11 CAULKING, SEALANTS & WEATHERSTRIPPING

11.1 CAULKS & SEALANTS

ESSENTIAL KNOWLEDGE

Caulks and sealants are barriers to moisture and air infiltration with the ability to accommodate movement. However, not all joints are meant to be caulked; some provide an exit for air or moisture trapped within the wall assembly. The distinction between caulks and sealants is essentially the degree of permeability (adsorption) and the ability to conform to movement. Caulk typically provides for less movement but is easier to work and is used for interior applications, while sealants are used for exterior purposes. Here, both are referred to as sealants. The selection of sealants is made more difficult by the numerous claims and confusing terminology used by the industry to distinguish products among numerous manufacturers. There is no single product that is suitable for all uses, or provides optimal properties for a specific use. Manufacturers' instructions and technical assistance should be closely followed. The selection of caulk should be guided by knowledge of the materials that are to be adhered and the material properties that are most critical, such as durability or ease of installation. The degree of durability required and the anticipated degree of movement also should also be established. Movement is expressed as a percentage of the joint's width, either positive (+) for expansion or negative (-) for contraction. The temperature at the time of installation is critical so as to utilize the sealant's full range of flexibility to expand and contract. The width of the joint should be determined during mean temperatures. Small joints prove to be the most difficult to seal because the smallest movement can represent a significant percentage of expansion. Interior applications typically do not require the same degree of elasticity because the temperature is maintained within a narrow range.

Sealants have evolved with new formulations for lower cost, ease of installation, flexibility, and durability, but no one product is ideal in all these respects. Among the most common sealant types:

- Latex and oil-based sealants, generally referred to as caulks with low flexibility and relatively poor durability, are low cost and easy to work, suitable for interior applications not exposed to prolonged moisture.
- Acrylic latex, sometimes referred to as rubberized latex, is a more durable and elastic variation suitable for interior and exterior applications.
- Butyl rubber is commonly employed in insulated window assemblies because of its adhesion qualities and the ability to resist water and temperature extremes. It has only moderate flexibility and is difficult to install.
- Silicone, among the most flexible, is not generally paintable, is difficult to remove, and is not suitable for porous materials.
- Polyurethanes have excellent movement and durability characteristics, but the flexibility degrades over time and they are difficult to apply and clean up.

TYPES OF CAULKING MATERIALS

WHAT'S INSIDE THE TUBE? Most caulks have a petrochemical base such as oil, resin, butyl rubber, vinyl acrylic, acrylic, polyethylene, polyurethane, polyvinyl acetate, etc. Additives such as stabilizers, preservatives, ans plasticizers give the caulks their final properties. The chart below lists the major types of caulking compounds and suggested applications

BASE TYPE	RETAIL $ (per 10 oz)	EST. LIFE (years)	USES	CLEAN UP
Oil	1.00 - 2.00	1 - 3	Most dry surfaces *	paint thinner
Polyvinyl acetate	1.50 - 2.00	1 - 3	Indoor surfaces only *	water
Styrene rubber	2.00 - 2.50	3 - 10	Most dry surfaces *	paint thinner
Butyl	2.50 - 3.00	4 - 10	Masonry and metal * *	paint thinner
Acrylic latex	2.00 - 4.00	5 - 20+	Most dry surfaces *	water
Kraton	5.00 - 7.50	10 - 15	Most dry surfaces *	paint thinner
Polyurethane	4.50 - 10.00	15 - 20+	Masonry * *	acetone, MEK
Silicone	4.00 - 7.00	20+	Glass, Aluminum * (not for masonry)	paint thinner naphtha, toluene

* wood, drywall, aluminum; e.g. gaps in wood frames around perimeter of house, plumbing penetrations, gaps in rough openings around windows and doors, boots around supply and return HVAC grills, seal between bottom plates and subfloor
* * gaps in masonry construction

The joint between a frame's seal plate and a masonry foundation has historically been sealed using caulk or adhesive, and can be a labor intensive process. A new alternative for sealing this and other long linear joints is foam tape. This product can be faster to apply and provides a good seal by expanding to fill gaps.

SOURCE: GREENSEAL'S CHOOSE GREEN REPORT. MARCH 1997

FIGURE 1 TYPES OF CAULKING MATERIALS

All sealants require surface preparation and appropriate primers as directed by the manufacturer. Sealants are only able to provide for movement in two directions; if the sealant contacts a third surface it will detach from the surface with the least adhesion. Sealants typically are applied with half the width adhered to either side of the opening in an hour glass shape (Fig. 2). The width of the opening is exposed on one side and must be prevented from adhering to materials along its other side with a non-adhering surface referred to as a bond breaker or backer material. The bond breaker material also serves to shape and support the profile of the sealant and serve as a secondary barrier. The breaker must be compatible

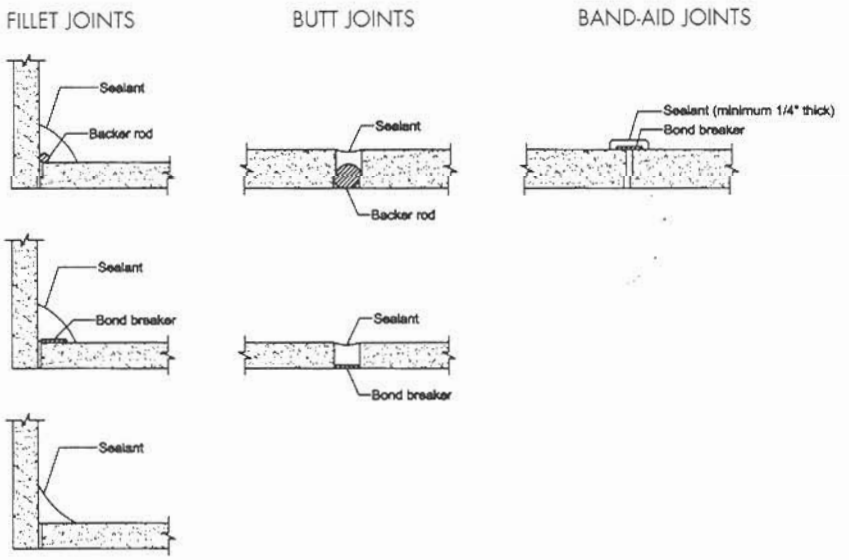

FIGURE 2 TYPICAL SEALANT JOINTS

with the sealant material and durable. Expansion (open) joints commonly use a compressible tube or rod-shaped material held in place by friction. Control (closed) joints and lap joints use a tape-like material with the sealant bridging from either side like a bandage. Although other materials are used as breakers, polyethylene and polyurethane are the most common.

TECHNIQUES, MATERIALS, TOOLS

INSTALL SEALANT MATERIALS.

Proper installation of sealant is absolutely critical to performance. The methods of installation vary among manufacturers and it is best to consult their literature for instructions. All sealants require proper preparation but the methods are beyond the scope of this book and the manufacturer's literature should be consulted. Sealants are available in essentially four types: preformed, tube, cartridge, bulk. Typically, the easier the installation method, the lower the anticipated performance. For this reason materials available in tubes tend to be water soluble caulk materials suitable for interior repairs. Materials designed for exterior purposes, specifically windows and doors, require higher performing materials and larger quantities. These materials generally require some form of mechanical means of applying the sealant. The traditional hand-operated gun provides a relatively simple device with convenient cartridges. These guns are available in several variations to provide more control over the application. Larger bulk-loading guns are also available to provide for economy in the packaging of materials or when two-part sealants are to be combined on site. Applications of large amounts of sealant are ideally suited for power-assisted equipment. Traditionally this was pneumatically driven, requiring an air compressor. New equipment developed specifically for this purpose is either electrically or battery driven. A new product, the Prazi™ Drill Mate, is attached to a conventional drill for this purpose (Fig. 3). With the requirements of application being so specific, these power tools and preformed materials provide for consistency of application.

ADVANTAGES: New automated tools and new materials provide for greater ease of installation and performance than ever before. The wide variety of materials is suitable for virtually any condition.

DISADVANTAGES: The improper selection of sealants has the potential of damaging or discoloring adjacent materials.

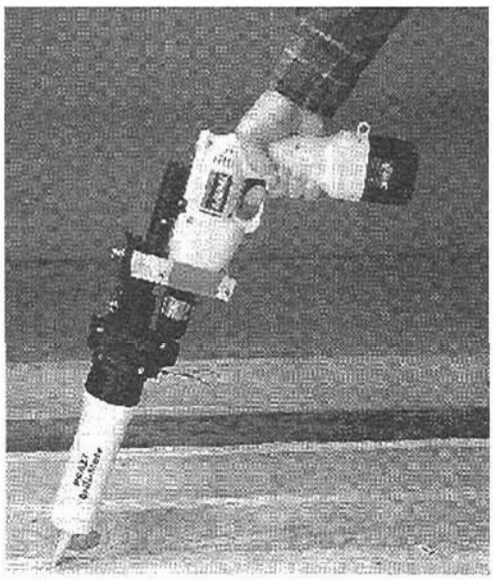

FIGURE 3 POWER CAULKING ATTACHMENT FOR CONVENTIONAL DRILL AS MANUFACTURED BY PRAZI USA

FURTHER READING

"Building Sealing and Ventilation, Green Seal's Choose Green Report," March 1997.

"The Theory of Caulk," John Sanger, http://www.paintstore.com/book/pwc/PWC_Archives/-caulk/103.html.

Caulking, Al Brendenberg, *Today's Homeowner*, http://index.todayshomeowner.com/todayarticles/-paint/04.97.62.html.

"Caulking about the Weather," Josh Garskof, *Old-House Journal*, November/December 1996.

"Caulks and Sealants," *Fine Homebuilding*, Bruce Greenlaw, June/July 1990.

"Premature Sealant Failure," David H. Nicastro and Joseph P. Solinski, *The Construction Specifier*, April 1997.

"Silicone Caulking Basics," Brian Zavitz, *Fine Homebuilding*, August/September 1997.

PRODUCT INFORMATION

AEG, 3 Shaw'S Cove, P.O. Box 6003, New London, CT 06320-1777.

Insta-Foam Products, Inc.,1500 Cedarwood Dr., Joliet, IL 60435; 800-800-3626.

Macklanburg-Duncan, 4041 North Santa Fe, Oklahoma City, OK 73118; 800-654-8454.

Polytite, 324 Rindge Avenue, Cambridge, MA 02140; 800-776-0930; www.polytite.com.

Prazi™ Drill Mate, Prazi U.S.A., 118 Long Pond Rd., Suite G, Plymouth, MA 02360; 508-747-1490.

Resource Conservation Technology, 2633 N. Calvert Street, Baltimore, MD 21218; 410-366-1146.

11.2 WEATHERSTRIPPING

ESSENTIAL KNOWLEDGE

While sealants provide an uninterrupted barrier between materials, weatherstripping provides for the movement of independently operating components such as door panels and window sashes. Weatherstripping resists air and water infiltration, and is also effective in reducing noise transmission and as a barrier to smoke and fire. Weatherstripping also has value for interior applications where sound resistance is desired, presuming the door panel is not hollow core, in which case the door serves to amplify the sound.

There are three basic types of weatherstripping: inter-locking assembly; compression seal; and sliding seal. Interlocking seals are arguably the most durable. Constructed of corrosion-resistant metals such as aluminum and bronze, they work best on fenestration that operates consistently and does not necessarily maintain a continuous tight seal. Occupants of older homes are familiar with such materials that, when painted or bent, will prevent the door from closing. There are six common assemblies for interlocking seals in which two corresponding materials join to form a tight fit when closed.

Compression seals, particularly in combination with a locking mechanism, generally provide a tighter and more durable barrier than a sliding seal and are utilized in most new window and door products. Compression seals are described as tube seal, flipper seal, or leaf seal. The tube seal is effective and durable but is suitable for installation with minor variation in width. Flipper and leaf seals are not as effective nor durable but can accommodate a greater variation in width. Compression seals are usually of a mate-

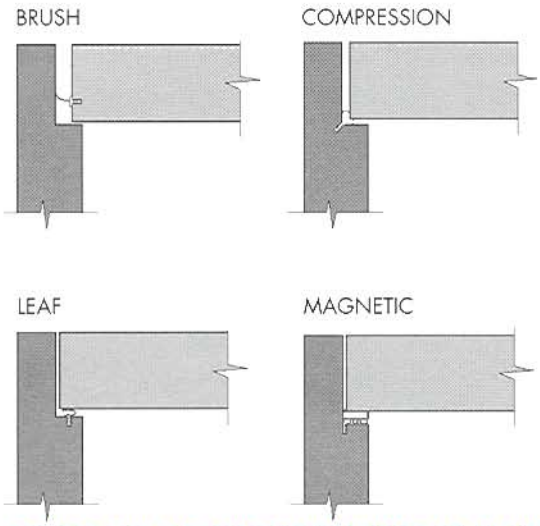

FIGURE 4 TYPES OF WEATHERSTRIPPING AT JAMB

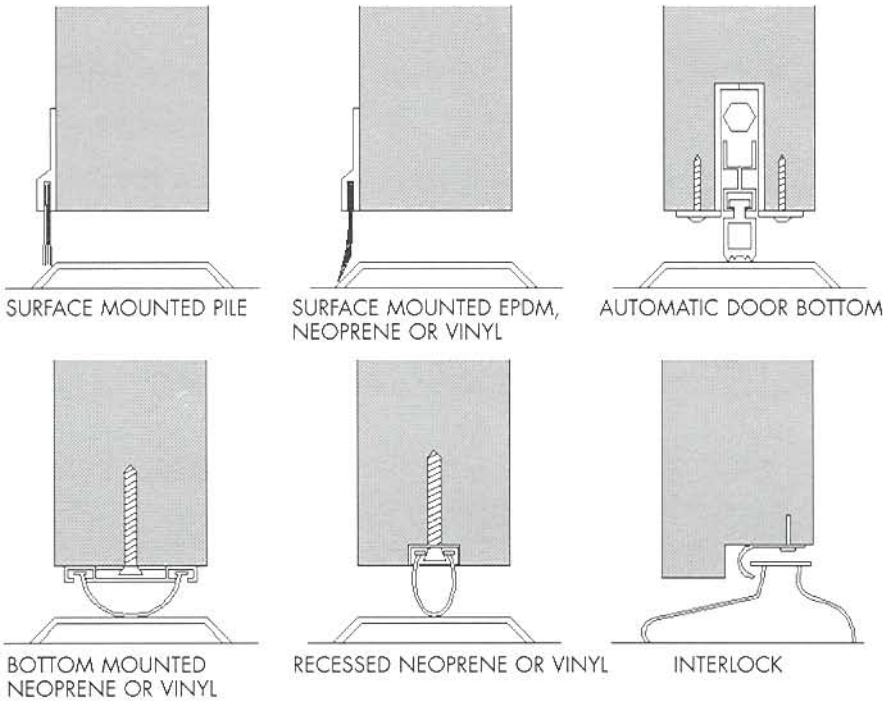

FIGURE 5 TYPES OF WEATHERSTRIPPING AT THRESHOLD

rial that returns to its original shape to provide a tight fit with the surface it is resisting. Such materials, which are said to have "memory," include silicone, EPDM rubber, neoprene, open and closed cell foam, vinyl, wool or synthetic pile, and spring metal. Silicone and EPDM both have good memory properties and remain flexible in cold temperatures. Neoprene is a less costly alternative but is not as durable or flexible under cold temperatures. Compression seals utilizing silicone, EPDM, and neoprene are the best materials for acoustical applications. These materials are attached by either mechanical fasteners, adhesive, or friction fit. A variation of the compression seal is a magnetic strip in combination with a flexible gasket. When in combination with ferrous metal doors, windows or a steel strip this assures a tight seal.

Sliding seals provide resistance to friction on sliding components and are described as sweep-sill or brush-seal. Sweep-sills have a blade-like profile. Sliding seals require materials resistant to friction, such as polypropylene or nylon. Face mounted seals are most effective because there is relatively little variation in the width of the opening. Weatherstripping may be applied by means of adhesive, by friction fit, or mechanically.

Typically the same material is used at the full perimeter, with the exception of a door sill. A threshold must be durable against wear of moving parts and traffic. Thresholds are typically fabricated of very durable materials such as metal in combination with inserts that function as tube seals either in compression or sliding (Fig. 5). A raised threshold provides contact with the sweep or seal only when the door is closed. In addition to interlocking and resilient types, door bottom seals are available as an automatic operable mechanism (Fig. 6). As a door closes a button on the hinge side of the jamb compresses a seal in a downward motion against the threshold. Weatherstripping may also be used in opposition with itself, two brushes, two flippers, or two compression seals.

The standard, "ANSI A156.22: Door Gasketing Systems," is valuable in evaluating the performance of respective weatherstripping types for appropriate selection.

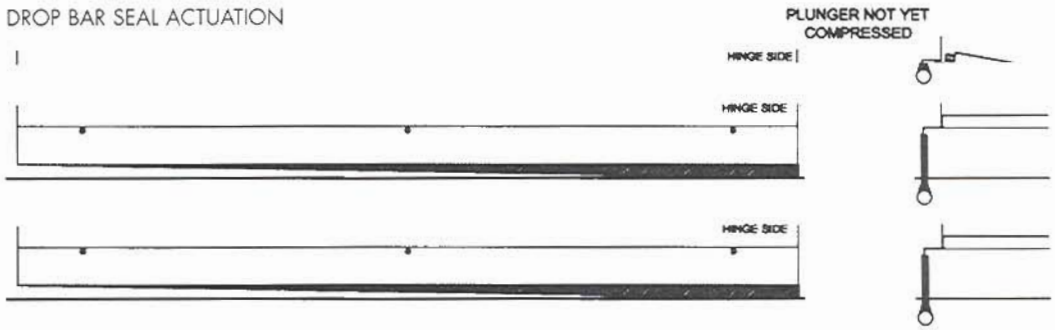

FIGURE 6 AUTOMATIC THRESHOLD SEAL

TECHNIQUES, MATERIALS, TOOLS

The majority of problems associated with doors is attributable to the installation of hardware and weatherstripping. Prior to any weatherstripping, the window or door should be repaired or determined to be properly operating. Typically the same material is applied to all sides with the exception of the door sill. The installation of new materials is a labor intensive process. When this work is to be performed by a professional only the best quality materials should be selected for they will represent a small portion of the overall cost and assure the greatest durability. Products with lower durability or effectiveness may be suitable because of the ease of installation provided to the amateur. New tools have been developed specifically for the purpose of installation, significantly reducing the skill required, and if numerous windows or doors require repair may justify the cost.

1. INSTALL NEW OR REPLACEMENT INTERLOCKING WEATHERSTRIPPING.

Interlocking weatherstripping typically requires the modification of the door or window and jamb to provide a pair of aligned components. Older windows and doors commonly employ this type and simply require replacement of these worn elements. This type allows the door or window to operate without impedance or resistance.

ADVANTAGES: Provides a very durable seal that does not impede function.

DISADVANTAGES: Does not provide for a full contact seal and requires skilled labor for new installations.

2. INSTALL NEW OR REPLACEMENT RESILIENT (COMPRESSION OR SLIDING) WEATHERSTRIPPING.

Compression and sliding types may be generally described as resilient weatherstripping. The resilience of these materials provides the opportunity to accommodate irregular surfaces and those with a tight seal achieved with full contact. Numerous products are available for this purpose with a wide variety of performance. Compression does not necessarily insure a tighter seal; manufacturer's recommendations for sizing should be carefully observed. The recently developed ANSI standard not only establishes compliance but provides guidance in the selection of appropriate materials.

ADVANTAGES: Compression materials typically provide the tightest seal and are generally very durable. Installation can usually be accomplished with a low degree of skill. New materials employed in sliding seals have significantly improved their durability while providing a tight seal. These materials are often applied to the surface of a door.

DISADVANTAGES: Resilient materials may prevent the tight closure of the door or sash, impede the function of hardware, and are generally less durable. Some materials are subject to damage under cold conditions or exposure to UV light.

3. INSTALL NEW OR REPLACEMENT DOOR THRESHOLDS.

Thresholds are available in a variety of configurations, which will determine the type of weatherstripping appropriate. Thresholds that employ a raised stop may continue the compression seal around the full perimeter. Other assemblies work in combination with either sweep or compression seals that are attached to the door unit and are compressed against the threshold. Some threshold units with integral seals are undesirable because the seals are subject to damage from foot traffic. A variation of a threshold seal is the automated door bottom that deploys a seal downward when the door is in the closed position.

ADVANTAGES: New, durable materials are designed to last many years while improving thermal performance of the assembly.

DISADVANTAGES: The replacement of the entire threshold requires a degree of skill. New, unique designs may prove to be difficult to repair in the future.

FURTHER READING

"Choosing Gasketing Products," *The Construction Specifier*, Helen Rose, April 1997.

"Retrofit Weatherstripping with Silicone Bead," *Journal of Light Construction*, Gary Katz, November 1993.

"Weatherstripping Entry Doors," *Old House Journal*, December 1986, pp.470-471.

"ANSI A156.22 Door Gasketing Systems," American National Standards Institute, available from the Builders Hardware Manufacturers Association.

PRODUCT INFORMATION

Accurate Metal Weatherstripping Co. Inc. , 725 S. Fulton Ave., Mount Vernon, NY 10550; 914-668- 6042.

Macklanburg-Duncan, 4041 North Santa Fe, Oklahoma City, OK 73118; 800-654-8454.

Pemko Co., Box 3780, Ventura, CA 93006; 805-642-2600.

Resource Conservation Technology, 2633 N. Calvert Street, Baltimore, MD 21218; 410-366-1146.

Schlegal Corp., Retroseal Division, P.O. Box 23197, Rochester, NY 14692; 800-828-6237.

Weatherbead Insulation Systems, 47-46-46 Hepburn Dr., Indio, CA 92201; 800-966-0159.

Zero International, 415 Concord Ave., Bronx, NY 10455; 212-585-3230.