

W1.59

**closed circuit grinding
ball mills**

1 Advantages of closed circuit grinding

Open circuit grinding to arrive at desired product fineness results in generation of a large number of a very wide range of particle sizes ; some are coarser than the designated size; a great majority are much finer.

Thus in open circuit grinding % residues for same fineness expressed in blaine are higher than in case of closed circuit grinding for same blaine. In other words, the closed circuit grinding, range of particle sizes is much narrower. This is because, the separator removes from its feed particles that are ground to the desired fineness.

Depending on the efficiency of separation, a quantity of fines still go into the circulating load for regrinding into mill.

While the mill alone does the grinding separator improves size reduction conditions of the mill. In theory the output of the mill should increase by the extent by which fines have been removed in the separator.

The increase in capacity is limited for low finenesses but very much higher for higher finenesses.

Use of high efficiency separators pushes up this increase further; therefore in mills with high efficiency separators circulating loads are smaller than with conventional separators.

Since closed circuiting requires auxiliaries like air slide, elevator and separator, sp. Power consumption for the system as such goes up in the range of blaines of 2600-3000.

But for higher blaines, it comes down as compared to open circuit grinding.

Cement strengths are also dependent on particle sizes; 3-30 micron particles contribute most to the strength

Mills in closed circuit grinding produce cements which for same strength need smaller blaine

Table 1

opc grade	blaine in open circuit	blaine in closed circuit for same strength
275	3100	2750
375	3500	3150
475	5200	4850

2 multiplying factors for arriving at capacities for cements of different blaines multiplying factors

Table 2

blaine	o.p.c.	slag cement
2000	1.35	1.2
2700	0.9	0.72
3000	0.83	0.7
3500	0.65	0.53
4000	0.5	0.4
4500	0.42	0.3
5000	0.35	0.25

example open circuit grinding
opc
capacity at 3000 Blaine 100 tph
capacity at 4000 Blaine $100 \times 0.5 / 0.83 = 60$ tph

slag cement
capacity at 3500 Blaine 100 tph

capacity at 4500 Blaine $100 \times 0.3 / 0.53 = 56.6$ tph

application of curve to closed circuit grinding

3000 BI open circuit = 2650 BI closed circuit

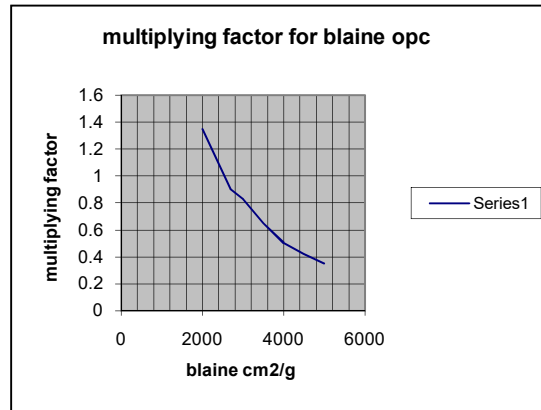
factor for increase in capacity in closed circuit = $1 / 0.83 = 1.2$ from Tale 2

4000 Blaine open circuit = 3650 Blaine closed circuit

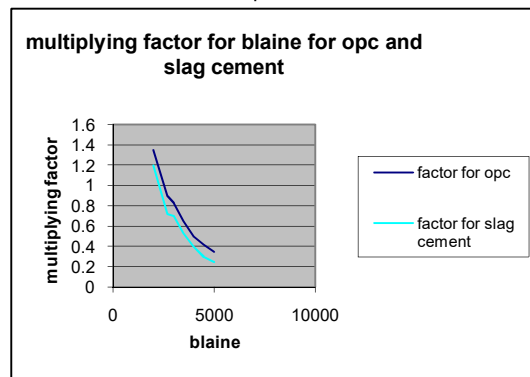
factor for increase in capacity in closed circuit = $0.6 / 0.5 = 1.2$ from Table 2

see Tables 1 & 2 and Graphs 1 & 2 below.

Graph 1



Graph 2



Specific Power for large mills is 10-15% lower than for small mills for higher capacities and for higher fineness of product, closed circuit grinding is better

To make cements of different finenesses closed circuit grinding is preferred because fineness can be easily varied and loss in production is less.

In open circuit grinding it may be necessary to change grading of grinding media as well.

When making blended cements like slag or ppc, closed circuit grinding is a better option

compiled with help from
Manuals of Manufacturers and
like RB2, RB4, RM1