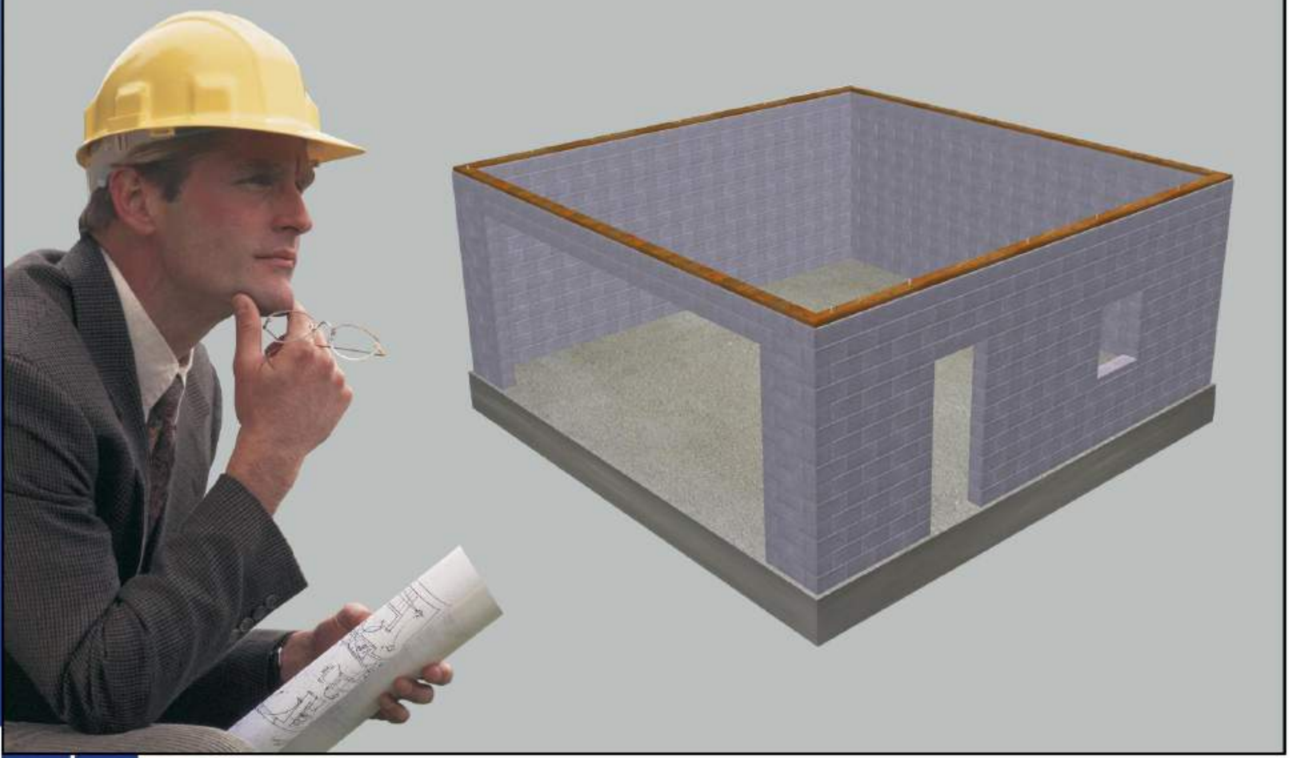
A Mason's Guide to the FlexLock® Wall System

A Complete Handbook on FlexLock® Technology



A Mortarless, Groutless Alternative to Standard Masonry

Residential * Commercial * Big Box Stores
Schools * Partition Walls * Sound Walls

Cercorp Initiatives

A Mason’s Guide to the FlexLock® Wall System

Dominic Cerrato

FIRST EDITION

This Guide is Dedicated to Mary Whose
Immaculate Heart is the Inspiration for FlexLock®

IMPORTANT

When designing any kind of structure, there are many factors that must be taken into consideration. Among theses are the terrain, geographic location, the cost and type of materials, as well as national and local building codes. This guide was written to provide a basic understanding of the FlexLock® Wall System. As a result, it is not intended to cover every possible situation or even prescribe a specific design.

It is the sole responsibility of the reader to ensure that the most current edition of this guide is used. Free updates to this edition can be foind and downloaded at www.cercorp.com.

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Introduction

A. General Overview

The FlexLock® Wall System is a complete masonry system designed as a mortarless alternative to standard concrete block construction. The system's multi-patented technology produces significant competitive advantages through the use of an interlocking design, precision bearing surfaces, and post-tensioned tendons.

Useful for residential, commercial, and industrial applications, the FlexLock® system consists of two integrated sub-systems; masonry and hardware. Together, these combine to produce a solid structure with the unique capacity to systematically absorb external forces. The competitive advantages are:

Mortarless Except for the first course, the FlexLock® system requires no mortar between the joints or grouting of the cores.

Reduced Construction Time The FlexLock® Wall System can be assembled three to four times faster than conventional block construction.

Work Force/Market Sensitive According to the World Center for Concrete Technology, the average age of a journeyman in the U.S. is 52 years old and estimates indicate a shortage of over 50,000 masons. Because FlexLock® requires one journeyman (the rest being stackers), it can accommodate this shortage by configuring itself to the current labor pool.

Completely Reusable Should the need ever arise, as in the case of interior partition walls, the unique interlocking surfaces allow for total disassembly rendering the components useful for other construction projects. This also allows for mistakes to be easily fixed.

All Season Construction Conventional block walls require expensive additives to enable the mortar to cure in sub-zero temperatures. As a result, many colder climates do not build during the winter months. Because the FlexLock® Wall System uses very little mortar, it can be assembled in any temperature zone extending the working season.

Super Strong Wall Structural tests conducted by the National Concrete Masonry Association demonstrate that FlexLock® has three to four times the reserve strength as standard masonry. This, along with the ability to flex, enables the system to dissipate loads while still maintaining its structural integrity. This feature is expected to make the FlexLock® Wall System applicable to seismic regions.

Lower Overall Construction Costs The above advantages further translate into significant monetary savings.

B. System Components

As noted earlier, the FlexLock® Wall System is comprised of two sub-systems; masonry and hardware. It is the unique combination of these, along with the diamond-ground mating surfaces of each block, that give the system its strength and structural integrity.

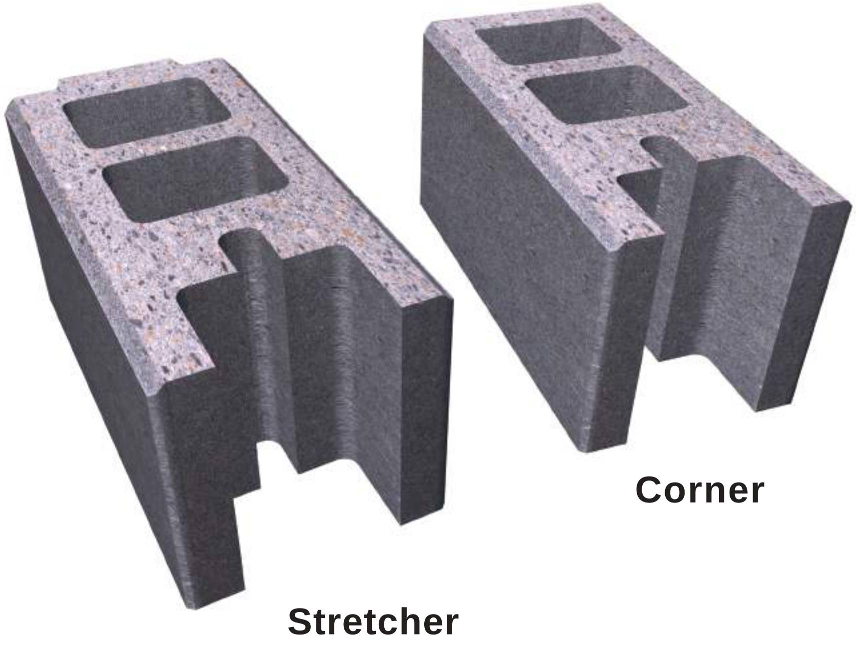


Fig. 1.1

The Stretcher and Universal Corner Unit

I. Masonry Sub-System

The stretcher, universal corner and bond units make up the masonry sub-system. Although other units such as half-stretchers and bullnose can be easily produced, the stretcher, corner and bond units are extremely versatile and will suffice for most projects *(Fig. 1.1 & Fig 1.2)*. FlexLock® can also be produced as architectural units such as split face, ground and fluted.

Stretcher: The stretcher unit is comprised of parallel shells with ground bearing surfaces. The thick main web at the front of the unit contains a vertical slot through which the tendon is placed. The unit has male and female interlocking mating surfaces on two of its six sides. To allow ease of assembly, these are deliberately kept loose and only engage when the wall is under a lateral load.

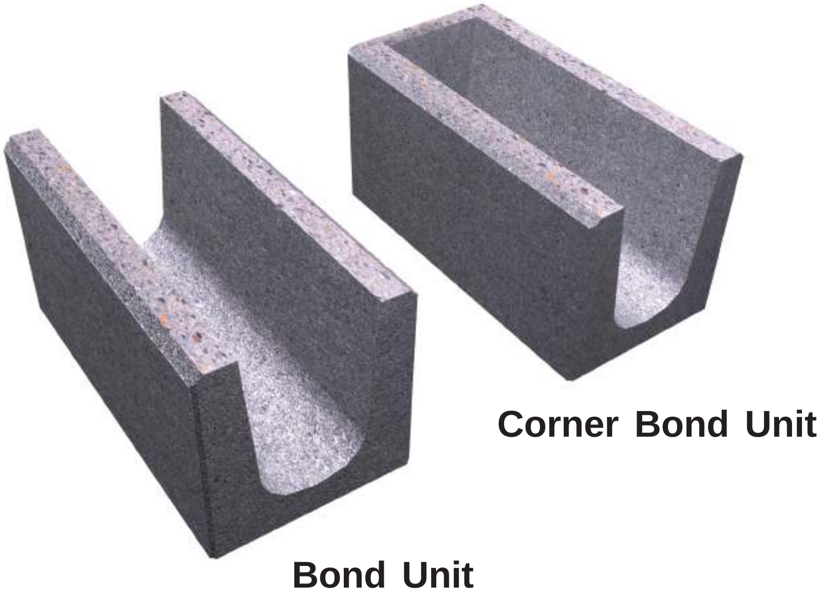


Fig. 1.2

Bond (Channel) Block

Corner: The universal corner unit is comprised of a continuous shell on three of its four sides. Like the stretcher unit, the thick main web at the front of the unit contains a vertical slot through which the tendon is placed. Depending on its orientation, a single unit can be used for both inside and outside right angles. Beyond its use as a corner block, the universal corner unit is also used as a jamb block. This provides a smooth solid surface along openings to attach a window and door jamb.

Bond Unit: The bond unit (*Fig. 1.2*), sometimes called a channel block, is a hollow concrete masonry unit with depressed sections forming a continuous channel in which reinforcing steel can be placed for embedment in grout. The bond unit is also available with a return to effect corners. Like the stretcher and corner, the bond beam is ground on both bearing surfaces.

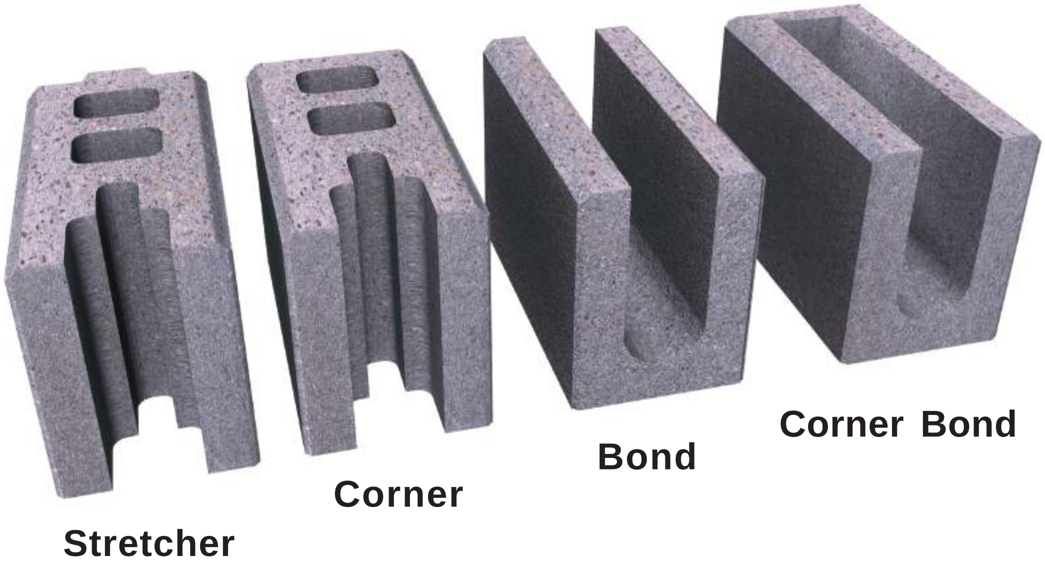


Fig. 1.3

Six Inch Partition Units

Six Inch Units: Depending on local market demand, FlexLock® may also be available in six inch units. These are used for interior partition walls and fencing. The six inch units are twelve inches long and eight inches high (*Fig. 1.3*). Although much of this guide can apply to six inch units, the guide is primarily directed to construction using eight inch units.

II. Hardware Sub-System

FlexLock® hardware is comprised of various steel components used to tie the system together and provide its strength. Only the basic hardware components are described here. The remaining specialized elements can be found on the web e-store at **www.cercorp.com.**

Fig. 1.4

Bearing Plate

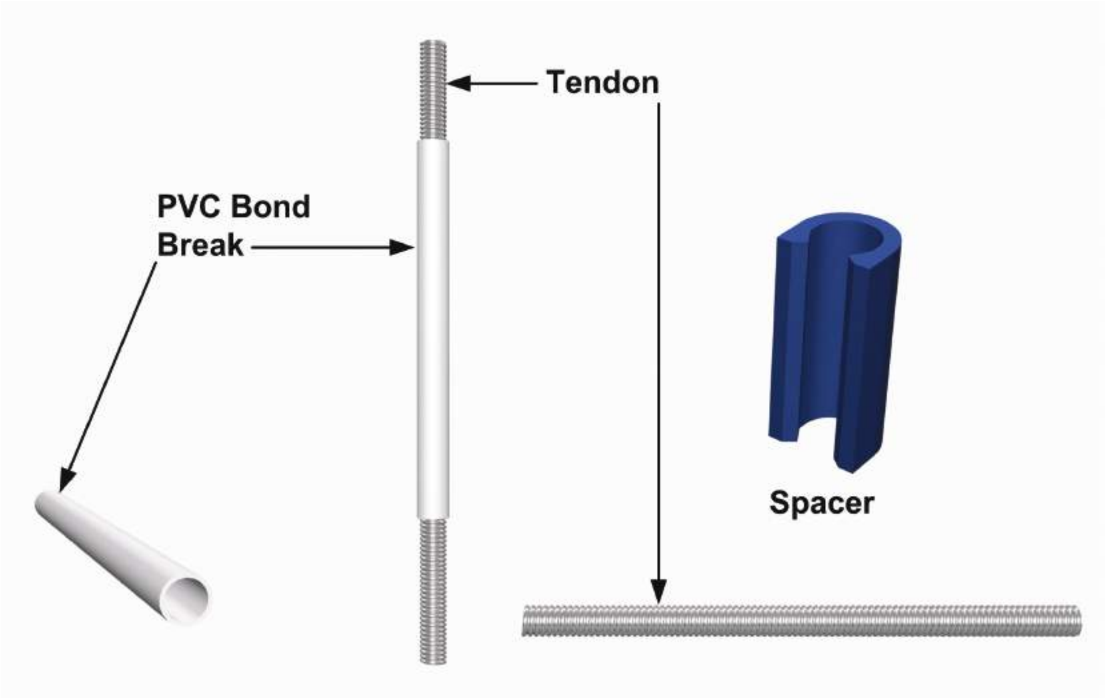


Fig. 1.5

Tendons

Bearing Plate: The bearing plate *(Fig. 1.4)* is a simple $^5/_8$" mild steel rectangle measuring $7^7/_8$" x 4". The plate has one $^7/_8$" hole in the middle to accommodate post-tensioning.

Tendons: The tendons *(Fig. 1.5)* are comprised of #5 Grade 60 ASTM A615 all-thread-rebar designed and tested for compressing masonry units. The $^5/_8$" nominal threads are cold rolled with a minimum ultimate strength of 28.8 Kips and a minimum yield strength of 19.2 Kips. The innovative all-thread design minimizes waste and allows for easy threading. Tendons are available in lengths of 5', 10', and 20'.

Bond Break: A $^3/_4$" class 200 (SDR21) nominal PVC tube is used to create a bond break (*Fig. 1.5)* between the tendon and surrounding grout. This is used in a bond beam application and available in ten foot lengths.

Spacers: PVC spacers *(Fig. 1.5)* are used to reduce the space between the masonry slot and the tendon. When forces are applied perpendicular to the wall (out-of-plane), the spacers provide a vertical interlock dispersing the load through the tendon. For convenience, the spacers snap and lock around the tendon eliminating the need to thread them from the top.

Nuts, Washers and Couplings: Fasteners such as hex nuts, washers and couplings *(Fig. 1.6)* are all designed to exceed 100% of the tendons ultimate strength. A special wing nut can be used, along with a universal bearing plate, to temporarily lock down a wall during construction. All components are machined to specific tolerances to yield a highly effective, yet durable, threaded connection.

Fig. 1.6

Hardware Components

Corrosion Protection: All tendons and fasteners are hot-dipped galvanized to ASTM A-153. Other forms of corrosion protection such as epoxy, mastic wrap, and heat shrink plastic tubing are available through the local FlexLock® supplier.

Using Mortar and Grout with FlexLock®: As noted earlier, FlexLock® is a mortarless and groutless system. It is mortarless in the sense that mortar is not used between the head and bed joints. It is groutless in the sense that grout is not used to fill the vertical cores. Since these are the two principal ways in which grout and mortar are used in masonry, FlexLock® is considered both virtually mortarless and virtually groutless. However, the system is not completely mortarless and groutless. Mortar is used between the footing and first course. Grout is used in the jamb, sills, lintels, and bond beam. Grout and mortar can also be used to mate FlexLock® additions to conventional masonry, and in special situations. In many respects, FlexLock® is really a hybrid between post-tensioning and conventional masonry, exploiting the structural capabilities of both, and allowing the experienced mason to make an easy transition. These two methods blend seamlessly into one comprehensive system to provide today's masonry contractor with the advantage to stay competitive.

C. Understanding the System

Mortar and grout, combined with horizontal and vertical steel reinforcement, provide traditional masonry with its strength. However, with FlexLock® the strength is achieved through post-tensioning. Post-tensioning is a method of strengthening masonry or other materials with high-strength steel bars known as tendons.

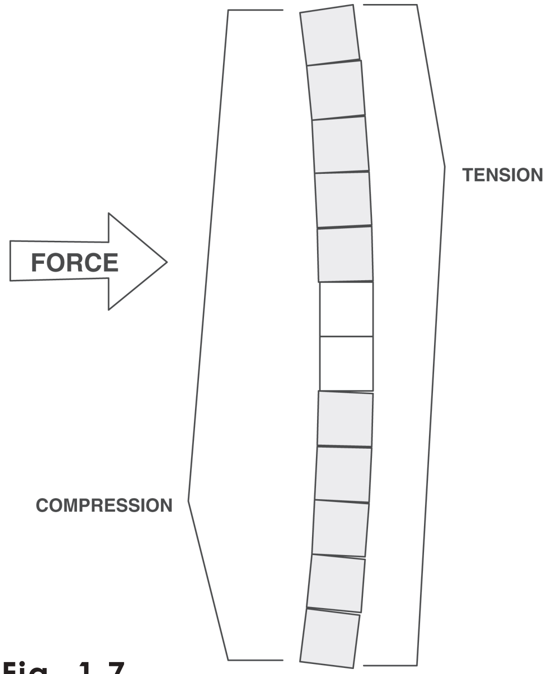


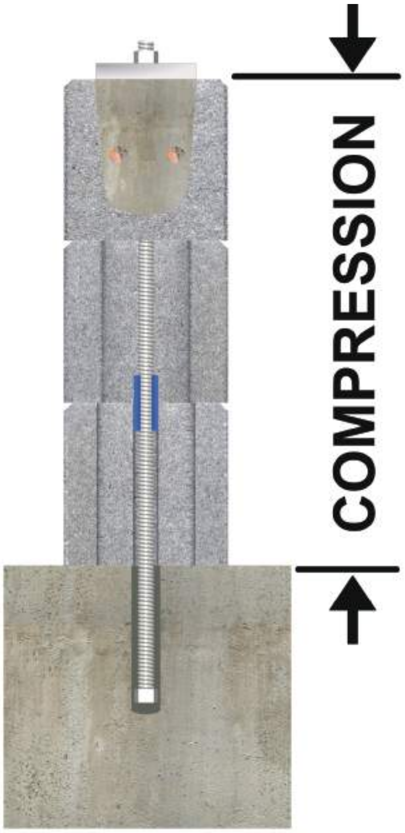
Fig. 1.7

Structural Dynamics

The benefits of post-tensioning can be realized by understanding a few basics about concrete. Concrete is much stronger in compression (when it's pushed together), than in tension (when it's pulled apart). In traditional masonry construction, if loads such as high winds or hydrostatic pressure are applied to a wall, the wall will tend to deflect or bow away from the applied force *(Fig. 1.7)*. This deflection will cause the outer surface (the one taking the load) to compress, while the inner surface (the one opposite the load) elongates under tension. Typically, steel reinforcing bars are grouted in the block cores as tensile reinforcement to limit structural failure.

This method is known as passive reinforcement because it does not carry any of the applied load until the wall deflects. On the other hand, post-tensioning provides a form of active reinforcement. Because it is pre-stressed prior to any load, the tendon is effective as a reinforcing element prior to any deflection.

In the FlexLock® Wall System, the precision units are held in compression, from top to bottom, with high strength steel tendons *(Fig. 1.8)*. While the bottom of the tendon is typically anchored into the footing, the top of the tendon is secured through a steel bearing plate on top of a bond beam. There, a hex nut and flat washer are used in conjunction with a small hydraulic



Wall Compression **Fig. 1.8**

jack or torque wrench to tension the tendon and compress the masonry. With a bond beam grouted solid at the top of the wall, and the tendons firmly fixed into the footing, a solid crown is formed at the top and bottom. This sandwiches the entire structure under compressive force giving it considerable strength *(Fig. 1.9)*.

Fig. 1.9

Structural Concept

In masonry construction, this form of post-tensioning is only possible with the specially designed FlexLock® units. If traditional CMUs were dry stacked and tensioned, they would crack. The reason for this has to do with the way blocks are produced. While they are dimensionally accurate along their sides, block height can vary plus or minus 1/8". When two blocks of varying heights are placed side by side, and another is placed on top in a running bond, the subsequent downward force introduced by post-tensioning will cause the block on top to shear *(Fig. 1.10)*. This phenomena, known as "point loading," is overcome in traditional masonry by mortar. The patented FlexLock® system overcomes point loading by calibrating the block heights to extremely tight tolerances. This eliminates the point loading problem allowing the units to behave as though they were mortared.

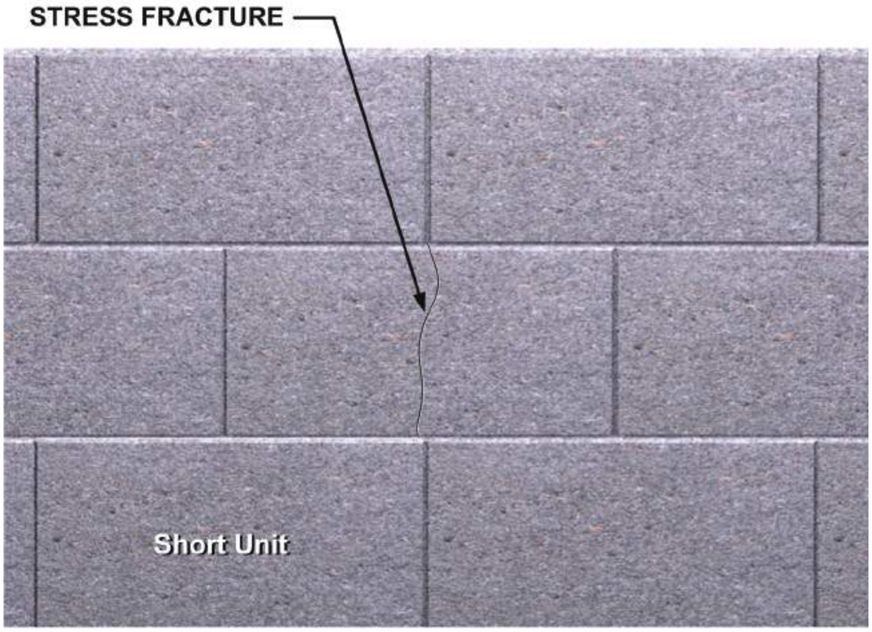


Fig. 1.10

Point Loading

Another unique aspect of the FlexLock® Wall System is the manner in which the units are post-tensioned. In mortared systems that use post-tensioning, the tendon is placed through the center of the hollow cores. In the FlexLock® system,

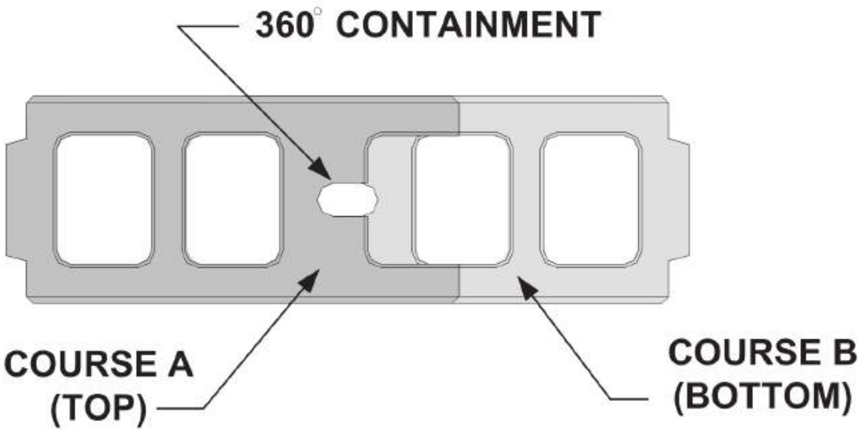


Fig. 1.11

Alternating Courses

the tendon is contained in a specially designed slot. The slot places the tendon in a restricted space enabling the tendon, with the spacer, to engage the masonry units when the wall is deflected. This engagement allows the wall to further resist the force by pressing against the already stressed tendon. The orientation of the stretcher units are alternated at each course allowing for a 360 degree containment of the tendon *(Fig. 1.11).* When catastrophic forces are applied to a FlexLock® wall, the wall begins to deflect without losing its structural integrity *(Fig. 1.12)*.

Unlike traditional masonry walls which deflect slightly and then experience a brittle failure, FlexLock® continues to deflect while maintaining its structural load. This FlexLock® feature will continue as the force increases within the elastic limit of the tendon. If the force is removed at this time, the wall will return to its initial position. It is only when the force exceeds this elastic limit (to the yield point) of the steel tendons or the block themselves shear, that the wall goes into failure. The yield point is the point at which the tendon is permanently deformed. Testing indicates that the FlexLock® Wall System is two to three times the strength of standard masonry walls.

D. The Work Force

THE FLEXLOCK® WALL SYSTEM IS NOT A DO-IT-YOURSELF PROJECT. The integrity of the system assumes competency in the masonry trade and certification in using the system. For a certification program near you, contact Cercorp or a FlexLock® producer.

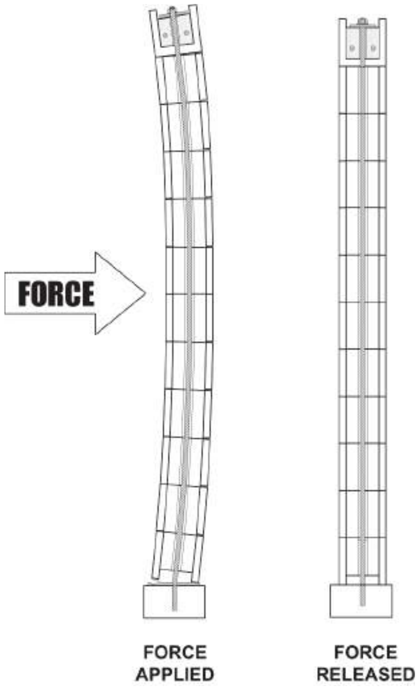


Fig. 1.12

Wall Bounces Back

Crew Composition: The typical workforce would include three categories of workers: masons, stackers and laborers. Masons are journeyman bricklayers who have undergone FlexLock® certification training. Masons install tendon anchors, lay the first course, tension the system, and provide quality assurance throughout the job. Stackers are mason apprentices with at least a basic understanding of the masonry trade. While their primary task is to stack block, they are required to undergo FlexLock® certification so that established standards and practices are followed. Laborers are mason tenders whose primary function is material handling. It is their job to ensure that the stackers have block within a 10' radius of where they are laying block.

As in standard masonry, crew size will vary according to the job requirements. At minimum, a job will include one mason, one stacker and one laborer. As a rule of thumb, the following ratios are recommended: one mason for every ten stackers, and one laborer for every one stacker *(Fig 1.13)*.

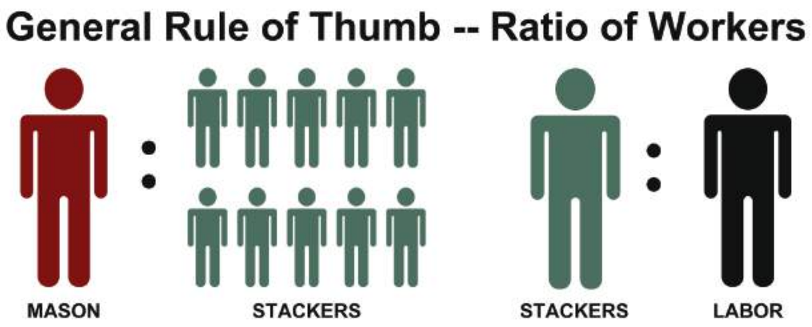


Fig. 1.13

To increase productivity on large jobs, or to improve efficiency on repetitive projects, the workforce can also be broken down into specialized groups. This is discussed in detail in the chapter entitled: Managing FlexLock®.

Crew Size: One way to determine the crew size of a particular job is to use productivity rates. Productivity rates indicate the quantity of block that can be stacked in a single hour by an average stacker. While this is somewhat simplistic since no two jobs are the same, this method can provide a rough estimate of the crew composition based on the size of the job, and the time required to complete it.

While the mason supervisor is ultimately responsible for the job, in the FlexLock® system, the stackers drive the productivity. The entire project revolves around their ability to receive and stack block in an efficient and effective manner. On small jobs, the mason may stack block as well, adding to the overall productivity, but on most jobs he will be laying the first course, tensioning the system, and providing quality assurance. The 1:1 ratio of labors to stackers ensures that a stacker need not move more than ten feet in any direction to obtain block. By knowing the productivity rate of a stacker, and the number of block in a given job, it is possible to estimate the number of stackers it takes to complete that job in a given period of time.

It has been calculated that a single stacker, supported by a single laborer, can safely stack 120 FlexLock® units per hour (see justification below). With this rate, it can be determined that a project requiring 2400 units can be completed with one stacker in 20 hours (2400 units ÷ [120 units per hour x 1 stacker] = 20 hours). If a second stacker was added, the project would take only 10 hours (2400 units ÷ [120 units per hour x 2 stacker] = 10 hours). This means that the crew size can be varied to fit the job schedule.

It is important to realize that, despite the fact that FlexLock® corners go up as quickly as straight walls (need only orient the block 90 degrees when stacking) unique job requirements mean that this calculation is only a rough estimate. Still, productivity rates provide a realistic basis to reasonably plan and manage the project.

For many, the thought of laying 120 block per hour is impossible, and if possible, not sustainable over any period of time. Often, this way of thinking is a result of an incomplete understanding of two essential factors: FlexLock® construction methods and industrial standards for calculating productivity rates. Where this Guide discusses FlexLock® building methods in Chapter 4, the following section explains productivity rates as they pertain to FlexLock®.

Productivity Rate Through Time Studies: Standard industrial engineering methods accurately calculate productivity rates through the use of a time study. A time study is an observation technique used to determine the time required for a qualified well trained person, working at a normal pace, to perform a particular task. The end result of this study is the standard time it takes to stack a single FlexLock® unit.

Any job or task consists of several steps typically called work elements. These elements make up a cycle of repetitive work. In developing a time study, the stacking task was broken down into individual elements. These were then timed using a number of workers in various job situations. From these, an average time per element was calculated *(Fig. 1.14)*.

Number	Task	Description	Time
1	Fetch	Retrieve unit from cube	4 sec.
2	Lift	Pick up unit	2 sec.
3	Return	Go back to the wall	4 sec.
4	Inspect	Look over block	2 sec.
5	Check	Check surface for debris	3 sec.
6	Clean	Remove debris if any	1 sec.
7	Lay	Place block in wall	2 sec.
8	Seat	Rock to secure	2 sec.
		Cycle Time	**20 sec.**

Fig. 1.14

From the total cycle time, it is possible to determine what the industry calls Normal Time. Normal Time is the average observed performance time it takes to stack a single FlexLock® unit taking into account the performance rating of the stacker. The performance rating of an average stacker is 100% (= 1). If he is above average (faster), then he is given a rating above 100%; and if he is below average (slower), he is given a rating below 100%. Normal Time is calculated by multiplying the cycle time by the performance rating *(Fig 1.15)*.

Formula For Establishing Normal Time

NT = (CT) x (PR)

Performance Rating
Cycle Time
Normal Time

Applied to FlexLock

NT = (20 sec.) x (1)
NT = 20 sec.

Fig. 1.15

Normal Time provides a basis for determining the actual "real world" time it takes to stack FlexLock®. This "real world" time is called Standard Time, which is an industry benchmark used to accurately determine labor costs. Simply put, Standard Time is Normal Time adjusted for any planned non-productive time known as Allowances. Allowances are work delays that include: bathroom visits, drinks, physical or mental strain, tediousness, as well as heat and humidity. An Allowance Factor of 7% to 9% is considered an industry standard. Standard Time is calculated by multiplying Normal Time by 1 plus Allowances *(Fig 1.16)*.

Formula For Establishing Standard Time

ST = NT x (1 + Allowances)

Allowance Factor
Normal Time
Standard Time

Applied to FlexLock

ST = (20 sec.) x (1 + 0.09)
ST = 21.8 sec.

9% industry standard

Fig. 1.16

Applying the Standard Time formula to FlexLock®, and assuming all of the planned non-productive time, it takes an average person 21.8 seconds to stack a single FlexLock® unit. However, to be more conservative, it is recommended that in planning a job, a standard of 30 seconds should be used. This equates to 120 units per hour.

Safety

A. Safety Guidelines

Accidents may occur in the building industry. These may result in loss of time and partial or total disability. Many of these mishaps can be reduced if each person exercises care and observes the necessary safety precautions. Safety is the most important part of any job. The hazards of working with masonry are many and yet it is easy to forget them in the midst of the job. Still, the safety and well being of the workers must be of paramount concern.

While many of the designs and methods in this Guide have been tested for safety, there is still no substitute for common sense. Below are some general reminders of the precautions to be taken when working with masonry. In general, follow OSHA standards.

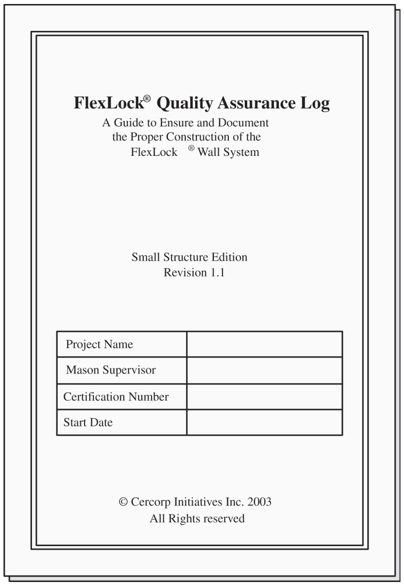
- Proper and appropriate safety training is essential.
- Make sure you use caution, care, and good judgment when following the procedures described in this Guide.
- Make sure that the electrical setup is safe: be sure that no circuit is overloaded, and that all power tools and electrical outlets are properly grounded. Do not use power tools in wet locations.
- Make sure you read container labels on paints, grouts, and other products: provide ventilation, and observe all other warnings. Consult MSDS for details.
- Make sure you read the tool manufacturer's instructions for using a tool, especially the warnings.
- Make sure you use the masonry saw in accord with the manufacturers safety instructions.
- Make sure you remove the key from any drill chuck before starting the drill.

- Make sure you pay deliberate attention to how a tool works so that you can avoid being injured.
- Make sure you know the limitations of your tools. Do not try to force them to do what they were not designed to do.
- Make sure the blade is secure in the masonrysaw before using.
- Make sure you use safety caps on exposed tendons as required by OSHA.
- Make sure you clamp small pieces firmly to a bench or other work surfaces when sawing or drilling.
- Make sure you wear the appropriate personal protective equipment when handling chemicals, doing heavy construction, or cutting.
- Make sure you wear a proper respirator when working around odors, dust or mist. Use a special filtering respirator when working with toxic substances.
- Make sure you wear eye protection, especially when using power tools or striking metal on metal or concrete: a chip can fly off, for example, when chiseling concrete.
- Make sure you are aware that there is seldom enough time for your own reflexes to save you from injury from a power tool in a dangerous situation: everything happens too fast. Be alert!
- Make sure you keep your hands away from the business ends of blades, cutters, and bits.
- Make sure you hold a portable circular saw with both hands so that you will know where your hands are.
- Make sure you use a drill with an auxiliary handle to control the torque when large size bits are used.
- Be knowledgeable of your local building codes when planning new construction. The codes are intended to protect public safety and should be observed to the letter.
- Avoid cutting very small pieces of masonry. Whenever possible, cut small pieces off larger pieces.

- Avoid changing a blade or a bit unless the power cord is unplugged. Do not depend on the switch being off; you might accidentally hit it.
- Avoid working in insufficient lighting.
- Avoid working while wearing loose clothing, hanging hair, open cuffs, or jewelry.
- Avoid working with dull tools.
- Avoid using a power tool on a work-piece that is not firmly supported or clamped.
- Avoid supporting a work-piece with your leg or other part of your body while sawing.
- Avoid carrying sharp or pointed tools, such as utility knives, awls, or chisels, in your pocket. If you want to carry tools, use a special purpose tool belt with leather pockets and holders.
- Make sure tendon couplings are fully engaged to their stop point to avoid coupling failure.
- Safety glasses and appropriate skin protection should be used when working with cement grout.

B. Quality Assurance

Unlike standard masonry, the FlexLock® Wall System requires precision units, a sound understanding of post-tensioned construction, and a comprehensive quality assurance guide. The FlexLock® Quality Assurance Log *(Fig. 2.1)* is designed to help supervising masons ensure and verify that FlexLock® structures are built in accordance with the highest standards. This requires strict adherence to the quality control requirements as set forth in the FlexLock® Quality Assurance Log and the Mason's Guide to the FlexLock® Wall System. Copies of the log can be obtained from licensed FlexLock® block producers or directly from Cercorp.



FlexLock® Quality Assurance Log

A Guide to Ensure and Document
the Proper Construction of the
FlexLock ® Wall System

Small Structure Edition
Revision 1.1

Project Name	
Mason Supervisor	
Certification Number	
Start Date	

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Fig. 2.1

Basic Print Reading

A. The Basics

The ability to read and understand architectural and engineering prints is an essential part of the masonry trade. These technical drawings describe the size, shape, location, and specification of various elements within the structure. The mason must be able to visualize these elements, translate them into standard trade practices so that the structure will be built as the designer intended. The following is only a basic overview of print reading with an emphasis on FlexLock® drawings.

LINE SYMBOLS

Line symbols are the most common element found on architectural drawings. A number of different line symbols are used to communicate specific aspects of the drawing. Traditionally, these symbols are referred to as the "Alphabet of Lines." *(Refer to Fig. 3.1)*

Border Lines

Border lines are solid, very heavy lines used to define a boundary. They provide a finished look to the print and indicate that no part of the drawing has been removed.

Object Lines

Object Lines are solid lines used to illustrate the outline of the visible features of an object. These may include such elements as walls, windows, and roof lines.

Cutting Plane Lines

Cutting plane lines are heavy solid lines used to show where an element has been sectioned to reveal internal features.

Short Break Lines

Short break lines are heavy solid lines used when a portion of the element is depicted as broken away to reveal a hidden feature. They are typically drawn freehand.

Hidden Lines

Hidden lines are broken lines that depict an edge or intersection of two surfaces that, from a given view, are not visible. Typically, foundation walls and footings are represented by hidden lines since, in elevation drawings, they are below grade and therefore invisible.

Center Lines

Center lines are broken lines that represent the center of symmetrical objects. On floor plans, these are often found in window or door openings.

Section Lines (Crosshatch Lines)

Section lines, sometimes known as crosshatch lines are light thin lines used to illustrate that a feature has been sectioned. They may be a general symbol or represent specific material. Typically, section lines are drawn at a 45m angle and approximately $^{1}/_{8}$” to $^{1}/_{16}$” apart.

Extension Lines

Extension lines are thin solid lines used to indicate where a dimension line ends.

Long Break Lines

Long break lines are thin solid lines used to indicate that all of the element(s) are not illustrated in the print. They have an “S” or “N” shape in the middle and usually extend $^{1}/_{16}$” past the element(s).

Dimension Lines

Dimension lines are thin solid lines used to illustrate the size or location of an element of the building. Typically they are placed outside the element they are describing unless space is limited. Every dimension line has a dimension figure, either a number or letter, placed in the middle of the line used to quantify the distance. Dimension lines are finished with some form of termination symbol.

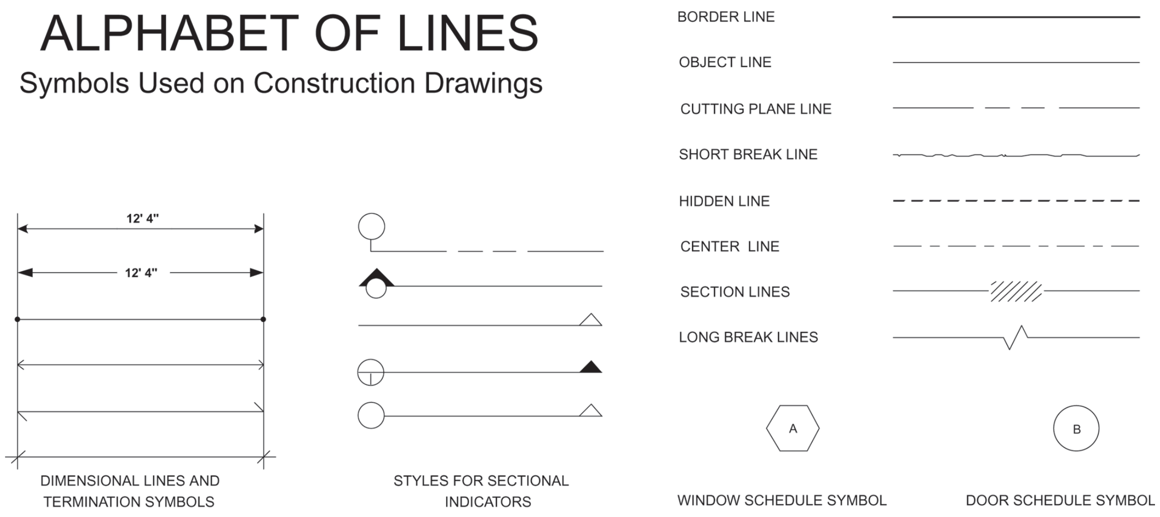


Fig. 3.1

SYMBOLS AND ABBREVIATIONS

Symbols and abbreviations are used on technical prints to save space. At times they may look like elements they represent, but most often they do not. Though an experienced mason should know topographical, plumbing, electrical and climate control symbols, this Guide will only concern itself with construction symbols. Some designers use modifications of the following: *(Fig. 3.2).*

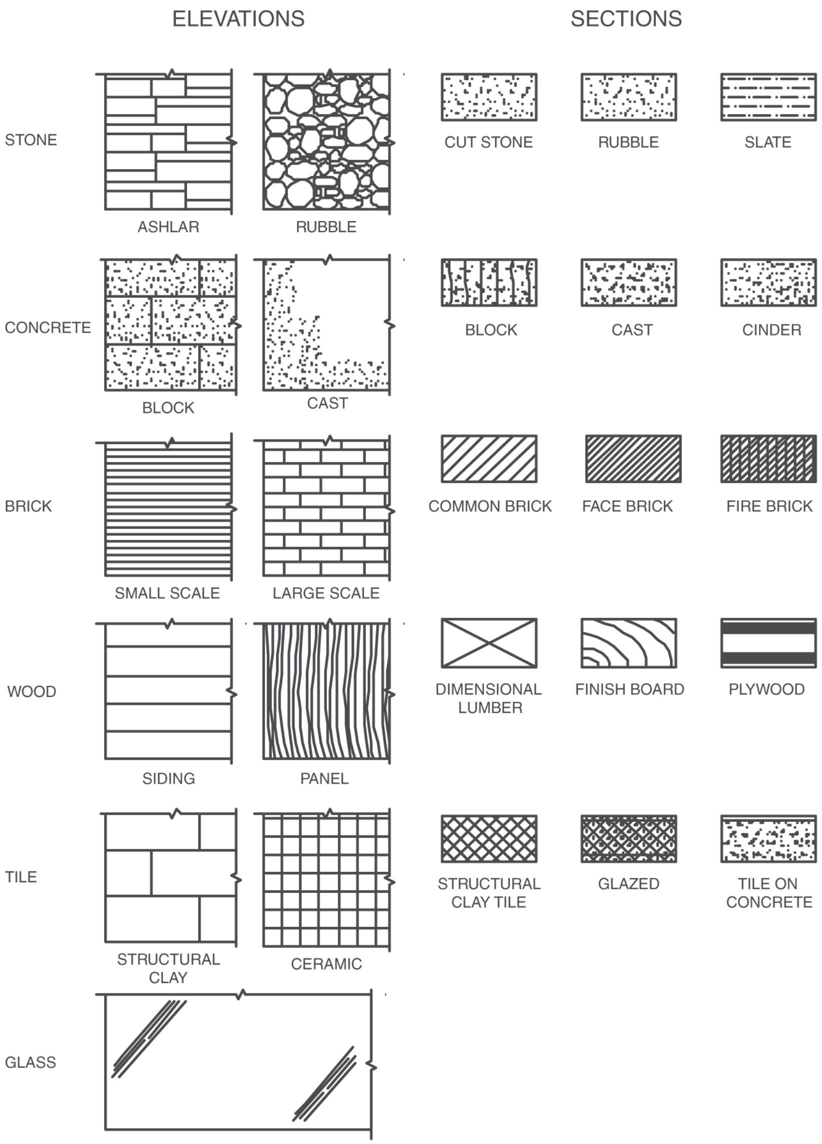


Fig. 3.2

Masonry Symbols

Key FlexLock® Symbols

While on paper the stretcher unit and the universal corner unit look somewhat alike, they are significantly different. The ability to see and understand this difference on the plans will avoid future problems in the field. In Fig. 3.3, the tendon is symbolized by either a small gray circle in the plan view or a broken line in the elevation view. This indicates that a vertical tendon occupies that slot.

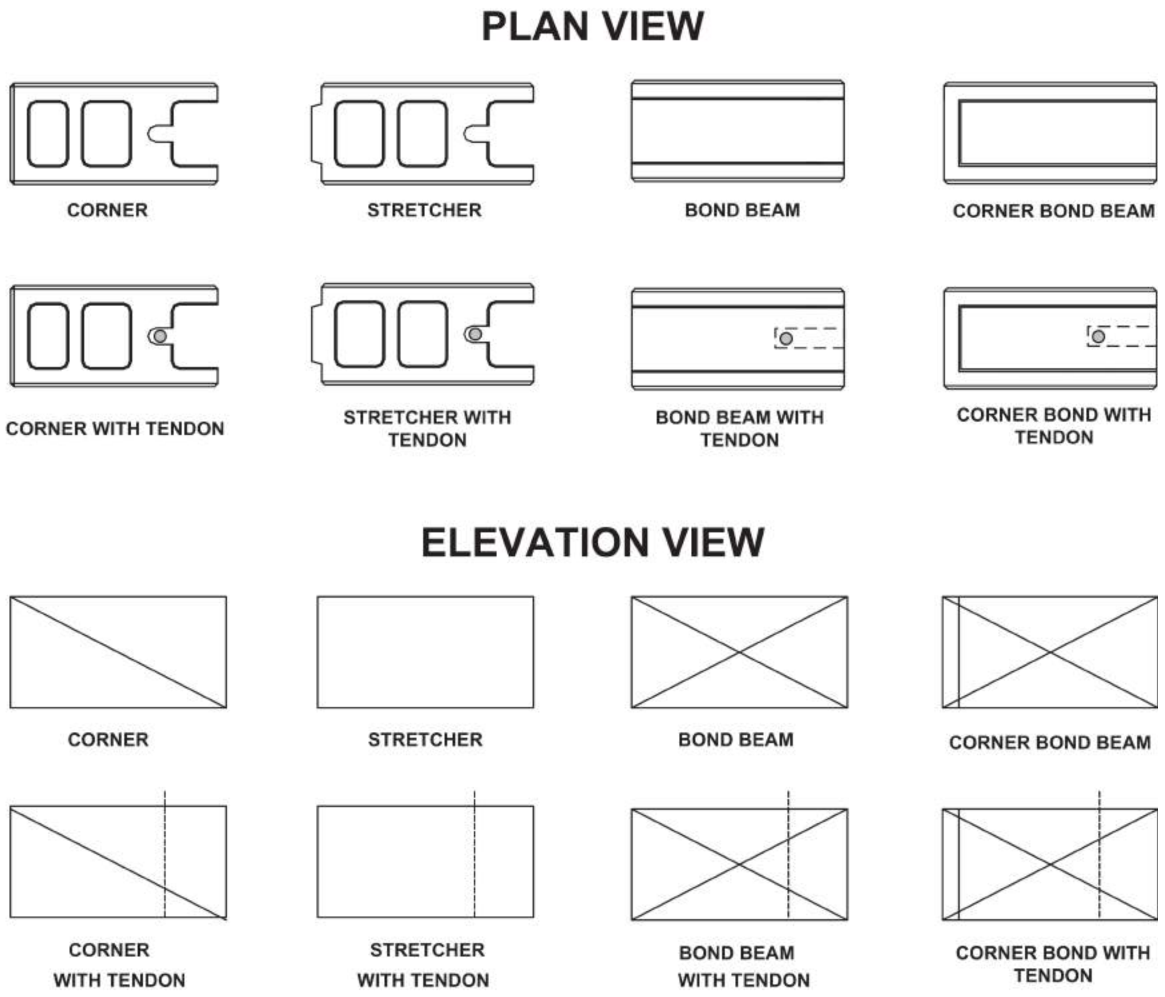


Fig. 3.3

Block Symbols

Depending on the required detail, diagonal lines on corner units may not be shown on elevation plans. In each of these cases adequate detail is already provided in the drawings .

The elevation view *(Fig. 3.4)* of a safe room indicates tendon placement and type of unit (stretcher or corner). Note that the tendons are placed 16” on center for maximum strength. Typically, tendons are placed 48” on center.

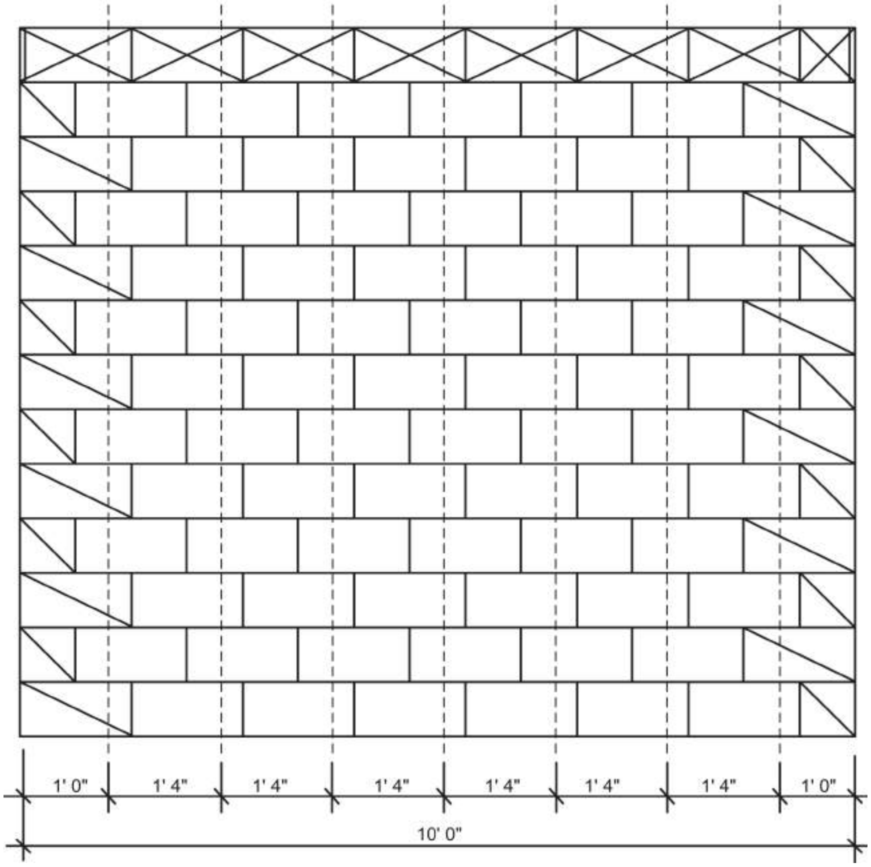


Fig. 3.4

Elevation View of FlexLock® Safe Room

In Fig 3.5, a (top) view of a FlexLock® safe room is shown. This simple drawing illustrates many of the line symbols discussed earlier. Also shown is the block orientation of the first course and the tendon placement in Fig. 3.6. Since correct block orientation and tendon placement are essential to the structural integrity of the system, masons must ensure that block are laid in the right direction and tendons are installed in their specified position. The designer determines the precise spacing of the tendons depending on the structural requirements.

IMPORTANT: The information contained herein has been compiled by Cercorp Initiatives Inc., and to the best of our knowledge accurately represents the application of FlexLock® technology in the illustrations and descriptions provided. Final determination of the suitability for the use contemplated, and its manner of use, are the sole responsibility of the user. Structural design and analysis shall be performed by a qualified engineer. It is the responsibility of the reader to ensure that the most updated information is used. Free updates to this edition can be found and downloaded at www.cercorp.com.

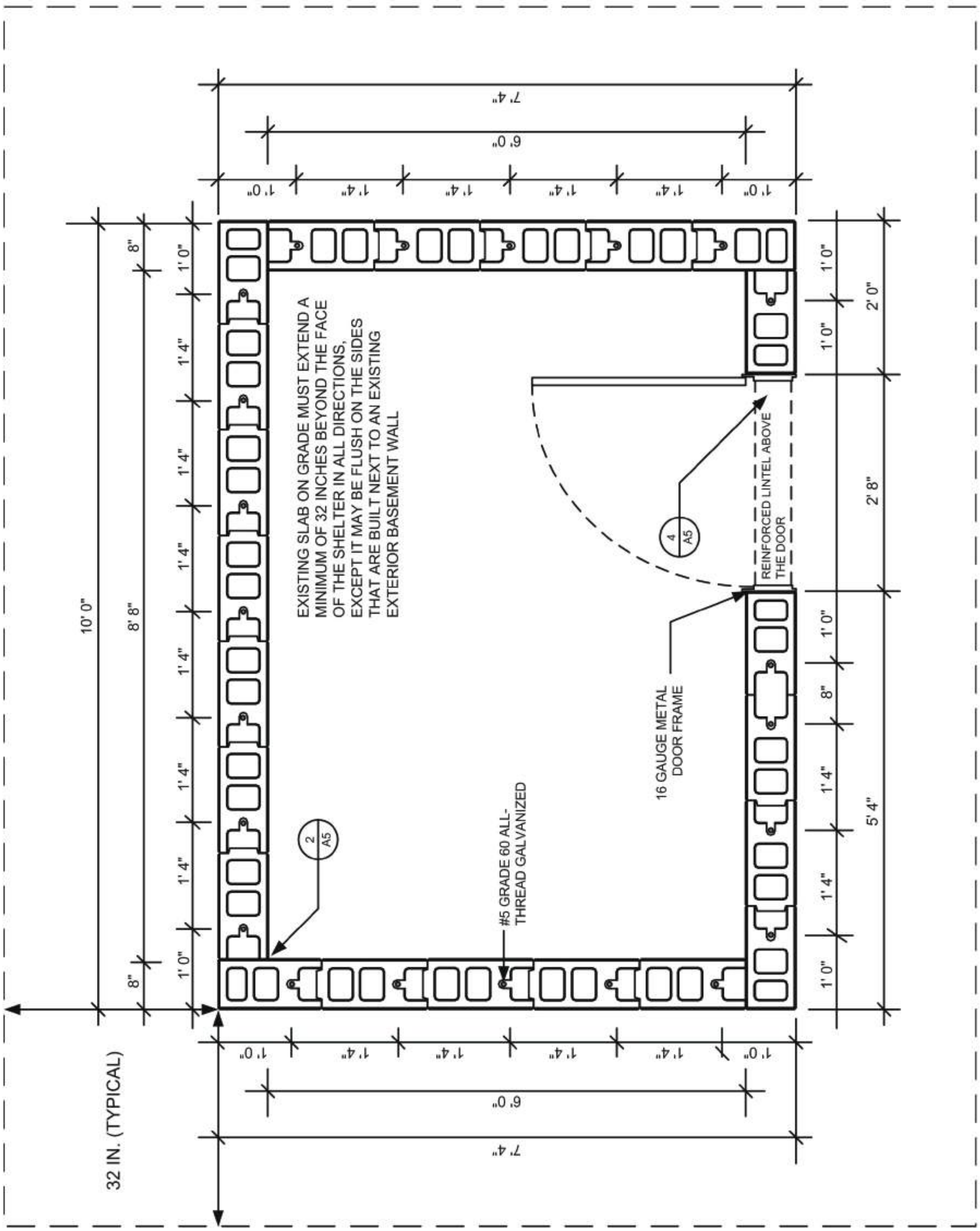


Fig. 3.5

Plan View of FlexLock® Safe Room

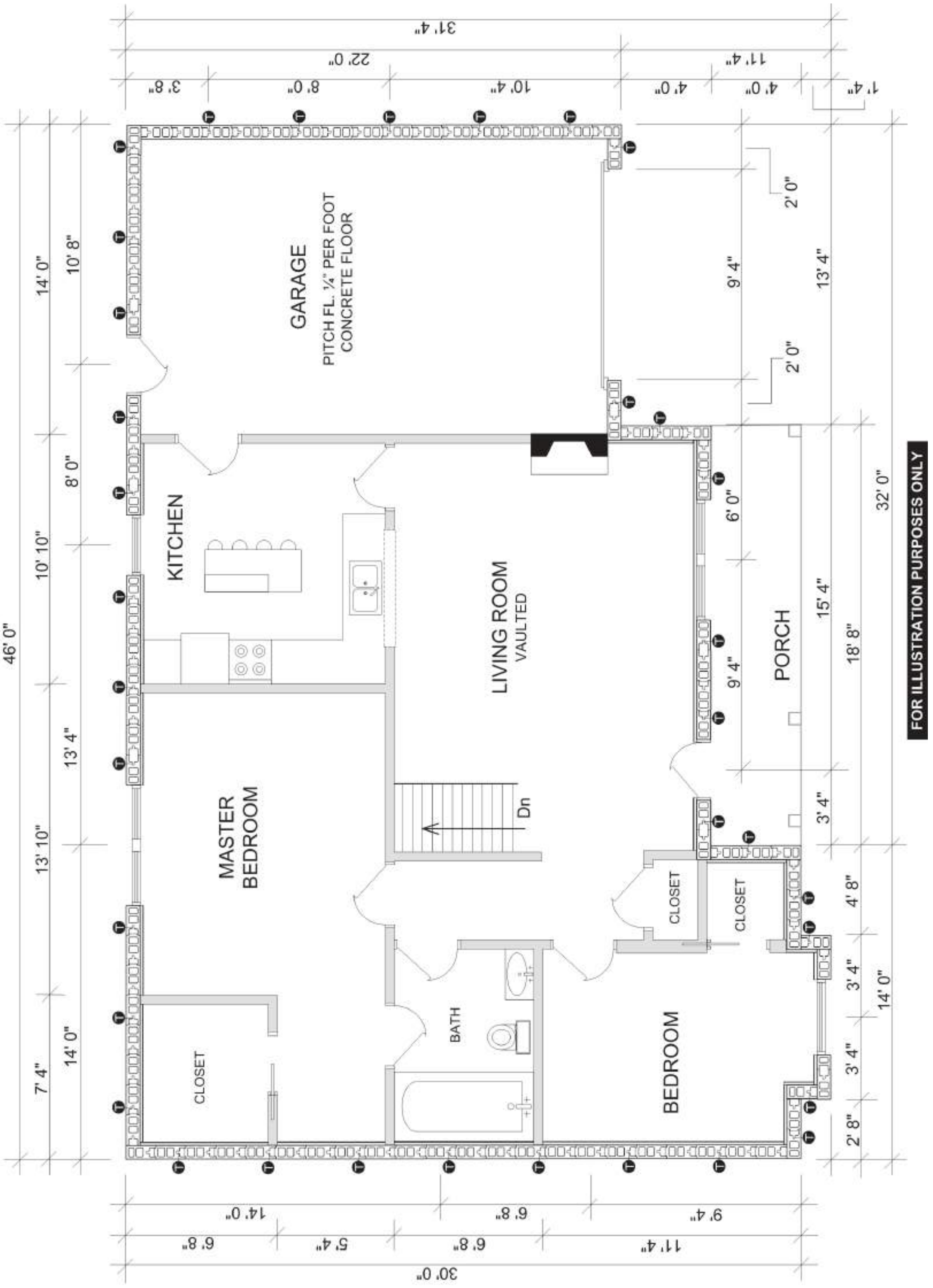


Fig. 3.6

House Floor Plan

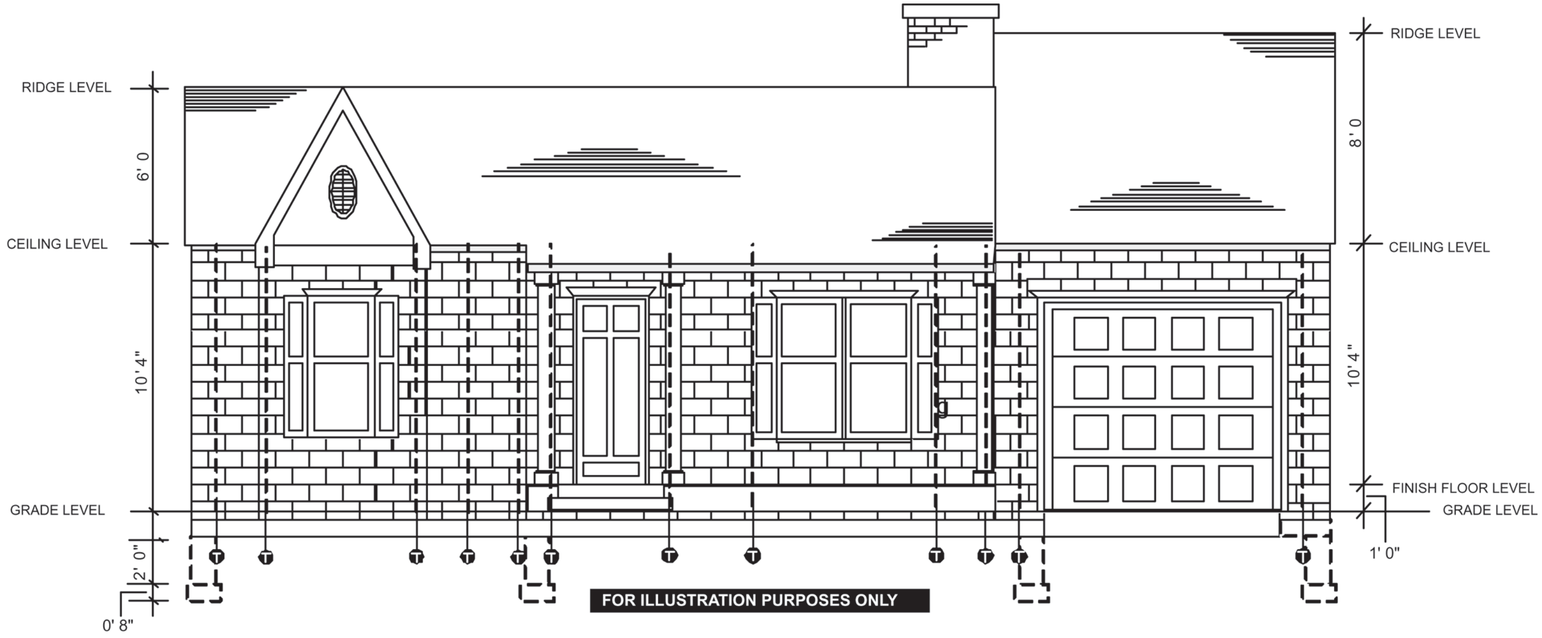


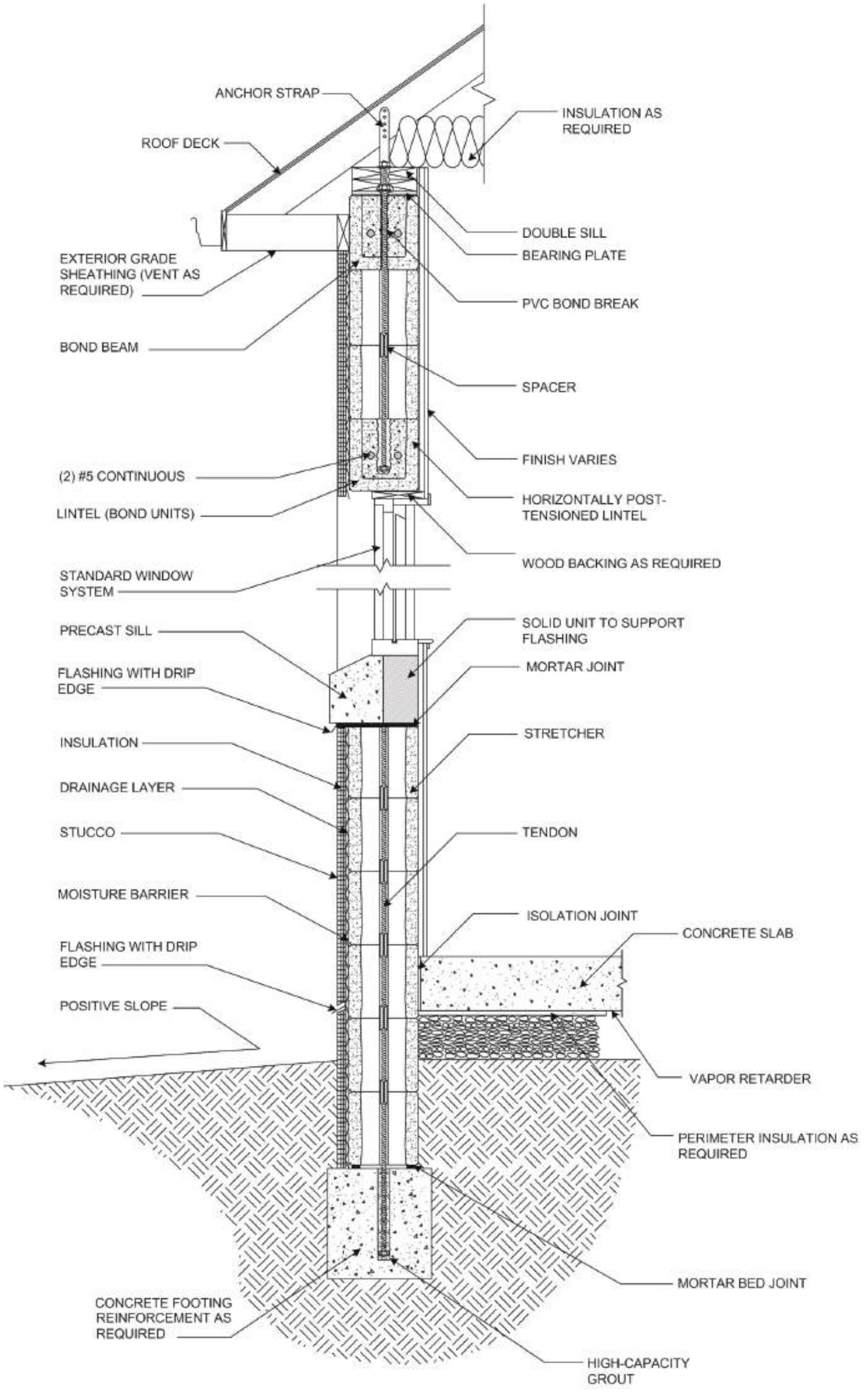
Fig. 3.7

House Elevation Plan

B. Details and Specifications

Beyond the plan and elevation drawings, a particular project will also consist of other technical prints. For instance, a roof or cellar plan may be necessary if the area is too complex or not shown clearly in other drawings. A framing plan, HVAC plan and plumbing plan may also be included, along with shop drawings to indicate such details as: reinforcing steel, cabinet work or electronics. Finally, drawing notes provide additional information to clarify details that might otherwise be confusing.

For the mason, the most common drawing is the wall section detail. A section detail is a longitudinal cut taken through the wall. It reveals the various wall components and how they relate (*Fig. 3.8, 3.9, & 3.10*). Other details such as: footings, stairs, fireplaces, and chimneys are typically provided. In addition, each set of drawings will come with a set of written specifications or "specs." These may range from a few pages to a few volumes. The drawings and the specs make up the construction documents. The construction documents provide a single reference point in the building process.



STUCCO EXTERIOR FINISH

Fig. 3.8

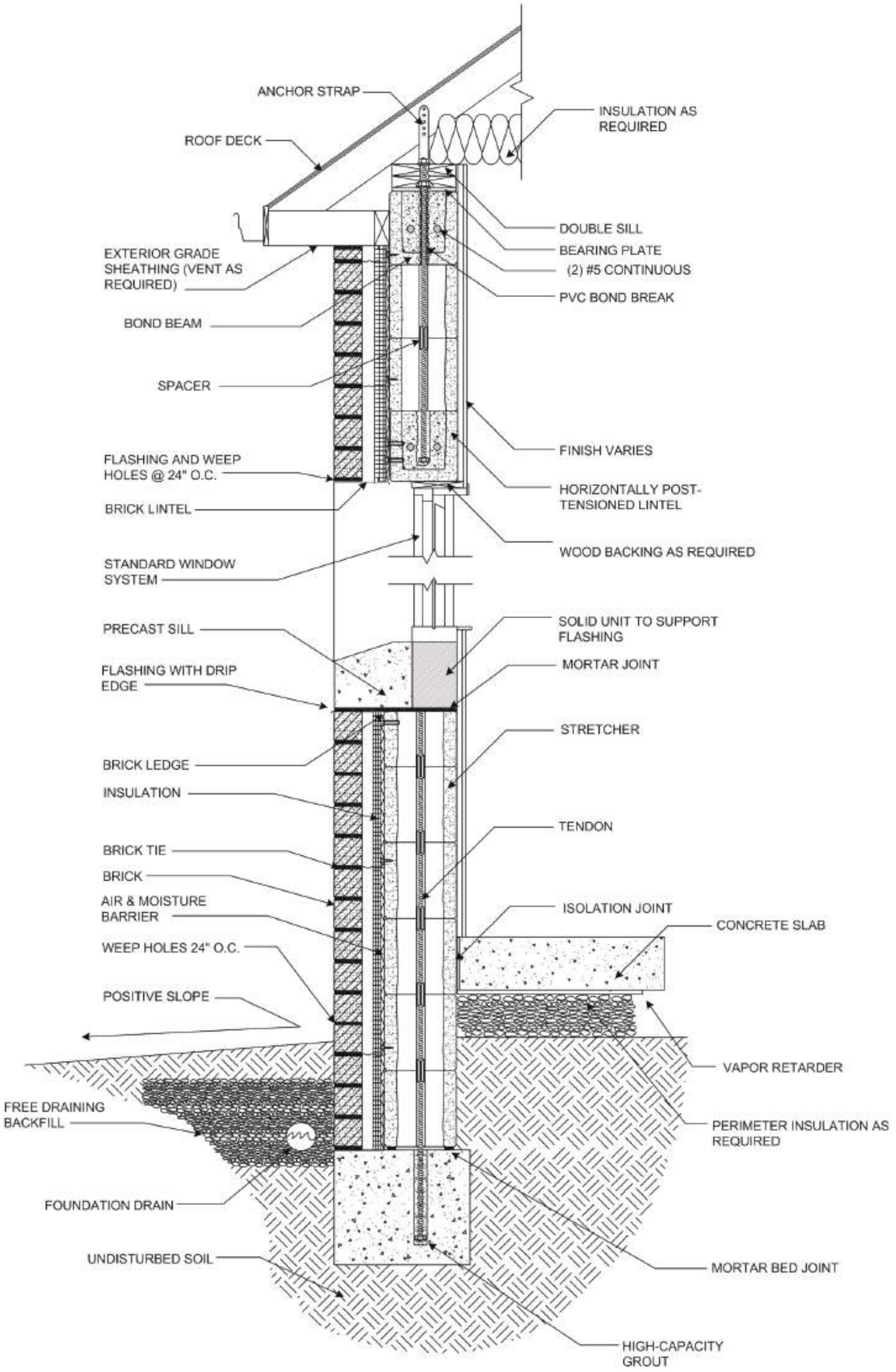


Fig. 3.9

BRICK VENEER

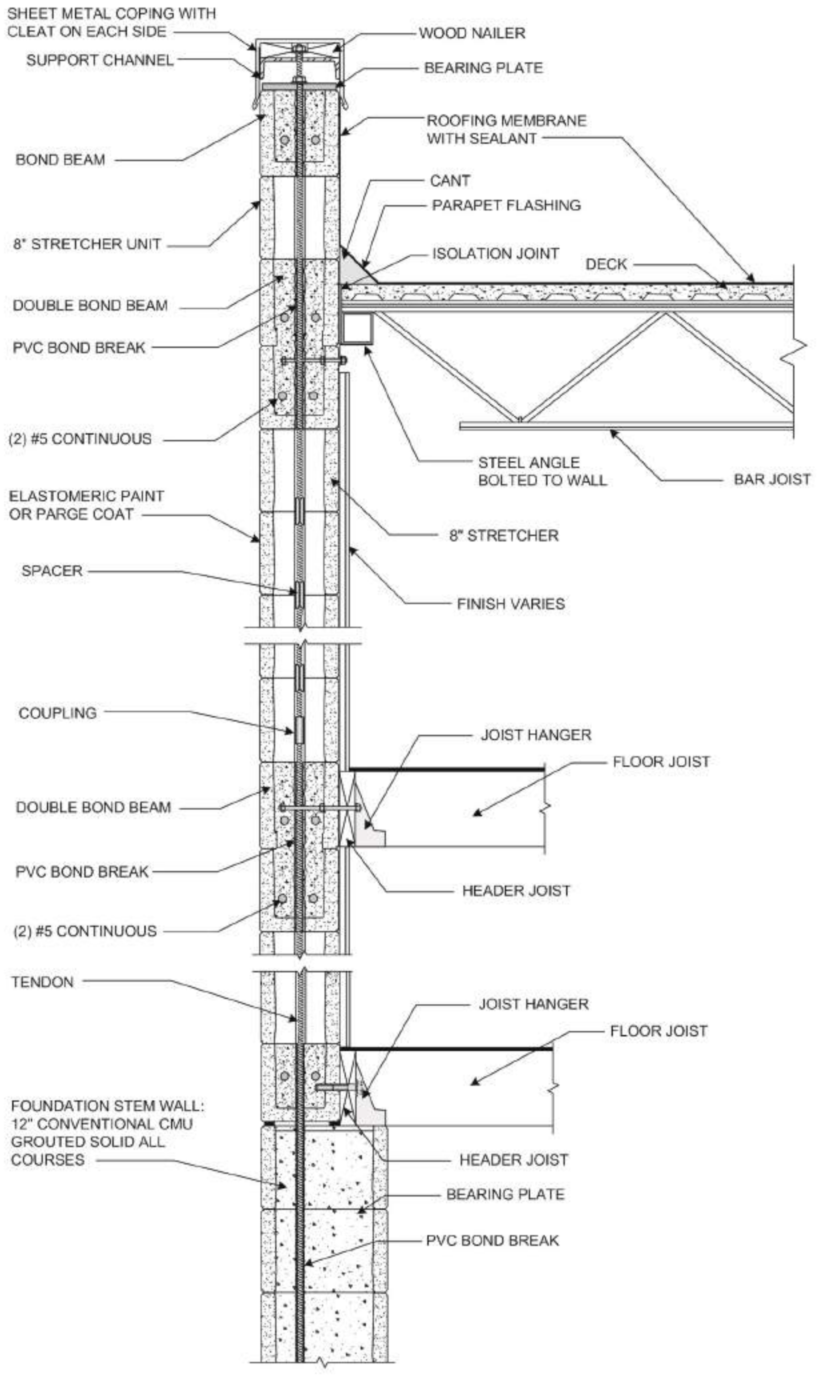


Fig. 3.10

SINGLE WYTHE WITH 12"
BASE AND PARAPET

Building Procedures

IMPORTANT : While FlexLock® construction is similar in many ways to conventional masonry, it is different enough to require a rethinking of how the project is managed. Developing a critical path that utilizes specialty teams will go a long way in avoiding delays and increasing productivity. A description of how this can be accomplish can be found in the chapter entitled, Managing FlexLock®.

Step 1 - Dig and Place Footing

As with standard masonry walls, a footing is necessary to distribute the building loads over a wider area *(Fig. 4.1)*. Typically, this is dug and placed by either the general contractor or a foundation sub-contractor. Footing size is generally related to such factors as: frost depth, soil conditions and the weight of the structure. Since this will vary depending on the type of structure, the footing must be in compliance with engineering specifications and local code requirements. Typically this will require a minimum footing of 12" wide by 18" deep. This is necessary to provide sufficient anchoring depth when using high capacity grout anchors. Care should be taken to ensure the footing is level and smooth and that the reinforcing bars do not interfere with tendon placement.

NOTE:
WHEN POURING THE FOOTING, ENSURE THAT THE REBAR ARE PROPERLY PLACED AND THEY DO NOT INTERFERE WITH DRILLING OF THE ANCHOR HOLE.

Fig. 4.1

Pouring the Footing

Step 2 - Laying Out the Wall

IMPORTANT: Consult and follow the FlexLock® Quality Assurance Log before construction. Ensure that all FlexLock® related work is conducted under a certified mason supervisor.

One of the most important parts of the project is laying out the wall. This begins by cleaning debris from the top surface of the footing, allowing for a good bond between the footing and the first course. Oil, grease, mastic, dirt, dust and loose concrete will act as a bond break and prevent mortar from adhering to the footing.

Following the design specifications, snap a chalk line outlining the perimeter of the building *(Fig. 4.2)*. Using a tape measure, ensure that the lines are square. Once the perimeter chalk line is set, make perpendicular marks showing the position of tendons as specified in the engineering drawings using the first course layout as a guide *(Fig. 4.3)*. Door openings should also be chalked in at this time.

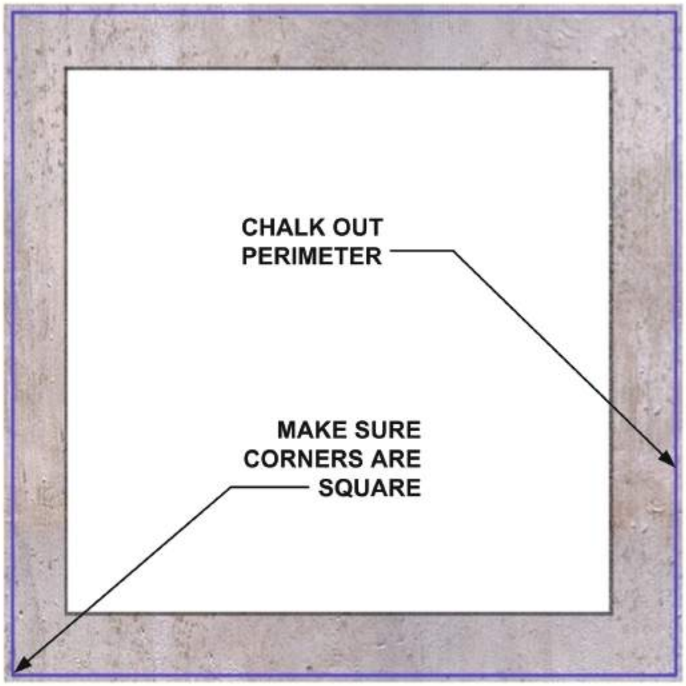


Fig. 4.2

Laying out the Perimeter

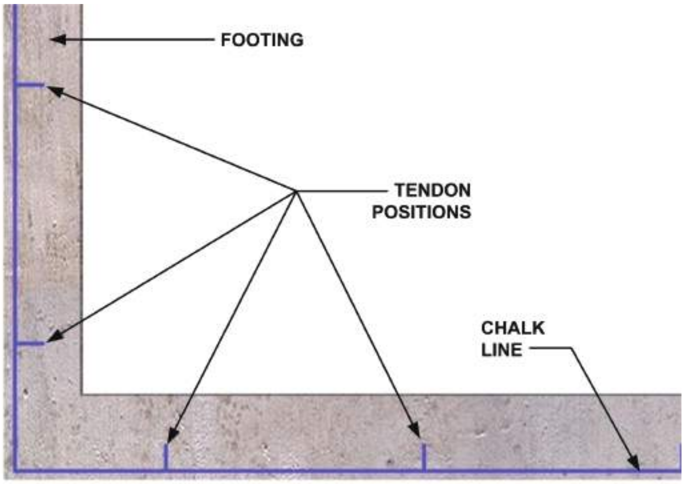


Fig. 4.3

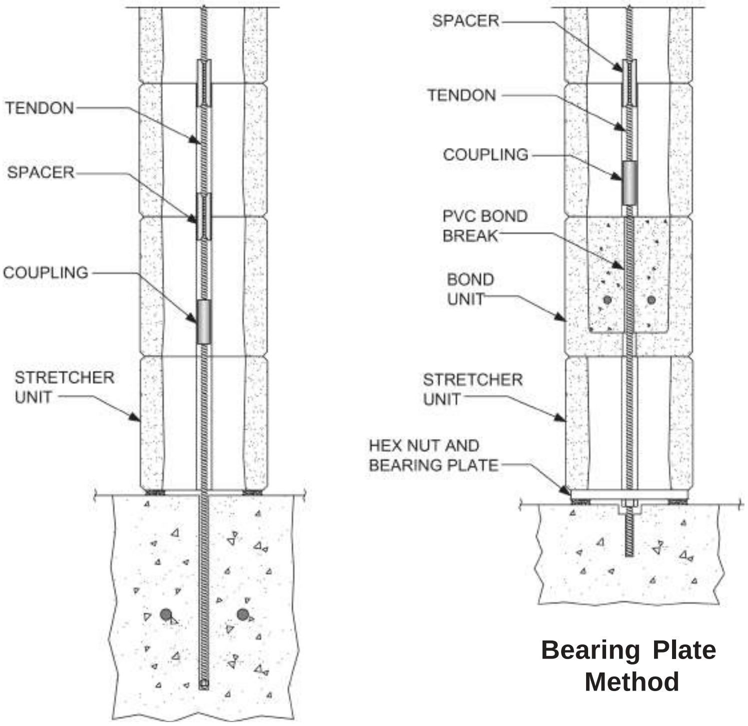
Marking the Tendon Position

Step 3 - Measuring Anchor Placement and Drill Holes

There are two methods of anchoring the tendons with the FlexLock® Wall System. Depending on the particular circumstances, either one can be used to achieve post-tensioning. A brief description is provided below with a more detailed descreption to follow.

As the name implies, the Footing Method of anchoring *(Fig. 4.4)* casts short tendon segments into the footing. This is accomplished after the footing is sufficiently set by drilling holes, filling them with high capacity grout, and then installing the anchor assembly. Once the high capacity grout cures, larger tendon segments are secured through the masonry and up the wall using stop-type couplings. When the tendons are tensioned, the masonry is compressed between the top bond beam and the footing enabling the wall to achieve its strength.

The Bearing Plate Method of anchoring *(Fig. 4.4)* uses an assembly comprised of a short tendon segment with a bearing plate sandwiched at the bottom. This assembly is situated between the footing and first course with the bearing plate resting against the bottom of the masonry unit embedded in the mortar bed. A portion of the tendon may extend into the footing, through a drilled hole, to act as a shear pin if required. Assembly of the wall can begin immediately with tendon segments attached through the use of stop-type couplings. When the tendons are tensioned, the masonry is compressed between the top bond beam and the lower bearing plate enabling the wall to achieve its strength. The Bearing Plate Method is typically used when there is insufficient footing or slab depth to support the Footing Method. When the Bearing Plate Method is used, the second course must be made up of bond units and fully grouted *(Fig. 4.4)*.



Bearing Plate Method

Footing Method

Fig. 4.4

Anchoring Methods

Footing Method of Anchoring

From the perpendicular tendon marks, measure 4” *(Fig. 4.5)*. This indicates the drill position for the tendon holes. String out the first course without mortar to check the layout and hole positions. By laying out the first course dry, it is possible to make an actual or three-dimensional check and avoid future problems *(Fig. 4.6)*.

When this is accomplished, a check can be made by taking a 16” section of PVC bond break and taping a large black indellible magic marker to the bottom *(Fig. 4.7)*. The tendon marker is then inserted into the designated tendon slots to verify correct tendon placement.

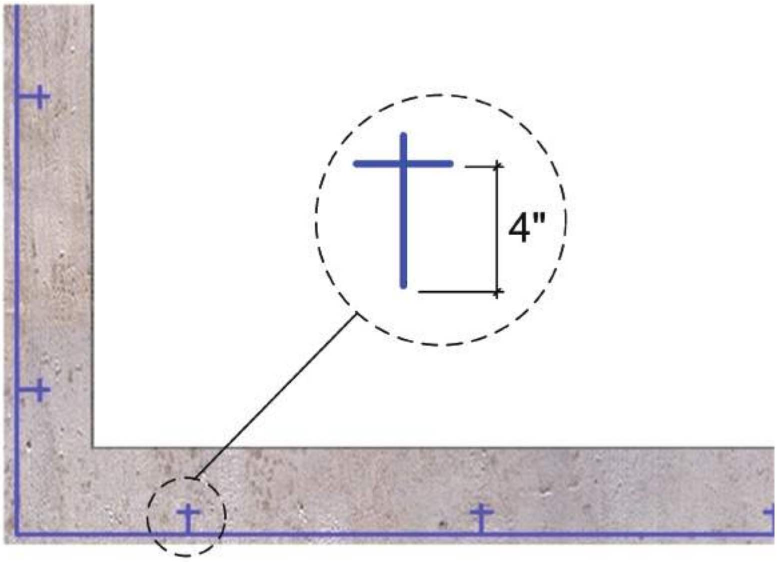


Fig. 4.5

Preparing to Drill for Tendon Placement

**Note:
Ensure porper orientation of the block and that the raised webs are at the top of the unit.**

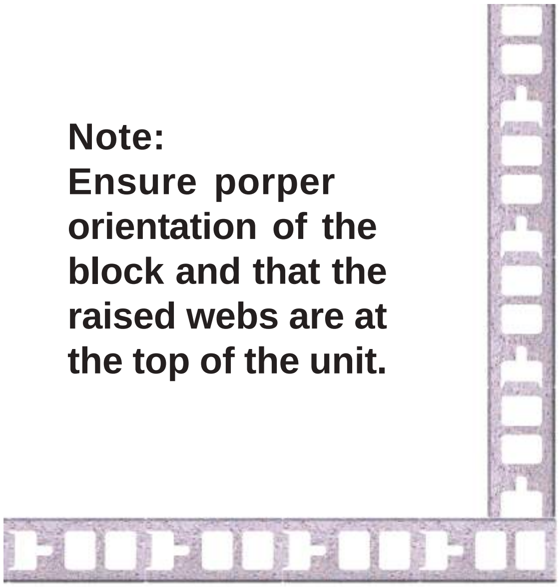


Fig. 4.6

First Course Layout

Fig. 4.7

Tendon Marker

Alternate Way of Determining Tendon Position

Because of the relatively small size of the vertical tendon slot in the unit, an error in measuring can result in serious misalignment problems. One way to overcome this is to dry lay the entire first course. Then, using an SDS hammer drill with a 1¼” masonry bit, drill a pilot hole through the tendon slot in each of the units requiring a tendon *(Fig. 4.8).* With the pilot holes complete, remove all of the block from the first course, and redrill the holes to the proper depth.

Take care to make sure that the blocks are orientated in the proper direction as specified on the drawings and that the head joints are butt against each other. Both the plan view (top) and elevation view (front) of the drawings should be consulted often to obtain accurate dimensions and block positions. The newly drilled holes should be located directly below the slots in the units. Depending on the application, not all units will have tendons running through them. Tendons are typically placed at 48” intervals but may be placed at 32” or 16” if required. Consult the drawings for proper tendon placement. With the layout, orientation, and hole positions verified, begin the anchor process.

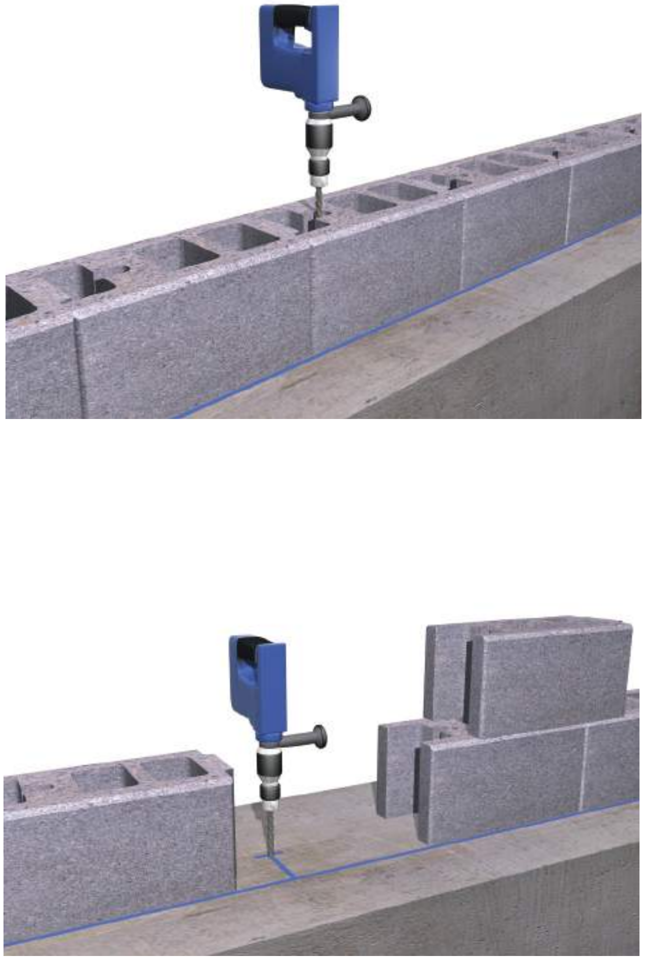


Fig. 4.8

Tendon Placement

Placement of Anchors

IMPORTANT: This is a critical component of the construction process. Great care should be exercised in following this procedure as any deviation could result in a bond failure. A FlexLock® certified journeyman mason should oversee and verify this operation. Since the high capacity grout for the anchors may take as much as 2 hours (quick setting) to 48 hours (slow setting) to reach adequate strength, it is essential to plan ahead in order to avoid delays.

1. Use proper safety equipment when using cement grouts (safety glasses and skin protection).

2. If the anchor holes have not already been drilled, drill a hole 12” deep (unless otherwise specified) in concrete footing using a hammer drill. The drilled hole should be 1¼” in diameter and should be clear of any reinforcing bar. Care needs to be taken to ensure that the hole is drilled

straight (vertical). Suggestions in assisting straight hole drilling include the use of drilling templates, leveling devices, doweling jigs, etc. It is important to note that the deviations of more than a few degrees can subject the anchor to bending.

3. Flush all holes clean with water and then blow excess water clear with compressed air.

4. Mix high capacity grout according to directions on the grout packaging. Use only grout approved for the FlexLock® system. This may either be a slow setting grout (48 hours) or a fast setting grout (2 hours). Never use epoxies in place of grout as these will soften under fire conditions resulting in significant load loses.

IMPORTANT: If the grout is not mixed properly or if the water cement ratio is incorrect, bond failure may occur.

5. When using the slow setting grout, the preferred method of grouting the anchor holes is with a hand grout pump *(Fig 4.9)*. This is because the pump allows the hole to be filled from the bottom up, eliminating air holes. A small tube is connected to the discharge end of the pump with the other end of the tube placed at the bottom of the anchor hole. Grout is pumped until it reaches the top of the hole. As the tube is removed and the level drops, continue to pump so that when the tube is completely removed, the grout is at the top of the hole. This method is by far the fastest way to grout. If a grout pump is unavailable, grout can be poured into the anchor holes with a funnel or large paper cup.

Fig. 4.9

Grout Pump and Anchor Assembly

6. When using an approved fast setting grout, take into consideration the workability time or pot life. This may be from 15 to 30 minutes depending on the mix design and water cement ratio. Follow the manufacturer's instructions exactly, and do not increase the amount of water to improve flowability. This will result in a weaker compressive strength and potential anchor failure. A grout pump should never be used with fast setting grout. Instead, the grout should be poured into the anchor holes using a small container.

7. Assemble the anchor system by screwing a hex nut on the bottom of a 32" tendon *(Fig 4.9)*.

8. Insert the anchor tendon into the drilled hole until it bottoms out by slowly screwing it in clockwise while pushing it down. This will allow the grout to flow around the deformations on the tendons. When the anchor reaches the bottom of the hole, secure a centralizing washer in the hole to align the anchoring tendon. **Remove excess grout around the base of the tendon.** This is critical for the bond test. Using a torpedo level, ensure that the anchor tendon is bottomed out and plumb. Once placed, do not disturb the anchor tendon until the grout has hardened.

9. Do not tension the anchor until the grout has reached adequate compressive strength which is typically between 5000-6000 psi. Low or high temperatures can delay or accelerate the setting of the grout.

IMPORTANT: Since slow setting grout may take as much as 48 hours to reach ultimate strength, it is essential to plan ahead in order to avoid delays.

Tendon Placement

The number and placement of tendons are critical to the integrity of the structure. Typically, these should be placed no less that 48” on center. However, because of door and window openings, as well as code and engineering requirements, consult an engineer familiar with the FlexLock® Design Guide before building.

Bond Test

Bond failure between the footing and the grout can occur because of poor surface preparation, the presence of contaminates such as oil or grease, insufficient mixing time, a disproportionate amount of water and adverse weather conditions. To verify the bond, a test must be conducted on each anchor tendon. The ability to test the anchors at this stage of construction will greatly reduce the time and expense incurred in the unlikely event of bond failure.

The bond test requires the use of a center-hole jack. This is the same jack used to tension the tendons at the top of the wall. This light weight unit can be purchased through Cercorp, or rented at your local block plant.

<u>Testing each anchor tendon prior to wall construction is critical.</u> Along with the test, a flat washer and hex nut is placed at the base of the anchor tendon against the footing to continue the tension after the jack is removed. This allows the anchor tendon to seat itself in the high capacity grout, and reduce overall load losses after the system is completely assembled.

Test Procedures

1. Make sure the grout is completely cured as per manufacturer's instructions.
2. Remove any loose debris from around the anchor tendon.
3. Place a flat washer and hex nut over the anchor tendon and screw down hand tight to the base against the footing.
4. Place the center-hole jack *(Fig. 4.10)* over the anchor tendon and around the base nut and washer.
5. Connect the jack to the tendon using the quick release clam shell and locking sleeve.
6. Pump the jack to the recommended tension.
7. Using a wrench, snug down the base nut until the pressure drops off on the jack's gauge. This will maintain the tension in the anchor zone after the jack has been removed.
8. Release the pressure, disconnect and remove the jack.

Fig. 4.10

Center-Hole Jack

9. Inspect the anchor tendon and surrounding grout plug for any signs of failure.
10. If the anchor tendon fails, remove the tendon, and repeat the installation process.

Test Cylinder

IMPORTANT: It may be required that a test cylinder be filled with grout to verify the strength should it be called into question after construction. The grout sample cylinder could eliminate any claim that the grout was mixed incorrectly. Test cylinders can be obtained from local material testing labs. The cylinder should be left in a secure place at the site for 24 hours so that weather conditions would be similar to those of the anchors. Using indelible magic marker, indicate the job number and date of the project. Store for a period no less than three years. Check with the architect or building official to determine if this test is required.

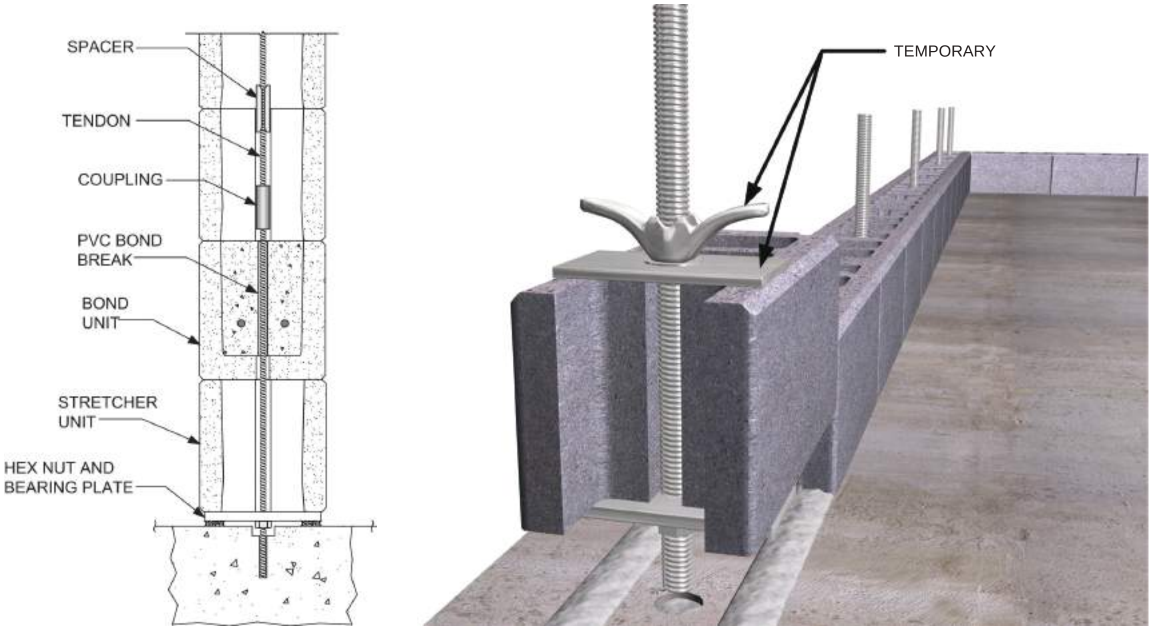


Fig. 4.11

Bearing Plate Method

Bearing Plate Method

As indicated earlier, another means by which tendons can be anchored is the Bearing Plate Method *(Fig. 4.11)*. This method accomplishes post-tensioning between a bearing plate under the first course and the top of a bond beam. The Bearing Plate Method is typically used when there is insufficient footing or slab depth to support the Footing Method.

Procedures

1. After the perimeter of the building has been chalked out, dry lay the first course.

2. Determine from the drawings the position of the tendons and indicate their placement on the footer next to the dry laid units.

3. Assemble the anchor assembly. This will consist of a 32" tendon, a bearing plate, and two hex nuts. The bearing plate is secured to the anchor tendon by sandwiching it between the two hex nuts. The placement of the bearing plate in relation to the anchor tendon will depend on whether the tendon will extend below the plate and into the footing. This configuration is used to pin the wall in place preventing lateral movement *(Fig. 4.11)*.

4. Using an SDS hammer drill, drill a hole through the vertical slots of the units that will have tendons passing through them. If the tendon will not extend below the plate, the hole should be in 1½" diameter with a depth of 1". This will accommodate the hex nut at the bottom of the bearing plate. If the tendon will extend below the plate to pin the wall into place, drill a 1¼" hole to a depth corresponding to the length that the tendon extends below the plate. It may be necessary after an initial pilot hole is drilled, to move the masonry units to achieve the desired depth. After this hole is drilled, using a 1½" diameter bit, counter bore that hole about an inch in depth. This will accommodate the hex nut at the bottom of the bearing plate.

5. Move the first course aside and blow the dowel holes clear with compressed air.

6. Follow the procedures found in Step 4 - Setting the Corners.

7. Lay the remaining block of the first course using the procedure found in Step 5 - Laying the First Course. Ensure that when placing the plate of the anchor assembly beneath the unit, no mortar gets between the plate and unit. One way to do this is to temporarily secure the anchor assembly to the unit using a second plate on top of the unit with a wing nut *(Fig. 4.11)*. If the tendon extends below the plate and into the footing, place a sufficient quantity of mortar in the hole to eliminate drift.

8. Once the block is laid and supported by the mortar on the bed joint, the wing nut and bearing plate can be removed. Place a stop-type coupling on the top of the tendon assembly and do not disturb until the mortar is set.

Special Note: In some high tension applications, it may be necessary to completely grout the cores of stretchers with anchor tendons.

9. Using the One Forward, One Back Method (described in Step 5 - Laying the First Course) dry-stack the second course with bond units modifying them as necessary to allow anchor tendons to pass through. Place a PVC bond break around each of the anchor tendons and stuff grout stop around the base of the bond break to keep the grout from flowing out. Reinforce the bond course with two #5 rebar and grout solid to ¼" below the top of the unit (Fig. 4.11). Make sure that the top of the shells on the bond course are completely free of any grout or foreign materials.

10. With the second course completely grouted, carefully dry-stack the third course with stretchers, ensuring their proper orientation with the prints. Great care should be used so as not to disturb the anchor tendons. Continue laying up the wall as described in Step 6 - Building the Corner Leads and Step 7 - Laying the Courses.

Step 4 - Setting the Corners

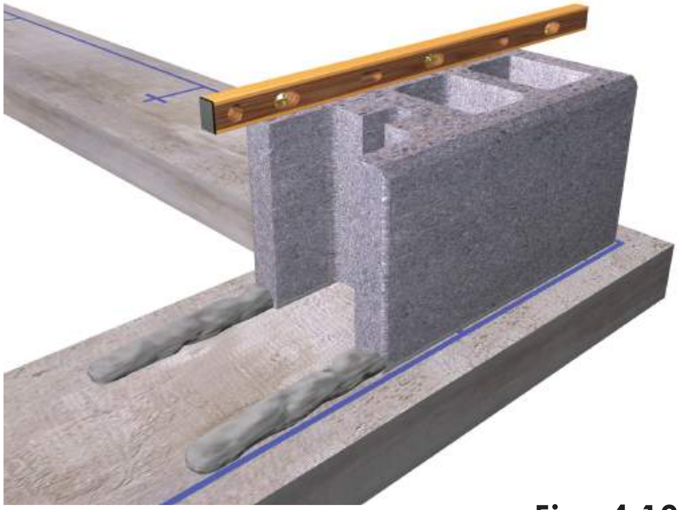


Fig. 4.12

Setting the Corner Block

IMPORTANT: As block is laid, make a quick visual inspection of the top of the shell. These bearing surfaces have been precision ground to prevent point loading. Any units that appear spalled or damaged are to be discarded. Failure to do so could compromise the integrity of the wall.

Setting the corners and laying the first course **MUST BE DONE BY A JOURNEYMAN** and employs the same process as conventional masonry. Apply a mortar bed in the corners and set the corner blocks in place. In order to facilitate an adequate bond and compensate for irregularities in the height of the footing, the mortar must be full, but no less than ¼" thick. An overly thick bed does not hold the block well and takes longer to set.

Be sure to orient the units in accordance with the plan drawings and align them with the chalk line *(Fig 4.12)*. Bring the corner units to course height by using either a transit or a laser level *(Fig. 4.13)*. The elevation, orientation and position of these units are critical to the integrity of the structure. On the first course, continually check the level of each unit along and across the top of the face shells.

Step 5 - Laying the First Course

With the corner units in place, use a trowel to spread a mortar bed between the corners. This levels the first course, keeps water out, and forms a solid bond between the structure and the footing. The mortar should be between ¼" and ⅜" thick. If a low spot is discovered while laying the first course, compensate by using mortar to correct the elevation. High spots may be cut away.

A nylon mason's line (string line) is used to ensure that the face shells are flush with one another. The line is stretched tightly from corner to corner and a line level is placed

Fig. 4.13

Bringing the Corners to Elevation

toward the middle. So as not to move the corners, a second block can be placed upright along each of the corners. A mason's line can then be stretched between these blocks without fear of displacing the leveled and plumbed corner blocks. The line is used to align the face of the units, and is moved up to each course as the wall is laid.

Fig. 4.14

Laying the First Course

In long spans, the mason's line may sag. This can be corrected with the use of a trig. A trig is a metal strip about four inches long with a slot at one end to hold the mason's line. This requires a stretcher to be temporarily placed in the middle of the span and brought to the proper elevation with a laser level. The flattened end of the trig is placed on this block with the slotted end catching the mason's line. A scrap piece of masonry is used to hold down the flat end of the trig on top of the stretcher from the corners to the centers.

Before laying the first course, consult the drawings to determine the type and placement of flashing and weep holes, if required.

Special Note: While much of the same information applies, this section will focus exclusively on laying the first course using the Footing Method of anchoring.

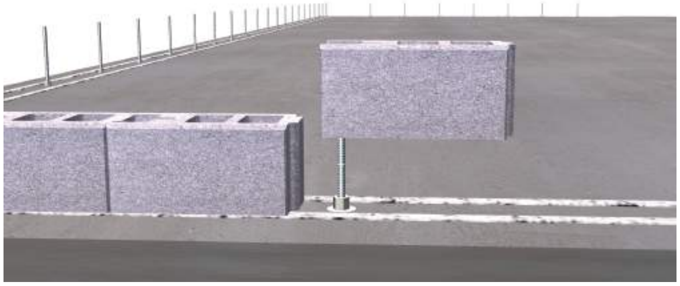


Fig. 4.15a

Position over Tendon

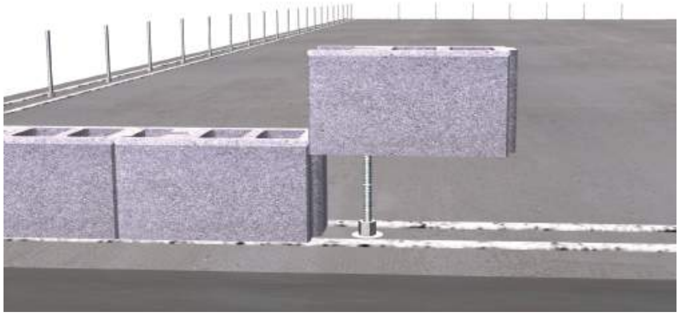


Fig. 4.15b

Align with Head Joints

General Considerations

Begin by laying the stretcher blocks in the proper orientation from the corners to the centers. As each unit is laid, place it over the tendon if one is present *(Fig. 4.15a)*. Then move the block so the head joints meet the previously laid unit *(Fig. 4.15b)*. Now, keeping the head joints aligned, slide the unit down into the mortar bed *(Fig. 4.15c)*. Care should be taken not to slide the units after they have been laid in mortar. This will result in squeezing mortar between the lower part of the head joints. Always position the block at the top and slide down into position. **THE UNITS ARE LAID WITH THE SIMULATED MORTAR JOINTS (CHAMFER) UP. DO NOT MORTAR THE HEAD JOINTS**. The dry head joints must be butted against each other with the face shells laid to the mason's line. In laying the units, place flashing and weep tubes as required by the drawings. Note any door openings and lay block accordingly *(Fig. 4.16)*. These openings require a corner block oriented so that the flat end faces the opening. This provides a smooth uniform surface facilitating the placement of a jamb. More detail on jambs, sills, and lintels are found later in this chapter.

Fig. 4.15c

Slide Down

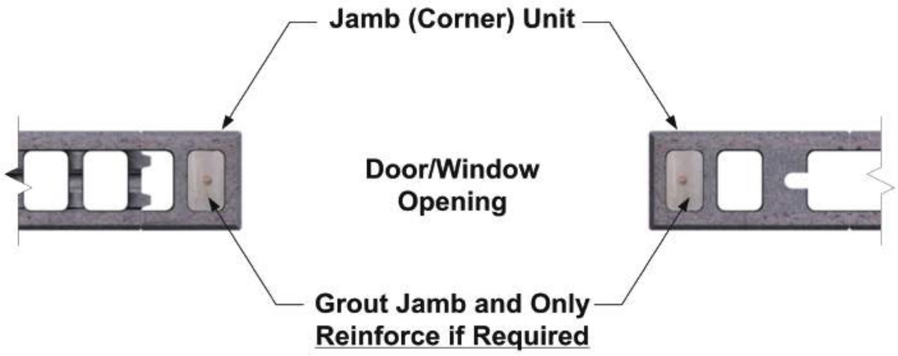


Fig. 4.16

Universal Corner Units Used as Jamb Blocks

Each unit must be checked to ensure that it is level, plumb and true. **ANY MISTAKE ON THE FIRST COURSE WILL WORK ITS WAY UP THE WALL SO IT IS CRITICAL THAT THIS PART OF THE CONSTRUCTION BE DONE BY AN EXPERIENCED JOURNEYMAN.**

Leveling the First Course

Laying the first course is critical to the integrity of the structure. This should always be accomplished by a FlexLock® certified journeyman bricklayer.

Unlike standard masonry, with FlexLock®, the first and second course are laid at the same time. This method was developed to eliminate the possibility of step joints. A step joint is any head joint where adjacent units are not at the same level, formng a slight step in the joint *(Fig. 4.17a)*. If a step joint occurs in the first course it can lead to point loading resulting in cracked block once the system is tensioned. Beyond the point loading issue, if a step joint is not repaired on the first course, it will only repeat itself each course as the wall is stacked up. Consequently, step joints must be remedied at the first course. Step joints can be repaired after the mortar on the first course has set, however care in laying the first course should virtually eliminate this problem. The method for repairing step joints can be found in Chapter 5, Section L of this Guide.

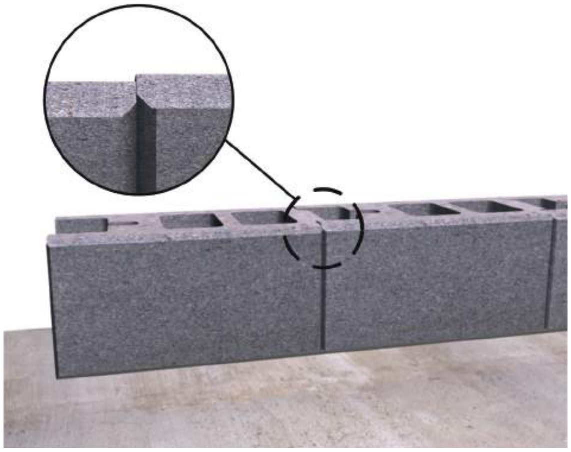


Fig. 4.17a

Since repairing step joints can be time consuming, the following procedure should be closely followed.

Procedure (One Forward, One Back Method)

1. With the corners set to elevation, lay the first unit level and plumb *(Fig. 4.17b)*. Check to ensure that there are no step joints between the new unit and the adjacent unit.

2. Now stack the first unit on the second course *(Fig. 4.17c)*. If there is a step joint below, the weight of the unit above will press upon the high portion of the unit below bringing it to the appropriate height. This should be verified by attempting to gently rock the new unit on the second course. If there is a slight rocking, push the block down to flush the joint. Check for level and plumb.

Fig. 4.17b

3. Lay the next unit on the first course. Check for level, plumb, and step joints *(Fig. 4.17d)*.

4. Stack a second unit on the second course *(Fig. 4.17e)*. Use the same process as described earlier in step 2 to eliminate any step joints below. Check for level, plumb, and step joints on the second course.

5. Repeat this process of "one forward, one back" in laying up the remainder of the first and second course.

Fig. 4.17c

Fig. 4.17d

Fig. 4.17e

Misaligned Anchor Tendons
In the event that the anchor tendon is not aligned with the slot on the first course, a simple cut can be made in the block to correct the misalignment *(Fig. 4.18)*. This can be done with a small brick hammer or masonry saw. Because lateral movement of the tendon increases as it goes up the wall, making cuts on subsequent courses are unnecessary.

As the blocks approach the center from each corner, if a trig was used, remove it along with the temporary stretcher. Lay in the closure block. If the layout is correct, the block should slide in with minimal force. Use a mason's level to plumb and level the closure block, then check the plumb and level of the entire first course. While the mortar is still pliable, check that all of the head joints are tight and make any adjustments at this time.

Fig. 4.18

Misaligned Tendon

Fig. 4.19

Placing the Stop-Type Couplings

With the first and second course laid, place the stop-type couplings on the anchor tendons *(Fig. 4.19).* When securing the couplings, always make sure the couplings are fully engaged. As a means to verify this, mark the anchor tendon 1¼" from the top with black indelible magic marker and then engage the coupling. The mark should be approximately ¼" from the coupling indicating it has been screwed to its stop. With the stop-type coupling in place, make the connecting tendon segment 1¼" from the end, and fully engage it into the top of the stop-type coupling. Hand tighten and make sure the anchor tendon stop-type coupling is fully engaged and snug, and then verify the position of the tendon by checking the mark on both tendons.

Step 6 - Building the Corner Leads

With the couplings in place, the corner leads are built up. The accuracy of the wall depends upon the corners, so great care should be given as to the manner in which they are laid. The corner lead is usually laid up four or five courses above the center of the wall. Check that each course is aligned, plumb and orientated properly. Proper orientation of the corner blocks ensure that the units are in the same plane and that each block is stepped back to achieve a running bond. The spacing is checked with a mason's level placed diagonally across the corners *(Fig. 4.20)*. All of the units should be lined up on the edge of the level. If there is a need to reinforce the corners, see Chapter 5, Section K of this Guide.

Fig. 4.20

Building the Leads

Step 7 - Laying the Courses

IMPORTANT: In laying the courses, it is important to remember to alternate the units (*Fig 4.21)* as specified in the plan drawing. This configuration allows for a virtual 360 degree containment of the tendon, while not requiring the mason to lift the units over the tendons. Before laying the third course, move the mason's line up to that course and make sure it is taut. The line will be used to align the face shells in the same plane. The bearing surfaces of the second course must be free of debris before the next course is laid so as not to cause point-loading and misalignment.

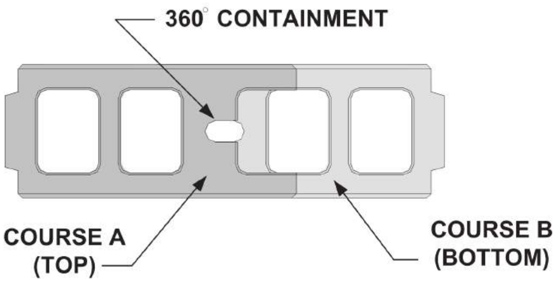


Fig. 4.21

Alternating the courses

As in the first and second courses, the units of the remaining courses are dry stacked from the corners to the centers with a closure block completing the course. A rubber mallet or deadblow hammer is used to align the block with the mason's line. Although the units should be checked regularly for plumb and level, they are precision ground and should be self-leveling and self-plumbing.

Tendon Spacers

The tendon spacer is a plastic snap-on device used to decrease the distance between the inner slot of the masonry unit and the tendon. When out-of-plane loads are exerted on the wall, FlexLock® technology relies on the engagement of the masonry and tendon to transfer the loads and maintain structural integrity. While this could be accomplished by just narrowing the diameter of the vertical masonry slot, such an approach would not allow for the use of stop-type couplings to connect tendon segments within the wall.

Fig. 4.21a

Tendon Spacers

Unless otherwise specified as in some partition wall applications, spacers are placed into each unit in the tendon path. As the unit is stacked around a tendon, the spacer is snapped on to the same tendon and slid down so that half of its length is in the vertical slot below. The orientation of the spacer, in respect to the masonry unit, is such that the curved portion of the spacer corresponds to the curved portion of the masonry slot below *(Fig. 4.21a)*. As the orientation of the blocks are alternated at each course, so too are the spacers, always maintaining the same position in respect to the vertical slot.

Continue to build the corner leads and lay up the courses alternating their orientation at each course. If the Bearing Plate Method is used, the second course must be fully grouted *(Fig 4.11)*. Remember to install the bond breaker before grouting. If the tendons are spaced properly and the block are alternated at each course, the tendon will be aligned with the slot in each block as the wall goes up *(Fig 4.22)*. Consult the drawings regularly for the placement of doors and windows. Should it be required, water and electrical conduit can be run during wall assembly. For more information see Chapter 5, Section E of this Guide.

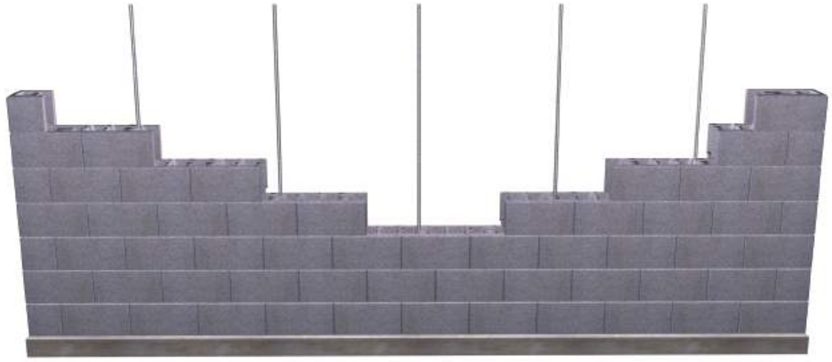


Fig. 4.22

Tendon Configuration

Special Note: Because FlexLock® is dry stacked, it does not require expansion joints in the traditional sense. The joints of each block, because they are not mortared, act as expansion joints.

The ICLS Method of Laying Block

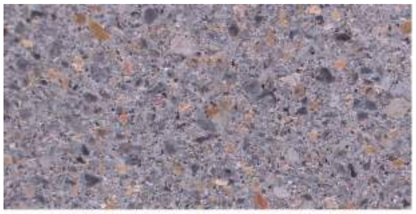
While FlexLock® is a precision unit manufactured to tight tolerances, it is possible that some units may slip past the quality assurance screening at the plant. FlexLock® masons and stackers are responsible for ensuring that no defective units are laid. They are the final line of defense, and can accomplish this by laying FlexLock® units according to the ICLS Method. ICLS is an acronym unique to this system and stands for: INSPECT, CHECK, LAY, AND SEAT.

> **INSPECT** Before laying each block, a quick visual inspection is made of the unit, and in particular the top and bottom of the shells. The unit shall have evenly ground bearing surfaces *(Fig. 4.23)*, and they must meet the minimum finish and appearance requirement as set forth in ASTM C90. Any skip-ground (a surface not fully ground) or damaged units are to be discarded.

CHECK Before laying the inspected units, make sure that the bearing surface on the course below is free of any debris to prevent point-loading.

LAY Lay the unit to the line, and against the head joint of the adjacent unit. Using your thumb, feel across the head joints to ensure that there are no “step joints”, and that the adjacent units are flush.

SEAT After the unit is laid, using both hands, attempt to rock the unit. The unit is “seated” when no movement is detected.



SMOOTH CALIBRATED SURFACE

ROUGH UNCALIBRATED SURFACE

Fig. 4.23

Bearing Surfaces

Doing it Right the First Time

Masons often complain that, “There is never enough time to do the job right, but always enough time to do it over.” The ICLS Method is essential to the integrity of the system, and assumes that the job is done right the first time. An experienced mason or stacker using the ICLS Method need only spend a few seconds per unit to ensure he won’t spend a few days and considerable money later on.

To expedite wall assembly, as stackers are quickly laying up the courses, the journeyman can occasionally walk behind and, with a 4’ level, check the plumb. Using a rubber mallet or deadblow hammer, he can “humer” the units into position. This allows the stacker to lay more rapidly and contributes to the overall appearance of the wall.

ASTM C 90 - 02a (7) Requirements

7.1 All units shall be sound and free of cracks or other defects that interfere with the proper placement of the unit or significantly impair the strength or permanence of construction. Minor cracks, incidental to the usual method of manufacturing or minor chipping resulting from customary methods of handling in shipment and delivery, are not grounds for rejection.

7.2 Where units are to be used in exposed wall construction, the face or faces that are to be exposed shall not show chips or cracks, not otherwise permitted, or other imperfections when viewed from a distance of not less than 20 ft (6.1 m) under diffused lighting.

7.2.1 Five percent of the shipment containing chips, not larger than 1 in. (25.4 mm) in any dimension, or cracks not wider than 0.02 in. (0.5 mm) and not longer than 25% of the nominal height of the unit, is permitted.

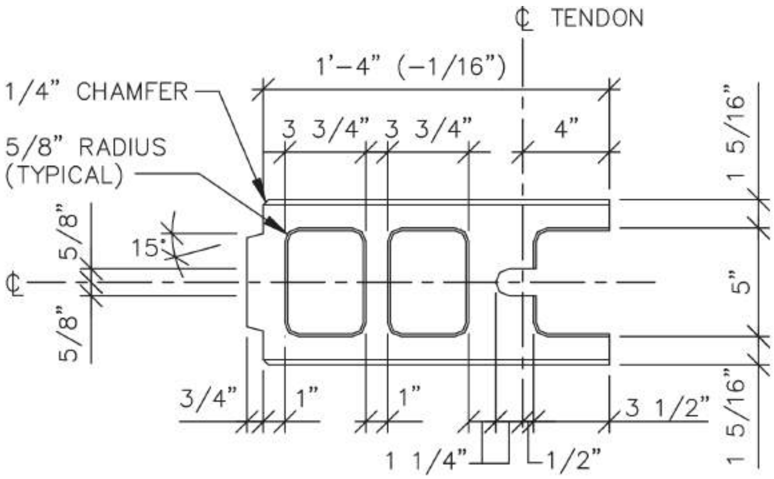
7.3 The color and texture of the units shall be specified by the purchaser. The finished surface that will be exposed in place shall conform to an approved sample, consisting of not less than four units, representing the range of textures and colors permitted.

7.4 A shipment shall not contain more than 5% of units, including broken units, that do not meet the requirements of 6.1, 7.1, 7.2, and 7.2.1.

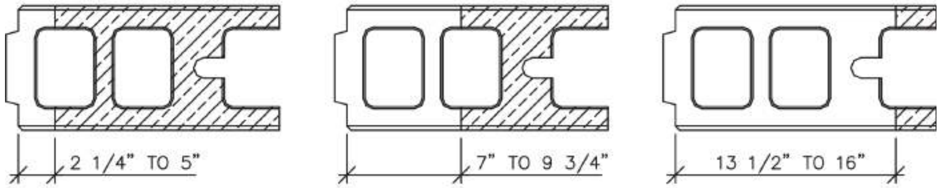
Step 8 - Half Blocks, Sills, Jambs and Lintels

Half Blocks

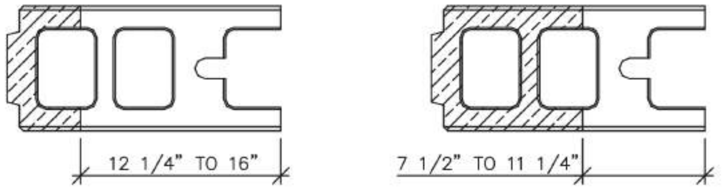
Although planning a modular building will save time and money, FlexLock® is well suited for non-modular, out-of-course construction. Half block and other sizes are cut from stretcher blocks *(Fig 4.24)*. The cuts must take into account the kerf of the saw blade to ensure a good fit. Depending on the orientation of the block on a particular course, the cuts can be made on either side. Regardless of the type of unit and placement *(Fig 4.25)*, cuts can be made almost anywhere depending on the desired appearance.



PLAN - STRETCHER UNIT



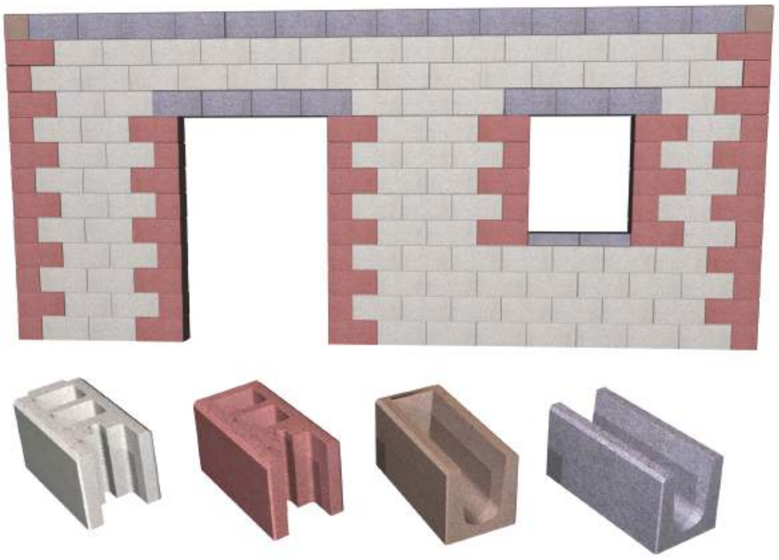
FEMALE END CUT OFF



MALE END CUT OFF

Fig. 4.24

Cutting Block for Out-of-Course Applications



Stretcher Corner Corner Bond Bond

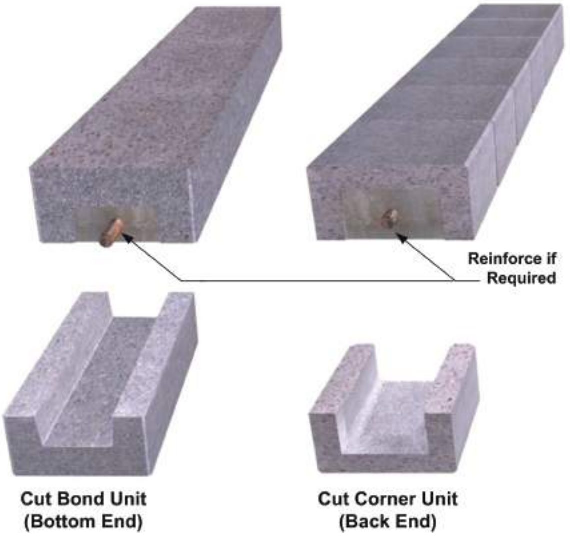
Fig. 4.25

Universal Corner Block used as Jamb Blocks

Sills

A sill is a flat or slightly beveled stone or masonry unit set horizontally at the base of a wall opening. While FlexLock® supports both stone and masonry variations (provided they meet the specified dimensions and tolerances), masonry construction is the most common. Beyond being less costly, it seamlessly matches the bond and texture of the surrounding masonry. FlexLock® masonry sills are made up of either corner or bond units laid end to end to form a channel for the placement of grout *(Fig. 4.26)*. Relatively easy to construct, sills can be put together on or off site.

Once the height of the opening is established, bond units can be cut along their horizontal axis. This cut must not only take into account the unit height in relation to the opening height, but must also accommodate the 5/8" bed of mortar placed between the sill and the course below. These units are then laid end to end to form a channel with the entire assembly sized to accommodate the width of the opening. The units must be perfectly level to one another and aligned. With the ends of the assembly blocked off to retain the grout, the channel is then grouted solid and, if required, reinforced. Ensure that the grout height is 1/4" to 1/2" from the top of the units. When the grout has sufficiently cured, the sill can be lifted into place and secured with a bed of mortar.



Cut Bond Unit (Bottom End) Cut Corner Unit (Back End)

Fig. 4.26

Sill Application

Another option would involve the use of modified corner units. Based on the desired height, the rear return is cut off and retained. Like the bond units, they are laid end to end to form a channel with the entire assembly sized to accommodate the width of the opening. Each of the units must be aligned with one another and completely level. With the ends of the assembly blocked off to retain the grout, the channel is then grouted and, if required, reinforced. As in the earlier method, ensure that the grout height is 1/4" to 1/2" from the top of the units. When the grout has sufficiently cured, the sill can be lifted into place and secured with a bed of mortar. Using the corner unit option, though more costly (requires twice as many units), is more attractive. The soldier-like appearance of the sill and the simulated mortar joints make it stand out as a handsome architectural element.

To tie the sill into the jambs, extend the rebar approximately six inches on either side of the sill. As the jambs are built up, the cells are grouted on either side. Notch the jamb block (on either side of the opening) at the sill to allow the rebar to extend into the jamb units. As the jamb cells are grouted, ensure that the rebar is completely covered by the grout, and clear of the vertical rebar. If required, a coping stone can be placed on the sill using either mortar or a masonry adhesive.

Special Note: For extra strength and stability, the units below the sill can be grouted solid.

Jamb Applications

A jamb is the inside vertical face of a doorway or window opening. In the FlexLock® system, universal corner blocks are used along the sides of windows and doors to create a flat solid surface. This enables the system to accommodate a buck board for door and window jambs *(Fig. 4.27)*. Regardless of the orientation of a particular course, corner blocks, when used as jamb blocks, always have the flat end face toward the opening. The cell closest to the opening is always slashed with grout, and if required, reinforced (*Fig. 4.28)*. As with stretchers, half blocks may be cut from the corner units. Depending on the architectural requirements, in planning for a door opening, it may be necessary to horizontally cut the first course to ensure that the door jamb is in coursing.

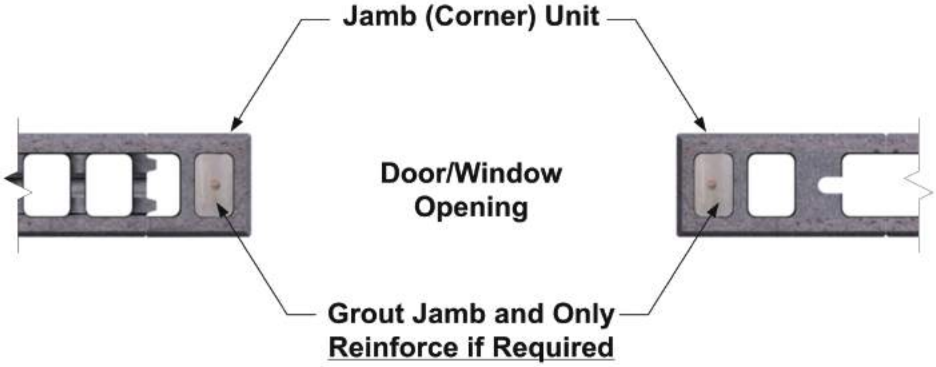


Fig. 4.27

Universal Corner Block used on Door Jamb

Lintel Applications

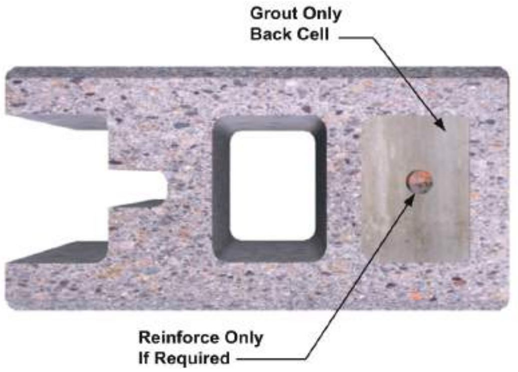


Fig. 4.28

Grouting the Jambs

Lintels are horizontal reinforced members placed over an opening or a recess in a wall to support construction above. Typically, lintels may be of fabricated steel, precast concrete, or reinforced masonry construction. While FlexLock® supports each of these variations (provided they meet the specified dimensions and tolerances), reinforced masonry construction is the most common. Beyond being less costly, it matches the bond and texture of the surrounding masonry. FlexLock® masonry lintels are made up of bond units laid end to end to form a channel for the placement of rebar and grout (Fig. 4.29). These structural members are relatively easy to construct, and do not require heavy lifting equipment. They can be constructed on or off site as long as the units are completely level to one another before the channel is poured. In general, lintels should have a minimum bearing of eight inches at each end. Consult the details and specifications as the design requirements may vary depending on the project.

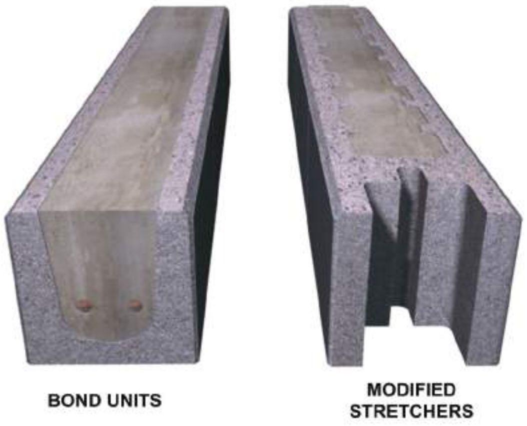


Fig. 4.29

Lintel Assembly

Procedures:

1. Lay the desired number of units end to end on a flat clean surface.

2. Using a level, ensure that the units are level relative to one another. The head joints must be completely flush to avoid point loading with the masonry on the course above.

3. Cut #5 rebar to fit the length of the lintel ensuring that it does not extend beyond the masonry units.

4. Block up both sides of the lintel securely. Take care to keep the head joints clean from leaking grout.

5. Pour grout until it fills about 1" to 2" from the bottom of the lintel.

6. Carefully place the rebar into the bond beam about one inch away from the face shell. It is important to ensure that the rebar is close to the tension side of the lintel (bottom) while having at least one inch of grout separating it from the bottom and side of the face shells (*Fig 4.30).*

7. Pour the rest of the lintel to about 1/2” to 1/4" from the top.

8. Let set until sufficiently cured.

To tie the lintels into the wall, extend the rebar approximately six inches on either side of the lintel. Notch the adjacent block on each side of the lintel to allow the rebar to extend into it. Grout those adjacent blocks (all cells) solid using a grout stop to prevent the grout from dropping through the bottom. As the cells are grouted, ensure that the rebar is completely covered by the grout.

Modified stretchers can also be used to create a lintel when bond units are not available using the same procedure described above *(Fig. 4.29)*. The webs are cut to create a six inch void to acommodate the grout and rebar. The units must be dry laid on a flat surface before grouting to avoid any step joints.

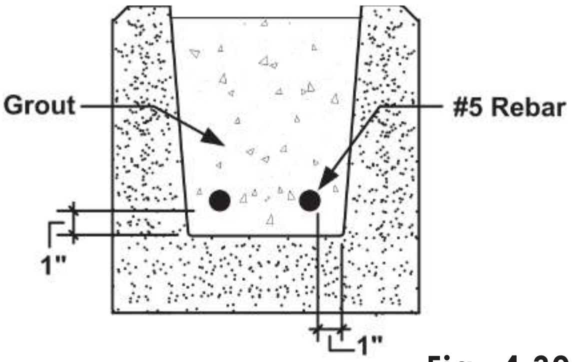


Fig. 4.30

Lintel Application

Step 9 – Bond Beam

A bond beam is an integral load bearing member in the wall comprised of one or more courses of grouted and reinforced masonry. As with standard masonry, a bond beam can be used anywhere within the wall, but is most often used at the top of the wall. When used at the top of the wall the tendons should be sized so that they extend 6-8” above the bond beam. This will later facilitate the placement of a wooden sill. Should it be required, foam or dry insulation can be applied before the application of the bond beam.

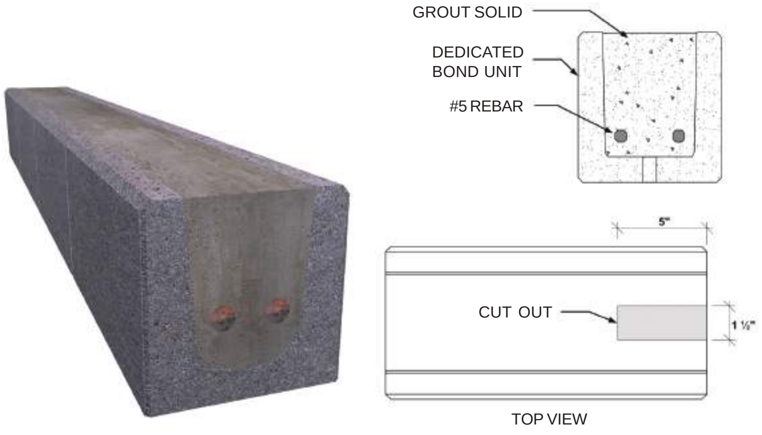


Fig. 4.31

Bond Unit Modifications

Procedure

1. Modify the bond units to allow the tendon to pass through. This is accomplished by making two parallel cuts and then knocking out the center to make a notch *(Fig. 4.32)*. This is done to only those units that have a tendon passing through them.

2. Notch one side of each of the corner bond units to allow the flow of grout and the placement of rebar around the corners. If corner bond units are not available, modify standard corner units to accomplish the same task *(Fig. 4.33)*.

3. Lay the bond course ensuring that the head joints are tight.

4. Place a grout stop into the notches around the tendons so that when the bond beam is grouted, grout does not escape to the course below.

Fig. 4.32

Notched Bond Unit

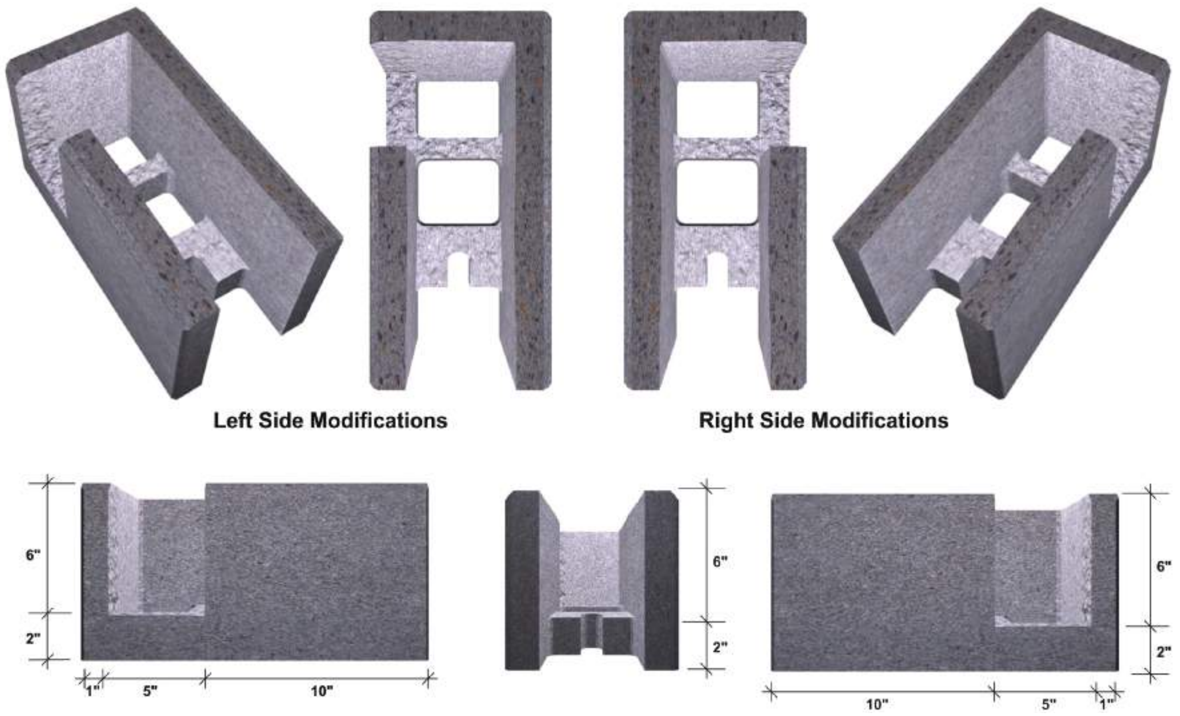


Fig. 4.33

Notched Corner Units

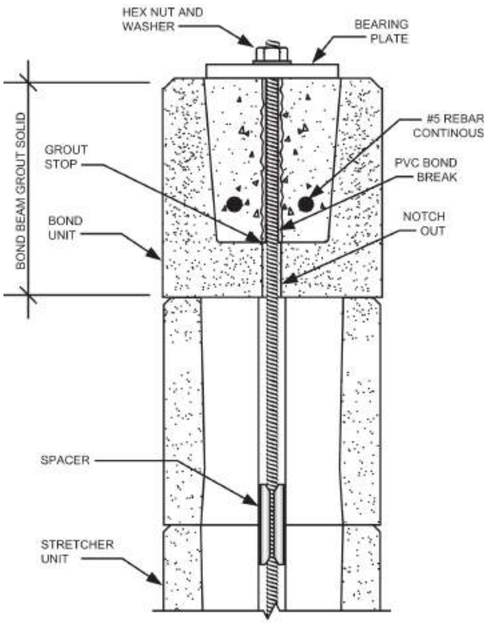


Fig. 4.34

Capping Detail

5. Cut lengths of PVC bond break (approximately 7") and place them over the tendons. Shove them onto the notch taking care not to disturb the grout stop. The bond break should not exceed the height of the shells or it will later interfere with the bearing plate.

6. Place two continuous # 5 rebar in the base of the bond beam channel on either side of the vertical tendon.

7. Carefully pour the grout into the bond beam. Completely fill it to approximately 1/4" to 1/2" from the top of the shell. Wipe the top of the shells clean of any excess grout *(Fig 4.34)*.

8. With the bond beam grouted, place a bearing plate over the tendon on top of the grout and gently seat so that it floats completely on the grout. Do not embed the plate into the grout. Place a flat washer over the tendon and thread a hex nut down to the plate. Make sure that the hex nut is loose and does not bear on the plate as this will embed the plate into the grout.

Alternate Capping Method

Should it be necessary to hide the bearing plate inside the bond unit, a double bond beam must be used *(Fig 4.35)*. This will allow for sufficient mass and strength to tension from the inside. In order for both of these bond courses to function as a single structural member, the top bond course will have to be modified to allow grout to flow from the top bond course into the lower bond course .

Procedure

1. Modify the bond units of the lower and upper bond course to allow the tendon to pass through *(Fig. 4.32)*.

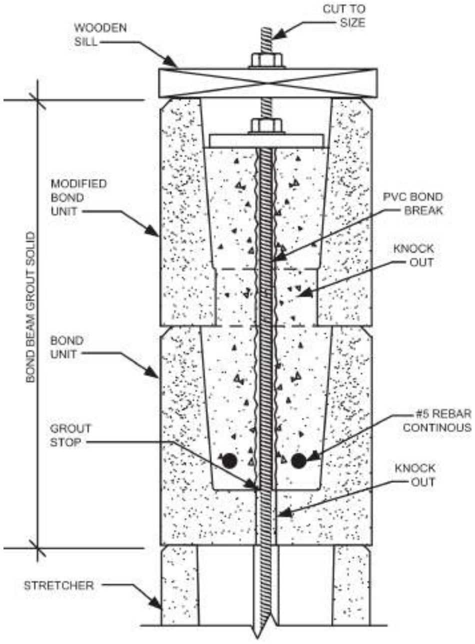


Fig. 4.35

Alternate Capping Method

2. Notch one side of each of the corner bond units to allow the flow of grout and the placement of rebar around the corners. If corner bond units are not available, modify standard corner units to accomplish the same task *(Fig. 4.33)*.

3. Modify the bond units of the upper bond course to allow the grout to flow through to the lower bond course *(Fig. 4.36)*.

4. Lay the lower bond course ensuring that the head joints are tight.

5. Place a grout stop into the notches around the tendons so that when the bond beam is grouted, grout does not escape to the course below.

6. Cut lengths of PVC bond break (approximately 14") and place them over the tendons. Shove them into the notch taking care not to disturb the grout stop. The bond break should not exceed the height of the shells or it will later interfere with the bearing plate.

Fig 4.36

Modified Bond Unit for Grout Flow

7. Place two continuous # 5 rebar in the base of the bond beam channel on either side of the vertical tendon.

8. Carefully pour the grout into the lower bond beam. Completely fill it to approximately 1/4" to 1/2" from the top of the shell. Wipe the top of the shells clean of any excess grout.

9. Lay the units of the upper bond course and place reinforcement if required.

10. Carefully pour the grout into the upper bond beam. Completely fill it to no greater than 2" from the top of the shell (to later accommodate the bearing plate and hex nut). Wipe the top of the shells clean of any excess grout.

11. As the grout in the upper bond beam begins to stiffen, place a bearing plate over the tendon and into the channel. Rock it slightly so that it is seated, **but do not embed it into the grout**. This will allow the plate to bear flush with the grout when the tendon is later tensioned.

Step 10 - Tensioning Methods

Tensioning the tendons is critical to the structural integrity of the system. **TENSIONING SHOULD ONLY BE DONE BY AN EXPERIENCED JOURNEYMAN MASON AND DOCUMENTED IN THE QUALITY ASSURANCE LOG**.

Center-Hole Jack

A center-hole jack is a hydraulic ram attached to a small frame. A hand pump is connected to the ram with a gauge to indicate the tensioning load (*Fig. 4.37)*. The amount of torque depends on the engineering requirements. Typically an interior partition wall is tensioned to 4 Kips, and an exterior loadbearing wall is tensioned to 8 Kips. Consult the drawings or the FlexLock® Design Guide for the actual tension for the particular structure.

Procedure

1. Place hydraulic jack and frame on top of the bearing plate.
2. Connect the jack to the tendon using the quick release clam shell and locking sleeve.
3. Verify that the anchor load chart corresponds with the jack that is being used. Determine from the load chart (provided with the gauge) the reading (psi) that corresponds to the required tension load (lbs).
4. Using the hand pump on the test jack, jack the tendon to half the prescribed load.
5. While the load is still on the anchor tendon, use a wrench to tighten the hex nut against the bearing plate, until the load indicated on the gauge begins to slightly fall.
6. Release the load on the jack.
7. Remove the jack from the tendon and continue lineally around the structure.
8. After all the tendons have been tensioned repeat the process, this time tension to the final load.

Tensioning with the Surface Method

Tensioning with the Recessed Method

Fig 4.37

Center-Hole Jack

Torque Wrench

Fig 4.38

Torque Wrench

A torque wrench may only be used if space requirements restrict the use of a center-hole jack, and only if the procedures found in this Guide are followed. A torque wrench *(Fig. 4.38)* is a tensioning device that uses a ratcheting mechanism designed to slip or "click" at a predetermined load.

It is essential to the integrity of the structure that a quality torque wrench is used and that it is calibrated. Manufacturers recommend that a torque wrench be calibrated every six months for a tool used professionally every day. If required, corrosion protection can be applied after the tendon is torqued.

IMPORTANT: Variations in the thickness of the galvanized zinc coatings provide inaccurate torque readings. As a result, any time a torque wrench is used, all of the zinc must be removed (from the tendon) where the hex nut comes in contact with the tendon. This can be done with a wire wheel on a small grinder.

Procedure

1. Ensure torque wrench is calibrated and properly rated.
2. Hand tighten nut against washer and plate.
3. Place socket over hex nut.
4. Torque hex nut to the recommended tension (*Fig. 4.39*).
5. Do not apply a lubricant to the threads unless specified.

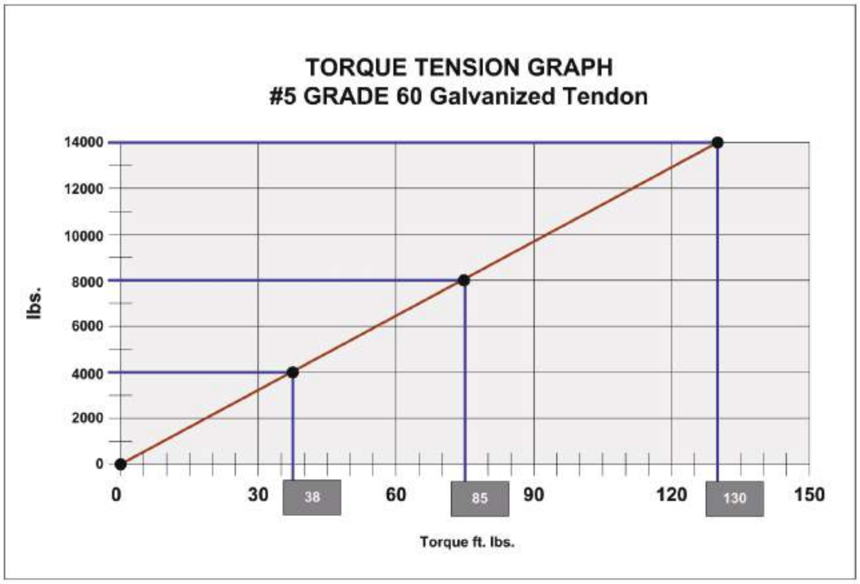


Fig 4.39

Step 11 – Partition Walls and Floor Joists

Interior masonry partition walls are used to separate rooms of buildings *(Fig. 4.40).* They are typically non-structural elements less than one story in height and not designed to take vertical or lateral loads. Partition walls can be cost-effective building elements if designed, detailed, and specified correctly. The versatility of FlexLock® technology makes it ideal for schools, dormitories, hotels, office buildings, municipal facilities, and just about every type of building. These may either be load or non-load-bearing walls.

I. Placing the Tendons

Although partition walls are typically non-load-bearing, they must be firmly anchored to adjacent walls, floor, and in many cases, ceilings.

1. Lay out wall with chalk lines to reveal its precise location in relation to the adjacent structural elements.

2. Dry stack the stretcher units comprising the first course beginning with a universal corner unit placing the closed end of the unit against the adjacent wall.

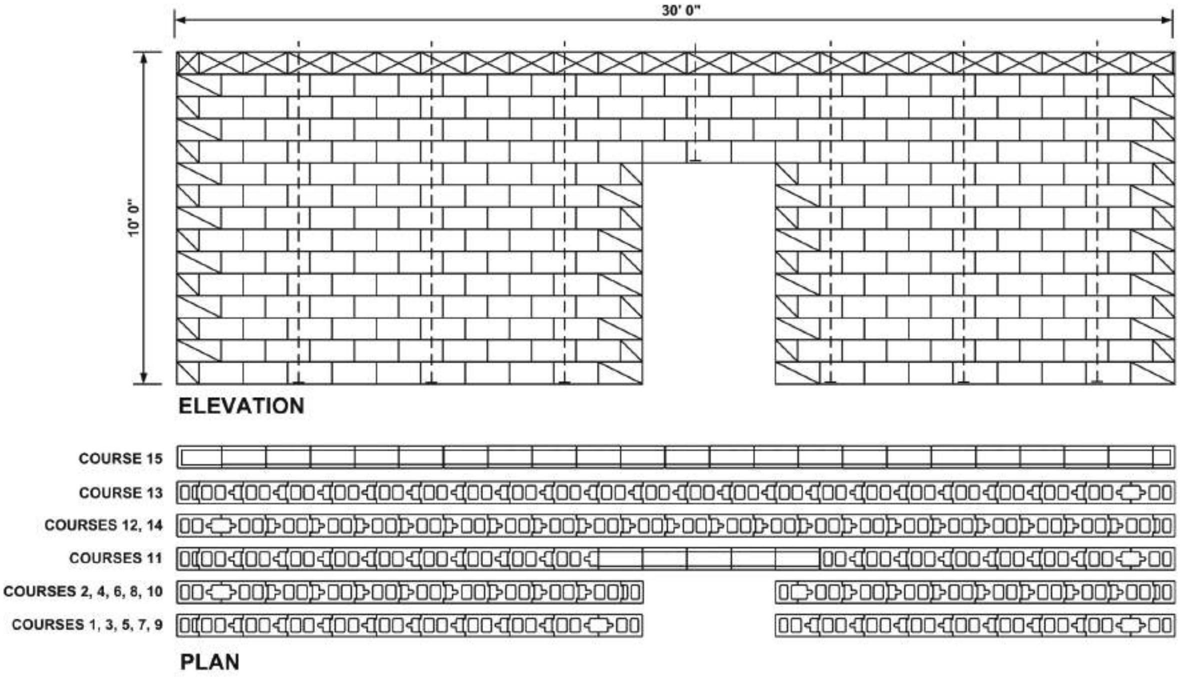


Fig. 4.40

Partition Wall

3. Accommodate any door openings and cut the last block ¼" short so that it fits against the terminating wall. They will be sealed with caulk or mortar when the job is complete.

4. If the wall does not terminate into another wall as in a restroom modesty wall, use stretchers until the last unit. Here, use a corner or bull-nose unit, this time positioned so that the closed portion of the unit caps the end of the wall.

5. With the first course in place mark the tendon locations.

6. Remove the block to allow enough room to drill the anchor holes.

7. If post-tensioning off the footer, the drilled hole should be 1¼" in diameter and should be clear of any reinforcing bar. Care needs to be taken that the hole is drilled plumb. Suggestions in assisting straight hole drilling include the use of drilling templates, leveling devices, doweling jigs, etc. It is important to note that the deviations of more than a few degrees can subject the anchor to bending. If using this Anchoring Method, go to Step 9.

8. In some cases, the concrete floor will not be thick enough to allow for full anchor embedment; although the low tension requirements of some non-load-bearing walls may allow for shallow embedment. As a result, it may be necessary to use the Bearing Plate Method. This enables post-tensioning to be accomplished off the first course, rather than the footing or slab. If the Bearing Plate Method is used, refer to Step 3 of this Guide. Otherwise, follow the remainder of this procedure.

9. Flush the holes with water and blow all holes clear of debris with compressed air.

10. Assemble anchor system by screwing a hex nut on the bottom of the anchor tendon. Toward the top of the anchor tendon, place an anchor centering device such as a flat washer to hold anchor tendon in place.

11. Mix high capacity grout according to specifications on the packaging. If temperatures are outside the range of 40-90 degrees fahrenheit, follow special instructions for grouting in extreme temperatures on the package. Never use epoxies in place of grout as these will soften under fire conditions resulting in significant load loses.

12. Pour or pump grout into the drill hole making sure that the drilled hole is completely full of grout. When pouring grout into the drilled hole, use a funnel or a large paper cup so that the grout flows directly into the hole.

13. Insert the anchor tendon into the drilled hole bottoming it out by slowly screwing it in clockwise while pushing it down. This will allow the grout to flow around the deformations. When the anchor reaches the bottom of the hole. Remove excess grout at the base of the tendon and use a centralizing washer to straighten the anchor. Using a torpedo level, ensure that the anchor tendon is plumb. Once placed, do not disturb the anchor tendon until the cement grout has hardened.

14. Do not tension anchor until the grout has fully cured (Low or high temperatures can delay or accelerate the setting of the grout).

15. Lay up the wall and complete as described earlier in this chapter.

II. Partition Bond Beam

As described earlier in this Guide, the partition bond beam is grouted and reinforced. Along with the Standard Capping Method *(Fig. 4.34)*, the bearing plate can be hidden as detailed in the Alternate Capping Method *(Fig. 4.35)*. For more information see Step 9 of this Guide.

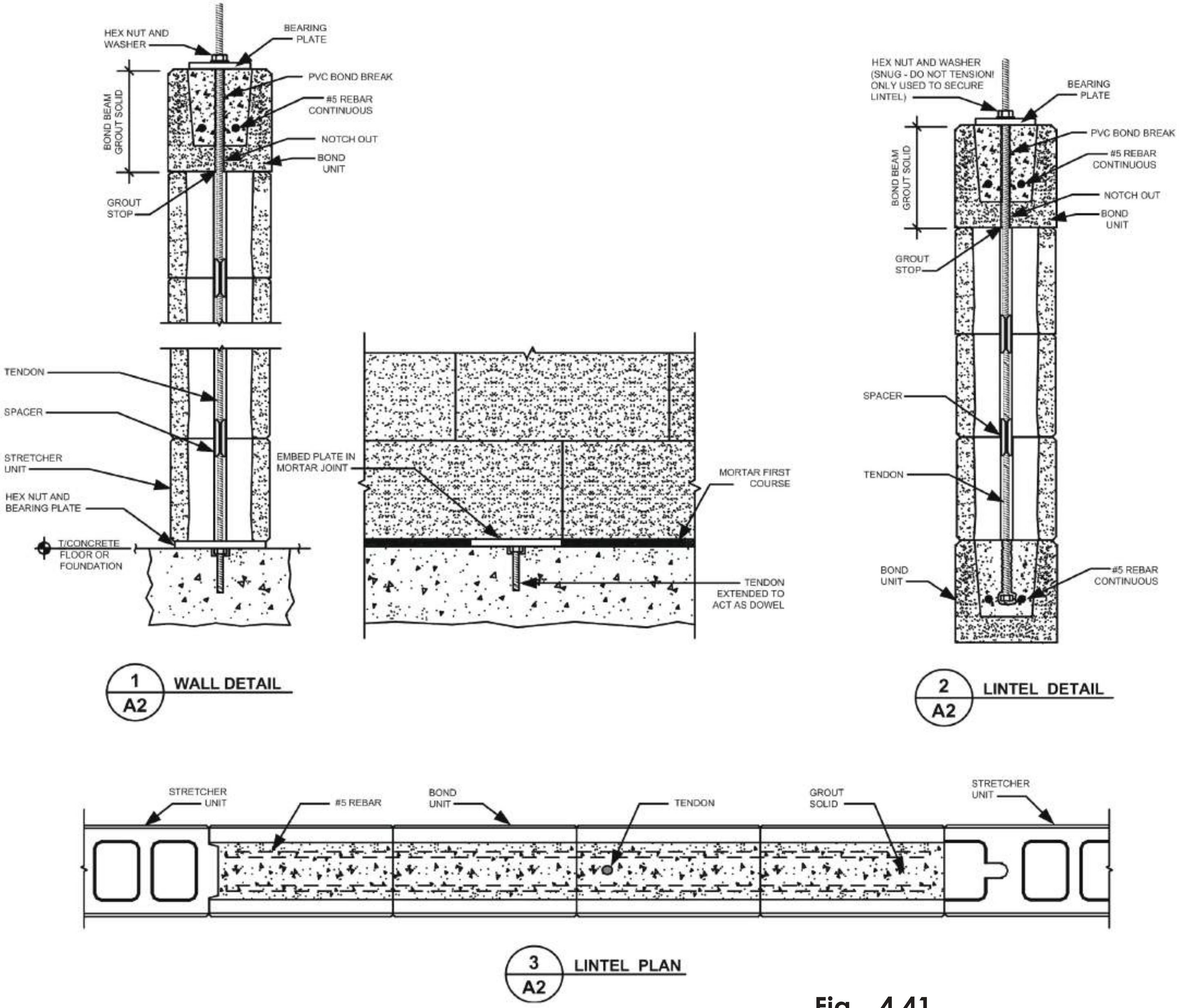


Fig. 4.41

Partition Wall Details

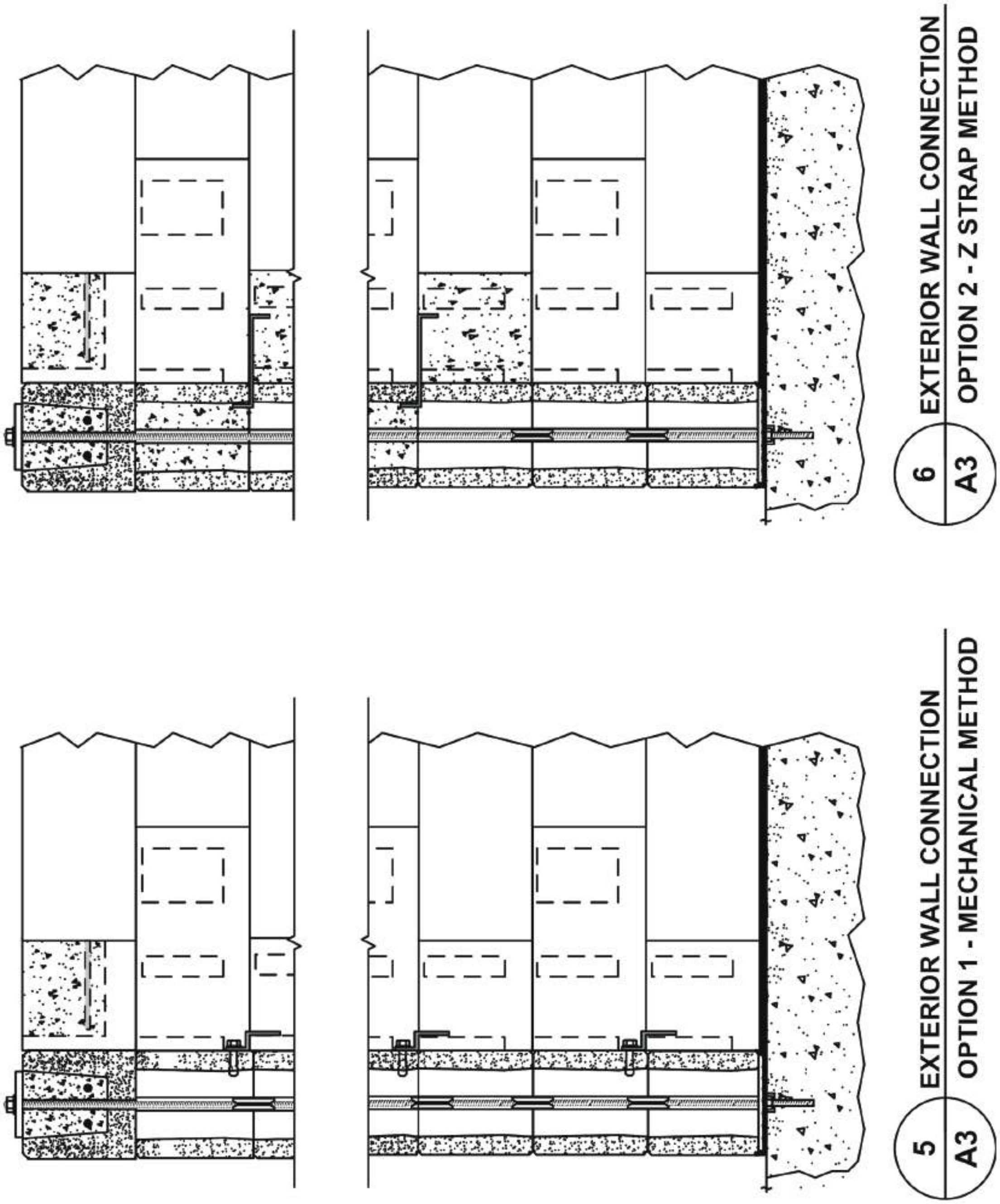
III. Wall Attachment

The method for attaching a partition wall to an adjacent wall will depend on a number of factors. There are three options each developed for a particular application and design constraint. If not specified in the drawings, consult a structural engineer, or city building official to determine the appropriate option.

Option One: Mechanical Method *(Detail 5-A3, Fig. 4.42)*
This method utilizes masonry anchor bolts with small metal clips. The bolt size and gauge of metal for the clips will depend upon design considerations. This hardware is not available through Cercorp, but can be easily procured and fabricated locally. This option is for relatively short partition walls.

Option Two: Z Strap Method *(Detail 6-A3, Fig. 4.42)*
This method utilizes a conventional z strap (also known as a metal tie bar) to anchor the partition using standard masonry practice. The z strap is typically available through a masonry supplier. This application is generally the preferred option for most partition walls.

Option Three: Integral Method *(Fig. 4.43)*
This method integrates the partition wall into the adjacent wall. Unlike pilasters, this method does not require grout or reinforcement. The entire wall is post-tensioned.



EXTERIOR WALL CONNECTION
OPTION 2 - Z STRAP METHOD

EXTERIOR WALL CONNECTION
OPTION 1 - MECHANICAL METHOD

Fig. 4.42

Partition Wall Details

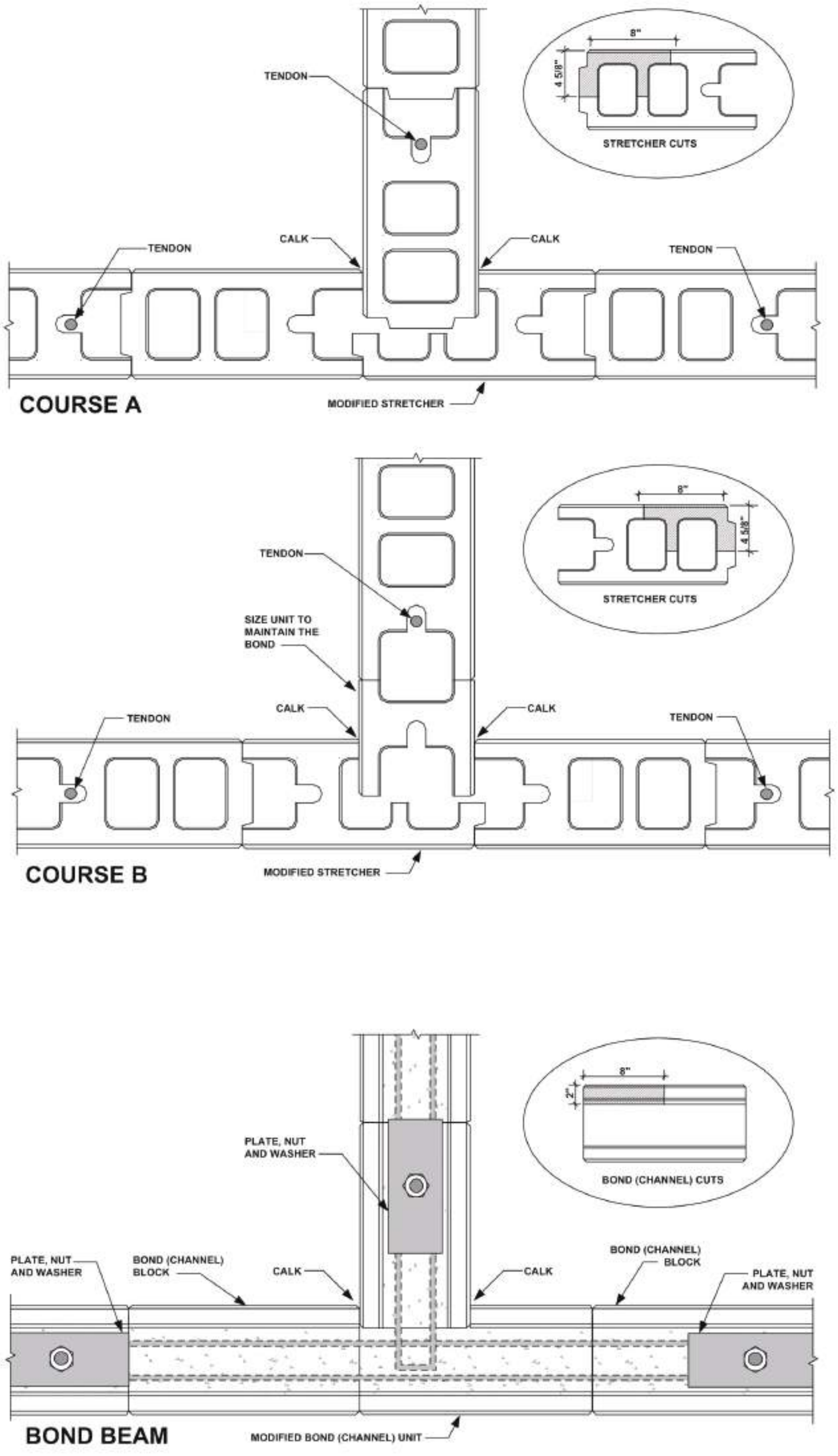


Fig. 4.43

Integral Method

IV. Laying up to the Deck or Underpinning

In some cases, as in firewalls, it may be desirable to lay the partition wall up to the deck omitting any space between the wall and ceiling. To accomplish this, the partition wall is laid a course or two below the deck, with the last course being the bond beam. The wall is then post-tensioned in the manner described in Step 10. Because of the limited space, a torque wrench can be used. The remaning course(s) up to the deck are laid in a conventional manner by mortaring only the bed joints. Any remaining space is either tucked closed or sealed with fire safing.

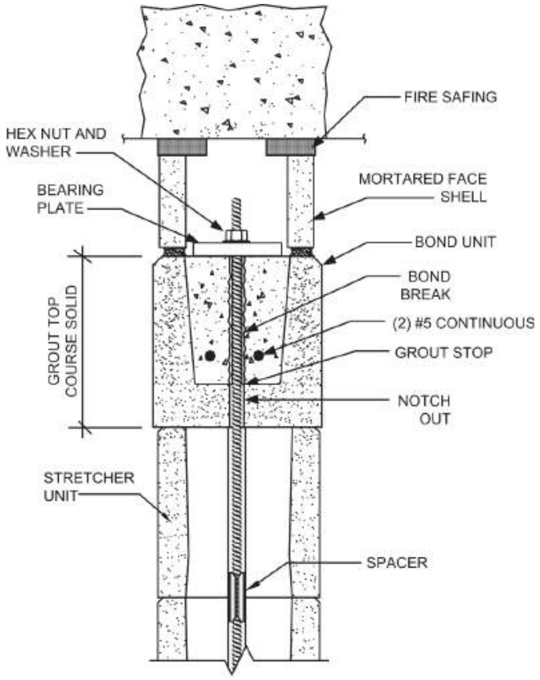


Fig. 4.44

Laying to the Deck

V. Floor Joists

A joist is a horizontal framing or formed steel member placed on edge to support a floor or roof by transmitting loads to bearing points. On wood framed floors and flat roofs, the joists are usually attached by means of joist hangers to the header joists which are attached to the outer load bearing walls. A joist hanger is a simple formed steel component used to support the end of load bearing joists and transmit loads to the header joist.

Because joists are placed between floors, the header joists must attach directly to the bond beam so that the floor/ ceiling loads are carried through the external walls *(Fig. 4.45).*

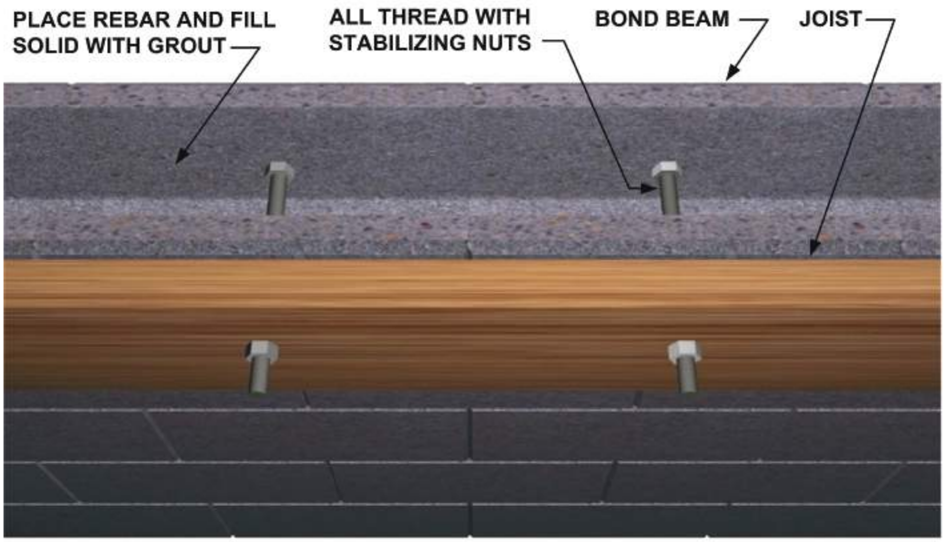


Fig 4.45

Joist Attachment

Procedure

1. The joist header should be placed against the top course of the double bond beam. Prior to laying that course, pre-drill $^{5}/_{8}$” holes to accommodate a $^{1}/_{2}$” national course all-thread. The holes should be positioned in the middle of an empty core. A plywood jig can be devised so as to ensure the holes are equally spaced and at the same level.

2. Lay up the final bond beam course.

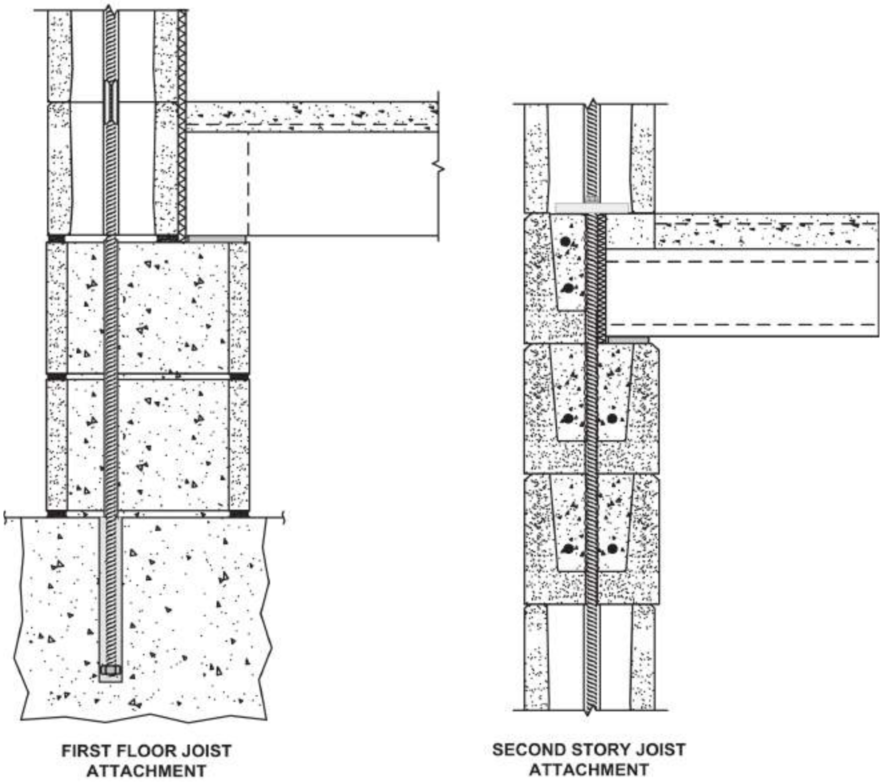
3. Cut 11 ¼” lengths of ½” national course all-thread, one for each of the holes.

4. With the units in place and before grouting, insert an all-thread through the pre-drilled hole.

5. As it emerges from the shell, reach into the cells and thread a flat washer and two hex nuts.

6. Push the all-thread back so that it touches the back of the core leaving the one hex nut at the back. Make sure that the back nut is fully engaged in the thread *(Fig. 4.45).*

7. Hand tighten the nut in the front so that the all-thread is snug within the core and emerges perpendicular from the unit as it comes through the shell.


FIRST FLOOR JOIST ATTACHMENT

SECOND STORY JOIST ATTACHMENT

Fig. 4.46

Floor Joists

8. Grout the bond beam as discussed earlier in this Guide and continue construction. Whether using the continuous or segmental method of tensioning as discussed in Step 12, the entire structure must be post-tensioned before the joist headers are attached and load is applied.

9. Pre-drill holes in the wooden header joist so that they match up with the all-thread rods.

10. Place the header joist on to the wall so that the protruding all-thread rods pass through it.

11. Using a flat washer and hex nut, secure the header joist to the outer wall.

Step 12 – Second Story Application

There are two methods to add another story. The Continuous Tensioning Method allows for the entire structure, from the footing to the cap, to be tensioned. In contrast, the Segmented Tensioning Method requires that each floor be independently tensioned off of the same tendon *(Fig. 4.47).* Although, depending on the engineering requirements, either method can be used, the Segmented Method provides redundancy in the form of segmental integrity. Segmental integrity allows for a portion of the tendon assembly to lose its tension without effecting the other portions of the wall.

Where a second story is desired, it may be necessary to mortar the bed joint between the bond beam and the first course on the second story. Because of tolerance stack up and human error, a check should be made of the first story to determine that it is level and plumb. If this is the case, no mortar is needed in either method.

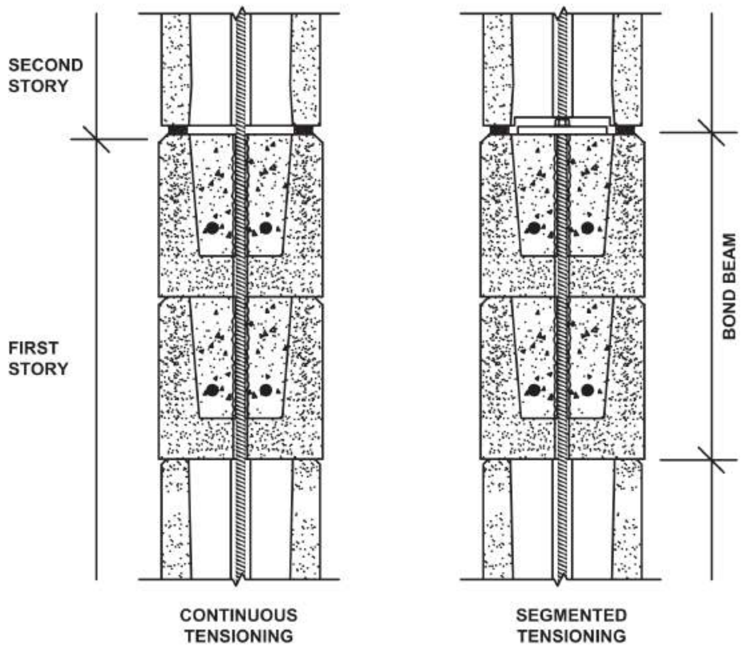


Fig. 4.47

Second Story Application

Other Construction Considerations

5

A. FLASHING

In broad terms, flashing is any kind of impervious material that keeps water from penetrating the wall. All barrier walls, sills, lintels, projections, and recesses should have some type of flashing to prevent deterioration. In fact, flashing should be installed any place where water can flow or accumulate. Flashing can be made of a number of materials such as sheet metals or bituminous membranes, and can be sealed using caulk or mastic. This material must be rust and corrosion resistant in order to withstand the effects of weathering for the life of the structure. While FlexLock® is flashed in much the same way as conventional masonry, the following illustrations describe how this is accomplished.

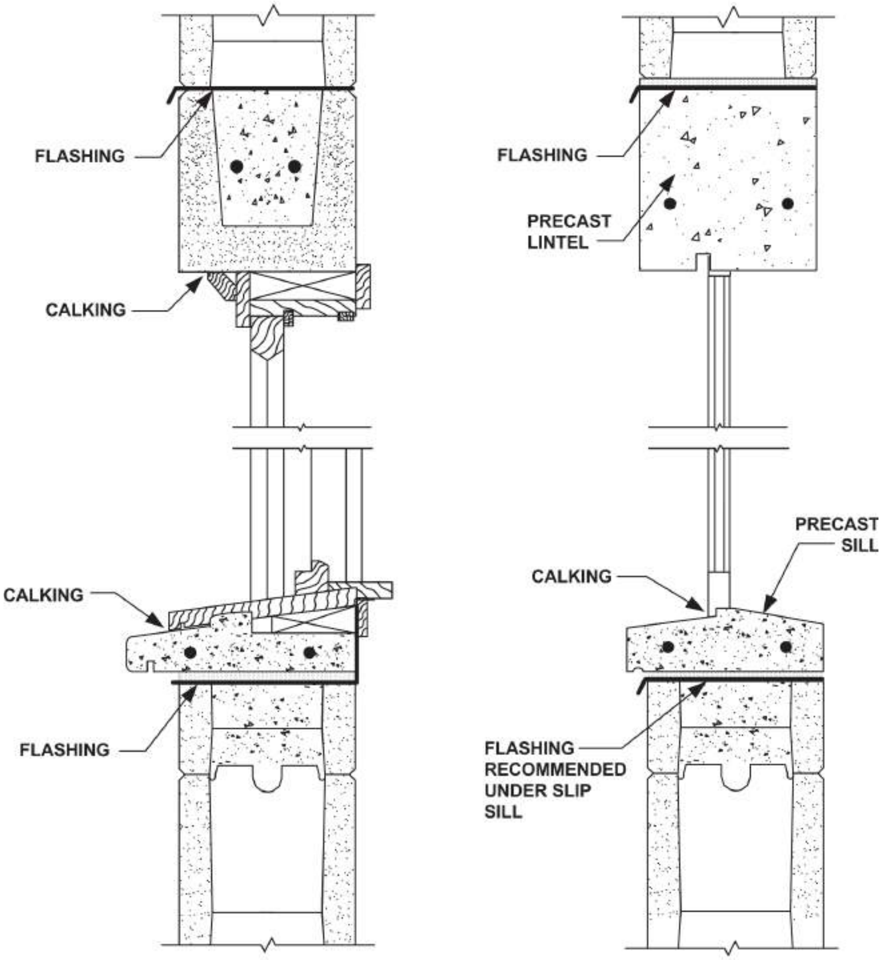


Fig. 5.1

Sill Flashing

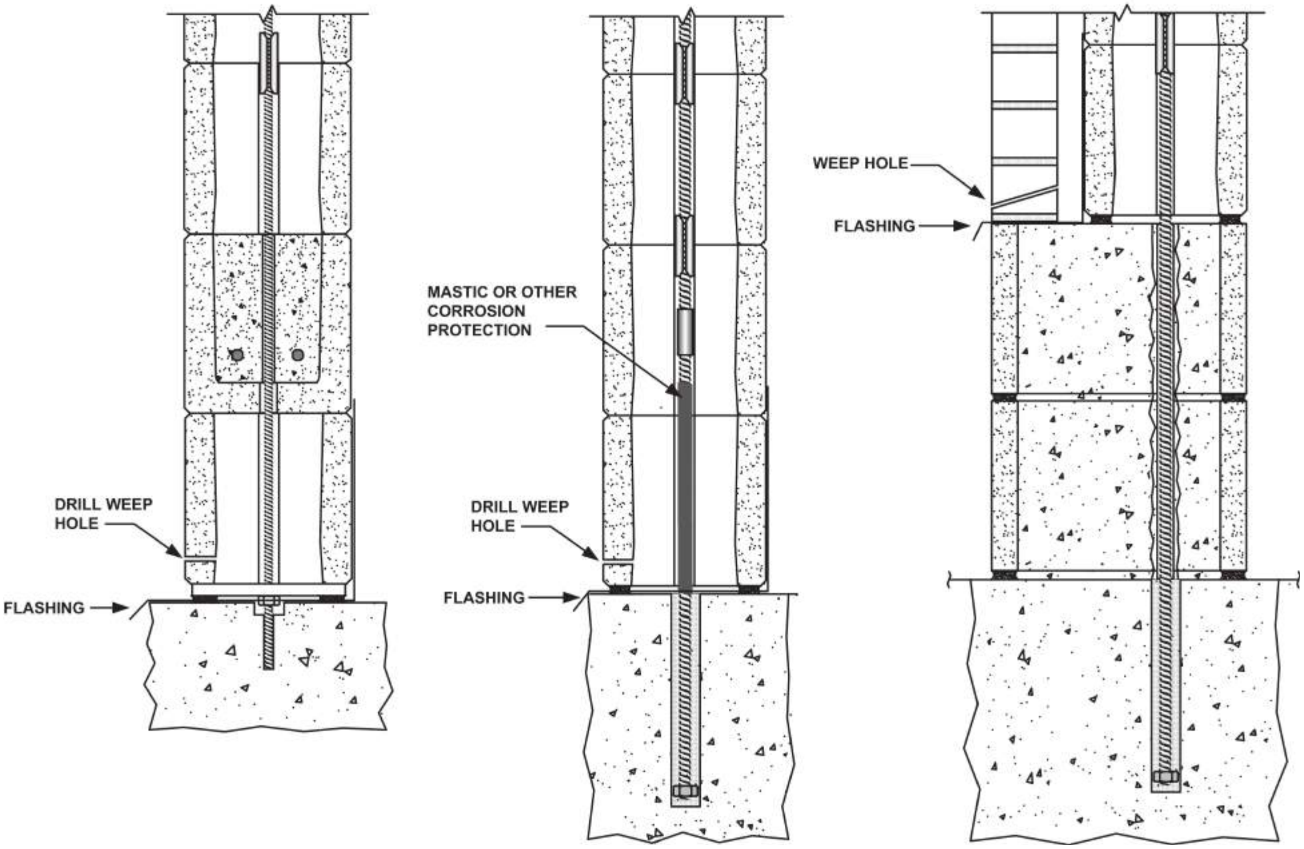


Fig. 5.2

Foundation Flashing

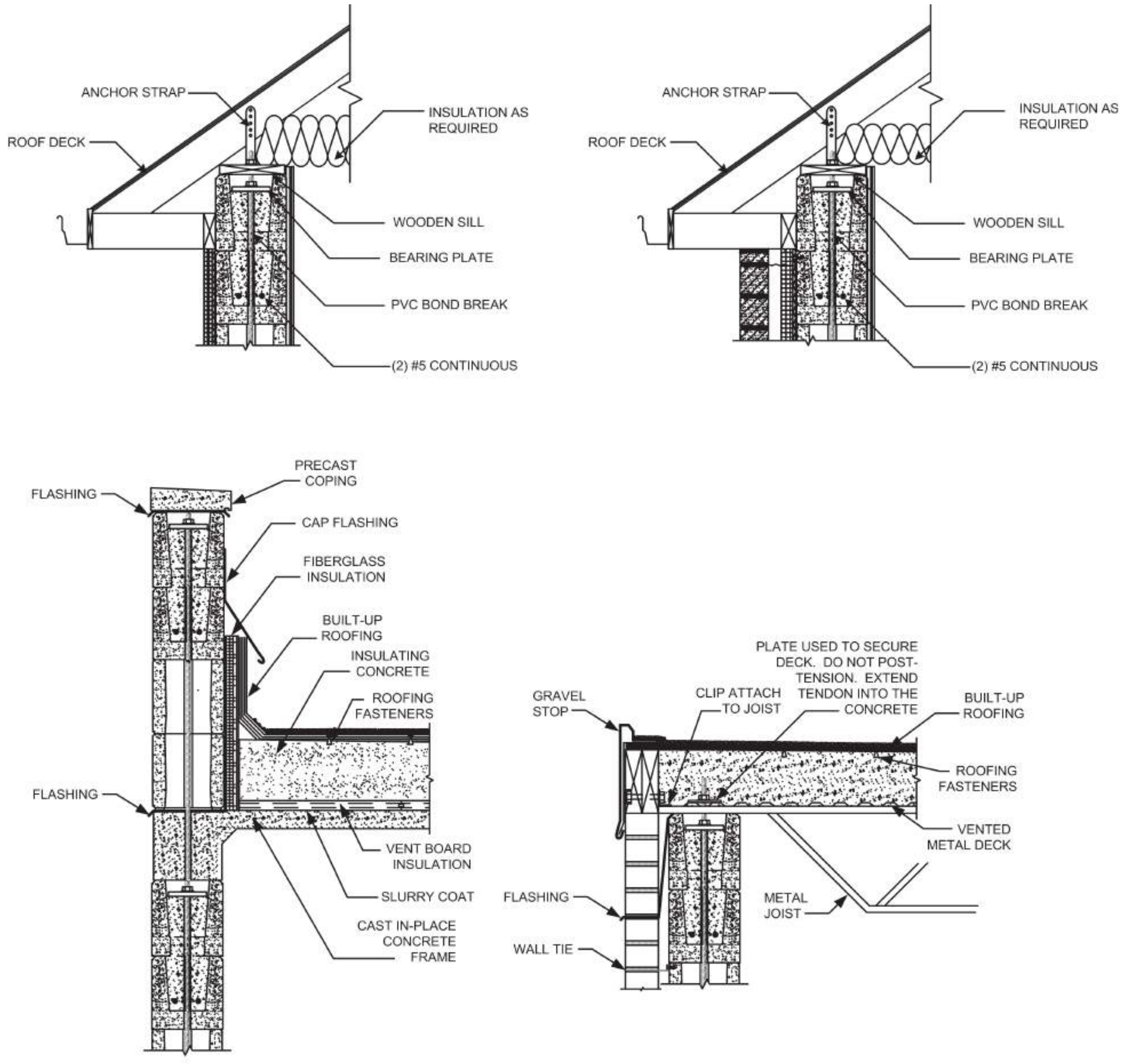


Fig. 5.3

Roof Flashing

B. Pilasters and Piers

PILASTERS

A pilaster is a strengthened section that is designed to provide lateral stability to a masonry wall. Pilasters can be the same thickness as the wall, but most often project beyond one or both wall faces. When they project out on one side of the wall, they are known as single pilasters. When they project out of both sides of the wall, they are known as double pilasters. Beyond increasing the strength of the structure, pilasters offer an economic advantage by permitting construction of higher thinner walls. In some instances, depending on load conditions, it will be necessary to install horizontal ties that encircle the vertical rebar. This essentially creates a closed loop around the vertical rebar to contain them when the pilasters are under considerable axial load. When deciding on the size and placement of pilasters, always consult a structural engineer or your local building official to ensure that the pilasters are appropriately sized for the load requirements. As illustrated below, the FlexLock® system uses a combination of post-tensioning and concrete reinforcement to create these structural elements.

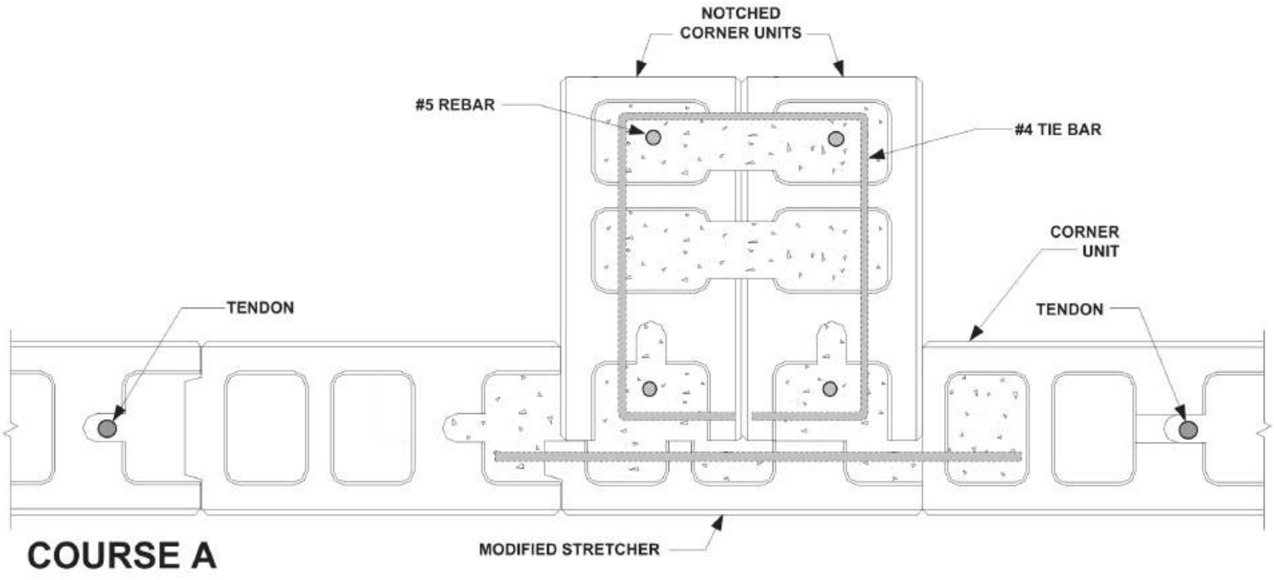


Fig. 5.4a

Single Pilaster

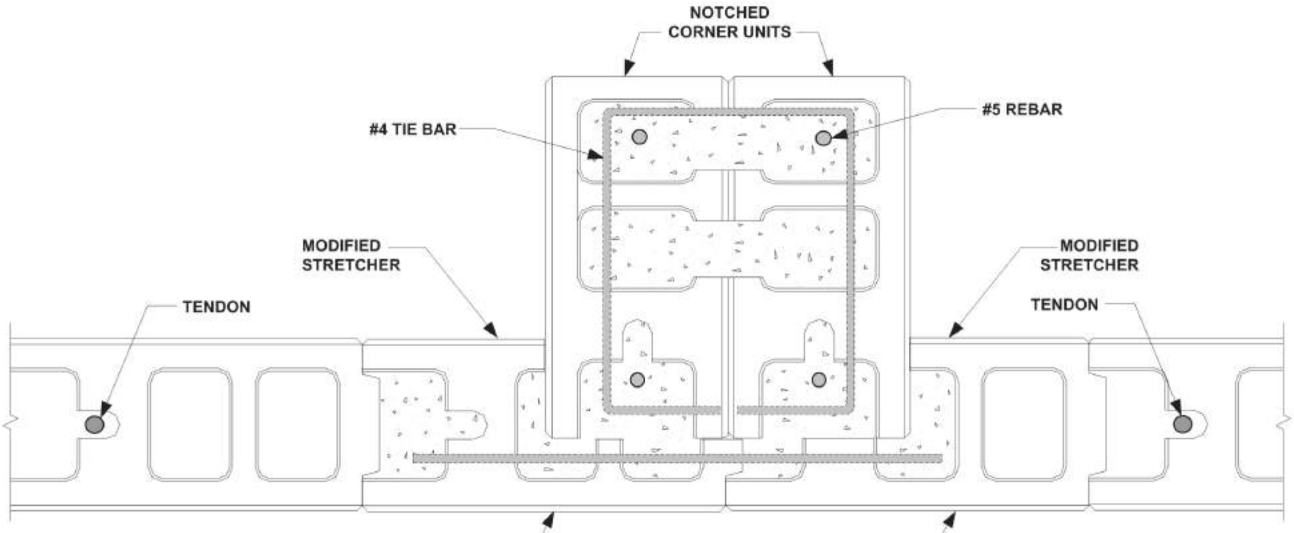


Fig. 5.4b

Single Pilaster

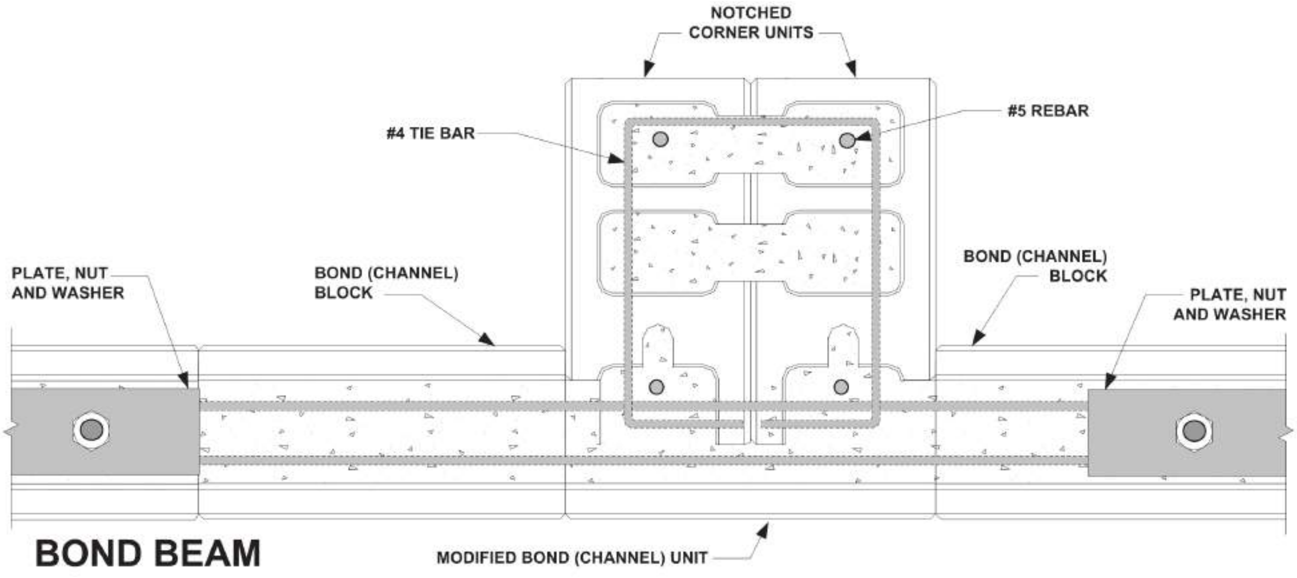
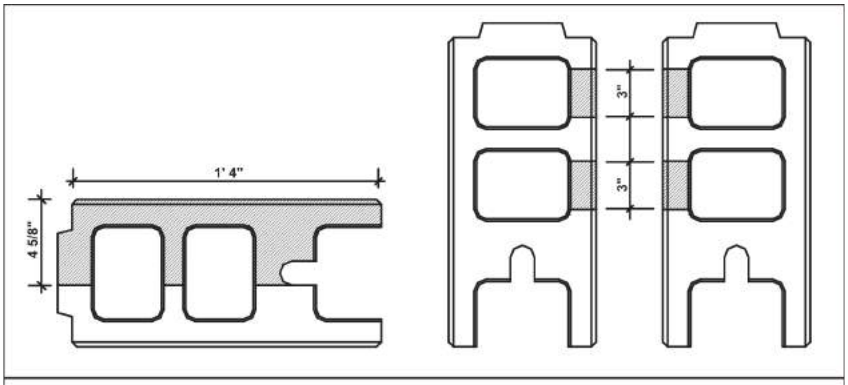
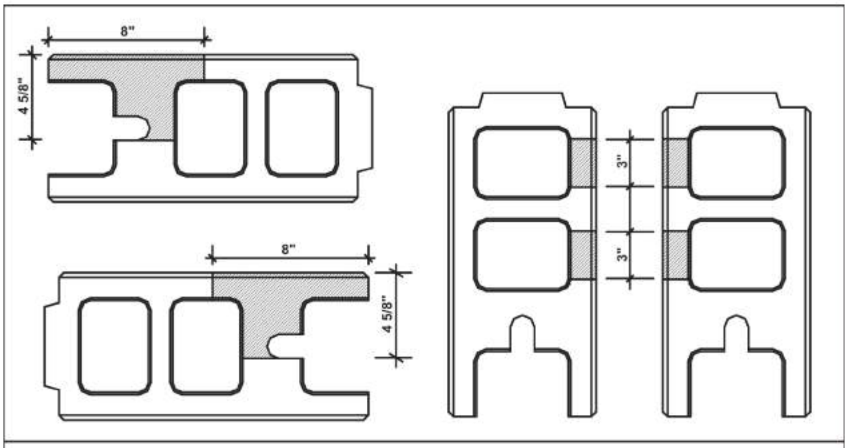


Fig. 5.4c

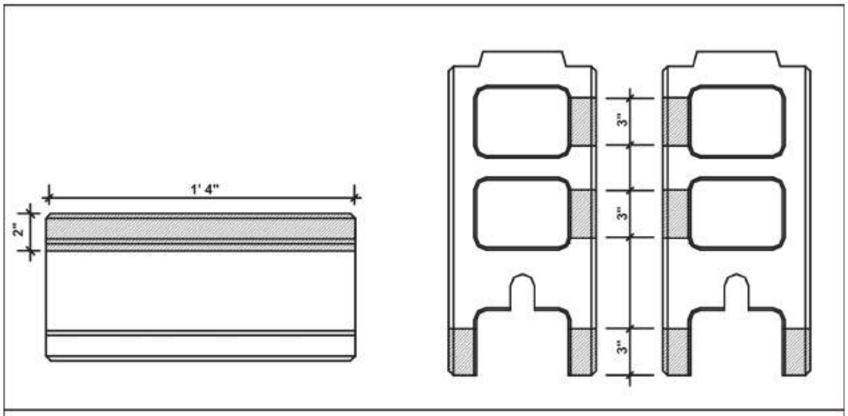
Single Pilaster



COURSE “A” CUTS



COURSE “B” CUTS



BOND COURSE CUTS

Fig. 5.5

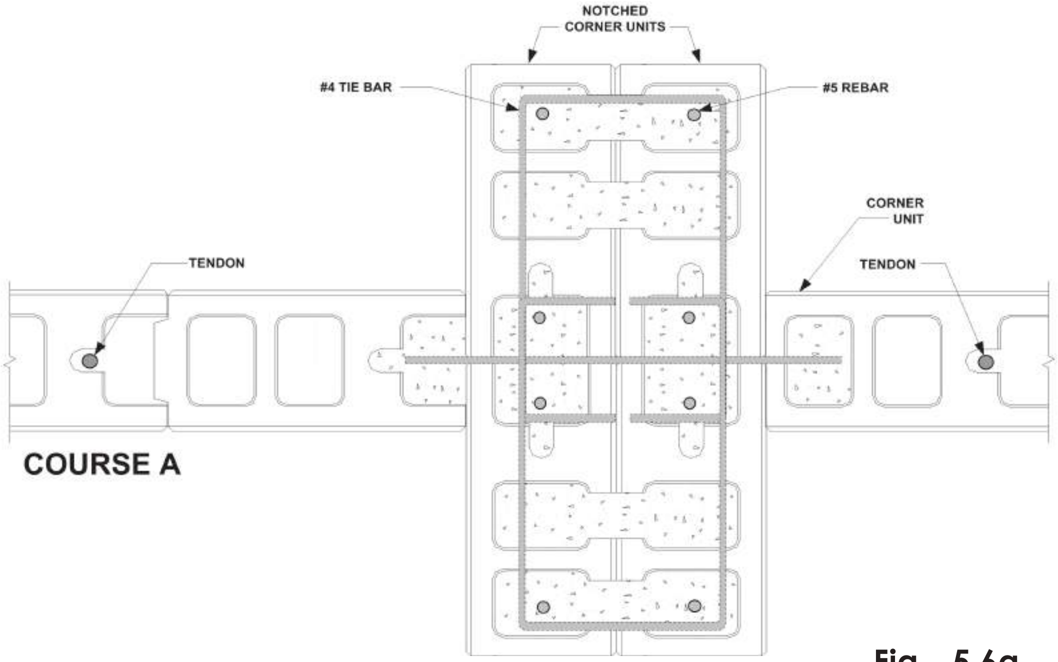


Fig. 5.6a

Double Pilaster

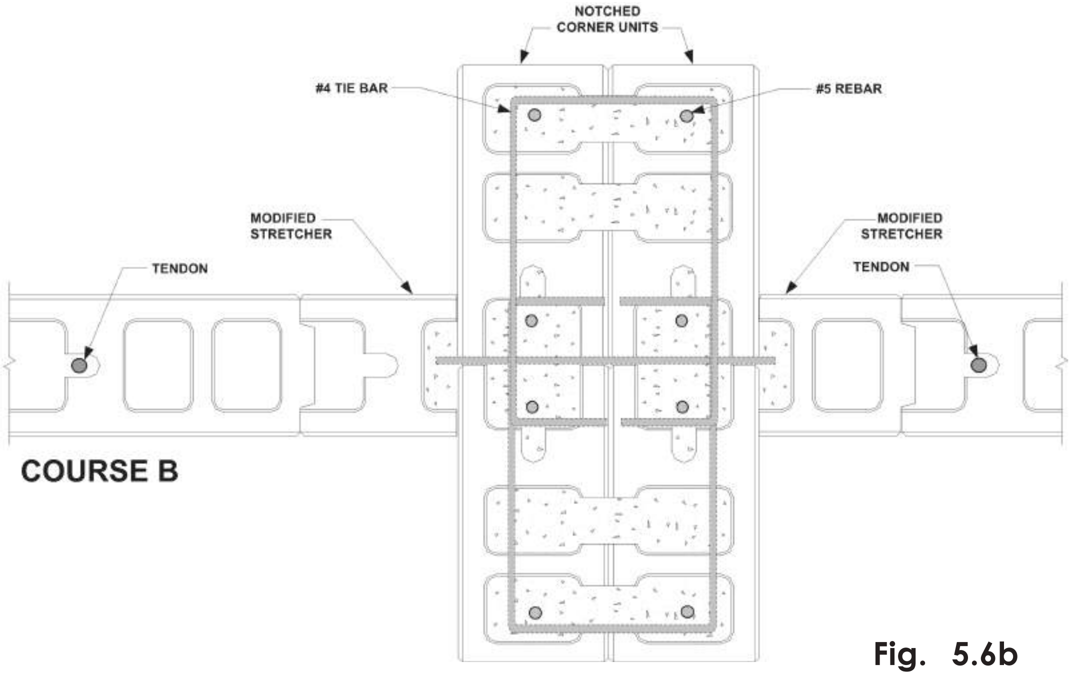


Fig. 5.6b

Double Pilaster

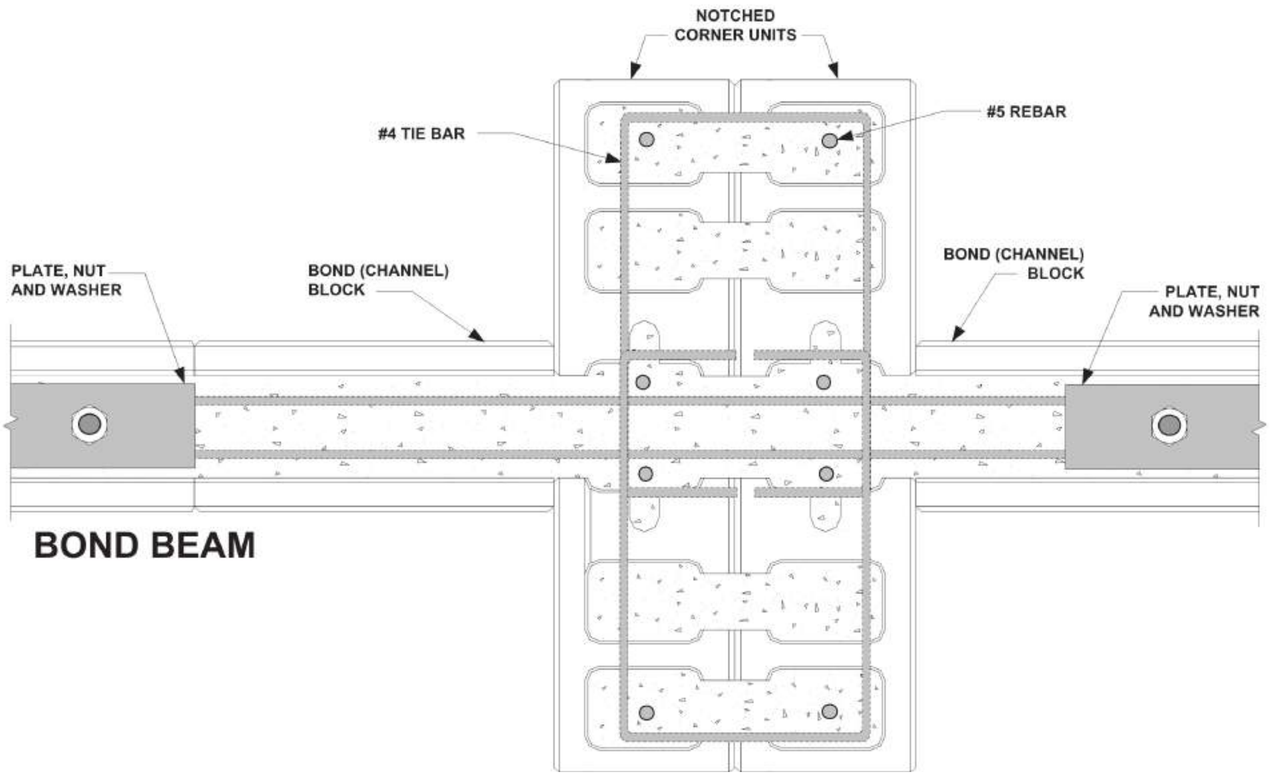
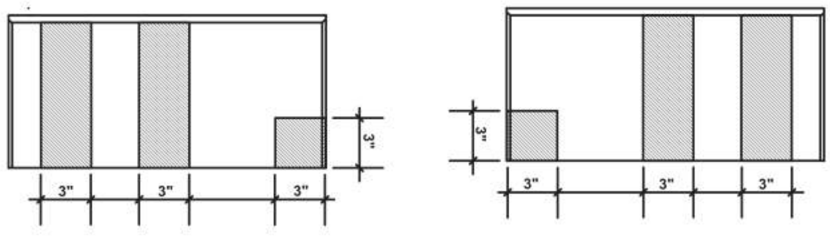
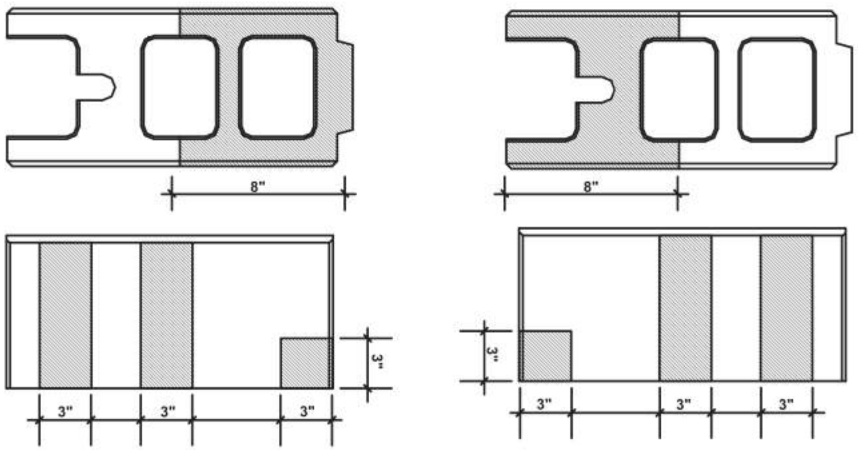


Fig. 5.6c

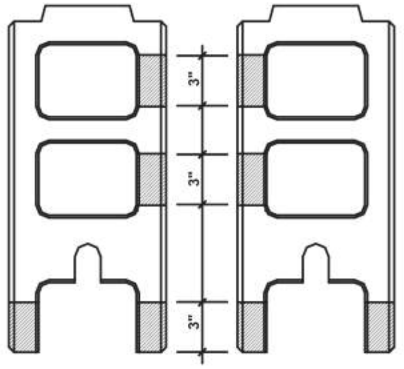
Double Pilaster



COURSE "A" CUTS



COURSE "B" CUTS



BOND COURSE CUTS

Fig. 5.7

PIERS

A pier or column is an isolated section or column of masonry. Piers function primarily as compression members when supporting beams, girders, trusses or similar elements. It may be used as a load bearing wall when it is not bonded to masonry at the sides, and its length does not exceed four times its thickness. Because a pier failure has the potential to cause collapse of other structural members, a series of special requirements are imposed on columns in addition to the requirements for reinforced concrete masonry wall design. Always consult a structural engineer or your local building official to ensure that piers are appropriately sized and placed for the load requirements. To create a FlexLock® pier, the units are dry-stacked, reinforced, and grouted. In some instances, depending on load conditions, it will be necessary to install horizontal ties that encircle the vertical rebar. This essentially creates a closed loop around the vertical rebar to contain them when the piers are under considerable axial load. Post-tensioning is not necessary for this application.

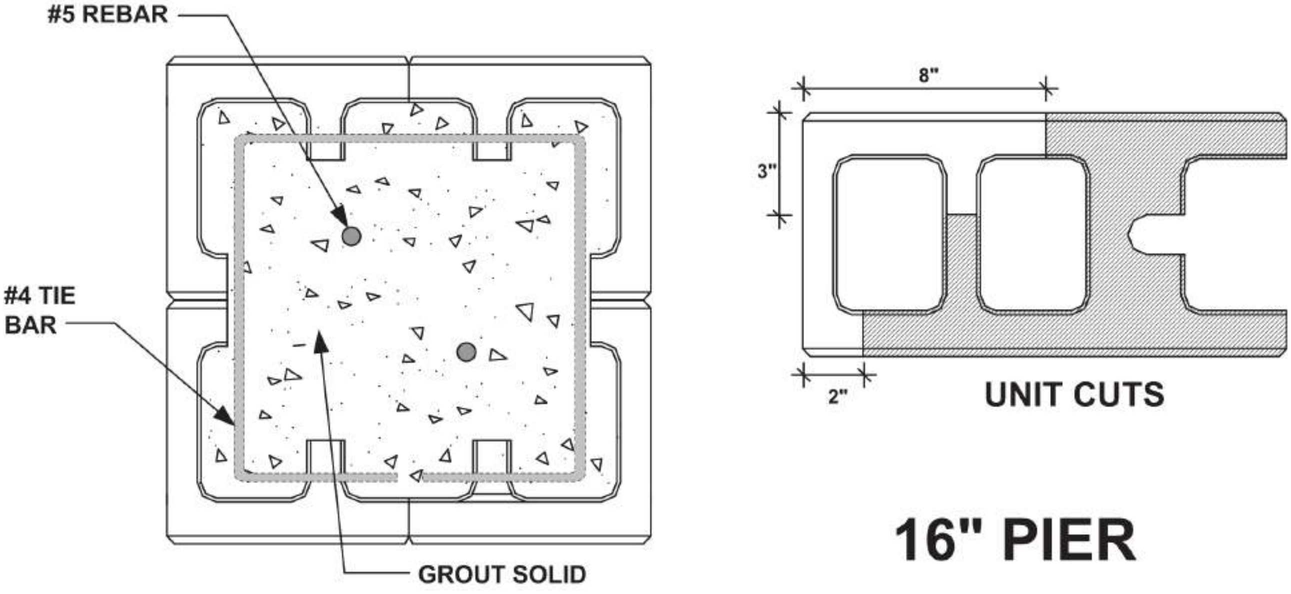


Fig. 5.8

C. Using 16” CMUs for a Brick Ledge

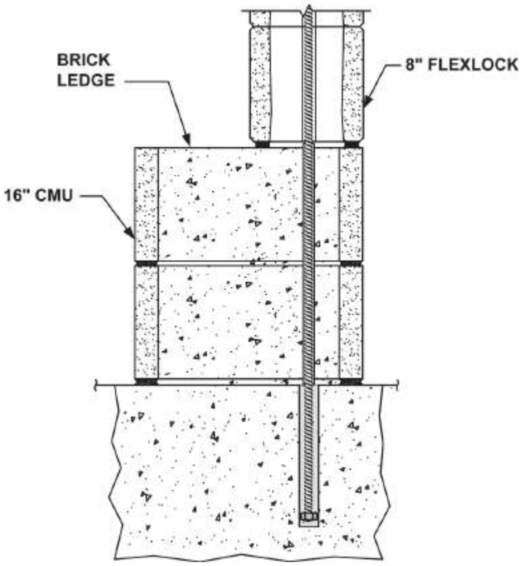


Fig. 5.9

Brick Ledge

Some applications may require single or multiple base courses of 16" units to create a brick ledge. This can be accomplished using 16” conventional CMUs. After the anchor tendons are located and installed on the footing, 16" block can be laid up to the desired base course(s) with the tendons passing through the cores. Care should be taken to ensure that the location of the tendons reflect where the 8" FlexLock® units will eventually sit in relation to the larger base course(s) below. A PVC bond break is then placed over the tendon from the footing to one inch above the top of the base course. None of the grout should touch the tendon itself. This allows the tendon to naturally elongate without pulling on the cured grout when tensioned. All of the cores (including those without a tendon), are then fully grouted up to the top of the base course. With the grout sufficiently cured, a bed of mortar is laid on top of the base course, and FlexLock® units are laid as outlined in Chapter 4, Step 5 of this Guide.

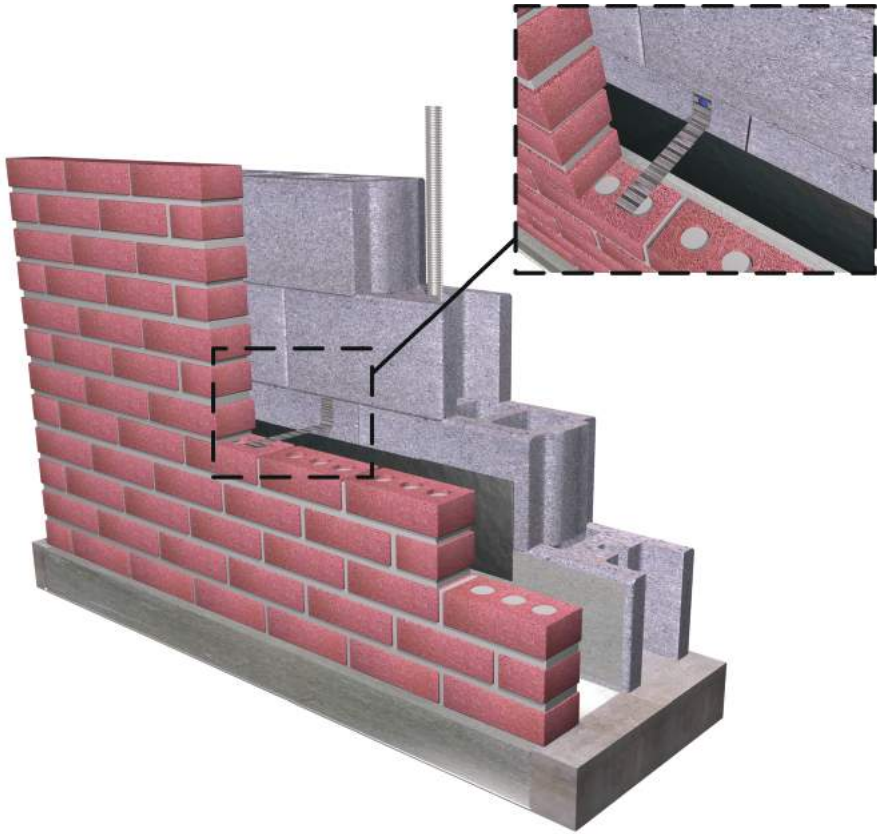


Fig. 5.10

Brick Veneer

D. Brick Veneer

In certain applications, it may be desirable to have a brick finish on a FlexLock® wall. Brick veneering employs a nominal three or four inch exterior brick tied to a backup wall creating a double wythe structure. Where the block wall acts as the structural element, the brick wall acts as a non-structured cosmetic element. Typically, the two wythes are separated by a one inch cavity. In conventional masonry, metal ties are used in the bed joints of both the brick and block to connect the two wythes together. These not only tie the veneer to the backup wall but, because the ties allow slight movement, the two wythes are able to expand and contract independantly. Since FlexLock® does not use mortar in the bed joints, it will be necessary to screw, or nail, various commercial ties to the FlexLock® units.

E. Routing Plumbing, Electrical and Duct Work

The vertical cores in FlexLock® allow for the routing of pipes and electrical conduit. Cores can be notched at the bottom of the block to allow horizontal access *(Fig. 5.11)*. Routing is best conducted as the wall is being built to ensure greater accessability. Consult the drawings to locate the position of the pipes and conduits, and install in accordance with the local building requirements.

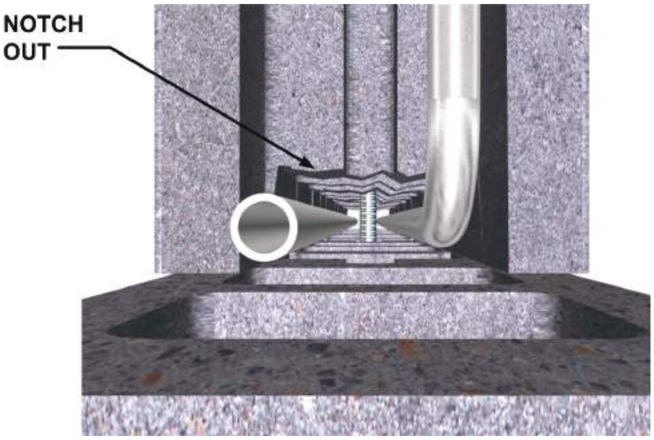


Fig. 5.11

Pipe and Conduit

Fig. 5.12

Through Holes

As in conventional masonry, through holes for plumbing and electrical can be either cut or drilled through the shells *(Fig. 5.12)*. If possible, holes are preferred as cuts are more likely to reduce the strength of the unit. To install an electrical box inside the block, the shell can be notched and, depending on the particular box, mounted in accordance with the manufacturer's instructions. Only place the electrical box in the middle cell so that the tensioning load on the wall is displaced to either side of the opening. It is always good practice to fill the remaining areas of the cell with grout.

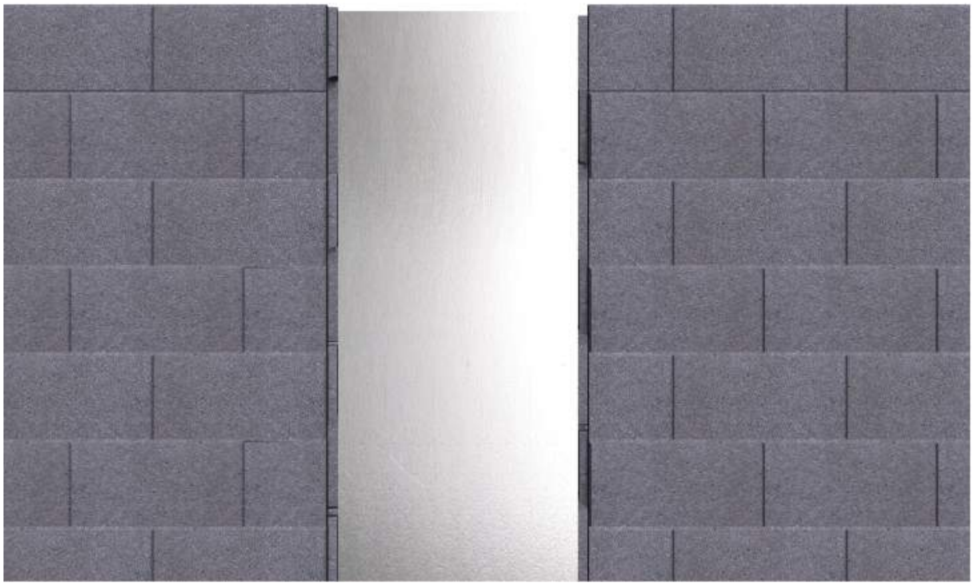


Fig. 5.13

Chase

A chase is a continuous recess built into a wall to receive pipes, conduits, and ducts *(Fig. 5.13)*. Chases are constructed by reducing the thickness of the wall at a particular point. This forms an interior groove or channel on the interior side of the wall. To create a chase, standard blocks are modified and reinforced. The reinforcement, which is accomplished with the use of mortar and rebar, is necessary because the strength of the wall has been reduced, along with the manner in which the modified block are tied into the larger structure.

Procedure

1. Consult the drawings, both plan and elevation, to locate the chase and determine its dimensions.

2. Check the size of the chase with the duct being installed. If there is a discrepancy, notify the supervisor.

3. Read the specifications to find out how the units are to be modified.

4. With the exterior lines of the wall already chalked out, chalk out the interior wall containing the chase.

5. Measure from the corner, or another established point, to locate the position in the wall where the chase will be built.

6. Because some chases are located by their center lines and others by their sides, be sure to read the plans carefully. Always use at least two established points to verify the position.

7. Once the chase has been located, chalk out its dimensions squaring the sides. Extend these lines on either side of the footing so that it can be seen when the first course is laid.

8. To establish the bond, dry lay the first course the entire length of the wall.

9. Remove the units where the chase will be constructed. These will be replaced by modified units. (If the duct does not extend to the first course, lay up unmodified units to the course where the duct begins).

10. Modify the units in accordance with the specifications, and dry lay them into position *(Fig. 5.14a)*. Measure the space to ensure it will accommodate the duct.

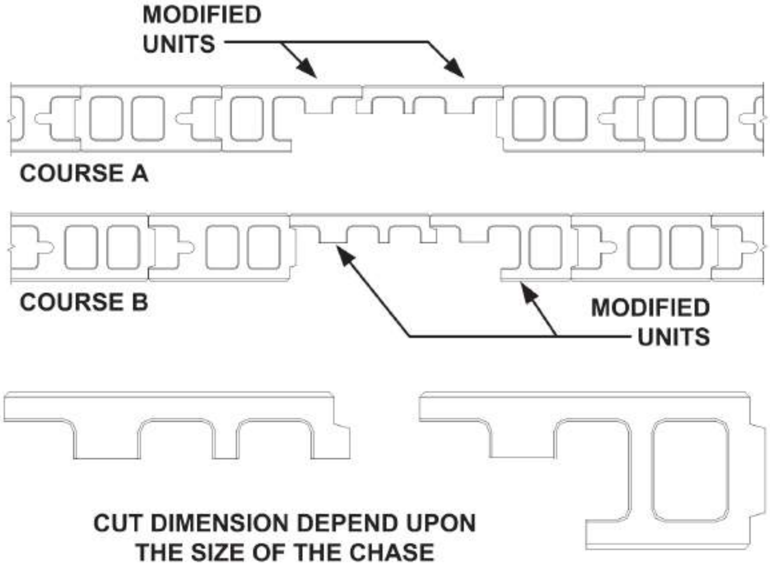


Fig. 5.14a

11. Lay the first course as described earlier in this Guide. Before laying and leveling the modified units, fill their cells with mortar *(Fig. 5.14b)*. The mortar must be stiff enough to maintain itself in the partial cells. During construction, mortar must not be allowed to fall into either the head or bed joints.

12. Along with filling the partial cells of the modified units, fill one cell of an unmodified adjacent unit on either end *(Fig. 5.14c)*. Place vertical rebar in these cells. This will be easier after four courses are laid. The rebar extends up the wall and into the bond beam.

13. Place short sections of horizontal rebar at each course to secure the modified units, and tie them into the rest of the wall *(Fig. 5.14c)*. Depending on the specifications, this can be done at each course, or every other course.

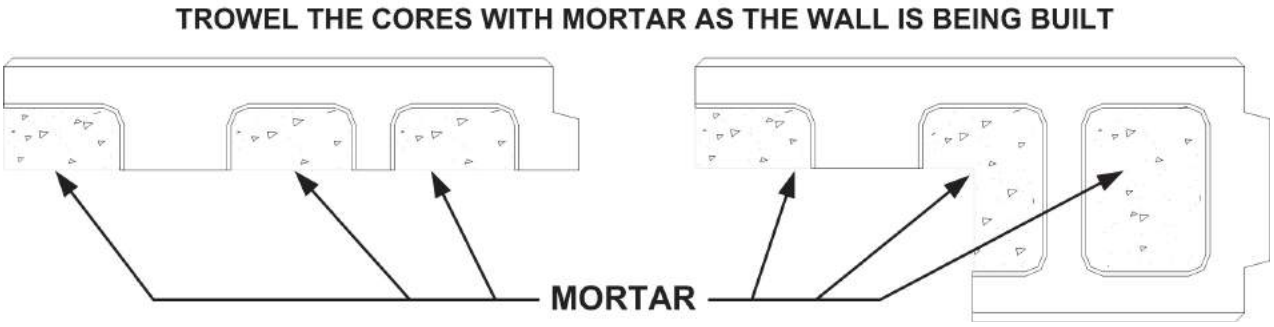


Fig. 5.14b

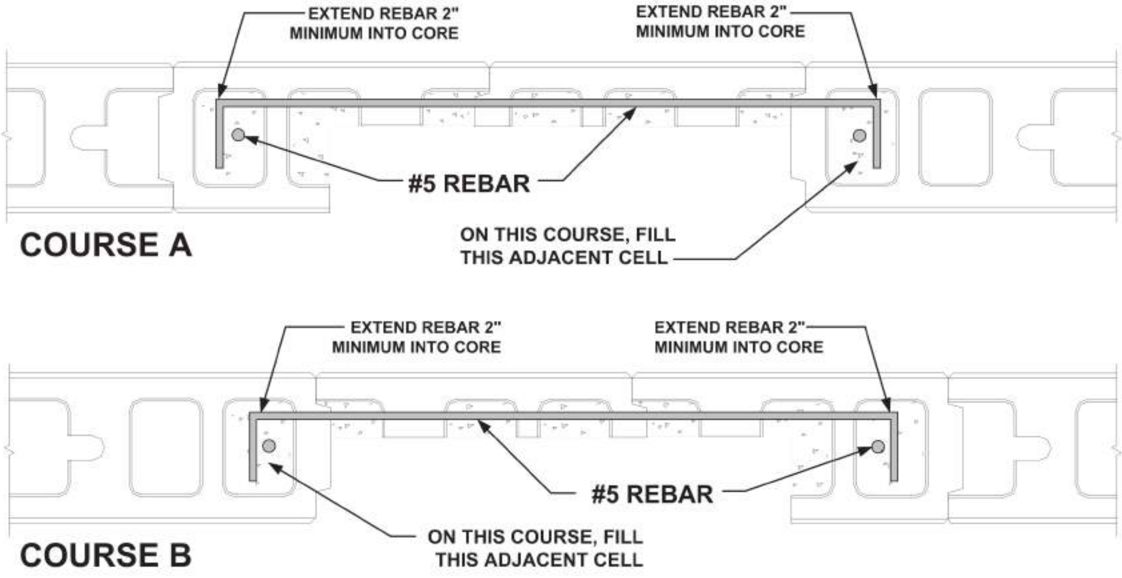


Fig. 5.14c

F. Placing an Opening After Construction

The placement of a new door or window after construction requires a careful consideration of the engineering requirements of that particular structure, the structural effects of the opening, local code requirements, and esthetic issues. There are a number of methods available to create the opening, maintain the structural integrity of the building, and provide for jamb attachment. Because of the many factors involved in this decision and the importance of using the right method on the right structure, specifiers, building officials and contractors are directed to contact Cercorp for technical assistance *(Fig. 5.15)*.

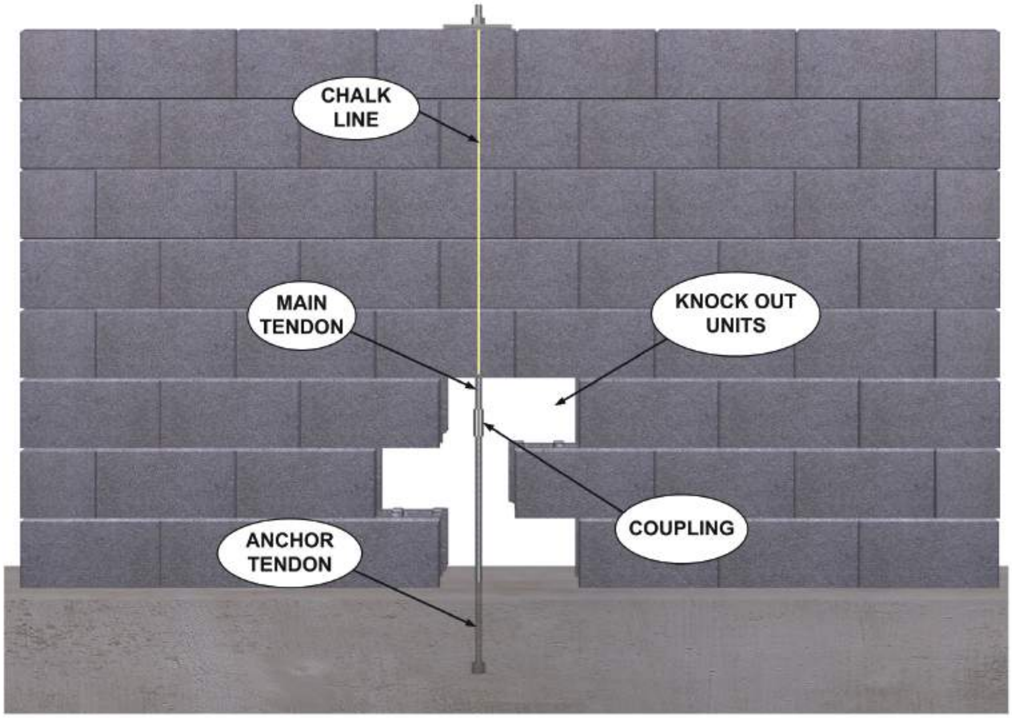


Fig. 5.15

Point of Access

G. Fencing and Sound Walls

Although Cercorp has developed a number of specialized post-tensioned units for fencing, these are only available in some markets. In general, these units use a smaller stretcher block about 6" wide, along with an 8" pilaster block. While there are advantages to these specialized systems, the FlexLock® 8" units make an excellent fence, especially when they are used with architectural finishes such as split face and fluted. The fence is constructed in the same manner as load-bearing walls except that they are finished at the top by a capping stone *(Fig. 5.16)*. The number and placement of the tendons will vary depending on the height of the wall, wind conditions, and building codes. The height of a FlexLock® fence must not exceed 6' unless designed by a professional engineer, and approved by a building official. To facilitate construction on large jobs, post-tensioned panels can be constructed using a double bond beam at the top and bottom *(Fig. 5.17)*. These panels can be built off-site and transferred to the jobsite for quick assembly. With a small crane, each panel can be lowered onto position between two steel I-beams *(Fig. 5.18)*.

Fig. 5.16

Fencing Wall

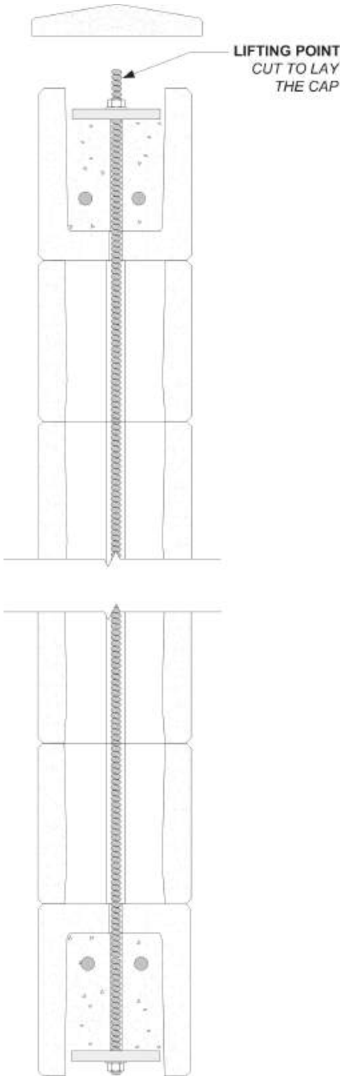


Fig. 5.17

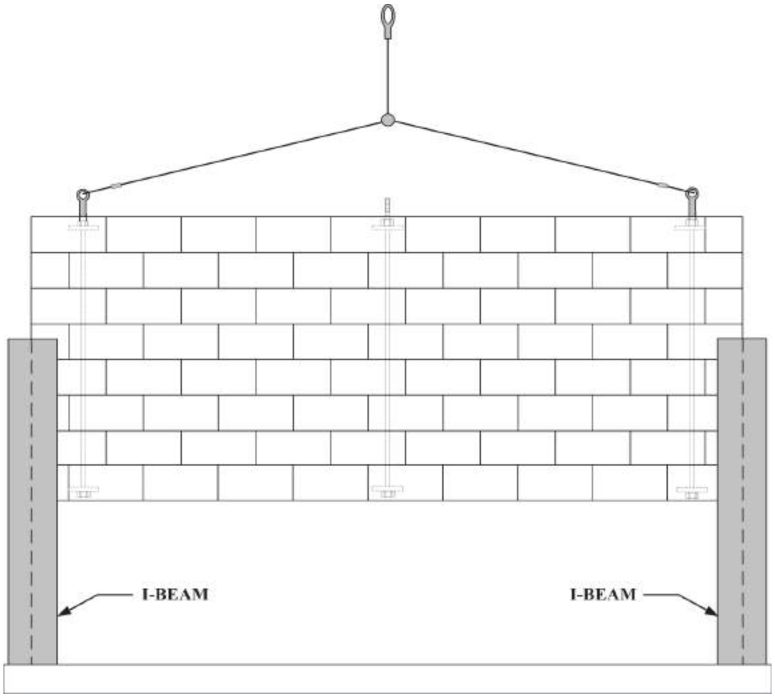
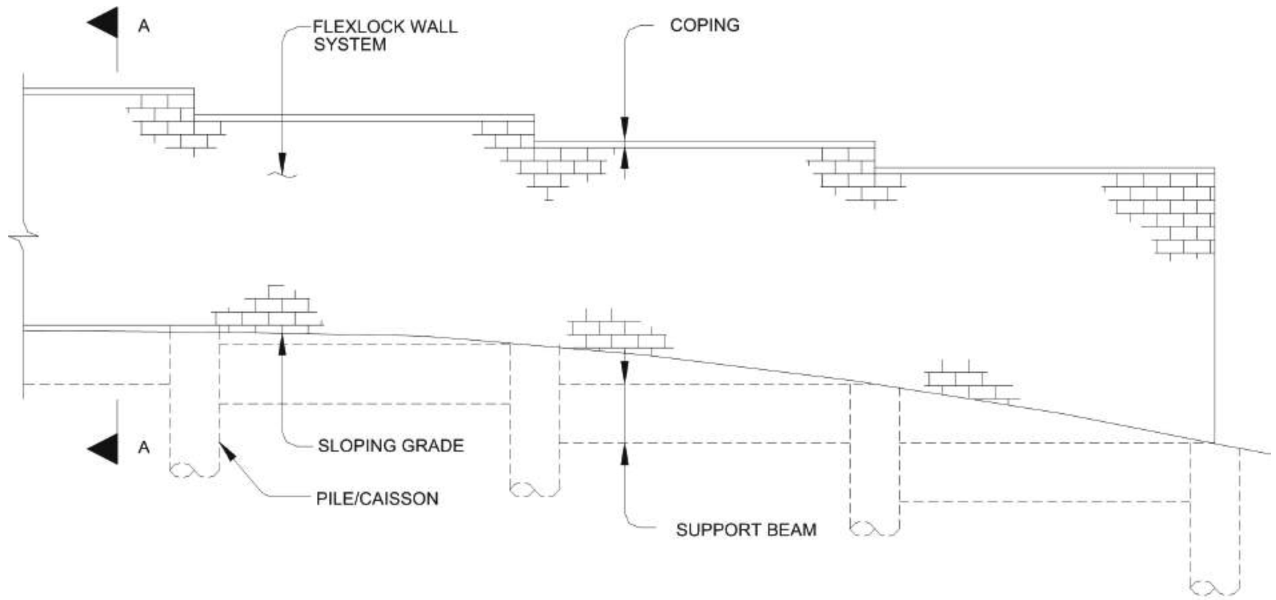


Fig. 5.18

Panel Insertion

Like fencing, 8" FlexLock® units can also be used for highway sound walls. In certain markets these may need to be designed for the specific applications (such as sound reduction) and in accordance with state and federal DOT regulations. Some examples are provided below.



ELEVATION

SOUNDWALL - SLOPING GRADE

Fig. 5.19

Example of a Sound Wall

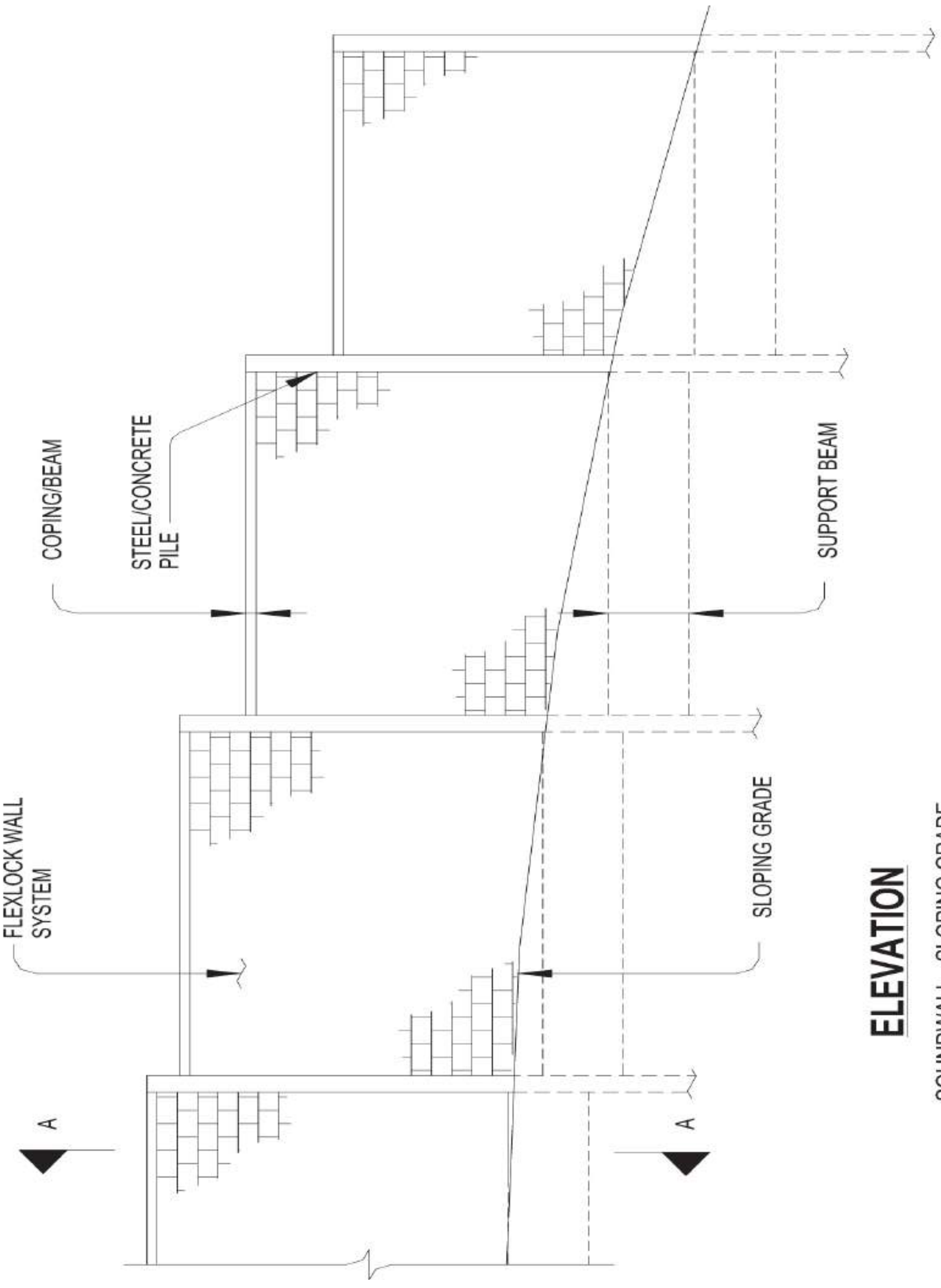
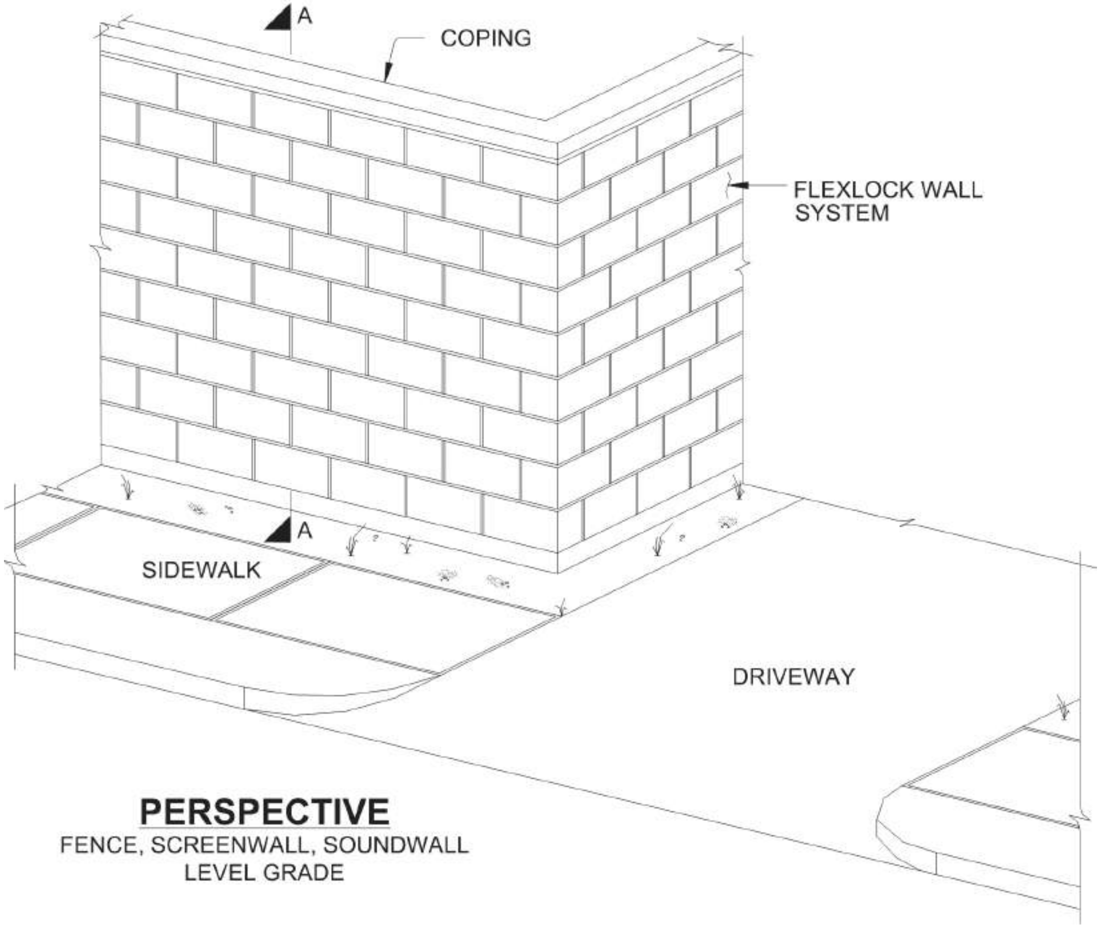

COPING/BEAM
STEEL/CONCRETE PILE
SUPPORT BEAM
FLEXLOCK WALL SYSTEM
SLOPING GRADE
A
A
ELEVATION
SOUNDWALL - SLOPING GRADE

Fig. 5.20



PERSPECTIVE
FENCE, SCREENWALL, SOUNDWALL
LEVEL GRADE

Fig. 5.21

H. Safe Rooms

Following the lead of FEMA, and later, the National Concrete Masonry Association (NCMA), Cercorp has developed a FlexLock® version of the safe room. The safe room allows residents to seek shelter during high wind events such as tornados and hurricanes.

While there are specific requirements for safe rooms (FEMA 320), and while these have been adapted for concrete masonry structures (Concrete Masonry Tornado Safe Rooms for Existing Single Family Structures, NCMA 2002), the high cost of interior safe rooms has limited their acceptance. One solution is to employ FlexLock® technology as a means to provide a strong shelter at an affordable price.

Although FlexLock® has undergone extensive structural testing, at the publishing of this Guide, it has yet to be submitted for FEMA testing. Nonetheless, it's post-tensioning technology provides a significant layer of protection at a price that most homeowners can afford.

The following illustrates how an interior safe room can be constructed using FlexLock® technology. While the tendons can be spaced at 48" on center strengthen is significantly increased when these tenons are placed at 32 or 16 inches on center.

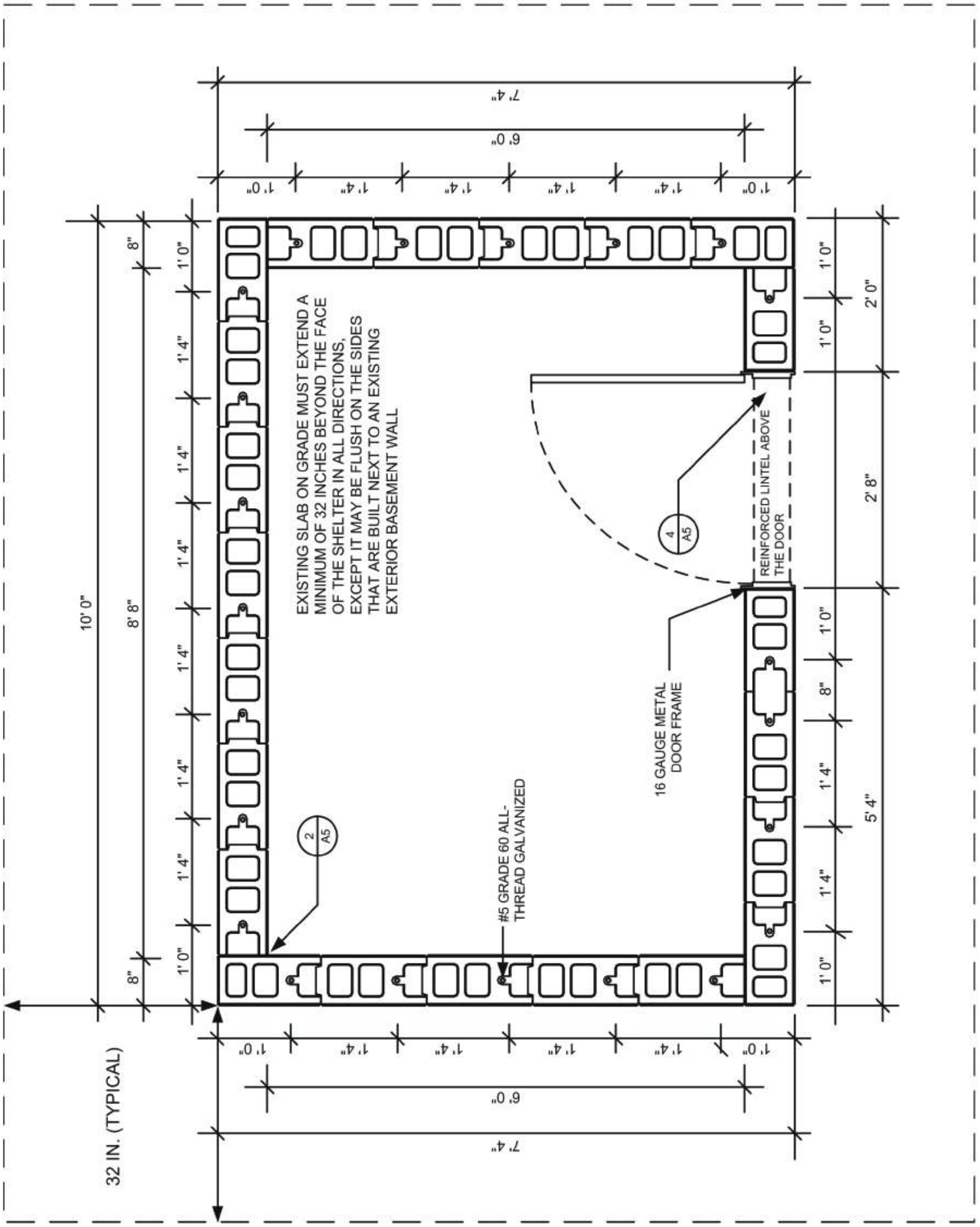


Fig. 5.22

Safe Room

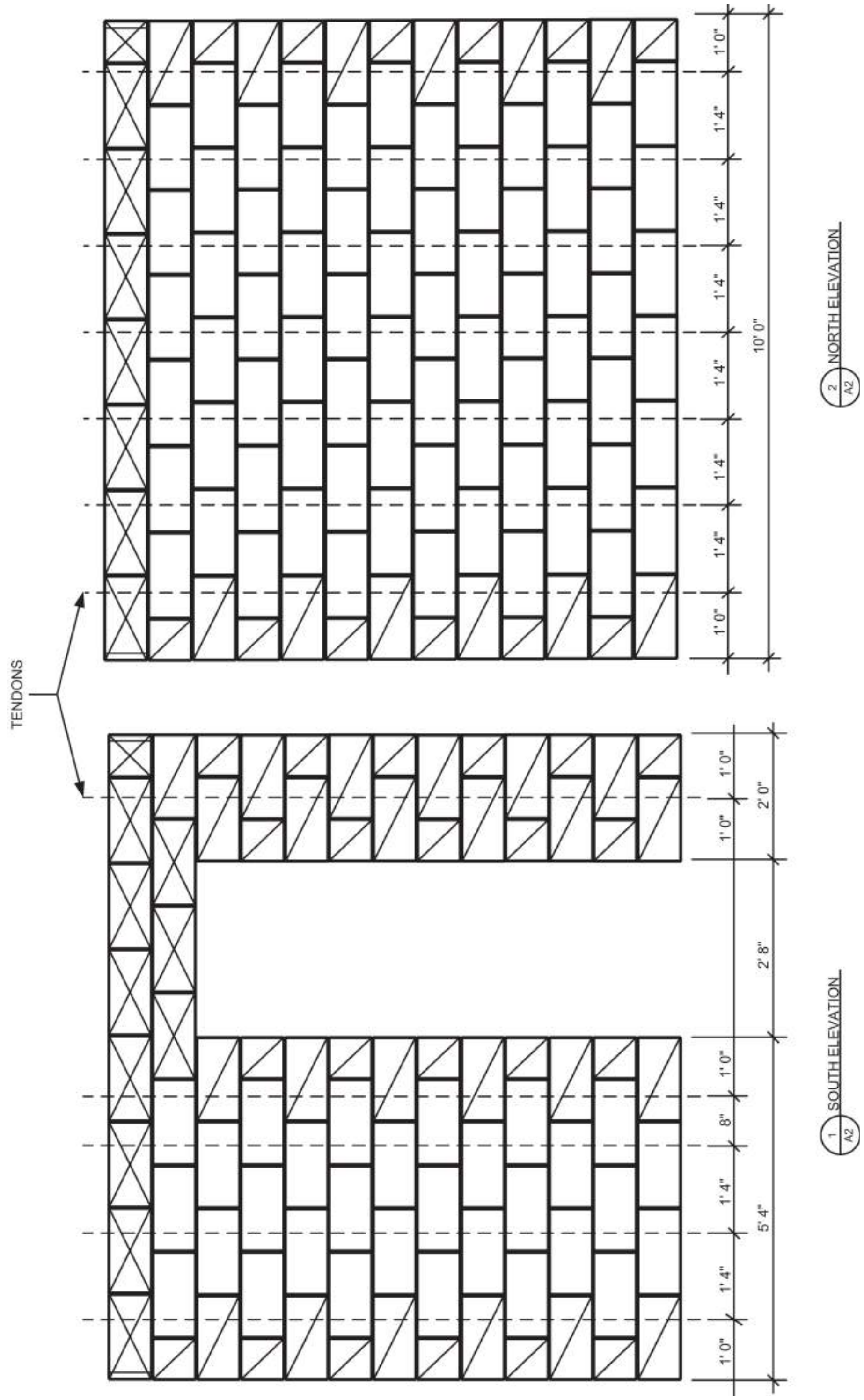


Fig. 5.23

Safe Room

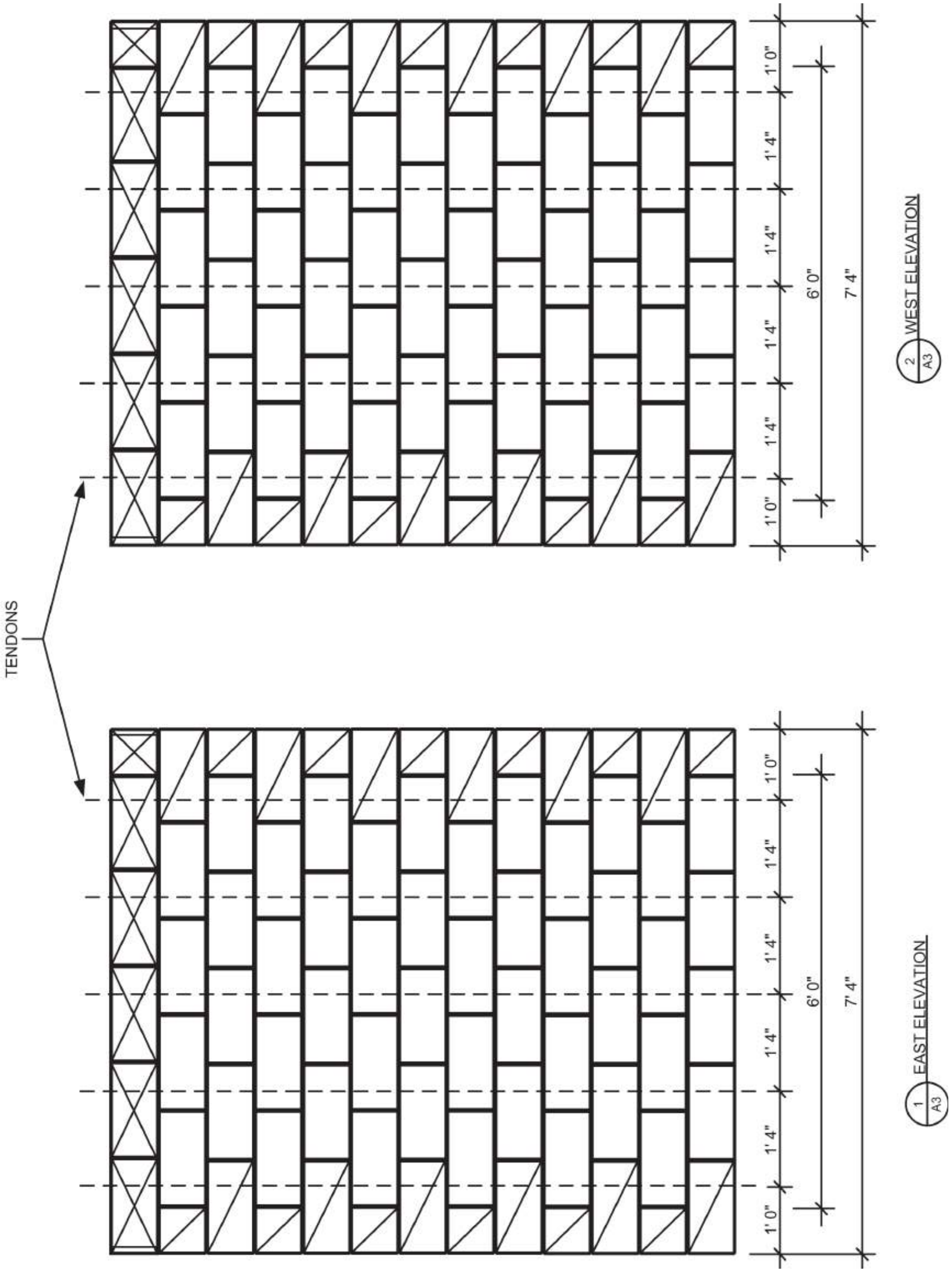
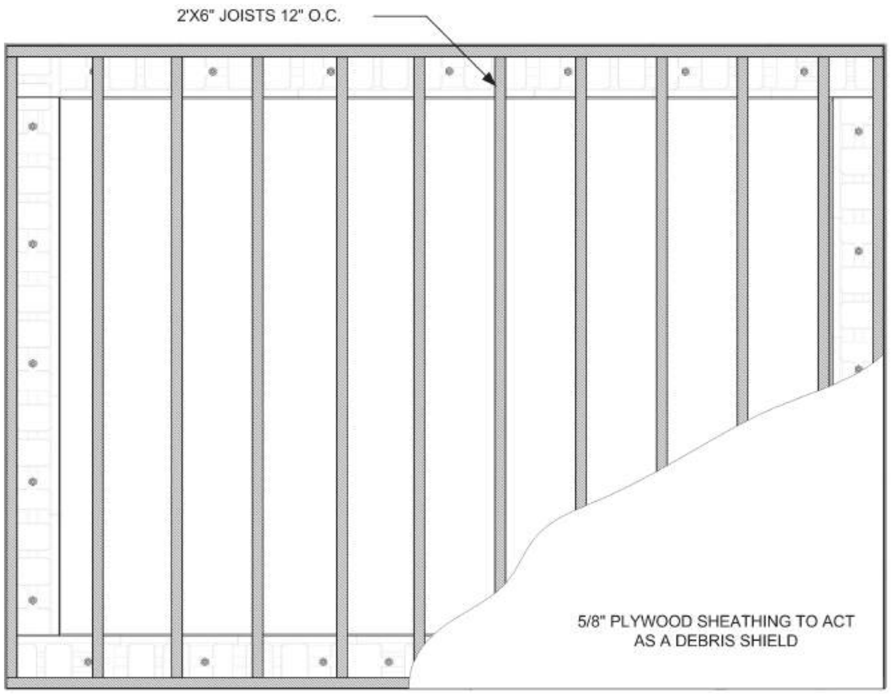
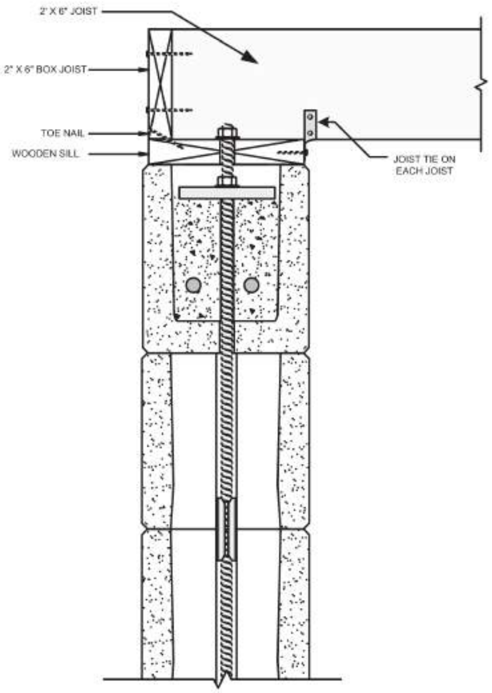


Fig. 5.24

Safe Room



1 A6 ROOF- PLAN JOIST DESIGN



2 A6 TYPICAL WALL/CEILING CONNECTION

Fig. 5.25

Safe Room

I. Scaffolding and Bracing

A scaffold provides an elevated working platform used to support men and materials. It is usually a temporary structure commonly used during construction. Scaffolds are sources of fatal and serious injuries with the primary cause of accidents falling from one level to another. These consist of three following categories:

1. Equipment Failure
2. Operating Procedures
3. Environmental Conditions

Contributing factors include:

1. Failure at Attachment Points (Scaffold Parts or Anchor Points)
2. Component Failure (Not Erected Properly)
3. Inadequate Fall Protection (Hand Rails/Mid and End-rails)
4. Improper Construction
5. Improper Work Procedures (Not Following Safety Rules)
6. Working in High Winds, Extreme Temperatures or in the Presence of Toxic Gases

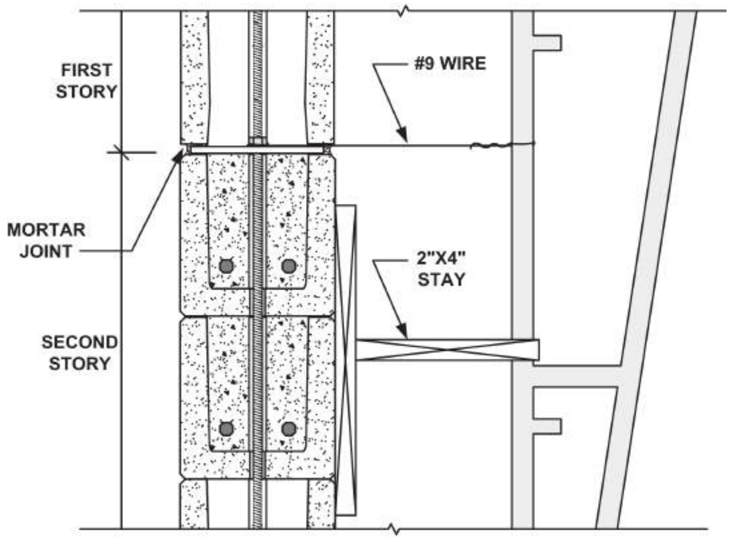


Fig. 5.26

Scaffolding Attachment

I. Scaffold Basics

The following measures must be taken to avoid serious injury during scaffold use:

1. Post scaffolding safety rules in a conspicuous place and ensure compliance.
2. Support scaffold posts, baseplate, or sills on a **solid foundation.** (On soil, this requires removing mud, compacting loose fill, and placing the base plates on a mud sill. Adjustable base plates should be used for leveling.)
3. Provide advanced planning in the erection, operation of, and dismantling of scaffolds.
4. Regulations require that all equipment is inspected prior to use and continually throughout the scaffolding operation, especially rental equipment.
5. Erection of scaffolding should be supervised by a **Competent Person** with authority, proper knowledge, skill and experience.
6. Wall scaffolds must be securely braced in accordance with state and federal codes and regulations *(Fig. 5.26)*.
7. Provide safe access (scaffold ladder attached to scaffold).
8. **Climbing cross braces is strictly prohibited**.
9. Provide adequate clearance (minimum 25 feet) in the vicinity of overhead electrical power.
10. Planking must meet current scaffolding safety requirements.
11. All rolling scaffolds must be fully planked.
12. All employees working on scaffolds are required to wear approved head protection.
13. Never overload the platforms and scaffold beyond the recommended load capacity. The scaffold and component parts must be capable of supporting at least four (4) times the maximum intended load.
14. Working platforms should completely cover scaffold openings; use planking constructed of lumber which has been properly inspected and graded appropriately. Scaffold planking material should be free of cracks and properly secured to the frame and never extend farther than **12 inches beyond the edge of the scaffolding.**

15. Regulations prohibit riding a rolling scaffold during transport. Secure or remove all materials and equipment when transporting.

16. Ensure that rolling scaffold caster brakes are in proper working condition and are applied/set when rolling scaffold is stationary.

17. All scaffold materials, upon dismantling, should be stockpiled safely.

II. Scaffolding Attachment to FlexLock® Structures

While many scaffolds are free standing, it is sometimes required that a scaffold be attached to the structure itself. Whenever this is required, and in order to ensure safety, the wall itself will have to be sufficiently stable and adequately braced.

According to OSHA, a scaffold must always be secured when its height exceeds four times the minimum base wythe (OSHA 1926.451 (c) (1)). This being the case, a four foot base wythe would require a tie at 16 feet. This is well above where a typical bond beam would be placed in a FlexLock® wall. Although it may not be necessary, a compensation mortar joint is placed on top of a bond beam to reduce tolerance stack up. At this joint, which is just above the bearing plate in the wall, a #9 wire can be wrapped around the tendon and placed through the mortar joint where it can be twisted around the scaffolding (*see Fig. 5.26*). In standard masonry, this is done by placing an 8-12 inch piece of rebar vertically in the core and twisting #9 wire around it. The core is then filled with grout and the wire is run through the mortar joint. When the mortar and grout are set, the wire is twisted around the scaffolding. In both cases, the wet mortar is dug out around the wire so that after its use, it can be clipped, the stub bent in, and the hole patched.

III. Bracing FlexLock®

FlexLock® walls are braced and shored in a manner identical to standard masonry construction. Prior to capping, and after the anchors are sufficiently cured, additional support can be obtained by temporarily placing a bearing plate over a tendon and threading a wingnut so that it rests on the bearing plate *(Fig. 5.27 & 5.27a).* The wingnut can then be "snugged up" by striking the larger wing with a rubber mallet thereby temporarily post-tensioning the wall.

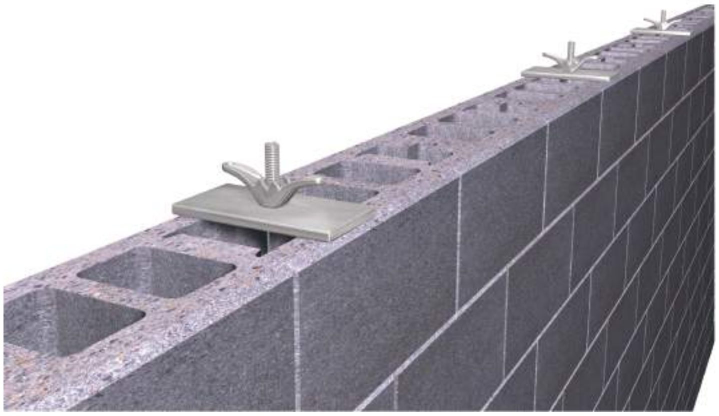


Fig. 5.27

Temporary Bracing

Codes and regulations relating to buildings and structures place responsibility on the contractor to provide a reasonable level of life safety for workers during construction. Until the recent development of the Standard Practice for Bracing Masonry Walls During Construction by the Council for Masonry Wall Bracing, there were no uniform guidelines for masonry wall stability. The standard only addresses strategies to resist the lateral loading effects of wind during construction. When other lateral loads such as impact, seismic, scaffolding, and lateral earth pressure are present, they need to be considered and evaluated separately. The following information provides further detail on the placement of bracing and should be consulted before construction.

Fig. 5.27a

1. Building Code Requirements for Masonry Structures, ACI 530-99/ASCE 5-99/TMS 402-99. As reported by the Masonry Standards Joint Committee, 1999.

2. NCMA Guide for Home Builders on Residential Concrete Masonry Walls, TR-134, National Concrete Masonry Association, 1994.

3. Standard Practice for Bracing Masonry Walls Under Construction, Council for Masonry Wall Bracing, July 1999 (Revised December 1999).

4. Bracing Concrete Masonry Walls During Construction, TEK 3-4B, NCMA.

J. Anchor Failure and Stress Fractures

I. Anchor Failure

Although every precaution should be taken to test the anchor bond before construction, it is conceivable that a tendon might fail when post-tensioning at the bond beam. While each structure might present unique problems in addressing the failure, the following procedure provides general repair guidelines.

IMPORTANT: Consult and seek the approval of a structural engineer familiar with FlexLock® and the appropriate building official before conducting any repair.

Procedure

1. Affirm that the tendon has failed. This is realized when the tendon will not take any tension.

2. Using a chalk line, accurately mark the vertical path of the tendon from the top course to the bottom on both sides of the wall.

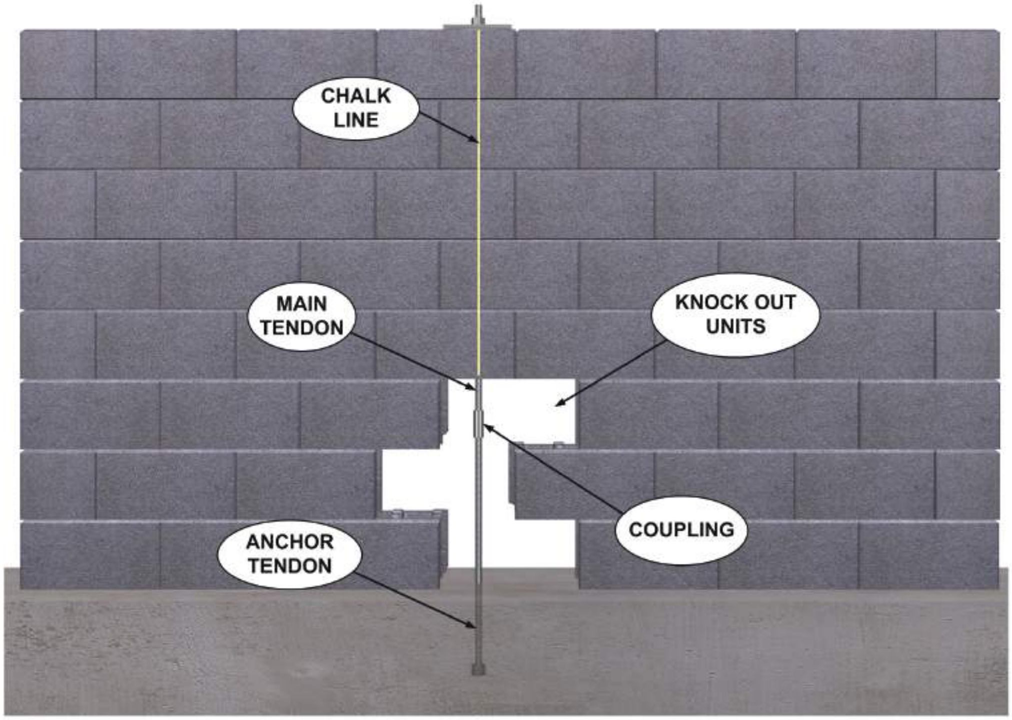


Fig. 5.28

Anchor Failure

3. At the bottom of the wall, knock out the units of the first three to five courses revealing the failed tendon *(Fig 5.28)*.

4. If possible, disconnect the anchor tendon from the main tendon at the coupling. If this is not possible, cut the tendon and remove the coupling.

5. Pull the anchor tendon from the hole and inspect the hole.

6. Run a drill through the hole to clear it of any remaining grout and increase its depth by approximately 1¼”. This is necessary to later re-couple the anchor tendon to the main tendon.
7. Flush the hole with fresh water and clear it with compressed air.
8. Take an anchor tendon and size it so that in can be inserted in the hole and easily coupled to the main tendon.
9. Prepare the anchor tendon by threading a hex nut on one end leaving approximately 1/4" of thread at the bottom. On the opposite end, thread a stop-type coupling until it is fully engaged.
10. Pre-fit the assembly by placing it in the hole and connecting it to the main tendon. It may be necessary to adjust the main tendon at the top using the hex nut above the bearing plate. When connecting the two tendons, ensure that the entire anchor tendon is turning with the attached coupling so that it is not disengaging the anchor tendon as it is engaging the main tendon. Remove the anchor tendon for grouting.
11. Mix high capacity grout in accordance with the manufacturer’s instructions and pump or pour into the hole until the grout reaches the top of the hole.
12. Insert the hex nut end of the anchor tendon into the hole turning it clockwise allowing the grout to completely surround the component. Once again, connect the stop-type coupling to the main tendon until it is fully engaged. When doing so, ensure that the entire anchor tendon is turning with the attached coupling so that it is not disengaging the anchor tendon as it is engaging the main tendon.
13. Allow the grout to cure as per manufacturer’s instructions so that it comes up to full strength. It is recommended that quick curing grout be used.
14. The tendons should be tested before repairing the masonry. Temporarily place 2"x4" bracing under the opened area (under the shells) so as to take up the compressive load while testing. Place a torque wrench on the hex nut at the top of the tendon and torque to the required tension and leave for 30 minutes.
15. After 30 minutes, check the tension again to ensure there has been no relaxation due to bond failure. Also visually inspect the anchor tendon where it enters the footing and ensure there are no visible signs of stress fractures in the grout.

16. If the tendon passes the stress test, release the tension by loosening the hex nut at the top of the tendon and remove the temporary bracing at the base of the wall.

17. The base of the wall can be closed using conventional masonry techniques. Shells of standard CMUs can be cut, and mortar applied to the head and bed joints on either side of the wall to close up the space. When esthetics is not a question, small plywood forms can be fixed to the wall and grout poured. In this case, the tendon must have a bond break so it can move freely when tensioned.

18. When the mortar and/or grout is sufficiently cured, the wall can be tensioned as described n Step 10 of this chapter.

II. Stress Fractures

Stress fractures *(Fig. 5.29)* are caused by a cumulative overload on the face shells caused by a number of factors including over-tensioning, excessive roof loading, and unit point loading. These external and/or internal cracks are the result of unequal compressive stresses which are frequently accelerated by environmental factors such as foundation settling and freeze-thaw cycles.

The most common cause of stress fractures is point loading due to poorly manufactured block or debris left on the bearing surfaces during assembly. A strict quality assurance program is required by all FlexLock® producers to ensure dimensionally accurate units. In the event that this program breaks down, the last line of defense is the ICLS method of laying block. This final quality control procedure, when closely followed, will result in virtually no point loading.

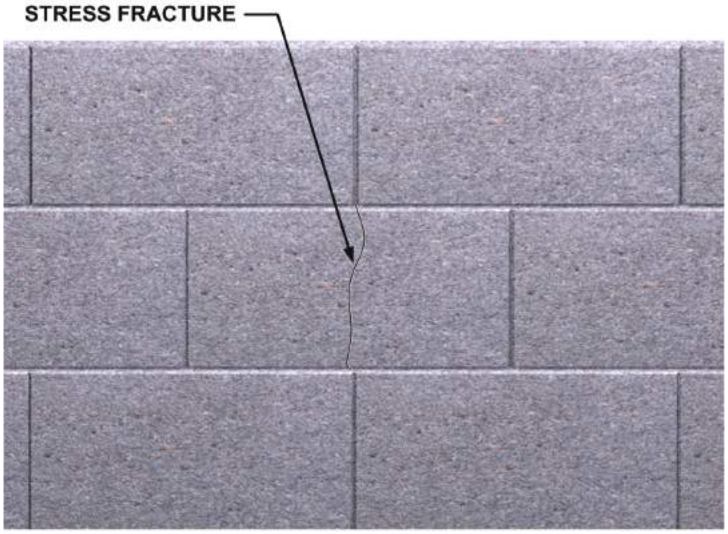


Fig. 5.29

Stress Fracture

In the event that stress fractures develop, they do not necessarily represent an immediate problem. The fracture means that the unit, which was previously under stress, has reached a certain equilibrium. Thus, instead of one stressed element, there are two less stressed elements. In cases of hairline fractures, the two halves will, in all likelihood, continue to support the load above. As long as there is only one fracture in the unit, and as long as that fracture stabilizes (no longer grows longer and/or wider), there need not be any concern. The situation should be observed regularly. **If there is any doubt, even when there are stabilized hairline fractures, contact a structural engineer to conduct an analysis.**

To prevent freeze-thaw and other environmental factors from widening the fracture, use a paintable silicone based caulk to fill the hole, and then apply a masonry paint matching the rest of the wall. This will not only resist the elements, but virtually restore the look of the wall. In cases where architectural block (split-face) is used, take a spare block, break off a piece and carefully pulverize it. Remove the large aggregates until you are left with the colored sand and cement. Using a clear silicone based caulk, fill the fracture and apply a light coat approximately one inch on either side of the fracture. Take the pulverized material and press it on to the wet caulk taking care not to mix it with the caulk. When the caulk is cure, the excess material can be brushed clear.

K. Reinforcing the Corners

In certain industrial and commercial applications, it may be desirable to strengthen the corners of the structure *(Fig. 5.30)*. This can be accomplished by grouting and reinforcing the corner cores. If required, rebar can be extended into the bond beam pinning the reinforced column of grout into the bond course.

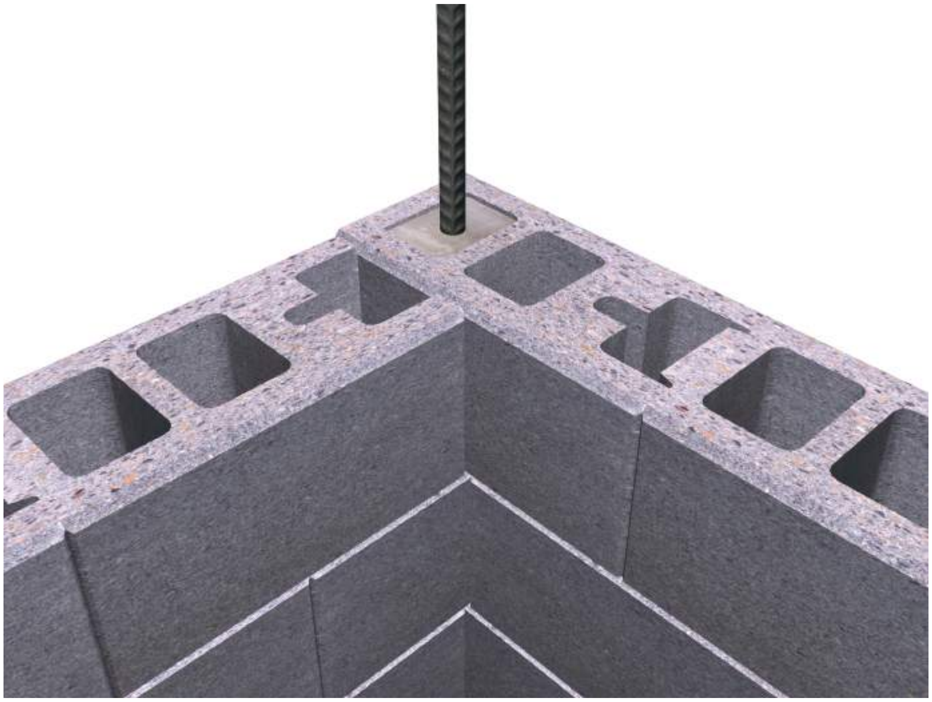


Fig. 5.30

Reinforced Corner

L. Repairing Step Joints

Although laying the first course as described in Chapter 4 of this Guide should eliminate step joints, it is still possible (because of human error) that a step joint could occur. A step joint is any head joint where adjacent units are not at the same level, forming a slight step in the joint *(Fig. 5.31).* If a step joint occurs in the first course it can lead to point loading, resulting in cracked block once the system is tensioned. Beyond the point loading issue, if a step joint is not repaired on the first course, it will only repeat itself each course as the wall is stacked up. Consequently, step joints must be remedied at the first course.

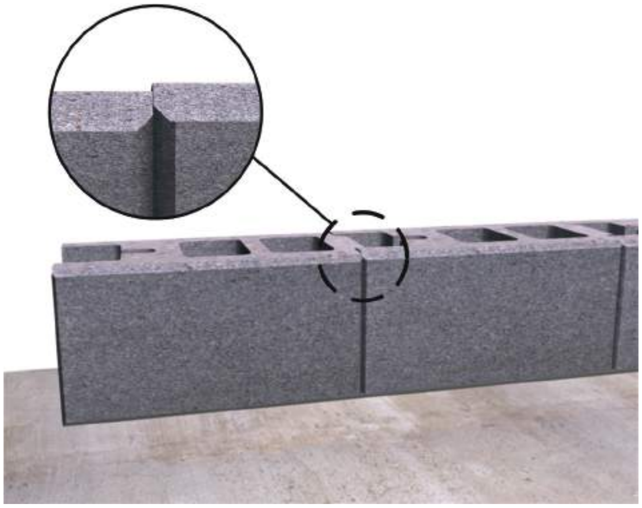


Fig. 5.31

Generally step joints can be identified by running the thumb along the top of the head joints feeling for any kind of change in height. A straight edge can also be used to see if there is any daylight between the joints. However, the sure test of a step joint is when a block is placed on the course above the suspected joint, and an attempt is made to rock the unit. If the block can be rocked, this indicates a step joint.

To repair a step joint after the mortar has set under the first course, the high unit has to be ground down using a masonry cup grinder and filled using the following procedure.

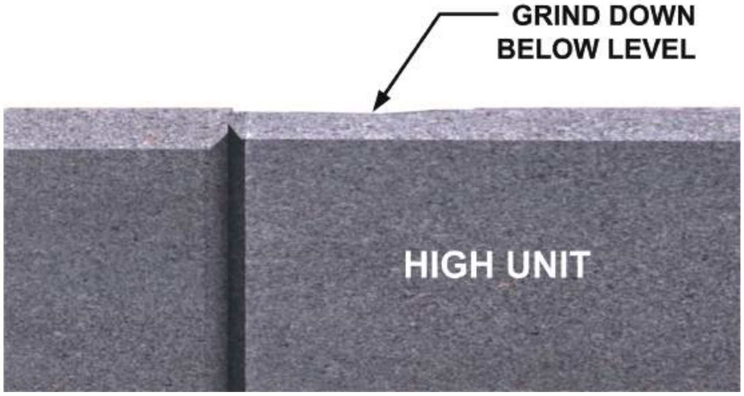


Fig. 5.32

Procedure

1. Place a unit over the suspected step joint as described above and rock to identify the high spot.

2. Use a masonry cup grinder to carefully grind down the high spot *(Fig. 5.32)*. This may have to be repeated a few times. Here the objective is not to try to get the surface perfectly level, but to grind the high spot slightly below level so that it can accomodate a small quantity of mortar *(Fig. 5.33).*

Fig. 5.33

3. Satisfied that sufficient material has been removed from the high unit, spread a small amount of mortar in the ground area and place another unit above it for the next course *(Fig. 5.34)*. The mortar will act as a filler compensating for the height difference. Tap on that top unit until it is perfectly seated and excess mortar is squeezed out. Check with a level to ensure that the unit on the second course is level and plumb.

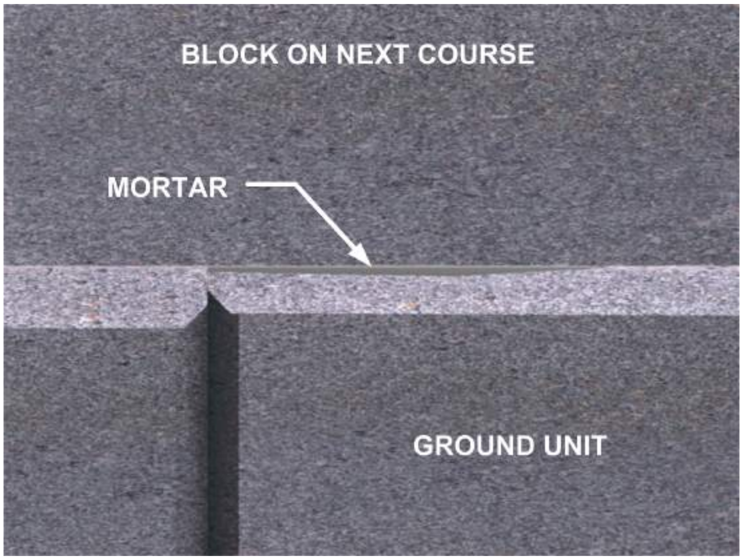
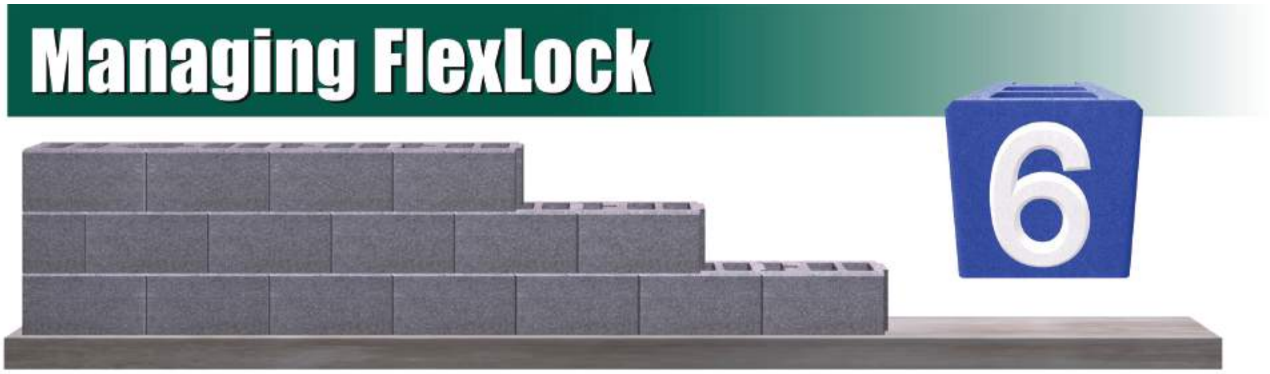


Fig. 5.34



MANAGING FLEXLOCK®

While FlexLock® technology is similar to standard masonry construction, there are significant differences. These differences are not only reflected in the system and its components, they are also reflected in the way a FlexLock® project is planned. In order to effectively manage any construction project, it is essential to understand the unique steps involved, and how each step relates to the others. By planning, organizing, staffing, directing, and controlling resources, a FlexLock® mason can track the project as it unfolds, and achieve his objectives in an effective and economical manner.

A. Workforce Planning

In planning a large FlexLock® project, it may be helpful to split the workforce into four specialized teams. This is particularly true if much of your work consists of FlexLock® construction. Depending on the make up of your workforce, and the number and size of the projects, members from one team can also be on another team. The important point here is that the right set of competent workers are assigned the right tasks at the right time. Smart planning can significantly reduce overall construction costs delivering a project early and under budget.

Anchor Team The first team, known as the Anchor Team, consists of a certified FlexLock® mason and at least one stacker. The team arrives at the site after the footing has been poured. Their primary purpose is to chalk out the first course and install the anchor tendons. Because this is a critical task, both members of the team should be FlexLock® certified and intimately familiar with the position of the anchors relative to each other.

Base Team The second team, known as the Base Team, consists of at least one certified FlexLock® mason and at least one stacker. It may also consist of a non-certified mason working under a FlexLock® certified supervisor. They begin work once all the tendons are installed and cured, to perform all of the anchor tests. The Base Team then lays the first and second courses.

Construction Team The third team, known as the Construction Team, consists of at least one certified FlexLock® mason along with at least one certified FlexLock® apprentice. They arrive at the site shortly after the first and second courses are complete. The Construction Team lays up the leads and the remaining courses under the supervision of a FlexLock® supervisor or mason. They are also responsible for grouting the bond beam and tensioning the system.

B. Critical Path Method

One of the most useful and effective means available to manage a FlexLock® project is the critical path method (CPM). CPM enables the mason or project manager to display the information needed to control the time variables on the jobsite. Like all construction projects, FlexLock® is comprised of individual tasks that are both separate, and at the same time, interdependent. For example, the crew pouring the footing is not the same as the crew installing the anchors. These tasks are interdependent in that the footing must be poured before the anchors can be installed. Keeping track of each interrelated task along with deciding their order and timing can be one of the most difficult and challenging parts of any construction project. Using CPM techniques, a project manager can overcome this challenge by breaking down the building process into distinct logical tasks. These tasks are then separated into specific activities. From these activities, individual plans are developed enabling the project manager to perform the various tasks in the appropriate sequence.

There are numerous commercial books and software solutions available to assist the project manager in using the CPM technique. Because CPM must be applied to a specific construction project, it is beyond the scope of this Guide to present this method in its entirety. Instead, a general scheduled report is provided to illustrate the importance of planning and the effectiveness of the method *(Fig. 6.1)*.

Notice that the reporting schedule lays out the individual activities in a logical step-by-step fashion, then graphically represents them in terms of their duration and relationship to the other activities. Where this schedule illustrates the activities on a larger scale, it is possible to use a similar reporting schedule to break down these activities into smaller tasks.

Whether a mason uses the CPM technique or another management system, the lesson is clear. By understanding the unique aspects of the FlexLock® system, and by planning well, the project will run smooth, and costs will be kept to a minimum.

Critical Path for FlexLock House

ACT ID	Description	Orig Dur	Rem Dur	Days													
				1	2	3	4	5	6	7	8	9	10	11	12	13	14
1000	Excavate Footing	1d	1d	■													
2000	Form Footing	1d	1d		■												
3000	Pour Footing (Cure Time)	7d	7d			■	■	■	■	■	■	■					
4000	Strip Footing	1d	1d					■									
5000	Laying out the Wall	1d	1d									■					
6000	Drill and Place Anchors	1d	1d										■				
7000	Test Anchors	1d	1d										■				
8000	Setting the Corners	1d	1d										■				
9000	Laying the First Course	1d	1d										■				
10000	Building the Leads	3d	3d											■			
11000	Laying the Courses	2d	2d											■	■		
12000	Setting the Bond Beam	1d	1d													■	
13000	Tensioning the System	1d	1d													■	

FOR ILLUSTRATION PURPOSES ONLY

Fig. 6.1

Water and Fire

A. Water Penetration

Resistance to water penetration is one of the key performance concerns in any masonry wall. A mortarless system, by definition, requires a dry fit between masonry components resulting in slight openings through which moisture can enter. FlexLock® units are designed with a water penetration strategy allowing water to penetrate the exterior face shell through the head and bed joints. The water is then directed through the wall cavity where flashing and weep holes drain it away. Although tests have indicated that this strategy can stop 97% of the water to the back shell in sustained gale force conditions, FlexLock® walls should never be used without additional waterproofing.

Waterproofing is the treatment of a surface or structure making it impervious to the passage of water under both hydrostatic and pneumatic pressure. For waterproofing to be effective, it must prevent water infiltration under both normal and extreme weather conditions.

In the industry, there are two general methods of waterproofing. Positive side waterproofing involves applying the water barrier to the exterior side of the structure. In contrast, negative side waterproofing involves applying the water barrier to the interior side of the structure. In most cases, positive side waterproofing is preferred as it protects both the structure itself and the interior from the destructive effects of water. This is particularly important in the FlexLock® system where, despite galvanization, the tendons should not be exposed to excessive moisture. Negative side waterproofing is almost always used as a remedial action in older structures where excavation is costly.

Waterproofing in below grade applications are typically dictated by building codes. In the absence of these, any decision on the type of waterproofing should be based on the average rain fall, moisture content in the soil and the level of the water table. Common to all conditions is some type of waterproof barrier and subsurface drainage.

Parging is the process of applying a surface coat of mortar to the exterior of the masonry. It is used to resist and/or completely impede water penetration. Since not all parging is waterproof, consult the manufacturer's specifications. Parging is usually applied in two equal layers of $^3/_8$" to $^1/_2$" mortar.

The first coat is called the “scratch coat.” Once applied, it is roughened or scratched to provide a mechanical connection for the second coat. After the first coat is cured, the surface is dampened and then the second finish coat is applied to form a dense surface. At the base of the wall a cove is formed to prevent water from accumulating at the base. As in conventional masonry, flashing is required in accordance with standard industry practices.

Bituminous or mastic materials can be applied directly to bare masonry although some codes require that it be applied over a parged surface. These can be sprayed, troweled, or rolled over the surface of the wall. An approved polyurethane foam can also be sprayed on exteriors providing a tough, watertight seal and add to the insulation value of the structure.

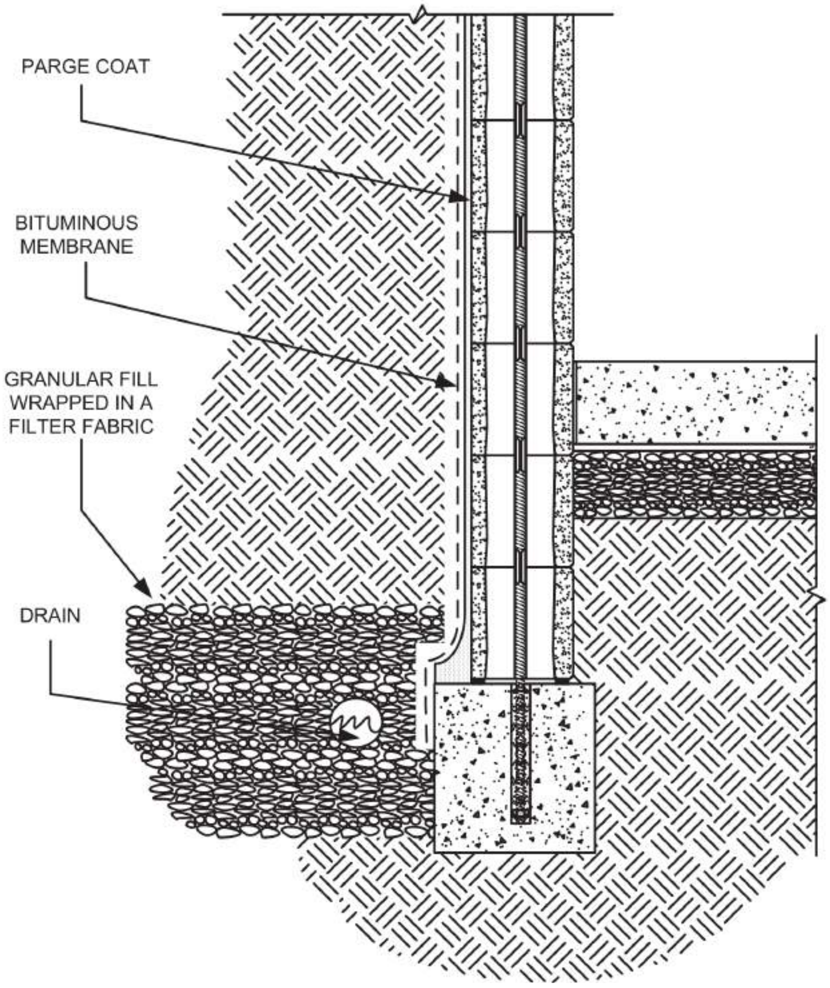


Fig. 7.1

B. Fire Rating

In accordance with the Standard Method for Determining Fire Resistance of Concrete and Masonry Construction Assemblies, ACI 216.1-97/TMS 0216.1-97, FlexLock® received a fire rating of 2 hours and 38 minutes. Should additional fire resistance be required, the hollow cells of the FlexLock® units may be filled with approved materials such as sand, pea gravel, crushed stone, vermiculite, perlite, etc., as provided for by ASTM Specifications C33, C331, C332, C516, or C549 (ref. 3,4,5,6, & 7).

GLOSSARY

Absorption: The weight of water a block absorbs, when immersed in either cold or boiling water for a stated length of time, expressed as percentage of the weight of the dry unit. *(ASTM Specification C67)*

Accelerator: Any chemical or other substance added to cement during the mixing process which increases the rate of hydration, shortens set time, and/or increases the rate of hardening or strength development.

Addition: A change in the design of a building to increase the overall dimensions; also the original design of a building constructed with connecting parts joined together to make one whole structure.

Admixtures: Materials added to concrete to impart special properties to the mortar.

Aggregate: Various hard materials such as sand, gravel, or crushed stone, added to cement to make concrete.

Anchor: A piece of assemblage, usually metal, used to attach building parts (plates, tendons, joists, trusses, etc.) to masonry or masonry materials.

Anchor bolts: Cement grouted bolts that are used to fasten tendons to the footing.

ANSI: American National Standards Institute. This group publishes the American National Standards, which are the approved standards and specifications in all the areas of building construction.

Apprentice (Mason): A person who has entered into an agreement with a trade committee and employers to work for a period of time to learn the trade. Registered with DoL and BAT/ATELS.

ASTM: The American Society for Testing and Materials, a scientific and technical organization formed for “the development of standards and characteristics and performance of materials, products, systems, and services; and the promotion of related knowledge.”

Backup: The part of a masonry wall behind the exterior facing.

Bar: See "Tendon."

Bar chairs: A small device used to hold up reinforcing wire or rods in concrete while the concrete is being poured.

Batterboard: A board set up outside the building line to hold the lines both prior to the excavation and after the excavation to relocate the building lines.

Beam and slab construction: A method of supporting a reinforced concrete floor by a system of reinforced concrete beams or girders.

Bearing capacity: The maximum pressure that soil or other material can withstand without failure. Specifically, with regard to foundations, the maximum pressure which soil can withstand without settlement of an amount that compromises the integrity or function of the structure.

Bearing Plate: A flat rectangular steel plate with one hole along its axis used to anchor the tendons.

Bed joint: The horizontal layer of mortar on which a masonry unit is laid. In the FlexLock® system, the bed joint refers to the horizontal joint between courses.

Block chisel: A chisel with a wide blade used in masonry work to cut more exact pieces of block.

Bond: 1. A method of tying various parts of a masonry wall by lapping the units one over another or by connecting with metal ties. 2. Patterns formed by exposed parts of masonry units. 3. Adhesion between mortar or grout and masonry units or reinforcement.

Bond bar: A flat piece of steel stock used in place of a bond beam in partition walls.

Bond beam: Course or courses of masonry wall grouted and usually reinforced in the horizontal direction. Serves as a horizontal tie of the wall, a bearing course for structural members, or as a flexural member itself.

Bond course: The course consisting of units which overlap more than one wythe (width) of masonry.

Breaking joints: Any arrangement of masonry units which prevents continuous vertical joints from occurring in adjacent courses.

Brick: A solid masonry unit of clay or shale formed into a rectangular prism while plastic and burned or fired in a kiln.

Brick veneer: A building of masonry in which the brick facing is attached to a surface of a frame with wall ties, and is not bonded to the veneered wall.

Building code: A set of regulations that are adopted by a city or town for the construction of buildings.

Building line: The outside line of the building.

Building permits: A permission form obtained from a state or local government to permit construction of a structure.

Bull nose: A masonry unit that is rounded on the corner(s).

Buttering: Troweling mortar onto a masonry unit.

Buttress: A piece of masonry built against a wall to give the wall more strength.

Capacity insulation: The ability of masonry to store heat as a result of its mass, density and specific heat.

Capping brick: Brick that is made for capping the top of a wall.

Cavity wall: A wall built of masonry units so arranged as to provide a continuous air space within the wall (with or without insulating material).

C/B ratio: The ratio of the weight of water absorbed by a masonry unit during immersion in cold water to weight absorbed during immersion in boiling water. Also called *saturation coefficient. (ASTM Specification C67)*

Chase: A continuous recess built into a wall to receive pipes, ducts, etc.

Closer: The last masonry unit laid in a course. It may be a whole or a portion of a unit.

Closure: Supplementary units used at corners or jambs to maintain bond patterns.

Column: A vertical member whose horizontal dimension measured at right angles to the thickness does not exceed three times its thickness.

Compressive strength: The measured maximum resistance to axial loading expressed in pounds per square inch (psi).

Concrete Masonry Unit (CMU): A hollow or solid block made from portland cement and aggregates for the purpose of building masonry walls.

Control joint: A groove that is cut, tooled or constructed in the surface of concrete to predetermine the place where a crack will occur due to shrinkage of the concrete. Also called *movement joint*.

Coping: The material or masonry units forming a cap or finish on top of a wall, pier, pilaster, chimney, etc.

Corner Block: See: “Universal Corner Unit**.”**

Counterflashing: The flashing that projects from the masonry wall over the base flashing to protect the upper end of the flashing.

Coupler: A hollow threaded cylinder used to connect lengths of tendons.

Course: One of the continuous horizontal layers of units in masonry.

Critical Path Method: A useful and effective means to manage a project by displaying the information needed to control the time variables on the job site.

Curing: The process in which mortar, grout, and concrete harden.

Curtain wall: An exterior, non-bearing wall built outside the building frame, generally with vertical support at ground level only, but may be (and generally is) laterally supported at each story level by anchoring to floors, roof or spandrel beams.

Dampproofing: Prevention of moisture penetration by capillary action.

Efforescence: A powder or stain sometimes found on the surface of masonry caused by water soluble salts leaching from within the material.

Exposed aggregate: A concrete finish that has the top of the surface cement washed off to show the stone aggregate.

Exterior wall: Any outer wall serving as a vertical enclosure of the building.

Face: 1. The exposed surface of a wall or masonry unit. 2. The surface of a unit designed to be exposed in the finished masonry.

Facing: Any material forming a part of the wall used as a finished surface.

False header: A header that does not tie two walls together. As when a half brick is used.

Fastener: Any hardware used to attach especially by bolting, tying, or nailing.

Field: The expanse of wall between openings, corners, etc., principally composed of stretchers.

Filled-cell masonry: Single-wythe masonry construction composed of hollow units in which all voids are filled with grout after the wall is laid.

Fireproofing: Any material or combination of materials or processes that increases fire resistance.

Flash set: A process by which concrete sets faster than normal because of too much heat.

Flashing: 1. A thin impervious material placed in mortar joints and through air spaces in masonry to prevent water penetration and/or to provide water drainage. 2. Manufacturing method to produce specific color tones in brick.

FlexLock® Wall System: A complete load-bearing post-tensioned masonry structure designed as a mortarless/groutless alternative to standard concrete block construction.

FlexLock® technology: the practical application of FlexLock® to commerce or industry.

Fluted block: Special manufactured concrete block where the exposed faces have vertical projecting ribs with slots in between for creative or ornamental masonry appearances.

Fly ash: The fine residue resulting from the burning of ground or powdered coal, used as an additive to improve workability of concrete or mortar.

Footing drain: Drain tile run installed around the building footing, inside or outside, to carry off ground water.

Furring: A method of finishing the interior face of masonry walls to provide a space for insulation, prevent moisture transmission, or to provide a level surface for finishing.

Furrowing: A process of forming indentations in the center of the mortar bed joints with the point of a brick trowel to distribute it evenly prior to laying brick on it.

Grounds: Nailed strips placed in masonry walls as a means of attaching trim or furring.

Grout: A mixture of portland cement, aggregates and water which is proportioned to produce pouring or pumping consistency without segregation of the constituents. Used to fill voids and cells, or collar joints in masonry walls so as to encase steel and bond units together for composite action.

high lift grouting*:* The technique of grouting masonry lifts up to 12 feet.

low lift grouting: The technique of grouting as a wall is constructed.

Grouted masonry: Multi-wythe masonry construction in which the space between wythes is solidly filled with grout.

Head joint: The vertical joint between masonry units.

Header: A masonry unit which overlaps two or more adjacent wythes of masonry to tie them together.

blind header: A concealed brick header on the interior of a brick wall.

clipped header: A bat placed to look like a header for the purpose of establishing a pattern; also called a false header. The header extends into the backup course.

flare header: A header of darker color than the rest of the wall.

Heading course: A continuous bonding course of header brick; also called a *header course.*

Heavyweight concrete: Concrete that is constructed from heavyweight aggregates and weighing about 390 pounds per cubic foot: used in the construction of laboratories as radiation shields.

Hex Nut: A perforated metal hexagon that has an internal screw thread and is used on a tendon to compress the masonry units.

High chairs: A manufactured product that is used to hold up reinforcing wire in concrete as the concrete is placed.

High early cement: A portland cement sold as Type III; sets up to its full strength faster than other types.

High-lift grouting method: Indicates that grout will be pumped into all wall voids after the masonry units, reinforcing steel and embedded items are built to full story height. High-lift grout is placed in one continuous pour by lifts, which allows time for consolidation and loss of water, but placed at such a rate as not to form intermediate construction joints or blowouts.

Hog: 1. A wall built to different heights (number of courses) on the two sides of an opening; such as on either side of a doorway or a window frame. 2. An uneven course in a masonry wall.

Hollow masonry: Single-wythe masonry construction composed of hollow units in which cells and voids containing reinforcing bars or embedded items could be filled in with grout as the work progresses.

Hydraulic: The ability of cement to harden when mixed with or under water.

ICLS: A method of laying FlexLock® units that holds the mason and/or apprentice accountable for the quality control.

Initial rate of absorption: The weight of water that is absorbed expressed in grams per 30 square inches of contact surface when a brick is partially immersed for one minute. *(ASTM Specification C67)*

International Masonry Institute (IMI): A labor/management cooperative of the International Union of Bricklayers and Allied Craftworkers and the contractors who employ its members.

International Union of Bricklayers and Allied Craftworkers (BAC): A service organization that helps improve BAC members' quality of life through access to well-paying jobs and quality benefits, and by building solidarity and support among all BAC members.

Isolation joint: A joint that completely separates one piece of concrete from another.

Joint reinforcement: An assemblage of steel reinforcing wires designed for use in masonry bed joints, serving to distribute stresses and to tie separate wythes together.

Journeyman: A mason who has learned his trade through an apprenticeship.

Kerf: The space made by a saw cut in masonry.

Layout: Process of measuring and marking building material to indicate placement of other materials, as in preparation for the initial course of masonry units for a wall.

Lead: The section of wall built up and racked back on successive courses.

Level: When an object is placed in a true horizontal plane or alignment.

Line block: A wooden or plastic block that is attached to a masonry corner or lead for the purpose of holding a line in position as a guide for laying individual masonry courses.

Lintel: A structural element placed over an opening in a wall.

Load-bearing wall: Any wall which, in addition to supporting its own weight, supports the structure above it without benefit of a complete load-carrying space frame in structural steel or reinforced concrete.

Low-lift grouting method: Indicates that grout will be placed in small increments as the masonry work progresses.

Mason Contractors Association of America (MCAA): A trade association that represents the needs of the industry non-union mason contractors.

Masonry cement: A mill-mixed cementitious material to which sand and water must be added. *(ASTM Specification C91)*

Masonry unit: Natural or manufactured building units of burned clay, concrete, stone, glass, gypsum, etc.

> **hollow masonry unit:** One whose net cross-sectional area in any plane parallel to the bearing surface is 74 percent or less of the gross.
>
> **solid masonry unit**: One whose net cross-sectional area in every plane parallel to the bearing surface is 75 percent or more of the gross.

Masonry wall reinforcement: A rigid wire joint reinforcement in either a metal truss or ladder design that is used in mortar bed joints in masonry walls to bond them together or to provide additional strength.

Modular masonry: Masonry construction where the overall size of the masonry walls are based upon the modular unit of 4 in. or multiples thereof.

Moisture barrier: Materials used to retard the flow of vapor and moisture and thus prevent condensation on walls. There are two types of barriers, the membrane type that comes in rolls and is applied as a unit of the construction, and the coating type that is applied with a brush.

Mortar: A plastic mixture of cementitious material, fine aggregate and water.

> **fat mortar**: A very sticky mortar containing a high percentage of cementitious components.
>
> **high bond mortar**: Mortar which develops higher bond strengths with masonry units than is normally developed with conventional mortar.
>
> **lean mortar**: Mortar which is deficient in cementitious materials; sandy and difficult to spread.
>
> **thin set mortar:** Mortar/adhesive seoiclly formulated to permit installation with an electric mortar gun, metal canister caulk gun or trowel.

National Concrete Masonry Association (NCMA): An association of producers of concrete masonry products,and suppliers of products and services related to the industry.

Nominal: A dimension for a masonry unit that includes an allowance for mortar joints. An example is a concrete block that is 15 5/8 in. in actual length but equals 16 in. when a standard 3/8-in. mortar head joint is added to the end of the block.

Non-bearing partition: A wall that does not support the structure above it; usually a partition wall or a filler wall.

Noncombustible material: Any material which will neither ignite nor actively support combustion in air at a temperature of 1200 degrees f when exposed to fire.

Nut: See: “Hex Nut” or “Wing Nut.”

OSHA: Occupational Safety and Health Act of 1970.

Overturning force: Any of several kinds of force, or a combination of forces, most commonly but not only wind, that have a tendency to overcome the stable equilibrium of a structure.

Parging: A material used to plaster block walls to seal and waterproof them. For FlexLock®, products used for surface bonding masonry are preferred.

Partition: Any interior wall, one story or less in height.

Pier: An isolated column of masonry.

Pilaster: A wall portion projecting from either or both faces and serving as a vertical column and/or beam.

Plasticity: The property of fresh cement paste, concrete or mortar which makes it adhere to the masonry units if mixed correctly.

Plug: A piece of unit masonry smaller than one half unit.

Plumb: A true vertical line or perpendicular alignment, such as a plumb line.

Plumb rule: A mason's hand level. It is used in a horizontal position as a level and in a vertical position to determine if a wall is plumb.

Portland cement: The fine, grayish powder formed by burning limestone, clay, or certain shales and then grinding the resulting clinker. The result is a cement that hardens when mixed with water and which is used as a base for mortars and concretes. Portland cement is a grade not a brand of cement.

Post-Tensioning: a method of strengthening masonry or other materials with high strength steel bars know as tendons

Prestressed concrete: Concrete placed around a steel member that is under tension when the pour is made.

Proprietary compound: In masonry work, a chemical compound protected by a patent, copyright, or trademark, which is used to clean masonry work.

psi: An engineering term meaning compressive strength measured in pounds per square inch.

Reinforced masonry: Masonry units, reinforcement, grout, and mortar combined in such a manner that the component materials act together in resisting forces.

Reinforcement: Structural steel shapes, deformed reinforcing bars or joint reinforcement embedded or encased in unit masonry in such a manner that it works with the masonry in resisting stress.

Retaining wall: A masonry wall that is constructed to restrain earthen fill.

Return: Any surface turned back from the face of the principal surface, such as window and door openings.

Reveal: That portion of the jamb or recess which is visible from the face of the wall.

Rod: See "Tendon."

Safe Room: A small, interior or exterior masonry structure used as a temporary shelter during tornados or hurricanes.

Scaling: The peeling away of the surface of concrete.

Shear wall: Any wall which resists a horizontal force applied in the plane of the wall (i.e. any wall not isolated along three edges.)

Shell: The CMU's outermost parallel load-bearing elements. Also known as the "face."

Shotcreting: Method of placing concrete on curved surfaces such as swimming pools under pneumatic pressure through a nozzle.

Slot: The recessed portion of a web in a FlexLock® unit used to accept the tendon.

Slump: A measure of consistency of freshly mixed grout measured to the nearest ¼ inch immediately after removal of the slump cone mold.

Sound: A characteristic of solid materials. The material is free of cracks, flaws, fissures or variations from an accepted standard. Specifically, with regard to aggregate, the ability to withstand the aggressive action to which concrete masonry might be exposed, particularly weather exposure.

Spall: A small fragment removed from the face of a masonry unit by a blow or by action of the elements.

Stackers: A mason apprentice whose primary task is to dry-stack FlexLock® units.

Step Joint: A condition that occurs when adjacent units are not at the same level, forming a slight step in the joint.

Story high: A trade term meaning one-story height of a house, usually 8 ft.

Story pole: A marked pole for measuring masonry coursing during construction.

Stretcher: A masonry unit laid with its greatest dimension horizontal and its face parallel to the wall face.

Structural member: Any part of a structure that, in addition to its own weight, carries the weight of forces of other parts of the building. Examples include: footings, foundations, piers, beams, lintels, exterior walls and some interior walls.

Structural wall: Any wall which supports vertical loads other than its own weight or which resists lateral movement from horizontal forces such as those caused by wind or an earthquake.

Subgrade: The prepared and compacted soil that functions as a base for a concrete slab or foundation.

Tendon: A continuously threaded steel bar designed to post-tension masonry units.

Tensile strength: The maximum stress that a material is able to resist under axial tensile loading, before failing.

Tie: Any unit of material which connects masonry to masonry or to other materials.

Tie Bar: A flat steel bar that attaches a partition wall to an adjacent wall.

Torque Wrench: A tensioning device with a rachet mechanism designed to slip or "click" at a predetermined load.

Traditional masonry: Masonry in which the design is based on empirical rules which control minimum thickness, lateral support requirements, and height, without a structural analysis.

Trig: A metal clip that is attached to a line on brick or block laid in the center of a masonry wall to keep the line from sagging or being blown out of alignment.

Trig block: A block set in mortar ahead of the line in the center of the course, which the metal trig is attached to keep the wall at the correct height and plumb.

Universal Corner Unit: A FlexLock® masonry block used to effect corners, jambs and bond beams.

Uplift force: An upward force on a structure caused by water, frost heave, or wind force on the side of a structure.

Veneer: A masonry facing which is attached to the backup but not so bonded as to intentionally act with it under load or movement.

Wall: A vertical member of a structure whose horizontal dimension measured at right angles to the thickness exceeds three times its thickness.

apron wall: That part of a panel wall between window sill and wall support

area wall: 1. The masonry surrounding or partly surrounding an area. 2. The retaining wall around basement windows below grade.

bearing wall: One which supports a vertical load in addition to its own weight.

cavity wall: A wall built of masonry units so arranged as to provide a continuous air space within the wall (with or without insulating material), and in which the inner and outer wythes of the wall are tied together.

composite wall: A multiple wythe wall in which at least one of the wythes is dissimilar to the other wythe or wythes with respect to type or grade of masonry unit or mortary.

curtain wall: An exterior nonbearing wall not wholly supported at each story.

enclosure wall: An exterior nonbearing wall in skeleton frame construction.

faced wall: A composite wall in which the masonry facing and backing are so bonded as to exert a common reaction under load.

fire wall: Any wall which subdivides a building to resist the spread of fire and which extends continuously from the foundation through or up to the roof.

foundation wall: That portion of a load-bearing wall below the level of the adjacent grade, or below the first floor beams or joists.

hollow wall: A wall built of masonry units arranged to provide an air space within the wall.

insulated cavity wall: A cavity wall that contains insulation of some kind.

knee wall: A wall or partition which does not extend to the ceiling.

load bearing wall: A wall which supports any vertical load in addition to its own weight.

nonbearing wall: A wall which supports no vertical load other than its own weight.

panel wall: An exterior, nonbearing wall wholly supported at each story.

parapet wall: That part of any wall entirely above the roof line.

party wall: A wall used for joint service by adjoining buildings.

perforated wall: One which contains a considerable number of relatively small openings; also called a *pierced wall* or *screen wall.*

shear wall: A wall which resists horizontal forces applied in the plane of the wall.

single wythe wall: A wall only one masonry unit in thickness.

solid masonry wall: A wall built of solid masonry units, laid continuously, with mortar joints completely filled with mortar or grout.

spandrel wall: That part of a curtain wall above the top of a window in one story and below the sill of the window in the story above.

veneered wall: A wall having a facing of masonry units or other weather-resistant noncombustible materials securely attached to the backing, but not so bonded as to intentionally exert common action under load.

Wall plate: A horizontal member anchored to a masonry wall to which other structural elements may be attached; also called a *head plate*.

Wall tie: A bonder or metal piece which connects wythes of masonry to each other or to other materials.

Wall tie, cavity: A rigid, corrosion-resistant metal tie which bonds two wythes of a cavity wall.

Wall tie, veneer: A strip of metal used to tie facing veneer to the backing.

Water/cement ratio: The proportion of water to portland cement in concrete, usually stated in gallons of water per 94-pound bag. The lower the water/cement ratio, the stronger the concrete will be.

Water reducing agent: An admixture material which either increases the workability of freshly-mixed mortar or concrete without increasing water content, or maintains workability with a reduced amount of water.

Water retentivity: That property of a mortar which prevents the rapid loss of water to masonry units with high absorption.

Waterproofing: Prevention of moisture flow through masonry due to water pressure.

Web: The elements in a CMU that tie the shells together.

Weep holes: Openings placed in mortar joints of facing materials at the level of the flashing to permit the escape of water or moisture.

Wing Nut: A metal cylinder with two opposing "ears" that has an internal screw thread and is used on a tendon to temporarily compress masonry units.

Workability: The property of fresh concrete or mortar which determines the ease with which it can be mixed, placed and finished.

Wythe: 1. Each continuous vertical section of a masonry wall, one unit in thickness. 2. The thickness of masonry units separating flues in a chimney.

Building with FlexLock®

The state-of-the-art guide to FlexLock construction

FlexLock is a dry-stack post-tensioned masonry wall system designed as an alternative to standard masonry construction.

The FlexLock Advantage

☑ **Mortarless/Groutless**
With the exception of the first course, the FlexLockWall System requires no mortar or grout between the joints or in the cores.

☑ **Reduced Construction Time**
The FlexLockWall System can be assembled at three to five times faster than conventional CMU construction.

☑ **Workforce & Market Sensitivity**
The FlexLockWall System only requires one journeyman mason to set the first course. Apprentices and laborers can be used to complete the structure.

☑ **Reuseable**
The unique interlocking surfaces allow for total disassembly rendering all of the components useful for other construction projects.

☑ **Lower Construction Costs**
The above advantages further translate into significant monetary savings.

☑ **Super Strong**
FlexLock has three to four times the reserve strength of conventional masonry.

Bar Code

$29.95

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