NEAR EAST UNIVERSITY

Faculty of Engineering

Department of Electrical and Electronic Engineering

Electrical Installation Project Drawing

Graduation Project
EE – 400

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Nicosia - 2008

ACKNOWLEDGEMENT

First of all,I would like to thank to Asst. Prof. Dr. Özgür Özerdem, who is the supervisor of my project. He contributed largely to my project by sharing his knowledge with me on electrical engineering and by providing detailed information to me on the subject of my project. I have no doubt that he will always be by the side of me whenever I need him, even after my graduation from university.

I wanted to express my gratitude to all my teachers, who thought me during my four years long study at the Near East University. I alsa wanted to thank to my classmates who made these four years at the university even more interesting and enjoyable.

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ABSTRACT

The electrical installation is one of the most impotant subject of an electrical engineering. Accoiding to this, the thesis is about an electrical installation of a building.

The main objective of this thesis is to provide an electrical installation with AutoCAD. For this thesis AutoCAD is very important. Also, with the help of AutoCAD, you can easily draw the part of you installation project.

According to this thesis you can learn to use AutoCAD and also leam to make cost calculation and other calculations for electrical installation as well.

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INTRODUCTION

This thesis is about electrical installations, which are very important for electrical engineering. This thesis explains how to design an electrical installation of a building by using the AutoCAD programmed.

This thesis consists of an introduction, seven chapters and a conclusion.

The first chapter is about historical review of installation work.

The second chapter is rules of the project

The third chapter is Electrical material is consist three mainly parts. One of them is insulators, conductors and cables.

The fourth chapter is about the electrical safety this is about electrical safety, protection and earthing.

Chapter five is circuit control devices; in this chapter consist circuit conditions contacts, switches and switch fuses, special switches.

Chapter six is light. This chapter is about the types of the lamps.

Chapter seven supply distributions and control, in this chapter consist overhead lines supply control and supply distribution.

CHAPTER -1-
HISTORICAL REVIEW

1.1 Historical Review of Installation Work

As one might expect to find in the early beginnings of any industry, the application and the methods of application of electricity for lighting, heating and motive power was primitive in the extreme. Large-Scale application of electrical energy was slow to develop. The firs twice use of it was for lighting in houses, shops and offices. By the 1870s, electric lighting had advanced from being a curiosity to something with a define practical future. Are lamps were the first form of lighting, particularly for the elimination of main streets. When the Incandescent-filament lamps, shop windows continued for same time to be lighted extremely by are lamps shop windows continued for same time to be lighted extremely by are lamps suspended from the fronts of buildings.

The earliest application of electrical energy as an agent for motive power in industry is still electricity's greatest contribution to industrial expansion. Dear 1900 have been regarded as a time when industrialist awakened to the potential of the new form of power.

Electricity was first use in mining for pumping. In the iron and steel industry, by 1917, electric pumices of both the arc and induction type were producing over 100,000 tons of ingot and castings. The first all- welded ship was constructed in 1920; and the other ship building process was operated by electric motor power for punching, shearing, drilling machines and would working machinery.

The first electric motor drivers in light industries were in the form of one motor-unit per line of. Shafting. Each motor was started once a day and continued to run throughout the whole working day in one direction at a constant speed. All the various machines and speed by mechanical means. The development of integral electric drivers, with provision for starting stopping and speed change, let to the extensive use of the motor in small kw ranges to drive and associated single machine, e.g. a late. One of the pioneers of the in the use of the motors was the film of Bruce pebbles, Edinburgh. The firm supplied, in the 1890s a number of weatherproof, totally enclosed motors for quarries in Dumfries shire, believed to be among the first of their type in Britain. The first electric winder ever built in Britain was supplied in 1905 to a Lanark oil concern. Railway electrification started as long ago as 1883, but it was not until long after the turn of this century that any major development took place.

Electrical installation in the early days were quiet primitive and often dangerous. It is on record that in 881, the installation in Hatfield house was carried out by an aristocratic amateur. That the installation was dangerous did not perturb visitors to the house who when the naked wires on the gallery ceiling broke into flame nonchalantly threw up cushions to put out the fire and then went on with their conversations. Many names of the early electric pioneers survive to day. Julius sax begun to make electric bells in 1855, and later supplied the telephone with which Queen Victoria spoke between Osborne, in the isle Wight , and Southampton in 1878. He founded one of the earliest pearly electric manufacturing firms, which exist today and still makes bells and signaling equipment.

The General Electric Company had its origins in the 1880s, as a company which was able to supply every single item, which went to form a complete electrical installation in addition it was guarantied that all the components offered for sale were technically suited to each other; were of adequate quality and were offered at an economic price specializing in lighting, Falk Stadelmann & Co. Ltd begun by marketing improved designs of oil lamps , then Gas Fittings , and ultimately electric fittings.

Cable makers W.T.Glover & Co. were pioneers in the wire field. Glover was originally a designer of textile machinery, but by 1868 he was also making braided still wires for the then fashionable crinolines. From this type of wire it was a natural step to the production of the insulated conductors for electrical purpose. At the Crystal Palace exhibition in 1885 he showed a great range of cables; he was also responsible for the wiring of the exhibition.

The well-known J. & P. Firm (Johnson & Phillips) begun with making telegraphic equipment, extended to generators and are lamps, and then to power supply. The coverings for the insulation provisions for cable were made when vulcanized rubber was introduced and it is still used today. The first application of a lead sheath to rubber- insulated cables were made by Siemens Brothers. The manner in which we name cables was also a product of Siemens, whose early system was to give a cable a certain length related to a standard resistance of 0.1 ohm. Thus a no .90 cable in their catalogue was a cable of which 90 yards had a resistance of 0.1 ohm. Cable sizes were also generally known by the Standard Wire Gauge. For many years ordinary VRI cables made up about 95 percent of all installations. They were used first in wood casing, and then in conduit wood casing was a very early invention. It was introduce to separate conductors, the separation being considered a necessary safeguard against the two wires touching and so causing fire. Choosing a cable at the turn of the century was quite a task. From one catalog alone, one could choose from 58 sizes of wire, with no less than 14 different grades of rubber insulation. The gates were described by such terms as light, high, medium or best insulation. Nowadays there are two grades of insulation up to 600 V and 600 V / 1,000 V. And the sizes of cables have been reduced to a more practicable seventeen.

During the 1890s the practice of using paper as an insulating material for cables was well establish. One of the earliest makers was the company, which later becomes a member of the present-day-BICC group. The idea of using paper as an insulation material came from America to Britain where it formed part of the first wiring system for domestic premises. This was twin lead-sheathed cables. Bases for switches and other accessories associated with the system were of cast solder, to which the cable sheathing was wiped, and then all joints sealed with a compound. The compound was necessary because the paper insulation when dry tends to absorb moisture.

In 1911, the famous 'Henley Wiring System' came on the market. It comprised flat-twin cables with a lead-alloy sheath. Special junction boxes, if properly fixed, automatically affected good electrical continuity. The insulation was rubber. It became very popular. Indeed, it proved so easy to install that a lot of unqualified people appeared on the contracting scene as 'electricians'. When it received the approval of the IEE rules, it became an established wiring system and is still in use to day.

At the time the lead-sheathed system made its first appearance, another rival wiring system also came onto the scene. This was the CTS system (cab-tire sheathed). It arouse out of the idea that if a rubber product could be used to stand up to the wear and tear of motor-car tires on roads, then the material would well be applied to cover cables. The CTS name eventually gave way to TRS (tough-rubber sheath), when the rubber-sheathed cable system came in to general use.

The main competitor to rubber as an insulating material appeared in the Late 1930s. This material was PVC (polyvinyl chloride), a synthetic material which came from Germany. The material though inferior to rubber so far as elastic properties were concerned, could with stand the effects of both oil and sunlight. During the Second World War PVC, used both as wire insulation and the protective sheath, became well established. As experienced increased with the use of TRS cables, it was made the basis of modified wiring system. The first of these was the Calendar farm-wiring system introduced in 1937. This was though rubber sheathed cables with a semi-embedded braiding treated with a green colored compound. This system combined the properties of ordinary TRS and HSOS (house-service over headed system) cables. So far as conductor material was concerned, copper was the most widely used. But aluminum was also applied as a conductor material. Aluminum, which has excellent electrical properties, has been produced on large commercial scales since about 1980s. Over head lines of aluminum were first installed in 1878. Rubber insulated aluminum cables of 3/0.036 inch and 3/0.045 inch were made to the order of the British Aluminum Company and used in the early years of this century for the wining of the staff quarters at Kinlochl even in Argyll shire. Despite the fact that lead and lead alloy prove to be of great value in the sheathing of cables, aluminum was looked to for a sheath of in particular, light weight. Many experiments were carried out before a reliable system of aluminum sheathed cable could be put on the market.

Perhaps one of the most interesting systems of wiring to come into existence was the MICS (mineral insulated copper-sheathed cable) which is used compressed magnesium oxide as the insulation, and had capper sheathed and copper conductors. The cable was first developed in 1897 and was first produced in France. It has been made in Britain since 1937, first by Pyrotenax LTD and later by other firms. Mineral insulation has also been used with conductors and sheathing of aluminum. One of the first suggestions for steel used for conduits was invade in 1883. It was then called "small iron tubes". However, the first conduits were being bitumised paper. Steel for conduits did not appear on the wiring scene until about 1895. The revolution in conduit wiring dates from 1987, and is associated with the name "Simplex" which is common enough today. It is said that the inventor, L.M Waterhouse, got the idea of close-joint conduit by spending a sleepless night in a hotel bedroom staring at the bottom-rail of his is iron bedstead. In 1989 he began the production of light gauge close-joint conduits. A year later the screwed-conduit system was introduced.

Non-ferrous conduits were also a feature of the wiring scene. Heavy-gauge copper tubes were used for wiring of the Rayland's library in Manchester in 1886. Aluminum conduit, though suggested during the 1920s, did not appear on the market until steel become a valuable material for munitions during the Second World War. Insulated conduits also were used for many applications in installation work, and are still used to meet some particular installation conditions. The "Gilflex" system, for instance, makes use of a PVC tube, which can be bent cold, compared with earlier material, which required the use of heat for bending.

Accessories for use with wiring systems were the subjects of many experiments; many interesting designs came onto the market for the electrician to use in his work. When lighting became popular, there arose a need for the individual control of each lamp from its own control point. The "branch switch" was used for this purpose. The term "switch" came over to this country from America, from railway terms which indicated a railway "point", where a train could be "switched" from one set of tracks to another. The "switch" so far as the electric circuit was concerned, thus came to mean a device, which could switch an electric current from one circuit to another.

It was Thomas Edison who, in addition to pioneering the incandescent lamp, gave much thought to the provision of branch switches in circuit wiring. The term "branch" meant a tee off from a main cable to feed small current-using items. The earliest switches were of the "turn". type, in which the contacts were wiped together in a rotary motion to make the circuit. The first switches were really crude efforts, made of wood and with no positive ON or OFF position. Indeed, it was unusual practice to make an inefficient contact to produce an arc to "dim" the lights. Needless to say, the misuse of the early switches; in conjunction with their wooden construction, led to many fires. Tumbler Pigeons. Many accessory names, which are household words to the electricians of today, appeared at the turn of century: verity's Mcgeoch, Tucker and Crabtree. Further developments to produce the semi-recessed, the flush the ac only and the "silent" switch proceeded space. The switches of today are indeed of long and worthy pedigrees.

It was one thing to produce a lamp operated from electricity. It was quite another thing to devise away in which the lamp could be held securely while current was following in its circuit. The first lamps were fitted with wire tails for joining to terminal screws. It was Thomas Edison who introduced, in 1880, the screw cap, which still bears his name. It is said he has got the idea from the stoppers fitted to kerosene cans of the time. Like much another really good idea, it superseded all its competitive lamp holders and its use extended thought America and Europe. In Britain, however, it was not popular. The bayonet-cap type of lamp – holder was introduced by the Edison &Swan Co. about 1886. The early type was soon improved to the lamp holders we know today.

Ceiling roses, too, have an interesting history; some of the first types incorporated fuses. The first rose for direct attachment to conduit come out in the early 1900s, introduced by Dorman & Smith LTD.

The first patent for a plug and socket was brought out by Lord Kelvin, a pioneer of electric wiring systems and wiring accessories. The accessory was used mainly for lamp loads at first, and so carried very small currents. However, domestic appliances were beginning too appear on the market, which meant that sockets had to carry heavier currents. Two popular items were irons and curling tong heaters, shuttered sockets were designed by Cramp ton in 1983.The modern shuttered type of socket appeared as a prototype in 1905, introduced by "Diamond H". Many sockets were individually fused, a practice which was later meet the extended to the provision of a fuse in the plug.

These fuses were, however, only a small piece of wire between two terminals and caused such a lot of trouble that in 1911 the Institution of Electrical Engineers banned their use. One firm, which came into existence with the socket-and-plug, was M.K. Electric Ltd. The initials were for "Multi-Contact" and associated with a type of socket outlet, which eventually became the standard design for this accessory. It was Scholars, under the name of "Wyle", who introduced a revolutionary design of plug and socket a hollow circular earth pin and rectangular current-carrying pins. This was really the first attempt to polarize, or to differentiate between live, earth and natural pins.

One of the earliest accessories to have a cartridge fuse incorporated in it was the plug produced by Dorman& Smith Ltd. The fuse actually formed one of the pins, and could be screwed in or out when replacement was necessary. It is rather long cry from those pioneering days to the present system of standard socket-outlets and plugs.

Early fuses consisted of lead wires; lead being used because of its low melting point. Generally, devices which contained fuses were called "cutouts", a term still used today for the item in the sequence of supply-control equipment entering a building. Once the idea caught on of providing protection for a circuit in the form of fuses, brains went to work to design fuses and fuse gear. Control gear first appeared encased in wood. But ironclad versions made their due appearance, particularly for industrial use during the nineties. They were usually called "motor switches". And had their blades and contacts mounted on a slate panel. Among the first companies in the switchgear field were Bill & Co, Sanders & CO and the MEM Co. whose "Kant ark" fuses are so well known today. In 1928 this company introduced the "splitter" which affected a useful economy in many of the smaller installations.

It was not until the 1930s that the distribution of electricity in buildings by means of bus bars came into fashion, though the system had been used as far back as about 1880, particularly for street mains. In 1935 the English Electric Co. introduced abuse bar turning system designed to meet the needs of the motorcar industry. It provided the overhead distribution of electricity into which system individual machines cloud be tapped wherever required; this idea caught on and designs were produced and put onto the market by Marry at & Place, GEC and Otter mill.

Turning came into fashion mainly because the larger sizes of conduit proved to be expensive and trouble some to install. One of the first turning types to be produced was the spring conduit of the Manchester firm of key engineering. They showed it for the first time at an electrical exhibition in 1908. It was semi circular steel toughing with edges formed in such way that they remained quite secure by a spring action after being pressed into contact. But it was not until about 1930 that the idea took root and is now established as a standard wiring system.

The story of electric wiring, its systems and accessories tells an important aspect in the history of industrial development and in the history of social progress. The inventiveness of the old electrical personalities, Compton, Swan, Edison, Kelvin and many others, is weekly worth nothing; for it is from their brain-children that the present day electrical contracting industry has evolved to become one of the most important sections of activity in electrical engineering. For those who are interested in details of the evolution and, development of electric wiring systems and accessories, good reading can be found in the book by J. Mellan by: The History of Electric Wiring (Macdonald, London).

Any comparison of manufacturers catalogues of say; ten years ago with those of today will quickly reveal how development of both wiring systems and wiring accessories have changed, not only physically, in their design and appearance but in their abi1ity to meet the demands made on them modem electrical installations, both domestic and industrial. What were once innovations, such as dinner switches, for instance, are now fairly common place where clients require more flexible control of domestic circuits. The new requirements of the regulations for Electrical installations will no doubt introduce more changes in wiring systems and accessories so that installations became safer to use with attendant reductions in the risk from electric shocks and fire hazards. New developments in lightning, for instance, particularly during the last decade or so, herald changes in the approach to installation work. Innovative changes in space and water heating using solar energy and heat punish, will involve the electrician in situations which can offer exciting challenges in installation work, not least in keeping up with the new face of old technology. Mote and more is the work of the electrician becoming an area of activity where a through grip of the technology involved is essential if one is to offer the client a safe, reliable and technically competent installation.

1.2 Historical Review of Wiring Installation

The history of the development of non- Iegal and statutory rules and regulations for the wiring of buildings is no less interesting than that of wiring systems and accessories. When electrical energy received an utilization impetus from the invention of the incandescent lamp, many set themselves up as electricians or electrical wiremen. Others were gas plumbers who indulged in the installation of electrics as a matter of normal course. This was all very well; the contracting industry had to get started in some way, however ragged. But with so many amateurs troubles were bound to multiply. And they did. It was long before arc lamps, sparking commuters, and badly insulated conductors contributed to fires. It was the insurance companies, which gave their attention to the fire risk inherent in the e1ectrical installations of the 1880s. Foremost among these was the Phoenix Assurance Co. whose engineer, Mr.Heaphy; was told investigate the situation and draw up a report on his findings.

The result was the Phoenix Rules of 1882. These rules were produced just a few months after those of the American Board of Fire Underwriters who are credited with the issue of the first wiring rules in the world.

The Phoenix Rules were, however, the better set and went through many editions before revision was though necessary. That these rules contributed to a better standard of wiring, and introduced a high factor of safety in the electrical wiring and equipment of buildings, was indicated by a report in 1892, which showed a high incidence of electrica1 fires in the USA and the comparative freedom from fire of electrical origin in Britain.

Three months after the issue of the Phoenix Rules for firing in 1882, the Society of Telegraph Engineers and Electricians (now the Institution of Electrical Engineers) issued the first edition of rule and regulations for the presentation of fire risks arising from electric lighting. These rules were drawn up by a committee of eighteen men, which included some of the famous names of day Lord Kelvin, Siemens and Cramp ton. The rules however were subjected to some criticism. Compared with the Phoemx Rules they left much to he desired. But the society was working on the basis of laying down a set of principles rather than as Heaphy did, drawing up a guide or "Code of Practice". A second edition of Society's Rules was issued in 1888. The third edition was issued in 1897 and entitled General Rules recommended for wiring for the supply of electrical energy.

The rules have since been revised at fairly regular intervals as new developments and the results of experience can be written in for the considered attention of all those concerned with the electrical equipment of buildings. Basically the regulations were intended to act as a guide for electricians and others to provide a degree of safety in the use of electricity by in experienced persons such as house holders. The regulations were, and still are not legal; that is they can not be enforced by the law of the land. Despite this apparent loophole, the regulations are accepted as a guide to the practice of installation work, which will ensure, at the very least, a minimum standard of work. The Institution of Electrical Engineers (IEE) was not alone in the insistence of good standards in electrical intuition of work. In 1905, the electrical trades union, though the London District Committee, in a letter to the Phoenix Assurance CO, said they view the alarm the large extent to which bad work is now being carried out by electric light contractors as the carrying out of bad work is attended by fires and other risks, besides injuring the trade, they respectfully ask you to upload a higher standard of work.

The legislation embodied in the factory and workshop acts of 1901 and 1907 had a considerable influence on wiring practice. In the letter act it was recognized for the first time that the generation, distribution and use of electricity in the industrial premises could be dangerous. To control electricity in factories and other prognoses a draft set of regulations was later to be incorporated into statutory requirements.

White the IEE and the statutory regulation were making their positions stronger, the British Standards Institution brought out, and is still issuing. The position of the six in this country. Is that they form the primary requirements which must by law be satisfied. The IEE regulations and codes of Practice indicate supplementary requirements. However, it is accepted that if an installation is carried out in accordance with the IEE wiring regulations, then it generally fulfills the requirements of the Electrical Supply Regulations. This means that a supply authority can insist upon all electrical work to be carried out to the standard of the-IEE regulations; but can not insist on a standard which is in excess of the IEE requirements .

The position of IEE rags, as they are popularly called, is that of being the installation engineers "bible". Because the regulations cover the whole field of installation work and if they are complied with, it is certain that the resultant electrical installation will meet they requirements of the all interested parties. There are, however, certain types of electrical installations, which require special attention to prevent fires and accidents. These include mines, cameras, theatres, factories and places where these are exceptional risks.

The following list gives the principal regulations, which cover electricity supply and electrical installations.

Non-Statutory Regulations:

1. Institute of Electrical Engineers Regulations of Electrical installations this covers intestinal and domestic electrical installations work in the buildings.

2. The Institute of Petroleum Electrical Code, 1963 - this indicates special safety requirements it is the petroleum industry, including protection from lighting and static. It is supplementary to the IEE regulations.

3. Factories Act, 1961. Memorandum by the Senior Electrical Inspector of Factories- deals with installations in factories.

4. Explanatory Motes on the Electricity Supply Regulations, 1937. - These indicate the requirements covering the supply and use of electricity.

5. Hospital Technical Memoranda nO.7 - Indicates the electrical services, supply and distribution in hospitals.

All electrical contractors are most particularly concerned with the venous requirement laid down by Acts of Parliament (or by orders and regulations made there under) as to the method of installing electric lines and fittings in various premises, and so to their qualities and specifications.

Statutory Regulations:

1. Building (Scotland) Act, 1959- provides for minimum standards of construction and materials including electrical installations.
2. Building Standards (Scotland) Regulations, 1981 contains minimum requirement for electrical installations.
3. Electrical Supply Reglilations, 1937 - indicates the requirements covering the supply and use of electricity and-deals with installations generally, subject to certain exemptions.
4. Electricity (Factories Act) Special Regulations, 1908 and 1944 - deals with factory installations; installations on construction sites, and installations of non-domestic caravans such as immobile workshops. These regulations come under the authority of the Health and Safety Commission.
5. Coal and Other Mines (electricity) Regulations, 1956 - deals with coalmine installations.
6. Cinematograph (safety) Regulations, 1952 - deals with installations in cinemas.
7. Quarries (electricity) Regulations, 1956 - deals with installations at quarry operations.
8. Agriculture (Stationary Machinery) Regulations, 1959 - deals with agricultural and horticultural installations.

Though these statutory regulations are concerned with electrical safety in the respective type of installations listed, there are Statutory Regulations, which are also concerned with electrical safety when equipment and appliances are being used. Included in these is the electricity at Work Regulations, which come into force in 1990. They are stringent in their requirements that all electrical equipment used in schools, colleges, factories and other places of work is in a safe condition and must be subjected to regular testing by competent persons.

Because of the rather legal language in which many of the Statutory Regulations are written, a number of them are made the subject of Guides and Explanatory Notes so that the electrical contractor and his employees are better able to understand requirements.

It should be noted that in addition the list above, there are guide a number of Statutory Regulation which deal with specific types of installations such as caravans and petrol stations. While it may seem that the electrician is completely surrounded by Regulations, it should be remembered that their purpose is to ensure not only the safety of the public, but work persons also. And it is also worth nothing that in the UK the record for the lowest number of electrical accidents is among the best in the world .It is requirement of the current edition of the IEE Regulations for electrical salvations that good workmanship and thence of approved materials contribute to the high level of safety provided in any electrical installations. The British Standard Institutions the approved for the preparation and issue of standards for testing the quality of materials and their performance once they are installed in buildings. A typical is BS 31 Steel conduit and Fittings for electrical wiring. The BSI also issues Codes of Practice, which indicate acceptable standards of good practice and takes the form of recommendations. These codes contain the many years of practical experience of electrical contractors. Same of the Codes of interest to the practicing electrician include:

BS 1003: electrical apparatus and associated equipment for use in explosive. Sphere of gas or vapor.

BS 7375: distribution of electricity on consumption and building sites.

BS 1018: electric floor-warming systems for use with off-peak and similar supplies of electricity.

Almost a century after the first wiring Regulations were issued a complete revision was made in 1981 with the appearance of the 15th edition under the title .Regulations for electrical installations. This edition differed from previous editions in its highly technical approach to the provision of electrical installations, based on the need for a high degree of quality of both materials and workmanship to ensure safety from fire, shock and burns. The technical content of the 15th edition of the Regulations placed a degree of responsibility on practicing electricians to become familiar with the electrical science principles and the technology which the installer must have in order to provide a client with an installation which is well designed and safe to use.

The16th edition is now published with yet more changes and differences in approach. From the 5th edition. The major changes include the smaller number of explanatory notes and fewer appendices. The 16th edition is also accompanied by a number of other publication Guidance Notes and an ON-Site Guide. The Guidance notes give detailed information on such topics as protection against electric shock, protection against over current, in periodic testing and special installations and locations and small three please installations without ilea need for the considerable amount of calculations which the 15th edition required in the design of an installation. The Guidance fact offers information, which will ensure hat an installation, has a high degree of built in safety without taking economic cost into consideration. The guide also contains mush need-tow information, thus making the technical aspects of an electrical installation mare accessible to the practicing electrician.

In short, the new 16th edition of the Regulations still places responsibilities on the electrician to fully understand the technical aspects of the work he carries out which only to be expected from a skilled and qualified work person.

CHAPTER -2-

RULES OF THE PROJECT

At drawing the electrical installation projects the current lines have to be 0.4 mm - 0.5 mm the low current lines have to be 0.2 mm – 0.3 mm the armatures , switches , sockets , etc. and the symbols of electrical devices have to be draw with 0.2 mm

We have to use writing template or number template when writing to Project.

The power calculating and the electrical installation Project have to be suitable to the rules of "TÜRK STANDARTLARI BAYINDIRLIK BAKANLIĞI ELEKTRİK TEKNİK ŞARTNAMESİ". At the drawing electrical installation Project the high of the electrical switches and electrical sockets, wall lamps and signal buttons. From ground are important.

At the practice

Devices :		**high from ground :**
Switches	....	120 cm
Sockets	....	40 cm
Wall lamps	....	190 cm
Conduit boxes	....	220 cm
Fuse box line	....	200 cm

Are putted higher from the ground. The devices have to put 30 cm far from door case and have to put 50 cm. far from window case. And in modern buildings the switches have to put 100 cm – 110 cm higher from. The ground in ground floor the sockets have to put as higher as like the switches just in case the water flood.

Nowadays improved cable channel and connecting devices with sockets have to put shorter then 40 cm high on the ground and wall.

In floor plans, power line plans lines and at the outlet the number of cable, crosscut and models with pipe model and its sizes are showed.

The power lines and the electric cable lines have to be numerated and this numbers are repeated a long the power lines and electric cable lines , the power lines are showed square , the electric cable lines are showed by circle.

At the electrical installation Project specially the column and the chimney etc... The architectural detailed have to state.

At the wet ground (toilets and bathroom) using the conduit box, switches, and the sockets are not permutated. The conduit box, switches and the sockets have to put to outside this place.

When we want to put a socket inside of the bathroom it is useful to use a special water leak proof socket.

The electric meter have to put a place where without damp , without dust , harmful heating changing weather like this and have to put a place that the competent can find and make control easily without asking the person who live .

In houses every subscriber can put the electric meter outside the own door, over the wall in the well hole, inside the covered parts or a ground where well weather coming dry and suitable places.

The electric meter can putted to the first enter in the places like shops, bureau, Office, etc... where the manager to see fit.

By the practice in the apartments the electric meter are putted to the ground floor in the electric meter panel.

The electric meter which has to be putted the dusted places and open area must putt the electric meter panel which made from galvanized iron.

The illumination line and socket line have to separate electric cable lines have to be numbered according to the exit and secondary panel (the numbers putted in circle).

The illumination and socket cable lines are protected by the circuit breaker. The short circuit current of the circuit breakers has to be at least 3 KA. The voltage loss has to calculate for the longest and the highest line. We can not draw a line surrounding of chimneys or columns at the Project. The switches, sockets, have to be put to a different place from chimneys and columns.

We can not put on joist or columns or near the joist or columns switches or sockets.

The electrical meter have to put to an enter of well hole in a box which have to be made from galvanization sheet.

At drawing the electrical installation projects and at the practice the lamp lines and the socket lines have to be different.

It can be connecting to the lamp line at most nine (9) lamps for the socket line it can be connecting at most seven (7) sockets.

But only the washing machine, dishwasher, and oven must have a along line and the power are different from the others.

Electrical device		power
Washing machine	....	2.5 kW.
Dish washer	....	2.5 kW.
Oven	....	2.0 kW.

By calculating the power we have to suitable this rule.

- As much as to eight (8) kW............ 60 %
- For the rest of power .... 40 %

By the practice we can use Bergman pipe under the plaster and on the plaster. But the plastic pipe can use only under the plaster.

CHAPTER -III-

ELECTRICAL MATERIALS

3.1 Insulators

An insulator is defined as a material, which offers an extremely high resistance to the passage of an electric current. Were it not for this property of some materials we would not be able to apply electrical energy to so many uses today. Some materials are better insulators than others. The resistively of all insulating materials decreases with an increase in temperatures. Because of this; a limit in rise in temperature is imposed in the applications of insulting materials, otherwise the insulation break down to cause a short circuit or leakage current to earth. The materials used for insulation purposes in electrical work are extensively varied and are of most diverse nature. Because no single insulating material can be rised extensively, different materials are combined to give the required properties of mechanical-strength, adaptability and reliability. Solids, liquids and gases are to be found used as insulation.

Insulating materials are grouped into classes:

Class A - Cotton; silk, paper and similar organic materials; impregnated or immersed in oil.

Class B - Mica, asbestos, and similar inorganic materials, generally found in a built-up from combined with cement binding cement. Also polyester enamel covering and glass-cloth and minacity.

Class C - Mica, porcelain glass quartz: and similar materials.

Class E - Polyvinyl acetyl resin.

Class H - Silicon-glass the following are some brief descriptions of some of the insulating materials more commonly found in electrical work.

Rubber

Used mainly for cable insulation. Can not be used for high temperatures as it hardens. Generally used with sculpture (vulcanized member) and china clay. Has high insulation-resistance value.

Polyvinyl Chloride (PVC)

This is a plastics material, which will tend to flow when used in high temperatures. Has a lover insulation resistance value than rubber. Used for cable insulations and sheathing against mechanical damage.

Paper

Must be used in an impregnated form (resin or oil). Used for cable insulation. Impregnated with paraffin was paper is used for making capacitors. Different types are available: Kraft, cotton, tissue, and pressboard.

Glass

Used for insulators (overhead lines). In glass fiber form it is used for cable insulation where high temperatures are present, or where areas are designated "hazardous". Requires a suitable impregnation (with silicone vanish) to fill the spaces between the glass fibers.

Mica

This material is used between the segments of commentators of the machines, and under slip rings of ac machines. Used where high temperatures are involved such as the heating elements of electronic irons. It is a mineral, which is present in most granite rock formations; generally produced in sheet and block form. Mechanize is the name given to the large sheets built up from small mica splitting and can be found backed with paper, cotton fabric, silk or glass-cloth or varnishes. Form includes tubes and washers.

Ceramics

Used for overhead line insulators and switchgear and transformer bushings as lead ins for cables and conductors. Also found as switch bases, and insulating beads for high temperature insulation applications.

Bakelite

A very common synthetic material found in many aspects of electrical work (e.g. lamp holders, junction boxes), and used as a construction material for enclosing switches to be used with insulated wiring systems.

Insulating oil

This is a mineral oil used in transformers, and oil filled circuit-breakers where are drawn out when the contacts separate, is quenched by the oil. It is used to mpregnate wood, paper and press board. This oi1 breaks down when moisture is present.

Epoxide resin

This material is used extensively for "potting" or encapsulating electronic items. In larger castings it is found as insulating bushings for switchgear and transformers.

Textiles

This group of insulating includes both natural (silk, cotton, and jute) and synthetic (nylon, beryline). They are often found in tape form for winding-wire coil insulation.

Gases

Air is most important gas used for insulating purposes. Under certain conditions (humidity and dampness) it will break down. Nitrogen and hydrogen are used in electrical transformers and machines as both insult ants and coolants.

Liquids

Mineral oil is the most common insult ant in liquid form. Others include carbon tetrachloride, silicon fluids and varnishes. Semi liquid materials included wax, bitumen and some synthetic resins. Carbon tetrachloride is found as are quencher in high voltage cartridge type fuses on overhead lines. Silicone fluids are used in transformers and as dashpot damping liquids. Varnishes are used for thin insulation covering for winding wires in electromagnets. Waxes are generally used for impregnating capacitors and fibers where the operating temperatures are not high. Bitumen is used for filling cable-boxes; some are used in paint form. Resins of a synthetic nature from the basis of the materials known as "plastics" (polyethylene; polyvinyl chloride, melamine and polystyrene). Natural resins are used in varnishes and as bonding media for mica and paper sheets hot-pressed to make boards.

3.2 Conductors

In electrical work, a conductor means a material which will allow the free passage of an electric current along it, and which presents negligible resistance to the current. If the conducting material has an extremely low resistance (e.g. a copper cable) there will, normally, be no effect when the conductor carries a current. If the conducting material has a significant resistance (e.g. Iron wire) then the conductor will show the effects of an electric current passing through it usually in the form of a rise in temperature to produce a heat effect. It should be remembered that the conduction of electric current is offered not only by metals, but by liquids (e.g. water) and gasses (e.g. neon). Conductors by nature differ so enormously from insulators in their degree of conduction that the materials which offer high resistance to electric current are classed as insulator. Those materials which fall in between the two are classed as semiconductors (e.g. germanium).

Copper

This metal has been known to man since the beginning of recorded history. Copper was connected with the earliest(electrical effects such as, for instance, that made by Galvan in 1786 when, he noticed the curious behavior of frogs legs hung by means of a cooper hook from an iron railing (note here the two dissimilar metals). Gradually copper became known as an electrical material; its law resistance established it as a conductor. One of the just application of copper as a conductor was for the purpose of signaling; afterwards the commercial generation of electricity looked to copper for electrical distribution. It has thus il prominent place and indeed is the fusty metal to come to mind when an electrical material is mentioned. As appoint of interest, the stranded cable, as we know it today has an ancient forebear. Among several examples, a bronze cable was found in Pompeii (destroyed AD 79); it consist of three cables, each composed of fifteen bronze e wires twisted round each other.

Copper is although, slow tarnishing and easily worked metal. lts high electrical conductivity marks, it out for an almost exclusive use for wires and cables, contacts, and terminations. Copper for electrical purposes has a high degree of purity, at least 99.9 per cent. This degree of purity results in a conductivity value only slightly less than that of suver (106 to 100). As with all other pure metals, the electrical resistance of copper varies with temperature. Thus, when there is a rise in temperature, the resistance also increases. Copper is available as wire, bar, rod, tube, strip, and plate. Copper is a safe metal; to strengthen it certain elements are added. For overhead lines, for instance, copper is required to have a high tensile strength and is thus mixed with cadmium. Copper is also reinforced by making it surround a steel core, either solid or stranded.

Copper is the basis of many of the cuprous alloy found in electrical work. Bronze is an alloy of copper and tin. lt is fairly hard and can be machined easily. When the bronze contains phosphorus it is known as phosphor-bronze, which is used for spiral springs Gunmetal (copper, tin, zinc) is used for terminals. Copper and zinc become brass, which is familiar as terminals, cable legs; screws and so on, where good conductivity is required, coupled with resistance to wear. Copper oxides slowly at ordinary temperatures, but rapidly at high temperatures; the oxide skin is not closely adherent and can be removed easily.

Aluminum

The use of aluminum in the electrical industry dates back to about the tim of this century when it was used for overhead line conductors. But because in the early days no precautions were taken to prevent the corrosion, which occurs with, bimetallic junctions (e.g. copper cable to aluminum bus bar) much trouble was experienced which discouraged, the use of the metal. Generally speaking, aluminum and its alloys are used today for electrical. purposes because of (a) weight; (b) resistance to corrosion; (c) economics (cheaper than topper); (d)ease of fabrication; (e) non-magnetic properties. Electrical applications in dude cable conductors, bus bars, casting in switchgear, and cladding for switches. The conductor bars used in the rotor of squirrel cage induction ac motors are also of aluminizing on account of the reduced weight afforded by the metal. Cable sheaths are available the aluminum. When used as conductors, the metal is either solid or stranded.

An oxide film is formed on the metal when exposed to the oxygen in the atmosphere. This film takes on the characteristics of an insulator, and is hard enough to with sand some considerable a abrasion. The film also increases the corrosion-resisting properties of aluminum. Because of this film it is important to ensure that alt electrical contacts made with the metal are initially free from it; if it does form on surfaces to be mated the film must be removed of broken before a good electrical contact can be made in a joint. Because the resistively of aluminum is greater than that of cooper, the cross-sectional area of the conductor for a given current-carrying capacity must be greater than that for a copper conductor.

Zinc

This metal is used mainly as a protective coating for steel and may be applied to the steel by galvanizing, shearardising or spraying. In electrical work it is found on switchgear components, conduit and fittings, resistance grids, channels, lighting fittings and wall brackets. Galvanizing is done by dipping iron or steel objects into molten metal after fluxing. Mixed with capper, the zinc forms the alloy brass. Sherardising is done by heating the steel or iron object to a certain temperature in zinc dust, to result in an amalgamation of the two metals, to form a zinc-iron alloy.

Lead

Lead is one of the oldest metals known to man. Lead is highly resistant to corrosion. So far as the electrical application of lead is concerned, apart from its use in priınarya and secondary cells, cable sheathing in lead was suggested as early as 1830-45. this period saw the quantity production of electrical conductors for inland telegraphs, and thoughts turned to the possibility of prolonging the life of the conductors: the earliest suggestion were that this could be done by encasing them in lead. Today lead is used extensively. Lead is not used pure; it is alloyed with such metals as tin, cadmium, antimony and cooper. Its disadvantages is that it is very heavy; it is also soft even though it,is used to give insulated cables a degree of protection from mechanical damage. One of its principle properties is its resistance to the corrosive effects of water and acids. It has a low melting point; this fact is made use of in the production of solder, where it is alloyed with in for cable jointing work. Lead alloyed with tin and copper is used as white metal for machine bearings.

Nickel

The metal is used in conjunction with iron and chromium to form what is known as the resistive conductor as heating elements for domestic and industrial beating appliances and equipment. The alloy stands up well to the effects of oxidation. Used with chromium only the alloy is non-magnetic; with iron it is slightly magnetic. It has a high electrical resistivity and low temperature coefficient. The most common alloy names are Nicnrome and Bright ray and Pyromic. Pure nickel is found in wire and strip forms for wire leads in lamps, and woven resistance mats, where resistance to corrosion is essentia1.

Carbon

This material is used for motor brushes (slip-ring and commutator), resistors in radio work. It has a negative temperature characteristic in that its resistance decreases with an increase in temperature.

Ferrous metals

These metals are based on iron and used for the construction of many pieces of equipment found in the electrical field (conduit, cable armoring, motor field poles and so on).

Because iron is a magnetic material, it is used where the magnetic effect of an electrical current is applied to perform some function. (E.g. in an electric bell).

The choice of magnetic materials today is extremely wide. For practical purposes magnetic materials fall into two main classes: permanent (or hand) and temporary (or soft).Permanent magnetic materials include tungsten and chromium steel and cobalt steel when magnetized they retain their magnetic properties for a long time. Cobalt-steel magnets are used for measuring instruments, telephone apparatus and small synchronous motors. Soft magnetic materials do not retain their magnetism for any appreciable time after the magnetizing force has been withdrawn. In a laminated sheet form they're found in transformer cores and in machine poles and armatures and rotors. Silicon-iron is most widely used material fore cores.

Rare and precious metals

In general, precious metals are used either for thermocouples or contacts. Among the rnetals used are silver, gold, platinum, palladium and iridium. Sometimes they are used as pure metals, otherwise as an alloy within the above group or with iron and copper, where special characteristics are required. For instance, a silver-iron alloy contact has a good resistance to sticking and is used in circuits which are closed with a high inrush (e.g. magnetizing currents associated with indicators, electromagnets and transformer). it is used also for small motor-starter contacts; the alloy maintains low contact resistance for very long periods. The following are some applications are rare and precious metals in contacts:

Circuit Brakers; silver, silver-nickel, silver-tungsten.

Contactors; silver, silver-tungsten. Relays. Silver, platinum, silver-nickel.

Relays. Silver, platinuim, silver-nickel

Starters.Platinum, rhodium,silver, coin silver. Silver is used for the fuse-element in HRC fuses.

Mercury, this material is used almost exclusively for mercury switches.In a vapor form it is used in fluorescent lamps (low-pressure lamps) and in the high-pressure mercury-vapor lamp.

Semiconductors

Oxides of nickel, copper, iron, zinc and magnesium have high values of resistance; they are neither conductors nor insulators, and are called semiconductors. Other examples are silicon and germanium. When treated in certain ways, these materials have the property of being able to pass a large current in one direction while restricting the flow of current, to a negligible value in the other direction.

3.3 Cables

The range of types of cables used in electrical work is very wide; from heavy lead sheathed and annored paper-insulated cables to the domestic flexible cable used to connect a hair diet to the supply. Lead tough-rubber, PVC and other types of sheathed cables used for domestic and industrial wiring are generally placed under the heading of power cables. There are however, other insulated copper conductors (they are sometimes aluminum) which; though by definitions are termed cables, are not regarded as such. In to this category fall for these rubber and PVC insulated conductors drawn into a some form of conduit or trucking for domestic and factory wiring, and similar conductors employed for the wiring of electrical equipment. In addition, there are the various types of insulated flexible conductors including those used for portable appliances and pendant fittings.

The main group of cables is "flexible cables". So termed to indicate that they consist of or more cores each containing a group of wires, the diameters of the wires and the construction of the cable being such that they afford flexibility.

Single-cote: These are natural or tinned copper wires. The insulating materials include butyl-rubber, silicon-rubber and the more familiar PVC.

The synthetic rubbers are provided with braiding and are self-colored. The IEE regulations recognize these insulating materials for twin- and multi-core flexible cables rather than for use as single conductors in conduit or trunking wiring systems. But that are available from the cable manufacturers for specific insulation requirements. Sizes vary from 1 to 36mm squared (PVC) and 50 mm squared (synthetic rubbers).

Two-core: Two-core or "twin" cables are flat or circular. The insulation and sheathing materials are those used for single-core cables. The circular cables require cotton filler threads to gain the circular shape. Flat cables have their two cores laid said by side.

Three cores: These cables are the same in all respects to single and two-core cables except, of course, they carry three cores.

Composite cables: Composite cables are those which, in an addition to carrying the currency-carrying circuit conductors, also contain a circuit-protective conductor.

To summarize, the following group of cable types and applications are to be found in electrical work, and the electrician, at one time or another during his career, may be asked to install them.

Wiring cables: Switchboard wiring; domestic at workshop flexible cables and cords. Mainly copper conductors.

Ship-wiring cables: These cables are generally lead-sheathed and annored, and mineral insulated, metal sheathed. Cables must comply with Lloyd's Rules and regulations and with Admiralty requirements.

Communication cables: This group includes television down-leads and radio relay cables; radio frequency cables; telephone cables.

Welding cables: These are flexible cables and heavy coeds with either copper or aluminum conductors.

Electric-sign cables: PVC and rubber insulated cables foe high voltage discharge lamps able to withstand the high voltages.

Equipment wires: Special wires for use with instruments often insulated with special materials such as silicon, rubber and irradiated polythene.

Appliance wiring cables: This group includes high temperature cables for electric radiators, cookers and so on. Insulated used includes nylon, asbestos and varnished cambric.

Heating cables: Cables for floor warming, road heating, soil warming, ceiling heating and similar applications.

Flexible cords: A flexible cord is defined as a flexible cable in which the csa of each conductor does not exceed 4mm squared. The most common types of flexible cords are used in domestic and light industrial work. The diameter of each strand or wire varies from 0.21 to 0.31 mm. Flexible cord come in many sizes and types; for convenience they are groups as follows:

1) Twin-twisted: These consist of one single insulated stranded conductors twisted together to form a core-cable. Insulation used is vulcanized rubber and PVC. Color identifications in red and black are often provided. The rubber is protected by a braiding of cotton, glazed-cotton and rayon barding and artificial silk. The PVC insulated conductors are not provided with additional protection.

2) Three-core (twisted): Generally as two twisted cords but with a third conductor colored green, for eating lighting fittings.

3) Three-core (circular): Generally as twin-core circular except that the third conductor colored green and yellow for earthling purposes.

4) Four-core (circular): Generally as twin-core circular. Colors are brown and blue.

5) Parallel twin: These are two stranded conductors laid together in parallel and insulated to form a uniform cable with rubber or PVC.

6) Twin-core (flat):This consists of two stranded conductors insulated with rubber, colored red and black. Lay side-by-side and braided with artificial silk.

7) High temperature lighting, flexible cord: With the increasing use of filament lamps which produce very high temperatures, the temperature at the terminal s of a lamp holder can reach 71 centigrade of more. In most instances the usual flexible insulators (rubber and PVC) are quite unsuitable and special flexible cords for lighting are now available.

8} Flexible cabbies: These cables are made with stranded conductors, the diameters being 0.3, 0.4, 0.5 and 0.6 mm. They are generally used for trailing cables and similar applications where heavy currents up to 630 A are to be carried, for instance, to welding plant.

CAPTER -IV-:
ELECTRICAL SAFETY-PROTECTION-EARTHING

4.1 Electrical safety:

The most common method used today for the protection of human beings against the risk of electrical shock is either:

1) The use of insulation (screening live parts, and keeping live parts out of reach).

2) Ensuring, by means of earthling that any metal in electrical installation other than the conductor, is prevented from becoming electrically charged. Earthing basically provides a path of low resistance to, earth for any current, which results from a fault between a live conductor and earthed metal.

The general mass, of earth has always been regarded as a means of getting rid of unwanted, currents,. charges of electricity could be dissipated by conducting them to an electrode driven in to the ground A lighting discharge to earth illustrates this basic concept of earth being a large drain for electricity. Thus every electrical installation, which has metal work , associated with it (the wiring system, accessories or the appliances used) is connected to earth. Basically this means if, say the framework of an electric fire becomes live the resultant current will if the frame is earthed, flow through the frame, its associated circuit protective conductor, and then to the general mass of earth. Earthing metal work by means of a bonding conductor means that all that metalwork will be at earth potential; or, no difference in potential can exist. And because a current will not flow unless there is a difference in potential, then that installation is said to be safe from the risk of electric shock.

Effective use of insulation is another method of ensuring that the amount of metalwork in an electrical installation, which could become live, is reduced to a minimum. The term double insulated means that not only are the live parts of an appliance insulated, but that the general construction is of some insulating material. A hairdryer and an electric shaver are two items, which fall into this category.

The following are some oft he points, which the inspecting electrician should look for:

1-) Flexible cables not secure at plugs

2-) Frayed cables

3-) Cables without mechanical protection

4-) Use unearthed metal work

5-) Circuits over-fused

6-) Poor or broken earth connections, and especially sign of Corrosion

7-) Unguarded elements of the radiant fires.

8-) Unauthorized additions to final circuits resulting in overloaded circuit cables.

9-) Unprotected or unearthed socket-outlets.

10-) Appliances with earthing requirements being supplied from two-pin BC adaptors.

11-) Bell-wire used to carry mains voltages.

12-) Use of portable heating appliances in bathrooms.

13-) Broken connectors, such as plugs.

14-) Signs of heating at socket-outlet contacts.

The following are the requirements for electrical safety.

1-) Ensuring that all conductors are sufficient in csa for the design load current of circuits.

2-) All equipment wiring systems and accessories must be appropriate to the working conditions.

3-) All circuits are protected against over current using devices, which have ratings appropriate to the current-carrying capacity of the conductors.

4-) All exposed conductive pans are connected together by means of CPCs.

5-) All extraneous conductive parts are bonded together by means of main bonding conductors and supplementary bonding conductors are taken to the installation main earth terminal.

6-) All control and over current protective devices are instal1ed in the phase conductor.

7-) All electrical equipment has the means for their control and isolation.

8-) All joints and connections must be mechanically secure and e1ectrica1ly continuous and be aceessible at all times.

9-) No addition to existing installations should be made unless the existing conductors are sufficient in size to carry the extra loading.

10-) All electrical conductors have to be install ed with adequate protection against physical damage and besuitably insulated for the circuit voltage at which they are to operate.

ll-) In situationswherea fault current to earth is not sufficient to operate an over current device, an RCD must be installed.

12-) All electrical equipment intended for use outside equipotent zone must be fed from socket-outlets incorporating an RCD.

13-) The detailed inspection and testing of installation before they are connected to a mains supply, and at regular intervals there after.

4.2Protection

The meaning of the word protection, as used in electrical industry, is not different to that in everyday used. People protect them selves against personal or financial loss by means of insurance and from in jury or discomfort by the use of the correct protective clothing the further protect there property by the installation of security measure such as locks and for alarm systems.

In the same way electrical system need to be protected against mechanical damage the effect of the environment, and electrical over current to be installed in such a fashion that person and or dive stock are protected from the dangerous that such an electrical installation may create.

Reasons for protections

1) Mechanical Damage: Mechanical damage is the term used to describe the physical harm sustains by various parts of electrical sets. Generally by impact hitting cable whit a hammer by obrasing. Ca-bles sheath being rubbed against wall comer or by collision (e.g. sharp object falling to cut a cable prevent damage of cable sheath conduits, ducts tranking and casing)

Fire Risk:

Electrical fire cawed by;

a-) A fault defect all missing in the firing.

b-) Faults or defects in appliances.

c-) Mal-operation or abuse the electrical circuit. (E.g. overloading)

4.2.1 Corrosion:

Wherever metal is used there is often the attendant problem of corrosion and it's prevented. There is two necessary corrosion for corrosion.

a-) The prevention of contact between two dissimi1ar metals ex copper & aluminum.

b-) Prohibition of soldering fluxes which remains acidic or corrosive at the compilation of a soldering operation ex cable joint together.

c-) The protection metal sheaths of cables and metal conductions fittings where they come in to contact with lime, cement or plaster and certain hard woods ex: corrosion of the metal boxes.

d-) Protection of cables wiring systems and equipment's against the corrosive action of water, oil or dumbness if not they are suitable designed to with these conditions.

4.2.2 Over current:

Over current; excess current the result of either and overload or a short circuit. The overloading occurs when an extra load is taken from the supply. This load being connected in parallel with the existing load in a circuit decreases. The overload resistance of the circuit and current increases which causes heating the cables and deteriorate the cable insulation. And the short-circuit.

Short circuit is a direct contact between live conductors.

a-) Neutral conductor. (Fuse)

b-)Earthed metal work (Operators)

4.2.3 Protectors of Over current

a-) Fuses

b-) Circuit Breakers

FUSE:

A device for opening a circuit by means of a conductor designed to melt when an excesive current flows along it .

There are three types of fuses.

a-) Rewireable.

b-) Cartridge.

c-) HBC. (High Breaking Capacity)

Miniature Circuit Breakers (MCB):

These protective devices have to elements, one thermal and one electro-magnetic. The fir, a bi-metal strip, operates for over loads and the second, a sensitive solenoid, detects short circuits. These types of fuses are most useful in today's. They have good advantages for example, after breaking circuit. The fuse may be reset and it has not got any damage after they have operated. Faulty circuit can be identified easily whit an ON or OFF position of device.

Current Operated EL CB (C/O ELCB)

Current flowing through the live conductor and back through the neutral conductor and there will be opposite magnetic area in the iron ring, so that the trip coils does not operate if a live to earth fault or a neutral to earth fault happens the incoming and returning current will not be and magnetic field will circulate in the iron ring to operate the trip coil.

4.3 Earthing

4.3.1 Earthing terms

Earth: A connection to the general mass of earth by means of an earth electrode.

Earth Electrode: A metal plate, rod or other conductor band or driven in to the ground and used for earthing metal work.

Earthing Lead: The final conductor by means of which the connection to the earth electrode is made .

Earthing Systems: In our electricity system, which is same to UK electricity, is an earthed 'system" which means that star or neutral point of the secondary side of distribution transformer is connected to the general mass of earth.

In this way, the star point is maintained at or about. OV. Unfortunately, this also means that persons or live stock in contact with a live part and earth is at risk of electric shock.

Three main Important Point Of Earthing:

1) To maintain the potential of any part of a system at a definite value with respect to earth.

2) To allow current to flow to earth in the event of a fault so that, the protective gears will operate to isolate the faulty circuit.

3) To make sure that in the event of a fault, apparatus "Normally death (OV)" can not reach a dangerous potential whit respect to earth.

4.3.2. Electric Shock:

This is the passage of current through the body of such magnitude as to have significant harmful effects these value of currents are;

lmA-2mA	Barely perceptible, no harmful effects
5mA-IOmA	Throw off, painful sensation
IOmA-15mA	Muscular contraction, cannot let go
20mA-30mA	Impaired breathing
50rnA and above	Ventricular fibrillation and earth

There are two ways in which we can be at risk.

a-) Touching live parts of equipment for systems. That is intended to be live. This is called direct contact.

b-) Touching conductive parts which are not meant to be live, but which have become live due to a fault. This is called indirect contact.

CHAPTER –V-

CIRCUIT CONTROL DEVICES

5.1 Circuit Conditions Contacts

All electrical circuits are required to have same means where by they can be energized and disconnected from their supply source. This is done by switches, of which there is a very wide variety of types available. A 'switch' is defined as a mechanical device capable of making; carrying and breaking current under normal circuit conditions, which may include specified overload conditions. Switches in domestic installations are familiar devices lised to control the supply to lighting, cooker and water-heating circuits. Socket-outlets may have switches incorporated. In a consumer unit, the main switch isolates the whole installation from the supply.

Certain types of circuit controls do not qualify as switches. These include thermostats for water-heaters and heating equipment, and touch switches or electronic switches. Some switches are used as isolators, which are designed to disconnect a circuit usually when the circuit has no current flowing in it.

Although circuit breakers tend to be regarded as devices used for protection of circuits against over current (overload and short-circuit), they also perform a duty as switches.

Circuit conditions

Electrical circuit has its own characteristics, which means that it will show same peculiar electrical property depending on the type of load connected to it. For instance, a circuit which has a purely resistive load (a resistor used as a lamp filament or heater element) will show a current, which rises when the circuit is first switched on and then falls as the element reaches its normal operating condition. This means that the switch or other circuit control device must at least be able to break the full-Ioad current taken by the resistor. This applies particularly if the circuit has a de supply. However, the supply is ac, when the switch contacts separate there may be a small are drawn out between the contacts.

This characteristic is even more noticeable when the resistor is in the form of a coil , (e.g. in a fire bar element). This effect is caused by the electrical property, which a coil has in an ac circuit. It is called the 'inductive effect'.

Contacts

There is in existence an extremely wide range of electrical-contact types used to control the flow of an electric current in a circuit. The action of any pair or pairs of contacts is (a) to 'make', to allow the current to flow, and (b) to 'break', to prevent the current flow. When this action is contained in a specially designed wiring accessory or apparatus it becomes one of the many form of devices used to control circuits, switches, contactors, circuit-breakers and the like.

The basic requirement of any pair of contacts are (a) low resistance of the contact material and (b) low resistance between the two contact surfaces when they meet to make the circuit.

5.2 Circuit-breakers

The Circuit-breakers can be regarded as a switch, which can be opened automatically by means of a 'tripping' device. It is, however, more than this where as a switch is capable of making and breaking a current not greatly in excess of ,its rated normal current, the circuit-breaker can make and break a circuit, particularly in abnormal conditions such as the occasion of a short-circuit in an installation. It thus disconnects automatically a faulty circuit.

A circuit-breaker is selected for a particular duty, taking in to consideration the following. (a) The normal current it will have to carry and (b) the amount of current which the supply will feed into the circuit fault, which current the circuit-breaker will have to interrupt without damage to itself.

Contactor

When a switching device has one or mare switches in the form of pivoted contact arms which are actuated automatically by an electromagnet, the device is known as a contactor. The coil of the electromagnet is energized by a small current, which is just sufficient to hold the pivoted contact arm against the magnet core, and in turn so hold the contacts (fixed and moving) together. Contactors are used in an extremely wide range of applications.

They fall in to two general types: (a) 'maintained' and (b) 'latched-in' in the first type, the contact arm "is maintained in position by the electromagnet. In the latched-in type, the contact arm is retained in the closed position by mechanical means.

Thermostat

The thermostat is used to control an electric heating appliance or apparatus so that a definite temperature is maintained. It is therefore, a switch, which operates with a change in temperature and is used in the temperature control of rooms, water-heaters, irons, cooker ovens and toasters. It maintains a temperature within defined limits by switching off the appliance when a higher temperature is attained, and switching it on again when a lower temperature has been reached. Expansion of a metal rod expansion of a liquid or a gas or the bending of a bimetallic strip. Applications of these methods are, respectively water-heaters, ovens and irons. The illustrations show the basic elements of each type of thermostat.

5.3 Switches and switch fuses

A switch is a device for controlling a circuit or pan of a circuit. The control function consists of energizing an electrical circuit, or in isolating it from the supply. The type of switch generally indicates the form, which this control takes. For instance a single-pole switch (usually called 'one-way') controls the Jive pole of a supply. A double pole switch controls two poles.

A common type of switch in use today is the micro-gap with a rating of 5 A, to control lighting circuits. Switches with a 15 A rating are also used to control circuits which carry heavier currents on both power (socket-outlet) and lighting arrangements.

Different type of switches can use on the electrical equipment of apartment. Switches have to be made suitable to TS – 41

Switch is equipment that it can on and off the electrical energy of an electrical circuit. The current can not be lower from 10 Ampere for using by 250 V. Electric circuit.

Switches are in four (4) groups

1 – Single key

2 – Commutator

3 _ Vaevien

4 – Button

Single Key

This can on and off a lamp or lamps only from one place. These switches are use usually in kitchen, toilets, room etc…

Commutator:

This can on and off two different lamp or lamps from one place at the same time or different time. These switches are used usually for a wall lamp, drawing room.

Vaevien:

This can on and off a lamp or lamps of the same time from different place. These switches are used usually in the balcony which has two doors or in the kitchen which have two doors.

Well hole switches:

These switches can on and off the lamp or lamps more than two (2) different place at the same time. These switches are used at the stair.

5.4 SOCKET:

Sockets are very important in our life because we need sockets in our home or in our work. To operate electrical devices sockets that we use have to be made to TS _ 40

Sockets are in two groups for a safety.

1 – Normal sockets

2 - Ground sockets

5.5BUTTONS:

Buttons are used for a door bell. When we push to the buttons then it is operate when we stop to the push button then it stops. At the electrical Project we have to fit to the rules of " BAYINDIRLIK BAKANLIGI ELEKTRİK TESİSATI ŞARTNAMESİ "

At the practice:

The switches from ground	120 cm
The sockets from ground	40 cm
The wall lamp from ground	190 cm
The conduit box from ground	220 cm
The fuse box from the ground	200 cm

CHAPTER -VI-
LIGHTING

Lighting plays a most important role in many buildings, not only for functional purposes (simply supplying light) but to enhance the environment and surroundings. Modern offices, shops, factories, shopping malls, department stores, main roads, football stadium, swimming pools – all these show not only the imagination of architects and lighting engineers but the skills of the practicing electrician in the installation of luminaries.

Many sources of light are available today with continual improvements in lighting efficiency and colors of light.

Lm:

This is a unit of luminous flux or (amount of light) emitted from a source.

Luminous efficacy:

This denotes the amount of light produced by a source for the energy used; therefore the luminous efficacy is stated in 'lumens per watt' (lm / W).

A number of types of lamps are used today: filament, fluorescent, mercury vapour, sodium vapour, metal Halide, neon. All these have specific advantages and applications.

6.1 FILAMENT LAMPS:

Almost all filament lamps for general lighting service are made to last an average of at least 1000 hours. This does not imply that every individual lamp will do so, but that the short-life ones will be balanced by the long-life ones; with British lamps the precision and uniformity of manufacture now ensures that the spread of life is small, most individual lamps in service lasting more or just less than 1000 hours when used as they are intended to be used.

In general, vacuum lamps, which are mainly of the tubular and fancy shapes, can be used in any position without affecting their performance. The ordinary pear-shaped gas filled lamps are designed to be used in the cap-up position in which little or no blackening of the bulb becomes apparent in late life. The smaller sizes, up to 150 W, may be mounted horizontally or upside-down, but as the lamp ages in these positions the bulb becomes blackened immediately above the filament and absorbs some of the light. Also vibration may have a more serious effect on lamp life in these positions Over the 150 W size, burning in the wrong position leads to serious shortening of life.

6.1.1 Coiled – Coil lamps:

By double coiling of the filament in a lamp of given wattage a longer and thicker filament can be employed, and additional light output is obtained from the greater surface area of the coil, which is maintained at the same temperature thus avoiding sacrificing life. The extra light obtained varies from 20 % in the 40 W size to 10 % in the 100 W size.

6.1.2 Effect of voltage variation:

Filament lamps are very sensitive to voltage variation. A 5 % over-voltage halves lamp life due to over-running of the filament. A 5% under-voltage prolongs lamp life but leads to the lamp giving much less than its proper light output while still consuming nearly its rated wattage. The rated lamp voltage should correspond with the supply voltage. Complaints of short lamp life very often arise directly from the fact that mains voltage is on the high side of the declared value, possibly because the complainant happens to live near a substation

6.1.3 Bulb finish:

In general, the most appropriate use for clear bulbs is in wattages of 200 and above in fittings where accurate control of light is required. Clear lamps afford a view of the intensely bright filament and are very glaring, besides giving rise to hard and sharp shadows. In domestic sizes, from 150 W downwards, the pearl lamp – which gives equal light output – is greatly to be preferred on account of the softness of the light produced. Even better in this respect are silica lamps; these are pearl lamps with an interior coating of silica powder which completely diffuses the light so that the whole bulb surface appears equally bright, with a loss of 5% of light compared with pearl or clear lamps. Silica lamps are available in sizes from 40 – 200 W. Double life lamps compromise slightly in lumen output to provide a rated life of 2,000 hours.

6.1.4 Reflector lamps:

For display purposes reflector lamps are available in sizes of 25W to 150W. They have an internally mirrored bulb of parabolic section with the filament at its focus, and a lightly or strongly diffusing front glass, so that the beam of light emitted is either wide or fairly narrow according to type. The pressed-glass (PAR) type of reflector lamp gives a good light output with longer life than a blown glass lamp. Since it is made of borosilicate glass, it can be used out-of-doors without protection.

6.1.5 Tungsten halogen lamps:

The life of an incandescent lamp depends on the rate of evaporation of the filament, which is partly a function of its temperature and partly of the pressure exerted on it by the gas filling. Increasing the pressure slows the rate of evaporation and allows the filament to be run at a higher temperature thus producing more light for the same life.

If a smaller bulb is used, the gas pressure can be increased, but blackening of the bulb by tungsten atoms carried from the filament to it by the gas rapidly reduces light output. The addition of a very small quantity of a haline, iodine or bromine, to the gas filling overcomes this difficulty, as near the bulb wall at a temperature of about 300^0C this combines with the free tungsten atoms to form a gas. The tungsten and the haline separate again when the gas is carried back to the filament by convection currents, so that the haline is freed the cycle.

Tungsten halogen lamps have a longer life, give more light and are much smaller than their conventional equivalents, and since there is no bulb blackening, maintain their colors throughout their lives. Mains-voltage lamps of the tubular type should be operated within 5 degrees of the horizontal. A 1000W tungsten halogen lamp gives 21 000 lm and has a life of 2000 hours. These lamps have all but replaced the largest sizes of g.I.s. lamps for floodlighting, etc. They are used extensively in the automotive industry. They are also making inroads into shop display and similar areas in the form of 1v. (12 V.) Single-ended dichotic lamps.

6.2 DISCHARGE LAMPS:

Under normal circumstances, an electric current cannot flow through a gas. However, if electrodes are fused into the ends of a glass tube, and the tube is slowly pumped free of air, current does pass through at a certain low pressure. A faint red luminous column can be seen in the tube, proceeding from the positive electrode; at the negative electrode a weak glow is also just visible. Very little visible radiation is obtainable. But when the tube is filled with certain gases, definite luminous effects can be obtained. One important aspect of the gas discharge is the 'negative resistance characteristic '. This means that when the temperature of the material (in this case the gas) rises, its resistance decreases – which is the opposite of what occurs with an 'ohmic' resistance material such as copper. When a current passes through the gas, the temperature increases and its resistance decreases. This decrease in resistance causes a rise in the current strength which, if not limited or controlled in some way, will eventually cause a short circuit to take place. Thus, for all gas discharge lamps there is always a resistor, choke coil (or inductor) or leak transformer for limiting the circuit current. Though the gas-discharge lamp was known in the early days of electrical engineering, it was not until the 1930s that this type of lamb came onto the market in commercial quantities. There are two main types of electric discharge lamp:

(a) Cold cathode.

(b) Hot cathode.

6.2.1 Cold Cathode Lamp:

The cold-cathode lamp uses a high voltage (about 3.5 kV) for its operation. For general lighting purposes they are familiar as fluorescent tubes about 25mm in diameter, either straight, curved or bent to take a certain form. The power consumption is generally about 8 W per 30 cm; the current taken is in milliamps. The electrodes of these lamps are not preheated. A more familiar type of cold-cathode lamp is the neon lamp used for sign and display lighting. Here the gas is neon which gives a reddish light when the electric discharge takes place in the tubes. Neon lamps are also available in very small sizes in the form of 'pygmy' lamps and as indicating lights on wiring accessories (switches and socket-outlets). This type of lamp operates on mains voltage. Neon signs operate on the high voltage produced by transformers.

6.2.2 Hot-Cathode Lamp:

The hot-cathode lamp is more common. In it, the electrodes are heated and it operates generally on a low or medium voltage. Some types of lamp have an auxiliary electrode for starting.

The most familiar type of discharge lamp is the fluorescent lamp. It consists of a glass tube filled with mercury vapour at a low pressure. The electrodes are located at the ends of the tube. When the lamp is switched on, an arc- discharge excites a barely visible radiation, the greater part of which consists of ultra-violet radiation. The interior wall of the tube is coated with a fluorescent powder which consists of ultra-violet rays into visible radiation or light. The type of light (that is the color range) is determined by the composition of the fluorescent powder. To assist starting. The mercury vapour is mixed with a small quantity of argon gas. The light produced by the fluorescent lamp varies from 45 to 55 lm/W. The colors available from the fluorescent lamp include a near daylight and a color-corrected light for use where colors (of wool, paints, etc.) must be seen correctly. The practical application of this type of lamp includes the lighting of shops, domestic premises, factories, streets, ships, transport (buses), tunnels and coal-mines.

The auxiliary equipment associated with the fluorescent circuit includes:

(a) The choke, which supplies a high initial voltage on starting (caused by the interruption of the inductive circuit), and also limits the current in the lamp when the lamp is operating.

(b) The starter;

(c) The capacitor, which is fitted to correct or improve the power factor by neutralizing the inductive effect of the choke.

The so-called 'switch less' start fluorescent lamp does not require to be preheated. The lamp lights almost at once when the circuits closed. An auto-transformer is used instead of a starting switch.

Mercury and Metal Halide Lamps:

The mercury spectrum has four well-defined lines in the visible area and two in the invisible ultra violet region. This u.v. radiation is used to excite fluorescence in certain phosphors, by which means some of the missing colors can be restored to the spectrum. The proportion of visible light to u.v. increases as the vapour pressure in the discharge tube so that colors correction is less effective in a high-pressure mercury lamp than in a low-pressure (fluorescent) tube.

High pressure mercury lamps are designed MBF and the outer bulb is coated with a fluorescent powder. MBF lamps are now commonly used in offices, shops and in door situations where previously they were considered unsuitable. Better color rendering lamps have recently been introduced MBF de-luxe or MBF-DL lamps and are at presents lightly more expensive than ordinary MBF lamps.

A more fundamental solution to the problem of color rendering is to add the halides of various metals to mercury in the discharge tube. In metal halide lamps (designed MBI) the number of spectral lines is so much increased that a virtually continuous emission of light is achieved, and color rendering is thus much improved. The addition of fluorescent powders to the outer jacket (MBIF) still further improves the color rendering properties of the lamp, which is similar to that of a de luxe natural fluorescent tube.

Metal halide lamps are also made in a compact linear from for floodlighting (MBIL) in which case the enclosed floodlighting projector takes the place of the outer jacket and in a very compact form (CSI) with a short arc length which is used for projectors, and encapsulated in a pressed glass reflector, for long range floodlighting of sports arenas, etc. In addition, single-ended low wattage (typically 150 W) metal halide lamps (MBI-T) have been developed offering excellent color rendering for display lighting, floodlighting and up lighting of commercial interiors.

No attempt should ever be made to keep an MB and MBF lamp in operation if the outer bulb becomes accidentally broken, for in these types the inner discharge tube of quartz does not absorb potentially dangerous radiations which are normally blocked by the outer glass bulb.

Sodium Lamps:

Low pressure sodium lamps give light which is virtually monochromatic; that is, they emit yellow light at one wavelength only, all other colors of light being absent. Thus white and yellow objects look yellow, and other colors appear in varying shades of grey and black.

However, they have a very efficacy and are widely used for streets where the primary aim is to provide light for visibility at minimum cost; also for floodlighting where a yellow light is acceptable or preferred.

The discharge U-tube is contained within a vacuum glass jacket which conserves the heat and enables the metallic sodium in the tube to become sufficiently vaporized. The arc is initially struck in neon, giving a characteristic red glow; the sodium then becomes vaporized and takes over the discharge.

Sometimes leakage transformers are used to provide the relatively high voltage required for starting, and the lower voltage required as the lamp runs up to full brightness a process taking up to about 15 minutes. Modern practice is to use electronic ignitrons to start the lamp which then continues to operate on conventional choke ballast. A power-factor correction capacitor should be used on the mains side of the transformer primary.

A linear sodium lamp (SLI/H) with an efficacy of 150 lm/W is available and in the past was used for motorway lighting. The outer tube is similar to that of a fluorescent lamp and has an internal coating of indium to conserve heat in the arc. Mainly because of its size the SLI/H lamp has been replaced with the bigger versions of SOX lamps as described above

Metallic sodium may burn if brought into contact with moisture, therefore care is necessary when disposing of discarded sodium lamps; a sound plan is to break the lamps in a bucket in the open and pour water on them, then after a short while the residue can be disposed of in the ordinary way. The normal life of all sodium lamps has recently been increased to 4 000 hours with an objective average of 6,000 hours.

High-Pressure Sodium Lamps:

In this type of lamp, the vapour pressure in the discharge tube is raised resulting in a widening of the spectral distribution of the light, with consequent improvement in its color-rendering qualities. Although still biased towards the yellow, the light is quite acceptable for most general lighting purposes and allows colors to be readily distinguished. The luminous efficacy of these lamps is high, in the region of 1001m per watt, and they consequently find a considerable application in industrial situations, for street lighting in city centers and for floodlighting.

Three types of lamp are available; elliptical type (SON) in which the outer bulb is coated with a fine diffusing powder, intended for general lighting; a single-ended cylindrical type with a clear glass outer bulb, used for flood-lighting, (SON.T); and a double-ended tubular lamp (SON.TD) also designed for floodlighting and dimensioned so that it can be used in linear parabolic reflectors designed for tungsten halogen lamps. This type must always be used in an enclosed fitting.

The critical feature of the SON lamp is the discharge tube. This is made of sintered aluminum oxide to withstand the chemical action of hot ionized sodium vapour, a material that is very difficult to work. Recent research in this country has resulted in improved methods of sealing the electrodes into the tubes, leading to the production of lower lamp ratings, down to 50W, much extending the usefulness of the lamps.

Most types of lamps require some from of starting device which can take the form of an external electric pulse ignitor or an internal starter. At least one manufacturer offers a range of EPS lamps with internal starters and another range that can be used as direct replacements for MBF lamps of similar rating. They may require small changes in respect of ballast tapping, values of p.f. correction capacitor and upgrading of the wiring insulation to withstand the starting pulse voltage. Lamps with internal starters may take up to 20 minutes to restart where lamps with electronic ignition allow hot restart in about 1 minute.

Considerable research is being made into the efficacy and color rendering properties of these lamps and improvements continue to be introduced.

Recent developments have led to the introduction of SON deluxe or DL lamps. At the expense of some efficacy and a small reduction in life far better color rendering has been obtained. They are increasingly being used in offices and shops as well as for industrial application.

6.3 ULTRA – VIOLET LAMPS:

The invisible ultra-violet portion of the spectrum extends for an appreciable distance beyond the limit of the visible spectrum. The part of the u.v. spectrum which is near the visible spectrum is referred to as the near u.v. region. The next portion is known as the middle u.v. region and the third portion as the far u.v. region. 'Near' u.v. rays are used for exciting fluorescence on the stage, in discos, etc.

'Middle' ultra-violet rays are those which are most effective in therapeutics. 'Far' ultra-violet rays are applied chiefly in the destruction of germs, though they also have other applications in biology and medicine, and to excite the phosphors in fluorescent tubes.

Apart from their use in the lamps themselves fluorescent phosphors are used in paints and dyes to produce brighter colors than can be obtained by normal reflection of light from a colored surface. These paints and dyes can be excited by the use of fluorescent tubes coated with phosphors that emit near ultra violet to reinforce that from the discharge. They may be made of clear glass in which case some of the visible radiation from the arc is also visible, or of black 'Woods' glass which absorbs almost all of it. When more powerful and concentrated sources of ultra-violet are required, as for example, on stage, 125W and 175W MB lamps with 'Woods' glass outer envelopes are used.

Since the 'black light' excites fluorescence in the vitreous humour of the human eye, it becomes a little difficult to see clearly, and objects are seen through a slight haze. The effect is quite harmless and disappears as soon as the observer's eyes are no longer irradiated.

Although long wave ultra-violet is harmless, that which occurs at about 3000mm is not, and it can cause severe burning of the skin and 'snow blindness'. Wavelengths in this region, which are present in all mercury discharge, are completely absorbed by the ordinary soda lime glass of which the outer bulbs of high pressure lamps and fluorescent tubes are made, but they can penetrate quartz glass. A germicidal tube is made in the 30W size and various types of high pressure mercury discharge lamps are made for scientific purposes. It cannot to be too strongly emphasized that these short-wave sources of light should not be looked at with the naked eye. Ordinary glass spectacles (although not always those with plastics lenses) afford sufficient protection.

Note that if the outer jacket of an MBF or MBI lamp is accidentally broken, the discharge tube may continue to function for a considerable time. Since short-wave u.v. as well as the other characteristic radiation will be produced these lamps can be injurious to health and should not be left in circuit.

CHAPTER -VII-
SUPPLY DISTRIBUTION AND CONTROL

7.1 Overhead Lines

The cheapest method of carrying power is by overhead line, particularly where light loads are concerned, as might be the case in a farm installation. Overhead line Qoles for low- and medium voltage services are of wood, generally 8m in length some 7m out of the ground. There are regulations, which govern the minimum lengths of span and minimum heights above ground for consumer's overhead wiring between buildings. In ordinary ground, the erection of poles presents no difficulty. The pole should be dug as narrow as possible in the direction of line. The pole should be positioned in one comer of the hole, so that in two directions it bears against undisturbed soil. Preferably, the butt of the pole should rest on a few inches of concrete or hard core, and be well rammed. In loose ground, cross-braces are necessary below ground level to present a larger area to the yielding soil.

Copper, owing to its high electrical conductivity, being second only to silver, and because it has good mechanical properties and resistance to corrosion, has for long been the most commonly used conductor, for overhead lines. One limitation to its use is the excessive sag that is necessary on long spans. In such instances, conductors with a higher tensile strength are used a composite conductor employing copper or aluminum strands round a steel wire; or a conductor of cadmium copper alloy. Overhead lines are subject to the requirements of the Overhead Lines Regulations, where a public supply is being carried. A conductor must have a breaking load at least 560 kg. Thus the minimum size fo a copper conductor is 8 SWG. The minimum permissible size of service line must be such as to have an actual breaking load of not less than 370 kg.

Conductors may be bare or insulated PBJ, VR or PVC, Line conduetors are attaehed to insulators carded on supports of wood, iron, steel, or reinforeed concrete. All wooden supports other oak or hardwood cross-arm must be impregnated with creosote. Two forms of insulators are used; the pin-type and the disk insulator for tension positions.

7.2 Supply control

It is a requirement of the Wiring Regulations that every consumer's installation shall be adequately controlled by switchgear which is readily accessible to the consumer and which shall incorporate

1) Protection against electric shock.

2) Protection against over current.

3) Isolation and switching.

The type and size of main switchgear to be installed depends on the type of premises and anticipated load. For the average domestic premises, the service cable (underground) is two-core and PILC or PVC insulated. This is suitable for a load of about 20 k W at 240V, single phase and 25mm squared csa, it is sufficient for the electrical requirements of most house holds. Industrial installations, unless they are very small workshops, are provided with three phases, four-wire services, usually 415V between phases, higher voltages are supplied where the load is large. The size of cable for an industrial load must cater for any future additions to the load or extensions to the factory. It is usual practice to install cables of sufficient capacity with appropriate switchgear; to save additional installation expense and outage time at a later date extensions are projected.

The location of the switchgear of a medium-voltage installation is at the main switchboard. This is situated in a substation or in a separate room on the premises to which any authorized persons have access and which is always kept clean and dry. The Switchgear, fuse gear and circuit breakers should have adequate breaking capacity current obtainable from the supply system. For medium sized installations, the switchgear is in the form of manually operate switch fuses. These units are available as metal clad, double or triple-pole and neutral switches with HRC fuses. Capacities are up to 300A, and can safely handle faulty currents up to 25MV A at voltages up to 660V ac. Large industrial loads are handled by circuit-breakers which, of course, incorporate the facilities for handling large amounts of short-circuit automatically. A typical switchboard fur a large installation usually consists of a main circuit breaker with a bus bar chamber from which are fed the various sub circuits of the installations, each having its own small-rated circuit breaker. It is a requirement of the IEE Wiring Regulations that all switchgear be labeled to identify their functions and the circuits they control. In addition, switches controlling emergency services such as fire alarms, firemen's lifts and sprinkler systems should be distinctively marked, for example, by painting them red.

The position of distribution fuse boards is important, and should be near the center of the load they are intended to serve. This reduces of the cost circuit cables, though the length between the supply intake position and particular distribution board should be taken into consideration so that the volt drop does not exceed the permitted maximum of 4 % of the nominal voltage of the supply.

7.3 Supply Distribution

With few exceptions, the types of electricity supply normally available are alternating current single-phase-two-wire, and three-phase-four-wire. In large factories involved in certain kinds of processes as steel mills, the internal works supplies for much of the rotating plant are dc. Direct current supplies outside industry are rarely available from a supply company, although they are, of course, in wide use of emergency lighting, battery charging and similar applications where the power requirement involved is small7823. Where the amount of power is large as in metal refining, the voltage is small (e.g. 10 V) and the current is correspondingly is large (e.g. 10,000 A).The de system in general use until the gradual changeover: to ac supplies was the three-wire system. This consisted of a de generator supplying a voltage of 500 V between two outer conductors known respectively as the 'positive outer' and the 'negative outer'. A middle wire, generally of smaller cross-sectional area, was earthed and thus provided a voltage of 250 V between any of the outer conductors and the neutral mid-wire. Thus, a 500 V motor could be supplied across the outers, while a domestic requirement of 250 V was met by connecting the mid-wire and the positive or negative-outers. This two-voltage facility was developed from the older single-voltage systems evolved before the turn of this century.

The ac systems came into their own because it was found possible to transmit large amounts of ac electrical power over long distances provided high voltage was used. AC is generated in the power station usually at 25,000 V. This generated voltage is transformed by generator transformers to transmission-line voltages of 132,275 and 400 kV. The transmission line from apart of what is known as the National Grid, which is an interconnected system of conductors (overhead lines and underground cables), which carry electrical power to points of use. All these points, the transmission voltage is reduced by transformers to 33 kV and 11 kV for large consumers. The voltage is farther reduced to 415/240 V for small consumers.

The single phase, 240V, 50 Hz systems is the normal supply for small dwellings, and other single occupier premises where the load demand is relatively small. The three-phase systems derived from a star-connected winding of a transformer, the star point being earthed. From this point a fourth conductor, the neutral, is taken to form a three-phase, four-wire system.

The voltage between any phase conductor and the neutral is 240 V. This system is the normal supply for commercial and industrial premises of medium size schools, hotels, blocks of flats, hospitals and the like. The lighting and heating circuits of individual tenements in blocks of flats are normally supplied from low-voltage circuits derived from this system, the load across the three phases being balanced as far as practicable. High-voltage three phase supplies are fed to very large consumers where total electrical load exceeds 100 kW. The voltages are either 11 or 33 kV. The consumer is offered a cheaper tariff if he takes a higher yaftage. A balance-load on a three-phase system is usually available only where three-phase motors are used. Heating loads, in most instances, can be connected across three phases and the neutral conductor omitted unless required for control purposes.

Cable sizes are dictated by the amount of electrical power to be carried. If a large power is to be taken to a consumer, high-voltage cable is use, to reduce the current and so the cross sectional area csa of the cable conductors. Because of the high voltage, however, the cable must be of necessity cost more to insulate. Despite this, there are sound economic reasons for carrying as much power as possible at a high voltage, leaving the larger csa cables to carry larger currents associated with individual circuits in an installation at low and medium voltages. The main economic reason is to reduce the amount of power loss in a conductor. There is also the important aspect of the loss in voltage along the length of the conductor as it carries the load current.

Underground cables are used where there is a visual objection to overhead lines to where it would not be convenient to use lines. Both paper and PVC insulated cables are used, with copper and aluminum conductors. The latter has now come into favor because it costs less than copper and has its lightweight requires a smaller cable-laying labor force. Copper conductors are stranded. Aluminum conductors are found in both stranded and solid forms. Belted cables are cheaper than careened types and are used for systems up to 11 kV.

Protection of underground cables against mechanical damage is provided for by steel-wire or steel-tape armoring. Steel-tape armoring cables are cheaper in first cost than the wired-armored types, but the bending radius is less and they can not be left 'bright', that is, with the jute serving removed to present a clean appearance surface work. Also, tape armoring can not be taken over plumbed or cone gland to the Armor clamp as in wire-armored cables.

There are three methods of laying underground cables: direct lying, draw-in and solid. The direct-laying method involves the cable being placed in a trench and taken covered with soil. In most instances, the cable is protected in wood planks, bricks, tiles or concrete slabs. Such cables should be armored, though if the risk of mechanical damage is small, bare-sheath cables can be used. Subsidence of the soil is an important factor in the installation of buried cables. And if the soil contains harmful chemicals, precautions must be taken to prevent the cable from being damaged by corrosion and electrolysis.

Direct lying is cheap, but replacement or renewal of the cable involves completely new excavation, which could be costly in the long terms. In the draw-in system, a line of conduits is glazed stone ware, cement or concrete. The tubes can be of earthenware or iron. After the ducts are laid, the cables are pulled into position from manholes or brick pits.

CONCLUSION

The thesis is electrical installation of a building. This part is the one most important part for engineering. Beginning of this thesis about history for installation, it's about what did happen and when did happen is about that.

The thesis is information about Electrical Materials, Electrical Safety protection Earthing, Circuit control devices, supply distribution and control final circuits and finally practical application were given.

If electrical installation does not wire properly, then it can cause the fire or it can damage whole cables in the building. Therefore, electrician should be careful while drowning the electrical installation project. The project must be suitable for Turkish standard.

In the practical part for drawing installation project by using AutoCAD is prepared. The calculation part is by using excel is prepared.

This project helps us to obtain information about calculation how we make according to what rules and the importance of grounding for human life, and we get detail information on the characteristics of materials which are used in buildings.

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