

Ultra-long face conveying



As longwalls get longer AFC challenges increase

There is a growing trend worldwide to increase longwall face lengths to over 400 m, particularly in thin seams. As longwalls get longer, the challenges for face conveyors increase. Longer face conveyors mean a greater mass of material to move, longer and heavier chains to move it, and of course, more powerful drive systems. Face conveyor technology is the most critical factor in the success of these operations, DBT reports.

DBT says it is mastering the challenges and "our customers' success in ultra-long longwalls has come from DBT's in-depth understanding of the issues associated with the chain, sprocket and drive train interface."

DBT has over five years' experience and seven longwall installations with face lengths of over 400 m, with the maximum face length currently 500 m at Mine West in Germany. The faces of all Deutsche Steinkohle (DSK) mines in Germany are over 300 m, and several are over

400 m. A number of longer faces have three 1,000 kW drive systems.

In the US, two mines – one with 2 m shields and another with 1.75 m shields – have delivered long-term high-production performance with very wide faces. The latter US longwall is 442 m wide, and the company has already mined more than 11 Mt with its DBT PF6 AFC and 48 mm chain system. This installation also has the highest installed AFC power worldwide with three 1,220 kW DBT CST 65 drives. A similar arrangement is being installed at another US mine in August, 2007. The DBT AFC system has produced consistent peak loads of over 5,440 t/h from the 330-m face at one US operation.

The first Australian DBT CST 65 gearboxes rated at 1,200 kW will be installed during 2007 at BMA's Broadmeadow operation, initially with two 1,200 kW drives. Once the longwall face is extended to 320 m, Broadmeadow will

have total installed power in excess of 3,000 kW, offering sufficient reserve to start the conveyor in a heavily overloaded condition. The mine will use DBT's proven 48 x 152 mm chain system which is typically achieving a service life of 11 Mt.

Longer longwalls mean greater stress and strain on all components of the face conveyor – and present a number of challenges. Considering the installed power of over 3,000 kW, a single failure can lead to catastrophic results from the release of stored energy. And production comes to a complete standstill until the problem is solved. Similarly, with such power and associated inertia, wear on components increases if the total system is not correctly designed, all contributing to an increased cost per tonne.

So what limits the length of a face conveyor? And what challenges had to be overcome? Firstly, the maximum available start-up torque for a fully loaded conveyor. DBT's Controlled Start Transmission (CST) drive system delivers maximum start-up torque and safe start-up even of a fully-loaded 400-m long conveyor.

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DBT's new PowerChain

conditions of the AFC path. This has not been so evident in shorter, lower-powered faces due to the increased stiffness of the chain system. In the past, DBT had experienced several mines in which drive frames had a vertical harmonic lift of over 200 mm, and where the chain/flight system had a natural horizontal harmonic or oscillation. Failure to dampen these oscillations results in severe damage to components of the AFC.

Other key factors include optimum geometry between the chain strand and the sprocket and a

large running surface between flight bars and pan profiles to minimize wear and friction. A successful combination of these measures results in significantly longer service life of the chain and drive sprockets, especially for long faces.

DBT has recently developed the new PowerChain® aimed at even higher-capacity face conveyors for longer faces, particularly in lower seam heights. First underground installations at stage loaders in two US operations are underway, with the start of the first such chain system in a full longwall scheduled to take place by 2008 at the latest. BMA Broadmeadow will also start using the PowerChain for its BSL from 2007.

DBT is moving towards a future where total installed power on the face conveyor can be well in excess of 4,500 kW. A careful step by step approach is being adopted, with detailed total system analysis and low-risk field testing along the way to ensure that customers get what they want: A reliable very high-production conveyor, with no risk of catastrophic failure – and of course the lowest overall cost of ownership. *IM*

The intelligent CST drive system is simply a planetary gearbox with an integrated multi-disc clutch with an infinitely adjustable slip and the new PMC®-D drive control unit featuring no-load motor start-up, AFC soft start, and synchronized heavy-load start-up. It also allows accurate load sharing between up to four drive motors with excellent and extremely fast overload protection in case of chain jams. The CST 65 model is rated for 1,200 kW per gearbox at 50 Hz (1,450 kW at 60 Hz), and the clutch delivers maximum efficiency with minimum operational slip. The use of multiple drives without load sharing leads to the inefficient use of energy and results in greater chain and sprocket wear. Precise load sharing substantially improves running chain tension variance.

Only a totally reliable automatic chain tensioning system – with a sufficient stroke at the tail drive – prevents the dangerous build-up of slack chain. One substantial benefit of the CST controlled clutch system – which was only understood when faces over 380 m began to operate – was the dampening of chain oscillations. Oscillations, or natural harmonics, arise due to the varying friction