

Keep It Cool

Evaluating the Key Elements of Rack Arm Louvre Systems



INTRODUCTION

In order to achieve optimal thermal and visual comfort, buildings need to use a substantial amount of energy for lighting, ventilation, heating, and cooling. To mitigate this, architects can employ natural and passive cooling measures to maintain a comfortable indoor temperature. They also need to consider the glare and reflection from external elements such as buildings or bodies of water. One of the most effective solutions in this regard is external shading.

External shading systems are architectural elements that can be used to efficiently regulate heat gain harvesting as well as manage UV, glare reduction and daylighting in commercial buildings and outdoor spaces. Their biggest advantage over interior shading systems is that they prevent solar energy from entering the building space in the first place, eliminating the main source of heat gain.

Modern commercial architecture uses a wide variety of shading systems in various types, materials and styles. This includes fixed or operable systems, external venetian blinds, tensioned shading systems, rack arms and louvre systems, awnings and roller shades.

Assessing and selecting the appropriate solution for the Australian climate and the building itself is key to delivering a healthy and thermally and visually comfortable indoor environment. Below, we look at the key design considerations and elements that make up an effective external shading system.



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INDOOR ENVIRONMENTAL QUALITY PARAMETERS

Solar gain control

Solar gain (or solar heat gain) refers to the heat increase of a structure that results from absorbed solar radiation.¹ HVAC systems must use excessive amounts of energy to cool spaces because of the heat that enters through windows.

The cooling load describes the amount of heat energy that would need to be removed from a space to maintain a comfortable temperature.² Roughly half of a building's cooling load occurs through the building envelope, mainly generated by solar radiation.³

External shading systems can significantly reduce cooling loads by blocking solar radiation. This was demonstrated in a 2015 Korean study that involved a fixed external shading device that was designed to provide shade to the building during a specified period during the day in which solar radiation was strong. The study found a 35.1% reduction in the total cooling load using the external shading device.⁴

Note that cooling load reductions will depend on the shading system used. Roller shading systems offer a different result than rack arm or venetian blind systems. The Korean study highlights the importance of selecting the right solution based on the needs of users and the location and orientation of the building in relation to the sun.

An external shading system is strongly advised for glass facades facing east and west because of the buildings' increased exposure to solar radiation due to the sun's angle. The adjustable angles of rack arm blades are useful for optimising shading and lighting at varying sun angles.

Daylighting

In recent years, there has been a strong emphasis on the link between lighting quality and productivity. Several studies have demonstrated that well-lit spaces, particularly those without uncomfortable glare, can

boost productivity.⁵ These developments have put the impetus on architects and designers to create daylit work environments free of glare, particularly for offices.

Adjustable external shading systems can block and/or reduce direct sunlight, depending on the system. Some systems can be retracted when the sun has moved away to restore views and allow light and glare to enter the building. Key factors to consider in the design of a shading system include the orientation of windows and the movement of the sun. The size of the room should also be noted, as larger rooms with multiple windows may require shading systems to operate independently to provide even levels of daylight when in use.⁶

The aforementioned 2015 study also looked at evaluating the effect of shading devices on daylighting in a glass curtain wall building with a large window-area ratio by installing shading devices. In this study, the daylighting achieved using an external shading device resulted in reduced visual discomfort and improved indoor daylighting performance.⁷

Airflow

One crucial factor that must be considered when designing a building or retrofitting it with energy-efficient features is natural ventilation. There is a growing body of evidence showing that good airflow has benefits for health, comfort and productivity,⁸ but it can also improve indoor air quality by reducing the likelihood of mould development and cycling out pollutants from indoor spaces. It can also result in energy savings associated with cooling.

When shading devices are positioned in front of an opening, they can block mass airflow through the opening. Adjustable shading systems, such as a rack arm louvre system, can help prevent this by regulating the amount of airflow according to internal and external conditions by slightly tilting the louvre.

SYSTEM DESIGN AND CONSTRUCTION

1. Building design

Important considerations when choosing the most suitable external shading system for a building include the shape of the facade, the window opening, space usage and the surroundings. Certain buildings have curved designs that result in complex angles and shapes that require sun shading. Irregular-shaped windows or openings that are on a slope or at an angle may call for more versatile shading solutions.

Not all shading systems can be fit for purpose. Shading systems need to be selected based on the building's requirements and the size and shape of the window. Rack arm louvre shading systems, for example, can be readily designed for sloped and shaped glazed areas, including uniquely shaped windows.



2. Wind loads

As wind speeds increase with elevation, certain external shading systems cannot be installed on high-rise structures. The location of these facade elements affects the wind pressures acting on them, and the resulting loads are transmitted to the building through the fixings.

When choosing a specific system, whether you are designing a vertical or horizontal screen, it is crucial to understand that the maximum span is influenced by the depth and profile of the panel you have chosen, as well as the local wind pressures. In addition, it is important to carefully consider the effects of wind pressure on various profiles and substrates.

3. Durability

As they are constantly exposed to the outside elements, external shading systems need to be diligently maintained so that they can perform optimally. Due to this, careful attention should be paid to the materials used to construct external shading systems.

Some products from brands that are not familiar with Australian conditions might not be suitable for the local climate. For example, some shading systems use plastic or PVC that is not UV stabilised for some of their component parts. These parts will eventually deteriorate from continuous use and exposure to the sun and rain, which will lead to the system's failure. Rack arm louvre systems are specifically designed to be used as an external shading system, therefore are robust, and have a long lifespan.

4. Operation method

Adjustable shading systems allow the user to control the desired level of heat gain, UV and glare entering a space. This is beneficial all year round; in winter, the user can allow more sunlight in to warm up the space, while in summer, they can control the sunlight to keep the space cool and reduce excessive glare. For all seasons, shading systems have been proven to reduce the reliance on HVAC systems and artificial lighting.

However, it is important to note that manual systems require active users. Manual systems need to be operated by the user using a physical crank attachment. Motorised systems can be operated via a number of methods, including remote control and/or an automated shade control system.

Research has shown that occupants do not operate window shades in an optimal fashion. It has been reported that only six percent of users were actively adjusting shades daily, while the majority of users adjusted shades seasonally (24%) or yearly (20%).⁹

In light of these findings, it is strongly recommended that automated systems are considered the first choice for external shading systems. In the absence of automated shading systems, shade operation is reliant on the user, who

is likely to be less efficient in managing heat gain and glare on a day-to-day basis than a system that is automated.

The majority of external shading systems can be automated and integrated into a Building Management System (BMS). For an external shading system to reach its peak performance levels and be successfully integrated into new or existing building management, guestroom automation or home automation systems, the automated shade control system needs to be specifically designed for that purpose.

5. Supply and installation

When selecting an external shading system, it is important to keep in mind where the system is manufactured. Lead times will affect project delivery and installation. Local suppliers will have the benefit of shorter delivery times and a reduced risk of shipping delays. The following are several other advantages to choosing a local supplier:

- opportunities for closer design collaboration;
- familiarity with Australian building codes and standards;
- quality assurance and safety standards;
- greater supply chain transparency; and
- local knowledge and ongoing support.

6. Sustainability

The market for sustainable buildings and products is being driven by the requirement for green building certification programs like LEED, Green Star and the WELL Building Standard. The benefits of sustainable building design include lower operating costs, healthier work environments, and a smaller environmental footprint.

External shading devices contribute to credits or points under green building schemes due to increasing thermal efficiency as well as controlled daylighting. For example, Visual Comfort is a criteria under Green Star, recognising the delivery of well-lit spaces that provide high levels of visual comfort to building occupants. Another criteria to consider is the reduction in energy consumption from HVAC usage.

Making an environmentally responsible choice is about choosing products and brands that are committed to sustainability. This may be demonstrated through the use of renewable raw materials, the use of renewable energy in the manufacturing process, and waste reduction initiatives. Other factors to consider include the recyclability of materials, durability and expected lifespan, maintenance requirements and end-of-life disposal.

For external rack arm louvre systems, the slats are made of either timber or aluminium. Both materials offer sustainable properties. For example, timber has the benefit of being a renewable material and, with the right upkeep, has a long lifespan. Aluminium is inherently resistant to the elements, easy to maintain and easy to recycle when components reach the end of their service life.

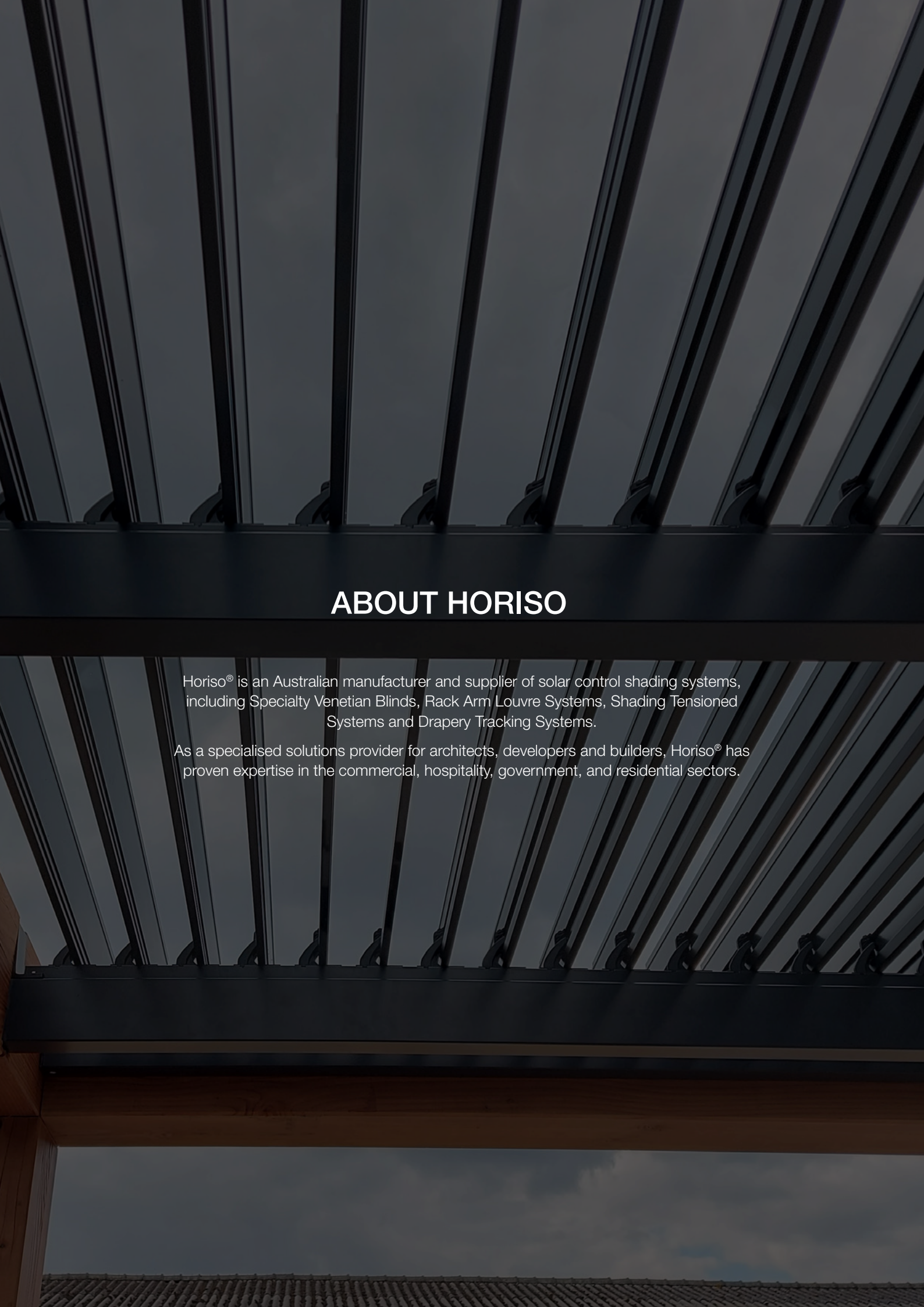
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EVALUATING RACK ARM SYSTEMS

Horiso is the Australian distributor of Sunshield® Unique Louvres, the world leader in operable Rack Arm Louvre Shading Systems. A perfect system for all types of shaped windows for maintaining light, solar control and privacy.

Rack Arm Systems use fixed support arms that hold aluminium or timber interlocking or overlapping slats that tilt from 0° to 90° by way of fixed (non-operable), manual, motorised or automation control. The tilting slats provide the optimal amount of daylight, minimising the need for artificial lighting and air-conditioner usage by maintaining effective airflow and reducing overall solar heat gain.

Design Consideration	Rack Arm Systems
Solar gain control	Exterior rack arm blades have a shading coefficient of less than 0.10 and can therefore prevent more than 90% of the solar energy from coming through the glazing and being converted into heat.
Daylighting	Can be used to optimise shading and lighting at varying sun angles.
Airflow	Can be used to optimise flow of air into any space.
Design flexibility	• Suitable for installation on standard and uniquely-shaped glazing, such as rectangular, triangular, trapezoidal and circular shapes. • Can be installed at any angle, such as on sloped and skylight structures. • Different blade colours, sizes and shapes offer different aesthetic looks to compliment the architectural appeal of a building.
Operation method	• Systems can be fixed or controlled via different methods, such as manual crank operation, motorised via standard controls, remote control, switches or sophisticated shading control systems. • Systems can integrate into any building management system, guestroom management system or home automation system. • Sophisticated shading control systems can be programmed based on pre-set times or wind or sun tracking.
Durability	• Rack arm systems require minimal maintenance and are easy to clean. • UV-stabilised components that will not break or crack under Australian conditions. • Aluminium slats are made from high-grade extruded aluminum, which means they are rigid and stable and can be recycled. • Timber slats made from sustainably sourced timber with certifications such as FSC and cradle to cradle.
Wind loads	Suitable for external and/or internal usage, and can withstand winds up to 100 km/hr.
Supply	Manufactured and assembled locally in Australia.
Sustainability	Contributes to achieving a high environmental green building rating.



ABOUT HORISO

Horiso® is an Australian manufacturer and supplier of solar control shading systems, including Specialty Venetian Blinds, Rack Arm Louvre Systems, Shading Tensioned Systems and Drapery Tracking Systems.

As a specialised solutions provider for architects, developers and builders, Horiso® has proven expertise in the commercial, hospitality, government, and residential sectors.



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