MINERAL PROCESSING

IV MODULE

FLOW SHEETS

A mineral processing plant designs consists of words, numbers and pictures. An engineers thinks in terms of sketches and drawings that are his or her pictures. To solve the problems, the engineer will start with a block to represent equipment, or a process step and then will show the entering and leaving raw materials. When asked to describe a process, an engineer will begin to sketch equipment, show how interconnected, and show the process flows and operating conditions.

Such sketches develop into flow sheets, which are more elaborate diagrammatic representations of the equipment, the sequence of operations, and the expected performance of a proposed plant or the actual performance of an already operating one. For clarity and to meet the needs of the various persons engaged in design, cost estimating, purchasing, fabrication, operation, maintenance, and management, several different kinds of flowsheets are necessary.

BENEFICATION OF FLOWSHEET OF IRON ORE

An iron ore is a mineral which is used after the extraction for iron and steel industry. Most of the ore naturally occurring are haematite and magnetite which is classified according to their iron content. Main problem associated with iron ore is the removal of unwanted particle i.e., gangue. Grades of iron ores are determined by the total Fe content. Low grades caanot be used in the iron and steel industry so they must be upgraded by reducing the gangue content and increasing the iron content. The process required to upgrade Fe in the iron ore content is known as Iron Ore Beneficiation.

Most of the iron ore from different habitat are different in properties and therefore requires different benefication techniques. These ore must be go through the different technique according to their gangue content. The process involves washing, jigging, magnetic separation, magnetic separation and floatation etc are used to remove the unwanted gangue material. But most of all the emphasis is put on to develop a cost effective techniques to improve the iron grade.

CRUSHING,GRINDING AND SCREENING

The main purpose of this operation is to reduce the size of the ore and liberate the valuable mineral. The main units may be primary, secondary, tertiary crushing operation. Jaw, gyratory, cone and roll crushers are used for crushing operation. Each product is screened after operation and the oversize material is fed again to the crushing unit for reduction operation we called this closed circuit grinding. Crushing operation depends on ore properties like hardness etc to determine the efficiency of each operating unit.

WASHING AND WET SCRUBBING

This process is primitive and widely used in lumpy iron ore processing to dislodge and remove friable and soft lateritic materials, fine materials and limonitic clay particles adhering to the ore. Wet scrubbing is also useful in hard and porous ores, which invariably have cavity/pores filled with clayey material that need substantial removal.

GRAVITY SEPARATION

This technique is used where iron bearing minerals are free from associated gangue materials. The specific gravity of iron bearing mineral is usually higher than he specific gravity of gangue materials. Efficiency depends largely on proper crushing and sizing of the ore. The process functioning are dense media separation, heavy media separation, jigging, spirals, cyclones.

MAGNETIC SEPARATION

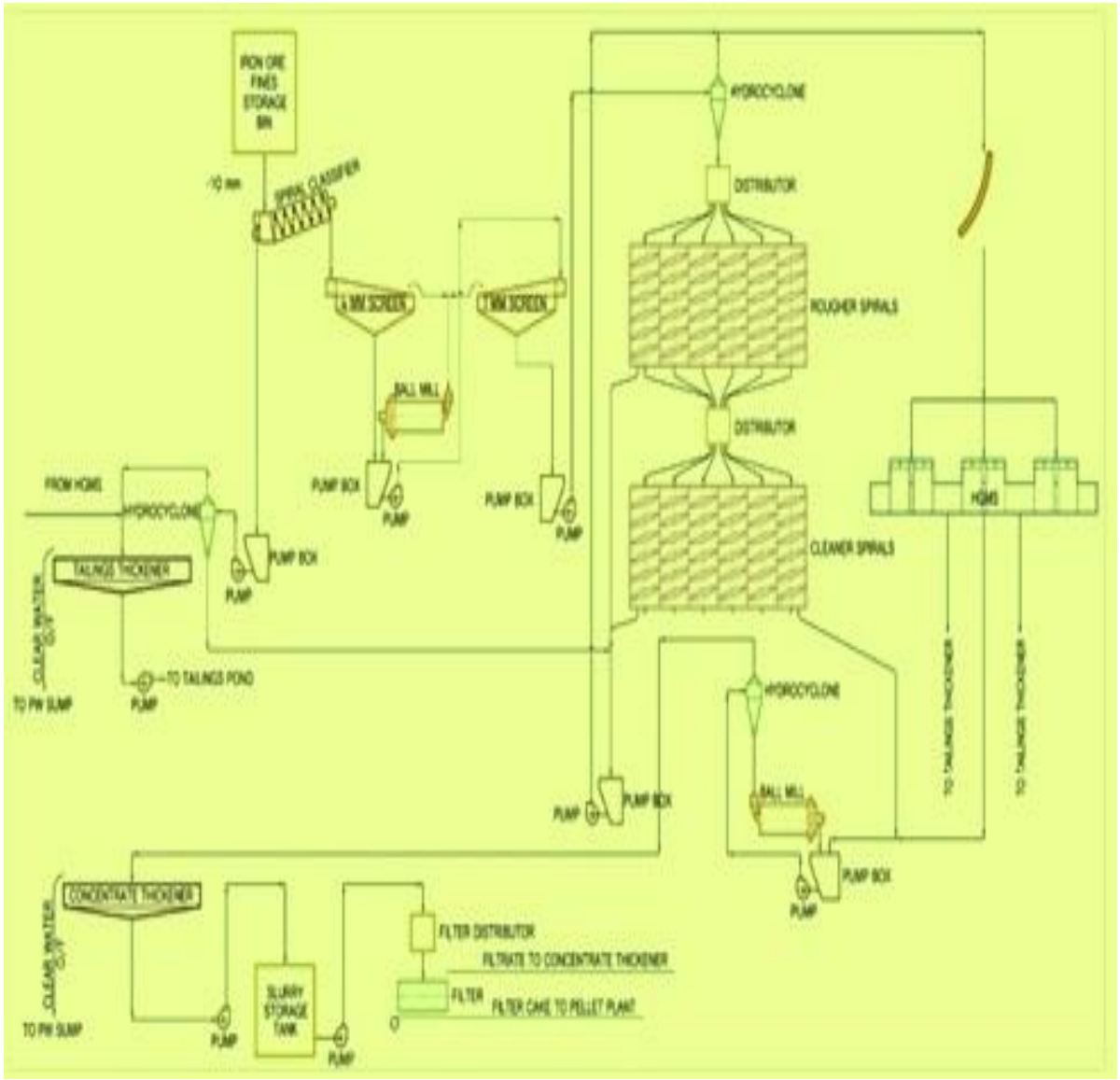
Magnetic separation technologies are used to take the advantage of the difference in the magnetic properties for separating iron ore from the non magnetic associated gangue materials. Magnetic separation can be conducted in either a dry or wet environment, although wet systems are more common.

Several types of magnetic separation technologies are used. These are described below.

- Wet and dry, low intensity magnetic separation (LIMS)
- High gradient magnetic separation (HGMS)
- Wet high intensity magnetic separation (WHIMS)
- Roll magnetic separators for processing weak magnetic ores
- Induction roll magnetic separation (IRMS) for concentrating dry ores

FLOATATION

Flotation process uses a technique where particles of one mineral or group of minerals are made to adhere preferentially to air bubbles in the presence of a chemical reagent. This is achieved by using chemical reagents that that preferentially react with the desired mineral. Several factors are important to the success of flotation activities. These include uniformity of particle size, use of reagent compatible with the mineral, and water conditions that will not interfere with the attachment of the reagents to the mineral or the air bubble.



BENEFICATION OF LEAD-ZINC SULPHIDE ORE

The main lead bearing ores are the sulphides. Galena usually occurs in association with sphalerite and other sulphides. Galena is differentially floated from other sulphides. Galena is readily floatable by using ethyl xanthate as collector in a pulp made alkaline with sodium carbonate. The sphalerite is depressed by using sodium cyanide. This depressed sphalerite is further activated after separation of lead by copper sulphate solution.

Crushing screening

Run of mine ore of 0.5 m size is screened through a 7.5 cm grizzly and the oversize is crushed in a jaw crusher. The undersize of grizzly and jaw crusher product is again screened over 1.5 cm vibrating screen and the undersize is collected in a bin. Oversize product is again crushed in a cone crusher to give a product of -1.5 cm size.

Grinding

The grinding circuit consist of a ball mill close circuited with a rake classifier

Conditioning

The overflow of classifier enters a conditioning tank where necessary reagents for depressing sphalerite and floating galena are added. After conditioning the pulp enters the bank of lead roughing floatation cells.

Lead floatation

The bank of floatation cell consists of 10 to 12 cells. As the pulp proceeds from left to right. It becomes leaner in valuable mineral, and the grade of the concerntrate become lower. Consequently, concentrate from the first four cells is only taken to cleaner cells and the concentrate of the remaining cells with the tailing of the cleaner cell is regrinded in a ball mill

classifier closed circuit and the overflow of classifier is fed back to rougher cells. The cleaned product of a cleaner cells is recleaned, thickened and finally filtered to yield the lead concentrate.

Zinc floatation

The tailing of the lead rougher cells which contains zinc, passes through a conditioner where reagents to activate sphalerie and pH modifier are added. Zinc floatation circuit is identical to lead floatation circuit and yields zinc concerntrate.