Large screens on small footprint raise production and lead recovery

- Reduced circulating load from 350% to 147% and slime content from 18% to 10%
- Production increased 11% and lead recovery grew by 9%
- Less total grinding energy consumption

Background

Sociedad Minera El Brocal, located at Tinyahuarco, Pasco Province, Peru, produces lead, zinc, copper, and gold. The original concentrator flowsheet began with three parallel rod mills operating in open circuit, followed by three parallel ball mills operating in closed circuit. A bank of ten 10-inch hydrocyclones was used for particle classification. As shown in Figure 1, rod mill discharge and ball mill discharge were combined in the same sump and pumped to the cyclones. The circulating load was about 350 percent, and overgrinding of the high specific gravity minerals such as galena resulted in significant slime losses before flotation. Cyclone feed and product particle size distributions are listed in Table 1.

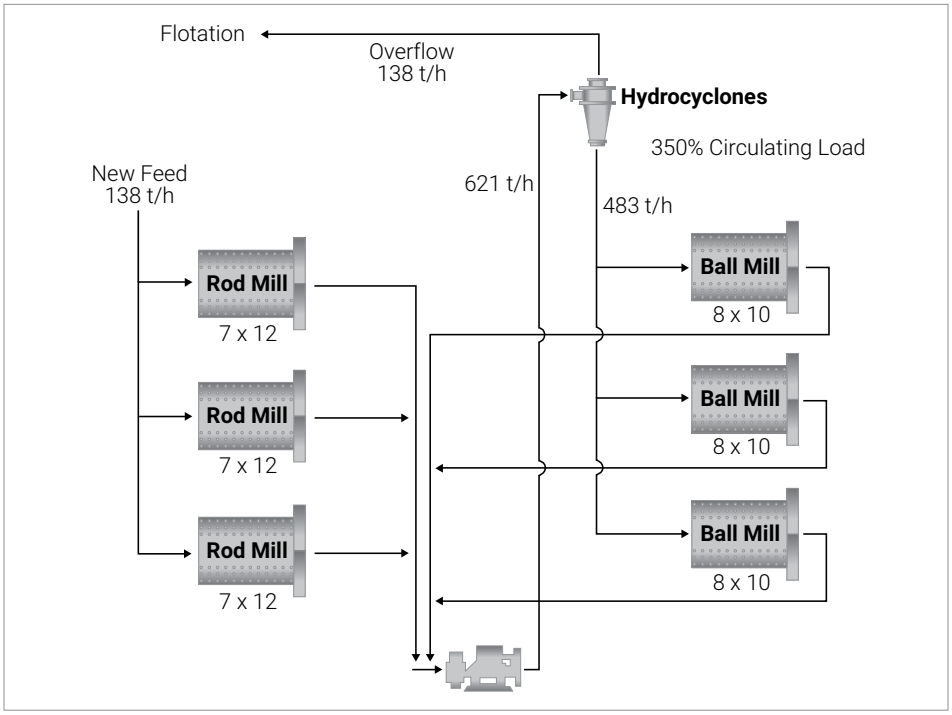

Figure 1: Brocal grinding circuit with hydrocyclone classification

Solution

Looking to increase capacity, Brocal was considering the addition of a fourth ball mill. As an alternative, they also considered ways to improve grinding efficiency. After learning of the Derrick® Stack Sizer®, they conducted full-scale tests at Derrick Corporation headquarters in Buffalo, New York. In response to the encouraging test results, Brocal installed two 5-deck Stack Sizers fitted with 0.50mm Polyweb® urethane panels to replace the 10 hydrocyclones.

OPENINGS	CUMULATIVE PERCENT PASSING		
SIZE (µm)	CYCLONE FEED	CYCLONE UNDERFLOW	CYCLONE OVERFLOW
500	72.4	71.6	98.6
300	62.3	59.9	96.2
212	49.2	45.0	91.7
150	36.3	28.4	85.4
75	20.5	11.4	67.7

Table 1: Brocal hydrocyclone feed and particle size distributions

The effect was immediate, as production increased 11 percent and lead recovery increased 9 percent, even though two of the three operating ball mills were shut down.

To take advantage of the increased grinding capability, Brocal added crushing, flotation, and filtration capacity, as well as three additional Stack Sizers. One of the two ball mills originally shut down was put back into operation, and rod mill rotational speed was increased.

Conclusion

As shown in Figure 2, production increased from 138 t/h (tons per hour) with the hydrocyclone circuit to 245 t/h with the Stack Sizer circuit, an increase of over 75 percent with less total grinding energy. The circulating load dropped to about 60 percent, and overgrinding was minimized. The slime content (particles finer than 10 microns) in the flotation feed was reduced from 18 percent to 10 percent, resulting in significant increases in metal recovery. Screen feed and product particle size distributions are shown in Table 2.

A comparison of the particle size distributions of the grinding circuit product (flotation feed) from the hydrocyclone circuit and the screen circuit is shown in Figure 3. For a similar concentrate grade, note that the Stack Sizer produces a coarser grind (different grind-to-grade relationship) than the hydrocyclone by reducing the amount of locked particles in the concentrate.

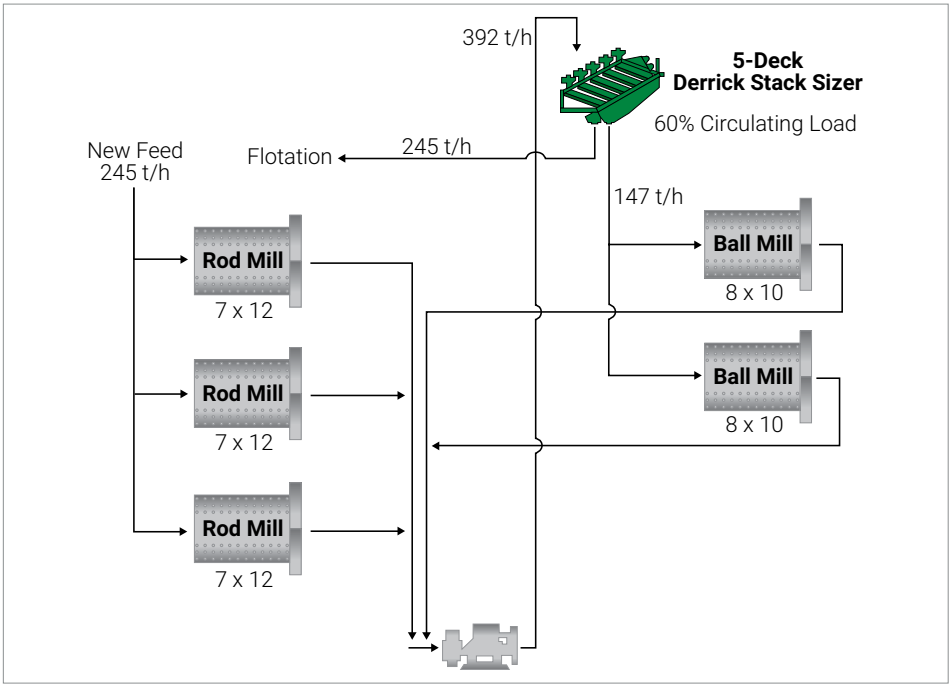

Figure 2: Brocal grinding circuit with Stack Sizer screen classification

OPENINGS	CUMULATIVE PERCENT PASSING		
SIZE (µm)	SCREEN FEED	SCREEN OVERSIZE	SCREEN UNDERSIZE
500	69.5	22.2	98.4
300	57.1	11.5	85.2
212	52.8	10.5	78.0
150	42.1	8.7	68.9
75	38.1	8.2	56.3

Table 2: Brocal screen feed and product particle size distributions

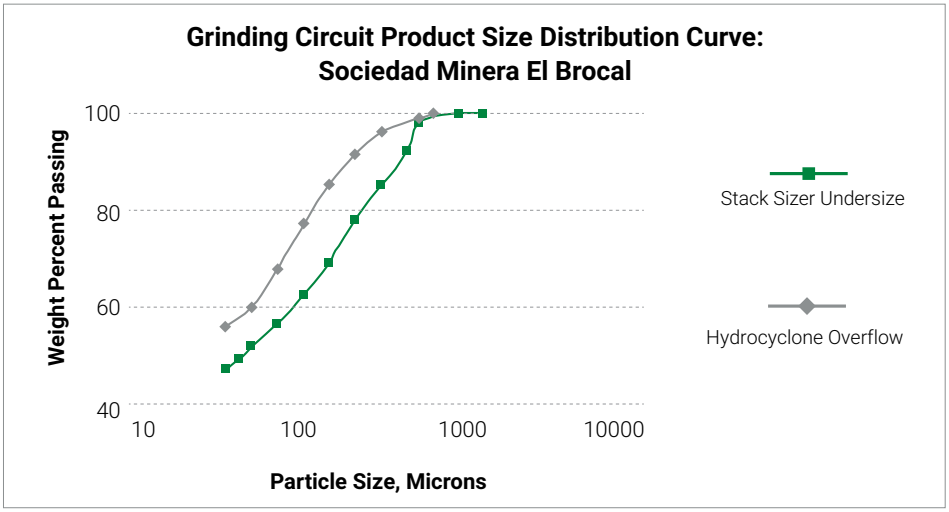

Figure 3: Comparison of grinding circuit products from hydrocyclone and screen circuits at Brocal

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