

# INSULATION

## PROPERTIES

Insulation decreases energy costs and increases the building's comfort level in winter and summer. Insulation should be placed between any area that separates a heated space from an unheated space; this includes all exterior walls, attics and floors over unheated areas.

Insulation products are made of fiberglass, wool, cellulose, extruded polystyrene, and aluminum foil. They come in bulk, blown and loose fill, foam boards, and reflective foils with or without layers of polyethylene air bubble pockets.

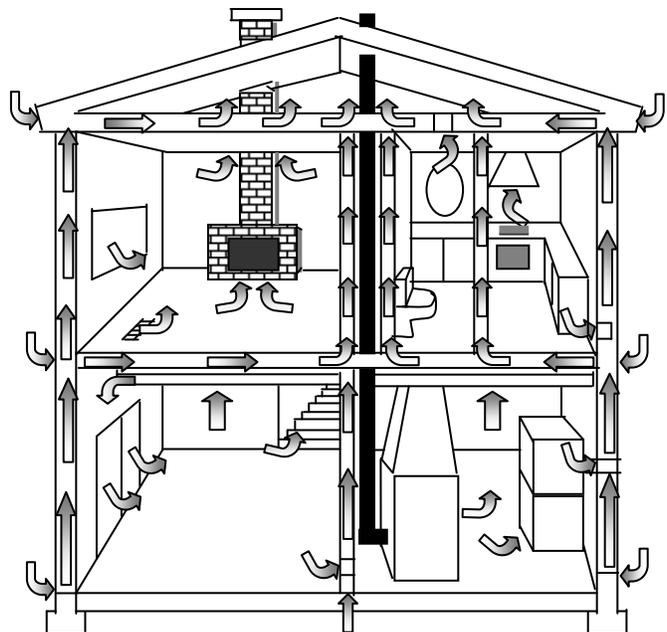
Mineral fiber and foam insulations are effective against heat loss through convection and conduction; they have no effect on radiated heat transfer. Adding reflective insulation will greatly reduce radiant heat loss. Over 75 % of a building's heat loss or gain is through radiation.

STEP Warmfloor™ must not be in direct contact with any conductive material. When using insulation with reflective aluminum foil, choose a one-sided aluminum backing and place the aluminum foil facing downwards.

Some insulation products have superior air infiltration barrier and vapor barrier properties, which restrict moisture and radon from penetrating into the building. A properly installed insulation is still required. Difficult areas to insulate are around pipes, wiring and electrical boxes.

Areas where heat is lost in the winter and gained in the summer due to free air flow openings.

Between foundation and sill	25%
Wall outlets	20%
Duct system	14%
Exterior windows	12%
Exterior doors	5%
Fireplace	5%
Recessed spotlights	5%
Range vent	5%
Dryer vent	3%
Other	3%
Sliding glass door	2%
Bath vent	1%



## **AIR FLOW**

Tests can be made to measure the air tightness of a building, to follow air movement, and to locate leaks throughout the home. Airtight houses have dramatically affected how air moves and how it impacts health and comfort. It is important to understand air pressure and the subtle, unseen way it affects the environment inside a house. Check for properly balanced air flow.

Inadequate ventilation can increase indoor pollutant levels and may lead to discomfort and even harmful health effects. STEP Warmfloor™ runs on low voltage and there is no dangerous storage of heat sources like gas and fuel, as with boilers and furnaces.

Installing a well-designed separate heating and cooling system provides the best levels of comfort. Cold air has a higher density than hot air. Cold air will fall or sink into the room, while hot air will rise. Initial cost may be a concern, but the comfort benefits and energy savings of separate heating and cooling systems as opposed to a hybrid system far outweigh the price.

## **MOISTURE**

Excessive moisture can contribute to a large number of problems, ranging from serious building damage to mold growth. The migration of moisture is determined by the combination of temperature, humidity and air movement. Mold and microbiologic contamination can be controlled with an even overall distribution of heat, as provided by STEP Warmfloor™.

During the heating season, the indoor humidity level should be maintained around 30 to 40 percent. With high humidity level, condensation forms on cold surfaces, while a too dry home will seem colder. STEP Warmfloor™ delivers the right amount of heating to a given space and the temperatures can be zoned at different levels with an electronic voltage regulator.

## **HEAT TRANSFER**

With radiant floors, the heat source is the floor itself and any covering placed over the top of that source may restrict heat transfer. It is therefore important to know the thermal transmission properties of the different floor covering materials. Both thermal conductivity and thermal resistance should be taken in consideration. STEP Heat Transmission products provide superior insulation over cold floors and give unparalleled heat transfer from radiant heated floors to floor coverings.

R-value is a measure of thermal resistance of a material in terms of heat transfer caused by conduction and convection. However it does not measure or rate a product's ability to reflect radiant heat energy. The tests that are used to show the R-factor of insulation may not correspond to the installed R-value. For example, insulation will lose much of its effectiveness with excessive moisture and a 4% void area will cause up to 50% increase in heat loss.

When higher thermal resistance is applied on the radiant floor, compensate by placing more insulation under the heating elements. STEP Warmfloor™ is self-regulating and will not overheat.

# INSULATION UNDER RADIANT FLOOR HEATING

Application	Coverage	Minimum Insulation	
		Imperial ft <sup>2</sup> h °F / Btu	Metric m <sup>2</sup> °C / W
<b>Slab on Grade</b>	(1) Perimeter to below frost line	0.125 (t <sub>i</sub> – t <sub>o</sub> )	0.04 (t <sub>i</sub> – t <sub>o</sub> )
	(2) 4 ft (1.2m) horizontal or vertical & wing at perimeter	R-5	0.88
	(3) Under entire slab	R-5	0.88
<b>Suspended Floor</b>	Under entire floor *		
Floor in contact with a heated area	Hard Surface	R-5	0.88
	Carpeted Surface	R-11	1.94
Floor in contact with the exterior, a crawl space, or a non-heated area	Hard Surface	R-13	2.29
	Carpeted Surface	R-19	3.35

\* For hydronic systems, electric cables and flexible heating films a 2-inch (5-cm) air gap is required. For self-regulating elements, do not leave an air gap.

Refer to STANDARD GUIDELINE for the Design and Installation of Residential Radiant Panel Heating Systems from the RPA.