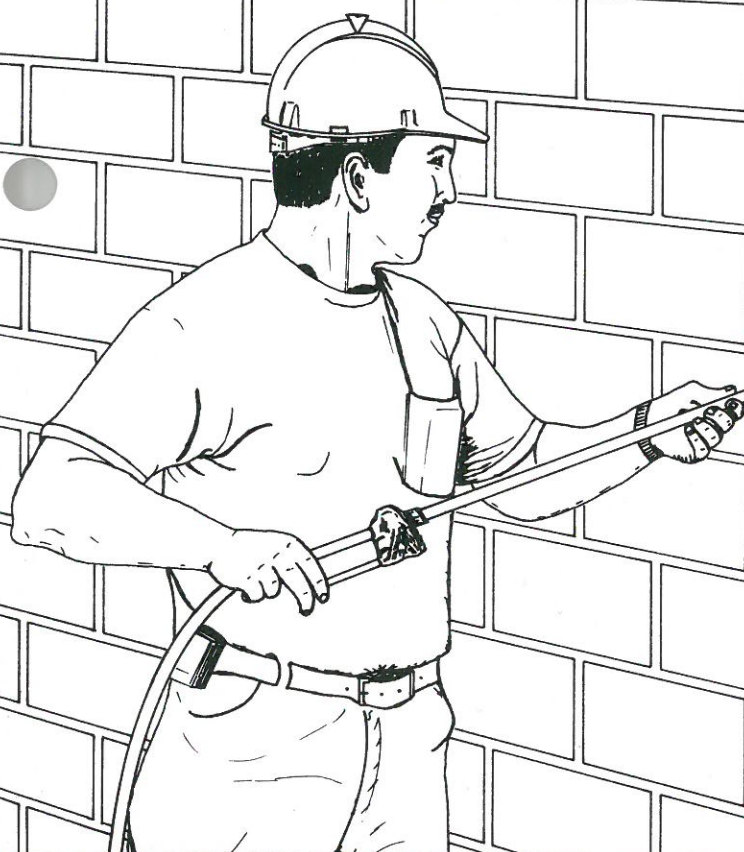


# Clear Water Repellent Treatments



## for Concrete Masonry

MASONRY INSTITUTE  
OF AMERICA

CONCRETE MASONRY ASSOCIATION  
OF CALIFORNIA AND NEVADA



**CLEAR WATER REPELLENT TREATMENTS**  
**FOR**  
**CONCRETE MASONRY**

Published  
by

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## HIGHLIGHTS

- **Teamwork:** Water penetration through concrete masonry is a shared concern and prevention requires a team effort of owners, developers, designers, contractors, subcontractors, manufacturers, and applicators.
- **Design:** Single wythe masonry construction mandates special design considerations, especially for projections, horizontal surfaces, sills, copings, parapets, joints, and penetrations.
- **Concrete Masonry:** By nature hydrophilic, concrete masonry systems require consideration of the masonry unit, mortar, and how they work together with water repellent treatments, joint sealers, and adjacent construction.
- **Water Repellent Treatment:** Technological advancements and concerns regarding volatile organic compounds (VOC's) have created a period of rapid change in water repellent treatment materials and application recommendations.
- **Pre-Installation Meetings:** A successful project depends on open communication lines and a clear understanding by all parties of the needs and concerns of the project, both of which can be assisted by pre- installation meetings.
- **Testing:** Laboratory testing provides general information regarding the abilities of certain materials. Field testing can provide information regarding specific products working together in a known situation. Projects need valid field testing.
- **Warranties:** The length of a warranty does not necessarily define the quality of a material. Warranties are legal documents intended to clarify responsibilities and should be carefully reviewed.

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## PREFACE

Working together, the construction industry, including designers, engineers, contractors, manufacturers, installers, and trade organizations can provide the information necessary to ensure watertight concrete masonry construction without hiding the natural beauty of concrete masonry. This document is intended to share information, which has been developed over the past two years, addressing concerns regarding clear water repellent treatments for single wythe concrete block masonry walls.

It is assumed that, like most documents of this type, those reading this will be searching for specific information related to particular concerns. Hopefully the Contents listing along with the Index will ensure easy access. For those planning a more in-depth review, it might be of interest to know who the intended audience was for specific sections.

The Introduction, Testing, Common Considerations, and Conclusions were intended to address the entire construction industry. The author, an architect and specifications writer, might have strayed occasionally toward addressing other architects and specifiers.

The sections on Design, Clear Water Repellent Treatments, and the Appendices were intended to be directed specifically toward the design industry, primarily architects and specifiers. But, these sections will hopefully prove beneficial to owners, developers, and others involved directly and indirectly in the construction industry.

The sections on Masonry Materials and Methods and on Water Repellent Treatment Application were intended to be directed toward contractors, subcontractors, and installers.

## TERMINOLOGY

The construction industry uses some terms differently and sometimes uses different terms to mean the same thing. In order to minimize the confusion the terms used in this document were based on those included in the 1992 Edition of the Construction Specifications Institute (CSI) *Manual of Practice*. A few terms warrant special recognition.

**Joint Sealers:** Terms such as joint sealers, sealants, caulking, and calking are often used synonymously relating to both elastomeric and nonelastomeric materials used to make joints watertight or airtight. Joint sealer was selected to prevent confusion regarding any perceived differences in the other terms and to be consistent with the term used in CSI's "MasterFormat," included as an appendix with the *Manual of Practice*.

**Mock-Ups:** For this document "mock-up" was used rather than "field sample" to be consistent with the definition given in the CSI *Manual of Practice* Appendix Section titled "SectionFormat." CSI defines mock-ups as "full-sized assemblies erected for review of construction, coordination of the work of several sections, testing, for operation, and education of the trades. These establish standards by which the workmanship will be judged."

**Pre-Installation Meetings:** Terms such as pre-construction and pre-application are often used related to meetings held to coordinate specific materials and construction techniques, and to sequence related work for complex items. The term "pre-installation meeting" is taken from the CSI "SectionFormat." Pre-construction meetings typically relate to meetings held prior to beginning the project rather than to meetings related to the coordination of specific materials and construction methods.



*Application of clear water repellent on split face concrete masonry wall.*

## SECTION 1 INTRODUCTION

### 1.01 What, Why, How?

What are clear water repellent treatments, why do we need them for walls constructed of concrete masonry, and how do we design, select, specify, and install them? Rapid changes in the clear water repellent treatment industry along with legislation limiting volatile organic compounds (VOC) have created a need for a more in-depth look at these questions.

Clear water repellent treatments prevent water intrusion into concrete masonry walls (and other masonry and concrete systems) without losing the color and texture of the base material. Water repellent treatments are not a form of waterproofing. They are intended for above ground use only and can not withstand water pressures from ponded water, water tables, or running water, even those found on small horizontal surfaces.

They do reduce capillary action, the passive movement of water into small pores of a substrate as water comes into contact with its surface. Used properly, they can also prevent some of the more active movement of water caused by slight to moderate water pressure due to wind-driven rain and sprinklers.

Why are water repellent treatments needed for concrete masonry? Concrete masonry continues to be a design preference for many types of buildings. Increased use of integral color, colored aggregates, and textured patterns have increased the desire to maintain the appearance of the concrete masonry rather than cover it with heavy elastomeric waterproof coatings.

Concrete masonry systems without water repellent treatments do not resist water penetration. In fact, cement based products such as concrete masonry, precast concrete and poured concrete are hydrophilic, that is they are permeable to water due to the natural pores in the cement matrix which form during the curing process. The size, number, and continuity of these pores affect the degree of permeability. Different aggregate gradations, cement and water contents, and curing methods also affect the permeability.

Designs with horizontal surfaces (including sills, parapets, and raked mortar joints), improper control joints, and penetrations such as those found at scuppers, plumbing and electrical services can add to the problem. Voids in the concrete masonry units along with cracks and holes in the mortar joints (referred to in the industry as beeholes) can also contribute to leakage. Unfortunately, most of these problems cannot be solved by use of clear water repellent treatments.

So, how are we to design, select, specify, and construct concrete masonry and clear water repellent treatments without the danger of water penetration?

The design team needs to understand how their designs affect the ability of concrete masonry systems to withstand water. The construction team needs to stay abreast of this rapidly changing subject and maintain lines of communication with both the design team and the manufacturer's representatives. And, manufacturers need to help by providing complete, accurate information to assist in selecting proper materials for the concrete masonry, mortar, and water repellent treatments.

Specifiers must provide clear and complete information to limit "low-balling" and substitutions of unacceptable products. And, the construction team, from the contractors, to the subcontractors, to the individual installers of each material, must recognize the importance of proper workmanship and compliance with the contract documents.



### 1.02 Recommendations and Guidelines.

In 1992 the Concrete Masonry Association of California and Nevada (CMACN) and the Masonry Institute of America (MIA) held several meetings with masonry contractors, concrete block producers, water repellent treatment manufacturers, applicators, architects, and developers to discuss the proper design and construction methods to make concrete masonry buildings water resistant. Numerous recommendations and guidelines were developed including the following:

1. Pay particular attention to the design phase of the project. Limit horizontal projections, sills, and tops of walls and waterproof those required by the project design with elastomeric coatings. Give special attention to the design of parapets.
2. Cross reference the appropriate specifications sections in Division 4 on masonry construction (typically Section 04220 - Concrete Unit Masonry) with those in Division 7 on water repellent treatments (typically Section 07180 - Water Repellents).
3. Specify pre-installation meetings to familiarize all parties with the intended methods for prevention of water penetration. The masonry materials, construction, water repellent treatments, and treatment at joints should be discussed along with the expected results and testing procedures.
4. Encourage the use of samples and mock-ups of masonry construction with the proposed water repellent treatments. Test the mock-ups for water repellency. Mock-up panels should be a minimum 5 ft. by 5 ft. panel and testing should be for at least two hours. Control joints and joint sealants should be included in the mock-up. Tests should be based on the Navy Hose Stream test or a similar field hose stream test (Refer to Section 6.03 on page 38).
5. Ensure the use of full shoved head and bed joints (mortar for at least the thickness of the face shell of the masonry unit), if necessary through the use of third party inspections.
6. Specify double struck joints for exterior masonry construction. Require beeholes visible from 5 to 10 feet to be filled by a qualified mason prior to application of the water repellent treatment.
7. Fill cracks which exceed 0.02" in width or 5% of the joint length with mortar by a qualified mason or with joint sealer by a qualified applicator.
8. Apply water repellent treatments in strict accordance with the manufacturer's installation instructions and recommendations, by a trained experienced applicator.
9. Field test the concrete masonry walls after the water repellent treatment has cured to assure water repellency.
10. Require a five year material and labor warranty from the manufacturer and the applicator through the general contractor.

### 1.03 Integral Water Repellent Treatments.

This document addresses the various types of clear water repellent treatments, both those which form a surface film and those referred to as penetrating type water repellent treatments. Integral water repellent treatments, however, are not specifically addressed.

Although the chemistry and properties of integral water repellent treatments are comparable to the penetrating type water repellent treatments, integral systems have different requirements and considerations.

Integral water repellent treatment admixtures may provide an alternative to the use of surface-applied sealers as a water repellent system for concrete masonry.



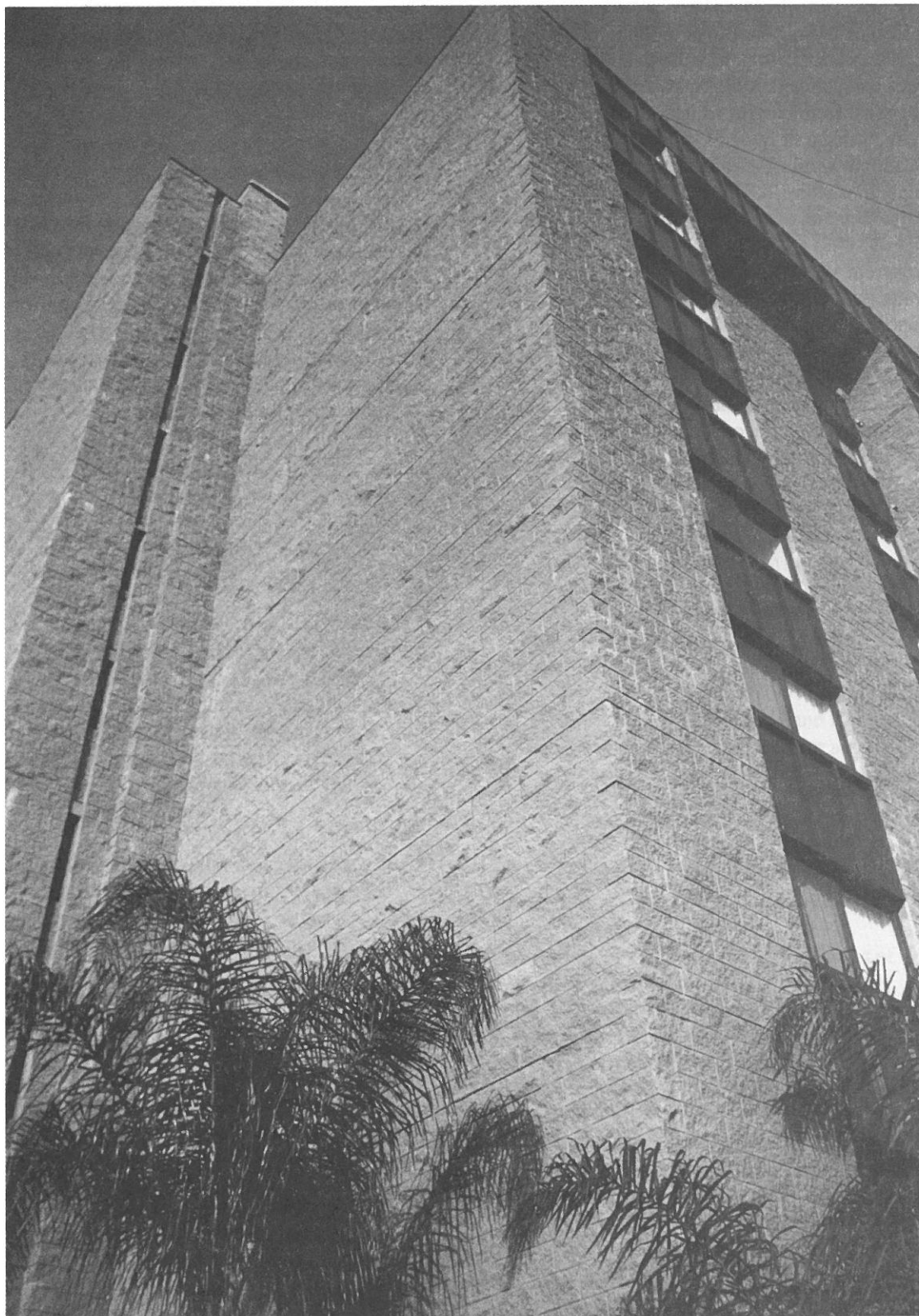
The factor which would be expected to influence the service life of an integral water repellent treatment admixture would be its chemical composition. There are several chemical technologies which are currently being utilized in integral water repellent treatment admixture formulations. The major categories which could be defined are: polymeric and non-polymeric based products.

Concrete masonry wall systems must resist water penetration not only through the concrete masonry units, but also through the mortar and where the mortar meets the concrete masonry units. Integral water repellent admixtures must therefore be included in both the concrete masonry units and in the mortar. The concrete masonry units and the mortar must bond tightly.

Those considering integral water repellent treatments should research the proposed products and confer with manufacturers for additional information.

#### **1.04 Communication.**

Ultimately, the success of clear water repellent treatments on concrete masonry depends on the efforts of everyone involved, the manufacturers, designers, specifiers, contractors, subcontractors, installers, and even the building owners. We must study the problems, learn potential solutions, and share our knowledge--we must communicate!



*Normandy Towers, Los Angeles, California, 9-story high rise building.*

## 2.01 The Designers' Point of View.

The decision to use a clear water repellent treatment on concrete masonry will typically be the result of a series of design considerations. In some cases it will be a decision made by the owner based on previous successful applications. It could also be based on a specific desired appearance by the designer, the owner, or both, such as the use of a tan colored concrete masonry slump block to provide an adobe appearance for a restaurant with a southwestern motif.

First there must be the decision to build a masonry building, or to use masonry as a primary part of the exterior enclosure of the building. Next the appearance of the concrete masonry must become an integral part of the appearance of the building, such as integral color, special aggregates, or texture. And finally, a clear water repellent treatment must also be included.

## 2.02 Benefits.

Selecting concrete masonry as an integral part of the building's appearance provides numerous benefits for the designer and the owner. Where the gray color of standard cementitious products might provide a cold appearance, use of integral colors and of special aggregates gives concrete masonry a warm appearance. The multitude of concrete masonry textures available provide an almost infinite variety of possibilities for building design. And, cost is typically competitive with other types of construction for many buildings.

Applying a clear water repellent treatment to concrete masonry can maintain the appearance of the concrete masonry while providing protection from water intrusion. Additionally, most clear water repellent treatments will keep the concrete masonry looking cleaner longer since a lower permeability prevents dirt from being drawn into the concrete masonry with the water.

## 2.03 Maintainability.

Owners are especially interested in the maintenance requirements for buildings. And designers need information regarding potential expectations as well as any potential concerns regarding clear water repellent treatments.

Maintenance is required for any type of coated material. Opaque coatings such as paints have an accepted maintenance period of five to ten years depending upon the quality of the coating and the harshness of the environment. Uncoated cementitious materials, including concrete masonry, tend to absorb dirt with moisture, a maintenance consideration in itself.

Clear water repellent treatments can prevent the absorption of dirt and improve the longevity of the system. But some form a film on the surface and are similar to opaque coatings relating to maintainability. Other clear water repellent treatments penetrate the surface and become integral with the concrete masonry wall, rather than coating over the surface. Exactly what this means to maintenance over a period of time can vary with the type of clear water repellent treatment used.

A penetrating type water repellent treatment may require less maintenance than a surface sealer type water repellent treatment. But, experience is too short yet to provide a clear understanding of the long term capabilities of even the best penetrating type water repellent treatments. Owners and designers should NOT assume that penetrating type water repellent treatments are maintenance free.

The benefits of a drier, cleaner building are important. But, it is equally important to note that any system will ultimately require maintenance. Where materials are being selected, it would be useful to ask manufacturers several specific questions.

## SECTION 2 DESIGN



1. What is the anticipated useful lifespan of the product and the anticipated period for reapplication of the clear water repellent treatment?
2. What maintenance is required prior to reapplication and what materials should and should not be used for periodic maintenance?
3. What requirements or limitations might affect reapplication (i.e. what preparation is required, does the original coating have to be removed, what materials might not be compatible)?
4. What limitations might exist regarding future requirements such as future requirements for reapplication of water repellent treatments, application of anti-graffiti coatings or opaque painting?
5. Based on present limitations on volatile organic compounds (VOC), is it anticipated that this product will still be available when reapplication is required?

designer begins a process of selection which includes the concrete masonry units, mortar, mortar joint profile, treatment of walls, horizontal surfaces, parapets, tops of walls, control joints, and joint sealers as well as the clear water repellent treatment.

**Design with Masonry Units.** Selection of concrete masonry units often begins and ends with the face appearance. The selection consists of: whether the units should be split face, scored, slumped, or fluted; what if any integral color is desired; and what bond pattern and mixture of units might be desired for the total building appearance.

Most designers use the standard running bond and a few use scored units in running bond to provide a stacked bond effect. Color and texture may be varied to develop a pattern within a wall.

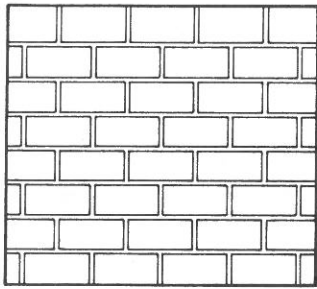
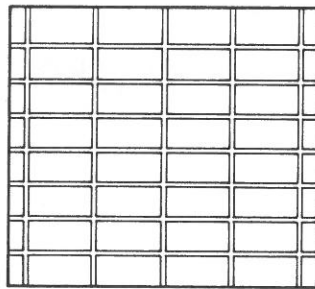
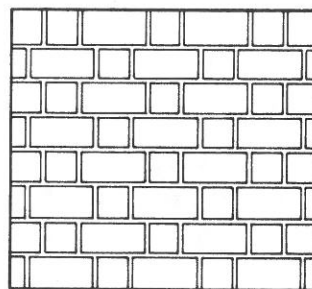
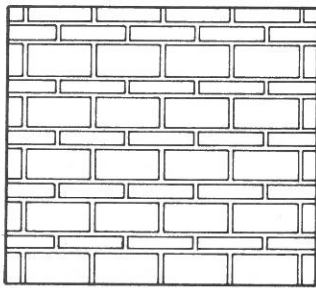
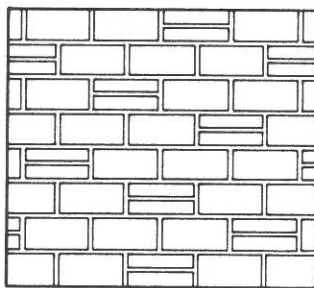
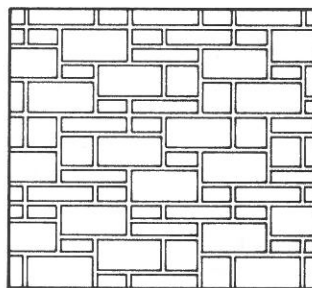
Designers may also use different masonry unit sizes to achieve creative wall patterns (see Figure 2-1). Simple changes in masonry unit heights create various coursed ashlar effects. More complex patterns using various unit sizes and split face concrete masonry creates a random ashlar affect, providing an appearance of stone.

## 2.04 Design.

When selecting concrete masonry as an expression of the exterior of a building, a



*Commercial office and manufacturing building -- Fresh Ideas -- Los Angeles, California*

**Common Bond** (8 x 16 Units)**Stack Bond** (8 x 16 Units)**Coursed Ashlar** (8 x 16 and 8 x 8 Units)**Coursed Ashlar** (8 x 16 and 4 x 16 Units)**Coursed Ashlar** (8 x 16 and 4 x 16 Units)**Random Ashlar** (8 x 16, 8 x 8, 4 x 16 and 4 x 8 Units)**FIGURE 2.1: Architectural Wall Patterns.**

**Designing Mortar Joints.** Both the mortar itself and the profile of the mortar joints, also have an effect on the appearance of a building. Designers may want to consider the color of the mortar, whether it is to match the masonry units, contrast, or be standard gray mortar.

Designers need to be familiar with the differences between types of mortar joints and their abilities to withstand weather (see Figure 2-2).

Tooled joints such as standard concave (or rodded) joints and "V" joints provide the best weathering joints. The mortar is compressed by the tooling process making the exposed surface denser. These joint profiles direct water away from the joint, rather than providing surfaces for water to collect.

Flush joints are not recommended for weathering joint. Cutting flush joints with a trowel can "tear" the mortar forming hairline cracks where water can penetrate. The joints tend to absorb more water where the flush joint is formed only by removing the excess mortar extending beyond the face of the masonry unit.

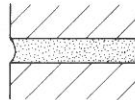
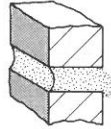
A weathered joint should also be used with caution in exterior concrete masonry construction since the recessed portion of the joint tends to absorb water from wind blown rain.

Struck, beaded, squeezed, and especially raked joints are not recommended for exterior concrete masonry. Each of these joints provide a natural ledge which increases the potential for water intrusion through the masonry at the joints.



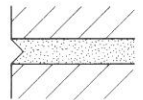
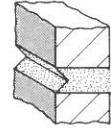
FIGURE 2.2 Mortar Joint Types

### RECOMMENDED JOINTS BEST WEATHER PROTECTION



#### Concave Joint

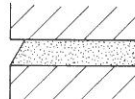
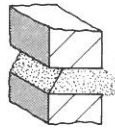
Most common joint used, tooling works the mortar tight into the joint to produce a good weather joint. Pattern is emphasized and small irregularities in laying are concealed.



#### "V" Joint

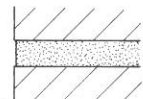
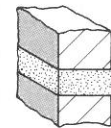
Tooling works the mortar tight and provides a good weather joint. Used to emphasize joints and conceal small irregularities in laying. Provides a line in center of mortar joint.

### ACCEPTABLE JOINTS WEATHER JOINT POSSIBLE WITH PROPER TOOLING



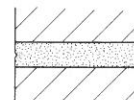
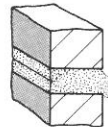
#### Weather Joint

Used to emphasize horizontal joints. Acceptable weather joint with proper tooling. Requires careful application of the clear water repellent.



#### Flush Joint

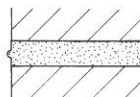
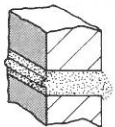
Used where wall is to be plastered or where it is desired to hide joints under paint. Special care is required to make joints weatherproof.



#### Grapevine Joint

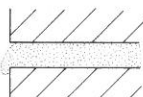
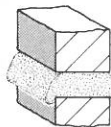
Shows a horizontal indentation.

### NON-WEATHER JOINT FOR SPECIAL EFFECTS ONLY



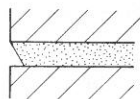
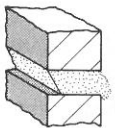
#### Beaded Joint

Special effect, poor exterior weather joint because of exposed ledge.



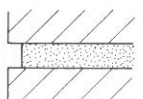
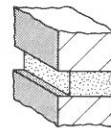
#### Squeezed Joint

Provides a rustic, high texture look. Satisfactory indoors and exterior fences. Not recommended for exterior building walls.



#### Struck Joint

Used to emphasize horizontal joints. Not recommended for exterior use as water will penetrate on lower ledge.

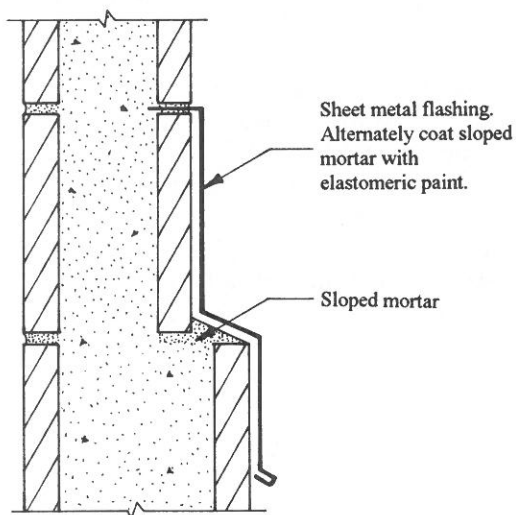


#### Raked Joint

Strongly emphasizes joints. Not recommended if exposed to weather.

**Projections and Sills.** The cells in concrete masonry construction, and the need to maintain alignment of the cells for reinforcing, limit the tendency of designers to create additional patterns by extending some units beyond the face of the wall. Although this process is possible with concrete masonry, the problems of increased water absorption and penetration through the exposed horizontal surfaces should be considered.

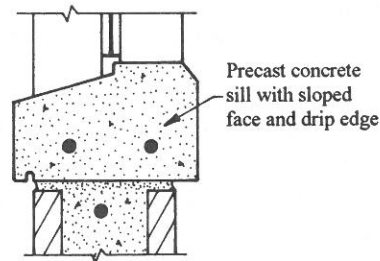
Most clear water repellent treatments are not designed to resist water penetration on horizontal masonry surfaces. Accordingly, ledges formed by projecting units out beyond the face of the wall should be either flashed with sheet metal or patched with an elastomeric coating (see Figure 2.3).



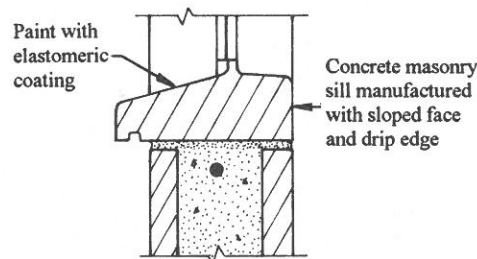
**FIGURE 2.3:** Ledge Details.

Sills provide a special challenge and proper design of sills at windows, louvers, and other openings is critical. Where possible, integral sills of window and louver units should extend beyond the face of the masonry unit. Where windows and louvers are recessed and sill extensions are not desired, special care needs to be taken to minimize potential water intrusion at the sill.

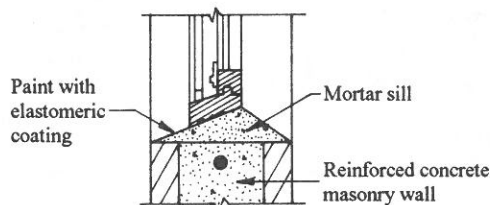
Dense, precast concrete sills, properly sloped and with drip edges, can provide an acceptable sill condition (see Figure 2.4). Avoid mortar sills since they are porous and crack. If used, they should be covered with flashing or coated with an elastomeric coating to prevent water intrusion (see Figure 2.4). Masonry unit sills should also be coated with an elastomeric coating.



**Precast Concrete Sill Detail**



**Concrete Masonry Sill Detail**



**Mortar Sill Detail**

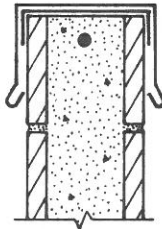
**FIGURE 2.4:** Sill Details.

#### **Copings, Parapets, and Tops of Walls.**

Masonry parapets require special attention during design and construction since they will be exposed to weather on both faces as well as on their tops.

Sheet metal caps can effectively resist water penetration through the tops of the parapets if the metal covers the entire top and extends at least two inches down over both faces of the masonry (see Figure 2.5).

Three inch extensions are preferred to allow for tolerances, and should be considered the minimum extension for split face and scored units. Four inch sheet metal cap extensions are preferred for fluted units to avoid wind-driven rain being blown under the cap. Refer to the Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) literature for proper design of sheet metal, including laps and weathertight installation.



Alternate wall cap without a wood nailer

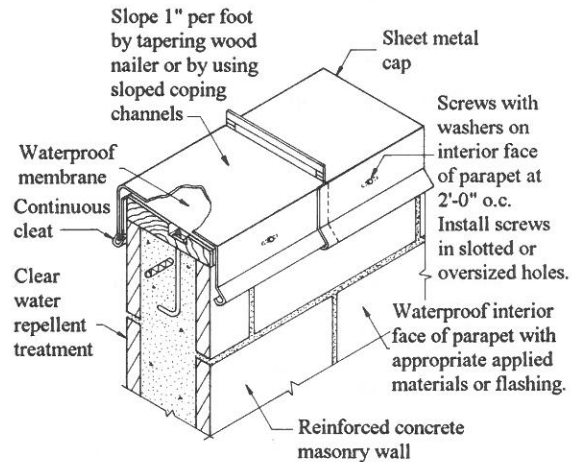


FIGURE 2.5: Parapet Wall Details.

Note that the recommendation is to extend the sheet metal cap two to four inches over the face of the unit, not to have only two inch to four inch legs on the metal cap. Where wood nailers are used and where the cap flashing is sloped to drain the water from the metal cap, the extension needs to be increased by the dimension of the nailer.

Extensions of the roofing cap sheets over the top of masonry parapets are not recommended. Roofing contractors tend to end the cap sheet several inches from the face of the masonry unit to prevent staining from the bituminous materials. This leaves several inches of the top of the masonry wall exposed. In addition, cap sheets tend to fishmouth due to expansion and contraction, allowing water to enter beneath the cap sheet. Sheet metal caps are therefore preferred.

If mortar caps are placed on top of parapets, they should be amply sloped so water will drain freely. They should also be painted with an elastomeric coating since mortar caps are prone to cracking. Similarly concrete masonry, precast concrete and stone copings should also be painted with an elastomeric coating due to the joints between the units.

**Roof Flashing Connections to Concrete Masonry Walls.** Counter flashing and base flashing are vital in resisting water penetration between roof structures and concrete masonry walls (see Figure 2.6). Consideration should be given so the wall strength is not adversely affected by extending the flashing too deeply into the mortar joints.

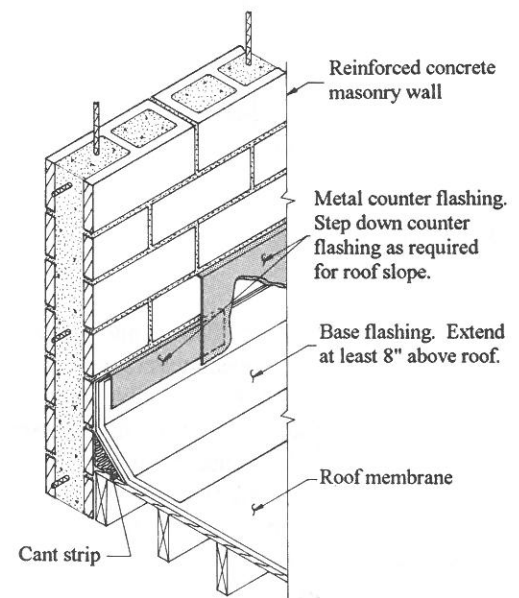


Figure 2.6: Base and Counter Flashing Systems.

**Control Joints.** Proper design of all structures requires recognition of expansion, contraction, and building movement. In concrete masonry structures control joints are used to reduce cracking from these movements. Reinforcing required in seismic areas permit wider spacings of expansion and control joints in concrete masonry.

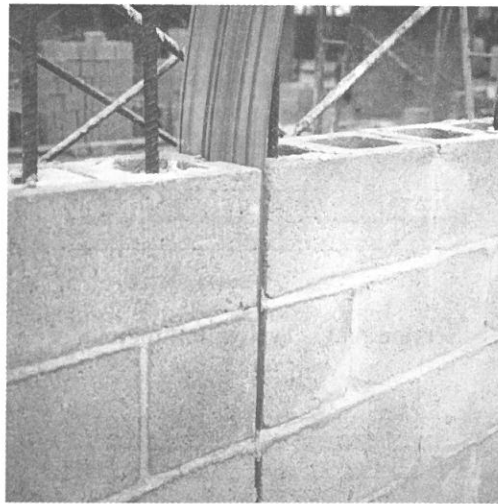
A control joint is recommended where an interior masonry wall intersects an exterior masonry wall unless the walls are designed to support each other. Control joints are also recommended: at large openings in concrete masonry walls; where there are major changes in concrete masonry wall heights; at changes in wall thickness; where there are control joints in foundations, floors, and roof construction; and in long runs of walls.

Where continuous horizontal steel reinforcing is required to extend through a control joint, sleeves can be placed over the reinforcing to allow the joints to move as designed. Non-structural reinforcing may be cut at the control joints to allow less restricted movement at the joint (see Figure 2.7).

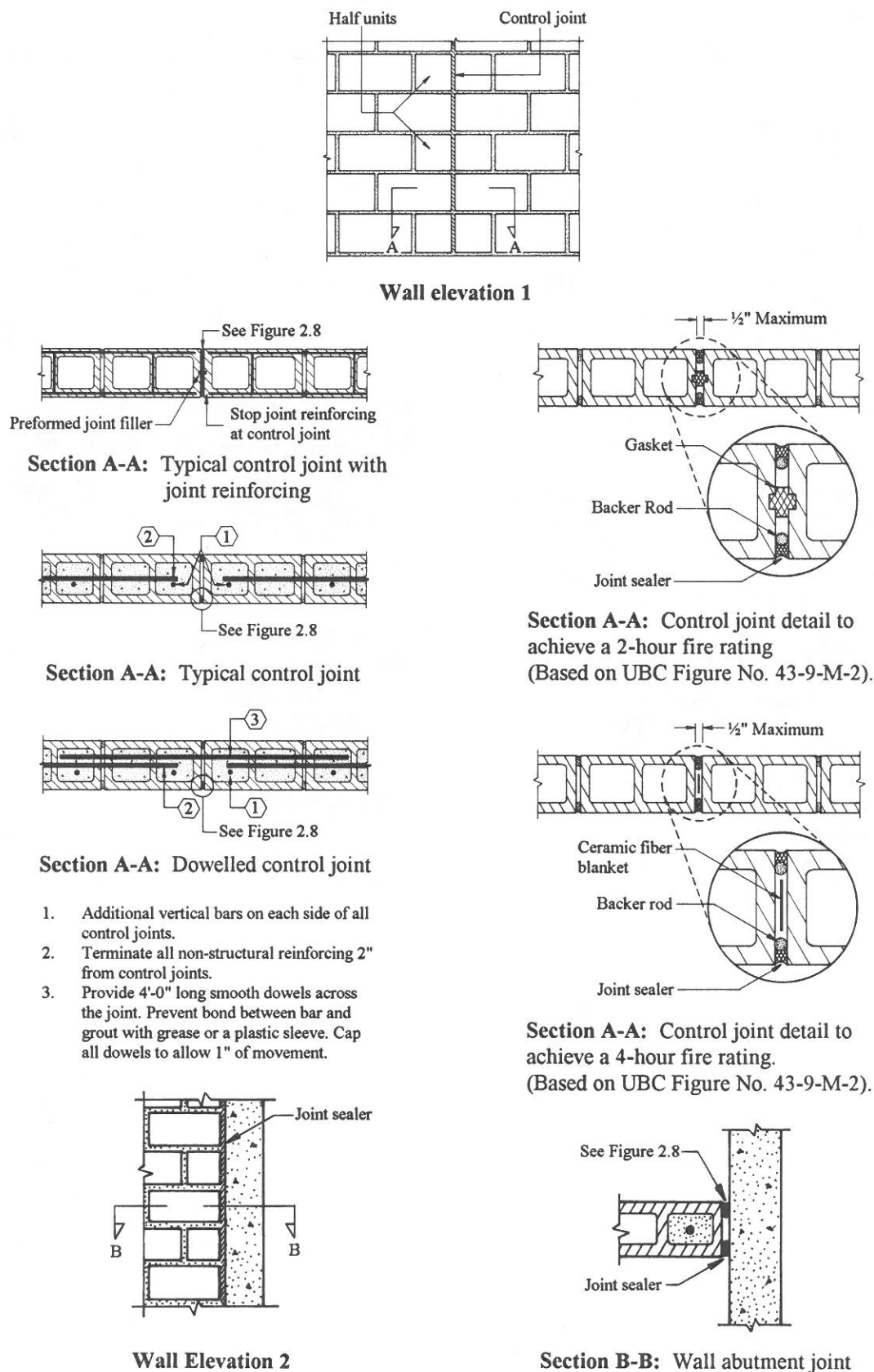
Recommendations vary regarding the appropriate location of joints in long, continuous masonry walls (see Table 2.1). Moisture controlled units (Type I) are recommended to minimize the possibility of shrinkage cracking. Where nonmoisture controlled units (Type II) are used, more control joints are advised.

**TABLE 2.1:** Spacing of Control Joints for Concrete Masonry Units with Horizontal Reinforcing.

Recommended Spacing of Control Joints	Vertical Spacing of Joint Reinforcement (Inches)			
	48	24	16	8
Expressed as Ratio of Panel Length to Height, $L/H$	2	2½	3	4
With Panel Length ( $L$ ) not to Exceed	40 ft	45 ft	50 ft	60 ft



*Control joint with preformed joint filler.*

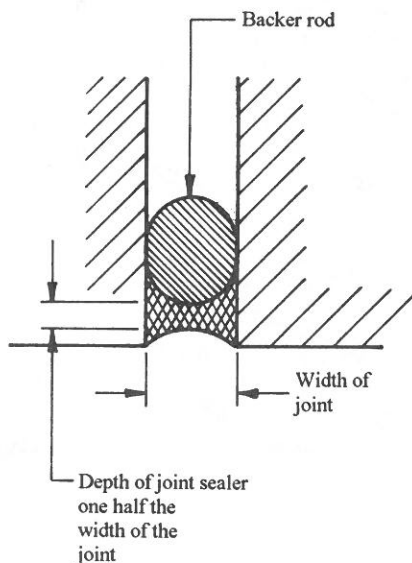
**FIGURE 2.7: Control Joint Details.**



**Joint Sealers.** Joint sealers are an integral part of the water resistance system for exterior concrete masonry construction. In addition to control and expansion joints, joint sealers are also required at windows and doors, other penetrations such as electrical conduits and scuppers, sills, and copings.

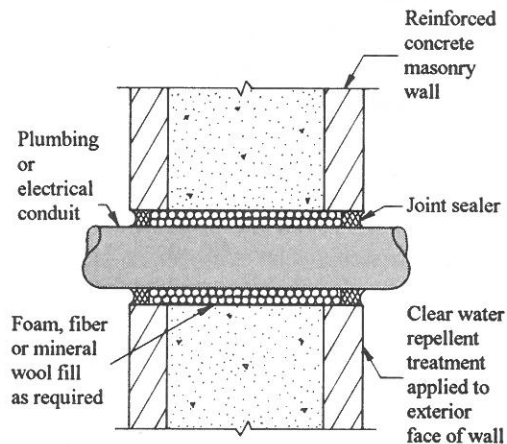
Proper design and application of joint sealers is critical. Joint sealers, profiles, joint width, and backing materials should be carefully coordinated with recommendations of joint sealer manufacturers (see Figure 2.8). Elastomeric joint sealers based on urethane, silicone, and polysulfide joint sealers are typical, although others exist.

Compatibility of the joint sealer with the clear water repellent treatment should be established as part of the design process and verified as part of a mock-up. The installation sequence of the water repellent and the joint sealer also needs to be determined. In some cases water repellent treatments can detrimentally affect the ability of joint sealers to bond to the concrete masonry, even with primers. It is also possible that application of water repellent treatments after installation of joint sealers will create a chemical reaction between the materials, changing the performance capabilities of either or both.

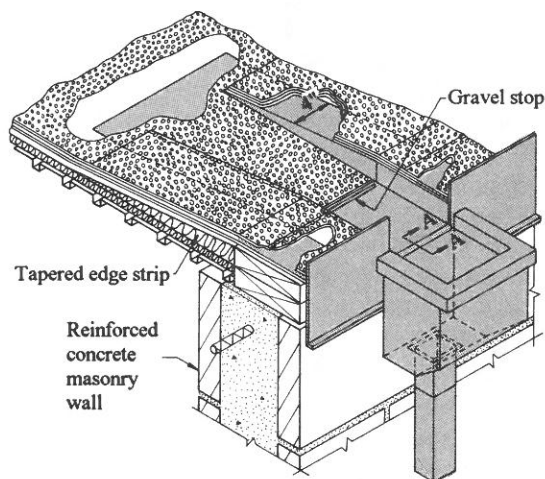


**FIGURE 2.8:** Joint Sealer Detail.

**Penetrations.** Openings throughout concrete masonry walls for scuppers, drains, plumbing and electrical conduits must be properly flashed and sealed so that the wall can effectively resist moisture penetration. Proper installation of joint sealers around pipes and conduits is especially important since the sealer often serves as not only a moisture barrier but also a flame barrier.



**Figure 2.9:** Pipe Penetration Detail.



**Figure 2.10:** Scupper Through Fascia with Conductor Head.

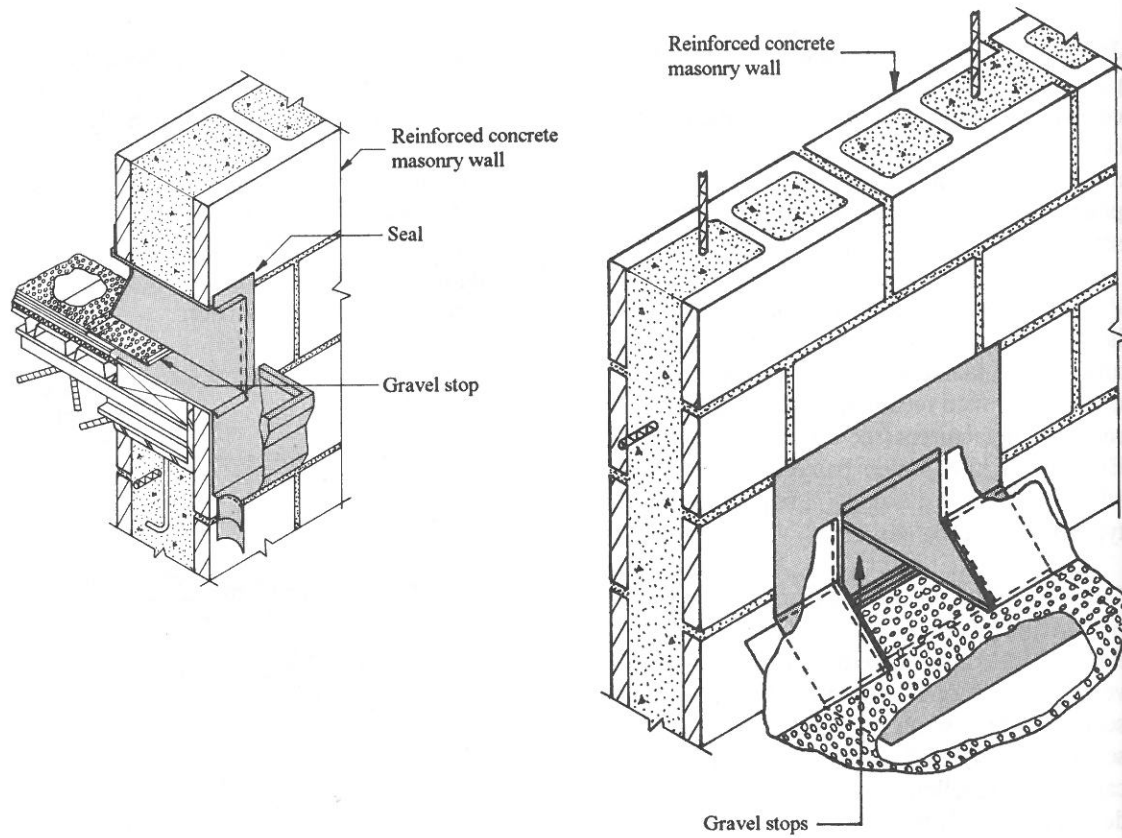


Figure 2.11: Through Wall Scupper.

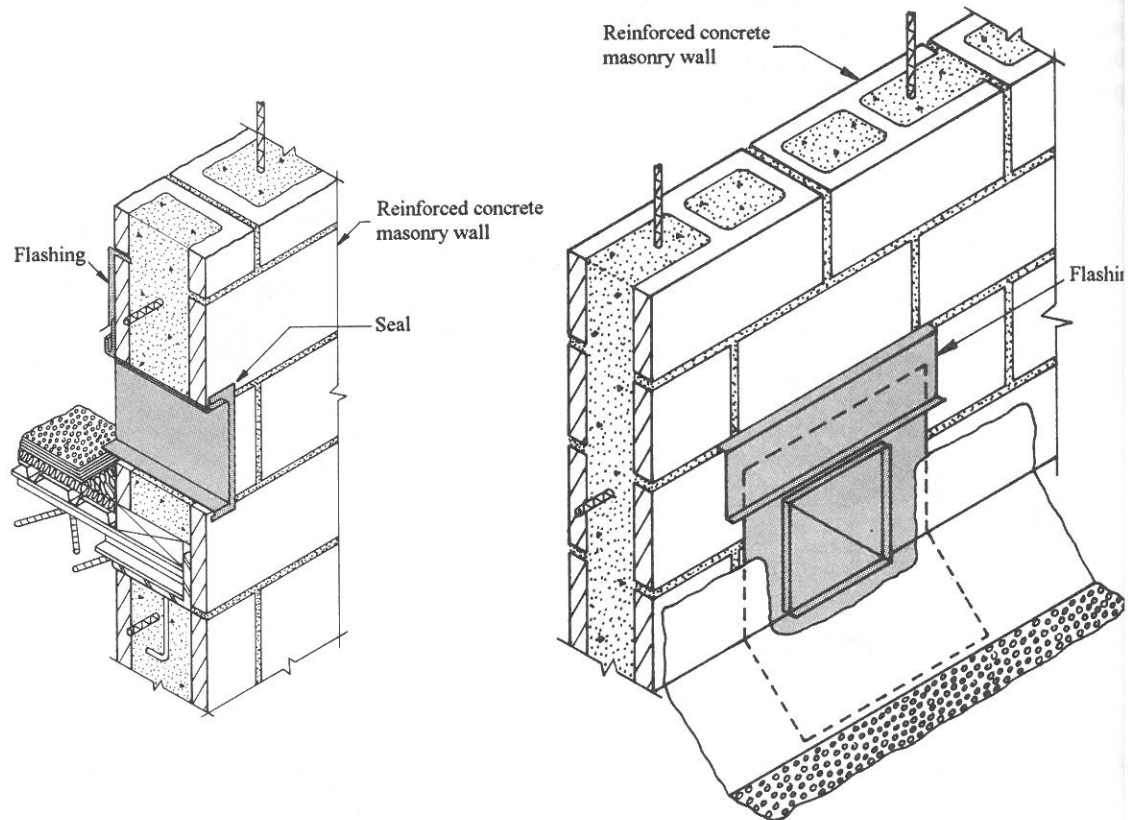


Figure 2.12: Overflow Scupper Design.

## 2.05 Specifications.

Preparations of specifications should occur as specific decisions regarding the type of concrete masonry, mortar, integral colors, aggregates, and water repellent treatments are being made. Files should be kept with decisions and information. Then, when the specifications are formally prepared, the information can be incorporated and the decisions will be limited.

The specifier must first decide where to incorporate the requirements for water repellent treatments. It is recommended that clear water repellents be specified in Section 07180 - Water Repellents, which the 1988 Edition of Masterformat recommends for "Transparent materials applied to exposed surfaces of masonry, concrete, stucco, or similar materials to provide resistance to moisture penetration." The final decision rests with the person preparing the specifications.

Whichever section is used, it is important to coordinate the sections in order to allow each bidder to know what is expected. Where Section 07180 is used, it would be appropriate to cross reference it under Part 1 of other related sections that might mistakenly assume it is part of their work. Those bidding Division 4 or Division 9 must know that a clear water repellent treatment is being used and is specified under another section.

Finally, a cross reference in Section 07900 - Joint Sealers should be provided if there is a need to test for compatibility between the joint sealer and the water repellent treatment.

Specifications should clearly identify submittal requirements for all materials. Samples of concrete masonry units and mortar should be treated with the water repellent to show what effects, if any, the water repellent has on the appearance, color, and texture of the masonry construction.

Requirements for water repellent applicators should also be specified under Part 1 of the section. Usually requiring a licensed applicator or at least five years successful

experience with the material specified is recommended. Where materials are new or experienced applicators are not locally available, it is prudent to require the manufacturer's representative or a licensed applicator to be present during the application to ensure installation instructions are being properly followed.

A mock-up should be required to show the complete installation of concrete masonry, mortar, water repellent, and joint sealers which might be affected by or might affect the water repellent. Testing of joint sealers may also be appropriate prior to purchase (to be specified in Section 07900 - Joint Sealers). Most nationally recognized sealant manufacturers will test their materials on different substrates to ensure compatibility prior to shipping.

Since multiple materials are involved, including masonry, water repellents, joint sealers, and adjoining materials, it is appropriate to specify a pre-installation meeting. This allows the various subcontractors involved an opportunity to meet and share concerns, potential conflicts, and scheduling requirements.

Warranties are typically the last thing included under Part 1 of a specification section. And like most products involved with the building enclosure, water repellent treatments typically have a variety of manufacturer warranties available. Manufacturer warranties are written by lawyers for the manufacturers. Accordingly, a manufacturer's standard warranty will likely protect the manufacturer more than the building owner. (see Section 7 - Common Considerations on page 41 and under Appendix B on page 46).

Warranties may include a provision requiring a representative of the product manufacturer to be present during installation of the treatment. Provisions for testing the effectiveness of the treatment immediately following installation and cure and during the warranted period may also be included. These requirements however, should generally be included in the contract documents.

A clear water repellent treatment should not be selected based on the length of the manufacturer's standard warranty. If a warranty is desired, it should protect the building owner. If you don't understand every word of a warranty, don't accept it without input from the owner's legal counsel. And, if the warranty limits the manufacturer's responsibility relating to implied or to expressed warranties, recognize that it is probably taking more protection away from the building owner than it is providing.

Selection of materials under Part 2 of the specifications generally requires either a proprietary, descriptive, or performance specification. At this writing the only reference standard known to be available is Federal Specification SS-W-110 C, Water Repellent, Colorless Silicon, Resin Based. And, few manufacturers are referencing it.

Performance specifications are still difficult to write, even for basic materials such as clear water repellent treatments. Every requirement must be specified and a method for measuring or ensuring the product meets each requirement must be specified and enforced. Ultimately this leads to a guessing game by contractors who call the specifier and ask what product was intended in the first place.

Descriptive standards, still favored by some government agencies, often have the same results. The contractor just calls the specifier to learn what was desired. The best way to write a descriptive specification is to use the generic title of the water repellent treatment along with specific tests which establish the primary performance requirements.

Proprietary specifications allow the easiest method of communication between the design and construction teams. The design team can research specific products and list those found acceptable. During the design process, literature and samples can be obtained and potential conflicts with other materials can be reviewed. The construction team can price products secure in their acceptance. Technically, proprietary specifications should also be allowed in government work as long as a method for reviewing and approving substitutions (the dreaded equals) is clearly

defined and meets applicable regulations.

Thus, where the contractor, subcontractor, or supplier would like to have another material considered, substitutions can be presented to the design team. The contract documents, usually in Division 1 - General Requirements, can provide a detailed process for requesting substitutions to allow everyone a fair opportunity to bid the project without costly rejections at inconvenient times and include any applicable government requirements.

Part 3 - Execution should be limited to specific requirements that the application is performed in accordance with manufacturer recommendations and installation instructions. Remember, some manufacturers provide footnoted information which is recommended, but may not be legally considered part of the instructions. Requirements to match approved samples and mock-ups can also be appropriate.

Where different manufacturers have different recommendations, it can be disastrous to include instructions in the specifications. In addition, experience sometimes causes a manufacturer to change instructions. Limit written requirements to those which are considered optional by the manufacturer, those which will be checked by the design team, and those which are too important to leave out of the contract documents.

Finally, clearly identify field quality control requirements such as manufacturer inspections and tests required after construction is complete. Testing with the mock-up belongs in Part 1 under Quality Assurance and shop testing done by the manufacturer for verification of performance requirements should be noted in Part 2 under Source Quality Control.

Who should do the inspections along with when they should be conducted will be discussed under the sections on water repellent treatment application. Testing requirements are covered in Section 6 beginning on page 35.

A guide specification is included in Appendix D starting on page 55.

### 3.01 Performance, Characteristics, and Resin Types.

Lists of clear water repellent treatments are constantly growing. Several possible classification methods exist including performance, characteristics, and resin types.

Performance classification of clear water repellent treatments includes using the term water repellent treatment rather than waterproof coating. Technically a waterproof coating seals a material from water in both its liquid and its gaseous states. Water from rain and from sprinklers is kept out, while water vapor is also both kept out and kept in the system. Water repellents are supposed to keep water out while still allowing water vapor to escape the system.

Clear water repellent treatments are, of course, intended to be clear. However, the term "clear" does allow some variance. Some clear treatments may not change the appearance of the concrete masonry or the difference can only be detected by water beading on the surface rather than being absorbed into the unit. Other clear treatments may darken the surface or provide a glossy appearance on the concrete masonry. These characteristics can be easily recognized on samples. Yellowing with age, not typically evident on samples, should also be considered during the selection of materials.

Clear water repellent treatments can also be described by the location of the treatment in the finished system. Terms commonly used include film-forming, penetrating, and integral water repellent treatments.

Those treatments described as film-forming prevent water intrusion by coating or covering the surface of the masonry system. Penetrating type treatments penetrate into the masonry system and fill the voids (or more correctly, line the pores) within the system rather than coat the surface. Integral water repellent materials are added during the manufacturing of the concrete masonry and during the mixing of the mortar and grout.

Resin type is often the most direct way to identify types of water repellent treatments. Few in the construction industry, however, have sufficient training and education in resin chemistry to do more than recognize terms and possibly relate them to a family of types of materials, such as petrochemical organic and silica based minerals.

A listing of those most commonly referenced in manufacturers' literature and industry information would include:

- Acrylics (Emulsions and Solutions)
- Stearates
- Silicone
- Siliconate
- Silicates (Alkali and Ethyl)
- Silanes
- Siloxanes

Proper pronunciation and enunciation may be the first concern when reviewing, selecting, and discussing proper clear water repellent treatments for concrete masonry. Discussions relating to whether they are monomeric or polymeric resins and whether they are suspended or dissolved in solvents can become exasperating.

Relating the characteristics to the resin types can be helpful. Acrylics, stearates, and some silicone water repellent treatments generally form a film on the surface of the masonry system. They also can be used to produce a higher sheen or "gloss" appearance. And, they can be used to darken or intensify colors and aggregates within the masonry units.

Silanes and siloxanes are typically penetrating-type water repellent treatments. They react with silicate minerals in the concrete masonry and mortar. The natural alkalinity of cementitious products typically act as the catalyst for the reaction, along with the moisture in the materials. Some silanes and siloxanes include catalysts in the treatment to promote or extend the reaction.

## SECTION 3 CLEAR WATER REPELLENT TREATMENTS



A general description in common language would be helpful. Unfortunately, variations in chemistry and combinations of materials cause generalizations to be only moderately useful in identification and selection. The following listing, however, might prove helpful in identifying families of materials and in providing information on the basic resin types.

**Acrylics.** Acrylic resins are polymers and copolymers. They form a film on the surface. Variations in chemistry of acrylics allow various forms from solids, to elastomers, to liquids. They are clear, and can be used with a wide variety of solvents, including water. Acrylic emulsions are typically water-based; acrylic solutions are typically solvent-based.

Acrylic emulsion resins include such tongue twisting terms as: methyl methacrylate copolymer; emulsified acrylic copolymer; modified acrylic; and emulsified acrylic. Chemical compositions of acrylics with other resins include emulsified acrylic copolymer with silicate. Most of these use water as the carrier, although glycol and glycol ether are also added to the water in some systems.

Acrylic solution resins are typically variations of the methacrylates: methyl methacrylates; methyl methacrylate copolymers; methyl ethyl methacrylate; methyl methacrylate ethyl acrylate; and isobutyl methacrylate. There are a wide variety of other types such as just plain acrylic, modified acrylic, oxidized acrylic, acrylate, acrylic ester, metallized vinyl, and even styrene butadiene. Acrylic solutions can also be combinations of the various acrylic resins and siloxane.

The common difference between acrylic emulsions and acrylic solutions is the solvent or carrier. Acrylic emulsions are water based. Acrylic solutions do not use water. The solvents for acrylic resins include mineral spirits, xylene, toluene, aromatic hydrocarbon, aromatic naphtha, aliphatic hydrocarbons, and a variety of combinations.

These volatile carriers are becoming a greater concern due to limitations in California and other areas on volatile organic compound (VOC) levels for architectural coatings and treatments.

**Stearates.** Stearate resins are based on stearic acids that form a "soap" in the masonry pores. Originally used as film formers, later chemistries of the stearates have been marketed as penetrating treatments and as integral water repellent treatments. Common terms include aluminum stearates and modified aluminum stearates. The solvents are typically mineral spirits.

**Silicones.** Silicones are polymerized resins which are referred to as organopolysiloxanes. Variations in the size and shape of the silicone polymer resin can vary whether the material is a film forming or penetration type water repellent treatment. There are silicone emulsions but most use mineral spirits or other organic solvents.

Of special interest are those silicone treatments which consist of only 3 to 6 percent solids (resins) when in the bucket. Because of this low solids content, silicone solutions have high VOC levels unless exempt solvents such as trichloroethane are used.

**Siliconate.** A water based form of silicone, siliconates are very alkaline and most siliconates presently available do not reflect the active silicate solids content which in most cases is only 50 percent of the total weight of solids. The remaining weight solids is either sodium or potassium hydroxide, which is why they are so alkaline.

Siliconates undergo a series of chemical reactions which provide the water repellent treatment for masonry substrates. A carbonite by-product is formed when the silicate reacts to form a silicone resin after evaporation of water and exposure to carbon dioxide.

Siliconates are considered more appropriate on brick masonry and less appropriate on concrete masonry.



**Silicates.** Alkali silicates are water based alkaline solutions which harden and densify cementitious materials.

Alkali silicates include sodium silicate, fluorosilicate, silanolate, potassium silicates, and potassium silicate blends. Ethyl silicates (also called silane ethers, ethyl silicate, orthosilicate esters, silicic ester silane, and tetraethylorthosilicate) mixtures include ethyl silicate with alkylalkoxy silane. The ethyl silicates include between 40 percent and 75 percent solids.

One form of silicate, ethyl silicate, uses alcohol or ketone as the carrier, and is used as an additive in organosilanes and siloxane treatments and is a consolidator rather than a water repellent treatment.

**Silanes.** Typically penetrating type sealers, silanes are technically alkyltrialkoxysilanes which is defined as "a monomeric organosilicon compound with an unhydrolyzable siliconcarbon bond." The silanes form a water repellent treatment by chemically bonding with the siliceous minerals in the concrete masonry system. Other terms for silane is alkylalkoxy silane and alkyltrialkoxysilane. Common carriers include alcohol and mineral spirits, but some forms are used with water as the solvent.

Volatile solvent forms of silane contain between 10 percent and 40 percent solids, with 20 percent and 40 percent being common and frequently being the difference between comparable products by a single manufacture. Some 100 percent silanes are also available.

**Siloxanes.** Another form of penetrating sealer, siloxanes are variations of the alkylalkoxysiloxanes which are oligomeric. They chemically bond to silicate minerals in concrete masonry. Variations include polysiloxane, oligomeric siloxane, modified polysiloxane, organosiloxane, oligomeric organosiloxane, and combinations of various siloxanes and silanes.

**Blends.** As noted in several of the resin types descriptions, different types of resins are often combined to improve the characteristics of the final water repellent treatment.

### 3.02 Considerations in Selection.

Concrete masonry construction is hydrophilic by nature; without some form of protection, water moves readily through the natural porosity of the units and mortar. The water can then find ways into the structure and potentially damage interior finishes and materials. Additionally, in areas where freeze-thaw conditions exist, water in the masonry system can expand and damage the system.

There is no specific correct approach to the selection of appropriate clear water repellent treatments for concrete masonry. Experience is typically the easiest means of finding an appropriate material. Those who have successfully utilized products can generally be secure that the same products can be expected to perform as well in similar conditions. Changes in technology and in regulations, especially regarding limitations on volatile organic compounds (VOC), can cause manufacturers to change formulations. Variations in conditions can also cause previous experience to be less applicable. In such cases it would be appropriate to research potential options. And, there are some important questions which should be considered during the research.

Information is available through exhaustive searches of periodicals and professional literature. Organizations such as the Concrete Masonry Association of California and Nevada (CMACN), the Masonry Institute of America (MIA), the National Concrete Masonry Association (NCMA), and the Sealant, Waterproofing & Restoration Institute (SWRI) provide information relating to areas of their specific interest. But, only major projects in major firms allow sufficient time for thorough review of such information. At best, such information is kept available in a file location which can be accessed when needed.

For most projects, manufacturers' literature and local manufacturer representatives are the key source of research information regarding the appropriate application of products. Certainly, it is in the manufacturers' interest to sell their products. Hopefully, manufacturers are the first to realize the danger to their reputation where products prove unsuitable for a specific known application.

The following list of questions should provide a uniform approach to research which can be used for comparison of various products.

1. *What are the manufacturer's recommended applications?*  
Different resins have different appropriate applications. The natural porosity of concrete masonry may be inappropriate for some forms of water repellent treatments. Manufacturers will typically note whether or not concrete masonry is an appropriate substrate, if not, the question should be asked.
2. *Is the product intended to be a surface film or penetrating sealer?*  
Most of the products are clearly formulated as either a surface film or penetrating type sealer, although some might be classified as a little of both. Where not clearly identified, the product is probably a surface sealer. Again, it would be best to check with the manufacturer to be certain.
3. *How many coats are recommended?*  
Differences in formulations make it important to understand the manufacturer's recommendations regarding application, especially the appropriate number of coats and the coverage rate in square feet per gallon. Timing between coats is also important to the application and inspection of the system. Some materials require sufficient time for the masonry to absorb the initial coat prior to reapplication. Otherwise chemicals might end up in the sewers or landscaping.
4. *Can the treatment be reapplied?*  
Some forms of water repellent treatments create a water barrier which even additional coats of the same material can not penetrate. It should be ascertained as to whether or not an additional coat or coats can be applied immediately, within a short period (a few days to a few months), and over the long term (after a few years).
5. *Can the treatment be coated?*  
Whether or not the treatment is compatible with other treatments and coatings might also prove important in the long term. A new building owner might want a new color and want the concrete masonry to be painted. Repeated vandalism might require addition of antigraffiti coatings. Or, the treatment might not prove successful for some unforeseen reason. Knowing whether or not the water repellent treatment can be retreated, painted, or coated can be useful in making early decisions.  
  
Where the water repellent treatment is classified as an antigraffiti coating as well, determine if there are specific types of graffiti for which the treatment will not allow easy eradication.
6. *What are the effects of weather during and immediately after application?*  
The manufacturer can tell you what the construction team should do if it rains during or right after application. Recommendations usually list conditions required prior to application, such as requiring a clean, dry substrate. And they typically give limitations on weather conditions including minimum and maximum temperatures.  
  
But, what should the construction team do if an unexpected shower begins in the middle of an application? Should they stop application and return after the rain ends? Should they (can they?) reapply the water repellent treatment to areas which were not yet dry when the rain began? Should the surface be protected from rain for a specific period after application?

7. *Are there any potential adverse effects such as chemical reactions with adjacent materials?*

Water repellent treatments on concrete masonry will be in contact with the same materials in contact with the concrete masonry: joint sealers (silicones, polyurethanes, polysulfides, acrylics, etc.); windows and doors (aluminum, wood, steel, bronze, etc.); metal flashings (copper, galvanized steel, stainless steel, aluminum, lead coated, etc.); and other siding materials (concrete, brick, metals, wood, plastics, stucco, etc.).

Other materials such as glass and landscaping materials may not be immediately adjacent, but could also be affected by water repellent treatments due to wind, overspray, and run-off. And finally, paints on any of the adjacent and nearby materials could also be affected.

Does the treatment chemically react with these materials, damaging one or both?  
Does the treatment prevent adhesion, such as the bond between the joint sealer and the concrete masonry?

8. *Are there any special limitations on application?*

As the inverse of recommended applications, limitations should include what materials should not be coated. Maximum porosity and minimum permeability requirements might be important. Temperature limitations and moisture content at time of application might be critical to the water repellent treatment. Types of aggregate in the concrete masonry may also have some bearing on success.

9. *Are there any known local limitations on use?*

State and local limitations on volatile organic compounds (VOC) might limit the availability of some otherwise excellent water repellent treatments in certain areas.

Such limitations may only be a concern in heavily populated areas. In other cases, such as in California, the limitations may extend to the manufacturing of the product as well as its sale and use.

10. *What are the long term expectations?*

Since water repellent treatments are going through a period of change, both in chemistry and in limitations on VOC, information on what happens over time is only assumption and speculation. Where treatments have existed without change, it might be appropriate to ask for the location of some of the older applications along with recommendations of owners, architects, and contractors who have used the products.

What is the anticipated life expectancy of the product: three years; five years; ten years; the life of the building? What happens to the treatment over time: does it yellow, peel, embrittle, degrade?

What, if any, maintenance is required: periodic reapplication, total replacement? And if it doesn't last forever, what needs to be done in the future: must the existing material be removed; can it be removed; can it be reapplied; can it be coated?

Finally, remember that warranties can be beneficial in comparing the relative quality of one manufacturer. But, too often they become a sales tool with little true relationship to the durability of the product. A warranty is only as good as the company behind the warranty, and the best companies stand behind their products regardless of the warranties.

With these questions answered, it should be possible to make a selection of appropriate clear water repellent treatments for a specific application.

### 3.03 Approvals.

Once the research is done and the product is selected, there always seems to be someone who wants a change. The selected products are no longer available. They will not be available in time to stay on schedule. Another product is less expensive. There are potential problems with the installer. The contractor, installer, or someone else has had a bad experience with the specified product or has had better luck with something else.

There are as many reasons for change as there are for selecting a product in the first place. And, recommendations for change should never be taken lightly.

A contractor or installer's experience can prove valuable, especially when others on the design team have no experiences, or at least no really successful experiences. Cost and scheduling are also of importance to any project. The problem is comparing apples to oranges--seldom will the proposed substitution be the same material, or even in the same resin family as the specified product.

When substitutions are proposed, the questions listed for selection become a potential means for comparison. The design professional needs sufficient information to make a valid decision. In some cases the owner may decide to become involved, especially where there is a sufficient monetary difference. Again, providing a comparison of the products based on the listed questions should allow the owner to determine whether or not the savings will be realized in the long term.

Design professionals should recognize the value of input from the construction professionals. Construction professionals should recognize the experience and research involved in selection by the design professional. And, the owners should recognize that there is a limit to how much time can be beneficially spent on any one subject in construction.



*Variety of concrete masonry units at a manufacturing plant.*

#### 4.01 Concrete Masonry Units.

The design team initiates the concept of using concrete masonry as the focal point of a building. They choose to use integral colors, special aggregates, and special textures which result in the need for clear water repellent treatments. But, the construction team makes that concept a reality. The contractors, subcontractors, suppliers, installers, and manufacturers translate the designer's ideas into a building.

The construction team must be given sufficient information to translate the idea into reality. They must also recognize the importance of reading beyond the drawings and words. No documents can be so complete as to tell everything desired, let alone everything necessary for a successful project. The design team provides the concepts and intent, the construction team the materials and methods.

The selection of concrete masonry units is facilitated by numerous books and brochures. These provide designers with information regarding the common sizes, shapes, colors, and textures. Standards such as ASTM C 90 and UBC Standard 24-4 provide technical requirements regarding required compressive strength, weight classification, grades, types (moisture controlled and nonmoisture-controlled), and maximum water absorption.

Face, color, and texture can be established by submittal of samples. These samples can indicate both compliance with the contract documents and any potential range in finish appearance which can be anticipated. Contractors and subcontractors need to be sure the proper communication is taking place between the design team and the manufacturer to prevent delays.

Weights of the units are seldom as great a concern as the compressive strength. Weights of concrete units relate more to structural design (dead loads) and ease of installation than to quality of concrete masonry.

The 1991 Edition of the Uniform Building Code Standard 24-4 classifies load-bearing concrete masonry units in two grades: Grade N for exterior applications, including below grade, and Grade S for interior applications and for exterior areas either protected from weather or with a weather-protective coating or treatment. ASTM C 90 - 90, *Standard Specifications for Load-Bearing Concrete Masonry Units*, deleted the grade classification because Grade S load bearing concrete masonry is no longer available.

ASTM C 90 and UBC Standard 24-4 also classify concrete masonry units based on moisture content. This provides some method for comparison and determination of how dry the concrete masonry units are when delivered. But, the moisture content classifications (Type I or Type II) give no indication regarding the rate of water absorption or the permeability of the masonry.

Visual inspection of concrete masonry prior to installation can prove especially beneficial in eliminating units with obvious flaws. Large surface voids and fissures in a unit can be a signal of greater hidden problems. Such units can be set aside for use in nonexposed locations or sent back to the manufacturer.

## SECTION 4 MASONRY MATERIALS AND METHODS



#### 4.02 Water Absorption and Permeability.

Water absorption and permeability of both the concrete masonry system and concrete masonry systems with clear water repellent treatments can provide some indication regarding the ability of the system to stop water. But, there are questions regarding what can be assumed from the information.

Concrete masonry systems may have a low rate of water absorption because a water repellent treatment either seals the masonry or coats the capillary channels, preventing the water from being absorbed. But, if the water passes through the masonry the absorption could be low and the permeability high.

Information from tests on sample panels are better measures of the ability of a concrete masonry system to prevent water penetration than either water absorption tests or permeability tests on concrete masonry, including concrete masonry units with water repellent treatments. Refer to Section 6 Testing on page 35.

Concrete masonry manufacturers and water repellent treatment manufacturers can work together to test sample panels and verify that specific materials work together rather than provide information regarding water absorption or permeability tests. This way both manufacturers can be sure that their products work well together.

An additional benefit in such tests would be a lap test. The water repellent coating should be applied to a portion of the test panel and allowed to cure or set overnight which would simulate standard job conditions. The remainder of the water repellent treatment could then be applied the next day. The resultant test information would then help validate the concrete masonry and water repellent treatment's ability to work on large scale jobs in a real- world situation.

Factors which affect rate of water absorption and permeability of a concrete masonry system include cement content, gap gradation of aggregates, type and quantity of fine aggregates, and the mix design. Permeability of the concrete masonry units affects the application of the water repellent coating. Excessive permeability of the units generally means that a greater quantity or a better quality of water repellent coatings is required to seal the units. The only definite method to determine proper application rate of a water repellent treatment is to run field test applications of the water repellent treatment and measure the amount necessary to stop water penetration through the assembly.

Quality control by concrete masonry manufacturers, experience by water repellent manufacturers, and experience by applicators of water repellents should provide suitable guidance to properly estimate many projects during bidding. Where new products are involved, care should be taken during bidding to work more closely with the masonry and treatment manufacturers to establish valid estimates based on known concerns.

Where too many unknowns exist, manufacturers need to let the design team know in advance that there are concerns. Privately funded construction can have testing performed early, prior to bidding, to minimize the unknowns. Even publicly funded projects can work with a variety of manufacturers of materials to provide more definite information while still permitting open bidding.

Permeability of the concrete masonry system is a critical concern. Materials manufacturers, especially water repellent manufacturers, can use established tests to allow for comparisons of treatment materials. And, tests can be made on completed construction to verify the effectiveness of the completed, clear water repellent coated concrete masonry assembly.



### 4.03 Variations to Concrete Masonry Construction.

While considering the ability of concrete masonry to withstand water intrusion, it is important to consider possible variations in masonry wall types. This book is primarily directed towards single wythe concrete masonry exterior walls.

Although not as typical today as it was in past, multi-wythe solid masonry construction is still used. Previous experience with multi-wythe construction was primarily based on clay products rather than concrete masonry. Due to the differences in permeability of concrete masonry and clay masonry, it would be best to assume multi-wythe concrete masonry shares the same concern as single wythe construction and would benefit from application of water repellent treatments.

Cavity wall construction offers another variation. In cavity wall construction the cavity can include a waterproof material or coating along with appropriate cavity flashing to direct water back to the outside through weep holes in the face wythe of masonry. Although probably not as critical, cavity wall construction can also benefit from application of a clear water repellent treatment on the exterior surface. Such duplication can limit potential failures due to improper flashing, problems with the cavity waterproofing system, blocked weep holes, and even minimize efflorescence.

Stucco applied over concrete masonry offers its own challenge. Where the stucco is applied on metal lath over a building paper, the system should act no differently than stucco over sheathing. Water penetrating the stucco, which is hydrophilic like concrete masonry, can be directed by the building paper to flashings and weeps in the plaster system.

Where stucco is bonded directly to concrete masonry, the only thing that can stop water penetration is the bonding material, a waterproof elastomeric coating or a water repellent treatment on the stucco.

### 4.04 Mortar.

Proper mortar mix, installation and tooling are necessary for the success of a concrete masonry system and the success of the wall's resistance to water penetration. Since mortar joints can represent 10 percent of the total wall surface area and since the mortar to block interface can provide a direct passage for water migration the use of trained and qualified mason contractors is vital.

Even with good workmanship however, problems and concerns can develop which reduce the wall's resistance to water intrusion. For instance, hairline cracks can form as the mortar and concrete masonry units dry and hydrate. Extremely hot, windy and dry conditions can contribute to the formation of shrinkage cracks by causing premature evaporation of water from the masonry system. Narrow cracks, less than about 0.02", can usually be sealed with clear water repellents. Wider cracks however, may require pointing with new mortar or sealing with elastomeric sealers.

Mortar joint patching and pointing may be required despite good quality workmanship. Line pin holes, nail holes and other holes in the mortar joints (commonly referred to as bee holes) should ideally be filled while the mortar in the joint is still fresh and plastic.

Recommendations for repairing such holes after the mortar joints have hardened vary and depend on the job conditions. Holes may be sealed by first wetting the hardened mortar and then filling the hole with fresh mortar. Acrylic emulsion modified mortars and other high bond mortars can be used provided that the mortar color can be effectively matched.

It should be noted that some masons prefer to do all patching and pointing after the wall has been cleaned since the cleaning procedure (especially sandblasting) can dislodge even the best placed patches.

It should also be noted that heavy sandblasting should be avoided since it can degrade the surface of the mortar and the concrete masonry unit.

As section 2.04, page 7, discusses, the mortar joint profile also has a significant effect on the wall's resistance to moisture penetration. Struck and raked joints form ledges which are prone to leakage (see Figure 2.2, page 8). Concave end "V" joints by contrast, direct the water away from the interior of the building and are recommended for exterior masonry construction.

Other factors such as type of mortar used, proportion of mortar materials, water contents of the mortar and block, and weather conditions before, during and after placement also affect the porosity of the mortar. For additional discussion on the subject, publications from organizations such as the Portland Cement Association (PCA) and the National Lime Association (NLA) are available.

#### 4.05 Construction Methods.

The construction team is ultimately responsible for construction means and methods. They must properly bid the project, obtain correct materials, coordinate schedules, install, finish, and verify the final product as being in compliance with the contract documents.

Coordination of the construction team and between the construction team and the design team are critical to the success of any watertight concrete masonry construction.

Samples provide the first line of communication between the construction and design teams. Where integral colors, special aggregates, and textures are required, the design team needs submittals as early in the project as possible. Submittals should be expedited to allow sufficient time for review and comments. Contractors also need to remember, any submittal is subject to potential rejection.



*Concave tooling of mortar joints with a sledrunner tool.*

Submittal of samples of concrete masonry units, mortar materials, clear water repellent treatments and joint sealers should be coordinated. Typically, samples of each material are submitted separately, allowing for the possibility that final results may differ from the samples. Samples of the selected masonry units and colored mortar should be coated with a sample of the specified clear water repellent treatment to minimize potential surprises.

Combinations of chemicals, such as the mineral oxides in color additives and the chemicals in the treatments, may react causing stains and discolorations.

Field mock-ups provide an additional level of communication between the design and construction teams. Even when not required in the contract documents, the construction team can benefit by having members of the design team review initial construction to verify acceptability of materials, tooling, and overall appearance.

Mock-ups can also be used to verify compatibility of adjacent materials such as joint sealers and water repellent treatments. Where problems are found, masking or special priming may be required to ensure proper bond of the joint sealer or protection of one material from a chemical reaction with the other.

Another potential use for mock-ups is preliminary testing of the application of the water repellent treatment related to the permeability of the completed concrete masonry system. Proposed applications can be completed on a portion of the mock-up, tested, and where proven inadequate, can be modified and retested to determine the proper applications required. Such field tests can include a lap test with a portion of the mock-up having the water repellent treatment applied and allowed to cure, and the remainder treated on the next day, simulating the work breaks in the application process.

Pre-installation meetings should be held after submittals have been approved, mock-ups completed, and prior to beginning construction. Parties directly affecting the

concrete masonry work should be required to attend including the various subcontractors, suppliers, and manufacturer representatives. Parties involved with materials such as joint sealers, windows, doors, sheet metal, roofing, and other materials which will be in direct contact with the concrete masonry system should also be invited.

The pre-installation meeting should include a general description of the work schedules, installation procedures, special considerations and concerns listed in the contract documents, information learned from mock-ups, and coordination required with adjacent work.

Materials delivered to the job site should be inspected to assure they are correct and in quantities sufficient to complete the project. Manufacturer recommendations for storage and handling should be reviewed and care should be taken that materials are not damaged and are suitable for installation. Materials not in compliance should be rejected and removed from the site.

During construction, both the owner's representative (typically the architect) and the contractor's field supervisor should verify compliance with the contract documents. They should verify that manufacturer recommendations and installation instructions are being followed, visits by manufacturer representatives and special inspectors have been fulfilled where required, and the finished installation is consistent with the samples and mock-ups.

Mortar joint tooling should be observed on a regular basis to ensure full head and bed joints are being maintained and proper tooling is being done. Masons should regularly check for beeholes and cracks and properly repair defects as work proceeds.

Proper treatment of control and expansion joints should be verified, as well as precautions to ensure the proper adhesion of joint sealers. Joints receiving sealants should be kept clean of mortar and debris. Edges may require masking prior to application of water repellent treatments.

Masonry construction should be cleaned using non-metallic tools or other manufacturer recommended processes during construction. Excess mortar and smears should be removed prior to application of water repellent treatments. Defective mortar should be pointed or replaced and finished to match adjacent work prior to application of water repellent treatments. Stains, paint, and efflorescence should also be cleaned from masonry surfaces prior to application of water repellent treatments.

Information regarding proper cleaning methods is available in several ASTM standards. ASTM D 4261 - 83 (1993), *Standard Practice for Surface Cleaning Concrete Unit Masonry for Coating* provides procedures for steam cleaning, detergent water washing, water cleaning, mechanical tool cleaning, vacuum cleaning, and air blast cleaning.

Additional information on cleaning of concrete surfaces can be found in ASTM D 4258 - 83 (1988), *Standard Practice for Surface Cleaning Concrete for Coating*. ASTM D 4259 - 88, *Standard Practice for Abrading Concrete* provides information on mechanically abrading, water blast cleaning and abrasive blast cleaning (sand blasting) concrete surfaces. Information on acid cleaning concrete ASTM D 4260 - 88, *Standard Practice for Acid Etching Concrete* provides information on acid cleaning concrete.

Application of water repellent treatments should be scheduled when conditions are in conformance with the water repellent treatment manufacturer recommendations. Weather conditions should be ascertained, for several days prior to, during, and for the predictable future after application of the water repellent treatment. Mortar joints should be fully cured.

Application of the water repellent treatment should be closely supervised to ensure compliance with manufacturer recommendations and installation instructions. Of special concern should be the acceptable experience of applicators and installation supervisors, compliance with manufacturer recommendations for application methods, equipment, number of coats or coverage per gallon of material required, and compliance with special application considerations developed during testing on the mock-up. Comparison should also be made to ensure the finished installation matches approved samples and mock-ups.

Finally, field tests should be performed using the methods specified in the contract documents. Where tests indicate failure of completed systems to comply with requirements, means to rectify the problems should be established, corrections made, and the system retested. Refer to Section 6.03 Field Test starting on page 38.

A substantial completion review should be made with members of the design team and with the owner to obtain acceptance of the finished installation. A list should be made of items which are not acceptable along with proposed methods for correction. Maintenance requirements, project record documents, and warranties should be collected, organized, and provided to the owner. After corrections noted during the substantial completion review have been made, a final inspection should be held with the design team and the owner to verify acceptance of the project.

### 5.01 Application.

Proper application of water repellent treatments is critical to the success of the concrete masonry system's ability to resist water. And, with the rapid changes in materials during the last decade, it is too easy to become complacent, relying on inappropriate experience rather than actual needs. Different materials require different approaches.

It's important to note that the earlier versions of clear water repellent treatments, such as acrylic solutions, required a dry substrate. Newer products, such as those based on silanes and siloxanes, tolerate or even require some moisture within the masonry to cure properly. Installers need to be aware that even products by the same manufacturer, with similar names, can have drastically changed chemical composition due to manufacturer improvements and due to limitations on volatile organic compounds (VOC).

And, as the chemistries, laws, and substrates change, so must the application change. Experience should be tempered with up-to-date training and constant vigilance regarding new recommendations and requirements. Reliance on experience, typically the strength of quality control, may be a weakness where installers fail to be properly retrained to recognize the differences being made which affect the clear water repellent treatment industry.

Applicators must review the contract documents for each project and the information provided by the manufacturers.

Manufacturer training and approval of installers should be obtained where such programs are available. Applicators should have five years successful experience in applying the specified materials on projects of comparable size and scope of work. Where this is not practical due to changes in the treatment systems, experience should include the use of similar clear water repellent treatments.



*Spraying water repellent chemicals on split face concrete masonry wall.*

### 5.02 Submittals.

Submittals provide contractors and subcontractors an early opportunity to verify contract requirements with the design professionals. Submittals benefit the construction team as much, or possibly even more, than they benefit the design team. They allow both parties to agree on what is expected early enough in the project to minimize the impact of potential misunderstandings.

Product data submittals allow the contractor to verify the acceptability of products planned for purchase prior to the actual purchase. Manufacturer's literature indicating exactly what product is intended should be submitted along with substantiating information required to verify conformance with the requirements in the contract documents.

Where proprietary specifications are used, product data can be limited to copies of the manufacturer's brochures. Where the brochures list several products, the specific materials intended for the project must be highlighted. Where options are indicated, those being provided should also be highlighted and those not being provided should be clearly struck out.

## SECTION 5 WATER REPELLENT TREATMENT APPLICATION



Where descriptive specifications are used, additional information will generally be required to allow comparison of the proposed product with the descriptions in the specifications. In most cases this will require additional testing laboratory reports. In some cases manufacturer certifications will be required indicating that the proposed materials comply with the contract documents. And, manufacturer certification may also be required indicating the proposed materials comply with specific regulatory requirements such as volatile organic compound (VOC) limitations.

The use of reference standards may be the basis for a type of specification called reference standards specifications, and reference standards may be included in other types of specifications to ensure specific industry standard requirements are met.

Where reference standards are listed, data substantiating compliance with the standards should be included with the product data submittal. At the time of this writing, the clear water repellent treatment industry does not have generally accepted product standards. Reference standards commonly listed are primarily test standards which are more accurately designated as performance requirements.

Performance requirements (such as a minimum percentage of improvement in efficiency regarding the effectiveness of the water repellent treatment in reducing water absorption based on ASTM C 140 - 91) may be listed in the contract documents. Data substantiating compliance with specified performance requirements should be included with the product data submittal, such as independent laboratory tests.

Submittal of samples provides the visual verification which is often of primary importance to the design team. If the design team expects to see a glossy finish, samples are the best way to let them know just how glossy a surface the material being proposed can produce. Similarly, if the design team doesn't want the treatment to change the appearance of the substrate, samples allow verification that no change occurs.

One cautionary note, the only way to be certain that the proposed product is appropriate is to apply it to the concrete masonry and mortar being proposed for use on the project. This requires early contact with the contractor to obtain approved samples of the concrete masonry and mortar for use in submittal of samples of the clear water repellent treatment.

There are substantial risks in submitting water repellent treatment samples on concrete masonry and mortar other than that which is to be used for the project. Decorative concrete masonry units and colored mortar contain varying amounts of mineral oxides for color, different aggregates, and in some cases admixtures. Each of these could be affected by the chemicals in the water repellent treatment. Such effects might result in stains, discolorations, or might change the appearance of the water repellent treatment itself.

Application of the water repellent treatment to proposed concrete masonry and mortar is less risky. However, rejection of the proposed concrete masonry and mortar would result in the necessity to reapply the treatment to additional submittals of the masonry and mortar.

### 5.03 Mock-Ups.

Once submittals are approved, mock-ups become the next step in verifying that the products in the concrete masonry system are acceptable. Mock-ups provide a large scale visual verification, an opportunity for field testing, and an opportunity for coordination of materials.

Design professionals are typically most interested in mock-ups to establish the visual characteristics of the finished masonry system. But, they also use mock-ups to establish the minimum quality of workmanship intended, giving direction on the acceptability of material variations, mortar joints, and tolerances.

Mock-ups also provide an opportunity to verify application methods for the clear water repellent treatments. Care should be exercised that the applicators will be actively involved in the final application and that notes are kept by the treatment subcontractor indicating any variations required from the manufacturer recommendations and instructions. The manufacturer's representative should also be present when the treatment is applied to the mock-up for technical information and guidance.

When possible, coverage of the mock-up with a clear water repellent treatment should be limited to a portion of the mock-up panel. This allows for comparison of the coated and uncoated substrate to establish if the treatment changes the appearance. It also allows for application of additional materials where the original proposed treatment materials are unacceptable in appearance or where they fail to comply with tests made on the mock-up.

Where joint sealers come in contact with water repellent treatments, mock-ups can provide an opportunity to assure the products are compatible when applied in accordance with manufacturer recommendations. Where the materials involved have been previously tested together, application to the mock-up allows simple verification. Where new products and previously untested products are involved, the mock-up provides valuable information in proper protection and application to prevent incompatibility.

Finally, mock-ups provide an opportunity to test the completed concrete masonry system to make sure the combination of parts performs appropriately. One or more types of tests can be run which allow easy visual inspection of front and back surfaces to establish if water penetrates the system. It also provides information which can be used during construction to minimize the possibility of similar defects occurring.

#### 5.04 Pre-Installation Meetings.

At least one pre-installation meeting should be held after approvals of submittals and mock-ups, and prior to beginning construction of concrete masonry systems. Attendance at the pre-installation meeting by the water repellent treatment team (manufacturer representative, subcontractor, and application supervisor) allows for mutual understanding of specific concerns.

Those responsible for application of the water repellent treatment will have the opportunity to verify scheduling so the masonry is complete and ready for the treatment within the proper time frame and preferable weather conditions. Special concerns for materials storage, availability of temporary facilities, and coordination with other trades can be expressed.

The pre-installation meeting also allows for any last minute questions to the design team regarding special considerations and concerns listed in the contract documents. Special requirements in the contract documents can be discussed, such as requiring masking at joints to receive sealants, especially where mock-up tests have indicated that the treatment and joint sealer materials are compatible.

And, persons involved with other materials adjacent to the concrete masonry and water repellent treatments can express any concerns they may have regarding potential damage to the concrete masonry system and potential damage to their materials by the treatment system. Methods of protecting adjacent materials which could be damaged by overspray, dripping, and wind blowoff can be discussed and agreed upon in advance.

### 5.05 Inspections.

Careful attention to detail by the treatment applicators is critical to the success of the project. The best way to assure proper application is to have periodic inspections which can establish that proper materials, quantities, and application methods are being used.

Both the contractor and the subcontractor responsible for application of the water repellent treatment must have qualified supervisors on the project. The contractor's supervisor should have observed the mock-up application and should be able to recognize that the same application methods are being used. Although the contractor's supervisor should be on the job site during construction, they should not be expected to be constantly observing any one subcontractor's work.

The clear water repellent treatment subcontractor's field supervisor should constantly observe the work and maintain the necessary quality control. For large projects, this may require a person who is constantly moving from application team to application team. For small projects the supervisor might actually be doing some or all of the application.

In either case, the treatment subcontractor's supervisor should be the one responsible for the first line of quality control. Manufacturer's literature, requirements in the contract documents, and notes from sample submittals and from mock-ups should all be reviewed and studied. Important information should be passed on to the applicators and any special directions should be given and checked to make sure everyone fully understands.

Manufacturer's representatives can often provide a second level of quality control. Where available and where required in the contract documents, a manufacturer's representative can make periodic visits to the job site to verify compliance with their application instructions. Some manufacturers require review by their representatives as part of their conditions for warranties. Where warranties are required, such special

conditions should be verified and the manufacturer informed about scheduled times for application.

Special inspectors (third party inspectors not connected with the contractor, subcontractor, or manufacturer) may provide an added level of quality control. Such third party inspectors should be versed in quality control requirements and will often have other quality control responsibilities on the project. Typically hired by owners (especially for government agencies), special inspectors will review the contract requirements, attend pre-installation meetings, observe mock-up construction and testing, and develop check lists to verify compliance.

The special inspector should periodically observe application of the water repellent treatment and verify compliance with information included on the check list. Where variations from the contract documents are observed, they will typically be noted and given to the owner and contractor.

### 5.06 Manufacturer Instructions and Recommendations.

Projects benefit when manufacturers and manufacturer representatives take an active part. Unfortunately, few have the time or staff necessary to provide on-site service even once during the average project. Their materials, and their reputations, rely on adequate information for successful application.

Most manufacturers provide technical assistance through brochures, technical literature, and application instructions. Many also provide special assistance through telephone contacts with technical experts. And, as mentioned, some also require on-site review by staff or trained suppliers to verify compliance in order to provide warranties.

The availability of assistance from manufacturers should be established early in the project and the construction team should take full advantage of the use of any special services made available.

Manufacturers' literature will typically establish the basics for use of the materials. Appropriate (and inappropriate) substrates will be identified as well as any special requirements. And, application instructions will be either included in the literature or sent with the materials.

During preliminary review of manufacturer literature it is important to note special considerations. Limitations are often highlighted or listed in bold type. Application instructions often include recommendations which may or may not apply to a specific project. The difference between an instruction and a recommendation may have important consequences on the success of a project. Where information is not clear, manufacturers should be contacted for guidance.

Climatic conditions appropriate for storage and for application must be found and identified. Temperatures between 40 degrees Fahrenheit and 100 degrees Fahrenheit are typically permissible. Climatic conditions should also be compared with requirements in the contract documents. Where differences are noted, the design team should be contacted. In some cases such special requirements are specified based on taking the most restrictive requirements of several manufacturers listed as acceptable in the contract documents, and may be waived based on manufacturer recommendations.

Conditions for approvals, such as review by a manufacturer's representative for warranties, should be established and complied with during the appropriate times in the construction schedule. Coordination recommendations to ensure compatibility with other materials such as joint sealers should also be established. Some manufacturers offer free testing to verify compatibility of materials.

Substrate preparation requirements should be reviewed as early as possible for special concerns and for variances with standard practice. An example might be limitations on use of metal tools in cleaning masonry. Such tools can leave metallic residue which sometimes detrimentally affects the clear treatment. Surface contaminants of any kind

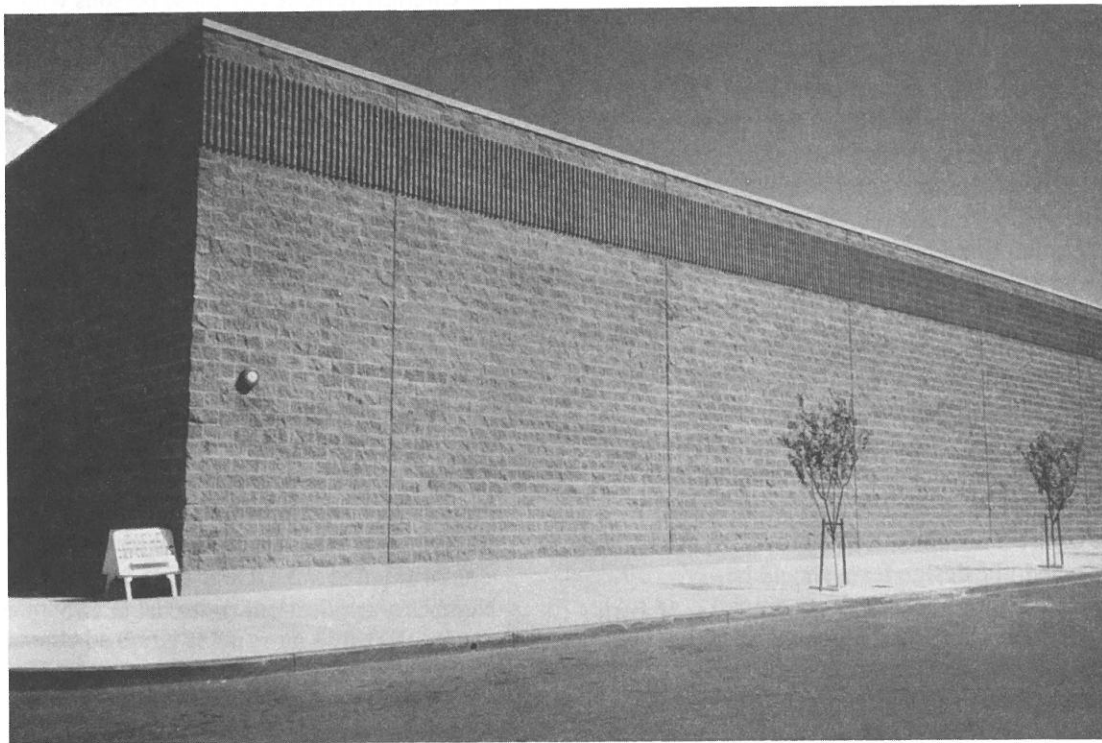
need to be removed, especially grease, asphalts, and oils which could prevent bonding or penetration of the joint sealer. Again, the manufacturer's recommendations should be compared with requirements in the contract documents and the differences must be resolved.

Manufacturer's application instructions need to be carefully reviewed by those persons who will be doing the work as well as those involved in supervision (including the general contractor, subcontractor supervisor, and any special third party inspectors). Copies of manufacturer's instructions should be kept in the field office along with any special notes made during mock-up preparation, and pre-installation meetings.

Proper application information might include:

- Protection necessary for adjacent surfaces (glass, landscaping, paints, prefinished materials).
- Preparation procedures for substrates to receive water repellent treatments.
- Number of applications (one coat or two coats).
- Minimum time span between coats.
- Maximum time span between coats (overnight, weekends, holidays).
- Climatic conditions for application (including methods to minimize or prevent wind blown materials).
- Tools for application.
- Timing of application based on other criteria (window installation, landscaping, painting of adjacent surfaces, joint sealers, etc.)
- Coverage rates and methods to verify.
- Application method (flood coat, fog spray, 6" to 10" run downs, wet-on-wet application, or keeping track of the number of gallons applied to a specific number of square feet of concrete masonry surface).

- Special application tips (distance of nozzle to surface, speed of swing across surface, variations in application based on temperature variations).
- Cleaning recommendations for removing water repellent treatments from other surfaces.



*Split face concrete masonry wall with four foot band of fluted units around top.  
Note: Control joints spaced approximately at a h/l of 1.*



## SECTION 6 TESTING

### 6.01 General.

Tests allow comparisons of products and systems. Several tests are available relating to clear water repellent treatments for concrete masonry. Some relate to individual components in masonry construction, such as ASTM C 140 *Methods for Sampling and Testing Concrete Masonry Units*. Others are intended to test completed masonry systems, such as ASTM E 514 *Test Method for Water Penetration and Leakage Through Masonry* and the Navy Hose Stream Test. Still others, like the RILEM Tube Test and the CTL Accelerated Field Test provide information on small segments of the construction.

ASTM E 514 has been the leading method for determining the rate of water penetration of concrete masonry systems. The test was developed for comparison of various masonry constructions in a laboratory environment. More recently a field adapted version has been used. Care should be taken, however, to consider the intent and application of both the laboratory and the field tests, as well as the uncontrolled variables.

One of the uncontrolled variables includes lack of direction for test area preconditioning, allowing a wall to be dry, fully saturated, or anywhere in between. A laboratory test sample is not subject to rain, high humidity, fog, dew, or other environmental conditions: field samples have to consider such variables. Another uncontrolled variable is based on the lack of a precisely defined water pressure and water quantity required for both the laboratory and field tests.

The importance of the concern for both the laboratory and field adapted tests based on ASTM E 514 is that they may not prove beneficial for comparison of masonry units. However, proper control of some of the anticipated variables can result in tests which can provide valid information regarding the capabilities of a concrete masonry system which includes a water repellent treatment. Care should be taken not to misinterpret the test results regarding the quality of the masonry unit or of the components separately.

The American Architectural Manufacturers Association (AAMA) Field Test Specification 501.2 field check have been used to test masonry construction for water leakage.

The Navy Hose Stream Test is similar to the AAMA 501.2 field test but uses a 5/8" hose and requires the water to be directed to where the stream is falling on the surface of the test panel simulating rain.

A field test has been developed by the International Union of Testing and Research Laboratories for Materials and Structures (RILEM), sometimes referred to as the tube test.

The Construction Technology Laboratories, Inc. (CTL) developed a test similar to the RILEM Tube Test. The CTL test, however, uses portable equipment to develop higher pressures than those used in the RILEM Test. The higher test pressures allow for an accelerated field test.

### 6.02 Laboratory Tests.

#### *ASTM C 140 - Methods for Sampling and Testing Concrete Masonry Units.*

ASTM C 140 provides methods for sampling and testing concrete masonry units for compressive strength, water absorption, weight, moisture content, and dimensions. Where ASTM C 90 provides specifications for various types, weights, and water absorption, ASTM C 140 provides tests to verify compliance.

Of special interest relating to performance of concrete masonry with clear water repellent treatments are the water absorption tests. Samples are immersed and weighed to determine wet, dry, and suspended immersed weights. A formula is then provided to determine the amount of absorption in pounds per cubic feet and in percent. The test was written to evaluate the concrete masonry, not treatments applied to concrete masonry.

However, the test can be used to determine the effectiveness of various types of clear water repellent treatments. Standard concrete masonry units can be tested to determine the absorption of the units. The same units can then be dried, coated with a clear water repellent treatment and retested. The percentage of change will indicate the improvement (lowered absorption rate) achieved by the application of the treatment. Remember, this test would only indicate the ability of the treatment related to a specific type of concrete masonry unit, not necessarily concrete masonry systems.

**ASTM E 96 - Test Methods for Water Vapor Transmission of Materials.**

ASTM E 96 provides methods to verify the ability of materials to permit water vapor transmission. One of the primary characteristics of a water repellent treatment is to prevent moisture from entering the system, but to still allow water vapor to escape.

Samples of nominal 1-1/4" (or less) thick sections of concrete masonry can be tested without a water repellent treatment to establish the basic water vapor permeability. Additional samples of equal thickness can then be tested with a clear water repellent treatment and the difference establishes the change in permeability caused by the application of the treatment. Remember, the intention of the treatment is to permit vapor transmission, so minimal change is desirable.

**ASTM D 1653 - Test Method For Water Vapor Permeability of Organic Coatings.**

ASTM D 1653 is a laboratory test which can be used to verify the permeability of film forming type water repellent treatments. Applicability of this test to a specific water repellent treatment material should be determined by the manufacturer.

**ASTM E 514 - Test Method for Water Penetration and Leakage Through Masonry.**

ASTM E 514 is a laboratory test intended to determine the resistance to water penetration and leakage through masonry wall panels subjected to wind-driven rain. The standard test includes a 36" wide by 48" high section of exposed masonry construction with a minimum of 8" overlap on all sides of the test area (a minimum 54" wide by 64" high section of wall would be used, but the typical specimen as shown in Figure 6.1, is 56" wide by 72" high).

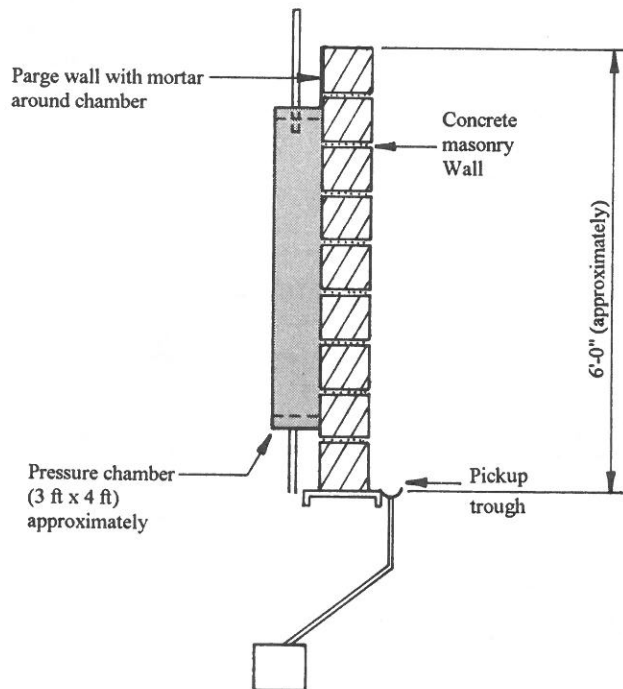
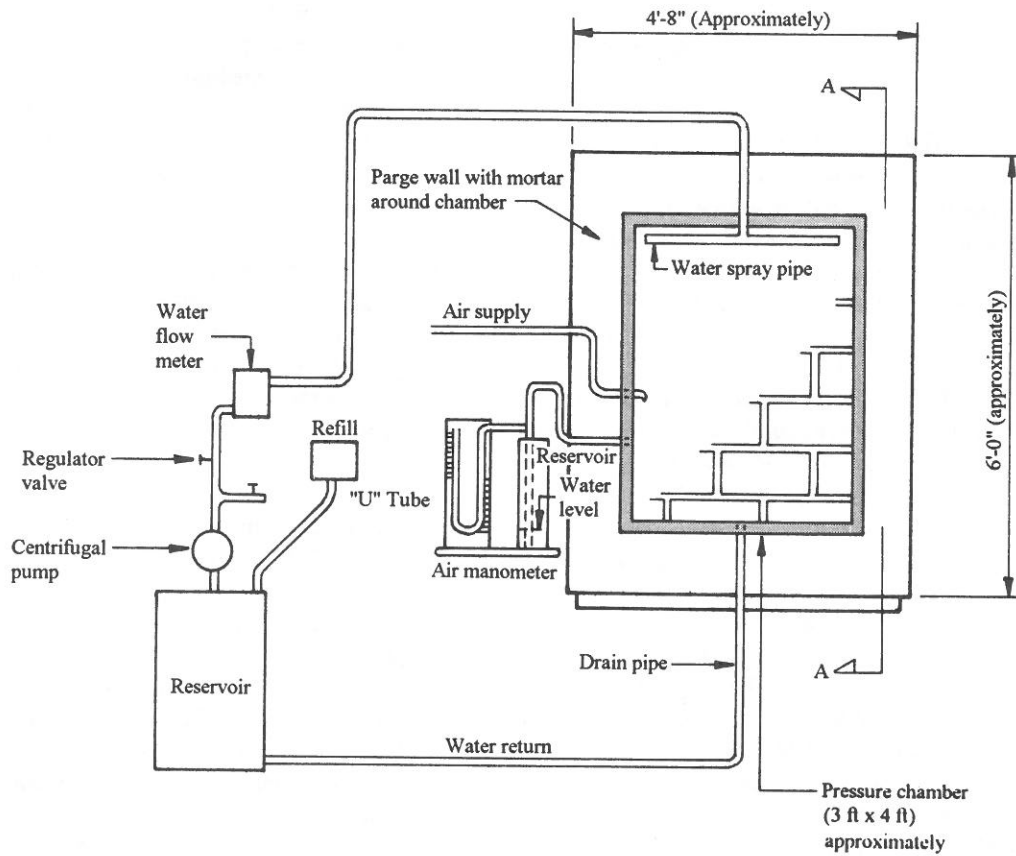
Three specimens are required for the test. The test determines the time of appearance of dampness on the back of the specimen; the time of appearance of the first visible water on the back of the specimen; the area of dampness on the back of the wall at the end of a four hour test period; and the total water collected from a trough on the back side of the wall.

This test can be used in three different ways. The first two are laboratory tests, the third is a field test version discussed in Section 6.03 - Field Testing on page 38.

ASTM E 514 can be used to test the ability of a specific clear water repellent treatment on a specific concrete masonry system. It can also be used by manufacturers of clear water repellent treatments to provide a comparison of the ability of the treatment to prevent water penetration and leakage through masonry construction in general. The *Clear Water Repellent Handbook* by the Sealant, Waterproofing & Restoration Institute (SWRI) provides guidelines for such comparative testing.

It is important to note that ASTM E 514 is designed to evaluate three principle variables: properties of materials including coatings; construction details of the wall; and the quality of workmanship. Because of this, it may be difficult to correlate the results of the testing with the performance of the water repellent treatment.

FIGURE 6.1: ASTM E 514 Wall Test Specimens



SECTION A-A

**ASTM D 4587 - Standard Practice for Conducting Tests on Paint and Related Coatings Using a Fluorescent UV - Condensation Light - and Water- Exposure Apparatus.**

Both ASTM D 4587 and ASTM G 53 involve the use of artificial weathering equipment. ASTM D 4587 uses the principles and operating procedures described in ASTM G 53 for exposure testing of paint and related coatings and materials.

**ASTM G 53 - Standard Practice for Operating Light- and Water-Exposure Apparatus (Fluorescent UV-Condensation Type) for Exposure of Nonmetallic Materials.**

ASTM G 53 describes a test apparatus for determining weathering and ultra-violet stability of materials such as clear water repellent treatments. The SWRI *Clear Water Repellent Handbook* recommends treated and untreated control samples be required to document gloss and color deviations based on exposure in the apparatus for 500 and 1000 hours. SWRI recommends reports be documented with color photographs.

Determining weathering with ASTM G 53 requires comparing tests on exposed treated and exposed untreated specimens from ASTM G 53 with the absorption tests described as part of ASTM C 140.

### 6.03 Field Tests.

**Modified ASTM E 514 - Test Method for Water Penetration and Leakage Through Masonry, Unofficial Field Test Modification of Standard Lab Test.**

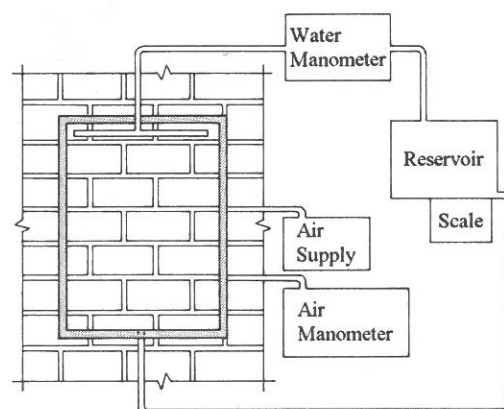
Although ASTM E 514 is a laboratory test there is a variation which can be used as a modified field test. This field test version is for use on a section of an actual concrete masonry wall and it can be applied in the field on a mock-up. Although expensive, this test can provide information regarding new treatment materials and combinations of

materials not previously tested.

The modified ASTM E 514 test anchors a test chamber to a section of wall approximately three feet by 4 feet (see Figure 6.2). Water is pumped from a calibrated tank into the test chamber and sprayed on the wall simulating 5.5 inches of rain per hour accompanied by 62.5 mile per hour winds.

After initial saturation of 1/2 hour of spraying, the water level in the tank is recorded. During the next four to eight hours of spraying the tank water level is recorded every 1/2 hour. The testing is stopped before eight hours if two consecutive recorded levels are the same.

An important cautionary note. The field variation of ASTM E 514 is also being used to attempt to provide qualitative analysis of the quality of in- place masonry construction. The experience of the concrete masonry industry is that such testing includes too many uncontrolled variables. Use of this test to determine quality of workmanship and materials based solely on the amount of water lost from a storage tank is at best questionable. At worst it can cause owners to require repairs to walls which otherwise perform adequately or assume such repairs will stop leaks which are caused by other problems.



**FIGURE 6.2: Modified ASTM E 514 Test Method.**

### American Architectural Manufacturers Association (AAMA) - Field Test Specification 501.2 for Water Leakage.

Variations of the American Architectural Manufacturers Association (AAMA) Field Test Specification 501.2 field check have been used to test masonry construction for water leakage. AAMA 501.2, intended for testing joints in metal curtain wall construction, provides a simple test using a 3/4" garden hose with a special nozzle with a control valve and pressure gage between the valve and the nozzle. The test requires access to the back side of the masonry system to check for water leaks.

### Navy Hose Stream Test.

The Navy has developed a hose stream field test for testing concrete masonry walls resistance to water penetration. Similar to the AAMA 501.2 test, the Navy test uses a 5/8" hose with a spray nozzle. The nozzle is located ten feet from the wall and aimed upward so the water strikes the wall at a 45 degree downward angle (see Figure 6.3).

This test is performed on an actual section of the building, approximately twenty days after the application of the water repellent treatment. The water is allowed to run continuously for three hours.

If the inside face of the masonry wall shows traces of moisture, additional coats of the water repellent treatment are required and the test must be repeated.

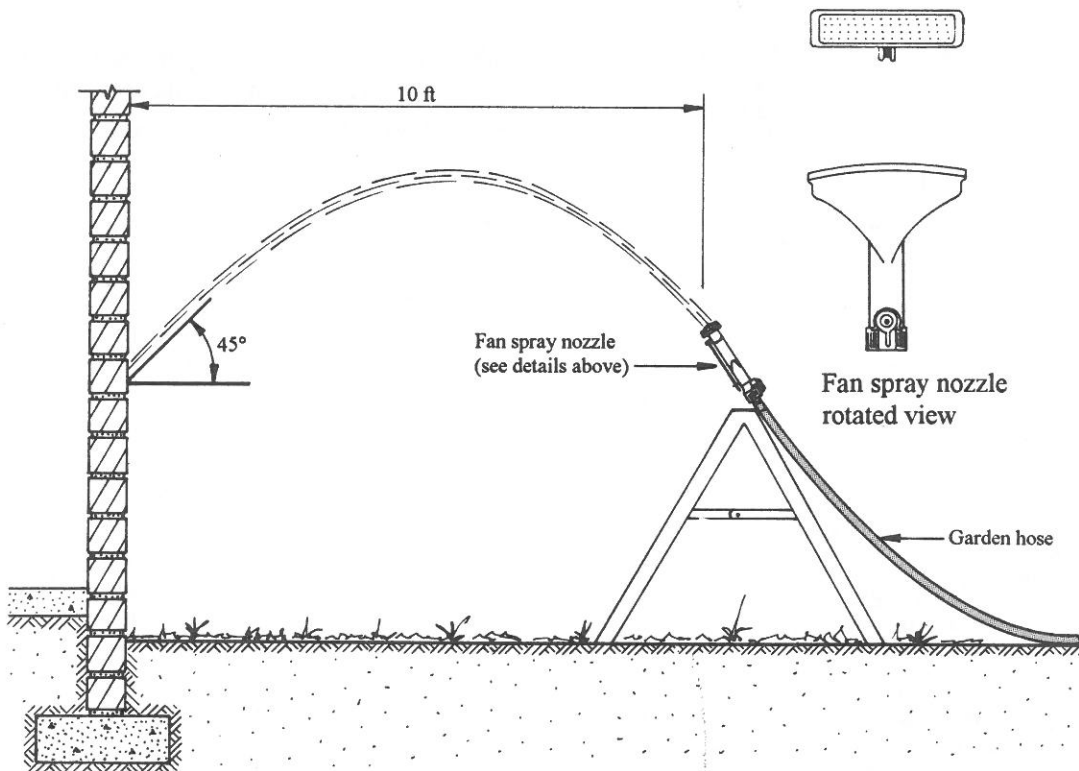


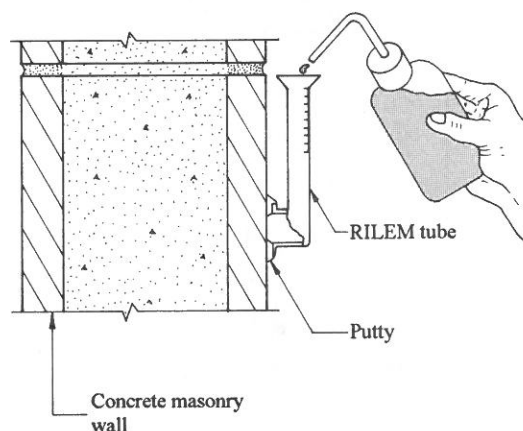
FIGURE 6.3: Navy Hose Stream Test.



### RILEM Test Method No. 11.4, RILEM Tube Test.

Another field test being used was developed by the International Union of Testing and Research Laboratories for Materials and Structures (RILEM), sometimes referred to as the tube test. A vertical plastic or glass tube with graduated markings is adhered to a masonry system with putty (see Figure 6.4). Permeability is measured based on the change of water level in the tube caused by the absorption of the water into the masonry system.

Although the RILEM test provides an inexpensive method for determining water penetration into the concrete masonry system, the results must be used with caution. The test is based on a measurement from only a small area and can be easily biased depending on where the tube is located.



#### Procedure:

1. Adhere RILEM tube to wall surface with putty. Press firmly to ensure full adhesion.
2. Fill the tube with water to zero (0) graduation mark at the top of the tube. Note: It has been estimated that when filled to this level, the water pressure on the wall is 0.14 psi which translates into a dynamic wind speed of 88.5 mph.
3. At predetermined time intervals such as 1, 2, 5 and 10 minutes measure the depth the water level has dropped.

### Construction Technology Laboratories, Inc. (CTL) - Accelerated Field Test Method for Water Penetration of Masonry.

According to literature from CTL, "The CTL accelerated field test of masonry water penetration employs the same basic principle as the RILEM Tube except the CTL test operates at higher pressures than the gravity pressures used in the RILEM Tube method. The CTL method also utilizes a constant pressure for the duration of each test. This higher sustained test pressure accelerates each test to less than three minutes. The graduated cylinder on the apparatus allows accurate measurement of the penetrating water."

A manually-pumped pressure tank allows pressures ranging from 5 to 15 psi and the testing device is portable, allowing tests at various locations by a single operator. The CTL literature notes that the method tests an area of approximately six square inches which allows isolation of a head joint, a bed joint segment, or a junction of joints. Two small holes are drilled in the mortar joints to secure the test apparatus on the wall, otherwise, the test is non-destructive.

FIGURE 6.4: RILEM Test.

## 7.01 Warranties.

Legal issues such as warranties should be carefully considered with legal counsel. Common misunderstandings of the purpose and application of warranties does, however, warrant discussion.

To many people the term "warranty" relates to a manufacturer's written product warranty. Buyers often assume that the warranty is intended to provide some kind of protection or at least fiscal assurance that the product is what the manufacturer claims. For instance if you buy a car with a warranty, you assume the dealer will repair that car if something doesn't work.

So, doesn't a manufacturer's warranty for a clear water repellent treatment provide the same kind of protection? If the treatment doesn't work the way the manufacturer said it would, shouldn't the manufacturer repair it? That depends upon what is stated in the manufacturer's warranty.

Misunderstandings related to warranties make it difficult for a person not trained in commercial law to tell when a warranty actually provides a special service to the buyer or when it is just another sales gimmick. The protection most of the public assumes to be coming from a warranty is actually included in what's called the "Uniform Commercial Code (UCC)." Basically, the UCC states that, unless otherwise agreed by the parties involved, the buyer has the right to expect the product to perform as implied or as expressed by the manufacturer.

Commonly found in manufacturer's standard warranties, however, is a statement (which must be capitalized or similarly set out) which notes that the warranty as written (by the manufacturer's lawyers) is in lieu of any implied or expressed warranties, including warranties of merchantability or fitness. This statement meets with a requirement in the UCC that allows a buyer to agree to use protection other than that given by the UCC. It is comparable to buying a car "as is."

Careful review of manufacturers' warranties, even from some of the best manufacturers, suggests their warranties are actually limiting their own responsibilities rather than protecting the buyer (the building owner in the case of construction).

Where manufacturers' standard warranties are being considered, it would be prudent to have legal counsel involved. Any conditions regarding exceptions, coverage, and responsibilities (of the contractor, supplier, installer, subcontractor, and manufacturer) should be clearly outlined. Any statement which is not clearly interpretable should be cause for not signing without prior legal representation.

The best solution is for everyone involved to be especially cautious when involved with warranties. Like any legal document, warranties should be reviewed by knowledgeable legal representatives. Where representation is not available, owners may be better off relying on the Uniform Commercial Code for protection rather than accepting manufacturers' standard warranties. Refer to Appendix A - Warranties.

## 7.02 Potential Problems.

Some of the construction industry's problems might be solved by recognizing potential problems early and avoiding them whenever possible.

**Architectural Features.** Features such as reveals, recesses, sills, and offsets can provide problems for water tight concrete masonry construction. Care must be taken to properly design areas where water is given more direct access into the masonry system, and into the building.

**Cracks and Voids.** All cementitious products shrink as they hydrate and crack once the low tensile capacity of the product is exceeded. In masonry construction, the most common form of hairline cracking (less than 0.02" wide) is in the mortar joints.

## SECTION 7 COMMON CONSIDERATIONS

More extensive cracking can be caused by unanticipated settling of the building, expansion and contraction of the roof, wall, and floor systems, and earthquake loads. Beeholes can also occur. Proper design of masonry systems, including appropriate placement of control and expansion joints can help minimize such problems. When noted, corrective action can be taken to repair cracks and beeholes. Where the cracks are static they may be repaired by repointing or patching.

Dynamic cracks, however, should be opened and properly sealed with an elastomeric joint sealer. Again, such repair work should take place prior to application of the clear water repellent treatment where possible. To determine if a crack is static or dynamic, place and monitor a small patch of plaster over the crack.

Most clear water repellent treatments are not intended to seal cracks and voids in masonry. Their chemical composition is intended to reduce capillary action. Therefore, voids and open cracks (wider than 0.02") require special attention such as proper pointing or filling with a joint sealer.

**Vertical Surfaces.** Parapet and fire walls are unique in that they are subject to water penetration from both sides. Differential temperatures can cause parapet torqueing (bending from the sun on one side only) creating cracks which further increase the possibility of water intrusion. Tooling of mortar joints on backs of parapets is important.

Due to these and other concerns, it is often appropriate to provide a true waterproofing material on the back (the unexposed face) of the parapet rather than a water repellent treatment.

**Multi-Level Parapet Walls.** Intersections of horizontal top surfaces of lower walls with the vertical extension of a taller parapet wall creates another potential leak location. Subject to cracking, such joints might best be treated as a control joint which allows movement.

**Horizontal Surfaces.** Treatment of

horizontal surfaces such as copings and sills requires special attention. Concrete masonry copings and sills are not recommended, even with clear water repellent treatments since the units are permeable and most water repellent treatments are not intended for horizontal applications.

Application of mortar over horizontal surfaces (mortar caps and mortar copings) is also not recommended since the mortar is permeable. Extending roofing over a coping is seldom effective since roofers tend to hold their materials back from the edge to prevent staining on exposed wall surfaces. This leaves horizontal masonry surfaces exposed to weather and causes the roofing membrane to fishmouth at the edges due to normal thermal expansion and contraction.

Sheet metal caps are the preferred method for treating copings and horizontal surfaces. The skirt of the metal cap must be long enough to extend at least two to four inches below the top of the masonry construction. A minimum four inch extension is recommended where heavily textured masonry units such as split face, scored and fluted units are used. Refer to Section 2.04 - Design page No. 9, related to copings, parapets, and tops of walls.

Remember that the extension of the metal flashing should be measured from the top of the masonry unit, not necessarily the top of the wall. Wood nailers on top of the masonry will typically add at least 1-1/2" to the required length of the metal flashing skirt.

Rakes, projections, and recesses which involve flat and even sloped concrete masonry surfaces should also be avoided. Where the design requires a sloped masonry surface, use of elastomeric coatings or other appropriate materials is recommended. Consult with waterproofing manufacturers for appropriate materials.

**Mortar Joints.** Concave or "V" mortar joints should be used for all exposed concrete masonry surfaces. These joints eliminate horizontal surfaces for standing water. Proper tooling of these joints also densifies the mortar and increases the adhesion between the mortar and the masonry units.

Tooling of mortar joints in scored and fluted concrete masonry is difficult because of the recesses in the units. Where joints are not adequate due to improper tooling, extensive bee-holes, and obvious voids, they should be repaired prior to the application of the clear water repellent treatment.

**Control Joints.** General guidelines on locating control joints are addressed in Section 2.04 on page 11.

Heavily reinforced concrete masonry in seismic zones typically require fewer control joints. But, standard rules of geometry should not be ignored. Control joints may be required where interior masonry walls intersect exterior walls. Large openings in concrete masonry systems and major changes in wall height also typically require control joints.

**Penetrations.** Scuppers, plumbing, and electrical conduits which penetrate masonry walls should be properly flashed and sealed with appropriate joint sealers. Joint sealers must be compatible with the clear water repellent treatments or surfaces should be masked to prevent problems such as sealant bond failure, loss of elasticity and adhesion, and discoloration of the sealant, the treatment, or both.

**Dissimilar Materials.** Connections between dissimilar materials, especially materials which have different thermal expansion and contraction coefficients, also need to be treated as dynamic joints. Metal and wood windows and doors are prime examples.

Junctures between concrete masonry and other cementitious products such as concrete and stucco should also be considered dynamic. Again, proper design requires flashing at heads and sills of windows and doors coupled with appropriate joint sealers designed to allow anticipated movement.

### 7.03 Issues Regarding Water Repellents

The following questions should be considered regarding water repellents.

1. What are manufacturer's recommended applications?
2. Is the product intended to be a surface film or penetrating sealer?
3. How many coats are recommended?
4. Can the treatment be reapplied?
5. Can the treatment be coated?
6. What are the effects of weather during and immediately after application?
7. Are there any potentially adverse effects such as chemical reactions with adjacent materials?
8. Are there any special limitations on application?
9. Are there any known local limitations on use?
10. What are the long term expectations?

See pages 20 and 21 for a discussion on each of these issues.

## SECTION 8 CONCLUSIONS

### 8.01 Getting Results.

Water leakage continues to be an area of concern and potential liability for the design team, construction team, and owners. Owners have to live with the leaks until they are repaired. The construction and design teams must spend time determining the cause and finding the solution to the leaks.

Accordingly exterior walls deserve special time and attention during design and construction. Design professionals must stay aware of the changes going on in the clear water repellent treatment industry and do their best to recognize when products have been changed. When new products and new versions of older products are being considered, the design professional needs to study the manufacturer literature and find buildings which have been treated with the proposed products. The designer should try to visit those projects and talk to the owners, design professionals, and construction personnel involved with the project.

The design professional should also take special care in the design and detailing of the project, in the proper material selection, and in the proper specification of the desired system. Manufacturers and local suppliers are generally ready and willing to provide technical assistance. Associations such as the Concrete Masonry Association of California and Nevada (CMACN) and the Masonry Institute of America (MIA) produce brochures and books which can assist the designer.

Proper materials selection should be based on experience and research. Experience helps clarify the questions which need to be answered, but, what is best for one project may or may not be best for the next. Avoid hasty conclusions based on partial information. And, finally, prepare specifications which clarify what is intended and what is important.

Details must clearly indicate the sizes and configurations of each building component and should show how materials are to be connected. Likewise, the specifications must give sufficient information regarding the

materials, intended performance, and any special requirements such as mock-ups, tests, pre-installation meetings, and warranties. Giving the bidders enough information to put a fair price on a project is one key to success.

The construction team must be aware of the contract document requirements and must ask questions if things are not clear. This requires an in-depth review prior to beginning the concrete masonry construction. Special requirements and areas worthy of extra consideration should be noted. Early review allows for timely solutions.

Manufacturers must provide complete, accurate product information preferably with photographs and samples. Manufacturers must also help train the design industry in the proper selection of, and applications for, their materials. Literature must clearly identify where materials should and should not be used. Where special conditions are typical, such as sloped surfaces at recess and penetrations, manufacturers' literature should help guide the design team to appropriate materials to treat these special conditions. Manufacturers' literature should also clearly indicate what special services are available such as technical assistance in the form of local or regional representatives and telephone numbers for technical assistance (preferably 800 numbers).

Finally, manufacturers must provide guidance and training for the construction industry. Applicators must be trained and where possible given a written approval or certification of training for specific materials. Installation instructions should be clearly written and recommendations should include specific information regarding when the recommendation is optional and when it relates to a special condition.

Working together the design, construction, and manufacturing industries can provide watertight concrete masonry construction.



### A.01 Reference List.

Much of the information used to prepare this document was collected by the Concrete Masonry Association of California and Nevada (CMACN) and the Masonry Institute of America (MIA) from architects, contractors, concrete masonry manufacturers, water repellent treatment manufacturers, and trade associations including, the National Concrete Masonry Association (NCMA) and the Sealant, Waterproofing & Restoration Institute (SWRI).

1. *Clear Water Repellent Handbook*, Sealant Waterproofing & Restoration Institute (SWRI), Kansas City, MO, 1990.
2. *1991 Masonry Codes and Specifications, with 1992 Supplements*, edited by Amrhein, J. E., and Samblanet, P. J, Masonry Institute of America, Los Angeles, CA., 1992.
3. *Reinforced Concrete Masonry Construction Inspector's Handbook*, Amrhein, J. E., and Merrigan, M. W, Masonry Institute of America, Los Angeles, CA., in cooperation with the International Conference of Building Officials, 1987.
4. *Reinforced Masonry Engineering Handbook, 5th Edition*, Amrhein, J. E. Masonry Institute of America, Los Angeles, CA., 1992
5. *Waterproofing Concrete Masonry*, Concrete Masonry Association of California and Nevada (CMACN), 1986.
6. "Measurement of Water Absorption", Gale, F., *APT Bulletin*, The Association for Preservation Technology International, Vol. XXI, Numbers 3/4, 1989, pp. 8, 9.
7. "Water Repellents for Concrete Masonry Walls", *NCMA-TEK 10B*, National Concrete Masonry Association, 1992.
8. "Permeable Results", Brown, M., *The Construction Specifier*, Construction Specifications Institute, Alexandria, VA, Vol. 45, No. 7, July 1992, pp. 87-90.
9. "Water Penetration Tests of Masonry Walls", *Masonry Information* IS219.03M, Portland Cement Association.
10. "Choosing a Water Repellent", Suprenant, B. A., *The Magazine of Masonry Construction*, Vol. 3, No. 4, April, 1990, pp. 5, 6 and 11.
11. "Architectural Sheet Metal Manual", 4th Ed., Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), Chantilly, VA., 1987
12. "TEK Note 3, Table 1" National Concrete Masonry Association, (NCMA), Herndon, VA., 1972
13. ASTM Standard Specifications C90; C140; D1653; D4587; E96; E514; G53, American Society of Testing and Material, Philadelphia, PA.

## APPENDIX A REFERENCES

## APPENDIX B WARRANTIES

### B.01 Warranty Forms.

Warranties are a form of legal contract and should be prepared with the advice and assistance of legal counsel. And, as with any legal document, care should be taken that it is fair to all parties involved. The following can help outline the basic types of warranties, what to watch for, what might be included, and what they can or should cover.

#### Project Guarantee: Between Owner and General Contractor.

The project guarantee is often the subject of confusion. Is a guarantee an agreement between two parties, such as the owner and contractor, and is a warranty a multi-party document, with the manufacturer, supplier, and installer being potentially involved? Even lawyers seem to argue regarding the differences.

The American Institute of Architects (AIA) Document A201-1987, *General Conditions of the Contract for Construction* only uses the term "guarantee" in the "Index" and there it states "See Warranty and Warranties." The wording used in the AIA A201-1987 can provide some guidance regarding proper language, considering it was written with the assistance of lawyers and is intended to be fair to both parties (owner and general contractor).

#### "3.5 WARRANTY

3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless otherwise required or permitted by the Contract Documents, that the Work will be free from defects not inherent in the quality required or permitted, and that the Work will conform with the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly

approved and authorized, may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, modifications not executed by the Contractor, improper or insufficient maintenance, improper operation, abnormal wear and tear under normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment."

Those familiar with contracts will remember that somewhere in the general conditions should be a time period related to the contractor's responsibility for correction of work, commonly considered the guarantee. Actually, AIA A201 Article 12 - Uncovering and Correction of Work, provides the requirement, but again does not use the term guarantee or warranty.

"12.2.2 If, within one year after the date of Substantial Completion of the Work or designated portion thereof, or after the date for commencement of warranties established under Subparagraph 9.9.1, or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition...."

#### Special Project Warranties: Defined in Contract Documents.

Project specifications often provide special requirements for extended warranties or guarantees.

Typically found under Part 1 of a section, these special project warranties may extend the responsibilities of the construction team, clarify special concerns for performance or durability, and extend the time frame of the warranty coverage.

Extension of responsibilities could include requirements for repairs to adjacent materials caused by a failure of the specified system. For example, leaks in exterior walls can cause both hidden and obvious damage, such as damage to interior partitions, floor finishes, and ceilings.

Concerns regarding performance and durability might include changes in appearance due to ultra-violet degradation, yellowing, or change in gloss. Other concerns include damage to adjacent materials including joint sealers, window finishes, and glass.

Extension warranty length of time provides the greatest amount of confusion and should be reviewed with special care. Manufacturer warranties often imply longer time periods are available. The standard one year correction of work period given in the AIA A201 Document might seem inadequate for some materials. Typically most contractors and installers involved with waterproofing and water repellent treatments should not be concerned with extending the period to five years, allowing for yearly weather cycles. Failures due to materials or workmanship usually become evident in the first two years.

A requirement for extended responsibility to five years might be asking a great deal from the contractor and installer, as well as the design professional. Keep in mind that five and ten year material warranties offered by manufacturers are not the same as extended special project warranties. The manufacturer is usually only offering money back or replacement material during that time extension if certain conditions in the extended warranty have been met. Manufacturer warranties do not typically cover the cost of labor or even the cost of actually determining how to correct the failure.

Is it fair to ask the contractor and installer to come back to a project nine years after completion because a leak has developed? And does the design professional want to tie themselves to the project for that extended time period? After the first few years it will be difficult to establish whether problems are due to the quality of materials, installation, lack of proper maintenance, building movements, or other causes beyond the control of those involved with construction.

#### **Manufacturer Warranties: Documents written by manufacturers.**

A manufacturer's warranty may protect the manufacturer rather than the purchaser of the product. Most states adhere to the *Uniform Commercial Code* (check in Louisiana) that requires products to be suitable for the purpose for which they are sold. The UCC does allow, though, that parties involved can make their own agreement, such as the "Sold As Is" concept in used cars.

Manufacturers' standard warranties usually include a statement in bold type which notes that the warranty is written in lieu of any implied or expressed warranties, including warranties of merchantability or fitness. This statement complies with the UCC requirement that the buyer and seller have made a special agreement, something other than the UCC. By signing such a document, the buyer may lose the right to assume the product will do anything other than what is said in the warranty, the warranty written by the seller and the seller's lawyers.

Manufacturers' warranties, even from the best manufacturers, typically limit their own responsibilities, even where they do provide specific protection to the building owner. Read the warranty carefully, look for conditions regarding exceptions, coverage, and manufacturer responsibilities. Don't sign anything unless it is fully understood.

Where the manufacturer's warranty precludes specific responsibilities, especially special warranties required in the contract documents, the contractor and subcontractor may be faced with absorbing the difference.

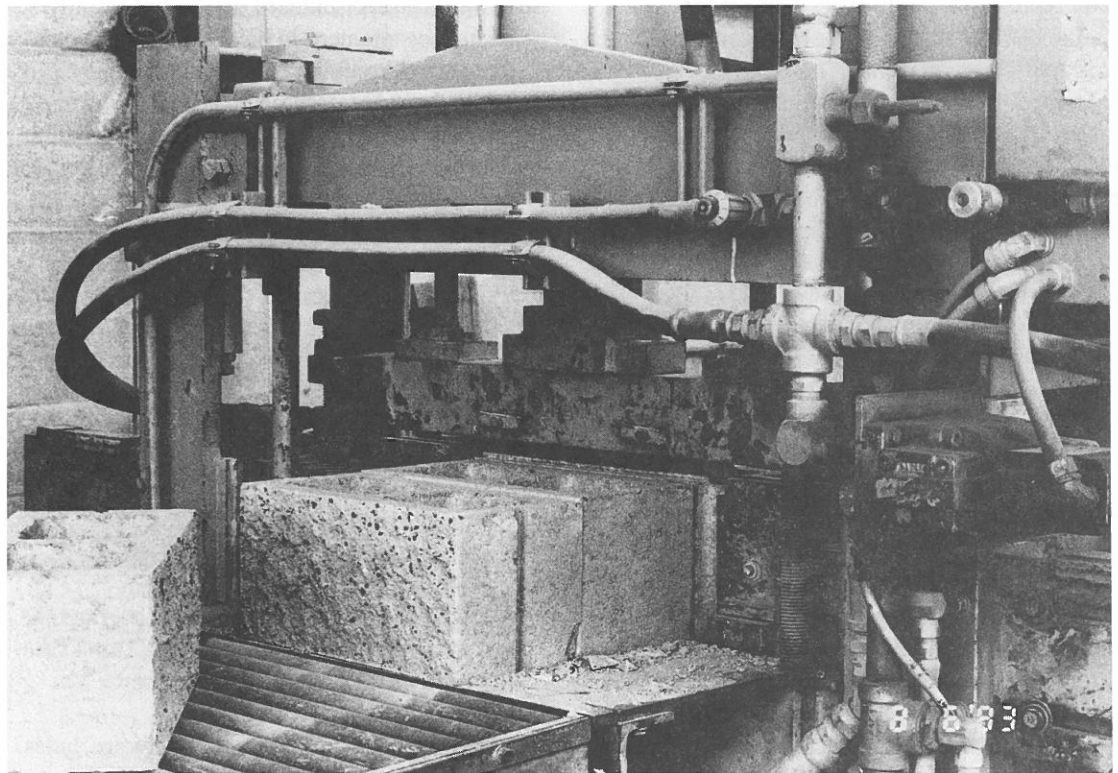
An example of a product warranty provided by a reputable clear water repellent treatment manufacturer stated,

"...warrants that (their product) is of excellent quality and has been manufactured and formulated to exacting standards. If the material is found defective, (the manufacturer) will, at its option, replace the defective material or refund the purchase price, provided the buyer has examined the material upon receipt and promptly notifies (the manufacturer) before the materials have been applied. By using this product, purchaser agrees that no other remedy including, but not limited to, incidental or consequential damages, shall be available to the purchaser."

The same form states,

"THERE ARE NO OTHER WARRANTIES, EITHER EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE THAT EXTEND BEYOND THAT DESCRIBED HEREIN. THIS WARRANTY MAY NOT BE MODIFIED OR EXTENDED BY REPRESENTATIVES OF (the manufacturer), ITS SALES AGENTS, OR DISTRIBUTORS."

Again, warranties are a form of legal contract and should be considered with the advice and assistance of legal counsel.



*Block splitter for making split face concrete masonry units.*



## C.01 Inspections.

Inspections are valuable in the success of a project. Whether by the design professional, contractor superintendent, subcontractor foreman, or by a special inspector hired by the owner, inspections allow for early detection of potential problems and improve communication.

Someone representing the design professional should inspect the project on a periodic basis to verify general conformance with the contract documents. They should verify that approved samples match the materials being used in mock-ups, that concerns are addressed in pre-installation meetings, and that construction meets the intent of the contract documents.

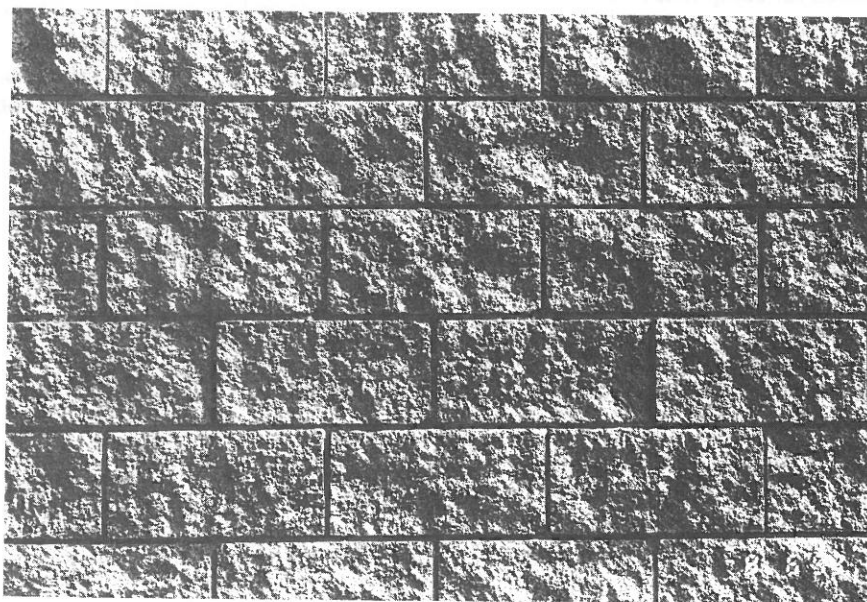
Construction superintendents need to make sure proper materials are delivered to the job site and are handled and stored in accordance with manufacturer recommendations. They must maintain communication between the design team and the installation team and make sure concerns and questions on both sides are addressed. They should also take time to observe the final installation as much as possible during the early phases, comparing what they see with the contract documents and the manufacturer's installation instructions.

The subcontractor's field supervisor or project foreman needs to provide the necessary consistency on the project. They need to be involved with the mock-up and initial construction, and need to keep the actual installers informed of any special requirements which might be beyond normal practice. The installation methods of each new installer should be observed to maintain consistency throughout the project and added instruction given when needed.

The special inspector typically observes and reports. They are not expected to provide on-site guidance. Their observations are recorded and given to the owner and others as directed by the owner. When a variation from the contract documents is considered critical, special reports must be made immediately, in person or by telephone, followed shortly by a written report.

The extent of items to be checked may vary regarding who is doing the inspection, the design professional, superintendent, foreman, or special inspector. Pages 50 and 51 highlight some elements which might be worth including on inspection check lists. Page 52 shows a sample water repellent manufacturer's inspection check list.

## APPENDIX C INSPECTION



*Split face concrete block wall.*



### **C.02 Site Inspection Check List Items.**

1. Contract Documents are available on site.
2. Approved samples, product data, and shop drawings are available on site.
3. Manufacturer recommendations and installation instructions are available on site.
4. The mock-up has been completed and approved.
5. Testing of the mock-up has been completed and approved.
6. The pre-installation meeting has been held and a list of attendees has been made, minutes recorded and distributed.
7. Materials have been delivered and verified in compliance with the contract documents and approved samples.
8. Materials have been stored in accordance with the contract documents and the manufacturer recommendations.
9. Weather conditions at the time of construction are within the requirements of the contract documents and the manufacturer recommendations.
10. The manufacturer's representative has made periodic field visits where required by the contract documents or where required by the manufacturer for a special warranty.
11. Concrete masonry installation has been spot checked for compliance with specified tolerances and the contract documents..
12. Reinforcing and grout have been inspected for compliance with the contract documents and approved shop drawings.
13. Mortar joints have been tooled in accordance with the contract documents and the approved mock-up.
14. Surfaces have been properly prepared for the clear water repellent treatment application in accordance with the contract documents and the manufacturer's instructions.
15. Adjacent materials and surfaces have been protected in accordance with the contract documents and the various manufacturer recommendations.
16. Clear water repellent treatment application is in accordance with the contract documents and the manufacturer's recommendations and installation instructions.
17. Special treatments of copings, backs of parapets, penetrations, control and expansion joints, horizontal masonry, and discontinuities have been completed in accordance with contract documents.
18. Finished construction matches approved samples and the mock-up.
19. Field tests have been successfully completed.
20. Substantial Completion has been recorded, with appropriate material and finish data information, warranties, and Project Record Documents completed and delivered to the Owner.
21. Required corrections noted during Substantial Completion review have been made and approved.
22. Final cleaning has been done.
23. Final inspection has been done.
24. Final Completion has been approved.

### C.03 Manufacturer's Warranty Checklist.

Where a special manufacturer's extended warranty is provided, additional special inspection may be required, usually by the clear water repellent treatment manufacturer's representative. Typically a field inspection report form will be filled out by the manufacturer's representative covering items such as the following.

1. Project:
2. Address:
3. Architect:
4. Architect's Address:
5. General Contractor:
6. GC's Address:
7. Water Repellent Treatment Applicator:
8. Applicator's Address:
9. Building Material:  
Note: Be specific: smooth block, split face block, slump block, etc.
10. Mortar Joints:
11. Bee Holes and Voids (Condition and Number):  
Note: Check for soundness, no voids or bee holes.
12. Mortar Joint Shrinkage Cracks (Location and Number):  
Note: Check for excessive mortar shrinkage cracks.
13. Efflorescence Deposits (Cleaning Required?):  
Note: Efflorescence indicates water problems. Identify problem areas and establish responsibility for correcting them prior to application of water repellent treatment.
14. Adequate Drainage Installations:
  - a. Gutters installed above walls that need them?:
  - b. Downspouts installed?:
  - c. Flashing and Scuppers Installed?:
  - d. Scuppers of Adequate Length?:
 Note: Adequate drainage installations must be provided so wall surfaces are not exposed to heavy running water.
15. Drainage Installation Adequately Sealed?:
16. Parapet Wall (Backside) Sealed?:
  - a. Material:
17. Protection for all Horizontal Surfaces such as Stem Walls, Parapets, Sills, Ledges, etc.?:
  - a. Materials:
18. Joint Sealers Installed?:
  - a. At Windows?:
  - b. At Doors?:
19. Dissimilar Material Joints Sealed?:
20. Expansion and Control Joints Sealed?:
21. Structural Cracking (Type and Location):  
Note: Repair prior to application of water repellent treatment.
22. Building Dry, Clean, and Ready for Sealing?:
23. Proper Grading of Landscape Away from Building Walls?:
24. Water Repellent Treatment Product Used:
25. Approximate Square Feet of Surface Treated:
26. Approximate Quantity of Materials Used:
27. Explanatory Comments.
28. Date:
29. Inspected By:
30. Company:

COMPANY  
FIELD INSPECTION REPORT (SAMPLE)

Project: \_\_\_\_\_

Address: \_\_\_\_\_

Architect: \_\_\_\_\_

Address: \_\_\_\_\_

General Contractor: \_\_\_\_\_

Address: \_\_\_\_\_

Water Repellent Applicator: \_\_\_\_\_

Address: \_\_\_\_\_

**Items to be checked prior to application:**

- |  |  |
|--|--|
| <p>1. Concrete Block Type:<br/>Standard ____ Split Face ____<br/>Fluted ____ Scored ____</p> <p>2. Mortar Joint Type<br/>Tooled ____ Raked ____<br/>Struck ____ Other ____</p> <p>3. Bee holes &amp; Voids (Number, Size and Location) _____</p> <p>4. Shrinkage cracks (Number, Width and Location) _____</p> <p>5. Efflorescence Deposit: Yes ____ No ____<br/>Cleaning Required: Yes ____ No ____</p> <p>6. Flashing &amp; Scuppers Installed: Yes ____ No ____<br/>Caulked: Yes ____ No ____</p> <p>7. Downspouts Installed: Yes ____ No ____</p> <p>8. Parapet Wall (Backside) Sealed:<br/>Tar ____ Roofpaper ____ Other ____</p> | <p>9. Type of Wall &amp; Parapet Caps:<br/>Metal ____ Elastomeric ____ Other ____</p> <p>10. Caulking Installed:<br/>Windows: Yes ____ No ____<br/>Doors: Yes ____ No ____</p> <p>11. Dissimilar Material Joints Caulked:<br/>Yes ____ No ____</p> <p>12. Control Joints Caulked: Yes ____ No ____</p> <p>13. Structural Cracking (Type Size &amp; Location) _____</p> <p>14. Building Dry, Clean &amp; Ready for Sealing:<br/>Yes ____ No ____</p> <p>15. Water Repellent Product(s) to Be Used:<br/>_____</p> <p>16. Approximate Sq. Ft. of Surface to Be Sealed: _____</p> <p>17. Approximate Quantity of Materials to Be Used: _____</p> |
|--|--|

*Any necessary explanatory comments on the above items should be made and attached to this form.*

**NOTE:** This inspection report is prepared to reference the general conditions of the surface(s) to be treated prior to application.

Date: \_\_\_\_\_

Inspected by \_\_\_\_\_

Company \_\_\_\_\_

## APPENDIX D GUIDE SPECIFICATIONS

### D.01 Clear Water Repellent Treatment Guide Specifications.

The following guide specifications for clear water repellent treatment can be used with technical information from manufactures to assist in preparation of contract documents. Care should be taken in editing the guide specifications to be applicable to the project and materials intended.

The format is based on The 1992 Edition of the Construction Specifications Institute (CSI) *Manual of Practice*, Appendices "Section Format" and "Page Format," modified to include notes to the editor. Notes to the editor are left justified and begin at the center of the page, above the paragraph being discussed unless indicated otherwise.

The section number is from the 1988 Edition of "Masterformat", also included in the appendices of the 1992 CSI *Manual of Practice*. The name has been modified from the Masterformat listing of "Water Repellents" to "Clear Water Repellent" to clarify the full intent of the section. The number is consistent with common trade publications such as the *Sweet's Catalog File*. Where integral water repellent is used, the Masterformat title might be more appropriate.

### D.02 Coordination.

**Drawings.** Drawings must be properly coordinated with the specifications. Where the treatment is to be applied to all exterior concrete masonry surfaces, the specifications reference may be adequate. Where there are special areas requiring waterproofing, such as sills, horizontal projections, or masonry copings, these areas should be clearly indicated on the drawings, typically in the sections or details.

Where more than one type of water repellent treatment is required, such as a clear water repellent treatment on exposed exterior surfaces and an opaque elastomeric waterproofing on concealed surfaces (such as the backs of parapets), the extent of each type should be clearly indicated, typically on sections or elevations.

The drawings should clearly indicate the size, configuration and location of the mock-up. Where a portion of the building is to be used for field testing, the drawings should indicate what specific area or the minimum square foot area of building wall which should be used for field testing.

**Related Sections.** Proper use of the paragraphs in Part 1 of the Section which identify "Related Sections" can allow easy scanning for what is intended to be covered within other sections. It also identifies other sections with specific requirements pertaining to the work in the section. It is not intended to list every material that might be in contact with the materials included in the section.

Some appropriate sections requiring coordination might include the following:

Sections covering floor sealers which might also serve as water repellent treatments, but not intended for concrete masonry systems: Such information might be specified in Division 3 - Concrete sections relating to general concrete materials, concrete accessories, concrete curing, concrete toppings, concrete cleaning, resurfacing or rehabilitation. Also found in Division 9 - Finishes sections relating to special flooring, floor treatment, special coatings, and painting.

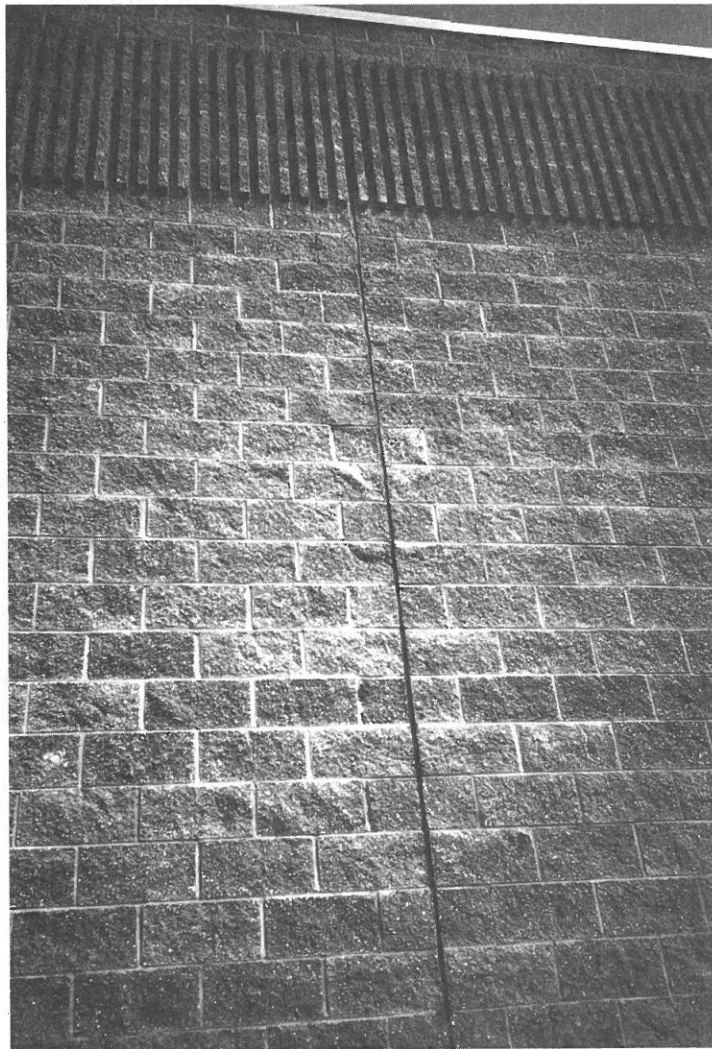
Waterproofing and similar systems which might be considered as treatments such as cementitious waterproofing or dampproofing systems: Such information might be included in Division 7 - Thermal and Moisture Protection sections on waterproofing and dampproofing.

**Joint Sealer (Sealant and Calking)**

**Sections:** Reference to these sections should be limited to those situations where mock-ups or other coordination is required to ensure compatibility between materials. Elastomeric joint sealers, calking compounds, compression seals, and joint fillers are typically included in Division 7 - Thermal and Moisture Protection, usually Section 07900 or Section 07910.

Special coatings sections which might be interpreted as water repellent treatments, including elastomeric coatings: Special coatings might be included in Division 9 - Finishes, usually in the Section 09800 - Special Coatings series or in the Section 09900 - Painting series of sections.

**Special Concerns.** When preparing the section on clear water repellent treatments take care to coordinate the various requirements between the concrete masonry system sections. Make sure comparable requirements related to mock-ups, field tests, and pre-installation meetings are included in each section which includes materials that must be a part of the entire system in order to ensure watertight construction. Where mock-ups and tests require joint sealers and elastomeric waterproof treatments to be included, these sections should also include comparable requirements.



*Close-up detail of control joint and fluted block accent band on building shown on Page 34.*



## SECTION 07180

### CLEAR WATER REPELLENTS

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. Section Includes: Provide clear water repellent treatment for exposed exterior surfaces of special color and texture concrete masonry construction.

LIMIT BELOW TO CLARIFYING  
COORDINATION AND TO PREVENT  
DUPLICATION OF BIDS.

B. Related Sections:

1. Section 04220 - Concrete Unit Masonry: Mock-ups and testing requirements for systems with clear water repellent treatment.
2. Section 07900 - Joint Sealers: Coordination for compatibility.
3. Section 09830 - Elastomeric Coatings: Opaque elastomeric waterproof coatings.

##### 1.02 REFERENCES

- A. ASTM C 140 - Methods for Sampling and Testing Concrete Masonry Units.
- B. ASTM E 96 - Test Methods for Water Vapor Transmission of Materials.
- C. ASTM G 53 - Standard Practice for Operating Light- and Water-Exposure Apparatus for Exposure of Nonmetallic Materials.

##### 1.03 SYSTEM DESCRIPTION

A. Performance Requirements:

1. Absorption: Provide treatment materials which have been tested on concrete masonry to indicate degree of change of absorption of concrete masonry units based on ASTM C 140.
  - a. Effectiveness: Minimum 85% over control units.
2. Water Vapor Transmission: Provide treatment materials which have been tested on concrete masonry to indicate degree of change of water vapor transmission through concrete masonry units based on ASTM E 96.
  - a. Change: No significant change in water vapor transmission.

WHERE GLOSS IS INTENDED, REVISE  
CHANGE TO READ "NO SIGNIFICANT  
CHANGE IN UNIT GLOSS, COLOR OR  
ABSORPTION."

3. Weathering and UV Stability: Provide treatment materials tested on concrete masonry in

accordance with ASTM G 53.

- a. Change: No significant change in unit color or absorption.

## 1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's literature for clear water repellent treatment.
- B. Samples: Submit samples of concrete masonry units approved for use in Project with water repellent treatment applied to half of each sample face; indicate which half has been coated.
- C. Quality Assurance Submittals:
  1. Test Reports. Submit test reports indicating compliance with performance requirements for absorption, water vapor transmission, and weathering and UV stability.
  2. Certificates.
    - a. Submit installer qualification certificates.
    - b. Submit manufacturer's installer approval certificate.
    - c. Submit certification indicating materials comply with applicable VOC limitations.
  3. Manufacturer's Instructions: Provide copies of manufacturer's installation instructions to field office.
  4. Manufacturer's Field Reports: Submit report of manufacturer's representatives indicating materials have been installed in accordance with manufacturer's instructions and recommendations.

## 1.05 QUALITY ASSURANCE

- A. Qualifications:
  1. Qualification of Manufacturer: Firm with minimum five years record of successful in-service experience of clear water repellent treatments manufactured for concrete masonry unit application.
  2. Qualification of Installers: Applicator with minimum five years successful experience in projects of similar scope using specified or similar treatment materials and approved by treatment manufacturer.

WHERE KNOWN, VOC LIMITATIONS SHOULD BE INCLUDED BELOW. WHERE UNKNOWN OR SUBJECT TO REGULAR REVISION, USE FOLLOWING GENERAL STATEMENT.

- B. Regulatory Requirements: Provide materials with not more than the maximum volatile organic compounds (VOC) as required by applicable authorities.
- C. Mock-Up: Prior to commencing work, including bulk purchase and delivery of material, apply clear water repellent treatment to concrete masonry mock-up indicated in Contract Documents.
  1. Testing: Provide field testing of concrete masonry system mock-up, including clear water repellent treatment; test to be observed by Owner's representative and water repellent treatment manufacturer's representative.

MODIFY BELOW WHERE RILEM OR ASTM  
E 514 TESTS ARE TO BE USED INSTEAD  
OF OR IN ADDITION TO AAMA 501.2.

- a. Application: Apply clear water repellent treatment to left side of mock-up and allow to cure prior to application of treatment to right side of mock-up.
  - b. Test: Twenty days after completion of application of treatment, test mock-up with 5/8 inch garden hose with spray nozzle located ten feet from wall and aimed upward so water strikes wall at 45 degree downward angle.
    - 1) Run water continuously for two hours.
    - 2) Observe back side of mock-up for water penetration and leakage; where leakage is detected make changes as needed to correct and retest.
  - c. Results: Cooperate with testing procedures and modify Project treatment application as required to pass mock-up tests for water penetration and leakage resistance.
2. Approval: Proceed with clear water repellent treatment work only after completion of field test application and approval of mock-up.

D. Pre-Installation Meeting:

1. Attend pre-installation meeting required prior to commencement of concrete masonry installation.
2. Review procedures and coordination required between concrete masonry and clear water repellent treatment work and between treatment work and work which could be affected by or affect treatment.
3. Convene additional pre-installation meeting prior to water repellent treatment application for coordination with work not previously coordinated including joint sealers as needed.

## 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver water repellent treatment products to job site in manufacturer's container with label intact and listing product identification, batch number and date of manufacture.
- B. Storage: Keep materials in original, unopened containers; prevent contamination by foreign materials.

## 1.07 SITE CONDITIONS

- A. Environmental Requirements: Comply with manufacturer's recommendations; do not apply clear water repellent treatments under following conditions.
1. During inclement weather, when air temperature is below 50 degrees Fahrenheit or above 100 degrees Fahrenheit.
  2. When rain or temperatures below 40 degrees Fahrenheit are predicted for a period of 24 hours before or after treatment application.
  3. Earlier than 3 days after surfaces became wet.
  4. When substrates might be frozen.
  5. When surface temperature is less than 40 degrees Fahrenheit.

## 1.08 WARRANTY

BELOW IS SPECIAL PROJECT WARRANTY, NOT STANDARD MANUFACTURER MATERIAL WARRANTY. MODIFY WHERE LONGER TERM IS CONSIDERED NECESSARY OR WHERE REPAIR OF MATERIALS DAMAGED BY LEAKS IS TO BE INCLUDED.

- A. Special Warranty: Provide for correcting failure of water repellent treatment to resist penetration of water.

1. Warranty Period: Five years.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

PROVIDE INFORMATION REGARDING ACCEPTABLE MANUFACTURERS AND PRODUCTS, OR SUFFICIENT DESCRIPTION TO ALLOW COMPETITIVE BIDDING.

- A. Clear Water Repellent Treatment:

MODIFY BELOW AS APPLICABLE. REQUIREMENTS FOR TYPE (PENETRATING OR SURFACE SEAL), CHEMICAL COMPOSITION, GLOSS, PERCENTAGE OF SOLIDS, AND OTHER ATTRIBUTES CAN BE INCLUDED AS APPLICABLE--VERIFY.

1. Appearance: Clear, non-yellowing water repellent treatment shall not alter appearance, color, or texture of substrate under any lighting conditions.
- B. Compatibility: Provide products which are recommended by manufacturer to be fully compatible with indicated substrates and joint sealers which are in contact with water repellent treatment.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

NOTE THAT SOME WATER REPELLENT TREATMENTS SHOULD BE APPLIED TO DAMP SURFACES.

- A. Verification of Conditions: Examine substrates; do not apply treatment to damp, dirty, dusty, or otherwise unsuitable surfaces; comply with manufacturer recommendations.
1. Do not begin application of clear water repellent treatment until voids and beeholes visible from 5 feet, and cracks greater than 0.02" wide in masonry substrate have been repaired.

### 3.02 PREPARATION

- A. Protection: Provide masking or covering for materials which could be damaged by application of clear water repellent treatment.

VERIFY REQUIREMENTS BELOW BASED  
ON COMPATIBILITY OF TREATMENT AND  
SEALANTS; WHERE COMPATIBILITY IS  
UNKNOWN USE FOLLOWING.

1. Sealant Coordination: Assure treatment compatibility with each type of joint sealer within or adjacent to surfaces receiving clear water repellent treatment.
  - a. Coordinate treatment application with joint sealers; where recommended by joint sealer manufacturer, apply treatment after application and cure of joint sealers.
  - b. Mask surfaces indicated to receive joint sealers which would be adversely affected by clear water repellent treatment where treatment must be applied prior to application of joint sealers.

CHECK MANUFACTURER FOR ITEMS  
REQUIRING PROTECTION.

2. Protect glass, glazed products, and prefinished products from contact with water repellent treatment.
  3. Protect landscape materials with breathing type drop cloths; plastic covers are not acceptable.
- B. Surface Preparation: Prepare substrates in accordance with water repellent treatment manufacturer's recommendations.
1. Clean surfaces of dust, dirt and foreign matter detrimental to proper installation of water repellent treatment.

### 3.03 APPLICATION

REVIEW MANUFACTURER'S LITERATURE,  
AVOID UNNECESSARY REPETITION.  
WHERE ITEMS NOTED AS  
RECOMMENDATIONS ARE GIVEN,  
SPECIFICATIONS CAN LIST THEM AS  
REQUIREMENTS WHERE DESIRED AND  
WHERE APPROPRIATE.

- A. General: Apply treatment in accordance with clear water repellent treatment manufacturer's instructions and applicable recommendations, including number of coats, maximum allowable coverage, and equipment.



1. Review procedures used for application of treatment to mock-up and recommendations for changes needed based on water penetration tests conducted on mock-up.
2. Consult with manufacturer's representative for site inspections, for proper application techniques not fully covered in manufacturer instructions, and for applicable recommendations.

### 3.04 REPAIR

- A. Repair or replace materials damaged by application of water repellent treatment.

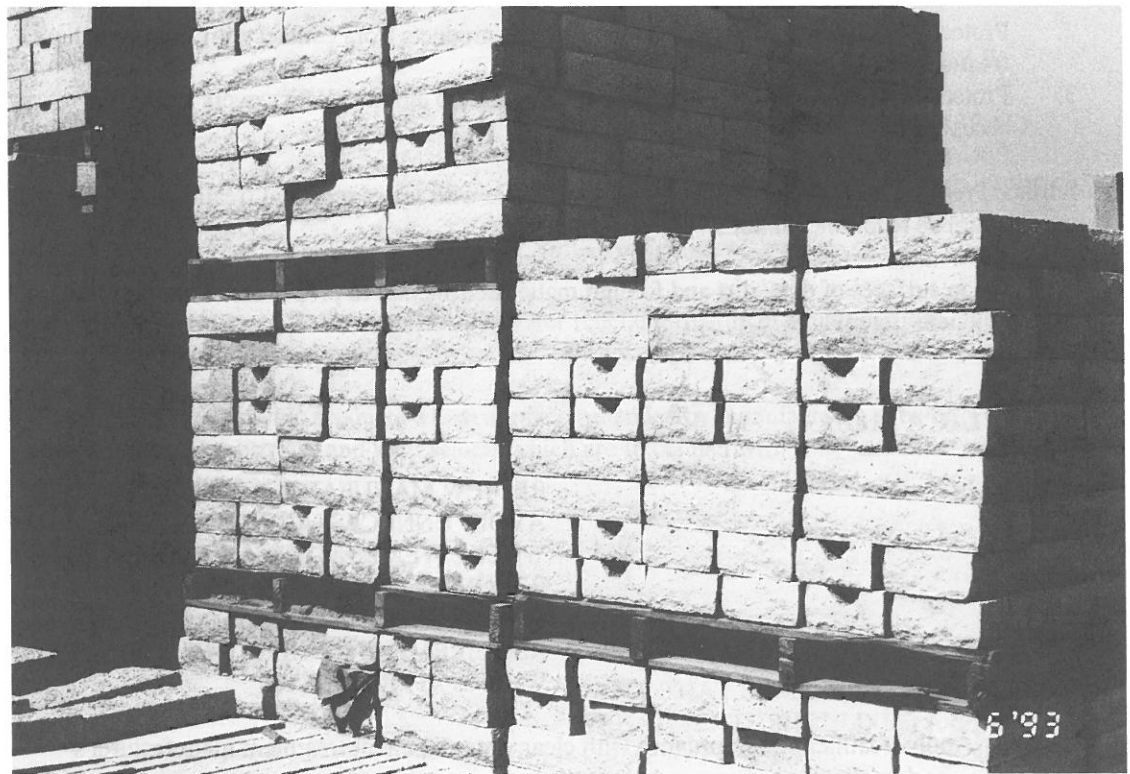
### 3.05 FIELD QUALITY CONTROL

- A. Site Inspections: Manufacturer's representative shall inspect application of water repellent treatment in progress to verify compliance with manufacturer instructions and recommendations.

### 3.06 CLEANING

- A. Clean water repellent treatment from surfaces not indicated to be treated immediately; comply with recommendations of materials manufacturers for proper cleaning techniques to prevent damage.

END OF SECTION



*4 inch high slumped concrete block.*

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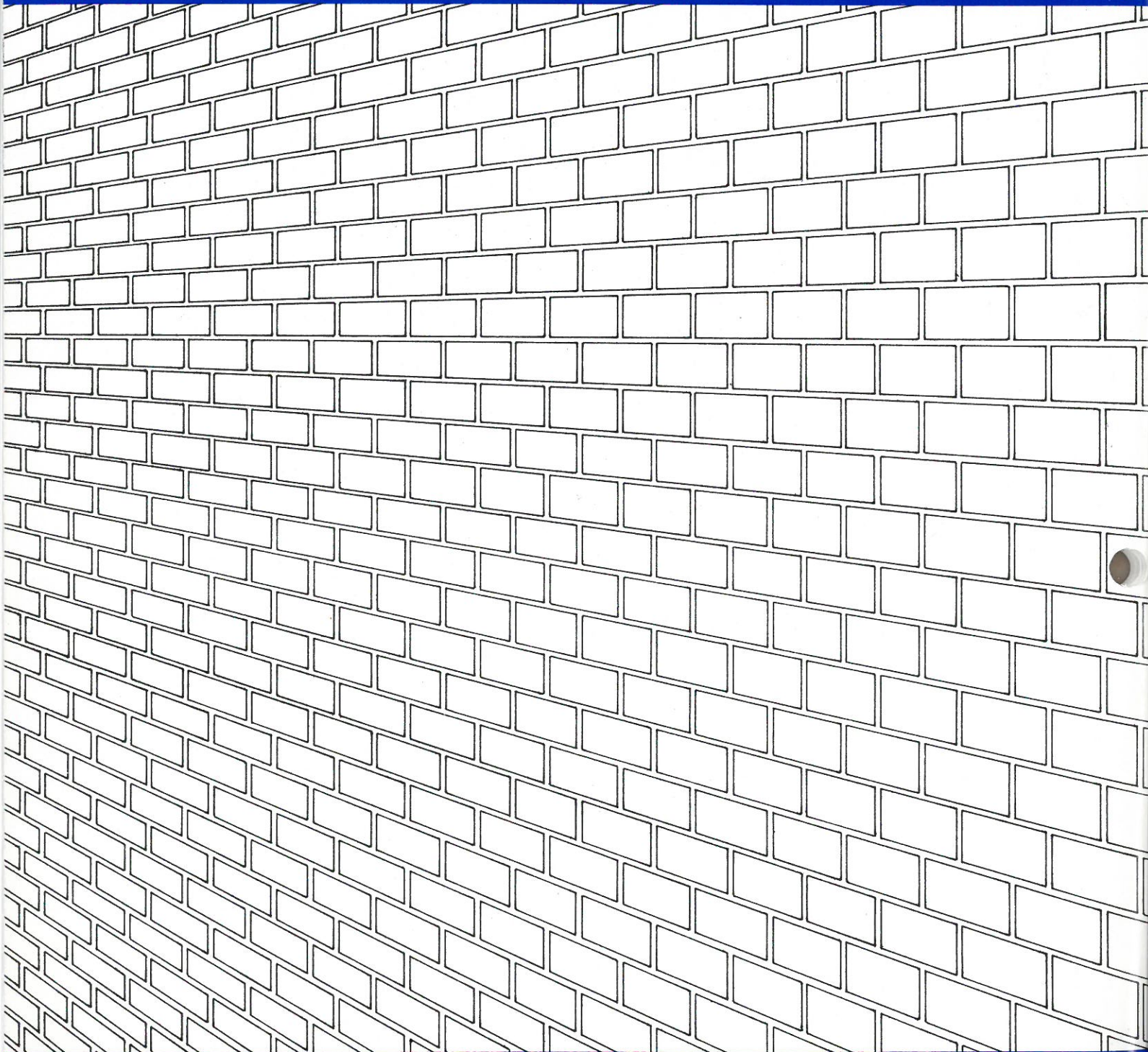
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