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Autoclaved Aerated Concrete Block Production

إنتاج بلوك الخرسانة الخلوية المعقمة

Introduction:

Autoclaved Aerated Concrete (AAC) is a lightweight, concrete-like material with many small, closed internal voids. **AAC** typically weighs one-sixth to one-third as much as conventional concrete and is about one-sixth to one-third as strong. It is suitable for bearing walls and shear walls of low- to medium-rise structures. Its thermal conductivity is one-sixth or less that of conventional concrete, making it energy efficient. Its fire rating is slightly longer than that of conventional concrete of the same thickness, making it useful in applications where fire resistance is important. Because of its internal voids, AAC has a low sound transmission, making it useful acoustically.

AAC Blocks and Panels are becoming popular building materials due to their lightweight and high strength. AAC is produced from the common materials, lime, sand, cement, and water, and a small amount of rising agent. AAC is economically and environmentally superior to the more traditional structural building materials such as concrete, wood, brick, and stone. AAC offers incredible opportunities to increase building quality and at the same time reduce costs at the construction site.



Advantages of Aerated Concrete Blocks:

- 1-Economical efficiency of construction.** The low cost of materials, as well as the large dimensions of blocks that have less weight ensure construction cost reduction. Less time required than laying bricks or blocks. Less weightless steel required.
- 2-Low density, low thermal conductivity.** Aerated concrete blocks have a density between 400 and 800 kg/m³ and the thermal conductivity coefficient ranging between 0.1 and 0.21 W/(m* 0C), which is why they are light and warm.
- 3-Good acoustic protection.** Aerated concrete ensures soundproofing 10 times better than a brick wall of the same thickness.
- 4-Fire safety.** Aerated concrete is a non-combustible, fire-resistant material, has the first class of fire-resistance, which exceeds the one of ordinary concrete.
- 5-Vapor permeability.** Aerated concrete has good vapor permeability. The vapor permeability coefficient is between 0.23 and 0.4 mg/(m*h*Pa). The houses made of aerated concrete “breathe”, and the microclimate inside is comfortable.
- 6-Environmental friendliness.** Aerated concrete contains natural, environmentally clean ingredients. The material does not release any harmful substances, does not age, and is not prone to decompose.

Disadvantages of aerated concrete:

- 1-The production cost per unit for AAC Block is higher.
- 2-Needs care during manufacture, so that the final surface of the aerated concrete is not too smooth, as this makes it more difficult to apply finishes.
- 3-Due to high water absorption finishes required to prevent environmental impact (weathering) on the aerated concrete, i.e. Cover autoclave aerated concrete with plaster, decorative facades, etc.
- 4-Efflorescence damage occurs through the high absorption and retention of water. Because there millions of pores in the AAC, besides efflorescence, any expansion of the water retained in the AAC may cause cracking in the structure.
- 5-Strength of AAC is reduced when wet and long term exposure to moisture will cause the disintegration of the material.
- 6-Aggressive environments may be also a disadvantage to using AAC.

Sizes of aerated concrete blocks:

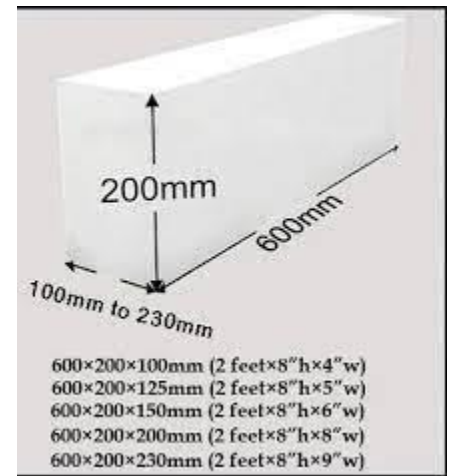
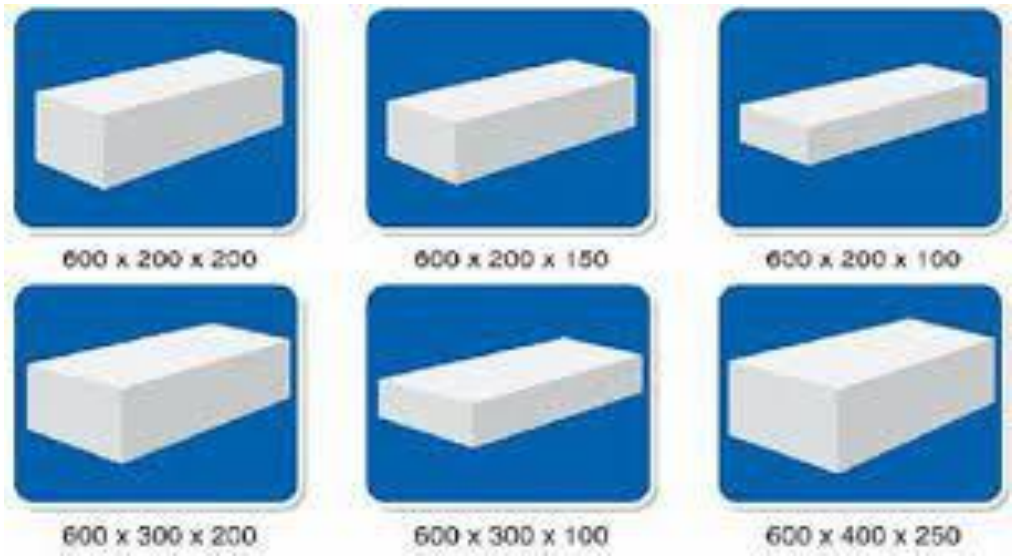
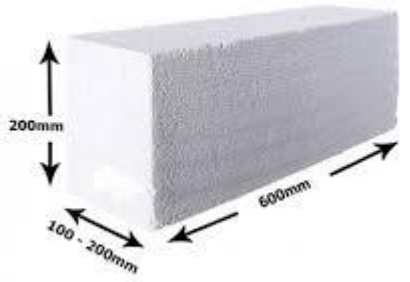
• Aerated concrete panels: that extend from the floor to the top of the wall.

Height: Up to 20 feet Width: 24 inches Thickness: 6, 8, 10, or 12 inches (4 inches thick inside).

*Aerated concrete blocks: They are larger and lighter than traditional concrete construction.

Height: Typically 8 inches Width: 24 inches long Thickness: 4, 6, 8, 10 and 12 inches The standard 8 x 8 x 24 inch unit weighs approximately 33 lbs..

* Other special shapes: It is used for bridges or as thresholds at window and door openings, or for the purposes of linking structural pieces in various shapes such as the U-shape, with thicknesses of 8, 10 and 12 inches.



Manufacturing process of Autoclaved Aerated Concrete block (AAC):

Autoclaved Aerated Concrete (AAC) is made from silica sand, lime, cement, and water, to which an expanding agent is added. The autoclaved aerated concrete production process differs slightly between individual production plants but the principles are similar. The AAC block manufacturing process involves the following steps:

1-Dosing and Mixing of the raw material process:

After raw material preparation, the next step of the AAC block manufacturing process is dosing and mixing. The process of dosing and mixing means the quality of the final products. Maintaining the ratio as Fly ash or Sand: Lime: Cement: Gypsum = 69:20:8:3.

Aluminum is used at 0.08% and water used at a ratio of 0.60 to 0.65 of dose and mixing to precisely mix all ingredients, and dosing and mixing ratios are used to form the correct mixture. Fly ash is pushed into a bowl. After the bulk is poured, the thrust stops. Likewise, lime powder, cement and gypsum are poured into individual containers. The required amount of each ingredient is filled into their individual containers; The control system fires for all elements in the mixing drum. A smaller bowl is also added to use aluminum powder as part of the mixing portion. After the mixture has been stirred for a specified time, it is ready to be poured into molds using a dosing system. The dosing system releases this mixture according to the procedures specified in the molds. The dosing and mixing process is carried out continuously because if there is a break between charging and discharging the elements, the mixture may begin to solidify and impede the work of the entire unit.

2-Casting process:

After Dosing and Mixing, Casting is a manufacturing process in which a liquid material is usually poured into molds which contains a hollow cavity of the desired shape and then allowed to harden the material. The solidified part is also known as a casting, which is ejected of the mold to complete the process.

3-Rising and Pre Curing process:

After the mixture is poured into greased molds, Aluminum reacts with Calcium Hydroxide and water to form Hydrogen. Loads of tiny Hydrogen bubbles are released due to this reaction. This leads to the formation of tiny distinct cells causing the slurry mix to enlarge. Such an increase may be twice its original size. This process is called rising. These cells are the reason behind the lightweight and insulating properties of AAC blocks After Casting the ready material is allowed to settle, rising and the pre-curing process takes around 1-4 hours, it is recommended to put up with a persistent temperature in the pre-curing area. Due to this, pre-curing is also referred to as heating room pre-curing. It must be protected from vibrations during pre-curing or else it might develop cracks.

4- Demolding and Cutting process:

Demolding and cutting are very critical processes in AAC block manufacturing. These two processes play a most important role in outlining the amount of rejection as well as the dimensional precision of the final bricks. After a mold is out of the pre-curing room, it is lifted by a crane or rolled on tracks for demolding operation. Mostly cutting process may be classified as flat-cake and tilt-cake based on how the green cake is de-molded and sent to the cutting line, generally used technology is tilt-cake technology. The tilt-cake technology uses two cutting machines. The horizontal cutting machine is used in the first stage, while the vertical cutting machine is used in the second stage.

5-Autoclaving process:

After Cutting, the blocks are conveyed to a large autoclave machine (a large pressure vessel, normally a steel tube), where the curing process is completed. Autoclaving is required to achieve the desired structural properties and dimensional stability. During this process quartz sand reacts with calcium hydroxide to form calcium silicate hydrate, which gives **AAC** its high strength and other unique properties. The process takes about 8 to 12 hours under temperature of about (180 0C), depending on the grade of material produced. Advanced level of strength of these blocks gives higher stability to the structure of the building. **AAC is manufactured from non-biodegradable materials.**

Technology development in **Autoclaved Aerated Concrete Plant helped brick manufacturers.** AAC block weighs up almost around 80% less as compared to the conventional red brick ultimately resulting in an excessive reduction of deadweight. Further, the reduced deadweight results in a reduction of the use of cement and steel which helps greatly in cost savings.

AAC Blocks have an attractive appearance and is readily adaptable to any style of architecture. Almost any design can be achieved with AAC.

After the autoclaving process, the material is ready for immediate use on the construction site. Depending on its density, up to 80% of the volume of an AAC block is air. AAC's low density also accounts for its low structural compression strength. It can carry loads of up to 8 MPa (1,160 psi), approximately 50% of the compressive strength of regular concrete.

<https://www.youtube.com/watch?v=6iiPL-U8uJs>

رابط فيديو صناعة البلوك الحرساني الخلوي

NOTE! Follow steps 1-11, then steps A-E

