The prevention of electrical injuries construction essay

Electricity is the flow of electrons through a conductor. Electrons flow away from an object through a conductor creates an electric current which is measured in ampheres.

The electrical force that pushes the electrical current is the voltage and it is measured in volts. The opposition to the flow of current through a conductor creates a resistance which is measured in Ohm unit.

Flows of electricity

Some substances such as metals usually have low resistance to the flow of electric current and they are called Conductors.

Glasses, plastics, rubber, dry wood are insulators. They slow or stop flow of electricity.

Normally air is an insulator but can become a conductor during an arc or lighting stroke.

Pure water is a poor conductor but small amount of impurities in water like salts, acids, solvents or other materials present in water can turn it to a good conductor of electricity.

Electrical safety is the recognition of hazards associated with use of electricity and taking necessary precautions so that the hazards do not cause injuries or death.

No one could overstate the importance of Electrical Safety knowledge.

It is essential to know how to stay and work safely with or within the vicinity of electricity because electrical current at home or at workplace have enough power that can be fatal if one is exposed to.

An electrical injury will occur when a person comes into contact with the current produced by a source. The source can be touch of any bare wire or electrical appliances with bare hands at home as well as it can be a natural source such as lighting.

Hazards of Electricity

When electrical systems breakdown, people are exposed to the following hazards:

Electrocution

Electric shock

Electrical burns

Falls

1. ELECTROCUTION

To electrocute is to be killed by electricity.

Electrocution is death by means of an electric current passing through the body.

The current usually have the capacity to stop the heart and cause death through heating and destruction of the tissue.

Effects of Electric Currents.

Current is the killing factor when in contact with electricity.

The table below shows the value for Human Resistance

Types of Resistance

Resistance value (Ohm)

Dry skin

100 000 to 600 000

Wet skin

1000

Hand to foot

400 to 600

Ear to ear

100

Source: www. lanl. gov/safety/electricalsafety /docs. pdf

2. ELECTRIC SHOCK

Electricity travels in closed circuits through a conductor. When human body (conducts electricity very well) accidentally becomes part of the electric circuit, this results in electric shocks, that is the electric current flow through the skin, muscles and vital organs.

The Severity of Shocks depends on:

Amount of current that flows into the body

Type of current that flows into the body (Direct or Indirect)

The current’s path through the body

The current intensity

Duration of the contact

Current frequency

Voltage

The amount of current depends on the potential difference and the resistance. The table below shows the effects current on the human body range from a tingling sensation to death.

Amount of current (miliAmphere, mA)

Effect on the human body

Less than 1 mA

Usually not perceptible to human body.

Between 1-5 mA

It can be anything between tingling or mildly painful sensation

5-9 mA

Painful sensation

9-25 mA

Muscular contraction

25-60 mA

Respiratory paralysis

60 mA or more

Ventricular contraction

(affects different chambers of the heart, contraction & relaxation of ventricles becomes eratic. If last long, it can be fatal)

Nerve damage

4A(Amphere) Or more

Heart paralysis (muscles stop contracting & relaxing, most probably lead to death)

5A or more

Tissue burning (if tissues are those of vital organ, lead to death.)

Source: lecturer’s class notes

3. Burns

Burns are the most common shocks related injury.

Direct Contact Burn

When somebody direct touch the flow of electrical current, burns occurs. Currents enter the body and exit where the individual is grounded.

It somebody suffers from a direct contact with electricity, two skin burns will be noticed: – at the site of entry

– where the electricity leaves the body

Also, internal burn may occur where the power traced through the body.

Electrical Arc

Electric arcing occurs when the potential difference is high enough for current to flow in air. Electrical arcs reach very high temperature causing the individual to receive deep thermal burn where the arc hits the body, consequently causing Flash & Blast Arcing.

Along with burns, arcing causes electrical shock, explosion if the volume of air is large. It is therefore advised not to approach high voltage line.

One of the most common examples of arcing is lighting (electricity travelling onto air). A root is created for the electricity to go earth. Thus, a metal rod is placed as a safe path for the electricity to travel to earth near tall buildings.. The metal rod is a conductor of electricity, it attracts electricity. Several more precautions are to be taken during lighting such as stay indoors, do not venture to the sea, stay away from metal materials and so on.

Flash Arcing is a short circuit through air that flashes over from one exposed live conductor to another conductor or to the ground. The high heat energy at a point of the arc is called the arc flash. Arc flash is caused by uncontrolled conditions of electrical current from phase to ground and phase to neutral accompanied by ionization of the surrounding air.

Arc flash burns the skin by direct heat exposure and causes ignition of clothing.

High intensity flash also causes damage to the eyesight.

Flash burns are very uncomfortable, most of those caused by shorter flashes are not serious and usually heal in 12 to 24 hours. However with longer flash of a couple of seconds, a permanent damage may occur from ultra violet light.

Arc Blast is the explosive effect caused by the expansion of air and other vaporized materials that are overheated by the sudden presence of an electric arc.

Arc blast can result from unintentional contact with electrical system.

4. FALLS

Slips, trips and falls are one of the most common accidents at workplace even at home.

It cab be that the electric shock is not as fatal but one can fall down and injured if working, standing at height on ladder or cranes. It can also lead to death at times.

Prevention of Electrical Injuries.

Maintain all electrical installations in good working order with proper grounding.

Have al installation, operation, maintenance and repair work done only by a qualified person * and make use of PPE during installation.

Regular inspections of electrical systems and make use of a checklist.

Properly install ground equipment with proper labeling and coding of wires.

Read all instructions, labels and installation manual before operating or servicing electrical equipment.

Turn off equipments when not in use. Disconnect the power to the equipment that is left unattended or out of service.

High voltage equipment should be discharged to ground through discharge rods after their switching off.

Provide enough sockets for equipment in use.

Avoid overloading sockets and using adaptors may cause fires.

Ensure that equipment is fitted with a correctly rated fuse.

Replace damage sections of cable completely and never repair cuts with insulating tape.

Use proper connection to join lengths of cable.

Do not wrap cables carrying electric current around any part of the body.

Do not touch live electrical parts.

Make sure that all connections are tight, clean and dry.

*a Qualified Person is one who has the skills and knowledge related to the construction and operation of the electrical equipment and installations and has received sufficient training to recognize and avoid the hazards involved.

ELECTRICAL SAFETY AT HOME

Electrical safety at home depends on 3 main factors:

Safe Electrical Installation

– a correct earthing system to protect residents from an excess flow of electrical current.

– encourage residents to make use of the installation in a correct way.

For example: if there is enough sockets in the house, individual will have no need to adapters. This eliminates the risk of fire.

In short, installation should be designed in such a way that it is safe in itself regardless of how it is used. For instance: separate circuits should be included for higher power appliances.

Safe design of electrical appliances & devices

The use of high quality sound electrical appliances together with electrical safety devices such as surge, residual current device and a proper grounding system eliminates the risk of electrical hazards at home.

However, it cannot be denied that there are people who use old appliances which do not meet the standards or they have a tendency to buy appliances manufactured in countries with low safety standards. This may be because of cheap price and insufficient electrical knowledge.

The Human Factor

Habits of people such as not switching off electrical appliances when not in use, overloading sockets, use of extension cable more often and the use of electrical equipment (hair dryer, electrical razors) in the bathroom may lead to electrocution or fire. If people make an effort to change their bad habits, safety will be ensured at domestic level.

Electrical safety at home cannot be thought of without the use and knowledge of certain safety devices.

House hold circuits

The circuits that are wired into a house by a qualified electrician all start with wires coming in from power lines outside that are connected to a fuse box.

Fuse boxes contain safety devices called fused or circuit breakers which are designed to prevent an excess of electric current entering the house by allowing a certain maximum current to flow in.

When electrical current flow is high, an electromagnet attracts a spring loaded switch which breaks the circuits and cuts the power supply. The switch must be reset before any current can flow again.

Circuit breaker v/s Fuse

Circuit breaker is similar to a switch. Domestic circuit beaker usually can withstand a current up to 13 – 16 Ampheres (in most cases 13 A).

How it works?

If a circuit breaker of 13 A current rating is inserted, it will allow 13 A current to flow into the circuit.

An automatic switch will open whenever there is a flow of above 13 A of current. This prevents appliances from getting damage. And it re-open again when the current flow is 13 A.

Fuse is a piece of metal that has relatively lower melting point than copper wires. It is rated according to the amount of current that affect the fuse.

For example: if it is a 13 A fuse, it will allow 13 A flow of current to flow through the fuse.

How does it works?

As soon as there a current flow of greater than 13A in the fuse, the fuse heats then melts and opens the circuit and current will not flow in the appliance.

Circuit breaker and fuse prevent electrical fires and overheating that can be caused by an overload of electricity.

However, circuit breaker can be used again and again but fuse need to be replaced. (Melted fused cannot be re-used).

Circuit breaker and fuse only prevents appliances from getting damage but they do not protect individuals from getting electric shock. Devices that protects from electric shock are:

Residual Current Device (RCD)

It is a device that disconnects a circuit when it detects an disproportion of the electric current.

It works on the principle that electricity flowing into a circuit must be equal to the current flowing out of a circuit.

If the RCD detects an imbalance in electrical current, indicating a leakage to earth, it immediately cut the electricity to supply to prevent electrocution.

RCD protection can save lives by protecting from fatal electric shock and can provide some protection against fires.

It is usually used on outdoor electrical equipment. RCD should always be used when operating power tools outside or in damp conditions as it ensures that current is switched off automatically if there a fault or accident.

Earth Leakage Circuit Breaker (ELCB)

It is sensitive enough to detect the even tiny amount of current present in faulty electrical system. It is slightly less sensitive than RCD. It shares the same function as RCD but because of its sensitiveness ELCB is less likely to cause false alarms.

Ground Fault Circuit Interrupter (GFCI)

It is a fast acting circuit breaker that is sensitive to very low levels of current leakage 5m(A) to ground. When leakage becomes hazardous, it interrupts the circuit, turning it off. It is normally used for outside outlets.

Arc Fault Circuit Interrupter (AFCI)

AFCLs are electrical devices designed to protect against fires caused by arcing faults in home electrical wiring. Arc fault protection will be required for any 15 to 20 ampheres branch circuit to bedrooms, family rooms, living rooms and so on.

Arcing faults can occur in damaged or old cords, poorly installed outlets or switch with loose connections and furniture pushed against plugs.

AFCIs use unique current sensing circuitry to discriminate between normal and unwanted arcing conditions. Once an unwanted arcing condition is detected, the control circuitry in the breaker will de-energize the circuit.

Once a resident is aware of the types of safety devices used at home, he may choose which device needs to be installed at his place depending the conditions of his house and equipments used.

ELECTRICAL SAFETY AT MY OWN HOUSE

An electrical survey with use of a checklist was carried out in my house by me to detect electrical hazards in my house. A checklist was designed.

Checklist Date: 20/10/2012

Inspection

Remarks

YES

NO

Are the family members aware of the hazards and the risks associated with the use of electricity?

Has the electrical installation undertaken by a qualified electrician?

Has the electrician issued a certificate of compliance on completion of all electrical works?

Is there any regular inspection or maintenance of the electric system?

Switches, sockets , lightings, & plugs

Do all the switch for lighting system work properly?

Do all sockets have surfaces that cover all wiring?

Is there overloaded sockets?

Are all the switch cool to touch?

Do the bulbs used at home correctly rated?

Are the bulbs changed by member of the family?

Does she/he crew the bulb tightly?

Are the switch & circuit breaker turned off before changing a bulb?

Do the plugs fit the outlet correctly?

Electrical appliances & Equipments

Are all equipment in good working conditions?

Has any family member receive an electric shock while touching any electrical appliances?

Are all appliances connected to separate socket?

Is proper type of plug used for each outlet?

Are all appliances unplugged when not in use?

Is there any appliance plugged in area where it may come into contact with water?

Are all equipments correctly fitted with a correct rated fuse?

Extension cord & cables

Is there use of extension cord in the house?

Are the extension cord used overloaded?

Is the extension use for a temporary basis?

Is there any cord lying on the floor?

Is there any damaged cable in the house?

Fuse box & Circuit breakers

Is the main fuse box accessible to children or other persons?

Does everyone in the house know where the fuse box is located and how to shut the power of the entire house off?

Is there any accessible bare wire near the fuse box?

Is ELCB or any other security device provided in the electrical system of the house?

Is the device tested regularly?

Are different circuit breaker provided for each circuit?

Are circuit breakers appropriate for the power required?

Is grounding provided for the whole house?

Lightning

Do the family members aware of the electrical hazards during lightings?

Do they make it a must to take necessary precautions during lightning?

Are all sensitive equipment (computer, television) unplugged during lightning?

Are surge protectors used on electronic device?

Problems detected during the survey

Extensions used are not for temporary basis and is overloaded.

Extensions’ cables lying on the floor.

There are no separate sockets available for each electrical appliance.

No proper type of plug for each outlet. Hair dryer is loosely fitted in a multi-plug.

Damaged iron cable

Use of electrical equipments with wet hands bare feet and wet hair.

Frequent use of knife (metal) to appliances fit the socket.

One socket is pushed against furniture in the living room.

2 melted sockets are found.

Unplugging of electrical equipments by pulling on the plug not the cord is noticed several times.

Electrical devices are covered with cloth so as to prevent dust.

Pictures of some of the electrical hazard were taken during the survey.

Report of the survey

What are the hazards identified can cause and their recommendations.

2 extensions are used in the house

The use extensions comprises of several hazards in itself.

Starting with the extension used in the bedroom.

It is not in good condition as it is wrapped with tape and on top of that it is overloaded, it has mobile charger, fan and mosquito killer heater plugged into it. This can cause overheating of the extension as well as fire.

The extension is placed on the floor besides the bed, any family member getting out of the bed may accidentally put his/her leg on the extension and get electrified. the cable lying on the floor can cause falls and injuries.

Secondly, in the computer room.

All the computer outlets (CPU, UPS, speakers, printer) and the internet live box are connected into the extension. Something fan and Mosquito killer heated are also connected. Though the extension is in good condition, it may overheat and cause fire since it overloaded. Moreover it is placed at the bottom of the computer table, thus any body using the computer may unintentionally touch the extension with his/her feet and receive shocks.

It is to be noted that the extensions are not used on a temporary basis, they are used everyday. Thus, the risk of the electrical hazard is higher.

What should be done?

The everyday use of extension should be eliminated by providing separate sockets for each outlet. If the extensions are still used, the user should be sure that it is in good condition and it is not overloaded. It should be placed in a place where nobody can get into contact to it and its cable and the cable of the outlets should not be lying on the floor.

There are no separate sockets for each appliance

Television, MBC antenna and Canal Sat decoder are all plugged in the same socket by the use of a multi-plug. These appliances need a quiet high voltage of current and since the multi-plug is overloaded, this can cause the fuse in the multi-plug to heat, melt and then cause fire.

What should be done?

The best solution is to provide separate socket for each outlet.

The multiple used should be in good condition and should be replaced with a new one more frequently.

There is no proper type of plug for each outlet.

The pins of the hair dryer do not fit into the socket available, hence a multi-plug is used. However the multi-plug used is not in a good condition and the pins of the hair dryer do not fit the multi-plug tightly. This loose connection may cause fire due to overheating and the person using it is at the risk of receiving electric shocks.

What should be done?

The pins of the hair dryer can be changed to pins which can fit the socket, thus no multi-plug will be required.

If the multi-plug is used, it should be replaced with a new one.

Damage cable of the iron

The defective cable of the iron may cause fire and electrify the one using it. Filling the iron with water while the switch is still on causes electric shock to the user as water is a good conductor of electricity. Regular use of the iron with wet hair and bare feet.

What should be done?

The damaged cable of the iron should be replaced.

The user should make it a must to turn off the switch before filling in water into the iron.

Avoid using iron with dry hair and always wear sandal while using iron.

Use of electrical equipment with bare hands.

In the kitchen, it is found that in rush mother uses mixer with wet hands in the kitchen. This can lead to electrification.

It is also noticed that a knife is frequently used to make the mixer’s and the radio’s plugs fit into the socket. This cause the person doing this unsafe act to receive electric shock.

Moreover slight shocks are often received in fingers when using the iron, hair dryer and DVD which if of metal casing when barefoot or wet hair.

What should be done?

Make sure hands are dry while using electrical appliances.

Do not use knife to make the plug fit in socket, use instead an insulator such as a piece of wood or plastic to do it.

One socket is pushed against a furniture

This hazard can cause fire and if this socket is used , it may cause the person using the socket to be electrified as he/she can hardly see where the appliances is being plugged.

What should be done?

The furniture can be moved away.

The socket should be removed and placed somewhere else.

2 melted sockets are found.

These melted sockets are useless. They simply need to be replaced to prevent fire and prevent anyone from receiving electric shock.

Family members unplug the television, microwave, radio and other electrical appliances by pulling the cord not the plug. The cord may at any time come out of the plug and cause the person to be electrified. This unsafe act may also cause fire. The only preventive measure is that this particular unsafe should never be practiced.

Electrical devices are covered with cloth so as to prevent dust.

Electricity needs proper ventilation particularly with high voltage appliances such as television, computers, refrigerator, and microwave.

Dust is generally stored at the back of the electrical appliances. This can result in overheating of the appliances as the fan available on the device cannot work efficiently.

Moreover, we have a tendency to cover the appliances with cloth as means of cleanliness to prevent dust on the appliances. This is another hazard that causes overheating and may result in fire usually after long use of the appliances.

What should be done?

We should make sure that dust is not accumulated at the back of appliances. This can be done by regular cleaning.

The appliances should not be covered when in use and after use when still hot.

Further recommendations to ensure electrical safety in my house:

Review of the electrical system by a qualified electrician to eliminate the risks and hazards detected in the survey.

This time the qualified electrician should issue a certificate for the the electrical network installation.

Testing of the ELCB device should be done.

Key terms and concepts of electrical safety.

Ground pin of the plug of an electrical device should never be removed so as to make it fit a 2-pin socket. Never force a 3-pin plug into a 2-pin socket.

Good points which I noticed in my survey

The main fuse box was found in the corner of the roof of the dining table. There used to have water linkage at that particular corner during heavy rain. 3 years ago the fuse box was shifted to a place on the same roof where there is no water linkage.

Correctly rated bulbs (60 watt) are used.

A surge protector is provided for the computer to prevent overheating is used.

All the switches in the house are in good conditions.

No bare electrical wires are found hanging on the roof or walls of the house.

CONCLUSION

Though electricity is a boon to mankind, it is also one of the nature’s most powerful and dangerous forces. If electricity enables us to live our lives with ease and comfort, it can take our life away as well. It cannot be denied that electricity is an integral and normal part of our everyday lives.

Electrical safety at home becomes a very important aspect. Each and every electrical hazard should be eliminated or reduced as far as reasonably

practicable as it takes only one mishap to cause a dangerous occurrence. An electrical safety system protects us from dangers of electricity.

In our modern homes, people use several electrical appliances ranging from dishwasher to electrical razor. Everything works electrically with a simple ‘ click’.

It is very easy for people to forget the risks associated with their use. Use of the electrical appliances is not forbidden but provided that people take the and make an effort to stick on the principles of the devices.

To stay safe from electrical hazards, good habits based on the knowledge and understanding of the safety measures should be developed. Proper precautionary measures and recommended safe practice should be adopted not only to keep ourselves safe but also people around safe from dangerous electrical occurrences.