JELD-WEN WINDOWS & DOORS

JELD-WEN Windows & Doors Presents

THE ELEVEN THEORIES OF WINDOW INSTALLATION

By Rod Clark & Jay DeKalb

Specifying the proper window is no less critical than installing it properly. Architects should be familiar with proper installation methods and installation problems in order to aid them in the selection process.

CONTINUING EDUCATION AIA

RESIDENTIAL ARCHITECT MAGAZINE CONTINUING EDUCATION

This course requires supplemental online reading in addition to the following article. For details on accessing the supplemental reading and to learn how to take the test, please see back cover.

THE EYES OF A BUILDING

The word 'window' comes from the ancient term 'wind eye,' descriptive of the means that would allow a person to see the oncoming storm or the morning sunrise. Windows are first recorded as a part of human habitation around 6500BC. Many of the same reasons windows were important then are no doubt also true today. For example, windows provide security. They let a view of the outside world come into the living space. They help adjust comfort – temperature and drafts – within the living space. And they admit daylight, reducing energy demand.

Today's windows can also separate the living space from the elements. The degree to which they are able to do that often depends upon how well the window has been installed. In fact, an improperly installed window can lead to a number of structural and aesthetic problems and can even adversely affect the health of the building's occupants.

Separating the living space from the elements is not the same as isolating the space. For example, separation does not mean that wind and water cannot infiltrate the opening. Water may indeed infiltrate the opening in which a window is installed without causing any damage whatsoever. Proper installation means that wind and water infiltration is managed with effective and proven construction methods.

If a window has been improperly installed, the errors in installation can very often be identified by a proper inspection. To assess the quality of an installation and thereby detect any flaws, it's helpful to understand the basic rules of good installation. It's also important to be aware of the local building code requirements. Code requirements will always supercede a manufacturer's recommended installation instructions. And, it's important to learn the step-by-step techniques for conducting an inspection of a window installation. A short primer on how to inspect a window installation is included online as required supplemental reading.

THE ELEVEN THEORIES OF INSTALLATION

Many installation materials and techniques can be used to achieve a successful installation. However, all successful methods must abide by the following basic principles.

RULE #1

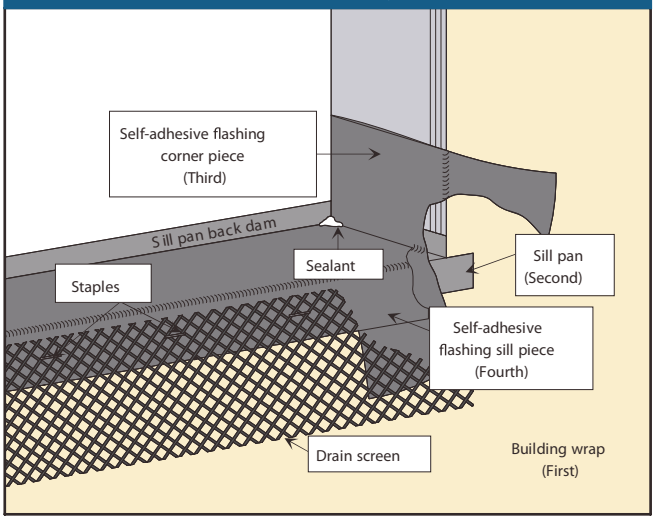
Build redundancy into the system. Fenestration products without welded corners and integral nailing fins will allow some water to enter through the exterior joints. Direct any water to the exterior.

LEARNING OBJECTIVES

The learner will:

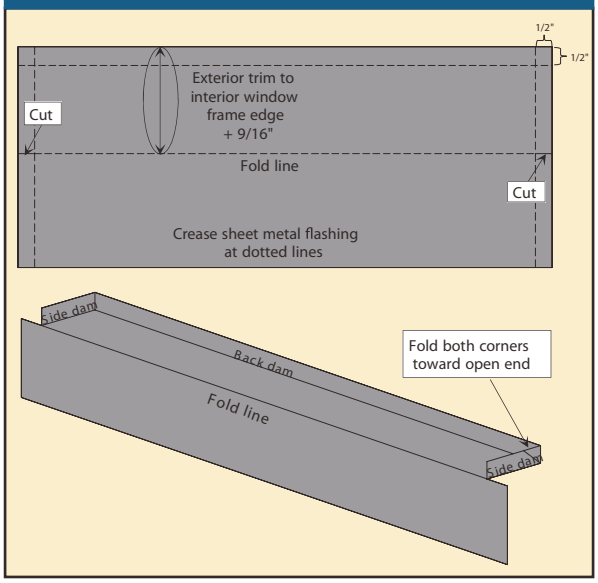
- Discover the relationship between the Theories of Installation and a successful job
- Recognize at least three issues associated with window installation
- Identify at least five different tests for inspecting a window installation for various types of windows

CORNER INSTALLATION SEQUENCE



Multiple layers give redundant defense to water infiltration, while a sill pan returns any water within the installation back outside the wall.

SILL PAN PREPARATION



The exterior frame, the flashing material, the building wrap, the sealant and the exterior siding are examples of effective redundancies. Each layer acts as an independent barrier to water infiltration should the adjacent layer fail.

Water is easy to manage if proper planning and construction techniques have been followed. For example, the sill pan must be designed to catch water that infiltrates the opening and divert it over the building wrap and beyond the wall cavity.

RULE #2

Tie the water plane of the window into the weather plane of the wall (usually building wrap) in a waterproof and contiguous manner. Failure to do this allows water to penetrate through the gaps and to enter the wall cavity.

The water plane of the window is the path water wants to take into the wall cavity. The weather plane of the wall is outside the exterior wall and beyond the building wrap. Once water is effectively diverted beyond the building wrap, it is rendered harmless.

Tie-in requires multiple steps. First, building wrap, then sill pan, self-adhesive corner piece, self-adhesive flashing and finally a drain screen to create a channel through which the diverted water will pass. It's easy to see why each one of these steps is necessary to prevent water from entering the wall cavity.

RULE #3

Sealants must conform to the joint design and expansion/contraction Parameters specified by the sealant manufacturer.

Sealants are applied where materials transition and where drainage will not be blocked. For example, sealant should not be applied to the gap above the header drip cap. Gaps should be shallow, narrow, clean and dry before sealing. Gaps should never be deeper than they are wide.

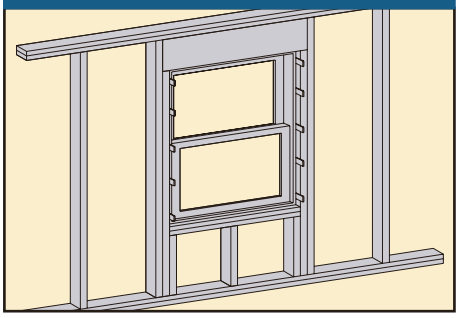
Transition materials may be of different substrates that expand and contract at different rates, therefore, check sealant capabilities. Adhesion is often tested on small pieces of material before sealants are applied.

RULE #4

Shim in a manner that reduces frame rotation under loading (wind, settlement, rough frame movement).

Rough opening must be square and plumb. Shims should be parallel, snug but not excessively tight, about 8" apart, and secured with structural adhesive or sealant. Clearly, shims are meant not to hold the window in place, but to locate it properly within the rough opening.

SHIM LOCATIONS



Shims are located uniformly and snugly between the window and the rough opening.

RULE #5

Fasten to the rough opening in a manner that does not put undo stress on the fenestration components.

Nails are placed through the nailing fin or exterior trim supporting the mass of the window in tension to accommodate wind and other normal mechanical forces such as expansion and contraction. Screws passing through drilled holes may be used on larger windows according to manufacturer's instructions.

THE ELEVEN THEORIES OF WINDOW INSTALLATION

RULE #6

Install the fenestration product square, plumb and level. It shall not have sags or bows that hinder the proper operation of the product or product components.

A window installed out of plumb or out of square will almost certainly exhibit problems over time. Operational problems or damaging water infiltration are likely results.

Installation out of plumb, square or level cannot be corrected after installation without removing the product and re-installing.

RULE #7

Apply all flashing in a shiplap manner and tie into the weather plane of the building.

Flashing applied properly defeats water infiltration using the law of gravity, and material designed to prevent absorption through capillary action.

Water can only defeat gravity if it finds a small channel where it can travel as though being absorbed. Usually an air pressure differential is also involved where the force of wind driven rain outside the building is greater than the air pressure within the building. Water is as easily drawn through openings under these conditions as soda through a straw.

RULE #8

Move the flashing failure point as far as possible from the interface of the rough opening and the fenestration product.

Wherever continuity of flashing is broken or penetrated, there is a possibility of failure. By using overlaps, multiple layers, sealants and gravity, continuity can effectively be maintained to the outer edges of the flashing.

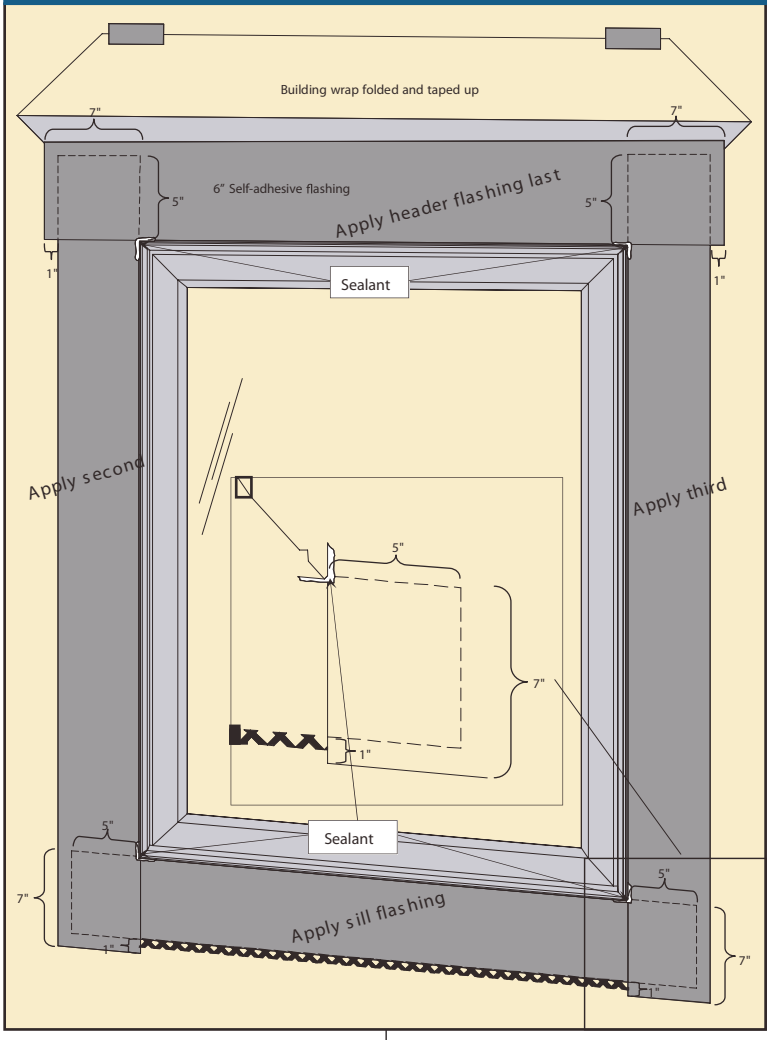
If the flashing failure point is below or well to the side of the rough opening, chances are it will have little or no impact on the installation. For this reason, it is wise to use 6" wide or wider flashing material.

RULE #9

Protect the head of the fenestration product from the accumulation of water.

The head of the installation is extremely critical to prevention of water infiltration, quite simply because the entire installation is below, where gravity will draw it freely into the installation and into the adjacent wall cavity. The correct way to protect the head of the installation is with a fabricated drip cap. That extends 1/8" past the corners of the window header. Drip caps are often pre-applied or shipped with the window.

PROPER FLASHING APPLICATION



RULE #10

Any flashing or pans used must self-seal if penetrated by nails, staples or screws.

Self adhesive flashing that also covers pans should be an adhesive butyl membrane that will self-seal around any penetration.

RULE #11

Reduce airflow around the fenestration product to the lowest level possible.

As wind and rain strike one side of a building, the force creates a positive pressure. As the wind passes, it creates a negative pressure on the opposite side of the building. If air can pass through a fenestration on the positive pressure side of the building it will most certainly take water with it into the wall.

TO ACCESS SUPPLEMENTAL READING: Go to www.residentialarchitect.com and select "Continuing Education Center". There you can download PDF files of this course and the required supplemental information.

TAKE THE TEST ONLINE FOR FREE: New users must create a new account. Returning users may log in. After logging in, click on "My Courses". Then select this course title to launch your test. A score of 80% or higher earns 1 AIA/CES HSW LU credit hour. Valid for credit through April 2009.

TEST QUESTIONS

1. True or False. Windows must be thoroughly sealed so that no water may infiltrate.
a. True
b. False

2. Wind can have an affect on water infiltration even when flashing is used because it:
a. Can force water around the glass
b. Can uplift the window and create a gap under the sill
c. Can cause water to wick through miniscule openings
d. Can penetrate even the best installations
e. Both C and D

3. Which of the following best assures an effective window installation
a. Redundant water infiltration barriers
b. A water plane tied to a weather plane
c. A drain screen from sill pan to outboard of the building wrap square and plumb rough openings
d. All of the above

4. True or False. Shims must be located so that an even number is on one side of the rough opening and an odd number on the other.
a. True
b. False

5. True or False. Windows that operate with difficulty after installation can usually be adjusted with a light sanding.
a. True
b. False

6. Sealants cannot be properly applied
a. In gaps that are deeper than they are wide
b. When materials are dry
c. When different substrates are covered by the same sealant
d. In the gap above the header drip cap
e. Both A & D

7. True or False. The flash point of an installation is where failure will first occur.
a. True
b. False

8. Shims can be affixed to the rough opening
a. With light finishing nails
b. Snugly
c. With construction adhesive
d. With sealant
e. Both C and D

9. True or False. Flashing may be installed in any order as long as it is self-adhesive, sealed and not penetrated with nails or screws.
a. True
b. False

10. True or False. A window may be installed with the sill slightly extended in order to help channel any water infiltration away from the wall cavity.
a. True
b. False

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Eleven Theories of Window Installation

You have the option of taking the test online free of charge or you may mail your test along with a check in the amount of $10. A score of 80% or higher earns 1 AIA/CES HSW LU credit hour. Certificates of completion are available upon request and delivered by email.

test>												
	1.	a	b				6.	a	b	c	d	e
	2.	a	b	c	d	e	7.	a	b			
	3.	a	b	c	d		8.	a	b	c	d	e
	4.	a	b				9.	a	b			
	5.	a	b				10.	a	b			

MAIL-IN TEST: Photocopy this page. Clearly circle the letter of the correct answers.
Mail this test with the completed form and check for $10, payable to ArchitectCES, to:

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Material resources used: Article addressing issues concerning health, safety, and welfare.

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