



GUIDELINES FOR EQUIPMENT OPERATION AND MAINTENANCE

	OPERATION	MAINTENANCE
<div><div>Generator</div><div>(12 kW minimum)</div><div></div></div>	<ul style="list-style-type: none">▶ Check oil before starting the generator.▶ Use regular unleaded gasoline. Do not fill tank to the top.▶ Never start or stop the engine with electrical devices plugged into the receptacles and devices turned on.▶ Let the engine stabilize and warm up for a few minutes before plugging in and turning on electrical loads.▶ Check the rated and surge wattage of electric loads to ensure that the generator is not overloaded.▶ Do not use the Automatic Idle Control. The generator does not have enough electrical capacity for the insulation blower at start-up.▶ Ground the generator. Make sure the generator's grounding wire is connected to the grounding wing nut and to an earth-driven copper or brass grounding rod.	<ul style="list-style-type: none">▶ Change the oil after every 50 hours of use.▶ Clean or replace the air cleaner pre-cleaner after every 25 hours of use.▶ Clean or replace the air cleaner cartridge after every 100 hours of use.▶ Change the oil filter after every 100 hours of use.▶ Clean the cooling slots after every 100 hours of use.▶ Clean or replace spark plugs annually.▶ Follow manufacturer's recommendations on maintenance schedule and service.
<div><div>Insulation Blower</div><div>(Krendl 1000 or J&R Krendl 1090)</div><div></div></div>	<ul style="list-style-type: none">▶ Connect fresh air hose to blower (not shown).▶ Use correct amperage and voltage from the generator so the blower is not damaged.▶ Connect hoses and tubing using clamps.▶ Use the least amount of hose/tube necessary.▶ Avoid kinks and bends in the hose/tube.▶ Reverse hoses to blow out clogs.	<ul style="list-style-type: none">▶ Replace air lock seals. If you notice a puff before insulation is fed through the hose, the seals may be going bad.▶ Lubricate chains, but not excessively.▶ Clean air filter.▶ Remove insulation from the hopper. When combined with a little water, Borax added to the insulation quickly corrodes the beaters.

The Hot Climate Initiative is a partnership between DOE and hot climate states to reduce energy costs for low-income persons by improving the energy efficiency of their homes while ensuring their health and safety. Drastic funding cuts in 1995 hit hot climate states hard, forcing substantial cutbacks in weatherization staff and services. Recent funding increases have allowed DOE to reinvigorate the Hot Climate Initiative to help states adopt new weatherization practices.

Direct technical questions to:

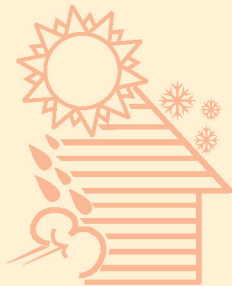
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U.S. DOE Hot Climate Initiative

DENSE-PACK
SIDEWALL INSULATION



This technical brief reviews installation techniques taught during the 2006 Florida whole-house weatherization training as part of the U.S. Department of Energy's Hot Climate Initiative. Materials provided during training contain more information.

Dense-pack sidewall insulation is one of the most cost-effective weatherization measures for Florida single-family homes. Dense-packing the sidewalls substantially improves the thermal envelope and air barrier by reducing heat loss in the winter, heat gain in the summer, and air infiltration year-round. Cellulose is an ideal material for this application because of its high R-value and ability to fill cracks and crevices within wall cavities. See the *Air Sealing* technical brief for more information on placing the air barrier in direct contact



Practice installing dense-pack sidewall insulation on a wall mock-up to learn the tricks for completely filling cavities.

BUILDING ASSESSMENT

- ▶ Inspect the exterior wall cavities to determine whether dense-pack sidewall insulation is warranted.
 - ▷ Remove exterior siding in several locations and drill test holes. (See *Assessing Sidewall Cavities*.)
 - ▷ Dense-pack all sidewall cavities if there is no insulation or if more than half of tested sidewalls are empty.
 - ▷ Skip sidewall insulation if all test holes indicate wall insulation.
 - ▷ If some wall cavities have existing insulation and some do not, drill additional test holes. If more than half the tested sidewalls are empty, dense-pack all sidewall cavities.
- ▶ Check for unvented space heaters. If present:
 - ▷ Do not dense-pack sidewalls if the space heater is the primary heating system, or
 - ▷ Replace space heater with a vented heating system before dense-packing sidewalls.
- ▶ Perform zonal testing to define the pressure boundary of the building and identify which walls should be dense-packed. (See the *Air Sealing* technical brief.)
- ▶ Determine whether to install insulation from the exterior or interior.
 - ▷ Exterior installation is relatively hassle-free for the client and contractor.
 - ▷ For interior installation, prepare clients for intrusion and dust. Notify clients that all items should be cleared away from all exterior walls to give workers access. Inform clients that holes in wall will be plugged and patched, but not sanded or painted.
- ▶ Note obvious wall defects, including large cracks. Dense-packing sidewalls can damage walls since insulation is compressed into a confined space. "Blowouts" occur when walls bulge and crack, allowing insulation to escape the cavity. Identifying these defects helps avoid blowouts.
- ▶ Estimate material needed to dense-pack sidewalls.
 - ▷ Measure the gross wall area and subtract the window and door areas for the entire house. Determine the wall cavity depth to be insulated. Generally, this is 3½".
 - ▷ A 30-pound bag covers approximately 34 ft² of exterior wall area or three sections of 8' walls (2"x4" studs, framed 16" on-center). Check manufacturer's specifications to estimate material needs.

PREPARING THE HOUSE FOR DENSE-PACK SIDEWALL INSULATION

- #1 Remove a section of exterior siding to expose sheathing. Drill through sheathing with a low-speed ½” drill (400-600 rpm) using a 2 ⅛” self-feed bit or equivalent. Find all blockages in the cavity using a non-conductive probe. Drill additional holes as needed to access the entire wall.

Accessing Sidewall Cavities: Removing And Reinstalling Siding

From the Exterior:

- Wood Lap Siding** – Use a thin edge pry bar or shingle ripper to remove nails from two courses of siding. The lower board should drop out once nails are removed. Start in the middle of the piece if the ends bind. Store boards in a safe place nearby. Replace any broken pieces with primed, new siding. When reinstalling, re-nail with galvanized or aluminum 6p-8p box nails.
- Aluminum, Steel, or Vinyl Siding** – Pull open the J-lock on the bottom of the siding. Use a zip tool to start the process. A clothesline with a knot at one end can be pulled along the inside lock seam to open the siding without bending it. For oxidized aluminum, use an orbital saw to cut the bottom of the siding, under the lip. Flip the siding up, being careful not to bend it, and wedge 4” supports between the wall and siding to support the siding. Use great care opening vinyl when it’s cold. Reinstall the siding by snapping the J-lock back on the bottom. Use the zip tool to rehook the J-locks.
- Masonite Lap Siding** – Face nailed: drive the nail head through with a punch. Spackle the old nail holes when you replace the siding. Blind nailed: follow the procedure for Wood Lap Siding.
- Wood Shakes and Shingles** – Score the paint vertically on each shake to be removed. Remove nails. Use a pry bar to loosen the shake. Pull down. Only remove shakes where holes will be drilled. Reinstall shakes by sliding them upward. Face nail with shake nails or 4p galvanized box nails.
- Cement Asbestos Shakes** – Check with the state OSHA office on how to identify and deal with suspected asbestos materials. Face nailed: pull the nails out with pliers or an end cutter. Be careful not to drop shakes. Store shakes in a safe spot nearby. Reinstall shakes by nailing through hole in shake. Blind nailed: remove the nails from two runs of shakes. Use a pry bar or shingle ripper to remove the blind nails from the top of the lower shake. Never drill or saw cement asbestos shakes.
- Asphalt Shingles** – Remove nails from two or three runs and remove the shingles. Fold the tar paper back to expose the sheathing. Reinstall shingles.

From the Interior:

- Sheetrock or Plaster (Interior)** – Cover contents of the house. Drill 2” holes in the plaster with a carbide-tipped hole-saw. Insulate the exterior cavity of partition walls to prevent bypasses. Use Styrofoam plugs to fill drilled holes and apply joint compound or spackle to each plug.

Few conditions prevent sidewall insulation from being installed. When significant problems prohibit safe installation of insulation from the exterior, blow insulation from the interior.

- #2 Move the generator to an open space. Set up the generator, placing it away from the blower on level ground. Be sure that the generator is grounded to prevent electrical shock.
- #3 Connect the 3” hose from the blower to the 2” hose using a tapered steel nozzle and clamps. Connect the 2” hose to the 1½” tubing using a tapered steel nozzle and clamps. Use steel nozzles to avoid clogging. Do not use duct tape to connect hoses and tubing.
- #4 The Blower Control should be set on 5 and the Slidegate on 2½. The Blower Control controls the air flow rate. Reduce the blower to avoid blowouts. The Slidegate controls the insulation feed rate.

BLOWING INSULATION

- #5 Push the tubing upward into each wall cavity until a blockage is felt. Verify the amount of tubing in the wall against the length of the cavity. Pull the tube out approximately 6” and begin blowing insulation.

- Insulation will fill the cavity from the bottom. Dense-packing insulation is accomplished by compressing the insulation from the top or bottom toward the drilled hole. Insulation will begin to dense-pack once the cavity is almost filled.

- #6 Slowly pull the tubing out of the hole as the flow slows. When the end of the tube reaches the hole, put the tube into the bottom of the cavity. Again, as the flow slows, pull the hose out slowly.

- An 8’ cavity should fill in 90 seconds to 2 minutes.
 - Turn off the feeder as the cavity fills and the wall starts to pack tight, but allow the air to run to prevent clogs. The proper density is achieved when insulation springs back after being compressed.
 - Shut down the blower if a cavity does not fill after 4 minutes. Find out where insulation is being blown.

- #7 As large cavities are filled, someone else should open small cavities around windows, above fire stops, and bracing. Carefully probe these cavities to find any hidden connections between framing and other cavities. After discovering a bypass, choose the best access point and decide how to block off the construction detail with dense-packed insulation.

- #8 Patch major blowouts. Replace drywall and secure with drywall screws. Blow insulation into cavity. Patch minor blowouts as insulation is being blown. Add drywall screws where walls need reinforcement. Touch up any damaged interior surfaces with Durabond or spackle.

- #9 Plug holes drilled in exterior sheathing with wood plugs and reinstall siding. Plug holes drilled in drywall with Styrofoam plugs. Apply a topcoat of Durabond or spackle to conceal the plug. Perform a blower door test to determine infiltration reduction. Clean the entire job site, both interior and exterior.



Remove siding and drill through sheathing to access wall cavities.



Push the tube into each cavity. Slowly pull the tube out as the flow of insulation slows.

TOOLS & EQUIPMENT

- Generator (12 kW)
 - Insulation blower
 - Non-conductive probe
 - 3” hoses and 2” hoses
 - 1-½” tubing
 - Tapered steel nozzles and clamps
 - ½” drill and hole saws
 - Vacuum cleaner and extension cords

Hand Tools: pry bar, shingle ripper, punch, zip tool, pliers, end cutter, putty knife, hammer

Extra Materials: fiberglass insulation, sheetrock (Gypsum), plugs, Durabond, spackle, sandpaper, drywall screws, nails, lumber of various sizes, wood primer, paint brushes, gasoline, gasoline container