

CAUSES for LEAKY WALLS in BRICK

Water penetration in masonry walls normally occurs at the mortar to unit interface, not through the brick itself. Brick does absorb water. However, it is virtually impossible for wind driven rain to be forced completely through a brick body. In the brick manufacturing process high kiln temperatures fuse raw materials into a solid water-resistant mass. Because of this, individual brick do not leak. However, wall systems of brick masonry units and mortar joints can and sometimes do allow water penetration, but this is invariably the result of water passage through holes in mortar joints, unfilled joints, or separations due to insufficient bond between the mortar and brick units.

A four inch thick masonry wall built from the best materials and with the best workmanship cannot be depended upon to completely resist water penetration caused by a wind driven rain. For this reason masonry wall systems should be designed and built to accommodate some amount of water penetration through the single wythe of brick without penetrating into the interior building envelope.

Two types of brick wall design systems are typical used for weather resistant construction; a drainage type wall or a barrier type wall. The brick veneer wall system used on most residential projects is called a “drainage type” wall system. A drainage type wall requires an unobstructed air space, properly installed flashing, and adequately spaced and open weep holes to conduct any water which has penetrated the exterior of the masonry to the outside.

These drainage system requirements are not just brick industry recommendation. **Flashing, weepholes, and an air space are Building Code Requirements.** The building code requirement for residential construction is the 1992 or later CABO (Council of American Building Officials) One and Two Family Dwelling Code. The 1992 and later CABO Code requires that masonry veneer systems include a 1” air space, flashing, and weep holes spaced at 4’0” O.C. The CABO code also requires crickets for chimneys greater than 30” wide. There are other factors which can cause or contribute to water penetration but a large percentage of leaky wall problems are due to missing or inadequate drainage wall details.

Joint selection and workmanship are other factors which can cause or contribute to water penetration problems. Mortar must be properly proportioned and mixed, joints must be filled completely, and joints must be properly tooled for weather resistant construction. Tooling is important for two reasons. Tooling helps compact and compress mortar ensuring that the joints are completely filled. Tooling also compresses and smoothes the mortar and cement at the joint surface which results in a harder and more water-resistant finish. “Tooling” masonry joints with broomsticks, the threaded portion of anchor bolts, or with wire brushes does not achieve the same results a tooling with proper joint finishing tools, and actually does more harm than good. Tooling of joints must be done only after the mortar has achieved the proper set or plasticity. Many masons refer to this proper set as “thumbnail” hard.

Proper construction practices including the preparation of materials and good workmanship are factors that affect the bonding properties of the mortar to the brick units and hence the weather resistance of a wall. Initial mortar selection should be based on the IRA (initial rate of absorption) or suction of the brick units. Mortar used with high suction brick units should have adequate water retentivity. Water retentivity can be increased by the addition of lime or by increasing the mix time which increases air content in the mortar. Brick units which have an IRA of 30 grams per minute may also require pre-wetting of the brick units. All of these factors can change in the field as the job proceeds depending on site conditions and weather and this may require adjustments to the mortar mix or the need to pre-wet. These adjustments cannot be pre determined or written in a project specification. These are job site decisions which require the judgement of an experienced mason.

Selection of a well-graded masonry sand is also important. Coarse sands tend to produce a grainy-textured mortar which has poor workability, poor bond strength, and poor water resistance.

Architectural details are also important factors in weather resistant construction. This includes the following details:

- Properly constructed chimney cap with a drip edge
- Roof crickets when required
- Flashing specified and installed at base of walls and above and below all openings
- Adequate slope on window sills
- Adequate frieze board coverage or caulking (consider that a wind driven rain can be driven vertically upward approximately 1” for each 10-mph increment in wind speed)
- Adequate slope on porches, driveways, and surrounding ground areas
- Properly installed gutters and down spouts
- Caulk around door and window openings

The information in the above general discussion represents not only good masonry practice and building code requirements but also years of construction and architectural experience. It is also the consensus of published information that is contained in numerous technical articles, well-known text books, American Institute of Architects' publications, and Brick Institute of America Technical Notes. The following is a partial list of some of those publications:

- Architectural Graphics Standards by Ramsey & Sleeper in collaboration with the American Institute of Architects
- Masonry Design and Detailing by Christine Beall
- Water Resistance of Brick Masonry Design and Detailing Part I of III BIA Tech Note 7
- Water Resistance of Brick Masonry Materials Part II of III BIA Tech Note 7A
- Water Resistance of Brick Masonry Construction and Workmanship Part III of III BIA Tech Note 7B
- Moisture Resistance of Brick Masonry Maintenance BIA Tech Note 7F
- Water Permeance in Brick Masonry by John C. Grogan
- Water Permeance of Masonry Walls: A Review of the Literature by C.T. Grimm
- Recommended practice for leak-free walls Brick Association of North Carolina
- American Standard Building Codes for Masonry
- Masonry Institute of Michigan Technical Series: Flashings
- Bricklaying: Brick and Block Masonry by Brick Institute of America
- Illinois Masonry Advisory Council: Flashing
- BOCA National Building Code
- Flashing is Key to Leak-Free Masonry by Christine Beall
- The Basics of Water Resistant Brick Walls by Gordon Jones
- Principles of Clay Masonry Construction BIA Students Manual

All of the details required for weather resistant construction are illustrated in General Shale "brick cards" **RECOMMENDED DETAILS ESSENTIAL TO DURABLE BRICK HOME CONSTRUCTION** and should be referred to for more information.

POSSIBLE FIXES FOR LEAKY WALLS IN BRICK BUILDINGS

Leaky wall problems can often be repaired. Repairs for a leaky wall problem can be as simple as applying a bead of caulk or as major as removal and replacement of brick. The determination of a repair procedure can be a complicated problem since there may be several factors causing the problem. Since leaky wall repairs can involve considerable expense a good deal of care should be taken before making any recommendations to a customer. *It should also be understood that leaky wall repair recommendations can be “trial and error” methods.* There is no real substitute for good masonry construction with critical drainage wall elements (flashing, weep holes, and air space) installed during the initial construction of the building. It is suggested that an engineer be consulted before making any repair recommendations to a customer.

- **Caulk frieze boards or chimney cap skirts**
- **Selective tuck-pointing**
- **Application of mortar bevel to corbel details**
- **Application of a water repellent**

The application of a good quality water repellent can sometimes be effective as a repair for leaky wall problems depending on the extent and cause of the problem. Water repellents will not fill holes and gaps in mortar joints but some materials do have some crack bridging capability for very fine mortar to brick separations. The homeowner should understand that water repellents are not a permanent repair and will require re-application. Siloxane based repellents can have a life expectancy of 10+ years. It is a good idea to consult with the material manufacturer to determine if application of a repellent is recommended and to determine which material to apply. Some manufactures such as ProSoCo make several grades of repellents some with better crack bridging capability than others. Additional information can also be found in BIA Tech Note #6A.

- **Replace chimney caps**
- **Commercial waterproofing installations**

Commercial waterproofing systems such as B-Dry can be installed from the inside of the building. These applications may be effective when water can be localized to a single point such as above a basement foundation wall. Before an application of these type are considered it must be determined that water is not causing damage at elevations above the foundation wall.

- **Removal of brick for flashing replacement**
- **Brick Removal and replacement**

This of course is a last resort but is sometimes the only effective solution for a water penetration problem.

Additional Information on Water Repellents

Protection from water penetration may be obtained by treating the walls with a breathable siloxane based water repellent such as **WeatherSeal Siloxane** as manufactured by ProSoCo Inc. 1-800-255-4255. The material should be applied in accordance with the manufactures use instructions.

Certain general conditions should be met before applying a water repellent to masonry walls:

- A. Appearance of the walls must be acceptable before application. It will be difficult or impossible to remove dirt, stains, or efflorescence after treatment.
- B. If tuck-pointing is required it must be done before the water repellent is applied. Tuck pointing mortar will not bond properly to a treated wall.
- C. The masonry must be dry.
- D. ***Do not use surface forming or acrylic based sealers on exterior masonry walls.*** The application of an acrylic sealer can actually do more harm than good when applied to an exterior masonry wall. Acrylic sealers can trap moisture inside a brick wall which can cause fogging or worse spalling of the brick during a freeze thaw cycle. Acrylic sealers can also cause a water penetration problems to become worse by what is sometimes called the funnel effect. Acrylic sealers are surface forming and can create small ledges or lips on the edges of the brick units which act to actually channel more water into the wall.
- E. The application of a water repellent may cause a slight change in appearance to the masonry wall. Treated walls will also appear different or “bead-up” when wet. To ensure satisfaction with appearance a test application should be made in an inconspicuous area.
- F. The application of any water repellent will not be effective if applied over poor masonry work. Mortar joints need to be filled and properly tooled. A water repellent will not bridge holes or fill gaps in mortar joints.

September 19, 2001
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