LED Lighting Update

A consumer guide to energy efficient LED lighting

WAC LIGHTING

Responsible Lighting™

The WAC Lighting Promise

The pace *of technological advancement can be dizzying, making it difficult to understand your opportunities and risks at any given moment to commit to an investment. WAC Lighting products and people make the decisions simple both now and for the long run.*

The Test

WAC Lighting's LED luminaires all must pass a basic test:
– Does it out perform conventional light sources to meet the application requirements?
– Does it showcase the best qualities of the technology?

As an LED leader, we engineer even the smallest details within our products. Drivers, PCB assemblies, and LED modules are customized to the needs of the design and the lighting application.

Peace of Mind

Not constrained by available module technology in the marketplace, WAC Lighting selects reliable technology at the cutting edge of innovation, testing independently, and extending the applicable life of the product. With in-house engineering, we offer peace of mind providing long-term support for the products we develop as the technology continues to advance.

Responsible Lighting

The standard we uphold is our deep commitment to eco-friendly manufacturing, extensive research and development, energy saving technology, design aesthetics and community involvement. With 90% of our products fabricated in our zero-landfill campus where we know all the inputs and throughputs, we can stand behind a 5 year warranty. WAC Lighting's portfolio of LED luminaires offers real world solutions and long term confidence.

Intro to LED Lighting

Applications

Capabilities

How efficient are LEDs?

The key strength *of LED lighting is reduced power consumption. When designed properly, an LED source will approach* ***80% efficiency****, which means 80% of the electrical energy is converted to light energy. The remaining 20% is lost as heat energy. Compare that with incandescent bulbs which operate at only about 5% efficiency (95% of the electrical energy is lost as heat).*

What does this mean for me?

Protect the Environment

» Consuming less energy results in fewer power plant and green house gas emissions.
» Long life means less trash, therefore reducing the amount of landfill waste.
» LEDs are 100% recyclable, containing no toxic metals, hazardous mercury or halogen gases.

Save Energy

» LED fixtures use *50% less* energy than CFL fixtures.
» LED fixtures use *85% less* energy than incandescent fixtures.
» Cooler operating temperature means less energy used for heat dispersion.

Save Money

» LED fixtures generally pay for themselves in less than 2 years.
» Return on investment can easily be 10 times the initial cost of the product.
» Minimal maintenance and long life means significant savings over the lifetime of the product.

Lumens not Watts

Consumers have *been purchasing light bulbs based on the amount of wattage, with the assumption being the higher the wattage the brighter the bulb. In reality, the amount of light generated is measured in lumens; wattage is the measure of energy being used to produce light. The more energy used, the higher our monthly bill, so why do we purchase bulbs by the amount of wattage? The chart below is a comparison of three light sources and the wattage (energy) required to achieve the same lumen output (amount of light). You'll notice that LEDs require significantly less wattage than CFL or incandescent bulbs to produce the same amount of light, therefore saving you money on your energy bill, while maintaining the same level of brightness.*

Power Consumption (Wattage)			Brightness
Incandescent	CFL	LED	Lumens
40	8-12	6-9	400-500
60	13-18	8-12.5	700-900
75-100	18-22	13+	1100-1750
100	23-30	16-20	1800+
150	30-55	25-28	2780

Light Source Comparison

	Incandescent	CFL	LED
Life	1,000 hrs+	10.,000 hrs+	50,000 hrs+
Efficacy (Lumens per Watt)	~10	~50-60	~70-90
Color Rendering Index	100	80+	80-90+
Color Temperature	2800-3000	2700-6000	2700-6000
Dimming	Easy	Poorly	Varies
RGB	No	No	Yes
Initial Cost	Low	Medium	High
Radiated Heat	High (85 btu's/hr)	Medium (30 btu's/hr)	Very Low (3.4btu's/hr)
UV Radiation	Minimal	Yes	None
Power Converted to Visible Light	~8%	~20%	~20-50%
Contains Mercury	No	Yes	No
Instant On	Yes	No	Yes
Operates at Low Temperatures	Yes	No	Yes
Durability	Fragile	Fragile	Durable
Size	Medium	Large	Small
Directional	No	No	Yes
Fixture Optical Efficiency*	50	50	~70-80

** % of light generated by the lamp source that is emitted by the fixture.*

Why choose LEDs?

Points of Interest:

Quality Of Light

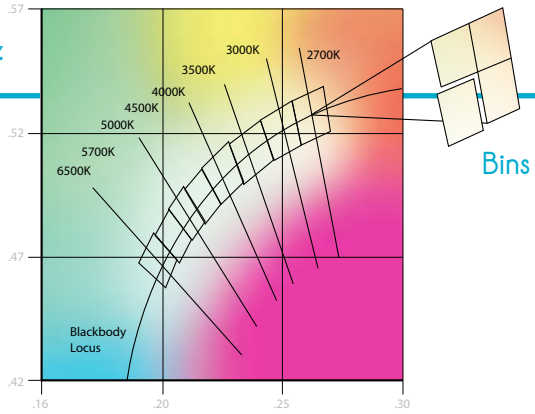
CRI (Color Rendering Index) refers to color accuracy, specifically the ability of a light source to reproduce the colors of objects similar to an incandescent lamp. A CRI of 85 to 100 indicates excellent quality color rendering.
CCT (Correlated Color Temperature) is used to measure the relative color appearance of white light. 3200K and below are considered warm white (more yellow), while 4000K and above are considered cool white (more blue).

Most of WAC Lighting's LED products have a CRI of 80 or higher and are available in both cool and warm color temperatures.

Consistency

The most challenging part in the production of LEDs is achieving a consistent and precise white color. Binning is the process of sorting the white LEDs into groups of similar colors. The regulation of this process is outlined by the ANSI standards for tolerances of white color variations within a color temperature group, or bin. Some LED manufacturers have adopted a more stringent process of sorting called micro-bins, specifying the color point to a scientific accuracy.

WAC Lighting uses micro-bin LEDs that exceed the ANSI binning standards, giving our fixtures optimal color consistency.



Dimming

LED technology responds to voltage and subsequent changes in current differently than traditional incandescent lighting, presenting a unique engineering challenge for maintaining consistent dimming.

WAC Lighting engineers full scale dimming on most of our LED products.

Efficacy

Efficacy measures how efficiently a light source produces visible light by comparing lumen output to wattage consumed. The higher the efficacy number the more efficient the fixture. It is important to verify that the published data from the manufacturer is tested for the efficiency of the complete fixture and not just the LEDs, as the true performance of the fixture may be less.

All published specifications for WAC Lighting LED fixtures are based on testing complete fixtures.

Example	LED	CFL	Incandescent
Wattage (Input Power)	8	15	60
Lumens (Light Output)	450	450	450
Efficacy (Lumens per Watt)	56	30	7.5

Optical Performance

LED fixture manufacturers should be able to demonstrate the real life performance of any given product through extended whole fixture testing.

WAC Lighting has published photometric data available on our website with downloadable specification sheets.

PHOTOMETRIC EXAMPLE

0° Aiming Angle (ceiling to floor)

	LED18S-CW			LED18F-CW		
Distance	FC	L	W	FC	L	W
6 ft	269	1.0	1.0	127	2.7	2.7
8 ft	151	1.4	1.4	71	3.5	3.5
10 ft	97	1.7	1.7	46	4.4	4.4
12 ft	67	2.1	2.1	32	5.3	5.3

FC– Initial footcandle level at the center of the beam
L– Beam length at the point the candlepower drops off to 50% of maximum
W– Beam width at the point the candlepower drops off to 50% of maximum

Lifetime

Rated lifetime is not a warranty. Many LED fixtures available today have a rated potential life of 50,000 + hours, however most product warranties only extend to 1 year.

WAC Lighting's LED luminaires are engineered for an average life of 50,000 + hours AND are backed by a 5 year warranty.

Essential Components of an LED Luminaire

① Driver – *Maintains proper current and voltage levels to the diodes.*

» High powered LEDs require constant current drivers in order to protect the diodes from over-current.
» Optimally designed fixtures include drivers that account for compatibility with dimmers.

WAC Lighting's LED luminaires and drivers have been tested and approved for dimming by our own UL certified laboratories.

② Heat Sink – *Provides heat transference to eliminate excess heat generated by diodes.*

» Optimal thermal management allows LEDs to shine brighter, last longer, and maintain color consistency over time.
» The more conductive the heat sink the smaller it needs to be; die-cast or extruded solid aluminum are among the best materials available.

WAC Lighting designs and engineers die-cast aluminum heat sinks proportional to the excess heat generated by the LEDs, resulting in optimal heat transference.

③ Diodes – *Semi-conductor chips that generate light when direct current is passed through.*

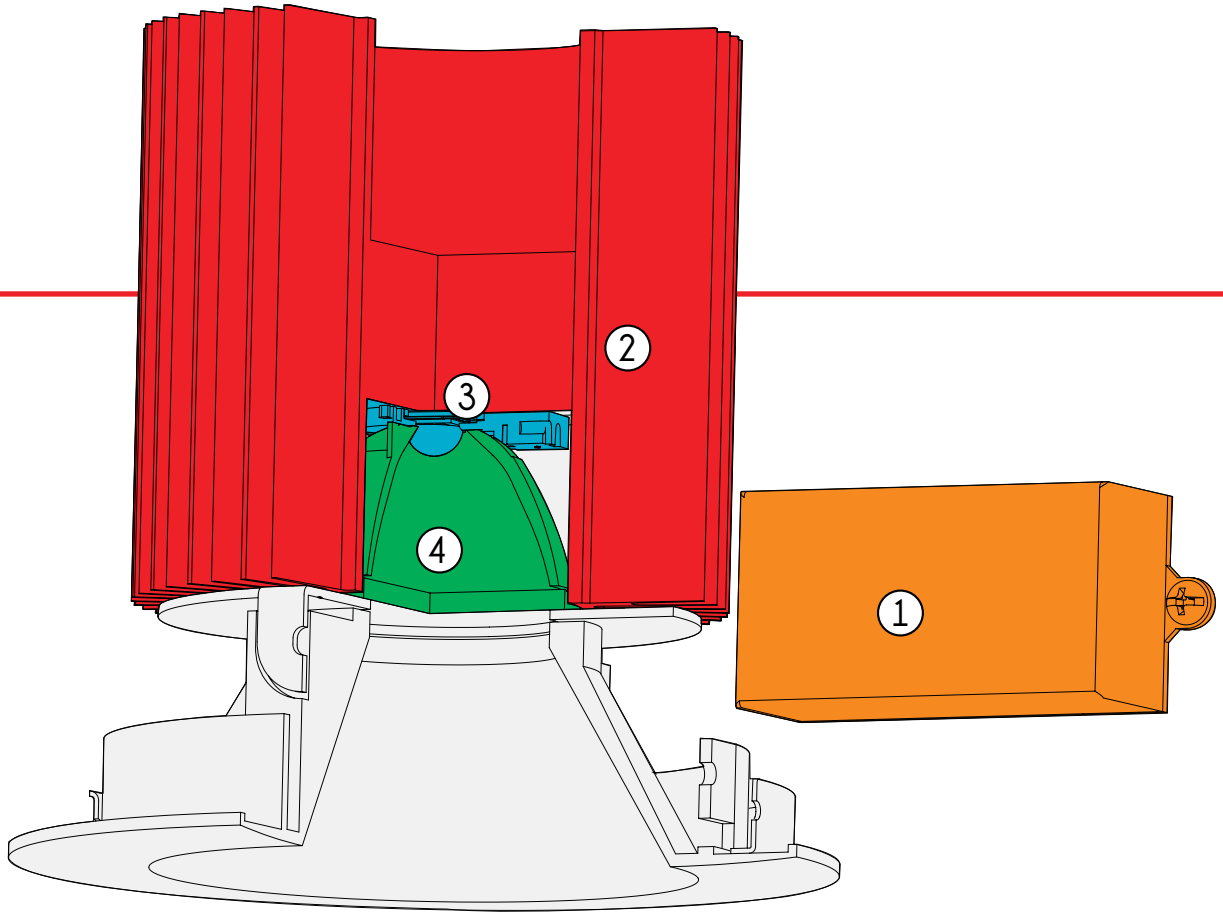
» Highly Efficient; up to 80% of the energy being used for generating light is converted into actual light output.
» Each Light Emitting Diode is designed to operate at a specific level of direct current, provided by the driver with which it is paired.

WAC Lighting uses diodes from the leading LED manufacturers in the industry for the highest quality and performance.

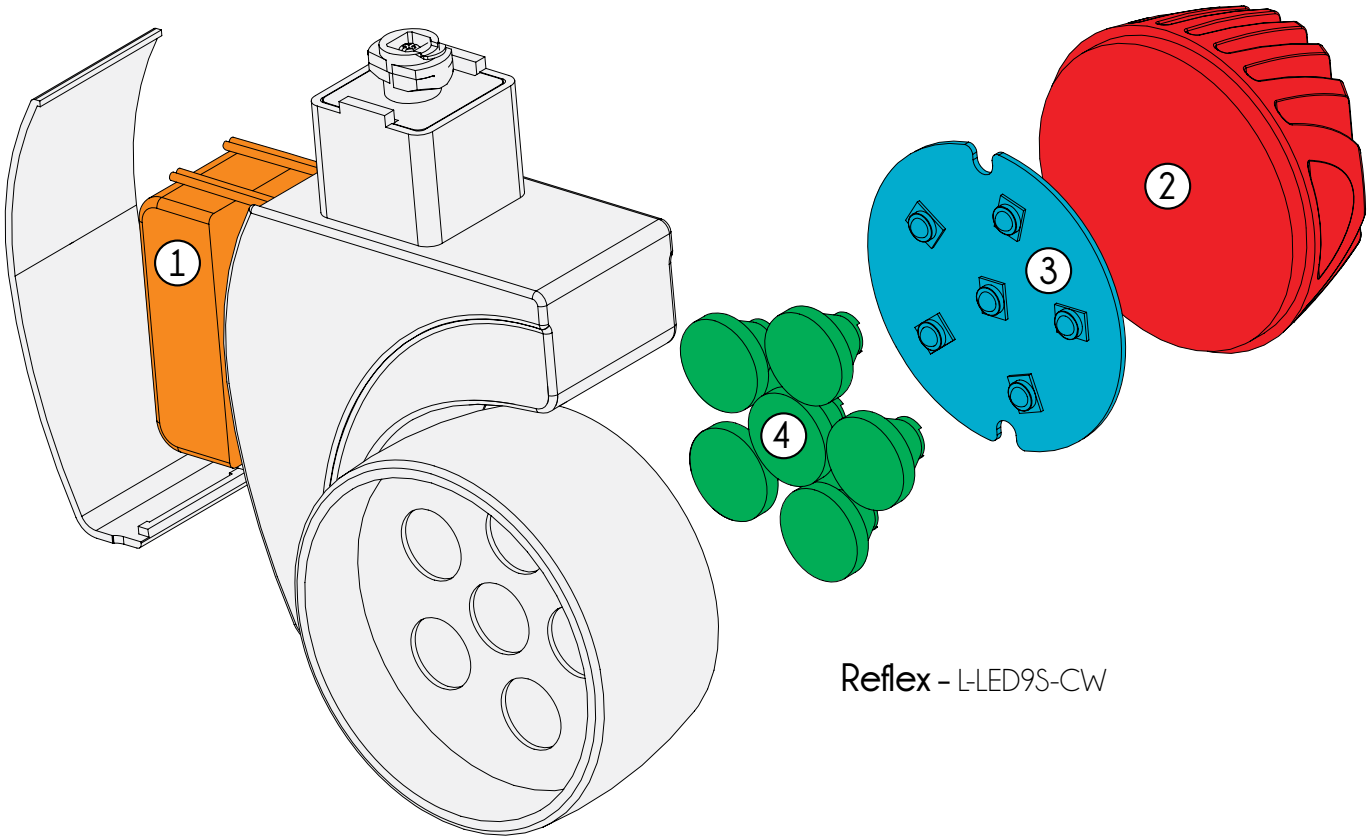
④ Secondary Optics – *Control the beam spread distribution of light from the collimated light of the LEDs.*

» Quality LED optics deliver over 90% of the emitted light more evenly over the lighted area, dissipating hot spots, rings and shadows.
» Due to the directional nature of LED light emission, much less light is lost in other directions not useful for the intended application.

WAC Lighting's LED luminaires may be equipped with various beam spreads for different functions.



Tesla™ – HR-3LED-T118F-W



Reflex – L-LED9S-CW

LED Lighting Today

LED Lighting *is creating a revolution in today's lighting industry. Gone are the harsh blue lights once thought to be an unnatural, and undesirable illuminating effect. Today, the color temperature of an LED can be selected as warm and inviting, or a cooler output for task-oriented applications.*

The small size and low profile of LEDs allow them to be used in spaces that are too small for other lamp sources. In addition, because LEDs give off light in a specific direction, they are more efficient in use than incandescent and fluorescent bulbs, which waste energy by emitting light in all directions.

Costs of LEDs have gone down considerably as well, much like the technology of smart phones.

Energy efficient lighting in a sleek silhouette that is also reasonably priced … Sounds too good to be true, and that is exactly why, at ***WAC Lighting, we will continue to offer you these solutions as they become available to fulfill all of your lighting needs!***

Within each application you will see a chart depicting the market share by technology in 2010 and the predicted growth by 2020.

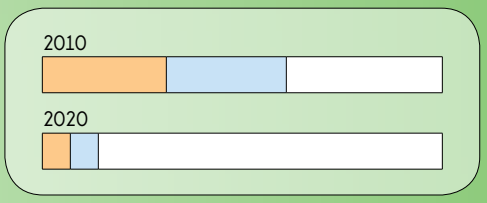
Key: INC HAL HID LFL CFL LED

– INCandescent – HALogen – High Intensity Discharge
– Linear Fluorescent Lighting – Compact Fluorescent Lighting – Light Emitting Diodes

SOURCE: McKinsey Global Lighting Market Model; McKinsey Global Lighting Professionals & Consumer Survey

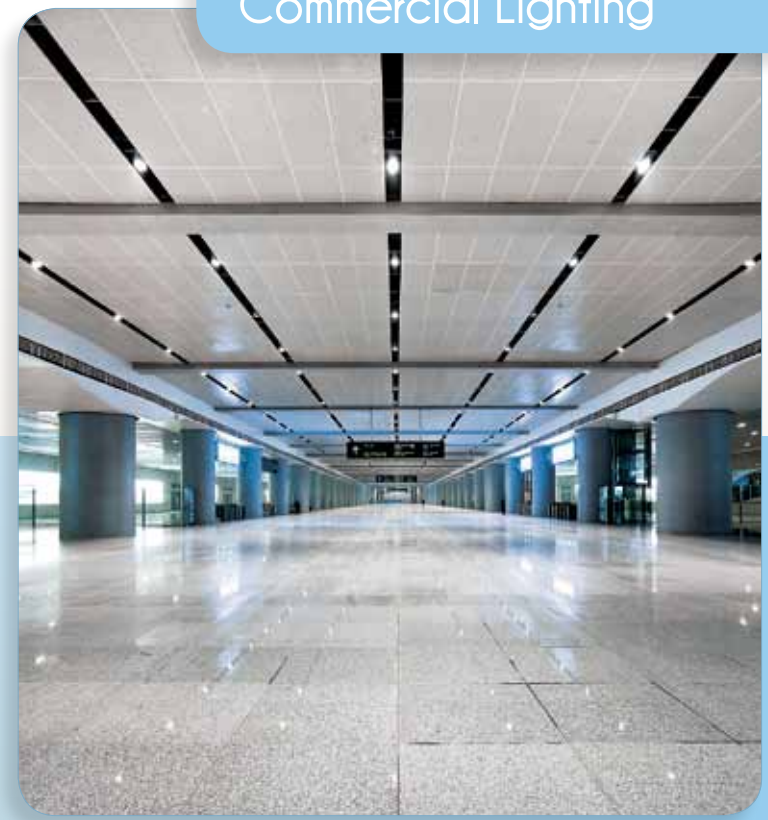
Architectural Lighting

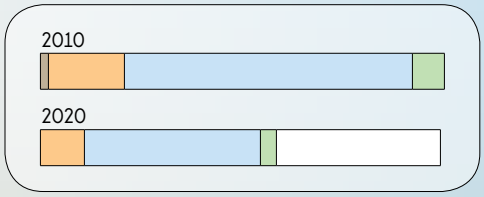
Great lighting is inspired by great spaces, and the world's most prolific architects and designers understand the true value of architectural lighting as a tool for aesthetics, function and performance. WAC Lighting's integration of cutting edge designs and advanced technologies is evident in our award-winning products.



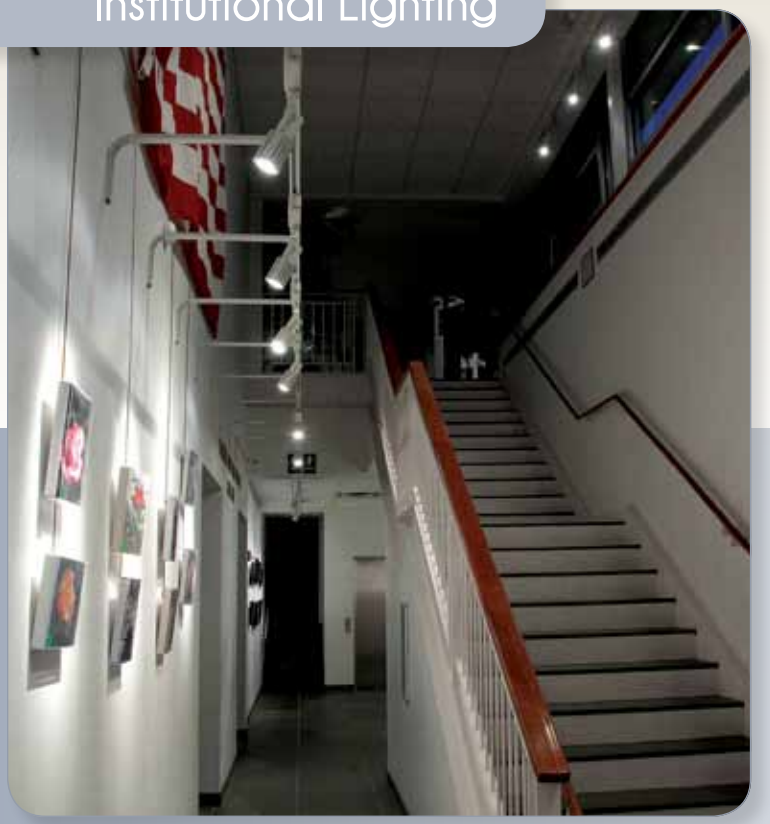
Commercial Lighting

WAC offers a host of creative lighting designs and LED solutions for numerous commercial spaces. Whether it's a national airport, train station or government building, our superior line of recessed and track fixtures, including a breadth of LED solutions, are ideal selections to illuminate the vast spaces of these applications while keeping glare and costs down.

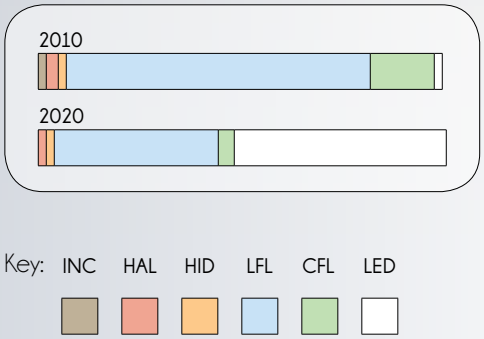




Institutional Lighting

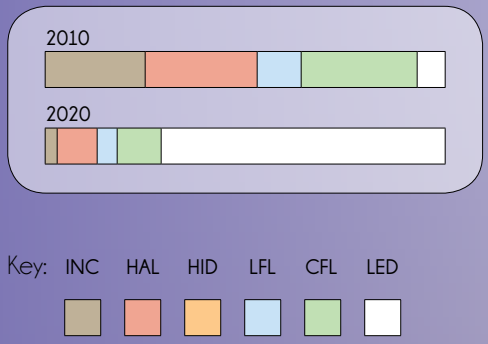


Hospitals save lives, and schools pave the way for our children's futures. More sophisticated lighting systems are being introduced into these facilities to help conserve energy and provide comfortable lighting. Our designs and innovative advancements in LED technology continue to move forward to satisfy these needs and provide a brighter future for all.

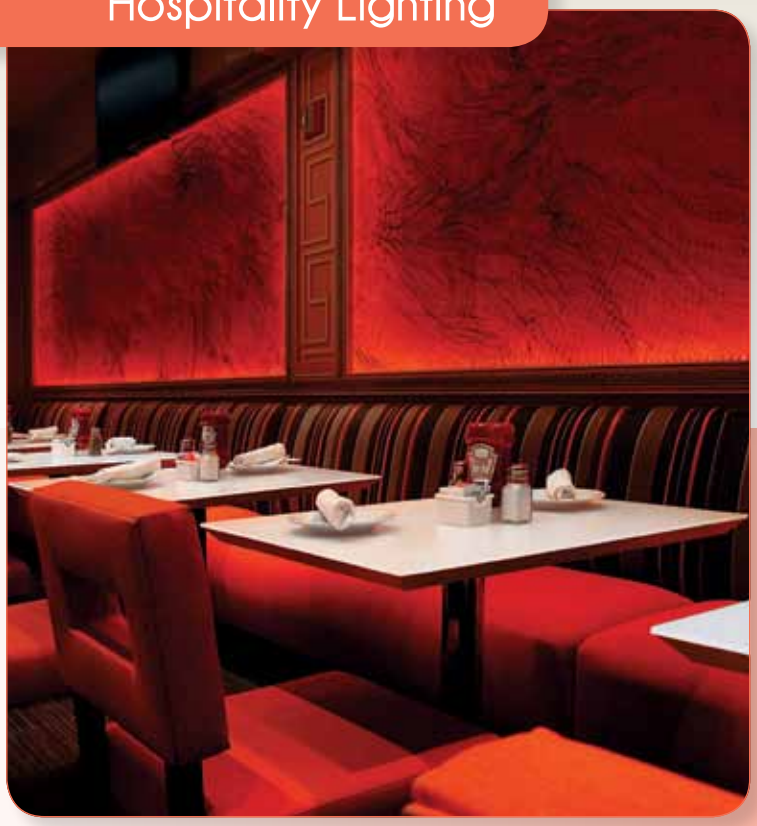


Residential Lighting

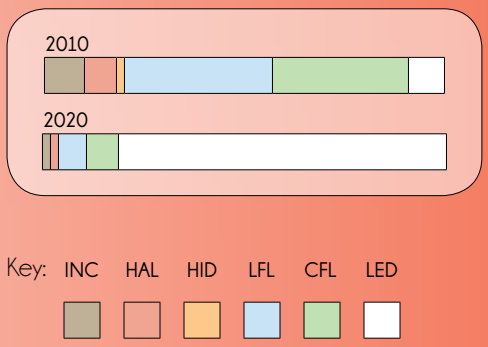
Our homes are where are hearts reside, and thus careful attention goes into every part of where we live. Lighting is critical for a residence to ensure proper illumination while maintaining the aesthetics of the room. The number of luminaires within a residence has consistently risen in the last 20 years, improving quality of life. LED Lighting makes that possible while also improving the utility bills.



Hospitality Lighting

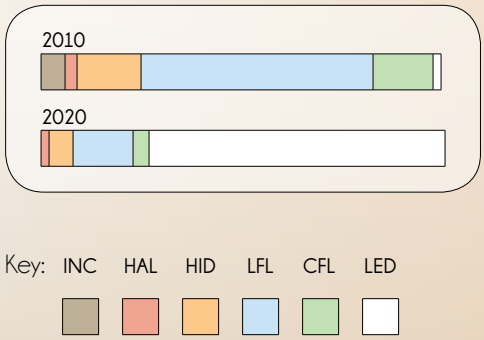


All the best addresses in town accommodate and indulge their guests. The success in creating a memorable experience by these service providers is dependent upon the lighting within. WAC Lighting recognizes this and offers a variety of luminaires designed to generate environments worthy of emotional response.



Retail Lighting

We create products designed to suit retail needs, whether it's to project light onto designer handbags in a boutique or luxury automobiles in a showroom. WAC Lighting offers the latest in energy efficient LED lighting products to provide maximum performance and robust versatility.



WAC Lighting LED Capabilities

Step inside *the world's finest boutiques, hotels and restaurants, museums, public spaces, corporate offices and luxury homes and look around. You will see that each of their architectural accents and design elements is showcased with lighting. Effective energy efficient solid state lighting is engineered and manufactured to bring out the best in today's residential and commercial environments.*

From pendants to track and recessed to undercabinet, WAC Lighting offers a vast array of state-of-the art luminaires for a multitude of applications. Add beauty and drama to any space while saving energy, reducing maintenance costs and extending the life of your decorative and functional lighting.

Recessed Luminaires

www.waclighting.com/go/LED_Recessed

Tesla™

- Up to 812 lumens
- 2 and 3.5 inch apertures
- Adjustable, Wall Wash, Pinhole
- 3000K and 4000K color temperatures
- CRI up to 85

Plana

- Up to 1300 lumens
- 4 and 6 inch apertures
- Adjustable, Wall Wash
- 3000K and 4000K color temperatures
- CRI up to 95

LEDme®

- Up to 600 lumens
- 2, 3 and 4 inch apertures
- 3000K and 4500K color temperatures
- CRI up to 80

Track Luminaires

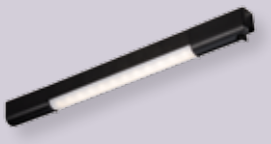
www.waclighting.com/go/LED_Track

LEDme®


Cartier


Impulse


Reflex


Wash Light

- High output LEDs, up to 675 lumens
- Warm and cool color temperatures
- Replaceable LED modules
- CRI up to 85

Paloma™

Vamp

- High output LEDs, up to 1300 lumens
- Warm and cool color temperatures
- Replaceable LED modules
- CRI up to 95

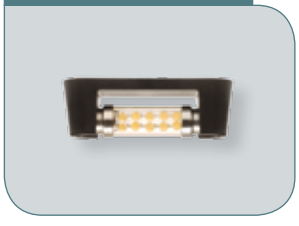
Low Voltage Track Luminaires

www.waclighting.com/go/LED_Linear

LEDme®

- Low power consumption; 1W and 1.5W
- 2800K and 4000K color temperatures
- Customize brightness in coves
- CRI: 80

Festoon Lamp Holder



- Low power consumption; 0.6W
- 3200K color temp
- Direct retrofit for existing 12V and 24V track system

Pendants

www.waclighting.com/go/LED_Pendants

LEDme® Quick Connect™ Pendants

Genesis

Quest

Über

300 Series Glass

500 Series Glass

- Up to 210 lumens
- 3000K color temperature
- Replaceable LED modules
- CRI up to 85

- Up to 230 lumens
- Use with any 300 or 500 series pendants
- Hundreds of options
- CRI up to 80

Quick Connect™ Pendants are compatible with all of WAC Lighting's canopies, tracks and rails.

Fixtures

www.waclighting.com/go/Fixtures

LEDme® Quick Connect™ Fixtures


Forza


Orb


Ovum


Charge


Portal

- Up to 280 lumens
- 3000K color temperature
- Replaceable LED modules

Quick Connect™ Fixtures are compatible with all of WAC Lighting's canopies, tracks and rails.

Cabinet and Niche Luminaires

www.waclighting.com/go/LED_Cabinet

Straight Edge™

Strip Light

- Up to 564 lumens
- Sleek low profile, 24V system
- Available in 5 lengths
- 2700K, 4500K color temperatures

LEDme®

Light Bars

Button Light

Mini Recessed

- Variety of fixture styles
- Durable aluminum construction
- Multiple color temperature options

InvisiLED®

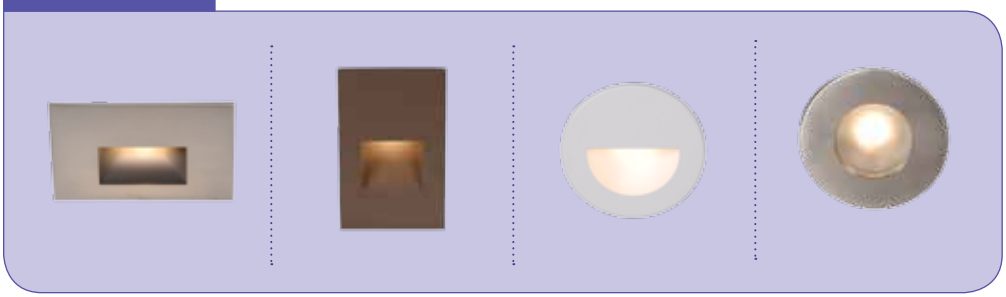
Tape Light

- 12V and 24V systems
- 2 color changing models
- Indoor and outdoor

Step and Wall Lighting

www.waclighting.com/go/Step_Lights

LEDme®



- Direct wiring, no driver needed
- 3000K color temperature
- Replaceable LED modules
- Indoor and outdoor

5 Year WAC Lighting
product warranty

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