Effects of Electrical Current Passing Through the Human Body and Safety Requirements

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Abstract

With the increasing growth of industrialization and mechanization of workplaces, electric accidents are becoming quite common, and many workers and individuals are unconscious of the potential electrical hazards that their workplaces present and increase their vulnerability. Electrical currents have a wide range of impacts on the human body, from a barely slight tingling to sudden cardiac arrest. Therefore, a sound understanding of the engineering perspective and the occupational health and safety risk assessments are essential to prevent and manage these hazards.

The severity of electrical current effects on the human body depends on various factors and based on their values stimulate different physiological impacts. Electrical current exposes workers to serious, extensive, and widespread occupational hazards which cause injuries and harm in many circumstances. Practically, due to the high number of accidents and potential risks, working people are exposed to electrical power while performing their daily tasks. In fact, the lack of awareness and concern for safety is the primary cause behind these tragedies. The first step to avoiding these hazards begins with safety awareness.

The awareness of electrical hazards and safety precautions of employees and individuals plays an important role in increasing the safety of lives, property, and the environment. To this end, a comprehensive risk assessment and point of view regarding the electrical current and its effects on the human body, and from an electricity source to first aid for electrical shocks are considered in this study. At first, the nature of electricity and the basic principles are provided, then it presents the effects and consequences of electrical current passing through the human body, as well as how the electrical hazards occur and make danger. Lastly, it comprises the basic guidance of safety requirements needed to prevent or minimize the electrical current hazards or risks to the human being.

Keywords: Electrical current, electrical hazard, electric shock, electrical safety

Introduction

As a source of power, electricity has prior importance and it is the most commonly used in all aspects of our daily lives. Electricity powers everything from residential appliances to office equipment, electric tools to industrial machines, both at home and at work [1]. In today's world, electrical energy is one of the key components of industrialization, and it has become an important indicator for obtaining the development of the countries. Concurrently with the need for electrical energy, "occupational health and safety" is also appearing as a rising value. With advances in technology and heavy industrialization, electrical accidents and injuries are on a rise worldwide [2]. In modern industrialized societies, the majority of severe electrical accidents are suffered by electrical utility employees or construction workers, while in other societies, where the infrastructure is less developed and there is more theft of electrical power, the majority of electrical accidents occur to amateurs [3].

Electric current is invisible and since it cannot be seen, tasted, heard, or smelled, it is often referred to as a "silent killer". Electricity is such a familiar force that individuals and employees may presume they know everything about it. But electricity may be both a friend and a foe, depending on how we approach it. Electrical shock; which can result in electrocution, significant burns, or falls that lead to additional injuries or even death, as well as electrical arc-flash and electrical arc-blast, have long been recognized as serious occupational hazards. Young people and new workers, who have a higher risk of work-related injury than more experienced workers, account for most of the above casualties. These accidents can be prevented since they are caused mainly by electric users who lack electrical knowledge, and basic safety awareness, also due to carelessness [4]-[6].

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When a person is in touch with two electrodes, an electrical current passes through the body that is in contact. The intensity of this current depends on several factors. The danger depends on the current, time of current flow through the body, the trajectory followed by this current, and a variety of other parameters [7]. Total protection is impossible, thus the best safety comes from identifying appropriate and well-thought-out compromises that prioritize people's safety. People's safety with respect to recognized hazards must be a top priority consideration at every stage of any project (when building, managing, and maintaining systems) [8].

Understanding Electricity

Safe handling of electricity requires a basic understanding of basic electricity physics, how electricity is distributed in the workplace, how electricity affects the human body physiologically, and the nature of electrical injuries [9]. The better you understand electrical energy, the safer you will be at work and at home. Even though you can't see electricity, you are aware of it every day. You see it is used in countless ways. You can't taste or smell electricity, but you can feel it. Electricity is a type of force that involves the flow of electrons through a conductor caused by an "Electromotive Force (EMF)" [10]. Local power companies provide the majority of our electricity, which is distributed to our homes, workplaces, and other locations via distribution systems [1]. High-voltage electricity is typically delivered from power plants to major population centers. The voltage is subsequently reduced and distributed for consumption to household and industrial users [9]. Single-phase alternating current is used in our homes and businesses, while 3-phase alternating current is typically employed in the industry.

Electricity Principles

You must comprehend the basics of electricity, including the terminology Voltage, Current, Resistance, and Ohm's Law, in order to understand electricity and electrical safety.

Voltage

Shortly we can say that Voltage is merely the pressure pushing a current through its path, without a voltage there will be no current. In other words, electrons flow through a conductor, when a force (EMF) is exerted that cause a potential difference, or voltage. The unit is volt (V) and a voltmeter is used to measure voltage [10, 11].

Current

The rate of charge flow is simply defined as electrical current [3]. Current is defined as the continuous flow of electrons passing through a given point. It is measured by an ammeter and the unit is amperes (A).

Benjamin Franklin (1706-1790), without the benefit of our modern atomic theories, surmised that electricity traveled from positive to negative, setting a convention that we still use today [11]. The conventional and actual flow of current is illustrated in Fig. 1.

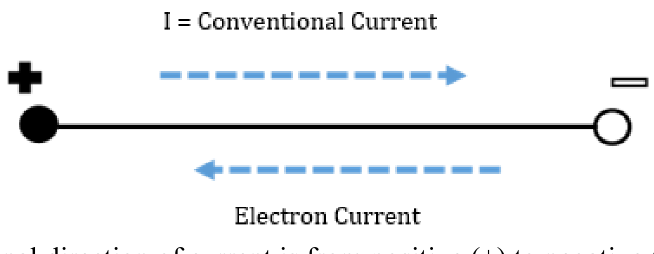

Figure 1. The conventional direction of current is from positive (+) to negative (-), the actual flow of electrons, however, is from negative to positive.

Resistance

When currents flow in conductors, the electrons collide with the lattice of atoms that make up the material. This impedes, or resists, the motion of atoms. The greater interference with electron movement in a material, the greater the resistance of that material. Resistance makes it possible to control current flow, generate heat, and supply the correct voltage to a device. The Greek letter omega (Ω) is used to designate the resistance unit's Ohms.

Ohm's Law

Ohm's law describes the relationship between the three basic electrical quantities; current, voltage, and resistance. In 1827, George Simon Ohm discovered that the flow of electrical current was directly proportional to the applied voltage and inversely proportional to the load's "resistance". This discovery became known as Ohm's Law [12].

For a resistor (R), the current (I) and the voltage (V) are related such that the current in a resistive element is directly proportional to the voltage. The required voltage equals the current multiplied by the resistance of the element. The Ohm's Law equation is given below in (1).

$$V = I \times R \tag{1}$$

Example 1: the human body resistance is typically estimated as 1 kΩ from hand to foot. Thus, if someone barefoot in wet concrete touches a 220 V line, the current passed through the body will be about 220 mA [3].

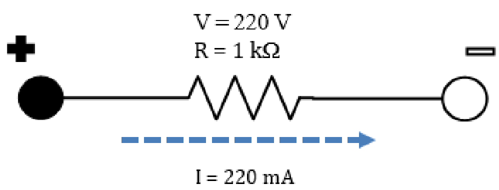

Figure 2. Circuit diagram of Example 1.

Physics of Electrical Current

Electrical current exists in 2 forms: alternating current (AC) and direct current (DC)

Alternating Current (AC)

As shown in Figure 3, an alternating current is one that changes rapidly in both direction and value within time. In an AC circuit, current flows from the positive terminal to the negative terminal, just as in a DC circuit. But the polarity of the AC terminals reverses at regular intervals, causing the direction of current flow to also reverse [10]. Alternating current is commonly used by domestic power suppliers.

While an alternating current passes through a circuit under an applied voltage, it is impeded and called "impedance". This impedance may be due to resistance, inductance, capacitance, or a combination of thereof and is measured in "Ω" [11].

Direct Current (DC)

Despite the fact that alternating current is more widely utilized in electrical work, the direct current has its own set of applications and benefits. As demonstrated in Figure 3, a direct current is one in which the flow direction does not change and may remain constant over time.

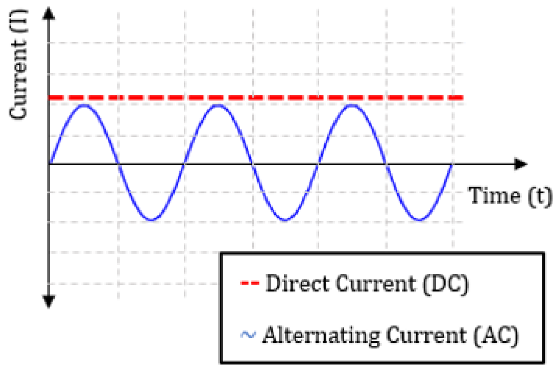

Figure 3. Direct current is constant over time, alternating current fluctuates over time.

The Human Body Resistance

Human skin resistance varies depending on the individual and the place or conditions in which they find themselves. The majority of today's research assumes a human body resistance of 1,000 Ω, however, to be on the safer side more utilities are assuming the human body resistance as 500 Ω [13]. Neither of them is truly representative of an individual worker. Many other elements influence a person's overall resistance. An individual's actual resistance can range from 500 Ohms to a few thousand Ohms. The body's resistance can be as high as 100,000 Ohms in dry settings, but it can drop to 1000 Ohms in damp conditions [9]. Values are usually given from hand to hand, a hand to both feet, or from one foot to the other foot. Calculations of the measured values yielded the electrical resistance for hand-to-hand

2,330 Ω and 1,130 Ω hand-to-feet [13]. Conversely, factors that increase body resistance include the wearing of appropriate protective equipment such as appropriate protective clothing covering the body, special insulating gloves, and safety shoes. Understanding the pathophysiology of electrical injury is pivotal in the diagnosis of the damage. The following discussion will address the most common factors and effects of electrical current on the human body.

Factors and Effects of Electrical Current Passing through the Human Body

Charles Dalziel in the late 1940s and early 1950s did much of the early research on the human body's reaction to electrical current. He used volunteers in his experiments and found that the body reacts to different levels of current in different ways. For the safety of the volunteers, the research was conducted only at low levels of current, with medical personnel present. Later, additional research was carried out to determine the correctness of extrapolating Dalziel's findings to higher current levels [13, 14].

A basic understanding of the electrical current hazard, along with the factors and physiological effects on the human body, is vital to an understanding of electrical safety. The following discussion will address the most common effects of electrical current on the human body. An electrical shock occurs when a person's body completes the current path between two energized conductors of an electrical circuit or between an energized conductor and a grounded surface or object [4]. Electric current enters the body at the point of contact and travels along with the tissues and structures that have the least resistance [2].

Factors Involved In the Physiological Effects

Electrical currents have a wide range of impacts on the human body, from a barely slight tingling to sudden cardiac arrest. The severity is determined by a number of factors:

A. Current:

The electrical currents based on their values stimulate different physiological impacts on the human body. Some values are interesting to know. What are the thresholds?

Perception thresholds: To 0.45 mA current is perceptible at the tongue. Beyond and from 0.3 to 3 mA the flow of alternating current (50 Hz) becomes noticeable on the skin and causes a tingling sensation and pain. Experiments on 169 people showed that the sensation occurs on average for a current of 1.086 mA [15]. To "International Electro-technical Commission (IEC)", the perception current value is 0.5 mA. Note that these are average values and depend on several factors. Hence from Dalziel, the value of current perception ranges from 0.3 to 99.7 mA [7].

Current is the killing factor in electrical shock. It determines the heat generated. It usually causes rhythm disturbances in the heart: Ventricular fibrillation is the common effect produced by high current intensity, as much the time of contact is getting more, it results in a more fatal effect [2,16,17]. The current needed to operate a 10-watt light bulb is eight to ten times more than the current amount that would kill a person [18].

Non-threshold drop: For currents above the current perception, the sensation becomes unpleasant and reached all the hands (touch hand or hand to foot) and can lead to muscle contraction.

B. Voltage:

When there is a potential difference between two parts of a body, the current will flow from one part of the body to another. The voltage value does not reflect the danger criterion; the danger criterion is the current through the body, which is determined by the contact voltage and the electrical impedance of the human body [7].

The IEC believes that voltages lower than 50 V are not dangerous [7]. High voltage (1000 Volts or more can be fatal) It ionizes the air particles and may arc across several meters, thereby causing damage beyond the point of physical contact. Low voltage injuries usually involve the hands or oral cavity [2,16,17].

C. Body impedance:

According to studies, the electrical impedance of the human body varies depending on a number of factors (contact points, the skin condition, the duration of contact, the contact voltage, etc.). The human body does not provide a linear resistance to current flow. Higher voltages have the ability to "break down" the skin's outer layers, thus lowering resistance [10]. Dry skin offers the highest resistance whereas skin immersed under water offers the lowest resistance thus, leading to more damage. Tissues offer the least resistance and allow maximum passage of current through the human body.

D. Duration of current flow:

The duration of the current flow has a great bearing on the final outcome. The time duration of the current flow determines the energy absorbed by tissues [19]. The danger is even greater when the time of current passing through the human body is big. At relatively high currents, if the shock is long enough, death is unavoidable; however, if the shock is brief enough, and the heart has not been harmed, disruption of the current may be followed by a spontaneous resumption of the heart's normal rhythmic contractions [10].

E. Frequency:

The vast majority of typical household and industrial equipment operates at frequencies between 50 and 60 Hz (cycles/second), which means that the current alternates back and forth 50 or 60 times each second and are the riskiest frequency. The current becomes less hazardous at frequencies over 50-60 Hz. The frequency of alternating current has significant implications for human safety that an extremely high AC frequency, may have therapeutic properties [19].

F. Pathway of current:

The current pathways through the body that passes via key organs are the most harmful. Current that flows from hand to hand, hand to head, or foot to hand (or head) and passes through critical organs, might harm vital organs like the heart and lungs [20].

G. Other influences:

They are very numerous, among them are age, health, body size, psychological state, medium temperature, the ambient atmosphere, the moisture, elevation and etc.

Physiological Effects

When a person is exposed to voltage, the body reacts like a normal receptor with a certain internal resistance. An electric current passes through the body, and the low-intensity current is perceptible by the tongue creating a sharp sensation. Beyond the intensity and a little more, it becomes perceptible to the skin and causes a tingling sensation and then pain with three serious risks [7, 8]:

- Tetanization: The current keeps the muscles it passes through contracting, and if it engages the chest, it may lead to respiratory arrest.
- Ventricular fibrillation: This occurs when the heart's rhythm is completely disrupted.
- Thermal effects: cause varying degrees of tissue harm, including profound burns when significant currents are in the case.

Table 1. shows that for a touch voltage of 220 volts, a current equivalent to 147 mA passes through the human body. To avoid any harm, this current must be broken in less than 0.18 seconds [8].

Table 1. Maximum breaking time according to prospective touch voltage.

Prospective touch voltage U_C (V)	Electrical impedance of the human body Z (Ω)	Current flowing through the body I_Δ (mA)	The maximum duration of flow t (s)
≤ 25	1075	23	∞
50	925*	54	0.48
	1725	29	∞
75	825*	91	0.30
	1625	46	0.60
100	800*	125	0.22
	1600	62	0.40
125	762*	164	0.17
	1562	80	0.33
220	700*	314	0,05
	1500	147	0,18
300	575*	521	0,025
	1 460	205	0,12
400	1 425	280	0,07
500	1 400	350	0,04

Note: A lower impedance value (having star*) can be used in some installations or under certain conditions (damp areas, moist skin, low resistance flooring, etc.).

Electric current may affect the normal functioning of the brain and stop respiration. For currents above 25 mA, the current path in the body may involve the respiratory muscles and lead to death by suffocation [1]. Chest obstruction can damage the heart and lead to electric shock (fatal accident) [7]. If the current flows through the heart, it causes the rhythmic pumping activity to be disrupted, finally causing the heartbeat to stop. Ventricular fibrillation is a condition in which the heart's ventricular muscle fibers contract abnormally, preventing a regular heartbeat [1]. When cardiac contractions are anarchic, the heart can no longer fulfill the role of the pump and the person becomes unconscious and not breathing. The human heart rate ranges from 60 to 100 beats per minute in typical circumstances. The heartbeat can increase to several hundred times per minute during an electric shock. If this situation is prolonged, irreparable damage will occur, followed by the death of the victim [7].

High-voltage burns are particularly serious because, in addition to local burns, deep burns developed along the electric current flow in muscle masses. Electro thermal burns are caused by the flow of electric current and are related to heat [7]. Tingling feelings give place to muscle contractions as the current is increased. As the current is raised, the muscular contractions and heat sensations get stronger. Pain sensations increase and voluntary control of the muscles in the present pathway becomes more difficult. The victim is unable to let go of the conductive surface being grasped when the current reaches 15 mA. The person is said to "freeze" to the circuit at this point. The "let-go" threshold is a term used to describe this point. When the current reaches 100 mA, the heart goes into ventricular fibrillation. Ventricular fibrillation is defined as "extremely rapid uncoordinated contractions of the heart ventricles resulting in a breakdown of coordination between the heartbeat and the pulse beat." When ventricular fibrillation develops, it will persist for a few minutes before death occurs. It is necessary to use a special device called a defibrillator to save the victim [10].

The “time/current limit curves” are defined by the standards in light of the two parameters to be considered while evaluating risk. These curves (refer to IEC 60479-1), give the varied limitations of the effects of electric current on the human body and define 4 main risk zones [8, 21].

Associated Injuries

Every year, thousands of people are injured in electrical accidents, including both experts and non-professionals. Approximately half of these accidents are linked to indoor low-voltage installations. The remaining half is due to a variety of factors, such as contact with overhead power lines or lightning [8]. The electrical injury occurs when the body becomes part of an electrical circuit. Direct electrical injuries can be classified into three categories [9]:

- Electrocution: which occurs when the electrical contact results in death
- Electric shock: which occurs when there is any contact with electricity and can range from a slight ‘zap’ to non-fatal fibrillation and/or burns
- Burns: the heating effects of electrical current can cause serious burns, especially at points where the electricity enters and exits the body [18]. Burns may be either internal or external.

There is a risk of shock and/or electrocution when working with electricity or electrical equipment operation. Electric shock (the most common hazard), arc flashes, and thermal burns are among the potential dangers that electrical workers may face [20, 22]. Other possible consequences of electric shocks may indirectly lead to falls, which can occur while working at heights following a small electric shock that causes a loss of equilibrium, or a throw from an electrical contraction of the extensor muscles [1,9].

Here in below the story of an electrical injury is discussed: The accident took place on Monday, October 9, 2017, in Günbuldu Village of Ağrı, Turkey. The shepherd Ramazan Taşdemir (17-year-old) while grazing the animals in the highlands of the village, sees a bird winged on the electric wire and flapping to get rid of it. Immediately Taşdemir climbed up the pole and rescued the bird. But while descending from the pole, the bottle of water in his back get in touch with the high voltage line and exposed him to electric current. As an outcome of electrical shock, while falling from the pole Taşdemir get hanged out from his foot on the pole and his hands were holding the wires. After rescuing him third-degree burns were observed on both hands and Taşdemir’s hands were cut after 4 hours of surgery. Opr. Dr. Mehmet Ozturk said, "Both hands were in a very bad situation, we struggled hard not to be crippled at a young age, but there was nothing left to do and we had to cut both hands under the elbow by surgery". The picture related to this story is shown in Figure 4.

Figure 4. Electrical accident; hands were cut off due to electrical current exposure.

Electrical injuries can also have "invisible" consequences as "visible" consequences (i.e., external and easily recognizable to others). The invisible consequences are internal and cannot be discernible easily by others because the harm is deeper in tissues and organs (such as muscles, internal organs, tendons, arteries, veins, and nerves). Many of these symptoms are vague and ambiguous, and they may not show right away after the incident, but may appear hours, days, weeks, months, or even years later, and they may worsen over time [23, 24]. These symptoms, which include those listed in the table below, can have an impact on a person's quality of life, reintegration into society, and capability to return to work [25].

Table 2. Invisible consequences of electrical injury.

Category	Symptoms
General	Chronic pain, fatigue, sleep disturbances
Physical	Muscle weakness, numbness, loss of sensation
Cognitive	Problems with concentration and memory, as well as a high level of distractibility
Psychological	Anxiety, depression, flashbacks and nightmares, post-traumatic stress disorder

Awareness of the mechanism of injury caused by various aspects of electric current is therefore pivotal in diagnosing, estimating the severity of the damage, and formulating a prompt therapeutic algorithm to reduce both morbidity and mortality [2]. Besides all the risks and hazards that electrical current could expose to the human body, electrical currents can be used in medical treatments to improve health, which have shortly discussed at the end of this paper.

Electrical Safety Requirements

Why is electrical safety so important?

In every work, the most important thing to remember is to stay safe. Electrical mishaps result in significant injury or death every year. Many of the victims are young persons who are just starting out in their careers. They are involved in accidents caused due to carelessness, the stress, and distractions of a new job, or a lack of understanding of electricity or safety [6]. Always there is a risk of electrical hazards, including electrical shock, whenever you work with power tools or on electrical circuits. At home or at work, everyone can be exposed to these dangers [5]. Workers who work directly with electricity, such as electricians, apprentices, power line workers, and other groups of the workforce, may be exposed to harmful conditions if adequate and proper precautions are not taken [20]. Not only is industrial safety crucial, but so is household electrical safety. In many households, the electrical systems in place are outdated and insufficient.

According to our research, the majority of electrical mishaps are caused by workers' unawareness, lack of knowledge, or carelessness [5]. Therefore, a sound understanding of the engineering perspective and the occupational health and safety risk assessments are essential to prevent and manage these hazards. The awareness of electrical hazards and safety precautions of employees and individuals plays an important role in increasing the safety of lives, property, and the environment.

What must be done to be safe?

The presence of electricity in modern life is increasing and more use of electricity means more potential electrical hazards. As people continue to put trust in electricity, the importance of electrical safety knowledge and awareness becomes essential for electricity users. It is never too late to begin learning how to utilize electricity safely [26]. At home or at work, everyone can be exposed to electrical dangers. Electricity is dangerous and should be addressed with caution; any source of energy, if not properly controlled or harnessed by those who utilize it, can result in severe danger. To this end, it is important to understand the causes and factors of electrical accidents at first, then the use of insulation, grounding, guarding, electrical protective devices, and safe work practices are some measures to prevent these mishaps.

Causes and factors of electrical accidents

The following are the most common causes of electrical accidents:

- Unsafe equipment usage or installation
- Unsafe work environment
- Unsafe work practices

Investigations into electrical accidents have identified some of the fatality and injury causes that point to a number of contributing factors which are: faulty insulation, loose connections, ground faults in equipment, improper grounding, unguarded live parts, defective parts, intentional use of obviously defective and unsafe tools, failure to de-energize electrical equipment when it is being repaired or inspected, and use of tools or equipment too close to energized parts.

The best approach to avoid the "visible" or "invisible" consequences of electrical accidents due to the above-mentioned causes and factors is, to prevent them by getting the proper safety training, wearing personal protective equipment (such as; safety hats, safety shoes, gloves, safety glasses, flame-resistant shirts & pants, face shields, fall protection equipment, and etc.), identifying electrical hazards, avoiding working with energized ("live") equipment, using insulated tools, and following safe work procedures [25, 27].

In order to avoid the risk of shock and electrocution, adequate protective devices such as circuit breakers, fuses, grounding, residual current devices (RCD), and ground-fault circuit interrupters (GFCIs), should be used in all electrical works [20]. Overcurrent devices should be installed where necessary. They must be of the size and type to cut off the current when it exceeds the conductor capacity. A proper selection takes into account not just the conductor's capacity, but also the power supply's rating and the possibility of short circuits [10].

Safety model

The most of electrically-related injuries and fatalities could easily be avoided. It is up to you to take responsibility for your own safety. Every day, take precautions to safeguard yourself and make safety a priority in your business. Use the three stages safety model (1- Recognize, 2- Evaluate, and 3- Control) to prevent electrical hazards.

To stay safe, workers must consider their profession and prepare for any threats. To avoid injury, one must be aware of and recognize potential hazards. We need to assess the risk and evaluate the scenario we're in. Hazards must be controlled by establishing a safe working environment, employing safe work practices, and reporting hazards to a supervisor. You will be significantly safer if you use the safety model to recognize, evaluate, and control hazards [5]. Controlling the electrical hazards gives the chance to limit or reduce accidents, injury, and fatalities [28].

Safety Basic Rules and Precautions

Most electrical mishaps occur as a result of either carelessness or a lack of understanding of the basic guidelines that should be followed when utilizing or working with electricity. The majority of these can be avoided by following basic safety precautions. Your individual work will have its own set of safety regulations. However, the following precautions are given as crucial safety basics [6, 20].

- Never intentionally subject yourself to a shock,
- Before beginning work, use a checklist to ensure that everything is in order and safe,
- Put up enough warning signs to alert people to the danger,
- Keep anything at least 10 feet away from high-voltage overhead power lines,
- Before using electrical tools, make sure they're in good working order. Stop using risky tools,
- Close any switch only after you've familiarized yourself with the circuit it controls and determined why it's open.
- In an emergency, find out where the breakers and boxes are,
- Take precautions when working on any circuit to make sure that the controlling switch is not operated while you are not present,
- When working on electrical equipment, avoid touching any grounded item,
- When working on live equipment with voltages of more than 30 volts, use just one hand. The likelihood of transmitting a current through the chest is considerably reduced by keeping one hand out of the way,
- Limiting the supply voltage to the lowest required to complete the task is one of the best techniques to reduce the risk of damage when utilizing electrical equipment [29]. The maximum supply voltage limit is 50 V (the standard limit value), however lesser supply voltages of 25 V or 12 V are employed in damp or submerged settings,
- Always check for and verify voltage absence and use insulating gloves and tools [30],
- Unless testing in an electrified setup is essential, all other electrical plant maintenance work should be performed in a de-energized state,
- Lock-out/tag-out procedures must be followed when working on a de-energized plant,
- All electrical plant work must be done by licensed and qualified experts.

First-Aid for Electric Shock

If someone is electrocuted, it is extremely important to detach the victim from the current as quickly as feasible while remaining safe. Do not contact the person until the electricity has been switched off.

You won't be able to aid if you become a second victim. Only perform first aid when the sufferer is in a safe area. Check the victim's pulse and breath. The person should be placed in a recovery position if he or she is unconscious but breathing regularly. If the victim is not breathing or has no pulse, cardiopulmonary resuscitation (CPR) should be started promptly by trained first aiders, and advanced life support (e.g. defibrillation) should be applied within eight minutes (National Institute of Occupational Safety and Health, 1998). The victim should then be treated by medical personnel as soon as possible. Even if there appears to be minimal immediate effect from the electric shock, assessment and treatment should be carried out because symptoms might take up to 48 hours to appear [1, 6, 9].

Electroconvulsive Therapy

Electroconvulsive Therapy (ECT) is a medical therapeutic procedure that is used worldwide to treat serious mental disorders. It is effective in the treatment of clinical depression (the most prevalent mental disorder), mania, and psychosis, as well as other neuropsychiatric disorders. To elicit generalized seizure activity, tiny electric currents are briefly sent through the brain via electrodes attached to the scalp during ECT. Its primary purpose is to alleviate psychiatric symptoms quickly and significantly [31]-[34].

Conclusions

Electricity is a versatile form of energy with widespread use, but it can be extremely dangerous if not correctly used and managed. When an individual comes in contact with energized conductors, they receive an electric shock and the current flows through the person's skin, muscles, and vital organs. Electrical currents have a wide range of impacts on the human body, from a barely slight tingling to sudden cardiac arrest. The severity is determined by a number of factors such as the current's path flowing through the body, the current intensity, the duration of the contact and etc. The electrical currents based on their values stimulate different physiological impacts on the human body. Tingling feelings give place to muscle contractions as the current is increased. Ventricular fibrillation is the common effect produced by high current intensity, the danger is even greater when the time of current passing through the human body is longer, and it results in a more fatal effect. A basic understanding of the electrical current hazard, along with the factors and physiological effects on the human body, is vital to an understanding of electrical safety. Safety practices help to reduce the risk of accidents, injuries, and fatalities. Ensuring safety and raising awareness among individuals is very important as knowledge is wealth. The electrical hazard posed a significant risk of death and injuries to individuals therefore, attention to safety is a necessary first step in any environmental setup. The more you understand about electricity, the safer you will be at work and at home.

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