NEAR EAST UNIVERSITY

Faculty of Engineering

Department of Electrical and Electronic Engineering

ELECTRICAL INSTALLATION PROJECT

Graduation Project

EE-400

Students:Mert Demircan(20090983) Mustafa Atik(20091345)

Supervisor: Assoc.Prof.Dr.Özgür Cemal Özerdem

Nicosia-2014

ACKNOWLEDGEMENT

First we want to thank Mr.Cemal Kavalcıoğlu to be our advisor.Under his guidance,we successfully overcome many difficulties and learn a lot about Electrical courses.We would like to thank you very much for him support and understanding over these past four years.

Also we would like to say thanks to Mr.Özgür Özerdem,who was the supervisor of our project.When we asked him any question about installation or anything he explained our questions patiently with his endless knowledge.

Then we would like to say thanks to all our teachers and their assistance,who helped and thought us anything during our education.

Especially we want to thank Innovation and Information Center's staff.All of them are friendly,helpful and polite.

Finally we would like to say thanks to our parents.They always motivated us with over these past four years.

TABLE OF CONTENTS

"We dedicate this thesis to our families for their

constant support and unconditional love."

INTRODUCTION

The thesis is about an electrical installation drawing.We decided to choose this subject because we believed,it will help us in our future carrier as well.In this thesis firstly we learned how we can design an electrical installation of the buildings.

Electrical installation drawing is enjoyable but it is challenging.You have to calculate and imagine continuosly.

First of all we calculate all of the dimensions of our buildings and how many lamps we need to placed.After placed lamps we put switches and sockets where it is necessary.We put busbands,distrubition boards and grounding all of the buildings.Finally we connect lamps,switches,sockets,busbands.etc. to our distrubition board.

We divide the thesis in to five parts.These are Introduction,six chapters,conclusion, references and appendix.

The first chapter is explanation about Electric.In this project we started to explain What is electricity?

The second chapter is Electrical Components.Which components did we use our Electrical Installation drawing.We tried to explain them.

The third chapter is Illumination Calculations.How we can calculate number of lamps and placement of the luminaries to the ceiling.

The fourth chapter is AUTOCAD application.In this part we tried to explain how we can use AUTOCAD.

The fifth chapter is about Voltage Drop and its calculation.

The sixth chapter is about Cost Calculation.

1.ELECTRICITY REVIEW

1.1.Electricity

Electricity figures everywhere in our lives.Electricity lights up our homes,cooks our food,powers our computers,television sets and other electronic devices.Electricity from batteries keeps our cars running and makes our flashlights shine in the dark.Take a walk through your school, house or apartment and write down all the different appliances, devices and machines that use electricity.But what is electricity?Where does it come from?How does it work?

Electrons, electricity, electronic and other words that begin with "electr..." all originate from the Greek word "elektor," meaning "beaming sun."

Electricity is the set of physical phenomena associated with the presence and flow of electric charge. Electricity gives a wide variety of well known effects, such as lightning,static electricity,electromagnetic induction and electrical current.In addition, electricity permits the creation and reception of electromagnetic radiation such as radio waves.In electricity,charges produce electromagnetic fields which act on other charges. Electricity occurs due to several types of physics:

- **Electric charge**:a property of some subatomic particles, which determines their electromagnetic interactions. Electrically charged matter is influenced by, and produces, electromagnetic fields.
- **Electric field**:an especially simple type of electromagnetic field produced by an electric charge even when it is not moving .The electric field produces a force on other charges in its vicinity.
- **Electric potential**:the capacity of an electric field to do work on an electric charge, typically measured in volts.
- **Electric current**:a movement or flow of electrically charged particles, typically measured in amperes.
- **Electromagnets**:Moving charges produce a magnetic field. Electrical currents generate magnetic fields, and changing magnetic fields generate electrical currents.

In electrical engineering, electricity is used for:

- **Electric power**:where electric current is used to energise equipment;
- **Electronics:**which deals with electrical circuits that involve active electrical components such as vacuum tubes, transistors, diodes and integrated circuits, and associated passive interconnection technologies.

1.2 Electrical Engineering

What is "electrical engineering"? Electrical engineering is concerned with research, design,development, manufacture, installation,operation,maintenance and management of equipment,plant and systems within the electrical,electronic,communication and computer systems areas.

These activities can apply to electricity generation,transmission,distribution,electrical installations in buildings and on industrial sites,electrical equipment manufacture, instrumentation and control systems applications in industry,communications networks, electronic plant and equipment and also the integration and control of computer systems.

Electrical engineering is a field of engineering that generally deals with the study and application of electricity,electronics and electromagnetism.Electrical engineering has now subdivided into a wide range of subfields including electronics,digital computers, power engineering,telecommunications,control systems,signal processing, instrumentation and microelectronics.The subject of electronic engineering is often treated as its own subfield but it intersects with all the other subfields,including the power electronics of power engineering.Electrical engineers typically hold a degree in electrical engineering or electronic engineering.Practicing engineers may have professional certification and be members of a professional body.Such bodies include the Institute of Electrical and Electronic Engineers (IEEE) and the Institution of Engineering and Technology (IET).Electrical engineers work in a very wide range of industries and the skills required are likewise variable.These range from basic circuit theory to the management skills required of project manager.

1.3 Power Engineering

Power engineering deals with the generation,transmission and distribution of electricity as well as the design of a range of related devices.These include transformers,electric generators,electric motors,high voltage engineering and power electronics.Power engineers may work on the design and maintenance of the power grid as well as the power systems that connect to it.Such systems are called on-grid power systems and may supply the grid with additional power,draw power from the grid or do both.Power engineers may also work on systems that do not connect to the grid,called off-grid power systems,which in some cases are preferable to on-grid systems.

1.4 Light

Light is part of the electromagnetic spectrum,which ranges from radio waves to gamma rays.Electromagnetic radiation waves as their names suggest are fluctuations of electric and magnetic fields,which can transport energy from one location to another.Visible light is not inherently different from the other parts of the electromagnetic spectrum with the exception that the human eye can detect visible waves.Electromagnetic radiation can also be described in terms of a stream of photons which are massless particles each travelling with wavelike properties at the speed of light.A photon is the smallest quantity of energy which can be transported.

Light is electromagnetic radiation that is visible to the human eye and is responsible for the sense of sight.Visible light is usually defined as having a wavelength in the range of 400 nanometres to 700 nanometres between the infrared with longer wavelengths and the ultraviolet with shorter wavelengths.These numbers do not represent the absolute limits of human vision,but the approximate range within which most people can see reasonably well under most circumstances.Primary properties of visible light are intensity, propagation direction,frequency or wavelength spectrum, and polarisation.

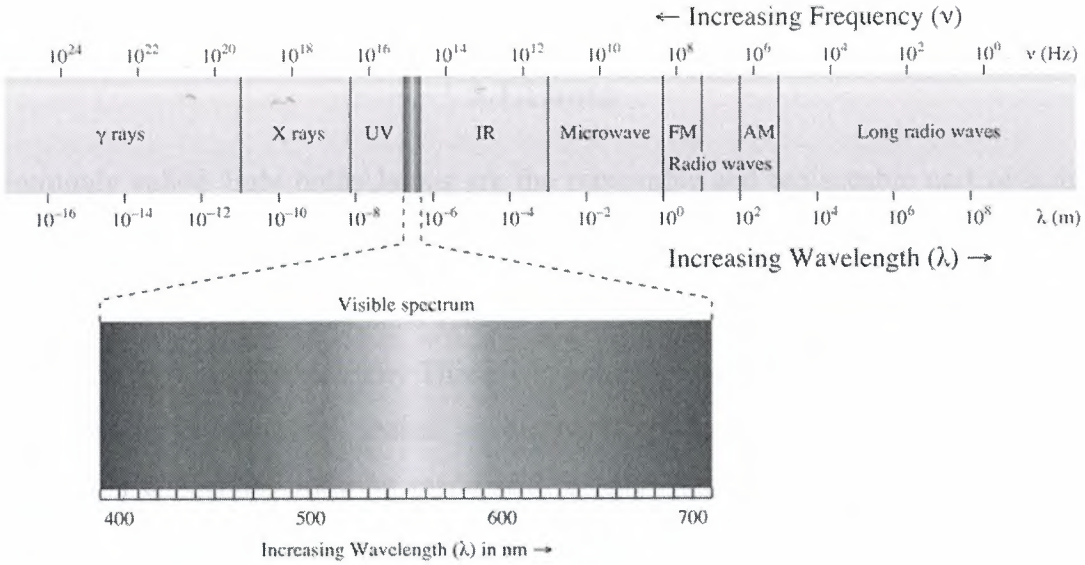


Figure 1.4 Electromagnetic Spectrum and Visible Light

1.5 Lighting

Lighting or illumination is the deliberate use of light to achieve a practical or aesthetic effect.Lighting includes the use of both artificial light sources like lamps and light fixtures, as well as natural illumination by capturing daylight.Daylighting is sometimes used as the main source of light during daytime in buildings.This can save energy in place of using artificial lighting,which represents a major component of energy consumption in buildings.Proper lighting can enhance task performance,improve the appearance of an area or have positive psychological effects on occupants.Forms of lighting:

- Indoor lighting
- Outdoor lighting

2.ELECTRICAL COMPONENTS

2.1.Lamp

Commonly called 'light bulbs',lamps are the removable and replaceable part of a light fixture,which converts electrical energy into electromagnetic radiation.

A lamp is a replaceable component such as an incandescent light bulb,which is designed to produce light from electricity.These components usually have a base of ceramic, metal,glass or plastic,which makes an electrical connection in the socket of a light fixture.This connection may be made with a screw-thread base, two metal pins,two metal caps or a bayonet cap.

Figure 2.1 The cross in a circle, which usually represents a lamp as an indicator.

There are several types of lamps:

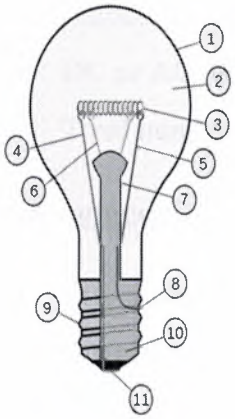
- Incandescent lamp
- ✓ Halogen lamp
- Gas-discharge lamp
- ✓ Fluorescent lamp
- LED lamp
- ✓ OLED lamp

2.1.1.Incandescent Lamp

Incandescence is the emission of light from a hot body as a result of its temperature. Incandescence usually refers specifically to visible light,while thermal radiation refers also to infrared or any other electromagnetic radiation.

An incandescent light bulb,incandescent lamp or incandescent light globe is an electric light which produces light with a filament wire heated to a high temperature by an electric current passing through it,until it glows.The hot filament is protected from oxidation with a glass or quartz bulb that is filled with inert gas or evacuated.The light bulb is supplied with electrical current by feed through terminals or wires embedded in the glass.Most bulbs are used in a socket which provides mechanical support and electrical connections.Incandescent bulbs are manufactured in a wide range of sizes, light output and voltage ratings,from 1.5 volts to about 300 volts.They require no external regulating equipment,have low manufacturing costs, and work equally well on either alternating current or direct current.Incandescent bulbs are much less efficient than most other types of electric lighting; incandescent bulbs convert less than 5% of the energy they use into visible light.Incandescent bulbs also have short lifetimes compared with other types of lighting; around 1000 hours for home light bulbs versus up to 10,000 hours for compact fluorescents and up to 100,000 hours for LED lamps.

As a result, the incandescent lamp is widely used in household and commercial lighting, for portable lighting such as table lamps,car headlamps and flashlights,and for decorative and advertising lighting.



1. Outline of Glass bulb
2. Low pressure inert gas (argon, nitrogen, krypton, xenon)
3. Tungsten filament
4. Contact wire (goes out of stem)
5. Contact wire (goes into stem)
6. Support wires (one end embedded in stem; conduct no current)
7. Stem (glass mount)
8. Contact wire (goes out of stem)
9. Cap (sleeve)
10. Insulation
11. Electrical contact

Figure 2.1.1 Incandescent Lamp

2.1.2.Halogen Lamp

Halogen lamps are also a type of incandescent lamps.A halogen lamp, also known as a tungsten halogen,quartz-halogen or quartz iodine lamp,is an incandescent lamp that has a small amount of a halogen such as iodine or bromine added.The combination of the halogen gas and the tungsten filament produces a halogen cycle chemical reaction which redeposits evaporated tungsten back onto the filament,increasing its life and maintaining the clarity of the envelope.Because of this, a halogen lamp can be operated at a higher temperature than a standard gas-filled lamp of similar power and operating life, producing light of a higher luminous efficacy and color temperature.The small size of halogen lamps permits their use in compact optical systems for projectors and illumination.

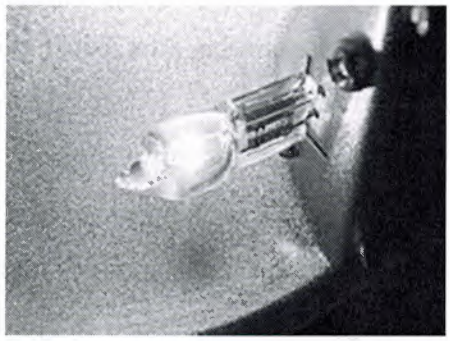


Figure 2.1.2 Halogen Lamp

Advantages:

- Easy connection
- Cheap
- Small size
- İmmediate turn on
- DC or AC usage
- Total number of switchings does not effect the life time

Disadvantages:

- Efficiency is low
- Operation cost is high
- Cause a lot of heat
- Short life time

- Purple colour

Usage areas:

- Cheap installations
- İllumination levels less than 150 lux
- Where warmlight is necessary

2.1.3.Gas-Discharge Lamps

Gas-discharge lamps are a family of artificial light sources that generate light by sending an electrical discharge through an ionized gas,a plasma.The character of the gas discharge depends on the pressure of the gas as well as the frequency of the current. Typically, such lamps use a noble gas (argon, neon, krypton and xenon) or a mixture of these gases.Most lamps are filled with additional materials,like mercury,sodium,and metal halides.In operation the gas is ionized,and free electrons,accelerated by the electrical field in the tube,collide with gas and metal atoms.Some electrons in the atomic orbitals of these atoms are excited by these collisions to a higher energy state. When the excited atom falls back to a lower energy state,it emits a photon of a characteristic energy,resulting in infrared,visible light or ultraviolet radiation.Some lamps convert the ultraviolet radiation to visible light with a fluorescent coating on the inside of the lamp's glass surface.The fluorescent lamp is perhaps the best known gas-discharge lamp.

Compared with incandescent lamp and even with LED lighting,gas-discharge lamps offer higher efficiency but are more complicated to manufacture,and require auxiliary electronic equipment such as ballasts to control current flow through the gas.

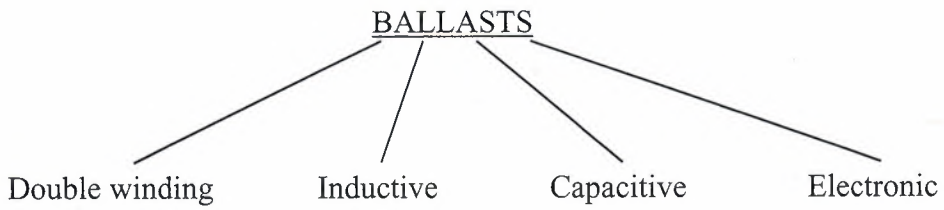
Figure 2.1.3. Gas-Discharge Lamp

2.1.3.1.Component of Discharge Lamp

2.1.3.2.Current Limiting Components

It is necessary to limit the current flowing through discharge lamps after the firing because if it is not limited as the conductivity in the lamp increase the current will increase and lamp may explode.

In AC systems this component limiting the current is ballasts.



Double winding Ballast

Used where the firing voltages are double of source voltage

Inductive Ballast

U type core is wound by copper winding cheapest ballast.By the help of a starter it supplies necessary firing voltage to the lamp increase supply voltage is less than firing voltage.

Capacitive Ballast

It is composed if on inductive winding in series with a capacitor.Usually the reactance of capacitor is double of inductor so the compersation is also done.

Electronic Ballast

With this type of Ballasts are voltage is converted to DC and AC capacitor is chargezed.By the help of a high frequency power oscilator S1&S2 semiconductor switches are triggened and a 20-100kHZ square use is generated.The capacitor connected in parallel to the lamp lets warming current to pass through lamp and helps firing it acts as starter in normal ballast circuits.

Electronic ballasts are more expensive but:

- İncrease lif time of the lamp
- No need for extra starter
- Decrease losses
- Less noise
- Light in weight

2.1.4.Fluorescent Lamps

A fluorescent lamp or fluorescent tube is a low pressure mercury vapor gas-discharge lamp that uses fluorescence to produce visible light.An electric current in the gas excites mercury vapor which produces short wave ultraviolet light that then causes a phosphor coating on the inside of the bulb to glow.

A fluorescent lamp converts electrical energy into useful light much more efficiently than incandescent lamps.The luminous efficacy of a fluorescent light bulb can exceed 100 lumens per watt, several times the efficancy of an incandescent bulb with comparable light output. Fluorescent lamp fixtures are more costly than incandescent lamps because they require a ballast to regulate the current through the lamp, but the lower energy cost typically offsets the higher initial cost.Compact fluorescent lamps are now available in the same popular sizes as incandescents and are used as an energy-saving alternative in homes.

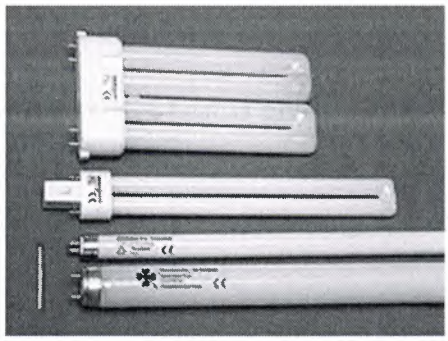


Figure 2.1.4 Fluorescent Lamps

Advantages:

- **Efficacy**

Fluorescent lamps convert more of the input power to visible light than incandescent lamps, though as of 2013 LEDs are sometimes even more efficient and are more rapidly increasing in efficiency.A typical 100 watt tungsten filament incandescent lamp may convert only 5% of its power input to visible white light (400–700 nm wavelength) whereas typical fluorescent lamps convert about 22% of the power input to visible white light.Fluorescent lamp efficacy is dependent on lamp temperature at the coldest part of the lamp.

- **Life**

Typically a fluorescent lamp will last between 10 to 20 times as long as an equivalent incandescent lamp when operated several hours at a time.Under standard test conditions general lighting lamps have 9,000 hours or longer service life.The higher initial cost of a fluorescent lamp is usually more than compensated for by lower energy consumption over its life

- **Lower luminance**

Compared with an incandescent lamp, a fluorescent tube is a more diffuse and physically larger light source.In suitably designed lamps, light can be more evenly distributed without point source of glare such as seen from an undiffused incandescent filament;the lamp is large compared to the typical distance between lamp and illuminated surfaces.

- **Lower heat**

About two-thirds to three-quarters less heat is given off by fluorescent lamps compared to an equivalent installation of incandescent lamps.This greatly reduces the size, cost, and energy consumption devoted to air conditioning for office buildings that would typically have many lights and few windows.

2.1.5.Led Lamp

An LED lamp is a light-emitting diode (LED) product that is assembled into a lamp (or light bulb) for use in lighting fixtures. LED lamps have a lifespan and electrical efficiency that is several times better than incandescent lamps, and significantly better than most fluorescent lamps, with some chips able to emit more than 100 lumens per watt. Like incandescent lamps and unlike most fluorescent lamps, LED lights come to full brightness without need for a warm-up time; the life of fluorescent lighting is also reduced by frequent switching on and off. Initial cost of LED is usually higher. Some LED lamps are made to be a directly compatible drop-in replacement for incandescent or fluorescent lamps. An LED lam packaging may show the lumen output, power consumption in watts, color temperature in kelvins or description and sometimes the equivalent wattage of an incandescent lamp of similar luminous output. LED chips need controlled direct current (DC) electrical power; an appropriate power supply is needed. LEDs are adversely affected by high temperature, so LED lamps typically include heat dissipation elements such as heat sinks and cooling fins. White LED lamps have achieved market dominance in applications where high efficiency is important at low power levels. Some of these applications include flashlights, solar-powered garden or walkway lights, and bicycle lights. Monochromatic (colored) LED lamps are now commercially used for traffic signal lamps, where the ability to emit bright monochromatic light is a desired feature, and in strings of holiday lights.

Figure 2.1.5 LED Lamp

As a result LEDs use for indication purpose.In recent years they are used for internal and external illumination.They are manifactured by gallium arsenite and gallium phospate.The colours are obtained by charging the ratios of arsenite and phospor.

Advantages:

- They are long life devices
- High efficiency
- Low operation cost
- Various colours
- Easily programmable

2.1.6.Oleds

An OLED (organic light-emitting diode) is a light-emitting diode (LED) in which the emissive electroluminescent layer is a film of organic compound which emits light in response to an electric current.This layer of organic semiconductor is situated between two electrodes; typically, at least one of these electrodes is transparent. OLEDs are used to create digital displays in devices such as television screens, computer monitors, portable systems such as mobile phones, handheld game consoles and PDAs.

A major area of research is the development of white OLED devices for use in solid-state lighting applications.There are two main families of OLED: those based on small molecules and those employing polymers.Adding mobile ions to an OLED creates a light-emitting electrochemical cell (LEC) which has a slightly different mode of operation.

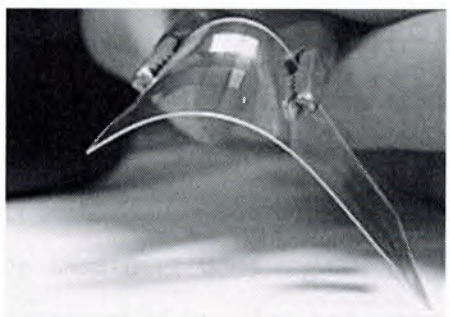


Figure 2.1.6 OLED

2.2.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.

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.

Electrical sockets for single phase domestic, commercial and light industrial purposes generally provide either two or three electrical connections to the supply conductors. Two pin sockets normally provide neutral and line connections, both of which carry current and are defined as live parts.Neutral is usually very near to earth potential, usually being earthed either at the distribution board or at the substation.

Plugs and sockets for portable appliances started becoming available in the 1880s, to replace connections to light sockets with easier to use wall-mounted outlets.Today there are approximately 20 types in common use around the world, and many obsolete socket types are still found in older buildings.Co-ordination of technical standards has allowed some types of plugs to be used over wide regions to facilitate trade in electrical appliances, and for the convenience of travellers and consumers of imported electrical goods.Some multi-standard sockets allow use of several different types of plugs; improvised or unapproved adapters between incompatible sockets and plugs may not provide the full safety and performance of an approved adapter

2.2.1.Types of Sockets

There are two basic standards for voltage and frequency in the world.One is the North American standard of 120 volts at a frequency of 60 Hz, and the other is the European standard of 220–240 volts at 50 Hz.

2.2.1.1.British and Related Types

Plugs and sockets for portable appliances originated in Britain in the 1880s and were initially two pin designs.These were usually sold as a mating pair, but gradually defacto and then official standards arose to enable the interchange of compatible devices.

- ✓ **BS 546**

Two-pole and earthing-pin plugs, socket-outlets and socket-outlet adaptors for AC (50-60 Hz) circuits up to 250 V is a British Standard for three pin AC power plugs and sockets.The plugs have three round pins arranged in a triangle, with an earthing pin.The plugs are polarized and unfused.Plugs are non-interchangeable between current ratings. Introduced in 1934, the BS 546 type has mostly been displaced in the UK by plugs and sockets to the BS 1363 standard. BS 546 is also the precursor of current Indian and South African plug standards.BS 546 plugs and sockets are still permitted in the UK.

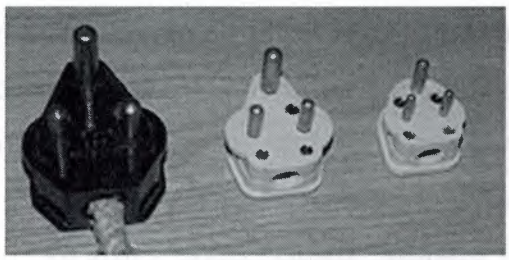


Figure 2.2.1.1 BS 546

✓ BS 1363

13 A plugs socket-outlets adaptors and connection units is a British Standard which specifies the most common type of single-phase AC power plugs and sockets that are used in the United Kingdom.Distinctive characteristics of the system are shutters on the line and neutral socket holes, and a fuse in the plug.BS 1363 was introduced in 1947 as one of the new standards for electrical wiring in the United Kingdom used for post-war reconstruction.The plug and socket replaced the BS 546 plug and socket, which are still found in old installations or in special applications.

Figure 2.2.1.1 BS 1363

2.3.Switch

In electrical engineering, a switch is an electrical component that can break an electrical circuit,interrupting the current or diverting it from one conductor to another.The most familiar form of switch is a manually operated electromechanical device with one or more sets of electrical contacts, which are connected to external circuits.Each set of contacts can be in one of two states: either "closed" meaning the contacts are touching and electricity can flow between them, or "open",meaning the contacts are separated and the switch is nonconducting.The mechanism actuating the transition between these two states (open or closed) can be either a "toggle" or "momentary" type.A switch may be directly manipulated by a human as a control signal to a system,such as a computer keyboard button, or to control power flow in a circuit, such as a light switch. Automatically operated switches can be used to control the motions of machines,for example, to indicate that a garage door has reached its full open position or that a machine tool is in a position to accept another workpiece.Switches may be operated by process variables such as pressure,temperature,flow,current,voltage and force,acting as

sensors in a process and used to automatically control a system.An ideal switch would have no voltage drop when closed, and would have no limits on voltage or current rating.It would have zero rise time and fall time during state changes, and would change state without "bouncing" between on and off positions.

2.3.1.Light Switch

In building wiring, a light switch is a switch, most commonly used to operate electric lights, permanently connected equipment, or electrical 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.

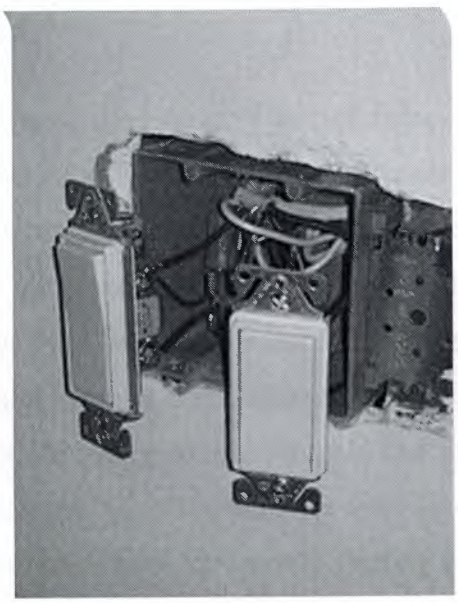


Figure 2.3.1 Light Switch

2.4.Cable

A cable is two or more wires running side by side and bonded,twisted or braided together to form a single assembly.The term originally referred to a nautical line of specific length where multiple ropes each laid clockwise are then laid together anticlockwise and shackled to produce a strong thick line,resistant to water absorption, that was used to anchor large ships.

In mechanics,cables,otherwise known as wire ropes,are used for lifting,hauling and towing or conveying force through tension.In electrical engineering cables are used to carry electric currents.An optical cable contains one or more optical fibers in a protective jacket that supports the fibers.Electric cables discussed here are mainly meant for installation in buildings and industrial sites.For power transmission at distances greater than a few kilometres see high-voltage cable and power cables.

2.4.1.Electrical Cables

Electrical cable is an assembly consisting of one or more conductors with their own insulations and optional screens,individual coverings,assembly protection and protective coverings.Electrical cables may be made more flexible by stranding the wires.In this process,smaller individual wires are twisted or braided together to produce larger wires that are more flexible than solid wires of similar size.Copper wires in a cable may be bare or they may be plated with a thin layer of another metal,most often tin but sometimes gold, silver or some other material.Tin,gold and silver are much less prone to oxidation than copper,which may lengthen wire life and makes soldering easier.Tinning is also used to provide lubrication between strands.Tinning was used to help removal of rubber insulation.At high frequencies, current tends to run along the surface of the conductor.This is known as the skin effect.

- Communications wire
- Optical Fiber

2.4.2.Communications Wire

For telephone,cable TV,Ethernet.

2.4.2.1.Twisted pair cable

Twisted pair cabling is the most popular network cable and is often used in data .This is due to its relatively lower costs compared to optical fiber and coaxial cable.networks for short and medium length connections (up to 100 meters or 328 feet).Unshielded twisted pair (UTP) cables are the primary cable type for telephone usage.In the late 20th century, UTPs emerged as the most common cable in computer networking cables, especially as patch cables or temporary network connections.They are increasingly used in video applications,primarily in security cameras.UTPs are the best balanced line wires available.

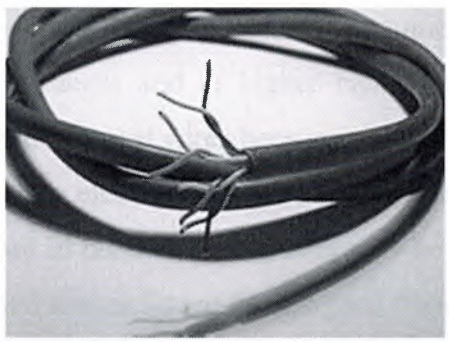


Figure 2.4.2.1 Twisted pair cable

2.4.2.2.Coaxial cable

Coaxial cables were extensively used in mainframe computer systems and were the first type of major cable used for Local Area Networks (LAN).Common applications for coaxial cable today include computer network (Internet) and instrumentation data connections,video distribution,RF and microwave transmission and feedlines connecting radio transmitters and receivers with their antennas.For these reasons,it is now generally being replaced with less expensive UTP cables or by fiber optic cables for more capacity.These cables, however, are increasingly connected to a fiber optic data communications system outside of the home.Most building management systems use proprietary copper cabling, as do paging/audio speaker systems.Security monitoring and entry systems still often depend on copper, although fiber cables are also used.

2.4.2.3.Structured Wiring

Most telephone lines can share voice and data simultaneously.Pre-digital quad telephone wiring in homes is unable to handle communications needs for multiple phone lines, Internet service,video communications,data transmission,fax machines and security services.

2.4.3.Optical Fiber

An optical fiber is a flexible,transparent fiber made of high quality extruded glass or plastic,slightly thicker than a human hair.It can function as a waveguide, or "light pipe",to transmit light between the two ends of the fiber.The field of applied science and engineering concerned with the design and application of optical fibers is known as fiber optics.

Optical fibers are widely used in fiber-optic communications,where they permit transmission over longer distances and at higher bandwidths (data rates) than wire cables.Fibers are used instead of metal wires because signals travel along them with less loss and are also immune to electromagnetic interference.Fibers are also used for illumination and are wrapped in bundles so that they may be used to carry images, thus allowing viewing in confined spaces.Specially designed fibers are used for a variety of other applications, including sensors and fiber lasers.

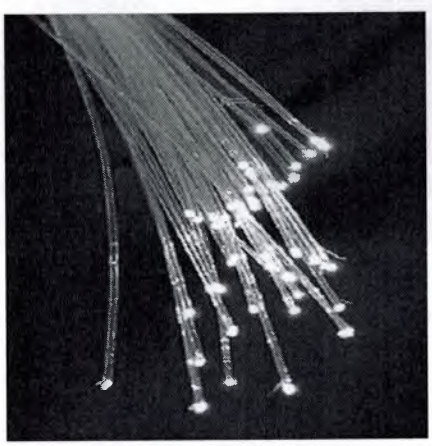


Figure 2.4.3 Fiber Optic cable

2.5.Distribution Board

A distribution board (or panelboard) is a component of an electricity supply system which divides an electrical power feed into subsidiary circuits,while providing a protective fuse or circuit breaker for each circuit, in a common enclosure.

2.5.1.North American breaker panels

The circuit breakers are generally placed in two columns.Circuit breaker panelboards are always dead front, that is, the operator of the circuit breakers cannot contact live electrical parts.During servicing of the distribution board itself, though, when the cover has been removed and the cables are visible,North American breaker panelboards commonly have some live parts exposed.The three power wires - two hot and one neutral - can be seen coming in at the top.The neutral wire is connect to the the neutral busbar to the left with all the white wires, and the other two are the hot wires attached to the main breaker.Below it are the two rows of circuit breakers with the circuits' red and black hot wires leading off.

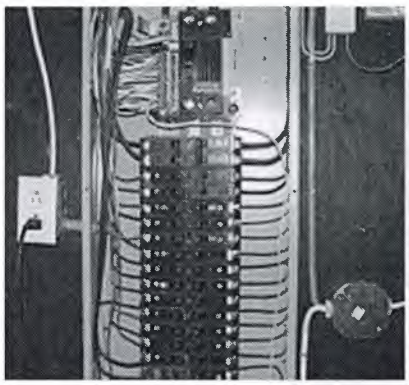


Figure 2.5. North American breaker panels

2.5.2.UK boards

In the UK, domestic and small commercial or public installations usually have single-phase supplies at 230V (nominal standard).The main distribution boards in these installations are called consumer units (CUs), though they may be known as fuse boxes; older consumer units used fuses until the advent of mini-circuit breakers (MCBs). Larger commercial,public and industrial installations generally use three-phase supplies, with distribution boards which have twin vertical rows of breakers.Larger installations will often use subsidiary distribution boards.The three incoming phase wires connect to the busbars via a main switch in the centre of the panel.On each side of the panel are two busbars, for neutral and earth.The incoming neutral connects to the lower busbar on the right side of the panel,which is in turn connected to the neutral busbar at the top left. The incoming earth wire connects to the lower busbar on the left side of the panel, which is in turn connected to the earth busbar at the top right.The cover has been removed from the lower-right neutral bar; the neutral bar on the left side has its cover in place. In a UK-style board,breaker positions are numbered top to bottom in the left hand column, then top to bottom in the right column.Each number is used to label one position on each phase, as below, and can be seen faintly in the photograph to the right.

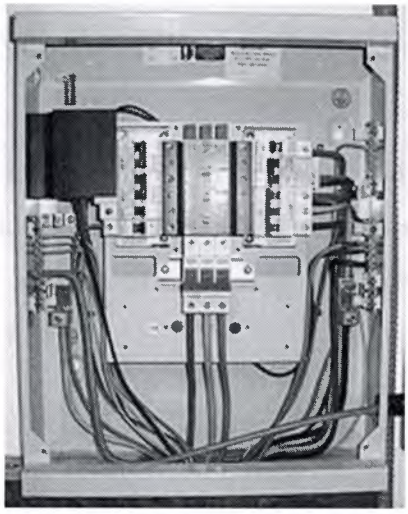


Figure 2.5.2. UK boards

2.6.Ground

In electrical engineering,ground or earth can refer to the reference point in an electrical circuit from which voltages are measured, a common return path for electric current or a direct physical connection to the Earth.Electrical circuits may be connected to ground for several reasons.In mains powered equipment,exposed metal parts are connected to ground to prevent user contact with dangerous voltage if electrical insulation fails. Connections to ground limit the build-up of static electricity when handling flammable products or electrostatic sensitive devices.In some telegraph and power transmission circuits, the earth itself can be used as one conductor of the circuit, saving the cost of installing a separate return conductor.

For measurement purposes the Earth serves as a constant potential reference against which other potentials can be measured.An electrical ground system should have an appropriate current-carrying capability to serve as an adequate zero-voltage reference level.In electronic circuit theory, a "ground" is usually idealized as an infinite source or sink for charge, which can absorb an unlimited amount of current without changing its potential.Where a real ground connection has a significant resistance, the approximation of zero potential is no longer valid.Stray voltages or earth potential rise effects will occur, which may create noise in signals or if large enough will produce an electric shock hazard.

The use of the term ground is so common in electrical and electronics applications that circuits in portable electronic devices such as cell phones and media players as well as circuits in vehicles may be spoken of as having a "ground" connection without any actual connection to the Earth.

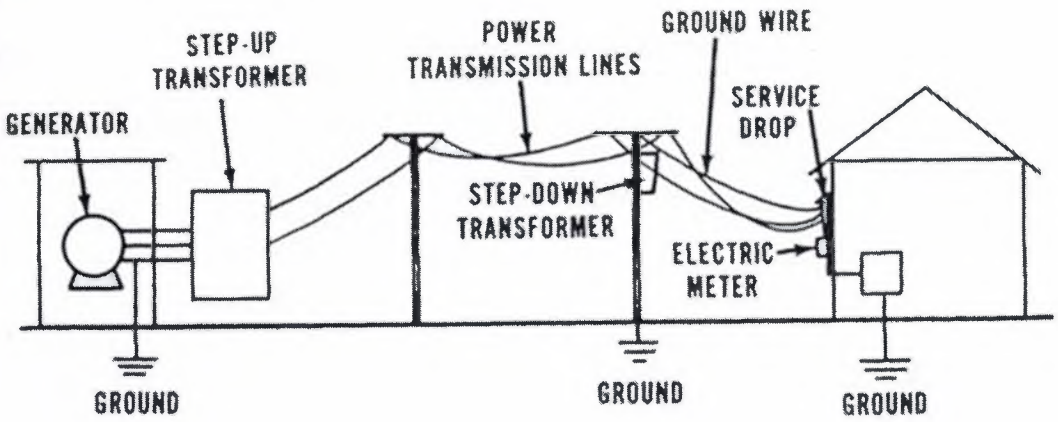
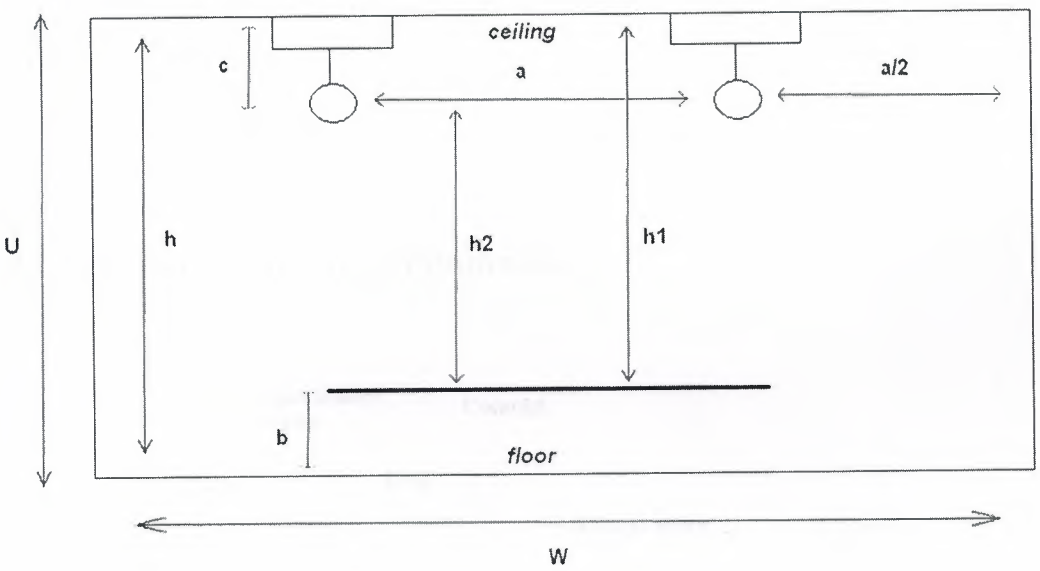


Figure 2.6. Ground(earth)

3.ILLUMINATION CALCULATIONS



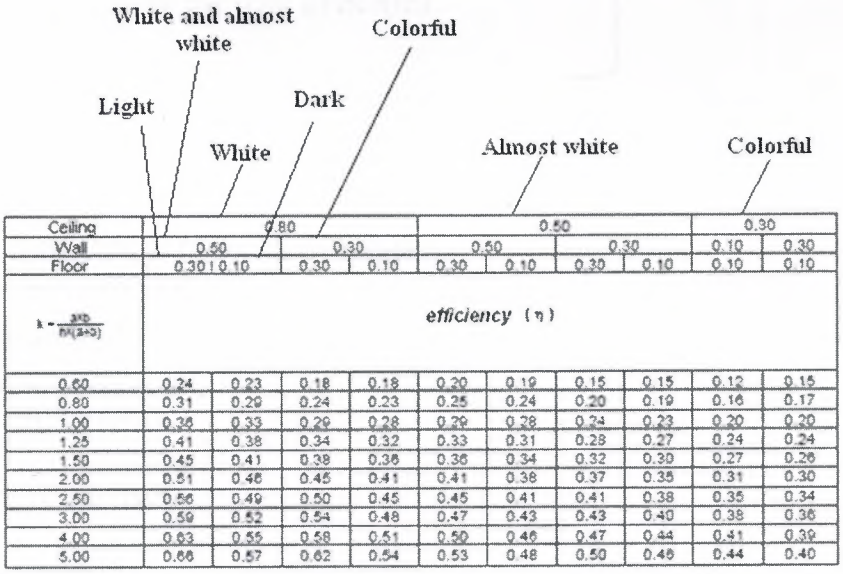
- **h**:height of the ceiling(m)
- **h2**:height of light source to working surface(m)
- ***h1***:*height of ceiling from working surface(m)*
- **c**:length of wire for the light source (m)
- **w**:width of the area to be illuminated
- **u**:length of the area to be illuminated
- **b**:height of the working surface from the floor(m)
- **a**:distance between light sources(m)

3.1.Reflection Factors

Reflection factors of the planes are important for illumination:

REFLECTION FACTOR OF SOME PLANES	
PLANE	**FACTOR**
GLASS-MIRROR	0.85-0.9
WHITE POINTED WALL	0.45-0.55
ALIMINIUM	0.85-0.9
WHITE	0.6-0.75
WHITE POINTED CEILING	0.45-0.55
LIGHT GREEN	0.45-0.65
LIGHT RED	0.3-0.5

3.2.Efficiency of Room Illumination

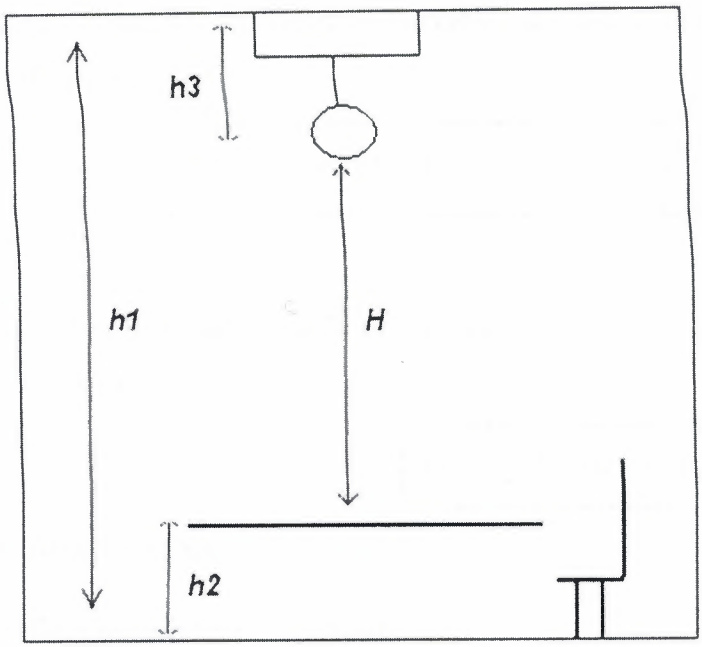


Ceiling	0.80				0.50				0.30	
Wall	0.50		0.30		0.50		0.30		0.10	0.30
Floor	0.30	0.10	0.30	0.10	0.30	0.10	0.30	0.10	0.10	0.10
$k=\frac{axb}{h(a+b)}$	*efficiency* (η)									
0.60	0.24	0.23	0.18	0.18	0.20	0.19	0.15	0.15	0.12	0.15
0.80	0.31	0.29	0.24	0.23	0.25	0.24	0.20	0.19	0.16	0.17
1.00	0.36	0.33	0.29	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

Interpolation formula:y2=y1+((x2-x1)/(x3-x1))(y3-y1)

3.3.Index Method(Usage Factor Method)

- The distance between the work plane and the Luminarie(Lamp) is important.



h1=height of the ceiling(m)

h2= height of the working surface from the floor(m)

h3=:length of wire for the light source(m)

H=work plane

H=h1-(h2+h3)

- k index(usage factor) is calculated:

k=(a*b)/((a+b)*H)

a=Width of the room

b=Length of the room

- The related efficiency is found from the table according to the k index value as the row and for column we check the reflection factors of ceiling walls and the floor.

If we don't find the efficiency on the table we have to use interpolation formula to find the efficiency.

Interpolation formula:y2=y1+((x2-x1)/(x3-x1))(y3-y1)

- The necessary total flux to illuminate the medium at required illumination level is calculated.

$\Theta t=(Eo*S)/(m*\eta)$

Θt=Total light flux

Eo=Illumination level(standard)

S=Area of the medium to be illuminated

η=Efficiency

m=dirt factor

NOTE:Dirt factor related to the medium it is the factor that how much dirt is collected on the luminary in time due to dust e.t.c.

In offices it is [0.8-0.9]

in places [0.7-0.6]

- Determine how many luminaries(lamp) is necessary for

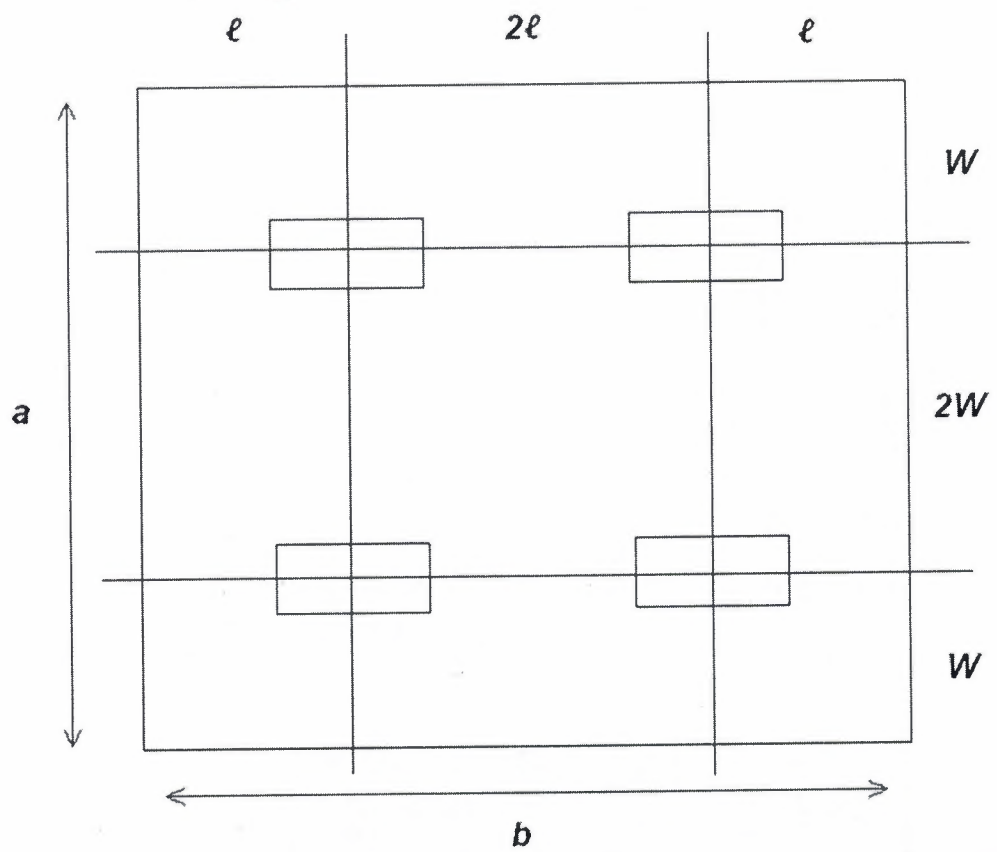
$N= (\Theta t)/(\Theta \ell *Z)$

N=Number of lamps

$\Theta \ell$=Light flux of the lamp

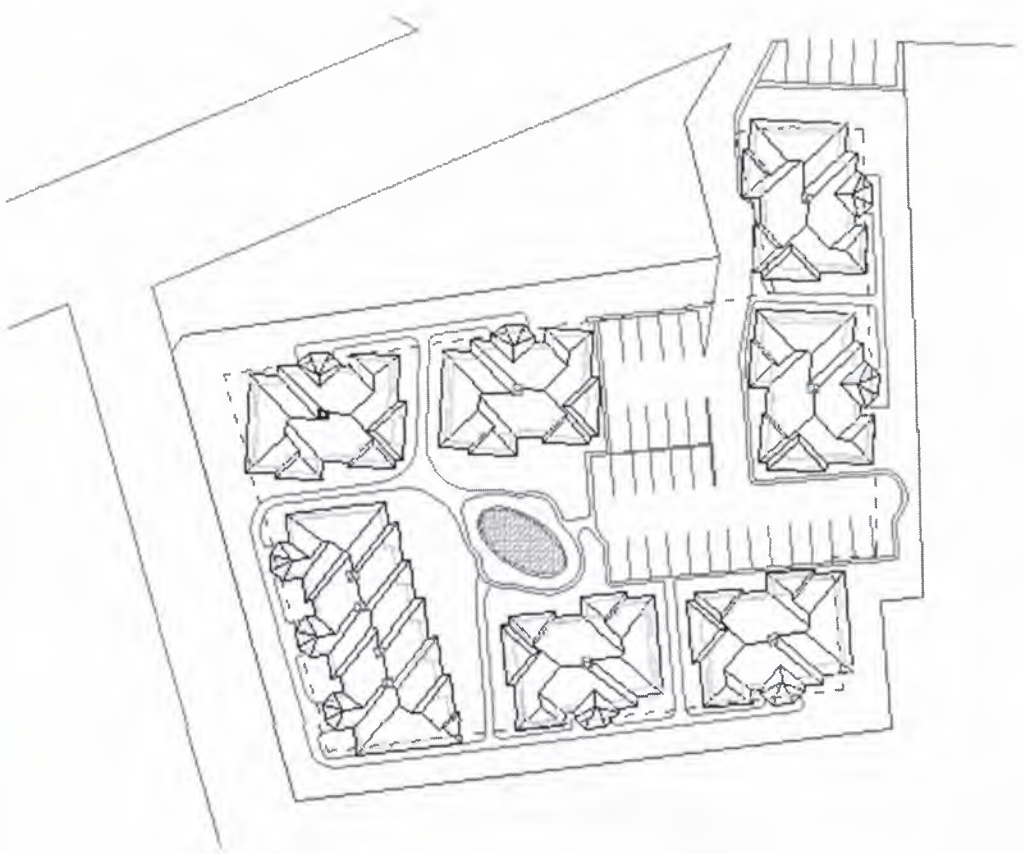
Z=Number of lamps per luminarie

3.4.Placement of the Luminaries to the Ceiling



W=a/(2*na)	na=number of luminaries in the width
ℓ=b/(2*nb)	nb=number of luminaries in the length

4.AUTOCAD APPLICATION



Our project is this and 7 buildings in there.In this project there are many bedrooms,kitchens,bathrooms,living rooms and toilets.

I. How can we drawing the all illumination of buildings?
II. How can we put the lamps on the project?
III. How can we lay to the power lines?
IV. How can we put electric switches and plugs?

We explain all of them step by step in detailed with use an AUTOCAD Electrical 2014.

For example bedroom.How can we draw it's illumination and electric installation?

- First of all we assume height of the ceiling is 3m, height of the working surface from the floor is 1m and length of wire for the light source is 0.4m.

We know: H=h1-(h2+h3)

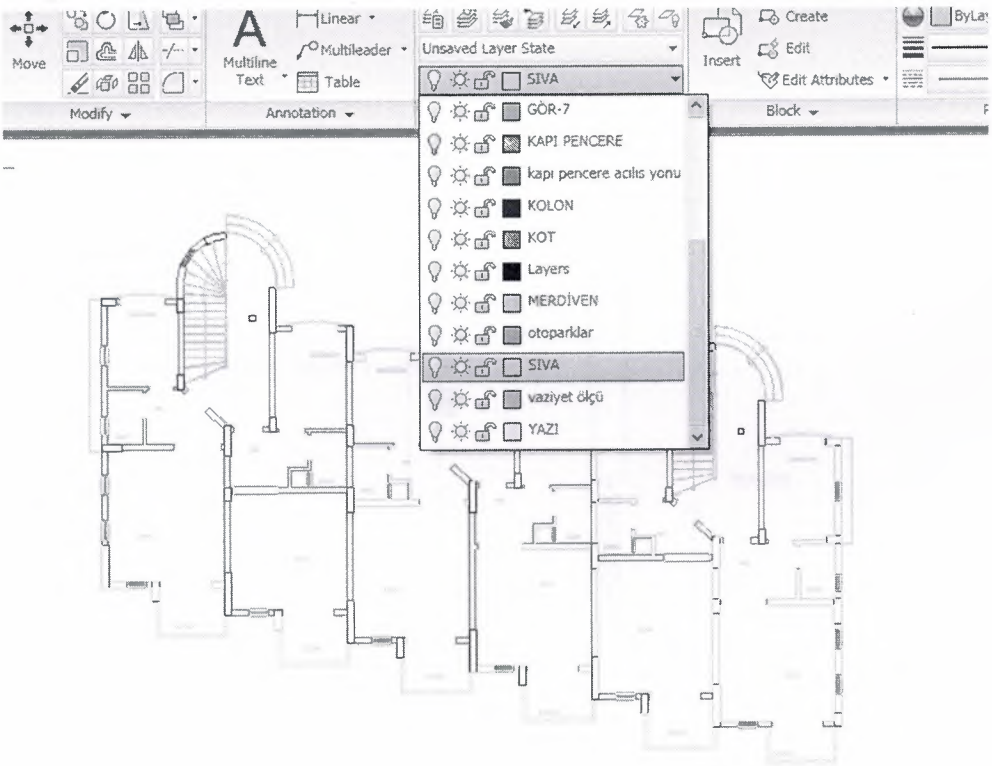
h1=3m

h2=1m

h3=0.4m

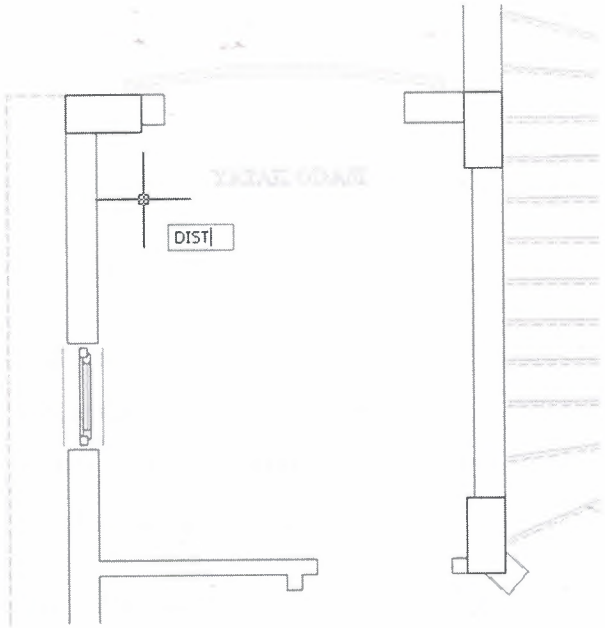
so H=3m-(1m+0.4m)=1.6m

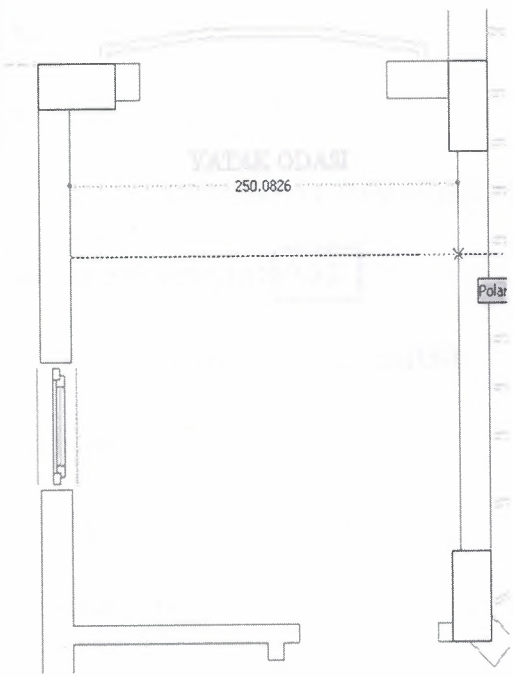
- Then we remove all plasters for correct measurement of rooms.

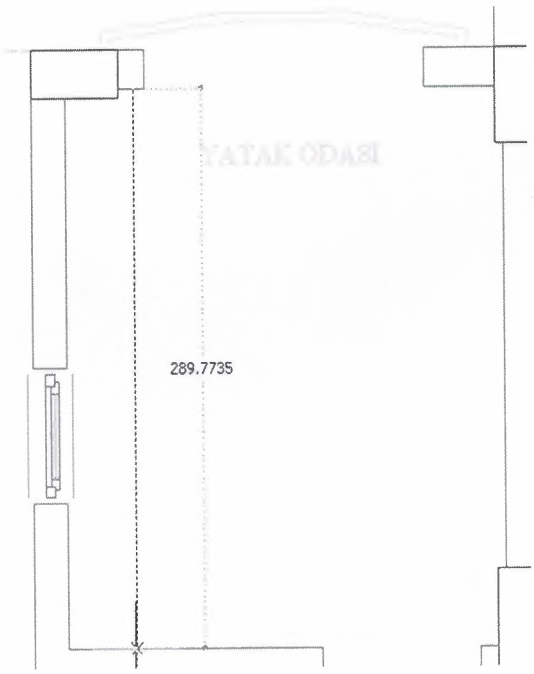


- After we measure all lenghts and widths of the rooms.

- We write "DIST" and starting the measure.







width=2.5m

length=2.9m

- We found work plane(H) and now we find k:

We know: k=(a*b)/((a+b)*H)

a=2.5m

b=2.9m

H=1.6m

k=(2.5*2.9)/((2.5+2.9)*1.6)=0.84

- We know the efficiency table and we assume ceil is white so it's coefficient is 0.8,walls are almost white and it's coefficient is 0.5 and floors are light so it's coefficient is 0.3.But our "k" is not in the table so we have to find k to use interpolation formula.

Interpolation formula:y2=y1+((x2-x1)/(x3-x1))(y3-y1)

x1=0.80 y1=0.31

x2=0.84 y2=?

x3=1.00 y3=0.36

y2=0.31+((0.84-0.80)/(1.00-0.80))(0.36-0.31)=0.32

so our efficiency(ŋ)=0.32

- Then we find total flux(Θt)

we know: Θt=(Eo*S)/(m*ŋ)

Eo=50 lux (for bedrooms)

S=area(a*b)

m=0.9

ŋ=0.32

Θt=(50*(2.5*2.9))/(0.9*0.32)=1,258,680lumen

- Now we can find the total number of lamps.

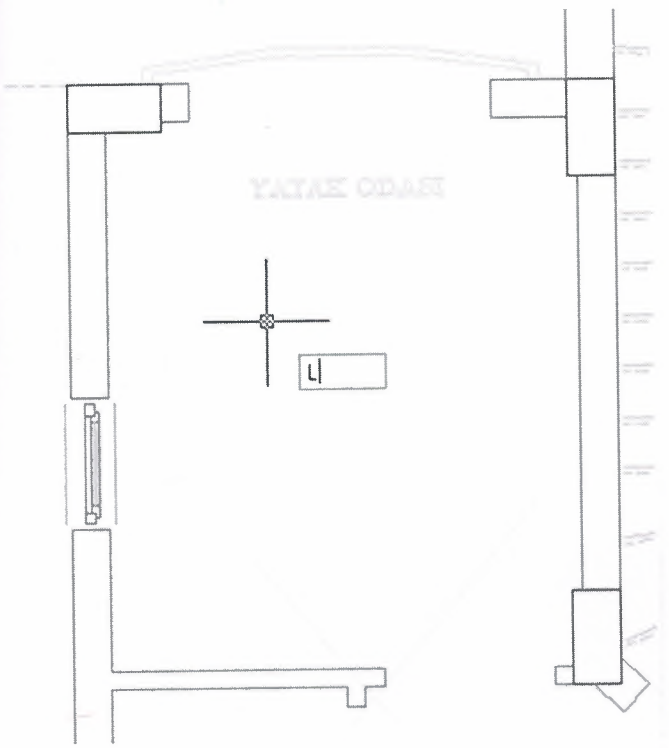
We know: N= (Θt)/(Θℓ)

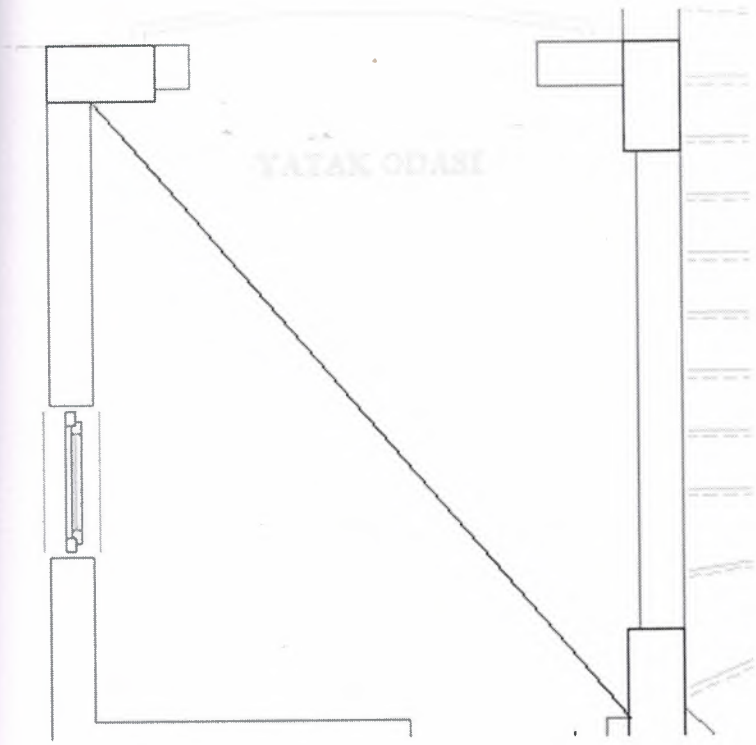
Θt=1,258,680lumen

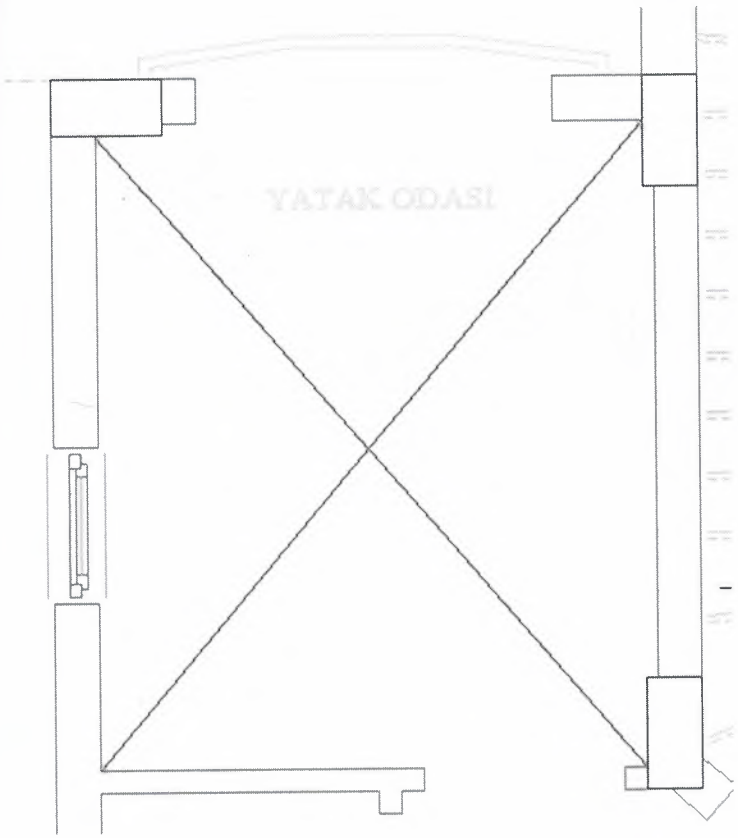
Θℓ=75 watt,960 lumen

N=1 LAMP

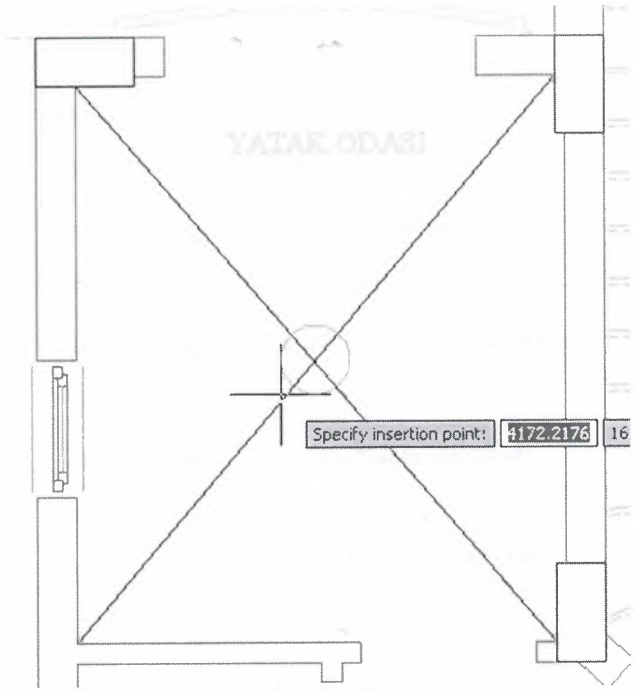
- We can draw on the AUTOCAD now
- First we have to find the middle of the room and we write "L" and draw the corner of the rooms



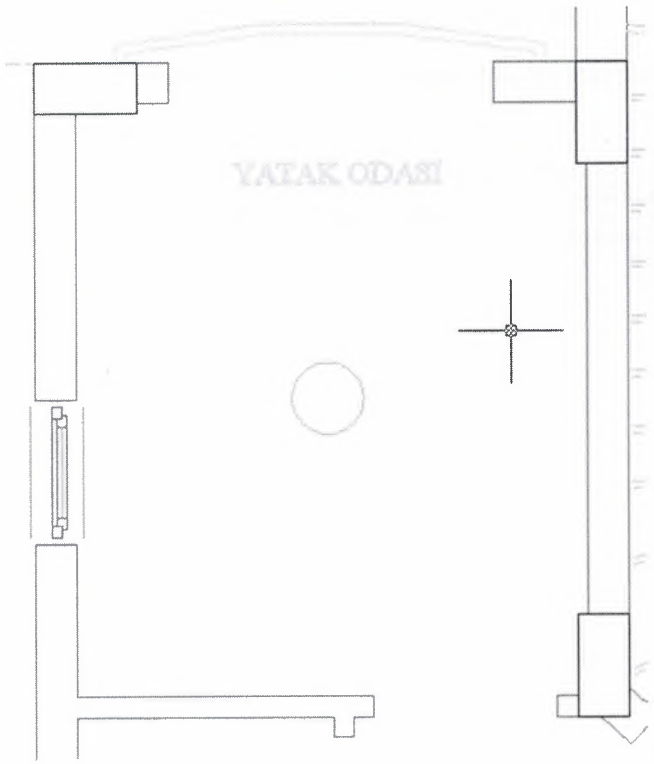

YATAK ODASI


YATAK ODASI

- Then we put the lamp middle of the room.



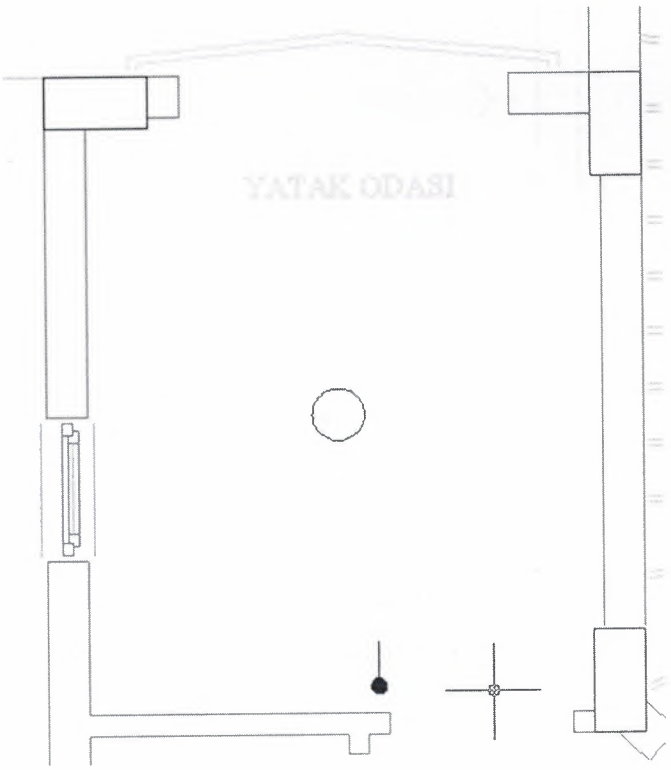
- After this,we remove the lines



- Our lamp is ready but we have to put a switch to turn on our lamp.

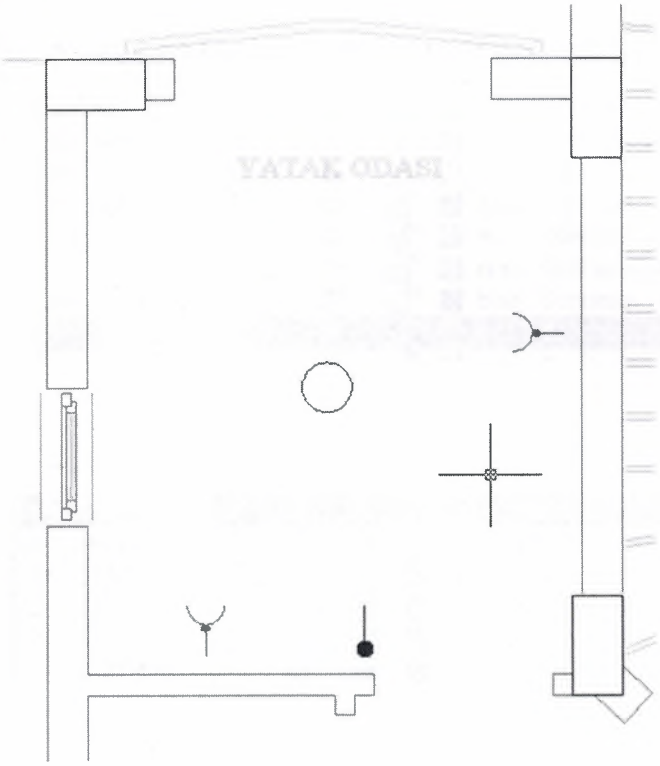
ANAHTARLAR		
SIRA NO.	SEMBOL	ANLAMI
51.		Tekli Anahtar
52.		Tekli Vaviyen Anahtar
53.		Dimmer Switch
54.		Düşük Gerilimli Anahtar (Max 48 volt)
55.		Sınır Anahtarı (Limit Switch)
56.	12	12'li Grup Anahtarı (Grid Switch)
57.		Ses Kontrol Anahtarı
58.		Kumandalı (Ses veya Dokunmatik) Dimmer Switch
59.		Tekli Ara Vaviyen Anahtar
60.		Vaviyen Dimmer Switch
61.		Kumandalı Anahtar

- We have a lot of switches but we have a one lamp and we use single switch.We copy on this board "single switch" and paste it in our project.



- We have a lamp and a switch but we have to put socket or sockets in our room. In Cyprus we use locked socket.

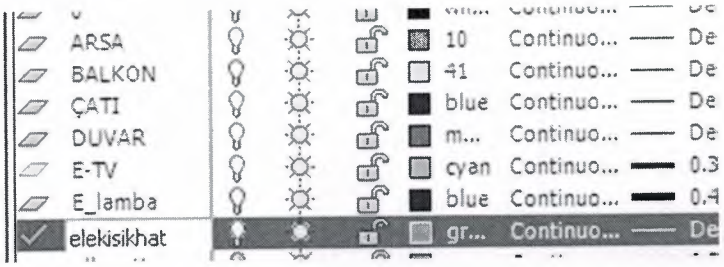
GÜÇ SEMBOLLERİ		
SIRA NO.	SEMBOL	ANLAMI
97.		13A Anahtarlı Priz
98.		13A Anahtarsız Priz
99.		Anahtarlı Non-Standart Priz
100.		İkili Anahtarlı Non-Standart Priz
101.	UPS	Kesintisiz Güç Kaynağı
102.		2x13A Anahtarlı Priz
103.		3 Faz Anahtarlı Priz (4 Kutuplu Kesici)
104.	WP	W/P Priz

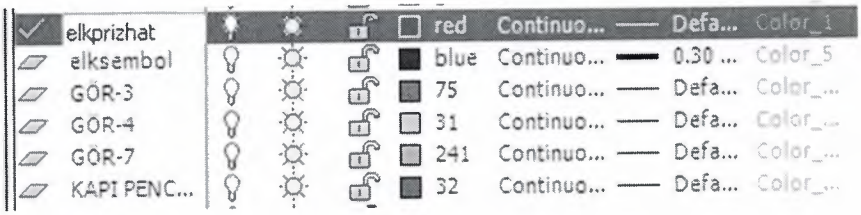


- We put a lamp,switch and sockets.But in this way they dont work.Because we have to connect all of them distrubition board to electrical lines.

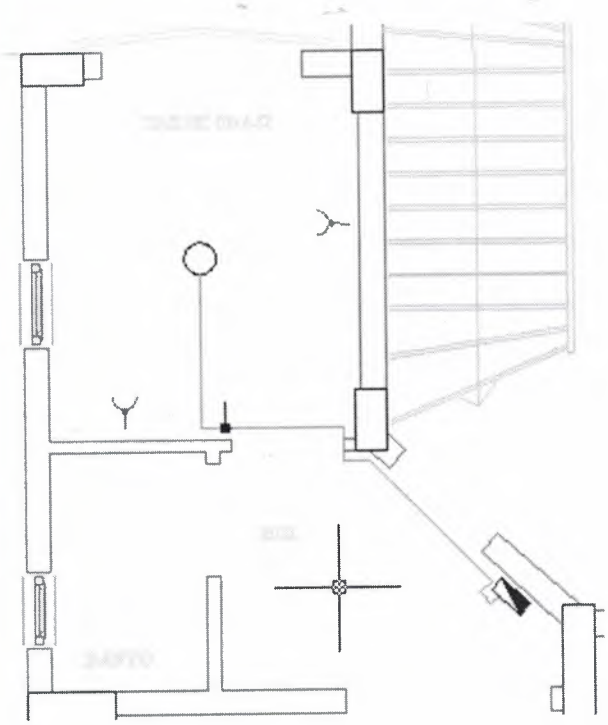
- We put our distrubition board on our hall.

- and we produce electric lamps and sockets lines colours.

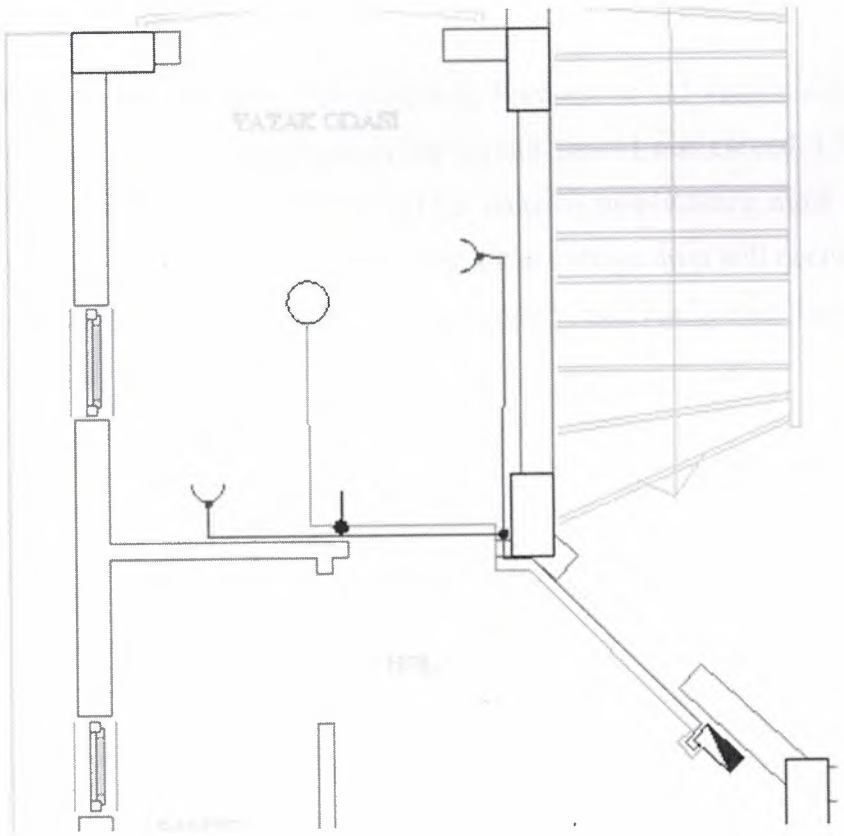




- We start the draw illumination line from distrubition board to lamp and switch.Then we write "L" on AUTOCAD.



- After we draw sockests line



5.VOLTAGE DROP

Wires carrying current always have inherent resistance,or impedance, to current flow. Voltage drop is defined as the amount of voltage loss that occurs through all or part of a circuit due to impedance.

A common analogy used to explain voltage,current and voltage drop is a garden hose. Voltage is analogous to the water pressure supplied to the hose.Current is analogous to the water flowing through the hose.And the inherent resistance of the hose is determined by the type and size of the hose - just like the type and size of an electrical wire determines its resistance.

Excessive voltage drop in a circuit can cause lights to flicker or burn dimly,heaters to heat poorly, and motors to run hotter than normal and burn out.This condition causes the load to work harder with less voltage pushing the current.

The National Electrical Code recommends limiting the voltage drop from the breaker box to the farthest outlet for power, heating, or lighting to 3 percent of the circuit voltage.This is done by selecting the right size of wire and is covered in more detail under "Voltage Drop Tables."

If the circuit voltage is 115 volts, then 3 percent of 115 volts is 3.5 volts.This means that voltage lost from the wires in the circuit should not exceed 3.5 volts and the outlet should still have 115 - 3.5 or 111.5 volts to supply.Since most appliances require an extension cord to plug into an outlet, some voltage drop will occur in the extension cord as well. Some motors will not run correctly, and could even burn up, if the voltage at the motor falls too low.

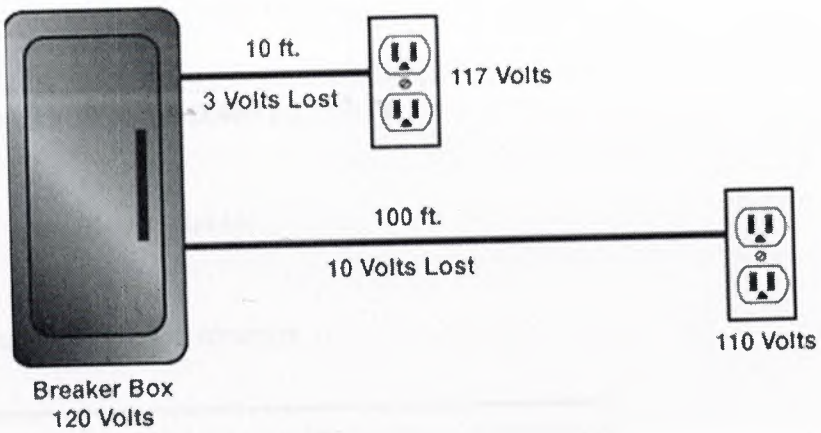
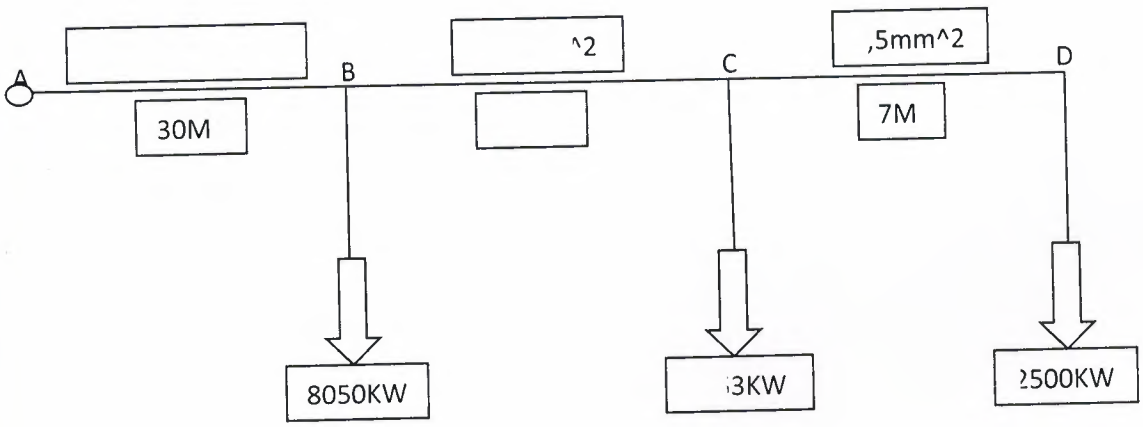


Figure 5. Voltage Drop

5.1.Calculation of Voltage Drop



The Voltage Drop Formula is:

$$V=(2*L*P) /(X * S * U)$$

P(AB)=8050+3153+2500=13703 KW

P(BC)=3153+2500=5653 KW

P(CD)=2500 KW

V(AB)=2*30*13703 / 56*121*220=0.55V

V(BC)=2*15*5653/56*30*220=0.46V

V(CD)=2*7*2500/56*2.5*220=1.13V

Total Voltage Drop=0.55+0.46+1.13=2.14

2.14> %1.5 its not acceptable!

So we will use our second formula

%eT= (2/X*U^2) ((L1*P1/S1)+(L2*P2/S2)+(L3*P3/S3))

If we apply this formula

%eT=(2*100/56*220^2)((30*13703/121)+(15*5653/30)+(7*2500/2.5))

%eT=0.97

0.97 % < 1.5 %

Its acceptable now!

6.COST CALCULATION

Type of Material	Number of Item	Price per Item	Total Cost
Normal switch	103	3.87 TL	398.61 TL
Commutator switch	94	6.61 TL	621.34 TL
Hanger type lamp	200	2.30 TL	460 TL
Globin with sensor	30	3 TL	90 TL
Fluorescent lamp	32	6 TL	192 TL
Normal glob	168	4 TL	672 TL
Socket	215	4 TL	860 TL
			TOTAL=3,293.95 TL

We referenced this materials on:

- www.ucuz.tk
- www.koctas.com.tr/
- www.viko.com.tr

We calculated only illumination materials of our buildings.We use 103 normal switch and 1 normal switch is 3.87 TL.We use 94 commutator switch and one of them is 6.61 TL.We use 200 hanger type lamp and one of them is 2.30.TL.We use 30 globin sensor an done sensor is 3 TL.We use 32 fluorescent lamps and one of them is 6TL.We use 168 normal glob and 1 glob is 4 TL.We use 215 sockets an done of them is 4 TL.

6.CONCLUSION

In this thesis we tried to explain Electrical Installation Project Drawing.Our project is electrical installation of buildings.It was enjoyable but sometimes challenging.

First we started to explain definitions of Electricity and its components.Because in this project the most important thing is Electricity.In this buildings if we don't have an electricity,electric components are not important.All of them works through the electricity.

Then we tried to explain Illumination calculations because it is important to calculate our building's illuminations.

After we showed how we can use AUTOCAD in AUTOCAD application part.We learned AUTOCAD in detail through this project.Then we explained voltage drop and its calculation.

In appendix we put illumination tables lamps,switches,sockets etc.

We use Excel,Word,Paint and some Microsoft Office applications in this project.

7.REFERENCES

[1] R. John Koshel,Illumination Engineering,Wiley-IEEE Press,New York NY 2012.

[2] http://www.britannica.com/EBchecked/topic/340440/light

[3] http://en.wikipedia.org/wiki/Lamp_(electrical_component)

[4] http://www.energyquest.ca.gov/story/chapter02.html

[5] http://www.emo.org.tr/ekler/

[6] http://olcum.org/oelcuemler/aydinlatma-olcumleri.html

[7] http://olcum.org/oelcuemler/topraklama.html

[8] http://epb.apogee.net/foe/frvd.asp

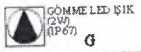
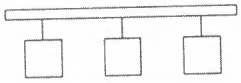
[9] http://www.emo.org.tr/ekler/eb53b5052d534ea_ek.pdf

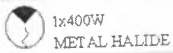
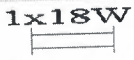
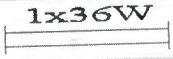
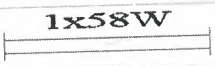
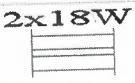
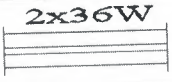
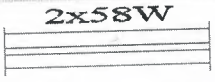
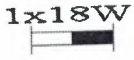
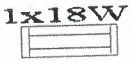
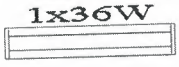
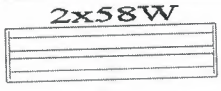
[10] www.koctas.com.tr/ampuller-reyonu-urunleri_14

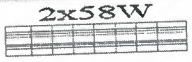
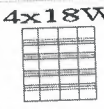
[11] www.ucuz.tk › Elektrik Malzemesi

6.APPENDIX

AYDINLATMA SEMBOLLERİ

SIRA NO.	SEMBOL	ANLAMI
1.		Askı Tipi Lamba
2.	İ.A.	Yanına Konduğu Lambanın İleri Aşama Olduğunu Anlatır
3.		Tavan Globu
4.		Duvar Globu
5.		Duvar Apliği (İç)
6.		Tablo Apliği
7.		Sıva Üstü Tavan Tipi Lamba (İç)
8.		Gömme Tip Spot Lamba (İç)
9.		Duvar Tipi Süs Armatürü (Dış)
10.		Duvar Üstü ve Yer Üstü Tip Süs Armatürü (Dış)
11.		Yere Gömme Tip Süs Armatürü (Dış)
12.		Duvara Gömme Tip Süs Armatürü (Dış)
13.		Dekoratif Askı Tipi Lamba
14.		Tek Lambalı Sokak Armatürü
15.		2 Lambalı Sokak Armatürü
16.		Sensörlü (Fotoselli) Lamba
17.		Avize
18.		Vantilatörlü Avize
19.		Havuz Lambası
20.		Sıva Üstü Raylı Armatür
21.		Acil Çıkış Lambası
22.		Led Işık
23.		Hortum Işık
24.		Fiber Optik Işık Kaynağı
25.		Fiber Optik Işık Armatürü
26.		Projektör

27.		Metal Halide Armatür
28.		PL Lamba
29.		Gömme Par Spot Lamba
30.		1x18W Tekli Floresan
31.		1x36W Tekli Floresan
32.		1x58W Tekli Floresan
33.		2x18W Çifteli Floresan
34.		2x36W Çifteli Floresan
35.		2x58W Çifteli Floresan
36.		1x18W Tekli W/P Floresan
37.		1x36W Tekli W/P Floresan
38.		2x36W Çifteli W/P Floresan
39.		2x58W Çifteli W/P Floresan
40.		1x18W Diffüzerli Floresan
41.		1x36W Diffüzerli Floresan
42.		2x58W Diffüzerli Floresan
43.		4x18W Diffüzerli Floresan

44.		2x18W Petek Diffüzerli Floresan
45.		2x36W Petek Diffüzerli Floresan
46.		2x58W Petek Diffüzerli Floresan
47.		4x18W Petek Diffüzerli Floresan
48.	G	Yanına konduğu Armatürün Gömme olduğunu anlatır
49.	S/Ü	Yanına Konduğu Armatürün Sıva Üstü Olduğunu Anlatır
50.		Yanına Konduğu Armatürün Akü Destekli Olduğunu Anlatır

ANAHTARLAR

SIRA NO.	SEMBOL	ANLAMI
51.		Tekli Anahtar
52.		Tekli Vaviyen Anahtar
53.		Dimmer Switch
54.		Düşük Gerilimli Anahtar (Max 48 volt)
55.		Sınır Anahtarı (Limit Switch)
56.		12'li Grup Anahtarı (Grid Switch)
57.		Ses Kontrol Anahtarı
58.		Kumandalı (Ses veya Dokunmatik) Dimmer Switch
59.		Tekli Ara Vaviyen Anahtar
60.		Vaviyen Dimmer Switch
61.		Kumandalı Anahtar
62.		Kilitli Anahtar
63.		Çekmeli Anahtar

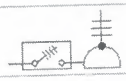
64.		Çekmeli Vaviyen Anahtar
65.		W/P Anahtar
66.	W/P	Water Proof
67.	IPXX	IP Derecesi
68.		Merdiven Otomatiği Düğmesi

GÜÇ SEMBOLLERİ

SIRA NO.	SEMBOL	ANLAMI
69.		Işıklı Sigortalı Heater Switch
70.		Işıklı Sigortasız Heater Switch
71.		45A Heater Switch
72.	ÇM	Çamaşır Makinesi
73.	BM	Bulaşık Makinesi
74.	AC	Klima (Air Conditioner)
75.	BS	Banyo Sobası
76.	SM	Su Motoru
77.	H	Hidrofor
78.	BD	Buzdolabı
79.	A	Ocak Üstü Aspiratör
80.	EK	El Kurutma Makinesi
81.	SK	Saç Kurutma Makinesi (Fön Makinesi)
82.	MF	Mikrodalga Fırın (Mikro Fırın)
83.	ÇÖ	Çöp Öğütme Makinesi
84.	I	Anında Su Isıtıcısı (Elektrikli Şofben)
85.	K	Kombi
86.	J	Jakuzi
87.	KM	Kurutma Makinesi

97.		13A Anahtarlı Priz
98.		13A Anahtarsız Priz
99.		Anahtarlı Non-Standart Priz
100.		İkili Anahtarlı Non-Standart Priz
101.		Kesintisiz Güç Kaynağı
102.		2x13A Anahtarlı Priz

88.		Fan Coil Unit
89.		Garaj Kapı Motoru
90.		Ocak
91.		Semaver
92.		Reklam TAbelası
93.		Elektrik Ocağı (Cooker) Kontrol Prizi
94.		Banyo Sobası
95.		Aspiratör (Fan) Duvar Tipi
96.		Tavan Vantilatörü

103.		3 Faz Anahtarlı Priz (4 Kutuplu Kesici)
104.		W/P Priz
105.		5A Tekli Priz
106.		Traş Prizi
107.		Yere Monte Bağlantı Ünitesi
108.		Sigortalı Bağlantı Ünitesi
109.		Sigortasız Bağlantı Ünitesi

110.		Tavan Vantilatör Anahtarı
111.		Zil
112.	Z/Ç/K	Zil / Çağırma / Kapı Açtırma Düğmesi
113.	3	3 Gruplu Zil Butonu
114.	Z/Ç/N/K	Zil / Çağırma / Neon / Kapı Açtırma Trafosu
115.	M	Merdiven Otomatiği
116.		Kapı Otomatiği
117.		Buton
118.		Saat
119.	T	Termostat
120.		Sabit Cihaz Bağlantı Noktası
121.	R.S.T. L1.L2.L3	Fazları Belirleyen Harfler
122.	M 3~ ..... KVA	3 Fazlı Motor
123.	G 3~ ..... KVA	3 Fazlı Jeneratör
150.		Geçiş Kutusu
151.		Kumanda Panosu
152.		Ana Dağıtım Tablosu
153.		Tali Dağıtım Tablosu
154.		UPS Dağıtım Panosu
155.		Sayaç Dolabı
156.		Mekanik Kontrol Panosu