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CLAY BRICKS MANUFACTURING

1. INTRODUCTION:

The fundamentals of brick manufacturing have not changed over time. However, technological advancements have made contemporary brick plants substantially more efficient and have improved the overall quality of the products. A more complete knowledge of raw materials and their properties, better control of firing, improved kiln designs and more advanced mechanization have all contributed to advancing the brick industry. Other Technical Notes in this series address the classification and selection of brick considering the use, exposure and required durability of the finished brickwork.

2. PRODUCT & ITS APPLICATION:

Brick is made of clay or shale formed, dried and fired into a durable ceramic product. There are three ways to form the shape and size of a brick: extruded (stiff mud), molded (soft mud) and dry-pressed. The majority of brick are made by the extrusion method. Brick achieves its color through the minerals in the fired clay or through coatings that are applied before or after the firing process. This provides a durable color that never fades or diminishes. Brick shrink during the manufacturing process as vitrification occurs. Brick will vary in size due to the manufacturing process. These variations are addressed by ASTM standards. The method used to form a brick has a major impact on its texture. Sand-finished surfaces are typical with molded brick. A variety of textures can be achieved with extruded brick. Brick manufacturers address sustainability by locating manufacturing facilities near clay sources to reduce transportation, by recycling of process waste, by reclaiming land where mining has occurred, and by taking measures to reduce plant emissions. Most brick are used within 500 miles of a brick manufacturing facility.

3. DESIRED QUALIFICATIONS FOR PROMOTER:

Graduate in any graduate.

4. MARKET POTENTIAL AND MARKETING ISSUES, IF ANY:

The construction sector is an important part of the Indian economy with the contribution of 10% in the GDP and is registering an annual growth of 9%. Clay fired bricks are the backbone of this sector. The Indian brick industry is the second largest producer of bricks in the world after China. India is estimated to produce more than 14000 crores of bricks annually, mainly by adopting age -old manual traditional processes. The brick sector consumes more than 24 million tons of coals annual along with huge quantity of biomass fuels. The per annum O2 emissions from Indian brick industry are estimated to be 42 million tons. Due to large scale construction activities in major towns and cities, a number of brick plants have been set up on the outskirts of these cities. The Asia's overall production has increased from almost 77 percentages to 86.67 percentage of total production of world.

NDIAN SCENARIO

Indian Brick Kiln industry is the second largest producer in the world after china, as per the 2015, estimates production has been increasing annually from 5-10 percentage due to rapid expansion of the urbanization and real estate sector. India estimated to have more than 150000 registered and unregistered brick kilns; producing more than 250 billion bricks. The main cost components of these industries are labour, coal, land, mud, rent and electricity; since it is the largest consumer of coal after the power and thermal sector, it is consuming around 25 million tons every year. Indian brick kilns expanded their capacity of production from 150 billion in 2015 to 200 billion in 2020, almost 150 percentages in the total world production. It consumes 350 billion tons of clay; employing 10 million people, which is twice to the China's brick kiln but ten times lower than the China's employee production capacity.

5. RAW MATERIAL REQUIREMENTS:

Clay is one of the most abundant natural mineral materials on earth. For brick manufacturing, clay must possess some specific properties and characteristics. Such clays must have plasticity, which permits them to be shaped or molded when mixed with water; they must have sufficient wet and air-dried strength to maintain their shape after forming. Also, when subjected to appropriate temperatures, the clay particles must fuse together. Types of Clay Clays occur in three principal forms, all of which have similar chemical compositions but different physical characteristics. Surface Clays. Surface clays may be the up thrusts of older deposits or of more recent sedimentary formations. As the name implies, they are found near the surface of the earth. Shales Clay: shale's clay is clays that have been subjected to high pressures until they have nearly hardened into slate. Fire Clays: Fire clays are usually mined at deeper levels than other clays and have refractory qualities. Surface and fire clays have a different physical structure from shale's but are similar in chemical composition. All three types of clay are composed of silica and alumina with varying amounts of metallic oxides. Metallic oxides act as fluxes promoting fusion of the particles at lower temperatures. Metallic oxides (particularly those of iron, magnesium and calcium) influence the color of the fired brick. The manufacturer minimizes variations in chemical composition and physical properties by mixing clays from different sources and different locations in the pit. Chemical composition varies within the pit, and the differences are compensated for by varying manufacturing processes. As a result, brick from the same manufacturer will have slightly different properties in subsequent production runs. Further, brick from different manufacturers that have the same appearance may differ in other properties.

6. MANUFACTURING PROCESS:

There are four different operations are involved in the process of manufacturing of bricks:

1. Preparation of clay
2. Molding
3. Drying
4. Burning

1. Preparation of clay for brick manufacturing:

Preparation of clay for bricks manufacturing is done in six steps: Unsoiling of clay we need pure clay for the preparation of bricks. The top layer of soil may contains impurities, so the clay in top layer of soil about 200mm depth is thrown away. This is called unsoiling. Digging After the removal of top layer, the clay is dug out from the ground and spread on the plain ground. Cleaning In this stage, the clay is cleaned of stones, vegetable matter etc. if large quantity of particulate matter is present, and then the clay is washed and screened. The lumps of clay are converted into powder with earth crushing rollers. Weathering the cleaned clay is exposed to atmosphere for softening. The period of weathering may be 3 to 4 weeks or a full rainy season. Generally, the clay is dug out just before the rainy season for larger projects. Blending if we want to add any ingredient to the clay, it is to be added in this stage by making the clay loose and spread the ingredient over it. Then take small portion of clay into the hands and tuning it up and down in vertical direction. This process is called blending of clay. Tempering In this stage, water is added to clay and pressed or mixed. The pressing will be done by cattle or with feet of men for small scale projects, pug mill is used as grinder for large scale projects. So, the clay obtains the plastic nature and now it is suitable for molding**.**

2. Molding of clay for brick manufacturing

In the molding process, prepared clay is mold into brick shape (generally rectangular). This process can be done in two ways according to scale of project.

Hand molding (for small scale)

Machine molding (for large scale)

Hand molding of bricks

If manufacturing of bricks is on a small scale and manpower is also cheap then we can go for hand molding. The molds are in rectangular shape made of wood or steel which are opened at the top and bottom. The longer sides of molds are projected out of the box to serve it as handles. If we take durability in consideration steel molds are better than wooden molds. In hand molding again there are two types and they are Ground molded bricks, Table-molded bricks

Machine molding of bricks

The bricks required are in large quantity, then machine molding is economical and also saves more time. Here also we are having two types of machines, Plastic clay machines, and Dry clay machines

Plastic clay machines: This machines contain an opening in rectangular shape and when we place the tempered clay in to this machine it will come out through this opening. Now, the rectangular strips coming out the opening are cut by wires to get required thickness of brick. So, these are also called wire cut bricks. Now these raw bricks are ready for the drying process. Dry clay machines: Dry clay machines are more time saving machines. We can put the blended clay into these machines directly without tempering. Means tempering is also done in this machine by adding some water. When the required stiffness is obtained the clay is placed in mold and pressed hard and well-shaped bricks are delivered. These are called pressed bricks and these do not require drying they may directly sent to burning process.

3. Drying of raw bricks

After molding process the bricks contain some amount of moisture in it. So, drying is to be done otherwise they may cracked while burning. The drying of raw bricks is done by natural process. The bricks are laid in stacks. A stack consists 8 to 10 stairs. The bricks in these stacks should be arranged in such a way that circulation of air in between the bricks is free. The period of drying may be 3 to 10 days. It also depends upon the weather conditions. The drying yards are also prepared on higher level than the normal ground for the prevention of bricks from rain water. In Some situations artificial drying is adopted under special dryers or hot gases.

4. Burning of bricks

In the process of burning, the dried bricks are burned either in clamps (small scale) or kilns (large scale) up to certain degree temperature. In this stage, the bricks will gain hardness and strength so it is important stage in manufacturing of bricks. The temperature required for burning is about 1100oC. If they burnt beyond this limit they will be brittle and easy to break. If they burnt under this limit, they will not gain full strength and there is a chance to absorb moisture from the atmosphere. Hence burning should be done properly to meet the requirements of good brick.

7. MANPOWER REQUIREMENT:

The enterprise requires 13 employees as detailed below**:**

Sr. No.	Designation of Employees	Salary Per Person	Monthly Salary ₹	Number of employees required				
				Year-1	Year-2	Year-3	Year-4	Year-5
1	Machine Operators	12,000	24000.00	2	2	2	2	2
2	Helpers	8,000	48000.00	6	6	8	8	10
1	Production supervisor	15,000	15000.00	1	1	1	1	1
2	Accounts/Stores Asset	12,500	12500.00	1	1	1	1	1
3	Office Boy	9,000	9000.00	1	1	1	1	1
	Total		108500.00	11	11	13	13	15

8. IMPLEMENTATION SCHEDULE:

The project can be implemented in 3 months' time as detailed below:

Sr. No.	Activity	Time Required *(in months)*
1	Acquisition of premises	1.00
2	Construction (if applicable)	1.00
3	Procurement & installation of Plant & Machinery	1.00
4	Arrangement of Finance	2.00
5	Recruitment of required manpower	1.00
	Total time required *(some activities shall run concurrently)*	3.00

9. COST OF PROJECT:

The project shall cost ₹ 37.50 lacs as detailed below:

Sr. No.	Particulars	₹ in Lacs
1	Land	4.00
2	Building	11.00
3	Plant & Machinery	13.00
4	Furniture, Electrical Installations	1.00
5	Other Assets including Preliminary / Pre-operative expenses	1.30
6	Margin for Working Capital	7.20
	Total	**37.50**

10. MEANS OF FINANCE:

Bank term loans are assumed @ 75 % of fixed assets.

Sr. No.	Particulars	₹ in Lacs
1	Promoter's contribution	9.38
2	Bank Finance	28.13
	Total	**37.50**

11. WORKING CAPITAL CALCULATION:

The project requires working capital of ₹ 7.20 lacs as detailed below:

Sr. No.	Particulars	Gross Amt	Margin %	Margin Amt	Bank Finance
1	Inventories	3.60	0.25	0.90	2.70
2	Receivables	1.80	0.25	0.45	1.35
3	Overheads	1.80	100%	1.80	0.00
4	Creditors	-		0.00	0.00
	Total	7.20		3.15	4.05

12. LIST OF MACHINERY REQUIRED:

A detail of important machinery is given below: Power Requirement: 5 HP

Sr. No.	Particulars	UOM	Qtty	Rate (₹)	Value (₹ in Lacs)
	Plant & Machinery / equipments				
a)	***Main Machinery***				
i.	Chimney	NOS.	1	550000	5.50
ii.	Tables and moulds	Nos	1	300000	3.00
iii.	pump sets	Nos	2	100000	2.00
b)					
i.	Water tanks	Nos	1	60,000	0.60
ii.	Electrical and EB charges	NOS.	1	21000	1.90
	sub-total Plant & Machinery				**13.00**
	Furniture / Electrical installations				
a)	Office furniture	LS	1	10000	0.10
b)	Stores Almirah	LS	1	5,000	0.05
c)	Computer & Printer	L. S.	1	10000	0.85
	sub total				**1.00**
	Other Assets				
a)	preliminary and preoperative				1.30
	sub-total Other Assets				1.30
	Total				**15.30**

13. PROFITABILITY CALCULATIONS:

Sr. No.	Particulars	UOM	Year-1	Year-2	Year-3	Year-4	Year-5
1	Capacity Utilization	%	60%	70%	80%	90%	100%
2	Sales	₹. In Lacs	21.60	25.20	28.80	32.40	36.00
3	Raw Materials & Other direct inputs	₹. In Lacs	14.18	16.55	18.91	21.28	23.64
4	Gross Margin	₹. In Lacs	7.42	8.65	9.89	11.12	12.36
5	Overheads except interest	₹. In Lacs	4.46	4.74	5.30	5.47	5.58
6	Interest	₹. In Lacs	2.81	2.81	1.88	1.41	1.13
7	Depreciation	₹. In Lacs	9.10	6.50	4.55	3.25	2.93
8	**Net Profit before tax**	₹. In Lacs	**-8.96**	**-5.40**	**-1.84**	**1.00**	**2.73**

14. BREAKEVEN ANALYSIS:

The project shall reach cash break-even at 54.25 % of projected capacity as detailed below:

Sr. No.	Particulars	UOM	Value
1	Sales at full capacity	₹. In Lacs	36.00
2	Variable costs	₹. In Lacs	23.64
3	Fixed costs incl. interest	₹. In Lacs	6.71
4	BEP = FC/(SR-VC) x 100 =	% of capacity	54.25%