PABLO

# Electrical safety at the lab.

**Electric shocks**;

It is normally caused by either touching a conductor that is live, called **direct contact** or by touching a metal part made live by an electrical fault called **indirect contact**. The most common cause of indirect contact is **over-current**.

# Electrical safety at the lab

Electrical volts greater than 50V ac can kill humans as well as livestock and must therefore be treated with great caution.

- Protection against **direct contact** with live parts is achieved by insulating those parts of the conductor which is exposed.
- Protection against **indirect contact** is also achieved by earthing and automatic disconnection of the supply in the event of a

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fault occurring by using fuses or Miniature Circuit Breakers[MCBs].

2.**Over-current**;

- It can be divided into two types[overload and short circuit current]

1. Overload Current [oc]; An overload current can be defined as a current which exceeds the rated value in an otherwise healthy circuit. This usually occurs when the circuit is being overloaded or

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abused and may result in currents in excess of 2 or 3 times the rated current flowing through the cct.

# Electrical safety at the lab

**Over current protection;**

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- All electrical equipment at the laboratory must be provided with protection against over-current. Fuses provide overcurrent protection when connected in the live conductor. They must **not** be connected to the neutral conductor or line.

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- MCB can also be used in placed of fuses as these have the added advantage of being able to reset a faulty circuit at a flick of a switch

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**Overcurrent;**

2. Short circuit current[scc]; a short circuit current is a fault that occur between live and neutral conductors or between live conductors and earth. This usually occur as a result of accidents. Scc can result in 100 of times higher than the rated current. In both Oc and scc, the basic requirement for protection are that, the fault current should be interrupted or isolated quickly. Otherwise this may cause

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temperature rise which might damage the insulation of the electrical installation.

- **Residual Current Device[RCD];**

  RCD is an electrical safety device which constantly monitors the balance of current through two coils connected to the live and neutral conductors of the load. In a healthy cct, these live and neutral currents balance. But if a fault occurs, the balance is lost and a trip circuit opens a switch to isolate the load.

- Modern RCD are very sensitive and can detect overcurrent of about 30mA and therefore a faulty cct

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can be isolated very quickly before the lethal limit is reached.


- Some electrical distribution boards are supplied with RCD incorporated in them already. These types are normally ideal for the laboratory or workshops. However where these types of protection is unavailable, like domestic installations, or when using portable tools or

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equipments away from the electrical service , a plug in RCD can be used.

- Secure Isolation;

When servicing any equipment at the lab, you must ensure that you isolate the equipments from the mains by switching it off. Every cct must be provided with a means of isolation [IEE Regulation 130-06-01] when working with a desktop unit it is usually simple. It's a matter of unplugging the equipment from the supply.

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Larger pieces of equipments may require isolating at the local isolator switch before work can commence.

- To deter anyone from re-connecting the supply while work is being carried out on an equipment a sign “DANGER service Engineer at work” or any suitable notice be displayed and the isolator secured where possible. You can

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also remove the fuses so that no one can easily re-connect the equipments.

- You may adapt the following procedure for secure isolation

1. First connect a test device to the supply which is to be isolated. The test device should indicate the mains voltage.
2. Next, isolate the supply and observe that the test device now reads zero volts.
3. Connect the test device to a known live supply or ‘proving unit’ to prove that the tester is still working.

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4. Finally secure the isolation and place a warning sign; only then should work commence.

- Live testing;
- There are also circumstances where fault finding or testing is carried out on live installations or equipments. Fault finding can only be successfully carried out live. In such cases the person carrying out the fault diagnosing must be

1. A trained person that understand the equipment and the potential hazard of working live.
2. Only use approved test equipments

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3. Set up appropriate warning  notices and barriers so that the work environment does not create a safety hazard.

- Fire must be avoided in the lab because it is very destructive and can cause great loss and damage to property and life. Any practice that will ignite fire at the lab must therefore be avoided.
- A fire is a chemical reaction which will continue if fuel, oxygen and heat is present. To eliminate a fire, one of these components must be removed.

This is often expressed as the fire triangle.

# Fire Triangle

# Fire control

- Fuel; it is found in the laboratory in many forms. These include patrols for portable generators, bottled gases for heating and soldering and most often solvents are flammable.

Rubbish also represent a source of fuel, wood, rags empty solvent cans and discarded packaging will all provide fuel for fire. To eliminate fuel as a source of fire, all flammable liquids and gases should be stored correctly usually in an outside locked store. The environment should also be kept clean with good 'housekeeping'

# Fire control

- Oxygen;
- Oxygen is all around us in the air we breathe but can be eliminated from a small fire by smothering with a fire blanket, sand or ‘foam’, Closing doors and windows, but not locking them, will limit the amount of oxygen available to a fire in a building and help prevent it from spreading. The minimal temperature at which a substance will burn is called the **Minimum Ignition Temperature[MIT]** and for most substances, this is considerably higher than the temp. of the surroundings.

# Fire control

Any practice that will unduly increase the MIT of equipments and materials at the lab should be avoided.

- Heat;
- Heat can be removed from fire by dousing with water. But water must **not** be used on burning liquids since the water will spread the liquid and the fire. Some fire extinguishers have a cooling action which removes heat from the fire.

# Fire control

- Fire is classified into 4 classes or categories

1. **Class A**: wood, paper and textiles
2. **Class B**:liquids fires such as petrol paints and oils
3. **Class C**: fires involving gas or spilled liquefied gases
4. **Class D**: very specialized fires involving burning metals

# Fire control

Electrical fires do not have any specialized category because once started, it can be identified as one of the categories.

- Fire extinguishers;
- They are for dealing with fires and deferent types of fire must be attacked with a different extinguisher. Using the wrong type of extinguisher could make matter worse. Eg. Water must not be used on a liquid or electrical fire. The normal procedure when dealing with electrical

# Fire control

fires is to cut off the electrical supply and use an extinguisher which is appropriate to what ever is burning.

# Fire Extinguisher Chart

| Extinguisher | | Type of Fire | | | | |
|---|---|---|---|---|---|---|
| Colour | Type | Solids (wood, paper, cloth, etc) | Flammable Liquids | Flammable Gasses | Electrical Equipment | Cooking Oils & Fats |
|  | **Water** | ✓ Yes | ✗ No | ✗ No | ✗ No | ✗ No |
|  | **Foam** | ✓ Yes | ✓ Yes | ✗ No | ✗ No | ✓ Yes |
|  | **Dry Powder** | ✓ Yes | ✓ Yes | ✓ Yes | ✓ Yes | ✗ No |
|  | **Carbon Dioxide (CO2)** | ✗ No | ✓ Yes | ✗ No | ✓ Yes | ✓ Yes |

# Fire extinguisher color coding

| Class of fire | Color of extinguisher |
| --- | --- |
| Class A | Green triangle |
| Class B | Red Square |
| Class C | Blue circle |

| | | |
|---|---|---|
| Class D | | Yellow Decagon |

# Recognition of Basic Electronic components

1. The Resistor;

   All materials have some resistance to the flow of an electric current, but in general, the term resistor describes a conductor specifically chosen for its resistive properties.

Resistors are the most commonly used electronic component and they are made in a variety of ways to suit the particular type of application. They are usually manufactured as either carbon composition or carbon film. In both cases the base resistive material is carbon.

# Recognition of Basic Electronic components

- Their general appearance is of a small cylinder with leads protruding from each ends as shown.