TECHNICAL BULLETIN

Best Practices: Metal Building Sealant Types and Application Guidelines

Overview

This document is an overview of the sealant types commonly used in metal building including general guidelines application. The intent is to highlight standardized testing used to compare the performance of various sealant products so the end user can make an informed decision on the correct product for a specific application. Finally, the benefits, features, and limitations of each sealant is presented to provide as a quick reference for roofing professionals, procurement departments, consultants and building owners.

Discussion

In 2013, MCA published the "Service Life Assessment of Low-Slope Unpainted 55% AlZn Alloy Coated Steel Standing Seam Metal Roof Systems". One key important conclusion from this research was that butyl sealants are a deciding factor in the end-of-life for metal roof systems decision.

"Butyl sealant life will be the deciding factor in establishing end-of-life for these roof systems."

Butyl sealants have shown no significant deterioration in cohesive tensile strength or cone penetration values after up to 35 years of performance at laps and joints. Even where some degree of de-polymerization was noted on 26 to 35-year-old roofs, actual sealant performance was judged to be entirely adequate and without issue.

"Accordingly, sealant service life is conservatively projected at 60 years."

Butyl sealants are crucial in determining end-of-life for metal roofs primarily due to the impracticality of replacing or repairing substandard sealants. In the process of repairing a metal roof, panels may often be damaged to the point of requiring replacement if the butyl sealants do not perform.

Although the service life study was focused on a single type of sealant used in metal construction, these same consequences can easily be applied to other sealants.

Any sealant used in latent metal construction details should be intended for long life as it is not easily repaired or replaced without potential damage to panels or other parts. Such details should accommodate expected movement through the design of the joint itself, not purely by sealant deformation.

Sealants are a minor component in the initial cost of metal construction, however improper selection and/or application can add significant cost or compromise performance in repair or replacement work if proper installation steps are not taken.

When comparing manufacturer data to determine the fitness of a particular sealant type, it is best to use test results related to standardized test methods. Companies often list proprietary test data which makes comparison to other sealants difficult at best. Internationally recognized standards such as ASTM, UL, and AAMA must be used for comparison as these standards are a) consistent between testing locations and b) generally require 3rd party independent laboratory testing. In addition, there are often regional and local test standards that must be completed to show the sealant materials meets the project performance requirements.

Finally, it is always recommended that a sealant manufacturer with an established history of supplying to the metal construction industry be used to avoid unexpected performance issues.

General Guidelines

The most common sealant types used in metal construction are butyl, polyurethane, and silicone. The most important best practice guidelines, regardless of the sealant type include:

1. Clean Surface for Adhesion – Lubricants are often used during the manufacturing process for many construction materials and residue from these lubricants can remain on materials shipped to the jobsite. It is necessary to clean away any residue or other foreign objects, like dust and debris, present on the materials intended to receive the sealant. It may even be necessary to use some manufacturer allowed solvents to remove any lubricant residue or foreign materials. Reference the material manufacturer, adhesive manufacturer, and any finish guidelines to determine the recommended products for this type of cleanup. It is critical that the cleaning process does not compromise any material or finish warranty and that any product used to clean the panel is able to be completely removed prior to the sealant application.
2. Dry and Condition Materials to Promote Adhesion – Sealants require a dry surface to adhere according to the manufacturer's performance expectations. If moisture is introduced prior to or during the adhesive application process, the moisture may not evaporate. Even a small amount of moisture could compromise the performance of the sealant over the life of the material joint. Trapped condensation can also lead to mold and mildew that may further compromise any sealant over time. Inspecting surfaces for moisture (liquid or frozen) and making sure that surfaces are thoroughly dry before sealant application is critical. Further information regarding humidity, dew point, and condensation can be found at: http://www.mbma.com/media/10.01.01Condensation.pdf.
3. Sealant Application on Site – Unless otherwise recommended by the substrate or sealant manufacturer, sealants should be applied at the building construction site where possible. Although it may seem to be time saving to pre-apply or batch apply sealants, this can lead to many problems including deformed, damaged, or contaminated sealants. Sealants are best applied at the moment required to continue construction. Exception: Some manufacturers pre-apply sealants to substrates at the time of production. These joint designs are designed and engineered for this type or pre-application with steps taken during fabrication to ensure compliance with manufacturer recommendations.
4. More is Not Always Better – Connection and expansion joints are designed to meet the needs of construction. Although it may appear harmless to add more sealant than required, this can cause issues of separation and buckling of the materials being joined long after the sealant installation. This may lead to the opposite effect from what is intended. Manufacturer instructions must be closely followed.
5. Right Sealant for the Right Application – Many sealant application locations are designed to meet specific construction requirements. Thermal movement, expansion and contraction, and weathering requirements are the most common reasons for the use of substrate compatible sealants. There are specific instances where non-compatibility of substrates can lead to corrosion. Always determine if the sealant chosen will perform as required through reference to literature and field testing. Most metal roof manufacturers provide a list of approved sealants and it is imperative to follow these recommendations. If a different sealant than what is recommended is planned for use, it is best to get approval from the metal roof manufacturer to avoid joint failure or compromise of the product warranty.

METAL CONSTRUCTION ASSOCIATION
8735 W. Higgins Road, Suite 300, Chicago, IL 60631
847.375.4718 | mca@metalconstruction.org | www.metalconstruction.org

BUILD LEGACIES METAL

6. Published elongation characteristics of any sealant are in ratio to joint dimension. In lap joints of sheet metal, the joint dimension is zero. (zero x 300% = zero) If differential movement is experienced between such joint components, the sealant is placed in shear rather than elongation.

Industry References:

- ASTM C1193 Standard Guide for Use of Joint Sealants
- SWR Institute, Technical Bulletin 7, "Liquid Sealant Types and Uses"

Sealant Specifics

Following is a list of common sealant types found in metal construction with highlights of product strengths and warnings of potential causes of performance problems.

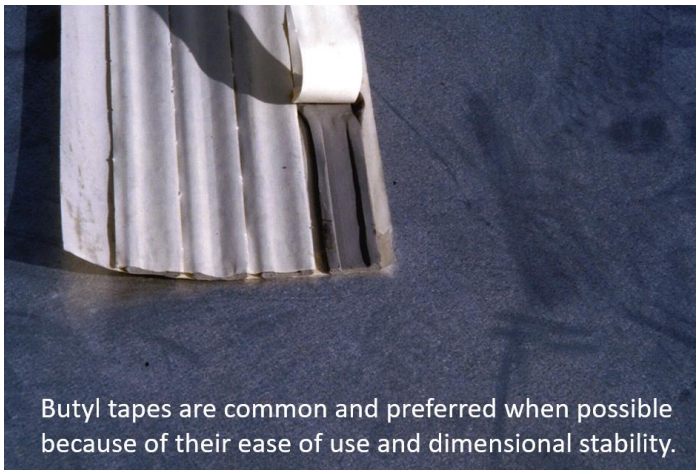
BUTYL

Highlights:

- Works well with a wide variety of substrates
- Generally non-curing, non-skinning, and will typically remain flexible and tacky for the life of the product
- Wide temperature use range: - 40°F to + 200°F
- Low VOC
- Available in both pumpable (tube) grades and tape formulations which may be used in combination.
- Life Expectancy 25+ years (according to manufacturers) Aged inspections indicate much longer service lives when unexposed within a lap joint.

Warnings:

- Non-skinning butyl sealants are not topical sealants. A small exposure at the end of a lap or penetration cover is acceptable, however butyl sealants should not be used in a way that exposes the bulk of the mastic to prolonged sunlight (UV). UV exposure will degrade the sealant over time leading to possible joint failure.
- When used within typical flashing or panel lap joints, differential longitudinal movement of joint components must be accommodated by the design of the joint, not deformation of the sealant itself.



Butyl tapes are common and preferred when possible because of their ease of use and dimensional stability.

- Tape sizes are chosen based on the construction situation and specific tolerances. Over-tightening fasteners can cause butyl tapes to over compress and compromise the desired seal.
- Butyl sealants become softer in excessive heat and harder in extreme cold. This makes the application of butyl sealants more critical due to the small width tapes that can deform when being removed from the paper liner and applied. Common practice is to moderate the temperature of butyls prior to application. Follow the manufacturer application temperature guidelines in order to ensure a quality application and proper seal.
- Non-skinning butyl sealants should not be painted. Painting a butyl sealant will create a skin and prevent the tape from remaining elastic over time.

Standardized Tests for Comparisons

- **ASTM C765** Standard Test Method for Low-Temperature Flexibility of Preformed Tape Sealants
- **ASTM C771** Standard Test Method for Weight Loss After Heat Aging of Preformed Tape Sealants
- **ASTM C782** Standard Test Method for Softness of Preformed Tape Sealants
- **ASTM C907** Standard Test Method for Tensile Adhesive Strength of Preformed Tape Sealants by Disk Method
- **ASTM C908** Standard Test Method for Yield Strength of Preformed Tape Sealants
- **EPA METHOD 24** Determination of Volatile Matter

METAL CONSTRUCTION ASSOCIATION
8735 W. Higgins Road, Suite 300, Chicago, IL 60631
847.375.4718 | mca@metalconstruction.org | www.metalconstruction.org

POLYURETHANE

Highlights:

- Excellent joint movement properties with elongation properties reaching as high as 600%
- Most polyurethanes are paintable or purchased in a wide range of standard colors
- Wide temperature use range: - 40°F to + 200°F
- Excellent UV resistance
- Life expectancy: A minimum of 10 – 15 years and in some cases more than 20 years (according to manufacturers)
  Generally compatible with butyl

Warnings:

- Use only polyurethane sealants that are designed specifically for metal and confirmed not to initiate or accelerate the corrosion process.
- Some metal coatings may require a pretreatment or primer prior to sealant application to promote adhesion or avoid damage to the metal coating. Always confirm compatibility with the sealant manufacturer.
- Allow product to cure prior to applying other sealants in the vicinity to avoid a negative chemical reaction during the curing process.

Standardized Tests for Comparisons

- **ASTM C794** Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants
- **ASTM D412** Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers – Tension
- **ASTM C639** Standard Test Method for Rheological (Flow) Properties of Elastomeric Sealants
- **ASTM D3278** Standard Test Methods for Flash Point of Liquids by Small Scale Closed-Cup Apparatus
- **AAMA 800** Sealants Manual
- **EPA METHOD 24** Determination of Volatile Matter

SILICONE

Highlights:

- Adhesion to a wide variety of substrates and finishes
- Joint movement properties with elongation properties reaching +100/-50%. Pre-cured silicone membrane movement can exceed 200%
- Wide temperature use range: - 40°F to + 400°F
- Low VOC
- Life Expectancy: More than 20 years (consult sealant manufacturers for specific information)

Warnings:

- Use only silicone sealants designed for metal construction with neutral cure. Some Room Temperature Vulcanizing (RTV) silicone sealants contain Acetic Acid which will cause bare metals such as Galvalume and Galvalume Plus to rust.
- Some metal coatings may require a pretreatment or primer prior to sealant application. Always confirm compatibility with the sealant manufacturer.
- Most silicone sealants are non-paintable.
- Allow product to cure prior to applying other sealants in the vicinity to avoid a negative chemical reaction during the curing process.
- Silicone sealants may stain some surfaces due to leaching over time. Check with the sealant manufacturer for specific application information.
- Generally, NOT compatible with butyl.

Standardized Tests for Comparisons

- **ASTM D412** Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers – Tension

METAL CONSTRUCTION ASSOCIATION
8735 W. Higgins Road, Suite 300, Chicago, IL 60631
847.375.4718 | mca@metalconstruction.org | www.metalconstruction.org

BUILD LEGACIES METAL

- **ASTM C794** Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants
- **ASTM C639** Standard Test Method for Rheological (Flow) Properties of Elastomeric Sealants
- **ASTM D624** Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
- **ASTM C920** Standard Specification for Elastomeric Joint Sealants

Summary

With many sealant choices available, the metal panel or building manufacturer and finish supplier recommendations should take precedent in selection of the best sealant for any application. If there is limited availability of the recommended sealant brand or no specific brand is recommended, the end user should compare standardized test results to determine the most appropriate sealant. Sealants are a small cost in relation to other components on a building, however proper selection and application is critical to enable long service life on any metal roof or wall component in a building.

Founded in 1983, the Metal Construction Association brings together the diverse metal construction industry for the purpose of expanding the use of all metals used in construction. MCA promotes the benefits of metal in construction through:

- Technical guidance
- Product certification
- Educational and awareness programs
- Advocating for the interests of our industry
- Recognition of industry-achievement awards
- Monitoring of industry issues, such as codes and standards
- Research to develop improved metal construction products
- Promotional and marketing support for the metal construction industry
- Publications to promote use of metal wall and roof products in construction

For more information, please visit the MCA Web site at www.metalconstruction.org

© 06/2020

METAL CONSTRUCTION ASSOCIATION
8735 W. Higgins Road, Suite 300, Chicago, IL 60631
847.375.4718 | mca@metalconstruction.org | www.metalconstruction.org

BUILD LEGACIES METAL