MONITORING & CONTROL IN COAL GRINDING SYSTEMS AND FUEL STORAGE SILOS

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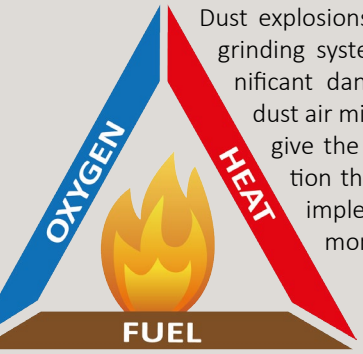


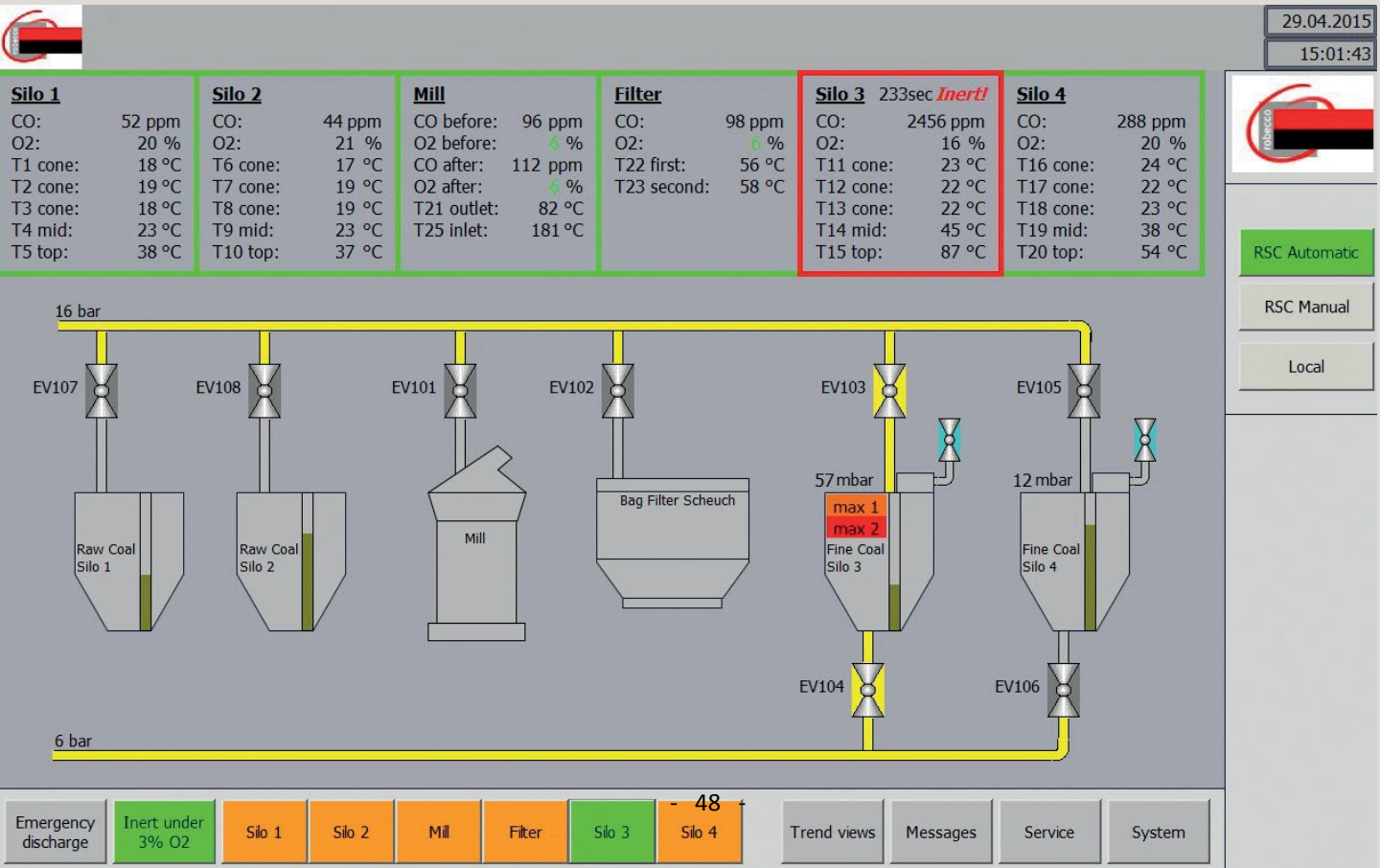
Dust explosions in the cement industry with coal grinding systems and fuel silos represent a significant danger. The presence of combustible dust air mixtures in different areas of the plant give the potential for an explosion, a situation that must be avoided through careful implementation of explosion control and monitoring equipment.

Fires and explosions generate high risks for people, the environment and production installations. The consequences are significant developments of heat and pressure. The fire and explosion safety of an installation is determined by risk factors of the process and products. High temperatures and material product characteristics can develop dangerous smouldering fires in the production process. To understand the risks of a production it is a requirement to look into the process. The knowledge of actual process parameters is essential to evaluate the risk.

Whereas dust concentrations cannot be controlled inside of grinding systems and fuel silos, the oxygen concentration can be altered. Apart from constructive explosion protection equipment and pressure-resistant construction methods in accordance with relevant guidelines, monitoring and control equipment is necessary for the safe operation of coal grinding plants and fuel storage silos.

To realise the safety of burning processes in the industry sector of heat gain or power supply, the selection of varied fu-

Below: Safe automatic control unit robecco secure center® (RSC).

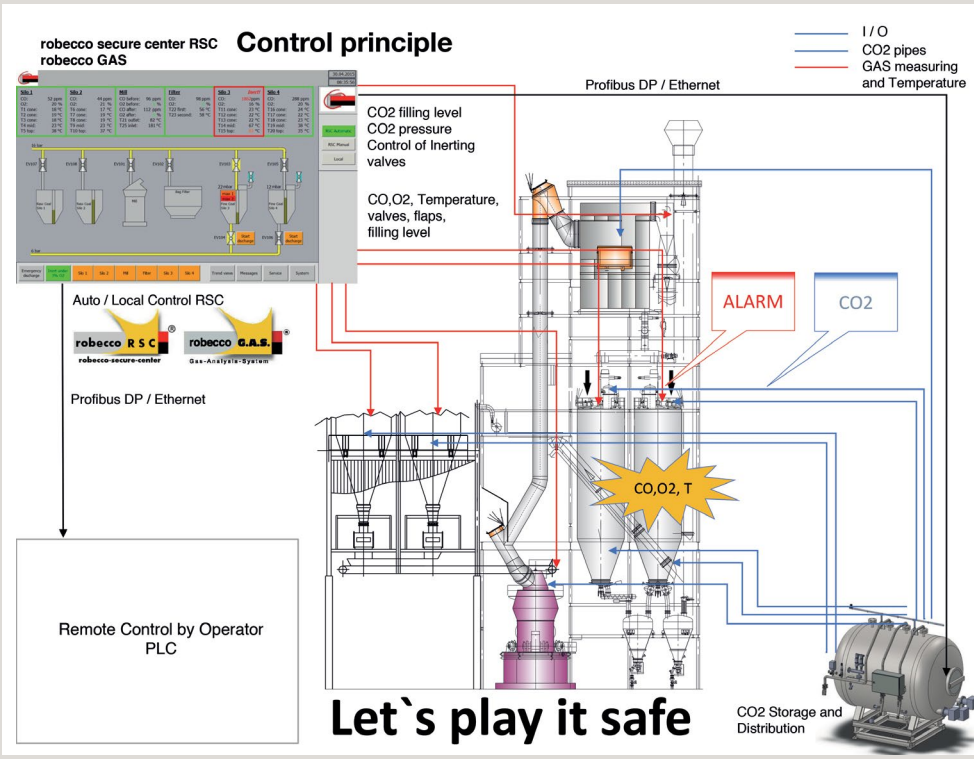


els becomes more and more important. Mills are used for the grinding process and the usual storage and containment of such materials are within silos. When using mills with connected bag filter installations and respective fuel storages, consideration must be taken regarding the explosion protection. It is mandatory to take into account a suitable monitoring and control system. Technical measuring and control equipment is necessary for the safe operation. Dust concentrations cannot be controlled, only the oxygen concentration can be varied.

If monitoring and control conditions inside coal grinding systems and fuel silos are existing it is possible to maintain an inert atmosphere, to gain early indications of potentially explosive atmospheres, to document sudden and abnormal events and to take appropriate preventative action if necessary.

To prevent explosions, the following is required:

- Gas measurement equipment for CO, CH_4, O_2 and other explosive gases
- An automatic central control system that can guarantee an inert atmosphere to prevent explosions
- Documentation of sudden and abnormal events
- Functionality control and self-monitoring of the used safety and measuring equipment
- Long life features
- Operator friendly systems
- Monitoring of correct maintenance procedures
- ATEX conformity and certification



Above: Control philosophy robecco secure center ® RSC.

How to measure?

The detection of smouldering fires will be realised mainly with CO and CH_4 analyser systems. Historically, oxygen-measuring instruments were not used in practicable plants, which supervise and guarantee the inerting procedure.

According to the guidelines (e.g. TRBS 2152, VDI 2263, CEN 15281) it is necessary and mandatory in dangerous situations to maintain and supervise the limiting oxygen concentration (LOC) for different fuels. For the control, plants have to consider the use of different fuels like petcoke, lignite or hard coal. Each fuel has different safety parameters, volatiles and a defined limiting oxygen concentration which are usually evaluated in laboratories. If the fuel will be changed because of better commercial availability, all safety parameters of a grinding and storage system have to be changed accordingly. Intelligent controls should transfer this changings automatically by demand of the operator.

Human factor

The plants operators are generally not aware of the possible consequences of fires and explosions and they are astonished by the speed of the phenomenon. Training of plant personnel in this matter is essential and should be updated regularly.

ATEX

According to the ATEX regulation, safety systems are total systems. It does not matter if parts are outside (e.g. a PLC) or inside (e.g. a sensor) of an explosive area. The safe and reliable functionality of devices and protection systems is required by ATEX to prevent uncontrollable explosions.

The control system has to connect safety systems and shall provide effective protection against hazardous system situations. Total systems are consisting of sensors, actors and an independent control. To realise preventive explosion protection and process monitoring, the following electrical control problems have to be considered: The installation of an automatic central monitoring and control system guarantees the inert atmosphere during chemical and physical processes. Operation, monitoring, and control can be performed automatically or manually. The following important equipment has to be implemented in the control system:

- Gas analyser systems
- Temperature sensors
- Inerting systems
- Valves and flaps

Safety limits according to CEN15281 and VDI2263-2:
Safety margin 1 as the highest limit is the limiting oxygen concentration (LOC) and varies with pressure and temperature.

Safety margin 2 is the maximum allowable oxygen concentration MAOC, which is usually a reduced figure by 1% below

LOC. The oxygen concentration fluctuates, safety measures are delayed, monitoring instruments can give out delayed alarms.

Safety Margin 3 is the maximum set point which is at the same time the alarm concentration for the control. Usually operation is a reduction by another 1 % below MAOC. To prevent false alarms there is a need to reduce the alarm level to a Set Point SP for the controller to maintain the oxygen concentration.

Controls should have special characteristics: The adjustment of the oxygen and carbon monoxide limit concentration in relation to the volatiles and process temperature is necessary because of the use of different fuels. The evaluation of the measured values and an alignment with typical trial processes has to be guaranteed. This makes operating reactions possible, e.g. sealing of leakages or prevention of a further entry of oxygen into the mill system, silos, and aggregates.

A safe switching over of the safety system from 'automatic mode' into 'manual mode' during process conditions, such as test run, maintenance, revision to avoid accidents must be guaranteed.

Controls must be able to take over self-sufficient system functions in case of failure situations of master systems:

The monitoring of all systemically relevant functions of the sensor system and the inerting plant with dosing station is necessary. An accurate inert gas dosing regarding effectiveness and environment is mandatory. To extinguish smouldering fires is only possible by reducing the oxygen concentration below 3 %. Simple shots of inert gases into a closed explosive atmosphere are ineffective and do not control the explosion risk. Maintaining of the existing inert gas stock and the future procurement of storage must be considered to have in each situation sufficient gas amounts available.

The functionality of the components has to be supervised, relevant errors or failures must be signalled to clear understandable alarms.

The automatic determination of the maintenance intervals, the maintenance dates and maintenance work of individual components in dependence of the actual working time and operating frequency guarantee operability and a safe and productive process.

Left: Turnkey robecco monitoring and control system 'robecco secure center® RSC'.

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LET'S PLAY IT SAFE!

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Expert and specialist for:

- Gas analyser systems
- Monitoring and control of explosive processes
- Silo control systems
- Inerting systems
- Emission monitoring

robecco GmbH is a German-based owner leaded company with activities in the field of preventive explosion protection.
robecco established excellent business relationships with globally operating engineering companies and production plants with preventive explosion protection systems.