



THE CONTROL LOGIC SPARK DETECTOR SYSTEM

The spark detector is used for surveillance of the dust extraction ductwork connected to the silo and to neutralize every spark before it can ignite the silo. The spark detection system then comprises one or more detectors, an automatic extinguishing group and possibly a monitoring station.

When a burning particle passes in front of the detector, the built-in relay is operated for 3 sec, a sound alarm is turned on, the solenoid valve of the extinguishing group turns open and the nozzle sprays water for 3 sec, usually long enough to extinguish the burning particle. The monitoring station, if present, comprises other spark detectors located downstream from the extinguishing group, and triggers an alarm if a spark is not extinguished in order to stop the fan and/or shut off the duct valve.

The spark detector is mounted on the external surface of the duct, using the mounting frame, which consists of a metal shell in two pieces, carrying inside an anti-vibration rubber cushion. In the base to be fixed to the duct is a tempered glass window through which the spark detector will see inside the duct. The lid closes with four handle screws and allows quick opening for inspecting and testing.

The spray nozzle of the extinguishing group is installed inside the duct and positioned in the center so as to spray in the same direction as the air flow towards the silo.

The solenoid valve that controls the water flow to the spray nozzle, is installed outside the duct, as near to the nozzle as possible.

A pressure switch can be mounted between solenoid valve and nozzle, outside the duct, to monitor the water flow to the nozzle and give an alarm in case of leak of water due to a fault inside the valve.

It is very important that the spray nozzle should be placed at right distance from the extinguishing spark detector, to allow for the time taken by the water to reach the inside duct. While electronic circuit delay time is negligible, water takes at least 0.2 sec to form the spray, and this time varies with the pressure. If we consider an air speed of 20-30 m/s inside the duct, and water pressure of 3-4 bar, a distance of 15 m between detector and nozzle is advised, though the minimum distance may be less, down to 6 m.

The graph on page 13 shows the minimum distance for various air velocities.

When duct is short and just allows for the minimum distance we recommend to increase water pressure to 5-6 bar.

In addition to the extinguishing operation, it may be advisable to close the duct by an electro-pneumatic fire damper valve, mounted downstream from the nozzle and the monitoring detectors, and controlled by either the extinguishing or the monitoring detectors.

The delay time of the duct valve should also be considered and then be placed at a sufficient distance. The closing time depends on the size, but we suggest to consider a time of 0.5-1 sec. The distance from the spark detectors should therefore be 15-30 m.

It may also be advisable to stop the fan of the dust extraction system, under control of the extinguishing or the monitoring spark detectors.

In complete systems the control panel supplies the stop command to close the duct valve and stop the fan.

The monitoring function performed by the spark detectors downstream from the nozzles, along with the pressure switch that monitors the water flow to the nozzles, is very important because it provides a higher level of safety and signals when a spark is not extinguished.

Reasons are many: faulty detectors, wiring problems, faulty solenoid valve, dirt blocking valve membrane, water pressure too low (1 bar or less), burning particle too large or big fire, etc. In these cases the system stops the fan, closes the duct valve, if any, and requires action by the operator for manual reset.

Remote testing is provided. When the TEST button on the control panel is pressed, a filament bulb lights inside each spark detector and is interpreted by the sensor as a spark. Therefore the whole system comes into operation: the solenoid valve turns open and the water nozzle sprays for 3 sec. The stop command is also activated and the sound alarm sounds until the operator presses the RESET button. The TEST function makes initial start-up operations easy and allows the system to be checked at any time.

The 24Vdc power supply required by the detectors is supplied by the control panel, that signals the operation of the spark detectors, the water flowing through the nozzles, and the alarm for unextinguished spark. The control panel houses the relays that control the extinguishing operation, the sound alarm, the duct valve closure and the fan stop. It also contains the remote test button and the manual reset.

The control panel is only supplied with the complete systems. In the simple systems, with no monitoring station and no pressure switch, the control panel is replaced by a simple power supply unit without visual signals, with only the TEST button.