Section 1: Introduction

1.1 An Introduction to Hebel AAC-Autoclaved Aerated Concrete

With today's demand for environmentally sustainable construction, visionary architects and builders are relying on the timeless strength and versatility of Hebel AAC. This solid building material delivers the advantages of energy efficient building and environmentally responsible construction, including improved air quality and lower insulation expenses.

Figure 1.1: Hebel AAC is a solid building material that delivers the advantages of energy efficiency

Panels of Hebel AAC are rapidly becoming the building blocks of a new, greener world. Thousands of architects, engineers, and builders around the world validate the properties of Hebel AAC in their own work because of its proven advantages for more than 80 years.

Hebel AAC is a Unique Building Concept. AAC is ultra lightweight concrete with a unique cellular structure that provides fire resistance, superior energy efficiency and acoustical properties. AAC is manufactured from silica sand, gypsum, lime, cement and water, to which an expanding agent is added. All ingredients are found in adequate supply throughout the world.

A History Rooted in Nature. AAC was developed by architect Dr. Johan Eriksson in 1923 at the Royal Technical Institute in Stockholm, Sweden, where he patented AAC under the brand name Ytong.

In 1945, Josef Hebel invented a method of producing reinforced AAC panels by incorporating steel into the manufacturing process, and patented reinforced AAC with the brand Hebel.

Today's Technical Advantage. Today, the experience and knowledge linked to the two brands of Hebel and Ytong have secured Xella as the world's leader of AAC production- with a team of 7,900 at work in 30 countries across the U.S, South America, Europe and Asia. To learn more about Xella's worldwide operations, visit www.xella.com.

Xella Aircrete North America, Inc. is a Georgia company, with manufacturing facilities in Adel. Xella Aircrete North America, Inc. produces Hebel AAC for commercial, industrial, and residential construction. Solid yet lightweight, Hebel AAC is an environmentally friendly building material that is both highly durable and easy to use, allowing faster more efficient construction projects.
Xella is reliable and service oriented. If you should require further information or have specific questions, please contact us. We will gladly see that you get the answers you need.

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Figure 1.2: Xella Plant in Adel, Georgia

1.2 Applications of Hebel AAC Products

The Hebel AAC building system includes products for a wide variety of construction applications including:

- Residential and Multi-family Housing
- Schools and Universities
- Hospitality
- Commercial and Industrial
- Sound Barrier Walls and Site Walls
- Fire Walls and Shaft Walls
- Mining Ventilation Controls

Hebel AAC provides a total building envelope solution that includes AAC precast panels and masonry units for both load bearing and non-load bearing applications. Hebel AAC products provide a total building system accommodating walls, floors and roofs.

Normally, an assembly of different materials with less than compatible properties is needed to satisfy the great demands made on buildings today. Hebel AAC meets the diverse demands better than any other material due to the numerous advantages of its physical and mechanical properties. Figure 3 demonstrates the versatility and diverse applications of Hebel AAC products.

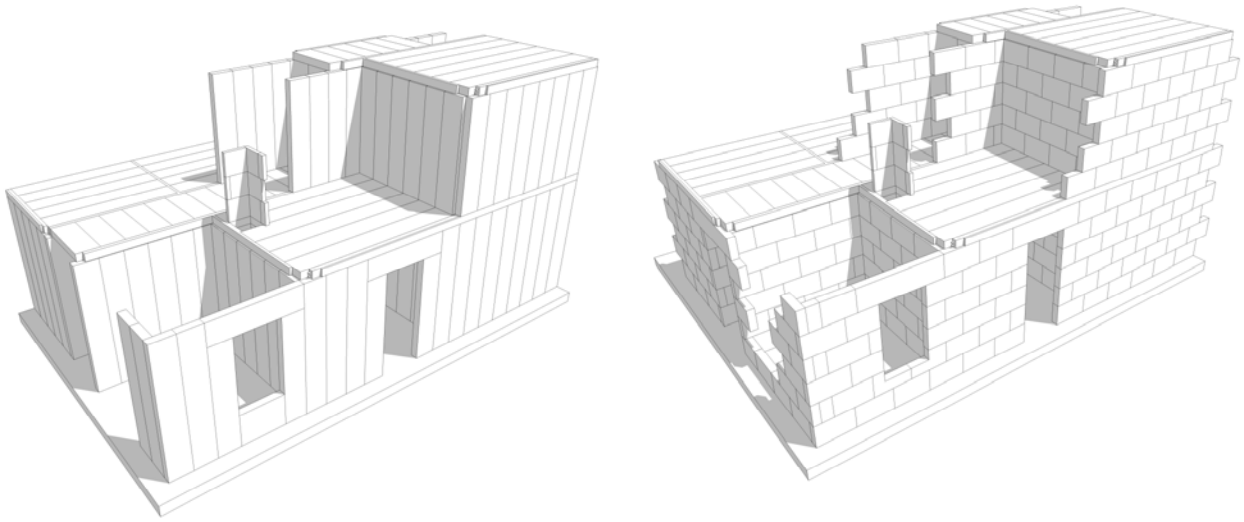

Figure 1.3: Applications of Hebel AAC

1.3 Manufacturing Process

Hebel AAC is made from silica sand, gypsum, lime, cement and water, to which an expanding agent is added. The Hebel AAC manufacturing process starts when the sand and gypsum are ground to the consistency of powder, in a ball mill. Raw materials are then automatically weighed and measured in the mixer along with water and the expanding agent.

After mixing, the slurry is poured into metal moulds in which the expanding agent reacts with the other elements. The mixing results in a reaction where small, finely-dispersed air spaces are formed. The moulds are sent to a pre-curing room for several hours. Next, the semi-solid material is transported to the cutting machine where the cuts are made using steel wires to form the sizes required for the building elements. The product consistency combined with our high precision cutting technology, results in pieces with dimensional tolerances for blocks (w, h, l) ±1/8" (± 3 mm) and for panels (w, h) ±1/8" (± 3 mm), (l) ±1/5" (± 5 mm).

Figure 1.4: Cutting Machine with steel wires

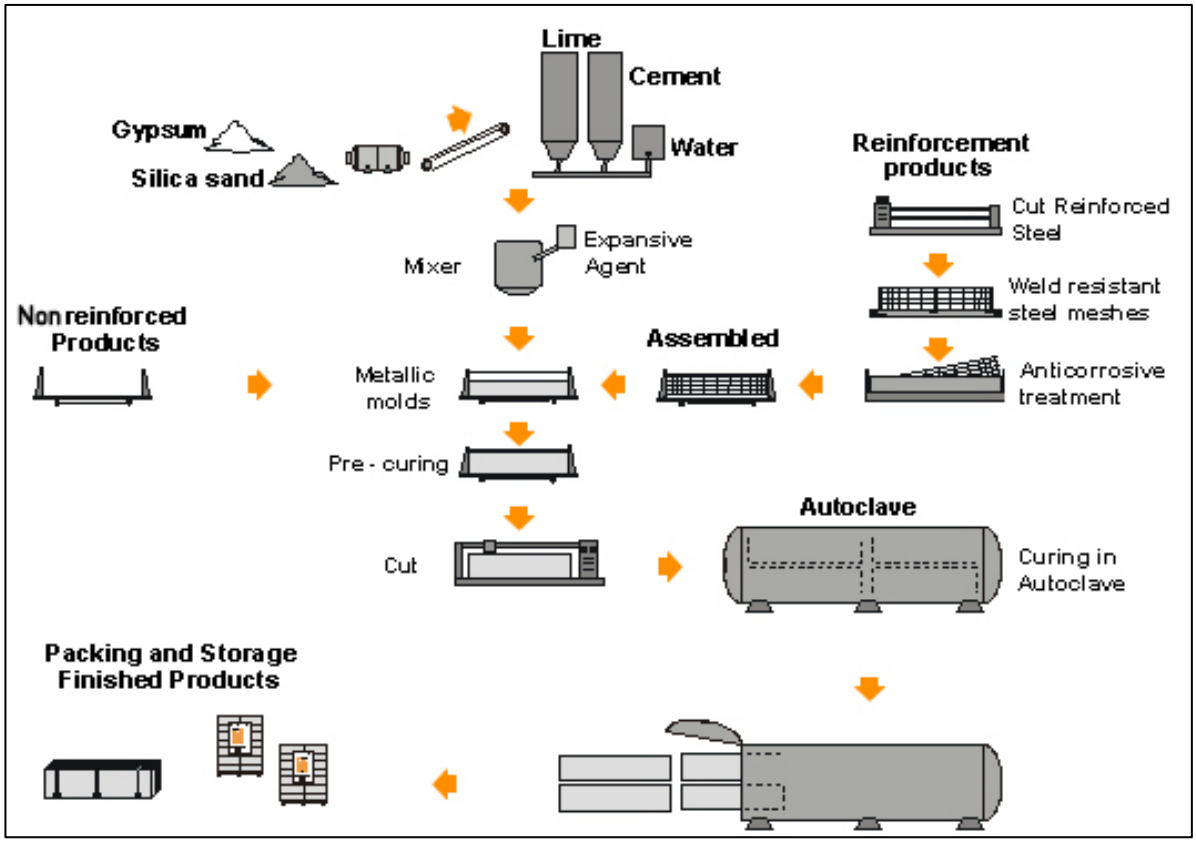

Figure 1.5: Diagram of Hebel AAC Production Process

Figure 1.6: Exterior view of Autoclaves

Figure 1.7: Interior view of Autoclaves

Figure 1.8: Anticorrosive Agent Application to Reinforcing Wires

The final phase in the production process is steam pressure curing in autoclaves for up to 12 hours. Block, panels and other AAC elements are removed from the autoclave, packaged and sent to the finished product storage.

Hebel reinforced elements, such as wall, floor and roof panels, and lintels contain steel reinforcement mesh that is treated for corrosion with a water based acrylic, and then placed in the mould before the mix is added. The manufacturing process is then the same as described above for un-reinforced elements.

1.4 Quality Control

Quality control and quality assurance at the Hebel plant begins with the purchasing of the raw materials and continues to the delivery of the final product. Raw material certificates are obtained from suppliers of sand, gypsum, cement, lime, aluminum paste and reinforcement steel. In-house quality assurance tests are conducted for silica sand, gypsum, cement and quicklime. Final product testing includes; compressive strength, dry bulk density, anticorrosion, and flexural testing of panels.

One critical step during manufacture is the formulation selection and mixing. This is a computerized process overseen by our full-time Quality Control Manager. Our plant is inspected on a regular basis by Underwriters Laboratories (UL) Follow-up services.

Hebel AAC Material Identification and Marking

Blocks are placed on pallets, shrink-wrapped and sent to storage or distribution.

Reinforced panels are marked before autoclaving with a stamp code containing information about date of production, mould number, project number and placement position.

Figure 1.9: Material Identification

Hebel AAC Shipping and Handling

Hebel AAC is shipped by trucks, platforms, or multimodal containers, etc. They can be transported by road, train and by sea for international projects. Hebel block and panel pallets should be handled by forklift trucks and/or cranes with appropriate straps to avoid damage to the material.

Figure 1.10: Hebel AAC Delivery to Project Site

1.5 Benefits of Hebel AAC

A Better Way to Build Hebel AAC embodies so many positive properties that could only be equaled by using a combination of different materials. Hebel AAC is able to satisfy the most diverse demands made on building materials today.

Precision The production process guarantees the exact dimensions of the pieces that comprise the Hebel building system. This property allows for building quality with straight and plumbed walls, resulting in savings of material and execution time for finishes. The precision of the pieces also allows for a perfect contact among them, resulting in better structural performance. The dimensional tolerance of the Hebel products is ±1/8" (± 3 mm).

Speedy/Easy Construction The main elements of the Hebel building system are prefabricated pieces, ready to be used in construction. These elements, combined with the minimum requirements in thin-bed mortar and the product's light weight, result in reduced construction times and a notable improvement in efficiency and productivity.

Workability Hebel AAC products are easy to cut, drill, slot, grind, etc., which makes them easier to install than other building materials.

Structural Versatility The wide variety of Hebel AAC products covers all of the requirements of construction: blocks for load bearing and non-load bearing walls, door and window lintels, roof or floor panels, wall panels, wall boards, mortars and finishes such as stucco and plaster.

Light Weight Ease Hebel AAC material is up to 4 times lighter than traditional concrete. Its light weight means significant advantages in transportation costs, ease of material handling at the building site, and overall speed of construction.

Better Fire Protection Safer materials are better materials. Hebel AAC is fire resistant, totally inorganic, and does not contain any combustible materials. A 4" thick wall built with Hebel AAC blocks provides 4-hour fire resistance (UL Classified). Hebel AAC products provide maximum fire safety. It heats up significantly less and more slowly than other building materials and has the fire-resistance rating to prove it. Not surprisingly, Hebel AAC's insulating properties are superior to other materials.

The Best Thermal Insulation Properties of any Solid Building Material Hebel AAC has excellent thermal insulation characteristics. The presence of these features in all the elements of the Hebel Building system equate to a comfortable environment inside the building without the need for additional insulation.

Good Acoustic Insulation The elements of the Hebel building system have acoustic insulation properties in excess of more traditional materials, reducing the transmission of sound.

Environmentally Sustainable Hebel AAC is a time-tested material that requires minimal maintenance. It does not contain any toxic substances during the manufacturing process nor in the final product. The material composition does not foster nor attract any pests.

Durability Hebel AAC products are very durable and will not degrade under normal climatic conditions. They have outstanding durability characteristics over traditional materials relative to humidity, freeze/thaw cycles and chemical attack.

High Compressive Strength Hebel AAC products are manufactured in various strength categories. Panels and blocks are available in strength categories AAC-2 and AAC-4. These strength classifications should not be confused with the permissible compressive stress. Hebel blocks and panels can take relatively high maximum compressive stress compared to their overall material strength, permitting completely adequate assumption of building loads in normal applications. Above and beyond that, higher compressive stress is allowed for Hebel AAC in thin-bed mortar than for masonry using ordinary mortar. Compressive strength, gross density and thermal insulation are attuned to each other in Hebel AAC products.

1.6 Reference of Building Codes and Standards

Summary of Standards and Codes Cited in this Manual

The following documents are cited regularly throughout the Hebel AAC Technical Manual.

ACI Documents

ACI 318 Building Code Requirements for Reinforced Concrete

ACI 530/ASCE 5 Building Code Requirements for Masonry Structures

ACI 530.1/ASCE 6 Specifications for Masonry Structures

ACI 523.2/R-96 Guide for Precast Cellular Floor, Roof and Wall Units

ASTM Standards

ASTM A82-95 Specification for Steel Wire, Plain, for Concrete Reinforcement

ASTM C39 Compressive Strength of Cylindrical Concrete Specimens

ASTM C177 Test Method for Steady State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus

ASTM C270 Specification for Mortar for Unit Masonry

ASTM C1386 Standard Specifications for Precast Autoclaved Aerated Concrete (AAC) Wall Construction Units

ASTM C1452 Standard Specifications for Reinforced Autoclaved Aerated Concrete Elements

ASTM C1660 Thin Bed Mortar Standard Specification for Thin-Bed Mortar for Autoclaved Aerated Concrete (AAC) Masonry

ASTM C1686-09 Standard Practice for Installation and Testing of Reinforced Autoclaved Aerated Concrete (AAC) Units

ASTM C1691-09 Standard Specification for Un-reinforced Autoclaved Aerated Concrete (AAC) Masonry Units

ASTM C1692-09 Standard Practice for Construction and Testing of Autoclaved Aerated Concrete (AAC) Masonry

ASTM C1693-09 Standard Specification for Autoclaved Aerated Concrete (AAC)

ASTM C1694-09 Standard Specification for Reinforced Autoclaved Aerated Concrete (AAC) Elements

ASTM E72 Standard Methods of Conducting Strength Test of Panels for Building Construction

ASTM E90-90 Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions

ASTM E119 Fire Tests of Building Construction and Materials

ASTM E514 Standard Test Method for Water Penetration and Leakage through Masonry

ASTM E518 Flexural Bond Strength of Masonry

ASTM E519 Standard Test Method for Diagonal Tension (Shear) in Masonry Assemblages

ASTM E426 Drying Shrinkage of Concrete Masonry Units

ASTM E447 Compressive Strength of Masonry Prisms

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WARNING. Property damage, personal injury or death may result from improper design, use, or installation. Licensed design and construction professionals, who maintain good standing with the governing authority and have the necessary knowledge, experience and judgment of the specific building system and its components, should be retained to ensure a proper design, use, and installation.

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