

Understanding Masonry Saturation Leakage

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Most masonry is water resistant, but it is not entirely waterproof. When masonry units are coupled with common sense architecture, masonry surfaces provide a good moisture barrier. However, a number of factors lead to chronic leakage problems, which can occur directly through the masonry surface. Factors such as the degree of weather exposure, the hardness and density of the masonry unit, and the porosity of the masonry unit or mortar joint, can play a role in how resistant the masonry surface is to water penetration.

For our purposes, Saturation leakage will be defined as water penetrating the masonry surface from the building exterior and finding its way into the building interior.

WHAT IS SATURATION LEAKAGE?

A Saturation leak occurs in masonry when water passes through or absorbs entirely into the porous surface of a masonry wall to such a degree that the moisture is transferred through the wall and finds its way into a living space in the home. These problems can be chronic and often perplexing because many saturation-emanated leaks seem to occur randomly or defy the usual symptoms of common void leaks. To help understand how saturation leakage occurs, we can compare masonry to a far more porous object such as a sponge. If you were to saturate *one side* of a thick sponge, the innate porosity of the sponge material would soon become saturated to the point it would transfer moisture and present itself on the opposite side of the sponge.

When saturation leakage occurs on a masonry surface the saturate water is transferred through the masonry surface from the outside and shows up in a living space after saturating through the masonry surface.

In many homes, saturation leakage can occur on a regular basis yet go undetected because the proximity of the leak is in a utility or non-utilized area of the home such as an attic or a crawl space. A typical undetected saturation leak occurs where the chimney passes through the roof and into the attic. Evidence of saturate water is often present near where the chimney enters the attic through the roof. This form of saturation leak can be a regular and harmless occurrence unless it begins to rot the wooden roof supports touching or near the chimney. Saturation leakage usually becomes a problem when the water shows up in some occupied or living environment of the home, thus causing noticeable damage to ceilings, walls or floors.

It is important to note that Masonry leakage *can* occur as a result of actual voids in the masonry surface due to structural damage, stress cracks, holes, or missing mortar joints. When any of these factors are present, a water problem can occur that closely resembles a saturate leak. For this reason, the initial inspection should include a close survey of the corresponding *exterior* masonry surface to determine if any exterior problems are present that could cause or *contribute* to the interior leak problem. It is important to try to avoid jumping to any fast conclusions about the origin of water leaks without a comprehensive evaluation. It is even more important not to spend any money if at all possible until the leak origin is as conclusively determined as possible.

An insidious reality of many chronic leaks is; “Many chronic long-term leaks often have *multiple* causes.” It is not uncommon an interior leak to have *multiple* origins. For this reason the symptoms and apparent contributing factors of the leak must be closely considered. Multiple origin leaks cause a lot of problems because money is spent on a cure and that procedure may be misunderstood as ineffectual because it only solved *one* cause of the leak and the leak had multiple causes.

COMMON SYMPTOMS OF NON SATURATION LEAKAGE

One commonly heard layman’s description of a saturation leak often sounds like this; “Water never or rarely shows up as running water or dripping water leak but instead shows up as a wet stain or discoloration that encompasses a broad area.” To better understand saturation type leaks

we will first distinguish some generalities of the more commonly understood; void or hole emanated leak. This may seem redundant but non-saturate, void, or hole-emanated leaks have general symptoms that distinguish them from saturate emanated leaks.

Generally speaking, a non-saturate, void, or hole-emanated leakage is identified by the following criteria:

1. The leak is present or evident every time or almost every time it rains.
2. The water from the leak runs down the wall surface in small streams that are visible or spreads out in a circular fashion from an origin point.
3. The leak emanates from the water entry epicenter and spreads out from the leak origin spot, gradually reducing and getting dryer as the leak distances itself from the origin point. Often there is a stain at the point where the leak typically reaches its farthest reach.
4. Non-saturate, void, or hole-emanated leaks, in addition to being circular or arced, are generally isolated to a single area.

COMMON SYMPTOMS OF SATURATION LEAKS

1. *Efflorescence is evident at the leak area.* Efflorescence is a term to describe mineral buildup at a point of evaporation. Water contains minerals and impurities. When water evaporates it separates itself from these minerals and impurities and deposits them at the point of evaporation. In long term saturation leakage, since water has frequently passed entirely through the masonry surface and evaporated, substantial mineral deposits can be found at this point of evaporation. Behind wallpaper efflorescence can be observed as lumps behind the paper. On the open wall, common efflorescence resembles fine salt or powdered sugar. Some of the minerals in efflorescence can be mildly caustic (acidic). When combined with moisture from saturate evaporation, these acidic minerals tend to damage or dissolve paint, or other building materials such as dry wall, plaster, or wood. Eventually the acid in the efflorescence can break down the composition of most of these building materials and can even deteriorate interior masonry, such as brick, fired clay, or a cinder block wall. The phenomenon of efflorescence is very common in old homes with basements made of hollow fired red clay tile. On these old walls, the bell-less footer drains clog and slow, and due to aging, the waterproofing on the basement wall begins to break down. This causes exterior ground water to build up outside the wall and creating hydrostatic pressures that push water into the masonry surface and eventually into the interior of the basement. Large areas of some older basement walls can be very difficult to keep painted because these walls have continuous saturation leakage taking place; and, as a result, efflorescence is constantly being deposited on the wall surface behind the paint. Areas such as these have chronic blistering of the painted surface. Many people with chronic basement painting problems are really suffering from chronic saturation problems in the basement wall.
2. Another common symptom of saturation leakage is; *the wet stain, leakage, or discoloration doesn't appear every time it rains or occurs inconsistently.* For saturation leakage to occur, the water has to travel completely through the masonry surface; which is often very dense. A light rain or a rainfall of short duration generally does not allow enough time for the masonry surface to become saturated enough to transfer moisture completely through the wall.
3. Severe saturation leakage can form beads of water on the interior masonry surface. These beads of water can form rivulets that will run down the interior wall in small streams and will closely resemble a non-saturate leak. It is more common, however, for saturation type leakage to show up as a stains, consistent wet areas, or discoloration from evaporating moisture depositing impurities from its journey through the wall on the wall surface.
4. The affected area has a consistent wetness and no obvious epicenter. Sometimes large areas are uniformly affected. Because the whole outer area is uniformly wet, this uniformity mimics to the inside and creates a consistent stain or wet area that corresponds to the water traffic on the exterior wall in some way.

HERE ARE SOME POINTS TO CONSIDER WHEN TRYING TO DETERMINE WHAT TYPE OF WATER PROBLEM YOU MIGHT BE EXPERIENCING:

1. The duration of rainfall. (The length of time it rained)
2. The intensity of rainfall. (How hard it rained)
3. The wind direction.
4. The length of time between rainfalls. Sometimes the first rain won't cause the leakage but a second or third rain occurring before the wall has time to dry will cause the wall to leak.
5. The actual porosity / density of the masonry surface.
6. Is there an architectural condition or failed gutter or downspout that brings water to affected area? Whenever water can run down, be held against, (as in the case of melting snow), or spatter against the surface, of a masonry wall for a continuum there is the possibility of saturate type leaks.

TYPICAL SATURATION LEAK TROUBLE SPOTS

Under or near the area where a chimney passes through the roof is the most common area for saturation leakage to occur. The chimney, in most cases is an unprotected masonry object that is subject to "All the weather all the time." Other vertical masonry walls receive protection from direct weather from the eaves, the gutters, or the architectural design of your home. The chimney receives no such protection and is exposed to all weather. Roof flashing and the surrounding roof is designed to "gasket" the chimney. This prevents water from passing past the roof, but since all masonry has some degree of porosity sometimes even the best roof or flashing job will not prevent water from "wicking" past the flashing through the masonry surface and finding its way into the home.

In a house with an attic, the chimney passes into the attic and evaporates on the exposed masonry before it can show up or become detected as a problem. A very high percentage of chimneys have this type of saturation leakage, yet it *goes undetected* because it does not present a problem in the dwelling area of the home. Until this type of leak is of a quantity large enough to cause damage in the attic or drip water to ceilings below, it will go unnoticed. The attic tends to be a warm place in many homes and the saturate water on the chimney surface evaporates quickly before it can penetrate far enough to cause any real problem.

Attic water problems frequently begin when the homeowner tries to convert the attic space into a living space. It is sometimes better to leave the natural brick exposed if the room design will allow for the masonry to breathe and evaporate saturate moisture. If this surface saturate moisture is covered with dry wall or another porous wall covering, the saturation leak that had been present and undetected since the house was built now becomes a problem leak or stain area. It is a lot to ask of saturated masonry to be completely wet on the outside of the house and then become completely dry on the inside of the house when you only give it a space of 18 to 24 inches to perform this feat. (18 to 24 inches is the average distance between exposed masonry and the inside of your house).

So the most common area where saturation leakage is found is where masonry passes through the roof and ends up in a living space without the benefit of an attic or several feet of "drying space." Rooms with Cathedral Ceilings that have fireplaces prominently rising up through the roof commonly have staining on the ceiling near where the chimney passes through the roof for this reason.

Another common factor that worsens chimney saturation problems occurs when the chimney structure has interior corbels. (See diagram #1) Interior Corbels are common when chimneys are reduced in size after they pass through the roof to save space inside the house or so they don't extrude from interior walls. It is very common for saturation leakage to occur at the point of the corbel (multiple indents) and for water to actually bead and drip straight down from these indent points. Chimneys with walls that remain vertical after passing through the roof tend to absorb and evaporate saturate water more efficiently than a wall with interior corbels. Even when a vertical wall contains measurable water content, because of its innate uniformity; water is evaporated and disbursed evenly. Walls that remain vertical and do not have corbels usually will show little evidence of saturation leakage. The problem with corbels is that gravity tends to pull saturate

water straight down from the moistened area of the wall and this water then drips directly from the bottom of the bricks at the corbel indents.

Room additions create similar problem to that of interior corbels because the *opening* to the addition room creates an ending to the wall similar to that of corbels. The leak commonly occurs at the top of the interior opening to the addition. The reason for this is; the top of the opening is the bottom of the wall above. This type of leak can occur under any opening to an addition room or sometimes in a garage extension. Any opening in a masonry structure with exposed masonry above can leak in this fashion. Water will tend to bead up and leak from the bottom of the steel support structure in these areas. This is the logical end to the wall and the water now has nothing below to absorb into so it just drips downward into the top framing of the room opening. Pulled by gravity and physics, the moisture passes past the roof flashing, form beads, and then drips from the bottoms of the hidden support structures that exist over room openings. There are many similar architectural configurations that can produce this type of leak. Any time exposed masonry existing above a room opening leaks at the top of the room opening there is a strong possibility of this is a saturation leak.

Any architectural configuration that consistently causes water to “run” down a wall, such as the convergence of several roof valleys can cause saturation leakage. The failure of a downspout or a gutter can create a saturation leak. To illustrate the porosity of masonry, it would be safe to say that if you directed your garden hose on any masonry part of your home for a sustained period of time, water would show up on the interior of your home.

SOLVING SATURATION LEAKAGE

By evaluating the interior leak and the corresponding exterior masonry area, it may be easy to recognize saturation type leakage before diagnosing it as a roof leak. Here is a protocol for diagnosing and solving saturation leakage.

1. Check for obvious voids the need for tuck pointing on the exterior masonry surface and make all necessary repairs.
2. With chimneys, above flat roofs, bay windows or near any other flashed masonry, check for voids in the flashing and make all repairs. In some cases when a living space shows up directly after passing through the roof one strategy to solve the saturation problem is to create a larger “drying space” where there is none. This can be accomplished by raising the height of the counter flashing. This will force saturate water to travel farther before passing through the roof and it will also reduce the ratio of exposed masonry vs. waterproof flashed masonry. Altering this ratio can sometimes create dramatic results to chronic leak problems.
3. The chimney or exterior problem area must be treated with a water proofing agent such as a silicone base product like Thomson’s Water Seal or a product like Silane BSM 40%, because to solve saturation leakage; the porosity of the masonry surface must be reduced. There are many products that can accomplish this and the product used depends on the severity and the composition of the masonry surface. Different products are used for limestone, sandstone, and brick. It is highly recommended that the sealing products used cause the masonry surface to become “water resistant” and *not* “waterproof.” “Waterproofing” a masonry surface in a cold climate can cause brick damage and spalling. Waterproofing agents begin to fail after about 3-4 years. After partial failure, the waterproofing agent will allow water to *pass into* one area of the wall but will lock moisture against the surface of the brick in an areas where the waterproofing is still viable. When this highly saturated masonry freezes in these areas it causes fracturing of the bricks. The expansive force of water freezing is over 30,000 pounds per square inch. Eventually these “fractured” masonry units will crumple and chip away. This process is called spalling. For this reason, It is better to use a product that reduces the surface porosity yet still allows the surface to “breathe” and dry out without trapping moisture.
4. In the case of chimneys, it makes a lot of sense to installed chimney screens with integrated hoods. Without hoods on the screens all the water runs down the chimney flues and interiors which are also somewhat porous. Flue openings are large and range from 8 inches square to almost 18inches square. These are large openings to allow

water to pass into your home and because of porosity the chimney is not an entirely separate entity. Hooded chimney screens keep most of the water out of the chimney interior and your basement; where the water eventually ends up during long sustained rains. An added bonus is chimney screens can improve the draw of your fireplace. Since wind comes from above and blows air down the chimney flue, having a hood on top of the flue actually improves the draw by deflecting this downward atmospheric pressure.

IN CONCLUSION

When determining the cause of a leak, Saturation leakage is a significant yet frequently overlooked cause. Leak diagnosis can be a very trying and tedious process and it can be very difficult to find the true origin of a water leak. Some leaks further confuse matters because they have *multiple* causes. It's a shame they haven't created an MRI for home leak discovery but until then we will have to rely on evaluating symptoms, operating out of logical protocols, and sometimes a little good luck.

I hope this information has been useful to aid your understanding masonry emanated saturation leakage. Please feel free to call me if you have further questions concerning the problems, repair, or restoration of your masonry home.

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