



The U.S. Environmental Protection Agency's **ENERGY STAR® Program** promotes the use of high-efficiency technologies and equipment. ENERGY STAR labeled homes use at least 30% less energy than homes built to meet the national Model Energy Code while maintaining or improving indoor air quality. These fact sheets are designed to help consumers learn more about the energy-efficient improvements to their ENERGY STAR labeled homes.

# DUCT INSULATION

## AIR DISTRIBUTION SYSTEM IMPROVEMENTS

Air distribution system ducts are designed to supply conditioned air from space heating and cooling equipment to the living spaces and return an equal volume of air from the living spaces back to the heating and cooling equipment to be conditioned. Ducts are usually located in unconditioned spaces such as attics, crawlspaces, garages, or unfinished basements and made out of thin materials that easily conduct heat. Due to the extreme winter and summer temperatures in these spaces, 10 percent to 30 percent of the energy used to heat and cool the air is lost to conduction through the duct surfaces. In order to maintain temperatures at a comfortable level, the heating and air conditioning equipment has to compensate for this heat loss or gain by conditioning additional air. Thus, uninsulated or poorly insulated ducts reduce the efficiency of the heating and cooling systems and increase energy bills.

Uninsulated or poorly insulated ducts can also cause occupant discomfort, especially during the winter months. As conditioned air moves through uninsulated ducts, it loses heat through conduction.

As a result, rooms served by long duct runs can experience "cold blow" because they typically have lower heating supply air temperatures. This problem can be more pronounced with heat pumps that deliver air at lower temperatures. Even when the furnace or air conditioner is not operating, heat loss occurs due to conduction through the duct surfaces.

The need for insulation can be reduced if the ducts are located within the conditioned space. In this location, any conductive losses and gains would be minimal since ducts would be exposed to indoor air temperatures. Some insulation is still required to ensure that the conditioned air is delivered at the desired temperature, and to prevent condensation on duct walls.

As shown in Figure 1, insulation R-values should be selected based on climate and duct location. The ENERGY STAR Program promotes the proper insulation of ducts as a means of improving system efficiency and lowering utility bills.

FIGURE 1: COST EFFECTIVE DUCT INSULATION R-VALUES<sup>a</sup>

If you live in a climate that is...	and your heating system <sup>b</sup> is a...	insulate to these levels in the...	
		unheated/unconditioned attic	unheated/unconditioned basement/crawlspace
<b>Warm</b> with cooling and minimal heating requirements (i.e., FL & HI:coastal CA; southeast TX;southern LA, AR, MS, AL & GA).	gas/oil or heat pump	R-4 to R-8	none to R-4
	electric resistance	R-4 to R-8	none to R-4
<b>Mixed</b> with moderate heating and cooling requirements (i.e.,VA, WV, KY, MO, NE, OK, OR, WA & ID; southern IN, KS, NM & AZ;northern LA, AR, MS, AL & GA; inland CA & western NV).	gas/oil or heat pump	R-4 to R-8	R-2 to R-8
	electric resistance	R-4 to R-8	R-2 to R-8
<b>Cold</b> (i.e., PA, NY, New England, northern Midwest, Great Lakes area, mountainous areas (e.g., CO, WY, UT, etc.)).	gas/oil	R-6 to R-11	R-2 to R-11
	heat pump or electric resistance	R-6 to R-11	R-2 to R-11

a. Adapted from Modera et al., "Impacts of Residential Duct Insulation on HVAC Energy Use and Life Cycle Cost to Consumers," ASHRAE Transactions (#AT-96-13-4).

b. Insulation is also effective at reducing cooling bills. These levels assume that you have electric air-conditioning.

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### RESOURCES

The following fact sheets are available by calling the U.S. Environmental Protection Agency's toll-free ENERGY STAR Hotline at 1-888-STAR-YES (1-888-782-7937): ***Right-Sized/Compact Ducts, Duct Sealing, and Locating Ducts Within Conditioned Space.***

***Bigger Is Not Better*** consumer brochure available from the Environmental Protection Agency's ENERGY STAR Hotline at 1-888-STAR-YES (1-888-782-7937).

### BENEFITS

Duct insulation can provide many benefits including:

**Improved comfort.** Duct insulation minimizes conductive heat losses and gains, allowing supply air to be delivered closer to design temperatures. In winter, "cold blows" will be reduced in rooms supplied with long duct runs. This can result in quicker recovery from night-time setbacks and a more consistent level of comfort throughout a house.

**Lower utility bills.** The average homeowner spends over \$600 per year on heating and cooling. Duct insulation minimizes conductive heat losses and gains and reduces heating and cooling systems' operating time. This results in lower utility bills, making homes less expensive to operate.

**Lower equipment cost.** Duct insulation can reduce space conditioning loads and, in some cases, allows for the installation of smaller, less costly heating and cooling equipment.