

DIVISION 14. LIGHTING REQUIREMENTS

Sec. 6-151 GLOSSARY OF LIGHTING TERMS.

<u>Authority:</u>	<u>The adopting municipality, agency, Town of Greenwich, CT.</u>
<u>Architectural Lighting:</u>	<u>Lighting designed to reveal architectural beauty, shape, and/or form for which lighting and other purpose is incidental.</u>
<u>Astronomical Time Switch:</u>	<u>An automatic lighting control device that switched outdoor lighting relative to time of solar day with time of year correction.</u>
<u>Backlight:</u>	<u>For an exterior luminaire, lumens emitted in the quarter sphere below horizontal and in the opposite direction of the intended orientation of the luminaire. For luminaires with symmetric distribution, backlight will be the same as front light.</u>
<u>BUG:</u>	<u>A luminaire classification system that classifies backlight (B), uplight (U), and glare (G).</u>
<u>Correlated Color Temperature:</u>	<u>The perceived color of the light emitted by a lamp, expressed in kelvin (K) units. The lower the kelvin rating, the "warmer" or more yellow the light; the higher the rating, the "cooler" or more blue the light.</u>
<u>Curfew:</u>	<u>A time defined by the authority when outdoor lighting is reduced or extinguished.</u>
<u>Foot-candle:</u>	<u>The unit of measure expressing the quantity of light received on a surface. One footcandle is the illuminance produced by a candle on a surface one-foot square from a distance of one foot.</u>
<u>Forward Light</u>	<u>For an exterior luminaire, lumens emitted in the quarter sphere below horizontal and in the direction of the intended orientation of the luminaire.</u>
<u>Fully Shielded Luminaire:</u>	<u>A luminaire constructed and installed in such a manner that all light emitted by the luminaire, either directly from the lamp or a diffusing element, or indirectly by reflection or re-refraction from any part of the luminaire, is projected below the horizontal plane through the luminaire's lowest light-emitting part.</u>
<u>Glare:</u>	<u>Lighting entering the eye directly from luminaires or indirectly from reflective surfaces that causes visual discomfort or reduced visibility.</u>
<u>Illuminance:</u>	<u>The amount of light falling on a surface, measured in footcandles (lumens per square foot).</u>
<u>Light Pollution:</u>	<u>Any adverse effect of artificial light including, but not limited to, glare, light trespass, sky-glow, energy waste, compromised safety and security, and impacts on the nocturnal environment.</u>
<u>Light Trespass:</u>	<u>Light that falls beyond the property it is intended to illuminate.</u>
<u>Lighting Zone:</u>	<u>An overlay zoning system establishing legal limits for lighting for particular areas or districts in a community.</u>

<u>Lumen:</u>	<u>The unit of measure used to quantify the amount of light produced by a lamp or emitted from a luminaire (as distinct from “watt,” a measure of power consumption).</u>
<u>Luminaire:</u>	<u>The complete lighting unit (fixture), consisting of a lamp, or lamps and ballast(s) (when applicable), together with the parts designed to distribute the light (reflector, lens, diffuser), to position and protect the lamps, and to connect the lamps to the power supply.</u>
<u>Luminance:</u>	<u>The amount of light per unit area of light travelling in a given direction, measured in candela per square meter.</u>
<u>Mounting Height:</u>	<u>The vertical distance measured from the average elevation of the existing natural grade or average elevation of the approved grade (if cut/fill activities are proposed) to the lowest light-emitting part of an installed fixture.</u>
<u>Non-residential:</u>	<u>Any outdoor lighting intended for use on a lot with a business (except home occupation), industrial, or institutional use (or, if undeveloped, is zoned for such use). Municipal buildings and facilities shall follow nonresidential standards.</u>
<u>Outdoor Lighting:</u>	<u>Lighting equipment installed within the property line and outside the building envelopes, whether attached to poles, building structures, the earth, or any other location; and any associated lighting control equipment.</u>
<u>Partially Shielded Luminaire:</u>	<u>A luminaire constructed and installed in such a manner that at least 90% of light emitted by the luminaire, either directly from the lamp or a diffusing element, or indirectly by reflection or re-refraction from any part of the luminaire, is projected below the horizontal plane through the luminaire's lowest light-emitting part.</u>
<u>Photoelectric Switch:</u>	<u>Electrical switch which automatically turn on when sufficient day light is not available. And off when sufficient light is available.</u>
<u>Residential:</u>	<u>Any outdoor lighting on a lot having a structure or structures whose primary use is residential (or, if undeveloped, is zoned for such use). Although reviewed as a commercial site plan, lighting plans for multifamily or condominium developments shall follow residential standards.</u>
<u>Temporary Lighting:</u>	<u>Lighting installed and operated for periods not to exceed 40 consecutive days.</u>
<u>Sky Glow:</u>	<u>The brightening of the nighttime sky that results from scattering and reflection of artificial light by moisture and dust particles in the atmosphere. Skyglow is caused by light directed or reflected upwards or sideways and reduces one's ability to view the night sky.</u>
<u>Spill Illuminance:</u>	<u>Unwanted light falling on areas outside those intended for illumination, and that causes annoyance, discomfort, distraction, or a reduction in visibility.</u>

Unshielded Luminaire: **A luminaire constructed and installed in such a manner that has no shielding at all that would otherwise specifically prevent light emission above the horizontal.**

Uplight: **For an exterior luminaire, flux radiated in the hemisphere at or above the horizontal plane.**

Sec. 6-151.1 ACRONYMS AND ABBREVIATIONS.

<u>Fc</u>	<u>Foot-candle</u>
<u>Ft</u>	<u>Foot</u>
<u>Lm</u>	<u>Lumen</u>
<u>Lx</u>	<u>Lux</u>
<u>M</u>	<u>Meter</u>
<u>IDA</u>	<u>International Dark Sky Association</u>
<u>IES</u>	<u>Illuminating Engineering Society</u>
<u>LED</u>	<u>Light Emitting Diode</u>
<u>LZ</u>	<u>Lighting Zone</u>
<u>ARC</u>	<u>Town of Greenwich Architectural Review Committee</u>
<u>PZC</u>	<u>Town of Greenwich Planning & Zoning Commission</u>

Sec. 6-151.2 PURPOSE.

- (a) **The purposes of this Division are to:**
- i. **Maximize energy conservation while minimizing light pollution, glare, and light trespass, as defined in this Division.**
 - ii. **Provide reasonable use of outdoor lighting for public safety, security, and to improve nighttime experiences, within both the built and natural environments of the Town of Greenwich.**
 - iii. **Provide guidelines for exterior lighting that will contribute to the safety and welfare of Greenwich residents.**
 - iv. **Protect wildlife habitats and ecologically sensitive areas to maintain the health and well-being of native flora and fauna.**
 - v. **Reduce the problems created by poorly designed and/or installed outdoor lighting.**

Sec. 6-151.3 GENERAL REQUIREMENTS.

- (a) **Conformance with all applicable codes. All outdoor lighting shall be installed in conformance with the provisions of this Division, the latest applicable Connecticut State Building Code, and the latest applicable Connecticut State Energy Code.**

- (b) Applicability. Except as described below, all outdoor lighting installed after the date of effect of this Division shall comply with these requirements. This includes, but is not limited to, new lighting, replacement lighting, or any other outdoor lighting whether attached to structures, poles, the earth, or any other location, including lighting installed by any third party.
- i. The following are not regulated by this Division:
 - A. Lighting within public right-of-way or easement for the principal purpose of illuminating streets or roads. No exemption shall apply to any lighting within the public right-of-way or easement when the purpose of the luminaire is to illuminate areas outside the public right-of-way or easement, unless regulated with a streetlighting ordinance.
 - B. Lighting for public monuments and public statues.
 - C. Temporary lighting for theatrical, television, performance areas and construction sites.
 - D. Underwater lighting in swimming pools and other man-made water features.
 - E. Temporary lighting and seasonal lighting consistent with the time limits provided in Division 16: Signage, provided that individual lamps are less than 10 watts and 70 lumens.
 - F. Emergency or egress lighting as may be required by applicable building codes.
 - ii. All lighting shall follow the provisions in this Division; however, any special requirements for lighting listed below shall take precedence:
 - A. Lighting specified or identified in a PZC special permit on advice of ARC.
 - B. Lighting required by federal, state, territorial, commonwealth or provincial laws or regulations.
 - iii. Luminaire specifications. All proposed LED lighting shall have a correlated color temperature (CCT) \leq 2700K, except where regulations for outdoor field lighting apply. For commercial zones, lighting shall not exceed 3000K without ARC approval.
 - iv. Existing non-conforming replacements. When non-conforming fixtures or luminaires include replacement for any reason (including but not limited to damage, end of life, upgrade, or vandalism) those fixtures shall be replaced in compliance with this Division. Buildings and lots with clusters of more than five (5) fixtures (e.g. parking lots, landscapes, large-scale building illumination) shall be brought into compliance when the majority of the luminaires (>50%) have reached the end of their life and/or have been fully depreciated by the IRS tax code.

Sec. 6-152 LIGHTING ZONES.

Lighting zones reflect the base (or ambient) light levels desired by a community and shall determine the limitations for lighting as specified in this Division. The Lighting Zones located within the Town of Greenwich shall be as follows:

- (a) LZ0. No ambient lighting

Undeveloped areas within national parks, state parks, forest land and rural areas and sites immediately adjacent to areas officially recognized as ecologically sensitive (wetlands, watercourses, tidal wetlands, and endangered species areas). These include areas along the Mianus River, Calf Island, Babcock Preserve, Mianus River Park, Schongalla Nature Preserve, Sachem Nature Preserve, Pomerance/Tuchman, Great Captains Island, Island Beach, Laddins Rock Sanctuary, Montgomery Pinetum, and Conserve Brook Preserve

(b) LZ1. Low ambient lighting

Developed areas within rural, open space, or other sensitive areas. The following zoning areas are considered LZ1: parks and open spaces larger than 1 acre in size, critical habitat areas, coastal zones, riparian zones, BEX-50 and BEZ-50R.

(c) LZ2. Moderate ambient lighting

Areas predominantly consisting of residential zoning, neighborhood districts, industrial lighting with limited nighttime use and residential mixed-use areas. The following zoning areas are considered LZ2: Business Zones – H-1, H-2, LB, LBR and WB Overlay; Residential from RA-4 to R-PR; CCRC; and special permit uses permitted in residential zones.

(d) LZ3. Moderate high ambient lighting

All other areas not categorized as LZ0, LZ1, LZ2, and LZ4 shall be considered LZ3, such as commercial-industrial and high-density residential areas. The following zoning areas are considered LZ3: Business Zones – CGB, CGBR, GB, GBO, MRCO, and WB.

Sec. 6-152.1 ALLOWABLE LUMEN OUTPUT FOR OUTDOOR LIGHTING.

For all outdoor lighting, the installed luminaire’s total initial light output shall not exceed the total site lumen limit. The total site lumen limit shall be determined using the hardscape area and table below. For sites with existing lighting, it shall be included in the calculation of total installed lumens. Hardscape shall be defined as sidewalks and pavement areas.

Table 1: Allowed Total Initial Lumens Per Site for Outdoor Lighting by Hardscape Area

<u>LZ0</u>	<u>LZ1</u>	<u>LZ2</u>	<u>LZ3</u>
<u>0.5 lumens per SF of hardscape</u>	<u>1.25 lumens per SF of hardscape</u>	<u>2.5 lumens per SF of hardscape</u>	<u>5.0 lumens per SF of hardscape</u>

Sec. 6-152.2 LIGHT TRESPASS.

No light trespass shall be allowed within and into LZ0 and LZ1 lighting zones from LZ3 or LZ4 lighting zones. For other areas, light trespass shall be limited to 0.5 fc at the property boundaries and 0 fc 10 feet beyond the property boundaries of the lot on which it is located, except as within a public street right-of-way for which there shall be no limit. Efforts shall be made to limit light trespass below the maximum permitted.

For property lines shared between two disparate lighting zones, special attention shall be paid to the light trespass onto adjacent properties. Large surfaces such as the sides of buildings and other potentially reflective

surfaces which may scatter inward-facing light outward beyond the property line must be managed to prevent such trespass. Examples include alteration of the surface coating, color, and/or placement of these structures to prevent scatter or manage the direction of scatter to avoid light trespass.

Sec. 6-152.3 RESIDENTIAL PROPERTIES.

The following types of lighting systems are not allowed on residential properties:

- (a) Landscape uplights, including those that are installed within or at the base of planting.
- (b) Building façade uplighting, except on a temporary basis related to holiday decoration.

For residential properties including multiple residential properties not having common areas, all outdoor luminaires shall be fully shielded and shall not exceed the allowed lumen output in Table 2 Row 1. Exceptions shall be as follows:

- (a) One partially shielded or unshielded luminaire at the main entry, not exceeding the allowed lumen output in Table 2 Row 2.
- (b) Any other partially shielded or unshielded luminaires not exceeding the allowed lumen output in Table 2 Row 3.
- (c) Shielded directional flood lighting aimed so that direct glare is not visible from adjacent properties and not exceeding the allowed lumen output in Table 2 Row 4. All flood lighting shall be controlled by a vacancy/motion sensor.
- (d) Open flame gas lamps.
- (e) Lighting installed with a vacancy sensor, where the sensor extinguishes the lights no more than 15 minutes after the area is vacated.

Table 2: Lighting Limits – Residential

<u>Row</u>		<u>LZ0</u>	<u>LZ1</u>	<u>LZ2</u>
<u>1</u>	<u>Maximum Allowed Luminaire Lumens* for each Fully Shielded Luminaire</u>	<u>630 lm</u>	<u>1260 lm</u>	<u>1260 lm</u>
<u>2</u>	<u>Maximum Allowed Luminaire Lumens* for Unshielded Main Entry Luminaire</u>	<u>N/A</u>	<u>420 lm</u>	<u>630 lm</u>
<u>3</u>	<u>Maximum Allowed Luminaire Lumens* for each Unshielded Luminaire excluding main entry</u>	<u>N/A</u>	<u>315 lm</u>	<u>315 lm</u>
<u>4</u>	<u>Maximum Allowed Luminaire Lumens* for each Shielded Directional Flood Lighting</u>	<u>N/A</u>	<u>700 lm</u>	<u>1260 lm</u>
<u>5</u>	<u>Maximum Allowed Luminaire Lumens* for each Low Voltage Landscape Lighting</u>	<u>N/A</u>	<u>50 lm</u>	<u>525 lm</u>

*Luminaire lumens = Initial lamp lumens for a lamp multiplied (x) by the number of lamps in the luminaire. Bollard lights shall not be more than 30" high.

Sec. 6-152.4 OUTDOOR SPORTS ILLUMINATION.

This section shall apply to residential courts and public/private commercial sports facilities not intended for television broadcast.

Measured on-field illuminance values, appropriate for the application, shall be as per IES RP-6-15 Sports and Recreational Area Lighting criteria together with modeled initial illuminance targets.

As the IES TM-15-11 Luminaire Classification System for Outdoor Lighting is not applicable to sports lighting, a modified approach to controlling backlight, uplift, and glare is applied with the following metrics:

- (a) Backlight – Directionality and application efficiency will be addressed indirectly through two methods that quantify off-site performance, one using the design luminance and another using measured illuminance. Backlight criteria will be difficult to meet without sufficient and appropriate setback of sports fields from the properly line.
 - i. Total designed lumens not contained within the area encompassing the field perimeter and an area immediately adjacent to that area that has a 33-foot offset. As modeled, no more than 15% of the total lumens may be outside of this region.
 - ii. Measured spill illuminance values, as measured with the light meter aimed in the direction of the brightest reading, shall not exceed criteria listed in Table 4 below nor shall it exceed the maximum initial spill illuminance values as modeled and specified in the design process. These measurements shall be taken a distance equal to 150’ beyond the edge of the field.

Table 3: Allowable Spill Illuminance To Control Backlight

<u>Lighting zones</u>	<u>Spill Illuminance at Setback</u>
<u>LZ1- LZ3</u>	<u>< 0.20 fc</u>

- (b) Uplight – All luminaires must be designed such as to not emit direct light above the horizon, unless required for the activity (i.e., aerial sports) being played. In those cases, only 8% of the total (directly) applied lumens as modeled may be in this zone. For modeling purposes, a horizontal ceiling grid shall be placed 5 feet above the top of the tallest pole, extending out to 150 feet beyond the edge of the field to determine compliance. Installation shall not deviate from the design.
- (c) Glare – Modeled luminous intensity from any luminaire for any viewing angle at 5’ above grade level, at a distance equal to 150’ beyond the edge of the field shall not exceed 1000 candela (absolute). Luminaires shall not emit more than 250 lumens in the “Very High” glare zone, ranging from 80° to 90° above nadir. This shall be verified through a luminaire photometric report, aiming summary report and visual inspection, or through an equivalent software application and visual inspection.

The lighting system shall achieve a minimum Application Efficiency of 70 lumens per watt, calculated per the following formula:

*Target Area is defined as the total grid area for the sports field and/or sports court as defined by the IES LM-5-04 IES Guide for Photometric Measurements of Area and Sports Lighting Installments.

- i. Color – Luminaire Correlated Color Temperature (CCT) may not exceed 3000K.

- ii. **Controls – Provide advanced controls and documentation for the following:**
 - A. **Automatic and/or remote-control system via smartphone apps, or direct remote communication to the owner or company facility responsible for handling the lighting controls, to enforce shut-off at locally established curfew time, not to be later than 10PM or 1 hour after event.**
 - B. **On-site manual and/or remote-control system shall also be provided to allow for the lights to be turned on or off at will (before curfew) to assure that only active sports fields are lighted.**
 - C. **Provide readily accessible controls to implement uniform and variable adaptive illumination levels for different task lighting needs on field. Adaptive dimming shall be possible across the range of 25% to 100% of full illumination.**
 - D. **For commercial facilities, a formal policy defining the appropriate level of illumination necessary for the specific activities and curfew times must be established and enforced.**
- iii. **Other Lighting – Installed field lighting is not to be used for illuminating other area tasks. For example, if parking and concession areas lighting is desired, those areas shall be illuminated by separate luminaires and systems not associated with sports field illuminance needs. Other outdoor lighting at the site must, at a minimum, meet the lighting standards and lighting codes established in this Division.**

Sec. 6-152.5 NON-RESIDENTIAL PROPERTIES.

A luminaire may be used if it is rated for the lighting zone of the site or lower in Backlight number. Luminaires equipped with adjustable mounting devices permitting alteration of luminaire aiming in the field shall not be permitted, unless otherwise noted. To be considered 'ideally oriented', the luminaire must be mounted with the backlight portion of the light output oriented perpendicular and towards the property line of concern.

The following types of lighting systems are not allowed on non-residential properties:

- (a) **Landscape uplights, including those that are installed within or at the base of planting. Building façade uplighting, except on a temporary basis related to holiday decoration.**
 - i. **Building façade lighting may be approved by special permit for historic monuments, institutional or municipal buildings**

Sign lighting may be ground-mounted, building-mounted, or internal to sign. Sign lighting luminaires may be adjustable but should be aimed towards the face of sign and to avoid spill light and glare.

- (a) **Lumen output maximum: 600 lm / ft²**

All luminaires shall have BUG rating (IES TM-15) reported (See Appendix A) and shall be installed according to the following tables:

Table 4a: Maximum Allowable Backlight.

<u>Allowed Backlight Rating*</u>	<u>LZ0</u>	<u>LZ1</u>	<u>LZ2</u>	<u>LZ3</u>
<u>Greater than 2 mounting heights from property line</u>	<u>B1</u>	<u>B3</u>	<u>B4</u>	<u>B5</u>

<u>1 to less than 2 mounting heights from property line, and ideally oriented**</u>	<u>B1</u>	<u>B2</u>	<u>B3</u>	<u>B4</u>
<u>0.5 to 1 mounting heights from property line and ideally oriented**</u>	<u>B0</u>	<u>B1</u>	<u>B2</u>	<u>B3</u>
<u>Less than 0.5 mounting height to property line and properly oriented**</u>	<u>B0</u>	<u>B0</u>	<u>B0</u>	<u>B1</u>

*For property lines that abut public walkways, bikeways, plazas, and parking lots, the property line may be considered to be 5 feet beyond the actual property line for purpose of determining compliance with this section. For property lines that abut public roadways and public transit corridors, the property line may be considered to be the centerline of the public roadway or public transit corridor for the purpose of determining compliance with this section. NOTE: This adjustment is relative to Table 4a and 4c only and shall not be used to increase the lighting area of the site.

** To be considered "ideally oriented." the luminaire must be mounted with the backlight portion of the light output oriented perpendicular and toward the property line of concern.

Table 4b: Maximum Allowable Uplight. A luminaire may be used if it is rated for the lighting zone of the site or lower in Uplight number.

	<u>LZ0</u>	<u>LZ1</u>	<u>LZ2</u>	<u>LZ3</u>
<u>Allowed Uplight Rating</u>	<u>U0</u>	<u>U0</u>	<u>U0</u>	<u>U0</u>
<u>Allowed % light emission above 90° for street or area lighting</u>	<u>0%</u>	<u>0%</u>	<u>0%</u>	<u>0%</u>

Table 4c: Maximum Allowable Glare. A luminaire may be used if it is rated for the lighting zone of the site or lower in Glare number.

	<u>LZ0</u>	<u>LZ1</u>	<u>LZ2</u>	<u>LZ3</u>
<u>Allowed Glare Rating</u>	<u>G0</u>	<u>G1</u>	<u>G2</u>	<u>G3</u>
<u>Any luminaire not ideally oriented*** with 1 to less than 2 mounting heights to any property line of concern</u>	<u>G0</u>	<u>G0</u>	<u>G1</u>	<u>G1</u>
<u>Any luminaire not ideally oriented*** with 0.5 to 1 mounting heights to any property line of concern</u>	<u>G0</u>	<u>G0</u>	<u>G0</u>	<u>G1</u>
<u>Any luminaire not ideally oriented*** with less than 0.5 mounting heights to any property line of concern</u>	<u>G0</u>	<u>G0</u>	<u>G0</u>	<u>G0</u>

***Any luminaire that cannot be mounted with its backlight perpendicular to any property line within 2X the mounting heights of the luminaire location shall meet the reduced Allowed Glare Rating in Table 4c. See Appendix B. Bollard lights shall not be more than 30" high.

Sec. 6-152.6 LIGHTING CONTROL REQUIREMENTS.

- (a) Automatic switching. Controls shall be provided that automatically turn off all outdoor lighting when sufficient daylight is available. Control devices or systems such as a photoelectric switch, astronomic time switch or equivalent functions from a programmable lighting controller, building automation system or lighting energy management system, all with battery or similar backup power or device, are acceptable. Automatic lighting controls are not required for the following:
- i. Lighting under man-made canopies
 - ii. Lighting for tunnels, parking garages, garage entrances, and similar conditions.
- (b) Automatic lighting reduction. All exterior lighting shall automatically reduce the total lumen output by at least 30% or be turned off completely either one (1) hour after the site is closed or after 10 p.m. Any interior lighting which contributes more than 1 fc, measured 5 feet from the building face, shall also comply. Lighting reductions are not required for any of the following:
- i. Lighting for residential properties including multiple residential properties not having common areas.
 - ii. When the outdoor lighting consists of only one luminaire.
 - iii. Code required lighting for steps, stairs, walkways, and building entrances.
 - iv. When in the opinion of the Authority, lighting levels must be maintained.
 - v. Motion activated lighting.
 - vi. Lighting governed by special use permit in which times of operation are specifically identified.
 - vii. Businesses that operate on a 24-hour basis.

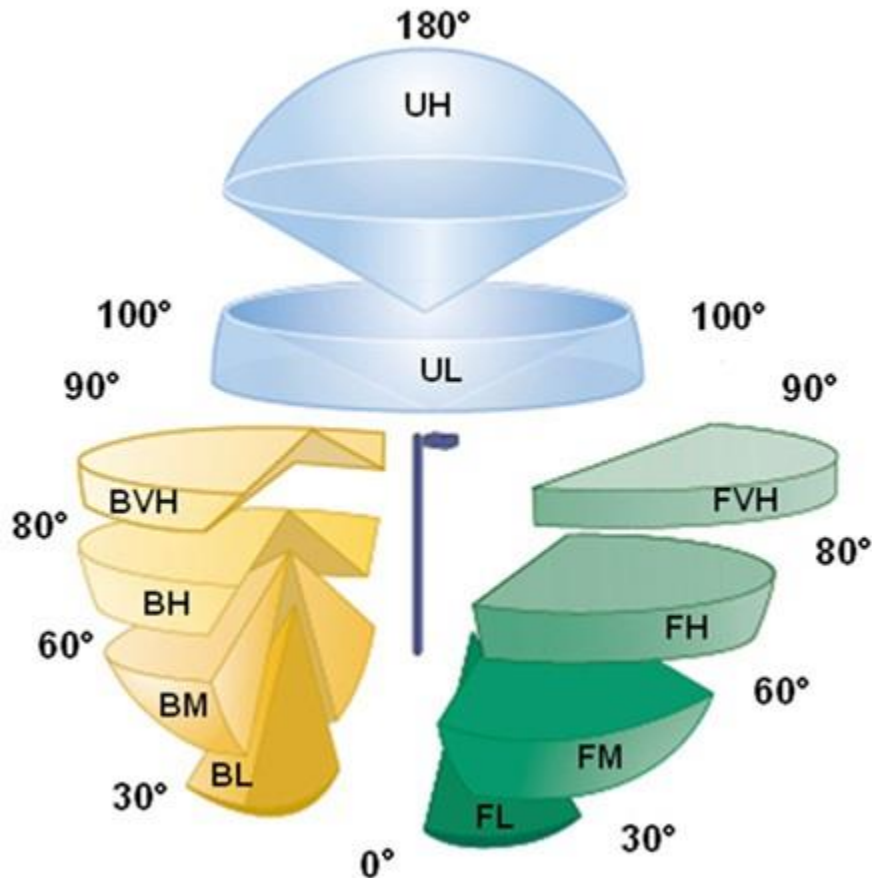
Sec. 6-153 ENFORCEMENT AND PENALTIES.

The review of the lighting design shall be part of the approval process where it is part of another review process described in the Chapter 6 (Land Use) of the Greenwich Code of Ordinances. Where lighting is not subject to any review process, violations from these regulations will be evaluated on a case-by-case basis. If a resident has a concern that an installation violates this regulation, they may file a complaint with the Town's Zoning Enforcement Officer.

- (a) Enforcement of this section shall be in accordance with Greenwich Building Zone Regulations Section 6-8.
- (b) Penalties for non-compliance with the requirements of this section, as may be allowable under Connecticut General Statutes, shall be pursuant to Greenwich Building Zone Regulations Section 6-202.

Appendix A BUG RATING

The BUG rating system is based on the maximum lumen output in the three primary solid angles (backlight, uplight, glare) of a luminaire's distribution. This rating system provides more effective control of unwanted light and avoids individual evaluation of a fixture's photometric properties. The B, U, and G ratings range from 0, the most limiting, to 5, the most lenient. This rating system has largely replaced the previous classification system of full-cutoff, cutoff, semi-cutoff, and non-cutoff.



<u>Backlight Subzones</u>	<u>Uplight Subzones</u>	<u>Glare Subzones</u>
<u>BVH: Backlight Very High (80-90°)</u>	<u>UH: Uplight High (100-180°)</u>	<u>FVH: Forward light Very High (80-90°)</u>
<u>BH: Backlight High (60-80°)</u>	<u>UL: Uplight Low (90-100°)</u>	<u>FH: Forward light High (60-80°)</u>
<u>BM: Backlight Mid (30-60°)</u>		<u>FM: Forward light Mid (30-60°)</u>
<u>BL: Backlight Low (0-30°)</u>		<u>FL: Forward light Low (0-30°)</u>

A.1 Backlight (B)

Backlight, also known as light trespass, refers to the light emitting from behind a fixture. This light usually protrudes outwards or towards the ground, illuminating an area that is not intended to be illuminated. Backlight is great when you're talking about improving the visibility of wristwatches or viewing your smartphone. But when you can't sleep at night because of the light shining out from behind a streetlight into your room, you might think twice about enjoying backlight. In order to get more light to head towards the front, manufacturers can use optics, reflectors, or glare shields to redirect it.

A.2 Uplight (U)

Uplight is the light that shines upwards from a fixture towards the sky — hence the alternate term "skyglow." This stray light is responsible for the light pollution often seen in large cities. In exterior lighting, any uplight is wasted light, as it is not going towards where people are. It will also block out the view of the stars and moon. Skyglow can be cut down by fully shielding your fixture and by making sure it's pointed towards the ground. This will also reduce energy use and cost. The IDA is particularly concerned with limiting uplight so more people can enjoy the stars at night.

A.3 Glare (G)

Glare, or forward light, is sometimes called "offensive light" because that's exactly what it does for most people. This light, which can be reflected or directed, makes it very difficult for people to see — especially when it shines directly into their eyes. It is especially dangerous when operating a motor vehicle at night. Glare can be reduced by using lights that aren't as bright or by selecting a light with a distribution pattern that's appropriate for your intended use.

A.4 BUG Rating Tables (Annex A – ANSI/IES TM-15-20)

The following Back Light, Uplight, and Glare ratings may be used to evaluate luminaire optical performance.

		<u>Backlight Rating</u>					
<u>Secondary Solid Angle</u>		<u>B0</u>	<u>B1</u>	<u>B2</u>	<u>B3</u>	<u>B4</u>	<u>B5</u>
<u>Backlight / Trespass</u>	<u>BH</u>	<u>110</u>	<u>500</u>	<u>1000</u>	<u>2500</u>	<u>5000</u>	<u>>5000</u>
	<u>BM</u>	<u>220</u>	<u>1000</u>	<u>2500</u>	<u>5000</u>	<u>8500</u>	<u>>8500</u>
	<u>BL</u>	<u>110</u>	<u>500</u>	<u>1000</u>	<u>2500</u>	<u>5000</u>	<u>>5000</u>

Uplight Rating

		Uplight Rating					
Secondary Solid Angle		<u>U0</u>	<u>U1</u>	<u>U2</u>	<u>U3</u>	<u>U4</u>	<u>U5</u>
Uplight / Skyglow	<u>UH</u>	<u>0</u>	<u>10</u>	<u>50</u>	<u>500</u>	<u>1000</u>	<u>>1000</u>
	<u>UL</u>	<u>0</u>	<u>10</u>	<u>50</u>	<u>500</u>	<u>1000</u>	<u>>1000</u>

Glare Rating for Asymmetrical Luminaire Types (I, II, III, IV)

		Glare Rating for Asymmetrical Luminaire Types (I, II, III, IV)					
Secondary Solid Angle		<u>B0</u>	<u>B1</u>	<u>B2</u>	<u>B3</u>	<u>B4</u>	<u>B5</u>
Glare / Offensive Light	<u>FVH</u>	<u>10</u>	<u>100</u>	<u>225</u>	<u>500</u>	<u>750</u>	<u>>750</u>
	<u>BVH</u>	<u>10</u>	<u>100</u>	<u>225</u>	<u>500</u>	<u>750</u>	<u>>750</u>
	<u>FH</u>	<u>660</u>	<u>1800</u>	<u>5000</u>	<u>7500</u>	<u>12000</u>	<u>>12000</u>
	<u>BH</u>	<u>110</u>	<u>500</u>	<u>1000</u>	<u>2500</u>	<u>5000</u>	<u>>5000</u>

Glare Rating for Symmetrical Luminaire Types (V)

		Glare Rating for Symmetrical Luminaire Types (V)					
Secondary Solid Angle		<u>G0</u>	<u>G1</u>	<u>G2</u>	<u>G3</u>	<u>G4</u>	<u>G5</u>
Glare / Offensive Light	<u>FVH</u>	<u>10</u>	<u>100</u>	<u>225</u>	<u>500</u>	<u>750</u>	<u>>750</u>
	<u>BVH</u>	<u>10</u>	<u>100</u>	<u>225</u>	<u>500</u>	<u>750</u>	<u>>750</u>
	<u>FH</u>	<u>660</u>	<u>1800</u>	<u>5000</u>	<u>7500</u>	<u>12000</u>	<u>>12000</u>
	<u>BH</u>	<u>660</u>	<u>1800</u>	<u>5000</u>	<u>7500</u>	<u>12000</u>	<u>>12000</u>

Appendix B

LUMINAIRE ORIENTATION

