

The Complete Guide To Under Cabinet Lighting




PEGASUS
LIGHTING

THE COMPLETE GUIDE TO UNDER CABINET LIGHTING

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The Essentials Of Great Lighting

Today, the kitchen has to be multifunctional. It's not only a place to prepare and eat food, but also a place to relax, a place to entertain, and a place to enjoy. It should be inviting, bright, functional, and easy to control. The right kitchen lighting will help you stay clean, organized, and safe, while letting you create the perfect atmosphere for an early morning baking frenzy, board games with the kids on a rainy afternoon, or spending a couple's night in.

Most of all, light layering (having multiple light sources for different purposes) is the most important, all-encompassing rule in kitchen lighting design. A single light source never does any space justice. You need different sources of light for different purposes. Ambient lighting, task lighting, accent lighting, safety lighting, and mood lighting are all essential parts of great kitchen design.

This book will first and foremost address task lighting in the kitchen.

Under cabinet lights are the most popular, attractive, and handy kind of task lighting for the kitchen. Lighting designers agree that the path to any beautiful, functional kitchen starts with excellent task lights. Kitchen task lights have one simple purpose – to help you out. When you really need to get down to business, to cook a gourmet dinner or finally scrub down those countertops, task lights allow you to see.

A Quick Overview of this Book

In this book, you'll learn how to get that perfect lighting in your own kitchen. You'll discover what kind of under cabinet lights will work best for your space, the ins and outs of every light source and fixture style, and even what kind of lights will work best with your personality. Then, move on to step-by-step instructions on how to layout, install, and operate your under cabinet lights.

Already have under cabinet lights in your kitchen? Just flip over to the maintenance section to learn what to expect from your lights over time, and how to fix common problems that may come up.

You may also want to note that under cabinet lights work in areas other than the kitchen – offices, labs, workstations, even in outdoor cooking areas. For more on this, visit the “Beyond the Cabinet” section.

The Basics of Under Cabinet Lighting

Q: What are under cabinet lights?

A: Under cabinet lighting is an essential addition to any kitchen, office space, or shelving unit. Their light shines down onto countertops or workspaces to provide task lighting and to complement general lighting throughout a space. Under cabinet lights normally fall into two different categories – linear or puck lights. Linear lights are long, and stretch the entire length of your cabinets. Puck lights are round, singular fixtures that provide concentrated pops of light under your cabinets.

Q: Are under cabinet lights known by any other name?

A: Just in case you’re wondering, under cabinet lights are known by a whole bundle of different names. Besides the name “under cabinet lighting,” which makes a lot of sense because they’re the lights you install under your cabinets, they’re also called undermount lights, under counter lights, under cupboard lights, and of course task lights. So if you’re looking to install any of those in your kitchen, this book will work for you.

Q: Where can you use them? (Why do you need them?)

A: Typically, you’ll find under cabinet lights in the kitchen. Whether you’re mixing, shredding, slicing, or dicing, having task lights in the kitchen creates a space where cooking is easier and more enjoyable. With a properly lit kitchen countertop you should even be able to distinguish the sugar from the salt, just by looking. Under cabinet kitchen lighting can also be a nice accent to your decorating scheme, drawing attention to your backsplash and your countertops, and making your kitchen look larger.

The bright, focused illumination from an under cabinet light’s slim profile is also ideal for offices, work stations in hospitals or doctors’ offices, bookcases, shelving, and more. Essentially, under cabinet lighting excels as an application in any area where you need task lighting and want the look to be contemporary and subtle.

Choosing Under Cabinet Lights

When picking out your lights, there are tons of options to choose from. How do you know what style of under cabinet lighting is right for your kitchen? This section will help you find your ideal under cabinet lights based on light source, fixture style, color, cost, energy-savings, special features, special needs, and how you use your kitchen.

Light Source

A great place to start when deciding which under cabinet lights are right for you is to first select the light source. The way each one produces light affects most other aspects as well - the fixture style, the color of light, the efficiency, and the rated life all hinge on this one thing. Here's what each light source is like:

Fluorescent

A regular fluorescent light bulb consists of a glass tube coated on the inside with a phosphorous substance. Inside the tube are mercury vapor and two tungsten coils at opposite ends.

To produce light, the tungsten heats up and passes electrons back and forth. The electrons collide with the mercury atoms, sending out UV light. Finally, the UV light, which isn't visible to the naked eye, passes through the lamp's phosphor coating, sending out the white light we see.

It's important to note that fluorescent lights have come a long way since the hideous greenish ceiling fixtures found in outdated schools and offices. New ones emit bright white light, and with instant start technology, they can turn on without flickering or buzzing. A fluorescent lamp emits light evenly over its entire surface, so you can have a uniform distribution of light across the length of your countertops.

If you like bright reliable light to help you spot even the smallest details on your countertops while making your backsplashes catch the eye, these lights are a great choice.

LED

Unlike other light bulbs, LEDs are an electronic light source. They produce light just by the movement of electrons in a semiconductor material. Electrons release energy in the form of photons, or light.

In essence, LEDs (light emitting diodes) are tiny light bulbs attached to electrical circuits. Collected together in clusters, they can produce enough light to be useful. Each LED light fixture contains many diodes. Manufacturers can arrange these diodes in almost any configuration, to be as streamlined or as decorative as you want.

Just like fluorescent lights, the LED is a newer light source that has come a long way since its start. LEDs seem to be quickly overtaking fluorescent lights as a very popular kind of under cabinet light. This is because they are more efficient, last longer, produce a higher range of color temperatures, and their sleek design lets them fit inside creatively designed fixtures.

If you have a custom lighting project in mind, or just like saving energy with your lighting, LEDs are a great choice.

Xenon

A xenon lamp is a kind of incandescent light bulb. The lamp has a thin tungsten filament within its glass envelope, and when electricity flows through it, it heats up until the filament glows white hot and produces light. Xenon light bulbs get their name from the xenon gas added within the lamp.

Why add gas? Regular incandescent light bulbs have vacuums within their envelopes because air oxidizes the glowing tungsten. An inert gas like xenon slows down this process, prolonging the life of the light bulb. The large gas molecules deflect the tungsten molecules, slowing their rate of evaporation and making the filament last longer.

Xenon is one of the noble gases on the Periodic Table, and it's odorless and colorless. It helps retard the filament's evaporation, and it also produces a bright-white light when stimulated by electricity. This makes xenon light bulbs more efficient, and allows them to run cooler than other incandescent and halogen lamps.

Xenon lights are another very popular choice for under cabinet lights, even though they aren't as efficient as fluorescent or LED lights. Xenon lights render colors perfectly, always maintaining the aesthetic integrity of your kitchen to a tee. They are also dimmable, so you can set different light levels in your kitchen. One very popular use would be keeping the lights dim at night as a kind of night light for when entering the kitchen later at night for a snack.

If you like working with incandescent lights, you'll be able to adapt to xenon lights with little effort.

Incandescent & Halogen

A quick note about these two light sources: Though you may be able to find incandescent and halogen under cabinet lights, we don't recommend using them. Both of these light sources tend to run very hot, which can cause a couple of problems. The excess heat can spoil perishables stored in cabinets or on counter space. It can also make your entire cooking space uncomfortably warm and run up your A/C usage.

Fixture Style

The next important choice you need to make when picking out your under cabinet lights is what kind of fixture to use. There are big distinctions here: linear or puck, recessed or surface mount, and plug-in, hardwired, or battery powered. Each kind of light works well for under cabinet lighting; the one you choose is really just a matter of preference.

Linear

Linear under cabinet lights are usually rectangular in shape. Some can be long and skinny while others may be a little wider. Bottom line, they come in a variety of lengths, widths, and heights, but they're all "linear" in shape. Some might also call them strip lighting. Since you can link many together off one power source, it's possible to connect multiple linear under cabinet lights under the entire length of your cabinet cavities to provide a uniform, well-distributed light for your whole countertop.

Some of the most popular kinds of linear task lights are thin, linkable lights that come in fluorescent, LED, and xenon or thin, linkable microfluorescent fixtures.

If you need something thinner than an inch, you should try light bars, light strips, or tape lights. Light bars (usually LED) can be as thin as 1/3", but when they're hidden under your cabinets, you won't be able to tell the difference between the light from these, and the light from more traditional linear fixtures. If you'd rather use xenon lights, but still want something low-profile, a xenon light strip might be just the thing. The thin, flexible strip allows for many creative installations. A very, very thin linear light source on the market is the LED tape light. They're less than 1/10" thick, and the strong adhesive backing on every reel will stick to almost any surface with ease.

Puck

Puck lights are singular, usually circular lights, only a few inches in circumference. Usually these lights are very simple, but you can find more decorative ones shaped like triangles or gemstones. Popular puck lights can come in xenon, LED, and fluorescent.

The biggest appeal of puck lighting is their versatility. A puck light can create a pool of light for a focal point, add another layer of light to a room, or work as a functional task light. Under cabinet puck lights for the kitchen give you the option to place pops of light where you need them most, or create an even layer of light installing multiple puck lights in a row.

Surface Mount Or Recessed?

You can use fixtures that mount directly on the surface under your cabinets for easy installation, or ones that are recessed into the bottom of the cabinets for an absolutely seamless look.

Most linear task lights are meant to be mounted on the surface underneath your cabinets, so you don't have to make large cuts into the built-in structure. A lot of people assume that non-recessed lights will have fixtures jutting out unattractively from underneath the cabinets. This really isn't the case – most of the surface-mount options are so thin that you'd have to literally stick your head underneath the cabinet and look up to see the actual fixture. If you can, for some reason, see the lights after installation, all you need to do is add a small vanity panel (bottom trim) to the bottom of the wall cabinet to completely conceal them.

If you absolutely love the clean look of a flat cabinet bottom, you can always choose to install recessed under cabinet lighting in your kitchen. Just keep in mind that usually all of the recessed options are also puck lights. It's much easier to recess the small, circular puck lights than larger linear fixtures.

Hardwired, Plug-in, or Battery?

How do you want to power your under cabinet lights? Whether you hardwire them, plug them in, or power them with batteries really depends on how much freedom you have in your space, and how much effort you want to put into installation.

Battery operated under cabinet lights are by far the easiest to install because they don't require any wiring, and usually they use adhesive to attach to a surface. You can put them anywhere you like, without having to worry about being near a power source. These are great to use in rental kitchens or when you're just not ready to commit to a more extensive lighting project. Most, if not all, battery operated lights you'll find are LED puck lights, so they'll last you a very long time.

There are a few disadvantages to these lights, however. Besides having a limited selection of fixtures to use, the light emitted from these fixtures usually isn't as high quality as many plug-in or hardwired lights. Also, you can't wire them all to one light switch or dimmer for convenient lighting control.

Plug-in under cabinet lights are also fairly easy install, but give you a little more freedom when choosing your fixtures and controlling them after installation. Simply attach the fixtures to the underside of your cabinets and plug them into a nearby outlet. Most plug-in lights, whether linear or puck, can link to each other so you don't have to plug in each individual fixture. You can operate all your under cabinet lights from one outlet and one on/off switch. The light quality of plug-in units will be higher than battery operated lights. They're another great choice for any kitchen, because the installation is minimal and can be done in an afternoon. The only disadvantage to plug-in lights is that you'll have to deal with at least one exposed cord running to an outlet. The plug-in look isn't quite as seamless as a hardwired fixture.

Hardwired under cabinet lights are the most convenient, professional, attractive choice because the light quality is excellent, the fixture options are diverse, there's no exposed wiring, and you can control them with a dedicated wall switch or dimmer. However, these lights are also the most difficult to install. You need to tap into a nearby power source, or pull a new circuit to the desired area to power the lights properly. Either way, electrical work is involved, so you may need to consider hiring a professional to install your direct-wired lights if you don't feel comfortable doing it yourself.

Voltage

You also need to decide on your under cabinet lights' voltage. Line voltage operates directly off your home's voltage supply, which in the U.S. is about 120 volts. Low voltage under cabinet lights (if you hadn't guessed) operates from a much lower voltage supply – 12 or 24 volts. While each fixture is an excellent choice for your kitchen, choosing one simply depends on your personal preference.

Line Voltage

These lights are high quality, easy to install, and generally cheaper upfront. Since they work off the standard voltage supply in your home, you don't need to wire your lights to a transformer in order to operate them correctly. You can simply connect them to power. Additionally, you can use them with standard line voltage dimmers instead of the ones made specifically for low voltage lights.

Low Voltage

When installing low voltage under cabinet lights, you will have to take some special measures. You'll need a transformer to convert your home's voltage supply to a much

lower number, and if you plan to use any accessories, like dimmers, they'll need to be compatible with your lighting system. However, low voltage lights are just as high quality as line voltage lights, and they generally last longer and even use slightly less energy. Plus, low voltage light bulbs tend to be much smaller - so you often have more diverse fixture options to choose from.

Efficiency

The more efficient a lamp is, the less energy it uses. An efficient light will use a small amount of energy to produce a large amount of light. Efficiency (also known as efficacy) is important to consider when choosing under cabinet lights, because you don't want lights that will unnecessarily inflate your energy bill. Good, efficient lights will save you money, and eventually pay for themselves with the energy they conserve.

Efficiency is measured in lumens per watt. Lumens measure a lamp's brightness, and watts count units of electrical power. You can use this measurement to determine any light source's efficiency.

An incandescent light bulb produces about 11-17 lumens per watt. Now let's have a look at how LED, fluorescent, and xenon under cabinet lights measure up.

LED

LEDs are one of the most efficient under cabinet lights you can find. They produce more lumens per watt than almost any other light source. Generally, that number is around 60-100+ lm/w.

Fluorescent

Fluorescent under cabinet lights are also very efficient. A linear fluorescent light can produce anywhere from 50-100 lm/w. A compact fluorescent lamp can produce about 35-50 lm/w.

Xenon

When you're dealing with xenon lights, the rate of lumens per watt can vary depending on the size and shape of the lamp. For this reason, it's very difficult to come up with an accurate average for the light source as a whole. Just know they're more efficient than incandescent light bulbs because of the xenon gas in their glass envelopes, but less efficient than fluorescent lights.

Rated Life

When you choose an under cabinet light with a long rated life, you'll save time and money keeping up with constant replacements.

The rated life of a lamp indicates the time when 50% of a large quantity of lamps will burn out. That means that 50% of these lamps will burn out before the rated life and 50% will burn out after the rated life. The rated life doesn't mean that each of the lamps will last that long. It's just a best estimate.

The average incandescent light bulb lasts about 1,000 hours. If you operate it 3 hours per day, the light bulb will most likely last less than a year. Let's see how that compares to the average rated lives of LED, fluorescent, and xenon lights.

LED

Quality LED lights usually last longer than other kinds of lights.

LEDs don't burn out like incandescent light bulbs. Instead they get progressively dimmer over their lifetimes until they no longer emit enough light to be useful. An LED is considered to be no longer useful – to have reached its rated life – when it emits only 70% of its original light.

While some LEDs may have a rated life of 100,000 hours, this is usually only under perfect laboratory conditions. This number decreases under real-world conditions, when the LED is affected by the rated life of its driver, or by exposure to excess heat. An excellent rated life for an LED under cabinet light is around 50,000 hours. Operated for 3 hours per day, that light could last over 45 years.

Fluorescent

Fluorescent lights usually last longer than xenon lights, but not as long as LEDs.

Depending on the size of the light bulb a fluorescent under cabinet light uses, it will last between 6,000 and 20,000 hours. Operated for 3 hours a day, that's anywhere from 5 to about 18 years. Generally, microfluorescent fixtures last longer than regular fluorescent under cabinet lights. This rating is based mostly on the light bulb, not the fixture. Once the light bulb burns out, you can replace it and keep using the same fixture.

When using fluorescent lights, you should also note that certain environmental factors could reduce the rated life. If you turn the lights on and off frequently, or use them with an incompatible dimmer switch, they won't last as long. Extreme cold and jarring vibrations can also cause fluorescent lights to burn out sooner, but you usually don't encounter these issues with under cabinet lighting.

Xenon

Xenon lights have the shortest rated lives of the three sources.

The average xenon under cabinet light lasts from 6,000 to 10,000 hours. If you use them for 3 hours every day, they'll usually last between 5 and 9 years. Although xenon lights are a kind of incandescent lights, they last so much longer because they have xenon gas in their glass envelopes. The large gas molecules help prevent the degradation of the lamp's filament, blocking the discarded tungsten molecules, keeping the filament stronger for a longer amount of time.

If you want to extend the life of your xenon light bulbs to rival fluorescents, and even LEDs, use them with a dimmer switch. When you keep a xenon light bulb dimmed by 10%, the light bulb will last twice as long. Dim it by 25% and enjoy the light bulb for 4 times as long. Dim it by 50% and the light bulb will last 20 times as long.

Color Temperature

Color temperature measures the color appearance of a light source. This varies between warm/reddish and cool/bluish. Light sources below 3,200K are considered warm, and light sources above 4,000K as cool.

Color temperature has nothing to do with the amount of heat a lamp emits, but rather the heat of its hue in degrees K (Kelvin). The Kelvin Scale is a temperature scale that references absolute zero (0 degrees Kelvin), which in theory, is the absence of all thermal energy.

These tables may help you better understand the concept and range of color temperature:

How Color Temperature Influences Environment

APPROX. COLOR TEMPERATURE	ASSOCIATED EFFECTS & MOODS	APPROPRIATE APPLICATIONS
2700K	Friendly, Personal, Intimate	Homes, Libraries, Restaurants
3500K	Friendly, Inviting, Non-threatening	New Offices, Public Reception Areas
4100K	Neat, Clean, Efficient	Older Offices, Classrooms, Mass Merchandisers
5000K	Bright, Alert, Exacting Coloration	Graphics, Jewelry Stores, Medical Exam Areas, Photography

The Color Temperatures Of Common Light Sources

APPROX. COLOR TEMPERATURE	LIGHT SOURCE
1600K	Sunrise or Sunset
1800K	Candlelight
1800K	Gaslight
2800K	Household Incandescent Lamp
3000K	Warm White Fluorescent Lamp
3500K	Neutral White Fluorescent Lamp
4100K	Cool White Fluorescent Lamp
5000K	Professional Light Booth
5200K	Bright Midday Sun
6500K	Heavily Overcast Sky

When choosing under cabinet lights, it's important to pay attention to color temperature because lighting of the wrong hue can seriously distort the look of your entire room. You want light of a color that will compliment your paint colors and make your food look tasty.

If your kitchen contains warm colors – reds, oranges, pinks – you should choose a warm light source so they'll look rich and luxuriant.

For a cooler toned kitchen, you should consider a cooler light source to intensify blues, greens, and whites. They'll appear clean, crisp, and bright.

You can also choose color temperature based on your sense of style or taste in decor. In a more traditional or romantic kitchen, always go for warmer light. In a modern or industrial kitchen, you can't go wrong with cooler lights.

Now that you know your ideal color temperature, here's how to get it in your kitchen. Read on to learn which light sources are available in which color temperatures:

LED

You can find LED under cabinet lights in almost any hue you can imagine. The latest technology enables them to mimic the familiar warm incandescent light, crisp neutral white light, and bright cool white light. They're even available in colored and color-changing varieties if you prefer something more exotic for your kitchen.

NOTE: In their simplest forms, LEDs can be red, green, blue, or amber. The color of an LED depends on the materials used to make it. A red LED, for example, is made with aluminum, gallium, and arsenic. To create a warm white LED, manufacturers will often

cover a blue LED with a yellow phosphorous coating. The final product will shine a lovely warm white, but it won't be as bright as an LED without a covering.

Fluorescent

Fluorescent lights can have a bad reputation. That greenish white light you might remember from old school buildings, offices, or hospitals will never make your kitchen look inviting, or your food look appetizing. But, those lights are a thing of the past. Current technology allows the fluorescent light's color temperature range to be much more attractive. Most fluorescent under cabinet lights fall in the range of cool white to neutral white.

Xenon

Xenon lamps look and act very much like incandescents. But because of the xenon gas within their glass envelopes, the light they produce is slightly cooler than the average incandescent, but warmer than a halogen lamp. They usually run between warm and neutral white light.

Color Rendering Index

A light fixture's color rendering index, or CRI shouldn't be confused with its color temperature. CRI is not the measure of a light's color, but rather the measure of its ability to render colors accurately. The scale ranges from 1 (low pressure sodium lamps) to 100 (the sun). An under cabinet light with a CRI of 85 or above is considered to be very good.

CRI is an important measurement to consider when picking out under cabinet lights, because it will affect the entire look of your kitchen. If you go through the trouble of picking out a particular shade of blue to paint your kitchen with, you don't want your lights to distort the color.

Xenon under cabinet lights have a perfect CRI of 100. Quality LED and fluorescent under cabinet lights can have a very good CRI range around 80-90.

Finish

While the finish, or color, of your under cabinet lights isn't as important because they're hidden from view, most fixtures come in several finish options. The most common finishes are white, black, and metallic variants like nickel, bronze, gold, chrome, and copper. When choosing the finish of your fixtures, you should either pick the one that most closely matches your cabinets, or match them with the finish of the rest of your

kitchen appliances.

Cost

Which under cabinet lights will get you the best deal? The answer to that question is a little complicated.

For instance, efficient LED under cabinet lights might cost a little more upfront, but they'll pay for themselves in energy savings and outlast most other lights, making them a better buy.

Many fluorescent and xenon under cabinet lights are already affordable, but they won't last as long as LEDs, and they won't save as much energy. You might choose to invest in these lights if you're not using very many, and the energy savings will be marginal, or if you plan to use them with a lighting control like a dimmer, decreasing your energy use and extending the life of your lights.

When investing in under cabinet lights, ask the following questions to determine your fixture's true cost:

- What's the initial number on the price tag?
- How much energy will this light use?
- How long will this light last?
- How much maintenance do these lights require?
- How many lights do I need?
- What accessories will I need to use with my lights?
- How do I plan to use my lights?

Special Features

Sometimes, you want under cabinet lights that can do a little more. Here are some special features you can choose for your under cabinet lights.

Motion Sensing Under Cabinet Lights

Having your under cabinet task lighting on a motion sensor can be incredibly helpful when your hands are dirty, because you won't have to stop your work to fiddle with them. Since you use task lights while moving around, performing tasks, you won't have to worry about them turning off while you work. Installing a motion detecting light in a hard to reach spot can be a big help.

If motion detecting under cabinet lights are what you want, your simplest option is to install battery operated LED lights with motion sensors built in. Your other option is to use a motion or occupancy sensor to control your under cabinet lights, instead of a standard light switch. Just make sure to put the switch in a location that will easily detect when you're moving around, but that isn't in close proximity to a heat source, where hot or cold drafts will blow directly on the sensor, or where unintended motion will be within the sensor's field of detection. These stimuli could cause the sensor to malfunction.

Dimmable Under Cabinet Lights

Dimmable under cabinet lights let you create different levels of light, changing the mood of your kitchen anytime you want. Unaccustomed to dimmable lights in the kitchen? It's actually a really great place to have them.

The kitchen is the center of family life. With lighting controls, it can be as versatile as any other room in your home. Here, a dimmer lets you brighten lights at breakfast or for preparing meals, and lower them to catch up with your family over an evening snack, all while saving energy.

All xenon under cabinet lights are dimmable, just like standard incandescent lights. You just need to hook them up to a compatible dimmer switch (low voltage or line voltage) and you're ready to go. Dimmable LED under cabinet lights are also fairly easy to find, but they require special LED compatible dimmers. It is very difficult, if not impossible, to find dimmable fluorescent under cabinet lights.

Under Cabinet Lights For Special Circumstances

If you need your lighting to go beyond the norm, under cabinet lights can help.

Temporary Lights For Rental Kitchens

When you moved into your current place, your kitchen probably had a single ceiling light fixture – a linear fluorescent, a track light – on a basic on/off light switch. The brightness of that single ceiling light is too jarring in the morning, and when you're chopping, dicing, and frying in the evening, it's not enough.

The best thing you can do in here is add one or two light layers for extra task light. Start with under cabinet lights, because they'll make it easier for you to see while cooking, and add a nice ambiance to the room. You can opt to leave the ceiling lights off when you want a lower light level, or use them with your ceiling lights when you've got your chef's hat on.

You are probably not permitted to hardwire or mount anything with screws, so your options are slightly more limited, but you've still got a variety of plug-in or battery-powered, adhesive-backed fixtures. Here are a few ideas:

LED Tape Lights offer bright, even illumination over your entire counter space. They're extremely low-profile, dimmable, energy-saving and come in a variety of colors and color temperatures.

Xenon Light Strips provide warm and crisp task light for your kitchen. The durable xenon light bulbs are each backed with adhesive, so they'll easily fit under your cabinets, and come loose when you're ready to move.

LED Battery Operated Puck Lights are an affordable choice for a little extra task lighting. Just pop them anywhere you need more light, and they'll last and last.

NOTE: When choosing a secondary light source for your kitchen, make sure the fixture's color temperature is similar to the light that you already have. Conflicting color temperatures won't make a bad lighting situation any better.

Under Cabinet Lights For The Aging

Lighting is vital for our health and well-being, and it becomes particularly important the older we get. As you age, two things happen to your eyes. The ability of your pupils to dilate decreases, which effectively makes them smaller, and your lenses become thicker. This means your retinas receive less light, and more of the light that gets through your pupils is absorbed or refracted before it gets to your retina, making an image softer.

When working in the kitchen, older eyes need more light, especially when distinguishing fine detail and contrast. Glare can also be an issue, hindering older people from doing necessary tasks. Dealing with these new challenges can become a bother or even a safety hazard, but a few simple task lighting solutions can help.

To Help Distinguish Fine Details:

Improve the uniform distribution of light in the space with even light layers, including under cabinet lights with a similar color temperature and lumen output as the rest of your lights.

Avoid the "drama" of bright and dark areas in the space, including the inevitable shadows under your cabinets. Linear under cabinet lights with even light distribution are probably your best option here.

To Help Distinguish Contrasts:

Use light sources with high color rendering capabilities like xenon or LED under cabinet lights. This will help while cooking with fine ingredients and cleaning up.

To Help Minimize Glare:

All your under cabinet task lighting fixtures should be well shielded; avoid using bare or exposed lamps.

For an easy transition from bright to dark spaces, make sure you have the ability to dim your lights when necessary.

Lights For Your Personality

As you know by now, so many varieties of under cabinet lights make it really overwhelming to choose the right ones. The good news is, whatever your personal taste, there's an under cabinet light out there for you!

It all depends on how you use your kitchen...

If you keep things very clean...

When you want crisp lines and sparkling countertops, fluorescent under cabinet lights will fit your sleek, modern eye. Don't worry – these aren't the outdated humming, green fluorescents that you might think of. New fluorescent lights emit crisp, bright light that compliment even the whitest cabinets and counters, while making sure you spot every last crumb.

You might be interested in:

- Microfluorescent Fixtures
- Thin Linear Fluorescent Under Cabinet Lights
- Fluorescent Puck Lights

If you're a perfectionist...

Not happy until your kitchen (and your food) looks just right? Xenon under cabinet lights are what you need. They emit attractive, warm light and won't distort your colors. (They have a perfect color rendering index of 100). With xenon lights, everything will appear just as you intend it to. They're also fully dimmable, so you can change the brightness level in your kitchen when the mood strikes you.

If you like to make a mess...

Some might think your intense cooking style is expressive; others might think it's slaphappy. If you hate recipes, but love to make a mess your kitchen, flipping a light

switch when your hands are covered in batter or sauce is really inconvenient. Instead, motion sensor under cabinet lights will turn on when you need them, letting you focus on the task at hand.

If you're environmentally conscious...

When your countertops are covered with fresh produce from your vegetable garden, just one of your many initiatives to be more sustainable, LED under cabinet lights are the perfect choice for you. They're one of the most energy efficient light sources around, so you'll never have to skimp on green. They also produce minimal heat, which will keep your fruits and veggies fresh longer.

If you're never in the kitchen (and like it that way)...

Perhaps you don't love cooking at all. When microwave dinners and french fries from the freezer are your idea of a good meal, and you limit your time in the kitchen to a bare minimum, you might want to consider just a few puck lights to illuminate the places you go most. Ensuring that you can see properly during your limited time in the kitchen will make sure it stays that way – limited.

Common Questions

Q: Is heat a problem?

A: Yes. When your under cabinet lights heat up, they can damage perishable food items and sensitive objects within your cabinets or on your countertops. They'll also make your cooking area a good deal warmer. That's why we advise against installing hot incandescent and halogen under cabinet lights. Stick with xenon, fluorescent, or LED lights. While they still produce heat, it's a great deal less than other light sources.

Q: How should I dispose of fluorescent light bulbs?

A: You may have also heard about the mercury content of fluorescent lights and the warning that they should never be thrown in the trash. So, why is this light bulb considered safe for your home but not for the trash?

The mercury content is not an issue unless the light bulb breaks. Each light bulb contains an extremely small amount, and it's not released at all as long as the light bulbs are intact. Given that information, most people assume that the fluorescent recycling issue has to do with preventing toxins from leaching into the soil in the landfill.

Actually, that's not quite it, because chances are fluorescents are going to break in the trash before they ever get to the landfill, which means the people with health concerns

at stake are waste management workers. Waste management workers can unknowingly handling trash with broken fluorescents and become exposed to dangerous levels of mercury.

If your fluorescent lamp burns out, it's very important to find an EPA approved fluorescent light recycling site. Some home improvement stores, such as Lowes and Home Depot, collect fluorescents for recycling at retail locations. You can also find recycling locations in your area on the EPA light bulb recycling site (<http://www.epa.gov/epawaste/hazard/wastetypes/universal/lamps/index.htm>).

Q: What if a fluorescent light breaks?

A: If a fluorescent light bulb does break in your home, follow these steps: Put gloves on, grab a mask to protect yourself against the dust, and gather the broken bits into a sealed container using a damp paper towel. Turn off your central air or fans for 15 minutes, and drop off the container at a recycling center.

Q: What does an ENERGY STAR® rating mean?

A: No one wants to use a light fixture that needlessly sucks energy, inflating energy bills. Efficient under cabinet or under counter lights are extremely effective at cutting down your energy use, without sacrificing style or quality. When you purchase an ENERGY STAR qualified product, you can rest assured that it meets the strictest energy efficiency guidelines set by the U.S. EPA and U.S. DOE.

How To Install Under Cabinet Lights

Now that you know exactly what kind of lights you want, it's time to get a little more technical. How do you get those lights out of the box and under those cabinets of yours? This section will tell you how many lights you'll need to use, what accessories you might like, and guide you through preparation. It also provides step-by-step instructions on how to install all different kinds of under cabinet lights – hardwired, plug-in, battery operated, surface mount, recessed, and more. Learn what you can do yourself and when you should call an expert.

How Many Lights Do You Need?

If you're installing linear (also known as strip) under cabinet lights...

Try to “fill up” your cavity with the longest fixture that will fit. The goal with linear lights is to keep your countertop and backsplash uniformly lit, so you want to match that cavity measurement as closely as possible. Usually, under cabinet lights are sold in standard increments of length. For example, you might be able to choose between 8in, 16in, 24in, or 32in. In that case, if your cavity measures 18 inches long, select the 16-inch fixture rather than the 8-inch fixture.

There are some exceptions to the standard increments of length rule: Fixtures like the Xenon Low Voltage Light Strip are totally customizable and may be ordered in any length measured to the nearest whole foot.

If you're installing puck under cabinet lights...

We recommend using 1 puck light for every 6-10 inches of cabinet space. If you're lighting 11-18 inches of space, use 2-3 puck lights. For 19-26 inches, you'll need 3-4 puck lights. For 27-34 inches, 4-5 puck lights. For 35-42 inches, 5-7 puck lights. For 43-50 inches, 6-8 puck lights, and so on. Just measure your space and divide it up accordingly. This will ensure that the light levels are consistent for the entire length of your cabinet, without causing awkward shadows.

If you'd like to use puck lights to highlight specific spots on your counters, you should place a puck light directly above each spot. Base the number of puck lights you purchase on how many places you wish to illuminate.

To be sure you have the right number of lights, test them out. Since puck lights are so small, you can temporarily tape them to the bottom of your cabinets. If the illumination is still not enough, you can add more puck lights without the hassle of uninstalling and/or repositioning every other light on the surface.

Important Accessories

The following are things you might need when operating your under cabinet lights. Just consult the literature that comes with your fixtures to determine which of these your lights require.

Low Voltage Transformers

If you've chosen low voltage under cabinet lights, you might also need a low voltage transformer. This will convert the standard voltage normally available (120 or 277 volts) to either 12 or 24 volts, the low voltage light's operating voltages. Some fixtures come with an internal transformer embedded within the fixture itself, while other under cabinet lights will require an external transformer (e.g., Xenon Low Voltage Light Strip).

If you need to purchase an external transformer, you can either choose an electronic or magnetic transformer to power your lights. Electronic varieties are lighter in weight, smaller in size, cooler to operate, and quieter than magnetic transformers. However, electronic transformers can't provide more than 300 watts of power. Magnetic transformers can provide as much as 1,200 watts of power.

To find a transformer with the correct wattage rating for your lighting system, calculate the total wattage of your lights. Choose a transformer with a wattage rating equal or slightly greater to that total.

NOTE: When using a 24-volt transformer, make sure the light bulbs you are using are rated for 24 volts, not 12 volts. If you use 12-volt lamps with a 24-volt transformer, they'll burn out immediately and could become a fire hazard.

LED Drivers

Some LED under cabinet lights may need a driver in order to function properly.

An LED driver is an electronic power source that provides the constant current or constant voltage for an LED to function properly. It converts line power to the appropriate voltage (usually 12 or 24 volts) and current (typically 200-1,000 milliamps or

mA). It may also include dimming or color correction controls. They can also provide overload, short circuit, and overheat protection.

Just like low voltage transformers, LED drivers can be electronic or magnetic.

Also like the transformer, the total wattage of the LEDs driven by the LED driver should never exceed the wattage rating of the LED driver. You'll always need one with a wattage rating greater than or equal to the combined total wattage of your LED fixtures.

NOTE: LED drivers are about 85% as efficient as LED fixtures. So, you should reduce your LED's estimated efficacy by 15% to account for the driver.

Hardwire Junction Boxes

If you plan to hardwire your lights, you might need a junction box. A hardwire junction box is a plastic or metal container that protects and conceals all standard electrical wire connections and exposed wires.

Dimmers

Dimmers are lighting controls that allow you to manipulate the light level of your under cabinet fixtures. You can install dimmers in place of regular light switches, or control your plug-in lights with a tabletop plug-in dimmer. To properly dim your under cabinet lights, it's important to purchase a dimmer that is compatible with your fixtures.

Since xenon lights are a kind of incandescent light they are dimmable. Line voltage xenon lights can use any standard incandescent dimmer. However, when you use a dimmer with a low voltage lighting system, the dimmer should always control the line voltage, or primary, side of the transformer. The dimmer you select to control an electronic transformer should be specifically designed to control that type of transformer whereas a dimmer selected to control a magnetic transformer should be specifically designed to control that type of transformer.

For LED and fluorescent under cabinet lights, the dimming process can be a little more complicated. First, you must choose a fixture that has been manufactured with dimming capabilities. Then, you should check what kind of dimmer is compatible with your fixture. Usually, it's an LED or fluorescent specific model. Generally, it's much easier to find dimmable LED under cabinet lights – dimmable fluorescents are much harder to come by. Also note that if your LED light fixtures require a separate driver, your dimmer needs to be compatible with it, too.

Before You Begin

Make sure your current kitchen circuit can handle the added wattage of your new lights. In order to find this out, multiply the amps by the volts. Most circuits have 120 volts. So if your circuit was 15 amps, you'd multiply 15×120. That amounts to 1800 – the total number of watts your kitchen circuit can handle. It's a good safe rule of thumb to use your circuit up to 80 percent of its capacity.

Installation

This section offers step-by-step instructions on how to install hardwired, plug-in, recessed, and battery operated under cabinet lights.

How To Hardwire Under Cabinet Lights

The most convenient way to operate under cabinet lights in the kitchen is to hardwire them to a wall switch. You can turn the lights on and off, and even dim them without having messy wires and plugs in your cooking space. However, when it comes to installation, direct-wiring your lights is probably the most involved process. If you're searching for advice on how to hardwire under cabinet lights, read on for step-by-step instructions. While we understand there are a lot of do-it-yourselfers out there who can very easily hardwire their new under cabinet lights, we always recommend hiring a fully licensed electrician when your project includes hardwiring under cabinet lighting.

After you choose your lights, you'll first need to prepare for installation:

1. Consult with an expert before you start. A professional electrical contractor in your geographical area will be able to advise you regarding any electrical details that you might have questions about, and make certain that you're satisfying all of the appropriate electrical codes.
2. Plan for the wiring. Where do you want your light switch to be? Close to the cabinets? Alongside the rest of your kitchen lighting controls? Determining this will help you know how much wiring you need. The electrical wiring runs within the wall and loops from one fixture to the next.
3. Position your under cabinet lights. For even lighting, we suggest you use linear lights along the length of your cabinets, or puck lights every 6-10 inches. For the best task lighting along your counters, we also recommend you place the lights close to the front of the cabinet. Finally, make sure your corner cabinet lighting is balanced to cover the area evenly, not causing shadows.
4. Gather the tools and mounting hardware. Most under cabinet fixtures come with a pack of appropriate hardware to use for installation. This includes screws that won't penetrate the bottom shelves of your cabinets. Cable bushing and wire

connectors of the right size are necessary for proper installation. You'll probably also need the following tools:

- Screwdriver
- Wire strippers
- Wire fish
- Wire nuts
- Electrical tape
- Drill with keyhole saw
- Drywall saw

Then, follow these steps for installation:

1. Disconnect the power. Locate the correct breaker and turn off the power supply to the switch outlet where you're going to connect the lights.
2. Attach the lights. Position the lights according to how you laid them out earlier. Take apart the lights and screw them where you want them to go. To make this easier, you may want to use a pencil to mark the bottom of the cabinets.
3. Cut the wall. Depending on your backsplash, you may have to peel it away from where you're installing the lights. Then, you should cut a channel behind the backsplash using your drywall saw. The channel should stretch from under the switch box to right near the farthest light. Finally, use the drill to bore a hole through the studs so you can run the wire.
4. Run the wire. On the bottom of each cabinet, use the drill again to make a hole for the wire for each light to come through. This is where you might need the wire fish to run the wires down the wall from one fixture, through the channel, and to the next fixture. If you are installing linkable under cabinet light fixtures you could also use linking cables to connect multiple fixtures to the one power source instead of direct-wiring each light to power. It is an option.
5. Wire the lights to the power source.
6. Wire the switch. At the switch outlet, make sure the electricity isn't on and then remove the receptacle. Bind the white wire and the connecting strand of cord together with a wire nut. Screw the black wire on the outlet onto the switch's bottom terminal, and screw the black wire that goes out to the lights into the switch's top terminal.
7. Cover your work. Cover the switch's terminals by wrapping it with your electrical tape. Then screw the switch back into the box. Attach the switch cover.

8. Test the lights. Restore power to your lights, and flip the switch to see if they work.
9. Patch things up. Finally, you can redo the drywall that you had to slice away for the wire channel, and reattach the backsplash.

How To Install Plug-In Under Cabinet Lights

When choosing under cabinet lights, plug-in fixtures are a great option. They offer high quality light, but don't require such an involved installation like hardwired lights.

If you're looking to update your kitchen with some plug-in under cabinet lights, just follow these easy instructions to have them up and running in no time. These 6 easy steps are applicable to linear and puck under cabinet lights of any light source.

Tools you might need:

- Drill with keyhole saw
- Screwdrivers
- Wire strippers
- Electrical tape and wire nuts, or linking cables and direct connectors

1. Plan your layout. Where do you want your lights to go? For even illumination, linear fixtures should cover the length of your cabinets, while puck lights should be spaced 6-10" apart. Find where the screws attach to each fixture and mark where they'll land on the cabinet.

2. Prep the lights. Most plug-in lights, whether linear or puck, can link to each other so you don't have to plug in each individual fixture. If you plan to wire your lights together, you may need to find the knockouts on the ends of the fixtures and pop them out.

3. Screw in the fixtures. Drill holes through any under hang between cabinets. This way, you can run your connectors or connecting wire straight through between fixtures. Fasten each of the lights to the bottom of the cabinet with screws.

4. Wire the fixtures. Feed your connectors from one fixture to another until they're all connected. If you are using electrical wire to connect each fixture together, use a pressure connector when securing the wire inside each fixture's knockout so it will stay in place. Use wire nuts when connecting wires, then cover and secure them with electrical tape.

5. Wrap it up. Reassemble the fixtures. Then secure any lamp cord to the bottom of your cabinets with wire staples or brackets so it's not in the way.

6. Flip the switch. Make sure all the lights turn on, and you're finished!

How To Install Recessed Under Cabinet Lights

Recessed puck lights are a simple, attractive light source for task lighting and accent lighting in the kitchen. These installation instructions are applicable to plug-in, hardwire, and battery operated lights of any light source. Once you have your perfect pucks picked out, we can get started.

Tools you might need:

- Tape
- Pencil
- Hole saw
- Drill
- Screwdriver
- Screws or mounting clips
- Connecting wires (if necessary)
- Driver or transformer (if necessary)

1. Determine how to place your lights. For even lighting, follow the 6-10 inch rule. We recommend you install the lights closer to the front of the cabinets or shelves. This will provide the brightest illumination, especially important for task lighting.

2. Test them out. Before you whip out the power tools, test out your placement by taping the puck lights in place. You can even turn them on to see how the final lighting scheme will appear. Make adjustments as you see fit. When you're happy with what you see, take a pencil and trace each light.

3. Grab the tools. Once traced, take down your puck lights. Double-check the dimensions of your tracings with the recommended diameter and depth from the manufacturer. (Usually the depth is about 1/2" give or take). Then, use a hole saw to drill into the bottom of your cabinets or shelves.

4. Attach. Drill holes for the screws. Permanently fasten the puck lights in their holes with mounting clips or screws.

5. Wire (if necessary). If your lights aren't battery operated, they'll plug into each other so you can operate them with one plug or light switch. For lights that require a driver or transformer, make sure the one you're using has an appropriate wattage rating. It should be able to accommodate a wattage equal to or slightly higher than the combined total wattage of your lights. To hide the wires, you can install a valance (a matching 1-2 inch strip attached as a lip at the

bottom of your cabinets), or simply staple the wires to the bottom of the cabinet. Just be careful not to damage them.

NOTE: If you'd like to hardwire these recessed puck lights, please see instructions in previous sections "How To Hardwire Under Cabinet Lights."

6. Test them out. Once everything is in place, turn on the lights to make sure you've installed them correctly. When everything checks out, you're finished!

How To Install Battery Operated Under Cabinet Lights

Battery operated under cabinet lights are by far the easiest to install. Since you don't have to do any wiring, you can mount them virtually anywhere.

The only tools you'll need:

- Batteries
- Screwdriver
- Tape
- Pencil
- Adhesive or screws and a drill

1. Power up. Open the lights and put in the batteries. Make sure each one turns on.
2. Plan the placement. Remember, there should be 6-10" of space between each puck light, and for the best task illumination, put them closer to the front edge under your cabinets.
3. Test the placement. Use tape of any sort to temporarily stick the puck lights in position. Turn them on and make sure you like the way they look. Then, mark where you would like each light to go with a pencil.
4. Install. If you're mounting with adhesive, wipe clean the light and the mounting area on the cabinet. Then stick the light under the cabinet. If you're using screws and/or mounting brackets, drill a hole for each screw under your cabinet and fasten the lights in place.

Under Cabinet Lighting Maintenance

Whether you installed them last year or last week, you want to get the most out of your under cabinet lighting. This chapter will provide you with all the information you need to optimize, maintain, and troubleshoot your kitchen task lights. What daily practices can you keep in mind to extend the life of your lights? What can you expect from your lights as they age? When should you replace a part of your fixture, and when is it time to get an entirely new light? Read on to learn this and more.

Best Practices For Operating Under Cabinet Lights

Keep these principles in mind to increase the longevity and efficiency of your under cabinet lights.

Xenon Lights

Xenon under cabinet lights thrive when you dim them. If you dim a xenon light fixture by 25%, it will use 20% less energy, and last 4 times as long. If you dim a xenon light fixture by 75%, it will use 60% less energy, and last 20 times as long.

So, make a point to dim your xenon lights whenever you can. You'll probably want to operate them at full brightness when preparing meals or cleaning, but at all other times when you're in the kitchen, you should keep them dimmed or off.

Fluorescent Lights

When you turn a fluorescent light on and off frequently, it degrades the fragile electrodes used to create light, reducing the lamp life. Therefore, you must be more mindful of how you operate them on a daily basis. You don't want to shorten their rated lives, but you also don't want to leave them on when you don't need them, using energy to power lights that you don't need.

LED Lights

LED under cabinet lights are very efficient, long lasting, and durable on their own, but there's one pesky little thing that can upset their equilibrium – heat. While cold temperatures actually make LEDs last longer, heat can increase the degradation rate of

the LED. This can cause the light output of an LED to decrease over time at a faster rate.

Make sure your LEDs are exposed to heat in the kitchen as little as possible. This may require you to keep them away from cooking areas like the stove and oven.

Other Ways To Extend Rated Life

Please note that operating an incandescent or halogen lamp at a voltage below its rated voltage will make the lamp last longer.

The actual life of an incandescent or halogen lamp equals the rated life of that lamp multiplied by the ratio of the lamp's rated voltage over the operating voltage, raised to the 12th power.

For example, the actual life of a certain lamp that is designed to be used with 130 volts is equal to the rated life of that lamp (let's say 1000 hours) x (130 volts/120 volts) raised to the 12th power. The actual life of this lamp is equal to (1000 hours) x (1.083) raised to the twelfth power = (1000 hours) x (2.61) = 2610 hours. This means that a lamp that has a rated life of 1000 hours and is designed to be used with 130 volts but is used with 120 volts instead will have an "Actual Life" of 2610 hours.

What to Expect Over Time

By now, you know that LEDs last longer than fluorescent under cabinet lights, and fluorescent under cabinet lights last longer than xenon under cabinet lights.

While xenon and fluorescent lights burn out at the end of their rated lives, LEDs just get progressively dimmer until they aren't useful anymore (when lumen output has dwindled to about 70% of the original brightness). If it appears that your LED lights have burned out, it's probably due to an electrical malfunction or some other problem with a component of the lighting system like the LED driver.

Replacing Parts And Fixtures

If your lights die or burn out, it's important that you know how to replace them. Should you maintain your current lights with replacement parts, or invest in completely new fixtures? It really depends on the light source...

Xenon Lights

If your xenon under cabinet lights burn out, which they're bound to do after several years, you can easily replace the xenon light bulbs and keep on using the fixtures. It's very easy to do, and is much more cost effective than replacing each light fixture in its

entirety. You may even want to keep a few spare light bulbs on hand so when the lights burn out, you can fix them on the spot.

Fluorescent Lights

It's also quite easy to replace fluorescent light bulbs within your under cabinet lights when they burn out. For most light fixtures, this will cost you less than replacing the whole light fixture, and it will save you time. Just make sure your replacement light bulbs are the same size, color temperature, and have the same lumen output as the light bulbs you're replacing.

LED Lights

With LEDs, the replacement process isn't so simple. Many LED under cabinet lights have diodes embedded within them, so it's nearly impossible to take them out and exchange them for new ones. So, when your LED dies, you'll need to replace the entire fixture. This shouldn't worry you too much, because by the time your LEDs need replacing many years down the line, you'll have a plethora of new, cost effective options to choose from.

Technological Advancements: What We Could See In The Future

The biggest thing to look forward to in the near future is the development of LED lights. While fluorescent and xenon lights have reached endpoints in their development, LEDs still have room for improvement. LEDs, in fact, have brought us into a very dynamic lighting revolution. Over time, the efficiency of LEDs will continue to increase, while their cost will continue to decrease until they dominate the market. We expect they'll follow in the footsteps of computers, calculators, and phones. The LED's light quality will get better too, offering you options that more closely simulate the properties of incandescent, xenon, and fluorescent lights. Finally, since an individual LED is much smaller than our incandescent and fluorescent lamps we are more familiar with, the form factor of light fixture design may start to change and possibly become very creative, exciting, and unique.

Troubleshooting: How To Solve Common Problems

If Your LEDs Glow, Even When Switched Off:

It's possible for LEDs to glow very faintly, even when they're not on. This is an issue that could damage your LEDs if it goes on for long enough.

Usually when this happens, it's caused by residual voltage in the electrical line that powers your LEDs. Because LEDs (made of clusters of diodes) are so efficient, the residual current left in the power cord after you turn the switch off can be enough to make one or more of the diodes glow or flicker.

There are 2 common solutions you can try here:

1. Install a zener diode on the same electrical line. This fixture will block any incoming current to your light bulb when it's switched off.
2. Use a light bulb with a larger cluster of diodes that requires a higher initial voltage to start.

However, this problem could also indicate that your circuit is set up incorrectly, or that there's a bigger current leakage issue in your home. In fact, many newer homes have special circuit breakers that trip when this happens. It can be a fire hazard or a sign of a problem. Before you do anything, you should have an electrician take a look.

If Your Fluorescent Lights Won't Turn On:

First, make certain that all of your fluorescent lamps are properly seated in each of their sockets. This means that both pins at both ends of each lamp are engaged entirely inside its socket and that the lamp has been rotated exactly 90 degrees so that a mark on the lamp lines up with the opening on the fluorescent fixture's socket.

Then, if you find defective light bulbs, replace them. Defective lamps are often blackened near their ends.

You should also verify that your fluorescent fixtures are wired correctly, which means that like colored wires are connected to each other (the black wires are connected to black wires, white wires are connected to white wires, and so on). Occasionally, some wire connections break off inside the wire nut, which can cause an open circuit.

If Your Fluorescent Lights Start To Flicker:

You want your task lighting to be even and consistent. If you notice that your fluorescent lamps have begun to blink, flicker, or "snake" with swirling lights, it's a problem that you should address. Luckily, there are some fairly simple solutions.

This might be happening because your lights haven't properly acclimated to their new environment. First, try turning the fluorescent fixture on and off several times at 30-minute intervals. If that doesn't work, you should keep the fluorescent light fixture on continuously for 24 to 48 hours, which will allow the lamps to "season" properly.

Cold temperatures can also cause these irregularities in fluorescent lamps. Though this shouldn't be a huge problem in a climate-controlled environment like the kitchen, you may want to verify that a ceiling fan or the air conditioning system isn't blowing cool air on the lamps.

Finally, this may indicate an electrical problem. Check to be certain that all of the wiring connections (splices) are secure and tight. Occasionally, some wire connections break off inside the wire nut, which can cause a poor electrical connection. If your lights are on a ballast, you should also use a multimeter to verify that it's receiving a constant amount of input voltage.

If Your Xenon Lights Start To Flicker:

Your xenon under cabinet lights may begin to flicker after you have used them for a while. If the problem continues and doesn't improve, there could be a few things going on.

Most likely, this is happening because of a bad light bulb with a filament about to break. To figure out which light bulb you need to replace, just close the cabinet door above the particular fixture a little harder than normal. When the vibration from the cabinet door closing shakes the fixture a little bit you should be able to see which light bulb is flickering. Replace that light bulb, and your lights should stop flickering.

If that doesn't work then the next step would be to check all of the electrical connections to ensure none are loose. You may want to hire a licensed electrician to do this.

Finally, if they're still flickering, you should verify that the lighting control you're using to operate them is compatible with xenon lights, especially if it's a dimmer. Normally, standard incandescent dimmers work with xenon lights, but you can check on the dimmer's packaging. You should also make sure the xenon lights and any included transformers for low voltage lights are dimmable.

If Your Xenon Lights Don't Dim Smoothly:

Dimming problems can happen with xenon lights if the switch you're using is incompatible with the light's transformer. The lights may not dim consistently, going from bright to very dim to flickering all within the top third of the dimmer's throw. The transformer may begin to hum very loudly as well.

This problem most commonly occurs when using an electronic low voltage transformer with low voltage xenon lights. If that's the case for you, then your best bet is to install an electronic low voltage dimmer.

Also, while it's normal for transformers to hum some while dimming, the right dimmer should make it less noticeable.

If Your Lights Dim When You Use the Microwave:

This is a common problem in older homes, you turn on the microwave, coffeemaker, or vacuum cleaner and all the lights in your kitchen get a little dimmer.

If this happens to you, your house probably has an outdated electrical service panel. When you use several electric appliances at once, it can overload the panel and cause dim lights.

When you're finally fed up with this problem, you need to call an electrical contractor to make an evaluation of your circuit requirements, and discuss installing new electrical wiring for dedicated circuits to the appropriate devices, like the microwave.

Beyond the Cabinet: Lights in Uncommon Places

While the name seems very specific – under cabinet lights, lights under the cabinets – these fixtures are quite versatile. This section will educate you in the unexpected ways you can use under cabinet lights in spaces beyond the underside of your kitchen cabinets. Read on to learn how to use these lights in outdoor kitchens, around offices, in labs, on bookshelves, above workstations, in museums, and more.

Outdoor Kitchens

Whether you're building an outdoor kitchen for the first time, or updating yours for warm weather, under cabinet lights can be a valuable addition.

What Under Cabinet Lights Will Add To The Outdoor Kitchen:

You need a light to rely on.

Most outdoor kitchens don't have a constant source of ambient light. Unless your space is complete with a ceiling and some sort of overhead fixture, you can't just rely on the sunlight. If you like the feeling of cooking in the open air, you'll need some sort of task lighting, especially when preparing food after dark.

Despite all the variable conditions in the outdoor kitchen, adding lights to specifically illuminate your countertops will ensure you'll always have adequate task lighting. The lights will come in handy when you grill meat or veggies, allowing you to check that they're fully cooked before serving. Under cabinet lights help you see when mixing and pouring drinks, and fixing snacks as well. Having extra task lights will also help you see to thoroughly clean your outdoor kitchen, so leftover crumbs won't attract unwanted pests.

Not to mention good task lighting adds a lovely ambiance to an outdoor space after dark.

Choosing Under Cabinet Lights For Your Outdoor Kitchen:

The first thing to look for in your under cabinet lights is weather resistance. Unlike task lighting in a regular kitchen, these need to hold up under the elements. They'll probably be exposed to rain, so always look for fixtures that are rated for use in wet locations.

Second, always use LEDs. Unlike other light sources, LEDs don't emit UV rays, which is what attracts insects to light. There's hardly much that's grosser than preparing guacamole while dodging a swarm of moths and gnats. Using LEDs will let you avoid the nuisance altogether.

Then, determine what style fixture you need, depending on the structure of your kitchen...

If you have traditional cabinets or shelves, you can use a more traditional style of under cabinet light. Mount rope lights or indoor/outdoor puck lights underneath the lowest shelf for the perfect task lighting.

If you have a raised bar or ledge above your counter (but no shelves), you'll need something very low-profile so it doesn't get in the way. Here, use LED tape lights for a sleek look. They'll stick to the lip of your overhang to provide bright task lighting.

For an outdoor kitchen against a wall, without cabinets or a bar, you have to get a little more creative. You can run a rope light where the wall and counter meet, or attach a series of battery operated night lights to the wall so they cast beams down onto your counter.

The trickiest kind of outdoor kitchen to light is one with a flat counter and no bar or walls. If you have a pergola or some sort of overhang, it might be easiest to hang pendants or rope lights to illuminate the counters from above. If your kitchen is simply in the open air, try embedding recessed accent lights directly into the countertop for extra brightness.

Workstations

The places where you get your serious work done – a workstation in the lab, a desk at work, a workbench in the garage, a craft area in the spare room – all need serious task lighting. It will help you get your job done quickly, comfortably, and with the highest accuracy.

Under cabinet lights can provide bright, even illumination when you install them in these areas. Though they're technically called "under cabinet lights," you can position them under shelves and overhangs for prime light anywhere you need it.

Here are some recommendations for using under cabinet lights in these task-oriented areas:

Labs

In the lab, you'll need a task light with an excellent color rendering index and the lowest heat output possible. This will help ensure accuracy for any tests and experiments you perform. LEDs are probably your best bet.

Offices

If adding an under cabinet light over your desk at work, consider a dimmable model. This will allow you to change the light level throughout the day to help yourself focus. Xenon or LED lights are best for this.

Workbenches

For a workbench in the garage or basement, you'll need something fairly bright, because ambient light tends to be inadequate in unfinished spaces. Fluorescent lights will give you plenty of brightness for your buck. However, if your garage tends to get cold in the winter (below 50 degrees Fahrenheit), fluorescents won't function very well. You'll be better off with LEDs, which thrive in the cold.

Craft Areas

When adding lights to highlight part of a craft station or room, you might consider installing puck lights to light up the areas you need to access individually. If you have one space for sewing and one space for scrapbooking, you won't have to turn on all the lights at once. Since aesthetics are important for crafting too, look for lights that have a fairly accurate color rendering – LED or xenon is best.

Displays

Not only do under cabinet lights make excellent task lights, their versatile designs work for many varieties of accent lighting too. Linear and puck light fixtures cast beautiful beams within curio cabinets, display cases, bookshelves, and more.

Here are some suggestions for using under cabinet lights as accent and display lighting:

Retail Showcases

When planning displays for your retail shop, you want your products to shine! Lighting is integral to retail design in almost any store. Your displays should entice customers and

show off your products in all their brilliance. Here's how you can use all kinds of under cabinet lights to enhance your showcase:

In the glass, counter-style showcase, customers can get up close to your products, so it's important to get the lighting right. However, make sure the actual light fixtures do not become focal points, blocking products with wires or lamp heads. Use recessed or low-profile under cabinet lights tucked away from view. The best way to do this is to install thin lighting strips (aka linear under cabinet lights) inside the showcase, just below where the edge of the counter is. Xenon lights strips and LED tape lights are both great for this application. They're low-profile, bright, offer gorgeous light with excellent color renderings, and are even dimmable.

A note on food display cases: If you're going to add lighting to a case containing baked goods or other foodstuffs, you'll want a light that doesn't generate a lot of heat. LEDs are your best bet here, because they run cooler than most other light sources.

Your window display is another place certain under cabinet lights can come in handy. A pretty window can be the number one determinant of store traffic. You likely have wall space to work with on all four sides of the window display, so it shouldn't be too difficult to align microfluorescent under cabinet fixtures against the edges for even, enticing illumination.

Shelving and Cabinets

Whether you're lighting a personal bookshelf or a display shelf for your business, under cabinet lights will make its contents stand out. Under cabinet lights are also perfect for drawing attention to items within china cabinets, hutches, and curio cases. Instead of installing lights underneath these structures, simply install them under each shelf within the cabinet.

If you prefer to highlight your entire shelf, running a light strip or a microfluorescent light fixture along each shelf will do the trick. Just make sure you install the lights in a place they can't be seen – that way they'll draw attention to what is important and really make your display pop. As an added bonus, they'll also provide a significant light source to the entire room.

Do you have a favorite painting, sculpture, or photograph sitting on a shelf? Feature it with a small puck light attached to the shelf above. This finishing touch draws attention to the item and adds diverse visual interest to the entire bookshelf.

Art and Museum Displays

Sometimes, a nice, thin under cabinet light is just what you need to enhance an art or museum display. From almost every angle, they can cast the perfect amount of light on an exhibit.

Downlighting: For display cases showcasing artifacts, dioramas, sculptures, paintings, or historic paraphernalia, a low-profile linear or recessed puck light will make sure they catch the eye. Puck lights will highlight individual points of interest, and linear lights will work to draw attention to a cohesive display.

Uplighting: For larger displays and exhibitions, you may prefer to aim light upward at your subjects. Using certain linear lights like light strips, light bars, tape lights, or microfluorescents will give uniform light across your exhibit. Install them behind the lips or ledges on your raised display platforms to make sure they don't distract from your subject matter. Recessed puck lights installed below a subject can create a beautiful glow about certain materials – especially glass.

Backlighting: You can also use thin, linear under cabinet lights - light strips, tape lights, light bars, microfluorescents, etc. – to light certain artwork or signage from behind. For a translucent piece or panel, simply run the lights behind it. For a hanging piece in a cove or nook, run lights around the backside of the opening in front of the subject. This will bounce light off the back of the cove, providing even lighting.

Note for sensitive pieces: If displaying old, delicate, or sensitive material, it's best to use LED lights. LEDs don't emit any UV radiation and generate little heat, so their light won't cause any damage.

Glossary

Use this section to find definitions of terms related to under cabinet lighting.

Accent Lighting: lighting that is used to accent or highlight a particular object such as a work of art. To be effective accent lighting should be approximately four or five times the level of ambient light in the room, area, or space. Houseplants can be accented by aiming an uplight at the wall behind the plant, creating a dramatic silhouette of the plant against the wall.

Ambient Lighting: general lighting that usually lights up an entire room or space.

Backlighting: lighting that illuminates an object from behind. The object to be illuminated is placed between the intended viewer and the light source. If the object is opaque, backlighting can cause the edges to "glow". With translucent objects (such as stained glass), backlighting illuminates the object by passing light through it. Backlighting is commonly used to accent artwork, photos, advertisements, or signage.

Ballast: an electrical device used with fluorescent lamps to supply sufficient voltage to start and operate the lamp but then limit the current during operation.

Circuit: a pathway for the flow of electrons, including capacitors, resistors, and/or transistors, connected by wires through which electrical current flows. If there is only one path for the current, the circuit is called a "Series Circuit." If there are multiple paths, the circuit is called a "Parallel Circuit."

Color Rendering Index (CRI): a measure of a lamp's ability to render colors accurately. The scale ranges from 1 (low pressure sodium) to 100 (the sun). A CRI of 85 is considered to be very good.

Color Temperature: a measure of the color appearance or hue of a light source which helps describe the apparent "warmth" (reddish) or "coolness" (bluish) of that light source. Generally, light sources below 3200K are considered "warm;" while those above 4000K are considered "cool" light sources. The color temperature of a lamp has nothing to do with how hot the lamp will get or how much heat is given off by the lamp. The letter, K, stands for Kelvin. This term is also referred to as the Correlated Color Temperature (CCT).

Compact Fluorescent Lamp (CFL): a generic name used for a whole family of small, single-ended fluorescent lamps with a folded, bridged, or spiral glass tube design and with high color rendering (CRI > 80) and a long life (> 8,000 hours).

Control: a device that controls a lighting system. A control can take the form of a dimmer, switch, or an occupancy sensor.

Dimmer: a device in an electrical circuit used for varying the brightness of light bulbs in a lighting installation. Dimming controls are ideal for almost any type of room because they can change the amount of lighting to suit each mood or activity and they can help you look good. The use of dimmers with incandescent, xenon, and halogen light sources also increases the life of the lamps and decreases the use of electricity. (Please see the Table below.)

PERCENTAGE DIMMED	ENERGY SAVINGS	LAMP LIFE INCREASE
10%	10%	2 x
25%	20%	4 x
50%	40%	20 x
75%	60%	> 20 x

Direct Current (DC): an electric current that flows in only one direction without changes, cycling or alterations. DC current is usually supplied by a battery, a DC transformer, or photovoltaic (PV) cells.

Direct Glare: a type of glare or excessive brightness that travels straight from a light source directly into the viewer's eye rather than being reflected off another surface (indirect glare). Glare hinders visibility and contributes to eyestrain. Direct glare can sometimes be attributed to a poorly designed light fixture, and a light fixture that produces an unusual amount of direct glare is sometimes called a "glare bomb."

Driver, LED: an electronic device that acts as the power supply for LEDs. A driver regulates the current in order to maintain steady lumen output and prevent variation.

Efficacy: a measurement of efficiency used to compare light output to energy consumption. Efficacy is measured in lumens per watt (similar to miles/gallon for a motor vehicle). A 100-watt light source that produces 1750 lumens of light has an efficacy of 17.5 lumens per watt (L/W).

LIGHT SOURCE	EFFICACY
Edison's first lamp	1.4 L/W
Infrared Lamps	6-9 L/W
Incandescent Lamps	10-40 L/W
Fluorescent Lamps	35-100 L/W

Mercury Vapor Lamps	50-60 L/W
Metal Halide Lamps	80-125 L/W
High Pressure Sodium Lamps	100-140 L/W
Theoretical max for white light	225 L/W

Electrode: an electrical conductor used to make contact with a nonmetallic part of an electrical circuit or light bulb (e.g., a semiconductor, an electrolyte, or the gases found in the glass envelope of a light bulb).

Electronic Ballast: a type of ballast with electronic components that increases the standard operating frequency of electricity from 60 cycles per second (the U.S. standard) to 20 kHz (20,000 cycles/second) or higher. This increase in operating frequency is important for greatly reducing the stroboscopic effect or flickering that is associated with fluorescent lamps. Electronic ballasts are an improvement over magnetic ballasts because they are quieter, lighter in weight, and more efficient in converting electrical energy into light energy while producing less heat.

Electronic Transformer: a type of transformer that includes an inverter, which allows for a substantially smaller size compared to a magnetic transformer with comparable wattage. The inverter causes the current to alternate at a frequency of 20-50 kHz. The higher the frequency, the smaller the transformer can be. The transformer "transforms" line voltage (usually 120-277 volts) into low voltage (usually 12 or 24 volts). Light fixture manufacturers often incorporate built-in electronic transformers in the fixture design because of their small size. NOTE: Due to its very high frequency the voltage of electronic transformers can not be measured with standard voltmeters; instead, a "true RMS" voltmeter with sufficient range should be used.

ENERGY STAR®: ENERGY STAR is a government-backed program (a joint program between the U.S. Environmental Protection Agency and the U.S. Department of Energy) helping businesses and consumers protect the environment through superior energy efficiency. If a lighting product is ENERGY STAR compliant, that means it has passed stringent testing by the government and is considered to be energy efficient. ENERGY STAR qualified products can be identified by a label on the packaging. The U.S. Environmental Protection Agency has established the following guidelines for determining the product specifications necessary to qualify for the ENERGY STAR label:

Product categories must contribute significant energy savings nationwide.

Qualified products must deliver the features and performance demanded by consumers, in addition to increased energy efficiency.

If the qualified product costs more than a conventional, less-efficient counterpart, purchasers will recover their investment in increased energy efficiency through utility bill savings, within a reasonable period of time.

Energy efficiency can be achieved through broadly available, non-proprietary technologies offered by more than one manufacturer.

Product energy consumption and performance can be measured and verified with testing.

Labeling would effectively differentiate products and be visible for purchasers.

Filament: a tungsten wire that lights up when an electric current passes through it.

Fluorescent Lamp: a low-pressure mercury electric-discharge lamp (light bulb) in which a phosphor coating on the inside of the glass tubing transforms some of the ultraviolet energy created inside the lamp into visible light.

Halogen Lamp: a type of incandescent lamp (light bulb) that contains halogen gases (such as iodine, chlorine, bromine, and fluorine), which slow the evaporation of the tungsten filament. Also, sometimes called a tungsten halogen lamp or a quartz lamp. The glass envelope that surrounds the filament of a halogen lamp should not be touched with bare hands. The natural oil from human hands will only help to shorten the life of halogen lamps. If you should accidentally touch the glass bulb, you should thoroughly remove your fingerprints with methylated spirit (denatured alcohol).

Hardwired: technically means that the light fixture is permanently connected to an electrical source. The light fixture is not hardwired if it gets power via a cord & plug.

Heat Sink: a component found in well-designed LED light fixtures that lowers the temperature of the LEDs by dissipating their heat. Heat sinks are also found in other electronic devices such as computers and lasers. They are often made of aluminum and have grooves, fins, and sometimes a fan.

Household Wire: "Household wire" is the term that is sometimes used to refer to the "non-metallic sheathed electrical cable" that is used behind all of the walls and ceilings in a home to connect the electrical panel to switches, junction boxes, ceiling fans, electrical outlets, exhaust fans, and light fixtures. The term, "Romex" is often incorrectly used as a generic term to refer to any "non-metallic sheathed electrical cable" just like the brand name Kleenex is often incorrectly used to refer to any brand of tissue. ROMEX® is a trademark of the Southwire Company which refers to their specific brand of "non-metallic sheathed electrical cable." The non-metallic sheathing is the outside rubber insulation around the entire cable. The cable inside the sheathing is usually made up of 3 wires: one wire with white insulation (neutral wire), one wire with black

insulation (power wire), and one copper wire with no insulation (ground wire). The size of the non-metallic sheathed electrical cable that is used to connect lighting fixtures in a home is usually described as "14/2 with ground" (although this may vary with geographical location). The "14/2" refers to the two insulated wires that are 14 gauge in size and the "ground" refers to the uninsulated copper wire.

Incandescent Lamp: a lamp in which light is produced by the passage of an electric current through a tungsten filament which is heated to the point of incandescence.

Infrared Radiation: a type of invisible radiation for which the wavelengths are longer (about 770 nm to 1100 nm) and frequency lower than those for visible radiation. (The visible spectrum is made up of red, orange, yellow, green, blue, indigo, and violet - ROYGBIV, for short.)

Instant Start: refers to fluorescent lamps that start instantly without pre-heating the cathodes and without the need for starters.

Junction Box: a plastic or metal container inside which all standard electrical wiring connections must be made. A junction box protects and conceals these electrical connections.

Kelvin Temperature Scale: a temperature scale that references to absolute zero (0 degrees Kelvin), which, in theory, is the absence of all thermal energy. In lighting, the Kelvin temperature scale is useful when describing the color temperature of a light source.

Knockout: a perforated piece of metal (usually in the shape of a circle) on a metal box (like a junction box) that is removed with a punch and hammer to permit insertion of electrical wire.

Lamp: a light source such as an incandescent, halogen, xenon, fluorescent, or HID lamp. In everyday usage the terms, "light bulb" or "bulb," are usually used instead of the term, "lamp." In everyday usage the term, "lamp," usually refers to a portable lamp like a table lamp or a floor lamp but in the field of lighting the term, "lamp," refers to what most people call a "light bulb." Strictly speaking, the term, "bulb," refers to the glass envelope part of the "lamp."

Lamp Lumen Depreciation (LLD): as any lamp ages, it produces less and less light, the extent of which depends on the type of lamp in question. The value that indicates the lifetime decay of a lamp's lumen output as the lamp is operated over time is called lamp lumen depreciation. This is exactly why the published "initial lumens" for a lamp are always greater than the "mean lumens" for that same lamp. Some causes for lamp lumen depreciation may be the depletion of the incandescent filament over time, the accumulation of evaporated tungsten particles on the inside of the incandescent or

fluorescent glass envelope, the photochemical degradation of the phosphor coating on the inside of a fluorescent glass tube, and the heat generated at the LED junction.

Layers of Light: layers of light in a given space are created by introducing task lighting (lighting by which people perform tasks), accent lighting (lighting used to highlight specific objects such as works of art), decorative lighting (lighting created by very attractive light sources such as chandeliers or mini pendants), and general lighting (lighting that fills the space). This technique (long favored by cameramen and cinematographers) can eliminate ugly shadows in the room and on your face.

Light Bulb: generally speaking this term is synonymous with lamp.

Light Emitting Diode: or LED is a small electronic device that lights up when electricity is passed through it. LEDs are quite energy-efficient and have very long lives. They can be red, green, blue or white in color.

Light Fixture: a complete lighting unit consisting of a lamp (light bulb) or lamps, a housing, a connection to an external source of electrical power, and sometimes a transformer, ballast, or driver that modifies the incoming power to meet the unique electrical needs of the lamp(s) being used. Examples of light fixtures are wall sconces, recessed downlights, mini pendants, table lamps, floor lamps, track heads, step lights, picture lights desk lamps, and recessed troffers. Synonym: luminaire.

Lighting Facts Label: a label located on LED lighting products indicating the performance consumers can expect from a product. Manufacturers voluntarily submit products to the U.S. Department of Energy for testing of the lumens, lumens per watt (efficacy), watts, CRI, and color temperature of the LED product. The Department of Energy (DOE) started issuing the Lighting Facts Label to encourage consumer trust in LED products. LED flashlights, nightlights, and holiday lighting are not eligible for the Lighting Facts Label (www.LightingFacts.com).

Light Source: a source of light (visible portion of the electromagnetic spectrum). There are many natural light sources such as lightning bugs, stars including our own sun, lightning, aurorae, and many artificial light sources such as fluorescent lamps including CFLs, incandescent lamps (including halogen lamps and xenon lamps), high pressure sodium lamps, metal halide lamps, low pressure sodium lamps, neon lights, cold cathode fluorescent lamps, "light sticks", LEDs of various colors, organic light emitting diodes (OLEDs), light emitting plasma, candle light, gas light, oil lamps, and kerosene lamps.

Line Voltage: in the USA and Canada the standard residential line voltage is 120 volts. (Before 1960 residential line voltage was 110 volts, a standard established by Thomas Edison.) Residential electric clothes dryers, however, operate on 240 volts. In the USA commercial line voltage may be 120 volts or 277 volts. In the USA both the residential

and the commercial line voltage may vary by $\pm 10\%$. Thus, residential line voltage may be as low as 108 volts and as high as 132 volts. The standard line voltage is different in other countries. For example, in Japan it is 100V; in Mexico it is 127V; in China and Russia it is 220V; in France, Germany, Italy, England, New Zealand, and India it is 230V, and in Australia it is 240V.

Low Voltage: although "low voltage" is generally defined as anything below 30 volts, low voltage lighting systems usually operate on 12 volts and sometimes 24 volts. It is important to note that a low voltage lighting system uses a transformer (electronic or magnetic) to transform the "incoming" voltage (usually 120 volts) to 12 or 24 volts because that is the voltage needed by the light bulbs in that lighting system. That is, the transformer of a low voltage lighting system uses the line voltage supplied in the home/building/facility but the light bulbs in that lighting system use the low voltage supplied by the transformer.

Lumen: an international unit (SI) of measurement used to describe the amount of light that a light source produces or emits. For reference please consult the table below.

INCANDESCENT LAMP WATTAGE	APPROX. LUMENS	INCANDESCENT WATTAGE	APPROX. LUMENS
4W	20 lumens	60W	615 lumens
7W	45 lumens	75W	960 lumens
10W	56 lumens	100W	1100 lumens
15W	95 lumens	150W	2850 lumens
25W	232 lumens	200W	3800 lumens
40W	360 lumens	300W	6280 lumens

NOTE: These lumen values are approximate because they can vary with the manufacturer of the lamp, the age of the lamp, the dirt on the lamp, whether the lamp is clear or frosted, the voltage rating of the lamp, and the exact voltage of the circuit.

Magnetic Ballast: a magnetic ballast uses magnetic inductance to regulate the voltage of a fluorescent lamp. Magnetic ballasts are noisier, heavier, and less efficient than electronic ballasts. Since magnetic ballasts do not alter the frequency of the electricity supplied to the lamp(s), a flicker or stroboscopic effect can be expected. Some people are more affected by this flickering of the light source and can develop headaches as a result.

Magnetic Transformer: a magnetic transformer includes an iron core wrapped with two sets of wires. The transformer "transforms" line voltage (usually 120 volts) into low voltage (usually 12 or 24 volts). One set of the wires connects to the line voltage or primary side, while the second set of wires connects to the low voltage or secondary side. Magnetic transformers are often larger, heavier, noisier, and less efficient than electronic transformers.

Mercury: a chemical element found in nature that is added to the inside of fluorescent (including CFLs), metal halide, and high pressure sodium light bulbs during their manufacturing process. It is a silvery-looking liquid metal at room temperature that is a neurotoxin; that is, a toxic substance that can attack the nervous system and brains of humans.

Niche Lighting: lighting that is specifically designed for a small architectural niche (a small area recessed into a wall that usually is topped with partial dome). Due to the small size of a niche, the lighting for a niche is generally very small and often hidden from view in the top dome and/or the sides of the niche.

Occupancy Sensor: an electrical device that detects the presence of humans and turns a light fixture on. Occupancy sensors can use infrared, ultrasonic, and/or audio technology to detect the presence of people in an area.

Outlet: a connection to power supply for an electric plug. Outlet design varies from country to country, but in the United States an outlet generally has 2 sockets that are designed for a plug with 2 or 3 prongs.

Pendant: pendant lights can provide both task and general lighting. Equipped with shades or globes to avoid glare, they are suspended from the ceiling over dinner tables, game tables, kitchen counters, or other work areas. When used over end tables or night tables, they free up the space occupied by table lamps. In general, pendants should be hung about 30 inches above the tabletop and be about 12 inches narrower than the table on all sides. Not to be confused with a jewelry pendant, which is usually a small to medium-sized ornamental piece of jewelry attached to a necklace or bracelet.

Phosphor: the coating on the inside glass tubing of a fluorescent lamp that transforms some of the ultraviolet energy created inside the lamp into visible light.

Quick Connector: an electrical connector made up of plastic on the outside and metal on the inside that allows electrical connections to be made by simply pushing short uninsulated wire sections into the holes of the quick connector. A quick connector is sometimes called a “push-in wire connector” or a “poke-in wire connector,” which is different from a screw-on wire connector (sometimes called “wire nut”).

Rapid Start: a fluorescent lighting system that does not require a starter and takes about 1 to 2 seconds to emit light. The ballast preheats the electrodes within the fluorescent lamp and initiates the arc without a starter or the application of high voltage to the electrodes of the lamp.

Rated Life: The rated life of a lamp signifies the time at which 50% of a large quantity of these lamps will have burned out. That means that 50% of these lamps will burn out

before the rated life and 50% will burn out after the rated life. The rated life does not mean that every one of the lamps will last at least that long.

Receptacle: the receiving end on an outlet that connects the power supply to a plug. A receptacle can have 2 to 4 holes, including a connection for grounding.

Rope Light: often describes a string of LEDs or miniature incandescent light bulbs (placed about 1.0in apart) connected in clear plastic tubing (about 0.5in in diameter) that can be plugged into an outlet.

Task Lighting: lighting that is specifically installed to light an area where a task is performed. Under cabinet lighting used in a kitchen is a good example of task lighting.

Three-Way Lamp: an incandescent lamp that offers 3 levels of illumination (brightness) by using 2 different filaments with one filament providing the lowest level of illumination, the second filament providing a higher level of illumination, and the 2 filaments together providing the highest level of illumination. A few compact fluorescent lamp (CFL) models now also offer 3 levels of illumination but by using a different mechanism.

Three-Way Switch: a wall switch that allows two switches like this to control one lighting system. Whenever one of the three-way switches is flipped in a given circuit, the light changes its state; that is, if the light was on, it then turns off and if the light was off, it then turns on.

Transformer: an electrical device that transforms the line voltage of a facility (usually 120 volts for residential settings and 277 volts for commercial settings) into the voltage that a low voltage lighting system requires (12 volts or 24 volts).

Tube: the outer glass envelope of some light sources.

Tungsten: a chemical element found in nature as a steel-gray metal that has the highest melting point of all the non-alloyed metals is, therefore, often used to make the filament in incandescent light bulbs.

Uplighting: a lighting technique that directs light on an object from a light fixture aimed upward. Uplighting can create an intimate environment such as using a candle in a restaurant, or it can create harsh shadows resulting in an eerie effect like that created by uplighting a statue. This technique is also used in landscape lighting to accent trees or bushes.

Ultraviolet Radiation (UV): a form of electromagnetic radiation that is not visible to the naked human eye and which has a wavelength of less than 400 nanometers (nm) and greater than 100 nm.

Volt: the standard unit of electrical force or pressure between two points in an electric circuit. The greater the voltage, the faster electrons will travel through a circuit, meaning the greater the current running through a circuit. The standard household line voltage in the U.S. is approximately 120 volts. The unit is named after Alessandro Volta, an Italian physicist who made the first electric cell.

Voltage: the difference in electrical charge between two points in a circuit expressed in volts; the electric pressure that exists between two points and is capable of producing a flow of current when a closed circuit is connected between the two points; the rate at which energy is drawn from a source that produces a flow of electricity in a circuit; synonyms: electrical potential, electromotive force, EMF; Formulae: volts = amps x ohms, $V = I \times R$, voltage = electrical current x electrical resistance.

Watt: a standard unit of power (the rate at which work is performed). The power created by 1 ampere passing across a potential difference of 1 volt is equal to 1 watt ($W=AV$). One watt also equal 1 joule per second ($W=J/s$). The unit is named after James Watt because of his work on steam engine technology. In lighting, watts indicate the amount of power a light bulb consumes not the light output of that light bulb.

Wattage: the amount of electrical power consumed by a lamp or light fixture measured in “watts”. One watt is equal to the power dissipated by 1 ampere of electrical current flowing across a resistance of 1 ohm or the power produced by 1 ampere of electrical current under an electromotive force of 1 volt. One horsepower is equal to 746 watts. Formulae: watts = volts x amps, $P = V \times I$, electrical power = electromotive force x electric current. NOTE: the wattage rating of light bulb does not indicate how much light is produced by that light bulb.

Wire Nut: a registered trademark of Ideal Industries that is sometimes used to identify a twist-on wire connector that is used to secure the ends of 2 or more electrical wires in order to make an electrical connection. Wire nuts are thimble-shaped, made of plastic or plastic and metal, and color-coded for wire capacity. Wire nuts are an acceptable and easy-to-use alternative to soldering wires together.

Xenon Lamp: a type of incandescent light bulb that contains xenon gas in the glass envelope. The primary reason that this is done is to lengthen the average rated life of the lamp. Depending on the lamp a typical xenon lamp may have a rated life of 10,000 hours whereas a similar halogen lamp may have a rated life of 2,000 hours. Unlike halogen lamps, xenon lamps may be touched with bare hands without affecting the rated life of the lamp. Xenon lamps also operate at cooler temperatures than comparable halogen lamps. Like halogen lamps, xenon lamps may be dimmed (using the right dimmer) whether the lamp is rated for low voltage (12 volts or 24 volts) or line voltage (120 volts).

Notes

Pegasus Lighting

Pegasus Lighting operates an e-commerce website that sells unique lighting products to a wide spectrum of customers in a friendly, helpful, efficient, and enlightening manner. We work to blend technology with the personal touch of outstanding customer service and an information-rich website.

Begun in 1993, Pegasus Lighting is a division of Edison Lighting Systems, Inc., which, in turn, has been in business since 1987. Pegasus Lighting is a member of the Better Business Bureau and provides its e-commerce customers with a secure website through Yahoo Merchant Services.

At Pegasus Lighting, we specialize in selling unique lighting products. What do we mean by unique lights? Well, they are those special products that make an impact on the design and quality of your home or business. On our website, you will find unique light fixtures for residential and commercial settings, with both traditional and modern styling. We strive to provide the most brilliantly constructed, highly efficient products, which is why we prefer to sell the newest LED, fluorescent, halogen, and xenon lights instead of incandescent and outdated fluorescent fixtures.

If you browse our website, you'll also discover that we are committed to making your Pegasus shopping experience a unique one. With every product, we provide detailed descriptions, step-by-step installation guides, and how-to articles to help you get the ball rolling. We have a generous return policy, an enthusiastic, knowledgeable customer service department, and a lively blog bursting with helpful info and tips. Whether you're picking out that perfect unique light fixture on our website, ripping open its package, or admiring a finished installation, we want you to be 100% satisfied. How can we help you today?

Annie Josey

Annie is Pegasus Lighting's E-Commerce Marketing Specialist. She writes for the Pegasus Lighting Blog, "Light Reading," manages the company's social media, assists in the company's marketing efforts, and, now, writes lighting e-books. Annie is a graduate of the University of North Carolina with Bachelor of Arts in English and a minor in Creative Writing. Moreover, Annie is an award-winning fiction and short story writer.

Christopher Johnson

Chris is Pegasus Lighting's Vice President & CIO. He is a Virginia Tech graduate with a Bachelor of Arts in Communications (Broadcasting and Public Relations focus) and a minor in Sports Management. Chris also has a Masters of Business Administration from Virginia Tech with a specialty in Information and Decision Support Systems. At Pegasus Lighting, he manages the company's technology infrastructure including the company's e-commerce website and blog, and the company's servers, computers, software, and communications network and documentation systems. Finally, Chris also manages all of the marketing and public relations efforts for Pegasus Lighting.

Shop Under Cabinet Lights

Visit <http://www.pegasuslighting.com/under-cabinet-lighting.html> to shop Pegasus Lighting's selection of under cabinet lighting.

Additional Assistance

If you would like any help with your under cabinet lighting project, have questions, or need assistance with any other lighting project, please visit <http://help.pegasuslighting.com/contact-us.html> to email, live chat, or call our toll-free number. One of our enthusiastic Customer Service Representatives will be more than happy to talk with you. Let us help you brighten your day (yes, pun intended).

The End

THE COMPLETE GUIDE TO UNDER CABINET LIGHTING

Annie Josey
&
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Pegasus Lighting
www.pegasuslighting.com

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