Have you ever wondered how many LED lights, or LED lumens, you need to light a room?

The question itself may be challenging and, when faced with having to calculate how much LED lighting you need to create a well lit space, it can get even more complicated. Here’s how to determine how many lumens you need to properly light your space.
Lumen output, also known as brightness or light output, is a measure of the total quantity of visible light emitted by a light source per unit of time, weighted according to the human eye's sensitivity to wavelengths of light, the study of which is known as luminous efficiency function. The reference point: a standard 100-watt incandescent light bulb produces about 1,500 – 1,700 lumens.

**Wattage Equivalence**
Since we've conflated watts and lumens, it's easier to talk about bulbs in terms of watts. So if a 100-watt incandescent produces 1,500 lumens, and a 10-watt LED does the same, the 10-Watt LED may advertise “100-watt equivalent” on its label.

**Efficacy**
The number of lumens a bulb produces for each watt it consumes. The higher the number, the more efficient the bulb. For example, lighting products that have been designated with the ENERGY STAR label are deemed high efficacy, meaning they have been determined to deliver the same features while using less energy.

---

**KEY TERMS**

**Lumens**
Lumen output, also known as brightness or light output, is a measure of the total quantity of visible light emitted by a light source per unit of time, weighted according to the human eye's sensitivity to wavelengths of light, the study of which is known as luminous efficiency function. The reference point: a standard 100-watt incandescent light bulb produces about 1,500 – 1,700 lumens.

**Watts**
Not a measure of brightness; instead, it's a measure of how much electricity (or energy) a light bulb consumes to reach its claimed brightness. Each type of light source, LED, fluorescent, halogen or incandescent has a different lumen-per-watt ratio. Below we're going to use lumens as a measurement to make sure we have enough light for a space.
The Breakdown—
How Much Light is Enough?

Determine Room Square Footage
Multiply the length times the width of the room to get the Room Square Footage. For example, if the room is 10 feet wide and 10 feet long, the Room Square Footage will be 100 square feet.

Determine the Foot-candles by Room Type
A footcandle is how bright a light is one foot away from its source. Lighting requirements/needs vary depending on the type of room being lit. For example, a bathroom or kitchen will require more footcandles than a living room or bedroom.

<table>
<thead>
<tr>
<th>Room</th>
<th>Footcandles Needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Living Room</td>
<td>10-20</td>
</tr>
<tr>
<td>Kitchen General</td>
<td>30-40</td>
</tr>
<tr>
<td>Kitchen Stove</td>
<td>70-80</td>
</tr>
<tr>
<td>Kitchen Sink</td>
<td>70-80</td>
</tr>
<tr>
<td>Dining Room</td>
<td>30-40</td>
</tr>
<tr>
<td>Bedroom</td>
<td>10-20</td>
</tr>
<tr>
<td>Hallway</td>
<td>5-10</td>
</tr>
<tr>
<td>Bathroom</td>
<td>70-80</td>
</tr>
</tbody>
</table>

Determine the Required Lumens
To determine the lumens needed, you will need to multiply your Room Square Footage by your room footcandle requirement. For example, a 100-square-foot living room, which needs 10-20 footcandles, will need 1,000-2,000 lumens. A 100-square-foot dining room, which needs 30-40 footcandles, will need 3,000-4,000 lumens.

Summary
For the average space of 250 square feet, you’ll need roughly 2,500-5,000 lumens as your primary lightsource (10-20 lumens x 250 square feet). In your dining room, you’ll want about 30 lumens per square foot on your dining table (you want to see your food, but not examine it), so if your table is 6 x 3 feet, that’s 540 lumens. Keep in mind, however, that these numbers are for typical conditions. If you have especially dark colored walls and furniture, or if you’re using fixtures with shades, you’ll need roughly an additional 10 lumens per square foot. We based our calculations on 8-foot ceilings. Finally, personal preference will play the largest part in your decision. If you like the room to be especially bright, you may want to add an additional 10 to 20% to our numbers. In fact, the best approach for most spaces is to aim high and install dimmers to bring the light down to desired levels.
# Footlight Candle Index

## Airplane Manufacturing
- Drilling, riveting, screw fastening: 75
- Final assembly, hangar: 100
- Inspection: 50-200
- Welding: 50

## Assembly
- Rough easy seeing: 20-50
- Rough difficult seeing: 50-100
- Medium: 100-200
- Fine: 200-500
- Extra fine: 500-1000

## Auditoriums
- Social activities: 5-10
- Assembly only: 10-20
- Exhibitions: 10-20

## Automobile Manufacturing
- Final assembly, finishing, inspecting: 200
- Body & chassis assembly: 100
- Body parts manufacturing: 100
- Frame assembly: 50

## Banks
- Lobby general: 10-50
- Writing areas: 20-70
- Teller stations, posting & keypunch: 50-150

## Barber Shops
- Beauty Parlor: 50-100

## Chemical Works
- Pattern making, trimming: 50-100

## Clothing Manufacturer
- Receiving, storing, shipping, winding, measuring: 20-50
- Pattern making, trimming: 50-100
- Shops, marking: 50-200
- Cutting, pressing: 200-500
- Sewing, inspection: 200-500

## Electrical Equipment Manufacturing
- Impregnating: 20-50
- Insulating coil winding, testing: 50-100

## Food Service Facilities
- Dining areas
  - Cashier: 20-50
  - Cleaning: 10-20
  - Dining: 5-20
  - Food displays: 30-100
  - Kitchen: 50-100

## Foundries
- Annealing furnaces: 20-50
- Cleaning: 20-50
- Core making: 50-200
- Inspection: 100-500
- Medium: 50-100
- Molding: 50-200
- Pouring, sorting: 50-100

## Garages-Motor Vehicles
- Storage: 5
- Traffic Lanes: 10
- Parking garage: 10-20

## Hospitals
- Rooms: 10-30
- Corridors: 5-30
- Emergency rooms: 50-100
- Operating rooms: 100-200

## Hotels
- Bathrooms: 20-50
- Bedrooms for reading: 20-50
- Corridors, elevators and stairs: 10-20
- Front desk: 50-100

## Iron & Steel Manufacturing
- Stock, hot top, checker
  - Cellar, calining: 10-30
- Building, slag pits, stripping yard: 20
- Control platforms, repairs, mixer building: 30
- Rolling mills: 30-50
- Shearing: 50
- Tin plate: 50
- Motor room, machine room: 30
- Inspection: 100

## Laundries
- Washing: 20-50
- Ironing: 20-100

## Library
- Ordinary reading, stacks: 20-50
- Book repair and binding: 20-50
- Study & notes, cataloging, card files, check desk: 20-100

## Machine Shops
- Rough bench: 20-50
- Medium bench, rough
  - Grinding, buffing: 50-100
- Fine bench and work: 200-500

## Materials Handling
- Loading trucking: 10-20
- Picking stock classifying: 20-50
- Wrapping, packing, labeling: 20-50

## Offices
- Accounting: 50-100
- Audio-visual areas: 20-50
- Conference areas: 20-70
- Corridors, stairways: 20(k)
- Drafting: 50-200
- General and private offices: 50-100

## Painting
- Space with VDT's: 75

## Printing
- Photo engraving, etching, blocking: 20-50
- Color inspecting: 100-200
- Presses: 50-100
- Proofreading: 100-200
- Composing room: 100-200

## Paper Manufacturing
- Paper machine reel, inspection: 100-200

## Paint Shop
- Spraying, rubbing, hand art, stencil: 20-50
- Fine hand painting & finishing: 50-100

## Paper Manufacturing
- Beaters, grinding: 20-50
- Finishing, cutting: 50-100
- Hand coating: 50-100
- Paper machine reel, inspection: 100-200
- Rewinder: 100-200

## Printing
- Photo engraving, etching, blocking: 20-50
- Color inspecting: 100-200
- Presses: 50-100
- Proofreading: 100-200
- Composing room: 100-200

## Textile Mills
- Cotton picking, carding, roving, spinning: 50
- Beaming & slashing: 150
- Drawing: 200
- Others: 100

## Warehousing, Storage
- Inactive: 5-10
- Active
  - Rough bulky: 10-20
  - Medium: 20
  - Fine: 20-50

## Welding
- General: 20-50

## Woodworking
- Rough sawing and bench work: 20-50
- Sizing, planing, rough sanding, medium quality machine and bench work, gluing, veneering, cooperage: 20-50
- Fine bench and machine work, fine sanding and finishing: 50-100
# Footlight Candle Index

<table>
<thead>
<tr>
<th>Building Area &amp; Task</th>
<th>Average Maintained Footcandles (Horizontal) (FC)</th>
<th>Range of Maintained Footcandles (Horizontal) (FC)</th>
<th>Average Maintained Footcandles (Vertical) (FC)</th>
<th>Range of Maintained Footcandles (Vertical) (FC)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WAREHOUSING &amp; STORAGE</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bulky Items—Large Labels</td>
<td>10</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small Items—Small Labels</td>
<td>30</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cold Storage</td>
<td>20</td>
<td>10 - 30</td>
<td>10</td>
<td>5 - 15</td>
<td></td>
</tr>
<tr>
<td>Open Warehouse</td>
<td>20</td>
<td>10 - 30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Warehouse w/Aisles</td>
<td>20</td>
<td>10 - 30</td>
<td>10</td>
<td>5 - 15</td>
<td></td>
</tr>
<tr>
<td><strong>COMMERCIAL OFFICE</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Open Office</td>
<td>40</td>
<td>30 - 50</td>
<td>@30° Above Finished Floor (AFF)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private Office</td>
<td>40</td>
<td>30 - 50</td>
<td>@30° AFF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conference Room</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td>Matte surface reflectance for the table 40% recommended</td>
</tr>
<tr>
<td>Restroom</td>
<td>18</td>
<td>7.5 - 30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lunch &amp; Break Room</td>
<td>15</td>
<td>5 - 20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>EDUCATIONAL (SCHOOLS)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Classroom</td>
<td>40</td>
<td>30 - 50</td>
<td>@30° AFF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gymnasium</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class I (Pro or Div. 1 College)</td>
<td>125</td>
<td>30</td>
<td></td>
<td></td>
<td>@30° AFF</td>
</tr>
<tr>
<td>Class II (Div. 2 or 3 College)</td>
<td>80</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class III (High School)</td>
<td>50</td>
<td>150</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class IV (Elementary)</td>
<td>30</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Auditorium</td>
<td>7.5</td>
<td>3 - 10</td>
<td>5</td>
<td>2.5 - 10</td>
<td></td>
</tr>
<tr>
<td>Corridor</td>
<td>25</td>
<td>10 - 40</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>INDUSTRIAL/MANUFACTURING</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assembly</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Simple (Large Item)</td>
<td>30</td>
<td>15 - 60</td>
<td>30</td>
<td>15 - 60</td>
<td></td>
</tr>
<tr>
<td>Difficult (fine)</td>
<td>100</td>
<td>50 - 200</td>
<td>100</td>
<td>50 - 200</td>
<td></td>
</tr>
<tr>
<td>Component Manufacturing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large</td>
<td>30</td>
<td>15 - 60</td>
<td>30</td>
<td>15 - 60</td>
<td></td>
</tr>
<tr>
<td>Medium</td>
<td>50</td>
<td>25 - 100</td>
<td>50</td>
<td>25 - 100</td>
<td></td>
</tr>
</tbody>
</table>


- Horizontal—horizontal plane that average maintained foot-candles are measured, for example a tabletop.
- Vertical—vertical plane the average maintained foot-candles are measured, for example a wall.
## Footlight Candle Index

<table>
<thead>
<tr>
<th>Building Area &amp; Task</th>
<th>Average Maintained Footcandles (Horizontal) (FC)</th>
<th>Range of Maintained Footcandles (Horizontal) (FC)</th>
<th>Average Maintained Footcandles (Vertical) (FC)</th>
<th>Range of Maintained Footcandles (Vertical) (FC)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EXTERIOR</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parking (Covered)</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td>1FC min, 10:1 Max to Min Uniformity</td>
</tr>
<tr>
<td>Parking (Open) (Medium Activity)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lighting Zone 3 (Urban)</td>
<td>1.5 .75 - 3</td>
<td>.8</td>
<td>.4 - 1.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lighting Zone 2 (suburban)</td>
<td>1 0.5 - 2</td>
<td>.6</td>
<td>.3 - 1.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gas Station Canopy</td>
<td>12.5 10 - 15</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety (Building Exterior)</td>
<td>1 0.5 - 2</td>
<td></td>
<td></td>
<td></td>
<td>If security is an issue—raise average level to 3</td>
</tr>
<tr>
<td><strong>RETAIL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General Retail (Ambient)</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Department Store</td>
<td>40 20 - 80</td>
<td>15 7.5 - 30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perimeter</td>
<td>75 35 - 150</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accent Lighting (Displays)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3 - 10 times greater than ambient light levels</td>
</tr>
<tr>
<td><strong>AUTOMOTIVE</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Showroom</td>
<td>50 25 - 100</td>
<td>10 5 - 20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Service Area</td>
<td>50 25 - 100</td>
<td>30 15 - 30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sales Lot (Exterior)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lighting Zone 3 (Urban)</td>
<td>20 10 - 40</td>
<td>20 10 - 40</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lighting Zone 2 (Suburban)</td>
<td>15 7.5 - 30</td>
<td>15 7.5 - 30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>GROCERY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Circulation</td>
<td>20 10 - 40</td>
<td>7.5</td>
<td>3.5 - 15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General Retail</td>
<td>50 25 - 100</td>
<td>20</td>
<td>10-40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perimeter</td>
<td>50 25-100</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>BANKING</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ATM</td>
<td>20 10-40</td>
<td>15</td>
<td></td>
<td>Vertical at face of ATM</td>
<td></td>
</tr>
</tbody>
</table>


- Horizontal—horizontal plane that average maintained foot-candles are measured, for example a tabletop.
- Vertical—vertical plane the average maintained foot-candles are measured, for example a wall.