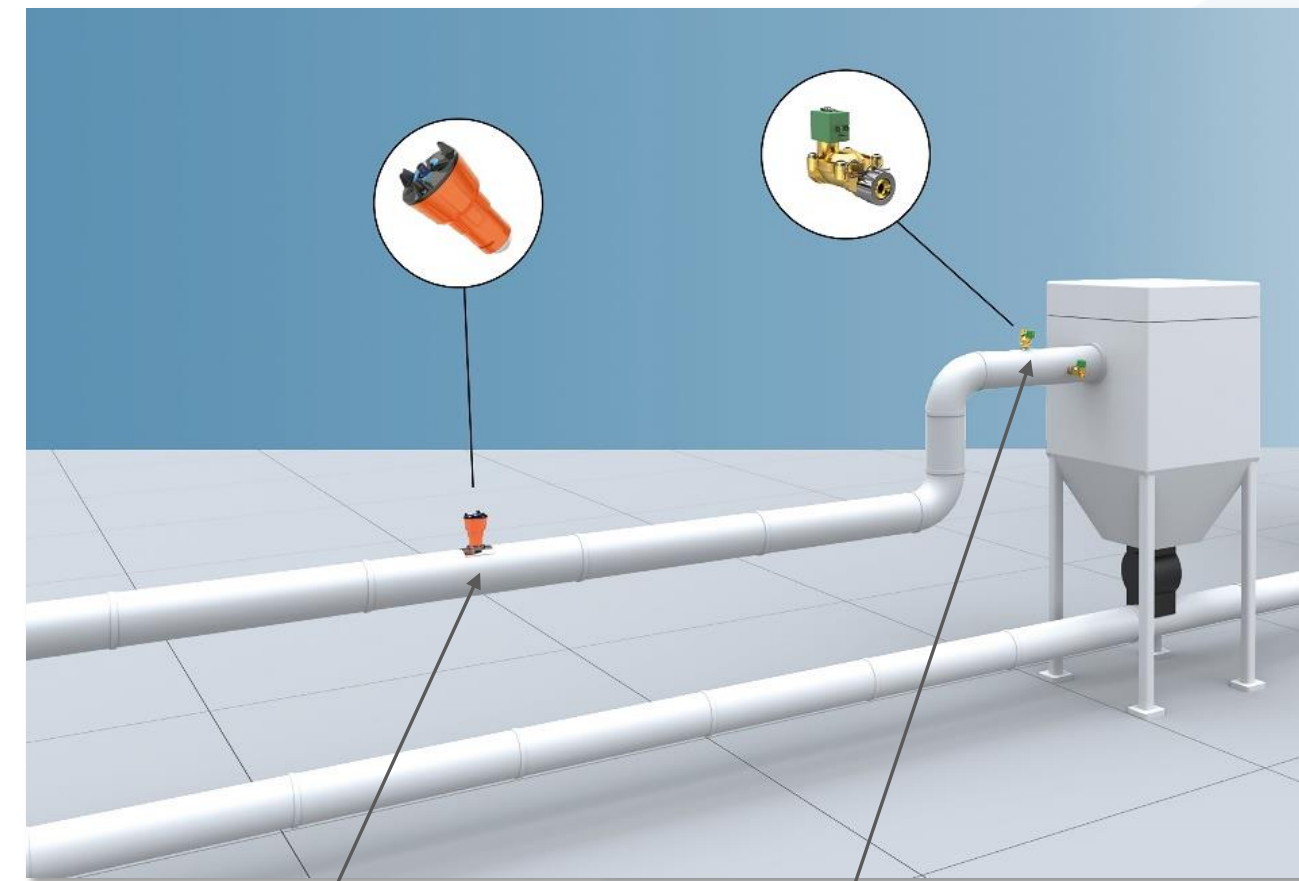
SYSTEM IN CHUTES / TRANSFER POINTS



Detection zone

Water Extinguishing zone

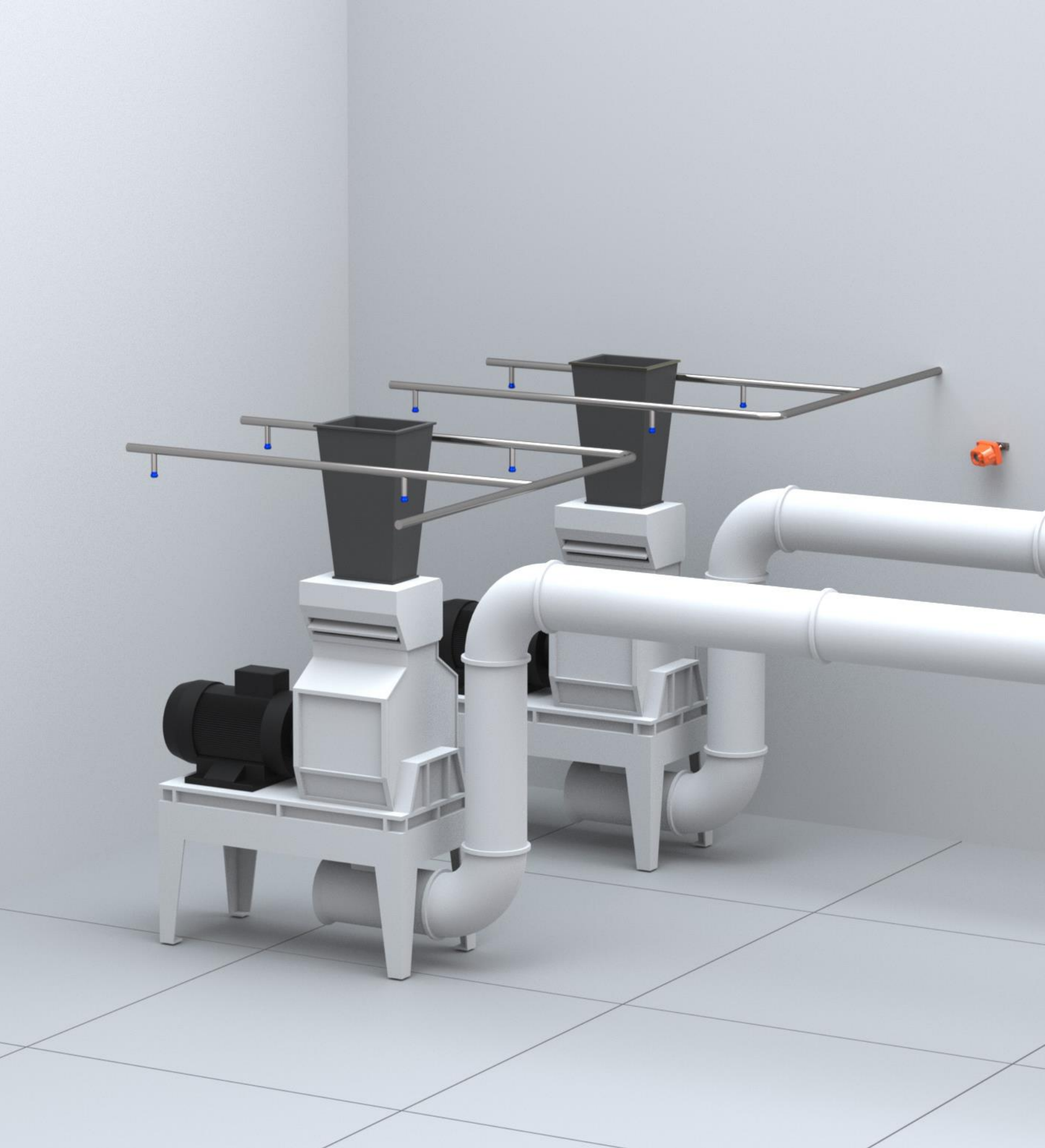
SYSTEM LOCATED IN DUCTS



Detection zone

Water Extinguishing zone





## The Quick Suppression System (QSS) Protection



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# Firefly Quick Suppression System

## Complete Systems

- Including Detection - Control unit - Suppression

## Fast Response Flame Detectors

- High performance flame detectors
- Many different type of detectors to suit each application

## Quick Acting Water Mist

- Efficient suppression of flames
- Uses small amounts of water

Can be used for spot-protection of any type of machine or high-risk area.



# Video - Principle of Firefly Quick Suppression System



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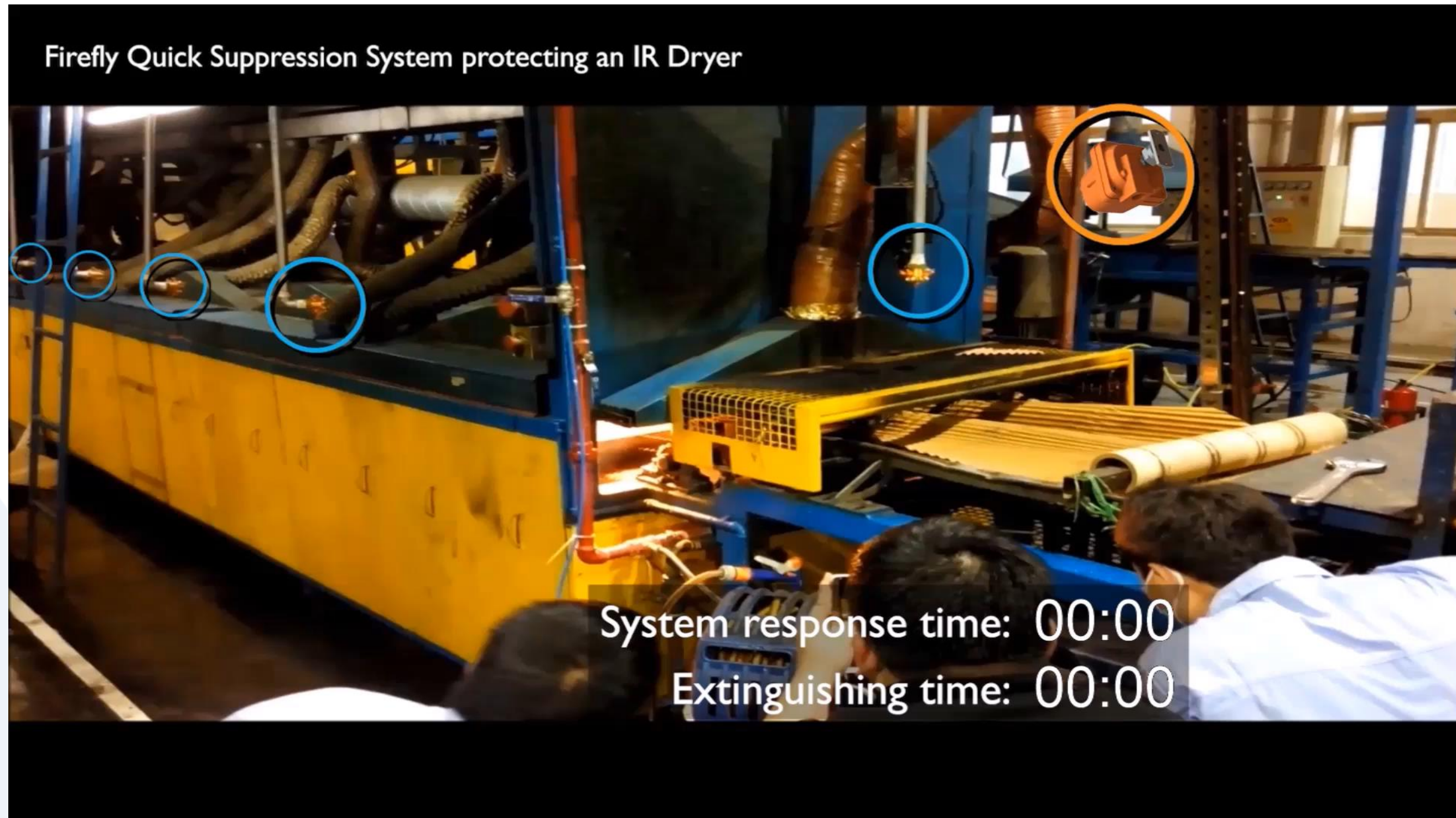


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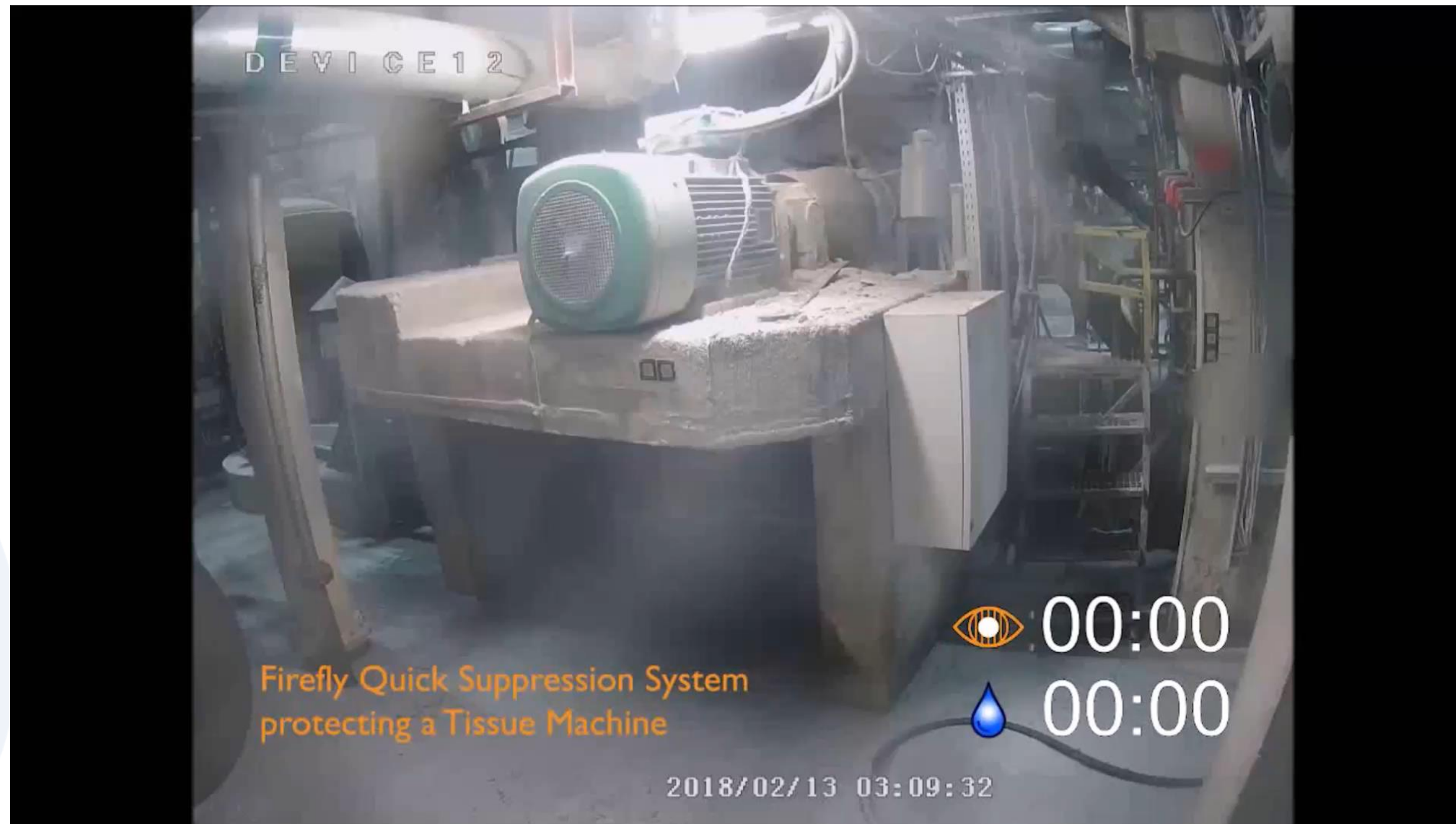


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# Live Fire Test - Firefly Quick Suppression System



# Video - Firefly System in Action in Tissue Machine



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# Firefly Quick Suppression System

Extremely Quick response time

- Probably the fastest fire protection system in the market
- Response time(\*) of 300ms - 3 sec (max. 5 sec)
- Most other active fire protection systems have 25 - 60 sec. response time
- Sprinkler systems have an average time of 4-8 minutes from a fire starts until water is activated



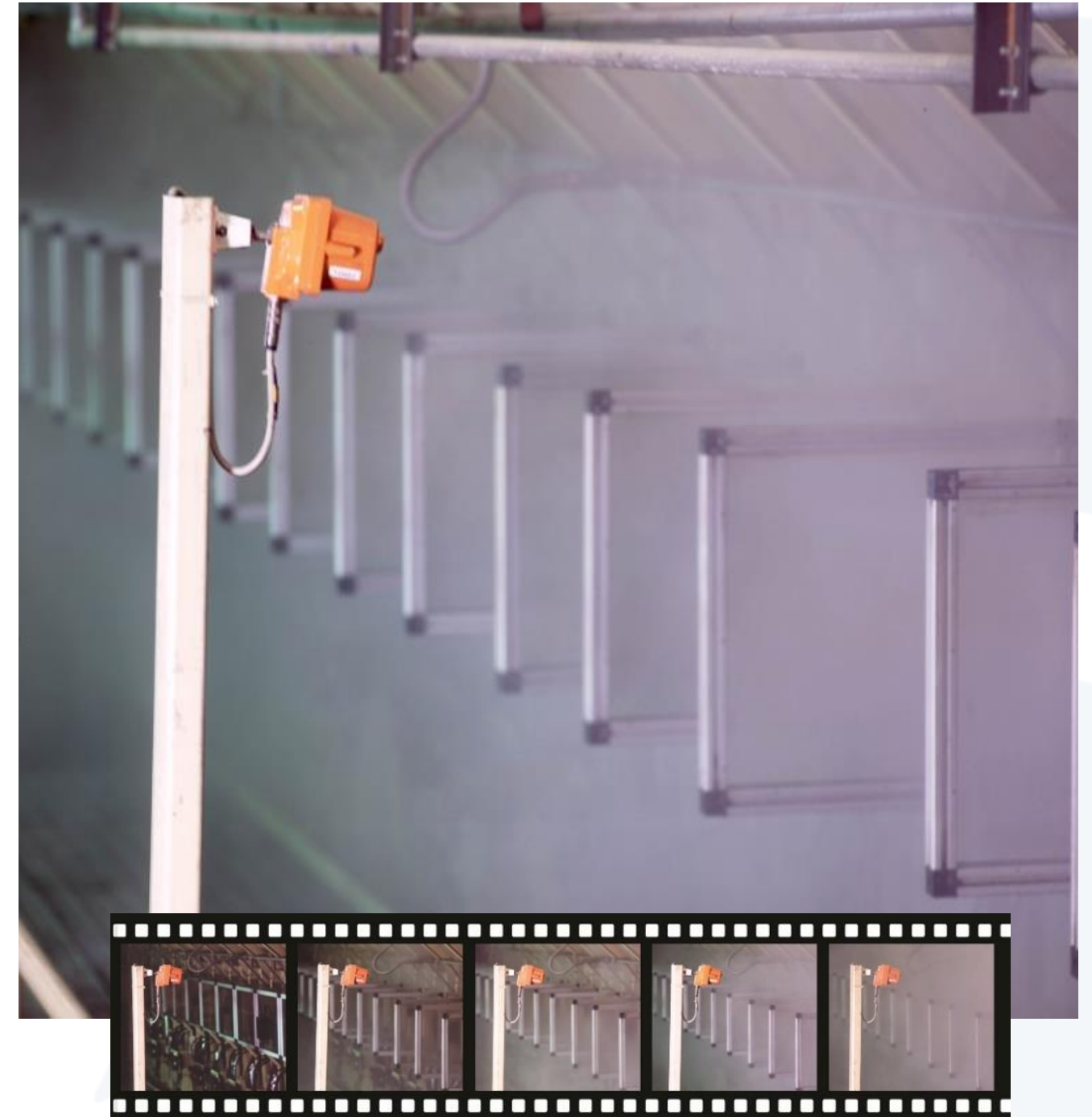
(\*) Complete System Response time = From a flame occurs until water comes out from the least favorable nozzle



# Firefly Water Mist

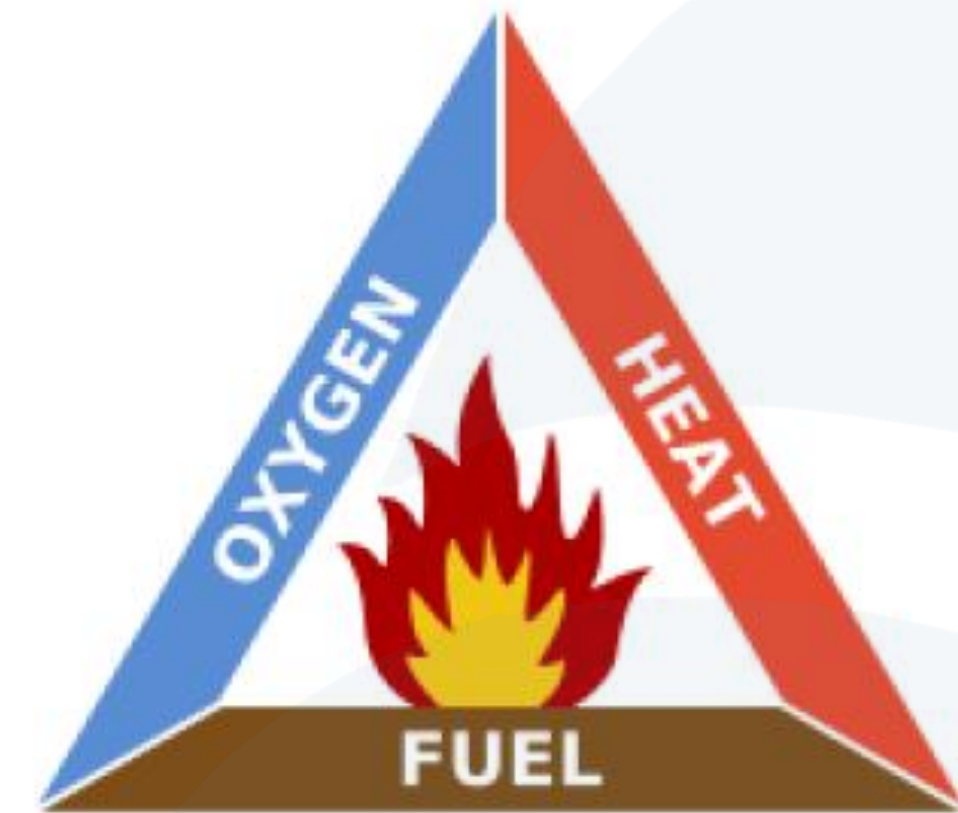
Firefly uses Low Pressure Water Mist

- Easy to install
- Efficient suppression capabilities
- Utilizes very small amount of water - Small impact on machinery



# Why Water Mist? How does Water Mist work?

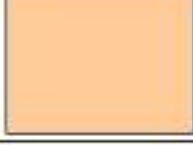
- Water mist reduces two of the Fire Triangle Elements:
  - Heat
  - Oxygen
- Traditional sprinklers only reduce the heat;
- A Performance-based technology that focuses on achieving specific outcomes or results and allows customisation for different applications.



*Source: 'How Does water mist work?' by IWMA (International Water Mist Association)*



# Applications of water mist

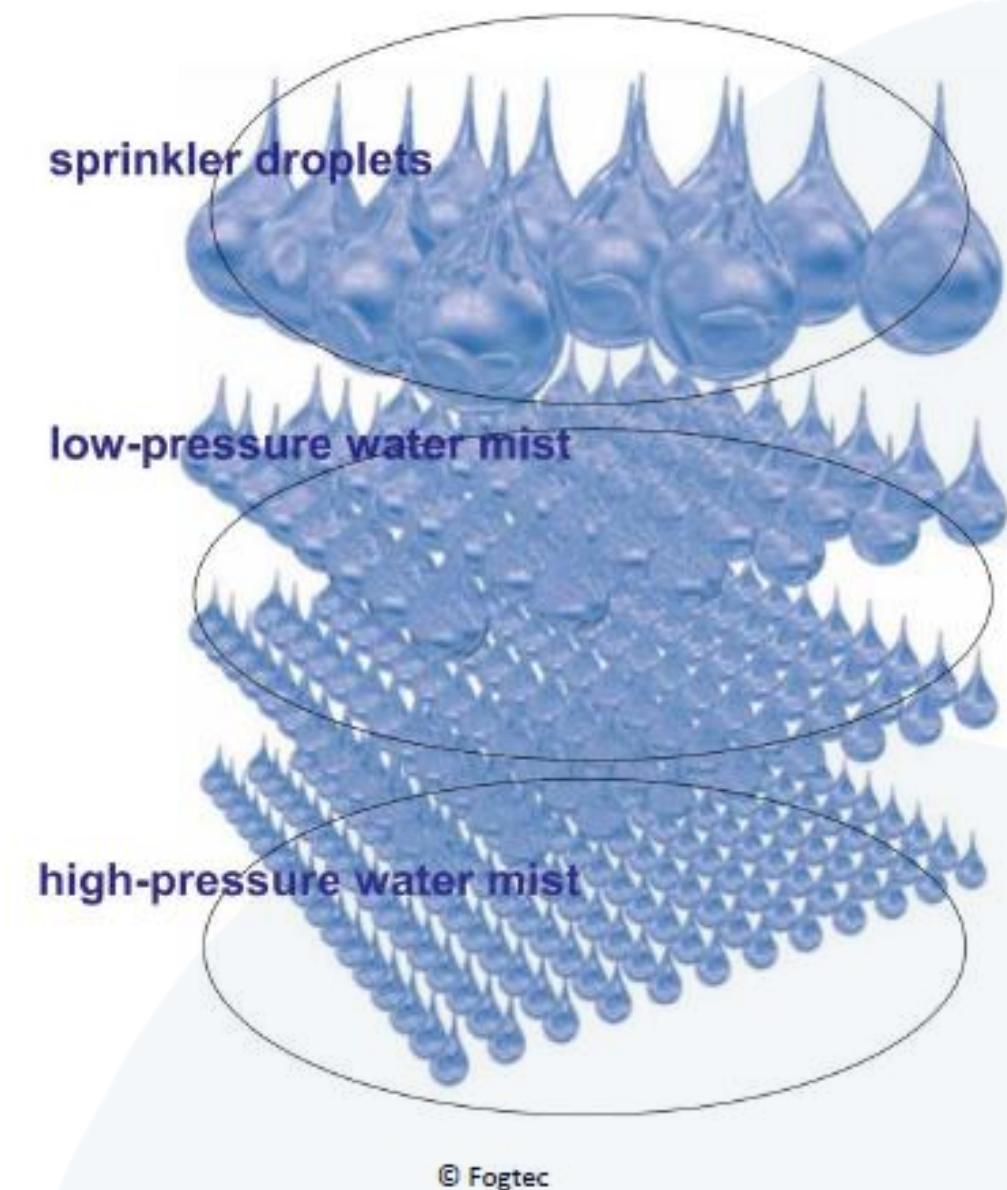
|              | Colours                                                                             |    |    |    |    |    |    |
|--------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| Types        |                                                                                     | Fires involving wood, paper, textiles etc.                                          | Fires involving flammable liquids, petrols & spirits etc.                           | Fires involving flammable gases, butane, propane etc.                                 | Fires involving burning metals, e.g. magnesium                                        | Fires involving electrical equipment                                                  | fires involving cooking oils and fats                                                 |
| Water Mist   |    |    |    |    |    |    |    |
| Water        |    |    |    |    |    |    |    |
| Foam         |   |   |   |   |   |   |   |
| Dry Powder   |  |  |  |  |  |  |  |
| M28 / L2     |  |  |  |  |  |  |  |
| Co2          |  |  |  |  |  |  |  |
| Wet Chemical |  |  |  |  |  |  |  |

Source: 'How Does water mist work?' by IWMA (International Water Mist Association)

# Benefits of water mist

- Eco-friendly and sustainable, do not harm people or animals.
- Use Less water and less space than a traditional sprinkler system. →lower cost.
- Can easily be retrofitted and extended.
- Cooling-effect and prevent re-ignition.

Source: 'How Does water mist work?' by IWMA (International Water Mist Association)



## Fire Test – Class A Fires (Wood Cribs)

Wood cribs are especially demanding to extinguish for water mist due to the powerful draft created in the center of the wood crib (“Chimney effect”).



# Fire Test– Class A Fires (Wood Cribs)



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## Fire Test – Class B Fires (Diesel Pool Fire)

Diesel with flash point of 40,1°C is used in the tests

According to EN 14972:2017 appendix A:  
The hazards protected may involve fuels with a similar or higher closed-cup flash point than used in the fire test.

Common fuels occurring in the applications we protect are:

- Hydraulic oil (flash point typically 150-315°C)
- Lubrication oil (flash point typically > 200 °C)



# Fire Test – Class B Fires (Diesel Pool Fire)



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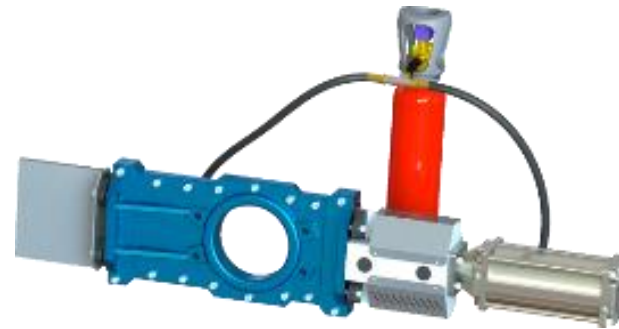
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# Other Firefly's Extinguishing Methods

- Quick acting Isolation valves
  - Many different models and sizes
  - Closing times from 65mS



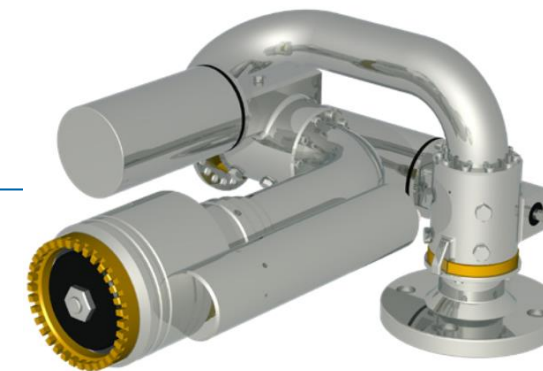
- Quick acting Diverter



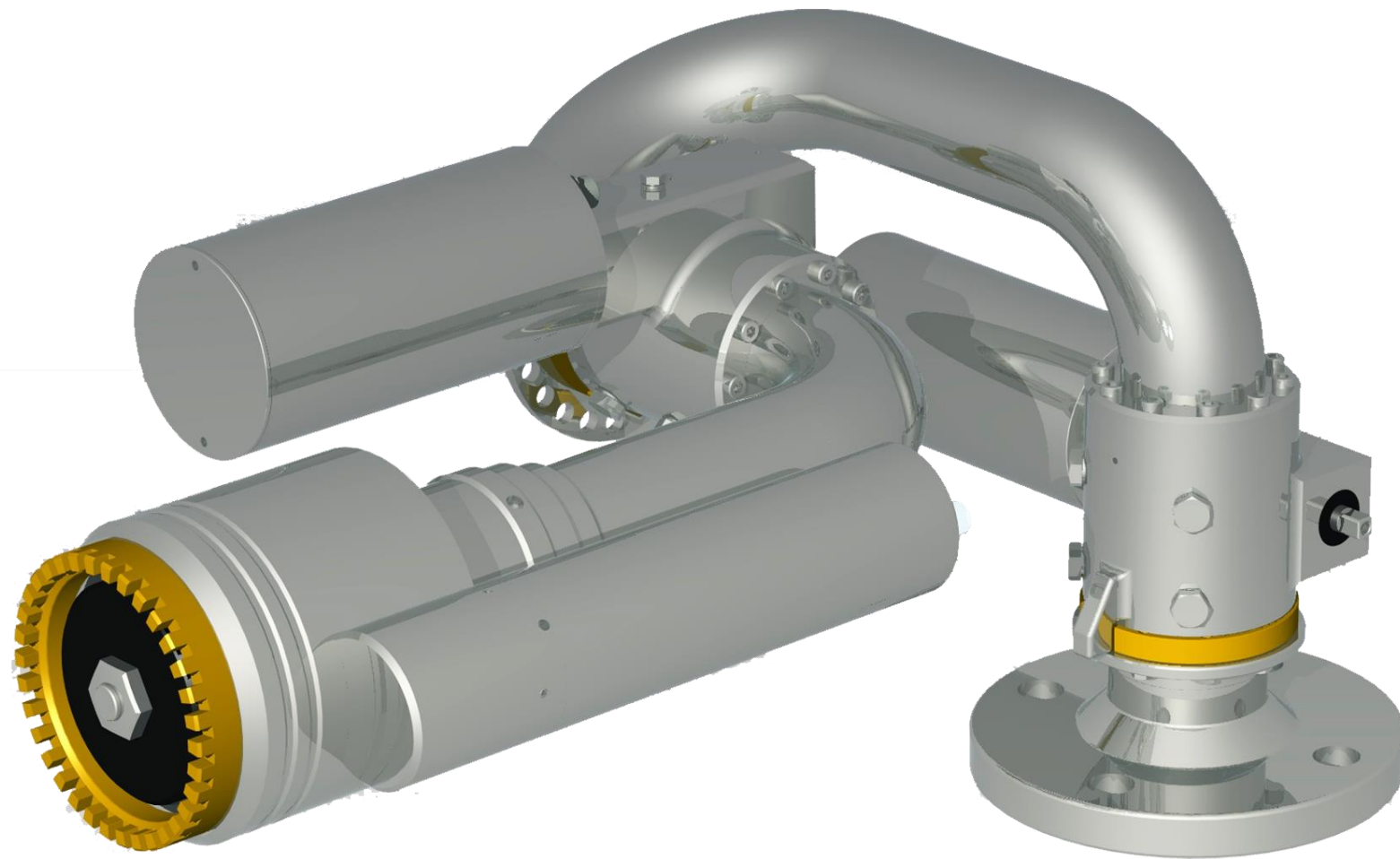
- Gas Extinguishing
  - CO<sup>2</sup>, Argon, etc.



- Water Cannon



# Firefly's Water Cannon



Large storage areas

When ceiling heights don't allow for good nozzle placement

When customers themselves specify that a water cannon is what they want/need.



# Firefly's Water Cannon

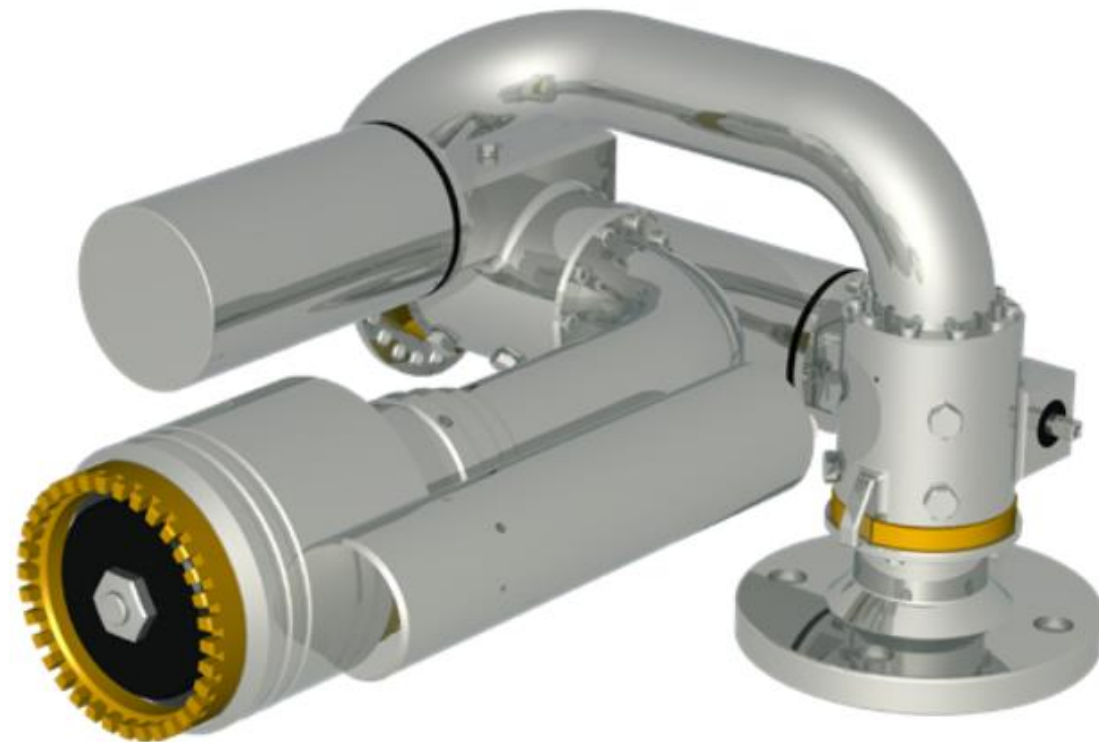
2 available versions

DN50 (2")

Water flow: 925 l/min @5 Bar

Operational reach: 30m @5 Bar

Coverage speed: 200 m<sup>2</sup>/min – effectively  
4,6mm/m<sup>2</sup>/min



DN80 (3")

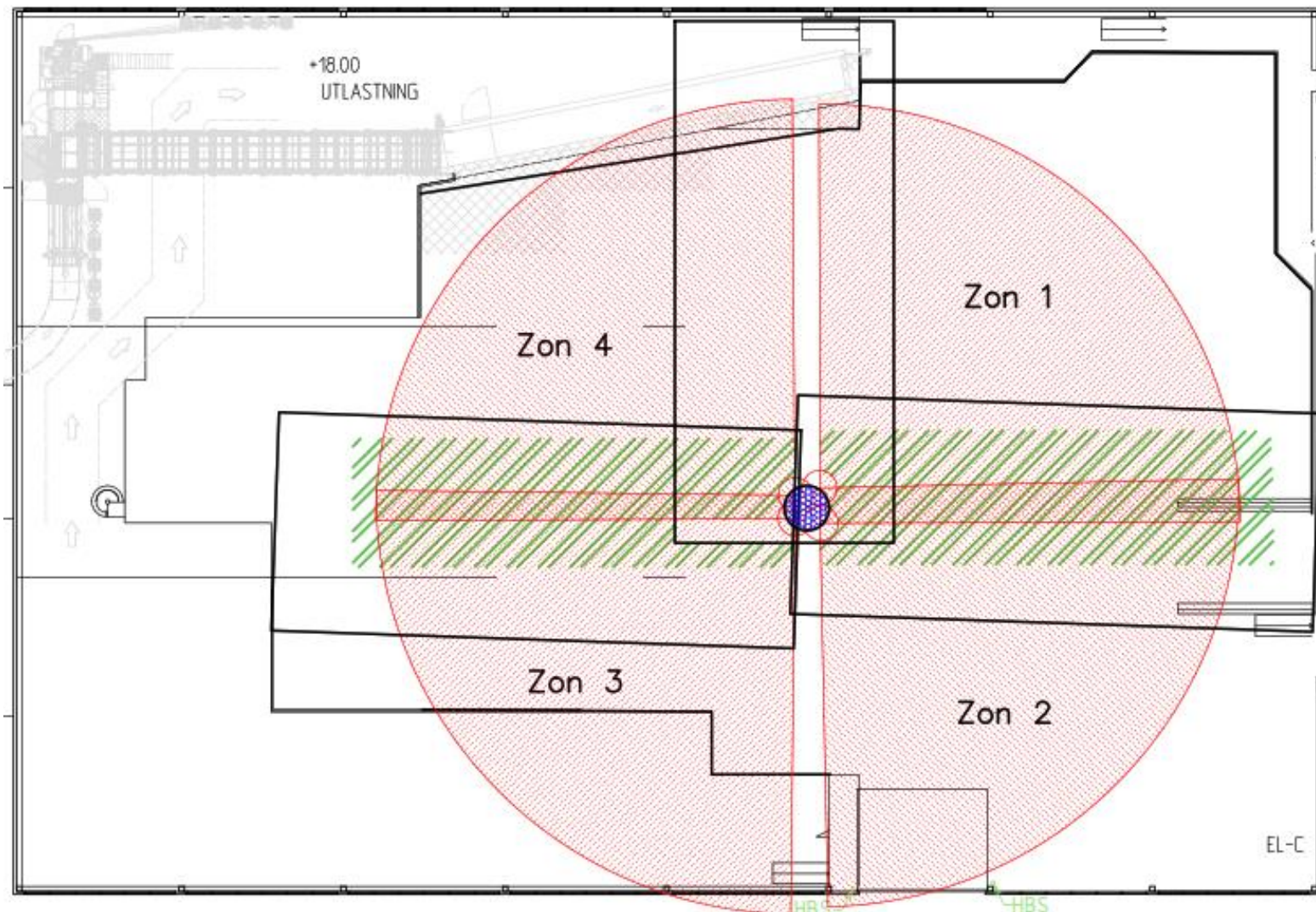
Water flow: 3250 l/min @5 Bar

Operational reach: 45m @5 Bar

Coverage speed: 200 m<sup>2</sup>/min – effectively  
16mm/m<sup>2</sup>/min



# Water cannon zones/scenarios

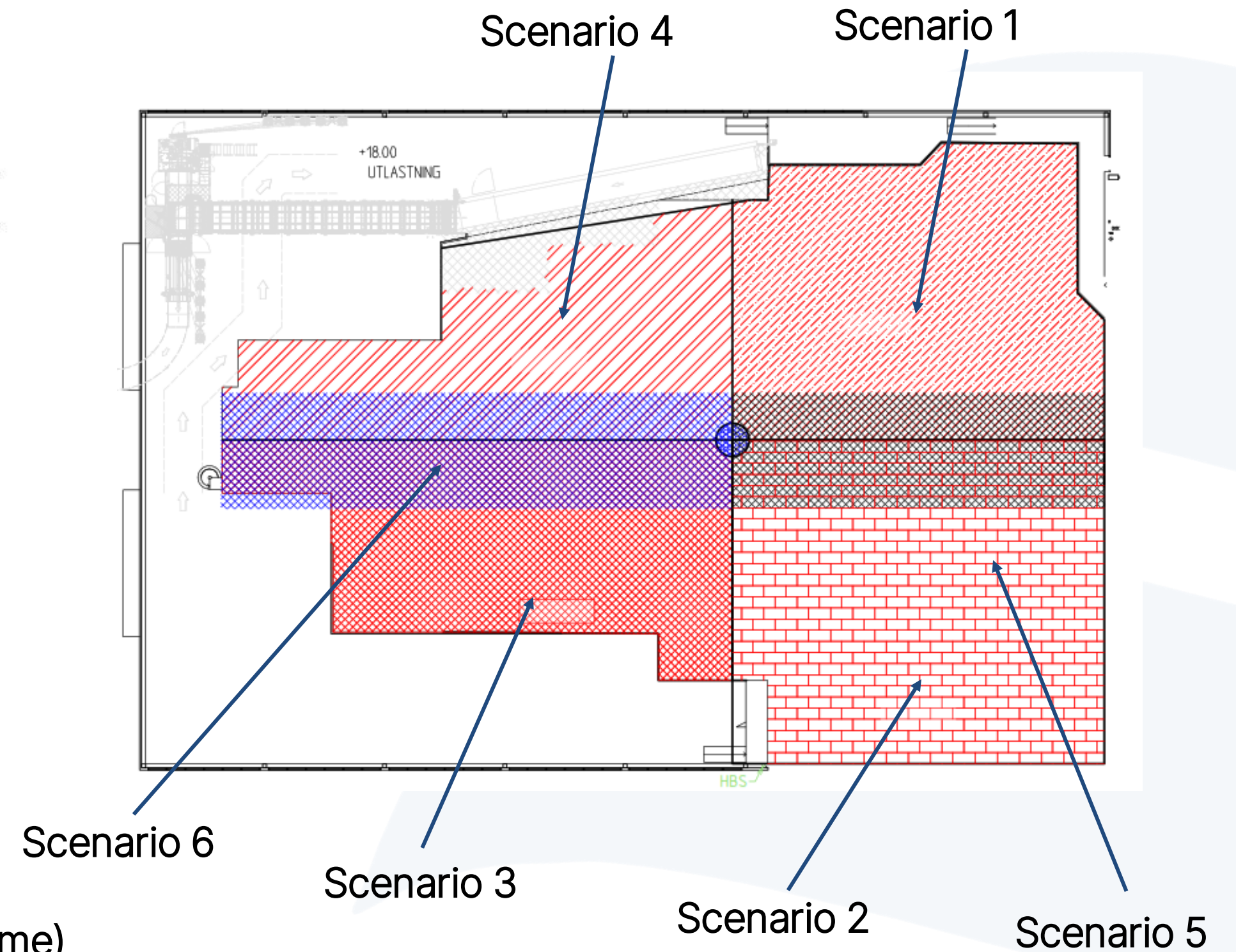
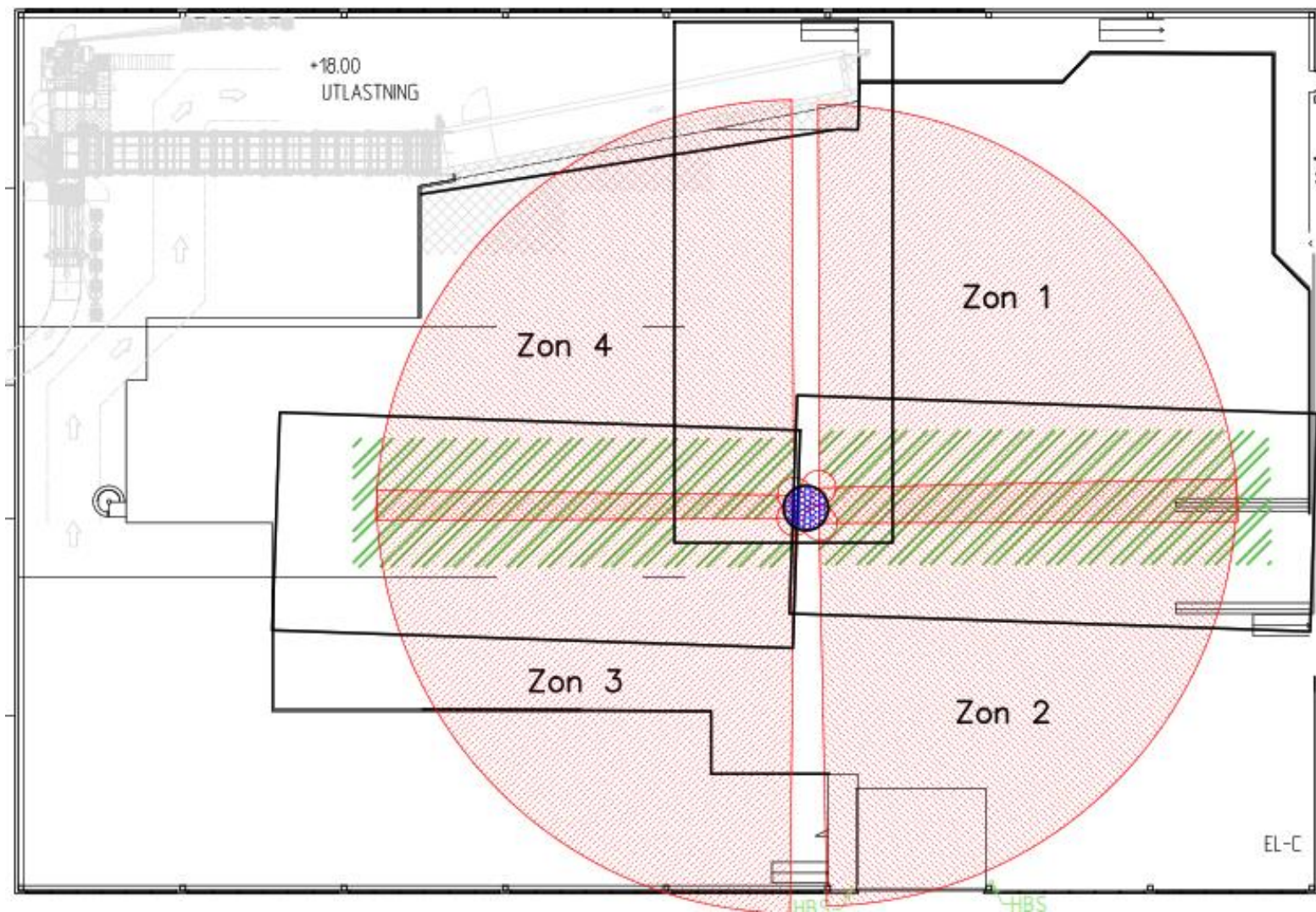


**Zone:** The area that we have identified as a risk that need protection.

**Scenario:** A situation that the water cannon will need to handle.

In this case, we have identified 4 different zones but 6 scenarios that the cannon will use depending on what is happening

# Water cannon zones/scenarios



\*Each water cannon can handle 10 scenarios (one at the time)





## Firefly Applications and 2 Customer Case Study



[www.prodetec.com.au](http://www.prodetec.com.au)



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# Customer Case No.1 – Firefly Systems for Tissue Industry

Fire in a Tissue Machine – Drive Side of Yankee



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# Customer Case No.1 – Firefly Systems for Tissue Industry

Fire in a Tissue Machine – Embosser



[www.prodetec.com.au](http://www.prodetec.com.au)

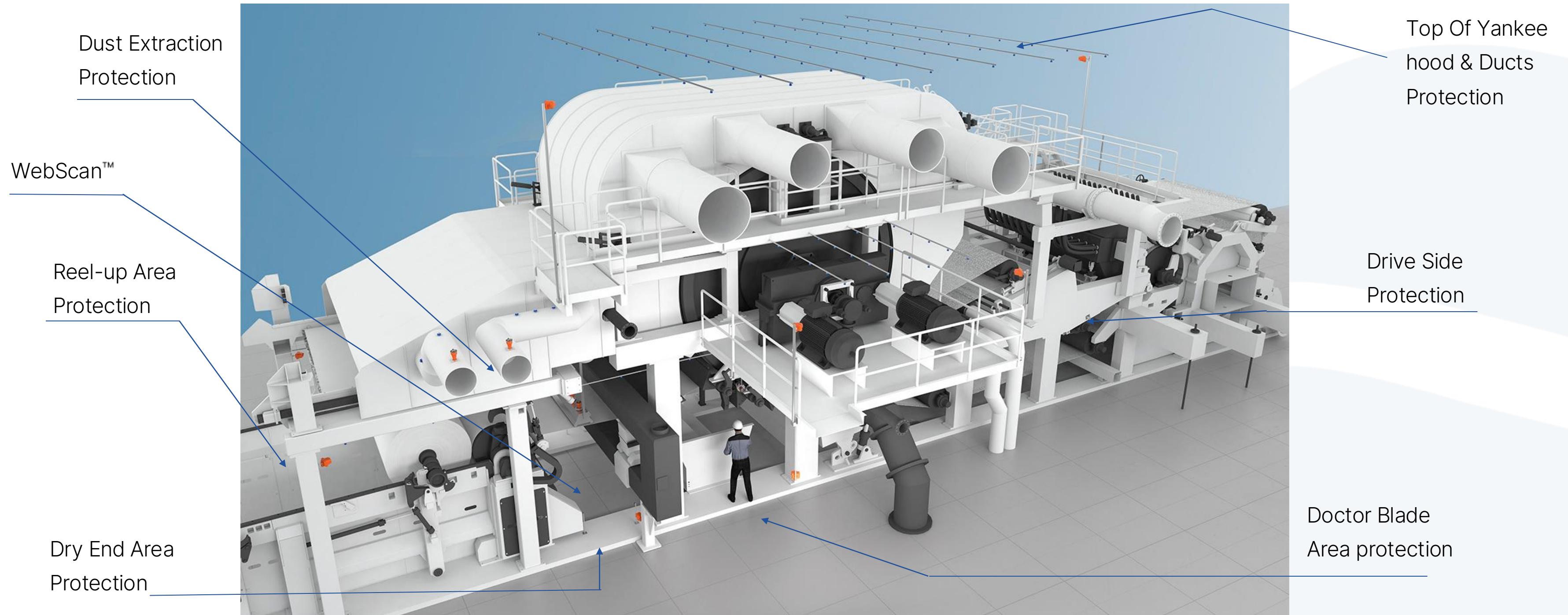


1300 588 888



[info@prodetec.com.au](mailto:info@prodetec.com.au)

# Firefly Tissue Solutions®



# Video Firefly System - Top of Yankee Hood and Ducts



[www.prodetec.com.au](http://www.prodetec.com.au)

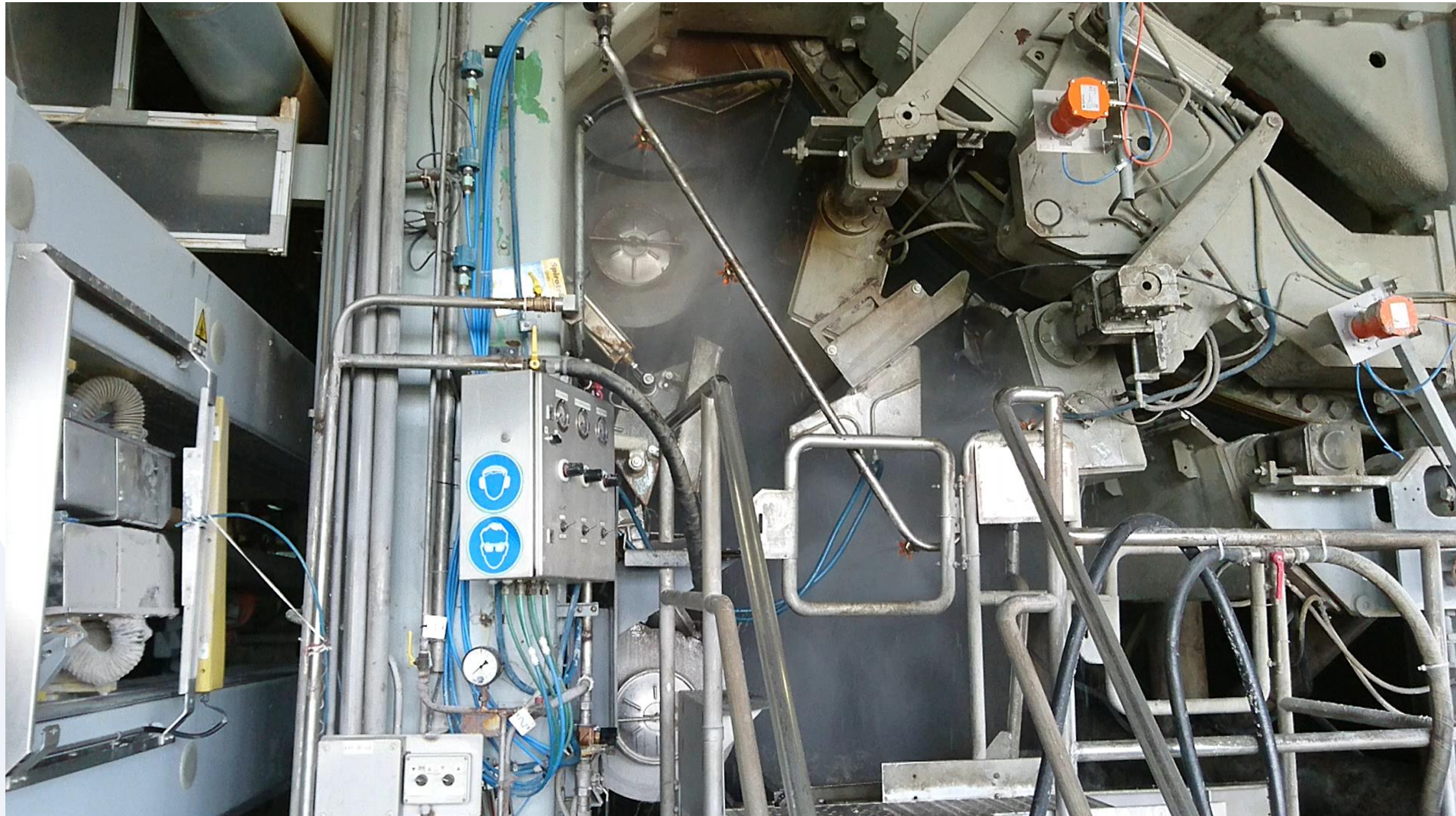


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# Video - Firefly Doctor Blade System



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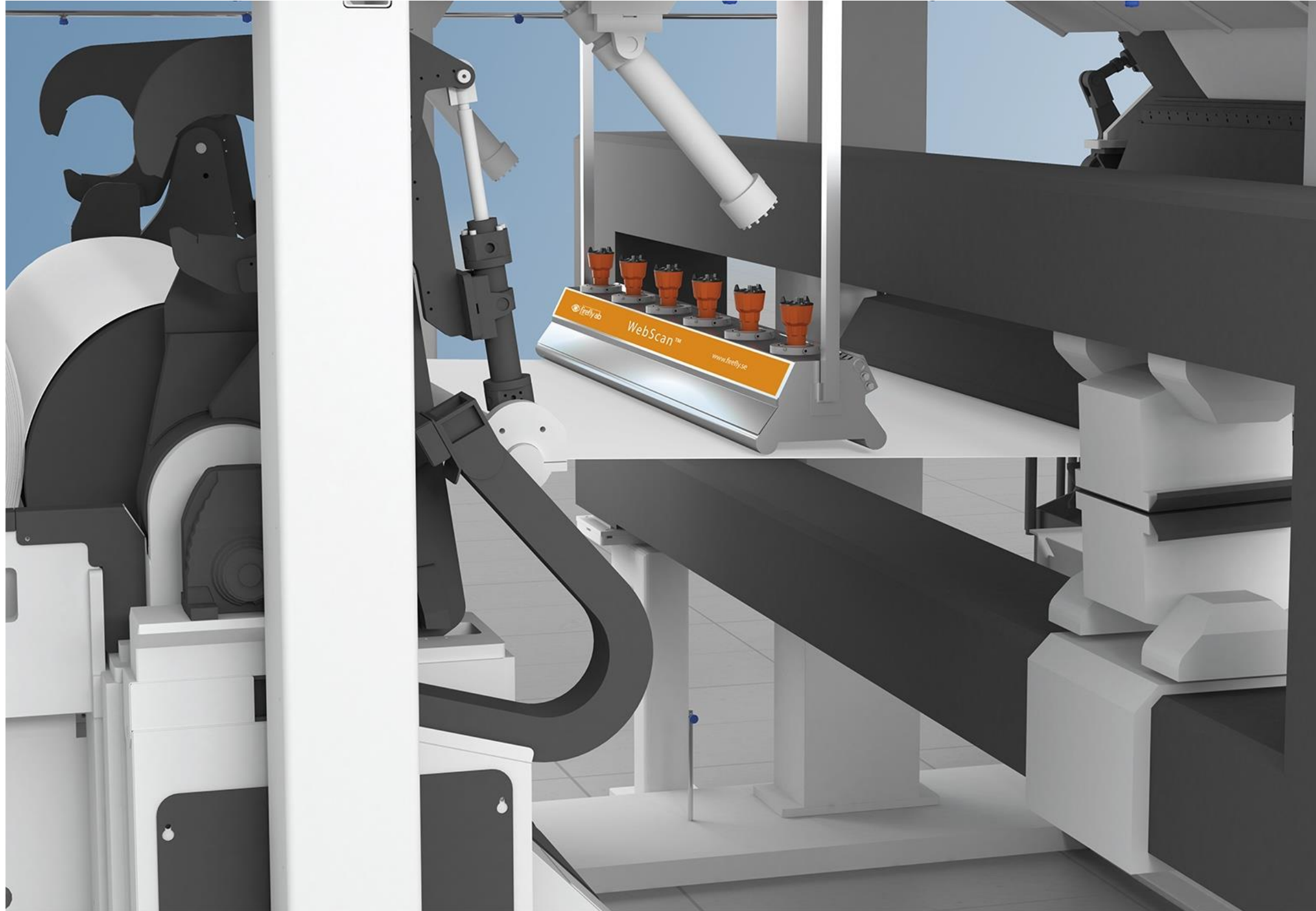


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# Firefly WebScan™



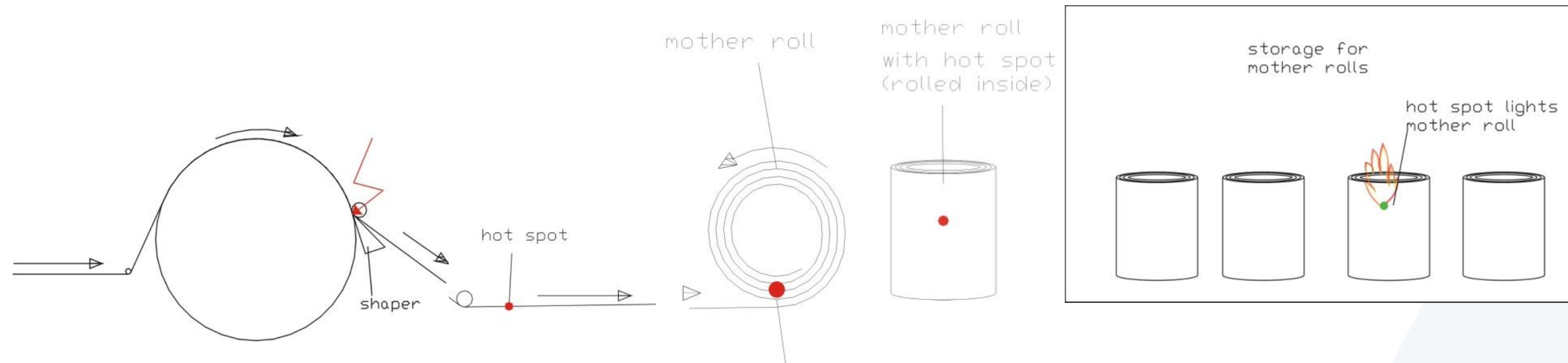
Detection of hot spots in the tissue web



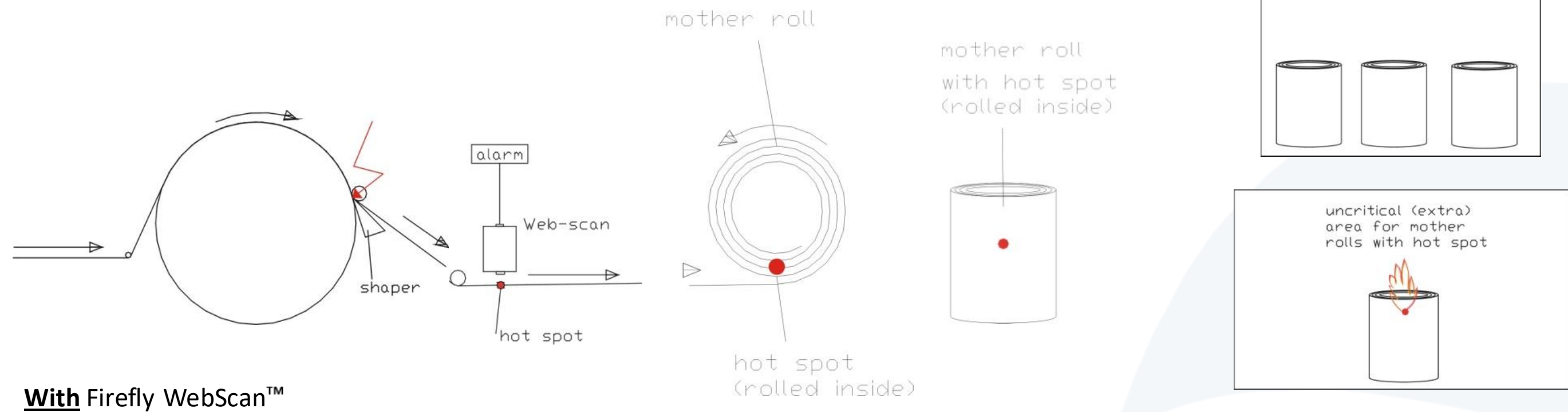
# Firefly WebScan™



# Firefly WebScan™



**Without** Firefly WebScan™



**With** Firefly WebScan™



# Customer Case No.2 – Firefly System for Polarbröd – the 3rd largest bread company in Sweden

MSB investigation after the fire at Polarbröd – the 3rd largest bread company in Sweden in August 2020:

“The fire was caused by combustible material igniting in the oven, something that has also happened before, but then the staff discovered the fire early and were able to extinguish it. This time the small fire followed the conveyor belt further into the process”

“It has become clear in the investigation how important it is with technical systems that can detect even small fires at an early stage and extinguish them at an early stage”.

Source:

<https://www.msb.se/sv/aktuellt/nyheter/2021/februari/manga-bidragande-orsaker-bakom-branden-i-polarbrods-fabrik/>



## Customer Case No.2 – Firefly System for Polarbröd – the 3rd largest bread company in Sweden





## Firefly Control System



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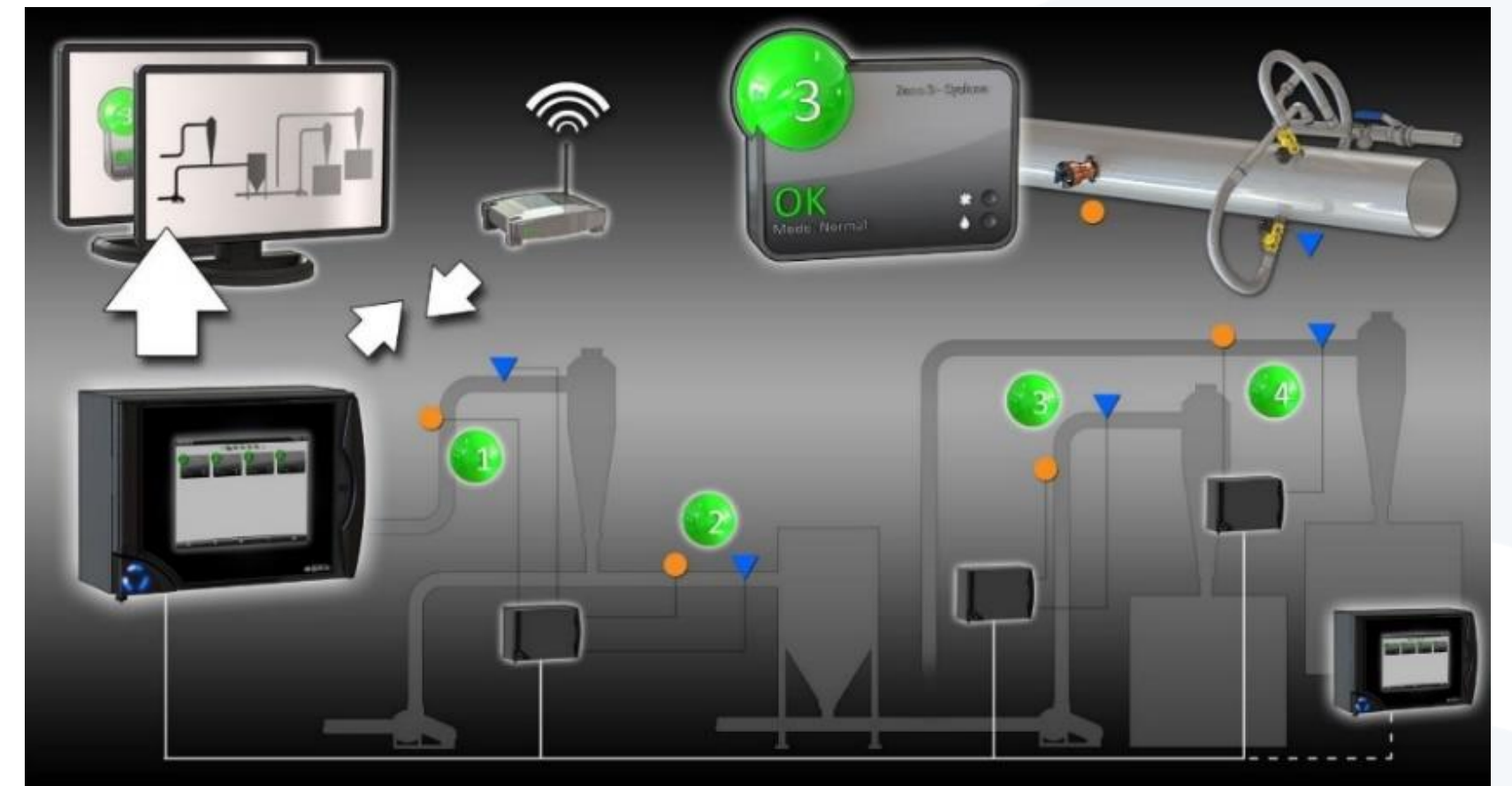
1300 588 888



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# Firefly Control System - System Architecture

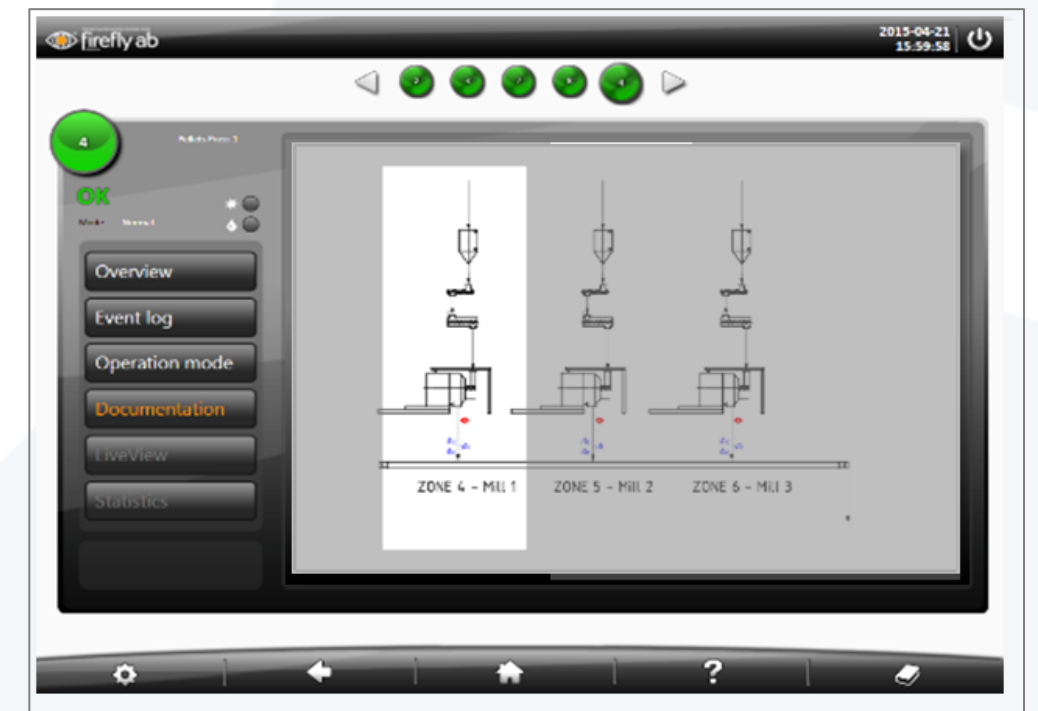
- Modular and decentralized system architecture
- Simple, cost-effective and easy installation
- Connected system with remote support
- Future-proof, easy to upgrade
- No zone limitations
- Possibility to have more than one screen in a network
- OPC UA compatible



# Firefly Control System - Intuvision

IntuVision™ is the operators interface for the Eximio system.

- 12.1" colour touch screen, included as standard in a Eximio System
- Clear, informative and user-friendly operators interface
- Application View - Drawings of each zone as standard
- Detailed information of connected equipment
  - E.g., Displays detector status with temperature, humidity etc. in detectors
- Logbook with up to 1,000,000 events, specified in millisecond





## Pressurized Water System



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# Pressurized Water System

Firefly can supply Booster Pumps and Bladder Tanks to achieve the required water pressure and water capacity for the system.

Normal working pressure: 7 - 9 bar

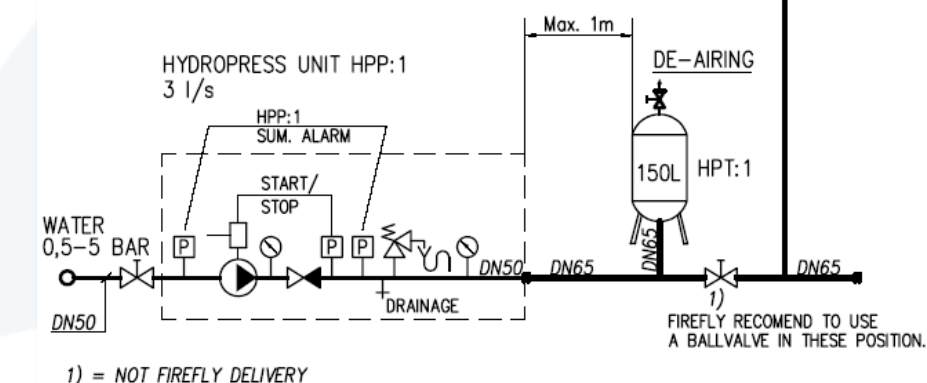
## For Spark Detection

Dimensioned for full extinguishing during 1 minute at the largest water zone + 50% extra, according to CEA4044.

## For Water Mist Suppression

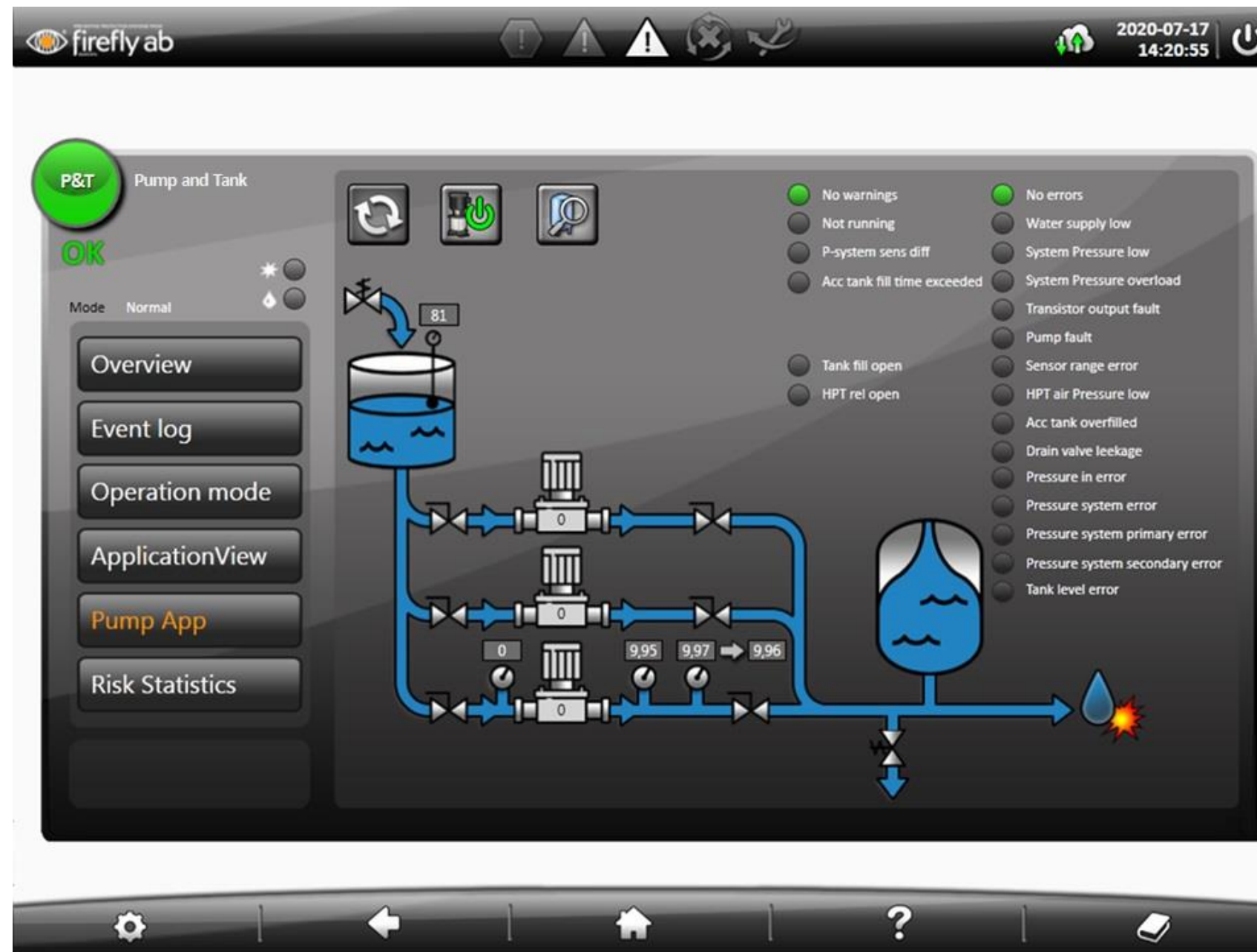
Dimensioned for duration of 10 minutes, according to EN-14972  
Or longer time if required by AHJ.

**For combination** of systems, Firefly will dimension the water system to cover both the Spark Detection and Water Mist criteria.



# Pressurized Water System

Unique Booster Pump System - APP in Eximio IntuVision™



# What is Fire Prediction?

Fire Prediction - Condition Monitoring Principles applied to fire risks

- Identification of deviations from normal process behavior
- Trend analysis over time
- Data-driven early warnings
- Information as decision support for operators and maintenance teams

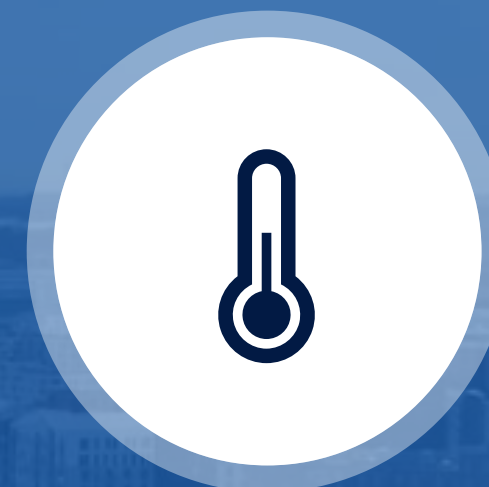
# Firefly Prediction Toolbox Examples



**Firefly PreSense™**  
IR Trend Monitoring



**Firefly MGD™**  
Multigas Monitoring



**Firefly TSK**  
Temperature Monitoring



**Thermal Camera**  
Thermal Monitoring



**Process  
Parameters**



**Additional Sensors**  
Vibration and Sound

# Why Fire Prediction?

The aim with Fire Prediction is to

- Identify fire risks at the earliest possible stage
- Provide operators with valuable insights into process and equipment health
- Enable proactive correction action before equipment failure or fire occurs

***“Saving lives and keeping customers in production.”***





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**Thank you.**

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