

Weatherizing Your Home: Caulking

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This NebGuide discusses caulking the home to reduce air infiltration and increase energy efficiency. *Caulking* seals cracks and joints. *Weatherstripping* seals around moving parts such as doors and windows.

Save Energy, Dollars and Increase Comfort

Even well-insulated homes can waste energy through air leakage or infiltration in the building shell. In fact, about 10% to 30 % of a typical fuel bill results from “accidental” air infiltration. Because air leaks occur around foundations, windows, foundations, chimneys and ducts, and utility entrances, weatherizing your home by caulking and weatherstripping can effectively reduce energy waste. This saves you money on fuel bills and pays back your weatherization costs in about one or two years with energy bill savings. Weatherizing also reduces drafts, insects, pests, dust, moisture entry, deterioration, and noise.

Detecting Leaks

The biggest leaks are often hidden in the attic, crawlspace or basement. Carefully inspect for leaks, or hire a qualified weatherization or energy audit professional to conduct an inspection to determine the location and amount of leakage or how “tight” the home is. Contact your area utility company or the state energy office — www.neo.state.ne.us/wx/wxindex.htm — for information about who conducts audits and tests.

Testing for leaks:

- On a cold, windy day, close all outside doors and windows. Turn on exhaust fans and the dryer to depressurize the home or temporarily seal a large fan in an open window to exhaust

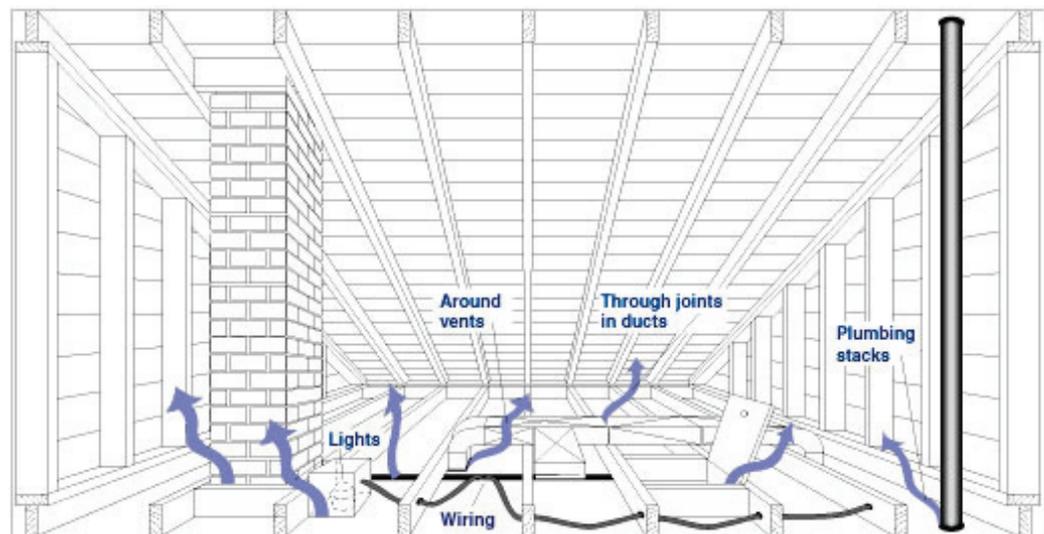
air. Use your hand, lightweight paper, or an incense stick to test for airflow around windows, doors, attic hatches, utility entrances, foundation and other areas including all walls. If you feel air or see smoke moving inside, you have a leak.

- Make sure carbon monoxide alarms are working and that any backdraft problems are handled by a heating and ventilation professional.

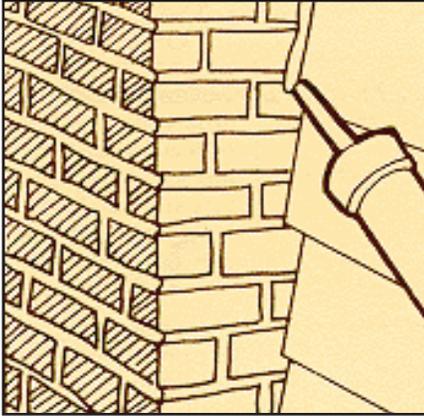
Assess Air Quality

Assess your home’s indoor air quality before tightening it. Every home needs a certain amount of fresh air to reduce pollutants and for any fuel burning appliances. Getting a home “too tight” is unusual but could happen. Combustion equipment needs adequate intake of air, regular inspections and maintenance to operate efficiently and safely. Check carbon monoxide alarms regularly. If you have air quality concerns, have a blower door test and combustion equipment testing before doing additional weatherization.

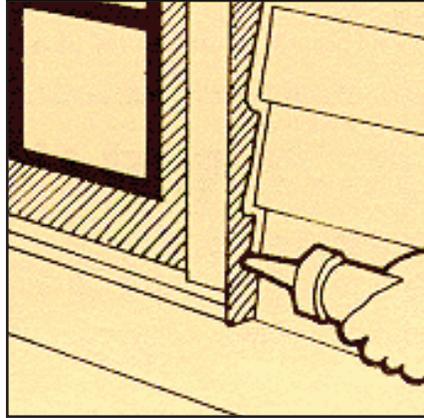
Don’t rely on air leakage for ventilation, since you cannot control it. Planned mechanical ventilation introduces outdoor air in a controlled manner and exhausts pollutants and moisture. Ask a qualified heating, ventilation and air-conditioning professional about adding more mechanical ventilation, if needed.



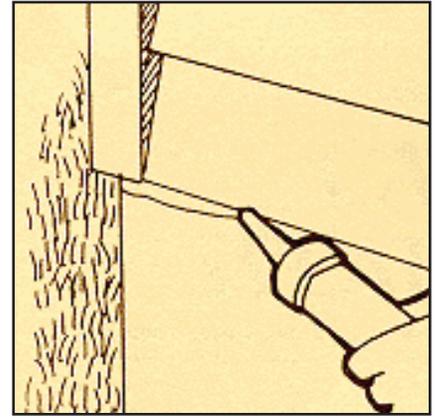
Common air leakage pathways through attic floor. Source: Virginia Energy Savers Handbook.



Caulk between two different siding materials.



Caulk around windows and doorframes.



Caulk where siding meets the foundation.

Source: Iowa State Extension

Whole-house mechanical systems manage the air exchanges and provide fresh air rather than relying on irregular airflows and holes that may be too big. Ask about energy-recovery or heat-recovery ventilators to bring in fresh air from outside and to exhaust air. Also available are power-vented gas furnaces and water heaters and sealed combustion units that have dedicated fresh-air intakes and separate exhausts to the outside.

Where to Caulk

Caulking compounds are used wherever two different materials or parts of the house meet. Caulk cracks and joints in a home's *interior* first, to limit air infiltration, and then *exterior* cracks and joints to further weatherize and protect the structure. Seal any crack between the home's shell and the outdoors, and between heated (or cooled) spaces and unconditioned spaces, such as an attic. Start in the attic, and then the basement if there is sufficient air intake to any combustion appliances.

Common places to caulk are:

Interior:

- Around attic hatch or door-frames and other attic penetrations (plumbing, vent stacks and knee walls).
- Around ceiling fixtures, outlets and switches. Use caution and turn off the power. Install foam seals or gaskets behind cover plates on outlets and switches, or use child-safety plugs. Contact a professional electrician about safety issues, especially with recessed lighting. Recessed lighting can cause leaks, but cannot be safely air-sealed unless it is insulation-contact (IC) rated. Professionals can construct a non-combustible box or barrier around the recessed light if there is access from the attic. Use Underwriters Laboratory (UL) approved airtight, IC-rated recessed light fixtures.
- Around window and doorframes. Do not caulk windows shut.
- Around pipes, outlets, wiring, cable, or vents in exterior walls and any soffits.
- Around water pipes, drains, bathtubs and plumbing fixtures.

- Joints between wallboard or paneling and the floor and ceiling on exterior walls.
- Between the sill plate and foundation wall and between sill plate and band or rim joist of exterior walls.

Exterior:

- Around window and doorframes. Do not caulk the storm window weep holes shut as they allow moisture that gets behind the storm window to escape.
- Between two different siding materials.
- Where siding meets the foundation.
- Corners and angles where siding materials meet.
- Around roof skylights, vents and chimney flashing. Areas around hot stacks or chimneys need sheet metal and high-temperature fire rated caulks.
- Around faucets, pipes, wiring, cables, outlets, or vents or any place that utilities penetrate the exterior walls.

Choosing Caulking Compounds

Caulking compounds come in several forms including:

- disposable cartridges that fit in caulking guns,
- pressurized caulking cartridges that need no caulk guns,
- aerosol cans,
- squeeze tubes, and
- peel and stick.

Caulking is intended to fill cracks less than 1/4" or 3/8" wide and must adhere to its material to work properly. Different compounds vary in how well they adhere to different materials and in their resilience, durability, flexibility, cost, ease of use and clean up, color, or ability to be painted. Some compounds may have special properties, such as mildew resistance. High-temperature caulks are used around areas that get hot, such as chimney flashing. Some caulks will bond to two different materials while allowing flexibility. Some foams expand more and may create pressure where pressure is not wanted such as around window and doorframes. Metal and porous materials like masonry or cement require special caulking compounds and some compounds require a primer when used on certain materials.

<i>Caulking Compounds</i>	<i>Use</i>	<i>Cleanup</i> <i>*See package specifications</i>	<i>Shrinkages</i>	<i>Adhesion</i>	<i>Durability</i>	<i>Cost</i>	<i>Comments</i> <i>Products vary. Read the label for product characteristics, use and safety.</i>
Latex	Interior: joints, cracks in porous materials, plaster, glass, tile and plastic. Fills nail holes.	Water*	5% to 10%	Good to excellent on most surfaces, porous materials. Will not adhere to metal.	Varies. About 2 to 10 years.	Low to Moderate	Easy to use. Lower water resistant when dry. Can mildew. Can be sanded and painted. Less elastic than other materials. Little flexibility once cured. Paint when used outdoors. Silicone-latex and vinyl-latex caulks also available.
Acrylic latex	Wood, drywall, plumbing penetrations, around doors and windows, etc. Primarily interior.	Water*		Most dry surfaces.	Moderate to high: 5 to 20+ years	Usually more expensive than other latex caulking	Easy to apply and cures fast. Low odor. Paintable. Comes in colors. Some acrylic caulking compounds also contain silicone for increased durability, better adhesion to building materials and increased flexibility. Performance varies.
Oil or resin-based.	Exterior seams and joints on building materials. Sticky. Limited temperature range.	Mineral spirits*	Moderate: 10 % to 20%	Good on many surfaces. Poor adhesion to porous surfaces like masonry.	Lower durability: 1 to 4 years.	Low	Rope and tube forms available. Tends to crack — oils dry out and cause material to harden and fall out; should be painted; can be toxic - check label.
Urethane/ Polyurethane	Exterior. Seals most dissimilar materials such as vinyl, stone, wood, metal and brick.	Solvent – see package. Use good ventilation.*	Little or none.	Excellent.	High durability — 20+ years.	High	Permits joints to stretch and compress. Sticks to painted surfaces and should be painted. Moisture resistant. Longer curing time. May need primer. Can be toxic. Resist abrasion.
Silicone: Household or Construction	Seals most dissimilar building materials such as primed wood, metal flashing, and brick. Also for tile, glass and non-porous materials. See label.	Dry cloth if immediate. Mineral spirits.*	Very little or none.	Good to excellent.	High durability — 20+ years	High	High flexibility and resiliency. Permits joints to stretch or compress. Sticks to painted surfaces, but paint will not adhere to most cured silicones. Available in clear and colors. Excellent moisture resistance. Resists sun rays (UV).
Polyurethane expandable spray foam	Expands when curing. Good for larger cracks indoor or outdoors. Use in non-friction areas as it becomes dry and powdery over time. Shake, hold can upside down, and fill spaces about 40% full.	Solvent such as lacquer thinner if immediately. May be messy to clean up.*	None; expands quite a bit.	Good to excellent. Excellent on most materials except glass. Masonry.	High durability — 15 to 20+ years	Moderate to high.	Flexible. Quickly expands to fit larger, irregular-shaped gaps. Can create pressure on door and window frames resulting in difficulty in opening and closing. Can be applied at variable temperatures. Must be painted for exterior use to protect from ultraviolet radiations. Some manufacturing processes produce greenhouse gases. Do not use near flames or hot items.
Water-based, low-expansion foam sealant.	Around window and door-frames at installation. Cracks in concrete, brick, vinyl, and wood. Not as useful in larger cracks as curing difficult.	Water.*	None; expands about 25%	Good to excellent.		High	Takes 24 hours to cure. Cures to soft consistency. Water-based foam product does not produce greenhouse gases. Will not over-expand to bend windows. Must be exposed to air to dry. Not as useful for large gaps as curing difficult. Not as water-resistant.
Butyl rubber	Seals most dissimilar materials metal, plastic, wood and concrete. Can be used in higher moisture area.	Mineral spirits.*	From 5% to 30%. Variable shrinkage.	Good to excellent on most materials. Does not adhere well to painted surfaces.	Moderate — 4 to 10+ years	Moderate to high	Flexible, not brittle. Paintable after about one week curing. May require two applications. Toxic, follow label precautions. Harder to apply but can be applied at lower temperature. Comes in colors. Water-resistant.
Backer-Rod, Closed-cell foam or Rope Caulk	For use in larger cracks — press in with a knife or screwdriver, then caulk. For good 2-sided adhesion.	See package specifications.		Promate 2-side adhesion	Some rope caulks last about a year if not sealed.	Low to moderate.	Oil-based rope caulk may stain painted areas. Used to fill larger gaps before caulking and sealing. Polyurethane closed-cell for exterior; open-cell for interior use.

Portions of this chart adapted from U.S. Federal Citizen Information Center. *Weatherize Your Home: Caulk and Weatherstrip*

When caulking two different materials, choose a compound that will remain flexible. Different materials expand and contract at different rates, creating joint stress. Large/deep cracks need backer rod, rope caulk or closed cell foam or fillers (sponge rubber, oakum or caulking cotton). Use metal, rigid foam, wood or drywall for larger gaps.

Caulking compounds are either water-based or solvent-based. Clean up water-based caulking compounds with water before they cure. Clean up solvent-based compounds with solvents and ventilate well.

Newer caulk products include synthetic-rubber, modified-silicone polymers, and polysulfides. Newer caulks may also be hybrid caulks combining the properties of several caulk types to create a more versatile product. Because company products vary, read the labels and uses for each product. For example, acid-cured silicones work best on nonporous surfaces such as glass and glazed tile. Neutral-cure silicones work better on wood and metal.

Read and follow manufacturer's instructions. Choose the appropriate type of product for each job, and a brand of quality caulking with a minimum life span of five years. Very durable quality caulking may be more economical over time and is important for areas exposed to severe weathering or that are difficult to reach.

Amount of Caulk Needed

Measure around the door and window frames, siding joints, cracks, and other places to be caulked. This will give you an estimate of the linear footage to be caulked. The product label will indicate the approximate linear footage it will cover for a bead of caulking about one-fourth inch in diameter.

Purchase enough caulking compound to complete the job. To save a partially used cartridge, put a nail in the tip. Wrap the cartridge with an airtight material and store in a cool, dry place. Caulking compounds have limited storage life.

Preparing to Caulk

Generally, apply caulk in dry weather and when outdoor temperatures are between 50° F and 70° F, when most building materials are at the midpoint between contraction and expansion and differences between indoor and outdoor temperatures are minimal. Make sure your **surface is clean, dry and grease-free** or the caulk may not adhere. If needed, clean the surfaces with a solvent and use a steel brush, screwdriver, ice pick, or putty knife to remove all old caulking. Work done now will keep you from having to repeat the job if the caulk does not adhere properly.

How to Caulk

Follow label safety precautions. Use neoprene rubber gloves and good ventilation. Skeleton or frame caulk guns use a lever to fill or release pressure on the cartridge and are easy to load.

Cut off the tip of the cartridge nozzle at a 45° angle. Use a nail to puncture the nozzle seal. The nozzle opening size determines the caulking bead size.

Use continuous movement and steady pressure for best results. Hold the caulking gun or caulk tube at a consistent 45° angle to the crack. Squeeze the trigger or press. **Push** the caulking compound deep into the crack, rather than laying it on the surface, to fill the gap completely and to avoid air bubbles or gaps. To break the caulking bead, use the release lever or pull back on the plunger rod and twist the caulking gun. For water-based caulks, wet a spoon or special tool with water to smooth the caulk into the crack. Inspect the home yearly for deteriorating caulk, and new cracks or openings.

Resources

- Lawrence Berkeley Laboratory. Home Energy Saver. [On-line.] Available: <http://hes.lbl.gov/hes/makingithappen/tips.html>
- U.S. Department of Energy. Consumer Energy Information. [On-line.] Available: <http://www.eere.energy.gov/>
- U.S. Government Service Office. Weatherize your Home: Caulk and Weatherstrip. [On-line]. Available: http://www.pueblo.gsa.gov/cic_text/housing/weather/weather.htm
- Virginia Dept. of Mines, Minerals & Energy. (2006). Virginia Energy Savers Handbook.
- Iowa State Extension.

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