

Best Practices for Weatherization

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Best Practices for Weatherization

What We Will Talk About

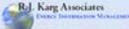
- Determining best practices for your weatherization program.
 - What are best practices?
 - Sources of best practices.
 - Process of effective development of best practices.
- Suggested best practices for northern climates.

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Best Practices for Weatherization

Based on Best Practices Projects

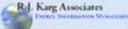
- North Dakota Weatherization Field Standards, 2002.
- Maine Weatherization Field Standards, 2004.
- New Hampshire Weatherization Field Standards, 2004.
- **Specification of Energy-Efficient Installation and Maintenance Practices for Residential HVAC Systems, Consortium for Energy Efficiency, 2000, www.cee1.org/resid/re-ac/hvac.php3.**
- Manual of Accepted Practices for Maine Model Energy Code, Maine Public Utilities Commission, 2005.
- Midwest Weatherization Best Practices Field Guide, 2005.

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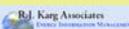
What's that Best Practice?!



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Best Practices for Weatherization

What are Best Practices?

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Best Practices for Weatherization

Best Practice Clean up in ND



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What are Best Practices? 1

- The most effective methods for installing energy saving measures.
 - Dense pack wall insulation for walls, for example.

What are Best Practices? 2

- The best materials to use for weatherization work.
 - Borate-only cellulose rather than cellulose with ammonium sulfate, for example.

What are Best Practices? 3

- The best equipment to use for weatherization work.
 - Insulation blowing machine that has capacity to supply a static pressure of at least 80 inches of water at the machine takeoff, for example.

What are Best Practices? 4

- The best maintenance schedule for weatherization equipment.
 - Combustion analyzers and carbon monoxide instruments should be calibrated according to the manufacturers recommendations (every six months), for example.

Is There a Maintenance Problem?



What are Best Practices? 5

- The most effective methods for performing diagnostic procedures.
 - Use advanced Building Tightness Limit (BTL_a) procedure to determine ventilation needs of the house for acceptable indoor air quality, for example.

What are Best Practices? 6

- The most effective methods protecting the health and safety of clients and weatherization workers.
 - For example:
 - Perform worst-case draft test after all work is completed in appropriate dwellings.
 - Perform worst-case draft test at the end of every work day in appropriate dwellings.

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NOT a Best Practice



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Sources of Best Practices

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Sources for Best Practices - 1

- Your state weatherization practices.
 - Don't forget to appraise the methods of your own program first.
 - Ask for ideas from energy coordinators, estimators/auditors, crew foremen, crew workers, contractors, and others. Include all in process so that they become interested in the process.

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Sources for Best Practices - 2

- Existing state, regional, or national weatherization standards.
 - Most state standards and some other relevant documents are in the "public domain".

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Sources for Best Practices - 3

- Consult with national experts in appropriate fields.
 - Interview experts. Have your questions ready and organized before you call.

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Sources for Best Practices - 4

- Field research.
 - Research that you conduct before deciding on a best practice method.
 - Pilot studies regarding tentative best practices.

Sources for Best Practices - 5

- Codes.
 - NFPA codes: 31 (oil), 54 (gas), 211 (venting), 70 (electric).
 - International Energy Conservation Code.
 - Local and state codes.

Sources for Best Practices - 6

- Manufacturer's information and standards.
 - For example, specifications for insulation blowing machines.
 - Blower door and duct blower instruction manuals.

Process of Effective Development of Best Practices

Recommendations for Best Practices Process - 1

- Determine for YOUR program.
- Process of selection should include as many people from YOUR program as possible.
 - Be creative with ways to get "buy in" at all levels, including top management (yes, Executive Directors, too).
 - Set up ongoing advisory group that is vertically integrated.
- The PROCESS is probably as important as the outcome (best practices).

Best Practices for Weatherization

Installing Foundation Insulation in ND



This is great for ND, but not in New England 25

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Recommendations for Best Practices Process - 2

- Use a high degree of diplomacy during process.
- Try not to force practices on those who will have to use them. Better to work for consensus during and after the process.
- Show respect for needs and routine at all levels.
- Try to structure as an ongoing process, rather than as a one-time event.
 - This sets up structure of continuity.
 - Brings credibility to efforts.

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Recommendations for Best Practices Process - 3

- Include a method for final approval and recognition of the best practices.
 - All attend a statewide meeting to discuss, adopt, and begin using.
- Build in and document a method of revising best practices at least once every two years.

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Recommendations for Best Practices Process - 4

- Recognize the issue that crews and/or contractors perform weatherization work.
- Unless your source is public domain, make sure you get permission to use method, protocol, recommendation, etc.
- Follow up with appropriate training. Try to use field training over classroom training.

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Recommendations for Best Practices Process - 5

- Format the best practices document so that it can be easily altered in the future.
- Always keep the program/agency mission statement in mind. This helps cut through self-interest.
- After your mission statement, make the best practices document the centerpiece of your program.

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NOT a Best Practice



Bubble wrap doesn't cut it! 30

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Model Weatherization Best Practices for Northern Climates

Blower Door

- Perform at least a pre- and post-weatherization blower door test and record CFM₅₀ values.
- While blower door is depressurizing, inspect interior of dwelling, including basement.

Wisconsin Blower Door Test



Air Sealing

- Use blower door guided air sealing methods.
- Develop a protocol for air sealing:
 - Target CFM₅₀ values (for example, Ohio).
 - Cost-effective air sealing (for example, Wisconsin).
- Thermal boundary and pressure boundary (air barrier) should be aligned.
- Do not seal penetrations in basement ceiling unless
 - Such sealing will minimize health and safety problems;
 - Such penetrations are leaking to the outdoors.

Attic Bypass in Rhode Island



From basement to attic

Attic Insulation

- Use borate-only cellulose.
- Complete attic bypass work before installing attic insulation.
 - If attic is floored, remove enough flooring to thoroughly inspect for and treat all air bypasses.
 - Do not install insulation above attic floor without written permission of client.
- If attic is already insulated, make sure that added insulation passes the energy audit SIR test.
- Ventilate attic properly.

2" Setback from Chimney



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Wall Insulation

- Dense pack closed walls with borate-only cellulose after all appropriate preparation work.
- Cellulose density shall average at least 3.5 lb/ft³ and not be less than 3.25 lb/ft³.
- Cellulose shall be installed with an appropriate tube long enough to reach ALL parts of each wall cavity.
- Siding shall be removed before each fill hole is drilled in the sheathing. Holes shall be plugged before the siding is replaced.
- Etc.

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Basement Insulation

- Basements usually should be considered part of the thermal envelope.
- Rim joist/sill area should be air sealed and insulated to at least an R-10.
- Basement walls should be insulated to 2 feet below grade if state energy audit yields an appropriate SIR.

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Crawl Spaces

- It is preferred to include crawl spaces as part of the thermal envelope.
- Install a ground cover on crawl space floor, regardless of the thermal boundary location.
- When appropriate insulate crawl space walls to at least R-10.
- Do not vent crawl space (climate dependant).

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Floor Insulation

- Insulate floors to a minimum of R-19.
- Install insulation so that it is in contact with the underside of the subfloor above.
- Fasten insulation securely in place, but do not use house wrap or chicken wire.

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Floor Insulation in Massachusetts



Window and Door Measures

- Window and door measures should be determined by cost-effectiveness procedures.
- Use lead-safe practices.

Indoor Air Quality

- Ensure that dwelling complies with ASHRAE 62.1 (BTLA) or 62.2 upon completion of the weatherization job.
- Identify IAQ problems and, if possible, eliminate sources.
- Measure flow at exhaust fans. Replace fans if required.

Worst-Case Draft Testing

- Perform a worst-case draft test at the end of each work day in appropriate dwellings.
- Perform a worst-case draft test after all weatherization work is completed.
- If dwelling fails the worst-case draft test, repair problem.

Zone Pressure Diagnostics

- Use ZPD when appropriate:
 - Attached garages.
 - Moisture problems in attics.
 - To check air sealing efforts (attic bypasses, basement walls, etc.).

Gas Water Heaters

- Check for adequate draft and lack of spillage under worst-case conditions.
- Carbon monoxide concentrations in the vent connector must be 50 ppm or less.
- Check for gas leaks at water heater and for the length of gas supply lines leading to water heater.

Furnaces and Boilers

- Perform a combustion efficiency test.
- Measure carbon monoxide in vent connector.
- Test for draft and spillage under worst-case conditions.
- Check for gas leaks at unit and in gas supply lines.
- Check for temperature rise in furnaces.
- Clock gas meter for gas systems.
- Oil systems must be cleaned and tuned annually.

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Oil Boiler w/o Service for 2.5 Years



Clogged
heat
exchanger
at top



Underside of
heat exchanger
from firebox



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Heating System Replacements

- Base replacements on energy audit SIR.
- When deciding whether to repair or replace, consider the remaining service life of existing.
- ALWAYS calculate the design heat load requirements for a replacement system.
- Whenever possible, replacement should be direct-vent, sealed combustion.

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Air Conditioning (Cooling)

- Window units should be removed during the heating season (preferred) or sealed with an airtight cover.
 - Replacement units should be ENERGYSTAR rated.
- For central units a professional service person should be hired to check coil air flow, inspect for refrigerant leaks and proper charge, and adjust controls.

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Heat Pumps

- All heat pumps with electric auxiliary must be served by a control system that minimizes the operation of the electric resistance heaters.
- Inform clients about routine operation and maintenance.
- A professional service person should be hired to check coil air flow, inspect for refrigerant leaks and proper charge, and adjust controls.

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Gas Range Testing

- Inspect the range top and oven burners for proper operation and maintenance.
- Measure the range top burners for carbon monoxide levels (as-measured).
- Measure the oven bake burner for carbon monoxide levels (air-free).
- Deliver appropriate client education regarding use and maintenance.

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Duct Leakage, Site-Built Homes

- Bring ductwork within thermal envelope, if possible.
- If cannot bring within thermal envelope, seal joints with mastic and insulate to a minimum of R-8.
- Seal large leaks within the thermal envelope and leaks that might have a hazardous impact on health and safety.

Taping Registers & Grilles for Duct Leakage Testing



Duct Leakage, Mobile Homes

- Convert belly return system to living-space return.
- Perform duct leakage test to the outdoors with duct blower and blower door, OR, use pressure pan.
- Sum of pressure pan reading should be three or less.

Sealing Duct Boots with Mastic



Mobile Home Measures

- Test and repair ductwork for leakage.
- Insulate ceilings, walls, and bellies when cost effective according to state energy audit.
- Replacement water heaters should be HUD approved.

Mobile Home Wall-Stuffing Method



Duct-Inducted Room Pressures

- Provide pressure relief when pressures are more than 3 Pascals between a room and the main body of the dwelling when the air handler is operating.
- Test and adjust before the final worst-case draft test.

Health and Safety

- Inspect and/or install smoke alarms.
- Inspect and/or install CO alarms where needed.
- Vent dryers.
- No unvented (vent-free) combustion.
- Use lead-safe weatherization practices.
- Inspect for health and safety problems.
- Perform worst-case draft test.



Baseload Measures

- Fluorescent lamps used for replacement should be ENERGYSTAR rated.
- Install low-flow showerheads.
- Replace refrigerators when appropriate.
 - Replacement refrigerators should be ENERGYSTAR rated.

Organic Refrigerator Meter

