NOT ALL CIRCADIAN LIGHTING IS EQUAL

The hottest-ticket in lighting right now is circadian lighting. But buyer-beware... not all so-called “circadian” lighting solutions are created equal.

What is circadian lighting?
It is lighting which prevents circadian (24-hour biological clock) disruption to optimize human health, safety and performance.

Learn the 3 key questions buyers should ask to anyone selling a circadian lighting solution. It will help you separate the wheat from the chaff.

ABOUT US

CIRCADIAN Light is producing intelligent circadian white light fixtures which regulate the dosage and timing of bio-active blue light to increase human health and productivity throughout the 24/7 day-night cycle.

The initial CIRCADIAN Light products are fully autonomous light fixtures that can be installed by any qualified electrician and regulate the timing of the bio-active blue light by time of day, season of the year and zip code (i.e. latitude and longitude) for up to 10 years without requiring any changes or additional input. They are specifically designed to boost productivity and decrease absenteeism, turnover, errors, and accidents in workplaces that operate around the clock.

By controlling the bio-active blue dosage, the proprietary CIRCADIAN LEDS reduce the harmful spectral wavelengths that have been associated with an increase of 35-65% in obesity, diabetes, heart disease, sleep disorders, depression, reproductive disorders and multiple cancers, including breast cancer and prostate cancer. CIRCADIAN® Lights solve the night lighting problem by providing high quality white light 24/7 and avoid the dimming and low color temperature approaches used by other so-called “circadian” lighting products, which do not sufficiently reduce the bio-active blue dosage.

3 Key Questions Buyers Should Ask

DaySync™ delivers over 20% blue content during the day

Less than 2% blue light content at night

CIRCADIAN® Light products are fully autonomous light fixtures that can be installed by any qualified electrician and regulate the timing of the bio-active blue light by time of day, season of the year and zip code (i.e. latitude and longitude) for up to 10 years without requiring any changes or additional input. They are specifically designed to boost productivity and decrease absenteeism, turnover, errors, and accidents in workplaces that operate around the clock.

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2 Main Street, Suite 340
Stoneham, MA 02180
781.439.6333 • circadianlight.com
info@circadianlight.com
QUESTION 1
How much blue light (between 440-490nm) is emitted at night? Is the fixture UL verified to provide less than 2% blue light?

Why ask?
- Exposure to blue-rich light sources (e.g., LEDs, fluorescents) in the evening and at night is a well-documented serious risk to our health by disrupting our circadian rhythms. This health risk has been recognized by the World Health Organization, the American Medical Association, the U.S. National Institutes of Health and many other independent agencies.
- Circadian disruption has been directly linked to poor sleep, anxiety, cancer, diabetes, obesity and many other conditions.
- Many lights that are marketed as “circadian”, “healthy” or “human-centric” contain too much blue light and continue to disrupt circadian rhythms.

Red Flag
- Changing color by time of day (e.g., white-color-tuning lights that change to warmer/yellower color at night) does not remove the harmful blue content, and still emits 8-10% blue.

Look for fixtures that are independently verified to provide less than 2% blue light content at night.

Red Flag
- If the lighting company cannot (or will not) tell you how much blue light is emitted at night.
- Many lights that are marketed as “circadian”, “healthy” or “human-centric”.

CIRCADIAN disruption has been directly linked to poor sleep, anxiety, cancer, diabetes, obesity and many other conditions.

Exposure to blue-rich light sources (e.g., LEDs, fluorescents) in the evening and at night can disrupt circadian rhythms, negatively impact our sleep, and contribute to poor performance and a jet-lag malaise.

Many lighting systems are manually operated and require the user to change the type of light that is provided. This can lead to being exposed to the wrong light by people forgetting to adjust the light property during the day.

Why ask?
- Blue light is the main cue for setting our circadian rhythms. We need blue-rich light (440-490nm) during the day to synchronize our circadian rhythms - BUT getting too much of it in the evening and at night can disrupt circadian rhythms, negatively impact our sleep, and contribute to poor performance and a jet-lag malaise.

Red Flag
- A circadian lighting system that does not automatically control the blue-light levels by time-of-day, season and location (latitude/longitude) to ensure you’re getting the right light at the right time. If the so-called “circadian” lighting system doesn’t do this, that’s a major red flag.

Why ask?
- If they have never tested their lights on human subjects in a controlled setting.
- Ask them what data they have collected from human subjects in a controlled setting.

Red Flag
- If they have never tested their lights on human subjects in a research study that’s a major red flag.

Comparison of Blue Content at Night: White Color Tuning vs CIRCADIAN NightSafe™

<table>
<thead>
<tr>
<th>Wavelength (nm)</th>
<th>Blue Content (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>400</td>
<td>0%</td>
</tr>
<tr>
<td>420</td>
<td>0%</td>
</tr>
<tr>
<td>440</td>
<td>1.7%</td>
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<tr>
<td>460</td>
<td>5.6%</td>
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<td>480</td>
<td>10.5%</td>
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<tr>
<td>500</td>
<td>15.4%</td>
</tr>
<tr>
<td>520</td>
<td>20.3%</td>
</tr>
<tr>
<td>540</td>
<td>25.2%</td>
</tr>
</tbody>
</table>

CIRCADIAN NightSafe™ light does not emit blue light, thus it is spectrally engineered to remove blue.

Comparison between White Color Tuning Products and CIRCADIAN NightSafe™

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<td>400</td>
<td>0%</td>
</tr>
<tr>
<td>420</td>
<td>0%</td>
</tr>
<tr>
<td>440</td>
<td>Less than 2%</td>
</tr>
<tr>
<td>460</td>
<td>5%</td>
</tr>
<tr>
<td>480</td>
<td>9.2%</td>
</tr>
<tr>
<td>500</td>
<td>16.7%</td>
</tr>
<tr>
<td>520</td>
<td>26.2%</td>
</tr>
<tr>
<td>540</td>
<td>33.0%</td>
</tr>
</tbody>
</table>

CIRCADIAN NightSafe™ light does not have a blue pump and is spectrally engineered to remove blue.

CASE STUDY: One-Year Follow Up with CIRCADIAN Lights.

50% reduction in employees with excessive sleepiness on the Epworth Scale, a standardized fatigue metric.
QUESTION 1
How much blue light (between 440-490nm) is emitted at night? Is the fixture UL verified to provide less than 2% blue light?

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- Many lights that are marketed as “circadian”, “healthy” or “human-centric” contain too much blue light and continue to disrupt circadian rhythms.
- Changing color by time of day (e.g., white color-tuning lights that change to warmer/yellower color at night) does not remove the harmful blue content, and still emits 8-10% blue. Look for fixtures that are independently verified to provide less than 2% blue light content at night.

Red Flag
- If the lighting company can’t (or won’t) tell you how much blue light is emitted at night, that’s a major red flag.
- If the blue-light emission levels are greater than 2% that is another red flag.

QUESTION 2
Will the light system automatically change the levels of blue light to provide the right light at the right time for my people?

Why ask?
- Blue light is the main cue for setting our circadian rhythms. We need blue-rich light (440-490nm) during the day to synchronize our circadian rhythms - BUT getting too much of it in the evening and at night - can disrupt circadian rhythms, negatively impact our sleep, and contribute to poor performance and a jet-lag malaise.
- Many lighting systems are manually operated and require the user to change the type of light that is provided. This can lead to being exposed to the wrong light by people forgetting to adjust the light properly during the day.

Red Flag
- A circadian lighting system that does not automatically control the blue-light levels by time-of-day, season and location (latitude/longitude) to ensure you’re getting the right light, at the right time. If the so-called “circadian” lighting system doesn’t do this, that’s a major red flag.

QUESTION 3
Have the lights been tested with human subjects in a medical research center? Are there any case-studies of real-world installations?

Why ask?
- Remember the goal of circadian lighting is to entrain circadian rhythms (and prevent circadian disruption) to optimize human health, safety and performance. Ask for evidence their lights achieve this.
- While many lighting companies call their lights “healthy” or “circadian” or promote them as “color-tuning” most companies have never tested their lights on human subjects. Nor can they provide any direct research linking their product to an impact on circadian rhythms.
- Ask them what data they have collected from human subjects in a controlled setting.

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Comparison of Blue Content at Night: White Color Tuning vs CIRCADIAN NightSafe™

Comparison between White Color Tuning Products and CIRCADIAN NightSafe™

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- Look for fixtures that are independently verified to provide less than 2% blue light content at night.

Red Flag
- If the lighting company can’t (or won’t) tell you how much blue light is emitted at night (what percent of visible light is blue)… that’s a major red flag.
- If the blue-light emission levels are greater than 2% that is another red-flag.

Comparison of Blue Content at Night: White Color Tuning vs CIRCADIAN NightSafe™

<table>
<thead>
<tr>
<th>Wavelength (nm)</th>
<th>BioActive Blue Content (%)</th>
<th>CIRCADIAN Blue Content (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>450</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>500</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
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Comparison between White Color Tuning Products and CIRCADIAN™ NightSafe™

<table>
<thead>
<tr>
<th>Blue Content (% of peak)</th>
<th>White Color Tuning</th>
<th>CIRCADIAN NightSafe™</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>1%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>2%</td>
<td>0%</td>
<td>0%</td>
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<tr>
<td>3%</td>
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<tr>
<td>4%</td>
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<td>5%</td>
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<tr>
<td>6%</td>
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<td>7%</td>
<td>0%</td>
<td>0%</td>
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<tr>
<td>8%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>9%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>10%</td>
<td>0%</td>
<td>0%</td>
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% Classified as Having Excessive Sleepiness

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<tr>
<th>Time of Measurement</th>
<th>Pre-Installation</th>
<th>Post-Installation</th>
</tr>
</thead>
<tbody>
<tr>
<td>50%</td>
<td>10%</td>
<td>5%</td>
</tr>
<tr>
<td>10%</td>
<td>5%</td>
<td>2%</td>
</tr>
<tr>
<td>0%</td>
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