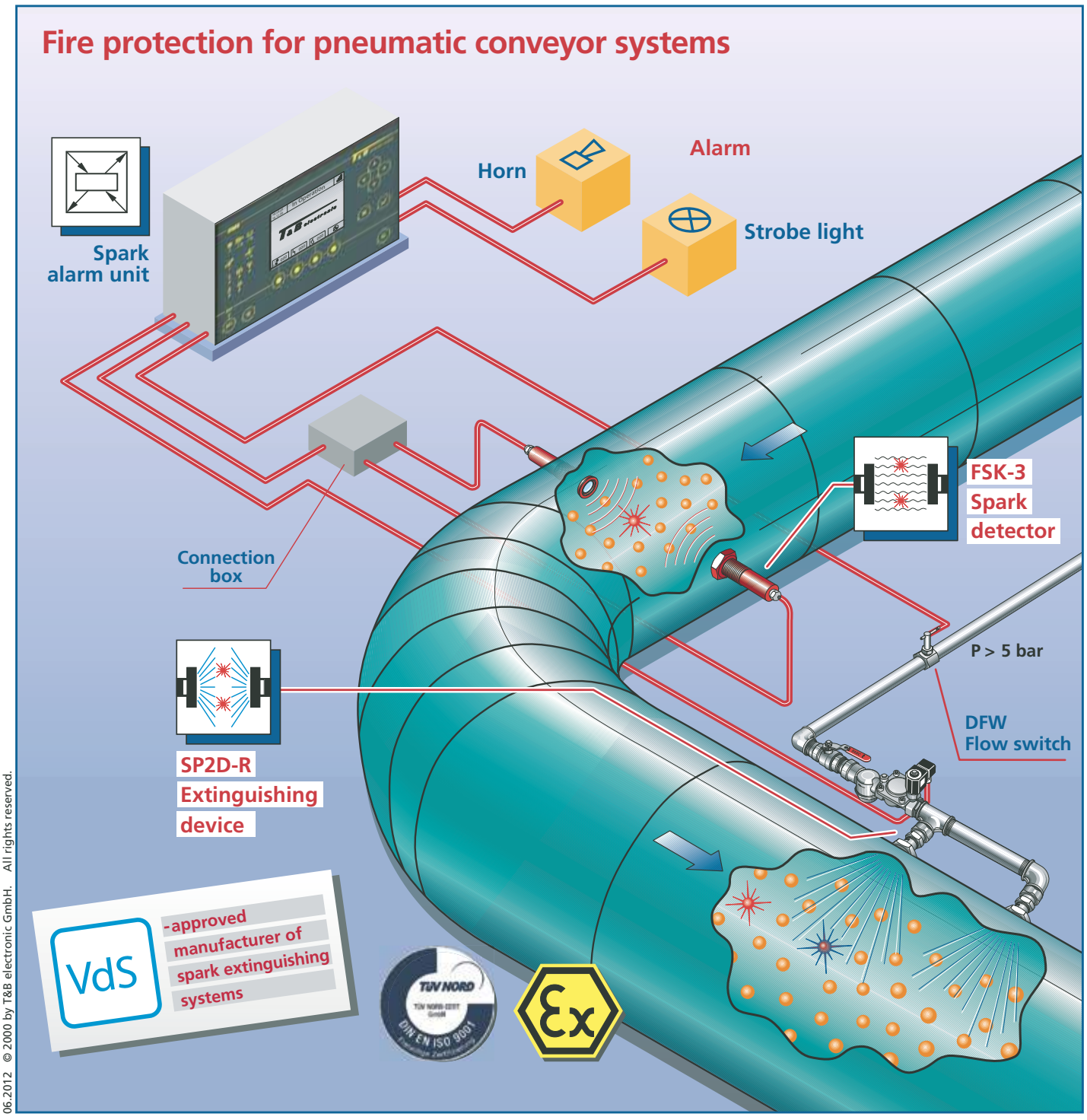
Detecting Sparks, Extinguishing Sparks!

Avoid damage to property, loss of production and danger to human life!

Fire protection for pneumatic conveyor systems



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CMC TECHNOLOGIES
PTY LIMITED ACN: 085 991 224, ABN: 47 085 991 224
Engineering & Industrial Instrumentation
Phone: +61 2 9669 4000
Fax: +61 2 9669 4111
Email: sales@cmctechnologies.com.au
Web Site: http://www.cmctechnologies.net.au
Unit 19, 77 Bourke Road,
Alexandria, NSW, 2015
AUSTRALIA

Igniting spark

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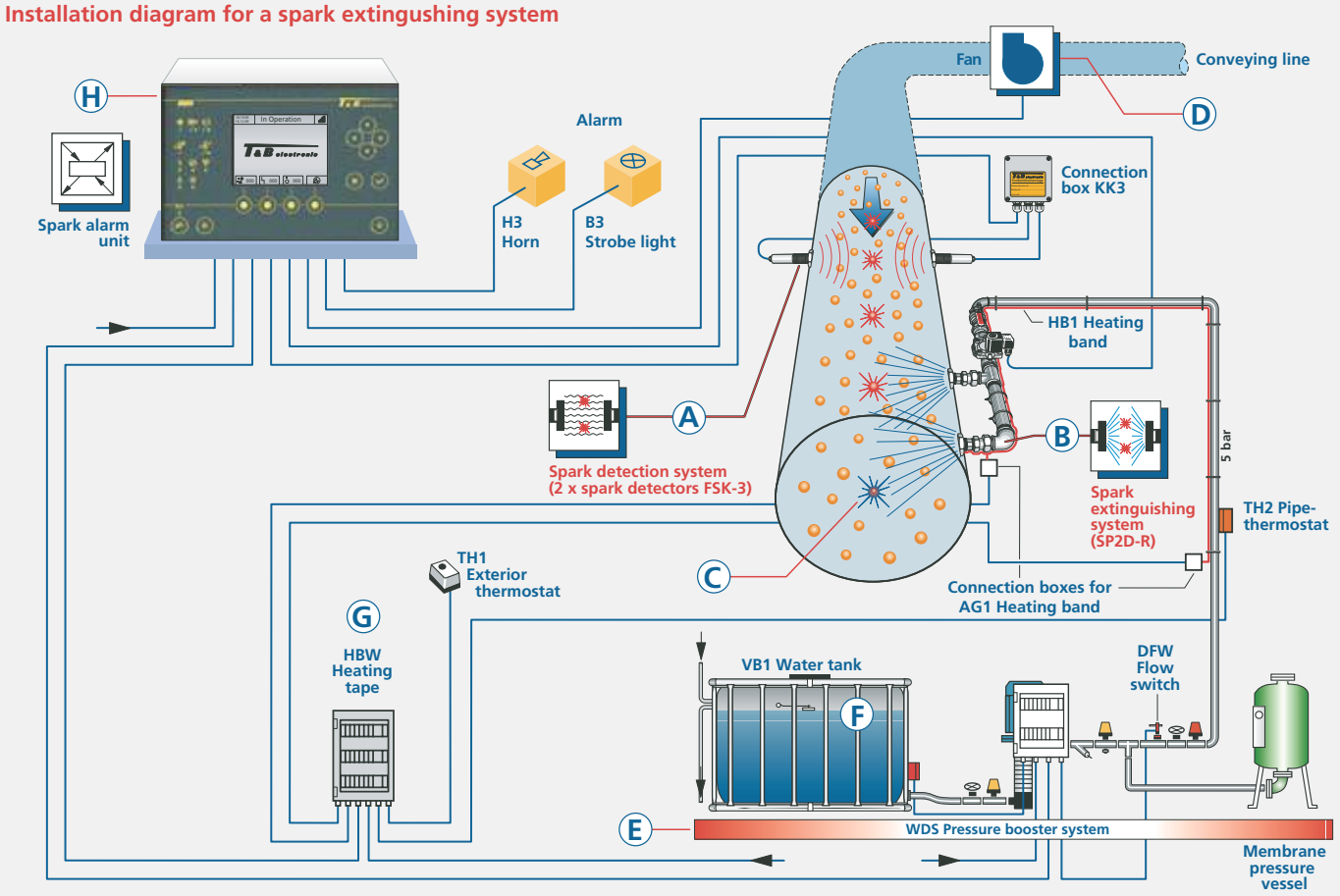
Installation diagram for a spark extingushing system



In pneumatic transport facilities and mechanical conveying systems transporting combustible materials, flying sparks are time and again causing fires and filter explosions. As a rule, flying sparks are caused by the machines used or by material impurities. Production down times, extensive damage to property and hazards for human life are the result. So as to rule out this risk, it is necessary to monitor extraction systems for flying sparks and to safeguard them by spark extinguishing systems. If spark extinguishing systems in compliance with the guidelines of the Association of Non-Life Insurers (VdS 2106) are installed, non-life insurers will grant a discount of up to 15%.

Function of a spark extinguishing system

In pneumatic conveyor lines, spark detectors and spark extinguishing systems should be installed downstream of the fan (because the latter may also generate sparks). The spark detectors detect minimal infrared rays and relay these to the spark detection centre. From there, the extinguishing system is actuated within milliseconds and extinguishing water is injected into the extraction line via special nozzles. The flying sparks have to pass this extinguishing mist and are in the process reliably extinguished. The minimum distance between a spark detector and the extinguishing equipment in an extraction system depends on the air velocity in the extraction line and the reaction time of the extinguishing system. The minimum distance in metres is calculated by multiplying the air velocity in m/s with a safety factor of up to 0.3 s (depending on the diameter of the delivery line). The safety factor designates the time between spark detection and build-up of the extinguishing mist. Within this period of time, an effective extinguishing water mist, which will be able to reliably extinguish the flying sparks, must be generated in the suction line. Thus, the following basically applies: the higher the air velocity, the greater the distance between spark detector and extinguishing system has to be to ensure that the extinguishing process always sets in before the spark arrives at the place of extinction.

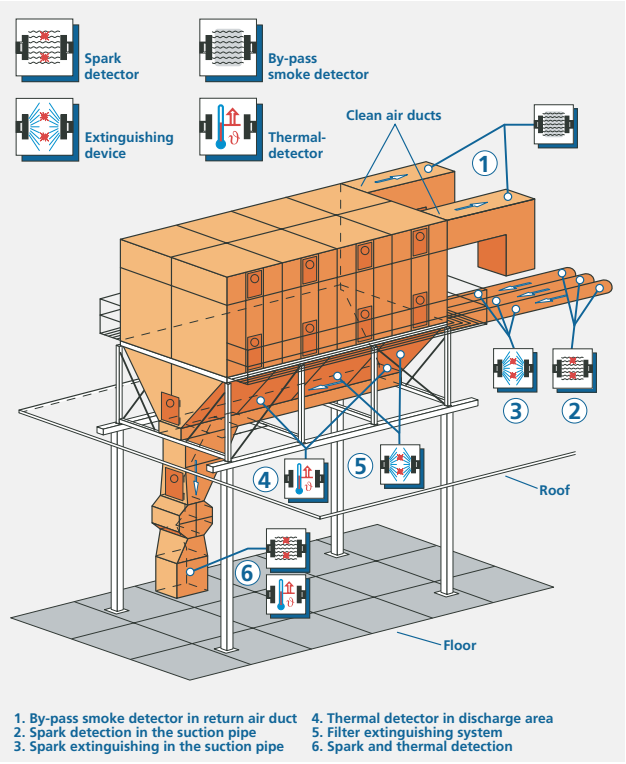
Here an exemplary calculation:
Suction/air velocity v = 30 m/s
Safety factor = 0.25 s
The minimum distance calculated on the basis of these figures:
= 30 m/s x 0.25 s = 7.5 m

Equipment of the spark extinguishing system

All delivery lines to the filter and chip silo should be equipped with a spark detection **(A)** and spark extinguishing system **(B)** downstream of the fan. The spark detection system **(A)** consists of at least two spark detectors monitoring the entire pipeline cross section. The spark extinguishing system **(B)** consists of a

quick-opening solenoid valve and at least one extinguishing nozzle. The extinguishing nozzles are provided with a shutting device to protect them from soiling. The extinguishing process is continued until the last detected spark **(C)** has passed the extinguishing section; then the automatic extinguishing system closes independently. However, the spark extinguishing system continues to remain ready for operation, so that newly arising flying sparks can immediately be combatted again. The minimum extinguishing time amounts to five seconds and is automatically extended in case of persistent flying sparks. During the production process, individual sparks are reliably extinguished. It is possible to effect a machine shut-down **(D)** by means of an adjustable spark threshold comprising between 1 and 999 sparks within a time unit. The number of sparks detected and the triggering threshold are visually displayed in the spark detection centre. So as to be able to generate a perfect spray pattern, a flow pressure of at least 5 bar must be present at the automatic extinguishing system. If that is not the case, a pressure booster **(E)** consisting of a vertical centrifugal pump with diaphragm pressure tank and a storage tank **(F)** will be used. The storage tank simultaneously serves to biologically separate mains water and extinguishing water. The extinguishing water can be connected to an existing sprinkler system. Extinguishing systems that are located in areas threatened by frost must be equipped with an electric trace heating. The trace heating **(G)** is controlled via an external thermostat with the associated heating strip monitoring system. All heated extinguishing water lines and the extinguishing system itself must be insulated. In the area around the valves and extinguishing nozzles, it must be possible to detach the insulation for maintenance purposes. The spark detectors are equipped with built-in test facilities. The new generation of spark detection centres (H) is equipped with an automatic detector test facility and the manual detector test is dispensed with in this case.

An extinguishing water monitoring system is constantly monitoring whether extinguishing processes are proceeding correctly and visually displays the extinguishing process at the spark detection centre.



Protection of a Hose filter systems: All suction pipes leading to the filter system are monitored by spark detectors (2) and protected by spark extinguishers (3). If a filter pipe starts smouldering, the alarm is actuated immediately by by-pass smoke detectors (1) in the clean air ducts. Fires due to self-ignition in the filter system are detected by thermal detectors (4) an the alarm given immediately, so that the filter extinguishing system (5) is also activated.

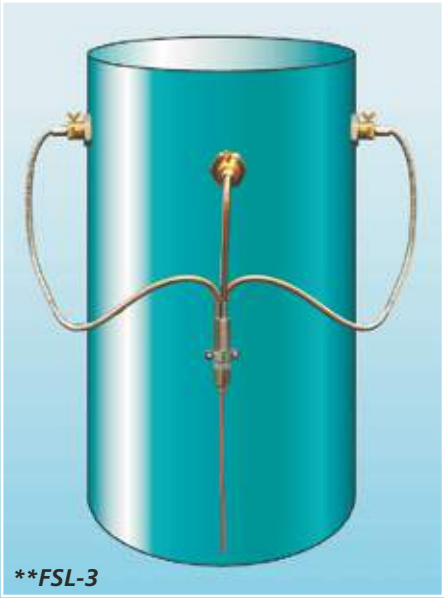
If a filter system is working with an air return system, bypass smoke detectors are provided for installation in the return air ducts. These will immediately report any smouldering fires in the filter hoses and cause the fans to be switched off. Two differential temperature indicators are additionally installed in the filter system and immediately trigger at a temperature > 85°C. It is possible to only trigger an alarm or to also actuate an extinguishing system. The spark detection centres are equipped with a microprocessor monitoring system. The results of the fire detection events and malfunctions are saved and displayed as plain text. Up to 2500 results can be saved.

Directives

The Association of Non-Life Insurers applies the directive for spark extinguishing systems (VdS 2106).

It stipulates among others that a spark extinguishing system may only be installed by an installation company that has been approved by the VdS. Only approved components and equipment may be used. For every spark extinguishing system, the approved installation company must compile an installation test, a schematic drawing detailing function and protected area as well as a hydraulic calculation. These documents must be submitted to the VdS during an acceptance procedure. Spark extinguishing systems must be checked and serviced by an approved installation company at regular intervals. Any defects detected must be immediately eliminated. Normally, maintenance at six-monthly intervals is adequate. The company operating the spark extinguishing system must maintain a logbook into which malfunctions, technical inspections, etc. are entered.

**FSK-3
**FST-3



**FSL-3

Spark detectors

Spark detector FSK-3

The spark detector FSK-3 is an opto-electronic recording system serving the detection of sparks in the infrared range. The spark detector is suitable for installation in closed pipeline systems without incidence of extraneous light. A special bracket serves to install the spark detector in pipelines with different nominal widths (100-2000 mm) without any difficulties and without changes to the existing extraction system. The viewing angle of the spark detector is approx. 120°. The spark detector is designed with type of protection IP 65. Maximum ambient temperature: 60°C.

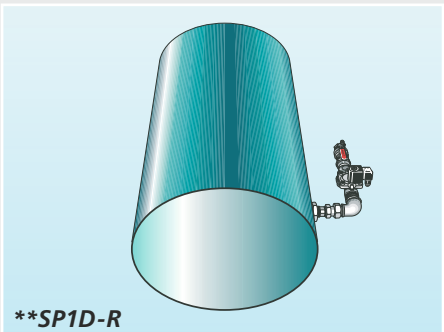
Spark detector FST-3

Design of enclosure as FSK-3, but with the following exceptions: daylight insensitive heat/spark detector for the detection of sparks and thermal radiation from 300°C onwards, with built-in daylight filter. Suitable for installation in open systems with incidence of extraneous light, but without direct solar radiation. Maximum ambient temperature: 60°C.

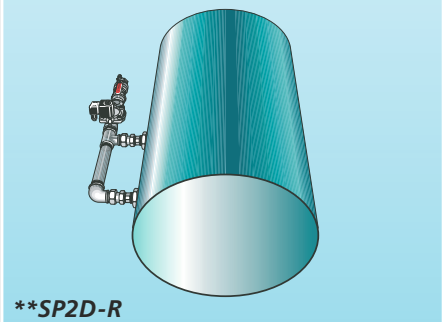
Spark detector FSL-3

Function as FSK-3, but as optical fibre spark detector for temperatures up to 300°C with 3 fibre optic arms.

**All detectors also available in ATEX design



**SP1D-R



**SP2D-R

Automatic extinguishing systems

The extinguishing equipment serves to quickly and reliably extinguish any flying sparks detected in mechanical and pneumatic transport facilities. Extinguishing systems are available in different designs and differ in the number of extinguishing nozzles used.

An automatic extinguishing system, e.g. SP2D-R, consists of a ball valve, dirt trap, solenoid valve, 2 extinguishing nozzles and pipework. The dirt trap consists of a fine-meshed screen and protects the solenoid valve against impurities. The amount of extinguishing water is accurately dosed and is injected via the extinguishing nozzle at an angle of 120°. The optimum extinguishing effect is already achieved with a few litres per extinguishing process. On account of the optimum dosing of the amount of extinguishing water, the downstream filter systems will not be adversely affected.

**All automatic extinguishing systems also available in ATEX design

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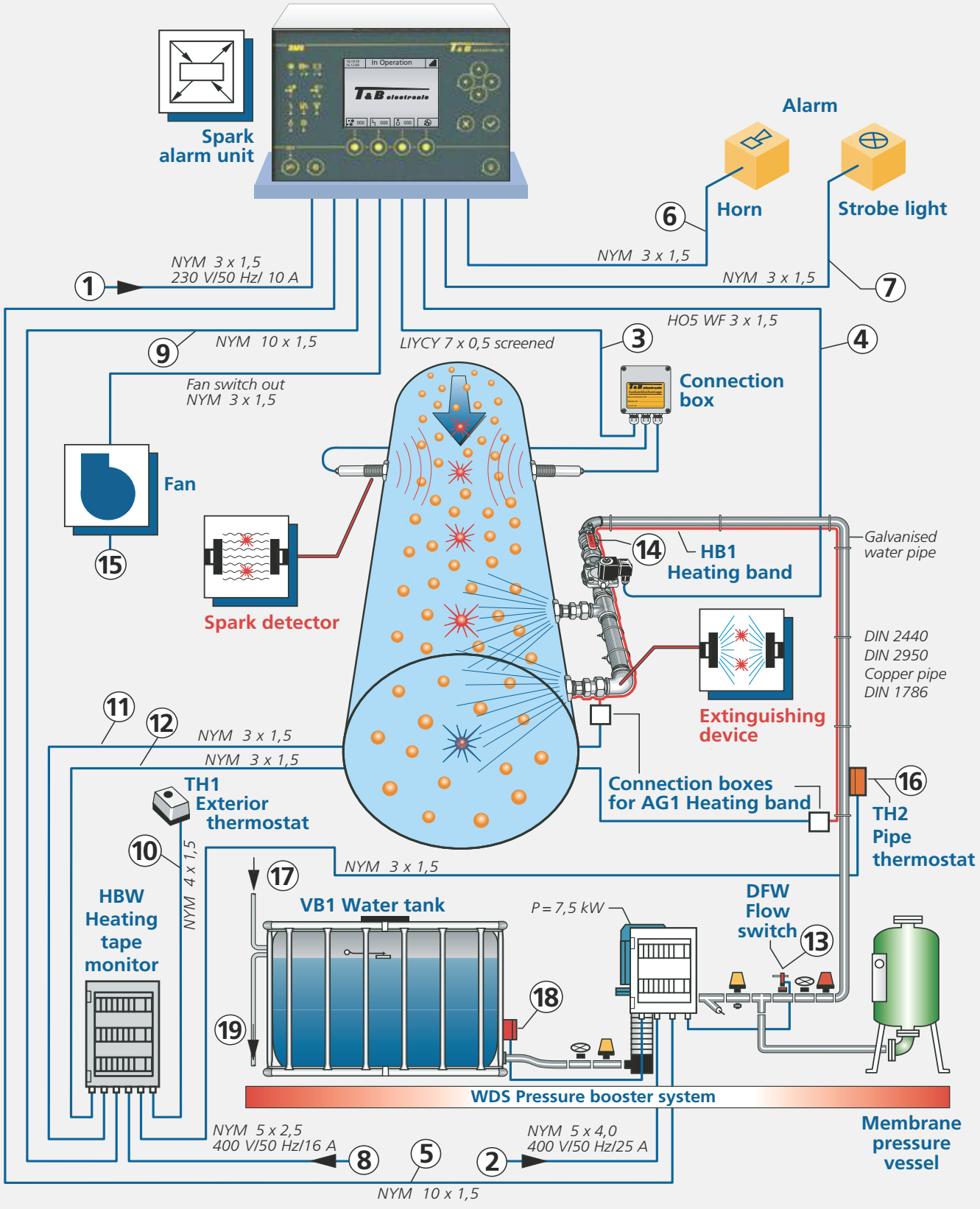
Spark detection centre BM 6

Microprocessor-controlled spark detection centre for 2 to max. 36 monitoring/extinguishing areas. Modular design in different versions:

- BM 6-2: upgraded for 2 lines
- BM 6-4: upgraded for 4 lines
- BM 6-16 and BM 6-36: Basic version upgraded for 4 lines, later expansion to 16 or 36 lines is possible at any time through the use of further components.
- 4 operating languages are pre-installed and can be switched over at any time.
- Up to 2,500 events can be stored in the log memory. All messages are shown in plain text.
- Connection of up to 4 spark detectors per line is possible.
- The number of detected sparks, the extinguishing time as well as machine shutdowns are recorded and displayed.
- Automatic self-monitoring of the entire spark detection and extinguishing section. The spark detectors are automatically tested at regular intervals.
- If a line is switched off, this will be visually displayed and recorded.
- All relay outputs (alarm, post-detection, malfunction, etc.) are freely programmable. Per area, 2 floating outputs 230 V/1 A are available.
- Visual display for an optional trace heating for the extinguishing water.
- Built-in emergency power supply for an operating time of 4 hours.
- Enclosure type of protection: IP 55
- An optional OPC interface is available for relaying events and for data exchange with other systems.
- A remote control function makes it possible to access the control centre via the Internet. On account of this, the T&B service is able to intervene online, providing support in the event of a malfunction, if a corresponding modem connection is ensured.

Installation Instructions for Spark Extinguishing Systems



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Explanation of Diagram:
Installation Instructions Spark Extinguishing Systems

The diagram shown depicts a standard spark extinguishing system for monitoring a suction line.

1. Electric supply cable to the spark detection centre 230/50 Hz fused with 10 A. It may not be possible to switch off the electric circuit and no other loads may be connected. The fuse in the main distribution must be identified and labelled in "red".
Cable type and cross section:
NYM 3 x 1.5 mm²

2. Electric supply cable to the pressure booster WDS 3 x 400 V/50 Hz fused with 25 A. No other loads should be connected to this electric circuit. The fuse in the main distribution must be identified and labelled in "red".
Cable type and cross section:
NYM 5 x 4.0 mm²

3. Electric supply cable to the spark detectors.
The spark detectors are provided with connectors, which are plugged in at the terminal box.
The connection from the terminal box to the spark detection centre is established by means of a multi-core shielded cable.
The terminal box must be installed in an easily accessible position and must be protected against moisture.
Cable type and cross section:
LIYCY 7 x 0.5 mm²

4. Electric supply cable to the extinguishing system.
The solenoid valve of the extinguishing system is provided with a connector. The connection should be established by means of a flexible cable as the space in the cable connector interior is restricted.
Cable type and cross section:
HO5 WF 3 x 1.5 mm²

5. Electric interlock between spark detection centre and pressure booster WDS.
Cable type and cross section:
NYM 10 x 1.5 mm²

6. Electric supply cable to the horn H4 (24 V DC).
Cable type and cross section:
NYM 3 x 1.5 mm²

7. Electric supply cable to the flashlight B4 (24 V DC).
Cable type and cross section:
NYM 3 x 1.5 mm²

8. Electric supply cable for heating strip monitoring HBW 3 x 400 V/50 Hz fused with 16 A.
No other loads should be connected to this electric circuit. The fuse in the main distribution must be identified and labelled in "red".
Cable type and cross section:
NYM 5 x 2.5 mm²

9. Electric supply cable between spark detection centre and heating strip monitoring HBW.
Cable type and cross section:
NYM 10 x 1.5 mm²

10. Electric supply cable to the external thermostat TH1.
The external thermostat must be fitted in an easily accessible and wind-protected position.
Cable type and cross section:
NYM 4 x 1.5 mm²

11. Electric supply cable to the self-regulating heating strip HB1.
Cable type and cross section:
NYM 3 x 1.5 mm²
The connection is made via the terminal boxes AG1.

12. Electric supply cable for the feedback signal of the self-regulating heating strip HB1.
Cable type and cross section:
NYM 3 x 1.5 mm²
The connection is made via the terminal boxes AG1.

13. Electric supply cable to the flow monitor DFW. If no pressure booster is available, a cable to the spark detection centre must be installed.
Cable type and cross section:
NYM 3 x 1.5 mm²
The flow monitor is by default wired with the pressure booster in the terminal box of the WDS.

14. A gate valve R=1ì is installed upstream of the extinguishing system. The gate valve must be secured against unintentional closing.

15. Electric supply cable for the interlock between spark detection centre and the fans to be switched off or other external switchgear.
Cable type and cross section:
NYM 3 x 1.5 mm² per area to be monitored.

16. Electric supply cable to the pipe contact thermostat
Cable type and cross section:
NYM 3 x 1.5 mm²

17. Storage tank for feeding the pressure booster.
The supply cable should have a cross section of min. R=1/2ì. The level of the storage tank is controlled via a built-in floating switch. The storage tank simultaneously serves to biologically separate extinguishing water and mains water.

18. Dry-running protection for the pressure booster
Cable type and cross section:
NYM 3 x 1.5 mm²

19. Overflow storage tank: A drain to which the overflow could be connected should be available.

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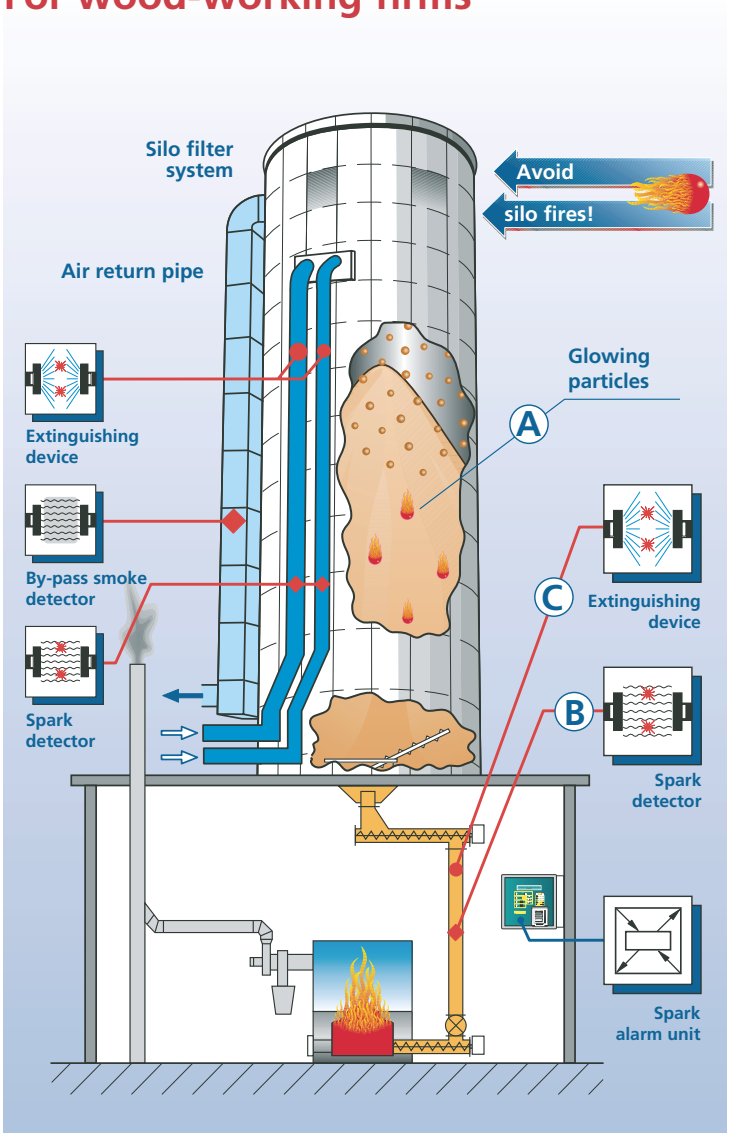
Fire protection for silos
Possible applications

For wood-working firms



Fire protection for chip silos

More and more frequently, silo fires have resulted from the fact that hot spots **(A)** from the firing plant could get into the silo. The fire only started several days afterwards.

Causes:

1. Leaks of the rotary gate valve upstream of the furnace.
2. No constant filling of the material feed to the furnace.
3. Only partly filled chip silo – thus a chimney effect is created – the embers were drawn from the furnace.
4. Hot gases – leading to spontaneous combustion inside the silo.

With the installation of a spark detection system **(B)** with extinguishing facility **(C),** these fire hazards can be effectively combatted. In addition, all pneumatic feed lines and return air ducts should be monitored for flying sparks.

Possible uses

Since 1984, more than **25,000** plant areas worldwide have been protected by T & B spark extinguishing systems. Fires or explosions may occur everywhere combustible materials are transported by mechanical or pneumatic means.

Here, automatic electronic spark extinguishing systems can be put to effective use.

Examples of areas where spark extinguishing systems are used:

Bitumen processing
Battery production
Manufacture of construction elements
Cotton wool industry
Chemical industry
Window factories
Firing plants
Animal feed industry
Flour mills
Glass industry
Rubber industry
Industrial bakeries
Wood flour industry
Timber processing operations
Coffee roasters
Coal dust extraction facilities
Synthetic materials industry
Kitchen furniture industry
Power stations
Food industry
Leather industry
Metal processing industry
Milk powder drying
Furniture industry
Waste incineration plants
Paper mills
Tire industry
Saw mills
Chipboard plants
Plywood plants
Shipyards
Chair factories
Chocolate industry
Tobacco industry
Textile industry
Carpentries
Pulp industry
Sugar industry

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