



3.3 AIR SEALING MATERIALS

SWS Detail: 3.0101 General Air Sealing; 3.0102 Specific Air Sealing

Air barriers must resist severe wind pressures. Use strong air-barrier materials like structural wood paneling, drywall, or sheet metal to seal large air leaks, especially if your region has powerful winds. Attach these strong materials with mechanical fasteners and seal them with caulk or adhesive. If a technician needs to access a shaft or penetration in the future, use a caulk that isn't a strong adhesive, such as acrylic latex.

Use caulk by itself for sealing small cracks. Use liquid foam for cracks larger than $\frac{1}{4}$ inch.

3.3.1 Material and Sealant Specs

Select materials and sealants that meet these SWS specifications.

1. Be compatible with their intended surfaces.
2. Allow for differential expansion and contraction between dissimilar materials.
3. Remove any material from the sealing area that could prevent full adhesion of the selected sealant.
4. Comply with the requirements of the applicable fire-safety code.
5. For indoor application, select low volatile-organic-compound (VOC) sealants.
6. For small holes (less than $\frac{1}{4}$ inch), install backing or infill material at least $\frac{1}{8}$ inch below the surface where you install the sealant.

7. For medium holes ($\frac{1}{4}$ inch to 3 inch), install backing or infill in or over all holes that you seal.
8. For large holes (greater than 3 inches), install rigid backing or infill in or over all holes that you seal.
9. Install support material for spans wider than 24 inches, except when air barrier material is rated to span more than 24 inches under load from wind or insulation.
10. Install only noncombustible materials and sealants with an ASTM E136 listing in contact with any device producing 200 degrees F or more — chimneys, vents, light fixtures, and flues, for example.

3.3.2 Air-Barrier Materials

Air-barrier materials should themselves be air barriers and also rated as fire blocks. *See Table 12-1 on page 558.*

Plywood, OSB, etc.

Three-quarter-inch plywood, OSB, and particle board are IRC-approved fire-blocking materials, and they're strong enough to resist windstorms. Attach these structural sheets with screws or nails along with any sealant or adhesive that effectively air seals the joint.

Drywall

Half-inch drywall constitutes a 15 minute thermal barrier, and is also an ignition barrier. When air sealing a fire-rated assembly in a commercial or multi-family building, choose five-eighths - inch drywall and a fire-rated caulking. Fasten drywall with screws and construction adhesive. Don't use drywall in damp locations where it may get wet.

Steel and Aluminum Sheet Metal

Installers use non-combustible sheet metal to seal around chimneys and other heat producing components. To seal around

chimneys, cut the sheet metal accurately, with less than a $\frac{1}{8}$ -inch gap, so that you can seal the gap with high temperature, non combustible caulk labeled ASTM E136.

Foam Board

Foam board may be a desirable product for air sealing; however it has less structural strength and fire resistance than the other materials discussed previously.

Cross-Linked Polyethylene House Wrap

House wrap and polyethylene sheeting are air barriers. These flexible materials aren't rated as fire-blocks, and they are structurally weak.

3.3.3 Stuffing Materials

Stuffing materials are used to insulate a cavity, to give the cavity a bottom, or to serve as supporting part of an air seal.

Backer Rod

Backer rod and caulking are the most reliable and long-lasting air seals. Backer rod is closed-cell polyethylene foam that creates a bottom barrier in a gap before caulking. Backer rod doesn't bond to the caulking, and so prevents three-sided adhesion that could tear the caulking bead apart with the materials' expansion and contraction of temperature extremes.

Fiberglass Batts

Fiberglass batts reduce air convection in cavities where they're installed. However, fiberglass batts are air permeable, even if compressed. Batts can support two-part foam sprayed over the opening of a cavity. Fiberglass batting is a good stuffing material for use with non-combustible caulk for penetrations through fire-rated assemblies because of its low combustibility.

Blown Cellulose or Fiberglass

Blown cellulose and fiberglass reduce air convection and air leakage through closed cavities. However neither material is an air barrier even when blown at high densities. Both are considered fire-blocks when installed in closed cavities because they block the passage of flames.

3.3.4 Caulking and Adhesives

The adhesion and durability of caulking and adhesives depends on their formulation and on the surfaces to which they're applied. Some caulks and adhesives are sensitive to dirt and only work well on particular surfaces, while others are versatile and dirt-tolerant. Remove debris and clean the joint to prepare the surfaces for caulking.

Water-Based Caulks

A wide variety of paintable caulks are sold under the description of acrylic latex and vinyl. These are the most commonly used caulks and the easiest to apply and clean up. Siliconized latex caulks are among the most adhesive and durable sealants in this group. Don't apply water-based caulks to building exteriors when rain is forecast since they aren't waterproof until cured, and they stain nearby materials if they are rained upon while curing. Don't apply water-based caulks during freezing weather.

Silicone Caulk

Silicone has great flexibility, but its adhesion varies among different surfaces. Silicone is easy to gun even in cold weather. Silicone isn't as easy to clean up as water based caulks, though it's easier than polyurethane or butyl. Silicone isn't paintable, so choose an appropriate color. High-temperature silicone may be used with galvanized steel to air seal around chimneys if labeled ASTM E136, meaning that the caulk is non-combustible.

Polyurethane Caulk

Polyurethane has the best adhesion and elasticity of any common caulk. It works well for cracks between different materials like brick and wood. Polyurethane resists abrasion and is used to seal critical joints in concrete slabs and walls. Polyurethane is also useful for sealing the fastening fins of windows to walls. Polyurethane is almost as sticky and adhesive as a construction adhesive. Cleaning it up is difficult so neat workmanship is essential. Polyurethane caulk doesn't gun easily, and should be room temperature or higher. Polyurethane caulk doesn't hold paint.

Acoustical Sealant

This solvent-based or water-based adhesive is used to seal laps in polyethylene film and house wrap. Acoustical sealant is very sticky, adheres well to most construction materials, and remains flexible. Acoustical sealant is used to seal building assemblies for sound deadening. Acoustical sealant is also used to seal the seams of polyethylene vapor barriers and ground-moisture barriers.

Water Soluble Duct Mastic

Duct mastic is the best material for sealing ducts, including cavities used for return ducts. A messy but highly effective sealant, duct mastic can be applied with a thickness of $\frac{1}{8}$ -inch with a brush or rubber glove. Have a bucket of warm water handy to clean your gloved hands and a rag to dry the gloves. Spread the mastic and use fiberglass fabric web tape to reinforce cracks more than $\frac{1}{8}$ -inch in diameter. Thorough cleaning of dust and loose material isn't necessary. Mastic bonds tenaciously to everything, including skin and clothing.

Stove Cement

Stove cement is a material that can withstand temperatures up to 2000° F. Use stove cement to seal wood stove chimneys and to cement wood-stove door gaskets in place.

Non-Combustible Caulk

Some elastomeric caulks are designed specifically for use in fire-rated assemblies. They are labeled ASTM E136, meaning that the caulk is non-combustible. Use this type of sealant when sealing penetrations through fire-rated assemblies in multifamily buildings.

Fire-Rated Mortar

Used with other air-sealing materials to seal various sized holes and gaps in multifamily buildings with fire-rated masonry building assemblies. This mortar often covers a foam air sealant to create a non-combustible surface for a combustible air seal.

Construction Adhesives

Construction adhesives are designed primarily to bond materials together. But they also create an air seal if applied continuously around the perimeter of a rigid material. They are often used with fasteners like screws or nails but can also be used by themselves. Some construction adhesives act like contact adhesives to bond lightweight materials without mechanical fasteners.

Use specially designed construction adhesives for polystyrene foam insulation because many general-purpose adhesives decompose the foam's surface.

3.3.5 Liquid Foam Air Sealant

Liquid closed-cell polyurethane foam is a versatile air sealing material in addition to an insulation material. Closed-cell foam

is packaged in a one-part injectable variety and a two-part spray-able variety.

Liquid-foam installation is easy compared to other materials to accomplish the same air sealing tasks. However, cleanup is difficult enough that you probably don't want to clean up multiple times on the same job. Instead identify all the spots needing foam application, make a list, and foam them one after another.

For all its convenience, liquid foam's durability as an air seal is questionable. Cracks in the foam tend to occur at cracks in the air-sealed material.

One-Part Foam

This gap filler has tenacious adhesion. One-part foam is best applied with a foam gun rather than the disposable cans. Cleanup is difficult if you're careless. When applied skillfully into gaps, one-part foam reduces air leakage, thermal bridging, and air convection. One-part foam isn't effective or easy to apply to gaps over about one inch or to bottomless gaps. This product can leave small air leaks because it cracks when the materials around it move or shift.

Two-Part Foam

Good for bridging gaps larger than one inch, this product is also known as low-density spray polyurethane foam (SPF). Two-part foam is popular for use with rigid patching materials to seal large openings. Cut foam board to as closely as possible around obstacles and fill the edges with the two-part foam. Two-part foam should be sprayed to at least an inch of thickness when it serves as an adhesive for foamboard patches over large holes for strength.

Foam Construction Adhesive

Polyurethane foam dispensed from foam guns is an excellent adhesive for joining many kinds of building materials. Foam