



## HOW TO MANUFACTURE HIGH QUALITY FLY ASH BRICKS

In India, Fly Ash-lime/gypsum/cement bricks are manufactured in large quantity near all thermal power plants using Vibro/Hydraulic press machines.

These bricks are being manufactured using Lime-Gypsum as well as cement/cement-gypsum as per availability of raw materials. These guidelines are helpful for brick manufacturers to produce consistent good quality Fly Ash Bricks to ensure Indian Standard IS:12894:2002.

Major factors on which Quality of Fly Ash Brick is dependant are:

1. Quality of Raw Materials
2. Handling and Storage of raw materials
3. Proportion of Raw Materials (Batching/Manual Batching)
4. Mixing of Raw Materials
5. Accuracy of mold of Machine
6. Accuracy of raw material feeding to mold
7. Quality Pressing of Raw Materials
8. Appropriate curing of product
9. Feedback system with existing Client Practices



## Quality of Raw Materials:

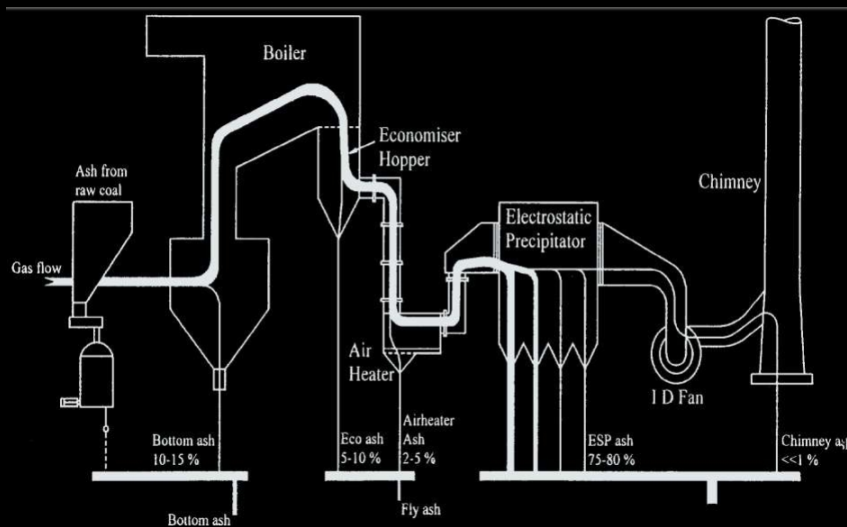
### Fly Ash (FA): [IS:3812 Part -1-2003]

For Production of good Quality Fly Ash Brick (FAB), Fly Ash (FA) should meet requirement specified in IS:3812 Part -1-2003. With an experience on field Fly Ash should be collected from 1<sup>st</sup> and 2<sup>nd</sup> field of ESP's, meets the quality requirement chemically and physically.

Pond Ash/Mound Ash, has comparatively less lime reactive than Fly Ash and also it will not have uniform reactivity, therefore it is recommended to have Lab testing of Pond Ash/ Mound Ash before making Fly Ash Brick to avoid bad quality issues.

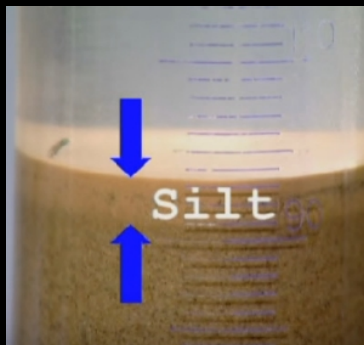
Fly Ash is transported from thermal power stations to Fly Ash Brick factory/Plant either by closed tankers called as bulgers or in trucks with tarpaulin or in bagged condition.

ESP stands for Electrostatic Precipitator.



Typical Ash Distribution In a Boiler

### Sand/ Stone Dust: (IS:383:1970)



Sand/ Stone Dust are available locally which is used for concreting works can be used for making Fly Ash Bricks.

Too much fine quality of stone dust should be avoided as it may increase required cement or lime ratio to achieve desired compressive strength of Fly Ash Brick.

In sand /stone dust, materials such as clay lumps, slit, coal particles shall not be more than 5%. This can be tested with field test with the help of measuring cylinder with water for every truck load of sand/stone dust.

To be stored appropriately to avoid increase in moisture content.



## **Hydrated Lime/Sludge Lime: [C grade of IS:712:1984 and IS:1514:1990]**

Hydrated lime used for Fly Ash Brick manufacturing, CaO Purity in the lime should not be less than 85% which can be conformed with test certificate or by buying standard products.

Lime needs to be stored in Bags under closed rooms to avoid moisture absorption.

Lime also has tendency to react with CO<sub>2</sub> present in the air in presence of moisture and produces CaCO<sub>3</sub> which does not have binding properties, thus spoils quality of Fly Ash Bricks (FABs).

Sludge lime which is a by-product of acetylene gas plant can also be used with few precautions as CaO content in sludge lime varies between 25 to 50% and is available in wet condition (in lumps). Thus, each lot of sludge lime is recommended for testing before use for its CaO content.

## **Gypsum: [IS:1288:1982]**

Chemical or mineral Gypsum can be used for Making Fly Ash Bricks (FAB). The Gypsum should be free of lumps and it should have purity about 60%. Lumps should be removed with screening, after screening the remaining Gypsum must be crushed and re-screened.

Mineral Gypsum has less purity as compared to chemical Gypsum, thus quantity of Mix to be optimized accordingly.

Storage to be done in bags only.

## **Cement:**

Ordinary Portland cement of 43/53 grade can be used in place of lime and gypsum, it is not required to test quality of as it is factory finished product.

Storage to be done in bags under closed room.



## Recipe/ Proportion of Raw Materials:

Proportion of Raw materials or recipe of Raw material has an important role in making desired/High Quality Fly Ash Bricks. The proportion for desired quality of Fly Ash Bricks will vary with quality of raw materials, compressive strength requirement and water quality.

The following proportion are recommended (can be tuned with area wise raw materials)

### Fly Ash, Sand, Sludge lime and Gypsum Bricks

Fly Ash	55-60%
Sand/Stone Dust	20-25%
Sludge Lime	15-20%
Gypsum	5%

### Fly Ash, Sand, Hydrated lime and Gypsum Bricks

Fly Ash	60-65%
Sand/Stone Dust	18-20%
Hydrated Lime	8-12%
Gypsum	5%

### Fly Ash, Sand and Cement Bricks

Fly Ash	50-60%
Sand/Stone Dust	32-40%
Cement	8-10%
Gypsum (Optional)	1%

The Strength of Fly Ash Brick produced with above proportions can be 7.5 to 10 N/mm<sup>2</sup> at 28 days curing.

The appropriate mixing proportion can be finalized by trail mixing to produce high quality Fly Ash Bricks.

### **Batching: [Batching can be either automatic/ manual (to reduce cost)]**

**Manual Batching:** The raw materials are brought by wheel barrows/carts to mixing section of plant. Manual batching is used to save costing of plant machinery but needs real time supervision for consistency in Quality of Fly Ash Bricks.

**Automatic Batching:** Automatic weigh batcher can be introduced to bring raw material in desired proportion to mixing section of Fly Ash Brick Plant



## Mixing at Mixing Section:

Pan mixer of appropriate capacity is used to mix all the raw materials. Pan mixer will help to break lumps in raw material, and it should be able to make homogeneous mix of recipe to have uniform quality of every Fly Ash Brick Produced out of Brick Plant.

Precaution: The quantity of raw material in Pan Mixer should never exceed rated capacity of Pan Mixer.

The good mixing section quality of plant is first step for making high quality bricks.

## Feeding and Molding of Mixed Material/Recipe:

The uniform feeding of Raw material in molds ensures the accurate shape and uniform strength of Fly Ash Brick.

The water content in the mix has to be on optimum level.

At Possible Machines the molds are designed for high accuracy of products and to achieve dimensions of final product mentioned in **IS:12894:2002**

## Compression of Molded raw material:

The quality compression of raw material is ensured at Possible Machines through hydraulic system with material sandwiched between MS Steel of base structure of Machine to support from below and high pressure hydraulic cylinder to compress from top side of mold, this scenario ensures no pressure leakage and entire Hydraulic Cylinder generated pressure is provided to raw material in the mould.

## Curing of Fly Ash Bricks:

These bricks then air dried for 1-2 days. Thereafter, air dried bricks should be water cured for minimum period of 15-20 days.

The curing can be done by water sprinkling/ by water pipe 2 times a day, over the period of 15-20 days.

Possible Machine's client do practice to air dry these bricks in shed for first day which results in increase of strength marginally without investing.

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