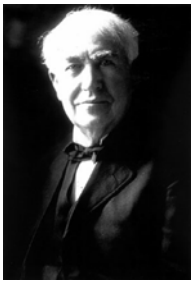
Light Sources

Text Book pp: 523-555 & 619-650

Architecture 342
Environmental Technology II
Prof. M. Boubekri



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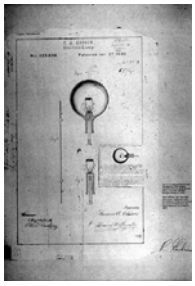
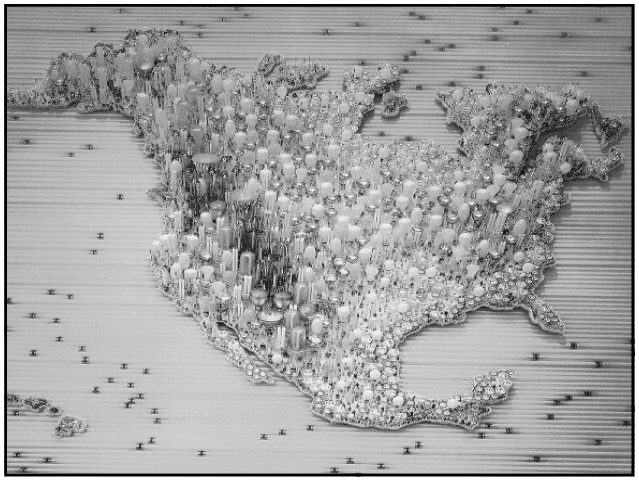
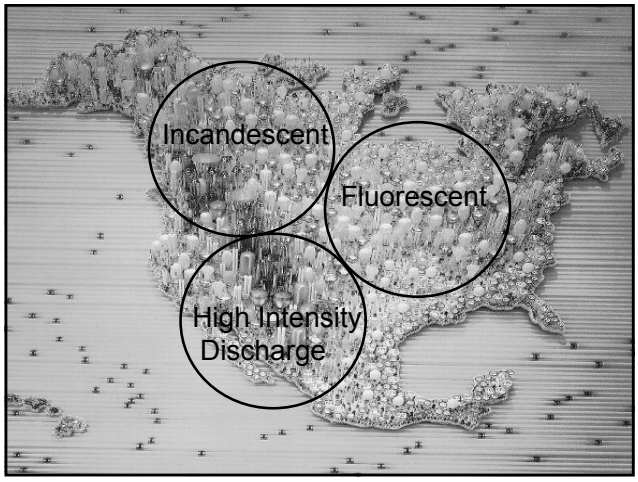
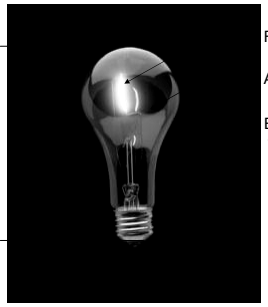






Incandescent Lamps

Incandescent Lamps



Generic Incandescent Lamp Identification

25 T 10 / IF 120 V

- Wattage
- Shape
- Size
- Glass Finish
- Operating Voltage

Incandescent Lamp Shapes

– A-lamp (Most common shape)

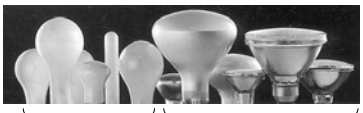
– Other shapes:

– F: Flame

– T: Tubular

– G: Globe

– P: Pear



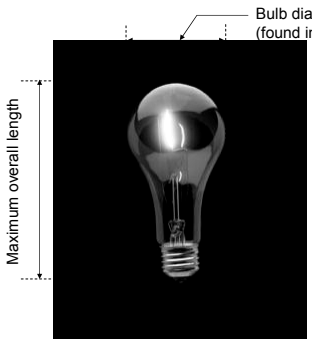
General Service

Reflector Lamps

Incandescent Lamp Shapes

Globe

Flame



- BULB FINISH:
  - IF: Inside Frosted
  - W: White
  - Green, Red, etc: (Colored).
  - CL: Clear

LAMP BASE:

Critical factor (Needed to identify exactly the lamp and in which type of socket it will fit)

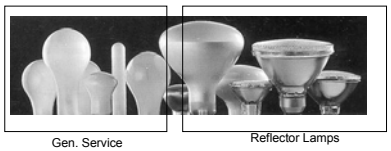
Types of Incandescent lamps

1. General Service Lamps:

   Characterized by their base typ
   and filament size.

   – Vibration Service: e.g. C-9 filament.
   – Rough Service: e.g. C-17, C-22
   – Three-way lamps

Incandescent Lamps

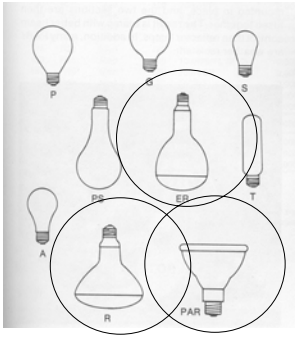


Gen. Service Reflector Lamps

Types of Incandescent lamps

2. Reflector lamps
   - R (**R**eflector)
   - PAR (**P**arabolic **A**luminized **R**eflector
   - ER (**E**lliptical **R**eflector)

Reflector Incandescent Lamps



R category

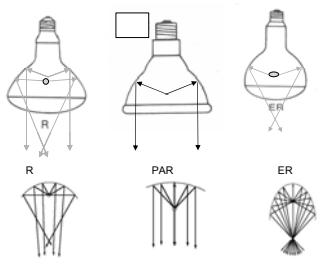
PAR category

ER category

LAMPS

INCANDESCENT LAMPS

- Reflector lamps



R PAR ER

Incandescent Tungsten-Halogen Lamps

Tungsten-Halogen Lamps

Typically halogen lamp's ID contains the letter Q (for Quartz) or H (for halogen)

e.g. Q500T3

Tungsten-Halogen Lamps

Characteristics:

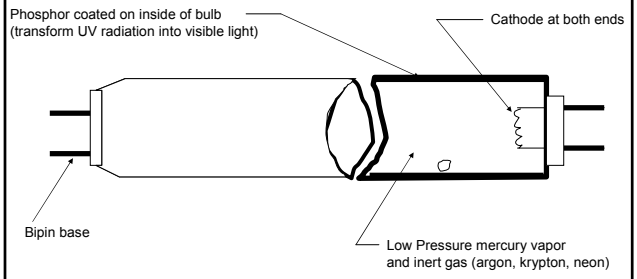
- Excellent color
- Whiter light than conventional incandescent (continuous light spectrum)

Incandescent Low Voltage Lamps

Incandescent Low Voltage Lamps

- Operating Voltage: 5.5 V or 12 V
- Applications of LVL:
  - High quality (dramatic) downlighting
  - pinpoint accent lighting
  - Little spill of light outside the beam (Precise beam control)

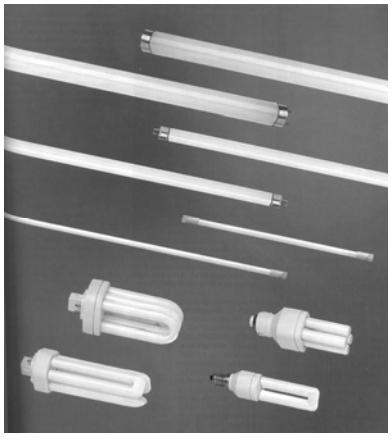
Fluorescent Lamps



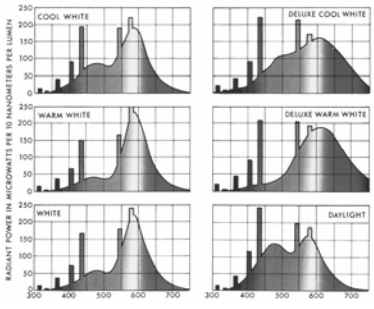
Types of Fluorescent Lamps

- Regular Fluorescent Lamps
- Compact Fluorescent Lamps

Regular (Line) Fluorescents



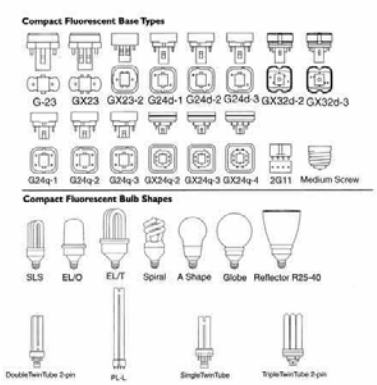
Fluorescent lamps



Compact Fluorescents

- Twin Tube: 7W, 9W, 13W
- Quad Tube: 13W, 26W, 32W
- Triple Tube: 18W, 26W, 32W

- Better CRI than regular FL.
- Smaller size
- Higher lumen output



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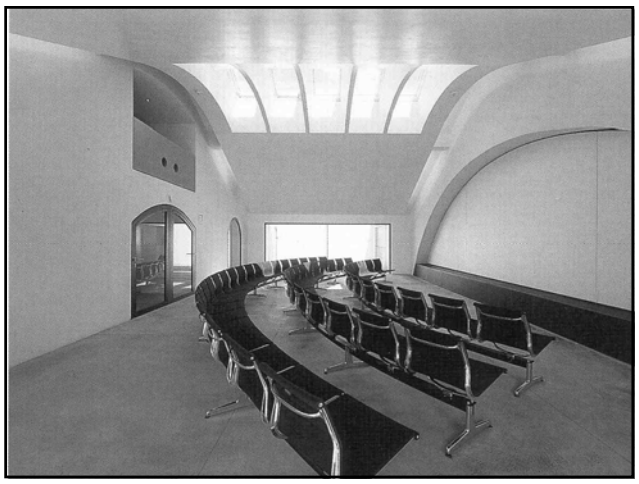


Fluorescent - Lamp Identification

ID = Fluorescent, Watts, Color
- e.g. F 40 CW or F 40 CWX

ID may contain also lamp size
- e.g. F 96 T12 / CW

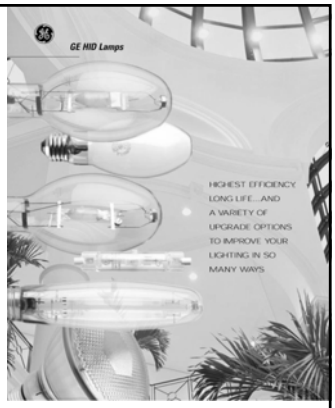
Compact Fluorescent - Lamp Identification

CFL13W

- **Description:** F96T12AL
- **Watts:** 75
- **Average Life Hours:** 12,000
- **Initial Lumens:** 5620
- **Shape:** T12
- **Base Type:** Fa8 single Pin
- **Kelvin:** 5000
- **CRI:** 92
- **Diameter:** 1.50 in. (38.10 mm.)
- **Nominal Length:** 96.00 in. (2,438.40 mm.)
- **Package Qty:** 1
- **Case Qty:** 15

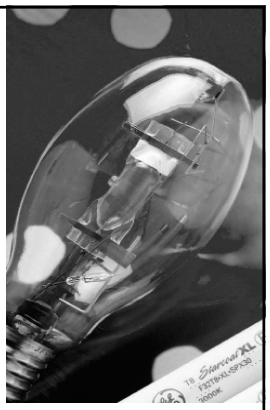
Full Spectrum F96T12AL

High Intensity Discharge Lamps



High Intensity Discharge Lamps

(Text pp: 1184-1195)



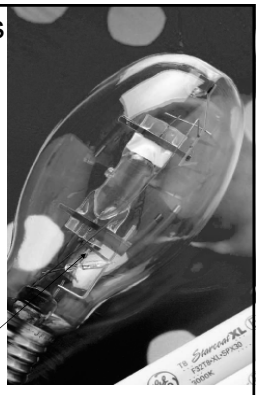
HID Lamps

- Mercury Vapor
- Metal Halide
- High Pressure or Low Pressure Sodium

Mercury Vapor HID Lamps

(Text pp: 1184-1195)

- First of the HIDs
- Color not great
- spectrum mostly is in the UV range



High pressure mercury vapor

Metal halide HID Lamps

(Text pp: 1184-1195)

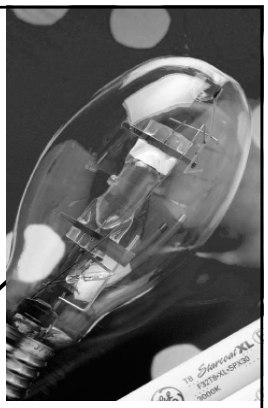
- An improved MV Lamps
  Addition of halides (thallium, indium, sodium) improves color.
- High efficacy and good color.

High pressure mercury vapor

High Pressure Sodium
(Text pp: 1184-1195)

- Have the highest lumen/w
- Very poor CRI
- CCT: 1900-2100K

High pressure Sodium

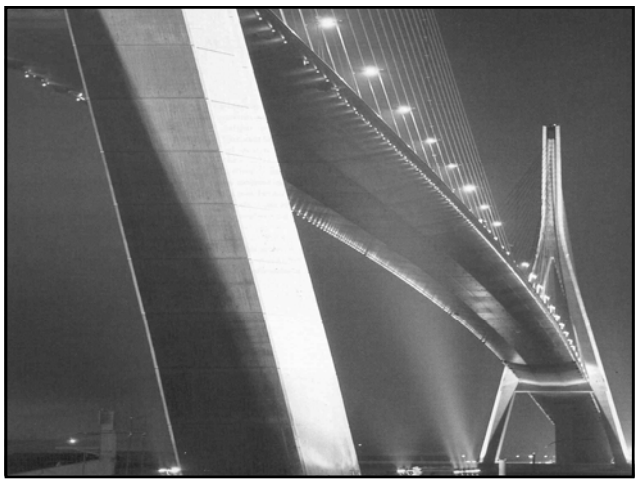


Low Pressure Sodium
(Text pp: 1184-1195)

- Monochromatic yellow color

Have
- Very lumen/w (~ 150lm/w)
- Very poor CRI
- 100% lumen maintenance
- Poor visual acuity

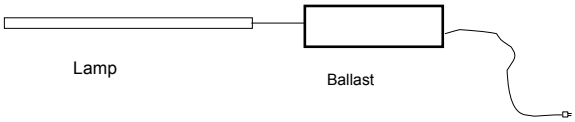
Low pressure sodium



HID Lamps



All fluorescent or HID
Lamps require a ballast



Roles of a ballast:

- Provides initial electric surcharge
- Regulates electric current during normal operation

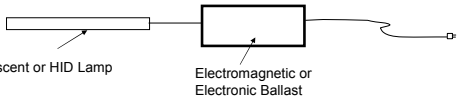
Ballasts

- What is a ballast?

A Ballast is a sophisticated transformer used with all fluorescent and HID lamps

•Role of a ballast?

✓Provides initial electric surcharge
✓Regulates electric current



Ballast




Ballasts

- A ballast may be lamp specific
- Some but not all ballasts may be dimmable
- Both electronic or magnetic ballasts may be dimmable

•http://www.advancetransformer.com/index.jsp

Ballasts

•All ballast have a Power Factor (PF)

• Power Factor = measure of how effectively the current is being converted into useful work output and more particularly is a good indicator of the effect of the load current on the efficiency of the supply system

$$0 \leq PF \leq 1$$

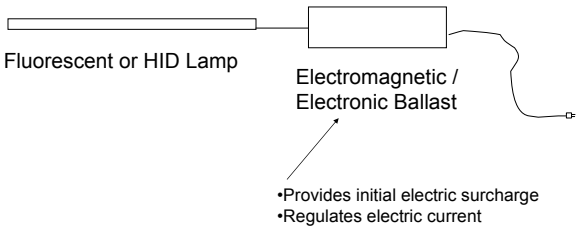
PF is closer to 1

•The higher the PF, the more efficient the ballast is

Fluorescent Lamps

- Sound Rating of ballasts:

Ranges from A to F
A: Least noisy
F: Most noisy



How does one chose a light source?

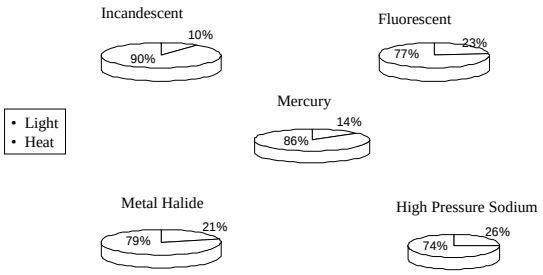
Characteristics of lamps:

- Beam spread & optical properties
- Efficiency (Lamp
- Color Properties (CCT & CRI)
- Lamp Life
- Lamp Lumen Depreciation

Characteristics of lamps:

- Beam spread & optical properties
- Efficiency of Lamps (Efficacy)
- Color Properties (CCT & CRI)
- Lamp Life
- Lamp Lumen Depreciation

Lamp Comparison

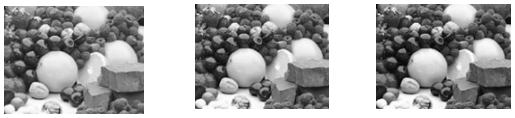


SUSTAINABLE LIGHTING

- INCANDESCENT LAMPS 10-15 L/W
- HALOGEN LAMPS 15-20 L/W
- FLUORESCENT LAMPS 70-100 L/W
- MERCURY VAPOR 60-70 L/W
- HIGH PRESSURE SODIUM & METAL HALIDE 80-110 L/W
- LOW PRESSURE SODIUM 200 L/W

Characteristics of lamps:

- Beam spread & optical properties
- Efficiency of Lamps (Efficacy)
- Color Properties (CCT & CRI)
- Lamp Life
- Lamp Lumen Depreciation

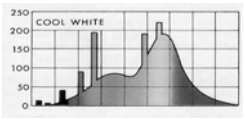


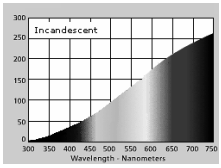
Warm (2000 – 3000K)

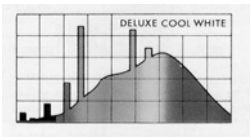
Mid-Range (3000 – 4000K)

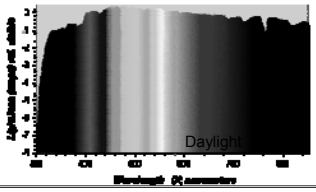
Cool (4000K +)

Specific Spectral Power Distributions









Characteristics of lamps:

- Beam spread & optical properties
- Efficiency of Lamps (Efficacy)
- Color Properties (CCT & CRI)
- Lamp Life
- Lamp Lumen Depreciation

Average Life of lamp (hours)

- Incandescent Lamps: 750 - 4,000
- Fluorescent Lamps: 10 - 20,000
- H. I. D. Lamps:

  Mercury: 24,000+
  Metal halide: 7,500 - 20,000
  HPS: 24,000+

Characteristics of lamps:

- Beam spread & optical properties
- Efficiency of Lamps (Efficacy)
- Color Properties (CCT & CRI)
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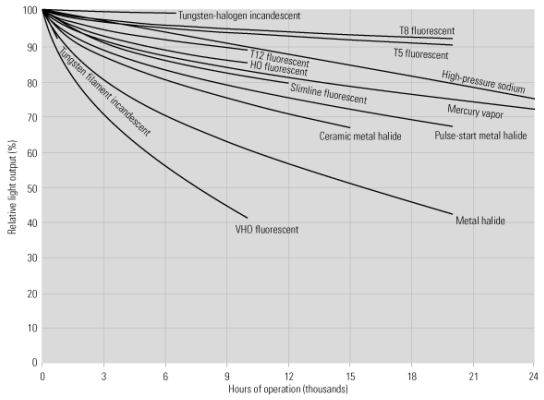
- Lamp Lumen Depreciation



Luminaires

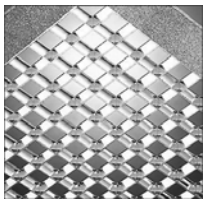
Characteristics of Luminaires:

- Beam spread & optical properties
- Efficiency of Luminaire
- Visual Comfort

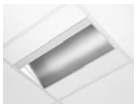
Characteristics of Luminaires:

- Beam spread & optical properties
- Efficiency of Luminaire
- Visual Comfort

Optical Properties



Parabolic troffer



Wall washer

Beam Spread

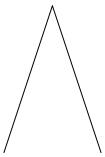
Narrow BS

BS <15 deg.

Medium BS

15 deg. < BS < 25 deg.

Wide BS



BS >25 deg.

Optical Properties

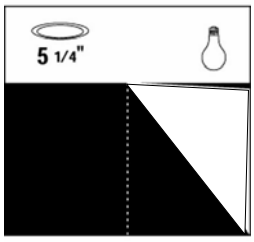
Spot lights

Role of Lamp/Luminaire combination:

- Wall washers
- Downlights / Ambient lighting
- Spot lights
- Accent lights
- Framing

Luminaire Types

Wall Washers



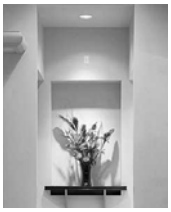
- Wall washers

Bad

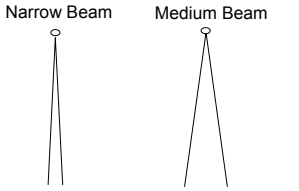
Good

- Wall washers

- Accent Lighting



Accent Lighting



BS < 15 deg.

15 deg. < BS < 25 deg.

Accent Lighting

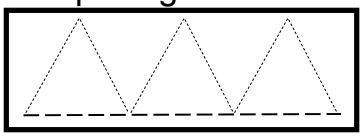
•It's often desirable to highlight individual features in a lighting scheme.
•Accent lighting tastefully sets the visual priorities in a room by directing attention to an object or space with dramatic emphasis.

•To be effective, accent lighting must be more precise and of higher intensity than the surrounding ambient illumination. Trims that provide directional control such as eyeballs and adjustables are especially effective in accent lighting applications. Low voltage MR16 and PAR 38 lamps are often utilized.

MR16

PAR38

Ambient Lighting
Spacing criterion



Indicates the maximum spacing allowed to maintain reasonable uniform illuminance.

Max. Spacing = SC . Height to lighted plane

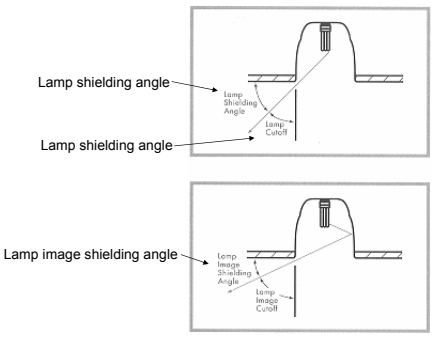
Characteristics of Luminaires:

- Beam spread & optical properties
- Efficiency of Luminaire:
  (% of bare lamp lumen output)
- Visual Comfort

Characteristics of Luminaires:

- Beam spread & optical properties
- Efficiency of Luminaire:
- Visual Comfort

Luminaire Comfort Criteria



Luminaire Comfort Criteria

Visual comfort probability (VCP):

Indicates the percent of people who are comfortable with the glare from a fixture.