

# Crushing and grinding practice at Ingaldhal copper mines

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## INTRODUCTION :

Ingaldhal copper mines are situated in the Bangalore — Bombay National Highway about 10 Kms from Chitradurga town (Karnataka State). The main mineral is chalcopryrite ( $\text{Cu FeS}_2$ ) occurring as a vein deposit in chlorite schist, the thickness of the veins varying from 60 cms to 18 cms. The estimated reserves of developed and blocked out ore is 0.2 million tonnes of grade 1.23% Cu. Probable reserves are one million tonnes at 1.0% copper.

The ore from the under ground mines is hoisted up and stored in the surface ore bins. It is transported by trucks to the hopper of the crushing unit.

## CRUSHING SECTION :

The R. O. M. ore is fed to a blake type  $50 \times 75$  cms double toggle jaw crusher of 40 tonnes/hr capacity. The 20 cm feed ore is reduced to 50 mm by the jaw crusher and is collected on a screen feed conveyor (45 cm size) which carries the material to a double deck vibrating screen. The double deck vibrating screen consists two screens of 30mm and 15 mm driven by 20 HP motor. The vibrating screen separates out the -15mm fraction which is collected in 350 MT capacity silo. The +15 mm fraction is carried to secondary crusher through the recycle belt conveyor (900 mm size) for further crushing. The product from this crusher is also collected by the 450 mm conveyor along with jaw crusher product and taken to the vibrating screen.

The secondary gyratory crusher is 94 cms size and driven by 75 H.P. motor and reduce the size of the ore from 50 mm to 15 mm.

## GRINDING SECTION :

The ore from the silo is drawn by a disc feeder and conveyed to the  $240 \times 300$  cm grate type ball mill, operating in closed circuit with a hydrocyclone. The cyclone is designed to give an overflow of 70% — 200 mesh size.

Lime is added to the ore by manual feeding on the mill conveyor belt so as to maintain a pulp pH of 9 to 10.

The cyclone over-flow is fed to the conditioner tank (size  $180 \times 180$ cm) while the under-flow is fed back to the mill. Potassium ethyl xanthate is added to conditioner tank as a 5 gpl. solution.

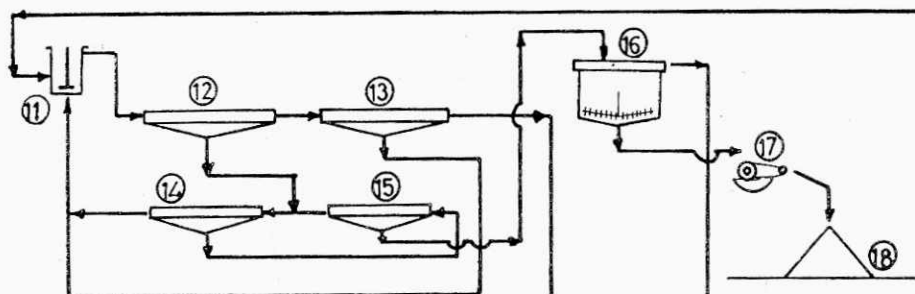
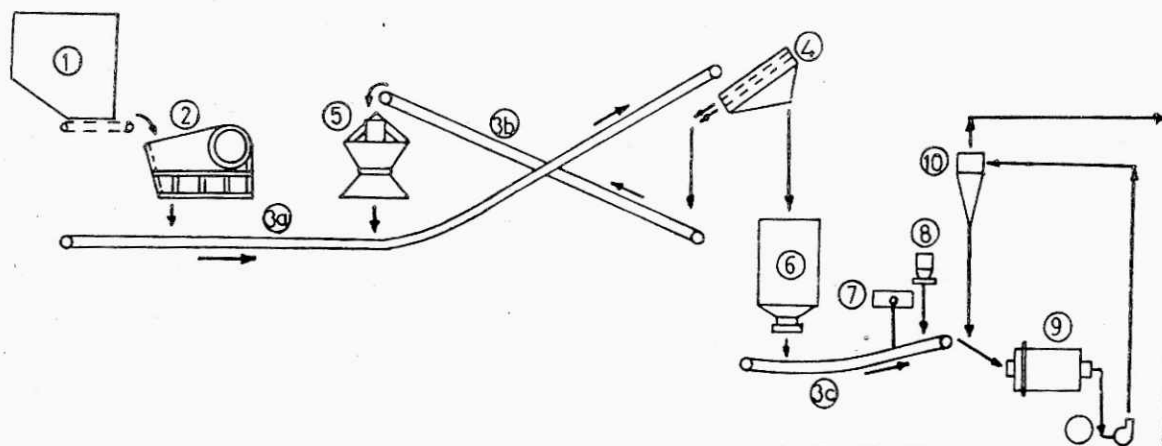
## FLOTATION SECTION :

From the conditioner, the slurry flows to the flotation cells and floated in 4 stages viz. rougher, scavenger, cleaner and recleaner.

There are four rougher flotation cells of 1620 lt. volume connected in series. Pine oil is added as a frothing agent to the cells. The floated concentrate from these cells is fed to the cleaner cells, where-as the tails from the rougher flotation cells flows in to the six scavenger cells of 1620 lt. volume in series. The scavenger concentrate and cleaner tails are fed back to the conditioner tank.

There are 4 cleaner cells of 1080 lt. volume in series. The cleaner concentrate is fed to two recleaner cells of 1080 lt. capacity. The tailing from recleaner cells goes to cleaner cells for further recovery of chalcopryrite. The concentrate from recleaner cells is pumped to concentrate thickener, and tails from the scavenger cells is pumped to tailing thickener.

# CHITRADURGA COPPER COMPANY LTD. CONCENTRATOR PLANT FLOWSHEET



## LEGEND

NO	DESCRIPTION
1	R O M ORE BIN
2	JAW CRUSHER
3a	BELT CONVEYOR
3b	BELT CONVEYOR
3c	BELT CONVEYOR
4	DOUBLE DECK SCREEN
5	GYRATORY CRUSHER
6	FINE ORE BIN
7	WEIGHTO METER
8	LIME FEEDER
9	BALL MILL
10	HYDROCYCLONE
11	CONDITIONER
12	ROUGHER FLOTATION CELLS
13	SCAVENGER CELLS
14	CLEANER CELLS

NO	DESCRIPTION
15	RE CLEANER GELLS
16	CONCENTRATE THICKENER
17	DRUM FILTER
18	CONCENTRATE CAKE
19	TAILING THICKENER

RECLAIM WATER    TAILING DISPOSAL

All the flotation cells are designed with automatic air suction and driven by a 20 H. P. motor.

The thickened slurry containing 50% solids is pumped out by O.D.S. pump and filtered in a belt discharge vacuum filter (size 120 × 240 cm). The cake containing 8 to 12% moisture is sent for bagging and the filtrate separated is fed back to concentrate thickener.

The concentrate is bagged in gunny bags with a net weight of 50 kgs and despatched.

#### The process data :

The average feed ore analysed 1 to 1.2% Cu. and concentrate grade varies 23 to 25% Cu. and tails grade varies from 0.05 to 0.075% Cu.

The consumption of raw material/reagents are as follows :—

Xanthate	—	0.005 Kg/MT
Pine oil	—	0.04 Kg/MT
Lime	—	1.2 Kg/MT
Grinding media	—	1.2 Kg/MT
Water	—	1690 litres/MT
Power	—	about 25 units/MT

#### Plant Practice :

1. The dust problem is not aggressive as the ore directly brought from the mines is normally wet. The residual dust is suppressed in the crushing section by spraying water on the screen feed conveyor.
2. The original design of the plant had a lime feeder. In practice it was found that it was

not very convenient to use and hence, the manual feeding of lime is adopted.

#### 3. Corrosion :—

The mine water used in the mill has pH 7.5 to 8.0 and there is not much of corrosion problem. However, the water is very hard and contains about 600 ppm of dissolved impurities and these tend to form a white crust in the interior of the water carrying pipes and these have to be cleaned periodically.

4. Whenever the head grade is found high, the re-cleaner cell will be used as a cleaner cell and grade of the concentrate is maintained by adjusting the gate and controlling air-suction. In other words, the rougher concentrate is cleaned in 6 cells and pumped to concentrate thickener. By this way, the load to the rougher cells and scavenger cells is reduced thus consequently minimising the tailing losses.

#### 5. Paddle :

The original design of the scavenger cells had only one set of froth collection paddles. Another set of paddles are added and the tailing losses were minimised.

#### Conclusions :

The plant was erected and commissioned during March 1973. It has so far milled about 0.5 million tonnes of ore and produced about 22,000 MT of concentrate.

#### Acknowledgements :

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