



Bulletin

BUILDING INSULATION

From Indian Green Building Council, CII-Sohrabji Godrej Green Business Centre, Hyderabad



Builders, Architects and Service Consultants alike are constantly looking for ways to enhance energy-efficiency in buildings.

Optimum level of building insulation not only helps lower monthly energy bills, but also adds to the overall comfort. Insulation helps maintain comfort temperature by reducing leakages.

With the advent of green technologies and practices, today the potential to save energy by design can be as high as 40-50 %.

Insulation in buildings is assuming tremendous importance and has a potential to reduce energy consumption to an extent of 5-8 %.

LEED-NC Platinum



Spectral Services
Consultants, Noida

Insulation: Wall - AAC Blocks, Roof: Extruded Polystyrene

LEED-CS Gold (Pre-Certified)



RMZ Millenia Business
Park, Chennai

Properties to be considered in selection of Insulation materials

R-value: Insulation is rated in terms of thermal resistance, called R-value, which indicates the resistance to heat flow. The higher the R-value, the greater the insulating effectiveness. The R-value of thermal insulation depends on the type of material, its thickness and its density.

R-value is the reciprocal of the time rate of heat flow through a unit area induced by a unit temperature difference between two defined surfaces of material or construction under steady-state conditions. R-value is expressed in $m^2 K/W$.

Why Insulation?

Buildings without insulation and air-tight envelope can result in major energy wastage.

Benefits of Insulation

- 5-8% energy savings with a payback of 1-2 years
- Provides thermal as well as acoustical insulation
- Resistant to moisture
- Resistant to air infiltration

Applications of Insulation materials

- Exterior walls
- Interior walls
- Over the deck (roof)
-

LEED-CS Gold



Olympia Technology Park, Chennai
Insulation: Wall - AAC Blocks

U-factor (thermal transmittance) is the heat transmission in unit time through unit area of a material or construction and the boundary air films, induced by unit temperature difference between the environments on each side. U-value is expressed in $W/m^2 K$.

The relationship between U-factor and R-value is not always exactly the inverse and therefore R-value cannot be precisely extrapolated for a material of different thickness. However, assuming an inverse relationship may be adequate.

Types of insulation materials

A range of insulation materials can be installed in the building.

LEED-EB Gold



Vestas India, Chennai
Insulation: Cavity walls

LEED-NC Gold



Grundfos Pumps India Pvt Ltd, Chennai
Insulation: Cavity walls

Autoclaved Aerated Concrete Blocks

Autoclaved Aerated Concrete (AAC) blocks are produced using materials including silica sand, lime, cement, gypsum, water, fly-ash and aluminum powder. The special combination of these substances yields a material with excellent construction properties such as thermal insulation, structural strength, density and fire resistance.

LEED-NC Platinum



ITC Green Centre, Gurgaon
Insulation: Wall - AAC Blocks,
Roof: Extruded Polystyrene

LEED-NC Platinum



Wipro Technologies, Gurgaon
Insulation: Wall - AAC Blocks,
Roof: Extruded Polystyrene

ASHRAE* Building Envelope Requirements

| Opaque Elements (Insulation) | Non Residential | | Residential | |
|---------------------------------|---|--|---|--|
| | Assembly Maximum (W/m ² K) | Insulation Minimum R value (m ² K/W) | Assembly Maximum (W/m ² K) | Insulation Minimum R value (m ² K/W) |
| Roofs, entirely above deck | U-0.360 | R-2.6 ci [#] | U-0.360 | R-2.6 ci |
| Roofs, entirely under deck | U-0.720 | R-5.2 ci | U-0.720 | R-5.2 ci |
| Walls, above grade | U-3.293 | - | U-0.857 ^a | R-1.6 ci ^a |

*ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers

[#]ci - continuous insulation

Typical thermal properties of insulation materials:

The typical U values of walls & roof materials are given below:

| Material | U-value (W/m ² K) | Thickness (mm) |
|---------------|------------------------------|----------------|
| RCC Walls | 1.95 | 225 |
| AAC Blocks | 0.67 | 230 |
| Concrete Roof | 2.5 – 3.0 | 150 |

The U-values of common insulation materials are given below:

| Material | U-value (W/m ² K) | Thickness (mm) |
|----------------------------|------------------------------|----------------|
| Extruded Polystyrene (XPS) | 0.028 | 60 |
| Glass Wool stuffing | 0.25 | 150 |
| Expanded Polystyrene (EPS) | 0.30 | 100 |
| Air (Still) | 0.20 | 30 |

LEED-NC Platinum



**CII – Sohrabji Godrej Green
Business Centre, Hyderabad**
Insulation: Wall - AAC Blocks,
Roof: Extruded Polystyrene

Extruded Polystyrene

Extruded polystyrene (XPS) is a type of insulation material with a high R-value, good moisture resistance, high structural strength and low weight. Extruded polystyrene is used extensively as thermal insulation in industrial, commercial and residential construction. It is commonly used in wall and roof applications.

Expanded polystyrene

Expanded polystyrene (EPS) is a type of insulation that provides thermal and acoustical insulation with characteristics such as low weight, high moisture resistance and high structural strength. Expanded polystyrene can be used to insulate the walls and roofs. Commercially this is often referred to as thermocol.

Glass wool

Glass wool is an insulation material which gives efficient thermal insulation. It is light in weight and provides good acoustic insulation also. It is commonly used for duct and wall thermal insulation.



Rat trap bond
filled with glass wool

Insulation applications

Heat balance of a building would reveal that atleast 15 to 20 % of the heat ingress into a building can be through walls and roof. Hence, insulating walls and roof is extremely critical in the energy performance of a building.

The insulation applications are given below:

1. Wall insulation

Walls can be insulated on exterior or interior depending on the architectural aesthetics required. Typical way of insulating an exterior wall is shown in figure 1.

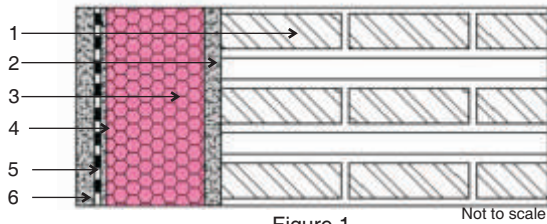


Figure 1

Exterior wall Insulation

Insulation on the exterior

1. Brick work
2. Plaster
3. Insulation
4. Polymerised mortar, 2 coats
5. Reinforced fibre
6. Elastomeric coat

In many of the buildings, insulation can be done on interior also as shown in figure 2.

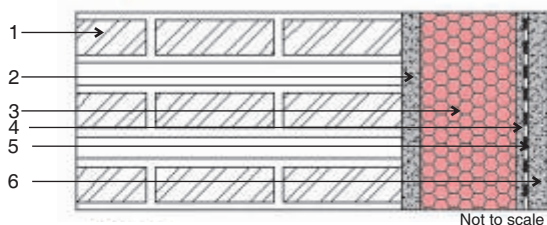


Figure 2

Interior wall Insulation

Insulation on the interior

1. Brick work
2. Plaster
3. Insulation
4. Polymerised mortar, 2 coats
5. Reinforced fibre
6. Elastomeric coat

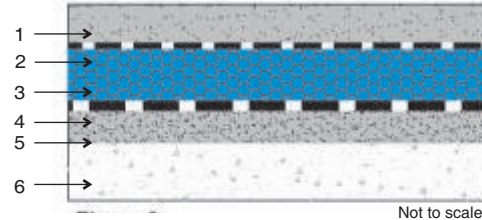
2. Air cavity walls

Air can also be an excellent insulator. Many of the buildings have been constructed with the masonry brick walls with an air gap of 20 to 30 mm, which provides good insulation.

3. Roof insulation

Roof can be insulated either over the deck or under the deck. Generally, over deck insulation is preferred, so as to avoid the absorption and retention of heat by the concrete surface.

Under deck insulation can also be considered but the thickness of insulation should be higher. Typical way of insulating the roof over the deck is shown in figure 3.



Not to scale

Figure 3

Over-deck Insulation

Over-deck Insulation

1. Final screed
2. Separation layer
3. Insulation
4. Water proof membrane
5. Base screed
6. Concrete roof deck

LEED India Rating and Insulation

Leadership in Energy and Environmental Design (LEED India rating system) of Indian Green Building Council (IGBC) awards ratings to green buildings by recognising environmental performance. Selection of insulation materials can contribute to the following prerequisite and credits in the LEED India rating system

| | |
|-------------------|-----------------------------|
| EA Prerequisite 1 | Minimum energy performance |
| EA Credit 1 | Optimise energy performance |
| MR Credit 4 | Recycled content |
| MR Credit 5 | Regional materials |

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If you are constructing a building, Go Green!

For LEED India & IGBC Green Homes registrations and green building services, kindly contact:

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