

## WHY HOME IMPROVEMENT EXPERT?

An easy way to get a quality job.

Research findings reveal significantly reduced energy savings and potential performance risks where home improvements are not properly installed. To help homeowners address this challenge, the U.S. Department of Energy has compiled world-class expert guidance from industry leaders and national laboratories in factsheets and checklists under the name **Home Improvement Expert**. Homeowners can leverage these expert recommendations to help ensure quality installation by attaching Home Improvement Expert checklists to vendor contracts and ensuring the vendor completes and signs the checklist before accepting the work.

## READY TO DO MORE?

This factsheet and accompanying checklist cover one of more than 20 home improvements covered by the U.S. Department of Energy Home Improvement Expert. Use them to help optimize energy savings and improve performance related to comfort, health, safety, and durability.

To download other checklists: [basc.pnnl.gov/home-improvement-expert](http://basc.pnnl.gov/home-improvement-expert)

For more customized home improvement recommendations:

- Get your **Home Energy Score** from a qualified assessor ([www.home-energy-score.gov](http://www.home-energy-score.gov))
- Schedule an expert assessment through **Home Performance with ENERGY STAR®** ([www.energystar.gov/homeperformance](http://www.energystar.gov/homeperformance)).



## BENEFITS

Installed correctly, a new oil or gas boiler can cut utility expenses while improving comfort.

Systems for heating and cooling your home cost more money and use more energy than any other system in your home—typically over 50% of your utility bill. High-efficiency sealed-combustion direct-vent oil and gas boilers have efficiencies exceeding 90% and improve safety by drawing combustion air from outside instead of indoors and exhausting emissions through sealed flues. However, a quality installation is integral to a well-performing system. Nearly half of all heating and cooling systems in U.S. homes are not installed to the manufacturers' instructions and perform below rated capacity and efficiency.

## RELATED HOME IMPROVEMENT CONSIDERATIONS

Before purchasing an oil or gas boiler, consider working with a qualified home energy assessor to evaluate other related home performance needs and opportunities. This includes:

- selection of two-stage or modulating equipment that can better adapt to significantly reduced heating and cooling loads when insulation and air sealing upgrades are planned;
- integration of a fresh air system to dilute dilute, exhaust, or filter contaminants;
- identification of insulation materials that may be contaminated with asbestos.

For more information on air conditioners, please search the **Building America Solution Center**, [basc.pnnl.gov](http://basc.pnnl.gov).

## TIPS FOR HIRING A CONTRACTOR

- Look for licensed, insured, and certified contractors.
- Check references and reviews on home improvement web sites.
- Get multiple bids in writing.
- Check with your utility and state, local, and federal weatherization programs for rebates and incentives.
- Include the Home Improvement Expert™ checklist in bids and contracts to ensure quality installation.
- Consider using a Residential Energy Services Network (RESNET) certified Home Energy Rating System (HERS) rater, Building Performance Institute (BPI) certified Building Analyst, or other qualified professional (e.g., licensed engineer or architect) to inspect the work.

**ENCLOSURE UPGRADES**

Attic Air Sealing and Insulation

Basement Wall Insulation

Framed Wall Insulation

Masonry Wall Insulation

Home Air Sealing

Vented to Unvented Attic

Vented to Unvented Crawl Space

Window Replacement

**HEATING & COOLING**

Air Conditioner Replacement

Gas Furnace Replacement

Heat Pump Replacement

Duct Sealing and Insulation

Oil or Gas Boiler Replacement

**HOT WATER HEATING**

Gas Tank Water Heater

Gas Tankless Water Heater

Heat Pump Water Heater

**FRESH AIR SYSTEM**

Bathroom Exhaust Fan

Kitchen Exhaust Fan

Balanced HRV/ERV

Balanced Supply plus Exhaust

Supply Integrated with HVAC

**PROPER SEQUENCING OF HOME IMPROVEMENTS**

Through the U.S. Department of Energy's Building America research program, expert guidance has been developed for optimizing whole-house energy-efficiency upgrades. This includes a recommended sequence for home improvements (shown below) to help ensure homeowners get the most out of their upgrade investments while minimizing potential harm from safety, indoor air quality, and moisture issues.

**STEP 1: ENSURE SAFE AND DURABLE**

Have experts assess opportunities to improve energy efficiency and identify comfort, moisture management, health, and safety issues.

**STEP 2: ENSURE FRESH AIR**

Ensure effective ventilation before increasing air tightness.

**STEP 3: ENSURE MOISTURE CONTROL**

Ensure adequate water protection before reducing the ability of walls to dry by adding air sealing and insulation.

**STEP 4: ENSURE DRAFT-FREE**

Capture air sealing opportunities not accessible after insulation is installed.

**STEP 5: ENSURE THERMAL COMFORT**

Insulate at least to the latest national code recommendations for your location after addressing related safety, indoor air quality, and moisture management issues.

**ANYTIME: EQUIPMENT UPGRADES**

Replace heating and cooling equipment, water heaters, windows, appliances, lighting, fans, and electronics when they fail or become out of date with ENERGY STAR® qualified products or better, and improve systems to operate more efficiently.



This U.S. Department of Energy checklist includes important specifications that can contribute to a complete and quality installation. All work shall comply with these specifications, all relevant codes and standards, and all manufacturer installation instructions. The contractor shall check each box on the checklist below and sign and date at the bottom to certify the work is completed.

## PREPARATION

- All accessible piping, radiators, and other components shall be inspected for damage or asbestos, and any observed problems shall be reported to the homeowner with recommendations for remediation before proceeding with the work. Alternately, in the case of hydro coil forced-air heating systems, the duct system shall be inspected, and any damaged, disconnected, undersized, unsupported, or excessively long ducts shall be repaired or replaced.
- Equipment shall be selected and sized in accordance with the Air-Conditioning Contractors of America (ACCA) Manuals J and S.

## INSTALLATION

- An ENERGY STAR-certified, high-efficiency, sealed-combustion, direct-vent boiler shall be installed.
- The boiler shall be installed in accordance with the ANSI/ACCA Standard 5 HVAC Quality Installation Specification.
- For improved efficiency, the boiler shall include a multi-stage or modulating burner with adjustable output to better match heating loads, reduce the number of on-off cycles (and cycling losses), and allow operation for longer hours at lower firing rates.
- The boiler shall be equipped with electronic controllers, which can increase equipment life, improve boiler efficiency, and enhance comfort by adjusting boiler water temperature, creating time-delay relays, performing automatic post-purge, preventing warm weather boiler operation, controlling the position of mixing valves, and controlling pump speeds.
- The condensate line shall drain to a sewer or to outdoors. If condensate is drained to outdoors then the drain pipe shall be protected from freezing with either insulation or heat tape. Also, a drain pan shall be installed under the boiler as a backup measure.
- An outdoor reset sensor shall be placed away from any exhaust vents including kitchen, bath, dryer, and mechanical system vents and it shall not be in direct sunlight during any portion of the day. For condensing boilers, an outdoor reset control shall be installed matching system output to actual load and a recommendation shall be provided to homeowners to not use a night-time temperature setback strategy. Settings for the boiler reset curve and flow rates shall be selected to optimize the performance of the system and to ensure that the return temperatures are low enough to promote condensing.
- If installation of a new direct-vent sealed-combustion boiler results in a vacated entry point in the chimney, the hole in the chimney wall shall be sealed.



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### COMMISSIONING

<input type="checkbox"/>	A minimum of a 20°F temperature differential shall be maintained between the supply and return temperatures under design conditions.
<input type="checkbox"/>	The temperature setting on the boiler reset curve shall be below the boiler's high limit setting.
<input type="checkbox"/>	The warm weather shutoff shall be verified to be set at a high enough temperature to prevent no-heat situations during the swing seasons.
<input type="checkbox"/>	Where present, the gas line shall be tested for leaks and a combustion safety test shall be performed after installation is complete.
<input type="checkbox"/>	If installing a direct-vent boiler results in an orphaned water heater still connected to an existing vent or chimney that may now have inadequate draft to remove the water heater combustion emissions, the contractor shall inform the homeowner of necessary remediation steps (e.g., installing a chimney liner) to provide proper venting and code compliance.

I hereby certify that, to the best of my knowledge and ability, all checked items on the above checklist have been accomplished as part of completion of this home upgrade.

Contractor Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Contracting Organization: \_\_\_\_\_

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