Wear parts pass the test

The Assarel Copper Mine, Bulgaria

Test mining excavator bucket in use at the work face on a Liebherr ER 994B - 771/14755 excavator

Test bucket no.1 produced from high yield strength steel with Creusabro wear plates welded into position

Following a comparative abrasion test program, run in conjunction with IMS Group over 12 months in extreme mining conditions, Liebherr Group is now offering customers the opportunity to purchase face shovels and excavator buckets equipped with Creusabro 8000 wear parts which have been proven to increase the wear life of the mining buckets by over 46%. Gilles Gros, product manager at IMS Group and Nick Taylor, business development manager, IMS UK, explain.

An important area of development for Liebherr was to offer an improved alternative solution to the standard material fittings on face shovel and excavator buckets. Normally manufactured using high yield strength steel for the body, 400 & 500 HB water quenched steel wear plates welded into position provide longer wear life for the work-front facing components.

The test program was carried out at the Assarel Copper Mine, Bulgaria, renowned for extreme abrasive conditions combined with temperature and variable weather. Two identical mining buckets were used on a Liebherr R 994B excavator. Both were produced in Liebherr's manufacturing plant in Colmar, France as two-part face shovel buckets with a backdoor, for unloading the excavated material.

The main body of the bucket along with the 120 mm thick cross section beams and 200-250 HB blades was high yield strength steel (690 MPa). The fixing parts and teeth adapters were cast steel while the side edges were Creusabro 4800 steel, 90 mm thick.

The wear parts for minining bucket number 1 were made from Creusabro 8000 steel, 30 mm thick. For Liebherr's original was mining bucket number 2, made from 400/500 HB steel.

To assess the overall difference in performance the testing schedule monitored the wear parts' thickness over a period of time as well as the thickness of the cross-sectional beam on the static back of the bucket manufactured from the standard high yield strength steel. The tonnages of material moved over the same time period were also monitored.

Both buckets were tested by digging directly at the mine work face, with excavations including dynamite blow out and natural mineral face, comprising a range of minerals including sulphur bornite and malachite azurite cuprite as well as a variety of grain sizes.

The face shovels were operating 23 hours per day, 7 days a week, extracting and unloading heterogeneous mineral into dumper trucks. Mining bucket No.1, which was the IMS Group test bucket equipped with Creusabro 8000 wear parts, operated for 6 months from October to March through the 'wet season' enduring extreme cold and moisture which causes additional stress and corrosion to the steel. Mining bucket No.2 - the Liebherr original equipped with 400/500HB wear parts - operated for 6 months from April to October, through the 'dry season'. ▶

Results - Bucket 2

The original Liebherr manufacture bucket was used for 2,540 hours mining work before requiring maintenance. A serious level of wear was found in the shovel bucket due to the abrasion effect from the continual throughput of the excavated material.

Due to the concentrated wear at the back of the shovel bucket the wear protection strip extremities were totally worn away and could not be measured

The beam's original 120 mm thickness was reduced to 22 mm in thickness following the abrasion effect on the extracted mineral on the steel.

Other consequences observed from the continual wear on the inside faces of the bucket were loss of mechanical resistance and distortion leading to risk of rupture and critical maintenance requirements. However no repairs were required on the outside surfaces.

Results - Bucket 1

On inspection after 2,600 hours use the Creusabro 8000 manufactured bucket required no maintenance at that time and went on to operate for 3,700 hours when minor refurbishment, primarily cleaning, was required.

Despite the longer working hours and more extreme conditions, the Creusabro 8000 had significantly reduced the level of abrasion and wear so the integrity of the shovel bucket was preserved and still able to operate fully.

Some grooving in the structural base of the bucket was observed but the level of maintenance required was minimal.

The wear protection strips on the static back of the shovel bucket were all in good condition. The strip measurements were easily made and showed the abrasion resistant steel had performed well compared with the standard water quenched 400/500HB resistant part, with minimal wear being recorded.

The test program monitored the thickness of these three strips

No visible dimensional difference between the initial and final alignment, and all protection strips down the side of the static back of the shovel bucket are fully intact

View of the serious wear effect in the centre of the shovel bucket. Measurements were not possible on the plate and strips due to the severe wear

Minimal wear has occurred during the test program retaining the integrity of the bucket operation. Small grooving in the structural base of the bucket can be seen

Conclusion

The Creusabro 8000 equipped hardware provided a 46% increase in working life of the face shovel buckets, due to the wear resistant properties.

Following this program Liebherr now offers face shovels and excavator buckets equipped with Creusabro 8000 wear parts. These results have also led to Assarel placing an order with Liebherr Mining Division for five new buckets, all of which will be lined with Creusabro 8000.

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Eliminating settlement ponds

Matec has recently introduced dewatering technology to North America. The company's line of water treatment equipment has been used worldwide with hundreds of installations, for the express purpose of cleaning up and recovering up to 90% of the washwater, and eliminating settlement ponds at quarries, mines and other aggregate facilities.

Washwater and settlement pond problems facing today's aggregate producers and mines include issues with conservation, zoning, environment, EPA flyovers and fines, water restrictions, high pumping costs, tying up real estate and the high cost of maintaining the ponds, including excavator and drag-line issues for dig-out. Overcoming these problems lies within the heart of the MATEC System, the only HPT High Pressure Filter Press and decanter-style Clarifier. Besides having a small footprint, the system has lower maintenance costs than any other methods of water recovery or dewatering, and essentially has no moving parts. The end result is a super-dry dirt cake that is so dense and so dry (80%+ solids), it can easily be stockpiled and sold as a desirable product for landfill cover or other purposes; the dirty water is cleaned, and as much as 90% of the water is recycled back into the process. The most significant benefits of going pondless are substantial cost savings and quick ROI as a result of freedom from environmental problems, no associated costs of settlement ponds and their upkeep, operating costs for energy, manpower, wear and tear on earthmoving equipment, and freed-up real estate.

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