AAC BLOCKS MANUFACTURING AND ITS APPLICATION

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THE COMPLETE SOLUTION FOR AAC BLOCKS MANUFATURING AND ITS APPLICATION IN BUILDING CONSTRUCTION.

Written By:

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1. DECLARATION

This is declare that I Abhimanyu Savliram Gangurde solely proprietor of Kalptaru Quality services and Traders Nashik, Maharashtra India have written this book on my own knowledge and experience. I have taken some reference from other books for few topics.

I also declared that all technical information is based on my 22 years work experience where I have worked.

2. CONTENT

3. Executive summary

This book is all about how the AAC block manufacturing process works as well as how it is applying in construction.

This book will help to the AAC block manufacturing companies in its manufacturing process as well as construction companies which are using AAC blocks.

It will help to the AAC Block manufacturing companies as below:

- Reduction in rejections and defects
- Process stabilization
- Improvement in product quality
- Technical Training guide for new comer in AAC block manufacturing companies

It will help to the Construction companies as below:

- Technical Training guide for new comer in AAC block manufacturing companies
- Solutions for avoidance of problems after construction.
- Improvement in construction quality
- Training guide to new comer in Construction companies

Chapter 1

Introduction

AAC manufacturing and application process is a complicated task which requires proper standard operating procedure, trained peoples and corrective and preventive actions on process problems.

For solving these problems this book has been constructed by means of the problems and its solutions during manufacturing and application.

It is difficult to cover all the aspects of AAC blocks manufacturing and application in detail. But I have tried through this book.

1.1 Importance and Significance:

This book will help you to solving the problems during manufacturing and develop your own standard operating procedure.AAC block manufacturing companies booming in India and there is tough competition in all companies related to quality and cost. Due to fast growing companies there is lack of trained peoples. Same in construction companies also.

Hence this book will help to all AAC block manufacturing and construction companies to train the new comers, process set up and for bringing innovation in product. It will help to improve product quality, productivity and need of customer requirement.

1.2 Scope and Objectives:

There are huge AAC Blocks companies coming in India rapidly because all construction companies are prefers AAC blocks for building constructions. AAC blocks are economically & environmentally savvy due to its size and technical properties.

But all companies of AAC block manufacturing and construction facing lot of problems related to process and applications. Hence I have tried to common solutions to all through this book.

Following objectives have been considered for this book.

- To understand the AAC blocks manufacturing process.
- To understand trouble shoot or corrective or preventive actions on AAC blocks manufacturing process
- To understand the AAC blocks application and precautionary measures during construction process.

1.3 Hypotheses:

This book has written for following hypotheses

This book is helpful to all workforces, managerial staff to increase productivity as well as rejection control. This book is helpful to develop common manufacturing and application process in all over India. This book designed by considering all aspects which is creating problem in manufacturing and application process.

1.4 Limitations:

This book has some limitations as below.

This book has not contained any chemical reactions of manufacturing process. All raw material chemical testing are not covered in this book because there is not possible to do the all tests in plant lab. Only the tests which give guidelines to drive the process are covered. This books contained needful and immediate noticeable information only.

Chapter 2

AAC Blocks Etymology

Autoclaved aerated concrete (AAC) Block is a lightweight building material used for constructing the buildings and high rise towers. Other names for this product include **autoclaved cellular concrete** (ACC), **autoclaved lightweight concrete** (ALC).

2.1 History

AAC was perfected in the mid-1920s by the Swedish architect and inventor Dr. Johan Axel Eriksson working with Professor Henrik Kreuger. It was patented in 1924 & production started in Sweden city Yxhult on 1929.Again "SIPOREX" brand started in 1939.

In 1943 Josef Hebel from Memmingen started his first plant in Germany. In 1978 LCC "SIPOREX" plant started in Saudi Arabia. In this way AAC industries slowly started to grow in all over world from 1978 & rapidly cover the market from 2012.

Today aerated concrete is produced by many companies, particularly in Europe and Asia. There is some production in the Americas and in Africa; there is one plant in Egypt. AAC production in Europe has slowed down considerably, but the industry is growing rapidly in Asia due to strong demand in housing and commercial space. China is now the largest aircrete market in the world with several hundred factories. China, Central Asia, India, and the Middle-East are the biggest in terms of AAC manufacturing and consumption. Due to its many desirable attributes AAC blocks has gain massive popularity in Northern, Western and Southern India. Almost 80% of the constructions using AAC blocks as a replacement of the traditional clay bricks.

2.2 Uses

AAC is well suited for high-rise buildings and those with high temperature variations. Due to its lower density, high-rise buildings constructed using AAC require less steel and concrete for structural members. The mortar needed for laying of AAC blocks is reduced due to the lower number of joints. Similarly, the material required for rendering is also lower due to the dimensional accuracy of AAC. The increased thermal efficiency of AAC makes it suitable for use in areas with extreme temperatures, as it eliminates the need for separate materials for construction and insulation, leading to faster construction and cost savings.

2.3 Advantages

AAC has been produced for more than 70 years, and it offers several advantages over other cement construction materials, one of the most important being its lower environmental impact.

- **Structural Saving**

AAC blocks reduce the dead weight which leading to reduce steel consumption in the construction of building due to its light weight as well as it's reduced the consumption of cement and mortar.

- **Faster Construction**

AAC block cut down on construction time by 25 % due to its dimension, light weight and less number of joints.

- **Acoustic Insulation**

AAC blocks offer unmatched acoustic insulation. Boost high sound absorption.

- **Lightweight**

AAC blocks are 3 times lighter than traditional bricks, making it easier to transport and reduce the construction time.

- **Eco Friendly**

It produces at least 30% less solid waste than traditional concrete. There is a decrease of 50% of greenhouse gas emissions. AAC blocks are made by Fly ash or Pond Ash or Sand via non polluting process of steam curing comprising of non-toxic elements. Hence AAC blocks are more eco friendly product for construction.

- **Water Proof**

AAC blocks have a microscopic cellular structure of aerated pores which has less water absorption property than regular bricks. Hence, building built by AAC blocks almost 80 % water resistant.

- **High Strength**

AAC Blocks has higher strength than regular bricks as compare to regular bricks due to steam curing at high pressure and high temperature.

- **Workability and flexibility**

AAC blocks can be cut easily, drilled easily, nailed easily and grooved easily. This allows the installation of electrical and sanitary fitting even after structure construction is complete.

- **Fire Resistant**

Owing to the unique cellular bee-hives like structure the fire resistance quotient of AAC blocks is very high. It can withstand up to 1400 ˚C and has a fire rating 4 – 5 hours.

- **Pest Resistant**

With the precision ratio of AAC Blocks being very high, results in smooth finishing preventing pests. The use of inorganic material also inherently prevents algae and fungi growth

- **Earthquake resistant**

The effect of earthquake is proportional to the weight of the structure.AAC blocks being a light weight subdues any damage by quakes or high winds largely.

- **Non Toxic**

There are no toxic gases or other toxic substances in autoclaved aerated concrete. It neither attracts rodents or other pests nor can it be damaged by such.

- **Great ventilation**

This material is very airy and allows diffusion of water. This reduces the humidity inside the building. AAC will absorb moisture and release humidity. This helps to prevent condensation and other problems that are related to mildew.

- **Cost Effectiveness**

Usage of AAC Blocks reduces project cost.

Cost Component	**Saving %**	**Estimated impact on project cost**	**Explanation**
Mortar material	60	2	Reducing in 1/3 number of joints thus an overall mortar saving up to 60 %
Plastering material	35	2	Exceptional dimensional accuracy and smooth surface eliminates need of 3 coat plaster walls and allows for a final 6 mm skin coat (putty gypsum plaster)
Wastage	10	0.5	Breakages in bricks might be as high as 15 % which in case of AAC blocks is less than 5 %.
Structural material(Steel and Concrete)	20	8	Being light weight AAC blocks drastically reduce the dead weight of the building. This translates to design of light weight structure leading to reduction in steel and concrete. (Up to 20 %)
Increase in floor space area	2	2	Being to exceptional thermal insulation and weather barrier property is possible to use thinner block which results in increase in carpet area.
Savings in CAPEX for HVAC systems	30	0.5	AAC Blocks have excellent insulation properties which results in saving in CAPEX and OPEX of HVAC systems.
Total Impact on project cost		15.00	

2.4 Disadvantages

AAC has been produced for more than 70 years; however, some disadvantages were found when it was introduced in the UK (where cavity wall with clay brick two-skin construction has been the norm).

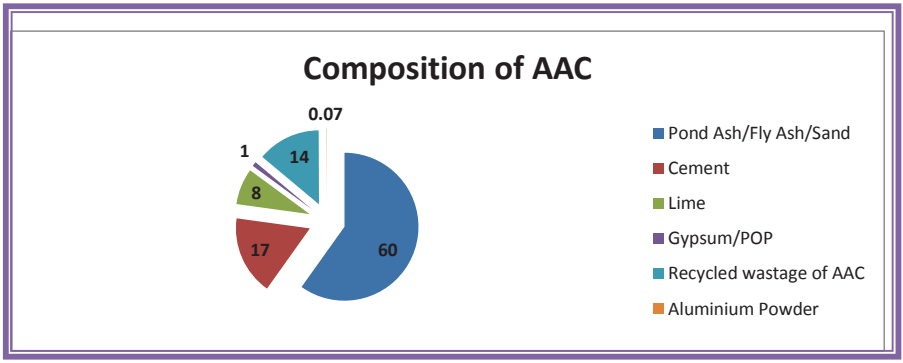
- Installation during rainy weather: AAC Blocks are known to crack after installation, which can be avoided by reducing the strength of the mortar and ensuring the blocks are dry during and after installation.
- Brittle nature: they need to be handled more carefully than clay bricks to avoid breakage.
- Attachments: the brittle nature of the blocks requires longer, thinner screws when fitting cabinets and wall hangings and wood-suitable drill bits or hammering in. Special, large diameter wall plugs are available at a higher cost than common wall plugs.
- Insulation requirements in newer building codes of northern European countries would require very thick walls when using AAC alone. Thus many builders choose to use traditional building methods installing an extra layer of insulation around the entire building.

Chapter 3

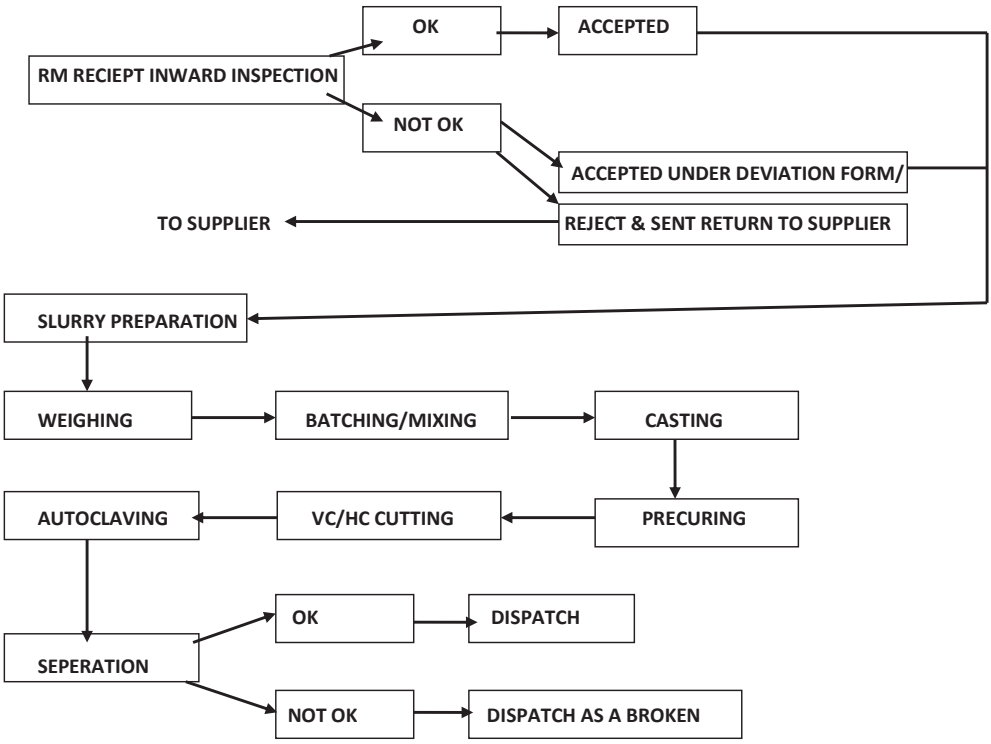
Manufacturing

Unlike most other concrete applications, AAC is produced using no aggregate larger than sand. Quartz sand, calcined gypsum, lime (mineral) and/or cement and water are used as a binding agent. Aluminum powder is used at a rate of 0.05%–0.08% by volume (depending on the pre-specified density). In some countries, like India and China, fly ash or pond ash generated from coal fire power plants and having 50-65% silica content is used as an aggregate.

3.1 Composition of AAC Blocks



3.2 PROCESS FLOW



Chapter 4

Troubleshooting

During the manufacturing process there is various process parameter defection occurred it will impacted on product quality leads to rejection in product.

Various trouble shoot solutions over raw material quality, process parameter deflection and rejections in AAC blocks described as below.

Raw Materials:

To manufacture AAC (Autoclaved aerated concrete) Blocks, following raw materials are mainly used:

A) Cement

B) Pond ash/Fly Ash

C) Lime

D) Gypsum

E) Al-Powder

F) Water

G) Additives

H) Return Slurry (Green wastes recycle)

These constituents are used in proportions according to specified and approved Recipe.

4.1 Troubleshooting and test of raw materials

Here we are going to know basic tests of raw materials which are possible in plant laboratory and troubleshoot over deviated specified parameters of raw material.

A) Cement: Following tests are to be carried out on cement as per IS 8112:1989 .

I) Bulk Density gm/cc: Requirement of bulk density is **1180 – 1220 gm/cc**. It is varied with the fineness of cement. It plays important role in maintaining the density of block. If it will vary, increase and decrease cement or total solids in recipe by increasing and decreasing other raw materials inversely proportional to results.

II) Normal consistency: Requirement of Normal consistency **29.5 -32.5 %.** It plays important role for maintain the water solid ratio in recipe. If it will vary, increase or decrease extra water in recipe with respect to result.

III) Loss on Ignition: Requirement of loss on ignition **2 %(max).** It plays important role in strength of block as well as proper aeration. If it will vary, increase cement in recipe

and increase the dose of foaming agent or additive.

IV) Retention on 170 Mesh: Requirement of Retention on 170 Mesh is **10% (max).** It plays important role in maintaining the density of block. If it will vary, decrease cements in recipe.

V) Specific surface area: Requirement of Specific surface area is **2950 – 3250 cm2/gm.** It plays important role in maintaining the density of block. If it will vary, increase and decrease cement or total solids in recipe by increasing and decreasing other raw materials inversely proportional to results.

VI) Setting time IST and FST: Requirement of IST is **150 minutes (max.)** and FST **180 minutes (max.).** It plays important role in cutting time or precuring time of AAC mould. If it will vary, increase Lime or discharge temperature in recipe.

VII) Strength of Cement: Requirement of Strength of Cement **36 – 38 MPa** in 3 days and **65-68 MPa** in 28 days. It is directly proportional to block strength. If it will vary, increase and decrease cement in recipe with respect to results.

VIII) Magnesia %: Requirement of magnesia is **1.50% (max).** It is directly related to block strength mould and dimension stability. If it will vary, increase the Gypsum or POP and reduce cement quantity in recipe.

IX) Calcium Silicates: It is very important parameter of cement. It's directly proportional to block strength and pores structure formation.

B) Pond Ash/Fly Ash : Following tests are to be carried out Pond Ash/Fly Ash as per IS 3812:Part 2

I) Bulk Density gm/cc: Requirement of bulk density is **940 – 980 gm/cc**. It is varied with the fineness of cement. It plays important role in maintaining the density of block. If it will vary, increase and decrease Pond Ash/fly ash or total solids in recipe by increasing and decreasing other raw materials inversely proportional to results

II) Moisture %: Requirement of moisture% **Max. 20 % for pond Ash** and **Max. 5 % for fly ash**. It plays important role in consumption and cost of raw material. If it will increase inform to supplier control the moisture %.

lll) Loss on Ignition: Requirement of loss on ignition **4 %(max).** It plays important role in strength of block as well as proper aeration. If it will vary, increase cement, reduce pond ash/fly ash in recipe and increase the dose of foaming agent or additive.

IV) Retention on 90 mic: Requirement of Retention on 90 Mesh is **15% (max).**It plays important role in maintaining the density of block. If it will vary, decrease pond ash/fly ash in recipe & increase other raw material to the constant total solid.

V) Water miscibility: Requirement of water miscibility should be easily miscible and no carben layer and other impurities will float on surface. It plays important role in proper aeration, mixing of material. If it has observed such, reduce the quantity of pond ash/fly ash and increase foaming agent (additive) dosing.

VI) Specific surface area: Requirement of Specific surface area is **2800 – 3000 cm2/gm.** It plays important role in maintaining the density of block. If it will vary, increase and decrease pond ash/fly ash or total solids in recipe by increasing and decreasing other raw materials inversely proportional to results.

VII) Silica content %: Requirement of silica content % is **min. 40 %.**It plays important role in aeration of mould as well as CSH formation in mould. It is giving strength and porous structure to the mould. If it is less strength and structure of block will be affected.

C) LIME : Following tests are to be carried out LIME as per IS 712:1984

l) Bulk Density gm/cc: Requirement of bulk density is **850 – 950 gm/cc**. It is varied with the fineness of cement. It plays important role in maintaining the density of block. If it will vary, increase and decrease Lime or total solids in recipe by increasing and decreasing other raw materials inversely proportional to results

II) Slaking temp.: Requirement of slaking temperature of lime is **40 – 50 in 20 minutes** and **54 – 60 in 40 minutes**. It plays important role in cutting time or precuring of mould as well as supports to aeration. If it will vary, increase or decrease lime in recipe inversely proportional to results.

III) Retention on 106 Mesh: Requirement of Retention on 106 Mesh is **10% (max).**It plays important role in maintaining the density of block. If it will vary, decrease lime in recipe.

IV) CaO %: Requirement of CaO % is **min. 85 %.** It plays important role in cutting time or precuring of mould as well as supports to aeration. If it will vary, increase or decrease lime in recipe inversely proportional to results.

V) MgO%: Requirement of MgO % is **max. 2 %.** It plays important role in aeration of mould and dimension stability during autoclaving. If it will vary, increase gypsum in recipe & reduce the lime in recipe.

D) GYPSUM/POP: Following tests are to be carried out Gypsum/POP.

I) Setting time: Requirement of setting time is **2 minutes (max.)** for POP and **3 minutes (max.)** for synthetic gypsum. Natural gypsum has no specified setting time. It plays important role in cutting time or precuring time of AAC mould. If it will vary, increase Lime or discharge temperature in recipe.

II) SO3 %: Requirement of SO3% is **40 % (max.).** It plays important role in cutting time or precuring time of AAC mould and dimension stability during autoclaving. If it will vary, increase Lime & decrease gypsum in mould in recipe.

E) Aluminium powder: Following tests are to be carried out Aluminium powder

I) Water miscibility: Requirement of water miscibility should be easily miscible and no Al-powder layer will float on surface. It plays important role in proper and rate of aeration. If it has observed such, Add foaming agent in Aluminium mixer during mixing. Increase Al-powder dosing in recipe.

II) Bulk density gm/cc: Requirement of bulk density is **1.25 – 1.85 gm/cc**. It is varied with the fineness of Al-powder. It plays important role in aeration of mould. If it will vary, increase and decrease Al-powder in recipe inversely proportional to results.

III) H2 gas evaluation: Requirement of H2 gas evaluation in 16 minute is **65 to 75** with 30 % of CaO. It plays important role in proper and rate of aeration. If it will vary, increase or decrease Al-Powder in recipe inversely proportional to results.

III) Retention on 45 Mesh: Requirement of Retention on 45 Mesh is **15 - 25 %.** It plays important role in maintaining the density of block. If it will vary, increase or decrease Al-Powder in recipe inversely proportional to results.

F) Water : Following tests are to be carried out water as per IS 456

I) pH: Requirement of pH is **7 ± 1**. It plays important role during autoclaving.

II) TDS: Requirement of TDS is **300 PPM (max).** It plays important role during autoclaving. If it will vary white mark or wet patches will observed on block surface.

III) Hardness: Requirement of hardness is **4 PPM (max).**

G) Additives: Following tests are to be carried out for Additives.

Additives mainly used in AAC block manufacturing are foaming agent (Soap solution, Surf), Soluble oil, Dispersive agents, Hardener, Accelerators___ etc.

It has common parameters are viscosity, pH, odour and colour.

It is varied with type of material. But common factor is the pH of foaming agent (Soap solution, Surf) & soluble oil should be more than 10. And pH of Dispersive agents, Hardener & Accelerators should be less than 7.

All are helping to aeration process of mould as well as CSH formation.

4.2 Troubleshooting in process parameters

A. Slurry Density of POND ASH / RETURN SLURRY:

Take one container to select the volume of the container i.e. 100 ml.

Take the POND ASH / RETURN SLURRY sample

Tare zero container weight.

Fill the sample gently into the container (without splashing outside surface of container) up to selected volume and weight to be taken.

Selected Volume of the container a

RM Sample Wt. b

Density = Mass/Volume

= b/a gm/cc

Most suitable for process

Pond Ash slurry – **1.48- 1.50 gm/cc**

Return scrap recycle slurry – **1.38 - 1.44 gm/cc**

PROBLEM : High or Low Slurry Density		
Sr. No.	**Impact on process**	**Action to be taken**
1	Mould Shrinkage due to high slurry Density caused less rise.	Decrease the slurry density as suitable to process. And increase Al-powder dosing.
2	Big pores in structure due to high slurry Density	Decrease the slurry density as suitable to process.
3	Flow increased or decreased w.r.t. Low and high slurry density.	Adjust the extra water with respect to flow required to process.

B. Mixing Time Check:

Mixing time automatically displayed in PLC. The time of mixing in minute is calculated from all raw materials coming in mixer to mixer discharge.

Mixing Time should be more than 3 min 45 seconds.

C. Flow check:

Take the slurry during casting the mould in a mug.

Clean the top surface of flow table and inside surface flow tester cylinder.

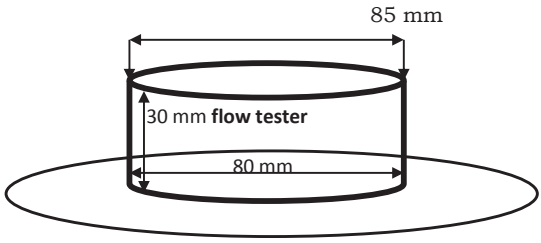
Keep flow tester cylinder on flow table.

Fill the slurry in flow tester cylinder.

Make cylinder empty on flow table.

Check the diameter of circular spread of slurry.

Record the diameter of circular spread of slurry as a flow of mould.



Flow table

Flow should be **21 to 24 cms**.

PROBLEM : High or Low Flow/spread

Sr. No.	**Impact on process**	**Action to be taken**
1	Mould Shrinkage or less rise due to low flow or spread.	Adjust the extra water with respect to flow required to process.
2	Cutting time increase due to increase in flow or spread	Adjust the extra water with respect to flow required to process.

D. Discharge Temperature check:

Take the slurry temperature by digital thermometer after casting the mould.

Record it as a discharge temperature of mould.

More suitable to process discharge temp is **38 – 42 deg cc**

PROBLEM: High or Low discharge Temp.

Sr. No.	Impact on process	Action to be taken
1	Rising Cracks due to high discharge temperature	Reduce the discharge temperature as suitable to process.
2	Cutting time more due to low discharge temperature	Increase the discharge temperature as suitable to process.
3	Flow increased or decreased w.r.t. Low and high discharge temperature	Adjust the discharge temperature with respect to flow required to process.

E. Empty height Check:

Take the empty mould height by measuring scale after all slurry discharge in empty mould. Record it as a empty height in report.

More suitable for process **280 - 300 mm**. depends on mould and cutting cake size.

PROBLEM : High or Low Empty Height after casting.

Sr. No.	Impact on process	Action to be taken
1	Over rising due to low empty height.	Reduce the total solid and Al-Powder consumption or check the slurry calculation.
2	Less Rise due to increase in empty height.	Increase the total solid and Al-Powder consumption or check the slurry calculation.

F. Rising Status:

Check the mould rising height after completion of rising of mould. Record it over rise less rise or OK in report.

PROBLEM: Over or Less Rising.

Sr. No.	Impact on process	Action to be taken
1	Over rising due to low empty height. Caused rising cracks and less Compressive strength.	Reduce the total solid and Al-Powder consumption or check the slurry calculation.
2	Less Rise due to increase in empty height. leads increase in less rise rejection	Increase the total solid and Al-Powder consumption or check the slurry calculation.

G. Penetration (Hardness) check:

Take out mould from pre curing room.

Keep the hardness tester on the top of hard mould.

Lock the testing rod in clip as the distance between testing rod end and hard mould top should be 510 – 515 mm.

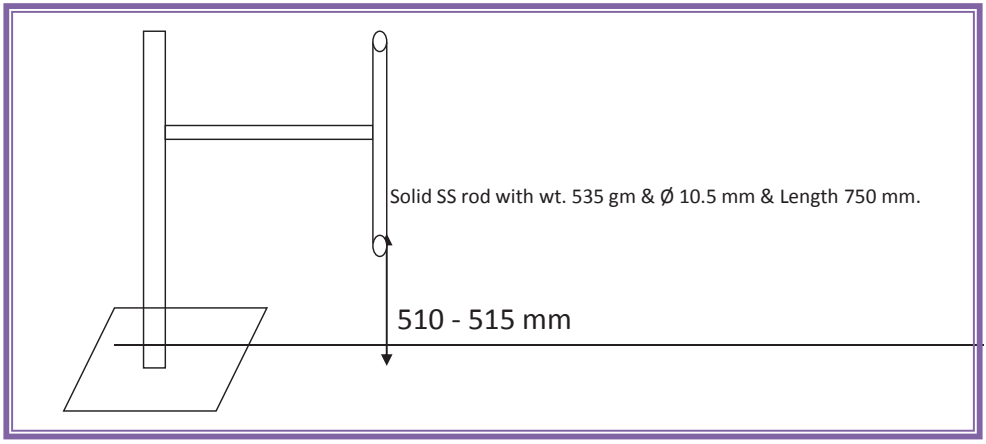
Left the rod and open the clip. So that rod will penetrate perpendicular in the mould.

Remove the penetrated rod and measure the distance of penetrated rod.

Record the distance as a penetration (Hardness) of mould.

More suitable for process is **120 – 150 mm.**

Record the distance as a penetration (Hardness) of mould.



PROBLEM: High or Low Hardness.		
Sr. No.	**Impact on process**	**Action to be taken**
1	Vertical cracks due to low penetration and high hardness.	Maintain the hardness for cutting cake as suitable to atmosphere and process.
2	Vertical cracks due to high penetration and low hardness.	
3	Block sticking after autoclaving due to high penetration and low hardness.	

H. Final Temperature check:

Take the hard mould final temperature by digital thermometer before cutting outside of the precuring room.

Record it as a final temperature of mould.

More suitable for process is **62 – 68 deg cc**.

PROBLEM: High or Low final Temperature.		
Sr. No.	**Impact on process**	**Action to be taken**
1	Rising cracks or vertical cracks due to high final temperature.	Reduce the lime or discharge temperature.
2	Consumption of Al-Powder and lime increased due to less rise by low final temperature	Increase the Lime or discharge temperature.

I. Final Cutting Time:

Record the casting (Discharge) time of the mould and send it to precuring room.

Note the time when mould sent for cutting.

The difference between both times is record as a final cutting time.

Time when mould sent for cutting - Casting (Discharge) time = Final cutting time.

More suitable is **2.00 – 2.25 hrs**.

J. Cutting wire Pressure:

Check the cutting pressure periodically on pressure gauge. Maintain it with respect to hardness of mould. Randomly check length, width & height of the cutting blocks of mould.

Cutting wire pressure more suitable for horizontal cutting is **3.00 – 4.00 kg/cm2**.

Cutting wire pressure more suitable for horizontal cutting is **3.50 – 4.50 kg/cm2**.

PROBLEM: High or Low cutting wire pressure.		
Sr. No.	**Impact on process**	**Action to be taken**
1	Vertical cracks due to low and high cutting wire pressure.	Maintain the cutting wire pressure for cutting cake as suitable to hardness and process.
2	Dimensional variation due to low cutting wire pressure.	
3	Increase in Cutting wire broken and uncut mould rejection due to high cutting wire pressure.	

K. Autoclaving Process:

Autoclaving process should be follow strictly and maintain the pressure and temperature in reports hourly.

Most Specified process is as below.

Rising (Time – pressure)

1st hour – 1 kg/cm2

1.50 hour – 3 to 5 kg/cm2

2.00 – 2.50 hour – 11 to 12.5 kg/cm2.

Holding (Time – pressure)

No more than 2 times pressure & temperature drop during 6 hours holding.

Releasing (Time – pressure)

1st hour – 10 to 11 kg/cm2

1.50 hour – 7 to 8 kg/cm2

2.00 – 2.50 hour – 0 kg/cm2.

PROBLEM : Process of Autoclaving		
Sr. No.	**Impact on process**	**Action to be taken**
1	Block sticking and high moisture in blocks due to steam loading (Rising) process more than 3 hrs.	Follow the steam loading (Rising) Process strictly.
2	Thermal cracks developed due to fast steam loading (Rising) process.	Follow the steam loading (Rising) Process strictly.
3	Low strength due to frequent pressure & temperature drop during holding or less hour holding.	Maintain the holding pressure and temperature by top up steam. Follow the process strictly.
4	Wet patches due to wetness in steam, trap not working and water TDS high used in boiler.	Check the TDS periodically of boiler. Maintain water level at glass gauge in boiler. Check the trap valve functions on daily basis.
5	White marks due to slow steam release, trap not working and water TDS high used in boiler.	Check the TDS periodically of boiler. Maintain water level at glass gauge in boiler. Check the trap valve functions on daily basis. Follow the steam releasing Process strictly.

4.3 Troubleshooting In process rejections and defects

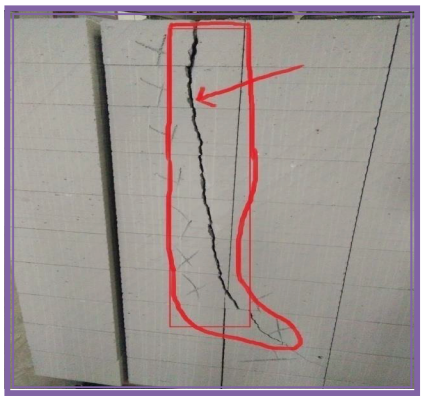
A. Rising Cracks:

Rising cracks developed during aeration of mould. It is observed after cutting of green mould. The length of crack is from 2 cm to 20 cm. It is observed on all cutting faces of green mould.

Sr. No.	Probable root causes	Action to be taken
1	Excess rising due to usage of excess aluminium.	Control the usage of aluminium by frequently monitoring rising height.
2	High rate of reaction or rising due to usage of additive or by Al-powder	Control the usage of additive & Al-powder by frequently monitoring rising height & rate of Hydrogen gas evolution of Al-powder(69 - 72)
3	High or low gas evaluation of Al-powder.	Rate of Hydrogen gas evolution of Al-powder(69 - 72)
4	Mould movement during rising.	Mould movement should not be done at the stage of peak rising.
5	Heavy coal and oil in pond ash.	Try to dissolve Heavy coal and oil in pond ash by adding soluble oil in service tank or try to separate it in service tank. Or don't accept such pond ash.
6	Very coarse pond ash.	Don't accept such pond ash. Increase the al-powder dosing & reduce the pond ash in recipe.
7	High discharge temp.	Reduce the discharge temp.
8	Cutting machine blower alignment.	Set The blower position.
9	Tilting crane operation jerky.	Set the tilting crane operation.
10	Excess use of Dispersive agent or D C	Reduce the quantity of consumption.
11	Low soluble oil or Soap solution(Foaming additive)	Increase the quantity of consumption

B. Vertical cracks:

Vertical cracks developed during cutting and movement of green mould. It is observed after cutting of green mould. The length of crack is from 20 cm to 1000 cm. It is observed from top to bottom of green mould straight or cross.



PROBLEM : VERTICAL CRACKS

Sr. No.	Probable root causes	Action to be taken
1	Excess rising due to usage of excess aluminium.	Control the usage of aluminium by frequently monitoring rising height
2	High rate of reaction or rising due to usage of additive or by Al-powder.	Control the usage of additive & Al-powder by frequently monitoring rising height & rate of Hydrogen gas evaluation of Al-powder(69 - 72)
3	Mould movement during rising.	Mould movement should not be done at the stage of peak rising.
4	Heavy coal and oil in pond ash.	Try to dissolve Heavy coal and oil in pond ash by adding soluble oil in service tank or try to separate it in service tank. Or don't accept such pond ash.
5	Very coarse pond ash.	Don't accept such pond ash. Increase the al-powder dosing & reduce the pond ash in recipe.
6	Cutting car movement & vibration problem.	Check the chain tightness. It's functioning. Plumber blocks tightness. Track and rack cleaning. Bearing greasing and its functioning.
7	Stamping roller alignment	Correct the stamping roller as should not press the mould or should not be taper to mould height & should not be rest on plate.
8	Tilting crane operation.	There should not be jerky movement during tilting the mould.

9	Lifting arm movement.	Check the movement up & down. Correct if not parallel.
10	Mould hard and soft	Cut the mould on 120 to 160 mm hardness.
11	Casting flow less or high.	Mould casting flow should be 21 - 24. Adjust it reducing or adding extra water in recipe.
12	Mould high final temp.	Mould final temp should be 62 - 68.Adjust it reducing lime in recipe or casting temp during batching.
13	High or low lime final temp.	Lime final temp should be 54 to 58. if more reduce the lime in recipe or load it mixing with low temp lime.
14	Total solid less.	Total Solid should be maintained as per required dry density with min. 22 % binder.
15	Disoperation of tilting crane by operator.	Check the operation as operator should keep mould down on marking only.
16	Cutting Blade setting.	Cutting blade should be straight line and parallel to each other. And should not loose & rough.
17	Cutting car stopper setting.	Cutting car stopper should fixed as it has 10 mm clearance from plate base
18	Cutting machine blower alignment.	Set The blower position.
19	Tilting crane operation jerky.	Set the tilting crane operation.
20	Casting temp high.	Adjust Casting temp.

C. BLACK MOULDS:

Black mould observed after cutting of green mould. It is uncut portion of green mould. This is occurred due to green mould not placed on cutting car.

PROBLEM : BLACK MOULDS

Sr. No.	Probable root causes	Action to be taken
1	Excess rising causes cake out of mould during tilting.	Frequently monitor & Control the excess rising by reducing usage of aluminium & Total solids in recipe.
2	Less rising due to usage of less aluminium or less solid.	Frequently monitor & Control the less rising by increasing usage of aluminium & Total solids in recipe.
3	Cutting car movement & vibration problem.	Check the chain tightness. It's functioning. Plumber blocks tightness. Track and rack cleaning. Bearing greasing and its functioning.
4	Tilting crane operation.	There should not be jerky movement during tilting the mould.
5	Cutting Blade setting.	Cutting blade should be straight line and parallel to each other. And should not loose & rough.
6	Cutting car stopper setting.	Cutting car stopper should fixed as it has 10 mm clearance from plate base
7	Disoperation of tilting crane by operator.	Check the operation as operator should keep mould down on marking only.
8	Mould hard and soft.	Cut the mould on 140 to 160 mm hardness.
9	Plate and mould fixing alignment	It should be straight and gap free.

D. CORNER DAMAGE:

Corner damage observed during cutting and movement of green mould and during handling of steam cured block.

PROBLEM : CORNER DAMAGE		
Sr. No.	**Probable root causes**	**Action to be taken**
1	Excess rising causes cake out of mould during tilting.	Frequently monitor & Control the excess rising by reducing usage of aluminium & Total solids in recipe.
2	Wire before cutting blade not at place.	Check frequently tightness and availability of Wire before cutting blade.
3	Cutting car movement & vibration problem.	Check the chain tightness. It's functioning. Plumber blocks tightness. Track and rack cleaning. Bearing greasing and its functioning.
4	Tilting crane operation.	There should not be jerky movement during tilting the mould.
5	Cutting Blade setting.	Cutting blade should be straight line and parallel to each other. And should not loose & rough.
6	Cake placing problem on Cutting car.	Cutting car stopper should fixed as it has 10 mm clearance from plate base
7	Operation of tilting crane by operator.	Check the operation as operator should keep mould down on marking only.
8	Mould hard and soft.	Cut the mould on 140 to 160 mm hardness.
9	Chamfer not done.	Before mould send to horizontal cutting, back end of mould should chamfered on both side.
10	Cutting car Speed	Adjust the cutting car speed to slower side

E. UNCUT:

Uncut blocks are those blocks where cutting wire broken and green mould passes as an uncut. It is observed during cutting and movement of green mould.

PROBLEM : UNCUT

Sr. No.	Probable root causes	Action to be taken
1	Cutting wire placing.	Ensure the cutting wire should be placed at proper position & proper tightness. Should not over tight at VC or loose at HC.
2	VC / HC cutting wire pressure low.	Maintain the cutting pressure 3.2 to 3.5 with respect to hardness of mould. If mould hard less than 140 reduce the Cutting pressure. It should not be below 3.0 at VC & 3.5 at HC.
3	Cutting car movement & vibration problem.	Check the chain tightness. It's functioning. Plumber blocks tightness. Track and rack cleaning. Bearing greasing and its functioning.
4	Cutting Wire broken.	Maintain the cutting pressure 3.2 to 3.5 with respect to hardness of mould. If mould hard less than 140 reduce the Cutting pressure. As well as check the clinkers, grass in pond ash slurry. Check all pond ash slurry rotary & other sieves.
5	Mould hard and soft.	Cut the mould on 140 to 160 mm hardness. If mould hard less than 140 reduce the Cutting pressure.
6	Cutting wire quality and Size.	It should be 0.6 mm and not more than 6 month pending wire to be use.
7	Cutting wire cylinder problem	Check the operation of cutting wire cylinder

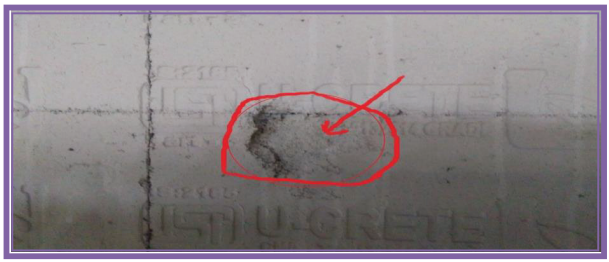
F. STICKING:

Sticking problem observed after autoclaving during separation. Sticking means two adjacent blocks not separate easily.

PROBLEM : STICKING		
Sr. No.	**Probable root causes**	**Action to be taken**
1	Cutting wire spring placing. If you are using	Cutting wire spring should not be misplaced from its position. If observed, correct the position of spring and stick with feviquick or remove the wire.
2	Mould soft cutting.	Cut the mould on below 160 mm hardness.
3	Autoclaving cycle deviation.(Slow release or slow Rise)	Control the autoclave rise as 1 kg in 1.25 hrs and remaining 10 Kg in 1.25 hrs. same for release also. If time exceeds check the trap functioning & slightly open more.
4	Autoclave trap functioning	Trap should have the smooth functioning. If not, Open drains slightly 2 to 3 times in complete cycle to remove the water.
5	Separation time after moulds will out of autoclave.	Mould to be separate before 8 hrs after out of autoclave.
6	Separator machine hydraulic pressure low for holding cylinders.	Maintain the Separator machine hydraulic pressure 4.5 for holding cylinders.
7	Excess natural gypsum.	Use the gypsum max. 1.5 % in recipe.
8	Very fine pond ash.	If pond ash is very fine slightly increase the al-powder and return slurry & reduce the pond ash.
9	Binders' % low in recipe.	Use the binders' min. 25% in recipe.

G. CHIPPING:

Chipping problem observed after autoclaving during separation as well as during demoulding of green mould. This is looks like snatching of material from the finished surface. It has been observed anywhere on finished surface.

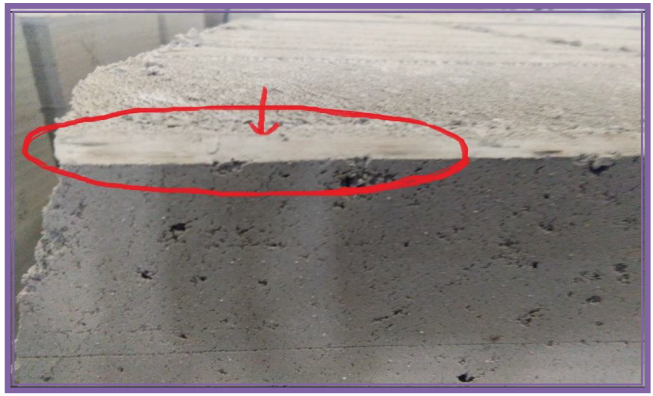


PROBLEM : CHIPPING

Sr. No.	Probable root causes	Action to be taken
1	Cutting wire spring placing.	Cutting wire spring should not be misplaced from its position. If observed, correct the position of spring and stick with feviquick or remove the wire.
2	Mould soft cutting.	Cut the mould on below 160 mm hardness.
3	Separation time after moulds will out of autoclave.	Mould to be separate before 8 hrs after out of autoclave.
4	Separator machine hydraulic pressure high for holding cylinders.	Maintain the Separator machine hydraulic pressure 4.5 for holding cylinders.
5	Excess gypsum.	Use the gypsum max. 1.5 % in recipe.
6	Very fine pond ash.	If pond ash is very fine slightly increase the al-powder and return slurry & reduce the pond ash.
7	Excess lime.	Lime in recipe should not be more than 10 %.Reduced it if problem seen.
8	Excess soluble oil or soap solution	Soluble oil & Soap solution should not be more than 5 lit. reduced it if problem seen.
9	Mould final temp at the time of cutting will high.	Reduced the lime. Final temp. Should be 65 - 70.
10	Stamping roller placing.	Correct the stamping roller as should not press the mould or should not be taper to mould height & should not be rest on plate.
12	Swinging motion at horizontal cutting.	Swinging motion should be normal. Not so fast.
13	Mould oil quality inferior	Set viscosity of mould oil & maintain quality.

H. AUTOCLAVE DAMAGE:

Autoclave damage observed after autoclaving during loading of green mould & unloading of autoclaved mould due to touching to autoclave surface.



PROBLEM : AUTOCLAVE DAMAGE		
Sr. No.	**Probable root causes**	**Action to be taken**
1	Ferry cart & tracks misalign with winching tracks.	Correct the track alignment by adjusting sensor or track place correction
2	Autoclave trolley tracks misalign with winching tracks.	Correct the track alignment by adjusting sensor or track place correction
3	Autoclave trolley tracks misalign with autoclave tracks.	Correct the track alignment by adjusting sensor or track place correction
4	Improper placing of cutting mould on wagon.	Check the operator operation for loading crane. Check loading crane alignment. Check the wagon placing.
5	Wagons improper locking.	Ensure & Control that each wagon should lock with other.

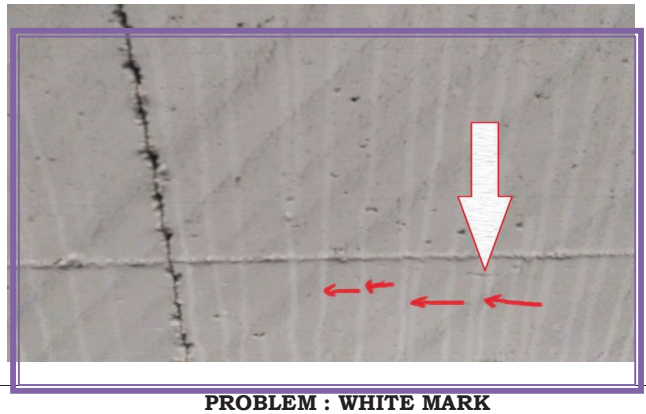
I. THERMAL CRACK:

Thermal cracks observed after autoclave. It is developed during autoclaving process. It is hairline cracks on the finished surface of autoclaved mould vertical or horizontal in position.

PROBLEM : THERMAL CRACK		
Sr. No.	**Probable root causes**	**Action to be taken**
1	Mould soft cutting.	Cut the mould on below 160 mm hardness.
2	Autoclaving cycle deviation.(Fast release or Fast Rise)	Control the autoclave rise as 1 kg in 1.25 hrs and remaining 10 Kg in 1.25 hrs. same for release also. If time exceeds check the trap functioning & slightly open more.
3	Autoclave trap functioning	Trap should have the smooth functioning. If not, Open drains slightly 2 to 3 times in complete cycle to remove the water.
4	Autoclaving cycle deviation.(frequently pressure drop during holding)	Valve should be check and tightened. Top up the pressure as soon as possible.
5	Excess time Cutting mould (Green Cake) outside the autoclave>3.00 hrs	Purging to done if such. Slow rising required.
6	Gypsum or POP not added.	Add Gypsum or POP as required in recipe.
7	Excess POP in recipe.	Add Gypsum or POP as required in recipe.
8	Excess dosing of (hardener additive) if using.	Add (hardener additive) as required in recipe.

J. WHITE MARK:

White Mark observed after autoclave. It is developed during autoclaving process. It is white lines on the finished surface of autoclaved mould in vertical position.

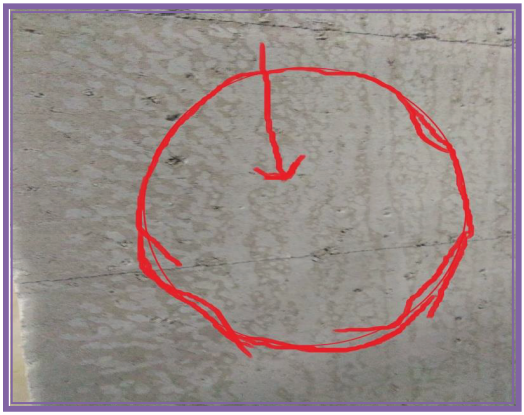


PROBLEM : WHITE MARK

Sr. No.	Probable root causes	Action to be taken
1	Autoclaving cycle deviation..(Slow release or slow Rise)	Control the autoclave rise as 1 kg in 1.25 hrs and remaining 10 Kg in 1.25 hrs. same for release also. If time exceeds check the trap functioning & slightly open more.
2	Autoclave trap functioning	Trap should have the smooth functioning. If not, Open drains slightly 2 to 3 times in complete cycle to remove the water.
3	Autoclaving cycle deviation.(frequently pressure drop during holding)	Valve should be check and tightened. Top up the pressure as soon as possible.
4	Boiler wet steam	Boiler steam should be saturated. Maintain the boiler header pressure more than 8 kg during rising.
5	Very Slow steam exchange.	Steam exchange should be done as 1 kg in 1.25 hrs.then exchange up to 5 kgs only.
6	Excess soap solution and soluble oil.	Soluble oil & Soap solution should not be more than 5 lit.Reduced it if problem seen.
7	Boiler water TDS or pH high.	Boiler water TDS or pH should be in range. If more charging to be taken. Check the chemical dosing.
8	Hard water usage for production.	Use hard water partly. Not 100 %.

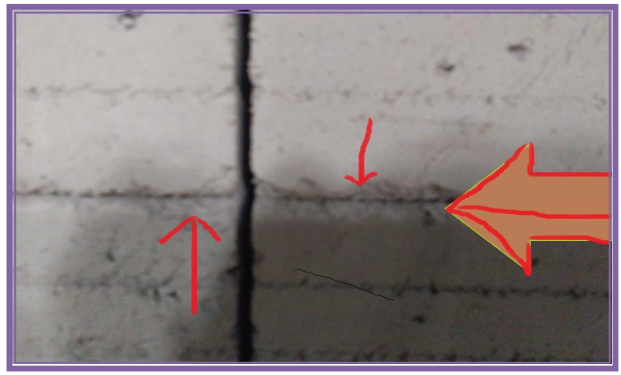
K. WET PATCH:

Wet patches observed after autoclave. It is developed during autoclaving process. It is white and wet portion on the finished surface of autoclaved mould in centre position.



PROBLEM : WET PATCH		
Sr. No.	**Probable root causes**	**Action to be taken**
1	Autoclaving cycle deviation.(Slow release or slow Rise)	Control the autoclave rise as 1 kg in 1.25 hrs and remaining 10 Kg in 1.25 hrs. same for release also. If time exceeds check the trap functioning & slightly open more.
2	Autoclave trap functioning	Trap should have the smooth functioning. If not, Open drains slightly 2 to 3 times in complete cycle to remove the water.
3	Autoclaving cycle deviation.(frequently pressure drop during holding)	Valve should be check and tightened. Top up the pressure as soon as possible.
4	Boiler wet steam	Boiler steam should be saturated. Maintain the boiler header pressure more than 8 kg during rising.
5	Very Slow steam exchange.	Steam exchange should be done as 1 kg in 1.25 hrs.then exchange up to 5 kgs only.
6	Autoclave not drained before opening.	Drain the autoclave at pressure zero after release.

L. ROUGH CUTTING:



PROBLEM : ROUGH CUTTING		
Sr. No.	**Probable root causes**	**Action to be taken**
1	Mould weak due to excess rising	Control the usage of aluminium by frequently monitoring rising height
2	Cutting car movement & vibration problem.	Check the chain tightness. It's functioning. Plumber blocks tightness. Track and rack cleaning. Bearing greasing and its functioning.
3	Lifting arm movement.	Check the movement up & down. Correct if not parallel.
4	Cutting Blade setting.	Cutting blade should be straight line and parallel to each other. And should not loose & rough.
5	VC/HC wire placing.	Ensure the cutting wire should be placed at proper position & proper tightness. Should not over tight at VC or loose at HC.
6	Cutting machine alignment.	Cutting machine groove beam should be parallel to each other.
7	HC wire spring placing.	Cutting wire spring should not be misplaced from its position. If observed, correct the position of spring and stick with feviquick or remove the wire.
8	VC Cutting machine swinging speed fast.	Swinging motion should be normal. Not so fast.
9	VC/HC wire cutting pressure low.	Maintain the cutting pressure 3.2 to 3.5 with respect to hardness of mould. If mould hard less than 140 reduce the Cutting pressure. It should not be below 3.0 at VC & 3.5 at HC.
10	Cutting car Speed	Adjust the cutting car speed to slower side
11	Cutting wire cylinder problem	Check the operation of cutting wire cylinder

M. LOW STRENGTH:

PROBLEM : LOW STRENGTH

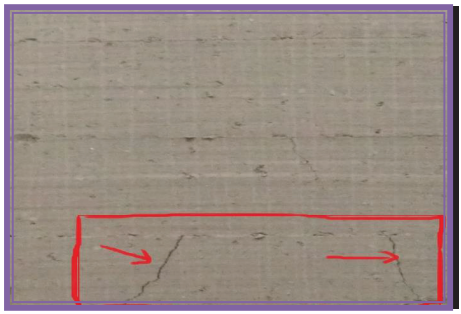
Sr. No.	**Probable root causes**	**Action to be taken**
1	Mould weak due to excess rising	Control the usage of aluminium by frequently monitoring rising height
2	Excess use of return slurry.	Max. 14 % Return slurry should be use in recipe.
3	Low total solid	Total solid should be as per required dry density.
4	Low binder in recipe.	Use the binder's min. 25% in recipe.
5	Autoclaving cycle deviation.(frequently pressure drop during holding)	Valve should be check and tightened. Top up the pressure as soon as possible.
6	Autoclaving cycle deviation.(less holding time)	Steam Holding hrs should be 8 hrs on 11 kg pressure and 7 hrs on 12 kg pressure.
7	Low strength of Cement.	Cement should be 53 grades with more than 65 strength in 28 days.
8	Purity of lime less.	Lime has purity more than 85 % i.e. Active CaO %
9	Mould soft cutting	Cut the mould on below 160 mm hardness.
10	Excess use of foaming agent Soap solution/Surf	Reduce the quantity of consumption.
11	Slurry temperature and mixing.	Increase the slurry temperature before discharge lime and cement or increase the mixing time of slurry before discharge lime and cement.

N. Dimension variation:

PROBLEM : Dimension variation		
Sr. No.	**Probable root causes**	**Action to be taken**
1	Cutting car movement & vibration problem.	Check the chain tightness. It's functioning. Plumber blocks tightness. Track and rack cleaning. Bearing greasing and its functioning.
2	Lifting arm movement.	Check the movement up & down. Correct if not parallel.
3	Cutting Blade setting.	Cutting blade should be straight line and parallel to each other. And should not loose & rough.
4	VC/HC wire placing.	Ensure the cutting wire should be placed at proper position & proper tightness. Should not over tight at VC or loose at HC.
5	Cutting machine alignment.	Cutting machine groove beam should be parallel to each other.
6	HC wire spring placing.	Cutting wire spring should not be misplaced from its position. If observed, correct the position of spring and stick with feviquick or remove the wire.
7	VC Cutting machine swinging speed fast.	Swinging motion should be normal. Not so fast.
8	Mould soft or hard cutting	Cut the mould on below 160 mm hardness.
9	VC/HC wire cutting pressure low.	Maintain the cutting pressure 3.2 to 3.5 with respect to hardness of mould. If mould hard less than 140 reduce the Cutting pressure. It should not be below 3.0 at VC & 3.5 at HC.
10	Excess MgO in Lime & Cement	MgO should be less than 1.5 % in lime & Cement. Use excess gypsum for dimension control.
11	Cutting car Speed	Adjust the cutting car speed to slower side
12	Cutting wire cylinder problem	Check the operation of cutting wire cylinder

O. BOTTOM HORIZONTAL CRACKS:

Bottom horizontal cracks observed during cutting and shifting of green mould. It is horizontal in position at bottom or at top throughout the mould.



PROBLEM : BOTTOM HORIZONTAL CRACKS

Sr. No.	Probable root causes	Action to be taken
1	Track alignment autoclave wagon with mould & Ferry cart.	Correct the track alignment by adjusting sensor or track place correction
2	Ferry cart tracks misalign with among 5 winching tracks.	Correct the track alignment by adjusting sensor or track place correction
3	Autoclave trolley tracks misalign with among 5 winching tracks.	Correct the track alignment by adjusting sensor or track place correction
4	Autoclave trolley tracks misalign with among 5 autoclave tracks.	Correct the track alignment by adjusting sensor or track place correction
5	Improper placing of cutting mould on wagon.	Check the operator operation for loading crane. Check loading crane alignment. Check the wagon placing.
6	Lifting arm movement.	Check the movement up & down. Correct if not parallel.
7	Mould hard and soft	Cut the mould on 140 to 160 mm hardness.
8	Operation of tilting crane by operator.	Check the operation as operator should keep mould down on marking only.
9	Placing of mould from Cutting car.	Check there is no mould should place on stopper or slide on stopper.

P. LESS RISING OR SHRINKAGE:

Less rise means mould not reached its aeration level required for cutting. And shrinkage means mould reached its aeration level suitable for cutting but shrinked automatically and converts into less rise. It is occurred during aeration of mould.

PROBLEM : LESS RISING

Sr. No.	Probable root causes	Action to be taken
1	Less rising due to using of less aluminium.	Control the usage of aluminium by frequently monitoring rising height
2	Less rate of reaction or less H2 gas evaluation by Al-powder	Control the usage of additive & Al-powder by frequently monitoring rising height & rate of Hydrogen gas evaluation of Al-powder(69 - 72)
3	Excess use of DC (Sodium dichromate).	Excess use of DC (Sodium dichromate).Adjust it with respect to total solid and quality of Al-Powder.
4	Mould leakage	Check the mould gasket and gypsum filling to avoid the mould leakage.
5	Heavy coal and oil in pond ash.	Try to dissolve Heavy coal and oil in pond ash by adding soluble oil in service tank or try to separate it in service tank. Or don't accept such pond ash to avoid shrinkage.
6	Very coarse pond ash.	Don't accept such pond ash. Increase the al-powder dosing & reduce the pond ash in recipe to avoid shrinkage.
7	Mould shrinkage due to excess use of DC or Dispersive additive.	Reduce the dosing of DC or Dispersive additive. Increase the dosing of Soluble oil or soap solution. Increase total solid and reduce the Al-Powder.
8	Mould shrinkage due to excess H2 gas evaluation of Al-Powder.	
9	Mould shrinkage due to fast temp rising of lime.	Reduce Lime and discharge temp.

Chapter 5

AAC Blocks stacking, handling and application norms

5.1 LOADING AND UNLOADING OF AUTOCLAVED AERATED (CELLULAR) CONNCRETE (AAC) BLOCK

The AAC blocks shall be handled with care during unloading from vehicle or loading in trolleys. Don't throw the block during loading and unloading to avoid damage, breakage or hairline cracks. Don't rest the block on corner or edges during loading and unloading to avoid corner damage or edge sharpness damage. Lift or handle once a single block for loading and unloading.

5.2 STORAGE AND HANDLING OF AUTOCLAVED AERATED (CELLULAR) CONNCRETE (AAC) BLOCK (IS:6041:1985)

The blocks shall be stored in such a way as to avoid any contact with moisture on the site. They shall be stock piled on planks or other supports free from contact with the ground and covered to protect against wetting. The blocks shall be handled with care. Blocks shall be stacked in height up to 2 meter height as on thickness or width. Blocks must be stacked in systematic arrangement so that counting of same may be easier.

5.3 APPLICATION OF AUTOCLAVED AERATED (CELLULAR) CONNCRETE (AAC) BLOCK FOR WALLS (IS: 6041:1985)

Autoclaved aerated (cellular) concrete blocks may be used for both load bearing and non-load bearing internal and external walls. The wall thickness shall be designed in accordance with the provisions of IS: 1905 - 1980".

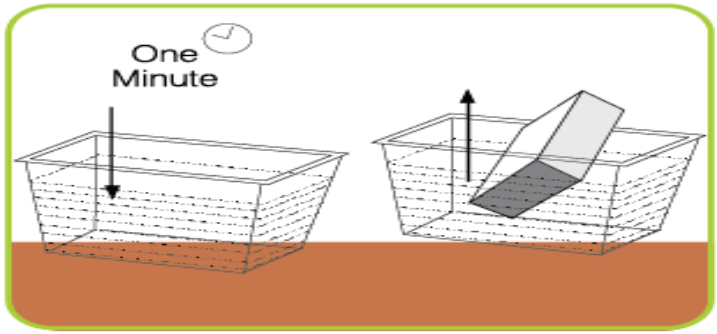
Autoclaved aerated (cellular) concrete blocks shall not be used in foundations and for masonry below damp-proof course.

Wall Thickness*:* The minimum (nominal) thickness of non-load bearing internal walls shall be 10 cm. The minimum (nominal) thickness of external panel walls in framed construction shall be not less than 20 cm. However, depending upon the local condition and desired effect of thermal transmission and sound reduction, 15 cm thick panel walls may be used, provided they are suitably braced and reinforced by lateral and vertical support. The minimum (nominal) thickness of external and internal load bearing walls shall be 20 cm and 15 cm respectively.

5.4 PREPARATORY WORK (IS: 6041:1985)

Wetting of Blocks - These blocks need not be wetted before or during the laying in the walls; in case the climatic condition so required, the top and the sides of the blocks

may be slightly moistened so as to prevent absorption of water from the mortar and ensure the development of the required bond with the mortar.



5.5 LAYING OF AUTOCLAVED CELLULAR CONCRETE BLOCK MASONRY IN SUPERSTRUCTURE (IS: 6041:1985)

Use of Mortar in Masonry - Mortar shall not be spread so much ahead of the actual laying of the units that it tends to stiffen and loose its plasticity, thereby resulting in poor bond. For most of the work the joints, both horizontal and vertical, shall be 10 mm thick. Except in the case of extruded joint construction, the mortar joints shall be struck off flush with wall surface and when the mortar has started stiffening, it shall be compressed with a rounded or U-shaped tool. This compaction is important, since mortar, while hardening has a tendency to shrink slightly and thus pull away from the edges of the block. The mortar shall be pressed against the units with a jointing tool after the mortar has stiffened to affect intimate contact between the mortar and the masonry unit and obtain a water-tight joint.

Operations for Laying Block Masonry *First Course* - The first course of cellular concrete block masonry shall be laid with greater care, making sure that it is properly aligned, levelled and plumbed, as this may assist the mason in laying succeeding courses to obtain a straight and truly vertical wall. The first layer of cellular concrete block masonry on plinth should preferably have groove/offset outside so that rain water coming down the wall falls out.

Before laying the first course, the alignment of the wall shall be marked on the damp-proof course. The blocks for this course shall first be laid dry, that is, without mortar along a string stretched between properly located corners of the wall in order to determine the correct position of the blocks including those of the cross walls jointing it and also adjust their spacing. It should be in plumb. To assure satisfactory bond, mortar shall not be spread too far ahead of actual laying of the block or it will stiffen and loose its plasticity.

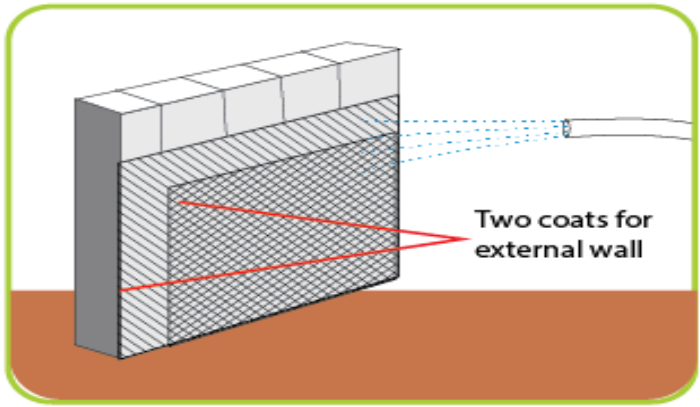
Closure Block - When installing the closure block, all edges of the opening and all four edges of the closure block shall be buttered with mortar. The closure block shall be carefully lowered into place. If any mortar falls leaving an open joint, the closure block shall be removed, fresh mortar applied and the operation repeated.

5.6 RENDERING AND OTHER FINISHES (IS: 6041:1985)

External Renderings - The exterior surface of all cellular concrete block walls shall be made waterproof by treating the walls with different types of renderings, depending upon the intensity of rainfall, nature of exposure, etc.

The renderings shall be applied in accordance with IS: 2402- 1963*. Renderings shall not be applied to the walls when these are wet or in monsoon. The walls shall be treated only after they are fully dried.

Internal Renderings - The interior surface of walls may be plastered with one coat of 6 to 12 mm thickness of 1: 2: 9 cement-lime-sand mortar or 1: 6 cement-sand mortars. Where a very smooth finish is desired, a second coat of 2 to 3 mm thickness of lime finish may be applied.



5.7 AVOIDANCE OF CRACK FORMATION (IS: 6041:1985)

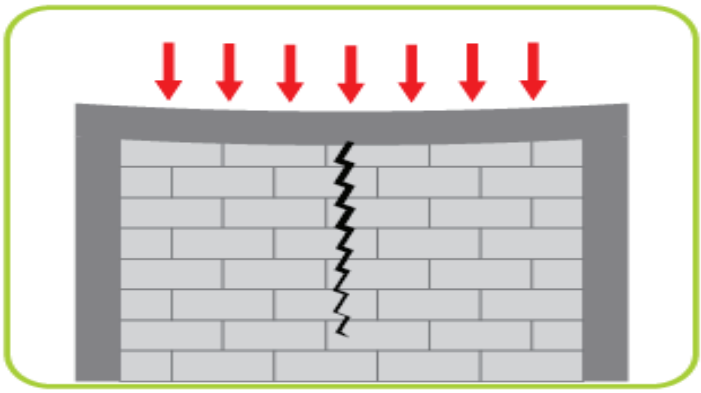
The major causes of cracks in the structures of the cellular concrete blocks and measures for their prevention are described as below

Sometimes you will find different type of cracks in a wall, which develop after a certain period of time. Cracks happen in both clay brick and AAC blocks walls. Sometimes a crack is observed after plastering. There is not a single reason for this occurrence, but by taking some precautionary measures, following certain guidelines and through proper workmanship these cracks can be eliminated or minimized.

Structural Movements: Cracks may occur due to alterations in Length, curvature or orientation of the structural members enclosing a wall or partition due to load settlement, thermal expansion or changes in moisture content.

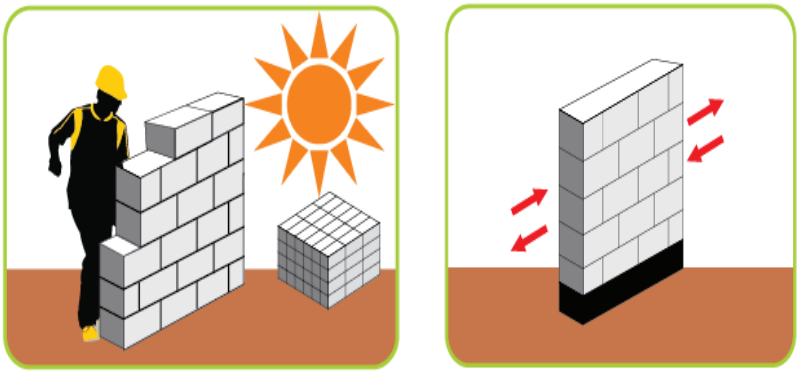
Floor deformation and movement*:* The floor upon which a partition is built may deflect under load brought upon it after it is built. Where such deflections tend to create non-continuous bearing, the partition shall be strong enough to span between the points of least floor deflection or shall be capable of adapting itself to the altered conditions of support without cracking.

Ceiling deflection and movement: A ceiling above a partition wall may deflect under loads applied after its erection, or through thermal or other movements. To avoid cracking as a result of such deflection, the partition wall shall be separated from the ceiling by a gap or by a layer of resilient material or lean mortar. Sometimes the beam above wall defects and imposes point loading on the wall and it may develop a crack. Care must be taken to avoid any possible deflection of the beam.



Control of Wall Movement Accompanying Temperature and Moisture Changes: Cracking in concrete masonry walls is often due to tensile stresses which develop when wall movements accompanying temperature and moisture change are restrained by other elements of the building, or when concrete masonry places restraint on the movement of adjoining elements.

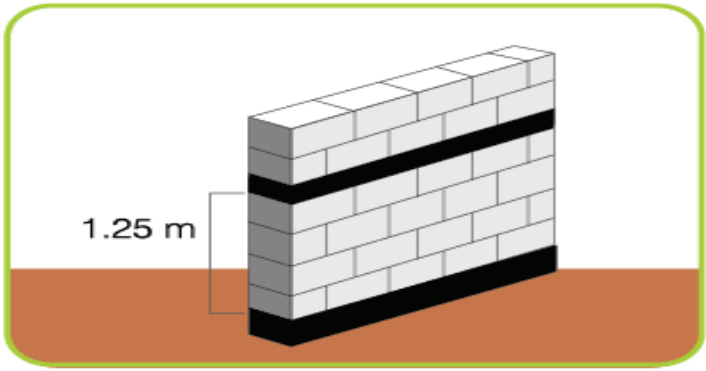
Hence climate is very important factor for construction of walls. Concrete work in very hot and windy climate should be avoided, and in case if it is not avoidable then precaution shall be taken to keep the temperature of fresh concrete down and to prevent quick drying of concrete



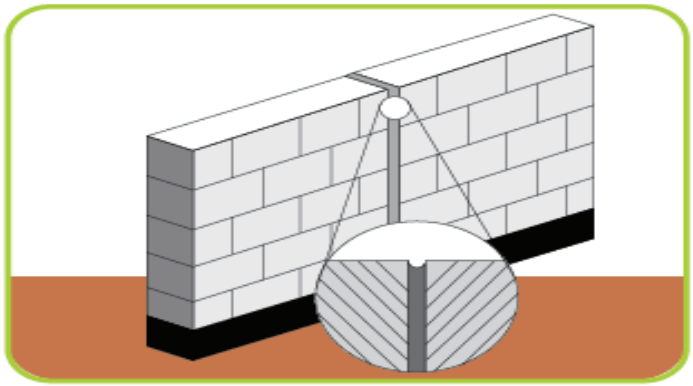
Joint Reinforcement: Horizontal joint reinforcement serves much the same purpose in crack control as bond beams; it increases the tensile resistance to cracking. Due to the generally closer spacing adopted, joint steel may be more effective in crack control than bond beams.

Joint reinforcement shall be used in conjunction with cement mortar not weaker than a 1: 2 mix. In walls exposed to the action of weather, the reinforcement shall have a mortar cover of not less than15 mm.

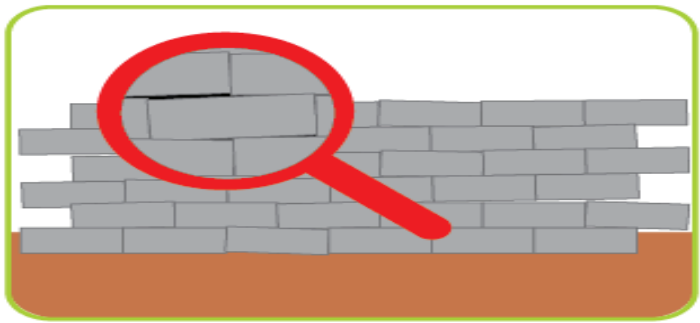
A reinforced bond beam must be made after every 1.2 meters in height and it should be discontinuous at control joints. The bond beam provides stability and strength and protects the wall for possible cracking.



Control Joints: These are employed to reduce restraint by accommodating movement of the masonry wall, or movement of structural elements adjacent to the wall, and thus to control cracking. They are, in fact, vertical separations built into the wall at locations where cracking is likely due to excessive horizontal stresses.

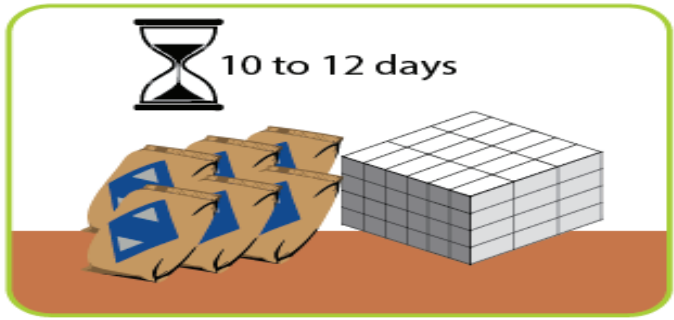


Quality of Workmanship and Levelling of Blocks: If blocks are not in one level, there are uneven stresses on the wall leading to cracks. For this purpose, first course of AAC blocks layers should be properly levelled using a 2 meter spirit level, and left for 24 hours for settling. And then the levelling of subsequent layers of blocks should be checked. Quality of workmanship is very important for crack prevention.



Quality of Blocks and Other Material: AAC blocks should have sufficient strength (≥ 3 N/mm2) as mentioned in construction standards with drying shrinkage within limit (< 0.1 %). Units should be free of cracks while in use and must be accurate in dimension within permissible limit. It is suggested to use mark AAC Blocks only. Quality of sand and cement is equally important and must be checked before use. For best results use Ready Mix mortars with proper quality of tensile and compressive strength.

Equilibrium Moisture Content: All building units should be used at equilibrium moisture content to avoid moisture movement. For this purpose, sufficient time must be given, say 10 to 12 days after receipt of material at construction site.



Conduit work for electrical fitting, nailing and plumbing: Use the tools like hacksaw or rotary cutter or mechanical chisel for conduit and plumbing work. Don't do it manually by hammer and chisel. Conduit work should be start after 24 hrs from laying of blocks. Normal nails once fixed may come out hence use fasteners or screwed nails. Anchors made of plastic or nylon will work. Use power drill for anchoring.

Chapter 6

Opinion and recommendation

I assume and assure that, this book will be helpful to all AAC block manufactures as well as construction industries. I have covered all useful information in this book. I have tried to brief all problems and solution of AAC block manufacturing and application. If any reader wants some more detail information related to this, can contact me on +91 7798436278 or mail me on abhivaishgangurde@rediffmail.com

I will always ready to help you. I will recommend this book to all employees who are working with AAC block manufacturing and construction companies.

If any company wants to train its employees through training I am always ready to train them on site.