

Use of Putzmeister solids handling pumps to extinguish fires in subsurface coal deposits

The Kosovan open-cast coal pits of Mirash and Bardh produce 97 % of the raw materials for generating power in the province of Pristina, and these brown coal deposits are slowly diminishing. Subsurface fires are further reducing the coal deposits, and so a mobile Putzmeister mixing and pumping plant has been utilised to fight against this problem.

The supply of brown coal these pits produce is currently only just sufficient to provide for the requirements of the power stations in the region. An increase in mining capacity is not however possible, due to technical problems with the equipment at the mines and improper handling of the deposits. The slopes, which are often too steep, and fires burning in the layers of brown coal below the surface damage the deposits and thus destroy important resources.

Self-igniting fires

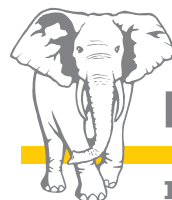
The subsurface deposit fires are ignited via spontaneous combustion, and this occurs in the tunnels previously made through the brown coal layer where they were improperly sealed.

Due to these poor seals fires can occur when oxygen is drawn into the brown coal layer as a result of fluctuations in air pressure. The supply of oxygen then triggers oxidation reactions in the brown coal, and if there is sufficient oxygen available it could heat the brown coal to such an extent that the layer itself ignites.



In Kosovo the coal pits are often close to the power plants, therefore any subsurface deposit fires will also be nearby

The Putzmeister plant for mixing and pumping is extremely mobile due to being housed in containers. The figure shows the silo, trough chain conveyor and screw feeder, the 20 ft container platform with KOS solids pump and electric and hydraulic power packs. On the left a 20 ft office container is shown.



Putzmeister

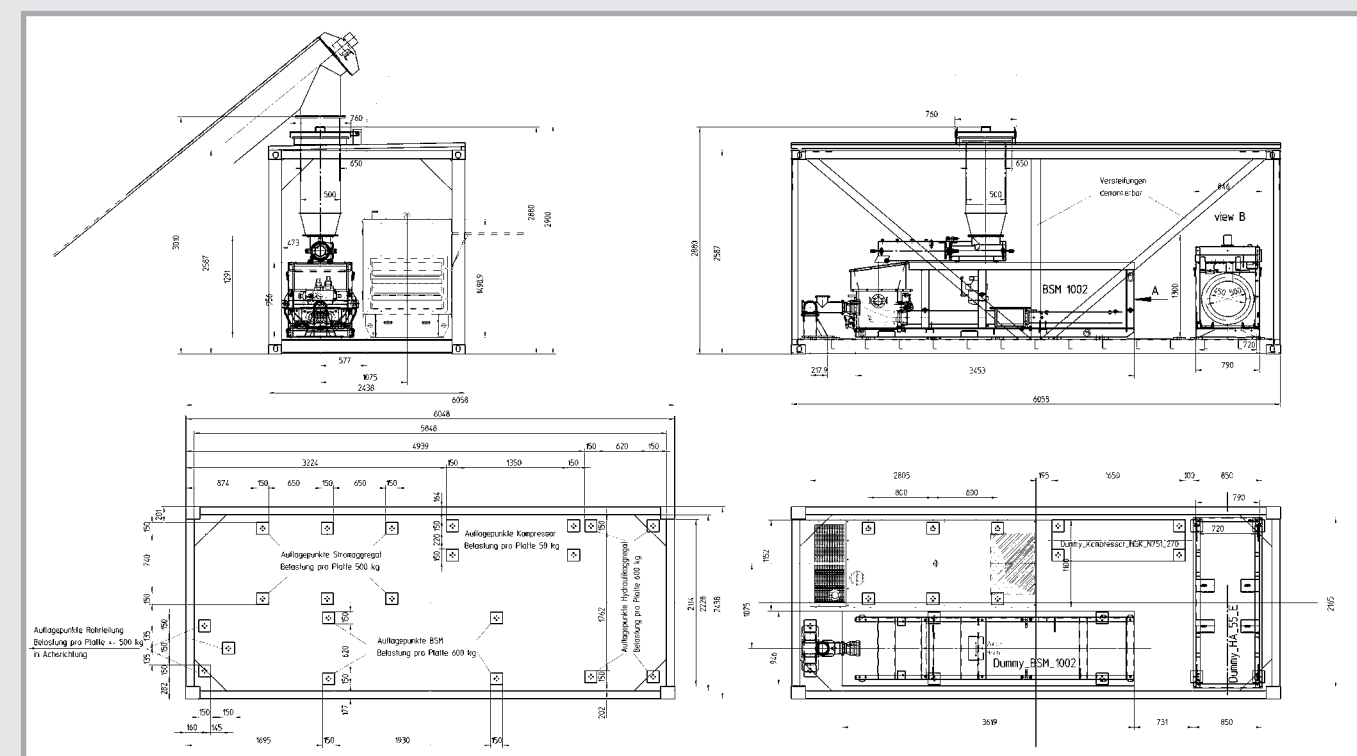
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These uncontrollable subsurface fires then proceed to form unidentified voids in the open pits, resulting in a loss of stability in the slopes and sidewalls of the mining operation. Heavy vehicles such as dumpers, diggers or cranes can then subsequently slip and fall into these voids that can suddenly appear without warning in the earth beneath them.

To save the resources that still exist, reduce the release of CO₂ and other toxic gases from unregulated combustion of the coal and increase the safety of the mining operations, Putzmeister worked in collaboration with Boss Pro-Tec to develop and supply a mobile mixing and pumping system. The equipment was designed for use in open pits to deal with subsurface deposit fires such as those in the Kosovan brown coal area.

As soon as oxygen is drawn into the coal layers because of fluctuations in air pressure, the deposits can be ignited and the fire will spread from there



Fire-fighting with pumped paste

A mixture of fly ash, binder and water is used to fight the fires, and is pumped in via special boreholes drilled to enable distribution of the material around the source of the fire. The supply of fly ash required is sourced from the local power plants in the area.

In detail, the combined mixing and pumping system consists of the following components:

- a material collection hopper used as a temporary silo, incorporating a trough chain conveyor
- a mobile screw conveyor
- a 20 ft container platform with installed KOS high-density solids piston pump including attached flow-type mixer, 55 kW hydraulic power pack and compressor
- a 20 ft office container
- a 20 ft pipe container to cater for approximately 300 m of delivery line, made up of ZX pipes, hoses and couplings

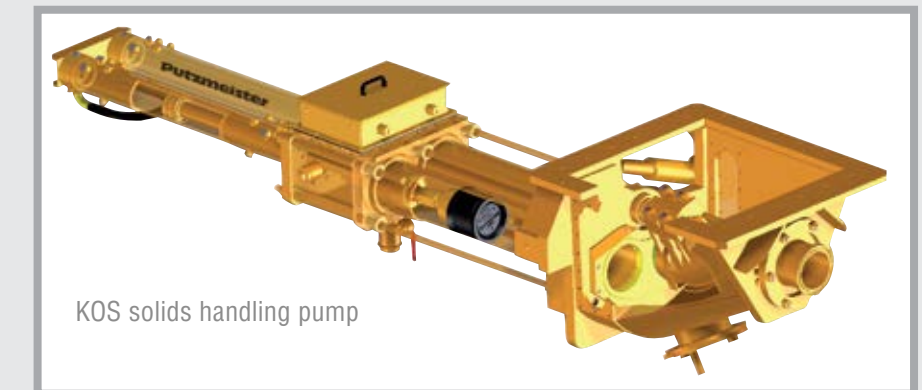
A plant design that is easy to move

During the system design process particular attention was paid to providing the individual components with the best possible mobility, so that the entire system can be re-located quickly and easily with the help of a crane and tracked vehicles. For this purpose a 20 ft transport slide was developed, on which the container parts can be lifted and moved to their new site of use with a pre-tensioned track.

The core of the mixing and pumping system is formed by a KOS solids handling pump on the container platform. The particular feature of the KOS series pump is the S transfer tube. The S transfer tube creates a secure connection with the delivery line

when switching from suction to pressure stroke, and thus enables operation that is practically continuous. Individual foreign bodies can be easily conveyed using this pump technology up to a particle size of 2/3 of the outlet diameter. The machine is almost identical to the Putzmeister BSM 1000 E ("Elefantino") piston pump that has been used for years in coal mining to pump concrete and other building materials. The compact pump unit is driven by a separate 55 kW hydraulic power pack.

The mixing and pumping system is designed for a capacity of up to 17 m³/h. When determining the design of the mixing and pumping process, the ever-changing distances between the power stations and sites



KOS solids handling pump



Glowing residue of brown coal



To extinguish the fires the Putzmeister KOS solids pump conveys a mixture of fly ash, binder and water into the predrilled bores. The consistency of the material can be quite stiff.

of use were taken into consideration. The fly ash is delivered to the open pit by an off-road tractor and trailer unit, therefore the supply can be quite irregular. To enable a continuous mixing and pumping process, this discontinuously supplied free-flowing fly ash is first tipped into a material collection hopper with a volume of approximately 20 m³. This acts as a buffer store to balance out any gaps between deliveries, and from there it is passed into a flow-type mixer via a trough chain conveyor and downstream screw conveyor. After adding water and binder, you have a pumpable medium, which can be conveyed by the Putzmeister solids handling pump through a pipeline with a cross section of 125 mm into the holes created to put out the fire.

The fires source is circled by boreholes

The selection of suitable places to make holes is determined before the boring process begins with the help of thermal imaging cameras and geophysical mapping where the generation of heat and gas allows. The boring rods used are capable of reaching depths of up to 40 m, however boring is often no deeper than 12 m below surface. The holes are positioned around the source of the fire below the surface, and then refilled with the pumped material. The small distance between the holes results in a wall, similar to a palisade wall, the objective of which is to prevent further

spreading of the fire and the supply of fresh oxygen. This therefore prevents the fire from spreading further to any of the other layers. If subsurface tunnels or crevices are bored into during creation of these preventative walls, material is pumped into them to form a plug, which then hermetically seals the area.

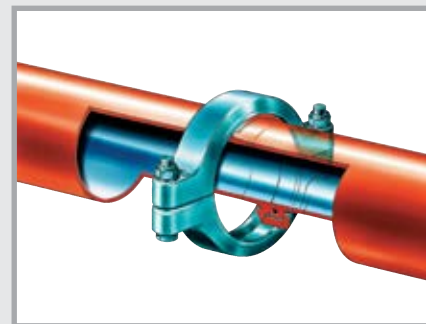
A generator installed on the container platform drives the entire mixing and pumping system, and so the independent operation of the system is therefore guaranteed. In order to be able to operate the system while protected from climatic influences, the entire control unit was installed in a suitably equipped 20 ft office container. Provision of another, equal-sized container for the transport and storage of 300 m of delivery line (pipes, hoses and couplings) completes the mixing and pumping system.

Safeguards that are protecting the future

The successful development and implementation of a compact, mobile mixing and pumping system, which is therefore suitable for use in open pits, was due to the combination of various components with the core Putzmeister KOS solids handling pump. By pumping a mixture of fly ash, binder and water to the specific areas, further spreading of the subsurface layer fires is reduced, and destruction of the remaining deposits is avoided.



Solids handling pump BSM 1000 E



ZX delivery line system

Furthermore, you can save time by tapping new nearby brown coal deposits during the process, which guarantees a more continuous power supply in the region, and also jobs in the area for the longer term.



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