# Determining How Many Lumens Are Needed To Properly Light A Space

**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 a space.

# 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

### 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.

### 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.

### 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.

| Source | Lumens | Watts |
|---|---|---|
| LED | 800 | 8-10W |
| CFL | 800 | 13-14W |
| Regular Incandescent | 800 | 60W |
| Halogen | 800 | 43W |

# The Breakdown— How Much Light Is Enough?

**Determine the Footcandles by Room Type**

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 are going to use lumens as a measurement to ensure we have enough light for a space.

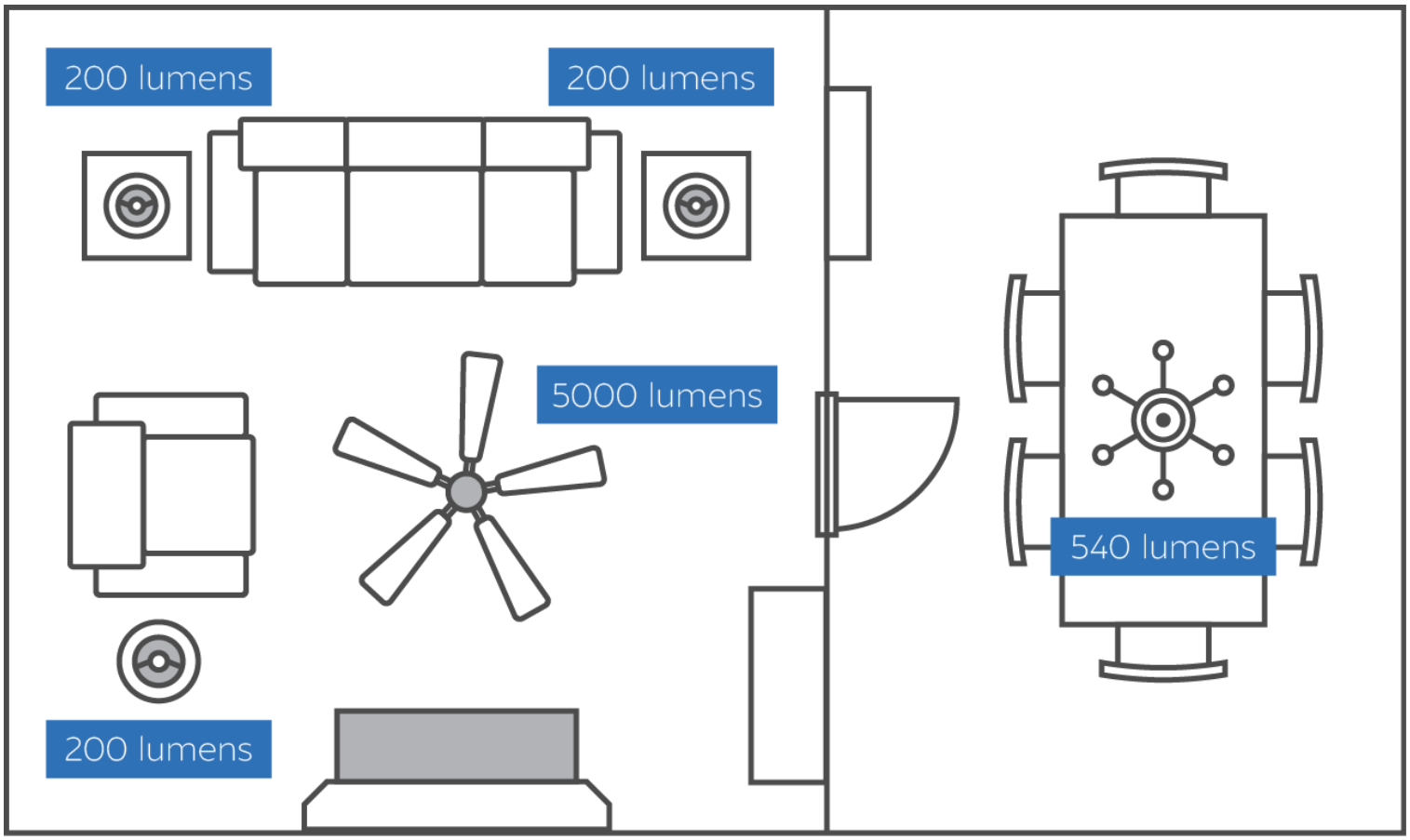
**Determine the Required Lumens**

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.

**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.

| Room | Footcandles |
|---|---|
| Living Room | 10-20 |
| Kitchen General | 30-40 |
| Kitchen Stove | 70-80 |
| Kitchen Sink | 70-80 |
| Dining Room | 30-40 |
| Bedroom | 10-20 |
| Hallway | 5-10 |
| Bathroom | 70-80 |




**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 assemble, hangar....100
- Inspection....50-200
- Welding....50

**Assembly**
- Rough easy seeing....20-50
- Rough difficult seeing....50-100
- Medium....100-200
- Fine....200-500(a)
- Extra fine....500-1000(a)

**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 Parlors....50-100

**Chemical Works**....30

**Clothing Manufacturer**
- Receiving, storing, shipping, winding, measuring....20-50
- Pattern making, trimming....50-100
- Shops, marking....50-200
- Cutting, pressing....100-500(a)
- Sewing, inspection....200-500(a)

**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
- Fine....100-500
- Medium....50-100
- Molding....50-200
- Pouring, sorting....50-100

**Garages-Motor Vehicles**
- Storage....5
- Traffic Lanes
- Parking garage....10
- Service garage....10-20
- Entrances....50
- Repair area....50-100

**Gymnasiums**
- Assemblies....10
- General exercise & recreation....30
- Exhibitions, matches....50

**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
- Linen room
- Sewing....100-200
- General....10-20

**Lobby**
- General lighting....10-20
- Reading and working areas....20-50

**Iron & Steel Manufacturing**
- Stock, hot top, checker cellar, calcining....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(a)

**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
- Lobbies, lounges and reception areas....0-20
- Mail sorting....50-100
- Off-set printing and duplicating area....20-50
- Spaces with VDT's....75

**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 couting....50-100
- Paper manchine 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....50-100

**Schools**
- Reading....20-100
- Typing....20-100
- Demonstrations....100-200
- Sewing....20-100

**Sheet Metal Works**
- General....100
- Tin plate inspection, galvanized, scribing....100-200

**Stores**
- Circulation area stockroom....10-30
- Merchandising, serviced....30-100
- Merchandising, self-service....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 With Maintained Footcandles

| Building Area & Task | Average Maintained Footcandles (Horizontal) (FC) | Average of Maintained Footcandles (Horizontal) (FC) | Average Maintained Footcandles (Vertical) (FC) | Average of Maintained Footcandles (Vertical) (FC) | Comments |
|---|---|---|---|---|---|
| **WAREHOUSING & STORAGE** | | | | | |
| Bulky Items—Large Labels | 10 | | 5 | | |
| Small items—Small Labels | 30 | | 15 | | |
| Cold Storage | 20 | 10 - 30 | 10 | 5 - 15 | |
| Open Warehouse | 20 | 10 - 30 | | | |
| Warehouse w/Aisles | 20 | 10 - 30 | 10 | 5 - 15 | |
| **COMMERCIAL OFFICE** | | | | | |
| Open Office | 40 | 30 - 50 | | | @30" Above Finished Floor (AFF) |
| Private Office | 40 | 30 - 50 | | | @30" AFF |
| Conference Room | 30 | | | | Matte surface reflectance for the table 40% recommended |
| Restroom | 18 | 7.5 - 30 | | | |
| Laundry & Break Room | 15 | 5 - 20 | | | |
| **EDUCATIONAL (SCHOOLS)** | | | | | |
| Classroom | 40 | 30 - 50 | | | @30" AFF |
| Gymnasium | | | | | |
| Class I (Pro or Div. 1 College) | 125 | | 30 | | |
| Class II (Div. 2 or 3 College) | 80 | | 20 | | |
| Class III (High School) | 50 | | 150 | | |
| Class IV (Elementary) | 30 | | 100 | | |
| Auditorium | 7.5 | 3 - 10 | 5 | 2.5 - 10 | |
| Corridor | 25 | 10 - 40 | | | |

https://www.lightingdesignlab.com/sites/default/files/pdf/Footcandle_Lighting%20Guide_Rev.072013.pdf

- 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 With Maintained Footcandles

| Building Area & Task | Average Maintained Footcandles (Horizontal) (FC) | Range of Maintained Footcandles (Horizontal) (FC) | Average Maintained Footcandles (Vertical) (FC) | Range of Maintained Footcandles (Vertical) (FC) | Comments |
|---|---|---|---|---|---|
| INDUSTRIAL/MANUFACTURING | | | | | |
| Assembly | | | | | |
| Simple (Large Item) | 30 | 15 - 60 | 30 | 15 - 60 | |
| Difficult (fine) | 100 | 50 - 200 | 100 | 50 - 200 | |
| Component Manufacturing | | | | | |
| Large | 30 | 15 - 60 | 30 | 15 - 60 | |
| Medium | 50 | 25 - 100 | 50 | 25 - 100 | |
| EXTERIOR | | | | | |
| Parking (Covered) | 5 | | | | FC min, 10:1 Max to formity |
| Parking (Open) (Medium Activity) | | | | | |
| Lighting Zone 3 (Urban) | 1.5 | .75 - 3 | .8 | .4 - 1.6 | |
| Lightin g Zone 2 (subu rban) | 1 | 0.5 - 2 | .6 | .3 - 1.2 | |
| Gas Station Canopy | 12.5 | 10 - 15 | | | |
| Safety (Building Exterior) | 1 | 0.5 - 2 | | | If security is an issue—raise average level to 3 |
| RETAIL | | | | | |
| General Retail (Ambient) | | 50 | | | |
| Department Store | 40 | 20 - 80 | 15 | 7.5 - 30 | |
| Perimeter | | | 75 | 35 - 150 | |
| Accent Lighting (Displays) | | | | | 3 - 10 times greater than ambient light levels |
| AUTOMOTIVE | | | | | |
| Showroom | 50 | 25 - 100 | 10 | 5 - 20 | |
| Service Area | 50 | 25 - 100 | 30 | 15 - 30 | |
| Sales Lot (Exterior) | | | | | |
| Lighting Zone 3 (Urban) | 20 | 10 - 40 | 20 | 10 - 40 | |
| Lightin g Zone 2 (Subu rban) | 15 | 7.5 - 30 | 15 | 7.5 - 30 | |
| GROCERY | | | | | |
| Circulation | 20 | 10 - 40 | 7.5 | 3.5 - 15 | |
| General Retail | 50 | 25 - 100 | 20 | 10-40 | |
| Perim eter | | | 50 | -100 | |
| BANKING | | | | | |
| ATM | 20 | 10-40 | 15 | | Vertical at face of ATM |