

RILEM TUBE TESTING AND BRICK MASONRY

Introduction

In some cases, a design professional or consultant may recommend RILEM tube testing of installed brick masonry when water leakage is occurring and/or the absorption characteristics of the brick are in question. This is a relatively simple and inexpensive test; however, its use and findings are often misunderstood and inappropriately applied. The intent of this document is to explain these misunderstandings and recommend more appropriate methods to evaluate brick veneer wall performance.

RILEM Tube Test Procedure

The equipment for a RILEM tube test consists of a small, flanged tube, less than 1 sq. in. in area, with graduated markings from 0 to 5 ml. There are two styles of tube: a vertical straight tube intended for horizontal surfaces and an L-shaped tube intended for vertical surfaces (Figure 1). The flanged end is placed against the surface to be tested and sealed using a removable putty. The graduated tube is filled with water and monitored at timed intervals until the cladding absorbs all the water. The results of the tests are presented as an absorption rate (volume of water over time).

Why RILEM Tube Testing Is Not Recommended

There are a variety of options to evaluate the water penetration resistance of a brick masonry wall assembly. However, RILEM tube testing is not considered a viable test for this purpose for multiple reasons:

- RILEM tube tests do not have consensus standards regarding their use. Within the masonry industry, there is no agreement regarding acceptable or unacceptable test result values using this procedure. This is partly due to lack of correlation with known properties of the brick.
- RILEM tube tests evaluate a single characteristic of brick or mortar (absorption) that is not the sole determination of wall performance. It is well-understood that brick masonry is an absorptive material; however, it is not the units alone that resist moisture. In the case of multi-wythe brick masonry, it is the assembly of multiple layers of brick and mortar and their overall workmanship. In the case of a drained masonry wall assembly, it is primarily the cavity, flashing and weeps that resist water ingress, not the absorbency of the brick veneer.
- RILEM tube test results cannot be used to determine the absorption properties that establish

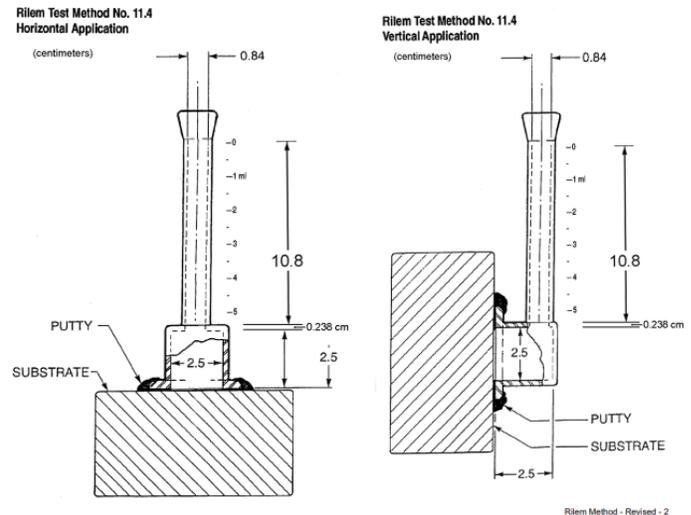


Figure 1: RILEM tube configurations [Ref. 7]

the Grade of the brick. Obtaining the absorption values used to determine brick Grade requires using the procedure in ASTM C67 that fully submerges the brick. No submerging of brick occurs during a RILEM tube test, nor are the other procedures in ASTM C67 followed. Consequently, RILEM tube testing is not appropriate to determine the absorption value associated with the Grade of brick. There is no known correlation between ASTM C67 absorption values and RILEM test results.

- RILEM tube tests on brickwork do not accurately reflect the performance of the masonry during in-service conditions. In service, most or all of the brick masonry is subjected to moisture at the same time, as would occur during a rainstorm. In a RILEM tube test, only the test area is wetted while the surrounding masonry is not. As a result, the water applied by the test will migrate away from the test area at a faster rate than would occur if the entire wall were wetted. The ability of the brickwork to readily accommodate water during the test can create the perception of excessive absorption when it actually demonstrates the reservoir capacity of the cladding.
- RILEM tube tests do not evaluate the performance of other critical components in a drainage wall system, such as flashing and weeps. A brick veneer wall assembly resists moisture as a system, so any tests conducted must incorporate all elements of the system in order to accurately assess the performance of the assembly. In a RILEM tube test, the drainage cavity, flashing and weeps are never

subjected to any moisture since it all remains in the brick. See “Recommended Alternate Testing Options” for testing standards that better evaluate the performance of a drainage wall system.

- The inherent variability of the results of RILEM tube testing is too large to draw conclusions about the water penetration characteristics of an entire wall assembly. This is often neglected by those who rely exclusively on the results of RILEM tube testing to assess the water resistance of brick masonry. A research study conducted at the University of Wyoming included RILEM tube testing as part of the evaluation of water penetration in brick masonry. It was found that the test results were so highly variable that a large number of tests per specimen were needed to achieve an acceptable level of error. For a specimen 12 sq. ft in area, conducting 56 RILEM tube tests would provide results with a sample error of 50%. To achieve sample errors of 10% or less, the number of tests conducted on this same area would need to be orders of magnitude greater. Consequently, to assess an entire wall assembly or multiple building walls and to draw any conclusions about the water penetration characteristics of that wall based on 50, 100 or even 500 RILEM tube tests is speculative at best.

Recommended Alternate Testing Options

Tests conducted on a much larger surface area of brickwork give a much closer approximation of the in-service behavior and water penetration resistance of a wall assembly. Although these tests are more expensive and time-consuming, they will provide more relevant and accurate data representing the wall performance than RILEM tube testing:

- ASTM E514, Standard Test Method for Water Penetration and Leakage Through Masonry (laboratory test)
- ASTM C1601, Standard Test Method for Field Determination of Water Penetration of Masonry Wall Surfaces (field test)
- ASTM C1715, Standard Test Method for Evaluation of Water Leakage Performance of Masonry Wall Drainage Systems (field test)
 - This test introduces water directly into the drainage cavity to evaluate flashings and weeps.
- ASTM E2128, Standard Guide for Evaluating Water Leakage of Building Walls
 - This document explains the recommended methodology to use when trying to diagnose the cause(s) of water ingress/leaks and includes references to other ASTM test standards, including modifications made to other test standards in order to adapt them for field testing.

Appropriate Uses for RILEM Tube Testing

The one instance in which RILEM tube testing is an appropriate absorption test for brickwork is when it is used for *comparative* porosity measurements of brick masonry surfaces with different surface treatments, coatings, etc. RILEM tube testing is one of the primary tests used in the field to assess the proper application of a water repellent applied to brickwork. When this is done, a RILEM tube test is performed in the same spot on the wall prior to the application of the water repellent and after the application of the water repellent, and the results are compared. A significant decrease in the rate of absorption indicates that the water repellent has been applied correctly and in the proper coverage rate.

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