Arriscraft.NOTE Series

Volume 4

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Introduction

This ARRISCRAFT•NOTE discusses the proper placement and construction of movement joints in thin adhered veneer applications.

There are basically two distinct types of movement joints used in construction: *elastic* and *inelastic*. Both of these joint types are designed to perform a specific function, and they should not be used interchangeably.

Inelastic movement joints include *construction joints* and *control joints*.

- *Construction joints* are used wherever the construction work is to be interrupted. They are usually located where they will least impair the strength of the structure.
- *Control joints* are largely used in concrete unit masonry construction to create a plane of weakness. When used in conjunction with joint reinforcement, they control the location of cracks due to volume changes resulting from shrinkage and creep. They are not generally sufficient to accommodate net material expansion.

Elastic movement joints include *building expansion joints* and *expansion joints*.

- *Building expansion joints* are used to separate a building into discrete sections so that stresses developed in one section will not affect the integrity of the entire structure.
- *Expansion joints* are used mainly in thin clay brick, calcium silicate, or stone veneer construction. They are used to segment the veneer to prevent cracking due to changes in temperature, moisture expansion, elastic deformation due to loads, and creep. They may be horizontal or vertical.

It is the elastic-type movement joint that is most appropriate for use in a thin adhered veneer application, and requirements for this type of joint will form the basis of the following discussion.

Movement Joints in Thin Adhered Veneer Applications

Movement joints can be constructed in a variety of different ways. They may include waterstops and pre-moulded foam or neoprene pads as barriers to keep mortar or other debris from clogging the joint. These materials must be highly compressible and elastic in nature in order to accommodate the expansion and contraction of the veneer materials. As such, the use of fiberboard or other similar materials are not recommended for use in movement joints.

No solid materials should bridge the movement joint as they would restrict movement and not allow the movement joint to perform its intended function.

Materials for Movement Joints

A good quality backer rod and joint sealant should be used to seal the exterior of the movement joint against moisture and air penetration. The sealant material should be selected by the designer to be highly elastic, resistant to weathering and ultraviolet radiation, and compatible with the thin adhered veneer materials, including any adjacent materials such as flashing membranes or metal elements.

The size of the movement joint should be considered when selecting the type of joint sealant. The sealant must be able to span the joint and accommodate the anticipated movements of all materials. As a rule of thumb, joint sealants used in movement joints should typically have a width-to-depth ratio of 2:1 in order to ensure adequate protection against moisture and air penetration (Figure 1).

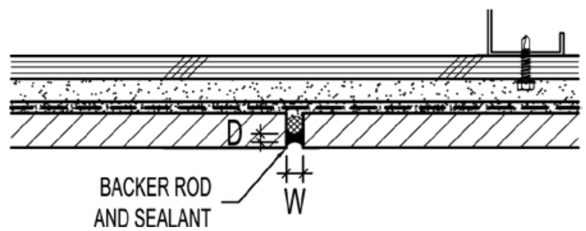

Figure 1

The inclusion of a good quality backer rod is important to proper joint design. The backer rod is used to:

- act as a bond breaker, forcing the sealant into two-point adhesion. It should be noted that sealant may fail prematurely when put into three-point adhesion as this subjects the sealant to shear stress in addition to tension/compression;
- achieve the required 2:1 width-to-depth ratio of the sealant; and
- provide a firm surface against which tooling can be done. Proper tooling optimizes the joint's weather resistance and ensures better adhesion of the sealant. The backer rod allows the sealant to be tooled into an hourglass shape, providing maximum flexibility.

For further information refer to ARRISCRAFT•NOTE (Vol. IV, No. 4) Important Criteria for Sealant and Backer Rod Selection.

Sizing of Movement Joints

Vertical movement joint frequency and size should be designed to accommodate the anticipated movement of the veneer materials. The joints must be of sufficient size to contend with the anticipated movements, without being so large as to be difficult to weather-proof. Typically, joints sized to resemble a mortar joint will be adequate to accommodate the anticipated movements and still be easily sealed against the elements.

The design of horizontal movement joints depends largely upon the anticipated loads and resulting deflections which are expected to occur at their particular locations.

Placement of Movement Joints
The actual location and frequency of movement joints is dependent upon the configuration of the structure as well as the expected amount of movement dictated by micro-environmental factors. They need to be designed as part of the building envelope by the designer and their location and extent must be clearly indicated on the building elevations. As a general rule of thumb, movement joints should be located at the following locations in thin adhered veneer:

- at changes in wall direction, such as building corners;
- at wall openings, such as windows and doors;
- at changes in building height, such as building junctions;
- at major changes in thickness of wall, such as pilasters;
- spaced periodically within continuous lengths of wall;
- at changes of building materials; and
- at horizontal deflection joints.

Corners: Walls perpendicular to one another will expand towards their juncture, typically causing distress at the first head joint on either side of the corner. Movement joints should be placed near corners to alleviate this stress (Figure 2).

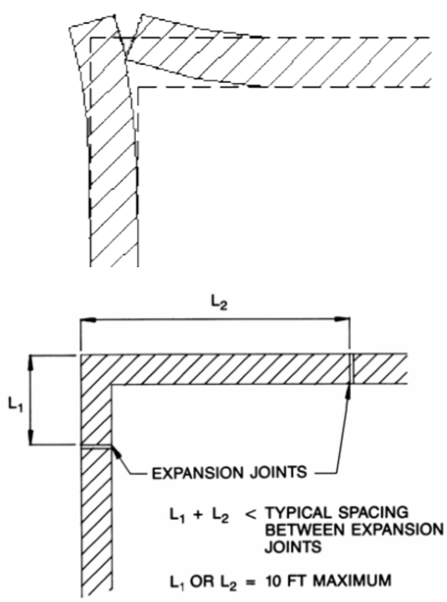

Figure 2

When corners are constructed with quirk mitered joints, a movement joint may be placed in the continuous vertical joint created by the miter (Figure 3).

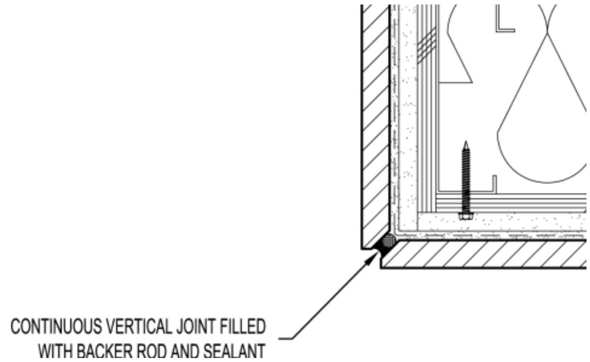

Figure 3

Intersections, Offsets and Setbacks: Parallel walls expand towards the offset, rotating the short thin adhered veneer leg or causing cracks within the offset. Movement joints should be placed at the offset to allow the parallel walls to expand (Figure 4). Intersecting walls not required to be bonded should also include a movement joint at the intersection.

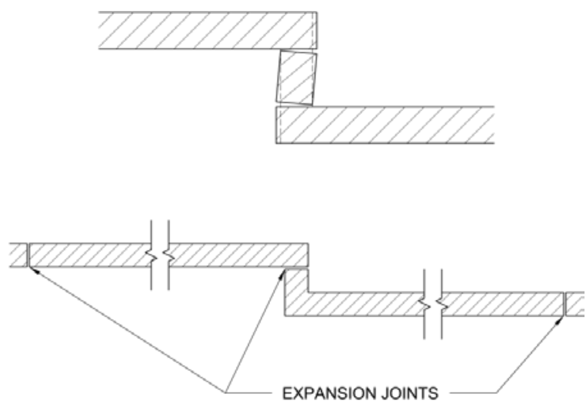

Figure 4

Wall Openings: More movement will tend to occur above and below openings due to the change in the wall's mass. The differential movement between areas of different wall mass may cause cracks to emanate from the corners of the openings. As these openings also tend to "weaken" the wall, they act as naturally occurring movement joints.

Junctions/Changes in Wall Height: Just as with wall openings, large variations in wall height should include a movement joint at the juncture to accommodate the differential movement tendencies of the two different wall masses.

Periodic Spacing within Continuous Lengths of Wall: Large expanses of thin adhered veneer will, by virtue of the aggregate sum of their individual dimensional changes, experience significant strain over the length of the wall. To alleviate this effect, continuous vertical movement joints should be incorporated along the length of the wall, generally at a spacing of between 20 - 25 feet (6 - 7.6 metres).

Changes in Building Materials: Different materials will react differently to the effects of thermal and moisture change. For example, aluminum frames and thin adhered veneer products will expand and contract at widely differing rates. The effects of such differential movement need to be accounted for and accommodated by the inclusion of a properly sized movement joint.

Horizontal Deflection Joints: Horizontal movement joints may be required where deflection joints are designed in the substrate (Figure 5). Differential movements of the veneer materials and the structural frame should both be considered.

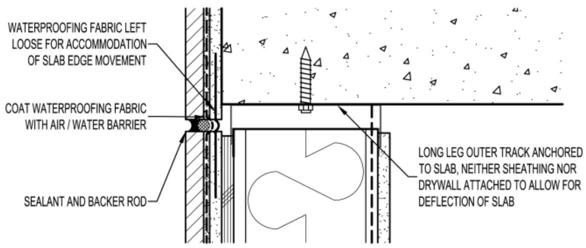

Figure 5

It is important that movement joints placed within veneer walls be continuous through all of the veneer materials. Movement joints should only terminate at an intersecting horizontal movement joint or the top or bottom of the wall.

Other Considerations Affecting Placement
Placement of movement joints may also be influenced by additional factors.

Parapets are exposed on three sides to extremes of moisture and temperature. This may cause substantially different movement from that of the wall below. Placing additional movement joints at these locations may be good practice.

Wherever spandrel wall sections are supported by a beam or floor slab, additional vertical movement joints may be required.

Allowance for differential movement between the building veneer and structural elements (such as steel beams, anchor points for signage, or utilities) should always be provided.

In certain circumstances, substrate choice may dictate the location of movement joints. Poured concrete or concrete masonry unit (CMU) substrates require control joint placement within the structural back-up. In such cases, movement joints within the thin adhered veneer must align with the substrate control joints (Figure 6).

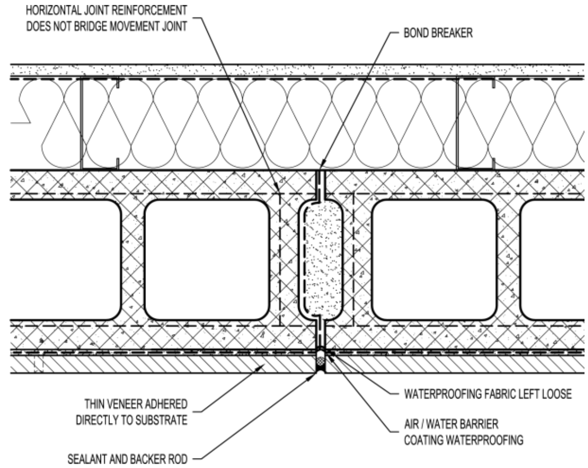

Figure 6

Aesthetic Considerations
Movement joint design and placement can impact the overall aesthetics of the building façade.

Following are considerations that can minimize their visual impact:

- Pigment vertical movement joints to match the color of the adjacent veneer units (Figure 7). When adjacent unit color changes up the height of the joint, change the sealant color to match (Figure 8).
- Pigment horizontal movement joints to match the color of the mortar joints.
- Silt the movement joint to create a mortar-like appearance (Figure 9).

Alternatively, movement joints may also be accentuated as part of the architectural design of the building face (Figures 10 and 11). Their placement in the wall can create symmetry (Figure 12) and create aesthetically pleasing façades.

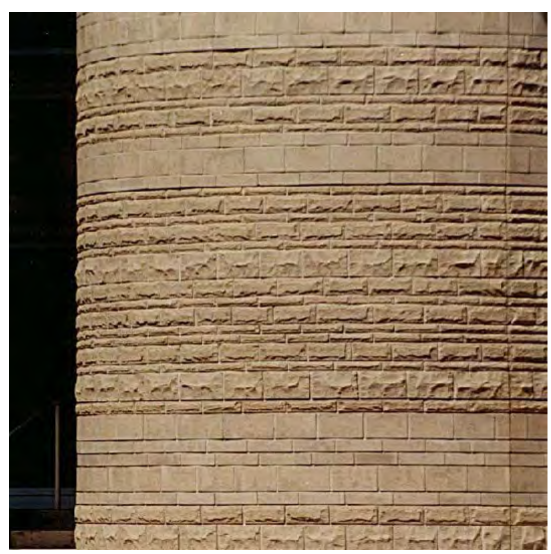

Figure 7: Sealant colored to match color of adjacent veneer units.

Figure 8: Change sealant color within the vertical joint to match changing unit colors up the height of the wall.

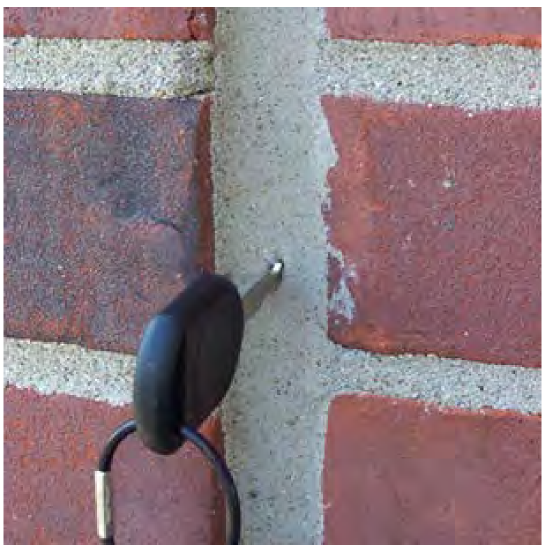

Figure 9: Silt the sealant surface to emulate mortar.

Figure 10: Movement joint placed at continuous notch in veneer.

Figure 11: Movement joint integrated into design.

Figure 12: Placement of movement joints creates wall symmetry.

Summary

This ARRISCRAFT•NOTE describes the different kinds of joints found in building construction and discusses the appropriate design and use of movement joints in thin adhered veneer construction.

Movement joints are used in thin adhered construction to allow for the differential movement generated by materials as they react to their own properties, environmental conditions and loads. In general, vertical movement joints should be used to break the thin adhered veneer into rectangular elements that have the same support conditions, the same climatic exposure and the same through-wall construction.

The information and suggestions contained herein are based upon the available data and information published by the listed references and the experience of Arriscraft architectural and engineering staff. More detailed information may be found by referring to any of the related references listed below.

The information contained herein must be used in conjunction with good technical judgment and a competent understanding of thin adhered veneer construction. Final decisions on the use of the information contained in this ARRISCRAFT•NOTE are not within the purview of Arriscraft and must rest with the project designer or owner, or both. It remains the sole responsibility of the designer to properly design the project, ensure all architectural and engineering principles are properly applied throughout, and ensure that any suggestions made by Arriscraft are appropriate in the instance and are properly incorporated through the project.

Related References

1. Brick Industry Association, Technical Notes on Brick construction 18, Volume Changes – Analysis and Effects of Movement, October 2006.
2. Brick Industry Association, Technical Notes on Brick Construction 18A, Accommodating Expansion of Brickwork, November 2006.
3. Canada Mortgage and Housing Corporation, Best Practice Guide, Brick Veneer Concrete Masonry Unit Backing, 1997.
4. Drysdale, Hamid, Baker; Masonry Structures – Behavior and Design – Second Edition, The Masonry Society, 1999.
5. Tile Council of North America, Inc., TCNA Handbook for Ceramic, Glass, and Stone Tile Installation, 2013.

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ARRISCRAFT•NOTE
MOVEMENT JOINTS FOR CLIPPED OR ANCHORED THIN VENEER

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Introduction
This ARRISCRAFT•NOTE discusses the proper placement and construction of movement joints in clipped or anchored thin quarried or manufactured calcium silicate unit veneer.

There are basically two distinct types of movement joints used in construction: *elastic* and *inelastic*. Both of these joint types are designed to perform a specific function, and they should not be used interchangeably.

Inelastic movement joints include *construction joints* and *control joints*.

- *Construction joints* are used wherever the construction work is to be interrupted. They are usually located where they will least impair the strength of the structure.
- *Control joints* are largely used in concrete unit masonry construction to create a plane of weakness. When used in conjunction with joint reinforcement, they control the location of cracks due to volume changes resulting from shrinkage and creep. They are not generally sufficient to accommodate net material expansion.

Elastic movement joints include *building expansion joints* and *expansion joints*.

- *Building expansion joints* are used to separate a building into discrete sections so that stresses developed in one section will not affect the integrity of the entire structure.
- *Expansion joints* are used mainly in clay brick, calcium silicate, or stone masonry construction. They are used to segment the veneer to prevent cracking due to changes in temperature, moisture expansion, elastic deformation due to loads, and creep. They may be horizontal or vertical.

It is the elastic-type movement joint that is most appropriate for use in a clipped or anchored thin veneer application, and requirements for this type of joint will form the basis of the following discussion.

Movement Joints in Clipped or Anchored Thin Veneer Applications
Movement joints can be constructed in a variety of different ways to fulfill these requirements. They may include waterstops and pre-moulded foam or neoprene pads as barriers to keep mortar or other debris from clogging the joint. These materials must be highly compressible and elastic in nature in order to accommodate the expansion and contraction of the veneer materials. As such, the use of fiberboard or other similar materials are not recommended for use in movement joints.

No solid materials should bridge the movement joint as they would restrict movement and not allow the movement joint to perform its intended function.

Materials for Movement Joints
A good quality backer rod and joint sealant should be used to seal the exterior of the movement joint against moisture and air penetration. The sealant material should be selected by the designer to be highly elastic, resistant to weathering and ultraviolet radiation, and compatible with the clipped or anchored thin veneer materials, including any adjacent materials such as flashing membranes or metal elements.

The size of the movement joint should be considered when selecting the type of joint sealant. The sealant must be able to span the joint and accommodate the anticipated movements of all materials. As a rule of thumb, joint sealants used in movement joints should typically have a width-to-depth ratio of 2:1 in order to ensure adequate protection against moisture and air penetration (Figure 1).

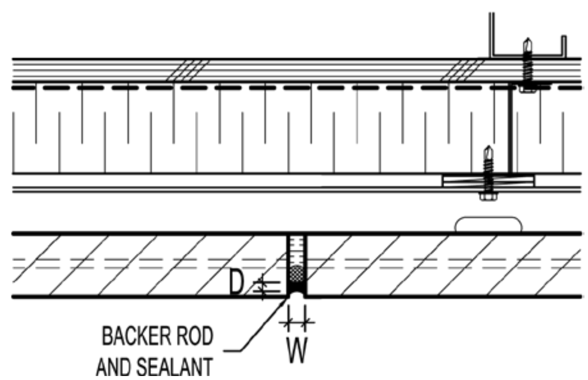

Figure 1

The inclusion of a good quality backer rod is important to proper joint design. The backer rod is used to:

- act as a bond breaker, forcing the sealant into two-point adhesion. It should be noted that sealant may fail prematurely when put into three-point adhesion as this subjects the sealant to shear stress in addition to tension/compression;
- achieve the required 2:1 width-to-depth ratio of the sealant; and
- provide a firm surface against which tooling can be done. Proper tooling optimizes the joint's weather resistance and ensures better adhesion of the sealant.

The backer rod allows the sealant to be tooled into an hourglass shape, providing maximum flexibility.

For further information refer to ARRISCRAFT•NOTE (Vol. IV, No. 4) Important Criteria for Sealant and Backer Rod Selection.

Sizing of Movement Joints
Vertical movement joint frequency and size should be designed to accommodate the anticipated movement of the veneer materials. The joints must be of sufficient size to contend with the anticipated movements, without being so large as to be difficult to weather-proof. Typically, joints sized to resemble a mortar joint will be adequate to accommodate the anticipated movements and still be easily sealed against the elements.

The design of horizontal movement joints depends largely upon the anticipated loads and resulting deflections which are expected to occur at their particular locations.

Placement of Movement Joints
When using a clipped or anchored thin veneer application there are two distinct installation types that may be used: open rainscreen and sealed rainscreen. The type of system used will determine the placement and frequency of movement joints.

A sealed rainscreen system consists of soft joints constructed in the horizontal and vertical joints between thin-clad veneer units. These soft joints would be constructed from a good quality backer rod and joint sealant, effectively creating movement joints at these locations. As a result, the only additional differential movement consideration that may arise would be at floor slab deflection joints. Horizontal movement joints should be placed at these locations (Figure 2).

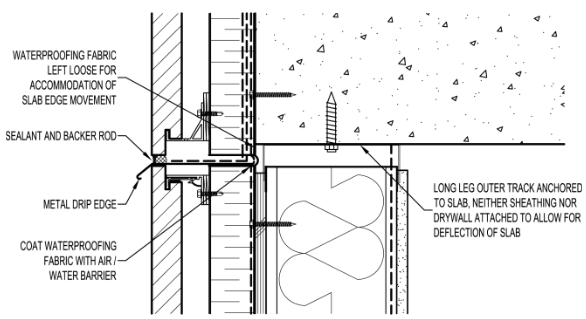

Figure 2

Open rainscreen systems using semi-rigid vertical water blockers require additional considerations for placement of movement joints. The actual location and frequency of movement joints in an open rainscreen system is dependent upon the configuration of the structure as well as the expected amount of movement dictated by micro-environmental factors. They need to be designed as part of the building envelope by the designer and their location and extent must be clearly indicated on the building elevations.

As a general rule of thumb, movement joints should be located at the following locations:

- at changes in wall direction, such as building corners;
- at wall openings, such as windows and doors;
- at changes in building height, such as building junctions;
- at major changes in thickness of wall, such as pilasters;
- at periodic lengths of continuous wall;
- at changes of building materials; and
- at horizontal deflection joints.

Corners: Walls perpendicular to one another will expand towards their juncture, typically causing distress at the first head joint on either side of the corner. Movement joints should be placed near corners to alleviate this stress (Figure 3).

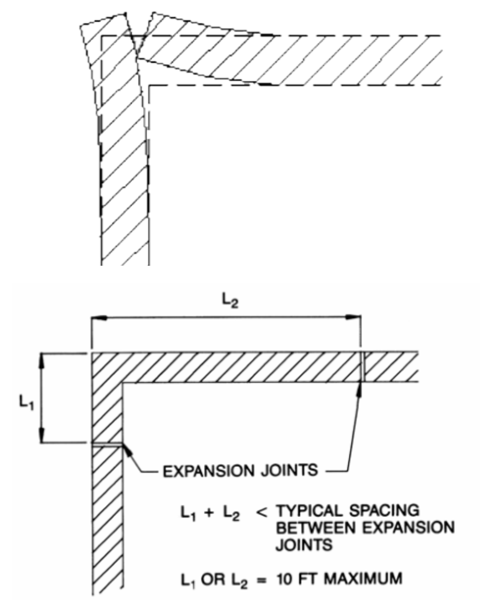

Figure 3

When corners are constructed with quirk mitered joints, a movement joint may be placed in the continuous vertical joint created by the miter (Figure 4).

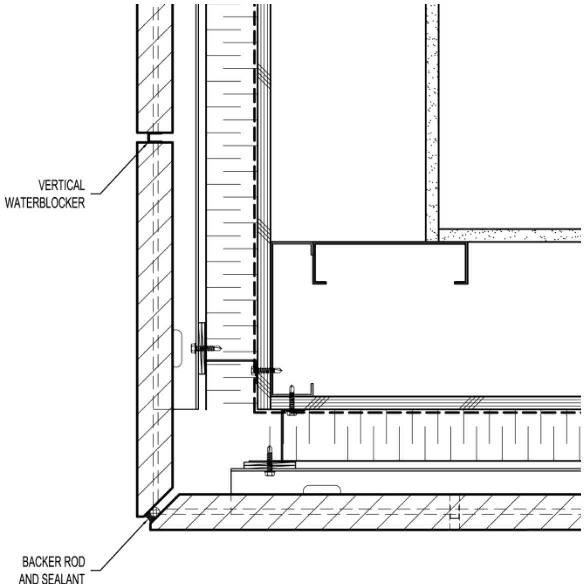

Figure 4

Intersections, Offsets and Setbacks: Parallel walls expand towards the offset, rotating the short clipped or anchored thin veneer leg or causing cracks within the offset. Movement joints should be placed at the offset to allow the parallel walls to expand (Figure 5). Intersecting walls not required to be bonded should also include a movement joint at the intersection.

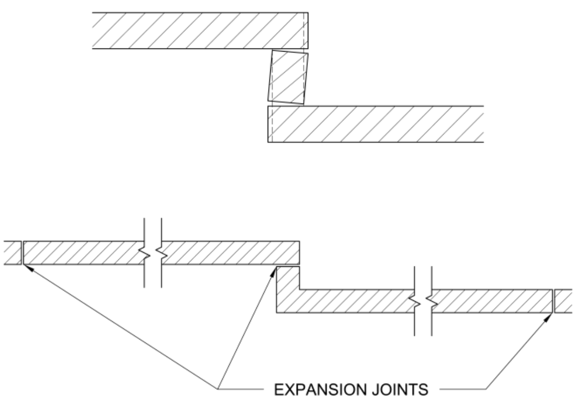

Figure 5

Wall Openings: More movement will tend to occur above and below openings due to the change in the wall's mass. The differential movement between areas of different wall mass may cause cracks to emanate from the corners of the openings. As these openings also tend to "weaken" the wall, they act as naturally occurring movement joints.

Junctions/Changes in Wall Height: Just as with wall openings, large variations in wall height should include a movement joint at the juncture to accommodate the differential movement tendencies of the two different wall masses.

Periodic Spacing within Continuous Lengths of Wall: Large expanses of clipped or anchored thin veneer will, by virtue of the aggregate sum of their individual dimensional changes, experience significant strain over the length of the wall. To alleviate this effect, continuous vertical movement joints should be incorporated along the length of the wall, generally at a spacing of between 20-25 feet (6-7.6 metres).

Changes in Building Materials: Different materials will react differently to the effects of thermal and moisture change. For example, curtain wall systems and clipped or anchored thin veneer systems expand and contract at differing rates. The effects of such differential movement need to be accounted for and accommodated by the inclusion of a properly sized movement joint.

It is important that movement joints placed within veneer walls be continuous through all of the veneer materials. Movement joints should only terminate at an intersecting horizontal movement joint or the top or bottom of the wall.

Other Considerations Affecting Placement

Placement of movement joints may also be influenced by additional factors.

Parapets are exposed on three sides to extremes of moisture and temperature. This may cause substantially different movement from that of the wall below. Placing additional movement joints at these locations may be good practice.

Wherever spandrel wall sections are supported by a beam or floor slab, additional vertical movement joints may be required.

Allowance for differential movement between the building veneer and structural elements (such as steel beams, anchor points for signage, or utilities) should always be provided.

Aesthetic Considerations

Movement joint design and placement can impact the overall aesthetics of the building façade.

Following are considerations that can minimize their visual impact:

- Pigment vertical movement joints to match the color of the adjacent veneer units (Figure 6). When adjacent unit color changes up the height of the joint, change the sealant color to match (Figure 7).
- Pigment horizontal movement joints to match the color of the mortar joints.
- Silt the movement joint to create a mortar-like appearance (Figure 8).

Alternatively, movement joints may also be accentuated as part of the architectural design of the building face (Figures 9 and 10). Their placement in the wall can create symmetry (Figure 11) and create aesthetically pleasing façades.

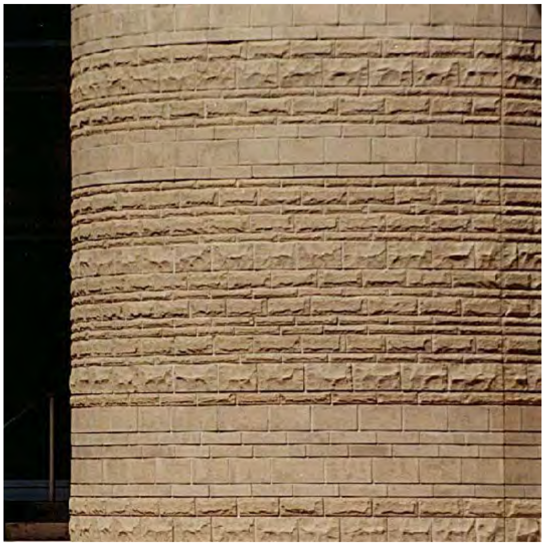

Figure 6: Sealant colored to match color of adjacent veneer units.

Figure 7: Change sealant color within the vertical joint to match changing unit colors up the height of the wall.

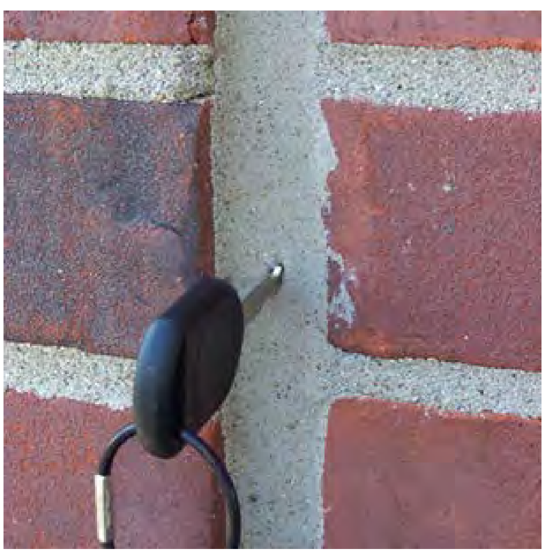

Figure 8: Silt the sealant surface to emulate mortar.

Figure 9: Movement joint placed at continuous notch in veneer.

Figure 10: Movement joint integrated into design.

Figure 11: Placement of movement joints creates wall symmetry.

Summary
This ARRISCRAFT•NOTE describes the different kinds of joints found in building construction and discusses the appropriate design and use of movement joints in clipped or anchored thin veneer construction.

Movement joints are used in clipped or anchored thin veneer construction to allow for the differential movement generated by materials as they react to their own properties, environmental conditions and loads. In general, vertical movement joints should be used to break the clipped or anchored thin veneer into rectangular elements that have the same support conditions, the same climatic exposure and the same through-wall construction.

The information and suggestions contained herein are based upon the available data and information published by the listed references and the experience of Arriscraft architectural and engineering staff. More detailed information may be found by referring to any of the related references listed below.

The information contained herein must be used in conjunction with good technical judgment and a competent understanding of curtain wall construction. Final decisions on the use of the information contained in this ARRISCRAFT•NOTE are not within the purview of Arriscraft and must rest with the project designer or owner, or both. It remains the sole responsibility of the designer to properly design the project, ensure all architectural and engineering principles are properly applied throughout, and ensure that any suggestions made by Arriscraft are appropriate in the instance and are properly incorporated through the project.

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2. Brick Industry Association, Technical Notes on Brick Construction 18A, Accommodating Expansion of Brickwork, November 2006.
3. Canada Mortgage and Housing Corporation, Best Practice Guide, Brick Veneer Concrete Masonry Unit Backing, 1997.
4. Drysdale, Hamid, Baker; Masonry Structures – Behavior and Design – Second Edition, The Masonry Society, 1999.
5. Ontario Masonry Industry Promotion Fund, 4C 8202, Movement Control, February 1982.
6. Ontario Masonry Industry Promotion Fund, 4C 8504, Restraints and Movements in Masonry Walls, April 1985.
7. TCNA Handbook for Ceramic, Glass, and Stone Tile Installation, 2013.

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Introduction

This ARRISCRAFT•NOTE discusses the important criteria to consider when selecting sealant and backer rod materials for use with masonry veneer applications.

A good quality backer rod and joint sealant should be used to seal the exterior of movement joints against moisture and air penetration. The sealant material should be selected by the designer to be highly compressible, resistant to weathering and ultraviolet radiation, and compatible with the veneer materials, including any adjacent materials such as flashing membranes or metal elements. The appropriate backer rod material should be selected for compatibility with the sealant.

The sealant must be able to span the joint width and accommodate the anticipated movements. As a rule of thumb, sealants used in movement joints should have a width-to-depth ratio of 2:1 in order to ensure adequate protection against moisture and air penetration (Figure 1).

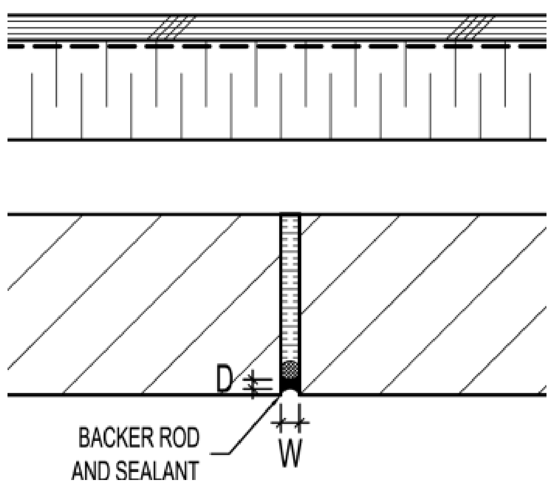

Figure 1

Sealant Materials

Sealant materials used for expansion joints can generally be separated into two distinct categories: *organic* and *inorganic*. The difference in the two categories lies in their chemical makeup and the backbone polymers used as the building block for an elastomer sealant.

Organic sealants consist of polymers made of organic Carbon and Oxygen molecules. Organic sealants can be further divided into several types such as butyl rubbers, polysulfides, and polyurethanes.

Butyl rubber sealants have good water resistance and low moisture vapor permeability, however they also offer relatively low movement capability, sensitivity to temperature, hardening, and high stain potential.

Polysulfides provide better movement capabilities than butyls, resist weathering and aging better, and provide good adhesion to nonporous surfaces such as glazing. When applied to porous surfaces a primer is typically required to provide proper adhesion.

Polyurethane sealants provide a watertight bond with most materials, often without the use of a primer, and possess a high elasticity to allow for movement of up to 50% of the joint width. Urethanes, like all organic sealants, tend to deteriorate more quickly than silicones with time and exposure to UV, resulting in drying, cracking and loss of elasticity.

Inorganic sealants consist of silicone polymers as the main building block for the resulting sealant elastomer. These polymers contain Silicon and Oxygen molecules. Inorganic sealants used in expansion joints for masonry construction are typically silicone sealants.

Silicone sealants provide a durable, long lasting joint seal that withstands the effects of sunlight, inclement weather, temperature extremes, and dynamic movement conditions. These benefits are derived from the material's chemical makeup. The superior weathering characteristics are a result of their UV resistance and low shrinkage. They remain flexible and durable over a wide range of service temperatures. Silicone sealants may or may not require the use of a primer to ensure adequate bond to adjacent surfaces.

Another item to consider is staining as a result of the silicone. Testing should be considered with quarried stones and many masonry units, as plasticizer and oil migration from silicone sealants have been known to stain adjacent surfaces. Some 'non-staining' formulations are now available.

Silicones are available in either acetoxy (acid-cure) or neutral-cure formulations. Acetoxy (short for acetyl-oxy) silicones release acetic acid while curing, whereas neutral-cure silicones release methanol. Acetic acid can prove detrimental to substrates such as metals, concrete and many types of masonry units, including calcium silicate masonry units.

Classification of Sealants

Both organic and inorganic sealants contain several classifications to further differentiate their performance and applicability. Sealant materials for veneer applications are tested and classified in accordance with ASTM C920, *Standard Specification for Elastomeric Joint Sealants*.

ASTM C920 designates sealants by Type, Grade, Class, and Use. These classifications detail how and where sealants should be applied.

Type: Type ***S*** sealants are *single-component* and require no jobsite mixing prior to installing. Single-component sealants cure when they react with moisture from the air. They are limited to a maximum depth of ½", while maintaining the 2:1 width-to-depth ratio discussed above. If the sealed joint is to be covered with a membrane or coating shortly after installation, it will not be able to cure.

Type ***M*** sealants are *multi-component* and require the mixing of materials together to allow chemically induced curing. One of the materials is a curing agent or catalyst. This allows them to be coated almost immediately after installation if desired. Multi-component sealants cure faster than single-component sealants and allow for more variety in colour choice as dyes or pigments may be added during the mixing process.

Grade: Grade ***P*** sealants are *pourable*, or self-leveling. This property makes them well-suited for use in horizontal applications.

Grade ***NS*** (*nonsag)*, or gunnable, sealants are ideal for vertical applications as the sealant will not move out of place once set.

Class: A sealant's Class defines its movement potential. The Class is listed as a number which indicates the percentage of movement (either contraction or expansion) the sealant can handle relative to the original joint width. A smaller Class number is associated with a sealant that is used for non- or minimal-movement type joints. Class 100/50 indicates a sealant capable of handling movements of 100% expansion and 50% contraction.

Use (related to exposure): The Use classification defines the applications that the sealant may be used in. Sealants with a Use factor of ***T*** are suitable for joints subjected to vehicular or pedestrian *traffic*, while Use factor ***NT*** sealants are classed as *non-traffic*. Non-traffic sealants are primarily used in walls, or around windows. Use factor ***I***, or *immersible* sealants, are designed for use in areas subject to water immersion.

Use (related to material): Use classifications also define what adjacent materials the product is suitable to be used with. ***M***, ***G***, and ***A*** Uses refer to *mortar*, *glass*, and *aluminum*, respectively. Sealants with Use factors of ***O*** are for use with all *other* materials than those previously listed.

Sealants can be (and often are) classified by more than one Use. For example, a sealant may be listed as Use NT, M, G, and A.

Masonry veneer, thin adhered veneer, and clipped or anchored veneer applications require appropriate selection of a sealant to ensure that any movement joints or other gaps in the wall remain weather-resistant. Silicone sealants, with their ability to accommodate high movement are the ideal choice for exterior applications with unit masonry and thin clad systems. Sealants should ideally conform to ASTM C920, Type S, Grade NS, Class 25 or 50, and Use M classifications.

Two such products that perform ably as expansion joint sealants are LATICRETE® MVIS Silicone Sealant™ and *Dow Corning*® 790 Silicone Building Sealant. Both products are high performance, single-component, neutral-cure, 100% silicone sealants. These products conform to the aforementioned properties under ASTM C920, making them well-suited for use with both full-bed and thin-adhered veneer expansion joint applications.

Sealant manufacturers should always be consulted for the applicability of their sealants for expansion joint applications.

Backer Rods
The inclusion of a good quality backer rod is important to proper joint design. The role of a backer rod is to:

- Act as a bond breaker, forcing the sealant into two-point adhesion. It should be noted that sealant may fail prematurely when put into three-point adhesion as this subjects the sealant to shear stress in addition to tension/compression;
- Achieve the required 2:1 width-to-depth ratio of the sealant; and
- Provide a firm surface against which tooling can be done. Proper tooling optimizes the joint's weather resistance and ensures better adhesion of the sealant. The backer rod allows the sealant to be tooled into an hourglass shape, providing maximum flexibility.

Backer rod materials are classified in accordance with ASTM C1330, *Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants*, into three types: type C - closed cell material, typo O – open cell material and type B – bi-cellular material.

Closed-cell backer rods possess very good water resistance properties and provide better insulation properties than other backer rod types. Single-component sealants that cure by reacting with moisture in the air should not be used with closed-cell backer rods. Closed-cell backer rods will not allow air in from the back of the sealant bead, retarding the curing process. Closed-cell rods are manufactured by injecting gas into an extruded plastic tube. Any punctures in the rod will lead to outgassing and result in a loss of the backer rod's rigidity and round shape. This may inhibit the flexibility of the sealant. Closed-cell backer rods are not recommended in applications where they may be compressed by more than 25% of their diameter.

Open-cell backer rods tend to be more flexible than closed-cell rods and may be compressed up to 75% of their diameter. This may mean that fewer sizes of backer rods will be required throughout a singular project. Open-cell rods do tend to absorb moisture which reduces their water resistance.

Bi-cellular backer rods: Bi-cellular backer rod materials take advantage of the positive properties of both open- and closed-cell backer rods. They are soft and pliable like open-cell rods, but contain a moisture-resistant outer plastic coating similar to a closed-cell rod. They do not contain any gases so unlike a closed-cell backer rod they will not outgas if punctured.

The appropriate type of backer rod will depend largely on the specified sealant. Compatibility characteristics between sealants and backer rods should be tested by ASTM C1087, *Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems*.

It should be noted that bond breaker tapes are also available for use with joint sealants. These tapes serve the first function of a backer rod by limiting the sealant to two-point adhesion. However, because they lack the form of a backer rod and are unable to assist in the tooling and shaping of the sealant, use of bond breaker tapes is only advised in applications where it is impractical to use a backer rod.

When using the recommended LATICRETE® MVIS Silicone Sealant™ or *Dow Corning®* 790 Silicone Building Sealant, open-cell backer rods are recommended.

Summary
This ARRISCRAFT•NOTE describes the different types of joint sealant and backer rods and discusses their appropriate design and use in veneer applications.

Sealants are used to resist moisture and air penetration in gaps or openings of veneer walls. Backer rods are used in conjunction with the sealant to ensure proper form and tooling of the joint.

The information and suggestions contained herein are based upon the available data and information published by the listed references and the experience of Arriscraft architectural and engineering staff. More detailed information may be found by referring to any of the related references listed below.

The information contained herein must be used in conjunction with good technical judgment and a competent understanding of masonry construction. Final decisions on the use of the information contained in this ARRISCRAFT•NOTE are not within the purview of Arriscraft and must rest with the project designer or owner, or both. It remains the sole responsibility of the designer to properly design the project, ensure all architectural and engineering principles are properly applied throughout, and ensure that any suggestions made by Arriscraft are appropriate in the instance and are properly incorporated through the project.

Related References

1. Gibb, J.F., Hidden, but Essential – A Technical Review of Backer Rods, The Construction Specifier, March 1980.
2. Brick Industry Association, Technical Notes on Brick Construction 18A, Accommodating Expansion of Brickwork, November 2006.
3. American Society for Testing and Materials, ASTM C920-14, Standard Specification for Elastomeric Joint Sealants.
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5. Marble Institute of America, Technical Bulletin Volume V, Issue II, Joint Sealants: Products & Application for the Natural Stone Industry, May 2010

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