

ART 2640, Building Systems of Interior Environments
Fall Semester 2020
Tuesdays & Thursdays 10:30-11:50
Online

Interior Lighting Lamp Types

Lamps

- Incandescent
- Fluorescent
- **High Intensity Discharge (HID)**
- Light Emitting Diode (LED)
- Cold Cathode (Neon)

HID Lamps

Three Common Types:

Metal Halide

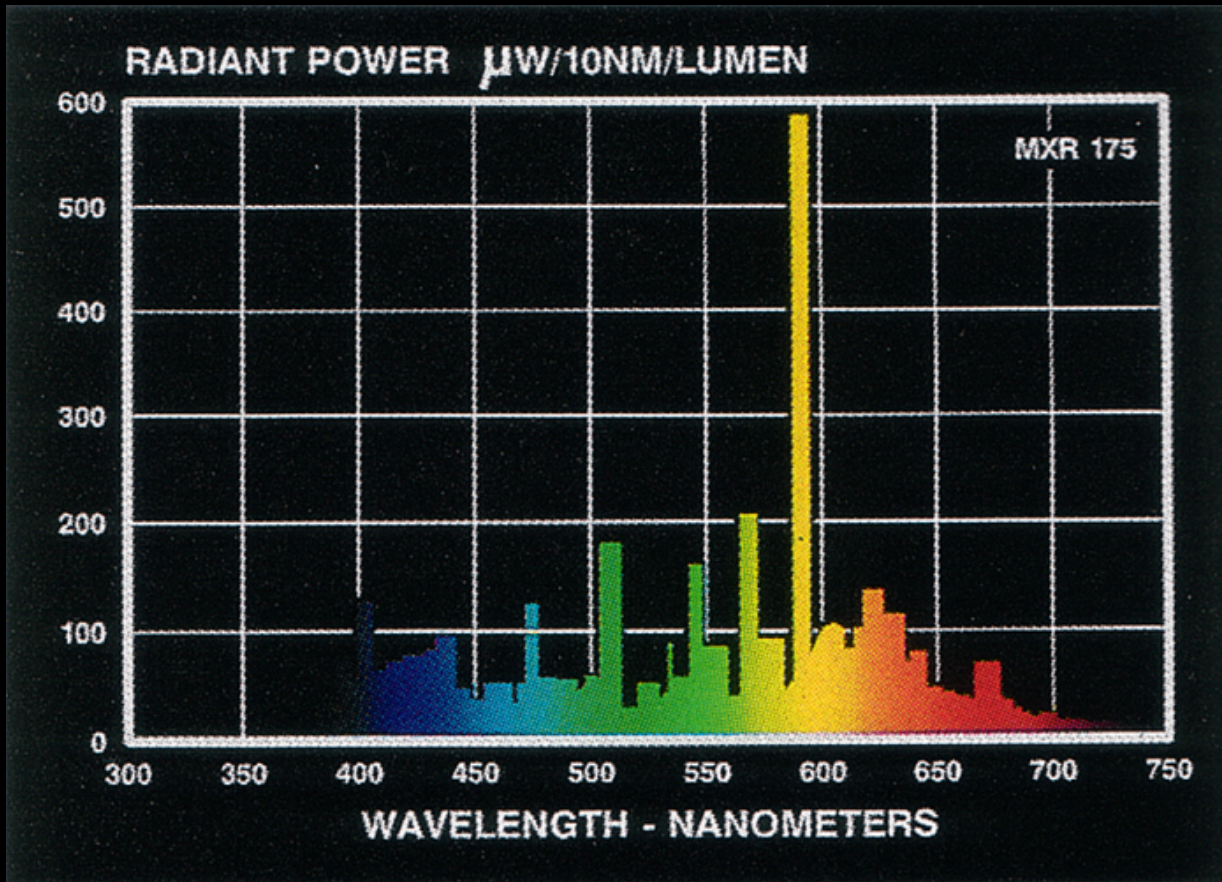
Ceramic Metal Halide

High Pressure Sodium

Mercury



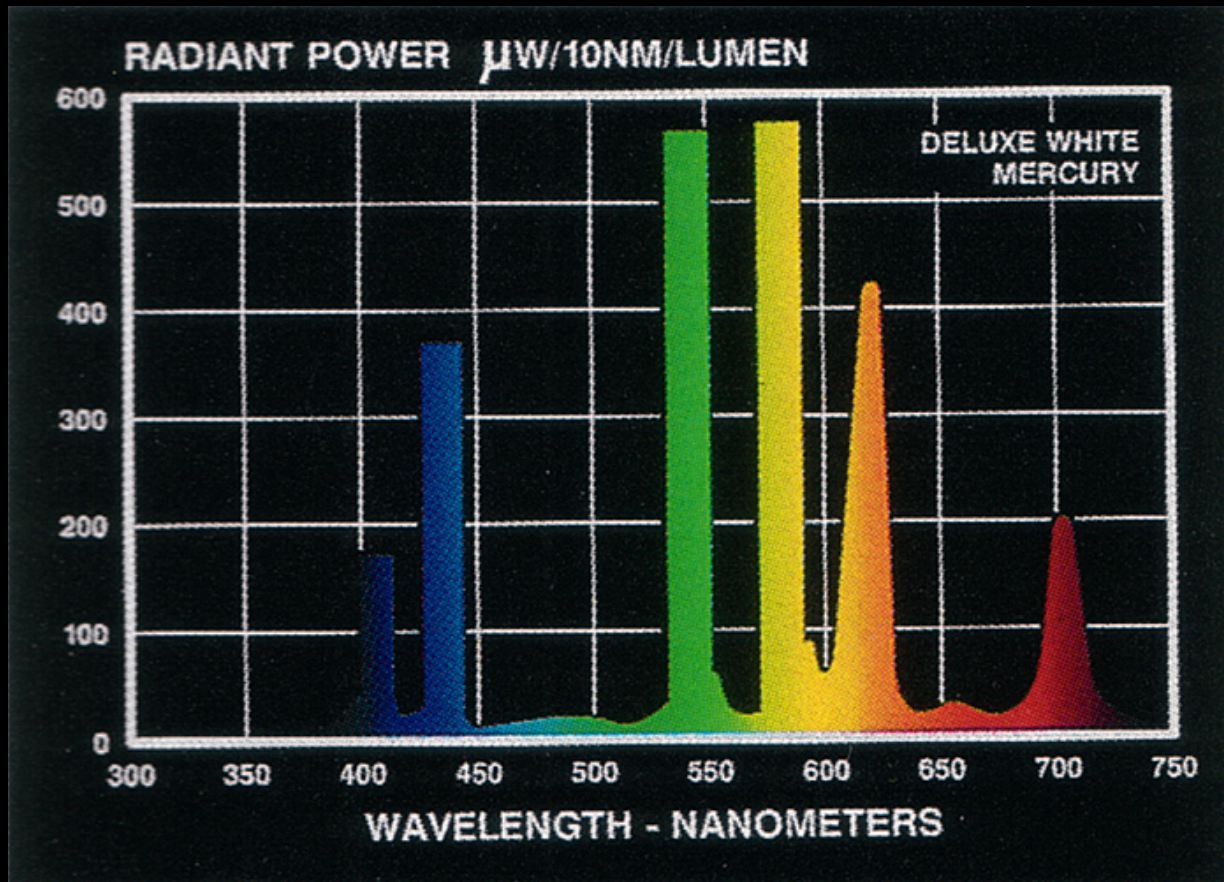
HID Lamps



Metal Halide Spectrum

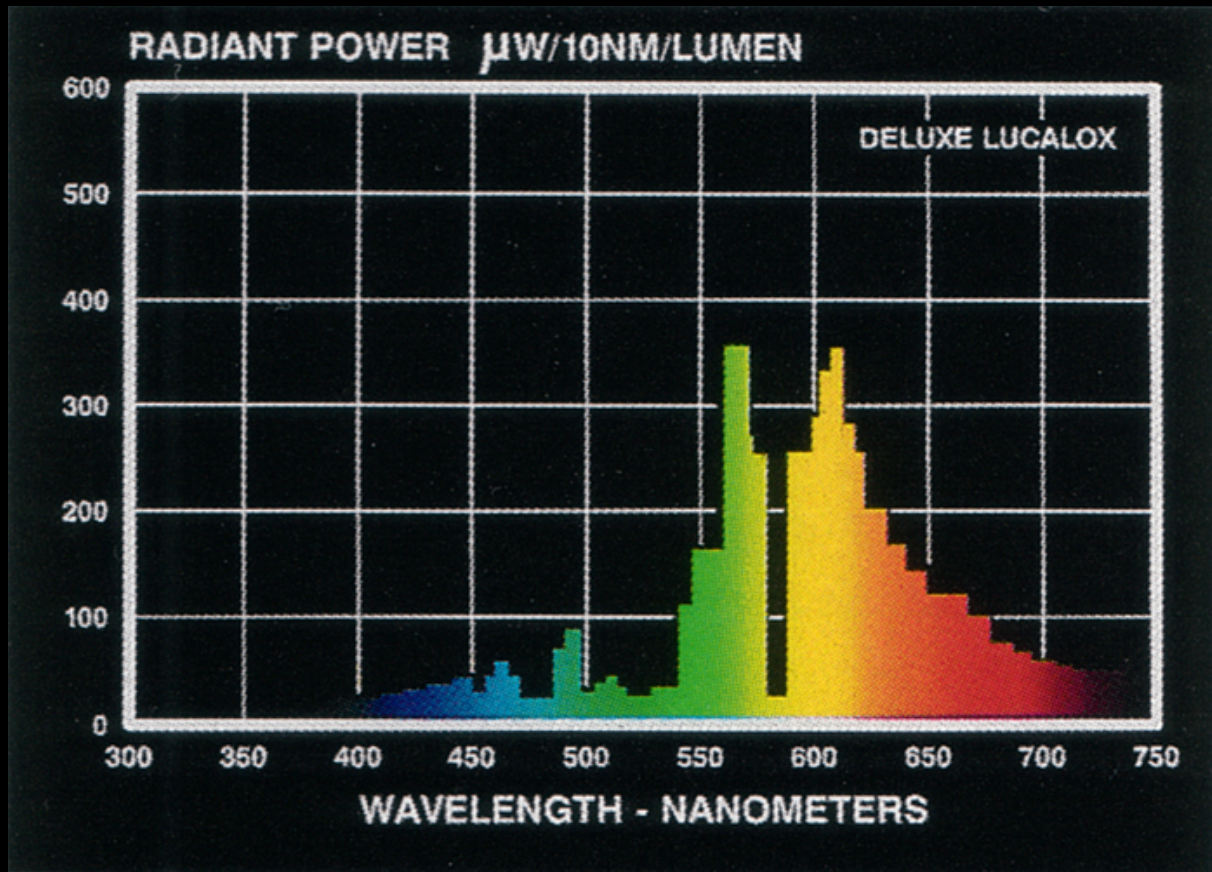
The Spike are a signature of High Intensity Discharge Sources

HID Lamps



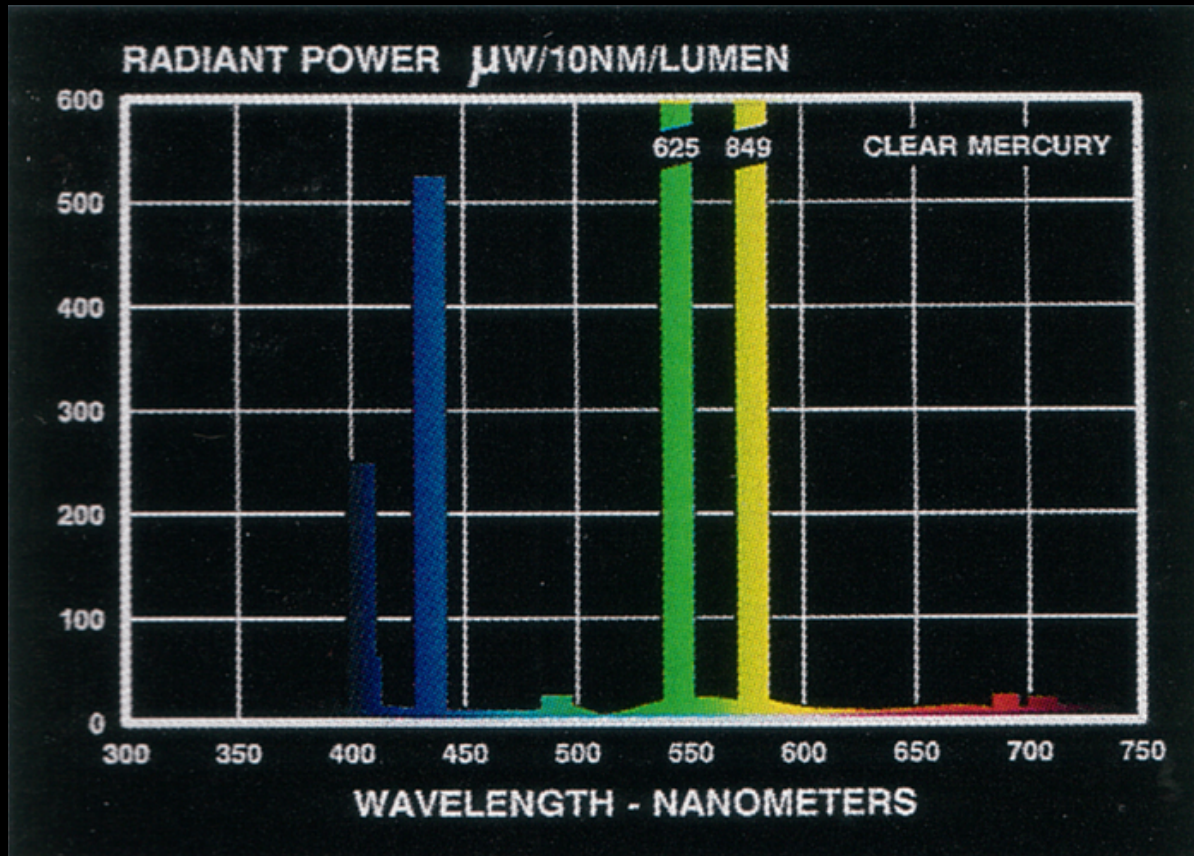
Deluxe Mercury

HID Lamps



Deluxe High Pressure Sodium Spectrum

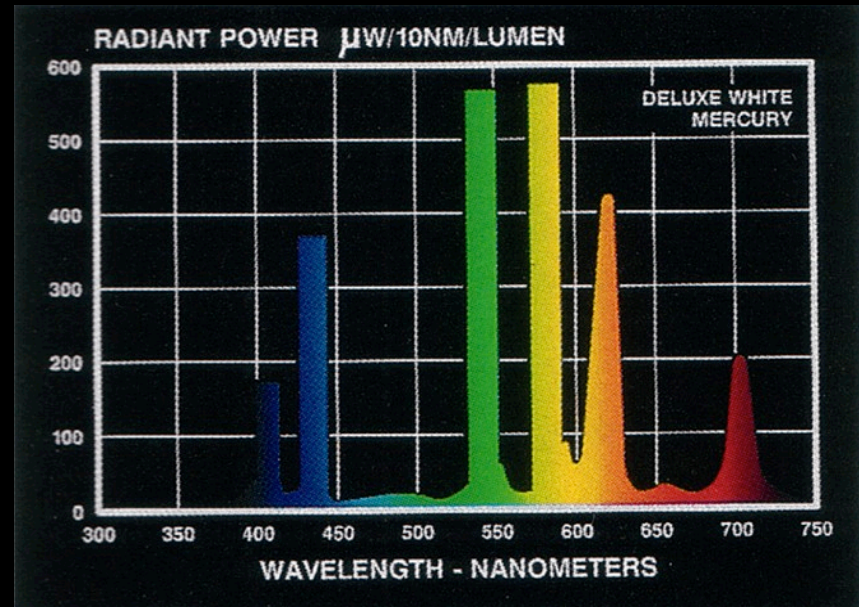
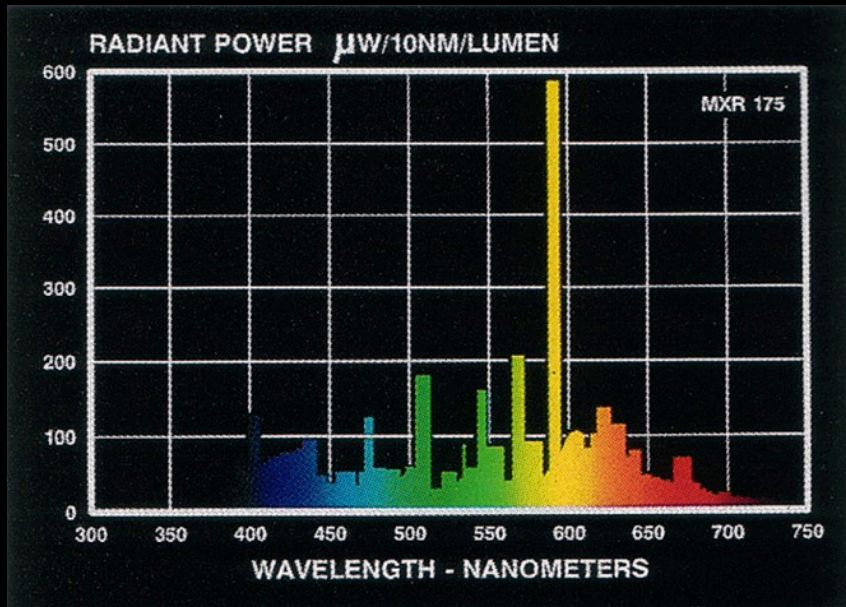
HID Lamps



Clear Mercury

Very Poor CRI

HID Lamps



Meal Halide Sources tend to have a high color temperature (visually cool)

The source seems to be whiter and cleaner than deluxe mercury lamps.

Available with good CRI.

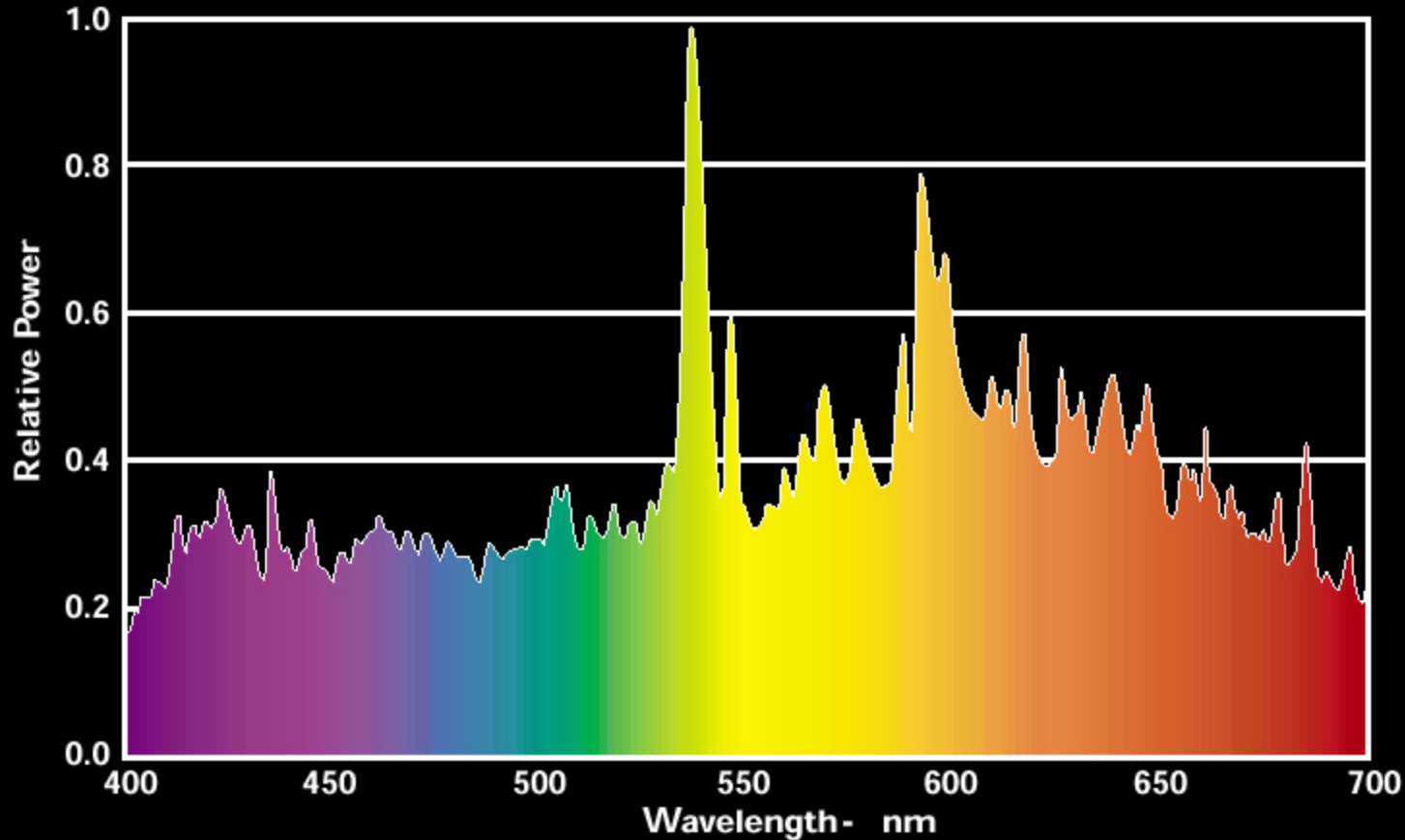
Deluxe Mercury sources tend to have a low color temperature (visually warm)

The source emphasizes the yellow, oranges and reds.

Available with risky CRI.

HID Lamps

MasterColor[®] HPS-RetroWhite



Ceramic Metal Halide (Halogen white light) with very good CRI. Ceramic Metal Halides are the predominate HID lamp source for architectural applications.

HID Lamps

Operation

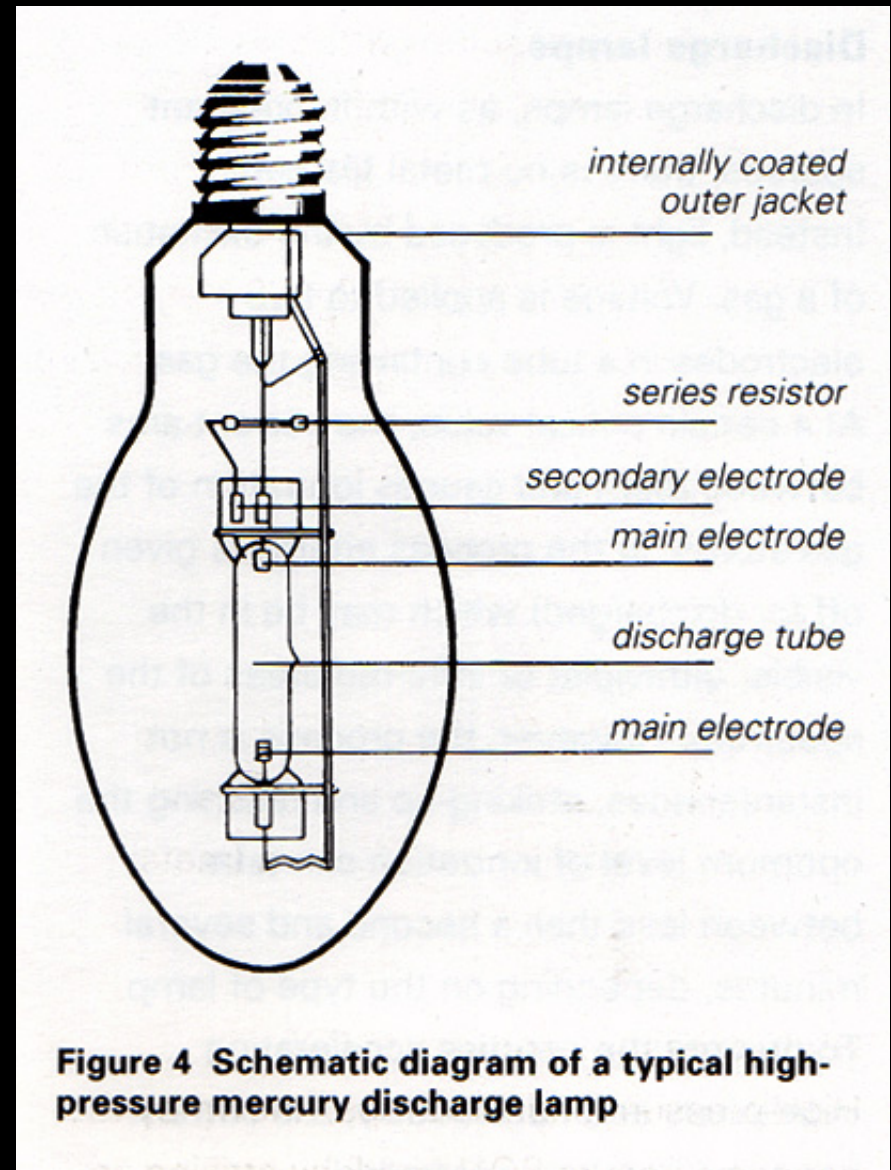
-- An electric arc is discharged in a sealed tube with a protective jacket.

-- Voltage is applied to electrodes, the electrons emitted vaporize elements in the tube producing light.

-- The elements in the tube determine the efficacy and color characteristics.

-- HID lamps operate at very high temperatures.

-- HID sources create a lot of UV radiation. The outer jacket prevents UV from being released from the lamp.



HID Lamps

Ballast

--The arc requires a ballast for operation.

-- The ballast provides voltage for initial striking of the lamp.

-- The ballast maintains the voltage for lamp operation.

The ballasts for HID lamps are often large and bulky.



HID Lamps

Most HID lamps do not come on instantly when turned on. HID lamps require a Strike Time.

The strike time is typically around 5 minutes.

If an HID source loses power, such as in a power outage, the lamp must cool down before it is restruck.

HID lamps must be accompanied by an auxiliary lighting systems to meet emergency lighting requirements.

HID Lamps

Most HID sources last between 5000 and 15,000 hours in architectural applications.

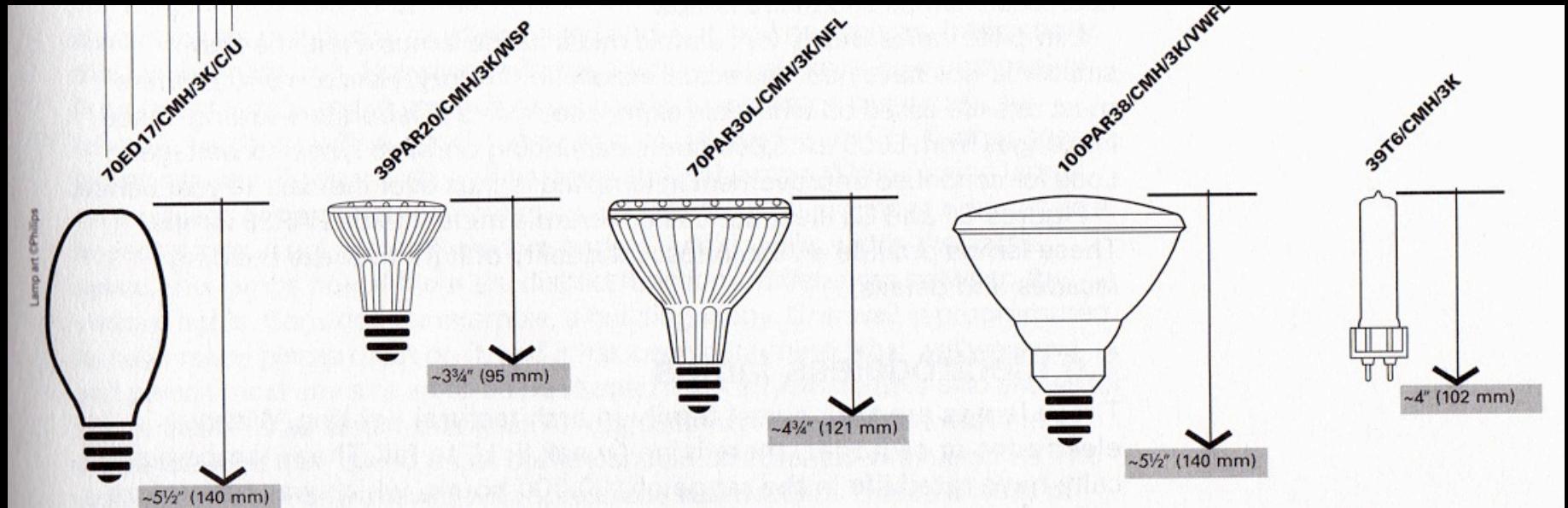
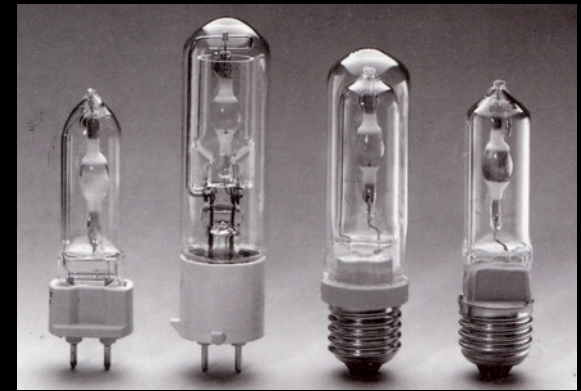
Dimming HID sources can be accomplished technically, but the quality of light is diminished to the point to make it an unsatisfactory option.

One of the central problems with HID lamps is color shift. The color of the light changes over the life of the lamp. Color Rendering and Color Temperature change as the lamp ages. (This problem is significantly reduced with ceramic metal halides.)

Metal Halide sources are the predominate lamps used in architectural applications.

HID Lamps

Metal Halide Lamp Shapes



Ellipsoidal

PAR

PAR

PAR

Tube

CRI for HID range between 82 and 93.

Color temperature range between 3000 and 4100 degrees.

HID Lamps

HID lamps are typically found in high bay areas where re-lamping is an important issue.

With the recent development of ceramic HID and PAR shapes HID sources are being used in retail and other color important design applications.

HID lamps have an efficacy of 75-125 lumens per watt. Incandescent lamps have a efficacy of 20 lumens per watt. (Large energy and labor savings.)

HID Lamps

Color Rendering Index (CRI or R_a):

An indication of the ability of the lamp to render object colors in a normal, natural way. The higher the number (0-100), the better the color appearance.

Color Temperature Kelvins (K):

A measure of the visual "warmth" or "coolness" of the light from the lamp. The higher the value the whiter or "cooler" the light appears.

Lumens- Mean:

Lamp light output (lumens) at 40% of rated lamp life for Metal Halide lamps and 50% of rated life for Mercury and HPS lamps.

MOL:

Maximum Overall Length in inches.

LCL:

Distance between the center of the filament and the Light Center Length reference plane, in inches.

Rated Avg Life - Hrs:

Lamp burning hours to median life expectancy.

Bulb:

Bulb shape followed by its size (the maximum diameter of the bulb expressed in eighths of an inch).

Lamp Description:

The lamp's identification code.

Lumens - Initial:

Initial light output.

ANSI Ballast Type:

Ballast type used to operate lamp.

Case Qty:

Number of product units packed in a case.

Fixture Req:

Describes fixture requirements for this lamp (see page 3-21).

Additional Information:

Typical application and/or other important information including footnotes ()*.

Product Code:

It is important to use this five-digit code when ordering to ensure that you receive the exact product you require.

Base:

The type of base.

Bulb	Base	Product Code	Lamp Description	Case Qty.	Fix. Req.	Additional Information	ANSI Ballast Type	Lumens Initial	Lumens Mean [†]	Rated Avg. Life Hours	MOL in.	LCL in.	Color Temp. K	CRI
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HIGH OUTPUT MULTI-VAPOR® METAL HALIDE LAMPS

400 WATTS

ED37	Mog	49656	MVR400/C/VBU	6	0	Coated, Vertical Base Up ±15°	M59	41000	25000	20000	11 ^{5/16}	7	3700	70
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MVR400 / C / VBU

Identifies as Multi-Vapor® lamp.

Identifies the lamp's wattage.

Outer bulb finish.

Burning position (see page 3-21)

HID Lamps

<i>Bulb</i>	<i>Base</i>	<i>Product Code</i>	<i>Lamp Description</i>	<i>Case Qty.</i>	<i>Fix. Req.</i>	<i>Additional Information</i>	<i>ANSI Ballast Type</i>	<i>Lumens</i>		<i>Rated Avg. Life Hours</i>	<i>MOL in.</i>	<i>LCL in.</i>	<i>Color Temp. K CRI</i>	
LUCALOX® HIGH PRESSURE SODIUM LAMPS (Continued)														
150 WATTS														
B17	Med	13252	LU150/MED	6	0	Clear	S55	16000	14400	24000 +	5 ³ / ₄	3 ¹ / ₂	2000	22
		26424	LU150/MED/CP	4	0	Clear, Consumer Pack	S55	16000	14400	24000 +	5 ³ / ₄	3 ¹ / ₂	2000	22
		13253	LU150/D/MED	6	0	Diffuse	S55	15000	13500	24000 +	5 ³ / ₄	3 ¹ / ₂	2000	22
ED23 ¹ / ₂	Mog	44043	LU150/55	12	0	Clear	S55	16000	14400	24000 +	7 ³ / ₄	5	2000	22
		26429	LU150/55/CP	4	0	Clear, Consumer Pack	S55	16000	14400	24000 +	7 ³ / ₄	5	2000	22
		44045	LU150/55/D	12	0	Diffuse	S55	15000	13500	24000 +	7 ³ / ₄	5	2000	22
		19266	LU150/55/SBY/LL	12	0	Clear, Standby Longlife, Dual Arc Tube	S55	16000	14000	40000	7 ³ / ₄	5	2000	22
ED28	Mog	44243	LU150/100	12	0	Clear	S56	15000	13500	24000 +	8 ⁵ / ₁₆	5	2000	22
		18245	LU150/100/D	12	0	Diffuse	S56	14000	12600	24000 +	8 ⁵ / ₁₆	5	2000	22

<i>Bulb</i>	<i>Base</i>	<i>Product Code</i>	<i>Lamp Description</i>	<i>Case Qty.</i>	<i>Fix. Req.</i>	<i>Additional Information</i>	<i>ANSI Ballast Type</i>	<i>Lumens</i>		<i>Rated Avg. Life Hours</i>	<i>MOL in.</i>	<i>LCL in.</i>	<i>Color Temp. K CRI</i>	
MERCURY LAMPS (Continued)														
400 WATTS														
BT37	Mog	32313	HR400DX33/BT	6	0	Deluxe White	H33	22600	14400	24000 +	11 ⁵ / ₁₆	7	3900	50
ED37	Mog	23974	HR400A33	6	0	Clear	H33	21000	13400	24000 +	11 ⁵ / ₁₆	7	5700	15
		23998	HR400DX33	6	0	Deluxe White	H33	22600	14400	24000 +	11 ⁵ / ₁₆	7	3900	50
R52	Mog	33879	HR400RDX33	6	0	Reflector, Deluxe White, 160° Beam Spread	H33	20800	13400	24000 +	11 ³ / ₄		3900	50

High pressure sodium and mercury lamps typically have unacceptable characteristics for use in architectural interiors. (Color rendering and color temperature.)

HID Lamps

Bulb	Base	Product Code	Lamp Description	Case Qty.	Fix. Req.	Additional Information	ANSI Ballast Type	Lumens Initial	Lumens Mean†	Rated Avg. Life Hours	MOL in.	LCL in.	Color Temp. K	CRI
CONSTANTCOLOR® CMH™ METAL HALIDE LAMPS														
70 WATTS														
T6	G12	35421	CMH70/T/830/G12	10	E	Clear (31, 33)*	M85 or M98 (Alt)	6200	4750	6000	3 ¹⁵ / ₁₆	2 ³ / ₁₆	3000	85
T6	R7s	34519	CMH70/TD/830/R7S	12	E	Clear, Horizontal ±45° Only (31, 33)*	M85 or M98 (Alt)	6200	4750	10000	4 ⁵ / ₈	2 ¹ / ₄	3000	85
BD17	Med	22119	CMH70/U/830/MED	6	E	Clear	M98	6200	4470	7500	5 ⁷ / ₁₆	3 ³ / ₈	3000	85
		22124	CMH70/C/U/830/MED	6	E	Coated	M98	5890	3800	7500	5 ⁷ / ₁₆	3 ³ / ₈	3000	85
PAR30L	Med	22152	CMH70/U/PAR30L/15	6	0	Beam Spread 15°, 25,000 CBCP	M98	4100	3140	6000	4 ³ / ₄		3000	85
		22159	CMH70/U/PAR30L/40	6	0	Beam Spread 40°, 7,000 CBCP	M98	4100	3140	6000	4 ³ / ₄		3000	85

Bulb	Base	Product Code	Lamp Description	Case Qty.	Fix. Req.	Additional Information	ANSI Ballast Type	Lumens Initial	Lumens Mean†	Rated Avg. Life Hours	MOL in.	LCL in.	Color Temp. K	CRI
HIGH OUTPUT MULTI-VAPOR® METAL HALIDE LAMPS														
175 WATTS														
ED23 ¹ / ₂	Mog	11420	MXR175/VBD	6	E	Clear, Vertical Base Down ±15°, Integral Ignitor (13)*	M57	17200	13400	10000	7 ³ / ₄	5	3200	70
		11417	MXR175/VBU	6	E	Clear, Vertical Base Up ±15°, Integral Ignitor (13)*	M57	17200	13400	10000	7 ³ / ₄	5	3200	70
		11203	MXR175/C/VBU	6	E	Coated, Vertical Base Up ±15°, Integral Ignitor (13)*	M57	16300	12500	10000	7 ³ / ₄	5	3200	70

Note the difference between Ceramic Metal Halides and Multi-Vapor Metal Halide lamps in color temperature and color rendering.

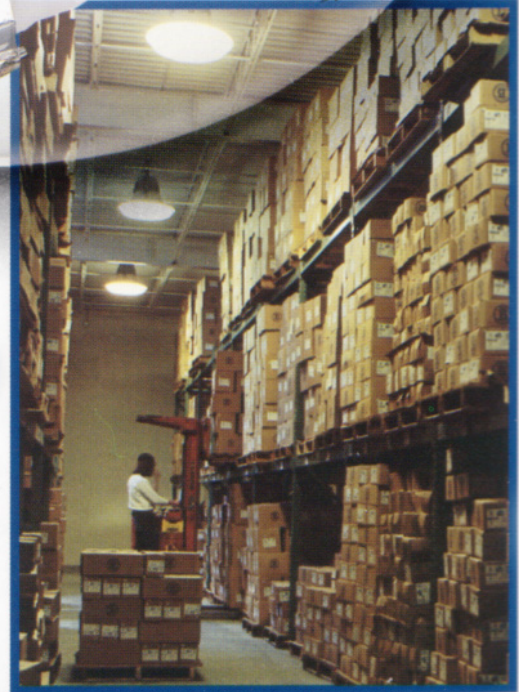
HID Lamps

Lamp	Hours	Watts	Lumens	Efficacy	Color Temp.	CRI	Shape Size
LU150/MED (HPS)	24000	150	14400	96 l/w	2000	22	B 17
HR400DX33 (Mercury)	24000	400	14400	36 l/w	3900	50	BT37
CMH70/T830	6000	70	4750	68 l/w	3000	85	T6
MXR175/VBD	1000	175	13400	77 l/w	3200	70	ED 231/2

HID Lamps



HID Lamps



HID Lamps



HID Lamps



HID Lamps



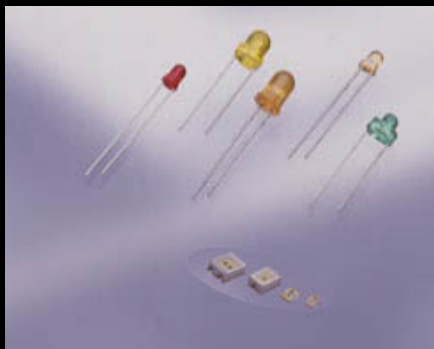
HID Lamps



Lamps

- Incandescent
- Fluorescent
- High Intensity Discharge (HID)
- **Light Emitting Diode (LED)**
- Cold Cathode (Neon)

LED ö Light Emitting Diode



LED Lamps

Light Emitting Diode Lamps

- No weak component in the construction and operation of the lamp. Lamp life is up to 100,000 hours
- Typically used in accent application, but expect this to change.
- Solid state lamps created from semiconductor materials
- Narrow band emitters they illuminate in a specific visible color or in the infrared
- To achieve the display screen effect three lamps are grouped together. (red green and blue)

LED Lamps

A leader in research and manufacturing of LED sources is Lumileds.

<http://www.lumileds.com/>

Low voltage Direct Current (DC) operation

Available with highly controlled option. (Similar to MR 16)

Lamps are cold to the touch

Fully dimmable

Similar energy efficiency as halogen incandescent.

LED Lamps

Wavelength Characteristics

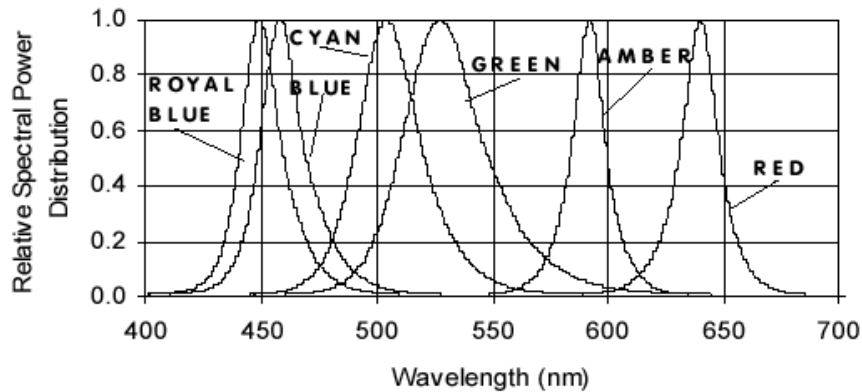
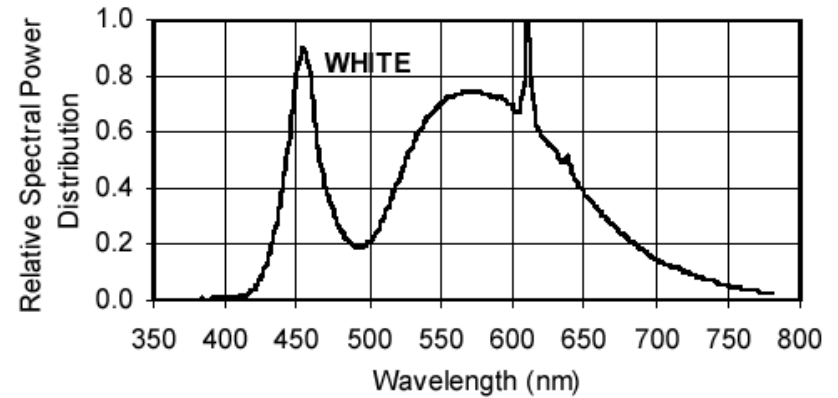


Figure 1. Relative Intensity vs. Wavelength



Narrow band emitters for different colored lamps.

Single white light sources available.

LED Lamps

Single Lamp Configurations

1" X 1" and smaller

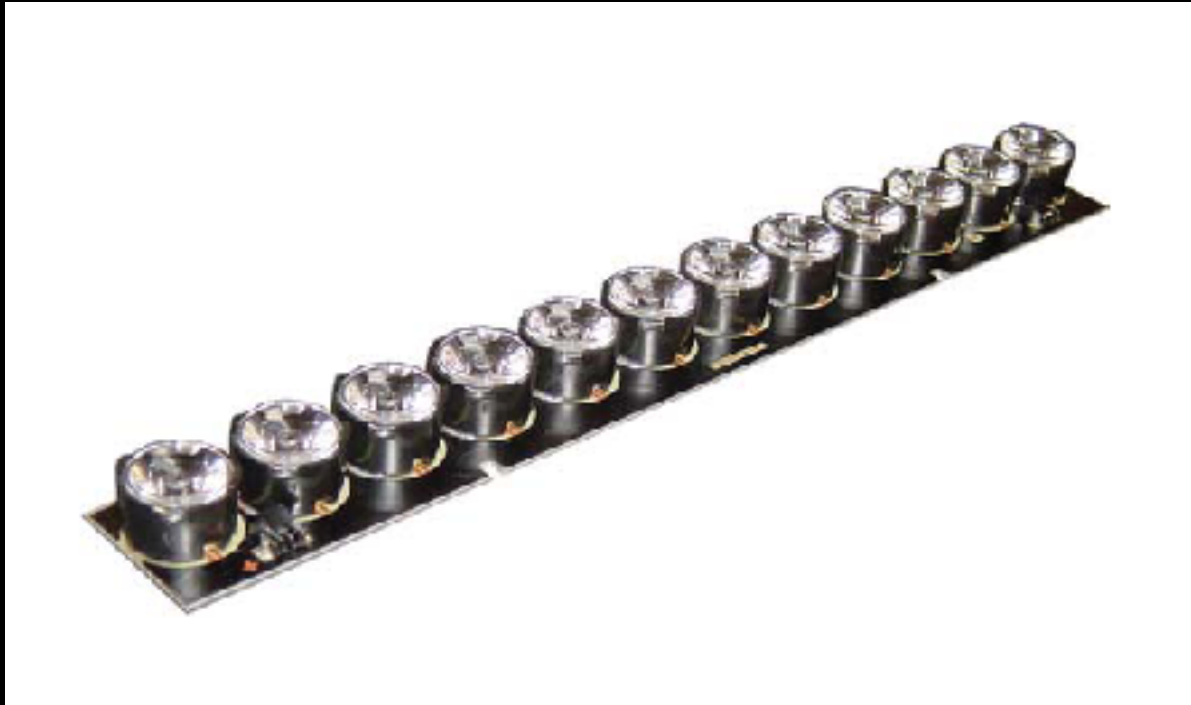
Typically found as reading lights in cars and airplanes. Can be used for accent lighting in small display cases.



LED Lamps

Linear: for under shelf, cove and concealed lighting applications.

1.5" X 10"



LED Lamps

Rings: Accent Lighting

Little over 3" in diameter

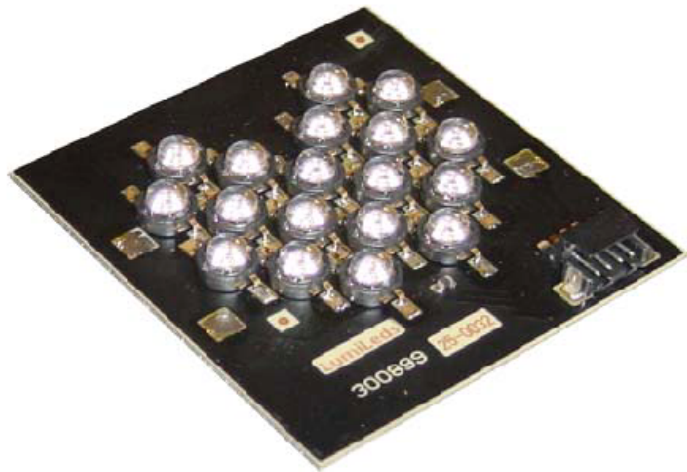


LED Lamps

Flood

Little over 2" X 2"

Accent lighting applications



LED Lamps

Flood



COLOR	DOMINANT WAVELENGTH OR COLOR TEMP.	LED COUNT	PART NUMBER	TYPICAL FLUX (lm)
WHITE	5500 K	12	LXHL-NW96	185
GREEN	530nm	12	LXHL-NM96	255
CYAN	505 nm	12	LXHL-NE96	300
BLUE	470 nm	12	LXHL-NB96	50
RED	627 nm	12	LXHL-ND92	450
AMBER	590 nm	12	LXHL-NL92	370
WHITE	5500 K	6	LXHL-NW97	90
GREEN	530 nm	6	LXHL-NM97	130
CYAN	505 nm	6	LXHL-NE97	150
BLUE	470 nm	6	LXHL-NB97	25
RED	627 nm	6	LXHL-ND93	225