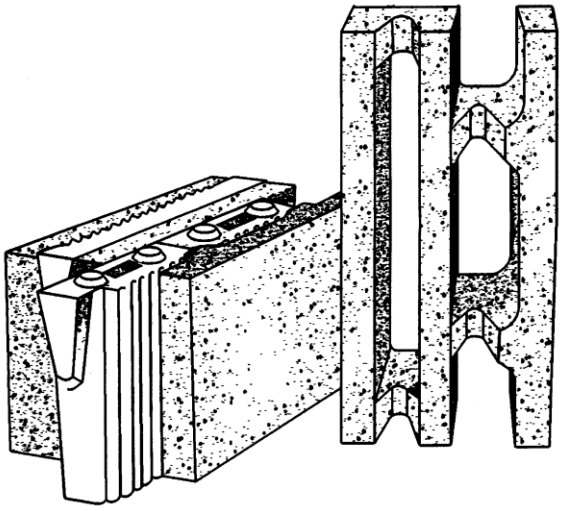
ENDURA™
WALL SYSTEM

Construction Manual

All details and specifications contained herein are subject to and governed by local building code.



UNIQUE FEATURES OF THE ENDURA™ CONCRETE BLOCK SYSTEM

1. Three-wall, Multiple-cell design

A. Long outer cavity of the 8“ CMU and the center cell of the 12“ CMU are always insulated.

B. Inner cell provides insulation and insulation interlock between block or may be used for reinforcing rebar and grout.

C. Reinforced masonry, inner cell is protected thermally while allowing for flexibility in design and application. (Figure1)

2. Long thermal-pathway

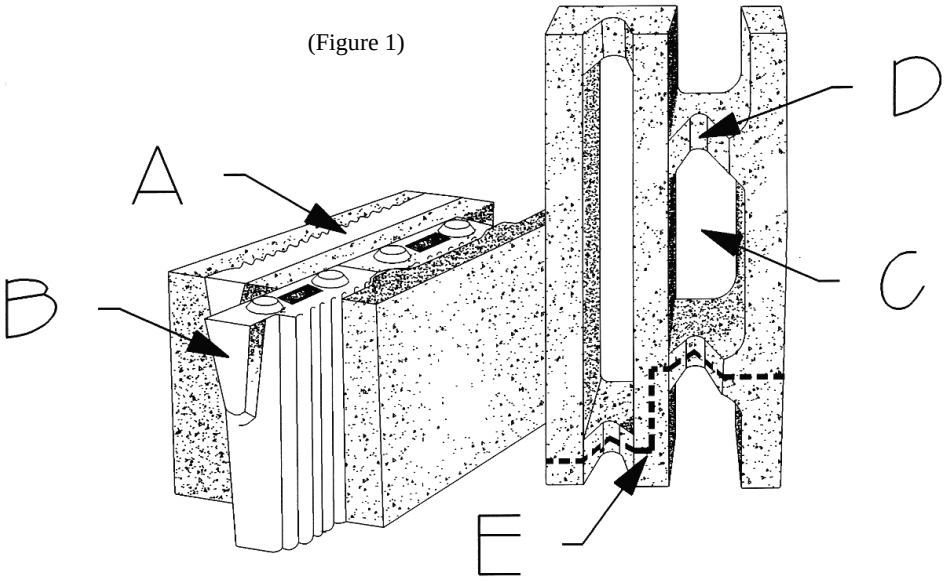
D. Reduced cross webs reduce thermal pathways by 40%.

E. Offset cross webs extend an 8“ CMU normal to a 12“ path from outside to inside. In the 12“ CMU, from 12“ to 20“.

3. Mortarless construction

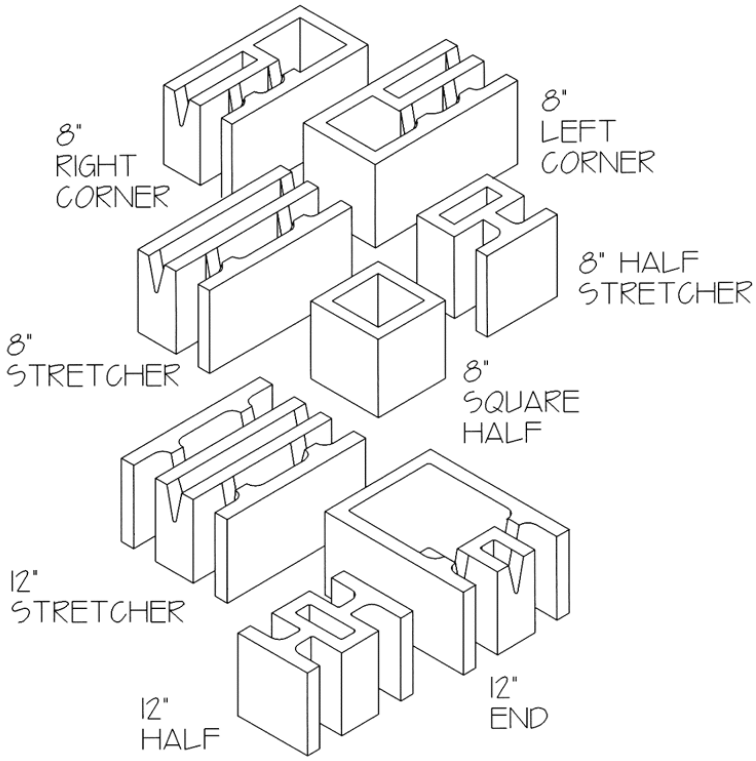
No mortar between block for simple and fast construction. Finished with rock-hard Surface Bonding Cement Endura Structural Coating on both sides of the wall.

(Figure 1)



THE COMPONENTS
The Block and Block Shapes

(Figure 2)



The ENDURA™ Concrete Masonry Unit (ENDURA™ CMU) comes in full 8“ x 8“ x 16“ and full 12“ x 8“ x 16“ block sizes and may be made at most block producing companies from their molds or molds supplied by ENDURA.

The 8“ wide CMU system consists of five different block shapes and the 12“ wide block system consist of three block shapes (Figure 2). Both the 8“ and 12“ block shapes are produced to full, not nominal, dimensions.

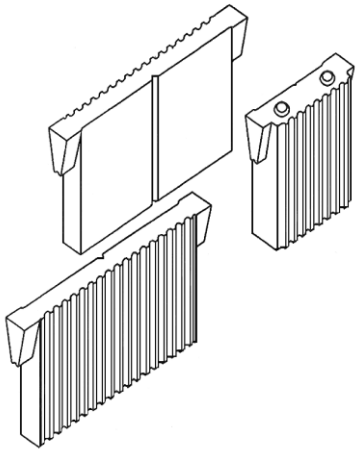
The 8“ x 8“ x 16“ stretcher block has two primary insulation openings, the long, thin outside cell is always insulated and the inner off-set cells and half-cells accept insulation inserts or rebar and grout when required by design. The open-end half insulation cells interlock each block and stop air transmission through the end joints. When rebar and grout are used, the reinforcing cells are still insolated from the outside by the outer, long insulation cell and the inner cell insulation located on either side, above or below the grouted cells.

THE INSULATION

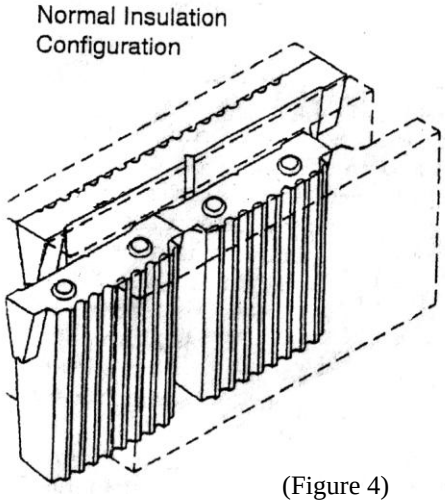
There are two insulation insert sizes, long and short. One long insert fits in each long outer cell. Two short inserts fit in the inner cells, one centered in the block while the other interlocks into the next block in line. Short inserts are left out where cells are used for reinforcing rebar and grout. The inserts are installed by workers on the job-site as the walls are erected.

Where no reinforcing cells occur, the 8" CMU uses one long insert and two short inserts while the 12" CMU uses one long insert four short inserts.

(Figure 3)

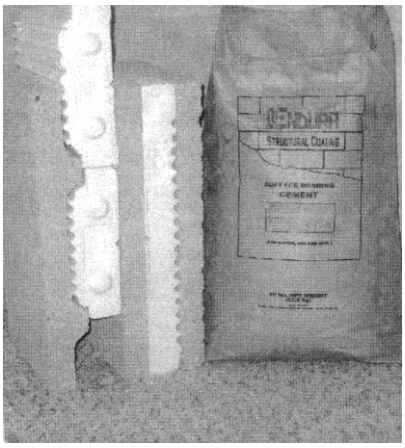


The inserts are molded with a score line ("V") down the middle of the flat side where they may be broken to fit half cores in the end block and beside window and door openings.



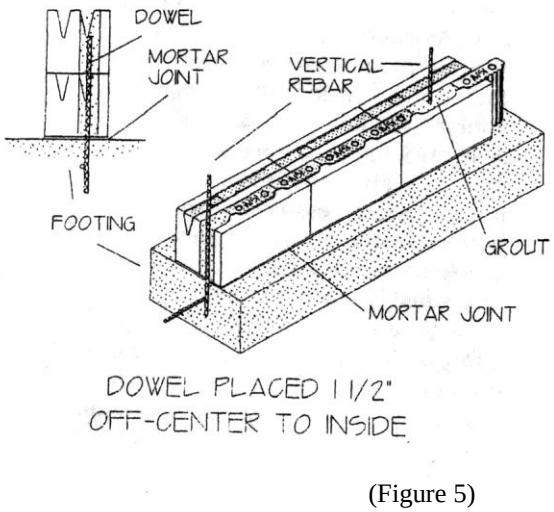
(Figure 4)

STRUCTURAL/COATING SURFACE BONDING CEMENT



Structural/Coating surface bonding cement is a mixture of Portland Cement, fine silica sand, chopped fiber glass fibers, chemical plasticizers and anhydrators. In the field, Structural/Coating needs only the addition of potable water.

Structural/Coating is applied at a minimum thickness of 1/8" to **both sides** of the wall. Different surface finishes such as skiptroweled exterior or smooth interior may be achieved. No additional furring need be applied to either side of the wall, but facades such as brick may be easily added. Interior wall texture is applied when the interior frame walls are textured so no variation in wall appearance is seen. Structural/Coating may also be finished as a scratch-coat as substrate to elastomeric exterior finishes or skiptroweled with stucco and painted.



(Figure 5)

BUILDING THE ENDURA™ INSULATED WALL

The American Society for Testing and Materials (ASTM) publishes a *Standard. Practice for Construction of Drystacked, Surface-Bonded Walls;* designation: ASTM C 946. ENDURA™ recommends users become familiar with and build to this standard.

Before any construction takes place, building plans should be studied carefully to identify all wall openings, lintels, beams and reinforcing schedules as well as all electrical boxes and raceways required in the portion of wall to be built with the ENDURA™ system. It is the responsibility of the masonry contractor to include all these things in the job. As soon as practical, all wall details should be marked on the floor slab so no items or openings are missed.

A) All materials, the ENDURA™ Structural/Coating surface bonding cement, the ENDURA™ CMU, and ENDURA™ insulation inserts should be delivered and stored off the ground to prevent contact with water. They should be protected from rain or other moisture with a suitable waterproof covering.

The Footing

B) When the footing is poured, place deformed rebar dowels to conform to engineering and local building code requirements. (**Caution:** The placement of rebar dowels must align with the inside smaller cell of the ENDURA™ CMU.) (Figure 5) It is recommended that footings be formed and poured to allow accurate level. Care should be taken to place doweling accurately aligned with the inner cells of the ENDURA™ CMU units to be placed.

First Course

C) The first course of ENDURA™ CMU can be placed, if needed, in a full bed of mortar laid to a line with the top surface level, and cross-leveled and butted together with no mortar in the head joints.

Strike bed joint flush. No mortar shall be placed in the cores to receive grout or insulation inserts.

D) Courses of ENDURA™ CMU between the leveling courses, (see "leveling courses," below) shall be placed without mortar on the bed or in head joints. Place units in running bond. Removed burrs and crumbs by "rubbing" block together as needed, and butt blocks tightly.

E) Mason should mark the floor with chalk or crayon to indicate all openings and reinforcing cells. Workers then won't inadvertently install inserts in grout cells or stack above the sill heights. Insert vertical rebar, following the proper reinforcing plan, into open cells where insulation inserts have been left out.

F) Allow for door openings and plan for control joints if they are required.

Note: It is recommended that footing with ENDURA™ System stem walls be used (rather than the monolithic floor and footing technique) to improve building thermal performance in areas where there are severe frost zones. After the footing, first course, and stem wall are completed concrete floors may be poured adjacent in the inner face of the wall. It is recommended that insulation be used beneath concrete floors to increase building thermal performance and floor thermal comfort.

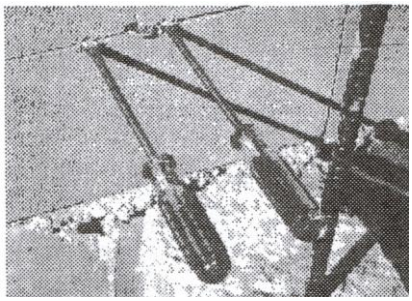
Stacking The Wall

After marking on the floor the exact location of reinforcement cells, door openings, and the location of electrical outlet boxes (to be placed when block is stacked to proper height) workers should stock sufficient quantities of block including all parts for one grout lift (four feet). Stock block pre-cut with electrical box openings and position where each electrical outlet or box is located. Stock each corner with equal left and right corner block, three each for every four feet. When large cell openings are specified, ie: plumbing vents, use corner block in the wall. Stock each window opening with half stretchers, or half corners, one for each course beside the opening.

Begin stacking the walls at the corners, confirming level and plumb as each unit is laid. Courses of ENDURA™ CMU shall be placed without mortar on the bed or head joints. Place units in running bond. Shim corners when corner block are shorter in height than stretchers in the wall. Butt block tightly as courses are laid to avoid wall length gain. If length gain occurs, check for dips or high spots (these cause head joints to gap either at the top or bottom of the head joint showing the block to be crooked) and shim the individual block to straighten.

Be sure to insert insulation into all appropriate spaces in the block as each course is placed. Stack wall to first bond beam height, inserting all insulation in cells not reserved for reinforcement.

When the first bond beam height is reached, check corners for plumb and level and overall height. Use metal shims or mortar to plumb and level the wall to a line strung from the corners. Using two large flat-blade screwdrivers, lift block to allow shims to be placed. Start as low possible, preferably just above the first course to achieve the maximum benefit from the shim placement. Use a rubber-head mallet to move block in the wall. Insulation brick masonry wall ties cut to 1"-2" lengths work well as shims. Be careful to strike block only where cross-webs exist to avoid breakage.



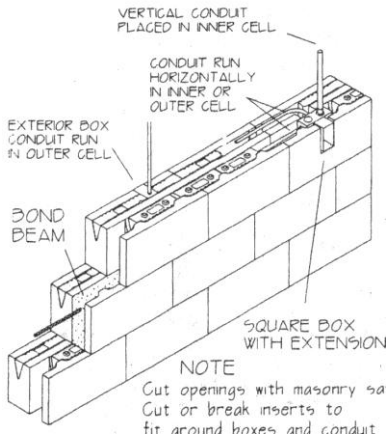
Leveling Courses: If any course is out of level by more then ½" in 10', re-level and plumb wall with a mortar joint according to the standard ASTM C-946. If the wall is properly shimmed as stacking is done, leveling courses are avoided. Typically, shimming is done when four feet in height is reached and every two feet thereafter so workers on scaffold can still reach over the wall to the outside for shim placement. Normally very few shims are required.

If block cutting is required for fit, use corner block, cutting the large-cell end.

ELECTRICAL RACEWAYS

When electrical wall outlets and switch boxes are called for (Figure 6), precut box openings in the necessary number of block for all outlets and switch units. Place boxes and conduit as units are laid. Cut or break insulation to fit around each box.

During the wall stacking, insert pre-cut (electrical box) block in the appropriate course. Where outlets fall under a window, conduit must be run horizontally within the outer or inner insulation cells. Break or cut the insulation inserts to insulate around conduit.



(Figure 6)

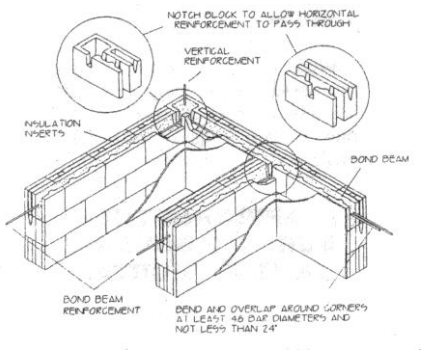
ENDURA™ INSULATION INSERTS AND SHIMS

The ENDURA™ insulation inserts are designed to reduce the need for shimming of the wall in addition to their interlocking and insulation features. However, for straight, true and plumb stacking, shims may be required.

Shims must be corrosion resistant metal or plastic with a minimum compression strength of 2000 psi, or steel protected from corrosion by a coating of zinc at least 0.8 oz/ft, or by coating of cadmium or zinc of equivalent corrosion resistance. Use shims, mortar, a bond beam course, or surface bonding cement to plumb and level units when necessary. The insulation inserts do not provide a sufficient compression rating to be used as a replacement where shims are required. Flat brick masonry wall ties cut to 1"-2" lengths work well as shims.

REBAR, GROUT AND OTHER STRUCTURAL CONCERNS

When horizontal rebar and grout (bond beams) are required (many seismic zones require rebar and grout to be installed at levels such as every four feet) any inaccuracy that developed in stacking the wall may be corrected by laying a course in mortar. This is called a leveling course.



(Figure 7)

Except where engineering demands would require otherwise, all rebar and grout should be placed in the inner core of the block (the cores or cells where the ends of the block are open) (Figure 7).

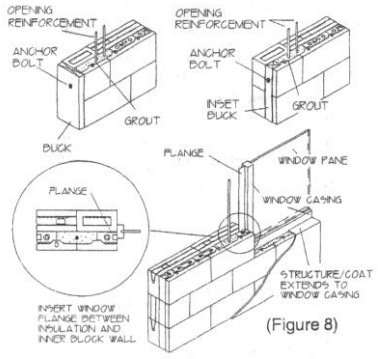
The grout used should be of a slump of not less than 8“, generally 9“ or 10“.

Windows and Doors

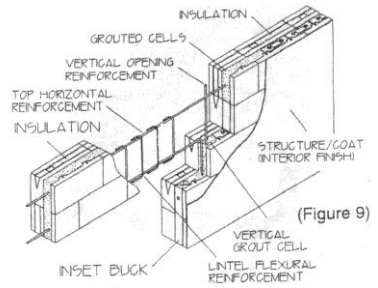
Windows may be attached to wood bucks built into openings or slid directly into block openings. Windows with flanges may be installed prior to installing the lintel by sliding the window down from above along the edge of the center wall of the block between half inserts and the block (Figure 8).

To install doors, bucks are cut from 2 x 4’s which fit in the open half-cell facing the opening and are flush with the end of the block (stretcher and half stretcher block are used to provide this open half cell). Bolts extending into the next available vertical grout cell hold these bucks in place. Workers should hold the bucks in place when grouting so the force of the flowing grout does not push them from the half cell.

Bolts used to anchor the window or door bucks or jambs extend into the fully grouted cell adjacent to the opening (Figure 8).

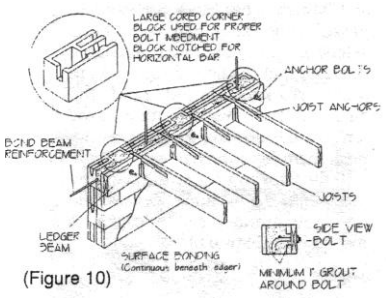


Over doors and windows, lintels are created with rebar and grout. (Figure 9). A vertical rebar and grout cell will run next to each window or door. Blocks forming this lintel should be laid upside down allowing the rebar to be positioned (in tension) in the lower portion of the created solid grouted lintel beam.



Lintel size is determined by engineering and may be made with one or more courses above the opening. For large span lintels, steel beams are sometimes designed and are supported by vertical grout columns formed with the full cell end block and the full cell square half block including the appropriate engineered rebar.

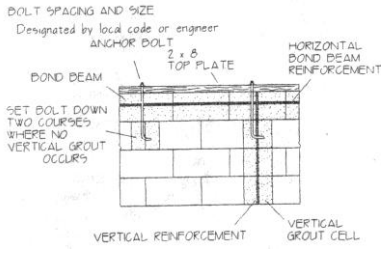
LEDGER BOLT AND ANCHOR BOLT PLACEMENT



(Figure 10)

Finishing the top of the wall usually requires a bolted top plate or hurricane straps (Simpson strap meta-20's or what engineer specifies. Set anchor bolts into the bond beam when grouting (Figures 10 & 11). The next course below can accommodate longer bolts by eliminating the insert in that cell to allow for grout.

For attachment of LVL's, expansion bolts (red heads) are suggested, or what engineer specifies.



(Figure 11)

SURFACE BONDING THE FINISHED WALL

It is recommended that the finishing of the wall be done in two stages:

1) When the wall is stacked to height, finish the **interior** of the wall with the initial Structural/ Coating bonding-coat to allow the surface bonding to be continuous behind interior framing. Studs may be nailed to the finished wall using conventional masonry nails or screws.

2) The exterior should only be finished after the roofing system is in place and the wall fully loaded and most of the major construction has been done on the building. It is advisable to wait for the final exterior coating so cosmetic damage to the finish is avoided.

Mixing The Surface Bonding Cement

In a wheelbarrow or mortar mixer, put in water and Structural coating Surface Bonding Cement and mix only until all material is wet and plastic. Over mixing can cause the fiberglass strands to shatter and bond to each other, creating clumps. Power mixers require only about a 30 to 45 second mixing cycle. **Structural coating is ready to use, do not add any sand, lime, or other material to the mix. Only the addition of bonding agents designed for cementitious coatings may be added when needed.**

A small amount of water may be added up to 30 minutes after the initial mixing if the material begins to thicken.

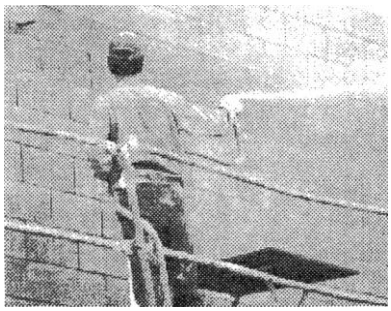
Mix only enough material as may be applied in one hour under normal 40 degree F to 100 degree F weather. Usually one man can mix and apply one to two bags of material in one hour.

Applying The Surface Bonding Cement (Mortar)

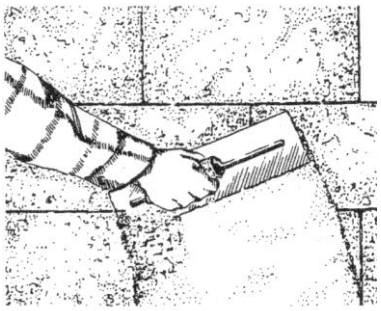
Endura™ handles and approves only Endura™ Structural/Coating. Substitutions are not covered by the I.C.B.O. Evaluation and are at builder's risk.

Once the block wall has been stacked to height, the wall should be wetted thoroughly but not soaked. This block wetting and the keeping of the block damp while applying the surface bonding cement is very important (See Figure 13). Dry block will suck the moisture out of the surface bonding cement causing loss in bonding strength. In very dry climates or where drying winds are prevalent during application, this wetting process must be watched carefully to assure proper adhesion and strength.

Apply the structural coating surface bond cement when the weather is about 40 degrees F (8 degrees C), and insure that the surface is maintained above this temperature for at least 24 hours after application. In cold climates where the weather will fall below this temperature, drape the wall and use a space heater to maintain the proper 40 to 100 degrees F temperature.



The surface bonding cement is easily worked with conventional plastering tools and is handled much like conventional stucco.


(Figure 12)

The surface bonding cement should be applied to a minimum thickness of 1/8" (3mm) using upward stokes (Figure 12) and sweeping in a diagonal direction with the trowel. All block and joints should be covered evenly, forcing the material into any cracks. Excessive vertical troweling may cause bed joints to reveal. Over troweling should be avoided.

If for any reason the work is interrupted, stop application at the neutral point such as a door or window opening, at a corner or floor level. If this cannot be done, stop within the face of the block. It is important for strength that fresh surface bonding cement be applied over cracks and block joints.

As a rule of thumb, speed is very important in applying the surface bonding cement since initial set comes in about one hour.

Any second smooth or texture coat can be applied immediately (within a few hours) after the first coat has been applied and taken its initial set but can support the additional weight of the material. Second coat applications made after 24 hours of initial set could require the addition of a bonding agent to the material to insure a good bond. The base coat could be scratched to allow bond when a second coat is specified.

Curing The Surface Bonding Cement

The surface bonding cement takes its initial set within one to two hours and will gain much of its ultimate strength within 24 hours of application. To insure maximum performance and proper hydration, the surface of the finished wall should be misted regularly (Figure 13), at least twice a day for the first full day and twice a day for two days in very dry or drying climates. In very cold weather, keep the surface bonding cement from freezing for the first 48 hours after application.

(Figure 13)

Appearance and Maintenance

The surface bonding cement may be textured into a variety of stucco appearing finishes using steel, rubber, wooden or sponge trowels to create the different textures. Endura™ recommends the creation of a test panel at the job site prior to coating the finished wall. It is not recommended that the surface bonding be the finished coat. A WORD OF CAUTION HERE. Each plaster has his own particular touch with the towel. If the project is large, and several plasters are employed, make certain the texture choice is one all workmen can produce uniformly.

Painting

Once the surface bonding cement has cured, the finish may be painted with any good quality masonry paint. For best results, buy a product recommended as "alkali resistant for application over cement and masonry surfaces." Wait 48 hours before applying water based paints and 28 days before applying oil base paints.

Damproofing

The surface bonding cement is an excellent damproofing agent over masonry. It may be used below grade instead of conventional parge to provide water protection and prohibit moisture penetration.

Precautions

Additives

Surface bonding cement is carefully formulated and requires only the addition of potable water prior to application. With the exception of concrete bonding agents, NO OTHER INGREDIENTS SHOULD BE USED.

Although accelerators, retardants and other admixtures are commonly used in concrete construction, their use in the surface bonding cement will produce adverse side effects.

CAUTION

SURFACE BONDING CEMENT (MORTAR) MAY CAUSE SKIN OR EYE INJURY. CONTAINS PORTLAND CEMENT.

FRESHLY MIXED CEMENT, MORTAR, CONCRETE OR GROUT MAY CAUSE SKIN INJURY. AVOID CONTACT WITH SKIN WHERE POSSIBLE, AND WASH EXPOSED SKIN AREAS PROMPTLY WITH WATER.

IF CEMENT OR CEMENT MIXTURES GET INTO THE EYE, RINSE IMMEDIATELY AND REPEATEDLY WITH WATER AND GET PROMPT MEDICAL ATTENTION!

Special Applications

When applying the surface bonding cement in temperatures over 100 degrees F (38 degrees C) or under very low humidity conditions, take special precautions to keep the wall and mix from drying too fast during the first 48 hours.

SPECIAL CONSIDERATIONS

Endura™ recommends the complete consideration in all aspects of construction as to the relationship of the parts to the thermal efficiency of the wall assembly. For instance, Endura™ does not recommend the use of metal frame windows or doors since metal is an excellent conductor of heat and cold. Secondly, Endura™ recommends that special attention be devoted to the thermal quality of the windows and doors to be installed. The best insulated wall cannot help if poor thermal quality windows or doors are used.

TECHNICAL QUALIFICATIONS

The Endura™ Reinforced Masonry System was designed for use under the direction of the Uniform Building Code and qualifies for use in applications where the advantages of masonry construction are desired. **All design should dictated by structural engineering.**

ENDURA™
WALL SYSTEM

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