

Module 3 Illumination Systems

Lesson

11

Illumination Systems I

Instructional Objectives

1. List Components of an Illumination System.
2. What is a Luminaire?
3. What are various forms of Lighting?

Illumination Systems

It is time we looked at an illumination system as a whole. These systems tend to produce radiation close to natural radiation. They employ artificial sources. These sources obey Laws of Illumination. The quantification is done through Photometry. Thus an Illumination system consists of Lamp which may be Incandescent lamp, Discharge lamp or Fluorescent lamp along with control gear placed in a suitable luminaire.

Luminaries

Luminaire or Luminaries provide support and electrical connection to Lamp or Lamps within it. They control, distribute and direct the Light on to the object. They ensure that lamps are operated in a way such that operating temperature is kept within prescribed limits. They should be easy to install and maintain, aesthetically pleasant and economically viable. Systems may be commercial or general. Usually Fluorescent Lamps with one or more at a preferred mounting height less than 5 – 6 m are used for general lamps. Fluorescent Lamp may be Batten Fully exposed or Multi lamp type. Ventilated-Reflectors with Mirrors optics are used. Difference lies in control of Luminous Intensity, Luminous distribution, No. of Lamps. One may recall that for a

Point source of radiation $\propto \frac{1}{d^2}$ (e.g one can recall that Incandescent Lamp),

Line source of radiation $\propto \frac{1}{d}$ (e.g. Tube Lights), and

Plane Source of Radiation \propto independent of distance (Ideal situation).

Here 'd' is the distance to the source of light. Designer aims in locating Lamps in this fashion. Reflectors help in controlling and directing the light. Louvres-opening with slanted Slates are often employed. Fins / vanes are provided to ventilate. Batten mounted lamps amounts to no control. Most systems have enameled reflectors. Improved ones have Mirror reflectors. Additional control obtained through louvre shields and opalescent shades. Reflectors help direct in a desired solid angle. Louvres may have Square Mesh Box type Luminaries or Diamond Mesh or Lamellae -Thin Plate Layer type.

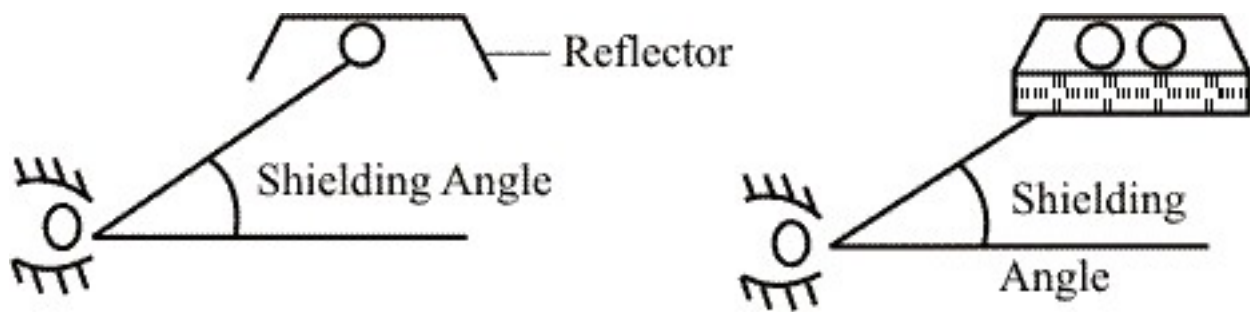


Figure 1: Typically Luminaries with reflectors & Louvre

Fig 1 shows a typical luminaire with reflector and louvre. The luminaries may be recessed in the ceiling, mounted on the walls (or a surface) or take box shape as shown in Fig 2. They are suspended at times.

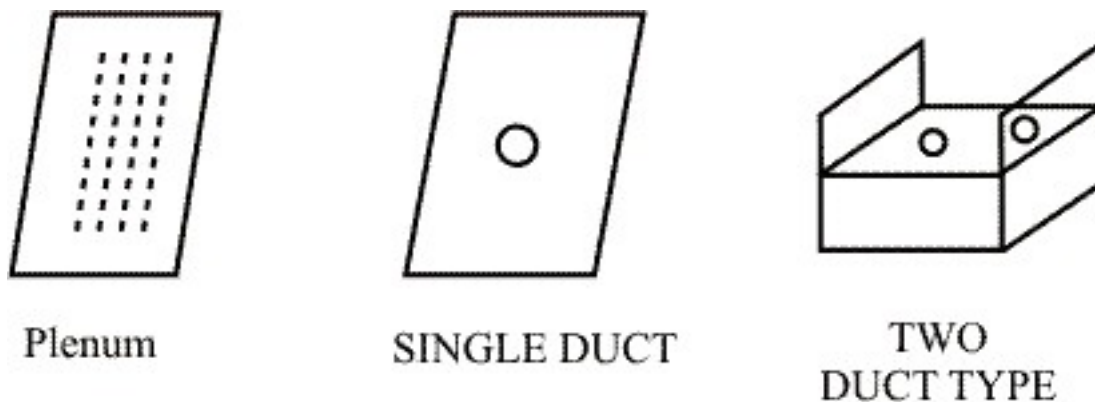


Figure 2: Box Type Luminaries

Efficiency of Luminaries is expressed in terms of Light Output Ratio 'LOR'

$$\text{LOR} = \frac{\text{light output with luminaries}}{\Sigma \text{ individual light output(w/o luminaries)}}$$

This includes both downward as well as upward light. Down ward light is important from the utilization point of view. Hence, DLOR is crucial. Up ward light illuminates indirectly by reflection. With Mirror Reflectors, LOR goes up and Glare comes into Consideration.

Industrial Luminaries

Coming to industrial areas if in the Interior-up to 6m Fluorescent Lamp with matt white reflector are employed. In High bays beyond 6m Discharge Lamps with Mirror Reflectors are employed. Luminaries in Hazardous Areas are specially deigned. They are encapsulated in boxes made of steel or cast iron exterior housing to avoid any explosion, sturdy resisting pressure.

Categories of Explosive Areas

In this respect explosives are as are categorized as

Zone 0 – Explosive all the time,
Zone 1 – Normally Explosive and
Zone 2 – Explosive Abnormally.

Here moisture & dust are taken care by Gasketed Luminares – Completely sealed eg: in a Shower or a Laundry. Emergency Lighting is required when normal lighting fails. Escape Lighting sufficient for evacuation typically 1 – 10 lx. Safety Lighting – 5% normal Lighting is provided in Potentially Hazardous areas. Stand by power supply required for activation of vital implements. A permanent, separate, self supporting Power system which is reliable and mains rechargeable batteries in each Luminaire are provided

Non Permanent - Auto Switching - Emergency Generator - Battery Supply is also used.

Road Lighting

Conventionally they are arranged in a column, mounted on a wall or suspended by a span wire. Plane of Symmetry being in vertical plane perpendicular to the axis of the road along the road. **Catenary** – suspended from a catenary cable parallel to the axis of road. Plane of symmetry parallel to the axis of road. They employ Corrosion Resistant sturdy materials and are usually closed.

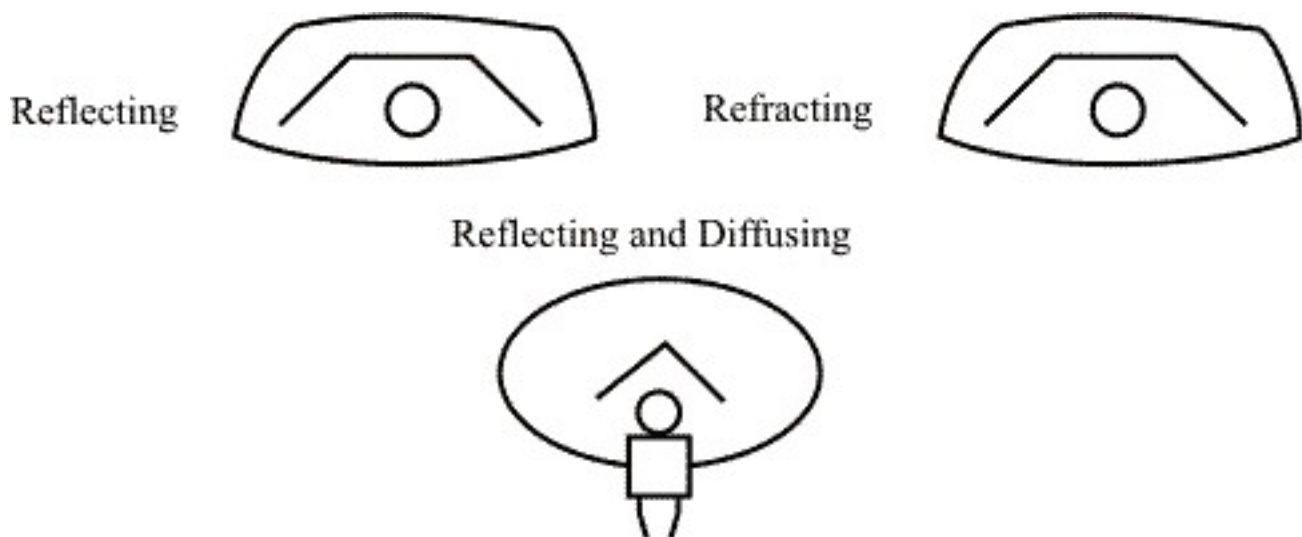


Figure 3: Typical Post top Lanterns

Flood Lights

Rain Proof Lamp holder with wide / narrow beam Reflectors are used for flood light. They are usually High wattage Incandescent Lamps, Halogen Lamps, High Pressure Mercury Vapor Lamp or Low / high Pressure Sodium Lamp.

Spot lights / down lights are usually used with Screens, Reflectors, Filters, Colored envelope and Closed Lamps.

Down lights are Spot lights when suspended.

This lesson has had a look at the components of an Illumination system under various scenarios.

Lecture Summary

- Illumination system comprises of a lamp (the artificial source of light), luminaires & the control gear
- Commercial luminaires can be categorized into
 - General
 - Industrial
- Luminaires are characterized by the way they control & direct light :
 - luminous intensity
 - luminous distribution
 - number of lamps
- Use of mirrors in luminaires are avoided as they cause glare
- Efficiency of a luminaire is talked in terms of light output ratio (LOR). This includes both downward as well as upward light.
- Practically DLOR (downward LOR) is of importance
- Luminaires for hazardous areas :
 - maintains temp.
 - is encapsulated to resist pressure
- Gasketed luminaires which are completely sealed takes care of handling moisture & dust.
- Emergency lighting should have self supporting power system to provide lighting when normal lighting fails

Tutorial Questions

- Which type of lighting are used for general lighting & why?
Incandescent & fluorescent lamps are preferred because they have a good CRI & provide near day light illuminance
- What are louvers?
They are opening with slanted slates often used with luminaires to control & direct light
- What are the different luminaires considered placement wise?
 - box type,
 - recessed in the ceiling,
 - mounted on a surface and
 - suspended from a ceiling
- What type of lighting is used in industrial lighting?
For interior lighting fluorescent lamps with matt white reflectors are used while for high bays discharge lamps with mirror reflectors are used
- What are the different types of emergency lighting used?
 - Escape lighting – just sufficient lighting,
 - Safety lighting – not less than 5% of normal lighting,
 - Standby lighting – for activation of vital implements when power fails