U.S. DEPARTMENT OF ENERGY | Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

Home Improvement Expert™ Factsheet

Duct Sealing and Insulation

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

For more customized home improvement recommendations:

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

BENEFITS

Properly sealed and insulated heating and cooling ducts can reduce your utility bills by up to 20% while improving comfort, health, and durability.

Air ducts distribute conditioned air from your central heating and cooling equipment to warm and cool your home. However, they are often poorly sealed and under-insulated. Leaky supply ducts can lead to potential moisture-related problems as well as higher utility bills. Leaky return ducts located in unconditioned spaces can draw in hot and cold air along with dust, pollen, moisture, soil gases, and pests, which can increase utility bills while reducing the air quality in your home. That's why sealing and insulating your ducts effectively is critically important, especially if they are located in an unconditioned attic, basement, or crawl space.

RELATED HOME IMPROVEMENT CONSIDERATIONS

Before sealing your ducts, consider working with a qualified home energy assessor to evaluate other related home performance needs and opportunities. This includes:

- installing new heating and cooling equipment;
- integration of fresh air into the heating and cooling system to to provide ventilation; and
- integration of high-capture filters in the return duct to more effectively remove particulates from the air you breathe.

For more information on ducts, please search the Building America Solution Center, 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 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.

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For more resources, visit
basc.pnnl.gov/home-improvement-expert

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Home Improvement Expert™ Checklist

Duct Sealing and Insulation

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

☐	The entire length of the duct system (e.g., in the attic, basement, or crawlspace) shall be inspected and damaged ducts shall be repaired or replaced. Flexible ducts with excessive length shall be cut to proper length and sharp bends shall be corrected so bends are greater than or equal to one duct diameter radius.
☐	All unsupported horizontal duct runs shall be supported with hanger strap or saddle supports that are at least 1.5 inches wide and spaced no more than 4 feet apart, in accordance with the Air Conditioning Contractors of America (ACCA) Manual D and manufacturer's recommendations. Additional supports shall be provided before and after sharp bends in the ductwork. The maximum permissible sag between supports shall be ½ inch per foot.
☐	Before sealing the ducts, leakage testing shall be performed in accordance with Residential Energy Services Network (RESNET) Standard Chapter 8 or ACCA Standard 5. Based on this pre-test, a targeted maximum level of duct leakage shall be determined and provided to the owner, preferably 10% or less of total air flow.
☐	Airflow shall be measured at each register with a powered flow hood as specified in the RESNET Standard Chapter 8 to help determine likely locations of leaks or damage.

INSTALLATION

☐	All duct leaks, connections, and plenums shall be sealed with UL-approved mastic, UL 181 tape, or equivalent (e.g., aersol sealant) used in strict accordance with manufacturer's instructions.
☐	If the air filter is installed in a filter box attached to the air handler, the filter access panel should be fitted with an air-tight gasket.
☐	Duct boots in unconditioned spaces shall be sealed to finished surfaces with caulk, spray foam, or other approved sealants.
☐	All accessible ducts in unconditioned areas (attics, crawlspaces, basements, and garages) shall be insulated to ≥ R-8 for supply ducts and ≥ R-6 for return ducts.
☐	Insulation moved during duct sealing and insulating shall be replenished to levels that meet or exceed pre-retrofit levels.
☐	A MERV 8 or higher filter shall be installed in the filter rack.

COMMISSIONING

☐	After the ducts are sealed, air leakage shall be tested per RESNET Standard Chapter 8 or ACCA Standard 5 and results provided to homeowner to verify that duct leakage is less than or equal to the target level, preferably 10% or less of total air flow.
☐	Air flow across the coil shall be tested following procedures approved by ANSI/ACCA Standard 5 QI-2015 to verify it is within the CFM range specified by the equipment manufacturer. If it is not, adjustments shall be made by a qualified HVAC contractor.
☐	A pressure balance test shall be performed with bedroom doors closed. Where pressure differentials are ≥ 5 Pascals, transfer grills or jump ducts shall be installed with openings equal to 1 $in.^2$ free opening per CFM of supply air to the bedroom. Jump duct boots shall be sealed to finished surfaces with caulk, spray foam, or other approved sealants.

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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