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What is Health-Bright™ Lighting Technology?

Health-Bright™ lamps are designed to maximize visual perception, reduce eye strain, eliminate adverse effects of flicker or harmonic hum, and address spectral deficiencies that can negatively impact health, wellbeing, and human performance. Simply put, Health-Bright™ technology is the first and only advanced artificial lighting that specifically addresses particular aspects of health, energy savings, safety, and the environment. For decades, scientists and doctors have known lighting influences how we feel, think, react, and perform. Yet, very little attention was given to creating healthful lamps… light that is more than just adequate, but that actually promotes wellbeing.

To understand the Health-Bright™ approach, it is important to define certain characteristics of typical artificial lighting. First, artificial light is any light generated from a source other than day-lighting, meaning the sun. There are four generally known interior lighting types:

- Incandescent (filament bulbs)
- Fluorescent (T12, T8, T5, CFL)
- High Intensity Discharge "HID" (halogen, metal halide, high pressure sodium, etc)
- Light Emitting Diode (LED)

Each of these technologies has significant drawbacks. For example, incandescent bulbs are very hot and extremely inefficient which is why they are being phased out by law. Although fluorescent lamps are more efficient, they are considered among the least healthful interior lights because their typical spectrum is highly deficient compared with natural sunlight and they can vibrate or "flicker" at rates between 60 cycles and 120 cycles per second. This flicker causes a strobe effect that has been associated with headaches, eye strain, general fatigue, sleep disorders, seasonal mood swings, and malaise. In addition, fluorescent ballasts often cause a hum or buzz that can be very distracting within the workplace. Although there are several brands of fluorescent lighting that generate "full spectrums" to mimic sunlight, the intensity and uniformity of the light output is lacking and fluorescent bulbs notoriously lose from 20% to 30% of their lumen output within the first few months of operation.

Still, a great deal of interior lighting retrofitting is being done using T8 and T5 fluorescent fixtures. Unfortunately, the prime motivating factor is energy efficiency and low initial cost

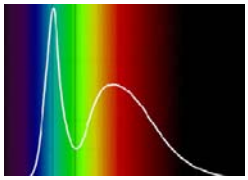
without considering adverse health consequences and reduced productivity. The saying, "You get what you pay for," appropriately applies to such lighting. In order to upgrade to "full spectrum" fluorescent bulbs, prices frequently double or even triple. Ballasts for T8 and T5 fixtures can often be the most expensive part of a fixture, increasing maintenance costs well beyond the cost of bulb replacement. Equally important, most T8 and T5 bulbs are in service well beyond their useful life cycle. These bulbs should never be used until they fail. They should be replaced before performance falls below 60% of their rated lumen output which requires regular and diligent measurements with an appropriate light meter.

High intensity lights like halogen are efficient, but usually produce a blue spectral bias. This emphasis upon the short wavelength creates a perceptible imbalance that makes colors oblique and more difficult to distinguish. Spectral bias has been linked to eye strain and cannot be tolerated in working environments that require high color resolution as measured by the color rendition index (CRI). Moreover, halogen and other high intensity lighting are very hot with bulb surface temperatures exceeding 900°F. This means fixtures must be safely mounted away from general access to avoid serious burn injuries or fires. Monochromatic lamps like high pressure sodium (HPS) produce extreme spectral bias in the orange range, making color differentiation virtually impossible. HPS is not generally used indoors, but is deployed in outdoor work areas, for road lighting, in garages and parking lots.

High intensity lighting often suffers from narrow dispersion patterns because the light source is concentrated and substantially relies upon fixture geometry and reflector design to project light with rapidly deteriorating lumen intensity at the periphery of the light projection. This requires significant pattern overlapping to create lighting uniformity. What may be saved in efficiency per fixture can be lost in the number of fixtures needed to provide a satisfactory result.

Light Emitting Diode (LED) fixtures have become increasingly popular because of their modern appearance and energy-saving properties. However, LED lamps suffer from spectral bias with peaks in blue and yellow. Further, individual LED failures within a multi-LED fixture can degrade light output well before the end of the anticipated life-cycle. LED lamps tend to be expensive, but have very good power efficiencies. On the other hand, LED lighting suffers from a phenomenon know as "droop" which is an inability to maintain lumen output as power is increased. Droop limits the power-to-output potential for LED lighting, forcing the use of more lamps to achieve acceptable lumen levels. Like high intensity lighting, power savings can be lost to lamp redundancy.

One of the most significant drawbacks to LED is overcoming the emission gap resulting from the green-yellow region of the visible spectrum (515-600 nm). Even when multiple LEDs of different colors are combined to simulate white-light, or one or two different colored LEDs are used to activate phosphors to produce white light, current designs lack efficient production of blue-red or green-yellow photons for true white-light color. The result is a highly distorted or uneven white light that can cause negative reactions in people who are sensitive to the spectral irregularities.



Most important and not widely publicized, it is **dangerous** to look directly at a white LED light source. This is because the small focal point is extremely bright. If there is ultra-violet skew,

the eye can be damaged by direct exposure. This is why LED lighting without lenses is **not recommended for elementary or middle schools.** Although LEDs can be incorporated into a wide variety of designs for offices, often an unusual design within the workspace can be distracting and may not offer the illumination quality necessary for optimum productivity. Unquestionably, LEDs offer decorators many choices for an impressive front office or waiting room. However, decorators are not lighting engineers and frequently choose aesthetics over lighting quality. Adverse health issues of LEDs are just beginning to be addressed.

Introducing Health-Bright™ Lighting Technology

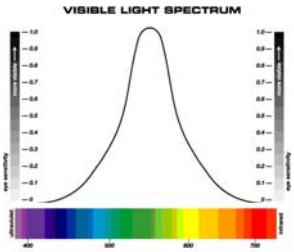
Health-Bright™ technology employs a totally different approach called Magnetic Induction Light (MIL). This process was actually invented and patented in 1891 by the famous inventor Nikola Tesla. MIL is an extremely efficient way to produce very high quality light using **60% to 80% less energy** than conventional incandescent bulbs. However, Tesla's invention was not commercially embraced because MILs have no electrodes and can last in excess of 100,000 hours. This implied that MILs would rarely need replacing, which was not a good business model at that time.

Today, the extremely long MIL life-cycle represents a significant advantage, **saving as much as 600% in maintenance costs** compared with conventional interior lighting. The combination of high quality light, energy savings, and long life makes MIL an excellent starting point for developing the ultimate line of healthful and sustainable fixtures. Ultra-Tech™ Lighting has taken MIL to the next level by incorporating these important unique features:

- Tuned frequency solid state electronic ballast eliminates undesirable harmonics
- Electronic ballast specifically designed to match each MIL bulb wattage and color temperature (Kelvin)
- Highly refined and balanced phosphorous bulb coatings to produce properly balanced spectrum to increase visual acuity
- High Color Rendition Index (CRI) exceeding .90 increases color differentiation
- Special nano-reflective materials maximize lamp output within visually effective range
- Fixture geometry increases efficiency and lighting pattern versatility
- Specialized lenses provide optimum dispersion with minimal lumen loss
- Cool operating temperatures
- Instant strike – do not require cool-down or long warm-up
- Insensitive to on/off cycles

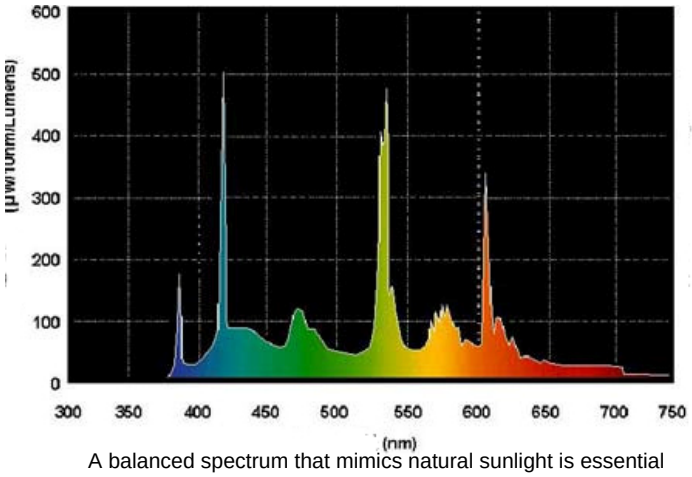
Consider the Health-Bright™ differences. Studies suggest that as much as 80% of headaches in working environments may be due to lighting. In particular, the strobe effect (SE) caused by flicker in fluorescent lighting has been linked to migraines and even epileptic reactions known as photosensitive epilepsy (PSE). In fact, there are some individuals who can become nauseated when exposed to certain strobe frequencies, and some fatigue syndromes are now being linked to the strobe effect of T5 and T8 fluorescent lighting. Moreover, strobe effect can actually be dangerous in certain work environments that require manual dexterity and concentration. On moving assembly lines, strobe effect can actually interfere with movement perception much the same was as a disco strobe light appears to stop action. Strobe effect can interfere with basic tasks like reading, viewing video, or using a display monitor that may have a confounding alternative strobe frequency. **In effect, strobe effect is simply bad for lighting.**

Health-Bright™ technology incorporates an electronic ballast that operates at 1,900 times the frequency of fluorescent ballasts to activate an extremely stable light and eliminate SE. Health-Bright™ lamp ballast frequencies range from 110,000 cycles per second (cps) to 250,000cps as compared with 60cps and 120cps produced by fluorescent ballasts operating on standard U.S. electricity (110V @ 60Hz alternating current). This means that Health-Bright™ technology eliminates one of the primary suspected causes of headaches, queasiness, and disorientation. Health-Bright™ technology generates steady consistent light for a more healthful environment.



An equally significant problem shared by incandescent, fluorescent, HID, and LED lighting is an uneven or truncated visually perceptible spectrum. The human eye only processes a very narrow band of the electromagnetic spectrum between 400 and 790nm. Within this range, the eye has greater sensitivity to the middle spectrum; green-yellow light. HID are notorious for a high UV and blue bias. This is why a direct view of an HID source tends to look blue-white. This bias distorts color perception, causing yellow and green to wash out. By the same measure, LED lights must use filters or phosphors to simulate white light. This process lowers efficiency by limiting lumen output and does not achieve an even spectral distribution that targets enhanced visual acuity. Based upon current technology, the maximum color temperature measured in Kelvin (K) for most LEDs is less than 5,000K. Generally, the range is between 2,500K and 3,000K. This means that even if the LED fixture is balanced to produce a more healthful spectrum, the intensity of the output within the targeted range is modest.

Health-Bright™ technology maximizes visual acuity and associated perception by aligning the spectral output to the needs of human vision. The magnetic induction light uses a specialized phosphorous formulation that produces spectral peaks in conjunction with the eye's photosensitivity. However, these spectral adjustments are also highly correlated to the full visible spectrum of sunlight. The result is a more natural light that evokes wellbeing. Studies demonstrate that mental and physical performance is enhanced by properly balanced light. While nothing beats nature, Health-Bright™ comes as close to healthful natural light as possible.



A balanced spectrum that mimics natural sunlight is essential for maximum visual perception and acuity. By adjusting for spectral sensitivity, Health-Bright™ lighting actually enhances the ability to distinguish colors and resolve shapes and dimensions.

The spectrum is also related to color intensity which is measured as Kelvin. This is not the same as the actual lamp heat temperature; rather it is the brightness within the spectral range. Most lighting is limited to a maximum of 5,500K which is approximately the same as overcast daylight. Consider that 5,500K is almost the **maximum** for HID and most LED. Florescent bulbs generally fall between 2,500K and 3,000K; anything higher is usually a special order. Health-Bright™ lighting technology reaches 10,000K. This provides a significant additional margin of brightness that can increase visual performance while reducing eye strain and fatigue.

Health-Bright™ is actually a combination of exceptional lighting and light therapy… all in one. For example, light therapy for treating Seasonal Affective Disorder (SAD) has only recently been recognized as an effective approach for certain forms of lethargy and depression associated with seasonal changes. The Centre for Addiction and Mental Health in Toronto, Canada, conducted a study to examine light therapy as an add-on treatment for adult ADHD. Fifty-five percent of the subjects experienced less depression symptoms and approximately twenty-eight percent had **full** or partial improvement in ADHD symptoms measured by questionnaires and lab testing.

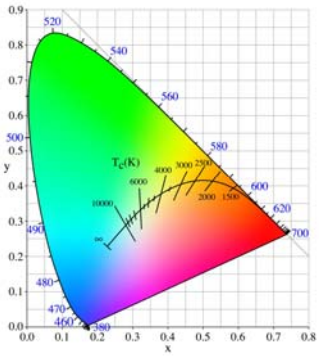
In academic environments, appropriate lighting can relieve:

- Inattention
- Hypo-arousal (lethargy and fatigue)
- Hyper-arousal (jumpiness, irritability, sensitivity, insomnia)
- Impulsive response to stimuli
- Concentration problems

These conditions are often associated with attention deficit hyper activity disorder (ADHD). However, the wrong lighting can cause symptoms to manifest in a general population. Health-Bright™ coincidental therapeutic effects can address light-related problems that may not have been properly identified. This is critically important in educational environments, offices, retail stores, warehouses, and assembly facilities. The fact is that almost all forms of work require visual acuity and mental concentration. What is gained in productivity by using Health-Bright™ technology goes far beyond the hard savings on electricity and maintenance.

Another interesting Health-Bright™ advantage is the correlation to light absorption by chlorophyll; from 380nm-480nm and 650nm-700nm. Just enough light within these ranges helps to promote vibrant indoor plant growth. Health-Bright™ does not release light in ultra-violet ranges associated with eye damage such as cataracts.

The Health-Bright™ Difference



Only Ultra-Tech™ Lighting MIL fixtures use Health-Bright™ technology for indoor and security lighting. Consider these unique features:

No other lighting delivers more visually effective lumens with less energy. However, the most impressive aspect of Health-Bright™ may be found in increased productivity. How often is lighting performance measured in terms of improved student test scores or greater production line output? What is the cost of worker fatigue, sick days, and vision-related errors? What is a more healthful environment worth? When these primary objectives of lighting are placed into the cost/benefit analysis, Health-Bright™ outshines all the rest.

By taking lighting up to 6,500K or even 10,000K, Health-Bright™ fixtures provide more **usable** light at the work surface. Whether it is a student's desk, office space, an assembly line, retail shelving, or the proofing room for a printing operation, more usable light means better overall

performance. To be sure, Health-Bright™ lighting can improve environments for hospitals, nursing homes, showrooms, studios, exhibition areas, and medical buildings. With the same metric, optimum lighting using a 6,500K to 10,000K lamp can be accomplished with lower wattage, saving energy.

Of course, Health-Bright™ technology is available from 3,500K up to 10,000K. There are some applications that require a lower color temperature, but with the same spectral balance.

The Ultimate Value Proposition

Consider a salaried worker earning $40,000 per year plus typical benefits of 12% on base pay and 6.2% FICA tax. The total annual cost of the worker is $47,280. According to numerous studies, full spectrum light can potentially increase worker productivity between 10% and 20%. Student test scores in double-blind studies have moved up between 5% and 20% simply by changing lighting. This suggests using a compromised light will *decrease productivity.* When quantified, the numbers are significant:

Salary/taxes/benefits	Efficiency Improvement	Value Proposition
$47,280.00	5%	**$2,364.00**
	10%	**$4,728.00**
	15%	**$7,092.00**
	20%	**$9,456.00**
$59,100.00	5%	**$2,955.00**
	10%	**$5,910.00**
	15%	**$8,865.00**
	20%	**$11,820.00**

With only five workers raising efficiency 5%, increased productivity is worth $11,820 at the $40,000 base pay level and $14,775 at the $50,000 base pay level. More likely, improvements would be in the 15% range which translates to $35,460 at the $40,000 base pay and $44,325 at the $50,000 base pay… almost the value of another full salary. Keep in mind that these are *annual* savings that repeat every year. When presented in a payback analysis, productivity increases cover lighting costs within a few months.

In a technical paper, "The economic burden of lost productivity due to migraine headache: a specific worksite analysis," authors Burton WN, Conti DJ, Chen CY, Schultz AB, Edington DW report that a large financial service industry company with 80,000 employees loses between $21.5M and $24.4M per year; approximately $305 per worker annually. However, the actual average worker loss from light-related disorders can be many times more because light impacts the total worker population to produce adverse affects such as depression, sleep depravation, non-migraine and migraine headaches, lower immune response, and general malaise. Based upon correlated studies, as much as 20% of absenteeism may be light related. This suggests that an associated reduction of absenteeism among just five workers can represent 100% of a man year.

Associated financial advantages go much further when considering impacts upon healthcare costs. Better lighting means better working conditions. This lowers illness and healthcare overheads. For self-insured firms, this is a major consideration.

Health-Bright Advantages Go Beyond Lighting

Health-Bright™ technology provides a major environmental feature that goes beyond lighting. Today's environmental awareness and our sustainability needs are addressed by the "Green" nature of MIL fixtures. Unlike fluorescent bulbs, mercury lamps, and other lighting that uses dispersed mercury, MIL bulbs employ a solid mercury amalgam slug that can be clipped and recycled. There are no PCBs or circuit boards like LED lamps. MIL glass bulbs are 100% recyclable. Even the induction magnets can be sent back to Ultra-Tech™ Lighting for recycling or simply disposed of as metal.

A small solid mercury amalgam ball is easily and safely snapped off for recycling. Magnets are recyclable metal and the remainder of the bulb is disposable glass.

With serious legislative proposals to impose high disposal fees on hazardous waste, the environmentally friendly design of MIL bulbs is an important consideration. The extraordinary 100,000 hour expected life-cycle represents eleven years, operating 365 days by 24 hours per day. For most applications, Health-Bright™ technology lamps will continue to perform for more than a quarter of a century. This means less maintenance, less disposal, less potential fees, and a more sustainable lighting.

By comparison, fluorescent and compact fluorescent (CFL) bulbs have dispersed mercury that requires bulbs to be disposed of as hazardous waste. Breathing in vapors from a broken fluorescent bulb is highly toxic and can lead to mercury poisoning and respiratory problems. In fact, many lung disorders experienced by rescue workers and clean-up crews at the World Trade Center site have been linked to the thousands of fluorescent bulbs that were crushed and dispersed into the atmosphere.

Although LED bulbs do not contain mercury, the circuit boards that drive LED lamps can contain toxic chemicals such as PCBs. Since LED strips are frequently bonded or integrated into the circuit boards, expired lamps must be handled as hazardous waste.

The fact that Health-Bright™ lighting can reduce energy consumption by up to 70% represents a substantial decrease in carbon footprint, helping to curb greenhouse gas emissions such as CO_2, NOX, and SOX. According to the Energy Information Association (EIA), lighting accounts for up to 40% of overall electric consumption on average. This means that a 60% reduction in lighting power can drop overall energy use by more than 20%.

From a health perspective, no other technology gives you all the features and advantages of Health-Bright™ technology. Find out more by contacting:

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60 Watt
80 Watt
120 Watt

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40 Watt
60 Watt
80 Watt
120 Watt

High-Bay fixture available in:

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