

PMP MILL 14

Calculation of Ball Mills Evaluation of Ball Size Composition



MODULE FOR BALL MILLS

PMP MILL 14, just as module PMP MILL 13, also utilises the energy characteristic for describing the comminution behaviour of the grinding material. The demand conditions in ball mills are characterised by the power input and the ball size composition.

Special diagram- and table views serve for displaying ball size compositions. At the same time, diverse composition values can be selected, which proved of value regarding the direct influence of grinding effectiveness, transport behaviour and energy input. The following example refers to the compartment 2 of a ball mill with 3.85 m inner diameter and 8 m length.

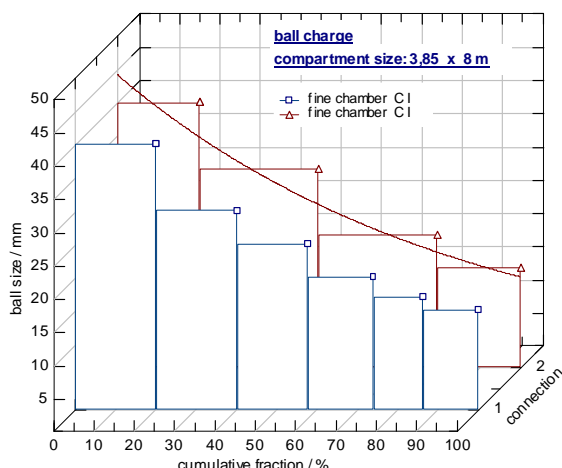


Fig.1: Views concerning the ball size composition

PMP presents the **ball size composition diagram** as a specific diagram view. This view can be chosen as a two-dimensional xy-diagram or for comparing aims as three-dimensional as well. (see Fig.1)

The **PMP-ball size composition table** (see below) contains

- ◆ accumulated mass fractions
- ◆ fraction values
- ◆ grinding media mass, absolute
- ◆ grinding media quantity
- ◆ grinding media surface

TABLE OF BALL SIZE COMPOSITION

ball size	compartment 2	compartment 2	compartment 2	compartment 2	compartment 2
	p cum.	fraction p	fraction m	ball quantity	ball surface
mm	%	%	t		m ²
40	20.40	20.40	25.06	95249	478.77
30	40.50	20.10	24.69	222456	628.98
25	57.80	17.30	21.25	330856	649.63
20	74.20	16.40	20.14	612586	769.80
17	86.50	12.30	15.11	748118	679.23
15	100.00	13.50	16.58	1195287	844.90

CHARACTERISTIC VALUES

The calculation of the ball size compositions values is effected by

- ◆ medium ball sizes, related to ball mass, ball surface, ball quantity
- ◆ the hydraulic diameter as an appropriate measurement for the size of the clearances to be filled with grinding material.

In the example, the selected ball size composition is shown in the **PMP-characteristic table**.

material density of balls	rhoMK [g/cm ³]	7.85
grinding media mass	mMK (calc) [t]	122.9
medium ball size, mass-related	dK3 [mm]	29
medium ball size, surface-related	dK32 [mm]	23
medium ball size, quantity-related	dK0 [mm]	19
hydraulic diameter	dKh [mm]	10
surface of grinding media, volume-related	SvMK [m ² /m ³]	205

Fig. 2: PMP – Ball size composition values

NEW BALL SIZE COMPOSITION

Regulations for ball size compositions, as the approved calculation according to SCHRAMM or GAITSCH, can be consulted for the new ball size composition. Similarly, portion masses per ball size can be entered. Furthermore, PMP MILL 14 offers support for determining the largest ball size.

APPLICATION BENEFITS

The benefit of this PMP-Module for ball mills results from the direct connection of characteristic values for grinding media filling with evaluation characteristic values and characteristic curves for energy input and comminution. These possibilities can be applied profitably for model building and detailed simulation calculations.