



Grinding Media Wear · where the top-ups take the charge

Each chamber worked through its top-ups, size by size: the grading drift, the new sizes, the undersize balls and the scrap.

Licensed to: Sample file · worked example on a demonstration plant

WORST DRIFT, FIRST CHAMBER	WORST DRIFT, SECOND CHAMBER
13.1 points off target	14.1 points off target

YOUR FIGURES

	Today		
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The projection

Number of top-ups to look ahead	6		top-ups
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First chamber · every size used, largest first

Ball size (mm)	Tonnes now	Added each top-up (t)	Target share (%)
110	0.00	0.00	0
100	7.90	3.00	12
90	13.16	0.00	20
80	15.79	0.00	24
70	15.79	0.00	24
60	13.16	0.00	20
50	0.00	0.00	0
40	0.00	0.00	0
30	0.00	0.00	0
25	0.00	0.00	0
20	0.00	0.00	0
17	0.00	0.00	0

Second chamber · every size used, largest first

Ball size (mm)	Tonnes now	Added each top-up (t)	Target share (%)
110	0.00	0.00	0
100	0.00	0.00	0
90	0.00	0.00	0
80	0.00	0.00	0
70	0.00	0.00	0
60	0.00	0.00	0
50	0.00	0.00	0
40	27.18	5.00	20
30	38.05	0.00	28
25	32.62	0.00	24

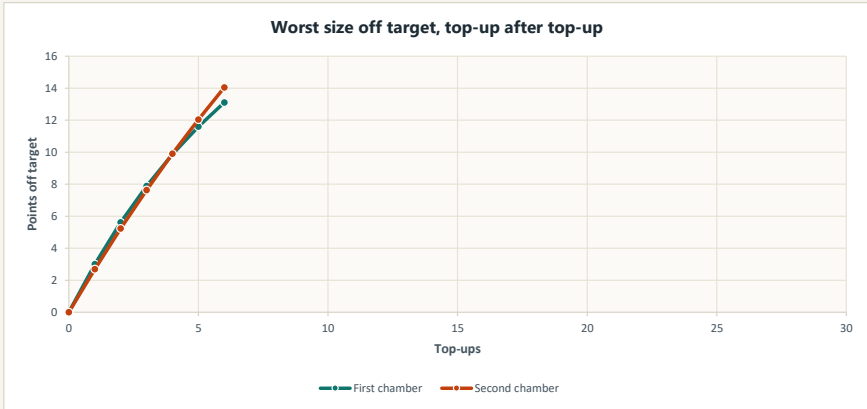
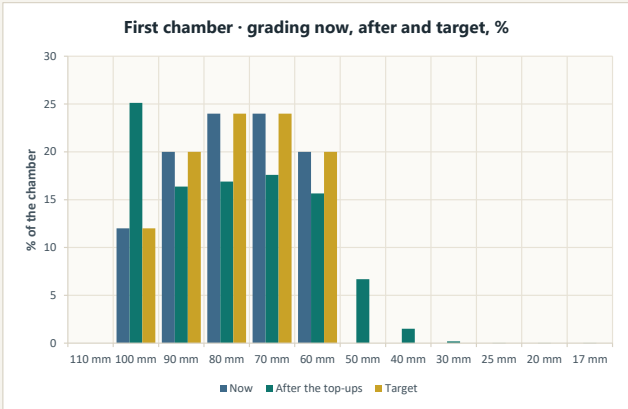
UNDERSIZE, FIRST CHAMBER	SCRAP
8.4 % of the chamber	2.080 t over the top-ups

RESULTS

	Today				What it means
Steel after the top-ups, first chamber (t)	65.80				
Steel after the top-ups, second chamber (t)	133.82				
Worst size off target, first chamber (points)	13.1	ACT			The size furthest from its target share after the top-ups: above 3 points watch, above 8 act.
Worst size off target, second chamber (points)	14.1	ACT			
Average ball after, first chamber (mm)	70.2				
Average ball after, second chamber (mm)	25.3				
Undersize balls, first chamber (%)	8.4	ACT			Balls smaller than the smallest size designed for: space, weight and power with no impact.
Scrap over the top-ups (t)	2.080				

20	24.46	0.00	18
17	13.59	0.00	10

Yellow cells are yours. Everything else is worked out as you type.



WHAT TO DO FIRST

ACT	FIRST CHAMBER After 6 top-ups the 100 mm size is +13.1 points off its target: it is building up. 3.00 t is added each time and the charge cannot absorb it at that size. Do: Move part of the make-up off 100 mm onto the size below it; change one size at a time and re-project before the next top-up. Why: The tonnage is not the problem, the mix is. Adding the right weight of the wrong size moves the grading a little further every month.
WATCH	FIRST CHAMBER - NEW SIZES Sizes that are not in the charge today appear in it after 6 top-ups: 50 mm, 40 mm, 30 mm, 25 mm, 20 mm, 17 mm. Nobody adds them: they are the bigger balls worn down. Do: Expect them at the next axial sample; plan when to screen them out. Why: This is what wear looks like inside a mill. Balls do not vanish, they move down the size ladder until somebody takes them out.
ACT	SECOND CHAMBER After 6 top-ups the 40 mm size is +14.1 points off its target: it is building up. 5.00 t is added each time and the charge cannot absorb it at that size. Do: Move part of the make-up off 40 mm onto the size below it; change one size at a time and re-project before the next top-up. Why: The tonnage is not the problem, the mix is. Adding the right weight of the wrong size moves the grading a little further every month.
ACT	UNDERSIZE BALLS 8.4 % of the first chamber will be balls smaller than 60 mm, smaller than anything designed for: 5.53 t of steel doing very little. Do: Screen the charge at the next long stop; take out everything below 60 mm and replace it by weight with the top size. Why: Small balls in a first chamber have no impact energy. They fill space, carry weight and absorb power without breaking anything.
READ	AVERAGE BALL The average ball in the first chamber moves from 73.8 mm to 70.2 mm over 6 top-ups (1.620 to 1.392 kg). Do: Read this beside the ball charge check, which judges the average ball weight against the 1.35 to 1.65 kg band. Why: A small tonnage of fine balls is an enormous number of balls, so the average ball weight falls much faster than the tonnage suggests.

READ

SCRAP

Over 6 top-ups 2.080 t of steel wears past the bottom of the size ladder and leaves the mill.

Do: Compare it with what is actually swept out at the next stop.

Why: If the mill gives up far more scrap than this, balls are breaking rather than wearing: a steel quality question, not a grading one.

READ

WHAT THIS DOES NOT TELL

This calculation works the wear out from the tonnage added: the steel it loses always comes to exactly what is put in. It cannot tell how fast the steel wears.

Do: For that, divide the ball consumption over a year by the cement made in the same year, in grams per ton; then try the make-up sizes here against it.

Why: Being straight about what a calculation cannot do is worth more than a confident number that was never in the model.