NEAR EAST UNIVERSITY

Faculty of Engineering

Department of Electrical and Electronic Engineering

Name of Project

Electrical Installation of Hotel Project By Using Autocad

Graduation Project

EE – 400

Students:Mahmut Ensar Artan
Student No:20122326

Supervisor: Assoc.Prof.Dr.Özgür C. Özerdem

Nicosia-2015

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ABSTRACT

The electrical installations are an application of the theories and rules in Electrical Engineering.

This Project is an important study of the electrical installations made in a hotel.This hotel design according to the EMO standards.There are many standards.And i choise most appropriate one .

The main achieve in that thesis is to self improvement and give an Outlook about the electrical installations and how it is worked and done under a specific regulation, in order to accomplish a desired objective.

INTRODUCTİON

Our aim for this thesis how to installation a electric circuit for hotel.In that topic we are going see what is the fundamental definations of electric circuit elements like luminaries, cables , switches, cables control panels and calculations.

I am beliving that ,this project is going to help me to my future career.Since i was in high school i always interesting with electrical circuits that project giving me chance to prove my talent on illumination.

As possible i can i am going to try tos hare every information and details i have.The conculation that we will get it will be very successful.

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Chapter 1. General Parts Of Illumınation

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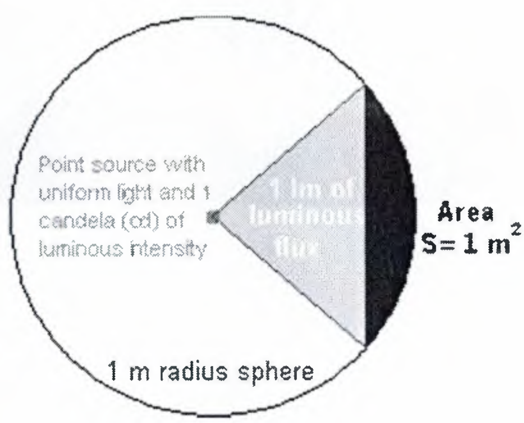
General Parts Of Illumination

1.1)-What is light?

Light is electromagnetic radiation within a certain portion of the electromagnetic spectrum. The word usually refers to visible light, which is visible to the human eye and is responsible for the sense of sight. Visible light is usually defined as having awavelength in the range of 400 nanometres (nm), or 400×10^{-9} m, to 700 nanometres – between the infrared (with longer wavelengths) and the ultraviolet (with shorter wavelengths). Often, infrared and ultraviolet are also called light.

1.1.a)- Luminous Flux

Luminous flux is the quantity of the energy of the light emitted per second in all directions. The unit of luminous flux is lumen (lm). One lumen is the luminous flux of the uniform point light source that has luminous intensity of 1 candela and is contained in one unit of spatial angle (or 1 steradian). Steradian is the spatial angle that limits the surface area of the sphere equal to the square of the radius. This concept is shown in the figure for 1 m radius of the sphere. Since the area of sphere is $4pr^2$ then the luminous flux of the point light source is 4p lumens.



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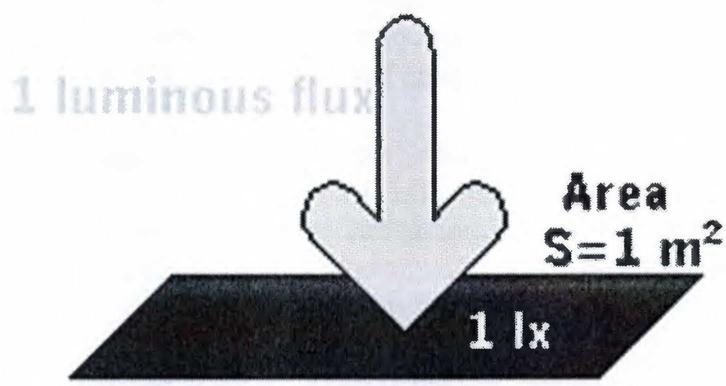
The unit of luminous intensity is candela. There is a standard that details the candela definition. This includes the standard light source and the physical conditions of the measurement.

1.1.c)- Illuminance(Illumınation)

This definition determines the amount of light that covers a surface. If Ø is the luminous flux and S is the area of the given surface then the illuminance E is determined by E=Ø/S.

The unit of illumination in SI system is lx, and in foot-pound system it is foot-candle. One lx is the illuminance of 1 m^2 surface area uniformly lighted by 1 lm of luminous flux. The following drawing explains this definition. One foot-candle is 10.76 lux.



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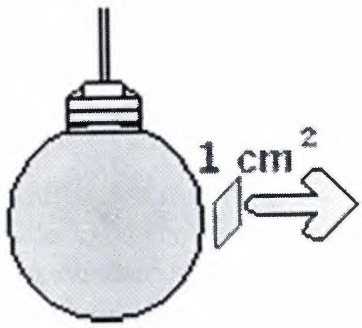
Luminance L is the luminous intensity emitted by the surface area of 1 cm^2 (or 1 m^2) of the light source. Mathematiclly it is L=I/S where I is the luminous intensity and S is the area of the source surface perpendicular to the given direction.
The unit of luminance is cd/m^2 or cd/cm^2 (in some applications lm/cm^2 or Lambert can be used). The following figure shows the concept.



The luminance value indicates glare and discomfort when we look at the lighting source. These values are very high for the sun or a small lamp and are low for large lighting fixtures.

1.1.e)-Illumination Level(Lux)

The lux (symbolized lx) is the unit of illuminance in the International System of Units (SI). It is defined in terms of lumen s per meter squared (lm/m^2). Reduced to SI base units, one lux is equal to 0.00146 kilogram per second cubed (1.46×10^{-3} kg / s^3).

One lux is the equivalent of 1.46 milliwatt (1.46×10^{-3} W) of radiant electromagnetic (EM) power at a frequency of 540 terahertz (540 THz or 5.40×10^{14} Hz), impinging at a right angle on a surface whose area is one square meter. A frequency of 540 THz corresponds to a wavelength of about 555 nanometer s (nm), which is in the middle of the visible-light spectrum.

The lux is a small unit. An alternative unit is the watt per meter squared (W / m^2). To obtain lux when the illuminance in watts per meter squared is known, multiply by 683. To obtain watts per meter squared when the illuminance in lux is known, divide by 683 or multiply by 0.00146.

Illuminance varies inversely with the square of the distance from the source on a free-space line of sight. If the distance is doubled, the illuminance is cut to 1/4; if the distance increases by a factor of 10, the illuminance becomes 1/100 (0.01 times) as great.

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Glare is difficulty seeing in the presence of bright light such as direct or reflected sunlight or artificial light such as car headlamps at night. Because of this, some cars include mirrors with automatic anti-glare functions.

Glare is caused by a significant ratio of luminance between the task (that which is being looked at) and the glare source. Factors such as the angle between the task and the glare source and eye adaptation have significant impacts on the experience of glare.

1.2)-Type Of Electric Lamps

A lamp is an energy converter. Although it may carry out secondary functions, its prime purpose is the transformation of electrical energy into visible electromagnetic radiation. There are many ways to create light. The standard method for creating general lighting is the conversion of electrical energy into light.

1.2.a)-Incandescence

When solids and liquids are heated, they emit visible radiation at temperatures above 1,000 K; this is known as incandescence.

Such heating is the basis of light generation in filament lamps: an electrical current passes through a thin tungsten wire, whose temperature rises to around 2,500 to 3,200 K, depending upon the type of lamp and its application.

There is a limit to this method, which is described by Planck's Law for the performance of a black body radiator, according to which the spectral distribution of energy radiated increases with temperature. At about 3,600 K and above, there is a marked gain in emission of visible radiation, and the wavelength of maximum power shifts into the visible band. This temperature is close to the melting point of tungsten, which is used for the filament, so the practical temperature limit is around 2,700 K, above which filament evaporation becomes excessive. One result of these spectral shifts is that a large part of the radiation emitted is not given off as light but as heat in the infrared region. Filament lamps can thus be effective heating devices and are used in lamps designed for print drying, food preparation and animal rearing.

1.2.b)-Electric Discharge

Electrical discharge is a technique used in modern light sources for commerce and industry because of the more efficient production of light. Some lamp types combine the electrical discharge with photoluminescence.

An electric current passed through a gas will excite the atoms and molecules to emit radiation of a spectrum which is characteristic of the elements present. Two metals are commonly used, sodium and mercury, because their characteristics give useful radiations within the visible spectrum. Neither metal emits a continuous spectrum, and discharge lamps have selective spectra. Their colour rendering will never be identical to continuous spectra. Discharge lamps are often classed as high pressure or low pressure, although these terms are only relative, and a high-pressure sodium lamp operates at below one atmosphere.

1.2.c)-Types of Luminescence

Photoluminescence occurs when radiation is absorbed by a solid and is then re-emitted at a different wavelength. When the re-emitted radiation is within the visible spectrum the process is called fluorescence or phosphorescence.

Electroluminescence occurs when light is generated by an electric current passed through certain solids, such as phosphor materials. It is used for self-illuminated signs and instrument panels but has not proved to be a practical light source for the lighting of buildings or exteriors.

1.2.d)-Volution of Electric Lamps

Although technological progress has enabled different lamps to be produced, the main factors influencing their development have been external market forces. For example, the production of filament lamps in use at the start of this century was possible only after the availability of good vacuum pumps and the drawing of tungsten wire. However, it was the large-scale generation and distribution of electricity to meet the demand for electric lighting that determined market growth. Electric lighting offered many advantages over gas- or oil-generated light, such as steady light that requires infrequent maintenance as well as the increased safety of having no exposed flame, and no local by-products of combustion.

During the period of recovery after the Second World War, the emphasis was on productivity. The fluorescent tubular lamp became the dominant light source because it made possible the shadow-free and comparatively heat-free lighting of factories and offices, allowing maximum use of the space. The light output and wattage requirements for a typical 1,500 mm fluorescent tubular lamp is given in table 1.

Table 1. Improved light output and wattage requirements of some typical 1,500 mm fluorescent tube lamps

Rating (W)	Diameter (mm)	Gas fill	Light output (lumens)
80	38	argon	4,800
65	38	argon	4,900
58	25	krypton	5,100
50	25	argon	5,100 (high frequency gear)

By the 1970s oil prices rose and energy costs became a significant part of operating costs. Fluorescent lamps that produce the same amount of light with less electrical consumption were demanded by the market. Lamp design was refined in several ways. As the century closes there is a growing awareness of global environment issues. Better use of declining raw materials, recycling or safe disposal of products and the continuing concern over energy consumption (particularly energy generated from fossil fuels) are impacting on current lamp designs.

1.2.e)-Performance Criteria

Performance criteria vary by application. In general, there is no particular hierarchy of importance of these criteria.

Light output: The lumen output of a lamp will determine its suitability in relation to the scale of the installation and the quantity of illumination required.

Colour appearance and colour rendering: Separate scales and numerical values apply to colour appearance and colour rendering. It is important to remember that the figures provide guidance only, and some are only approximations. Whenever possible, assessments of suitability should be made with actual lamps and with the colours or materials that apply to the situation.

Lamp life: Most lamps will require replacement several times during the life of the lighting installation, and designers should minimize the inconvenience to the occupants of odd failures and maintenance. Lamps are used in a wide variety of applications. The anticipated average life is often a compromise between cost and performance. For example, the lamp for a slide projector will have a life of a few hundred hours because the maximum light output is important to the quality of the image. By contrast, some roadway lighting lamps may be changed every two years, and this represents some 8,000 burning hours.

Further, lamp life is affected by operating conditions, and thus there is no simple figure that will apply in all conditions. Also, the effective lamp life may be determined by different failure modes. Physical failure such as filament or lamp rupture may be preceded by reduction in light output or changes in colour appearance. Lamp life is affected by external environmental conditions such as temperature, vibration, frequency of starting, supply voltage fluctuations, orientation and so on.

It should be noted that the average life quoted for a lamp type is the time for 50% failures from a batch of test lamps. This definition of life is not likely to be applicable to many commercial or industrial installations; thus practical lamp life is usually less than published values, which should be used for comparison only.

Efficiency: As a general rule the efficiency of a given type of lamp improves as the power rating increases, because most lamps have some fixed loss. However, different types of lamps have marked variation in efficiency. Lamps of the highest efficiency should be used, provided that the criteria of size, colour and lifetime are also met. Energy savings should not be at the expense of the visual comfort or the performance ability of the occupants. Some typical efficacies are given in table 2.

Table 2. Typical lamp efficacies

Lamp efficacies	
100 W filament lamp	14 lumens/watt
58 W fluorescent tube	89 lumens/watt
400 W high-pressure sodium	125 lumens/watt
131 W low-pressure sodium	198 lumens/watt

1.2.f)-Main Lamp Types

Over the years, several nomenclature systems have been developed by national and international standards and registers.

In 1993, the International Electrotechnical Commission (IEC) published a new International Lamp Coding System (ILCOS) intended to replace existing national and regional coding systems. A list of some ILCOS short form codes for various lamps is given in table 3.

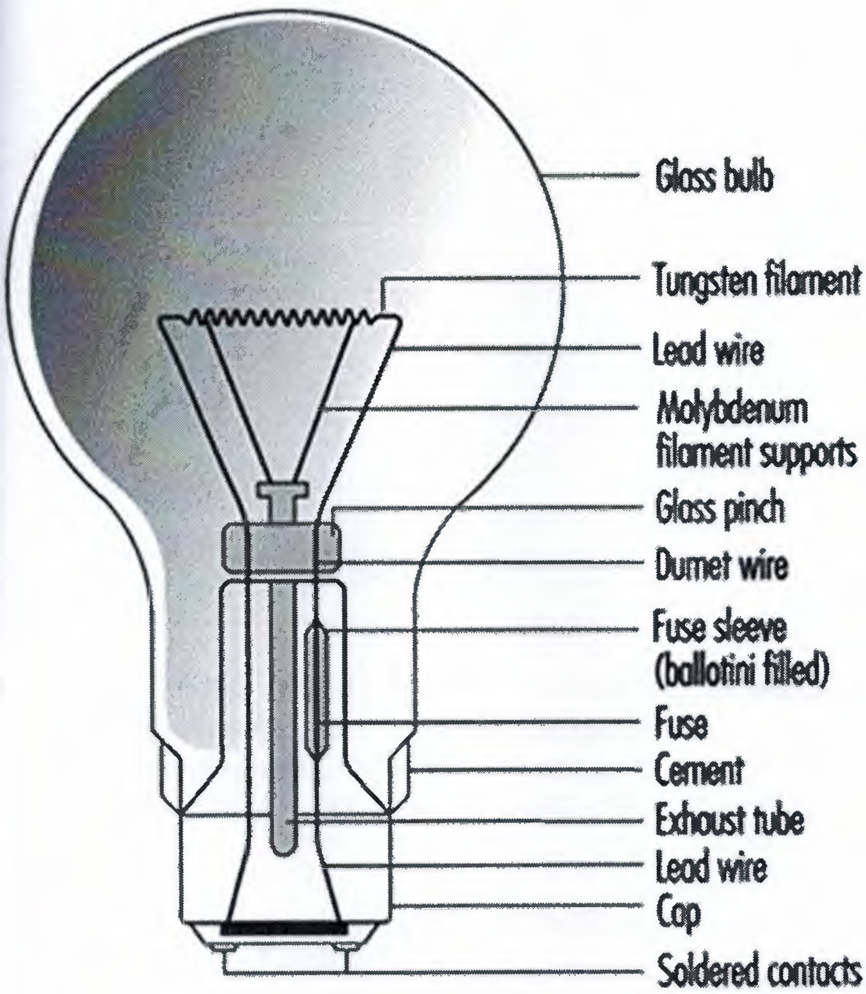
Table 3. International Lamp Coding System (ILCOS) short form coding system for some lamp types

Type (code)	Common ratings (watts)	Colour rendering	Colour temperature (K)	Life (hours)
Compact fluorescent lamps (FS)	5–55	good	2,700–5,000	5,000–10,000
High-pressure mercury lamps (QE)	80–750	fair	3,300–3,800	20,000
High-pressure sodium lamps (S-)	50–1,000	poor to good	2,000–2,500	6,000–24,000
Incandescent lamps (I)	5–500	good	2,700	1,000–3,000
Induction lamps (XF)	23–85	good	3,000–4,000	10,000–60,000
Low-pressure sodium lamps (LS)	26–180	monochromatic yellow colour	1,800	16,000
Low-voltage tungsten halogen lamps (HS)	12–100	good	3,000	2,000–5,000
Metal halide lamps (M-)	35–2,000	good to excellent	3,000–5,000	6,000–20,000
Tubular fluorescent lamps (FD)	4–100	fair to good	2,700–6,500	10,000–15,000
Tungsten halogen lamps (HS)	100–2,000	good	3,000	2,000–4,000

1.2.g)-Incandescent lamps

These lamps use a tungsten filament in an inert gas or vacuum with a glass envelope. The inert gas suppresses tungsten evaporation and lessens the envelope blackening. There is a large variety of lamp shapes, which are largely decorative in appearance. The construction of a typical General Lighting Service (GLS) lamp is given in figure 1.

Figure 1. Construction of a GLS lamp



Incandescent lamps are also available with a wide range of colours and finishes. The ILCOS codes and some typical shapes include those shown in table 4.

Table 4. Common colours and shapes of incandescent lamps, with their ILCOS codes

Colour/Shape	Code
Clear	/C
Frosted	/F
White	/W
Red	/R
Blue	/B
Green	/G
Yellow	/Y
Pear shaped (GLS)	IA
Candle	IB
Conical	IC
Globular	IG
Mushroom	IM

Incandescent lamps are still popular for domestic lighting because of their low cost and compact size. However, for commercial and industrial lighting the low efficacy generates very high operating costs, so discharge lamps are the normal choice. A 100 W lamp has a typical efficacy of 14 lumens/watt compared with 96 lumens/watt for a 36 W fluorescent lamp.

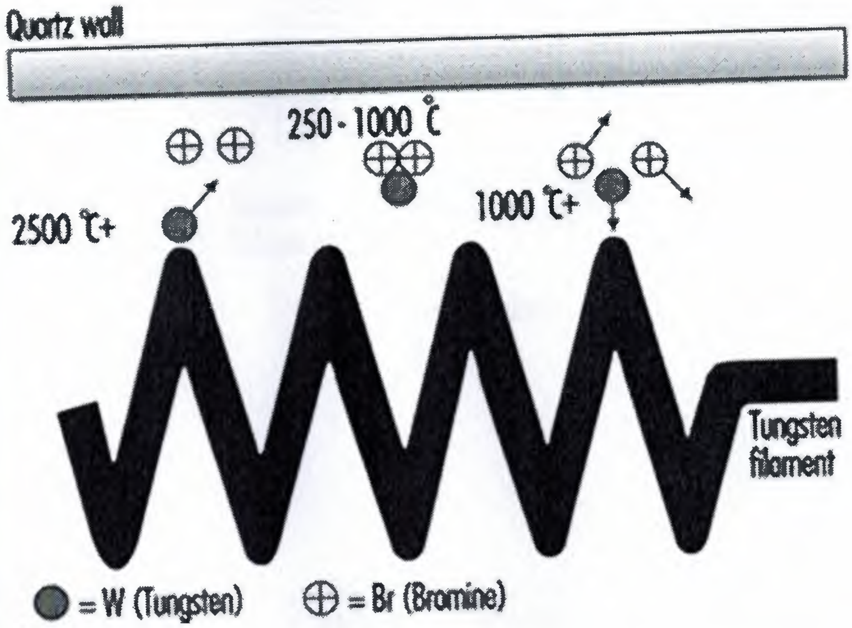
Incandescent lamps are simple to dim by reducing the supply voltage, and are still used where dimming is a desired control feature.

The tungsten filament is a compact light source, easily focused by reflectors or lenses. Incandescent lamps are useful for display lighting where directional control is needed.

1.2.h)-Tungsten Halogen Lamps

These are similar to incandescent lamps and produce light in the same manner from a tungsten filament. However the bulb contains halogen gas (bromine or iodine) which is active in controlling tungsten evaporation. See figure 2.

Figure 2. The halogen cycle



Fundamental to the halogen cycle is a minimum bulb wall temperature of 250 °C to ensure that the tungsten halide remains in a gaseous state and does not condense on the bulb wall. This temperature means bulbs made from quartz in place of glass. With quartz it is possible to reduce the bulb size.

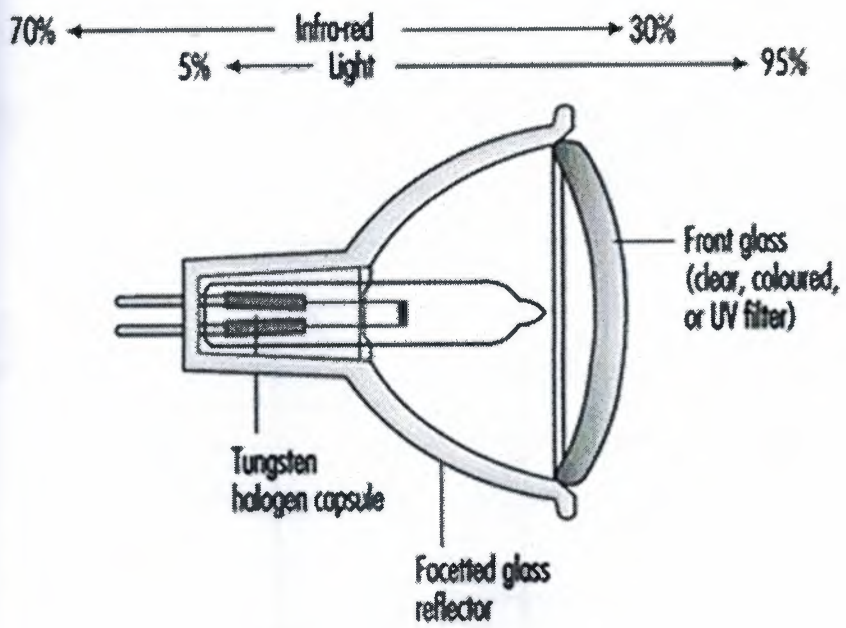
Most tungsten halogen lamps have an improved life over incandescent equivalents and the filament is at a higher temperature, creating more light and whiter colour.

Tungsten halogen lamps have become popular where small size and high performance are the main requirement. Typical examples are stage lighting, including film and TV, where directional control and dimming are common requirements.

1.2.ı)-Low-Voltage Tungsten Halogen Lamps

These were originally designed for slide and film projectors. At 12 V the filament for the same wattage as 230 V becomes smaller and thicker. This can be more efficiently focused, and the larger filament mass allows a higher operating temperature, increasing light output. The thick filament is more robust. These benefits were realized as being useful for the commercial display market, and even though it is necessary to have a step-down transformer, these lamps now dominate shop-window lighting. See figure 3.

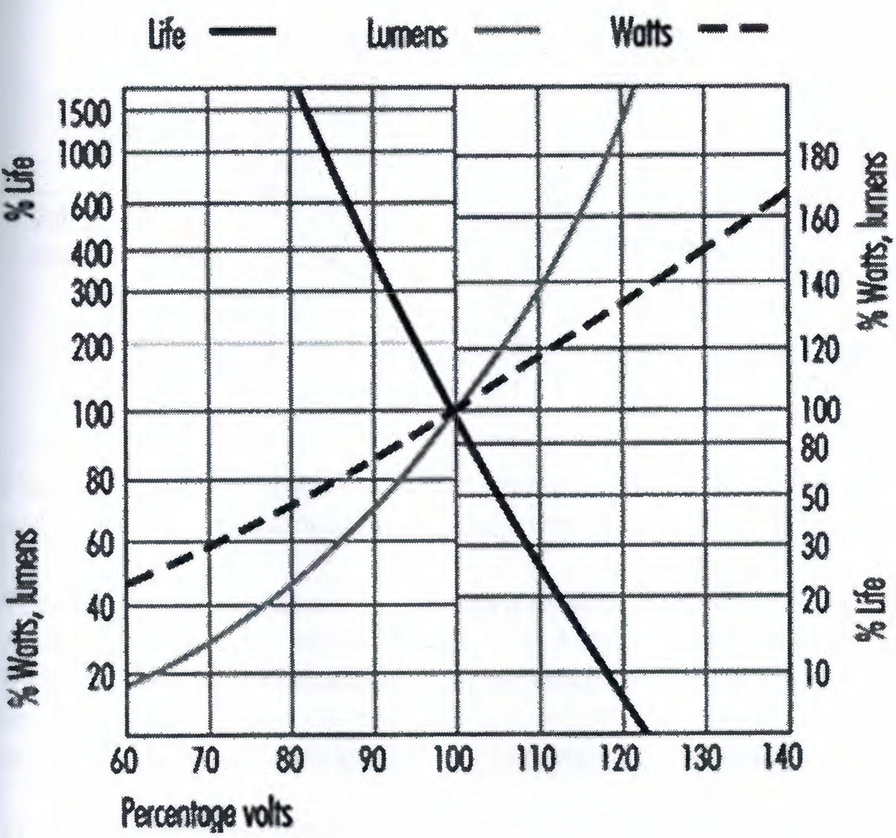
Figure 3. Low-voltage dichroic reflector lamp



Although users of film projectors want as much light as possible, too much heat damages the transparency medium. A special type of reflector has been developed, which reflects only the visible radiation, allowing infrared radiation (heat) to pass through the back of lamp. This feature is now part of many low-voltage reflector lamps for display lighting as well as projector equipment.

Voltage sensitivity: All filament lamps are sensitive to voltage variation, and light output and life are affected. The move to "harmonize" the supply voltage throughout Europe at 230 V is being achieved by widening the tolerances to which the generating authorities can operate. The move is towards ±10%, which is a voltage range of 207 to 253 V. Incandescent and tungsten halogen lamps cannot be operated sensibly over this range, so it will be necessary to match actual supply voltage to lamp ratings. See figure 4.

Figure 4. GLS filament lamps and supply voltage



Discharge lamps will also be affected by this wide voltage variation, so the correct specification of control gear becomes important.

1.2.i)-Tubular Fluorescent Lamps

These are low pressure mercury lamps and are available as "hot cathode" and "cold cathode" versions. The former is the conventional fluorescent tube for offices and factories; "hot cathode" relates to the starting of the lamp by pre-heating the electrodes to create sufficient ionization of the gas and mercury vapour to establish the discharge.

Cold cathode lamps are mainly used for signage and advertising. See figure 5.

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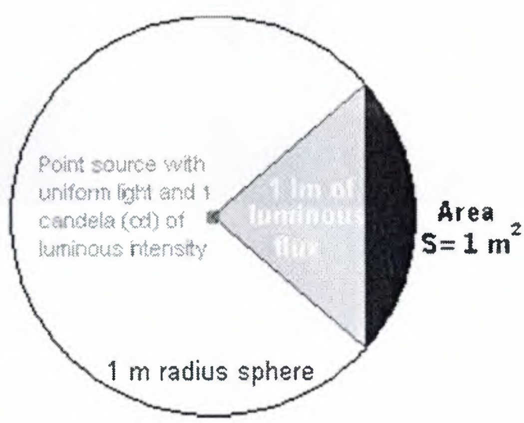

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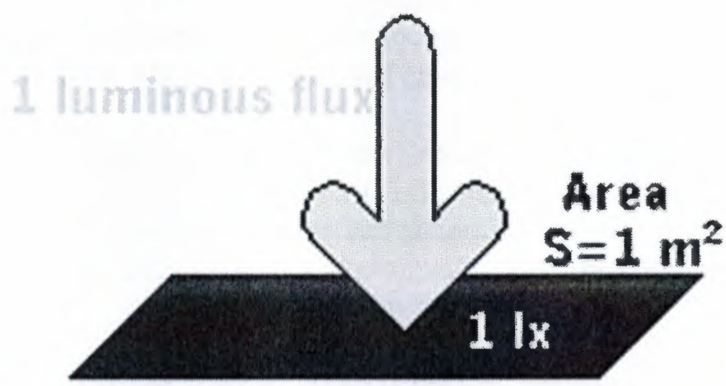

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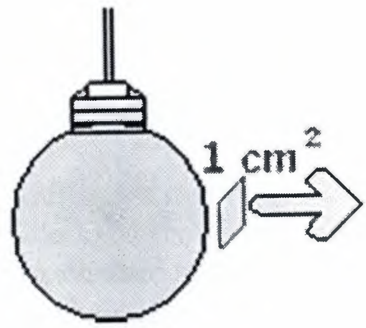

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An electric current passed through a gas will excite the atoms and molecules to emit radiation of a spectrum which is characteristic of the elements present. Two metals are commonly used, sodium and mercury, because their characteristics give useful radiations within the visible spectrum. Neither metal emits a continuous spectrum, and discharge lamps have selective spectra. Their colour rendering will never be identical to continuous spectra. Discharge lamps are often classed as high pressure or low pressure, although these terms are only relative, and a high-pressure sodium lamp operates at below one atmosphere.

1.2.c)-Types of Luminescence

Photoluminescence occurs when radiation is absorbed by a solid and is then re-emitted at a different wavelength. When the re-emitted radiation is within the visible spectrum the process is called fluorescence or phosphorescence.

Electroluminescence occurs when light is generated by an electric current passed through certain solids, such as phosphor materials. It is used for self-illuminated signs and instrument panels but has not proved to be a practical light source for the lighting of buildings or exteriors.

1.2.d)-Volution of Electric Lamps

Although technological progress has enabled different lamps to be produced, the main factors influencing their development have been external market forces. For example, the production of filament lamps in use at the start of this century was possible only after the availability of good vacuum pumps and the drawing of tungsten wire. However, it was the large-scale generation and distribution of electricity to meet the demand for electric lighting that determined market growth. Electric lighting offered many advantages over gas- or oil-generated light, such as steady light that requires infrequent maintenance as well as the increased safety of having no exposed flame, and no local by-products of combustion.

During the period of recovery after the Second World War, the emphasis was on productivity. The fluorescent tubular lamp became the dominant light source because it made possible the shadow-free and comparatively heat-free lighting of factories and offices, allowing maximum use of the space. The light output and wattage requirements for a typical 1,500 mm fluorescent tubular lamp is given in table 1.

Table 1. Improved light output and wattage requirements of some typical 1,500 mm fluorescent tube lamps

Rating (W)	Diameter (mm)	Gas fill	Light output (lumens)
80	38	argon	4,800
65	38	argon	4,900
58	25	krypton	5,100
50	25	argon	5,100 (high frequency gear)

By the 1970s oil prices rose and energy costs became a significant part of operating costs. Fluorescent lamps that produce the same amount of light with less electrical consumption were demanded by the market. Lamp design was refined in several ways. As the century closes there is a growing awareness of global environment issues. Better use of declining raw materials, recycling or safe disposal of products and the continuing concern over energy consumption (particularly energy generated from fossil fuels) are impacting on current lamp designs.

1.2.e)-Performance Criteria

Performance criteria vary by application. In general, there is no particular hierarchy of importance of these criteria.

Light output: The lumen output of a lamp will determine its suitability in relation to the scale of the installation and the quantity of illumination required.

Colour appearance and colour rendering: Separate scales and numerical values apply to colour appearance and colour rendering. It is important to remember that the figures provide guidance only, and some are only approximations. Whenever possible, assessments of suitability should be made with actual lamps and with the colours or materials that apply to the situation.

Lamp life: Most lamps will require replacement several times during the life of the lighting installation, and designers should minimize the inconvenience to the occupants of odd failures and maintenance. Lamps are used in a wide variety of applications. The anticipated average life is often a compromise between cost and performance. For example, the lamp for a slide projector will have a life of a few hundred hours because the maximum light output is important to the quality of the image. By contrast, some roadway lighting lamps may be changed every two years, and this represents some 8,000 burning hours.

Further, lamp life is affected by operating conditions, and thus there is no simple figure that will apply in all conditions. Also, the effective lamp life may be determined by different failure modes. Physical failure such as filament or lamp rupture may be preceded by reduction in light output or changes in colour appearance. Lamp life is affected by external environmental conditions such as temperature, vibration, frequency of starting, supply voltage fluctuations, orientation and so on.

It should be noted that the average life quoted for a lamp type is the time for 50% failures from a batch of test lamps. This definition of life is not likely to be applicable to many commercial or industrial installations; thus practical lamp life is usually less than published values, which should be used for comparison only.

Efficiency: As a general rule the efficiency of a given type of lamp improves as the power rating increases, because most lamps have some fixed loss. However, different types of lamps have marked variation in efficiency. Lamps of the highest efficiency should be used, provided that the criteria of size, colour and lifetime are also met. Energy savings should not be at the expense of the visual comfort or the performance ability of the occupants. Some typical efficacies are given in table 2.

Table 2. Typical lamp efficacies

Lamp efficacies	
100 W filament lamp	14 lumens/watt
58 W fluorescent tube	89 lumens/watt
400 W high-pressure sodium	125 lumens/watt
131 W low-pressure sodium	198 lumens/watt

1.2.f)-Main Lamp Types

Over the years, several nomenclature systems have been developed by national and international standards and registers.

In 1993, the International Electrotechnical Commission (IEC) published a new International Lamp Coding System (ILCOS) intended to replace existing national and regional coding systems. A list of some ILCOS short form codes for various lamps is given in table 3.

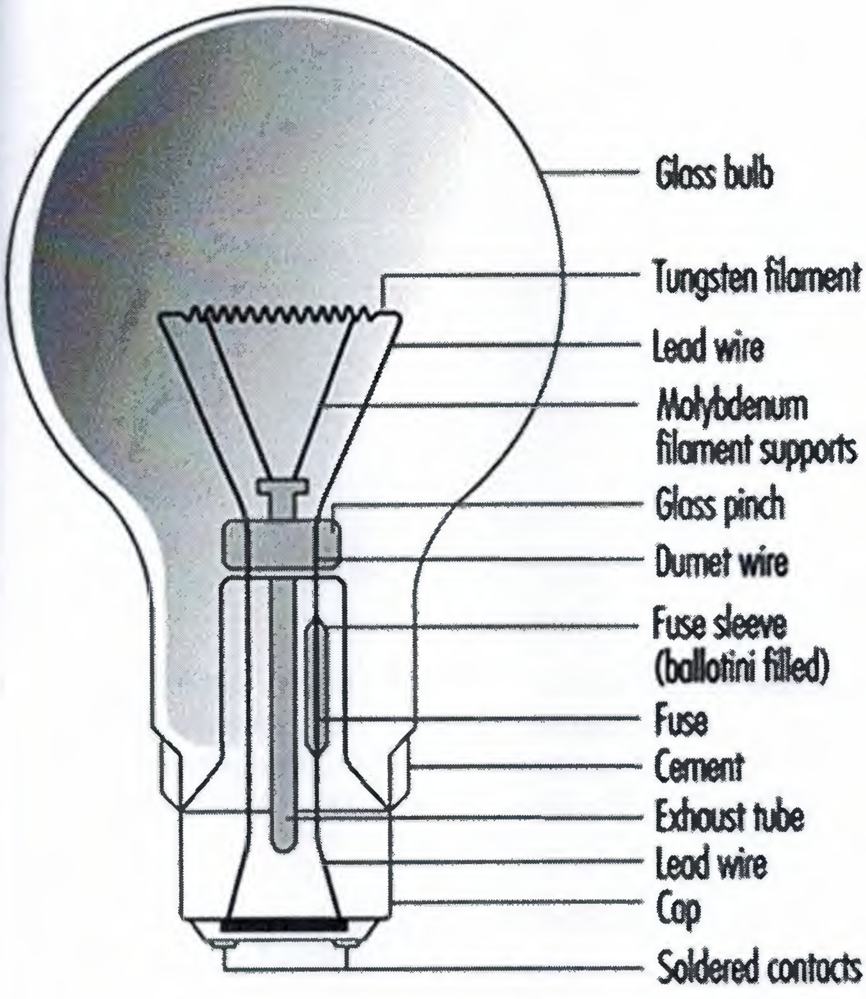
Table 3. International Lamp Coding System (ILCOS) short form coding system for some lamp types

Type (code)	Common ratings (watts)	Colour rendering	Colour temperature (K)	Life (hours)
Compact fluorescent lamps (FS)	5–55	good	2,700–5,000	5,000–10,000
High-pressure mercury lamps (QE)	80–750	fair	3,300–3,800	20,000
High-pressure sodium lamps (S-)	50–1,000	poor to good	2,000–2,500	6,000–24,000
Incandescent lamps (I)	5–500	good	2,700	1,000–3,000
Induction lamps (XF)	23–85	good	3,000–4,000	10,000–60,000
Low-pressure sodium lamps (LS)	26–180	monochromatic yellow colour	1,800	16,000
Low-voltage tungsten halogen lamps (HS)	12–100	good	3,000	2,000–5,000
Metal halide lamps (M-)	35–2,000	good to excellent	3,000–5,000	6,000–20,000
Tubular fluorescent lamps (FD)	4–100	fair to good	2,700–6,500	10,000–15,000
Tungsten halogen lamps (HS)	100–2,000	good	3,000	2,000–4,000

1.2.g)-Incandescent lamps

These lamps use a tungsten filament in an inert gas or vacuum with a glass envelope. The inert gas suppresses tungsten evaporation and lessens the envelope blackening. There is a large variety of lamp shapes, which are largely decorative in appearance. The construction of a typical General Lighting Service (GLS) lamp is given in figure 1.

Figure 1. Construction of a GLS lamp



Incandescent lamps are also available with a wide range of colours and finishes. The ILCOS codes and some typical shapes include those shown in table 4.

Table 4. Common colours and shapes of incandescent lamps, with their ILCOS codes

Colour/Shape	Code
Clear	/C
Frosted	/F
White	/W
Red	/R
Blue	/B
Green	/G
Yellow	/Y
Pear shaped (GLS)	IA
Candle	IB
Conical	IC
Globular	IG
Mushroom	IM

Incandescent lamps are still popular for domestic lighting because of their low cost and compact size. However, for commercial and industrial lighting the low efficacy generates very high operating costs, so discharge lamps are the normal choice. A 100 W lamp has a typical efficacy of 14 lumens/watt compared with 96 lumens/watt for a 36 W fluorescent lamp.

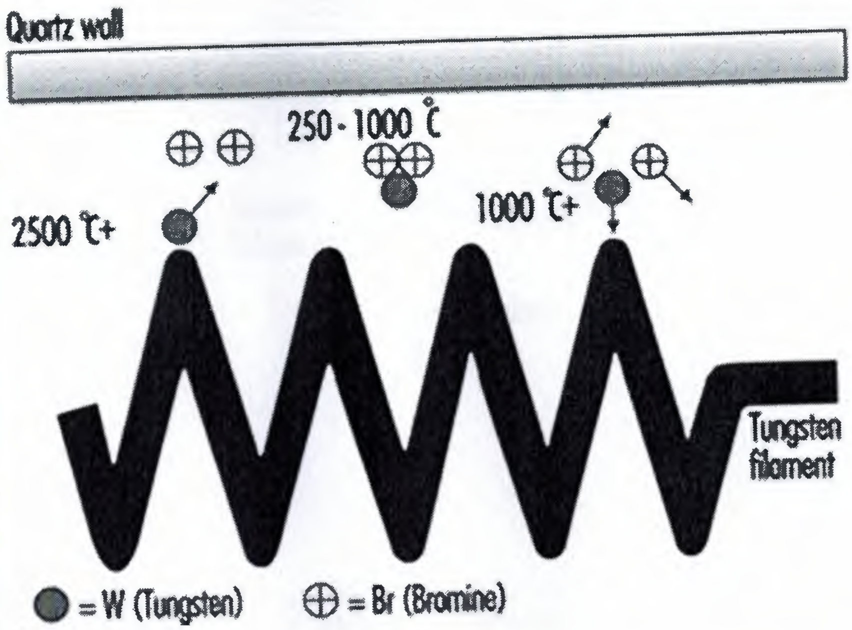
Incandescent lamps are simple to dim by reducing the supply voltage, and are still used where dimming is a desired control feature.

The tungsten filament is a compact light source, easily focused by reflectors or lenses. Incandescent lamps are useful for display lighting where directional control is needed.

1.2.h)-Tungsten Halogen Lamps

These are similar to incandescent lamps and produce light in the same manner from a tungsten filament. However the bulb contains halogen gas (bromine or iodine) which is active in controlling tungsten evaporation. See figure 2.

Figure 2. The halogen cycle



Fundamental to the halogen cycle is a minimum bulb wall temperature of 250 °C to ensure that the tungsten halide remains in a gaseous state and does not condense on the bulb wall. This temperature means bulbs made from quartz in place of glass. With quartz it is possible to reduce the bulb size.

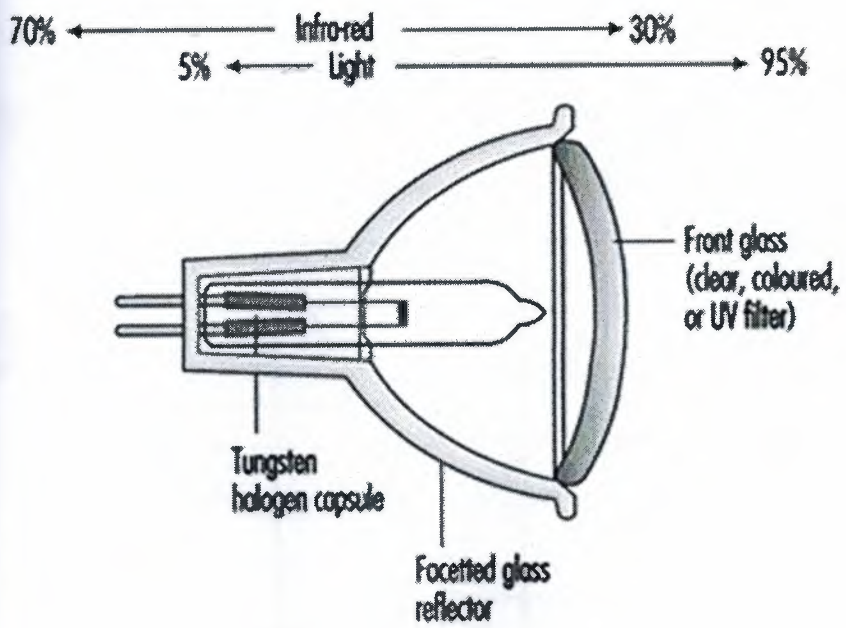
Most tungsten halogen lamps have an improved life over incandescent equivalents and the filament is at a higher temperature, creating more light and whiter colour.

Tungsten halogen lamps have become popular where small size and high performance are the main requirement. Typical examples are stage lighting, including film and TV, where directional control and dimming are common requirements.

1.2.ı)-Low-Voltage Tungsten Halogen Lamps

These were originally designed for slide and film projectors. At 12 V the filament for the same wattage as 230 V becomes smaller and thicker. This can be more efficiently focused, and the larger filament mass allows a higher operating temperature, increasing light output. The thick filament is more robust. These benefits were realized as being useful for the commercial display market, and even though it is necessary to have a step-down transformer, these lamps now dominate shop-window lighting. See figure 3.

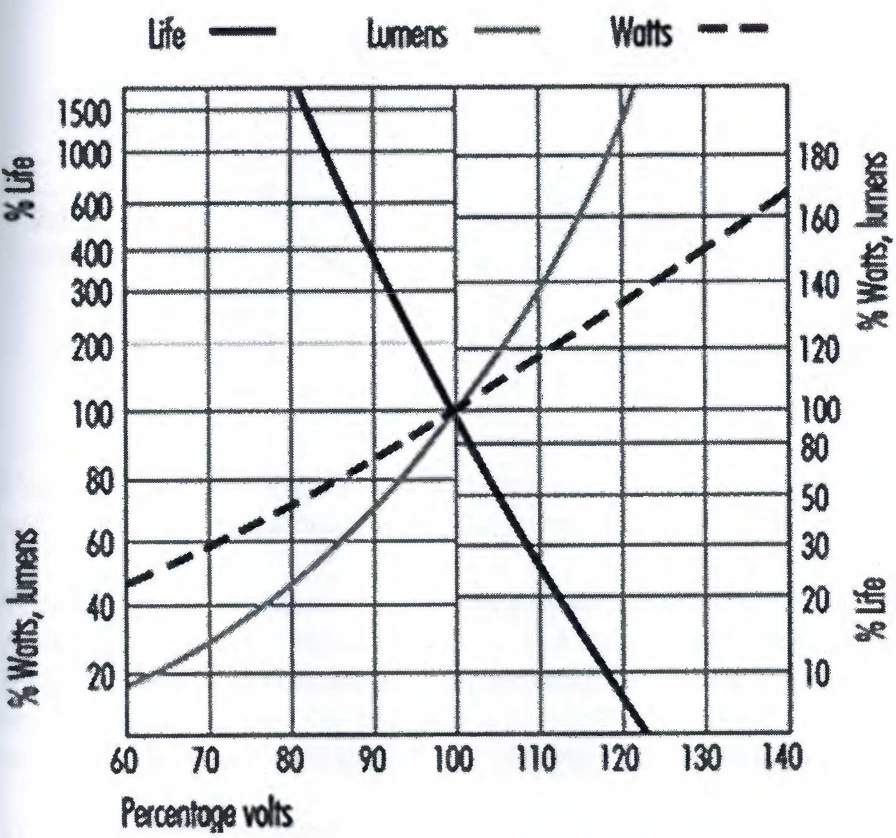
Figure 3. Low-voltage dichroic reflector lamp



Although users of film projectors want as much light as possible, too much heat damages the transparency medium. A special type of reflector has been developed, which reflects only the visible radiation, allowing infrared radiation (heat) to pass through the back of lamp. This feature is now part of many low-voltage reflector lamps for display lighting as well as projector equipment.

Voltage sensitivity: All filament lamps are sensitive to voltage variation, and light output and life are affected. The move to "harmonize" the supply voltage throughout Europe at 230 V is being achieved by widening the tolerances to which the generating authorities can operate. The move is towards ±10%, which is a voltage range of 207 to 253 V. Incandescent and tungsten halogen lamps cannot be operated sensibly over this range, so it will be necessary to match actual supply voltage to lamp ratings. See figure 4.

Figure 4. GLS filament lamps and supply voltage



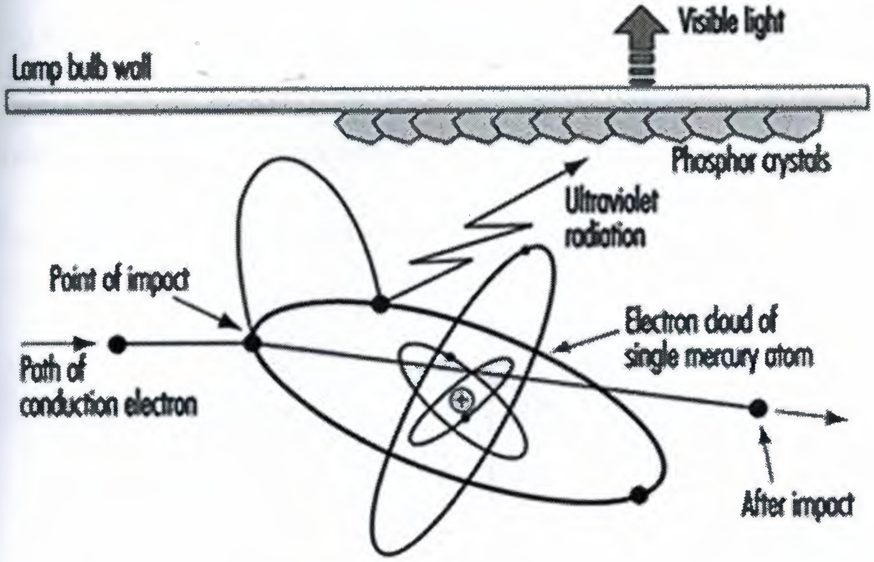
Discharge lamps will also be affected by this wide voltage variation, so the correct specification of control gear becomes important.

1.2.i)-Tubular Fluorescent Lamps

These are low pressure mercury lamps and are available as “hot cathode” and “cold cathode” versions. The former is the conventional fluorescent tube for offices and factories; “hot cathode” relates to the starting of the lamp by pre-heating the electrodes to create sufficient ionization of the gas and mercury vapour to establish the discharge.

Cold cathode lamps are mainly used for signage and advertising. See figure 5.

Figure 5. Principle of fluorescent lamp



Fluorescent lamps require external control gear for starting and to control the lamp current. In addition to the small amount of mercury vapour, there is a starting gas (argon or krypton).

The low pressure of mercury generates a discharge of pale blue light. The major part of the radiation is in the UV region at 254 nm, a characteristic radiation frequency for mercury. Inside of the tube wall is a thin phosphor coating, which absorbs the UV and radiates the energy as visible light. The colour quality of the light is determined by the phosphor coating. A range of phosphors are available of varying colour appearance and colour rendering.

During the 1950s phosphors available offered a choice of reasonable efficacy (60 lumens/watt) with light deficient in reds and blues, or improved colour rendering from "deluxe" phosphors of lower efficiency (40 lumens/watt).

By the 1970s new, narrow-band phosphors had been developed. These separately radiated red, blue and green light but, combined, produced white light. Adjusting the proportions gave a range of different colour appearances, all with similar excellent colour rendering. These tri-phosphors are more efficient than the earlier types and represent the best economic lighting solution, even though the lamps are more expensive. Improved efficacy reduces operating and installation costs.

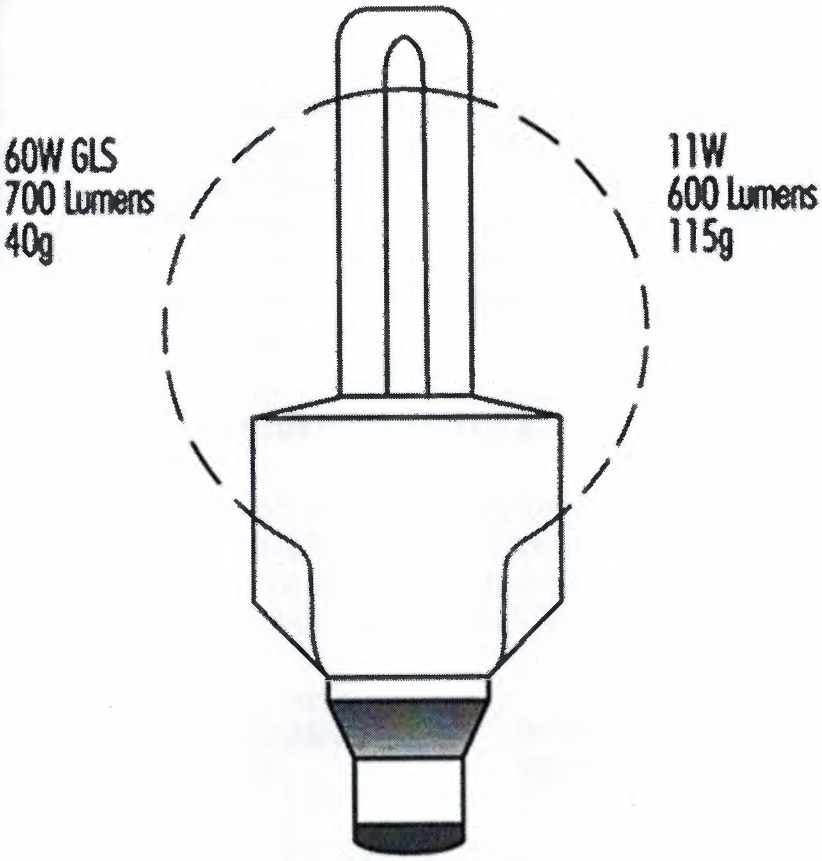
The tri-phosphor principle has been extended by multi-phosphor lamps where critical colour rendering is necessary, such as for art galleries and industrial colour matching.

The modern narrow-band phosphors are more durable, have better lumen maintenance, and increase lamp life.

1.2.j)-Compact Fluorescent Lamps

The fluorescent tube is not a practical replacement for the incandescent lamp because of its linear shape. Small, narrow-bore tubes can be configured to approximately the same size as the incandescent lamp, but this imposes a much higher electrical loading on the phosphor material. The use of tri-phosphors is essential to achieve acceptable lamp life. See figure 6.

Figure 6. Four-leg compact fluorescent



All compact fluorescent lamps use tri-phosphors, so, when they are used together with linear fluorescent lamps, the latter should also be tri-phosphor to ensure colour consistency.

Some compact lamps include the operating control gear to form retro-fit devices for incandescent lamps. The range is increasing and enables easy upgrading of existing installations to more energy-efficient lighting. These integral units are not suitable for dimming where that was part of the original controls.

High-frequency electronic control gear: If the normal supply frequency of 50 or 60 Hz is increased to 30 kHz, there is a 10% gain in efficacy of fluorescent tubes. Electronic circuits can operate individual lamps at such frequencies. The electronic circuit is designed to provide the same light output as wire-wound control gear, from reduced lamp power. This offers compatibility of lumen package with the advantage that reduced lamp loading will increase lamp life significantly. Electronic control gear is capable of operating over a range of supply voltages.

There is no common standard for electronic control gear, and lamp performance may differ from the published information issued by the lamp makers.

The use of high-frequency electronic gear removes the normal problem of flicker, to which some occupants may be sensitive.

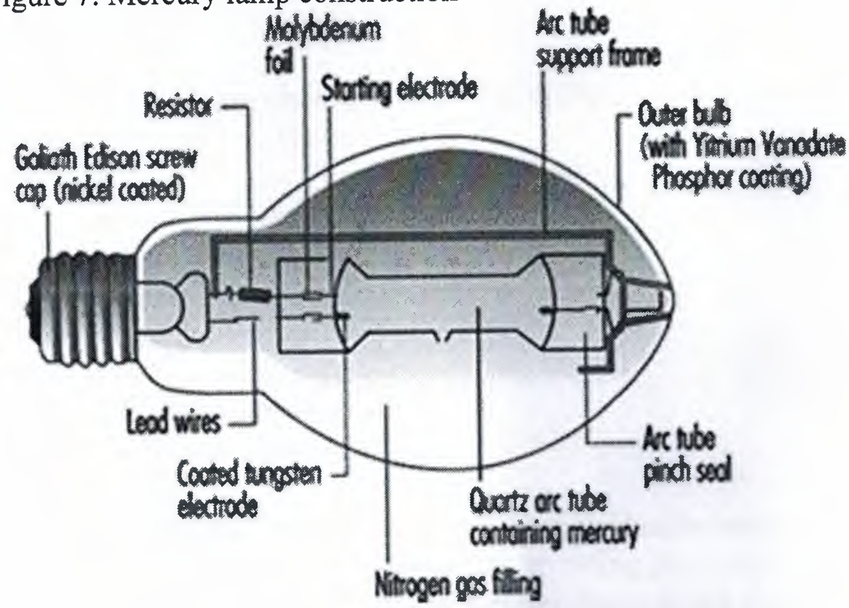
1.2.k)-Induction Lamps

Lamps using the principle of induction have recently appeared on the market. They are low-pressure mercury lamps with tri-phosphor coating and as light producers are similar to fluorescent lamps. The energy is transferred to the lamp by high-frequency radiation, at approximately 2.5 MHz from an antenna positioned centrally within the lamp. There is no physical connection between the lamp bulb and the coil. Without electrodes or other wire connections the construction of the discharge vessel is simpler and more durable. Lamp life is mainly determined by the reliability of the electronic components and the lumen maintenance of the phosphor coating.

1.2.l)-High-Pressure Mercury Lamps

High-pressure discharges are more compact and have higher electrical loads; therefore, they require quartz arc tubes to withstand the pressure and temperature. The arc tube is contained in an outer glass envelope with a nitrogen or argon-nitrogen atmosphere to reduce oxidation and arcing. The bulb effectively filters the UV radiation from the arc tube. See figure 7.

Figure 7. Mercury lamp construction



At high pressure, the mercury discharge is mainly blue and green radiation. To improve the colour a phosphor coating of the outer bulb adds red light. There are deluxe versions with an increased red content, which give higher light output and improved colour rendering.

All high-pressure discharge lamps take time to reach full output. The initial discharge is via the conducting gas fill, and the metal evaporates as the lamp temperature increases.

At the stable pressure the lamp will not immediately restart without special control gear. There is a delay while the lamp cools sufficiently and the pressure reduces, so that the normal supply voltage or ignitor circuit is adequate to re-establish the arc.

Discharge lamps have a negative resistance characteristic, and so the external control gear is necessary to control the current. There are losses due to these control gear components so the user should consider total watts when considering operating costs and electrical installation. There is an exception for high-pressure mercury lamps, and one type contains a tungsten filament which both acts as the current limiting device and adds warm colours to the blue/green discharge. This enables the direct replacement of incandescent lamps.

Although mercury lamps have a long life of about 20,000 hours, the light output will fall to about 55% of the initial output at the end of this period, and therefore the economic life can be shorter.

1.2.m)-Metal Halide Lamps

The colour and light output of mercury discharge lamps can be improved by adding different metals to the mercury arc. For each lamp the dose is small, and for accurate application it is more convenient to handle the metals in powder form as halides. This breaks down as the lamp warms up and releases the metal.

A metal halide lamp can use a number of different metals, each of which give off a specific characteristic colour. These include:

- dysprosium—broad blue-green
- indium—narrow blue
- lithium—narrow red
- scandium—broad blue-green
- sodium—narrow yellow
- thallium—narrow green
- tin—broad orange-red

There is no standard mixture of metals, so metal halide lamps from different manufacturers may not be compatible in appearance or operating performance. For lamps with the lower wattage ratings, 35 to 150 W, there is closer physical and electrical compatibility with a common standard.

Metal halide lamps require control gear, but the lack of compatibility means that it is necessary to match each combination of lamp and gear to ensure correct starting and running conditions.

1.2.n)-Low-pressure sodium lamps

The arc tube is similar in size to the fluorescent tube but is made of special ply glass with an inner sodium resistant coating. The arc tube is formed in a narrow "U" shape and is contained in an outer vacuum jacket to ensure thermal stability. During starting, the lamps have a strong red glow from the neon gas fill.

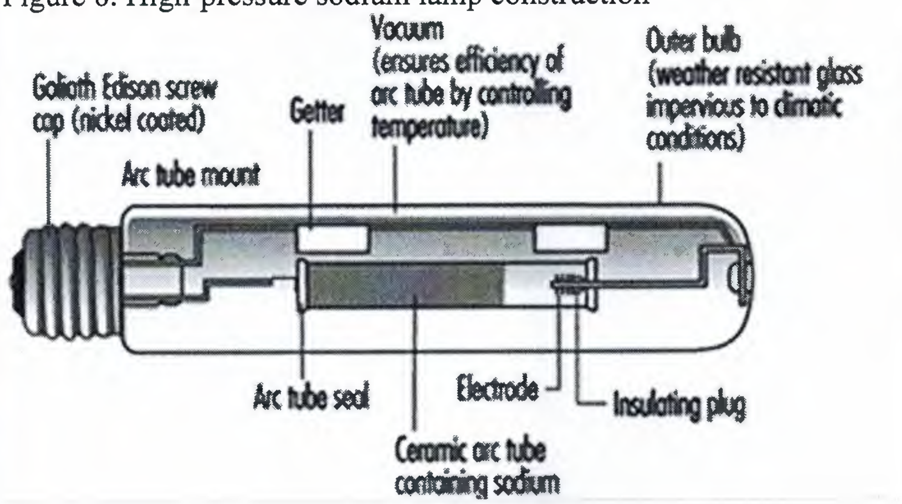
The characteristic radiation from low-pressure sodium vapour is a monochromatic yellow. This is close to the peak sensitivity of the human eye, and low-pressure sodium lamps are the most efficient lamps available at nearly 200 lumens/watt. However the applications are limited to where colour discrimination is of no visual importance, such as trunk roads and underpasses, and residential streets.

In many situations these lamps are being replaced by high-pressure sodium lamps. Their smaller size offers better optical control, particularly for roadway lighting where there is growing concern over excessive sky glow.

1.2.o)-High-pressure sodium lamps

These lamps are similar to high-pressure mercury lamps but offer better efficacy (over 100 lumens/watt) and excellent lumen maintenance. The reactive nature of sodium requires the arc tube to be manufactured from translucent polycrystalline alumina, as glass or quartz are unsuitable. The outer glass bulb contains a vacuum to prevent arcing and oxidation. There is no UV radiation from the sodium discharge so phosphor coatings are of no value. Some bulbs are frosted or coated to diffuse the light source. See figure 8.

Figure 8. High-pressure sodium lamp construction



As the sodium pressure is increased, the radiation becomes a broad band around the yellow peak, and the appearance is golden white. However, as the pressure increases, the efficiency decreases. There are currently three separate types of high-pressure sodium lamps available, as shown in table 5.

Table 5. Types of high-pressure sodium lamp

Lamp type (code)	Colour (K)	Efficacy (lumens/watt)	Life (hours)
Standard	2,000	110	24,000
Deluxe	2,200	80	14,000
White (SON)	2,500	50	

Generally the standard lamps are used for exterior lighting, deluxe lamps for industrial interiors, and White SON for commercial/display applications.

1.2.p)-Dimming of Discharge Lamps

The high-pressure lamps cannot be satisfactorily dimmed, as changing the lamp power changes the pressure and thus the fundamental characteristics of the lamp.

Fluorescent lamps can be dimmed using high-frequency supplies generated typically within the electronic control gear. The colour appearance remains very constant. In addition, the light output is approximately proportional to the lamp power, with consequent saving in electrical power when the light output is reduced. By integrating the light output from the lamp with the prevailing level of natural daylight, a near constant level of illuminance can be provided in an interior.

1.3)-Illumination Calculation

The tables prepared for k-factor are used for this method.These tables are prepared according to the reflection factors of the walls ceiling and floor of the mediums to be illuminated.

Efficiency Table

Ceiling	0.80				0.50				0.30	
Wall	0.50		0.30		0.50		0.30		0.10	0.30
Floor	0.30	0.10	0.30	0.10	0.30	0.10	0.30	0.10	0.30	0.10
$k=\frac{ab}{h(a+b)}$	η									
0.60	0.24	0.23	0.18	0.18	0.20	0.19	0.15	0.15	0.12	0.15
0.80	0.31	0.29	0.24	0.23	0.25	0.24	0.20	0.19	0.16	0.17
1.00	0.36	0.33	0.29	0.28	0.29	0.28	0.24	0.23	0.20	0.20
1.25	0.41	0.38	0.34	0.32	0.33	0.31	0.28	0.27	0.24	0.24
1.50	0.45	0.41	0.38	0.36	0.36	0.34	0.32	0.30	0.27	0.26
2.00	0.51	0.46	0.45	0.41	0.41	0.38	0.37	0.35	0.31	0.30
2.50	0.56	0.49	0.50	0.45	0.45	0.41	0.41	0.38	0.35	0.34
3.00	0.59	0.52	0.54	0.48	0.47	0.43	0.43	0.40	0.38	0.36
4.00	0.63	0.55	0.58	0.51	0.50	0.46	0.47	0.44	0.41	0.39
5.00	0.66	0.57	0.62	0.54	0.53	0.48	0.50	0.46	0.44	0.40

Formulas:

K=(A*B)/((A+B)/H)   H=h1-(h2+h3)   A=width of the room B=length of the room

K=is the index (usage factor)   Øt=(Eo*S)/(n*m)

Eo=Standard illumination level(lux)

S=Area of the room

N=efficiency

ØA=light flux of the lamp

N=Øt/(ØA*Z)

Z=Number of in luminarie

CHAPTER 2

2)-Electrical Wires&Cables

More often than not, the terms wire and cable are used to describe the same thing, but they are actually quite different. Wire is a single electrical conductor, whereas a cable is a group of wires swathed in sheathing. The term cable originally referred to a nautical line of multiple ropes used to anchor ships, and in an electrical context, cables (like wires) are used to carry electrical currents.

Whether indoors or outdoors, proper wire and cable installation is of paramount importance - ensuring a smooth electricity supply, as well as passing electrical inspections. Each wire and cable needs to be installed carefully, from the fuse box to the outlets, fixtures and appliances. The National Electrical Code (NEC) and Local Building Codes regulate the manner of installation and the types of wires and cables for various electrical applications.

2.1)-Understanding Electrical Wire

Some factors that will affect your choice of electrical wiring include color, label information and applications. The information printed on the wire covering is all that you need to choose the correct wire for your home. Here's some detailed information on the various features of electrical wire, which will help you choose the correct composition:

2.1.a)-Size of Wires

Each application requires a certain wire size for installation, and the right size for a specific application is determined by the wire gauge. Sizing of wire is done by the American wire gauge system. Common wire sizes are 10, 12 and 14 – a higher number means a smaller wire size, and affects the amount of power it can carry. For example, a low-voltage lamp cord with 10 Amps will require 18-gauge wire, while service panels or subpanels with 100 Amps will require 2-gauge wire..

2.1.b)- Wire Lettering

The letters THHN, THWN, THW and XHHN represent the main insulation types of individual wires. These letters depict the following NEC requirements:.

- T – Thermoplastic insulation
- H – Heat resistance
- HH – High heat resistance (up to 194°F)
- W – Suitable for wet locations

- N – Nylon coating, resistant to damage by oil or gas
- X – Synthetic polymer that is flame-resistant

2.1.c)- Types of Wires

There are mainly 5 types of wire: .

- **Triplex Wires :** Triplex wires are usually used in single-phase service drop conductors, between the power pole and weather heads. They are composed of two insulated aluminum wires wrapped with a third bare wire which is used as a common neutral. The neutral is usually of a smaller gauge and grounded at both the electric meter and the transformer.
- **Main Feeder Wires :** Main power feeder wires are the wires that connect the service weather head to the house. They're made with stranded or solid THHN wire and the cable installed is 25% more than the load required.
- **Panel Feed Wires :** Panel feed cables are generally black insulated THHN wire. These are used to power the main junction box and the circuit breaker panels. Just like main power feeder wires, the cables should be rated for 25% more than the actual load.
- **Non-Metallic Sheathed Wires :** Non-metallic sheath wire, or Romex, is used in most homes and has 2-3 conductors, each with plastic insulation, and a bare ground wire. The individual wires are covered with another layer of non-metallic sheathing. Since it's relatively cheaper and available in ratings for 15, 20 and 20 amps, this type is preferred for in-house wiring.
- **Single Strand Wires :** Single strand wire also uses THHN wire, though there are other variants. Each wire is separate and multiple wires can be drawn together through a pipe easily. Single strand wires are the most popular choice for layouts that use pipes to contain wires.

2.1.d)- Color Codes

Different color wires serve different purposes, like:.

- **Black :** Hot wire, for switches or outlets.
- **Red :** Hot wire, for switch legs. Also for connecting wire between 2 hardwired smoke detectors.
- **Blue and Yellow :** Hot wires, pulled in conduit. Blue for 3-4 way switch application, and yellow for switch legs to control fan, lights etc.

- **White :** Always neutral.
- **Green and Bare Copper :** Only for grounding.

2.1.e)- Wire Gauge, Ampacity and Wattage Load

To determine the correct wire, it is important to understand what ampacity and wattage a wire can carry per gauge. Wire gauge is the size of the wire, ampacity is how much electricity can flow through the wire and wattage is the load a wire can take, which is always mentioned on the appliances..

2.2)-Understanding Electrical Cable

An electrical cable also has different types, color and application as its determining factors. Here's a brief about cables that you need to understand to determine the correct cable for your home.

2.2.a)- Types of Electrical Cables

There are more than 20 different types of cables available today, designed for applications ranging from transmission to heavy industrial use. Some of the most commonly-used ones include:.

- **Non-Metallic Sheathed Cable** : These cables are also known as non-metallic building wire or NM cables. They feature a flexible plastic jacket with two to four wires (TECK cables are covered with thermoplastic insulation) and a bare wire for grounding. Special varieties of this cable are used for underground or outdoor use, but NM-B and NM-C non-metallic sheathed cables are the most common form of indoor residential cabling.

- **Underground Feeder Cable** : These cables are quite similar to NM cables, but instead of each wire being individually wrapped in thermoplastic, wires are grouped together and embedded in the flexible material. Available in a variety of gauge sizes, UF cables are often used for outdoor lighting and in-ground applications. Their high water-resistance makes them ideal for damp areas like gardens as well as open-to-air lamps, pumps, etc.

- **Metallic Sheathed Cable** : Also known as armored or BX cables, metal-sheathed cables are often used to supply mains electricity or for large appliances. They feature three plain stranded copper wires (one wire for the current, one grounding wire and one neutral wire) that are insulated with cross-linked polyethylene, PVC bedding and a black PVC sheathing. BX cables with steel wire sheathing are often used for outdoor applications and high-stress installations.

- **Multi-Conductor Cable** : This is a cable type that is commonly used in homes, since it is simple to use and well-insulated. Multi-conductor or multi-core (MC) cables feature more than one conductor, each of which is insulated individually. In addition, an outer insulation layer is added for extra security. Different varieties are used in industries, like the audio multicore 'snake cable' used in the music industry.

- **Coaxial Cable** : A coaxial (sometimes heliax) cable features a tubular insulating layer that protects an inner conductor which is further surrounded by a tubular conducting shield, and might also feature an outer sheath for extra insulation. Called 'coaxial' since the two inner shields share the same geometric axis, these cables are normally used for carrying television signals and connecting video equipment.

- **Unshielded Twisted Pair Cable** : Like the name suggests, this type consists of two wires that are twisted together. The individual wires are not insulated, which makes this cable perfect for signal transmission and video applications. Since they are more affordable than coaxial or optical fiber cables, UTP cables are often used in telephones, security cameras and data networks. For indoor use, UTP cables with copper wires or solid copper cores are a popular choice, since they are flexible and can be easily bent for in-wall installation.

- **Ribbon Cable** : Ribbon cables are often used in computers and peripherals, with various conducting wires that run parallel to each other on a flat plane, leading to a visual resemblance to flat ribbons. These cables are quite flexible and can only handle low voltage applications.

- **Direct-Buried Cable** : Also known as DBCs, these cables are specially-designed coaxial or bundled fiber-optic cables, which do not require any added sheathing, insulation or piping before being buried underground. They feature a heavy metal core with many layers of banded metal sheathing, heavy rubber coverings, shock-absorbing gel and waterproof wrapped thread-fortified tape. High tolerance to temperature changes, moisture and other environmental factors makes them a popular choice for transmission or communication requirements.

- **Twin-Lead Cable** : These are flat two-wire cables that are used for transmission between an antenna and receiver, like TV and radio.

- **Twinaxial Cable** : This is a variant of coaxial cables, which features two inner conductors instead of one and is used for very-short-range high-speed signals.

- **Paired Cable** : With two individually insulated conductors, this cable is normally used in DC or low-frequency AC applications.

- **Twisted Pair** : This cable is similar to paired cables, but the inner insulated wires are twisted or intertwined.

2.2.b)- Cable Color Code

Color coding of cable insulation is done to determine active, neutral and earth conductors. The NEC has not prescribed any color for phase/active conductors. Different countries/regions have different cable color coding, and it is essential to know what is applicable in your region. However, active conductors cannot be green/yellow, green, yellow, light blue or black..

2.2.c)-Cable Size

Cable size is the gauge of individual wires within the cable, such as 14, 12, 10 etc. – again, the bigger the number, the smaller the size. The number of wires follows the wire-gauge on a cable. So, 10/3 would indicate the presence of 3 wires of 10-gauge within the cable. Ground wire, if present, is not indicated by this number, and is represented by the letter 'G'.

Safety is very important, and if your installation of wires and cables is not proper, it could lead to accidents. Before you start any electrical project that includes wiring and cabling, you need to obtain permission from your local building inspector. Once the job is done, get the installation inspected for compliance with local codes and regulations.

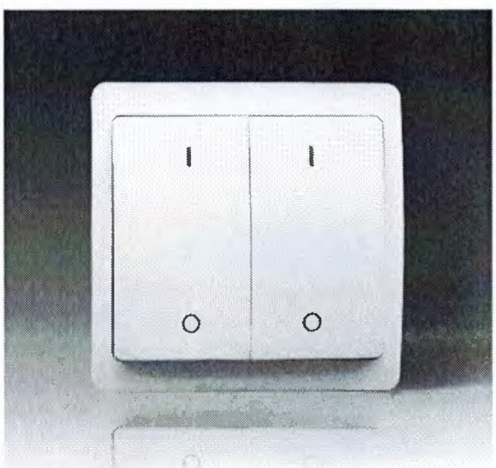
CHAPTER 3

3.1)-Light Switch

In building wiring, a light switch is a switch, most commonly used to operate electric lights, permanently connected equipment, orelectrical outlets. Portable lamps such as table lamps will have a light switch mounted on the socket, base, or in-line with the cord. Manually operated on/off switches may be substituted by remote control switches, or light dimmers that allow controlling the brightness of lamps as well as turning them on or off. Light switches are also found in flashlights and automobiles and other vehicles.

3.1.a)-Wall-mounted switches

Switches for lighting may be in hand-held devices, moving vehicles and buildings. Residential and commercial buildings usually have wall-mounted light switches to control lighting within a room. Mounting height, visibility, and other design factors vary from country to country. Switches are often recessed within a finished wall. Surface mounting is also fairly common though is seen more in commercial industrial and outbuilding settings than in houses. A light switch box (a pattress box) has a plastic, ceramic or metal cover to prevent accidental contact with live terminals of the switch. Wall plates are available in different styles and colours to blend in with the style of a room.



NEAR EAST UNIVERSITY

Faculty of Engineering

Department of Electrical and Electronic Engineering

Name of Project

Electrical Installation of Hotel Project By Using Autocad

Graduation Project

EE – 400

Students:Mahmut Ensar Artan
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ABSTRACT

The electrical installations are an application of the theories and rules in Electrical Engineering.

This Project is an important study of the electrical installations made in a hotel.This hotel design according to the EMO standards.There are many standards.And i choise most appropriate one .

The main achieve in that thesis is to self improvement and give an Outlook about the electrical installations and how it is worked and done under a specific regulation, in order to accomplish a desired objective.

INTRODUCTİON

Our aim for this thesis how to installation a electric circuit for hotel.In that topic we are going see what is the fundamental definations of electric circuit elements like luminaries, cables , switches, cables control panels and calculations.

I am beliving that ,this project is going to help me to my future career.Since i was in high school i always interesting with electrical circuits that project giving me chance to prove my talent on illumination.

As possible i can i am going to try tos hare every information and details i have.The conculation that we will get it will be very successful.

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CHAPTER 1

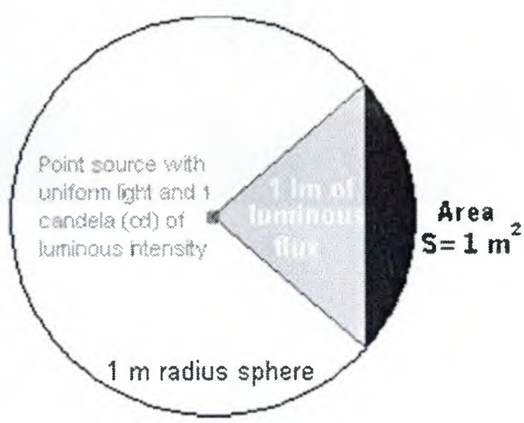
General Parts Of Illumination

1.1)-What is light?

Light is electromagnetic radiation within a certain portion of the electromagnetic spectrum. The word usually refers to visible light, which is visible to the human eye and is responsible for the sense of sight. Visible light is usually defined as having awavelength in the range of 400 nanometres (nm), or 400×10^{-9} m, to 700 nanometres – between the infrared (with longer wavelengths) and the ultraviolet (with shorter wavelengths). Often, infrared and ultraviolet are also called light.

1.1.a)- Luminous Flux

Luminous flux is the quantity of the energy of the light emitted per second in all directions. The unit of luminous flux is lumen (lm). One lumen is the luminous flux of the uniform point light source that has luminous intensity of 1 candela and is contained in one unit of spatial angle (or 1 steradian). Steradian is the spatial angle that limits the surface area of the sphere equal to the square of the radius. This concept is shown in the figure for 1 m radius of the sphere. Since the area of sphere is 4pr² then the luminous flux of the point light source is 4p lumens.



1.1.b)- Luminous Intensity

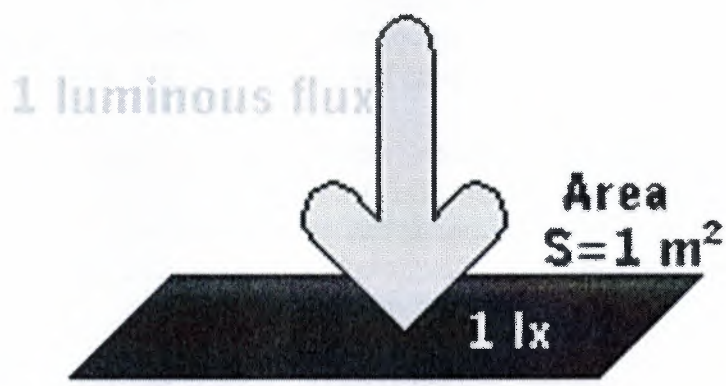
Luminous intensity is the ability to emit light into a given direction, or it is the luminous flux that is radiated by the light source in a given direction within the unit of the spatial angel. If the point light source emits Ø lumens into a small spatial angel ß, the luminous intensity is I=Ø/ß.

The unit of luminous intensity is candela. There is a standard that details the candela definition. This includes the standard light source and the physical conditions of the measurement.

1.1.c)- Illuminance(Illumınation)

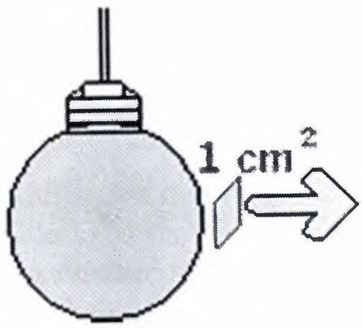
This definition determines the amount of light that covers a surface. If Ø is the luminous flux and S is the area of the given surface then the illuminance E is determined by E=Ø/S.

The unit of illumination in SI system is lx, and in foot-pound system it is foot-candle. One lx is the illuminance of 1 m^2 surface area uniformly lighted by 1 lm of luminous flux. The following drawing explains this definition. One foot-candle is 10.76 lux.



1.1.d)-What is Luminance

Luminance L is the luminous intensity emitted by the surface area of 1 cm^2 (or 1 m^2) of the light source. Mathematiclly it is L=I/S where I is the luminous intensity and S is the area of the source surface perpendicular to the given direction.
The unit of luminance is cd/m^2 or cd/cm^2 (in some applications lm/cm^2 or Lambert can be used). The following figure shows the concept.



The luminance value indicates glare and discomfort when we look at the lighting source. These values are very high for the sun or a small lamp and are low for large lighting fixtures.

1.1.e)-Illumination Level(Lux)

The lux (symbolized lx) is the unit of illuminance in the International System of Units (SI). It is defined in terms of lumen s per meter squared (lm/m^2). Reduced to SI base units, one lux is equal to 0.00146 kilogram per second cubed (1.46×10^{-3} kg / s^3).

One lux is the equivalent of 1.46 milliwatt (1.46×10^{-3} W) of radiant electromagnetic (EM) power at a frequency of 540 terahertz (540 THz or 5.40×10^{14} Hz), impinging at a right angle on a surface whose area is one square meter. A frequency of 540 THz corresponds to a wavelength of about 555 nanometer s (nm), which is in the middle of the visible-light spectrum.

The lux is a small unit. An alternative unit is the watt per meter squared (W / m^2). To obtain lux when the illuminance in watts per meter squared is known, multiply by 683. To obtain watts per meter squared when the illuminance in lux is known, divide by 683 or multiply by 0.00146.

Illuminance varies inversely with the square of the distance from the source on a free-space line of sight. If the distance is doubled, the illuminance is cut to 1/4; if the distance increases by a factor of 10, the illuminance becomes 1/100 (0.01 times) as great.

1.1.f)-Glare

Glare is difficulty seeing in the presence of bright light such as direct or reflected sunlight or artificial light such as car headlamps at night. Because of this, some cars include mirrors with automatic anti-glare functions.

Glare is caused by a significant ratio of luminance between the task (that which is being looked at) and the glare source. Factors such as the angle between the task and the glare source and eye adaptation have significant impacts on the experience of glare.

1.2)-Type Of Electric Lamps

A lamp is an energy converter. Although it may carry out secondary functions, its prime purpose is the transformation of electrical energy into visible electromagnetic radiation. There are many ways to create light. The standard method for creating general lighting is the conversion of electrical energy into light.

1.2.a)-Incandescence

When solids and liquids are heated, they emit visible radiation at temperatures above 1,000 K; this is known as incandescence.

Such heating is the basis of light generation in filament lamps: an electrical current passes through a thin tungsten wire, whose temperature rises to around 2,500 to 3,200 K, depending upon the type of lamp and its application.

There is a limit to this method, which is described by Planck's Law for the performance of a black body radiator, according to which the spectral distribution of energy radiated increases with temperature. At about 3,600 K and above, there is a marked gain in emission of visible radiation, and the wavelength of maximum power shifts into the visible band. This temperature is close to the melting point of tungsten, which is used for the filament, so the practical temperature limit is around 2,700 K, above which filament evaporation becomes excessive. One result of these spectral shifts is that a large part of the radiation emitted is not given off as light but as heat in the infrared region. Filament lamps can thus be effective heating devices and are used in lamps designed for print drying, food preparation and animal rearing.

1.2.b)-Electric Discharge

Electrical discharge is a technique used in modern light sources for commerce and industry because of the more efficient production of light. Some lamp types combine the electrical discharge with photoluminescence.

An electric current passed through a gas will excite the atoms and molecules to emit radiation of a spectrum which is characteristic of the elements present. Two metals are commonly used, sodium and mercury, because their characteristics give useful radiations within the visible spectrum. Neither metal emits a continuous spectrum, and discharge lamps have selective spectra. Their colour rendering will never be identical to continuous spectra. Discharge lamps are often classed as high pressure or low pressure, although these terms are only relative, and a high-pressure sodium lamp operates at below one atmosphere.

1.2.c)-Types of Luminescence

Photoluminescence occurs when radiation is absorbed by a solid and is then re-emitted at a different wavelength. When the re-emitted radiation is within the visible spectrum the process is called fluorescence or phosphorescence.

Electroluminescence occurs when light is generated by an electric current passed through certain solids, such as phosphor materials. It is used for self-illuminated signs and instrument panels but has not proved to be a practical light source for the lighting of buildings or exteriors.

1.2.d)-Volution of Electric Lamps

Although technological progress has enabled different lamps to be produced, the main factors influencing their development have been external market forces. For example, the production of filament lamps in use at the start of this century was possible only after the availability of good vacuum pumps and the drawing of tungsten wire. However, it was the large-scale generation and distribution of electricity to meet the demand for electric lighting that determined market growth. Electric lighting offered many advantages over gas- or oil-generated light, such as steady light that requires infrequent maintenance as well as the increased safety of having no exposed flame, and no local by-products of combustion.

During the period of recovery after the Second World War, the emphasis was on productivity. The fluorescent tubular lamp became the dominant light source because it made possible the shadow-free and comparatively heat-free lighting of factories and offices, allowing maximum use of the space. The light output and wattage requirements for a typical 1,500 mm fluorescent tubular lamp is given in table 1.

Table 1. Improved light output and wattage requirements of some typical 1,500 mm fluorescent tube lamps

Rating (W)	Diameter (mm)	Gas fill	Light output (lumens)
80	38	argon	4,800
65	38	argon	4,900
58	25	krypton	5,100
50	25	argon	5,100 (high frequency gear)

By the 1970s oil prices rose and energy costs became a significant part of operating costs. Fluorescent lamps that produce the same amount of light with less electrical consumption were demanded by the market. Lamp design was refined in several ways. As the century closes there is a growing awareness of global environment issues. Better use of declining raw materials, recycling or safe disposal of products and the continuing concern over energy consumption (particularly energy generated from fossil fuels) are impacting on current lamp designs.

1.2.e)-Performance Criteria

Performance criteria vary by application. In general, there is no particular hierarchy of importance of these criteria.

Light output: The lumen output of a lamp will determine its suitability in relation to the scale of the installation and the quantity of illumination required.

Colour appearance and colour rendering: Separate scales and numerical values apply to colour appearance and colour rendering. It is important to remember that the figures provide guidance only, and some are only approximations. Whenever possible, assessments of suitability should be made with actual lamps and with the colours or materials that apply to the situation.

Lamp life: Most lamps will require replacement several times during the life of the lighting installation, and designers should minimize the inconvenience to the occupants of odd failures and maintenance. Lamps are used in a wide variety of applications. The anticipated average life is often a compromise between cost and performance. For example, the lamp for a slide projector will have a life of a few hundred hours because the maximum light output is important to the quality of the image. By contrast, some roadway lighting lamps may be changed every two years, and this represents some 8,000 burning hours.

Further, lamp life is affected by operating conditions, and thus there is no simple figure that will apply in all conditions. Also, the effective lamp life may be determined by different failure modes. Physical failure such as filament or lamp rupture may be preceded by reduction in light output or changes in colour appearance. Lamp life is affected by external environmental conditions such as temperature, vibration, frequency of starting, supply voltage fluctuations, orientation and so on.

It should be noted that the average life quoted for a lamp type is the time for 50% failures from a batch of test lamps. This definition of life is not likely to be applicable to many commercial or industrial installations; thus practical lamp life is usually less than published values, which should be used for comparison only.

Efficiency: As a general rule the efficiency of a given type of lamp improves as the power rating increases, because most lamps have some fixed loss. However, different types of lamps have marked variation in efficiency. Lamps of the highest efficiency should be used, provided that the criteria of size, colour and lifetime are also met. Energy savings should not be at the expense of the visual comfort or the performance ability of the occupants. Some typical efficacies are given in table 2.

Table 2. Typical lamp efficacies

Lamp efficacies	
100 W filament lamp	14 lumens/watt
58 W fluorescent tube	89 lumens/watt
400 W high-pressure sodium	125 lumens/watt
131 W low-pressure sodium	198 lumens/watt

1.2.f)-Main Lamp Types

Over the years, several nomenclature systems have been developed by national and international standards and registers.

In 1993, the International Electrotechnical Commission (IEC) published a new International Lamp Coding System (ILCOS) intended to replace existing national and regional coding systems. A list of some ILCOS short form codes for various lamps is given in table 3.

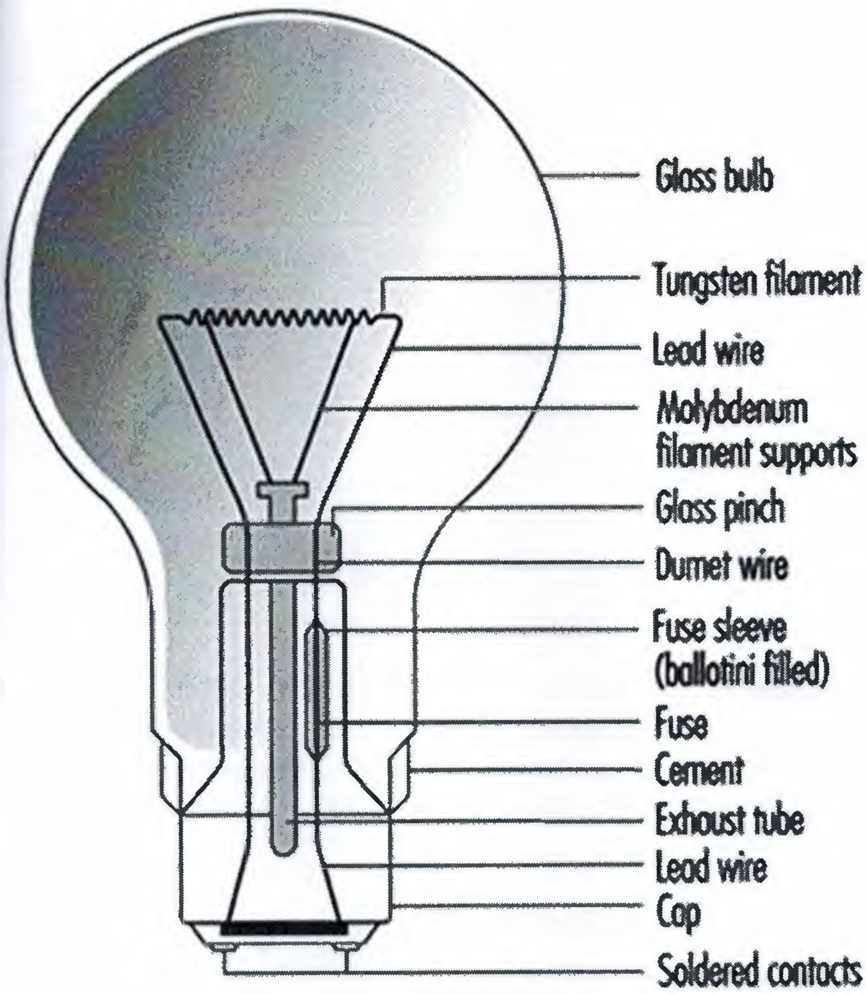
Table 3. International Lamp Coding System (ILCOS) short form coding system for some lamp types

Type (code)	Common ratings (watts)	Colour rendering	Colour temperature (K)	Life (hours)
Compact fluorescent lamps (FS)	5–55	good	2,700–5,000	5,000–10,000
High-pressure mercury lamps (QE)	80–750	fair	3,300–3,800	20,000
High-pressure sodium lamps (S-)	50–1,000	poor to good	2,000–2,500	6,000–24,000
Incandescent lamps (I)	5–500	good	2,700	1,000–3,000
Induction lamps (XF)	23–85	good	3,000–4,000	10,000–60,000
Low-pressure sodium lamps (LS)	26–180	monochromatic yellow colour	1,800	16,000
Low-voltage tungsten halogen lamps (HS)	12–100	good	3,000	2,000–5,000
Metal halide lamps (M-)	35–2,000	good to excellent	3,000–5,000	6,000–20,000
Tubular fluorescent lamps (FD)	4–100	fair to good	2,700–6,500	10,000–15,000
Tungsten halogen lamps (HS)	100–2,000	good	3,000	2,000–4,000

1.2.g)-Incandescent lamps

These lamps use a tungsten filament in an inert gas or vacuum with a glass envelope. The inert gas suppresses tungsten evaporation and lessens the envelope blackening. There is a large variety of lamp shapes, which are largely decorative in appearance. The construction of a typical General Lighting Service (GLS) lamp is given in figure 1.

Figure 1. Construction of a GLS lamp



Incandescent lamps are also available with a wide range of colours and finishes. The ILCOS codes and some typical shapes include those shown in table 4.

Table 4. Common colours and shapes of incandescent lamps, with their ILCOS codes

Colour/Shape	Code
Clear	/C
Frosted	/F
White	/W
Red	/R
Blue	/B
Green	/G
Yellow	/Y
Pear shaped (GLS)	IA
Candle	IB
Conical	IC
Globular	IG
Mushroom	IM

Incandescent lamps are still popular for domestic lighting because of their low cost and compact size. However, for commercial and industrial lighting the low efficacy generates very high operating costs, so discharge lamps are the normal choice. A 100 W lamp has a typical efficacy of 14 lumens/watt compared with 96 lumens/watt for a 36 W fluorescent lamp.

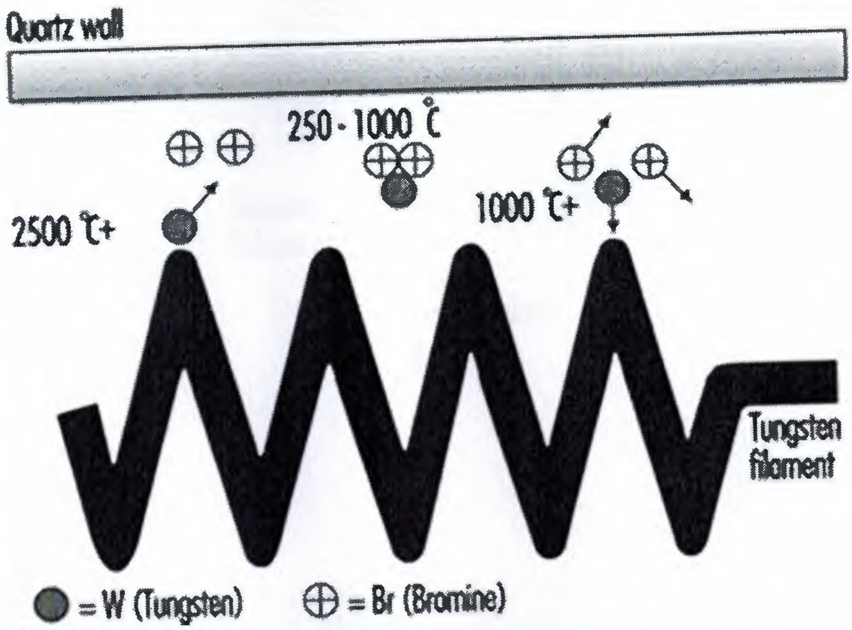
Incandescent lamps are simple to dim by reducing the supply voltage, and are still used where dimming is a desired control feature.

The tungsten filament is a compact light source, easily focused by reflectors or lenses. Incandescent lamps are useful for display lighting where directional control is needed.

1.2.h)-Tungsten Halogen Lamps

These are similar to incandescent lamps and produce light in the same manner from a tungsten filament. However the bulb contains halogen gas (bromine or iodine) which is active in controlling tungsten evaporation. See figure 2.

Figure 2. The halogen cycle



Fundamental to the halogen cycle is a minimum bulb wall temperature of 250 °C to ensure that the tungsten halide remains in a gaseous state and does not condense on the bulb wall. This temperature means bulbs made from quartz in place of glass. With quartz it is possible to reduce the bulb size.

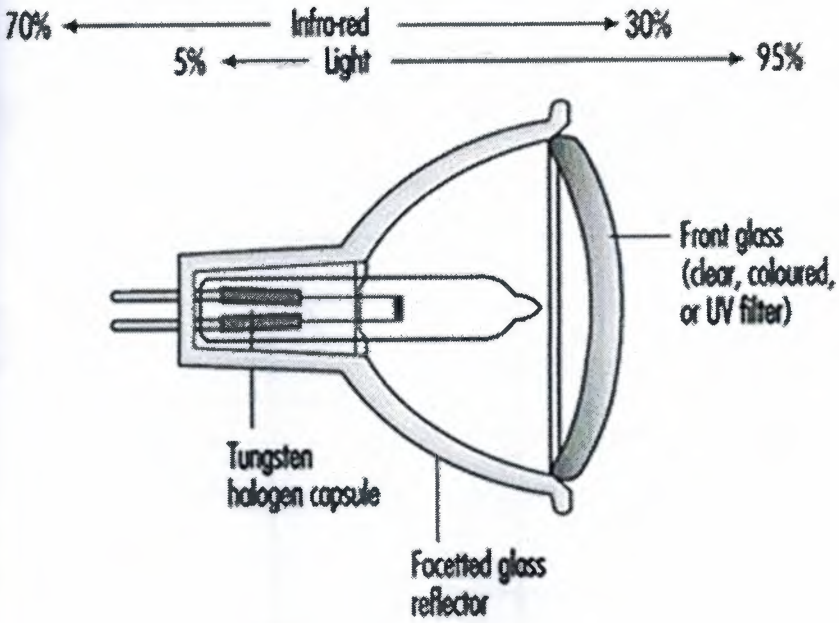
Most tungsten halogen lamps have an improved life over incandescent equivalents and the filament is at a higher temperature, creating more light and whiter colour.

Tungsten halogen lamps have become popular where small size and high performance are the main requirement. Typical examples are stage lighting, including film and TV, where directional control and dimming are common requirements.

1.2.ı)-Low-Voltage Tungsten Halogen Lamps

These were originally designed for slide and film projectors. At 12 V the filament for the same wattage as 230 V becomes smaller and thicker. This can be more efficiently focused, and the larger filament mass allows a higher operating temperature, increasing light output. The thick filament is more robust. These benefits were realized as being useful for the commercial display market, and even though it is necessary to have a step-down transformer, these lamps now dominate shop-window lighting. See figure 3.

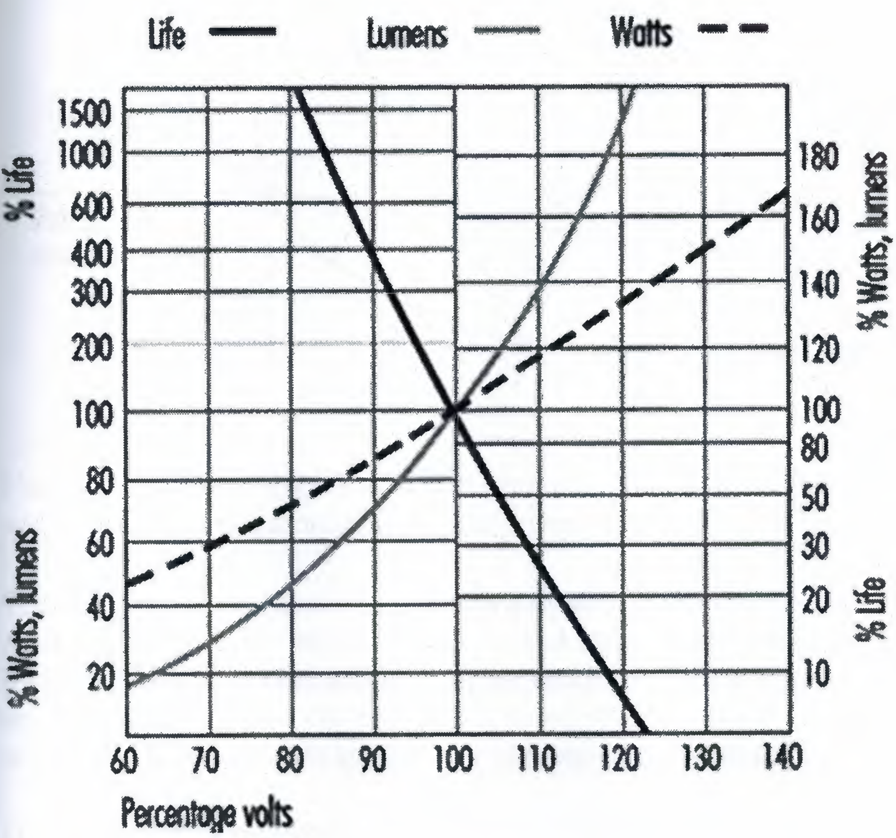
Figure 3. Low-voltage dichroic reflector lamp



Although users of film projectors want as much light as possible, too much heat damages the transparency medium. A special type of reflector has been developed, which reflects only the visible radiation, allowing infrared radiation (heat) to pass through the back of lamp. This feature is now part of many low-voltage reflector lamps for display lighting as well as projector equipment.

Voltage sensitivity: All filament lamps are sensitive to voltage variation, and light output and life are affected. The move to "harmonize" the supply voltage throughout Europe at 230 V is being achieved by widening the tolerances to which the generating authorities can operate. The move is towards ±10%, which is a voltage range of 207 to 253 V. Incandescent and tungsten halogen lamps cannot be operated sensibly over this range, so it will be necessary to match actual supply voltage to lamp ratings. See figure 4.

Figure 4. GLS filament lamps and supply voltage



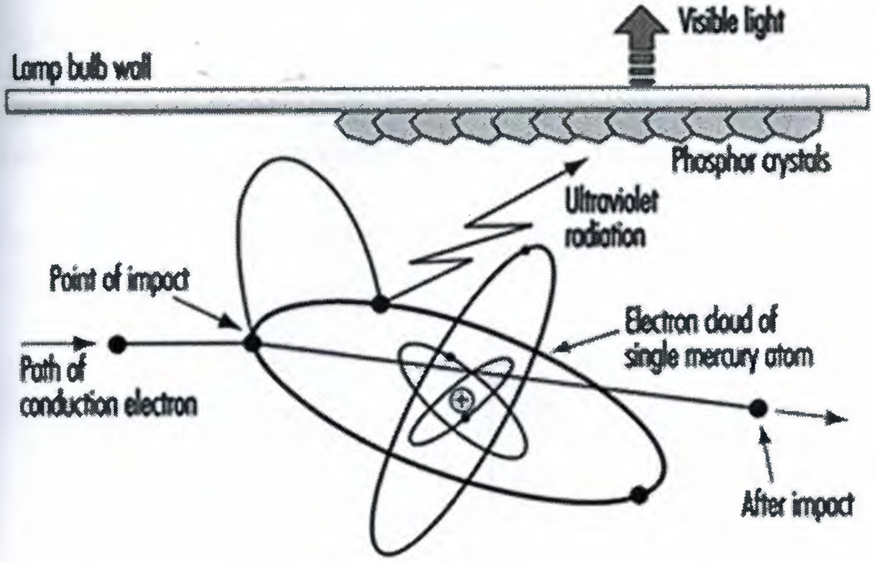
Discharge lamps will also be affected by this wide voltage variation, so the correct specification of control gear becomes important.

1.2.i)-Tubular Fluorescent Lamps

These are low pressure mercury lamps and are available as "hot cathode" and "cold cathode" versions. The former is the conventional fluorescent tube for offices and factories; "hot cathode" relates to the starting of the lamp by pre-heating the electrodes to create sufficient ionization of the gas and mercury vapour to establish the discharge.

Cold cathode lamps are mainly used for signage and advertising. See figure 5.

Figure 5. Principle of fluorescent lamp



Fluorescent lamps require external control gear for starting and to control the lamp current. In addition to the small amount of mercury vapour, there is a starting gas (argon or krypton).

The low pressure of mercury generates a discharge of pale blue light. The major part of the radiation is in the UV region at 254 nm, a characteristic radiation frequency for mercury. Inside of the tube wall is a thin phosphor coating, which absorbs the UV and radiates the energy as visible light. The colour quality of the light is determined by the phosphor coating. A range of phosphors are available of varying colour appearance and colour rendering.

During the 1950s phosphors available offered a choice of reasonable efficacy (60 lumens/watt) with light deficient in reds and blues, or improved colour rendering from "deluxe" phosphors of lower efficiency (40 lumens/watt).

By the 1970s new, narrow-band phosphors had been developed. These separately radiated red, blue and green light but, combined, produced white light. Adjusting the proportions gave a range of different colour appearances, all with similar excellent colour rendering. These tri-phosphors are more efficient than the earlier types and represent the best economic lighting solution, even though the lamps are more expensive. Improved efficacy reduces operating and installation costs.

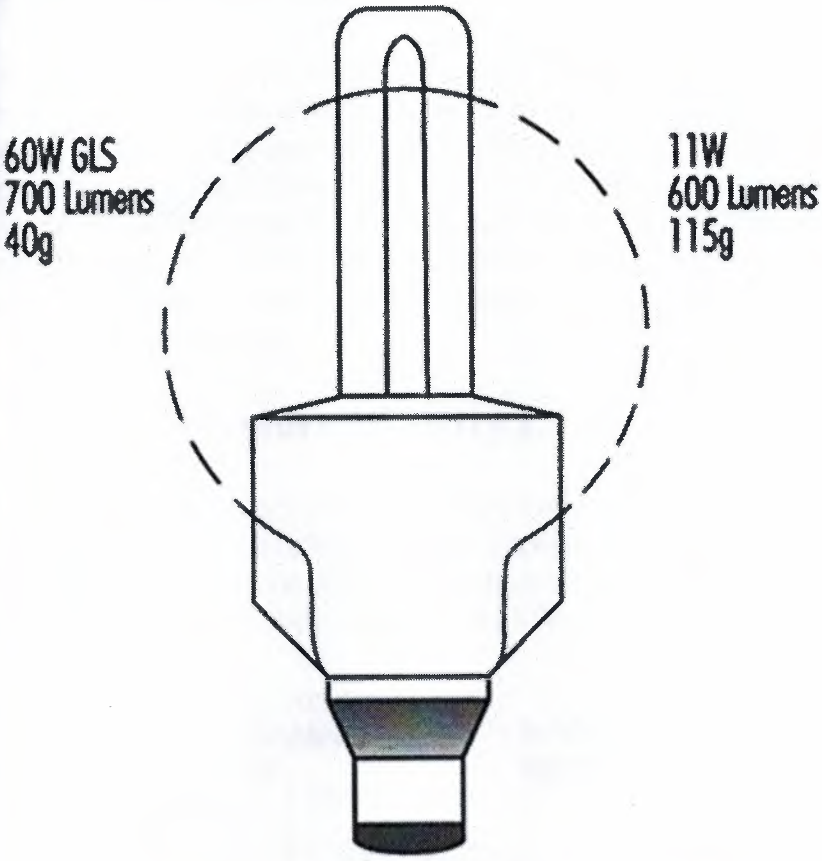
The tri-phosphor principle has been extended by multi-phosphor lamps where critical colour rendering is necessary, such as for art galleries and industrial colour matching.

The modern narrow-band phosphors are more durable, have better lumen maintenance, and increase lamp life.

1.2.j)-Compact Fluorescent Lamps

The fluorescent tube is not a practical replacement for the incandescent lamp because of its linear shape. Small, narrow-bore tubes can be configured to approximately the same size as the incandescent lamp, but this imposes a much higher electrical loading on the phosphor material. The use of tri-phosphors is essential to achieve acceptable lamp life. See figure 6.

Figure 6. Four-leg compact fluorescent



All compact fluorescent lamps use tri-phosphors, so, when they are used together with linear fluorescent lamps, the latter should also be tri-phosphor to ensure colour consistency.

Some compact lamps include the operating control gear to form retro-fit devices for incandescent lamps. The range is increasing and enables easy upgrading of existing installations to more energy-efficient lighting. These integral units are not suitable for dimming where that was part of the original controls.

High-frequency electronic control gear: If the normal supply frequency of 50 or 60 Hz is increased to 30 kHz, there is a 10% gain in efficacy of fluorescent tubes. Electronic circuits can operate individual lamps at such frequencies. The electronic circuit is designed to provide the same light output as wire-wound control gear, from reduced lamp power. This offers compatibility of lumen package with the advantage that reduced lamp loading will increase lamp life significantly. Electronic control gear is capable of operating over a range of supply voltages.

There is no common standard for electronic control gear, and lamp performance may differ from the published information issued by the lamp makers.

The use of high-frequency electronic gear removes the normal problem of flicker, to which some occupants may be sensitive.

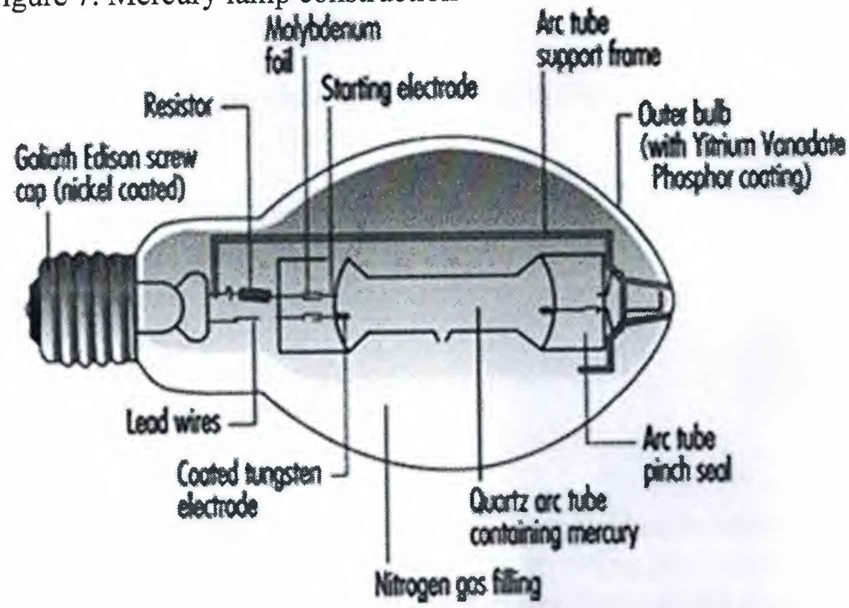
1.2.k)-Induction Lamps

Lamps using the principle of induction have recently appeared on the market. They are low-pressure mercury lamps with tri-phosphor coating and as light producers are similar to fluorescent lamps. The energy is transferred to the lamp by high-frequency radiation, at approximately 2.5 MHz from an antenna positioned centrally within the lamp. There is no physical connection between the lamp bulb and the coil. Without electrodes or other wire connections the construction of the discharge vessel is simpler and more durable. Lamp life is mainly determined by the reliability of the electronic components and the lumen maintenance of the phosphor coating.

1.2.l)-High-Pressure Mercury Lamps

High-pressure discharges are more compact and have higher electrical loads; therefore, they require quartz arc tubes to withstand the pressure and temperature. The arc tube is contained in an outer glass envelope with a nitrogen or argon-nitrogen atmosphere to reduce oxidation and arcing. The bulb effectively filters the UV radiation from the arc tube. See figure 7.

Figure 7. Mercury lamp construction



At high pressure, the mercury discharge is mainly blue and green radiation. To improve the colour a phosphor coating of the outer bulb adds red light. There are deluxe versions with an increased red content, which give higher light output and improved colour rendering.

All high-pressure discharge lamps take time to reach full output. The initial discharge is via the conducting gas fill, and the metal evaporates as the lamp temperature increases.

At the stable pressure the lamp will not immediately restart without special control gear. There is a delay while the lamp cools sufficiently and the pressure reduces, so that the normal supply voltage or ignitor circuit is adequate to re-establish the arc.

Discharge lamps have a negative resistance characteristic, and so the external control gear is necessary to control the current. There are losses due to these control gear components so the user should consider total watts when considering operating costs and electrical installation. There is an exception for high-pressure mercury lamps, and one type contains a tungsten filament which both acts as the current limiting device and adds warm colours to the blue/green discharge. This enables the direct replacement of incandescent lamps.

Although mercury lamps have a long life of about 20,000 hours, the light output will fall to about 55% of the initial output at the end of this period, and therefore the economic life can be shorter.

1.2.m)-Metal Halide Lamps

The colour and light output of mercury discharge lamps can be improved by adding different metals to the mercury arc. For each lamp the dose is small, and for accurate application it is more convenient to handle the metals in powder form as halides. This breaks down as the lamp warms up and releases the metal.

A metal halide lamp can use a number of different metals, each of which give off a specific characteristic colour. These include:

- dysprosium—broad blue-green
- indium—narrow blue
- lithium—narrow red
- scandium—broad blue-green
- sodium—narrow yellow
- thallium—narrow green
- tin—broad orange-red

There is no standard mixture of metals, so metal halide lamps from different manufacturers may not be compatible in appearance or operating performance. For lamps with the lower wattage ratings, 35 to 150 W, there is closer physical and electrical compatibility with a common standard.

Metal halide lamps require control gear, but the lack of compatibility means that it is necessary to match each combination of lamp and gear to ensure correct starting and running conditions.

1.2.n)-Low-pressure sodium lamps

The arc tube is similar in size to the fluorescent tube but is made of special ply glass with an inner sodium resistant coating. The arc tube is formed in a narrow "U" shape and is contained in an outer vacuum jacket to ensure thermal stability. During starting, the lamps have a strong red glow from the neon gas fill.

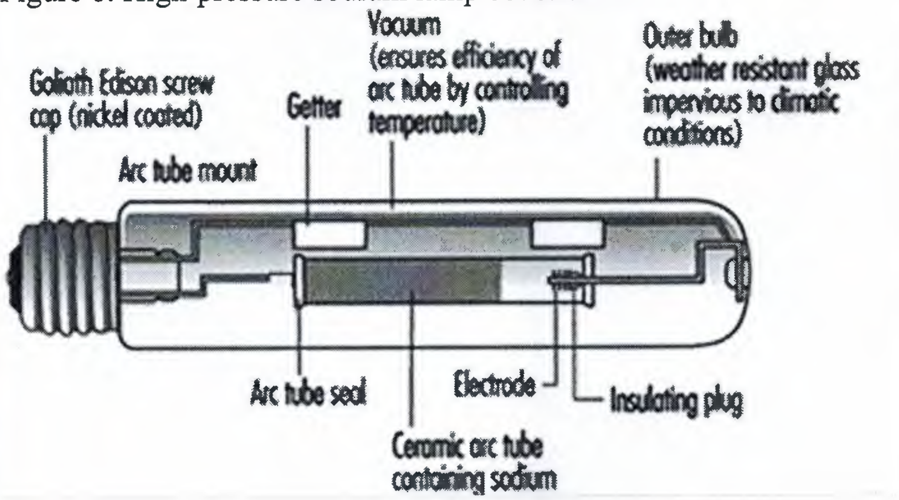
The characteristic radiation from low-pressure sodium vapour is a monochromatic yellow. This is close to the peak sensitivity of the human eye, and low-pressure sodium lamps are the most efficient lamps available at nearly 200 lumens/watt. However the applications are limited to where colour discrimination is of no visual importance, such as trunk roads and underpasses, and residential streets.

In many situations these lamps are being replaced by high-pressure sodium lamps. Their smaller size offers better optical control, particularly for roadway lighting where there is growing concern over excessive sky glow.

1.2.o)-High-pressure sodium lamps

These lamps are similar to high-pressure mercury lamps but offer better efficacy (over 100 lumens/watt) and excellent lumen maintenance. The reactive nature of sodium requires the arc tube to be manufactured from translucent polycrystalline alumina, as glass or quartz are unsuitable. The outer glass bulb contains a vacuum to prevent arcing and oxidation. There is no UV radiation from the sodium discharge so phosphor coatings are of no value. Some bulbs are frosted or coated to diffuse the light source. See figure 8.

Figure 8. High-pressure sodium lamp construction



As the sodium pressure is increased, the radiation becomes a broad band around the yellow peak, and the appearance is golden white. However, as the pressure increases, the efficiency decreases. There are currently three separate types of high-pressure sodium lamps available, as shown in table 5.

Table 5. Types of high-pressure sodium lamp

Lamp type (code)	Colour (K)	Efficacy (lumens/watt)	Life (hours)
Standard	2,000	110	24,000
Deluxe	2,200	80	14,000
White (SON)	2,500	50	

Generally the standard lamps are used for exterior lighting, deluxe lamps for industrial interiors, and White SON for commercial/display applications.

1.2.p)-Dimming of Discharge Lamps

The high-pressure lamps cannot be satisfactorily dimmed, as changing the lamp power changes the pressure and thus the fundamental characteristics of the lamp.

Fluorescent lamps can be dimmed using high-frequency supplies generated typically within the electronic control gear. The colour appearance remains very constant. In addition, the light output is approximately proportional to the lamp power, with consequent saving in electrical power when the light output is reduced. By integrating the light output from the lamp with the prevailing level of natural daylight, a near constant level of illuminance can be provided in an interior.

1.3)-Illumination Calculation

The tables prepared for k-factor are used for this method.These tables are prepared according to the reflection factors of the walls ceiling and floor of the mediums to be illuminated.

Efficiency Table

Ceiling	0.80				0.50				0.30	
Wall	0.50		0.30		0.50		0.30		0.10	0.30
Floor	0.30	0.10	0.30	0.10	0.30	0.10	0.30	0.10	0.30	0.10
$k=\frac{a \cdot b}{h(a+b)}$	η									
0.60	0.24	0.23	0.18	0.18	0.20	0.19	0.15	0.15	0.12	0.15
0.80	0.31	0.29	0.24	0.23	0.25	0.24	0.20	0.19	0.16	0.17
1.00	0.36	0.33	0.29	0.28	0.29	0.28	0.24	0.23	0.20	0.20
1.25	0.41	0.38	0.34	0.32	0.33	0.31	0.28	0.27	0.24	0.24
1.50	0.45	0.41	0.38	0.36	0.36	0.34	0.32	0.30	0.27	0.26
2.00	0.51	0.46	0.45	0.41	0.41	0.38	0.37	0.35	0.31	0.30
2.50	0.56	0.49	0.50	0.45	0.45	0.41	0.41	0.38	0.35	0.34
3.00	0.59	0.52	0.54	0.48	0.47	0.43	0.43	0.40	0.38	0.36
4.00	0.63	0.55	0.58	0.51	0.50	0.46	0.47	0.44	0.41	0.39
5.00	0.66	0.57	0.62	0.54	0.53	0.48	0.50	0.46	0.44	0.40

Formulas:

K=(A*B)/((A+B)/H) H=h1-(h2+h3) A=width of the room B=length of the room

K=is the index (usage factor) Øt=(Eo*S)/(n*m)

Eo=Standard illumination level(lux)

S=Area of the room

N=efficiency

ØA=light flux of the lamp

N=Øt/(ØA*Z)

Z=Number of in luminarie

CHAPTER 2

2)-Electrical Wires&Cables

More often than not, the terms wire and cable are used to describe the same thing, but they are actually quite different. Wire is a single electrical conductor, whereas a cable is a group of wires swathed in sheathing. The term cable originally referred to a nautical line of multiple ropes used to anchor ships, and in an electrical context, cables (like wires) are used to carry electrical currents.

Whether indoors or outdoors, proper wire and cable installation is of paramount importance - ensuring a smooth electricity supply, as well as passing electrical inspections. Each wire and cable needs to be installed carefully, from the fuse box to the outlets, fixtures and appliances. The National Electrical Code (NEC) and Local Building Codes regulate the manner of installation and the types of wires and cables for various electrical applications.

2.1)-Understanding Electrical Wire

Some factors that will affect your choice of electrical wiring include color, label information and applications. The information printed on the wire covering is all that you need to choose the correct wire for your home. Here's some detailed information on the various features of electrical wire, which will help you choose the correct composition:

2.1.a)-Size of Wires

Each application requires a certain wire size for installation, and the right size for a specific application is determined by the wire gauge. Sizing of wire is done by the American wire gauge system. Common wire sizes are 10, 12 and 14 – a higher number means a smaller wire size, and affects the amount of power it can carry. For example, a low-voltage lamp cord with 10 Amps will require 18-gauge wire, while service panels or subpanels with 100 Amps will require 2-gauge wire..

2.1.b)- Wire Lettering

The letters THHN, THWN, THW and XHHN represent the main insulation types of individual wires. These letters depict the following NEC requirements:.

- T – Thermoplastic insulation
- H – Heat resistance
- HH – High heat resistance (up to 194°F)
- W – Suitable for wet locations

- N – Nylon coating, resistant to damage by oil or gas
- X – Synthetic polymer that is flame-resistant

2.1.c)- Types of Wires

There are mainly 5 types of wire: .

- **Triplex Wires :** Triplex wires are usually used in single-phase service drop conductors, between the power pole and weather heads. They are composed of two insulated aluminum wires wrapped with a third bare wire which is used as a common neutral. The neutral is usually of a smaller gauge and grounded at both the electric meter and the transformer.
- **Main Feeder Wires :** Main power feeder wires are the wires that connect the service weather head to the house. They're made with stranded or solid THHN wire and the cable installed is 25% more than the load required.
- **Panel Feed Wires :** Panel feed cables are generally black insulated THHN wire. These are used to power the main junction box and the circuit breaker panels. Just like main power feeder wires, the cables should be rated for 25% more than the actual load.
- **Non-Metallic Sheathed Wires :** Non-metallic sheath wire, or Romex, is used in most homes and has 2-3 conductors, each with plastic insulation, and a bare ground wire. The individual wires are covered with another layer of non-metallic sheathing. Since it's relatively cheaper and available in ratings for 15, 20 and 20 amps, this type is preferred for in-house wiring.
- **Single Strand Wires :** Single strand wire also uses THHN wire, though there are other variants. Each wire is separate and multiple wires can be drawn together through a pipe easily. Single strand wires are the most popular choice for layouts that use pipes to contain wires.

2.1.d)- Color Codes

Different color wires serve different purposes, like:.

- **Black :** Hot wire, for switches or outlets.
- **Red :** Hot wire, for switch legs. Also for connecting wire between 2 hardwired smoke detectors.
- **Blue and Yellow :** Hot wires, pulled in conduit. Blue for 3-4 way switch application, and yellow for switch legs to control fan, lights etc.

- **White :** Always neutral.
- **Green and Bare Copper :** Only for grounding.

2.1.e)- Wire Gauge, Ampacity and Wattage Load

To determine the correct wire, it is important to understand what ampacity and wattage a wire can carry per gauge. Wire gauge is the size of the wire, ampacity is how much electricity can flow through the wire and wattage is the load a wire can take, which is always mentioned on the appliances..

2.2)-Understanding Electrical Cable

An electrical cable also has different types, color and application as its determining factors. Here's a brief about cables that you need to understand to determine the correct cable for your home.

2.2.a)- Types of Electrical Cables

There are more than 20 different types of cables available today, designed for applications ranging from transmission to heavy industrial use. Some of the most commonly-used ones include:.

- **Non-Metallic Sheathed Cable** : These cables are also known as non-metallic building wire or NM cables. They feature a flexible plastic jacket with two to four wires (TECK cables are covered with thermoplastic insulation) and a bare wire for grounding. Special varieties of this cable are used for underground or outdoor use, but NM-B and NM-C non-metallic sheathed cables are the most common form of indoor residential cabling.

- **Underground Feeder Cable** : These cables are quite similar to NM cables, but instead of each wire being individually wrapped in thermoplastic, wires are grouped together and embedded in the flexible material. Available in a variety of gauge sizes, UF cables are often used for outdoor lighting and in-ground applications. Their high water-resistance makes them ideal for damp areas like gardens as well as open-to-air lamps, pumps, etc.

- **Metallic Sheathed Cable** : Also known as armored or BX cables, metal-sheathed cables are often used to supply mains electricity or for large appliances. They feature three plain stranded copper wires (one wire for the current, one grounding wire and one neutral wire) that are insulated with cross-linked polyethylene, PVC bedding and a black PVC sheathing. BX cables with steel wire sheathing are often used for outdoor applications and high-stress installations.

- **Multi-Conductor Cable** : This is a cable type that is commonly used in homes, since it is simple to use and well-insulated. Multi-conductor or multi-core (MC) cables feature more than one conductor, each of which is insulated individually. In addition, an outer insulation layer is added for extra security. Different varieties are used in industries, like the audio multicore 'snake cable' used in the music industry.

- **Coaxial Cable** : A coaxial (sometimes heliax) cable features a tubular insulating layer that protects an inner conductor which is further surrounded by a tubular conducting shield, and might also feature an outer sheath for extra insulation. Called 'coaxial' since the two inner shields share the same geometric axis, these cables are normally used for carrying television signals and connecting video equipment.

- **Unshielded Twisted Pair Cable** : Like the name suggests, this type consists of two wires that are twisted together. The individual wires are not insulated, which makes this cable perfect for signal transmission and video applications. Since they are more affordable than coaxial or optical fiber cables, UTP cables are often used in telephones, security cameras and data networks. For indoor use, UTP cables with copper wires or solid copper cores are a popular choice, since they are flexible and can be easily bent for in-wall installation.

- **Ribbon Cable** : Ribbon cables are often used in computers and peripherals, with various conducting wires that run parallel to each other on a flat plane, leading to a visual resemblance to flat ribbons. These cables are quite flexible and can only handle low voltage applications.

- **Direct-Buried Cable** : Also known as DBCs, these cables are specially-designed coaxial or bundled fiber-optic cables, which do not require any added sheathing, insulation or piping before being buried underground. They feature a heavy metal core with many layers of banded metal sheathing, heavy rubber coverings, shock-absorbing gel and waterproof wrapped thread-fortified tape. High tolerance to temperature changes, moisture and other environmental factors makes them a popular choice for transmission or communication requirements.

- **Twin-Lead Cable** : These are flat two-wire cables that are used for transmission between an antenna and receiver, like TV and radio.

- **Twinaxial Cable** : This is a variant of coaxial cables, which features two inner conductors instead of one and is used for very-short-range high-speed signals.

- **Paired Cable** : With two individually insulated conductors, this cable is normally used in DC or low-frequency AC applications.

- **Twisted Pair** : This cable is similar to paired cables, but the inner insulated wires are twisted or intertwined.

2.2.b)- Cable Color Code

Color coding of cable insulation is done to determine active, neutral and earth conductors. The NEC has not prescribed any color for phase/active conductors. Different countries/regions have different cable color coding, and it is essential to know what is applicable in your region. However, active conductors cannot be green/yellow, green, yellow, light blue or black..

2.2.c)-Cable Size

Cable size is the gauge of individual wires within the cable, such as 14, 12, 10 etc. – again, the bigger the number, the smaller the size. The number of wires follows the wire-gauge on a cable. So, 10/3 would indicate the presence of 3 wires of 10-gauge within the cable. Ground wire, if present, is not indicated by this number, and is represented by the letter 'G'.

Safety is very important, and if your installation of wires and cables is not proper, it could lead to accidents. Before you start any electrical project that includes wiring and cabling, you need to obtain permission from your local building inspector. Once the job is done, get the installation inspected for compliance with local codes and regulations.

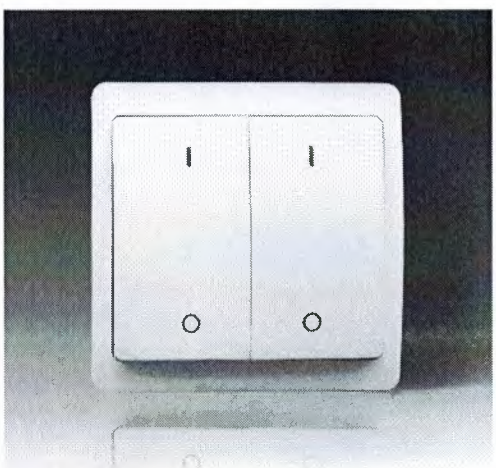
CHAPTER 3

3.1)-Light Switch

In building wiring, a light switch is a switch, most commonly used to operate electric lights, permanently connected equipment, orelectrical outlets. Portable lamps such as table lamps will have a light switch mounted on the socket, base, or in-line with the cord. Manually operated on/off switches may be substituted by remote control switches, or light dimmers that allow controlling the brightness of lamps as well as turning them on or off. Light switches are also found in flashlights and automobiles and other vehicles.

3.1.a)-Wall-mounted switches

Switches for lighting may be in hand-held devices, moving vehicles and buildings. Residential and commercial buildings usually have wall-mounted light switches to control lighting within a room. Mounting height, visibility, and other design factors vary from country to country. Switches are often recessed within a finished wall. Surface mounting is also fairly common though is seen more in commercial industrial and outbuilding settings than in houses. A light switch box (a pattress box) has a plastic, ceramic or metal cover to prevent accidental contact with live terminals of the switch. Wall plates are available in different styles and colours to blend in with the style of a room.



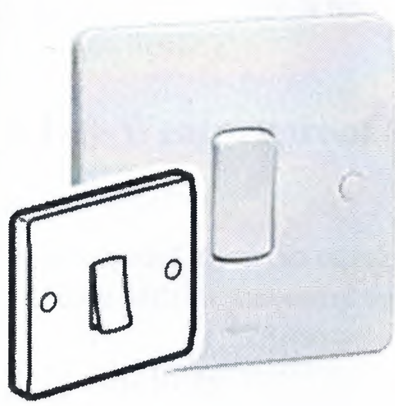
3.1.b)-Single Pole Switch

The single pole switch is the general purpose workhorse of switches. Single pole switches turn a light, receptacle or device on and off from a single location. A characteristic of a single pole toggle switch is that it has anon and off marking on the switch, something you will not find on a three or four way switch. Make sure the switch is wired in the correct direction so the words "on" and "off" are facing correctly.

A single pole switch has two terminals and is wired to the hot (black) wire.

One brass colored terminal is for the incoming hot wire and the other is for the outgoing hot wire to the device. The switch may or may not come with a ground terminal (green screw). As a general rule, you never wire the switch to the neutral wire.

Please note, sometimes you may see a white wire attached to the single pole switch but only when it is functioning as a hot wire. In those cases the white wire should have a wrap of black tape on it near the switch terminal to let one know the wire is a hot wire and not a neutral wire.



3.1.c)-Double Pole Switch

The double pole switch also has "on" and "off" markings and functions similar to a single pole switch in that it turns something on and offfrom one location. However, because it has four brass terminals instead of two terminals it can handle switching two hot wires which allows it to switch a 240 volt circuit (or "220/221 whatever it takes..." if you're a Mr. Mom fan (1983)). The switch will also come with a ground terminal (green screw).

So bottom line, double pole switches are typically used to switch receptacles and appliances using 240 volt circuits.

3.1.d)-Dimmer Type Switch

Dimmers are devices used to lower the brightness of a light. By changing the voltage waveform applied to the lamp, it is possible to lower the intensity of the light output. Although variable-voltage devices are used for various purposes, the term dimmer is generally reserved for those intended to control light output from resistive incandescent, halogen, and (more recently) compact fluorescent lights (CFLs) andlight-emitting diodes (LEDs). More specialized equipment is needed to dim fluorescent, mercury vapor, solid state and other arc lighting.

3.1.e)-Weatherproof

Weatherproof means so constructed or protected that exposure to the weather will not interfere with its successful operation.

3.2)-Sockets

AC power plugs and sockets are devices that allow electrically operated equipment to be connected to the primary alternating current (AC)power supply in a building. Electrical plugs and sockets differ in voltage and current rating, shape, size and type of connectors. The types used in each country are set by national standards, some of which are listed in the IEC technical report TR 60083, Plugs and socket-outlets for domestic and similar general use standardized in member countries of IEC.

Generally the plug is the movable connector attached to an electrically operated device's mains cable, and the socket is fixed on equipment or a building structure and connected to an energised electrical circuit. The plug has protruding prongs, blades, or pins (referred to as male) that fit into matching slots or holes (called female) in the sockets. Sockets are designed to prevent exposure of bare energised contacts. Sockets may also have protruding exposed contacts, but these are used exclusively for earthing (grounding).

To reduce the risk of users accidentally touching energized conductors and thereby experiencing electric shock, plug and socket systems often incorporate safety features in addition to the recessed slots or holes of the energized socket. These may include plugs with insulated sleeves, recessed sockets, sockets with blocking shutters, and sockets designed to accept only compatible plugs inserted in the correct orientation.

CHAPTER 4

4)-Circiut Breakers

Electrical circuit breaker is a switching device which can be operated both manually and automatically for controlling and protection of any electrical power system. As the modern power system deals with huge currents, the spacial attention should be given during designing of circuit breaker to safe interruption of arc produced during the opening/closing operation of circuit breaker.

4.1)-Types of Circuit Breakers

4.1.a)-Miniature Circuit Breaker

Low-voltage MCB (Miniature Circuit Breaker) uses air alone to extinguish the arc. These circuit breakers contain so-called arc chutes, a stack of mutually insulated parralel metal plates which divide and cool the arc. By splitting the arc into smaller arcs the arc is cooled down while the arc voltage is increased and serves as an additional impedance which limits the current through the circuit breaker. The current-carrying parts near the contacts provide easy deflection of the arc into the arc chutes by a magnetic force of a current path, although Magnetic blowout coils or permanent magnets could also deflect the arc into the arc chute (used on circuit breakers for higher ratings). The number of plates in the arc chute is dependent on the short-circuit rating and nominal voltage of the circuit breaker.

In larger ratings, oil circuit breakers rely upon vaporization of some of the oil to blast a jet of oil through the arc.[4]

Gas (usually sulfur hexafluoride) circuit breakers sometimes stretch the arc using a magnetic field, and then rely upon the dielectric strength of the sulfur hexafluoride (SF_6) to quench the stretched arc.

Vacuum circuit breakers have minimal arcing (as there is nothing to ionize other than the contact material), so the arc quenches when it is stretched a very small amount (less than 2–3 mm (0.079–0.118 in)). Vacuum circuit breakers are frequently used in modern medium-voltage switchgear to 38,000 volts.

Air circuit breakers may use compressed air to blow out the arc, or alternatively, the contacts are rapidly swung into a small sealed chamber, the escaping of the displaced air thus blowing out the arc.

Circuit breakers are usually able to terminate all current very quickly: typically the arc is extinguished between 30 ms and 150 ms after the mechanism has been tripped, depending upon age and construction of the device. The maximum current value and let-through energy determine the quality of the circuit breakers.

4.1.b)-Residual Current Breaker

A residual-current device (RCD), or residual-current circuit breaker (RCCB) is an electrical wiring device that disconnects a circuit whenever it detects that the electric current is not balanced between the energized (line) conductor(s) and the return (neutral) conductor. In normal circumstances, these two wires are expected to carry matching currents, and any difference usually indicates ashort circuit or other electrical anomaly is present. Even a small leakage current can mean a risk of harm or death due to electric shock if the leaking electric current passes through a human being; a current of around 30 mA (0.030 Amps) is potentially sufficient to cause cardiac arrest or serious harm if it persists for more than a small fraction of a second. RCCBs are designed to disconnect the conducting wires quickly enough to prevent serious injury from such shocks. (This is commonly described as the RCD being "tripped".) Injury may still occur in some cases, for example if a person falls after receiving a shock.

A RCD does not provide protection against unexpected or dangerously high current when current is flowing in the usual wires in the circuit, therefore they cannot replace a fuse or protect against overheating or fire risk due to overcurrent (overload) or short circuits if the fault does not lead to current leakage. Therefore RCDs are often used or integrated as a single product along with some kind ofcircuit breaker, such as a fuse or MCB ("miniature circuit breaker"), which adds protection in the event of excessive current in the circuit. RCDs also cannot detect the situation where a human being accidentally touches both conductors at the same time, since the flow of current through an expected device, an unexpected route, or a human being, are indistinguishable if the current returns through the expected conductor.

RCDs are usually testable and resettable devices. Commonly they include a button that when pressed safely creates a small leakage condition, and a switch that reconnects the conductors when a fault condition has been cleared. Depending upon their design, some RCDs disconnect both the energized and return conductors upon a fault, while others only disconnect the energized conductor, and rely upon the return conductor being at ground (earth) potential. The former are commonly known as "double pole" designs; the latter as "single pole" designs. If the fault has left the return wire "floating", or not at its expected ground potential for any reason, then a single pole RCD model will leave this conductor still connected to the circuit when it detects the fault.

4.1.c)-Earth leakage circuit breaker

An Earth Leakage Circuit Breaker (ELCB) is a safety device used in electrical installations with high earth impedance to prevent shock. It detects small stray voltages on the metal enclosures of electrical equipment, and interrupts the circuit if a dangerous voltage is detected. Once widely used, more recent installations instead use residual current circuit breakers which instead detect leakage current directly.

Calculations And Design

First Floor

1)-Swimming Pool Part 1

In swimming pool room we use waterproof luminaries and switches.
Calculation:

A=9,61 B=15,20 H=3 Eo=300 Qa=2850

K=(A*B)/((A+B)/H)=2 N=0,51

Øt=(Eo*S)/(n*m)=107405,9

N=Øt/(ØA*Z)=16

Part 2

Calculation:

A=3,45 B=10,9 H=3 Eo=300 Qa=2850

K=(A*B)/((A+B)/H)=1 N=0,36

Øt=(Eo*S)/(n*m)= 39171,88

N=Øt/(ØA*Z)=6

2)-Sauna

In sauna room we use waterproof luminaries.
Calculation:

A=4,30 B=2,7 H=3 Eo=100 Qa=2850 Z=2

K=(A*B)/((A+B)/H)=0,6 N=0,24

Øt=(Eo*S)/(n*m)= 6046

N=Øt/(ØA*Z)=1

3)-Hammam

In hammam room we use waterproof luminaries.
Calculation:

A=5,19 B=6,15 H=3 Eo=200 Qa=2850 Z=2

K=(A*B)/((A+B)/H)=1 N=0,36

Øt=(Eo*S)/(n*m)=22165

N=Øt/(ØA*Z)=4

4)-Meeting Room 1

Calculation:

A=9,37 B=7,75 H=3 Eo=500 Qa=2850 Z=2

K=(A*B)/((A+B)/H)=1,5 N=0,45

Øt=(Eo*S)/(n*m)= 100857,6

N=Øt/(ØA*Z)=15

5)-Meeting Room 2

Calculation:

A=9,76 B=13,25 H=3 Eo=500 Qa=2850 Z=2

K=(A*B)/((A+B)/H)=2 N=0,51

Øt=(Eo*S)/(n*m)= 158480,4

N=Øt/(ØA*Z)=28

6)-Children Playing Place

Calculation:

A=4,54 B=6,66 H=3 Eo=300 Qa=2850 Z=2

K=(A*B)/((A+B)/H)=1   N=0,36

Øt=(Eo*S)/(n*m)= 31496,25

N=Øt/(ØA*Z)=5

7)-Fitness

In Fitness room we use waterproof luminaries and Switches.
Calculation:

A=12,63 B=7,49 H=3 Eo=300 Qa=2850 Z=2

K=(A*B)/((A+B)/H)=1,5   N=0,45

Øt=(Eo*S)/(n*m)= 78832,25

N=Øt/(ØA*Z)=12

8)- Internet cafe

Calculation:

A=6,64 B=4,64 H=3 Eo=300 Qa=2850 Z=2

K=(A*B)/((A+B)/H)=1   N=0,36

Øt=(Eo*S)/(n*m)= 32093,33

N=Øt/(ØA*Z)=6

9)- Dressing Room

Calculation:

A=5,12 B=3 H=3 Eo=200 Qa=2850 Z=2

K=(A*B)/((A+B)/H)=0,6 N=0,24

Øt=(Eo*S)/(n*m)= 16000

N=Øt/(ØA*Z)=3

10)-WC

Calculation:

A=2,5 B=3,5 H=3 Eo=200 Qa=2850 Z=2

K=(A*B)/((A+B)/H)=0,6 N=0,24

Øt=(Eo*S)/(n*m)= 9114,583

N=Øt/(ØA*Z)=1

11)- Warehouse

Calculation:

A=5,22 B=3,4 H=3 Eo=100 Qa=2850 Z=2

K=(A*B)/((A+B)/H)=0,6 N=0,24

Øt=(Eo*S)/(n*m)= 9243,75

N=Øt/(ØA*Z)=2

12)- Common room

Calculation:

A=7,5 B=5,5 H=3 Eo=100 Qa=2850 Z=2

K=(A*B)/((A+B)/H)=1 N=0,36

Øt=(Eo*S)/(n*m)= 14322,92

N=Øt/(ØA*Z)=3

13)-Massage room

Calculation:

A=3,59 B=2,6 H=3 Eo=300 Qa=2850 Z=2

K=(A*B)/((A+B)/H)=0,6 N=0,24

Øt=(Eo*S)/(n*m)= 14584,38

N=Øt/(ØA*Z)=2

14)-Staff Service

Calculation:

A=8,93 B=7,5 H=3 Eo=300 Qa=2850 Z=2

K=(A*B)/((A+B)/H)=1,5 N=0,45

Øt=(Eo*S)/(n*m)= 55812,5

N=Øt/(ØA*Z)=10

14)- Foyer

Calculation:

A=6,21 B=6 H=3 Eo=300 Qa=2850 Z=2

K=(A*B)/((A+B)/H)=1 N=0,36

Øt=(Eo*S)/(n*m)= 38812,5

N=Øt/(ØA*Z)=7

Second Floor

1)-Nightclub Part 1

This area need a special illumination.But we use standard procedure.

Calculation:

A=11,85 B=11,32 H=3 Eo=300 Qa=2850 Z=2

K=(A*B)/((A+B)/H)=2 N=0,51

Øt=(Eo*S)/(n*m)= 98633,82

N=Øt/(ØA*Z)=18

Part 2

Calculation:

A=3,5 B=5,28 H=3 Eo=300 Qa=2850 Z=2

K=(A*B)/((A+B)/H)=0,8 N=0,31

Øt=(Eo*S)/(n*m)= 22354,84

N=Øt/(ØA*Z)=4

2)-Bar

Calculation:

A=9,27 B=2 H=3 Eo=300 Qa=2850 Z=2

K=(A*B)/((A+B)/H)=0,6 N=0,24

Øt=(Eo*S)/(n*m)= 28968,75

N=Øt/(ØA*Z)=5

3)- Kitchen 1

Calculation:

A=4,35 B=3,45 H=3 Eo=500 Qa=2850 Z=2

K=(A*B)/((A+B)/H)=0,6 N=0,24

Øt=(Eo*S)/(n*m)= 39082,03

N=Øt/(ØA*Z)=6

4)- Kitchen 2

Calculation:

A=4,35 B=3,45 H=3 Eo=500 Qa=2850 Z=2

K=(A*B)/((A+B)/H)=2 N=0,51

Øt=(Eo*S)/(n*m)= 141544,1

N=Øt/(ØA*Z)=24

5)-Shopping

Calculation:

A=4,86 B=3,86 H=3 Eo=300 Qa=2850 Z=2

K=(A*B)/((A+B)/H)=0,8 N=0,31

Øt=(Eo*S)/(n*m)= 22693,06

N=Øt/(ØA*Z)=4

6)- Warehouse 1

Calculation:

A=7,74 B=5,85 H=3 Eo=100 Qa=2850 Z=2

K=(A*B)/((A+B)/H)=1 N=0,36

Øt=(Eo*S)/(n*m)= 15721,88

N=Øt/(ØA*Z)=3

7)- Warehouse 2

Calculation:

A=3,44 B=3,74 H=3 Eo=100 Qa=2850 Z=2

K=(A*B)/((A+B)/H)=1 N=0,36

Øt=(Eo*S)/(n*m)= 6700,833

N=Øt/(ØA*Z)=1

8)-WC

Calculation:

A=3,27 B=4,33 H=3 Eo=200 Qa=2850 Z=2

K=(A*B)/((A+B)/H)=1 N=0,36

Øt=(Eo*S)/(n*m)= 14749,06

N=Øt/(ØA*Z)=3

9)- Entrance

Calculation:

A=7,61 B=4,39 H=3 Eo=200 Qa=2850 Z=2

K=(A*B)/((A+B)/H)=1 N=0,36

Øt=(Eo*S)/(n*m)= 34799,9

N=Øt/(ØA*Z)=6

Third Floor

1)- Restaurant Part 1

Calculation:

A=7,85 B=15,85 H=3 Eo=300 Qa=2850 Z=2

K=(A*B)/((A+B)/H)=1,5 N=0,45

Øt=(Eo*S)/(n*m)= 103685,4

N=Øt/(ØA*Z)=18

Part 2

Calculation:

A=5,66 B=7,55 H=3 Eo=300 Qa=2850 Z=2

K=(A*B)/((A+B)/H)=1 N=0,36

Øt=(Eo*S)/(n*m)= 103685,4

N=Øt/(ØA*Z)=6

2)- Kitchen

Calculation:

A=5,64 B=3,7 H=3 Eo=500 Qa=2850 Z=2

K=(A*B)/((A+B)/H)=0,8 N=0,31

Øt=(Eo*S)/(n*m)= 42072,58

N=Øt/(ØA*Z)=7

3)-Entrance

Calculation:

A=17,63 B=4 H=3 Eo=300 Qa=2850 Z=2

K=(A*B)/((A+B)/H)=1 N=0,36

Øt=(Eo*S)/(n*m)= 73458,33

N=Øt/(ØA*Z)=12

4)- Office

Calculation:

A=6,2 B=7,2 H=3 Eo=300 Qa=2850 Z=2

K=(A*B)/((A+B)/H)=1 N=0,36

Øt=(Eo*S)/(n*m)= 46500

N=Øt/(ØA*Z)=8

4)- Office (Manager Office)

Calculation:

A=7,77 B=3,56 H=3 Eo=300 Qa=2850 Z=2

K=(A*B)/((A+B)/H)=0,8 N=0,31

Øt=(Eo*S)/(n*m)= 33461,13

N=Øt/(ØA*Z)=6

5)- Service Part 1

Calculation:

A=5,85 B=7,56 H=3 Eo=300 Qa=2850 Z=2

K=(A*B)/((A+B)/H)=1 N=0,36

Øt=(Eo*S)/(n*m)= 46068,75

N=Øt/(ØA*Z)=8

Part 2

Calculation:

A=7,94B=3,9 H=3 Eo=300 Qa=2850 Z=2

K=(A*B)/((A+B)/H)=1 N=0,36

Øt=(Eo*S)/(n*m)= 32256,25

N=Øt/(ØA*Z)=6

6)-A Bölgesi

Calculation:

A=8,46 =22,32 H=3 Eo=50 Qa=2850 Z=2

K=(A*B)/((A+B)/H)=2 N=0,51

Øt=(Eo*S)/(n*m)= 138843,5

N=Øt/(ØA*Z)=24

Fourth ,Fifth and Sixth Floor

1)-Rooms

Calculation:

A=4,2 =3,6 H=3 Eo=50 Qa=2850 Z=2

K=(A*B)/((A+B)/H)=0,6 N=0,24

Øt=(Eo*S)/(n*m)= 3937,5

N=Øt/(ØA*Z)=1

2)-Corridor

Calculation:

A=16,85 =1,9 H=3 Eo=100 Qa=2850 Z=2

K=(A*B)/((A+B)/H)=0,6 N=0,24

Øt=(Eo*S)/(n*m)= 16674,48

N=Øt/(ØA*Z)=3

References

1)-http://www.ilo.org/iloenc/part-vi/lighting/item/262-types-of-lamps-and-lighting

2)-http://homerepair.about.com/od/electricalrepair/ss/switch_types_2.htm#step-heading

3)http://www.openelectrical.org/wiki/index.php?title=Circuit_breakers

4)- http://en.wikipedia.org/wiki

CONCLUSİON

According to all information that i gather it. Finally i made my graduation project.That thesis show us how to make electrical installation.we investigate Light, luminaries,cables,switches and calculations.İn the hotel project we use many cable many luminaries and switches.And How to apply them to real electrical installation.I take illumination course which is help me to get a lots of information from it.