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
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.
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

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

**Base:**
The type of base.

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

**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 (notations [*]).

**ANSI Ballast Type:**
Ballast type used to operate lamp.

**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.

**Rated Avg Life - Hrs.:**
Lamp burning hours to median life expectancy.

**MOL:**
Maximum Overall Length in inches.

**LCL:**
Distance between the center of the filament and the Light Center Length Reference Plane, in inches.

## Color Rendering Index (CRI or \( R_\varepsilon \)):
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.

## HIGH OUTPUT MULTI-VAPOR® METAL HALIDE LAMPS

### 400 WATTS

<table>
<thead>
<tr>
<th>Bulb</th>
<th>Base</th>
<th>Product Code</th>
<th>Lamp Description</th>
<th>Case Qty</th>
<th>Fix. Req.</th>
<th>Additional Information</th>
<th>ANSI Ballast Type</th>
<th>Lumens Initial</th>
<th>Lumens Mean</th>
<th>Rated Avg Life Hours</th>
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<th>LCL</th>
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</table>

**MVR400 / C / VBU**

- Identifies as Multi-Vapor® lamp.
- Identifies the lamp’s wattage.
- Outer bulb finish.
- Burning position (see page 3-21)
**HID Lamps**

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

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<td><strong>MERCURY LAMPS (Continued)</strong></td>
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</table>
Note the difference between Ceramic Metal Halides and Multi-Vapor Metal Halide lamps in color temperature and color rendering.
## HID Lamps

<table>
<thead>
<tr>
<th>Lamp</th>
<th>Hours</th>
<th>Watts</th>
<th>Lumens</th>
<th>Efficacy</th>
<th>Color Temp.</th>
<th>CRI</th>
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</table>
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

Narrow band emitters for different colored lamps.

Single white light sources available.

Figure 1. Relative Intensity vs. Wavelength
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

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<tr>
<th>COLOR</th>
<th>DOMINANT WAVELENGTH OR COLOR TEMP.</th>
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<th>PART NUMBER</th>
<th>TYPICAL FLUX (lm)</th>
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<td>12</td>
<td>LXHL-NE96</td>
<td>300</td>
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<tr>
<td>BLUE</td>
<td>470 nm</td>
<td>12</td>
<td>LXHL-NB96</td>
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<td>RED</td>
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