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**Caulks And
Sealants Guide**

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1. INTRODUCTION

Sealing cracks and joints is an important preparation step. Moisture trapped in building materials can cause failure of both materials and coatings. Buildings heat loss can occur when construction joints are sealed poorly. Moisture damage can take place when water enter the building through joints and cracks.

Caulks and sealants are applied to help in preventing these problems. Caulks and sealants conform to add shaped openings and create moisture resistant barrier. They can be applied on interior or exterior surfaces to provide smooth, continuous surface for coating application.

Caulks are applied to construction joints which have little or no movement. Sealants are elastic compounds used in joints which may have movement.

Expansion and contraction of building materials can cause joint movement due to temperature changes, impact and vibrations.



Stadiums



Water Treatment Plants



Pedestrian Structures

2. Types Of Caulks & Sealants

2.1 Caulks

They are used to seal joints that have a little or no movement. They are used on back-to-back angles, skip welding, laps and seams.

The most common types of caulking materials are:

2.1.1 Oil-Based Caulks:

Oil-based caulks dry slowly. They exposed caulk surface hardens, but the center remains soft and tacky. They are inexpensive but must be reapplied every one or two years.

2.1.2 Butyl Rubber Caulks:

They last longer than oil-based caulks. When cured they became springy but tough. They are used to seal point subjected to mild shocks or little movement, around doors and windows and on masonry and metal joints.



2.1.3 Acrylic Latex Caulks:

They are lasting from 5-10 years. They are odorless, mildew-resistant and flow well. Acrylic latex caulks set quickly. They can be used on damp substrates because they are water-based. They can be over coated. They can be applied on wood, metal, concrete and tiles.



2.2 Sealants

They are used when there is movement in the construction joints caused by vibration, impact or temperature changes.

There are two basic types of sealants elastomers and chemical cured sealants.

2.2.1 Elastomers:

Elastomer is a natural or synthetic rubber-like material. They can be resistant to oil, heat, chemicals and ozone. They are flexible, low in cost, have a high shrinkage and poor stretch recovery.

They are used on joints with up to 10% expected movement such as doors and windows.

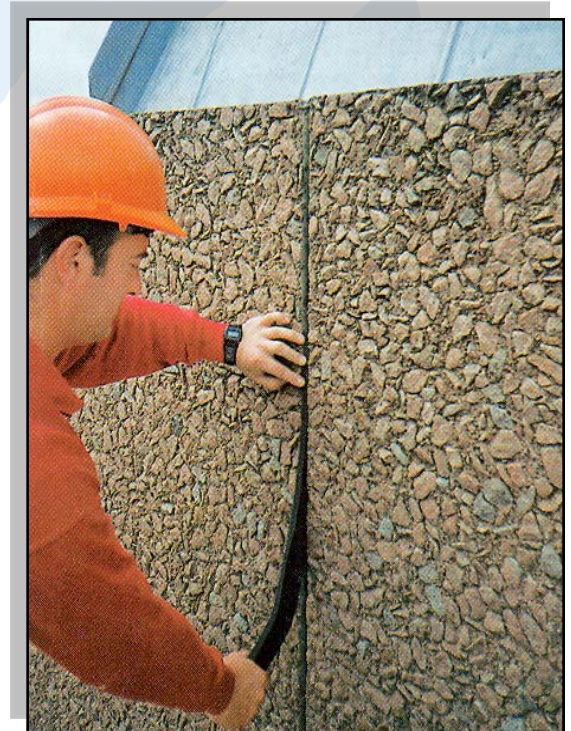
They cure when solvent released. Typical types of elastomers are butyl rubber and acrylics.

2.2.1.1 Butyl Rubber Sealant:

They set by solvent release. They stay soft and flexible for ten years.

They adhere well over a wide range of temperature.

They have excellent weather resistance, UV-light resistance, short tack-free time and paint-ability.



2.2.1.2 Acrylic Sealants:

They adhere well to unprimed surfaces. They last for 20 years and remain flexible. They are non-staining. But they also have some disadvantages as strong odor, soft setting, and it can't resist permanent water exposure.

2.2.2 Chemical Cured Sealants:

Chemical cured sealants use the moisture to chemically cure. Common types of this sealant are the following:

2.2.2.1 Polyurethanes:

They are superior sealants used on parking lots, decks, side walks and terraces. They allow 25% movement. They characterized with excellent weather resistance, strength and good adhesion. They adhere to most surfaces as glass, masonry, plastics and marble. They last for 20 years. Primes may be needed for polyurethane application.



2.2.2.2 Poly Sulphides:

They can be one or two component material. One component type is used for movement up to 35%. The maximum joint dimensions are (d x w) as ($\frac{1}{2}$ " x $\frac{3}{4}$ "). They are flexible, resistant to weather and water.

They have a wide application temperature range. Two component poly sulphide can seal joint (w x d) as ($\frac{3}{4}$ " x $\frac{3}{4}$ ") and permit up to 50% joint movement. They adhere well to most substrates. They always need primers for application.

2.2.2.3 Silicons:

Silicon sealants are weather resistant, flexible and become tack free within one hour. They can last for 20 years. They are unaffected by temperature variations. They are used on joints with up to 25% movement. They adhere well to most surfaces including aluminum and glass.



3. Properties Of Caulks & Sealants

There are different kinds of caulks and sealants with different properties. These properties determine the proper caulk or sealant for a specific job.

3.1 Base:

Caulks have an oil or resin base. Oil-based caulks dry slowly, remain soft and are less durable comparing to resin-based type which have a longer life, dry quickly and are easy to clean.

3.2 Solid Content:

It represents the percentage of solid particles in the base. Solids include fillers such as mica, clays & talc. The solid content is given by a percent by weight. A lower solid content means a thinner caulks with great shrinkage.

3.3 Shrinkage:

It is how much the caulks shrink after application. Low shrinkage is desired, especially for exterior use. Too much shrinkage can cause cracking.

3.4 Elongation:

It is how far the cured caulk can stretch before it breaks. If the length is doubled, the elongation is 100%.

3.5 Flexibility:

It is the measure of its ability to withstand movement and maintain its sealing quality.

3.6 Cohesion Strength:

It is the ability of material to stick to itself. It is important for good weather resistance.

3.7 Adhesion Strength:

It is the ability of the caulk to adhere well to the surfaces to which it is applied.

Good adhesion is necessary. Loss of adhesion can occur due to high humidity, improper surface preparation or use of wrong types of caulks.

3.8 Paintability:

They vary in their ability to accept paint. Acrylics have excellent paintability. Poor paint ability causes a paint peeling. Colored caulks can be used with color match the painted surface.

3.9 Colours:

Caulks can be produced in a wide variety of colours. Also they are available in clear. Colours can be added to caulks for the purpose of matching the paint colour.

3.10 Tack-Free Time:

It is the time when the caulk is firm enough to be painted or finished.

3.11 Drying Time:

It is the time of how long it takes for an oil or resin-based caulk to hardens or set on the exterior.

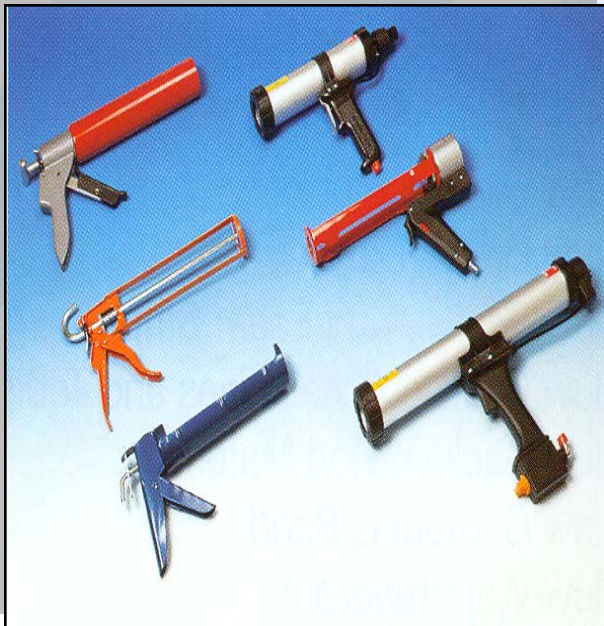
3.12 Cure Time:

It is how long it takes for caulks or sealants to completely harden.

4. Tools & Equipment

Tools and equipment vary according to the type and size of job. For a small job, a hand caulking guns are used. These guns can handle a 300 mls. or more.

For large job, commercial equipment are available, as air or pressure operated flow guns. Air operated pail pumps are used to hold and supply amounts of caulks. Other equipment includes knives are to be used according to job size & cost effectiveness.



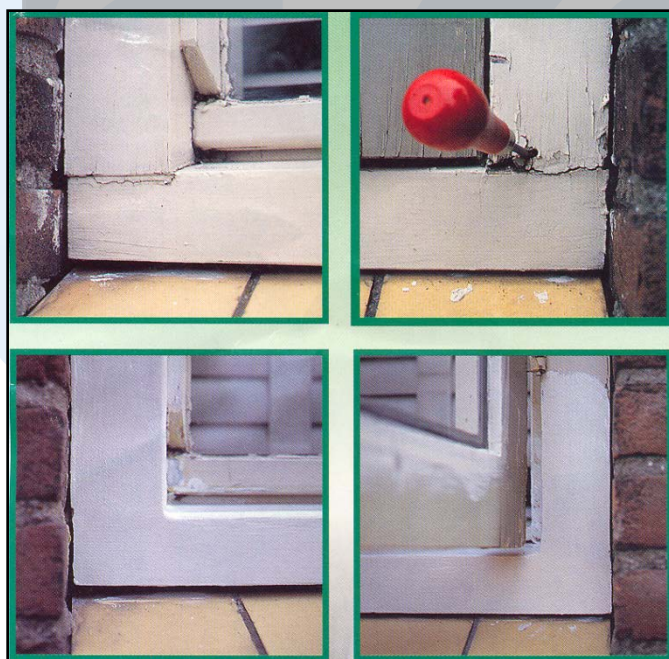
5. Application

Application of caulks and sealants requires reading the instructions carefully, precautions including joint cleaning and priming also information on application temperatures, pot life and coverage application rates.

5.1 Surface Preparation:

All joint surfaces must be prepared before joint sealing. All foreign materials, old caulks and sealants, grease & oil must be removed. Use wire brushes, hand tools, power tools or abrasive blasting for surface preparation. On previously sealed surfaces, old sealing materials must be removed.

Conservation /
sealing of open
joints.



Conservation
/ repair of
decayed
wood.

5.2 Priming & Joint Sealing:

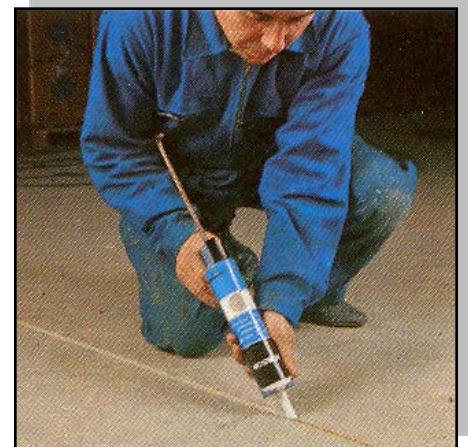
Porous surfaces usually require priming. Primers vary according to variety of caulks and sealants. The primed surfaces should be allowed to dry thoroughly before joint sealing.

Bond breaker tapes are used to keep the sealant from sticking into the back of the joint. They allow sealant to move with the joint. Bond breaker is made of polyethylene or similar materials.

Elastomeric materials do not adhere to these materials. The right width and depth of bond breaker should be checked according to joint dimensions.

Backer rod is a polystyrene foam. It provides a backing so that the material will not flow through the joint. To use a caulking gun:

- Insert the cartridge into the caulking gun.
- Cut the cartridge nozzle close to the tip.
- Leave an opening slightly larger than the joint opening.
- Puncture the tube seal with a long nail.
- Place the tip of the caulk cartridge in the joint.
- Apply a gun pressure to the cartridge by pushing the plunger handle against the tube and rotating it 90°.
- Squeeze the gun trigger until a caulk protrudes.
- Draw a continuous smooth bead along the joint.
- Stop the flow of the caulk by relieve the gun pressure.
- Use a rounded knife or similar tool to work the caulk into the joint.
- Smooth the caulk into the joint.



6. Safety

It is important to apply all safety precautions to handling and application. Adequate lighting is essential. If ladders, scaffolding staging are to be used, all equipment must be safe.

Proper ventilation is needed especially with materials contain toxic compounds or fumes which may cause lung and eye irritation. Avoid eye and skin contact with solvent-based sealants. Wear gloves and eye protection. Disposable clothes are sometimes recommended.



You may use disposable clothes.



Wear goggles and gloves while working to protect yourself.

7. Guideline Sealant Coverage

Recommended Width mm X Depth mm		Total applied mtrs per cartridge or foilpack of 310 ml.	Required no. of cartridges of foilpacks of 310 ml. per 100 mtrs	Total applied mtrs. per foilpack of 600 ml.	Required no. of foilpacks of 600 ml. per 100 mtrs.
4	4	19.4	5	37.54	3
5	5	12.4	8	23.99	4
8	5	7.8	13	15.09	7
8	8	4.8	21	9.29	11
10	8	3.9	26	7.55	13
10	10	3.1	32	6.00	17
12	8	3.3	30	6.39	16
12	10	2.6	39	5.03	20
15	10	2.1	48	4.06	25
15	12	1.7	59	3.29	30
15	15	1.4	71	2.71	37
18	10	1.7	59	3.29	30
18	15	1.1	91	2.13	47
20	10	1.5	67	2.90	35
20	15	1.0	100	1.94	52
25	12.5	0.9	111	1.74	57
25	15	0.8	125	1.55	65

Use backer rod to achieve the right joint depth (f.e. PU or PE backer rod) All information is based on net-usage (not including spillage/waste). Practical spilling/waste, can vary from 0 – 40% depending on type of joint, joint dimensions and way of application.

8. Product Selection Guide

Product Name	Description	Theoretical Coverage Rate
* Resin Base Joint Sealants : PROFLEX LM	PROFLEX LM is a high quality, one component, polyurethane sealant with high modulus for a wide range of sealing and bonding applications	1.3 kg/l
* Bituminous Base Joint Sealants : BITUJOINT	BITUJOINT is a cold applied elastomeric joint sealant which is well proven and offers outstanding surface performance, after application it converts to a tough resilient elastomeric with a durable and long lasting seal complies with ASTM D 1850.	1.3kg/l

9. Glossary

Abrasion resistance:

Ability of an adhesive to resist degradation due to mechanical wear by hard and rough objects (mechanical erosion) thanks to the ability to dissipate the applied mechanical energy.

Acrylic:

A type of synthetic polymer that is (generally) very resistant to degradation (oxidation, UV, etc.), has very good to excellent flexibility and elasticity, and has inherently high adhesion qualities.

Adhesion:

Power of an adhesive layer to hold the parts of an assembly together. The two surfaces are held together by interfacial forces which may consist of valence forces or interlocking action. Quantitative tests are available for measuring the adhesive strength under various environmental conditions; measured in units such as psi.

Adhesive failure:

Separation of two bonded surfaces that occurs within the bonding material. The adhesive separates entirely from the substrate.

Note: Adhesive failure occurs when the adhesive strength of a bonding material is greater than its cohesive strength. Insert the cartridge into the caulking gun.

Alkyd:

Formed by condensation of polyhydric alcohols with polybasic acids. May be regarded as complex polyester (thermoset).

Asphalt / Bitumen:

Dark brown to black cementitious material, solid or semisolid in consistency, in which the predominating constituents are bitumens which occur in nature as such or are obtained as residue in refining petroleum. The principal ingredient in asphalt is a mastic.

Backer rod:

Backer rod is typically a foam-like material used to properly configure expansion/contraction joints and to provide a surface that either the sealant will not adhere to or will be so flexible in its own right that, even though the sealant adheres to it, does not hinder the needed movement capability of the sealant itself. Backer rod usually comes in long lengths of a circular profile and is pressed into the joint just before the sealant is applied.

Bead:

Sealant or compound after application in a joint irrespective of the method of application, such as caulking bead, glazing bead, etc. Also a molding or stop used to hold glass or panels in position.

Bond strength:

Unit load applied in tension, compression, flexure, peel, impact, cleavage, or shear, required to break an adhesive assembly with failure occurring in or near the plane of the bond.

Measured in Pounds per Square Inch (PSI).

Note: The term adherence is frequently used in place of bond strength.

Butyl rubber:

Butyl rubbers are copolymers of isobutene and small amounts of isoprene. These rubbers are frequently mixed with natural and styrene-butadiene rubbers for obtain special properties like resistance to aging, initial tack at low temperatures, and good peel-off.

Cohesion:

State in which the particles of a single substance are held together by primary or secondary valence forces observed in the tendency of the substance to stick to itself.

Elastic:

The property of a material which allows it to be stretched substantially and, upon immediate release of the stress, to return with force to its approximate original length. An excellent example is a rubber band; it can be stretched and will return to its original strength many times. If a material can be deformed under stress but will not return to its original shape or dimension it is not elastic.

Elastomeric:

Materials that are "elastomeric" could also be said to be "elastic". Both terms describe what most people would refer to as "rubberiness", or behaving like rubber (which stretches and compresses, and returns to its original shape instantly after stress is removed).

Expansion joint:

A type of building joint where a significant distance is left between two substrates so as to accommodate normal building expansion & contraction due primarily to temperature changes. A sealant placed in this type of joint is subject to being stretched and compressed, rather than being sheared.

Flexible:

The property of a material to undergo deformation under stress, but not exhibit the ability to stretch and return to its original shape when the stress is relieved. An excellent example is a sheet of paper: it can be bent but will tear if you try to stretch it.

Gasket:

Piece of material that seals two parts together. Prevents air or fluids from leaking between the parts.

Joint thickness:

The average distance between the parts to be stuck together (= thickness of the layer of adhesive).

Natural rubber:

It is a polymer produced in the sap of rubber trees (*Hevea Brasiliensis*) and some other plants. As a natural product, it is formed as a latex which can be collected and dried. The polymer is cis-polyisoprene. It is not cross-linked in the natural state and only becomes a durable solid when it is cross-linked, by for example, vulcanization.

Oil caulk:

This is a type of caulking of low performance, primarily in the area of poor elasticity, flexibility, yellowing, and an inability to accommodate joint movement. (Adhesion is often very good, however.) The caulk is usually heavily loaded with filler and relies on either linseed or soybean oil as its binder.

Rubber:

Cross-linked or vulcanized material that is capable of recovering from large deformations quickly and forcibly, and can be modified to a state in which it is essentially insoluble in boiling solvent, such as benzene, methyl ethyl ketone or ethanol toluene zoetrope.

Sealants and caulks:

Sealants are materials that are initially fluid or semi-fluid, placed between two opposing solid materials, become solids themselves (by solvent evaporation or chemical reaction), bond to the surfaces they are applied to and accommodate joint movement. In architectural applications, sealants and caulks use their ability to accommodate joint movement to seal out the intrusion of water, wind, pollutants, dust and insects. "Sealants" are generally considered to deliver appreciably higher performance than "Caulks" – while they both serve the same basic purpose.

Shore hardness:

For sealants, the 'A' scale is usually used, whereby a hardened steel pin (which is connected to a calibrated spring meter) is pressed into the sealant and its depth of penetration is measured. Shore hardness is a strong indicator of modulus. Low modulus sealants have shore hardnesses of 20 or less. Medium modulus sealants have values from 21 to 50; while high modulus materials have shore hardnesses above 50.

Thermoplastic:

A material which will repeatedly soften when heated and harden when cooled. Virtually all sealants that are not chemically curing are of this type.

Thermoset:

A material which will undergo or has undergone a chemical reaction by the action of heat, catalysts, ultraviolet light, etc., leading to a relative insensitivity to temperature changes.

10. Full Service Support

Prokem has built an excellent reputation by providing a high level of both technical and commercial support for its clients. This support ranges from its research and development to its technical office and client service office.

Prokem provides the best possible training, technical data sheets, training videos and CDs also it organize seminars, presentations and fairs so as to facilitate transfer of knowledge to clients.

Such contribution to the achievement of successful results reflects *Prokem's* long-standing dedication to quality assurance.



11. Reference

- American University, Cairo (AUC).
- Den Braven.
- www.specialchem4adhesives.com



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