

What are Best Practices?

- The most effective methods of saving energy while maintaining comfort, ensuring health and safety, protecting investment, and minimizing maintenance costs.

Cost-Effectiveness Ranking

- Systems maintenance
- Attic insulation with air sealing
- Wall insulation/general air sealing
- Floor insulation
- Lighting and appliances
- Water saving measures
- Replace heating/cooling systems
- Windows

What are Best Practices?

- The best maintenance schedule for equipment.
 - Clean and tune oil-fired appliances each year, gas-fired appliances every two years.
 - Regularly maintain cooling equipment.

Oil Boiler w/o Service for 2.5 Years



Occupant now suffers from chronic CO poisoning.

What are Best Practices?

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

What are Best Practices?

- **The best materials to use for energy-efficient rehab.**
 - **Borate-only cellulose rather than cellulose with ammonium sulfate.**

What are Best Practices?

- The most effective methods for performing diagnostic procedures.
 - Use blower doors for air leakage testing of detached single-family dwellings.
 - Use infrared analysis for checking insulation coverage in walls.

Blower Door Testing



Blower doors measure air leakage.

Test results are expressed as CFM₅₀ values.

What are Best Practices?

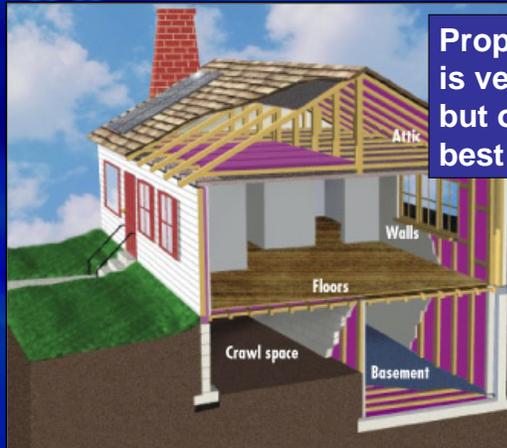
- The most effective methods for protecting the health and safety of occupants and workers.
 - Perform combustion safety testing after all work is completed in appropriate dwellings.

Unvented Space Heater

Provide an effective heating system so that occupants are less likely to use unvented combustion for space heat.



Where to Insulate



Properly insulating is very important, but only one of many best practices.

Blower Door

- Perform at least a pre- and post-rehab blower door test and record CFM_{50} values.
- While blower door is operating, inspect interior of dwelling, including basement.

Finding Leaks while Blower Door is Running



Air Sealing

- Use blower door guided air sealing methods.
- Develop a protocol for air sealing:
 - Search for leaks with blower door on.
 - Target CFM₅₀ values.
 - Cost-effective air sealing.



Common Leak

Top of double walls between apartments with vent stack.

Search and fill using foam to air seal in attic.



Look for dirty fiberglass

Plug Chimney Chase

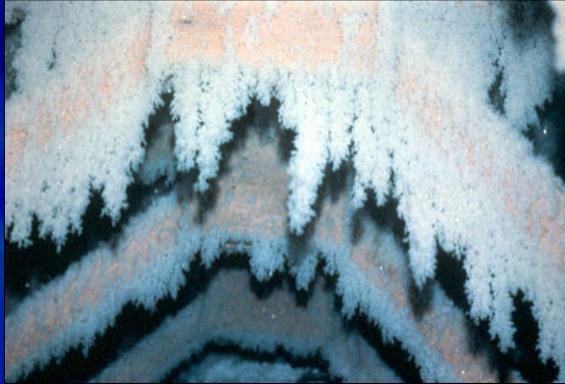


Seal with 26 gauge galvanized steel

Attic Insulation

- Use appropriate insulation.
 - Blown cellulose, borate-only.
 - Blown fiberglass.
 - Fiberglass batts.
- Complete attic bypass work **BEFORE** installing attic insulation.
- If attic is already insulated, make sure that added insulation passes the cost effectiveness test.
- Ventilate attic properly.

Delicate, but Destructive



Frost in
an attic!

Why?

Open-Blow Cellulose in Attic



2" Setback from Chimney



Fiberglass in Attic



Wall Insulation

- Dense pack closed walls with borate-only cellulose.
- Cellulose density of 3.5 to 4.5 lb/ft³.
- Cellulose should be installed with an appropriate tube long enough to reach ALL parts of each wall cavity.
- Siding should be removed before each fill hole is drilled in the sheathing. Holes should be plugged before the siding is replaced.



Dense pack cellulose
blown into wall

Fiberglass Batts In Wall



Infrared to Test Insulation



Basement Insulation

- Basements usually should be considered part of the thermal envelope.
- Rim joist/sill area should be air sealed and insulated.
- Basement walls should be insulated if cost effective.

Fiberglass on Wall



Northern climate

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.
- Do not vent crawl space (climate dependant).

Part of Thermal Envelope



Part of Thermal Envelope



Two-Part Foam



Floor Insulation

- Insulate floors if part of thermal envelope.
- 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 to hold it up.

Insulation of Floor Overhang in Massachusetts



Window and Door Measures

- Window and door measures usually do not pass the cost-effectiveness test, but there are often other reasons to replace.
- Use lead-safe practices during replacement.

Replacement Windows



U-value = 0.3 for these units

Indoor Air Quality

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

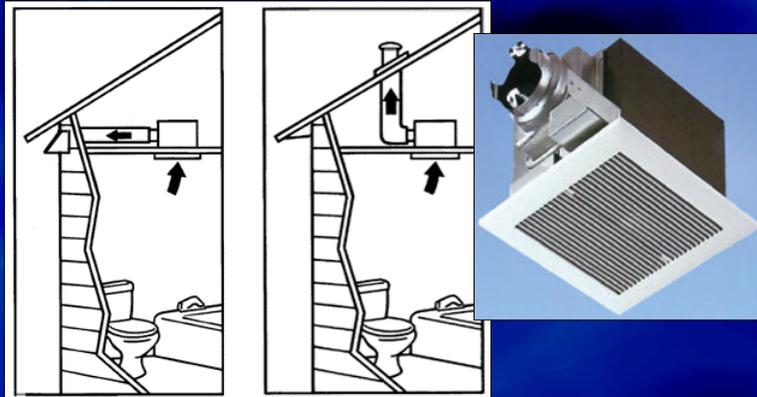
If Needed, Replace Existing Range Hood Fan



Venmar S1311LS range hood with 40 CFM background & 75, 160, and 270 CFM high speeds.

Very quiet

Panasonic Exhaust Fans



Exhaust Fan Flow Meter



Gas Water Heaters

- Make sure heater is properly insulated.
- Plan for replacement rather than being surprised by an emergency.
- Replace unit with a high Energy Factor.
- Replace with direct-vent or mechanically vented unit.

Atmospheric Gas Water Heater



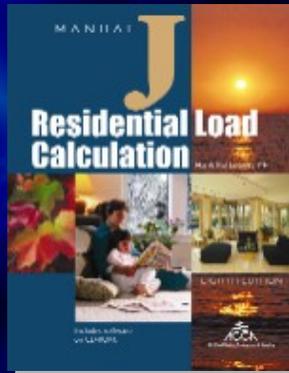
Direct-vent unit
with concentric,
double-wall
vent connector

Heating Systems

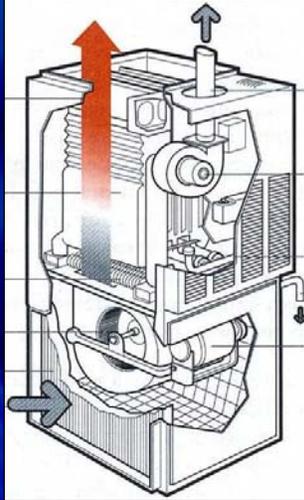
- Base replacements on cost effectiveness.
- When deciding whether to repair or replace, consider the remaining service life of existing system.
- **ALWAYS** calculate the design heat load requirements for a replacement system.
- Whenever possible, replacement should be direct-vent, sealed combustion.

Load Calculation Manual

Manual J, 7th or 8th edition



Condensing Gas Furnace



Space Heater, Direct-Vent



Air Conditioning/Heat Pumps

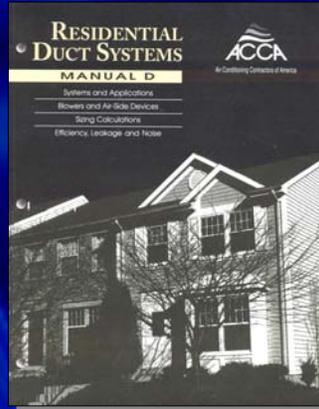
- Remove window units during the heating season (preferred) or seal with an airtight cover.
- For central units a service person should check coil airflow, inspect for refrigerant leaks and proper charge, and adjust controls.
- Heat pumps with electric auxiliary must have control system that minimizes the operation of the electric heaters.

Good Ducts Start with Good Design

This is NOT good design!



Duct Design Standard is *Manual D*



Duct Leakage

- 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.

Duct Blower



For determining
duct leakage



Ducts Should Be Permanently Tight



Mechanically
fastened

Sealed with
mastic

Return Air is Essential

- Return air paths are critical to a good duct system.
- A closed door can serve as an air distribution damper!!
- Provide pressure relief when pressures are more than 3 Pascals between a room and the main body of the dwelling with door closed and air handler operating.



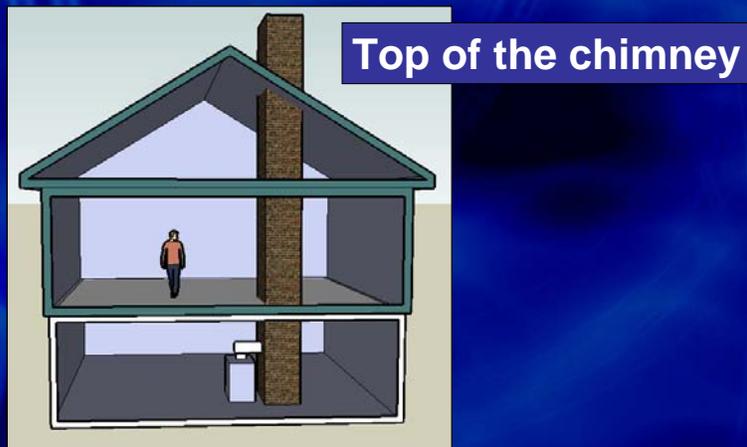
Health and Safety

- Inspect and/or install smoke alarms.
- Inspect and/or install CO alarms where needed.
- Vent dryers.
- No unvented (vent-free) combustion.
- Use lead-safe rehab practices.
- Inspect for health and safety problems.
- Maintain all equipment properly.
- Perform combustion safety tests.

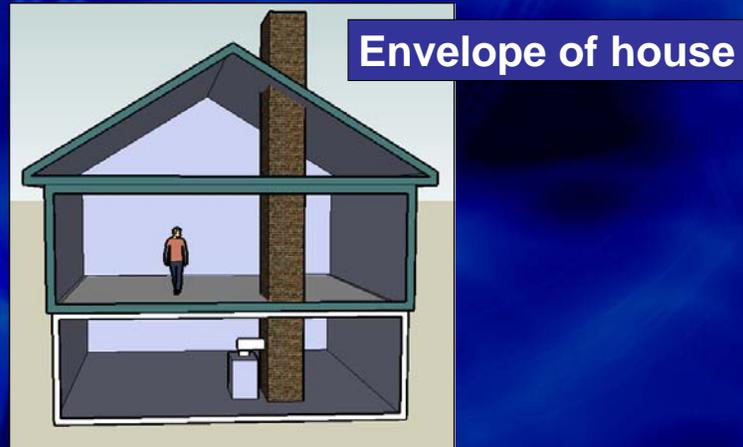
Combustion Safety Testing

- Perform combustion safety testing after all rehab work is completed.
- Check for gas leaks.
- If appliance fails the testing, mitigate problem.

Where Does the Vent System End?



Where Does the Vent System Begin?



Combustion Safety Testing

- Determine worst-case conditions in combustion appliance zone (CAZ).
- At worst-case conditions, test:
 - Spillage.
 - Draft.
 - Carbon monoxide.



**Checking for
carbon monoxide**

Gas Range Testing

- **Inspect the range top and oven burners for proper operation and maintenance.**
- **Measure the range top burners for carbon monoxide levels.**
- **Measure the oven bake burner for carbon monoxide levels.**
- **Deliver appropriate education regarding use and maintenance.**



Gas oven testing

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Lighting and Appliances

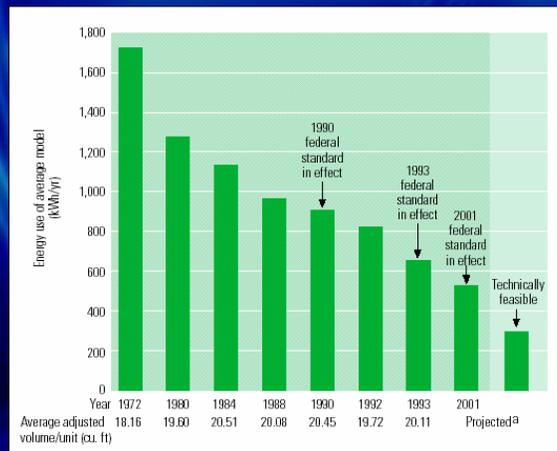
- Fluorescent lamps used for replacement should be ENERGYSTAR rated.
- Install low-flow showerheads.
- Install low-flow toilets.
- Replace refrigerators when appropriate.
 - Replacement refrigerators should be ENERGYSTAR rated.

Incandescent vs. CFLs



1/4 to 1/3 energy for same lumen output

Energy Consumption U.S. Refrigerators



Best Practices Standard

- **Summary**
 - **Develop a best practices standard for the properties for which you are responsible.**
 - **Revise your standards annually.**
 - **Include details of best practices standards in any work contract.**