W1.63

cooling of cement in grinding

1 Cooling of cement

It is necessary to restrict temp. of cement between 100-110 ^{o} c to prevent dehydration of gypsum

Open circuit ginding cannot prevent rise in temp merely by venting. It becomes necessary to inject water in the mill in last compartment and some times in both compartments of the mill

Closed circuit grinding offers better possibility of cooling cement and maintain its temp. within 100 - 110 ^{o} c.

2 Ventilation

Vent gases through mill help movement of material inside mill through diaphragms and to airsweep fines.

They also serve to remove grinding heat generated and thereby to keep temp. of cement within limits mentioned above

Conventionally used values of vent air are :

1) 4-5 air changes per minute of internal volume of mill
2) 12-13.5 m^3/hr/hp of grinding mill for mills without internal water spray
3) 400-1200 m^3 per ton of cement
4) When using internal water spray, the vent volume is reduced to 8.5 m^3/hr/hp
5) quantity of water injected is ~2-4 % of the capacity of the mill

3 Cooing of shell

small cement mills have been cooled by spraying water on the outside of the mill shell. The temperature of cement could be brought down by 30-40 ^{o}c

4 linternal water spray

Controlled quantity of water is spread in the hottest part of the mill i.e. the last compartment.

If the clinker fed to milli is hot, water may also be sprayed into the first compartment.

Water may be sprayed either with the help of compressed air or by using high pressure pumps and atomising nozzles. A typical water spraying circuit is attached.

When water is sprayed, the humidity of vent air is high and hence ducting and dust collector are insulated to prevent condensation.

Direction of water spray is towards the feed end.

Requirements of water and compressed air for mills of different h.p. drives are shown in table atached.

Table 1

mill motor h.p.	water to be sprayed litres/hr	compressed air at 2 atmos pr. m^3/hr
500	500	25
750	750	37.5
1000	1000	50
1250	1250	62.5
1500	1500	75
1750	1750	87.5
2000	2000	100
2250	2250	112.5
2500	2500	125
2750	2750	137.5
3000	3000	150
3250	3250	162.5
3500	3500	175
3750	3750	187.5
4000	4000	200
4250	4250	212.5
4500	4500	225
4750	4750	237.5
5000	5000	250

5 Dust Collector

Bag type dust collector is well suited for mills without water spray, if it is possible to keep temperature within limits with vent air
Electrostatic precipitators are well suited with water spray because of higher humidity of vent gases.

6 Closed circuit operation of cement mills

Presently closed circuit cement mills have become very common. In closed circuit, cement could also be cooled in air separators by passing ambient air through air separator as well.
The disharge from the mill (product+circulating load) passes through air separator thru which cooling air is admitted. It is then vented thru the bag filter or esp along with vent air.
Cooling air quantity required would be 0.2-0.3 kg/kg of separator feed

example

If mill capacity is 100 tph and circulating load is 300 %
feed to separator would be 4*100=400tph=400000kg/hr
cooling air quantity to be passed thru separator=100000kg/hr or
77520 nm^3/hr or 0.77nm^3/kg of product.
In case of high efficiency separators the air quantity required to be passed thru separator for separation and air sweeping of mill product out of separator is very much higher than in case of conventional air separators mentioned above Hence with systems using high efficiency separators internal water sprays would not be required nor would it be difficult to keep temperature of cement within desired limits

example

A mill of 100 tph capacity operating in closed circuit with high eficiency separator, air required to be passed through separator would be ~90000nm^3/hr On an average air thru separator would be between 0.8-1.0 nm^3/kg of product as compared to 0.77 nm^3/kg in case of conventional separtors. Therefore internal water sprays have become more or less redundant in case of closed circuit cement mills.

See fig. no 6.30.17 in chapter 30 of section 6 of the Book

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