AEG

New Inverter Drive for a Belt System for Mineral Salt Conveying at the Deutsche Solvay Werke

A new conveying technology using the the AC inverter of AEG

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The mineral salt mine Barth, a branch of the Deutsche Solvay Werke GmbH on the Lower Rhine, is conveying a daily quantity of up to 12,000 tons of mineral salt from a depth of 740 to 800 meters.
From the works chambers, which are at present located in a distance of up to 5 km from the conveying shaft, the mineral salt transportation is done by large plants using circulating belts.

The existing belt systems were so far divided over 2 to 4 slipring motors as a drive unit via a gear onto two drive reels and operated with constant speed. In the sturdy mining operation, the contactor-controlled resistance starting devices of AEG have proven and will still remain in service with the existing belt systems.

As early as 1979, the Deutsche Solvay Werke (DSW) and AEG worked out together the layout of a speed controlled belt system. This layout has now been supplemented and realised when building a new conveying section. The task definition for the new System was to build a drive unit being capable of conveying up to 1,600 tons of "white gold" per hour over a distance of 750 meters. Here, a difference in altitude of 89 meters was to be considered.

Another requirement was to equip the belt system with a process control system (PLC). Instead of the rigid system fed slipring motors, which, despite the rotor resistance, would have exerted a three times higher impulse torque onto the mechanical system and the belts, inverter-fed short-circuit rotor standard motors were to be used. The setting and limiting of the belt speeds as well as the limiting of the torques must be guaranteed by the AC-inverters.

In co-operation between AEG Wesel, the AEG workshop in Dortmund and the sales department Drive Technology of AEG's Power Electronics, the solution of the plant with a complete mains station is being installed with the following components on an accessible sledge station of approx. 11 meters length

2 cast-resin transformers, each having 800 kVA
15 kV ring cable panel
6 low-voltage panels
Monoverter 25OkVA, 500V inverters with a superordinated
control unit.

This station was at first used to feed 3 AC 3-phase short-circuit rotor motors, each having 200 kW, whereas the belt system is driven through a total of 2 drive reels. Enough space for adding on a fourth motor has been provided.

The static inverters are suitable as current intermediate circuit inverters (1 inverter) for 4-quadrant operation. Motor and generator operation (driving/braking) with system feedback is possible. Safe starting against the static friction of the large number of the support rolls and accelerating up to nominal speed with the belt being charged with full load is guaranteed.
After starting of the belt system, the individual drive units are, depending upon the load state, connected or disconnected automatically in staggered order. Shutdown, also of the fully loaded belt, is done electrically down to zero speed, possibly with mains feedback without any avoidable load to the mechanical system or the blocking brake.

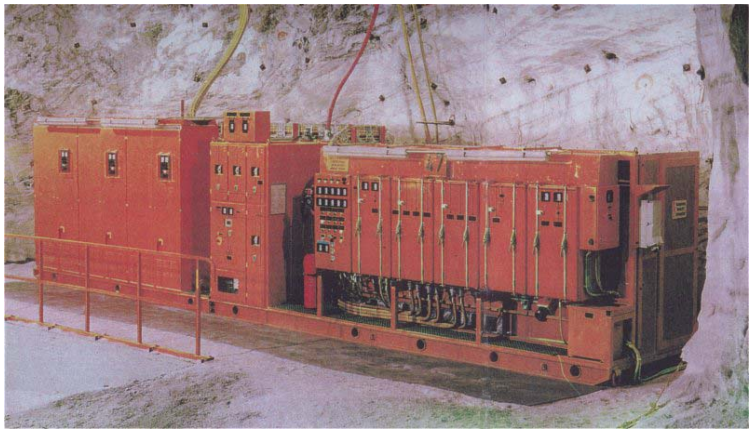
In all operational cases, a sufficient motor torque is made available, and the torque and thus the belt tension will be limited to 1.2 times the nominal torque. Review operation with crawl speed is possible without any additional equipment. Emergency operation in case of failure of one inverter is possible, because individual feeding with load compensation control was chosen.

The delivered control unit consists of an extended programmable logic control, type Logistat A020, and a system assembled from Logidynmodules for the treatment of plant specific values, such as speed, load determination and distribution, and so on.

The following facts lead to the solution worked out together by the operator and the supplier:
To use short-circuit-rotor motors with lower costs instead of motors with slip rings.
To avoid investment and power losses of the resistance stands of slip ring motors.
To have an economized design without an inspection and testing drive.
To buy and use a much cheaper belt.
To spare power losses of 50kW.

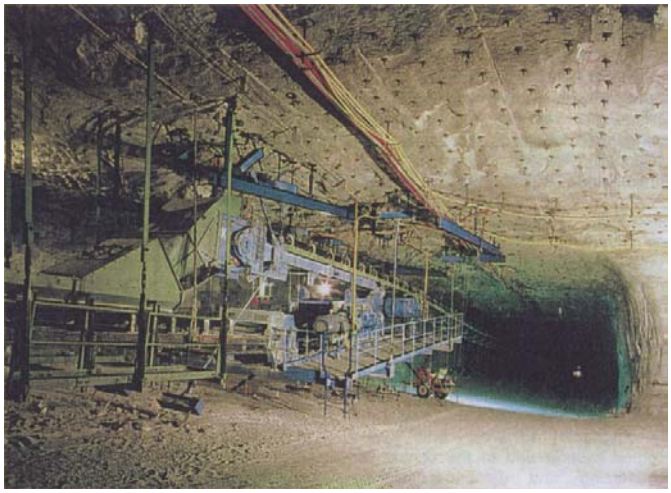
To have lower maintenance time and costs, shut-down and faults.
To run the conveyer-plant with Lower wear in the rolls, in the belt and the gear.

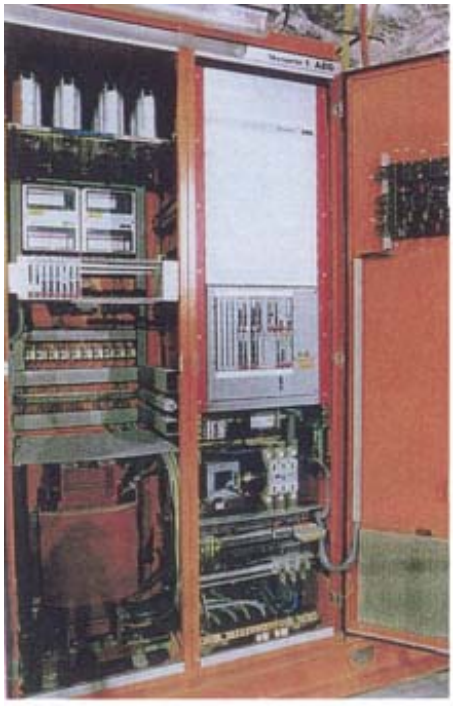
Following a careful assessment without considering the cost advantages due to the considerably more material-saving operation of the plant, the additional investment in comparison to a conventional plan will be set off in only two years time.



The above picture shows the whole sledge station accommodated in a mine niche of pure mineral salt. On the right, you can see the conventional part of the load station, comprising a 5-kV ring cable panel and a 6-panel low-voltage distribution system in a robust mining version (already proven in blasting areas). Behind the panels, the transformer boxes, each containing one 800-kVA transformer, are located. On the common, flanged skid assembly on the left, the three Monoverter units, type 250/500, are installed.

The next picture shows the mechanical part of the large conveyor belt plant can be recognized. On the right, below the dumping head, the two drive reels with the three 200-kW, 500V three phase squirrel cage motors can be seen. The entire mechanical system is, as well as the conveyor belt measuring 750 meters, mounted at the roof in the oblique running section.





The next picture shows one of the inverters, which is in the left part additionally equipped with a compact Logistat A020 (PLC) automation unit and an extension unit as a superordinated control system.
Below the automation units, you can see the rack with the plant-specific signal processing system.
The new plant allows optimising the filling facto of the belt - this being attained by the belt speed being adapted to the quantities conveyed. This leads to an even load of the downstream belt plants being equipped with speed-constant, conventional drives, and thus to the prevention of disturbances in the conveying operation.
The commissioning of the plant as well as the unrestricted conveying operation have proven that the requirements towards the speed control System and to the control for connecting and disconnecting the individual motors have been fulfilled. The careful expectations regarding material-saving operations for the mechanical equipment and especially for the belt have been exceeded

During preparation of this paper, a second plant was delivered for the mineral salt mine Borth. Because of the disadvantages of conventional conveying, DSW will modernize further plants step by step.

With this speed-controlled belt plant using AEG's current inverter, which was the first of its kind to be taken into service in West Germany, the cooperation between AEG and DSW lead to a considerable progress in conveying technology.

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