



Mill Power · what the drive should pull

The power the ball charge should take, checked against the ammeter, chamber by chamber.

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SHOULD PULL AT THE MOTOR	ENERGY PER TON
3,846	32.05
kW	kWh/t

BALLS IN THE MILL	SPEED
201.7	74.8
t	% of critical

YOUR FIGURES

	Today	What if	
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The mill

Mill diameter inside the liners	3.81		m
Mill speed	16.20		rpm
Motor efficiency	95		%
Gearbox efficiency	95		%

First chamber

Length	3.81		m
Free height (tape, liner top to balls)	2400	2300	mm
Bulk weight of the balls	4.50		t/m³

Second chamber

Length	7.62		m
Free height (tape)	2400	2300	mm
Bulk weight of the balls	4.65		t/m³

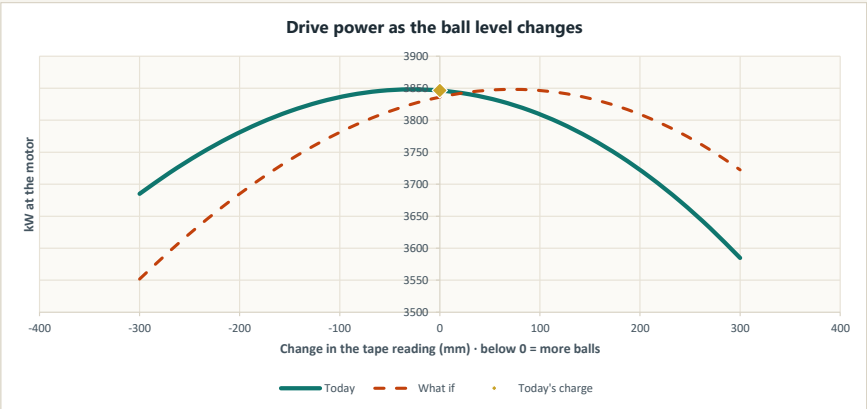
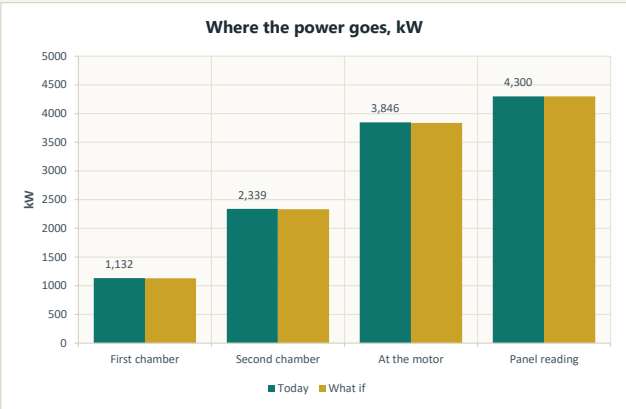
Operation

Mill output	120.0		t/h
Drive power read on the panel (optional)	4300		kW

Yellow cells are yours. Leave a What-if cell empty to keep today's figure; type a new one to see what changes, before anything is changed in the plant.

RESULTS

	Today		What if	Change	What it means
Should pull at the motor (kW)	3,846	ACT	3,836	-10	The grinding power plus the motor and gearbox losses: what the panel should read.
Ammeter against calculation (%)	11.8		12.1	+0.3	Within 5 % the tape and the drive tell the same story; above 10 % one of them is wrong.
Energy per ton of cement (kWh/t)	32.05		31.97	-0.09	Only comparable at the same Blaine: grinding finer raises it even when nothing is wrong.
Grinding power, first chamber (kW)	1,132		1,129	-3	
Grinding power, second chamber (kW)	2,339		2,333	-6	
Filling, first chamber (%)	33.6	GOOD	36.9	+3.2	Cement mills: 26 to 34 % is the working band; below 22 or above 38 % costs output.
Filling, second chamber (%)	33.6	GOOD	36.9	+3.2	
Balls, first chamber (t)	65.8		72.1	+6.4	
Balls, second chamber (t)	135.9		149.0	+13.1	
Speed against critical (%)	74.8	GOOD	74.8	0	Critical speed = $42.3 / \sqrt{D}$. Cement mills run 70 to 78 % of it.
Critical speed (rpm)	21.67		21.67	0	



WHAT TO DO FIRST

GOOD	WHAT THE DRIVE SHOULD PULL With 201.7 t of balls at 33.6 % and 33.6 % filling, turning at 74.8 % of critical, the grinding takes 3,471 kW. After motor and gearbox losses the panel should read about 3,846 kW. Do: Go and read the panel, and compare it with that figure. Why: This is the one number in the whole calculation that can be physically verified.
ACT	THE DRIVE IS PULLING MORE THAN IT SHOULD The panel reads 4,300 kW against 3,846 kW calculated: 11.8 % high. Either there are more balls in the mill than the tape says, or the mill is not turning at the speed entered, or the liners have worn and the bore is bigger than the diameter typed. Do: Re-measure the free height in three places and average; confirm the shell rpm with a tachometer, not the drawing; check the liner thickness at the next stop. Why: A charge heavier than thought is the usual answer, and it costs the extra kW for no extra grinding.
READ	ENERGY PER TON At 120 t/h this mill takes 32.05 kWh for every ton of cement. Do: Track this figure against the same Blaine, not on its own. Why: kWh per ton only means something at a fixed fineness: grind finer and it rises even when nothing is wrong.
