Managing Daylight and Energy

Integrated Louvers and the Three Types of Heat Transfer

The future of vision & daylight control

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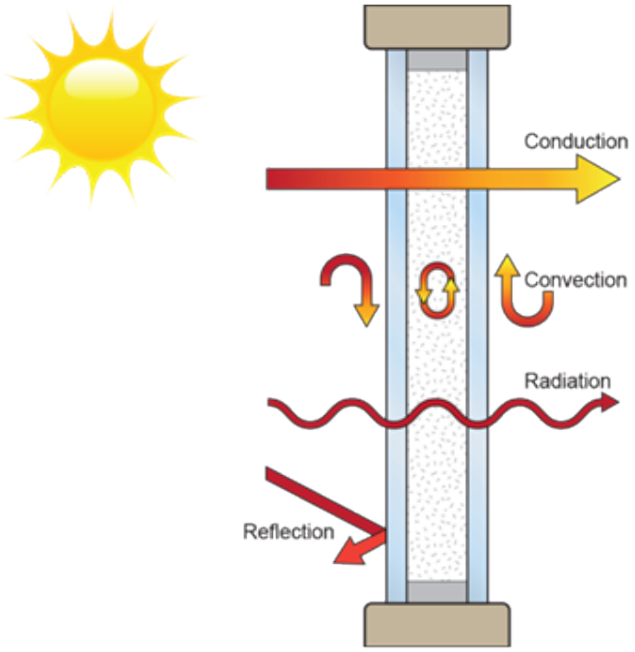
INTRODUCTION – MEASURING U-VALUES

Heat moves through space in three ways – by conduction, convection and radiation transfer. Knowing this is important for managing daylight and energy and the “U-value” of a building. A U-value is a measure of heat loss in a building element such as a wall, floor or roof. It can also be referred to as an ‘overall heat transfer co-efficient’ and measures how well parts of a building transfer heat. This means that the higher the U-value, the worse the thermal performance of the building envelope. Therefore architects, builders and consumers seek lower U-values for door and window unit ratings as they are proof of better performing products.

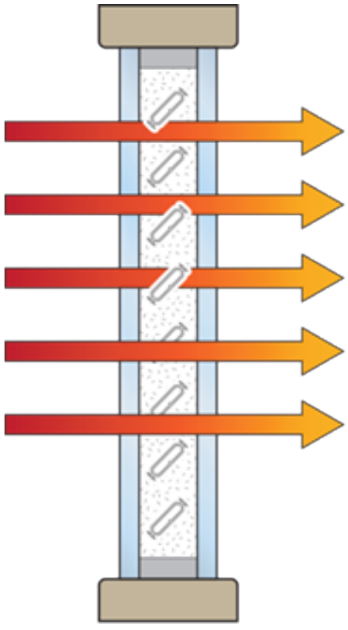
The U-value of a building takes into consideration all three types of heat transfer: Conduction, Convection and Radiation.



CONDUCTION - HEAT TRANSFER WITHIN MATERIALS OTHER THAN FLOWING FLUIDS

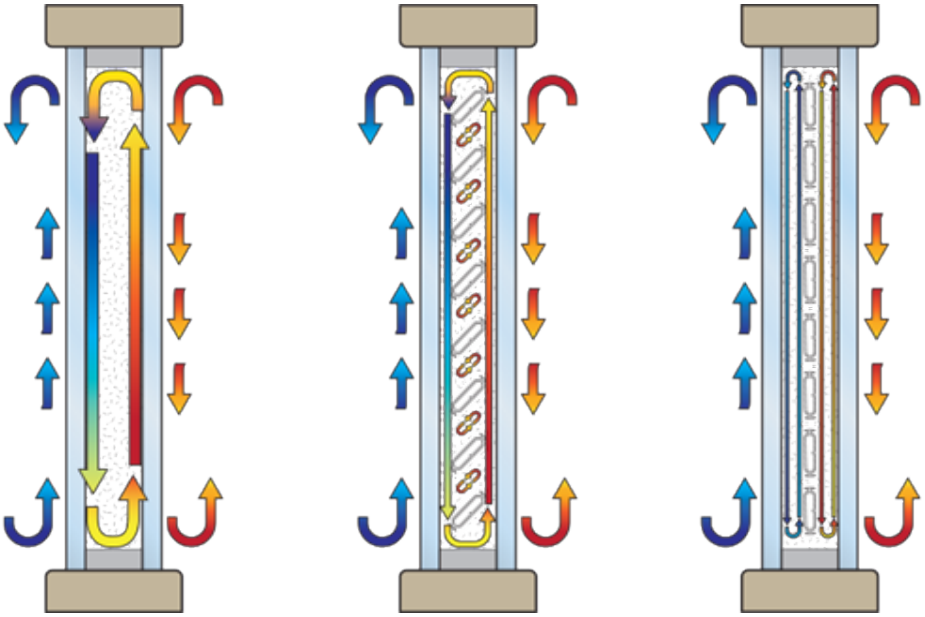
Conduction is the transfer of heat between substances that are in direct contact with each other – the transfer of thermal energy between neighboring molecules in a substance due to a temperature gradient. The better the conductor, the more rapidly heat will be transferred. Conduction occurs when a substance is heated, particles will gain more energy, and vibrate more. These molecules then bump into nearby particles and transfer some of their energy to them. This then continues and passes the energy from the hot end down to the colder end of the substance.

Integrated louvers are made with a larger distance between the louver tip (in fully open position) and the glass to minimize the conduction heat transfer effect potentially caused by the proximity of the louvers and the glass. If the louvers are positioned even at a slight angle, conduction heat transfer is significantly lowered. As the louvers reach a fully closed position, the conduction heat transfer bridge becomes non-existent.



CONVECTION - HEAT TRANSFER VIA FLOWING FLUIDS

Free, or natural, convection occurs when bulk fluid motion (steams and currents) are caused by buoyancy forces that result from density variations due to variations of temperature in the fluid. Thermal energy is transferred from hot places to cold places by convection. Convection occurs when warmer areas of a liquid or gas rise to cooler areas in the liquid or gas. Cooler liquid or gas then takes the place of the warmer areas which have risen higher. This results in a continuous circulation pattern. A good example of convection is in the atmosphere. The earth's surface is warmed by the sun, the warm air rises and cool air moves in.



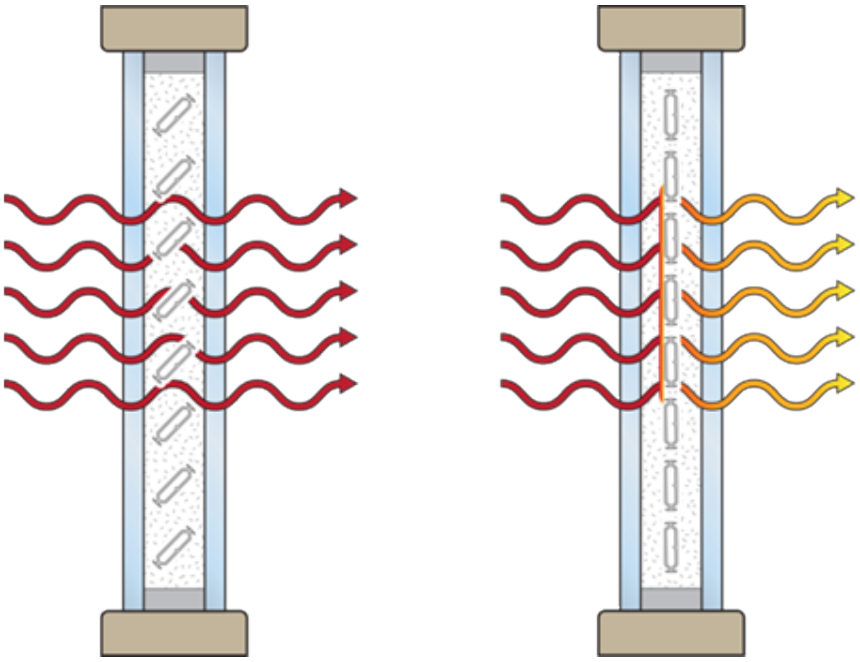
In the above diagrams, the size of the arrow corresponds to the speed of the air inside the cavity. Smaller arrows signify slower air circulation; larger arrows indicate faster air circulation.

1st image – No Louvers: Arrows are large, meaning air circulates very fast and there is limited control of heat transfer, which leads to higher U-values.

2nd image – Partially Open Louvers: Arrows are medium-sized, meaning air circulates slower due to presence of louvers in an open position. This offers greater control of convective heat transfer, thereby helping reduce U-values.

3rd image – Fully Closed Louvers: Arrows are small, meaning air circulation has slowed down drastically and closed louvers have broken the airspace into two subspaces, thereby preventing heat loss by convection loops typically found in standard insulating glass units. This has the effect of improving U-values for significantly enhanced thermal performance.

RADIATION - HEAT TRANSFER VIA ELECTROMAGNETIC WAVES



Radiation is a method of heat transfer that does not rely upon any contact between the heat source and the heated object as is the case with conduction and convection. Radiation allows heat to be transferred through wave energy. These waves are called Electromagnetic Waves, because the energy travels in a combination of electric and magnetic waves. This energy is released when these waves are absorbed by an object. For example, when energy travels from the sun to your skin, you can feel your skin getting warmer as energy is absorbed. The energy a wave carries is related to its wavelength - a “wavelength” is defined as the distance between two consecutive wave crests. During hot summer days, integrated louvers can be closed to reduce heat gain by radiation. The same applies for cold winter nights – integrated louvers can be closed to keep the heat in. U-values are thereby vastly lowered.

CONCLUSION

U-values are the measure of the thermal conductivity of a window or other building material. More precisely, if there is a temperature difference between the air on either side of a window, it measures how quickly heat will pass through the window. Low U-values permit heat to be transferred through the window slowly, and a high U-value indicates that heat is transferred quickly. The greater the difference between the desired indoor temperature and the outdoor temperature, the more important U-values are.

Internal or integrated louvers are active U-value thermal-control elements that can be used to effectively modulate all three types of heat transfer from external sources. They redirect and/or block transmitted daylight to control solar heat gain and light.

Insulating glass with integrated louvers can offer the following benefits by lowering the glazing U-values:

- Boost energy efficiency for optimal building thermal performance;
- Support enhanced comfort, health and productivity of building occupants;
- Decrease the need for air conditioning in the summer and heating in the winter;
- Support energy efficiency compliance/excellence.

THE CREATORS OF VISION CONTROL® Insulating Glass with Integrated Cord-free Louvers

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