NSW GOVERNMENT

NSW Resources Regulator

SAFETY BULLETIN

AUGUST 2019

Brake coupling disintegrates, ejecting components

This safety bulletin provides safety advice for the NSW mining industry.

Issue

During maintenance work involving the replacement of liner plates on a large ball mill, the spring-applied drum brake failed to prevent the unplanned movement of the main drum.

The drum was out of balance because some of the liner plates had been removed. The unbalanced load transmitted sufficient force through the drive train to overcome the holding brake force. Consequently, the drum spun in the reverse direction under gravity. This rotation of the drum drove back through two gearboxes, with a combined ratio of 700 to 1, (refer to figure 1) brake coupling and electric motor. The inching gearbox over revved and seized.

The brake coupling disintergrated. Metal fragments were ejected more than 40 metres away. One piece travelled 35 metres, penetrating through a steel shed and into a 200 litre oil drum stored inside.

Figure 1 The drive assembly showing two gearboxes (left and right), motor and failed brake assembly

Circumstances

The ball mill was being relined as part of a planned shutdown. The inching operation had been successfully completed 45 times during this shutdown.

The operator was manually controlling the repositioning of the ball mill drum by driving the electric inching drive motor through the 700 to 1 ratio gearbox. When the drum was in position, the operator would activate the stop button that would apply the drum brake.

In this instance, the brake failed to hold the drum. With the drum rotating and now driving the system backwards, it picked up speed.

The speed was estimated to be four times faster than when the drum was driven by the motor. Consequently, the speed of the gearbox, coupling and motor was excessive and, accordingly, the gearbox seized. Workers ran for cover. The noise generated by the spinning drum was compared to a jet engine starting up. The brake drum coupling exploded into pieces, destroying the protective guarding and ejecting metal fragments.

Investigation

It was found that the brake spring tension was initially set to 600 Nm (the site's procedure) however the site could not identify how 600 Nm was determined or if the spring tension was rechecked as part of the repositioning process and associated multiple brake applications.

A third-party technical expert was consulted to calculate the required spring tension to hold the out of balance drum. For the incident scenario where liners were removed, it was calculated that a spring tension of 1350 Nm was required to achieve a suitable factor of safety.

Recommendations

The following recommendations are made:

1. Mine operators must ensure that when conducting maintenance on ball mills and breaker drums, that the drum is prevented from moving in an unplanned manner, in such a way that the risk of harm to workers is reduced to as low as is reasonably practicable.
2. If a braking system is used to hold the drum, the force necessary to hold the drum in a locked position must be calculated by a competent person. The assessment of the required braking force must consider:
    a. assessing for the worst-case scenario for an out-of-balance drum position.
    b. applying an appropriate factor of safety when calculating the braking force.

   c. the braking force required to hold the drum must be calculated for each individual ball mill and breaker.

3. Mine operators must ensure that the braking components are inspected and adjusted by a competent person before using the brake for holding the drum in a locked position. This should be included in project schedules, when repeated use of the brake is planned.
4. Check the brake components and adjustment regularly, when conducting multiple applications of the brake unit.
5. Update mine procedures with any changes identified in the recommendations.
6. Review procedures for liner replacement. The procedures should consider/minimise the effect of drum imbalance.
7. Conduct refresher training for workers in any changes to procedures.

NOTE: Please ensure all relevant people in your organisation receive a copy of this safety bulletin and are informed of its content and recommendations. This safety bulletin should be processed in a systematic manner through the mine's information and communication process. It should also be placed in the mine's common area, such as your notice board where appropriate.

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