JKL Miniature Fluorescent Lamps

World’s Most Complete Line of Miniature Fluorescent Lamps & Inverters, Including Cold Cathode, Hot Cathode and Ultraviolet

JKL COMPONENTS CORPORATION
Innovative Solutions in Lighting
JKL MicroLume® Fluorescent Lamps

- Space-Saving Solutions for Complex Designs
- Up to 20,000 Hours Life at Standard Operating Current
- Extremely Stable Electrical & Optical Characteristics
- Vibration & Shock Resistance to Over 100 Gs
- Variable Brightness with Low Power Consumption
- Light Weight, Low Profile Design
- Optimum Reliability & Unmatched Selection

Miniature Fluorescent Lamp Technology

A miniature fluorescent lamp is a gas discharge light source which produces its output from an electrically-stimulated fluorescent phosphor coating. These lamps are widely used for back-lighting LCDs, and find increasing application in machine vision, image scanning, biomedical analysis, task lighting and a variety of special purpose detection devices.

JKL Components Corporation is a pioneer in the development of a complete family of compact, highly-reliable miniature fluorescent lamps in a wide variety of configurations and styles. They offer engineers and designers the practical benefits of small size, significant light output, cool operation and minimal weight.

JKL mini-fluorescent lamps are available in three styles:

Cold Cathode Fluorescent Lamps (CCFL)
An rigid electrode plate at the ends of this lamp creates an electrical stimulation directly through the tube, increasing durability and extending lamp life. These require higher starting and operating voltages at low current. These cool operating, high output lamps generate from 3,000 to 30,000 cd/m², and are available in cool white, warm white and tri-stimulus (RGB) white light. Ideal for applications ranging from LCD back-lighting to low voltage garden lighting. They deliver up to 20,000 hours life and consume as little as one-half watt. This results in extended operating times between charges in battery powered devices.

Hot Cathode Fluorescent Lamps (HCFL)
These lamps have lower starting and operating voltages than CCFL styles. Their hot cathode design employs a filament which is heated as high current is passed through it, producing higher surface intensity and greater light output than comparable CCFL lamps, but with shorter lamp life. They produce from 10,000 to 30,000 cd/m², with power consumption of approximately 3 watts. Lamp blackening often associated with fluorescent lamps has been eliminated to assure long and uniform light output. Lamp life at rated current is 1,500 to 3,000 hours. Special inverters are available.

Ultraviolet Fluorescent Lamps (UVFL)
These miniature ultraviolet lamps operate in the very narrow light spectrum from 352 to 386 nanometers for black light inspection and detection. Special UV-C lamps are offered in the 253.7 nanometer spectrum for germicidal applications. JKL miniature UV lamps provide a compact, energy-efficient solution for a variety of critical applications where space conservation, ease of maintenance and long life are important. Lamp design is similar to CCFL styles, using special phosphors. Lamp life is 3,000 to 5,000 hours, with power consumption as low as 0.5 watt.

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Getting Started Using this Catalog

This catalog contains the widest selection of miniature and sub-miniature fluorescent lamps in the industry.

Lamps range in size from 2.6mm diameter x 25mm in length, to 10mm diameter by 350mm in length. This catalog includes the world’s smallest UV lamp, the only rectangular CCFL lamp, sub-miniature leaded fluorescent lamps, and a variety of specially shaped light sources. The lamp information contained herein has been organized to assist you in selecting the correct lamp and style for your application. It includes proper consideration for spectral characteristics, operation conditions, expected life and inverter selection.

A fluorescent lighting system generally consists of two components – the lamp and an inverter, which converts DC to AC to power the lamp. Special considerations, such as low temperature operation, color characteristics and lamp testing, are addressed in this catalog.

If you don’t find the data you require, please call a JKL Components Corporation miniature lighting specialist toll free at 800 421-7244.


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Ordering Fluorescent Lamps

A JKL fluorescent lamp part numbers follow a formula that is designed to assist you in determining the exact lamp for your application. Basic part numbers are included within each product section of this catalog. However, special options or features can be obtained with a suffix to the basic number. If you do not find your special needs met within these pages, please contact a JKL lighting specialist at 800 421-7244.

BF

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Number of Leads

A – Two Leads
B – One Lead

Output Color

01 – Warm White
20 – RGB High Output White
21 – Cool White

Notes:
1. Nominal heater wattage: 6
2. Current @ 12-14 volts: 0.300-0.700 amps
3. Sleeve color per CIE 1931 x/y color coordinates
4. External temperature control recommendation: Polymeric PTC Device; reference SAE-930012 Technical paper
5. Nominal maintaining temperature with external control: 45-65ºC

Accessories

Colored Silicone Sleeves – Specially-formulated silicone tubing matching any CIE Color Coordinates allows outstanding light transmissibility with absolutely uniform color. Eliminates the need for stocking multiple color lamps, and adds an ability to change colors as applications evolve. Minimum order required.

CCFL End Caps – Available in a variety of standard configurations for securing lamps to PC boards in either single or multiple configurations. Provides protection to lamp ends and assures isolation from shock and vibration.

Connectors and Assemblies – A value-added product enhancement available to your specifications.
Technical Considerations - Choosing the Right Lamp

Miniature cold cathode fluorescent lamps (CCFL) are the preferred solution for illuminating large display areas, backlighting liquid crystal displays, or satisfying extremely long life expectancy requirements. They are vibration and shock resistant, offer variable levels of brightness, and are very energy efficient with low power consumption.

The relative newness of miniature fluorescent lamps has resulted in a lack of industry standard sizes and electrical specifications. The careful designer must obtain complete performance specifications on both the lamp and inverter to correctly determine critical factors affecting brightness, heat, light uniformity, spectral output and the battery life of the host device.

Cold cathode lamps enjoy the broadest application range among the various miniature fluorescent lamp types and configurations offered by JKL, and are available in the greatest variety of diameters and lengths. Measuring from just 1/8” (3mm) in diameter, in lengths ranging from 1” to 15” (25mm to 360mm), these versatile lamps have a typical life expectancy of 20,000 hours at design current drive. A very low heat generation of only 10 to 15°C above ambient, combined with very stable electrical and optical characteristics, makes miniature fluorescent lamps an ideal choice for a variety of applications. These range from solar powered exterior lighting and backlighting vending machine product displays to uniform illumination of laptop computer screens.

How They Work

All cold cathode fluorescent lamps operate on AC. They are low pressure discharge lamps, filled with a noble gas (typically argon) and a small amount of mercury in a phosphorous-coated tube. By changing the phosphor coating inside the lamp, a broad range of colors, as well as true ultraviolet, can be produced.

It is important to note that some environmental programs prohibit use of components containing mercury, which could affect using CCFL lamps.

Understanding Lamp Life

The lifetime rating for a miniature fluorescent lamp is defined as "the point at which a lamp’s initial emitted brightness or uniformity is reduced by 50%." Brightness can be enhanced by increasing (over-driving) lamp current, but will result in reduced lamp life and increased operating temperature. Overdriving seldom results in catastrophic lamp failure, but does cause noticeable degradation in output.

CCFL lamps typically operate from 300 to 800VAC, depending on lamp length. This is much higher than other light sources, but overall power consumption is much lower.

Lamp Operating Temperatures

The optimum ambient temperature range for CCFL efficiency and brightness is 25 to 40°C. Operating temperature is extremely important. The colder the temperature, the lower the brightness and the greater the voltage requirement to turn on the lamp.

These lamps can operate at temperatures from 5 to 50°C, but performance is drastically affected at both ends of this range. Heaters may be used in extremely cold applications, but remember that light output is temperature dependant and CCFL lamps are more suitable for moderate operating environments.
Q. What is the color (Kelvin) temperature of fluorescent lamps?
A. Color temperature depends on the phosphor used to manufacture the lamps. The most common JKL lamp phosphors produce the following color temperatures.

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<th>Phosphor Type Color Temperature</th>
<th>-01 (Warm White)</th>
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<td>-20 (RGB White)</td>
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<td>-21 (Cool White)</td>
<td>7300 to 7500 °K</td>
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Q. Can I run more than two lamps on a single inverter?
A. It is possible to run more than the number of lamps recommended on a single inverter, but it is not a recommended practice. To obtain optimum performance, advise the specific lamp/inverter combination you are seeking to determine if modifications will be required.

Q. How far from the lamp can I position the inverter?
A. This is greatly dependent on the lamp/inverter combination and their proximity to a ground plane. As a rule, the maximum lead length should be less than 8 inches. If the leads are of unequal length, the ground lead should be the longer.

Q. Can I power fluorescent lamps directly from the wall outlet?
A. No! You must use a properly-matched DC input inverter. All lamp specifications and operating characteristics are based on inverter power.

Q. What is the effect of lamp length or diameter on brightness?
A. Using the same drive current, the surface intensity of the smaller diameter lamp will be greater. Longer lamp lengths of the same diameter still have greater total light output.

Q. Do you make an inverter that plugs directly into a wall outlet?
A. No. JKL inverters are DC to AC devices. A DC source, such as a power supply or battery must be used to power the inverter.

Q. Do fluorescent lamps get hot?
A. When operated at the specified drive current of 5mA/mm, the lamp ends near the electrodes will be approximately 40°C over ambient. The body will be 10°C to 15°C over ambient.

Q. What are the preferred methods of mounting fluorescent lamps?
A. Any method that does not put stress on the glass envelops and/or the lead to the glass seal on the lamp end is acceptable. Most common methods are to solder the leads (with a strain relief bend) directly into a PC board, or to secure the lamp ends with a custom silicon end cap.

Q. Can fluorescent lamps be flashed on and off?
A. Yes. The turn-on time can be controlled, but the turn-off time is limited to the specific decay properties of the phosphor, which varies.

Q. What type/size wire is needed for fluorescent lamps?
A. The wire must have an insulation at or above 1500 volts. Small gauge 25 or 26 is acceptable. See JKL application note AI-004 for details.

Q. How can I increase lamp brightness?
A. Lamp brightness may be increased by increasing the drive current. This is not recommended because it will shorten lamp life and may shift the output spectrum.

Q. How much infrared is present in JKL ultraviolet lamps?
A. Less than 5% of peak output is present, and is primarily at lamp ends.

Q. Does the fluorescent lamp/inverter produce EMI/RFI?
A. They combine to produce some RFI emission, and it may be necessary to shield the inverter after determining the result of systems testing.

Q. Are lamps and inverters approved to UL, CSA, TUV, VDE or other safety standards?
A. Safety agency approvals have not been sought for these components. Most companies obtain agency approval at the system level. The PC board does not have an UL listing.

Q. How much mercury is contained in fluorescent lamps?
A. This varies by lamp diameter; typically 3mg for 3.2mm diameter to 9mg for the 9mm diameters.

Q. Will fluorescent lamps work at cold ambient temperatures?
A. The lower the temperature, the lower the light output and the higher the required starting voltage. See chart in Section 6.

Q. How long should I expect fluorescent lamps to last?
A. Typically 5,000 to 20,000 hours when operated within specification parameters. Lamp life is stated as the point at which the lamp emits less than 50% of its initial output.

Q. What is the shelf life of fluorescent lamps?
A. Typically, these lamp's shelf life is over five years. However, long term storage should include packaging with desiccants.

Q. How much of the lamp's overall length is actually lit?
A. The entire length gives off illumination, except for 5 to 8mm at each end.

Q. Can I be shocked by the inverter or the fluorescent lamp?
A. Yes! Although current is low, the inverter output can exceed 1000 volts. Proper precautions should be observed when operating these lamps.

Q. Are special or custom fluorescent lamps available?
A. Specials may be obtained. However, minimum order quantities and set-up charges would likely be required.

Q. Are there any limits on lamp length for miniature fluorescent?
A. The limit is dependent on the diameter of the lamp and the availability of an inverter to properly drive the lamp. 3mm lamps would typically be from 25mm to 400mm long.

Colored Lamps

Construction of the lamps includes a glass tube coated on the inside with an inorganic phosphor. The phosphor coating is a tri-phosphor RGB (Red-Green-Blue) type. It is composed of individual red, green, and blue emitting phosphors. Varying the phosphor ratios will change the characteristics of the white light emitted. If monochrome light output is required, lamps may be manufactured using a single phosphor component. The following spectral radiance graphs give color characteristics of lamps using individual red, green, and blue phosphor components.
Sub-Miniature Fluorescent Lamps

- World’s Smallest UV and CCFL Lamps
- Measuring as Small as 2.4mm x 25mm
- Space-Saving Low Profile Designs
- Cool, Energy Saving Operation
- Long Lamp Life up to 20,000 Hours
- Wide Selection of Standards
- Full Range of Accessories & Options

The JKL family of miniature fluorescent lamps, inverters and accessories offers you a single source solution to an exceptionally wide range of illumination needs.

Available in the most popular lamp types (CCFL, HCFL, Black Light UV and Germicidal UV), these products incorporate the latest in fluorescent lamp design, technology and miniaturization.

Optimum Combination of Miniaturization, Light Weight and Luminous Intensity

The JKL Components approach to satisfying your lighting needs provides you with optimum performance, minimum space utilization, and exceptional reliability.

We have developed new design concepts and manufacturing processes to provide a highly efficient light source from the smallest, most reliable lamps available in the industry. Standard lamp diameters range from 2.4mm to 10mm, in lengths from 25mm to 360mm.

JKL applications engineers are available to assist you in avoiding problems often encountered in design applications using miniature fluorescent lighting, and to help you select the lamp that is most appropriate for your requirement.

New Xenon CCFL is Environmentally Safe, and Mercury-Free

This new line of cold cathode fluorescent lamps utilizes Xenon gas as its discharge excitation source. It is ideal for cold temperature start-up, offering faster response time and higher light output than that of traditional lamps. It also eliminates the need for a lamp heater generally required for CCFL lamp start-up in temperatures below 20°C.

Initially available in three lengths, the new JKL FLE Series lamps are excellent as a CCD light source (see page 9).

For additional details, contact JKL Engineering Services at 800 421-7244.

Special-purpose lamp inverters available. See Pages 14 & 15.
For additional information, contact us at 800 421-7244.
Cold Cathode Fluorescent Lamps

- High Luminance & Efficiency
- Low Power Consumption, up to 20,000 Hours Lamp Life
- Light Weight & Cool Operating
- Ideal for Backlighting LCD Displays
- Choice of Cool, Warm and Hi-Output RGB White
- New Mercury-Free Xenon CCFL Lamp is Environmentally Safe

Cold cathode fluorescent lamps are relatively efficient compared to light sources such as incandescent lamps. CCFL lamps convert about 20% of applied electrical energy into usable photopic light in the 380 to 780 nanometer range. Factors influencing efficiency include lamp size, driving wave shape, temperature in achieving desired usable light for a given application.

Temperature has an extreme effect upon lamp's mercury vapor pressure, which results in optimal efficiency in the 45 to 65°C range. As ambient operating temperature increases past optimal, lamps produce less efficient electrical-to-light conversion. Driving lamps at higher current levels can also raise the lamp temperature. Smaller diameter lamps with less body mass tend to increase in temperature more rapidly and to a higher level at higher than rated currents.

Designed to withstand shock and vibration forces, these durable and efficient cold cathode lamps provide exceptional light output from a low-profile miniature footprint. They are available in standard diameters ranging from 3mm to 10mm, and in lengths from 25mm to 350mm. In addition, JKL Components offers a limited line of specially shaped CCFL designs in C, L and U shape configurations, which minimize the number of lamps to illuminate a display while providing greater efficiencies.

Standard light outputs range from cool or warm white, to tristimulus RGB illumination that is ideal for backlighting LCD displays. Color sleeves of highly-stable silicone are also available to exact color coordinate specifications. Manufactured utilizing a unique “tipless” lamp design that saves space and increases reliability, the CCFL line can be safely mounted directly to PC boards. Special-purpose lamp inverters available. See Pages 14 & 15.

For additional information, contact us at 800 421-7244.

Rectangular CCFL Lamp (BFX1723)
# COLD CATHODE FLUORESCENT LAMPS (CCFL)

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<th>STARTING VOLTAGE (Typ. Vrms)</th>
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## U-SHAPED FLUORESCENT LAMPS

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<th>LAMP VOLTAGE VL (Vrms)</th>
<th>LAMP WATTS (@5mA)</th>
<th>STARTING VOLTAGE (Typ. Vrms)</th>
<th>INTENSITY (Cd./m²)</th>
<th>LIFE Hrs (Typ.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BF3U7588</td>
<td>3.0</td>
<td>NA</td>
<td>525</td>
<td>2.6</td>
<td>1200</td>
<td>28,000</td>
<td>20,000</td>
</tr>
<tr>
<td>BF6U22134</td>
<td>6.5</td>
<td>NA</td>
<td>410</td>
<td>2.1</td>
<td>1125</td>
<td>6,500</td>
<td>5,000</td>
</tr>
<tr>
<td>BF8U3096</td>
<td>8.0</td>
<td>NA</td>
<td>45</td>
<td>2.0</td>
<td>N/A</td>
<td>10,000</td>
<td>3,000</td>
</tr>
</tbody>
</table>

## COLD CATHODE FLUORESCENT XENON LAMPS

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>DIAMETER (mm)</th>
<th>LENGTH (mm)</th>
<th>LAMP VOLTAGE VL (Vrms)</th>
<th>LAMP WATTS (@5mA)</th>
<th>STARTING VOLTAGE (Typ. Vrms)</th>
<th>INTENSITY (Cd./m²)</th>
<th>LIFE Hrs (Typ.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FLE5280</td>
<td>5.6</td>
<td>280</td>
<td>260</td>
<td>19</td>
<td>1100</td>
<td>4,000</td>
<td>2,000</td>
</tr>
<tr>
<td>FLE5330</td>
<td>5.6</td>
<td>330</td>
<td>355</td>
<td>19</td>
<td>1300</td>
<td>4,000</td>
<td>2,000</td>
</tr>
<tr>
<td>FLE5396</td>
<td>5.6</td>
<td>396</td>
<td>400</td>
<td>19</td>
<td>1500</td>
<td>4,000</td>
<td>2,000</td>
</tr>
</tbody>
</table>
Cold Cathode Ultraviolet Fluorescent Lamps

- Choose Models in 365 Nanometers or 254 Nanometers Wavelength
- Small Diameter, High Efficiency Design
- Absolute Spectral Resolution
- Ideal for Black Light Stimulation of Fluorescent Materials in Scanning, Detection and Verification
- Excellent for Specialized Germicidal and Medical Fluorescing Applications
- World’s Smallest UV Lamps
- Enhances Daylight Visibility of Flat-Panel Displays

Measuring as small as 3mm diameter by 25mm in length, the JKL line of narrow spectrum (black light) fluorescent lamps - in the 365nm wavelength - offer specifiers an unmatched combination of compact size, light weight, rugged reliability and long-lived performance.

These low-profile lamps withstand in excess of 100Gs, making them ideal for both stationary or hand-held scanning, detection or verification applications. In addition, their small footprints dramatically reduces required PC board space.

JKL Components also offers a limited line of miniature germicidal lamps, operating primarily in the 254nm wavelength. Ultraviolet lamps in this range emit short wavelength UVC radiation to kill various micro-organisms.

JKL narrow spectrum UV lamps are a wise choice of designers of devices used in currency verification and credit card validation.

**CAUTION: EYE DANGER**

Ultraviolet radiation in the UV-C short wavelength region is dangerous to the eyes. Appropriate protection needs to be utilized when working with these lamps.

Special-purpose lamp inverters available. See Pages 14 & 15.

For additional information, contact us at 800 421-7244.

---

**UVA Spectral Emissions**

**UVC Spectral Emissions**
**Miniature Narrow Spectrum Ultraviolet Lamps**

Measure only 3mm in diameter in length from 25mm.

The BF1190 axial UVC lamp is a high output ultraviolet source.

**COLD CATHODE ULTRAVIOLET BLACK LIGHT LAMPS (365 nm Wavelength-UVA)**

<table>
<thead>
<tr>
<th>LAMP PART NUMBER</th>
<th>LAMP DIA. (mm)</th>
<th>LAMP LENGTH (mm)</th>
<th>ARC LENGTH (mm nom.)</th>
<th>LAMP CURRENT (mArms)</th>
<th>LAMP VOLTAGE (Vrms)</th>
<th>LAMP WATTS (W)</th>
<th>OUTPUT mW/Cm2 @ 25.4mm</th>
<th>LIFE HRS. (Typ.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BF325-UV1</td>
<td>3.0</td>
<td>25</td>
<td>10.5</td>
<td>2.5</td>
<td>350</td>
<td>0.70</td>
<td>0.30</td>
<td>3,000</td>
</tr>
<tr>
<td>BF350-UV1</td>
<td>3.0</td>
<td>50</td>
<td>20</td>
<td>2.5</td>
<td>488</td>
<td>0.98</td>
<td>0.30</td>
<td>5,000</td>
</tr>
<tr>
<td>BF3100-UV1</td>
<td>3.0</td>
<td>100</td>
<td>70</td>
<td>5.0</td>
<td>675</td>
<td>1.35</td>
<td>0.25</td>
<td>5,000</td>
</tr>
<tr>
<td>BF3120-UV1</td>
<td>3.0</td>
<td>120</td>
<td>90</td>
<td>5.0</td>
<td>865</td>
<td>1.35</td>
<td>0.25</td>
<td>8,000</td>
</tr>
<tr>
<td>BF3240-UV1</td>
<td>3.0</td>
<td>240</td>
<td>210</td>
<td>5.0</td>
<td>950</td>
<td>2.50</td>
<td>0.20</td>
<td>5,000</td>
</tr>
<tr>
<td>BF455-UV1</td>
<td>4.8</td>
<td>55</td>
<td>25</td>
<td>5.0</td>
<td>400</td>
<td>0.78</td>
<td>0.30</td>
<td>5,000</td>
</tr>
<tr>
<td>BF959-UV1</td>
<td>9.0</td>
<td>59</td>
<td>30</td>
<td>5.0</td>
<td>375</td>
<td>0.75</td>
<td>0.15</td>
<td>8,000</td>
</tr>
</tbody>
</table>

**COLD CATHODE ULTRAVIOLET GERMACIDAL LAMPS (254 nm Wavelength-UVC)**

<table>
<thead>
<tr>
<th>LAMP PART NUMBER</th>
<th>LAMP DIA. (mm)</th>
<th>LAMP LENGTH (mm)</th>
<th>ARC LENGTH (mm)</th>
<th>LAMP CURRENT (mArms)</th>
<th>LAMP VOLTAGE (Vrms)</th>
<th>LAMP WATTS (W)</th>
<th>OUTPUT mW/Cm2 @ 25.4mm</th>
<th>OUTPUT FLUX (mW)</th>
<th>LIFE HRS. (Typ.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BF850-UVC</td>
<td>8.0</td>
<td>50</td>
<td>20</td>
<td>5.0</td>
<td>150</td>
<td>0.75</td>
<td>30</td>
<td>800</td>
<td>20,000</td>
</tr>
<tr>
<td>BF8100-UVC</td>
<td>8.0</td>
<td>100</td>
<td>70</td>
<td>5.0</td>
<td>200</td>
<td>1.0</td>
<td>30</td>
<td>2400</td>
<td>20,000</td>
</tr>
<tr>
<td>BF727-UVC</td>
<td>7.0</td>
<td>27</td>
<td>2</td>
<td>1.5</td>
<td>135</td>
<td>0.2</td>
<td>1</td>
<td>75</td>
<td>10,000</td>
</tr>
<tr>
<td>BF1190-UVC</td>
<td>11.0</td>
<td>90</td>
<td>40</td>
<td>10.0</td>
<td>160</td>
<td>1.6</td>
<td>85</td>
<td>4000</td>
<td>20,000</td>
</tr>
</tbody>
</table>

**NOTE:** All UV Lamps may be operated at reduced current drive to improve lamp life. Contact JKL Technical Support @ 800 421-7244 for details and options.

The BF727 radial lead lamp is a low-cost, high reliability UVC fluorescent light source.

The BF1190 axial UVC lamp is a high output ultraviolet source.

Miniature Narrow Spectrum Ultraviolet Lamps measure only 3mm in diameter in length from 25mm.
Hot Cathode Fluorescent Lamps

They are available in diameters of 6 to 12mm, in lengths from 37 to 300mm. Applications include illumination of large LCD panels, backlighting displays, and in a variety of appliances and instruments requiring exceptionally bright light, but in a compact, low-profile footprint.

Available in a variety of sizes, as well as shapes (on special order), the JKL Hot Cathode line offers variable intensity, greater light distribution over more of the lamp’s overall length, and very high efficiency.

Special-purpose lamp inverters available. See Pages 14 & 15.

For additional information, contact us at 800 421-7244.

New technology employed in the HCFL Line eliminates the normally-required pre-heat circuitry, slashing start-up time and dramatically reducing the size and complexity of its inverter. This also eliminates lamp blackening often associated with traditional high intensity fluorescent lamps. This assures uniform output over the life of the lamp, with little degradation in performance.

### INSTANT-START HOT CATHODE FLUORESCENT LAMPS (HCFL)

<table>
<thead>
<tr>
<th>LAMP PART NUMBER</th>
<th>LAMP DIA. (mm)</th>
<th>LAMP LENGTH (mm)</th>
<th>LAMP CURRENT (mA)</th>
<th>LAMP VOLTAGE (VRms)</th>
<th>LAMP WATTS (W)</th>
<th>STARTING VOLTAGE (Typ. VRms)</th>
<th>INTENSITY (Cd./m²)</th>
<th>LIFE HRS. (Typ.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BF5667-20</td>
<td>5.6</td>
<td>67</td>
<td>20</td>
<td>45</td>
<td>0.9</td>
<td>520</td>
<td>18,000</td>
<td>3,500</td>
</tr>
<tr>
<td>BF667-20</td>
<td>6.5</td>
<td>67</td>
<td>20</td>
<td>40</td>
<td>0.8</td>
<td>470</td>
<td>17,000</td>
<td>3,500</td>
</tr>
<tr>
<td>BF867-20</td>
<td>8.0</td>
<td>67</td>
<td>20</td>
<td>35</td>
<td>0.7</td>
<td>400</td>
<td>10,000</td>
<td>3,500</td>
</tr>
<tr>
<td>BF890-20</td>
<td>8.0</td>
<td>90</td>
<td>20</td>
<td>45</td>
<td>0.9</td>
<td>480</td>
<td>10,000</td>
<td>3,500</td>
</tr>
</tbody>
</table>
Cold Cathode Fluorescent Lamp construction typically includes a hollow glass cylinder which has been coated on the inside with a phosphor material composed of rare earth elements such as zinc silicate and various types of halophosphates.

The tube is then sealed at both ends, each of which also contains a gettered, mercury dispensing electrode and an iron-nickel cathode connected to copper sheathed iron alloy leads.

Lamps normally contain 2 to 10 milligrams of mercury, and a mixture of gasses such as argon and neon. When high voltage is applied to the electrodes, ultraviolet energy at 254nm is produced as the mercury and the internal gasses are ionized. The resulting ultraviolet energy from the mercury discharge stimulates the phosphor coating inside the lamp, producing visible light output in the 380 to 780nm range, also known as the photopic region.

The most widely used CCFL lamps utilize phosphors specially compounded for good color rendering in illuminating liquid crystal displays (LCDs). They are referred to as triphosphor RGB lamps, producing bright white light, utilizing a combination of red, green and blue phosphors.

Light output for lamp phosphors is measured in degrees Kelvin (°K). A typical RGB fluorescent lamp is rated at 5600°K, which approximates daylight. The cooler blue the lamp color, the higher Kelvin rating. Inversely, a lower Kelvin rating produces a warmer the lamp color. Lower Kelvin ratings have a warm (red/yellow) appearance. Higher Kelvin ratings are typically blue-white.
Fluorescent Lamp Inverters

The diagrams presented below represent typical wiring connections for JKL fixed output inverters. These diagrams depict many of the most commonly used configurations for powering either one or two lamps.

**Wiring Diagrams**

**1 Lamp - 5mA Output**

**1 Lamp - 10mA Output**

**1 Lamp - 6mA Output**

**2 Lamps - 5mA Output**

**INVERTERS FOR CCFL & UV LAMPS**

<table>
<thead>
<tr>
<th>JKL PART NUMBER</th>
<th>NUMBER OF OUTPUTS</th>
<th>INPUT VOLTAGE (Vdc)</th>
<th>INPUT CURRENT (mA)</th>
<th>OUTPUT VOLTAGE (Vrms)</th>
<th>OUTPUT CURRENT (mA)</th>
<th>OUTPUT FREQUENCY (kHz)</th>
<th>OUTPUT TEMP (°C) Typ / Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>BXA-501</td>
<td>1</td>
<td>5</td>
<td>180</td>
<td>700</td>
<td>5</td>
<td>45</td>
<td>25 / 50</td>
</tr>
<tr>
<td>BXA-502</td>
<td>1</td>
<td>5</td>
<td>250</td>
<td>650</td>
<td>4</td>
<td>80</td>
<td>25 / 50</td>
</tr>
<tr>
<td>BXA-503</td>
<td>1</td>
<td>6</td>
<td>350</td>
<td>1200</td>
<td>5</td>
<td>35</td>
<td>25 / 50</td>
</tr>
<tr>
<td>BXA-12529</td>
<td>2</td>
<td>12</td>
<td>260</td>
<td>850</td>
<td>5</td>
<td>30</td>
<td>25 / 50</td>
</tr>
<tr>
<td>BXA-12529 / PSI</td>
<td>2</td>
<td>12</td>
<td>260</td>
<td>850</td>
<td>5</td>
<td>30</td>
<td>25 / 50</td>
</tr>
<tr>
<td>BXA-12553 / KIT</td>
<td>1</td>
<td>12</td>
<td>180</td>
<td>700</td>
<td>5</td>
<td>25</td>
<td>25 / 50</td>
</tr>
<tr>
<td>BXA-12563 / KIT</td>
<td>1</td>
<td>12</td>
<td>210</td>
<td>1000</td>
<td>5</td>
<td>37</td>
<td>25 / 50</td>
</tr>
<tr>
<td>BXA-12576</td>
<td>1</td>
<td>12</td>
<td>150</td>
<td>800</td>
<td>4</td>
<td>105</td>
<td>25 / 50</td>
</tr>
<tr>
<td>BXA-12577</td>
<td>1</td>
<td>12</td>
<td>150</td>
<td>800</td>
<td>4</td>
<td>105</td>
<td>25 / 50</td>
</tr>
<tr>
<td>BXA-12579 / KIT</td>
<td>2</td>
<td>12</td>
<td>550</td>
<td>1500</td>
<td>5</td>
<td>30</td>
<td>25 / 50</td>
</tr>
<tr>
<td>BXA-24529</td>
<td>2</td>
<td>24</td>
<td>140</td>
<td>1000</td>
<td>5.5</td>
<td>30</td>
<td>25 / 50</td>
</tr>
</tbody>
</table>

*Safe, environmentally secure potted housing.

**INVERTERS FOR HCFL LAMPS**

<table>
<thead>
<tr>
<th>JKL PART NUMBER</th>
<th>Number of Outputs</th>
<th>Input Voltage (Vdc)</th>
<th>Input Current (mA)</th>
<th>Output Voltage (Vrms)</th>
<th>Output Current (mA)</th>
<th>Output Frequency (kHz)</th>
<th>Output Temp (°C) Typ / Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>BXA-12558</td>
<td>1</td>
<td>12</td>
<td>180</td>
<td>1000</td>
<td>5.5</td>
<td>30</td>
<td>25 / 50</td>
</tr>
<tr>
<td>BXA-24558</td>
<td>1</td>
<td>24</td>
<td>180</td>
<td>1000</td>
<td>5.5</td>
<td>30</td>
<td>25 / 50</td>
</tr>
<tr>
<td>BXA-5558</td>
<td>1</td>
<td>5</td>
<td>180</td>
<td>1000</td>
<td>5.5</td>
<td>30</td>
<td>25 / 50</td>
</tr>
</tbody>
</table>

Cold Cathode Mini-Fluorescent Lamps can be Accessorized with a Wide Selection of Specially Designed DC-AC Inverters.

**INVERTERS FOR CCFL & UV LAMPS**

**INVERTERS FOR HCFL LAMPS**

*Safe, environmentally secure potted housing.*

NOTE: For detailed & application information and specifications, see our website: www.jkllamps.com
<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Voltage</th>
<th>Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>BXA-1003</td>
<td>Single</td>
<td>12 VDC</td>
<td>6mm</td>
</tr>
<tr>
<td>BXA-1004</td>
<td>Single</td>
<td>12 VDC</td>
<td>8mm</td>
</tr>
<tr>
<td>BXA-1203</td>
<td>Dual</td>
<td>12 VDC</td>
<td>6mm</td>
</tr>
<tr>
<td>BXA-1204</td>
<td>Dual</td>
<td>12 VDC</td>
<td>8mm</td>
</tr>
</tbody>
</table>

*Recommended Lamp Lengths*

*Consult Factory for Assessment*
Unique Applications for CCFL Lighting Technology

Automotive Instrument Cluster

This unique assembly of specially formed RGB white fluorescent lamps is being proposed as a long-lasting, cool operating alternative to the incandescent lighting employed in most automotive instrument panels. This application requires bright, adjustable lighting which can be directed to display areas located within the dashboard. These often employ light guides and related directional devices to illuminate a specific location. Incandescent lamps have been the traditional choice because they provide dramatically greater brightness and light dispersion than alternatives such as highly directional LEDs. In many applications ranging from instrument panels to radios or heating and cooling controls, as many as 36 lamps may be used, creating significant heat and jeopardizing component reliability. The new design approach provides cool operation and long, reliable life, while reducing initial labor content by more than 60%.

Solar Powered Garden / Architectural Lighting

Eliminating the need for power transformers and hard wiring, this is a unique alternative to traditional low voltage lighting systems. They are used in illuminating walkways, enhancing landscaping, and providing security/safety lighting. The self-contained design employs a solar collector, a simple power inverter, and a fluorescent lamp that provides hours of light output which is activated by a photo sensor. The CCFL lamp is extremely long-lasting and consumes very little power, providing comparable light output to traditional low voltage systems. This new concept permits easy relocation of individual units without the need for a transformer, timer and hundreds of feet of low voltage cabling.
Verification of Currency Using UV Black Light

Narrow spectrum (352 to 386 nanometers) ultraviolet lamps, measuring as small as 3mm diameter by 25mm in length, are being employed in many nations as a method of detecting counterfeit currency or verifying newly-issued bills embedded with special fluorescing inks. The extremely small size of these lamps has made them a logical choice in many countries where UV-sensitive strips have been used in currency. Ultraviolet light can also be used to detect, cure or alter fluorescing materials in applications ranging from food service, public health and medicine to industrial controls and commercial printing.

**Standard LCD Screens**

<table>
<thead>
<tr>
<th>Display Size</th>
<th>Horizontal</th>
<th>Vertical</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.4 inch</td>
<td>170.4 mm</td>
<td>127.8 mm</td>
</tr>
<tr>
<td>10.4 inch</td>
<td>221.1 mm</td>
<td>152.4 mm</td>
</tr>
<tr>
<td>11.3 inch</td>
<td>230.4 mm</td>
<td>160.9 mm</td>
</tr>
<tr>
<td>12.1 inch</td>
<td>246.0 mm</td>
<td>184.5 mm</td>
</tr>
<tr>
<td>14.5 inch</td>
<td>294.9 mm</td>
<td>221.2 mm</td>
</tr>
<tr>
<td>15.1 inch</td>
<td>307.2 mm</td>
<td>230.4 mm</td>
</tr>
<tr>
<td>16.1 inch</td>
<td>359.0 mm</td>
<td>287.2 mm</td>
</tr>
<tr>
<td>22.9 inch</td>
<td>465.5 mm</td>
<td>349.2 mm</td>
</tr>
</tbody>
</table>

**Currency Verification**

**Lap-Top Computer Screen Illumination**

Providing for bright, uniform lighting across the entire screen is an essential ergonomic consideration for any manufacturer of laptops or other hand-held displays (including video games). This is accomplished by mounting fluorescent lamps on one or two edges of the interior bezel surrounding the display, resulting in a uniform surface illumination. Correct “balancing” of lamp power consumption with the laptop electronics can extend useful hours of operation between charges by up to 15%.

**LCD Display for Hand-Held Television**

Cold cathode fluorescent lamps illuminate LCDs used to create the color picture for hand-held televisions. The RGB bright white phosphors deliver sharp, vivid color for the display. These hand-held units are designed for rough handling, low power consumption and uniform lighting. CCFL lamps assure high reliability, long life and cool operation, while actually extending the operating life of rechargeable batteries between charges.
Spectral Performance Characteristics

Lamps are constructed using a glass tube, coated on the inside with phosphors. The phosphor coating is a tri-phosphor RGB (Red-Green-Blue) type. It is composed of individual red, green, and blue emitting phosphors. Varying the phosphor ratios will change the characteristics of the white light emitted.

If monochromatic light output is required, lamps may be manufactured using a single phosphor component. The table and spectral graphs to the left and below give color characteristics of lamps using individual red, green, and blue phosphor components.

Spectral Performance

<table>
<thead>
<tr>
<th>Lamp Color</th>
<th>Peak Wavelength (nm)</th>
<th>CIE 1931 x</th>
<th>CIE 1931 y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td>658</td>
<td>0.59</td>
<td>0.30</td>
</tr>
<tr>
<td>Green</td>
<td>528</td>
<td>0.24</td>
<td>0.63</td>
</tr>
<tr>
<td>Blue</td>
<td>436</td>
<td>0.15</td>
<td>0.08</td>
</tr>
</tbody>
</table>

Spectral Radiance
If It Lights, and You Need It, We Have It!

JKL Components Corporation offers one of the broadest lines of miniature lamps, lamp assemblies and lighting accessories in the nation. We’re a just-in-time quality supplier to many of America’s largest and most demanding high volume OEM companies, and are recognized as an innovative leader in miniature lighting design, manufacturing and engineering.

The following pages outline a small portion of the standard JKL products, most of which are available from stock. If you don’t see what you require, please contact us directly, via E-mail or on the worldwide web.

The BXD-1208-01 eight outputs power inverter is a new addition to the JKL line. It operates on 12VDC input, and has dimming capabilities.

Specially designed, leaded fluorescent lamp provides a unique solution of OEM companies requiring very directed, cool white light in a minimum of space.

JKL offers the broadest line of standard miniature and sub-miniature lamps and lighting accessories in the nation. We inventory a very extensive selection of incandescent and special purpose lamps, lamp sockets, harnesses and related accessories.

![Image of Lamp Brightness vs Temperature](image1)

![Image of Lamp Temperature vs Drive Current](image2)

![Image of Lamp Brightness at 24°C](image3)
JKL is the first supplier of miniature and sub-miniature lamps for automated assembly, designed to withstand the rigors of auto-insertion equipment and processes. They are available in through-board and surface mount styles, utilizing tape-and-reel or ammo-pack carriers.

This ultra-miniature T-1 dual mount incandescent PCB lamp assembly houses its lamp in a flexible neoprene base which permits through-hole installation directly to the PC board.

This dual contact gas-filled wedge base lamp assures glitch-free socket connection for higher reliability, provides greater light output permitting the use of a smaller size lamp, and extends lamp life.

This new welded wire miniature lamp assembly provides eight times longer lamp life than traditional wedge base lamps. They perform better and cost less because its special manufacturing process creates a superior sealed atmosphere that results in brighter, more reliable performance.

The uniquely designed line of JKL Neo-Wedge™ lamp assemblies feature a simple twist-to-lock base that makes direct contact with PC board trace. This enables designers to extend light up to 50mm above the PCB surface.

JKL Bi-Pin Lamps with snap-in base provide a cost effective means of extending light from PC board in applications where the display is some distance in front of the board, or where light pipes are used for distributed illumination.

JKL is the first supplier of miniature and sub-miniature lamps for automated assembly, designed to withstand the rigors of auto-insertion equipment and processes. They are available in through-board and surface mount styles, utilizing tape-and-reel or ammo-pack carriers.
JKL has the capability to provide specially designed sockets, cable and harness assemblies, and complete lighting assemblies at very competitive prices for prototype and pre-production applications, and the facilities to deliver high volume quantities.

A complete line of precision optical and medical lamps provides a single source solution for users of a wide variety of instruments requiring extremely bright illumination.

Molded Silicone filter caps are translucent, impervious to color shift, and available in over 2000 colors, assuring an economical means of adding color to standard incandescent lamps, while keeping lamp inventories at a minimum.

Xenon and Krypton filled lamps for flashlights and other portable illuminating devices provide extremely bright light output, while extending lamp life.

JKL has the capability to provide specially designed sockets, cable and harness assemblies, and complete lighting assemblies at very competitive prices for prototype and pre-production applications, and the facilities to deliver high volume quantities.

JKL Components Corporation offers the broadest selection of standard miniature and sub-miniature lamps, lamp assemblies and lighting accessories in the industry.

Low cost JKL through-board, sub-miniature SMT lamps equipped with silicone filter caps are ideal for high volume, auto-insertion applications.
**Glossary of Fluorescent Lighting & Photometric Terminology**

**Active Component:** A component capable of voltage or current gain or switching.

**AGC:** Automatic gain control.

**Ambient:** Associated with a given environment.

**Ampere:** A unit of electrical current or rate of flow of electrons. One volt across one ohm equals one ampere.

**Anode:** Positive electrode.

**Ballast:** The electrical device required for all discharge lamps that limits lamp current. Additional functions may be incorporated in the basic unit such as starting circuits and dimming control.

**Ballast Capacitor:** Limits lamp current and isolates lamps from each other and the power inverter (transformer). Typically a 3KVDC ceramic disc capacitor in the 15 to 100pF range for CCFL lamps.

**Ballast Resistor:** A Series resistance used to maintain a constant lamp current.

**Buffer:** A circuit that increases the driving capability of a signal.

**CCFL:** Cold cathode fluorescent lamp acronym. Also called CCFT for cold cathode fluorescent tube.

**Candela:** A unit of luminous intensity of 1/60th sq. cm of a blackbody radiator operating at the temperature of the solidification of platinum.

**Candelas per Square Meter (Cd/m2 ) Also called NIT:** The term for luminous (surface) intensity of a light source. This can be converted to foot-lambert by dividing Cd/m2 by Pi (3.146).

**Candle:** See Candela.

**Cathode:** Negative electrode.

**Chromaticity:** The color of light, as defined by its chromaticity coordinates, generally using the CIE diagram.

**CIE:** The Commission Internationale d’Eclairage (CIE) is the international commission on illumination, devoted to international cooperation in the field of lighting.

**CIE Chromaticity Coordinates:** The Cartesian coordinates used to define a color in the 1931 CIE color space. They are designated as s, y, and z and are the ratios of each of the tristimulus values X, Y and Z in relation to the sum of the above.

**CIE Tristimulus Colorimeter:** An instrument used to measure color using tristimulus filters, which match the CIE color matching functions.

**CIE Tristimulus Values:** The CIE tristimulus values represent red, green and blue stimuli required to match a color, and are designated as X, Y and Z.

**Cold Spot:** The area of the lamp which is coldest, where excess mercury may condense. Condensed mercury inside the lamp usually appears as small dark specs.

**Correlated Color Temperature:** Term used to describe the color of white light sources. Specifically, it is the temperature of a Planckian (black body) radiator, which produces the chromaticity most similar to that of the light source. It is usually expressed in degrees Kelvin (°K).

**Decoupling:** Filtering to prevent undesired AC signal coupling.

**Direct Coupling:** Coupling of two stages or circuits by a wire, resistor or battery.

**Dominant Wavelength:** A single wavelength of light that matches the color of a given sample when combined in suitable proportions with white light and a suitable adjustment of intensity.

**Dumet:** An alloy composite, commonly in the form of wire composed of 42% nickel and 58% iron, with a cladding of OFHC copper to the extent of 18 to 28% by weight. Widely used in lamps and electron tubes as electrical lead wires and feed-throughs.

**Filter Photometer:** A photometer that incorporates a filter with a response trimmed to match the 1931 CIE photopic function. Photopic quantities are obtained directly by measuring the light after it passes through a photopic filter.

**Fluorescence:** Emission of light or other electromagnetic radiation by a substance when exposed to radiation.

**Foot Candle:** A unit of luminance on a surface one square foot in area, on which there is a uniformly distributed flux of one lumen, or the illumination at a surface all points of which are at a distance of one foot from a uniform source of one candela.

**Foot Lambert:** A unit of luminance equal to 1/π candela per square foot.

**Fuse:** A protective device that opens a circuit on overcurrent.

**Ground Stripe:** A conductive or semi-conductive stripe of material (typically carbon-based paint or copper foil about 1 to 2mm wide) extending up to 90% of the length of the lamp and connecting to one end. The end where the ground stripe contacts the lead is the “ground end.” This ground stripe enhances the ability of the lamp to ionize (start) at lower temperatures.

**Harmonic:** A sinusoid having a frequency that is an integral multiple of the fundamental frequency.

**Hermetic Seal:** A seal preventing the passage of air, water, vapor or other gases.

**Hue:** The attribute of color by which a color is perceived to be red, green, blue, yellow, etc. Achromatic colors like black, white and gray do not exhibit hue.

**Hysteresis:** A lag effect similar to mechanical friction, sometimes expressed by the terms “slop”, “stickiness” or “dead zone”.

**Illuminance:** Luminous flux incident on a surface per unit area. The SI of illuminance is the Lux (lumen/m2), and the English unit of illuminance is the foot-candle (lumen/ft2).

**Impedance (z):** A measure, in ohms, of the opposition to current flow in an AC circuit. Includes resistance and reaction.

**Incandescence:** The emission of light by raising a material to a high temperature.

**Interface:** The circuitry or connections between a computer and an I/O device.

**Inverse Square Law:** The intensity of light varies inversely to the square of distance from the source.

**Inverter:** A device for converting DC to AC by switching DC alternately in inverted polarity.

**Irradiance:** Radiant flux density.

**Lambertian Surface:** A uniformly diffusing surface for which the luminous intensity per unit area in any direction varies as the cosine of the angle between that direction and the normal angle to the surface, so it appears equally bright what-ever the direction from which it is viewed.

**Lamp Ionization:** The state of the lamp in which the fill gases and evaporated mercury are stimulated to emission of ultraviolet energy by the electrical potential applied to the lamp (i.e., start-up).

**Lamp Thermal Equilibrium:** The point at which the lamp stabilizes its output within a stable ambient temperature environment, a fixed current level and a static lamp position.
Life Hours: The time required for the lamp to reach 50% of its initial or rated luminance, and/or total output flux.

Life Test: The test of a component or unit under the conditions which approximate, or stimulate by acceleration, a normal lifetime of use.

Light Pipe: A transparent material that transmits light from one end to the other; whether rigid or flexible, straight or bent.

Lumen: A unit of “luminous flux”, defined as the amount of light which falls on one square meter of a surface at a constant distance of one meter from a source of one candela. Convert to MSCP (mean spherical candle power) by dividing lumens by 12.56 (4π).

Lumens per Watt: The measurement of efficiency of a light source, determined by dividing total visible output power (lumens) by total input power (electrical watts).

Luminance: Luminous flux emitted from a surface, per square foot, per unit area in a given direction. The SI unit is the Nits (cd/m²) and the English unit is the foot-lambert [1 foot-lambert = 3.426 cd/m²].

Luminous Flux: Radiant flux weighed by the 1931 CIE photopic V(1) function. The SI unit of luminous flux is the lumen. The luminous flux per steradian from a source whose luminous intensity is one candela is one lumen.

Luminous Intensity (Candlepower): The luminous flux per unit, solid angle or emitter, from a point source. The SI unit is the candela.

Lux: A unit of illumination (luminance) equal to one lumen per square meter. One foot-candle equals 10.4 lux.

Mean Spherical Candle Power (MSCP): A measurement of luminance attained by dividing lumens by 12.56 (4π).

Metamerism: Phenomenon in which spectrally different color stimuli appear to match under certain viewing conditions, but fail to match for other observers or illuminants.

NC: Normally closed. Also referred to as no connection.

Neon Bulb: A glass envelope filled with neon gas and containing two or more insulated electrodes. The tube will not conduct until the potential difference between two electrodes reaches the firing, or ionization, potential, and will remain conductive until the voltage is reduced to less than excitation.

NITS (nanometers): See Candels per square meter (Cd/m²).

Parasitic Oscillation: An undesirable high frequency oscillation caused by stray inductance or capacitance, and at a frequency unrelated to the operating frequency.

Passive Component: A component that is not capable of amplification or switching action.

Penning Gasses: Used within the lamp to enhance ionization. Also called gas mixture, fill gas or buffer gas. Typically consists of argon or neon.

Phosphors: Chemical substances that exhibit fluorescence when excited by ultraviolet radiation, x-rays or an electron beam. The amount of visible light is proportional to the amount of excitation energy. If fluorescence decays slowly after the exciting source is removed, the substance is said to be phosphorescent.

Photometer: An instrument used to measure photometric qualities such as luminance, illuminance, luminous flux and luminous intensity. It can be either a filter photometer of a spectroradiometer.

Photometry: The technology of generating and harnessing light and other forms of radiant energy whose quantum unit is the photon.

Photonics: The technology of generating and harnessing light and other forms of radiant energy whose quantum unit is the photon.

Photopic Function: The spectral response of the average human observer defined by CIE and called the Standard Observer Function. The response for a 2° visual field defined in 1931 is more commonly used than the 10° function defined in 1964.

Photovoltaic: Voltage generation as a result of light radiation.

Potting: Arubber or plastic insulating compound in which an assembly may be encapsulated for protection from vibration, moisture, etc.

Radiometry: The measurement of radiation in the infrared, visible and ultraviolet portions of the spectrum.

Relaxation Oscillator: An oscillator whose frequency is determined by the charging time of the resistance-capacitance circuit.

Remote Ballast Capacitor: Used when a lamp is positioned away from the inverter, typically at a distance of one to three feet via shielded cable.

Ringing: A damped oscillation in the output of a system as a result of a sudden change in the input signal.

Saturation: The point at which increasing one quantity no longer has an effect on the second quantity. The attribute of color perception that expresses the degree of departure from gray of the same brightness.

Spectroradiometer: An instrument to measure the spectral energy radiated by a source. The energy in the visible region of the spectrum can be used to calculate photometric and colorimetric parameters.

Standard Illuminant: A series of spectral power distribution curves recommended by CIE as standard light sources for light measurement.

Steradian: The solid angle of a sphere. The area of a spherical surface equal to the square of its radius. The total solid angle at a point in space is 4π steradians.

Strobe: To gate on and off at a regular rate.

Thermonics: Producing emission of electrons by heating.

Transducer: A device that converts energy from one form to another, especially one that converts some physical quantity to electric current or voltage for the purposes of measurement or control.

Trimmer: A small capacitor or resistor adjustable by screwdriver or thumbwheel for purposes of alignment.

Tristimulus Values: The amounts of each of the three primary colors that must be combined to match a sample.

Ultraviolet: The invisible region of the spectrum; those radiant energy rays that lie immediately beyond the violet ends of the spectrum, and between the wavelengths of approximately 100 to 380nm.

Ultraviolet A: The region of the electromagnetic spectrum from 320-400nm.

Ultraviolet B: The region of the electromagnetic spectrum from 280-320nm.

Ultraviolet C: The region of the electromagnetic spectrum that is less than 280nm.

Virtual Ground: Not actually grounded, but at ground potential for purposes of most calculations.

Visible Light: Electromagnetic radiation in the spectral range from 380 to 780 nanometers that is visible to the human eye.