

# NETBALL LIGHTING



## LIGHTING STANDARDS

Netball facility lighting is essential in supporting training and competition netball at both indoor and outdoor venues.

This factsheet outlines Australian standards and recommendations when planning and designing netball lighting projects.

Netball has seen a growth in both the number of courts that have been lit for competition and training purposes and an increase in the quality of the lighting installed. This is largely due to improvements in the technology, a better understanding of the standards for sports lighting and more cost-effective lighting solutions now available for the sport.

Court lighting should not intrude into the lifestyles of people away from the court. This includes neighbours and vehicular traffic. Sports facilities should integrate within local communities. Project Managers will need to investigate impacts on neighbouring properties and vehicular traffic as part of the lighting project.

Sports lighting standards have been introduced to ensure good visual conditions for players, athletes, referees, spectators and colour television (CTV) broadcast where applicable. The Australian Standard for Outdoor Netball is contained within AS 2560.2.2:2021 "Sports Lighting Part 2: Specific Applications". The relevant section is "2.9 Netball and Basketball". It is understood this standard is also adopted by Netball New Zealand.

The specific guidance on the Lighting for Indoor Netball is contained within section "2.8 Multipurpose indoor sports centres". Netball is classified as a group B activity

**Note:** While Illuminance (Lux) and Uniformity tend to be the main lighting technical criteria stipulated for designs, other criteria both quantitative and qualitative are also important, such as: Control of glare; Control of Obtrusive (spill) light; Colour rendering; Backgrounds; Lighting systems & equipment.

### Netball lighting guidelines recommendations

Netball lighting play level classifications are divided into three levels of play.

<b>Class 1</b>	International and national competition with large spectator galleries
<b>Class 2</b>	Mid-level local and regional competition, high level training
<b>Class 3</b>	Recreation or training, and low-level competition



## OUTDOOR NETBALL

**Table R1:** Outdoor Netball (Non-televised)

Lighting Class	Class 1 Top-Level Competition	Class 2 Mid-Level Competition	Class 3 Low Level Competition/ Training
Horizontal Illuminance Maintained Average Lux 1	500	200	100
Uniformity U1 (Min to Average)	0.7	0.6	0.5
Uniformity U2 (Min to Max)	0.5	0.4	0.3
Maximum Glare Rating (GR)	45	50	50
Colour Rendering Ra8	65	65	65

**Note:** Where two or more courts are adjacent, and with luminaires operating simultaneously U2 may be reduced by an absolute value of 0.1, e.g. from 0.4 to 0.3 for mid-level competition.

Illuminance measurements shall be made horizontally at the court surface level.

Illuminance Values pertain to the Principal Playing Area (PPA) being a court 30.5m x 15.25m. Standard courts will require 13 x 7 calculation points, and 7 x 4 measurement points.

It is recommended that the illuminance values within the Total Playing Area (TPA) being a court with safety run-offs defined as an area 37.5m x 22.5m are 75% of these are recommended for the Principal Playing Area (PPA). The measurement grid of points should extend into this zone at the same spacing.

Glare rating GR is determined by calculation. The GR observer positions are provided in figure 2.9.6 of the standard and consist of 12 points where the GR rating needs to be calculated.

# INDOOR NETBALL

## Netball lighting recommendations – Indoor netball (Non-televised)

Lighting criteria for Indoor Netball (Non-televised) is provided in AS 2560.2:2021 section 2.8 Multipurpose indoor sports centres.

**Table R2:** Indoor Netball (Non-televised)

Lighting Class	Class 1 State/National Competition	Class 2 Local/ Regional Competition	Class 3 Recreation and Training
Horizontal Illuminance Maintained Average Lux 1	750	500	300
Uniformity U1 (Min to Average)	0.7	0.7	0.6
Uniformity U2 (Min to Max)	0.5	0.5	0.4
Maximum Glare Rating (GR)	40	40	40
Colour Rendering Ra8	80	65	65

All illuminance measurements apply at the court surface level. Illuminance Values pertain to the Principal Playing Area (PPA) being a court 30.5m x 15.25m. Illuminance values 75% of these are recommended in the Total Playing Area (TPA) being a court with safety run-offs defined as an area 37.5m x 22.5m Illuminance levels shall be calculated on a 2m x 2m grid. Measurements shall be taken on a 4mx4m grid.

The luminaires chosen should have greater shielding angles than commercial luminaires. The use of refractors is recommended to reduce the luminance of the light source. Louvers or hoods are acceptable also.

Luminaires should be located so to be as much as possible away from the direct lines of site. Installations with poor quality light control will feature bright levels of light when viewed some distance away across the court. The use of GR calculations should provide an indication as to whether the light source selected is acceptable.

## Netball lighting recommendations – Colour television (CTV) lighting Netball lighting

The establishment of suitable lighting criteria requires special consideration. This involves consideration of changes in broadcast technology and the positions of the cameras.

Lighting for television broadcast involves a range of further design considerations and require expert lighting engineering guidance

Television broadcast is expected to be in an indoor netball or multipurpose stadium.

## Recommendations for colour television lighting include:

- Venues for which Colour Television broadcast requirements may exist require consideration of higher lighting levels and other more stringent lighting criteria than are listed in Tables R1 and R2
- Venues for which Colour Television broadcast requirements may exist require specialist lighting advice at the inception phase of a project to consider and reflect the changes in the technologies associated with CTV broadcast
- Recommendations for Colour Television Broadcast requirements may be found in the current publications CIE Technical Reports 83 and 169 and these should be considered in formulating the Sports Lighting CTV specification
- Reference is recommended to Lighting Criteria given in the “Free TV Australia Operational Practice OP-31 Lighting Requirements for Television” and the documents referenced by it. This is with a view to meeting future television standards as they evolve
- Free TV Australia has published a range of outdoor public broadcast requirements dealing with specific sports. Reference shall be made to any specific future publication dealing specifically with Netball and/or Basketball when setting the CTV lighting criteria
- Reference is also recommended to European Standard EN 12193 :2007 which also contains CTV broadcast lighting criteria for companion reference in formulating the Sports Lighting CTV specification



- The International Netball Federation (INF) lighting specifications of 1500 Lux (TV) horizontal for “Indoor Netball Facility Requirements” is a single criterion only. It is not recommended to be used in isolation of specialist advice and development of a comprehensive set of Lighting Criteria that adequately address the CTV broadcast requirements and with regard to the specific venue. There are a number of other lighting parameters other than the obvious Horizontal Illuminance on the Court surface that are important to consider and specify for venue sports lighting suitable for CTV.

### Free TV recommendations are as follows:

#### Vertical illuminances

- 1400 lux vertical (International);
- 1000 lux (National) to main camera position;
- 800 lux to cameras in other positions.

#### Uniformity

- Vertical Illuminance,  $U1=0.7$ ,  $U2=0.6$
- Horizontal Illuminance,  $U1=0.8$ ,  $U2=0.7$

#### Glare rating towards cameras

GR rating of 40

#### Colour temperature

4000K to 6500K, within venues lighting must all be within 500K

#### Colour rendering

>90 preferred  
(in practice lower levels are acceptable)

#### 50/60 cycle flick

Use LED luminaires designed not to flicker.

#### Qualitative requirements

Coaches boxes, audience, special interest areas shall also be illuminated to a suitable level to be determined according to the venue.

**Note:** The lighting levels proposed are ideal and may be impractical in many venues and lesser levels may be acceptable. The broadcaster should be consulted as to the suitability of a venue and to determine camera positions.

## GENERAL LIGHTING INFORMATION

All netball court lighting projects should be designed by a qualified lighting & electrical engineer. The information contained in this section is provided as a guide only.

### Getting Started

The qualified lighting and electrical engineer will require some detailed information before they can proceed with their design works. They will generally require the following:

- A feature survey and/or civil detailed design drawings to overlay the lighting design on. This will ensure you achieve the most accurate design outcomes.
- Information regarding the existing site
- The parameters to which the lighting is to be designed e.g. Competition, amateur.

Detailed plans showing all overhead and underground services.

- Details regarding existing and future power supply & demand – Sites often require power supply upgrades and/or power supply consolidation works as part of a netball court lighting project. This should be considered early in the project as the costs for such works, if required, can be expensive.
- Geotechnical testing suitable for pole foundation design.
- Light tower and footing design for each different type of pole and fitting combination you intend to install or design all of the light tower's footings according to the tallest and largest/heaviest light fitting combination if the budget allows.

**Note:** The foundation design of the same pole and floodlight system will differ between sites due to differing soil conditions. The number and type of light fittings per tower (wind sail area and weight), the site's wind rating and the site's soil type and wind rating can affect the depth and outside diameter of the concrete footing required.

## Lamp Source

The choice of a lamp source for a new installation is generally either metal halide and LED.

The preferred choice for netball lighting is generally LED due to the following advantages over metal halide:

- Instant operation
- Energy savings, in the order of 50%.
- Low maintenance due to long lamp life.
- Ability to provide improved lighting control allowing excellent lighting uniformity and less spill to outside courts.
- Ability to dim.

Metal Halide at the present time has the advantage of a lower capital cost and lower weight per fitting but is being phased out of the market and it is expected that future lamp replacements and parts may become costlier and more difficult to obtain.

The additional weight of LED may make it difficult to safely switch existing legacy system over on the same pole.

## Pole Configuration and Heights

The lighting towers should ideally be located on a side mount scheme.

There are, however, many multiple court facilities with corner light configurations which is also acceptable.

The layouts following are for a typical outdoor two-court facility. It complies with the relevant standards and recommendations for netball court competition standard lighting for a Class 2 facility. (Mid-level, Regional & Club competition level play).

The light fittings should also be mounted on cross arms at the top of the light towers, so they effectively illuminate the playing area. These cross arms can be up to 1.0m in length. The light fittings should be professionally aimed to achieve maximum illuminance and light uniformity across the court(s). Local Council light spillage regulations and Obtrusive Light standards can also have an impact on luminaire positioning. Therefore, any light spillage beyond the property fence line should be kept to a minimum and adhere to Australian Standard AS 4282:2019 'Control of the obtrusive effects of outdoor lighting'.

Corner lighting configurations are not ideal, however, they can be a good alternative when you are lighting multiple courts, where site constraints don't allow side lighting.

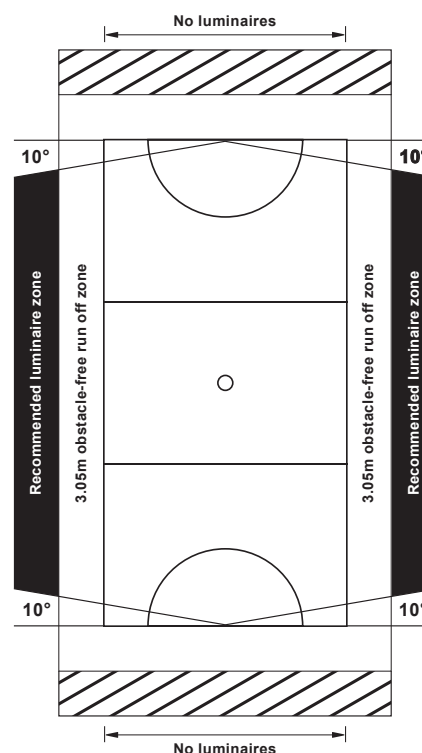
To control glare and ensure the best player experience pole heights shall be chosen depending on the level of play and the distance from the pole position to the centre of the court where there is a single court, or the centre between two adjacent courts. This is illustrated in figure 2.9.3 of the standard.

Level of Play	Formula for determining pole height
<b>Class 1</b> Top Level Competition	$(0.47xd) + 2$
<b>Class 2</b> Mid level competition	$(0.40xd) + 2$
<b>Class 3</b> Recreation or training and low level competition	$(0.36xd) + 2$

The placement of the light poles - luminaires - is determined by the luminaire design but should be located in the zones shown. Every luminaire has a particular photometric distribution or light 'footprint' that determines its exact placement relative to the playing area. The lighting engineer or light fitting supplier can provide information on the exact point of placement of the luminaire and this, in turn, determines where the light pole will be placed.

**Note:** The pole must be placed clear of the netball court and the clear/obstacle free run off zones for obvious safety reasons.

Pole footings and foundations should be designed by a Structural Engineer. Light Towers should be designed suitable for the installation and possibly to allow additional luminaires in the future. Light towers manufactured from steel should be hot dipped galvanised to help prevent rust. If the mast is to be painted, then this should occur over the galvanized finish.



## Preferred Pole Configuration

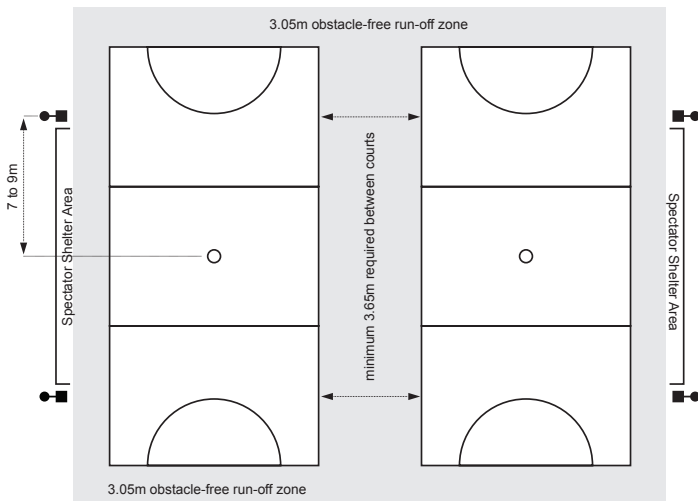


Figure 1: Side pole configuration

## Venues with Site Constraints

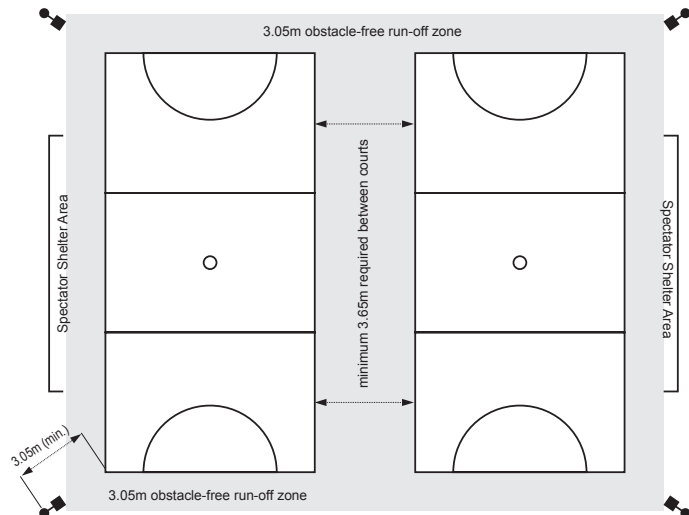


Figure 2: Corner pole configuration

## Choice of Lighting System

The critical elements when choosing a lighting system are illuminance and consistency of light over the principal playing area, run-off areas and glare. Of course, capital cost of the lighting system may also influence the choice. Generally, a more expensive lighting system often results in less maintenance and running costs.

## Illuminance

Illuminance can be improved by using higher light output lamps or a greater number of lamps. Increases in illuminance result in increased capital and running costs and a balance needs to be sought. The Australian Standard provides illumination levels suitable for the various levels of netball played. Ensure that your lighting adheres to the requirements described in Section 9.7.1 'Lighting standards' in this manual.

## Uniformity

Consistency of light is measured as 'uniformity'. This is also reported in the Australian Standard and Clubs should specify lighting to meet the appropriate Standard for their use. The measure of uniformity describes mathematically how even the light will be on the court. Where uniformity is poor, the eye struggles to follow the flight of the ball and predict its speed and when it will reach the player. Ensure that your lighting adheres to the national requirements.

Uniformity is improved by installing more luminaires and/or choosing luminaires with a suitable distribution designed to provide an even amount of light. The placement of the luminaires relevant to the court is important to maximise uniformity and this placement is determined by the optical design. Placement includes positioning relative to the court as well as mounting height. A lighting plan designed for one luminaire may not suit another luminaire.

## Light Loss Factors

Light loss occurs due to 2 factors termed 'lumen depreciation' and 'dirt depreciation'. All floodlights suffer from both.

Lumen depreciation is the reduction of light output from a lamp as it ages and is particularly important to consider with metal halide floodlights. LED floodlights will also slowly depreciate over time.

Dirt depreciation is affected by a number of differing environmental /atmospheric conditions (e.g.: airborne dust) and the interval selected between cleaning of the light fittings. It is worth noting the light loss factor is greater if the interval between regular cleaning of the light fittings is extended. Therefore, consideration needs to be given to the anticipated frequency of such maintenance when designing the lighting system to ensure the expected lighting levels at the end of the planned maintenance period remains greater than the desired minimum lighting levels.

The floodlight wiring should be sized to take account of voltage drop. Voltage drop increases as the length of cabling increases, which in turn affects light output of lamps. This is a common oversight when installing lighting systems and is usually a contributing reason to why lighting levels are unable to be sustained to the desired levels over time.

Voltage drop causing reduced lighting levels and premature lamp failure can also be experienced when electricity suppliers reduce the electrical supply through their networks (e.g. from say 240 Volts back to around 220 Volts). If this problem is suspected, you can request your sites voltage supply from your local electrical supplier. However, this verification should only be sought after ascertaining if there is not a voltage drop issue resulting from undersized cabling or excessive cable length.

## Player Glare

Glare can occur when the placement of the lamp is in the line of sight of the ball in main player view directions. Glare is reduced through lamp and reflector design, positioning of the light towers, height of light towers. Luminaire manufacturers develop designs to suit their particular luminaires when they are used for netball court lighting. All intermediate and low level of outdoor play classifications requires a maximum on court glare rating  $GR_{max} = 50$ . A rating of 45 is the maximum permitted for National Competition. A rating of 45 is preferred at all levels and can usually be obtained in most circumstances with good design.

Installations with poor glare control can also affect the amenity of neighbouring properties.

## Obtrusive (spill) Light

All external lighting designs are required to meet the requirements of AS/NZS 4282:2019 Control of the obtrusive effects of outdoor lighting.

Conformance to this standard shall be demonstrated by the results of calculations and analysis of design methods with respect to the standard. This should be provided with the lighting design. The standard sets illumination limits in the vertical plane limits depending on environmental factors and location.

The design should conform to the environmental zone which varies as to the usage and location of the space. For example: suburban areas in towns and cities are rated as category A3 with equates to 10 lux vertical illuminance and maximum luminous intensity per luminaire of 12500 cd at windows.

## LED Luminaire Selection

The choice of a luminaire (floodlight) will depend on a number of factors including quality, beam type, ability to shield stray light, weight, windage and expected life.

An LED luminaires life and colour shift over time is estimated using the North American IES standard LM80 which involves testing the luminaire overtime to determine long term performance.

The measurements obtained from this standard are used to determine a depreciation curve for the luminous flux. The data is extrapolated using the method described in the North American Technical Memorandum TM21 to determine the "Lumen Maintenance Life Projection (Lp)".

The end point of the extrapolation is typically 70 or 80% of the initial light output. There is a spreadsheet calculator available at the [www.energystar.gov](http://www.energystar.gov) website to perform the calculations.

It is important that all luminaires LM80 reports are considered to ensure the lighting fixture to be installed will have an adequate life suitable for the installation.

It is also important to not run the luminaire during the day as this may shorten the luminaire life.

## Circuit Switching

Switching should be undertaken to provide a per court lighting system if practicable.

The use of systems that allow booking of courts and ensuring the lighting is only operated as required are being developed by each state. The design should consider this option.

Lighting should be switched directly or preferably through a contactor. Switching from a switchboard circuit breaker is not permissible as this is unsafe and not permitted under the wiring rules.

## Dimming

LED sources can often be easily dimmed.

Where light spill environmental considerations are paramount the additional cost of a dimming system would be justified.

Dimming allows the installation to be set to precisely the amount of illuminance desired and provides the additional advantages of additional energy savings and increasing the life of the luminaire.

There are a lot of different systems for dimming that include by communication cable, wifi and Bluetooth.

## COMMISSIONING AND CERTIFICATION

Upon completion of the works the project manager should ensure that the installation is properly commissioned and, in the case where matches are to occur, lighting certification occurs.

### Commissioning

The project manager should ensure at handover that all equipment and switching is operational.

Switchboards should be properly labelled, and a filled-out circuit schedule is mounted within the board.

The registered electrical contractor (REC) must provide a certificate of electrical safety at handover which should within the statement adequately describing the works that have taken place.

## Lighting Certification

Upon completion of the works, lighting certification of the installation should be provided.

Certification is to undertake the following:

- An illuminance (lux) level test can be conducted using a calibrated light meter.
- A letter be provided with the auditor's details indicating the results and the level of play the installation meets.

This Certification shall be based on an audit of the lighting system by a suitably qualified consultant based on the qualifications and experience of the consultant in floodlighting for sports purposes. Suitable lighting consultants will include but are not limited to Members of the Illuminating Engineering Society of Australia and New Zealand Limited (IES - The Lighting Society) with sports lighting specialisation.

Ideally the designer should provide a certificate for the installation initially.

**Note:** Ensure that professional designs and professional products are used, and that the work is covered under your insurance policy.

## MAINTENANCE OF LIGHTING SYSTEM

Maintenance of lighting as with other aspects of netball court operation, thought must be given to maintenance of the lighting installation. A number of aspects of this should form part of the Site Owner's ongoing management plan. The management plan should include costing of these elements so that funds are reserved for this purpose.

**Note:** The court pavement and surface must be protected from maintenance personnel and equipment.

## Lamps

Metal Halide lamps should be changed upon a certain length of time depending on the lamp installed and its usage.

If lamps are failing and/or changing colour then a bulk lamp replacement should occur. Group replacement of all lamps simultaneously will deliver savings in access costs (cost of cranes, cherry pickers, travel, and site visit) and will also ensure that the lighting is even.

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## Luminaires

Luminaires require periodic servicing. Lenses become dirty, as do the reflectors.

In the case of metal halide fixtures, lamp usage causes the air inside the luminaire to heat and cool. The expansion and contraction of the air draws in airborne contaminants, pollutants, insects and the like as the seals age. With regard LED luminaires, the chamber is usually permanently sealed.

Contaminants are also deposited on the outside of the lens and baked on by the heat of the lamp. Court owners should seek advice from luminaire manufacturers on cleaning regimes and appropriate chemicals to use. The facility manager should not forget access needs when servicing luminaires. Generally, this maintenance will require an experienced electrician with a 'cherry picker' or other approved access method. Luminaire housings and electrical control gear should also be maintained. Cabling will require periodic checking by a qualified electrician, as will electrical distribution boxes, switchgear, and timers. Access by heavy vehicles onto the pavement area should be avoided. Light equipment or access via the surrounding areas is advisable.

## Light Towers

Light towers should also be inspected periodically. Footing bolts, welds and attachments may each deteriorate over time and a visual inspection during routine maintenance is recommended. There are also non-invasive structural integrity testing available if you are worried about the condition of a light tower. It is important that all structural assessments are undertaken only by structurally qualified persons.

## PUBLIC LIGHTING SYSTEM

Public lighting is recommended to improve access and safety throughout the netball facility. Lighting should be considered to provide sufficient light between the carpark and the netball courts and amenities:

- Carparking
- Paths
- Entry/exit points
- Directional signage

This may be further improved by setting a time delay on the sports lighting system, where the court lighting will switch off 5-10 after the system is switched off. This will allow users to exit the facility safely.

With acknowledgment and thanks to:



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