

THORN



Champion

High performance unobtrusive floodlighting





Telstra Stadium - Australia



The **Champion** of Sports Lighting

75 years of Lighting people and places

Thorn have a long and proud history in lighting, spanning 75 years, and demonstrating the finest ability in using the latest technology to provide the best solutions.

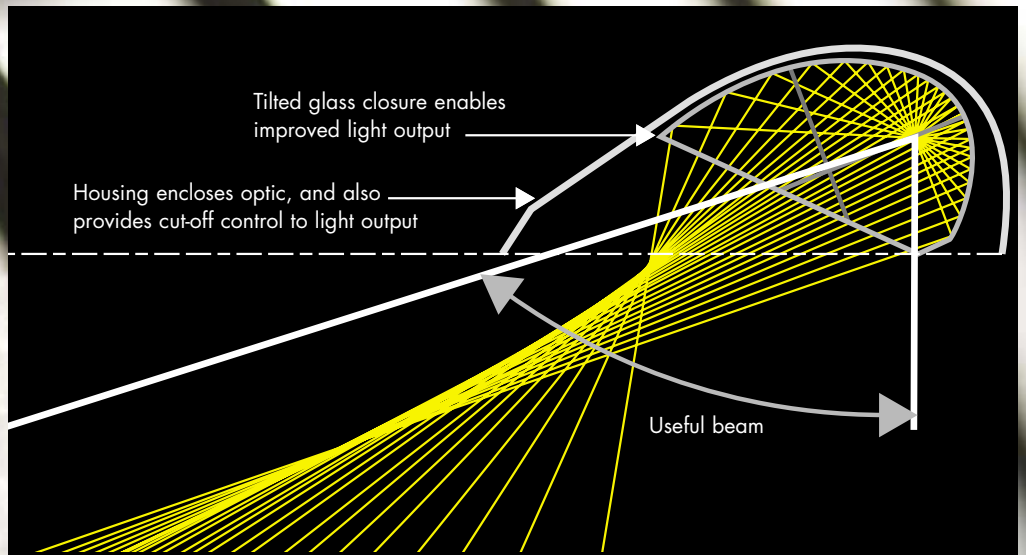
Over a 50 year period we have developed and applied the best in floodlighting - the provision of light to large areas. We have developed valuable knowledge and expertise in sport lighting.

We understand the need to meet the needs of players on the pitch, and also to safeguard the environment for the local community and for astronomers.

We understand the importance of lighting for sporting activities at all levels, from the part it plays in facilitating local community sports development, to the complex mix of needs associated with the worlds biggest sporting sites.

Recent Thorn achievements include lighting the Telstra Stadium in Australia, site of the 2000 Olympics, and the Suncorp Stadium in Brisbane, host to many of the 2003 rugby world cup games.







Champion is our number one solution to floodlighting small sports stadia and general areas where the control of obtrusive light is critical.

What is **Champion**?

The lighting industry has recently witnessed the emergence of the asymmetric Floodlight as a solution to sports facilities, small stadia and general area floodlighting projects where the control of obtrusive light is critical. Such floodlights are commonly referred to as 'flat glass floodlights', as they are designed to operate with the front glass parallel to the ground to avoid any direct upward contributions to artificial sky glow. However, the reality is that most 'flat glass' projectors will need to be tilted on-site in order to meet the illuminance and uniformity requirements of the installation.

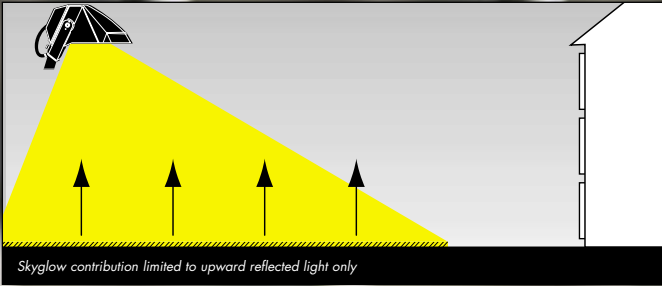
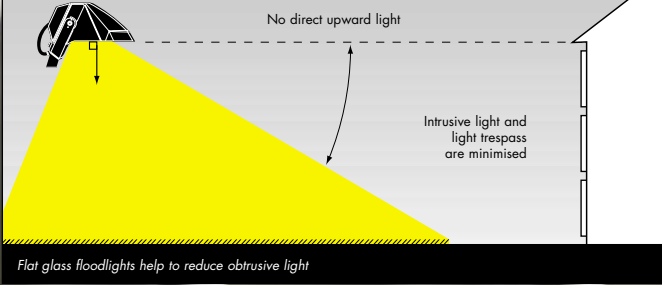
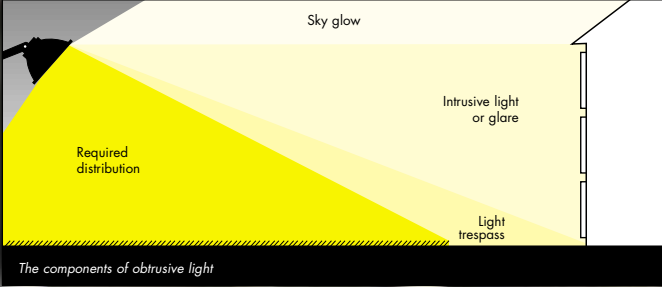
Champion is our new asymmetric floodlight for 1 and 2 kW lamps, incorporating an innovative design concept which takes the performance of asymmetric floodlights to the next level.

Instead of having a true 'flat glass' construction, which can limit the efficiency of a floodlight, Champion's front glass is inclined inside the floodlight. The front of the body acts as a cowl for full-cut-off and provides a 'virtual' light emitting surface which remains parallel to the ground. As a result, Champion combines many of the performance features of classic 'projectors' (high levels of light output) with those of 'flat glass' projectors (control of obtrusive Light).

Furthermore, each lamp option has a minimum of 4 lamp positions, adjustable on-site, to provide different photometries from just one installed position. Illuminance and uniformity requirements of floodlighting projects can be optimised without the need to tilt the floodlight, thus reducing contributions to obtrusive light.

The innovative design concept of Champion takes the performance of asymmetric floodlights to the next level by combining on pitch performance with the control of obtrusive light.







Obtrusive Light is a much talked about, and often highly emotive subject. But what exactly is it, and how can Champion help fight it?

Obtrusive light

The term, 'obtrusive light' is used to describe a number of undesirable by-products of exterior lighting installations. Obtrusive light can be a nuisance through either preventing us from seeing things or causing discomfort, by either receiving light that we do not want to receive, or by being able to see a light source that we do not want to see.

The main components of obtrusive light can be clearly identified and positive steps can be taken to minimise their effects, including the correct selection of lighting equipment and proper control of the light output. Such control must be inherent not only to the floodlight, but also to the installation design, if it is to be effective.

For exterior lighting installations, obtrusive light manifests itself in:

- Contributions to artificial sky glow
- Light spill (light trespass) which contributes to Intrusive light
- Glare

Artificial sky glow

Artificial sky glow is the phenomenon whereby light emitted from a source is reflected by particles of dust, moisture and cloud in the night sky, creating a halo of light above towns and other significant lighting installations, preventing us from seeing the stars.

Light spill (light trespass)

Light spill (or light trespass) is the spillage light, beyond the designated area for which it is intended, into an adjacent area. At best, it is a waste of light and energy. When it intrudes into peoples homes, it becomes intrusive light.

Glare

Glare can be a problem for sports participants, but it can also be a problem to residents living local to a lit installation. If floodlights are badly aimed, people will be able to look directly into the light source, causing visual discomfort, or be distracted by a bright source (the floodlight) appearing against a dark background (the night sky). This can also be a hazardous distraction to passing motorists.

The problem of glare is often taken into account for the on-pitch activities, however the problems caused to local residents are sometimes ignored.

Champion vs obtrusive light

We all have a duty to minimise the effects of obtrusive light.

The following sections of this brochure will examine in detail how the innovative design concept of Champion can help minimise obtrusive light more efficiently than existing floodlights.







Players, adjudicators and spectators of sport need good levels of lighting to ensure that neither performance nor the ability to follow the match is impaired.

Champion for sport

The exact lighting requirements of an installation are dependent upon the sport to be played and the competitive level. The higher the level of competition, the greater the requirements will be.

The requirements will also be higher for those sports where the visual information itself is more difficult to process. For example, the lighting of football terrains generally require lower levels of illuminance and uniformity than hockey terrains, where the ball is smaller and travels at greater speeds.

Illuminance and Uniformity

The lighting level (illuminance) of an installation obviously needs to be sufficient for the participants to effectively process the visual information of what is happening on the pitch (movement of people, balls etc).

Equally important is the uniformity of this illuminance. If there are parts of the pitch that are quite dark in comparison to its immediate surrounds, this will impair the effective processing of the visual information, even if the average illuminance of the total pitch is acceptable.

Imagine how difficult it would be to follow a hockey ball moving at high speeds in and out of dark patches on the ground.

Colour appearance and rendering of light

The colour appearance of the light, as well as the colour rendering properties (the degree to which colours are truly represented by the light) also help with the processing of visual information. The use of white light sources such as Metal Halide lamps is an effective way of enabling this, although 'yellow' sources such as High Pressure Sodium are often sufficient for lower levels of competitive activity.

Glare control

Bright sources (floodlights) visible against a dark background (the night sky) can cause discomfort and disability glare if the light is not correctly controlled and focussed on the target area (the pitch). The control of glare requires excellent inherent optical control and correct aiming of floodlights.

The Champion solution

Excellent levels of Illuminance and uniformity can be achieved due to its excellent light output and range of optical options

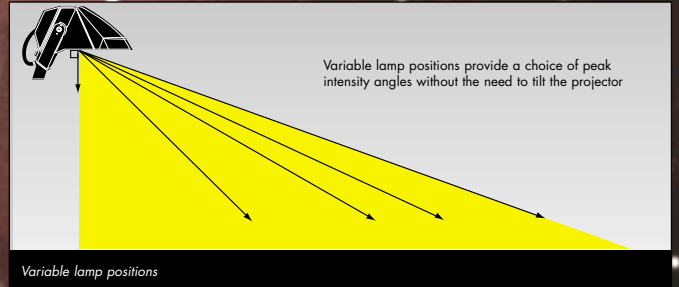
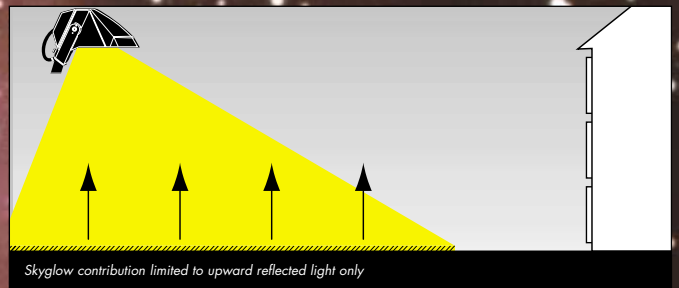
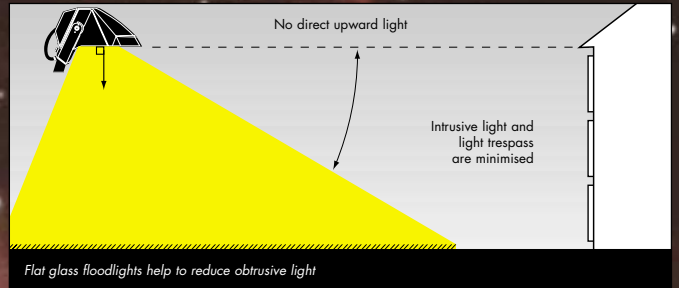
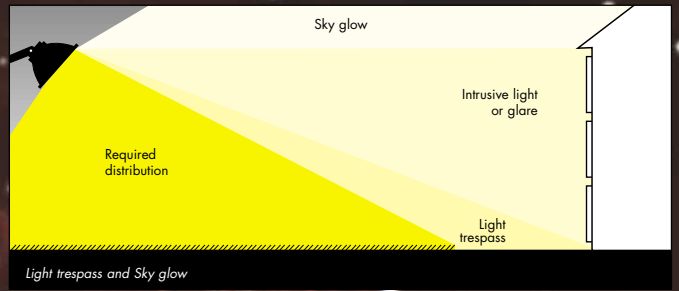
Excellent colour appearance and colour rendering can be achieved through its use of Metal Halide lamps*

Excellent glare control is provided through its unique optical construction (see Champion for the designer).

The proof of a floodlight's effective performance is in its ability to meet the requirements of the project design. On pages 18-21 of this brochure, you will find various standard template schemes designed using Champion for a range of sports and variety of competitive levels.

** High Pressure Sodium lamps are also offered in Champion for lower level sports installations*







The key concern of astronomers with regards to external lighting installations is the potential contribution to artificial sky glow, which can prevent us from seeing the stars at night.

Champion for astronomers

Artificial sky glow

Artificial sky glow is caused by a combination of direct and indirect contributions.

Direct contributions to sky glow

Direct contributions come from the upward light output of floodlights above the horizontal axes of their installed positions. This can be eliminated by the use of horizontal 'flat glass' floodlights, but only if the floodlights are installed with the light emitting surface parallel to the ground.

However, the increasingly demanding 'on-pitch' lighting requirements of sports installations will often require more than simple side-to-side rotational adjustment of the floodlights.

If the peak intensity angle of the floodlight is too low (i.e. it is not sufficiently asymmetric), it will need to be tilted so that sufficient lighting and uniformity levels are provided in the centre of the sports pitch. This will increase direct contributions to sky glow and the possibility of light trespass.

If tilting is out of the question, then the quantity of floodlights could be increased. However, this can result in 'over-lighting' of the installation and subsequent increases in Indirect contributions to sky glow (see below).

Another alternative could be to increase the mounting height of the floodlights, but this will increase the costs of the masts.

Therefore, in reality, 'flat glass' floodlights' are very rarely installed 'flat', rather diminishing the arguments for using this type of floodlight.

However, Champion has an adjustable lamp feature, which can provide a variety of different light outputs from a single installed position (e.g. with the virtual light emitting surface parallel to the ground).

Indirect contributions to sky glow

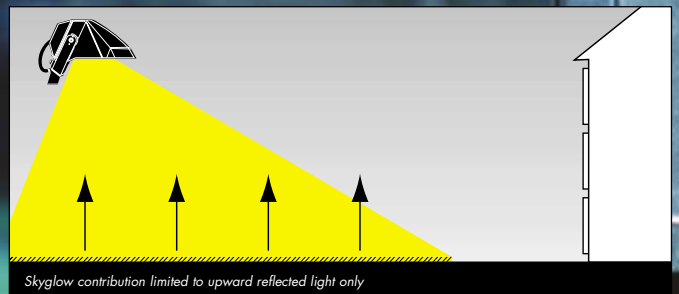
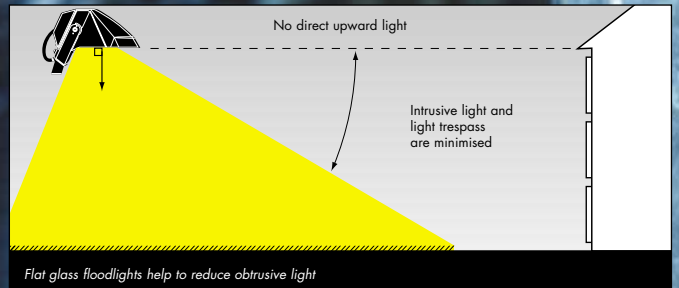
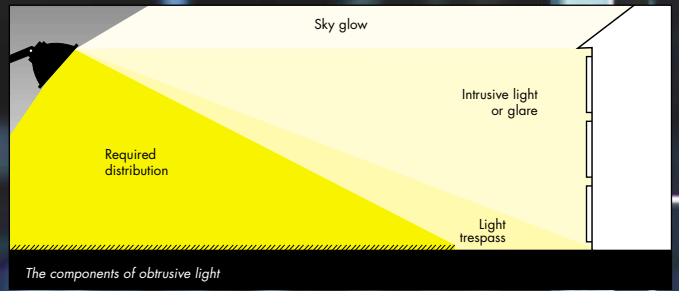
Indirect contributions come from the upward light reflected from the ground. In sports, for example, grass can reflect up to 10% of light while some artificial surfaces can reflect as much as 25%. The indirect contribution from an installation can therefore be quite significant but is often ignored as a contributor to obtrusive light.

Indirect contributions, unlike direct contributions, cannot be eliminated. There will always be some reflected light from an installation. However, we can seek to minimise it by lighting the target area to the lowest average lighting and uniformity levels consistent with the visibility requirements for the sport.

Take, for example, a sports pitch requiring an average lighting level of 250 lux with a uniformity rating of 0.6.

Lighting the pitch to less than 250 lux and less than 0.6 uniformity would mean that there is insufficient lighting for the participants. However, lighting the pitch to 300 lux would mean that the installation is 'overlit' by 20%, thus increasing indirect contributions to sky glow by 20%.

The innovative design concept of Champion not only enables it to be installed without tilting, thereby reducing direct contributions to artificial sky glow, but also to reduce the risk of over-lighting an installation, thereby reducing indirect contributions to artificial sky glow.





Residents living close to lighting installations are concerned about the amount of intrusive light and glare that they may be subjected to.

Champion for the community

There are two aspects of exterior lighting installations that can concern residents living close to the installation.

Intrusive light and vertical illuminance

Firstly, light that is projected beyond the area for which it is intended (spill light) can enter peoples homes (intrusive light) creating unwanted levels of illuminance in the home. Even with curtains drawn, this can be problematic and interrupt sleep.

The total Intrusive Light of an installation cannot be measured as it is something which is specific to an individual location. However, for each house within the neighbourhood, intrusive light can be measured as the vertical illuminance level of the windows. As such, given that the height of a typical 1st floor bedroom window is approximately 5 metres above ground level, it can be interesting to estimate the vertical illuminance levels at a height of 5 metres

The 'flat glass' solution

The recent increasing popularity of 'flat glass' solutions has helped to reduce both of these problems. The asymmetric distribution of the light enables the front glass of the projector to be installed parallel to the ground. The fitting then has a total cut off of the light distribution near to the horizontal such that the visibility of the lamp and the optics is diminished beyond the target area of the installation. If the cut off is even further below the horizontal, this will reduce further the possibility of spill light.

Note that as soon as a floodlight is tilted, vertical illuminance levels increase significantly.

Unfortunately, as we have previously seen, 'flat glass' floodlights are very rarely installed 'flat' due to the peak intensity angle (degree of asymmetry) not being sufficient to meet the illuminance demands of the installation in the centre of the pitch or the need to 'aim' the fittings to achieve sufficient uniformity.

The Champion solution

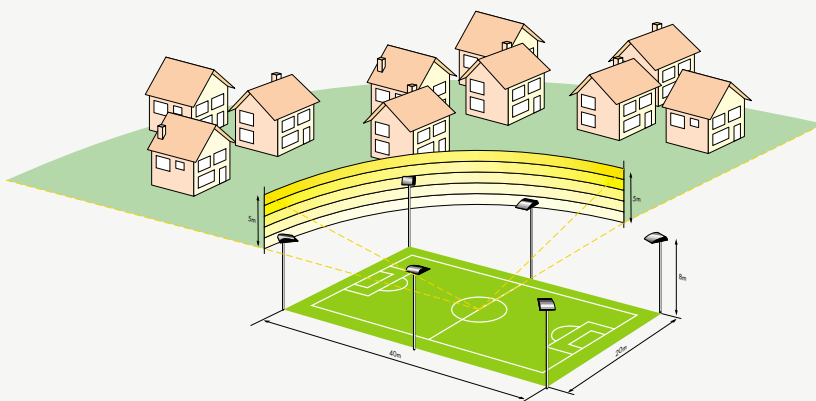
Champion provides a genuine 'no tilt' solution for most sports training and small stadia installations.

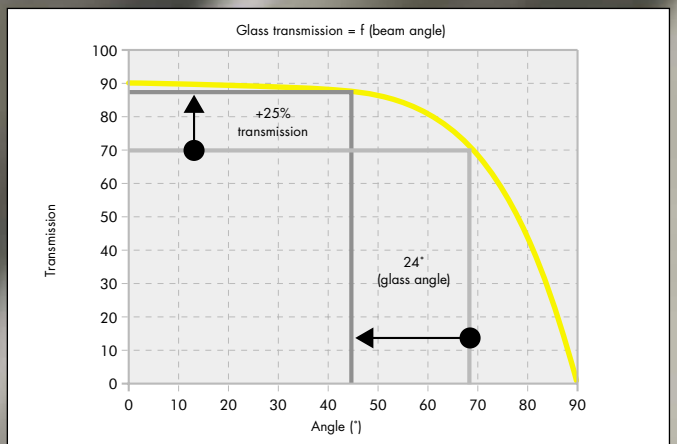
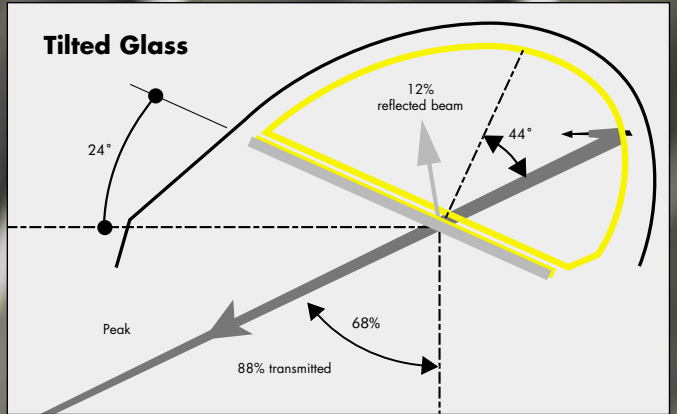
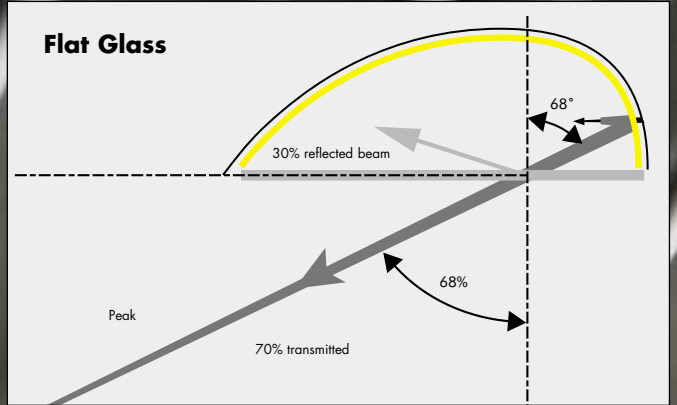
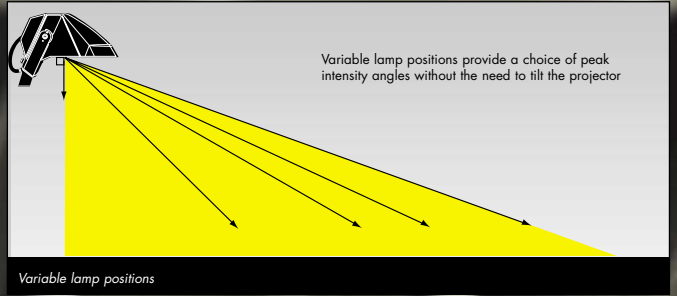
With peak intensity angles up to 68° from the perpendicular, the illuminance requirements at the centre of the playing area can be met without tilting.

Furthermore, since each lamp option has a minimum of 4 lamp positions, and thereby different photometric distributions from one installed position, any aiming required to optimise uniformity on the pitch can be realised through the selection of the lamp position, and not by tilting.

The Champion solution is the 'no-tilt' solution, reducing intrusive light and glare outside of the playing area.

The innovative design concept of Champion enables it to be installed without tilting, thereby helping to reduce glare and intrusive light.





Champion's innovative optic gives improved output efficiency





The role of the sports lighting designer is to find the right balance in meeting the needs of participants, astronomers and the local community.

Champion for lighting designers

The skill of the lighting designer is to find the right balance in meeting the needs of the various stakeholders of sports installations.

How can the lighting designer provide sufficient 'on-pitch' performance (illuminance and uniformity), with a minimum of floodlights and minimise 'off-pitch' obtrusive light (sky glow and light spill)?

Traditionally, at least one of these elements has had to suffer. 'Classic' style projectors with excellent light output properties can provide excellent on-pitch performance with a minimum of floodlights, but they lack the optical control to minimise contributions to sky-glow and spill light. Conversely, 'flat glass' floodlights can minimise obtrusive light, but have lower light outputs, thus increasing the number of floodlights required to light the installation.

Optical performance of 'flat glass' floodlights and 'classic' style projectors

When analysing the geometry of sports lighting installations such as football, hockey or rugby pitches, we can see that some floodlights will need to be aimed at more than 60° from the perpendicular, if sufficient illuminance is to be achieved in the centre of the playing area.

If the front glass is to be positioned parallel to the ground (flat), then the peak intensity angle of the floodlight needs to be somewhere between $60 - 70^\circ$ from the perpendicular.

When light passes through glass, some light is reflected back producing internal reflections which result, effectively, in lost light. If light passes through glass at 0° , then these internal

reflections are minimised and approximately 90% of light is transmitted. As the angle increases, so do the internal reflections and, thereby, light losses. At an angle of 70° , less than 70% of light is transmitted.

'Flat glass' floodlights will, at best, produce 20% less light than a 'Classic' style projector (which transmits light at an angle nearer to 0°) with the result that installations using 'flat glass' floodlights will require 20 – 30% more fittings.

The Champion solution

The optical design of Champion is unique and sets new standards for providing 'on-pitch' performance whilst minimising the number of floodlights required and the contributions to obtrusive light.

The reflector design of Champion is modelled on those of 'classic' style projectors. It is also highly efficient and designed to focus as much of the light produced by the lamp in the direction in which it is required.

Furthermore, because the front glass is inclined within the body, the light passes through the glass at an angle that does not generate significant internal reflections and light losses.

Champion generates light output ratios, and thereby on-pitch performances, normally associated with classic projectors.

The body of Champion has been designed to act as a cowl providing the 'light beam cut off' at 80° from the perpendicular that is required to minimise light spill. The cowl creates a 'virtual' light emitting surface, which is to be aimed parallel (flat) to the ground.

Champion provides all the optical control elements associated with 'flat glass' floodlights.

Finally, the adjustable lamp feature provides a variety of optical distributions, from a single installed position, which can be mixed to achieve the required levels of uniformity. Examples of this can be seen in the template schemes section of this brochure.

Champion provides excellent uniformity without the need to either tilt the floodlight, raise the mounting height or add extra floodlights to the scheme.

Additional accessories for increased control of obtrusive light

Adjustable 'vertical light shields' are particularly inventive accessories which have been developed for areas of extreme sensitivity to light spill. They are adjustable on site and enable the light beams to be 'cut off' at angles below 80° from the perpendicular.

The front shield cuts the light beam to the front (usually the most critical direction) and both sides of the fitting. There is another accessory for cutting the light beam to the rear.

The optical design of Champion combines output efficiency normally associated with standard floodlighting projects with the control of obtrusive light associated with 'flat glass' asymmetric floodlights.





Ease and safety of installation and maintenance for high power floodlights is crucial.

Champion for installers

When fittings are mounted at heights of anything up to 30m, any procedures need to be simplified wherever possible.

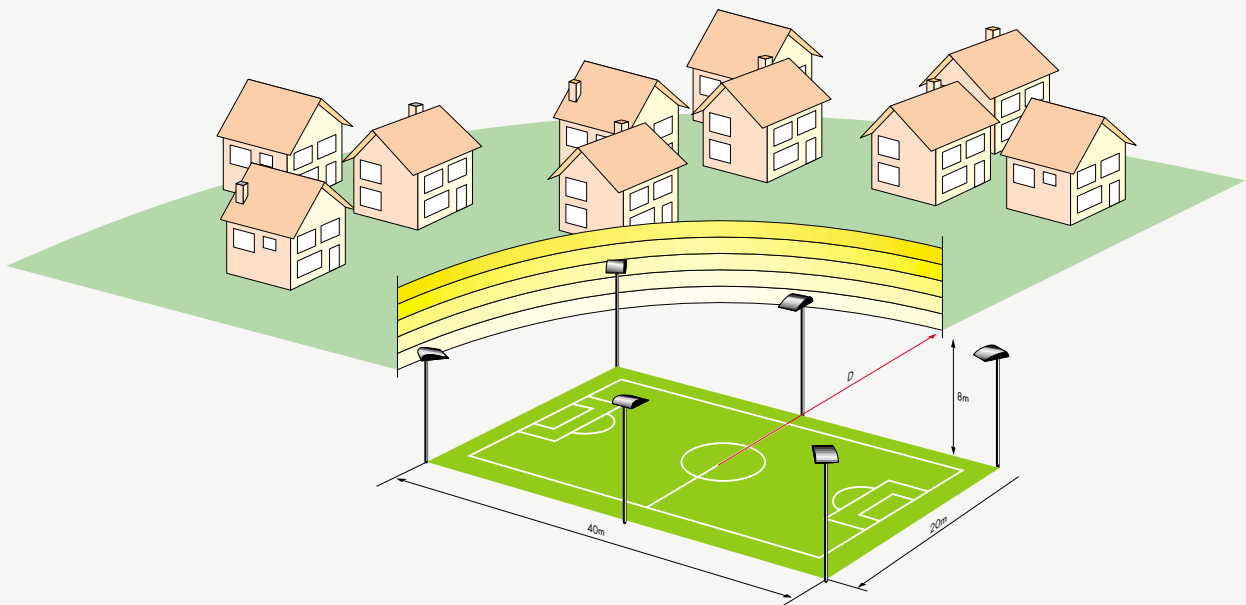
The inherent product design features of Champion make installation and maintenance both simple and safe.

1. A simple 'aiming sight' is
2. supplied with each floodlight to enable aiming in azimuth.
3. The top of floodlight is parallel to the 'virtual' light emitting surface. A 0° tilt of the unit can easily be assured by using a spirit level on the top surface of the unit.
4. The adjustable stirrup provides a number of possible mounting positions. Installation flexibility is furthered by the availability of a 'reverse mounting' stirrup accessory which enable all installed positions to be addressed.
5. The floodlight is IP66 rated,
6. including the ignitor box, which is mounted on the stirrup.
7. Safety is assured through an Class I Electrical rating combined with automatic power disconnection when the rear access door is opened.
8. Access to the lamp is via a rear door, and does not require tools to open,
12. simplifying maintenance procedures. The rear access door drops down to provide a tray for any tools.



All of the following template schemes have been designed using Champion with no tilting. No tilt = reduced artificial sky glow, reduced glare and reduced intrusive light.

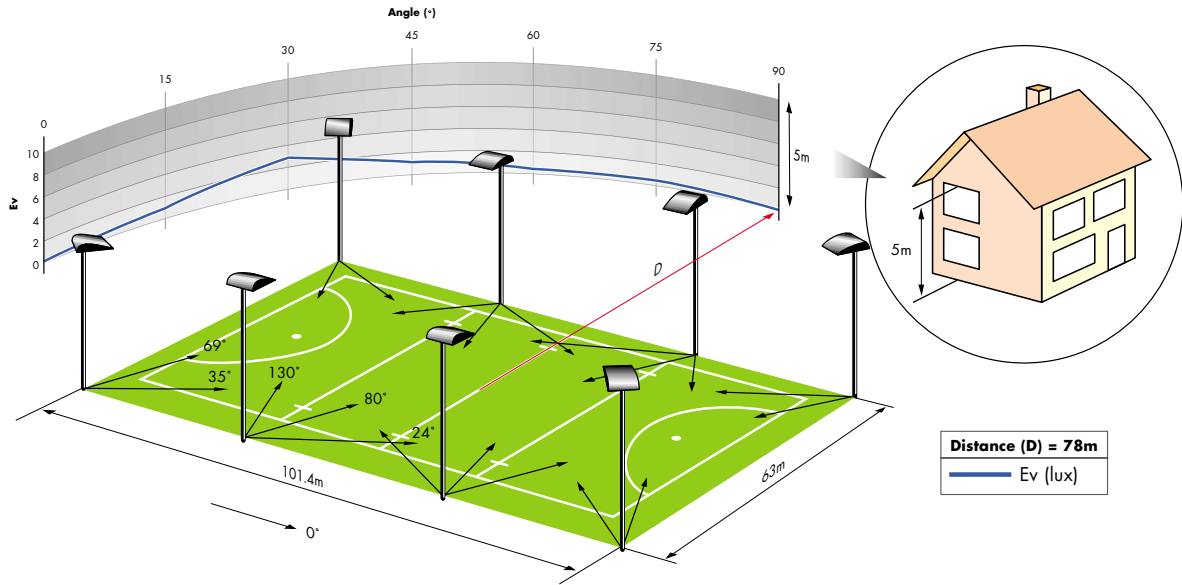
Champion template schemes



It is vital to ensure that while the requirements of on-pitch lighting are achieved, the off-pitch lighting levels are properly controlled, and calculated at the planning stage to ensure compliance with best practice standards.

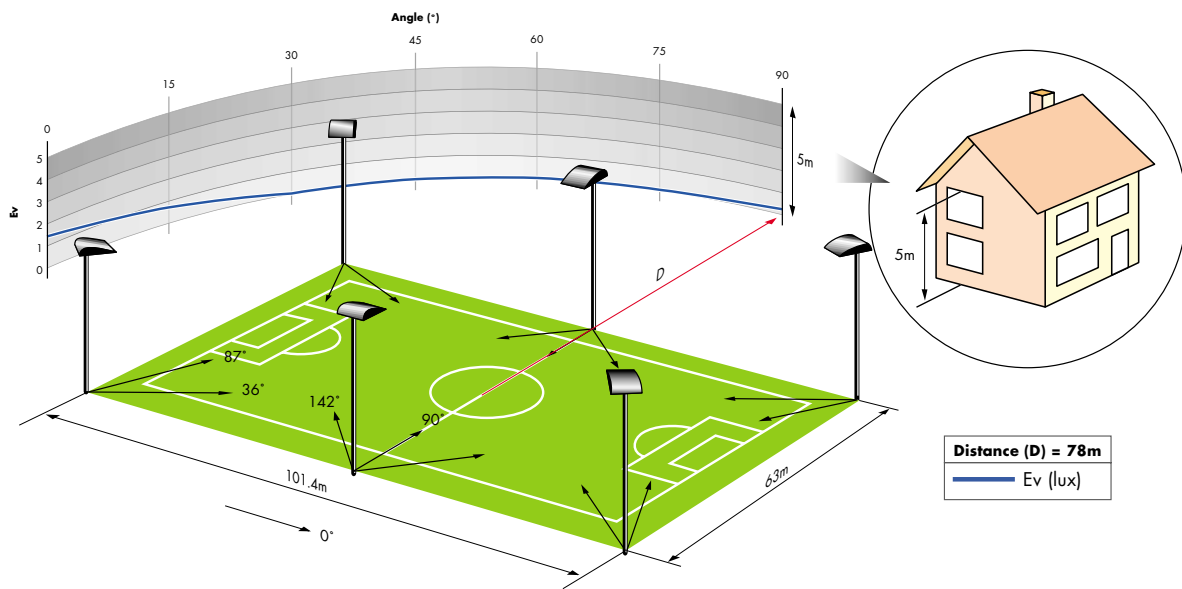
A typical 1st floor bedroom is approximately 5 metres above ground level, so the vertical illuminance at height 5 metres is of critical importance. This measurement ("Ev") is depicted on the vertical surface included in each of the following template schemes.

In all these schemes, the lighting levels quoted are "maintained" levels since they already take account of lamp output decline over life. All figures shown in these schemes are achieved without tilting the floodlight.



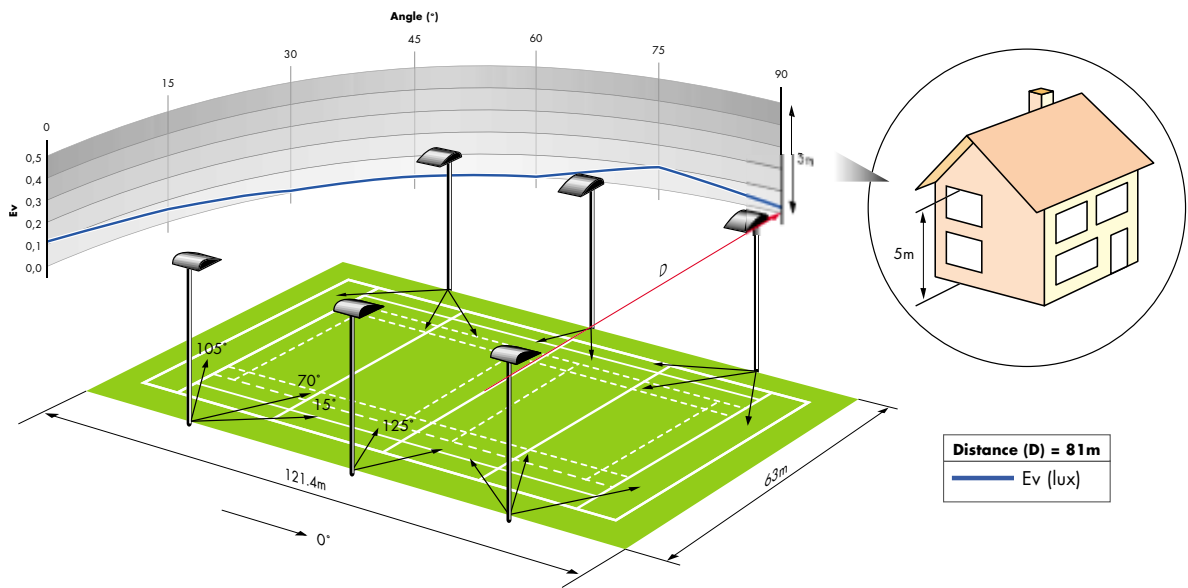
Hockey 350 lux

Pitch dimensions	55x91.4m	55x91.4m	Lamp type	HQI-TSL 2kW	Maintained Average Illuminance	Required	Achieved
Total Playing Area	63x101.4m	63x101.4m	Initial Lamp Lumens	225000		350	354
Calculation points	11 x 19	11 x 19	No. Of floodlights	20	Initial Average Illuminance	402	407
			No. Of columns	8	Uniformity (min/ave)	0.7	0.76
			Mounting Height	16	Uniformity (min/max)	0.5	0.51
					Glare rating (max)	50	43



Football 250 lux

Pitch dimensions	55x91.4m	55x91.4m	Lamp type	HQI-TSL 2kW	Maintained Average Illuminance	Required	Achieved
Total Playing Area	63x101.4m	63x101.4m	Initial Lamp Lumens	225000		250	263
Calculation points	11 x 19	11 x 19	No. Of floodlights	14	Initial Average Illuminance	287	302
			No. Of columns	6	Uniformity (min/ave)	0.4	0.71
			Mounting Height	15	Uniformity (min/max)	na	0.4
					Glare rating (max)	55	49

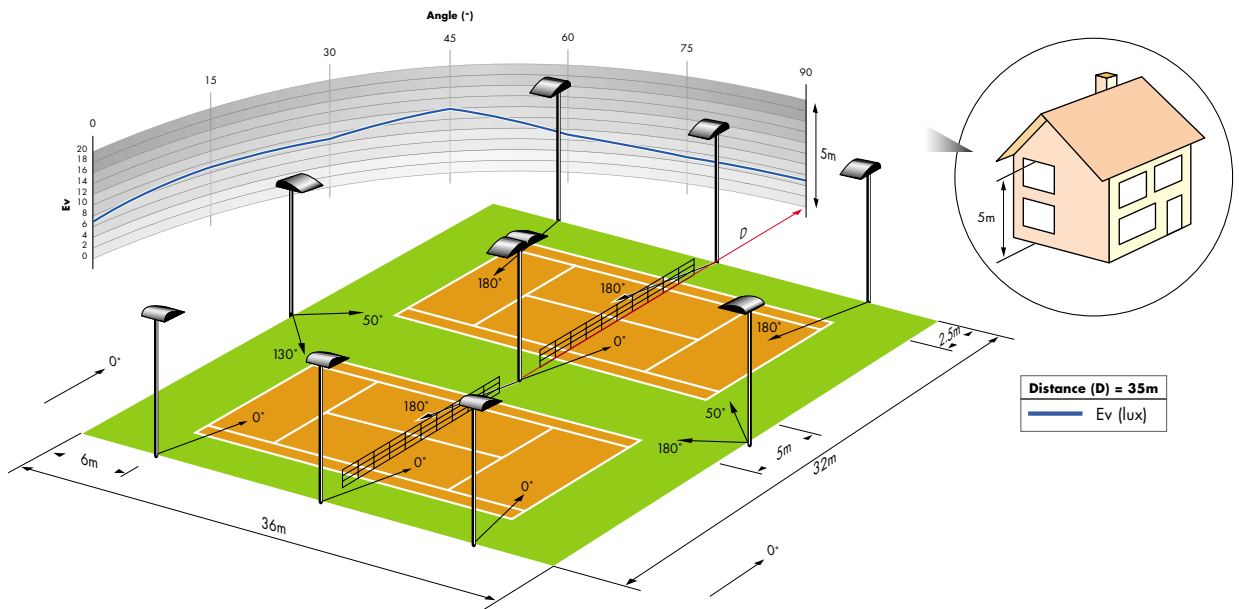


Rugby 250 lux

Pitch dimensions	55x101.4m	55x101.4m
Total Playing Area	63x121.4m	63x121.4m
Calculation points	11 x 21	11 x 21

Lamp type	HQL-TS S 2kW
Initial Lamp Lumens	225000
No. Of floodlights	16
No. Of columns	6
Mounting Height	15

	Required	Achieved
Maintained Average Illuminance	250	252
Initial Average Illuminance	287	290
Uniformity (min/ave)	0.4	0.61
Uniformity (min/max)	na	0.36
Glare rating (max)	55	51



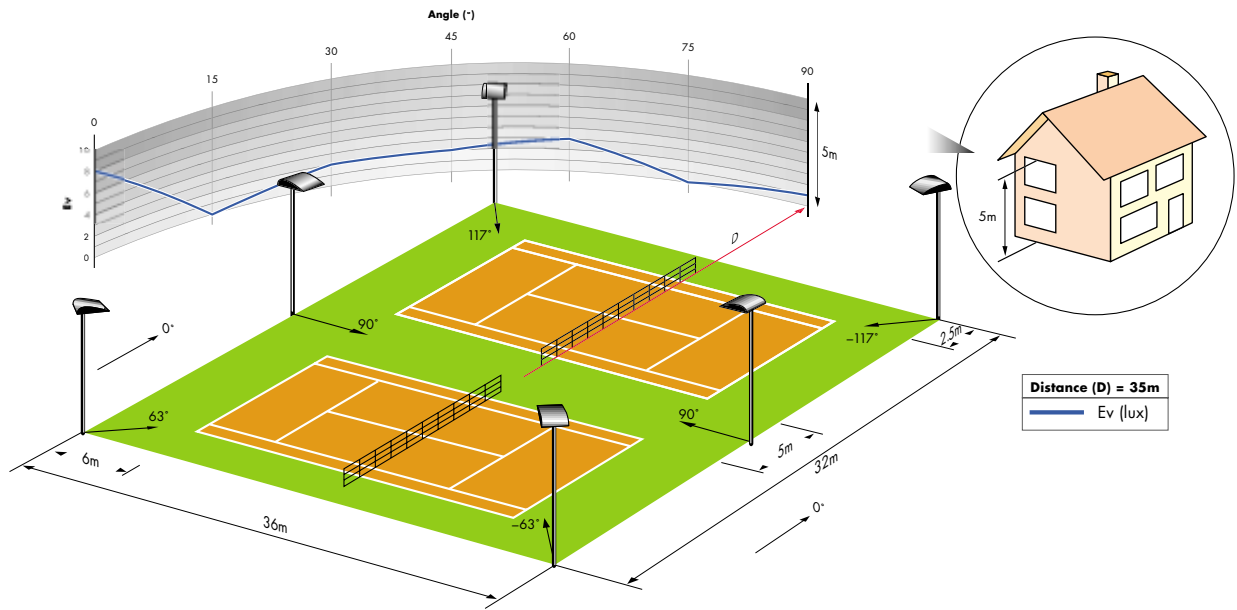
Tennis 1

Pitch dimensions	11 x 24m
Total Playing Area	32 x 36m
Calculation points	5 x 3m

Lamp type	1 kW MHN-LA
Initial Lamp Lumens	100,000
No. Of floodlights	12
No. Of columns	9
Mounting Height	8

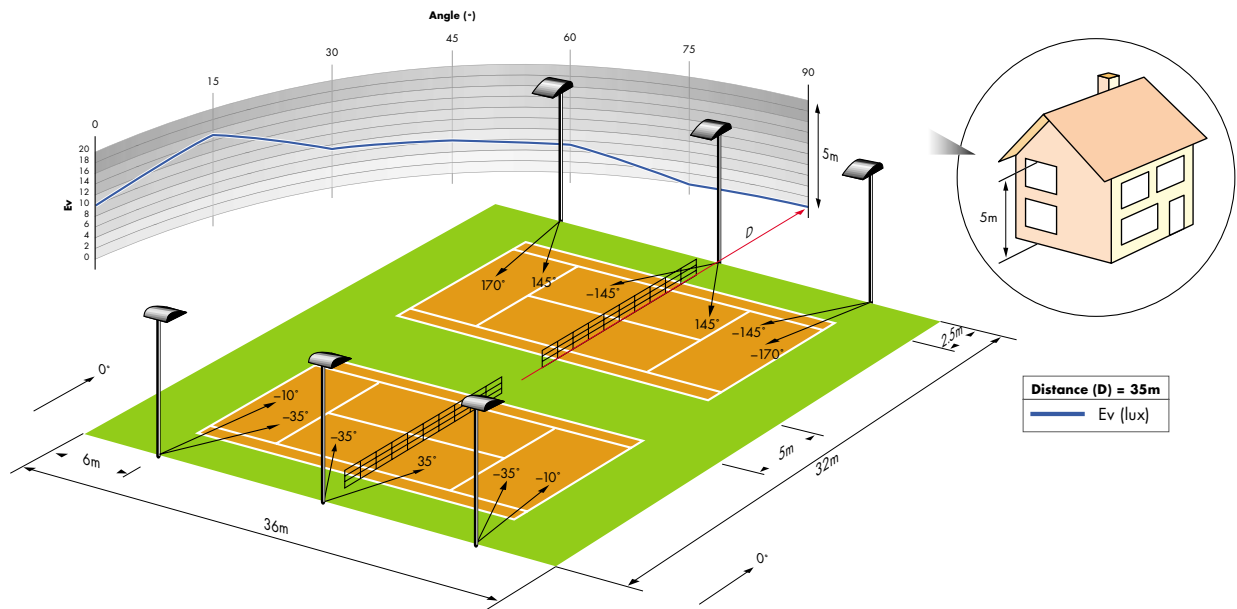
	Required	Achieved
Maintained Average Illuminance	500	500
Initial Average Illuminance	620	625
Uniformity (min/ave)	0.7	0.8
Uniformity (min/max)	0.5	0.62
Glare rating (max)	55	49

This scheme can be switched so that either one or both courts are lit.



Tennis 2

Pitch dimensions	11 x 24	Lamp type	2 kW HQI-TSL	Maintained Average Illuminance	Required	Achieved
Total Playing Area	32 x 36	Initial Lamp Lumens	225,000	Initial Average Illuminance	500	555
Calculation points	5 x 3	No. Of floodlights	6	Uniformity (min/ave)	0.7	0.75
		No. Of columns	6	Uniformity (min/max)	0.5	0.64
		Mounting Height	8	Glare rating (max)	55	49



Tennis 3

Pitch dimensions	11 x 24m	Lamp type	1 kW MHN-LA	Maintained Average Illuminance	Required	Achieved
Total Playing Area	32 x 36m	Initial Lamp Lumens	100,000	Initial Average Illuminance	400	450
Calculation points	5 x 3m	No. Of floodlights	12	Uniformity (min/ave)	0.7	0.93
		No. Of columns	6	Uniformity (min/max)	0.5	0.84
		Mounting Height	8	Glare rating (max)	55	49

In this scheme both courts must be lit.

Ordering guide

Dimensions

Photometric Data

Accessories/Attachments

- Lux Guillotine (front and sides)
- Lux Guillotine (rear)
 - also known as 'adjustable visor'.
- Wire guard.
- Reverse mounting Stirrup (required for certain mounting positions).

Lamps

1/2 kW HQI-TS/S metal halide double ended (Osram) short arc

2 kW HQI-TS/L metal halide double ended (Osram) long arc

1/2 kW MHN-LA metal halide double ended (Philips) long arc

1 kW HST (ST) high pressure sodium tubular.
Cap: E40

Materials/Finish

Body: die-cast aluminium (ENAB 44300), unpainted

Glass: 4mm toughened.

Wiring/ignitor box: polyamide (66 V0 Black: 20% glass fibre re-reinforced).

Screws: stainless steel.

Installation/Mounting

Rear access to lamp.
Automatic power interruption on opening of rear access door.
Stirrup fixed by M20 bolt through 22mm diameter hole, or through 15mm diameter holes.
Ballast and capacitors to be mounted separately.
Cable gland for 7.5-13mm cable.


Standards

Designed and manufactured to comply with EN60598.

Class I Electrical.

Windage: 0.21m².

IP66 (including the wiring/ignitor box).

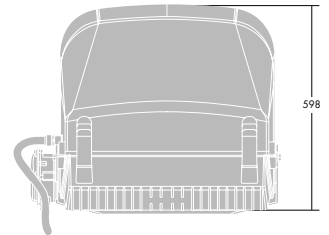
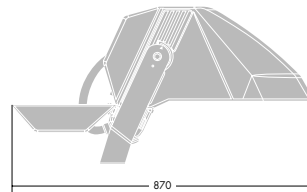
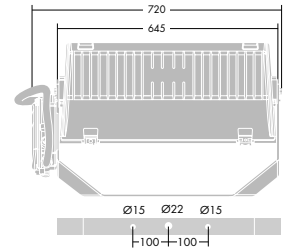
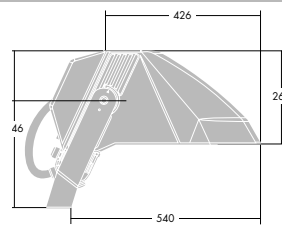
IP65 (Ignitor box for the Hot Restrike version) 

Specification

To specify state:

Die cast aluminium asymmetric floodlight for 1/2kW lamps, IP66 rated, rear lamp access, adjustable lamp position with internally inclined front glass and integral front cowl.

As Thorn Champion.

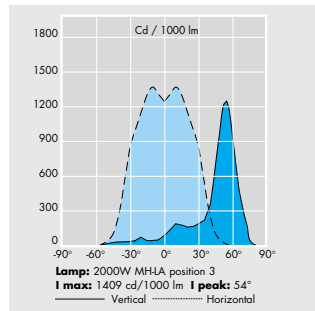
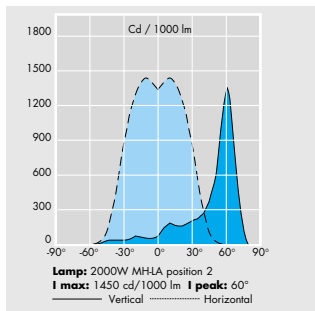
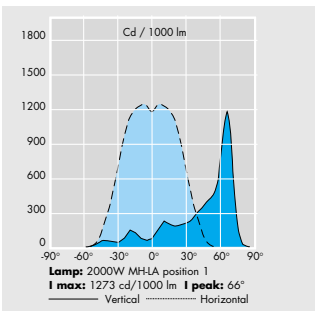
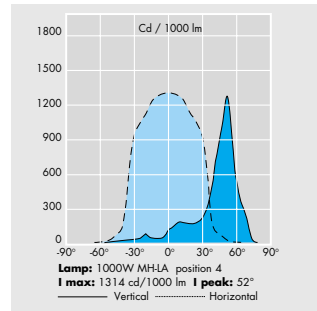
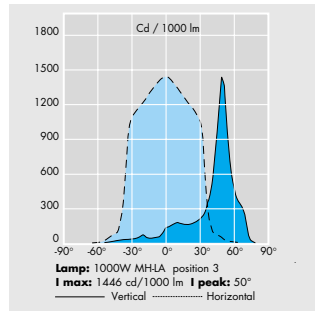
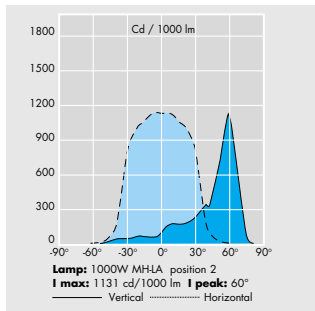
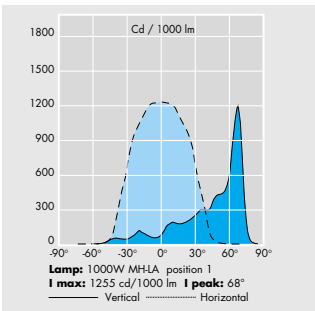
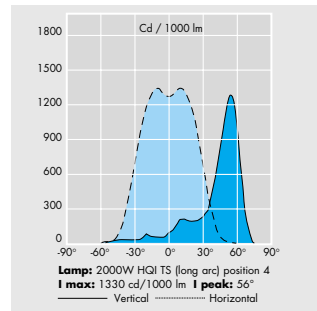
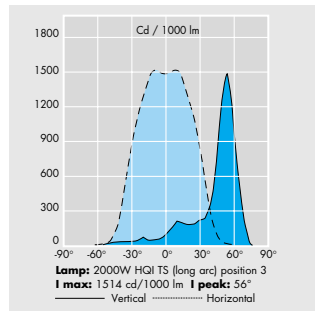
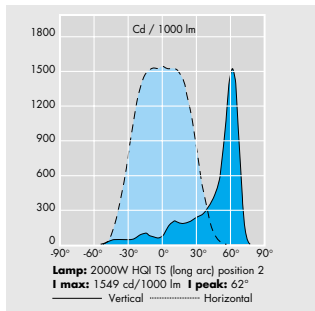
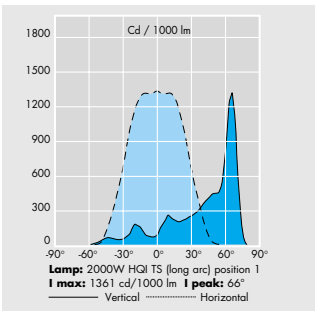
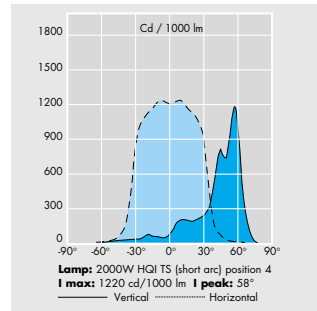
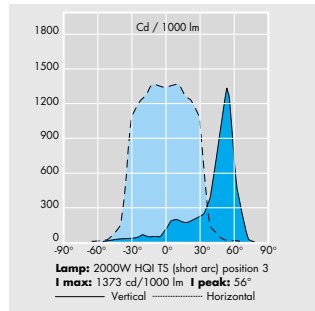
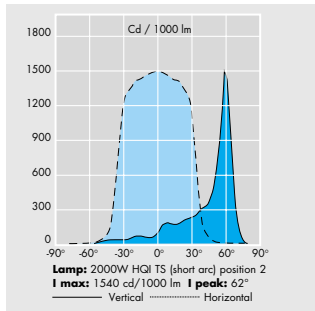
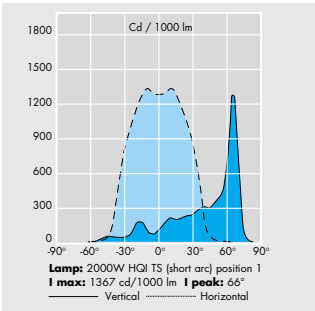
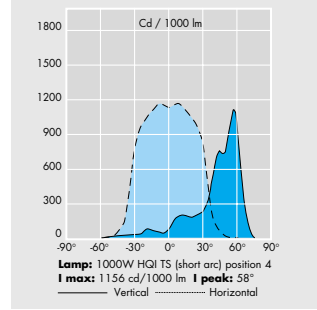
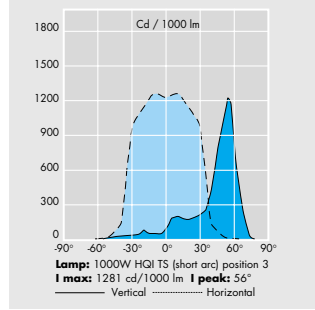
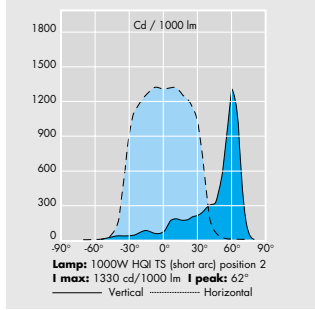
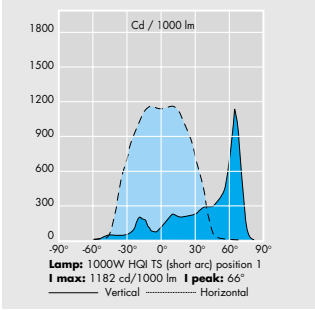
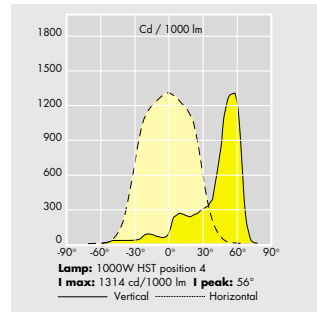
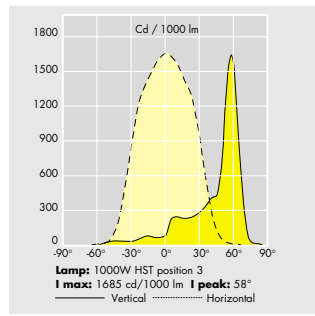
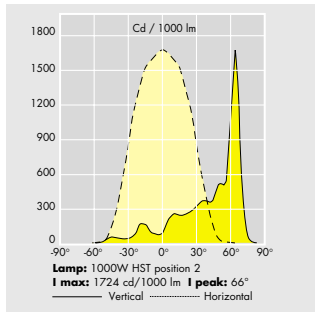
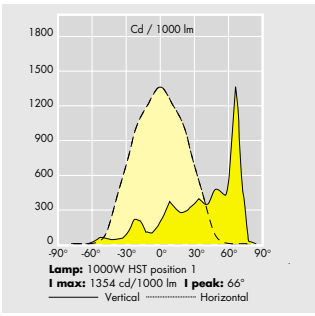


Ordering Guide Lamps and control gear to be ordered separately

Description		Weight (kg)	SAP code
CHAMPION 1K HST E40 WI	HST 1KW	20.6	96012471
CHAMPION 1K HST E40 NI	HST 1KW	20.6	96012472
CHAMPION 1K HQI - TSS O WI	HQI-TS 1KW (OSRAM)	20.6	96012473
CHAMPION 1K MH - LA P WI	MHN-LA 1KW (PHILIPS)	20.6	96012474
CHAMPION 2K HQI - TSL O WI	HQI-TS 2KW (OSRAM)	20.6	96012475
CHAMPION 2K HQI - TSS O WI	HQI-TS 2KW (OSRAM)	20.6	96012476
CHAMPION 2K MH - LA P WI	MHN-LA 2KW (PHILIPS)	20.6	96012477
CHAMPION HR 1K HQI - TSS O WI	HQI-TS 1KW (OSRAM) Hot Restrike	24.6	96012478
CHAMPION HR 2K HQI - TSS O WI	HQI-TS 2KW (OSRAM) Hot Restrike	24.6	96012479

Accessories

Description		Weight (kg)	SAP code
CHAMPION WG	Wire Guard accessory	1.8	96012480
CHAMPION REVERSE STIRRUP	Reverse stirrup accessory	4.4	96012481
CHAMPION AJ VS FRONT	Adjustable front and side visor	1.7	96012482
CHAMPION AJ VS REAR	Adjustable rear visor	0.9	96012483



THORN

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