

## Lighting Standards for Biathlon Ranges and Stadiums

There doesn't appear to be a set of guidelines specifically for Biathlon stadiums. The following will help get you started:

### Light Level - Jargon:

Light intensity measured on a plane at a specific location is called illuminance.

Illuminance is measured in footcandles, which are lumens per square foot at the work plane. You can measure illuminance using a light meter located on the work surface where tasks are performed. Using simple arithmetic and manufacturers' photometric data, you can predict illuminance for a defined space. (Lux is the metric unit for illuminance, measured in lumens per square meter. To convert footcandles to lux, multiply footcandles by 10.76).

Very good, clear explanations and diagrams at this location: [http://acl.co.uk/light\\_level.htm](http://acl.co.uk/light_level.htm)

### Sport Lighting Terminology and Standards for Archery and Shooting:

<http://www.sportcentric.com/vsite/vfile/page/fileurl/0,11040,5148-184554-201776-124404-0-file.00.pdf>

This brochure has explanations of sport lighting terminology and design. It also has recommended standards for archery and target shooting in the table at the end.

### Little League Baseball Stadiums:

Some useful diagrams in this booklet: <http://www.va4.org/forms/LightingStandards.pdf>

#### Extract: Standards for Lighting (Little League Baseball)

- I. Required Minimum Standards  
These minimum standards must be complied with for all lighting installations after the date of adoption by Little League. The effective date is July 1, 1992. Systems in full compliance shall meet all of the required minimum standards.
- II. A. Lighting
  1. Quantity  
There shall be a maintained minimum average quantity of 50 horizontal footcandles on the infield and a maintained minimum average quantity of 30 footcandles on the outfield. Design calculations to arrive at maintained light levels shall include a maintenance factor no greater than 0.7 and must include adjustments for actual tilt factor.
  2. Quality  
The quality of the lighting shall be determined on a basis of uniformity and smoothness.
    - a. Uniformity of the lighting shall be such that on the infield, the highest measure of quantity of light shall not be greater than 2 times the lowest quantity. For the outfield measurement, the highest quantity of light shall not be greater than 2.5 times the measurement of the lowest quantity of light.
    - b. Over the entire area of the infield and outfield, the change in the quantity of horizontal footcandles should not occur at a greater rate than 10 percent per 10 feet, except for the outside perimeter readings which may change at a greater rate.
  3. Lamps  
The approved lamp for Little League play is a 1500 watt metal halide. Lamps must have an ANSI code -- M48PC-1500/BU. Philips, Sylvania and General Electric are the only manufacturers currently approved.
  4. Footcandle Documents  
The manufacturer of the lighting equipment shall provide drawings showing the horizontal footcandle quantity at each point of measurement on the field. The drawing shall be in compliance with the minimum standards established above.

a. Area of Measurement

The areas for measurements are to be taken and the points of measurement within that area are shown in the graphic in the "LIGHTING PERFORMANCE" section of this chapter. It is important that measurements be taken at all the points to establish that the quantity and quality standards are being met.

b. Method of Measuring Light Quantities

The light meter is to be held 36 inches above the playing surface with the sensing surface horizontal to the ground so that it detects light coming downward to the sensing surface from all directions.

5. Aiming Angles

Aiming angles are a function of both pole height and the distance from fixture to aiming point. Little League has established minimum pole heights (see the graphs in this booklet) as well as minimum aiming angles. Both need to be met to be in compliance.

a. Light fixtures which are set back from the foul lines between home plate to third base and between home plate to first base shall be mounted at a height above the playing surface such that a line from the lighting fixture to the point on the field where its maximum intensity is aimed is a line that is at least 25 degrees below horizontal.

b. Light fixtures positioned beyond the outfield fence or along the foul line beyond third base and first base shall be mounted at a height with a minimum aiming angle of 25 degrees below horizontal for fixtures aimed toward the infield and 21 degrees for fixtures aimed across the outfield.

6. Aiming Recapture

The lighting equipment shall include a mechanical device for recapturing the original aiming when it is necessary to move the reflector for re-lamping.

7. Aiming Diagram

The manufacturer shall supply a drawing showing the aiming alignment of each fixture with measurements referencing the field and pole locations. 3, 4

8. Glare Considerations

Pole heights and locations should be established by the layouts in the graphs in this book to enhance playability.

9. Ballast and Capacitor Weight

The ballast and capacitor for each fixture shall be mounted away from the fixture and crossarm and onto the pole to avoid problems of misalignment caused by the weight of these components.