



Managing Daylight and Energy with Integrated Louvers

White Paper

The future of vision & daylight control

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UNDERSTANDING DAYLIGHTING DESIGN AND INTEGRATED LOUVERS

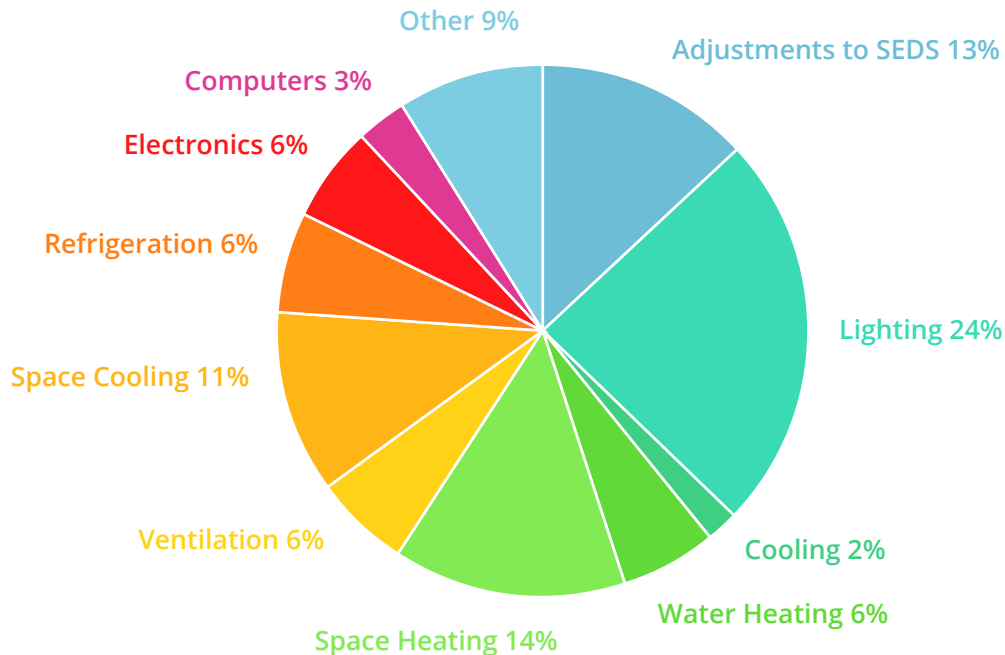
Architects today are moving away from the inefficient design approaches that have traditionally guided commercial and institutional building design. Growing trends toward energy efficiency, improved working environments and the desire for more recognizable buildings has led architects to increasingly consider daylighting as a key element of a building's design.

When daylighting design is properly incorporated into the architecture of a building, it can offer a host of benefits that range from improved productivity to reduced energy costs. In today's world, there is a real demand for architectural systems that support the mind, body, environment and bottom line.

LIGHTING IS A MAJOR ENERGY USER

Lighting is the major energy user in buildings. For example, about 24 percent of the energy consumed in commercial buildings in the US is for lighting purposes. The U.S. Energy Information Administration (EIA) estimates that in 2014, about 412 billion kilowatt hours (kWh) of electricity were used for lighting by the residential sector and the commercial sector in the United States. This was about 15 percent of the total electricity consumed by both of these sectors and about 11 percent of total U.S. electricity consumption.¹

USE OF ENERGY IN BUILDINGS



¹ The U.S. Energy Information Administration (EIA), FAQs, 2014

IMPORTANCE OF DAYLIGHT IN DESIGN

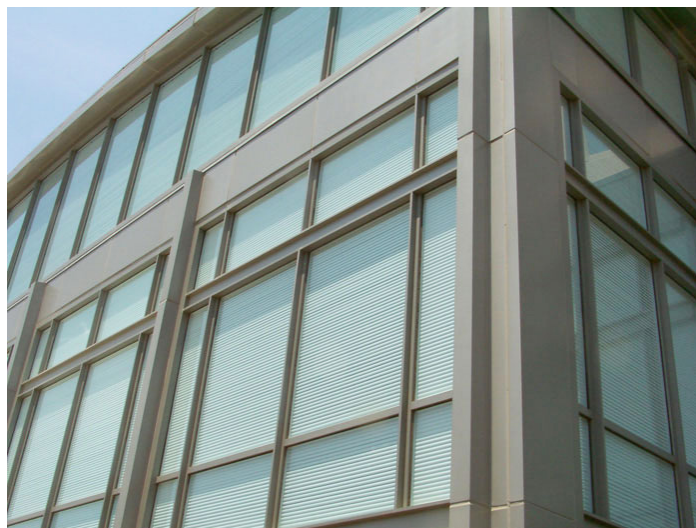
Daylighting is an effective way to reduce energy use in buildings. Large amounts of energy can be saved by using well-designed lighting controls that can take advantage of the natural light available. A good daylighting design can save up to 75 percent of the energy used for electrical lighting in a building.

Research suggests that in a daytime-occupied commercial building, dimmable daylight controls could reduce the total electricity and peak demand between 20 and 40 percent. For example, the day lit Lockheed Martin office building in Sunnyvale, California saves about \$500,000 each year in energy bills with improved daylighting design techniques.²

Daylighting or full spectrum lighting is considered essential for normal human activities. The absence of natural light upsets the body's normal rhythms, which leads to hormonal imbalances, sleep disorders and mood disturbances. In healthcare environments, there is a direct correlation between patient moods and sunlight. Typically, patients in properly sunlit rooms will be less stressed, less depressed and have shorter stays.³

Research indicates that simple exposure to natural daylight on a regular basis has consistently been shown to positively affect people's moods and improve stress levels. A study of office worker productivity conducted by the California Energy Commission found exposure to daylight was consistently linked with higher levels of concentration and better short-term memory. According to the Peter Kiewit Institute of Information Science, Technology and Engineering at the University of Nebraska, poor lighting in the workplace can lead to excessive sick days, worker discontent, high staff turnover rates and poor-quality work. Natural light, however, makes workers feel and work better, prevents eye strain, helps people retain what they have learned and boosts productivity.⁴

The effective use of daylighting also makes a big difference in learning environments. It is proven to improve student performance and expedite learning. Research has found that students in classrooms with the highest levels of daylight performed 7 to 18 percent higher on standardized tests than those with the lower levels of lighting. Also, students with the most daylighting in their classrooms progressed 20 percent faster on math tests and 26 percent faster on reading tests over the course of a year than those in classrooms with the least light.⁵



² Burke Miller Thayer. (1995). Daylighting and Productivity at Lockheed. Solar Today, 28-28. Retrieved April 1, 2015, from [http://bristolite.com/interfaces/media/Lockheed Martin Productivity Study 1983.pdf](http://bristolite.com/interfaces/media/Lockheed%20Martin%20Productivity%20Study%201983.pdf)

³ Wilson L. Intensive care delirium: The effect of outside deprivation in a windowless unit. Archives of Internal Medicine 1972; 130:225-226.

⁴ DayStar Sunlighting Systems. (1998). "Benefits of Natural Daylighting." <http://www.daystarsunlighting.com/benefits.htm>. Accessed June 11, 1998

⁵ Heschong Mahone Group. 1999. "Daylighting in Schools. An investigation into the relationship between daylight and human performance." p. 4)

DAYLIGHTING DESIGN – MANAGING THE POWER OF THE SUN

Daylight can be a powerful force and needs to be managed for optimal thermal and daylighting results.

Sunlight generates an incredible amount of energy. In the lighting industry, foot-candles are a common unit of measurement used to calculate adequate lighting levels of workspaces in buildings or outdoor spaces. To illustrate an example of the sun's power, on a clear day the sun provides 8,000 to 10,000 foot-candles of light. To put this in perspective, you only need 35 foot-candles to read.

In addition, sunlight generates more heat than visible light. The sunlight that pours through a typical 4' x 8' window can heat 15-30 gallons of water to temperatures appropriate for showering. For architects, the key challenge is to design for optimal daylight conditions while controlling solar heat gain.⁶

When developing a design, the local climate and sun path must be taken into consideration. Effective daylighting in building design needs to start with schematics that take into consideration how the building spaces will be used, illumination requirements, building positioning and local climate patterns. For example, in the morning there may be a need to capture sun's energy to warm up spaces when the sun is low in sky, but protect against glare. Whereas at noon, the concern is to avoid the hot midday sun to reduce cooling loads.

Sun patterns should be taken into account in determining window placement, what type of glazing to use, thermal insulation requirements and shading strategies. A building should be designed around the light and sun patterns to mitigate glare from direct sunlight and maximize the distribution of indirect lighting. Key design considerations should include window sizes and placement, solar shading devices, glass types, interior glazing and interior finishes.

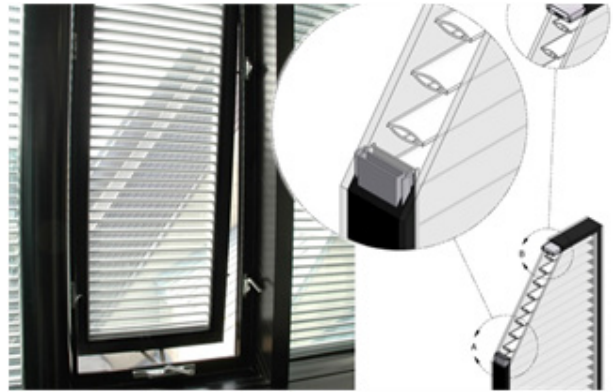


⁶ Kozlowski, D. (2006, April 10). Using Daylighting to Save on Energy Costs. Retrieved March 19, 2015.

DAYLIGHT OPTIMIZATION WITH INTEGRATED LOUVERS

What are integrated louvers?

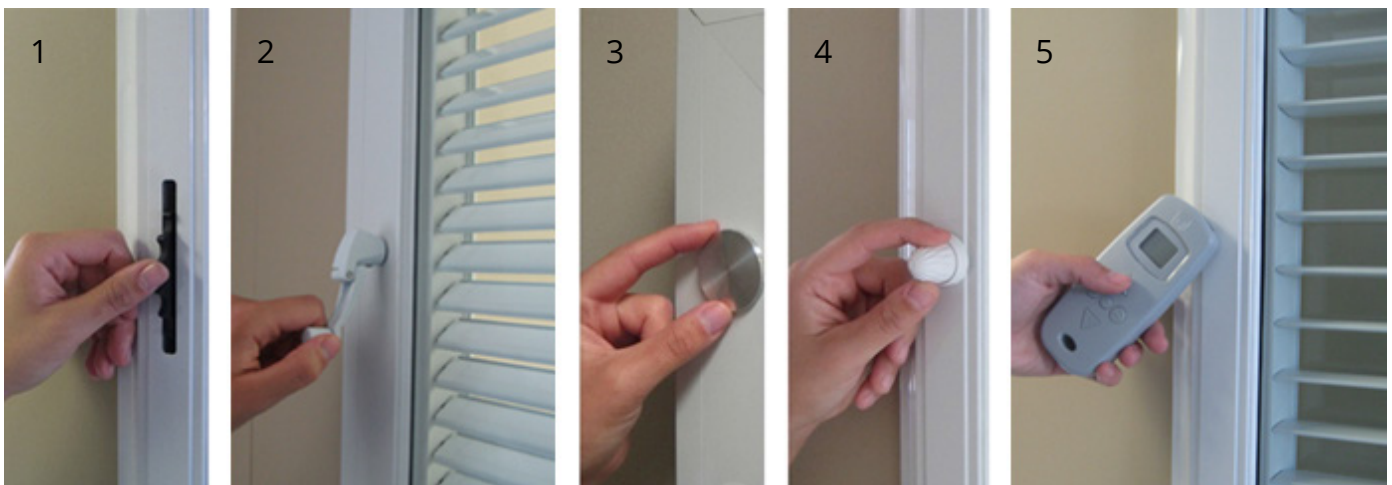
Integrated louvers are hermetically sealed glass units combining louvers within glass that can be customized to virtually any shape for interior and exterior glazing applications. Advanced louvered glazing technology typically eliminates strings and cords, ensures alignment, requires no maintenance and provides the ideal daylighting or privacy solution for commercial, residential, educational, healthcare or institutional environments. When installed in exterior applications, integrated louvers can significantly reduce energy consumption in support of LEED® requirements.



How are they operated?

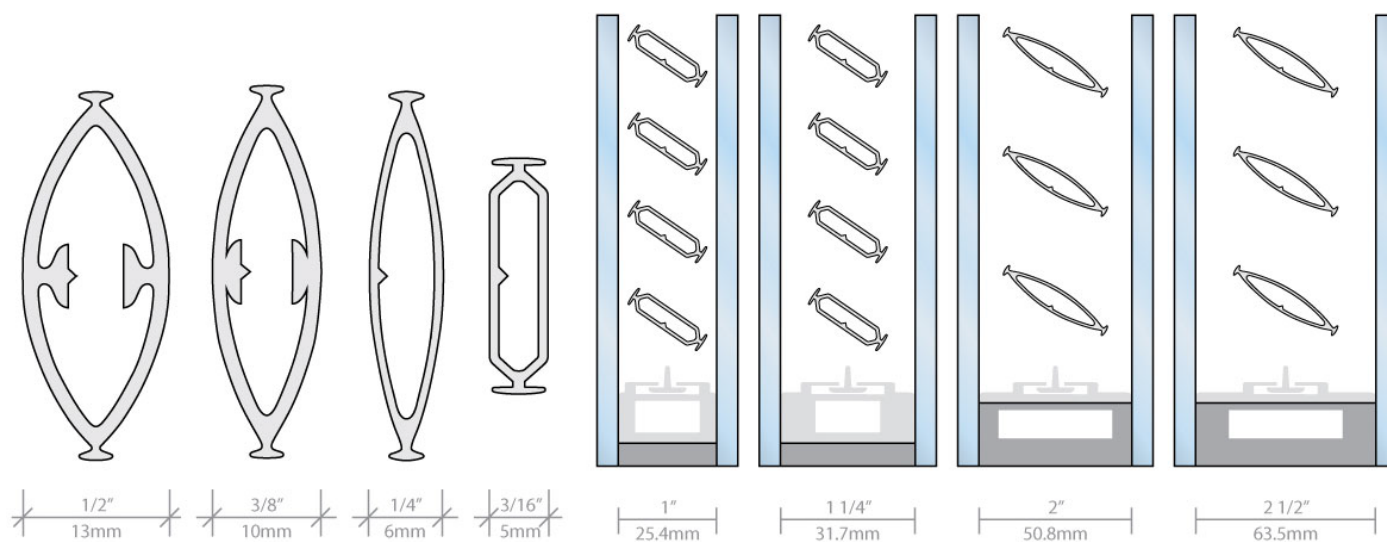
Integrated louvers typically come with a variety of control options.

1. **Thumbwheel controls** are usually self-reversing, suitable for limited space applications and accessible for one or both sides.
2. **Crank handle controls** are very easy to use, self-reversing, accessible from both sides and suitable for most applications.
3. **Aluminum knobs** are streamlined, self-reversing, and come with one or two sided controls that are ideal for sliding doors.
4. **Anti-ligature knobs** are sleek, come with self-reversing controls and are typically used in mental health facilities.
5. **Remote controls** are fast, precise and typically come with timer/sun sensor options. These controls are ideal for multiple panel and hard-to-reach installations.



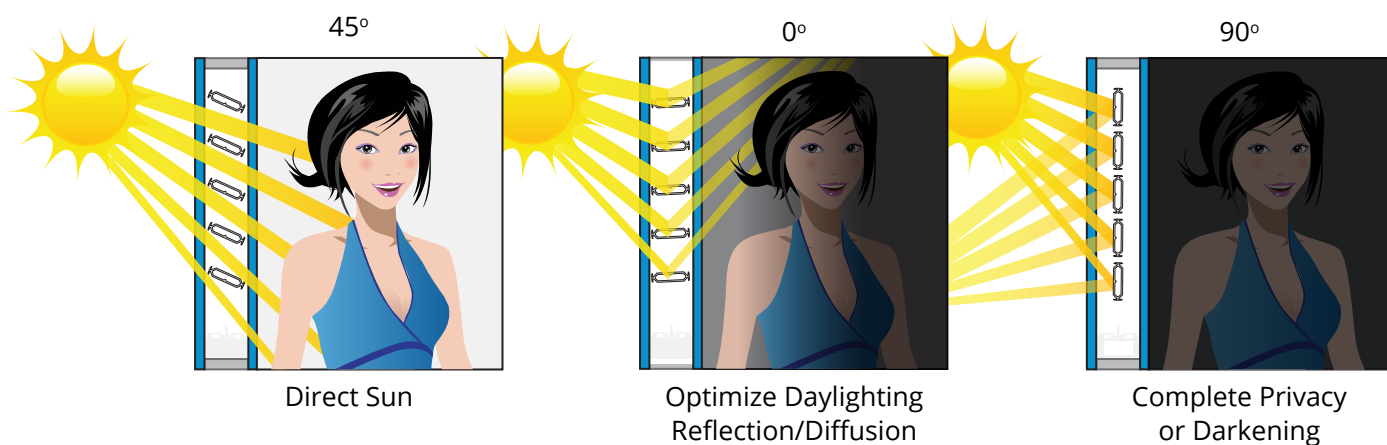
How are they constructed?

Louvers may be installed either horizontally or vertically. They are typically made of rigid, extruded aluminum and come in a variety of sizes and shapes. These interlocking blades offer utmost privacy and light control when closed. The unique hollow-chambered louvers provide maximum strength to the spacer and maintain the parallel alignment of the blades. The spacer houses high-quality desiccant that dehydrates the airspace, ensuring absolutely no condensation inside the hermetically sealed glass unit. Additionally, the thickness of the airspace provides superior sound control.



How do they work?

Integrated louvers ensure adjustable sunlight control for desired lighting levels. They can be fully opened to allow maximum daylight penetration. They can be partially opened and angled upwards to reflect off ceilings for a balanced reflective and diffused daylighting environment. And they can be fully closed for complete privacy, darkening and sunlight blocking. Integrated louvers offer significant functionality and benefits.

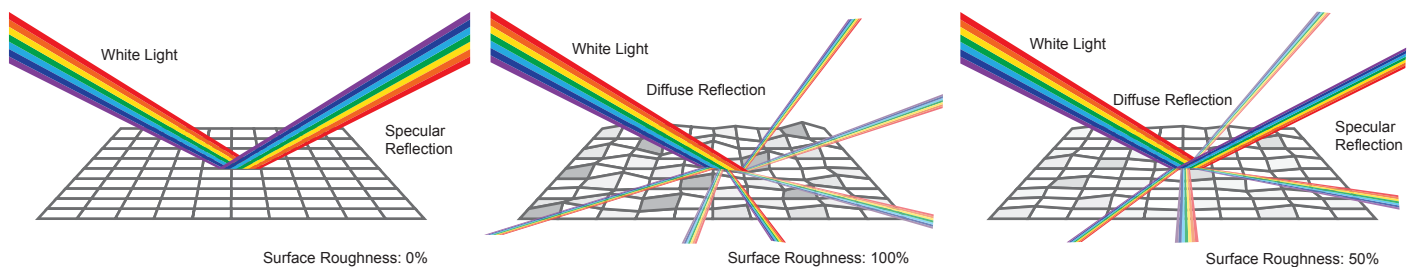


They manage the quantity and quality of light transmission to make sure that building inhabitants obtain optimal comfort. They typically feature precise control mechanisms that can rotate 180 degrees horizontally or vertically to distribute and diffuse light with a simple louver rotation. They can filter sunlight for thermal and human benefits, or reflect light back outside to block UV rays, unwanted glare and solar heat gain. Integrated louvers deliver vision when needed and privacy when required.

Mitigating glare and getting the right reflective conditions is critical to optimal daylight control. Integrated louvers will always maintain the right balance between reflection and diffusion.

Specular reflection is the mirror-like reflection of light from a single angle. With specular reflection, daylight can cause a significant glare problem. **Diffuse reflection** is the reflection of light from a surface where a ray is reflected at many angles rather than at just one angle. Standard louvers or blinds collect dust and grime which jeopardizes diffusion and impedes daylighting performance.

Painted integrated louvers promote **intermediate reflection** which achieves the right balance between reflection and diffusion for superior daylighting benefits. As the louvers are integrated, outdoor grime cannot settle on their surfaces to impede daylighting performance.



EXTERIOR DESIGN CONSIDERATIONS

Exterior daylighting design considerations are centered on using diffused light from outside – but not direct sunlight. Diffused daylighting creates uniform and consistent lighting. Additionally, daylighting should be used as a primary source of illumination.



1. Treat skylights or top lighting as light fixtures – they admit more light per unit area than windows, and can distribute it more evenly over a designated space.
2. Use exterior shading and control devices in hot climates to reduce heat gain and diffuse natural light before it enters the interior spaces.
3. Use insulating glass units with integrated louvers to filter daylight. Operable louvers typically deliver flexible heat and light control, and manage the quantity and quality of light transmission through fenestration. Motorized louvers or sun-blades can provide maximum daylight control.

INTERIOR DESIGN CONSIDERATIONS

Interior daylighting design strategies should complement exterior elements to maximize daylighting benefits.



1. Use atriums to maximize daylight into deep interior spaces. Atriums offer both aesthetic and daylighting benefits.
2. Use light colored surfaces throughout the building for enhanced light diffusion. Paint the ceiling white to promote daylight bounce and diffusion through interior spaces.
3. Use daylighting as the primary source of illumination. Electric light should be designed to supplement daylight – not the other way around – and should employ dimming controls for optimal results.
4. Increase the amount of brightness in a room by incorporating reflected daylight. For example, the use of light shelves – shelves that bounce light to the ceiling to reflect it down into the interior of a room – can enhance the amount of light in a room while decreasing the brightness of direct light from the windows.

BENEFITS OF DAYLIGHTING DESIGN WITH INTEGRATED LOUVERS

The benefits of having an integrated and cord-free louvered daylighting solution are compelling.

First and foremost, their control of heat and daylight ensures incomparable comfort. Not only do integrated louvers deliver higher energy-saving performance throughout the year, they block excessive solar heat to reduce air conditioning costs, protect against fading from damaging ultraviolet rays, and eliminate unwanted glare.

Secondly, consider the practical economic benefits. Integrated louvers are far more durable than other market alternatives and therefore have a correspondingly long lifespan. The insulating glass units are easy to install which lowers installation costs as compared to solutions that include separate glass and shading mechanisms. Additionally, integrated louvers are hermetically sealed which virtually eliminates cleaning and maintenance costs.

Thirdly, the overall esthetics are more pleasing. Integrated louvers do not sag or get misaligned. Their clean, uniform lines can enhance any design approach.

And finally, integrated louvers ensure the highest levels of hygiene. As they are hermetically sealed, they do not collect dust and germs and other bacteria, which make them ideal for healthcare and educational environments.

ABOUT UNICEL ARCHITECTURAL



For over 50 years, Unicel Architectural has built a reputation for the most advanced aluminum and glass solutions. These solutions encompass louvered glazing, skylights and more, to enhance major global construction initiatives with utmost quality and reliability. With its proprietary technology, Unicel's Vision Control® delivers unprecedented comfort and control of vision, light, temperature and sound with a patented combination of louvers between glass that are hermetically sealed and cordless. Unicel's solutions are guaranteed for longevity, optimized for energy efficiency, and customizable to any design, environmental or cultural requirements. Unicel combines its market leading know-how with great design to ensure optimal aesthetics and sustainable performance. For more information visit: www.unicelarchitectural.com

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