



# ENERGY STAR® Program Requirements for Solid State Lighting Luminaires

## Proposed Category “A” Additions

### Category A: Near-term Applications

#### Surface and pendant-mounted downlights

##### Comments on Surface and pendant-mounted downlights:

- The existing criteria specifically address recessed downlights. Given the photometric similarity amongst downlight applications surface and pendant-mounted downlights are being added to the criteria.

Application Requirements	
Minimum Light Output	≤ 4.5” Aperture: 345 lumens (initial) > 4.5” Aperture: 575 lumens (initial)
Zonal Lumen Density Requirement	Luminaire shall deliver a minimum of 75% of total lumens within the 0-60° zone (bilaterally symmetrical).
Minimum Luminaire Efficacy	35 lm/W
Allowable CCTs	2700 K, 3000 K and 3500 K for Residential products

#### Outdoor pole/arm-mounted area and roadway luminaires

##### Comments on beam uniformity metric:

- Goniophotometry measures luminous intensity only. Luminous flux can be derived from intensity data using zonal constants (a trigonometric function).
- Illuminance is also derived from intensity. The cosine law (a modified version of the inverse square law) states that illuminance = intensity x cos  $\Theta$  / distance<sup>2</sup>, i.e., higher intensity is required at higher vertical angles than at nadir to produce equivalent illuminances across the luminaire beam spread. Therefore, when concerned with regulating illuminance uniformity, it is more relevant to address intensity than luminous flux.
- Note also that luminous flux and intensity are not corollaries. Whereas zonal lumens represent a total and must sum to 100%, luminous intensity is an infinite measure and specific to the angle of measurement. This “disconnect” between flux and intensity underlies, in part, IESNA nullifying its luminaire cutoff classifications (superseded by the Luminaire Classification System, per IESNA TM-15-07).

Application Requirements	
Minimum Light Output	Luminaire shall deliver a minimum of 2,300 lumens (initial).
Zonal Lumen Density Requirement	Luminaire shall deliver 100% of total lumens within the 0°- 90° zone, with a maximum of 10% of total lumens delivered within the 80°- 90° zone (bilaterally symmetrical).
Beam Uniformity	<u>IES Outdoor Luminaire Classification Type II/III</u>

	<p>Maximum intensity (in candelas, cd) to be produced in the 55°- 65° zone (vertical), at a horizontal angle per IESNA TM-15 definitions, with the following requirements:</p> <ul style="list-style-type: none"> <li>• 10% - 35%<sup>†</sup> of the max. cd in the 0°- 25° range</li> <li>• 35% - 60%<sup>†</sup> of the max. cd in the 25°- 45° range</li> <li>• 35% - 95%<sup>†</sup> of the max. cd in the 65°- 75° range</li> <li>• ≤5%<sup>†</sup> of the max cd in the 80°- 90° range</li> </ul> <p><u>IES Outdoor Luminaire Classification Type IV</u></p> <p>Maximum intensity (cd) to be produced in the 55°- 65° zone (vertical), with the following requirements:</p> <ul style="list-style-type: none"> <li>• ≤50%<sup>†</sup> of the max. cd in the 0°- 40° range</li> <li>• ≤5%<sup>†</sup> of the max cd in the 80°- 90° range</li> </ul> <p><u>IES Outdoor Luminaire Classification Type V</u></p> <p>Maximum intensity (cd) to be produced in the 55°- 65° zone (vertical), with the following requirements:</p> <ul style="list-style-type: none"> <li>• 10% - 35%<sup>†</sup> of the max. cd in the 0°- 25° range</li> <li>• 35% - 60%<sup>†</sup> of the max. cd in the 25°- 45° range</li> <li>• 35% - 95%<sup>†</sup> of the max. cd in the 65°- 75° range</li> <li>• ≤5%<sup>†</sup> of the max cd in the 80°- 90° range</li> </ul> <p><sup>†</sup>All percentages are ±5%</p> <p>(Refer to IESNA TM-15-07 for luminaire classifications distribution types)</p>
Minimum Luminaire Efficacy	50 lm/W

### Outdoor pole/arm-mounted decorative luminaires

Application Requirements	
Minimum Light Output	Luminaire shall deliver a minimum of 2,300 lumens (initial).
Zonal Lumen Density Requirement	Luminaire shall deliver a minimum of 85% of total lumens within the 0°- 90° zone (bilaterally symmetrical).
Minimum Luminaire Efficacy	40 lm/W

### Outdoor wall-mounted area luminaires (“wall packs”)

Application Requirements	
Minimum Light Output	Luminaire shall deliver a minimum of 1,300 lumens (initial).
Zonal Lumen Density Requirement	Luminaire shall deliver 100% of total lumens within the 0°- 90° zone, with a maximum of 10% of total lumens delivered within the 80°- 90° zone (bilaterally symmetrical).
Minimum Luminaire Efficacy	40 lm/W

## Cove lighting - Asymmetric distribution

### Comments on cove lighting applications:

- Luminaires addressed in this category are high-performance architectural luminaires designed to provide indirect illumination by reflecting or redirecting light off of the ceiling.
- This category does not address luminaires used to accent the cove and/or provide low (i.e., “mood”) lighting levels, an application that does not require the light output and optical control specified in this category.

Application Requirements	
Minimum Light Output	<p>Luminaire shall deliver a minimum of 400 lumens (initial) per lineal foot. The light output requirement is calculated by the following equation:</p> $\frac{\text{Measured Fixture Length (inches)}}{12} \times 400 = \text{Minimum Required Light Output (lumens)}$ <p><b>Note:</b> The equation applies to all luminaire configurations. For rectangular geometries the “measured fixture length” is the longest dimension of the fixture. For circular geometries the “measured fixture length” is the diameter. For linear track luminaires the “measured fixture length” is the track length.</p>
Zonal Lumen Density Requirement	Luminaire shall deliver a minimum of 60% of total lumens within the 100°-150° zone (asymmetrically).
Minimum Luminaire Efficacy	56 lm/W
Allowable CCTs	2700 K, 3000 K, 3500 K, 4000 K, 4500 K, 5000 K

## Circular or square parking garage luminaires

Application Requirements	
Minimum Light Output	Luminaire shall deliver a minimum of 4,000 lumens (initial).
Zonal Lumen Density Requirement	Luminaire shall deliver a majority of total lumens (minimum 20% of total) in the 60°- 70° zone, with the majority of remaining lumens (minimum 15% of total) delivered in the 70°- 80° zone (bilaterally symmetrical).
Minimum Luminaire Efficacy	56 lm/W

## Bollards

### Comments on bollard specifications:

The minimum light output and zonal lumen density requirements in this category are intended to provide illumination comparable to existing technologies, while addressing glare issues. Specifically, the zonal lumen density requirements address the following:

- The light in the 50°- 70° zone lights the ground plane
- The restriction in the 80°- 90° zone is intended to limit or prevent glare
- The light in the 90°- 110° zone allows some uplight when bollards are mounted near buildings (typical in practice)
- The restriction over 110° is intended to prevent skyglow

Application Requirements	
Minimum Light Output	Luminaire shall deliver a minimum of 500 lumens (initial).
Zonal Lumen Density Requirement	Luminaire shall deliver the majority of total lumens within the following zones: <ul style="list-style-type: none"> <li>• &gt; 40% of total lumens within the 50°- 70° zone</li> <li>• &lt; 10% of total lumens within the 80°- 90° zone</li> <li>• &lt; 15% of total lumens in the 90°- 110° zone</li> <li>• no light emitted over 110°</li> </ul>
Minimum Luminaire Efficacy	26 lm/W

## Circular or square wall wash luminaires

Application Requirements	
Minimum Light Output	Luminaire shall deliver a minimum of 575 lumens (initial).
Zonal Lumen Density Requirement	Luminaire shall deliver a minimum of 50% of total lumens within the 20°- 40° zone (asymmetrical).
Minimum Luminaire Efficacy	30 lm/W
Allowable CCTs	2700 K, 3000 K, 3500 K, 4000 K

## Ceiling-mounted luminaires with diffusers

### Comments on Ceiling-mounted luminaires with diffusers:

- Given the broad range of form factors and photometric distributions for existing products in this category, a Zonal Lumen Density Requirement is not proposed at this time.

Application Requirements	
Minimum Light Output	Luminaire shall deliver a minimum of 750 lumens (initial).
Minimum Luminaire Efficacy	30 lm/W
Allowable CCTs	2700 K, 3000 K and 3500 K for Residential products

### Surface-Mounted Luminaires with Directional Head(s)

<b>Application Requirements</b>	
Minimum Light Output	Luminaire shall deliver a minimum of 250 lumens (initial) per head.
Zonal Lumen Density Requirement	Luminaire shall deliver a minimum of 85% within the 0-90° zone (bilaterally symmetrical).
Minimum Luminaire Efficacy	30 lm/W
Allowable CCTs	2700 K, 3000 K and 3500 K for Residential products