

## Section 1.1

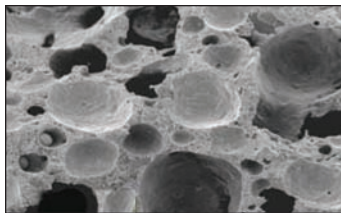
# AUTOCLAVED AERATED CONCRETE MASONRY UNITS

## INTRODUCTION

Autoclaved Aerated Concrete Masonry Units (AAC) are ultra lightweight concrete blocks with a unique cellular structure that provides superior energy efficiency, fire resistance and acoustical properties. AAC was developed by architect Dr. Johan Eriksson in 1923 at the Royal Technical Institute in Stockholm, Sweden, and was patented for manufacturing in 1924. Today, there are more than 300 manufacturing facilities producing AAC on 6 continents, in 235 countries worldwide, and in all climatic conditions.

## MANUFACTURING

The basic raw materials used in the manufacture of AAC are portland cement, lime, water, sand or fly ash, and aluminum. The sand is ground to a powder-like consistency and mixed with the remaining materials to form a slurry. The slurry is then poured into molds. Entrained air bubbles are created by a chemical reaction between the hydration products and the aluminum powder, which causes the material to rise in the mold. After curing for 45 minutes, the product is cut into the unit sizes by piano wires. The units then are steam-cured under pressure in autoclaves for 8 to 12 hours, which transforms the material into a hard calcium silicate. AAC manufacturing produces a naturally occurring mineral found in limestone deposits called Tobermorite.



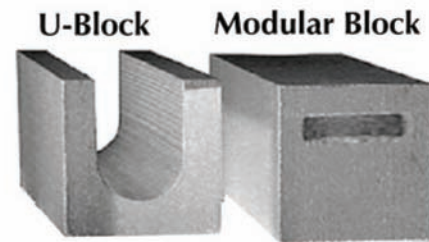
Air bubbles are created by a chemical reaction between the hydration products and the aluminum.



After curing, the material is cut into individual unit sizes.

## MATERIAL PROPERTIES

AAC ranges in density from 25 to 50 lb/ft<sup>3</sup> with compressive strengths ranging from 290 psi to 1090 psi, and is well suited for both loadbearing and non-loadbearing walls. AAC material conforms to ASTM C1693, and AAC masonry blocks are available in a variety of sizes. The nominal face dimensions are 8" high by 24" long with nominal thickness of 2", to 16".



The actual dimensions are 7 7/8" x 23 7/8" to allow for 1/16" to 1/8" thin-bed mortar joints. Jumbo blocks are available in 24" X 24" and 32" x 24" sizes. All units are produced to within a 1/8" tolerance of the specified dimension. Special shapes such as U-block and cored block are available for reinforced masonry. These units also facilitate the installation of electrical and mechanical systems.

ASTM C1693  
TABLE 1 Physical Requirements

Strength Class	Compressive Strength, psi (MPa)	Nominal Dry Bulk Density, lb/ft <sup>3</sup> (kg/m <sup>3</sup> )	Density Limits, lb/ft <sup>3</sup> (kg/m <sup>3</sup> )	Average Drying Shrinkage, %	
AAC-2	290 (2.0)	min	25 (400)	22-28 (350-450)	≤0.02
			31 (500)	28-34 (450-550)	≤0.02
			37 (600)	34-41 (550-650)	≤0.02
AAC-4	580 (4.0)		44 (700)	41-47 (650-750)	≤0.02
			50 (800)	47-53 (750-850)	≤0.02
			57 (900)	50-56 (800-900)	≤0.02
AAC-6	870 (6.0)		37 (600)	35-41 (550-650)	≤0.02
			44 (700)	41-47 (650-750)	≤0.02
			50 (800)	47-53 (750-850)	≤0.02

## CODES AND STANDARDS

AAC products and systems carry nationally recognized third-party approvals from ASTM, Underwriters Laboratories (UL), International Code Council (ICC), Autoclaved Aerated Concrete Producers Association (AACPA Certifications) and the Masonry Standards Joint Committee (MSJC 530 Code).

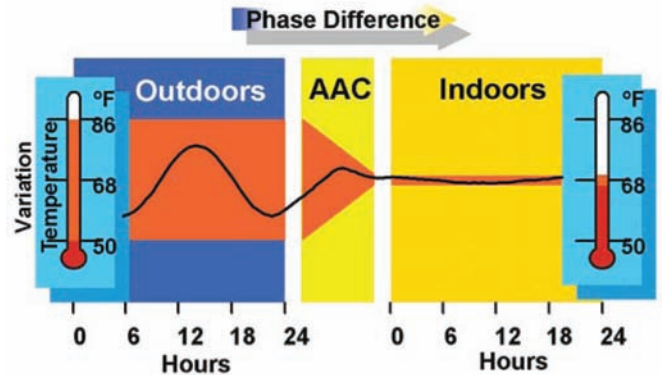
ASTM Standards contain material and installation specifications for AAC as illustrated in Figure 1 below. There are more than 40 UL listings for AAC. There are numerous other codes and standards, as well as manufacturer's recommendations and guidelines.

- ASTM C1660 Standard Specification for Thin-bed Mortar for Autoclaved Aerated Concrete (AAC) Masonry
- ASTM C1691 Standard Specification for Unreinforced Autoclaved Aerated Concrete (AAC) Masonry Units
- ASTM C1692 Standard Practice for Construction and Testing of Autoclaved Aerated Concrete (AAC) Masonry
- ASTM C1693 Standard Specification for Autoclaved Aerated Concrete (AAC) Masonry

Figure 1 - ASTM Standards for Autoclaved Aerated Concrete Masonry

## THERMAL ENERGY EFFICIENCY

Autoclaved Aerated Concrete Masonry Unit (AAC) walls are energy efficient. An 8" AAC block wall has a steady-state R-value of approximately 10, and a higher total equivalent performance R-value when factoring Dynamic Benefit for Massive Systems (DBMS or thermal mass). This means AAC can store and release thermal energy to control the temperature of indoor environments. This results in significantly reduced heating and cooling cost.



## ACOUSTIC PROPERTIES

AAC's high surface mass, coupled with the mechanical vibration energy dampening within its porous structure, produces a construction material with remarkable sound insulation and absorption qualities. Since its porous internal structure is comprised of 60%-70% air, AAC absorbs much more sound than conventional concrete and other materials, effectively reducing sound wave transmission. This makes it ideal for construction projects that require a high level of acoustic insulation, such as schools, apartments, hotels, and entertainment facilities. One county school board has constructed over 150 classroom buildings, a media center, and a new middle school with AAC. According to the school board, "The acoustics are outstanding and visitors universally note the quality of the environment in the classrooms."



AAC has passed both the Fire Test and Hose-Stream Test sections of ASTM E119.



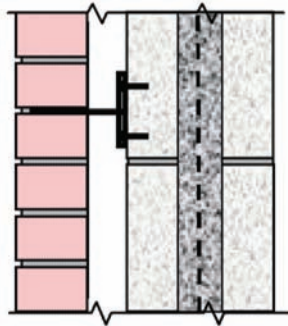
## STRUCTURAL PROPERTIES

AAC provides structural performance and its light weight may help in some engineering designs. It makes an excellent choice for low rise loadbearing buildings, partition walls, infill walls, shear walls and more. Vertical reinforcing can be installed in cored units and horizontal bars can be installed in bond beam units when required by the engineer.

## MOISTURE

Shortly after manufacture, the moisture content of AAC units is usually in the range of 25 - 35 percent by mass of the dry material. The lower the density, the greater the initial moisture content. In one to three years, the material gradually dries out to reach equilibrium at 4 to 6 percent moisture content. AAC autoclaving yields a product that has a very low linear shrinkage of 0.020%.

It is recommended that a breathable coating be applied on AAC wall surfaces to facilitate moisture dissipation. It is not recommended that non-breathable coatings be applied to both sides of an AAC wall. ASTM C1692 requires that AAC masonry exposed to weather be protected with an exterior wythe of masonry, a cladding system, or a coating. AAC was successfully tested for its ability to meet air barrier requirements. Air flow did not exceed 0.004 cubic feet per minute per square foot of wall area when subjected to a differential pressure of 1.57 pounds per square foot.



## MORTAR

The first course of AAC units may be set in standard ASTM C270 masonry mortar or thin-bed mortar. The remaining courses and all head joints are set in thin-bed mortar. These joints are typically 1/16" to 1/8", resulting in 8" modular dimensions. The thin-bed mortar is a modified polymer - portland cement-based product with adhesives and inorganic fillers as specified in ASTM C1660. AAC units can also be installed full-height with standard ASTM C270, 3/8" masonry mortar joints. However, the monolithic structural value is diminished and modular layout may become an issue.

## COATINGS AND FINISHES

As noted above, AAC exposed to the weather must be coated. Direct applications of breathable stucco and plaster make attractive and durable finishes for AAC walls. AAC can also be covered with tile, adhered stone and brick, siding materials, and many other finishes.



A breathable coating is recommended for at least one side of an AAC wall to facilitate moisture dissipation and must comply with ASTM and the manufacturer's recommendations.

## INSTALLATION

AAC units can be installed like traditional masonry units or with thin-bed mortar using special trowels. AAC can easily be cut and shaped with carbon serrated tools. Mechanical, electrical and plumbing systems can be accommodated with AAC cored and U-shaped units as in conventional construction. AAC can also accommodate all MEP systems by routing out the units after installation. The wall is then prepped and finished. There are many types of fasteners, connectors and anchors available for AAC installation.



## SPECIFICATIONS

AAC Masonry unit construction is specified in Division 4 - Masonry. Guideline specifications are available from IMI and AAC manufacturers. Specifications should contain language requiring AAC installers to be certified by the International Masonry Institute.

## DESIGNING WITH AAC



AAC can be shaped to conform to any design and can accommodate almost any detail. AAC is excellent for all buildings, including schools, hotels, dormitories, commercial structures, industrial facilities and homes.

AAC can be used for interior partitions, loadbearing walls, back-up walls, firewalls, stair enclosures, elevator shafts, column wraps, shafts and chutes.

*For answers to specific questions regarding AAC, call 1-800-IMI-0988.*

## AAC IS GREEN

Autoclaved Aerated Concrete (AAC) is an environmentally friendly building material that is used to save energy and enhance the quality of the built environment. AAC's high R-values contribute directly to the goals of higher performing building envelopes as well as to more specific building energy conservation goals such as those found in US Green Building Council's Leadership in Energy and Environmental Design (LEED) green building certification. Used in interior wall systems, AAC is capable of further enhancing thermal efficiency by absorbing excess heat from internal loads emitted by people, lights, and equipment.

AAC contains no Volatile Organic Compounds (VOC's), an area of specific concern in the design and construction of interior environments. AAC can further be coated by a variety of low VOC materials. These attributes directly address the intents of LEED Indoor Environmental Quality Low-Emitting Materials credits.

## ADVANTAGES OF AAC

- Lightweight
- Acoustically beneficial
- Offers design versatility
- Durable
- Energy efficient
- Structural
- Long lasting
- Environmentally friendly (Green)
- Weather resistant
- Compatible
- Mold resistant
- Easy to use
- Fire resistant
- Termite & pest resistant
- Cost effective
- Non-combustible
- Reduced construction time

*This document is intended for the use of industry professionals who are competent to evaluate the significance and limitations of the information provided herein. This publication should not be used as the sole guide for masonry design and construction, and IMI disclaims any and all legal responsibility for the consequences of applying the information.*

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