

60 Derrick[®] screens dramatically increase production, lower cost in ball mill grinding circuits

- Production rate increased by 30%
- Reduced flotation reagent consumption
- Power consumption dropped 20-25%

Background

OJSC Apatit (Apatit), a division of PhosAgro, is a phosphate producer in the Murmansk Region of the Kola Peninsula in Russia. Over several years, Apatit had experimented with various flowsheet options to improve classification efficiency and increase production rates. Their grinding circuit consisted of multiple parallel lines of ball mills operated in closed circuit with either screw classifiers or single- and double-stage hydrocyclones (see Figure 1-Original A.O. Apatit Flowsheet). With hydrocyclone classification, the fine particle overflow from the top of the hydrocyclones was combined with the product from multiple grinding lines and transferred to the flotation plant, while the underflow was returned to the ball mill for re-grinding, along with the raw or new feed stream. In this process, a circulating load of 300 to 350 percent was the accepted norm. In other words, the amount of material circulating back to the ball mill was 3 to 3-1/2 times the amount of new feed added to the mill!

Exploring the use of screens in 1996 and 1997, Apatit conducted full-scale tests of Derrick[®] Multifeed machines with various size urethane screen panels.



60 Stack Sizers at A.O. Apatit have dramatically increased plant performance by improving particle size separation

Although test results were positive, screens were ruled out due to the large number of machines required and limited space near the grinding mills. With development of the high-capacity Stack Sizer[®], Apatit decided to reevaluate screens for possibly improving grinding efficiency and increasing production rates.

Solution

In 2005, pilot-scale tests were conducted with a ball mill in closed circuit with a hydrocyclone to establish a correlation between the

pilot plant and commercial plant operation. Next, a single-deck Stack Sizer was installed in place of the hydrocyclone. While not surprising, the results exceeded expectations, demonstrating that the screens would increase production rates and reduce overgrinding.

In 2006, four Stack Sizers fitted with 0.39mm urethane panels were installed on a small line at Apatit. As shown in Figure 2, production rose by 30 percent, and the plant's circulating load was reduced from over 400 percent to about 135 percent! Production rate increased from 95 t/h with hydrocyclones to 124 t/h with Stack Sizers. And power consumption per ton dropped about 20 to 25 percent, as well. With a 30 percent increase in mill capacity, Apatit experienced a corresponding decrease in grinding hours to produce the same quantity of flotation feed. In more than three years of operation, screen panel life on the test line was more than 7000 hours and capacity increased 30 percent!

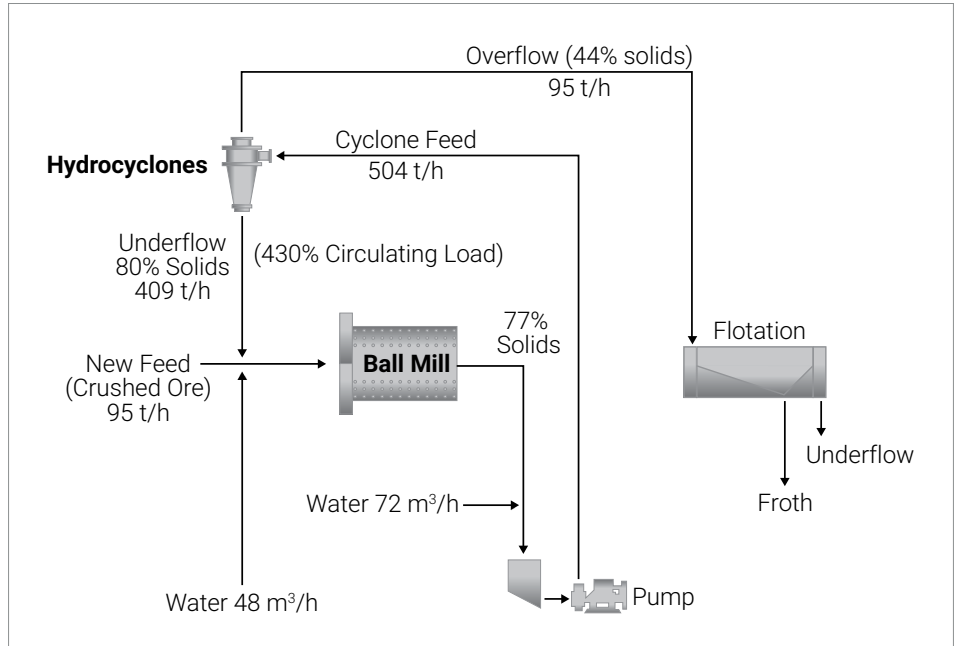


Figure 1: Original A.O. Apatit flowsheet

Conclusion

Based on results of the original upgrade, Apatit replaced hydrocyclones on 6 large mill lines with 60 Stack Sizers, 10 per line (see photo on page 1). Following an easy and trouble-free startup, the first line was up and operational in short order, quickly achieving a 30 percent increase in mill capacity!

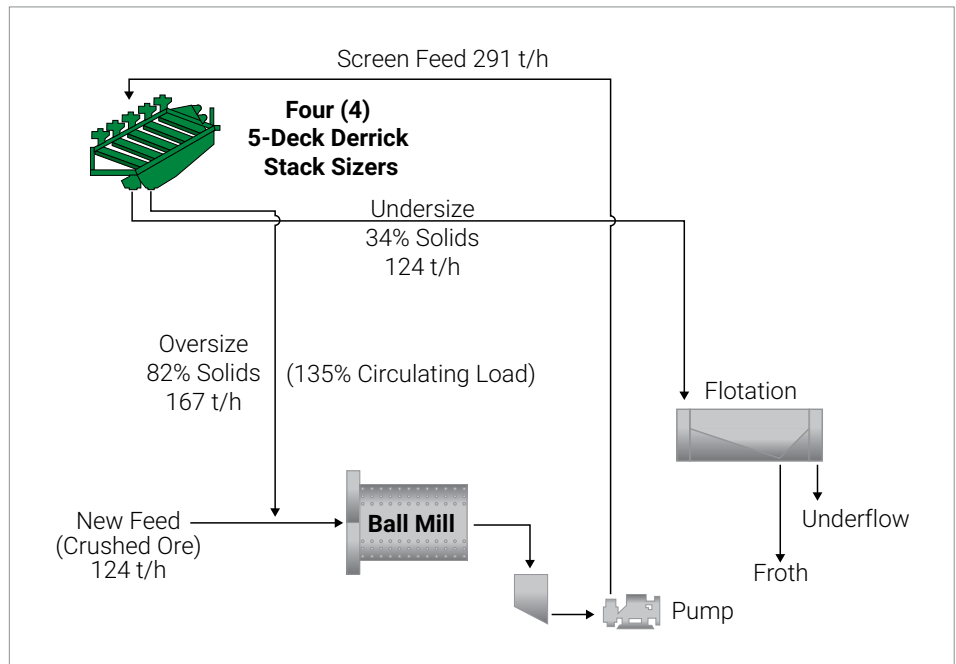


Figure 2: New A.O. Apatit flowsheet

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