ELECTRONIC COMMUNICATION AND MULTIMEDIA EQUIPMENT SERVICING

NTQF Level-II

Learning Guide-10

Unit of Competence:	**Assemble and Disassemble communication & multimedia Equipment**
Module Title:	**Assembling and Disassembling communication & multimedia Equipment**
LG Code:	**EEL CMS2 M04 LO10- LG- 10 1019**
TTLM Code:	**EEL CMS2 M04 TTLM 1019 v1**

LO1: Prepare product and work station for assembly

Instruction Sheet	Learning Guide #10

This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics –

- Preparing workplace
- Consulting **responsible person**
- Preparing and checking materials, tools and equipment
- Preparing part needed to complete the work

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, **upon completion of this Learning Guide, you will be able to**:

- Prepare workplace in accordance with **OH&S policies and procedures**
- Consult **responsible person** for proper work coordination
- Prepare and check **materials, tools and equipment** in accordance with established procedures
- Prepare parts and materials needed to complete the according to requirements

Learning Instructions:

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described in number 3 to 20.
3. Read the information written in the information "Sheet 1, Sheet 2, Sheet 3 and Sheet 4".
4. Accomplish the information "Sheet 1, Sheet 2, Sheet 3 and Sheet 4".in page ***20, 24, 37 & 48.***
5. Try to answer self-check, you can ask your trainer for correction. If you finished answering the Self-check, take correction or explanation from your trainer if it is not clear.
6. Submit your accomplished Self-check. This will form part of your training portfolio.
7. Read the information written in the "Information Sheet 2". Try to understand what are being discussed. Ask you Instructor for assistance if you have hard time understanding them.
8. Accomplish the "Self-check 2" in page -24.
   Ask from your teacher for correction (key answers) if any.
9. Read the information written in the "Information Sheets 3. Try to understand what are being discussed and ask you teacher for assistance if you have hard time understanding them.
10. Accomplish the "Self-check 3" in page – 37.
11. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (To get the key answer only after you finished answering the Self-check 3).
12. If you scored a satisfactory evaluation proceed to "Operation Sheet 1" in page- 48, however, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity #1.

Information Sheet-1	Prepare product and work station for assembly

1.1. Prepare product and work station for assembly

Work station is an area or place designed for an activity in accordance with the job requirement to work there needed job. Product and Work station is selected for safety issue. “Safety first!” must be the ‘motto’ of everybody practically at any job. To address safety issue of workplace the basic requirement is the application of kaizen principles.

Preparation of product and work station requires:

- Only functional and immediate requirement must present at a time
- Work station must free from hazard and risk
- Produce only the quantity required and no more
- Produce only what the customer needs
- Manufacture one at a time in response to the customer’s demands
- Excess inventory is prevented or controlled
- One-piece-flow system increases transparency
- Zero-fault principle must be applied.

An ergonomics workstation design plays a decisive role in reducing waste during production. From an ergonomic aspect, the main focus is on the worker. The modular system for designing individual workplaces enables optimal adaptation to task and individual worker concerned. Appropriate setting and work station is necessary to monitor all required tasks and avoid fatigue, look the following picture.

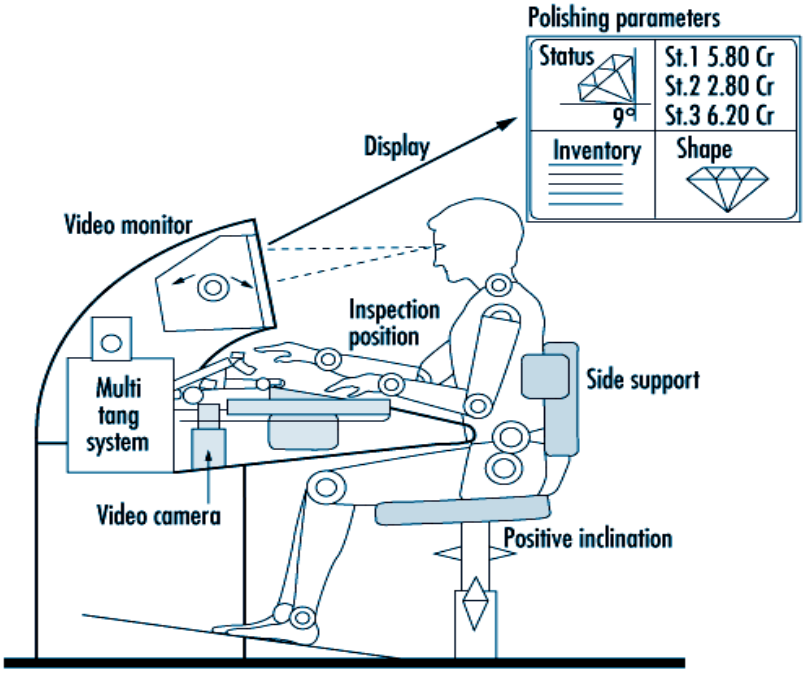

Fig. An Ergonomic workstation design

OH&S policies and procedures

1.1.1. Hazardous and risk assessment mechanisms

Hazard identification is the process of identifying all hazards in the workplace. A hazard is a source of potential harm or a situation with the potential to cause harm. When identifying hazards, the following must be taken into consideration:

The illustration of risk assessment procedure

Fig. Steps of risk assessment

Step 1: Identify Hazards

Consultation with concerned body or workers identifying all potentially hazardous things or situations that may cause harm. In general, hazards are likely to be found in the following;

- ✓ Physical work environment,
- ✓ Equipment, materials or substances used,
- ✓ Work tasks and how they are performed,
- ✓ Work design and management

In order to identify hazards the following are recommended:

- Past incidents/accidents are examined to see what happened and whether the incident/accident could occur again.
- Employees be consulted to find out what they consider are safety issues, i.e. ask workers about hazards near misses they have encountered as part of their work. Sometimes a survey or questionnaire can assist workers to provide information about workplace hazards.
- Work areas or work sites be inspected or examined to find out what is happening now. Identified hazards should be documented to allow further action. The work environment, tool and equipment as well as tasks and procedures should be examined for risks.
- Information about equipment (e.g. plant, operating instructions) and Material Safety Data Sheets is reviewed to determine relevant safety precautions.
- Welcome creative thinking about what could go wrong takes place, i.e. what hazardous event could take place here?

Step 2: Assess Risks

Risk assessment involves considering the possible results of someone being exposed to a hazard and the likelihood of this occurring.

A risk assessment assists in determining:

- ✓ How severe a risk is
- ✓ Whether existing control measures are effective
- ✓ What action should be taken to control a risk
- ✓ How urgently action needs to be taken.

- **A risk assessment should include:**
  - ✓ Identify factors that may be contributing to the risk,
  - ✓ Review health and safety information that is reasonably available from an authoritative source and is relevant to the particular hazard,
  - ✓ Looking at the types of injuries/illnesses/harm/damage that can result from the hazard, the number of people exposed.
  - ✓ The capability, skill, experience and age of people ordinarily undertaking work
  - ✓ The systems of work being used; and the range of reasonably foreseeable conditions.

- **Workplace layout, design and organization** –
  - ✓ How have the warehouses and plants been designed and laid out and how are products, tanks and racking positioned around the site.
  - ✓ Temperature of room or work area
  - ✓ size of site of work area
  - ✓ number of trainee or staff and
  - ✓ shifts

- **Design of equipment** –
  - ✓ How has racking and tanks been designed and by whom. Does it meet Ethiopian or International Standards?
- **How equipment is installed and disposed** –
  - ✓ How has pallet racking
  - ✓ tanks and forklifts been installed
  - ✓ commissioned and disposed
- **Management systems and procedures** –
  - ✓ Are all procedures valid, correct and current and are staffs aware of these procedures.
- **Human Behavior that contribute to risk–**
  - ✓ Effect of fatigue and
  - ✓ horseplay on operations
  - ✓ work after drinking alcohol
- **Emergency Situations** –
  - ✓ What affect will emergencies such as storms, fires or explosions have on operations?
- **Contractors involved in work practices** –
  - ✓ What task/process is operator conducting and what training do they have.
- **Training** –
  - ✓ Have all staff been trained in the operation of equipment or how to complete a task.
- **How often equipment is inspected and repaired –**
  - ✓ Is equipment being inspected in accordance with manufacturer specifications?

Step 3: Controlling Risks

Once a risk rating is determined, each hazard must have its existing risk control measures evaluated using the Evaluation of Control Effectiveness Table. This allows for determination of any additional requirement necessary.

Evaluation of Control Effectiveness Table

Well Designed Control ?		Effectively Implemented ?	
3	Needs improvement	3	Deficient *(b)*
2	Adequate	2	Marginal
1	Strong	1	Effective

Step 4: Implement additional risk controls

- ✓ Having identified the hazards in your workplace, assessed their risks and reviewed the existing controls, all hazards must be managed before people are hurt, become ill or there is damage to plant, property or the environment.
- ✓ The management of risks in the workplace requires eliminating risks so far as reasonably practicable in the first instance. Where elimination is not possible, then risks should be minimized, so far as reasonably practicable.
- ✓ All hazards that have been assessed should be dealt with in order of priority. The most effective control option/s should be selected to eliminate or minimize risks. The Hierarchy of Controls (see diagram below) ranks control options from highest level of protection and reliability to lowest. This should be used to determine the most effective control/s.

Step 5: Monitor and Review

Hazard identification, risk assessment and control is an on-going process. Therefore, regularly review the effectiveness of your hazard assessment and control measures at least every 3 years. Make sure that you undertake a hazard and risk assessment when there is a change to the workplace including when work systems, tools, machinery or equipment change. Provide additional supervision when new employees with reduced skill levels or knowledge are introduced to the workplace. The effectiveness of control measures can be checked through regular reviews as well as consultation with workers.

Maintaining records of the risk management process assists when undertaking subsequent reviews or risk assessments as it demonstrates decision making processes and informs how controls were intended to be implemented.

When do we must make risk assessment?

Workplace hazard identification, assessment and control is an on-going process. It should be undertaken at various times, including:

- If it has not been done before.
- When a hazard has been identified
- When a change to the workplace may introduce or change a hazard. Such as when changes occur to the work equipment, practices, procedures or environment.
- As part of responding to a workplace incident, even where an injury has not occurred.
- Where new information about a risk becomes available or concerns about a risk are raised by workers
- At regularly scheduled times appropriate to the workplace.

Definition of Terms

✓ **Hazard** - a situation or thing that has the potential to harm a person. Hazards at work may include: noisy machinery, a moving forklift, chemicals, electricity, working at heights, a repetitive job, bullying and violence at the workplace.

- Health hazards (cause occupational illnesses)
- Safety Hazards (cause physical harm - injuries

✓ **Risk** - The likelihood and consequence that a hazardous event will occur.

1.1.2. Implementation of safety regulations

To better clarify the issues and impediments related to the implementation and enforcement of a safety and health program standard, it would be valuable to address the following questions:

- How frequently is the safety and health program standard cited relative to other standards, how often are such violations cited as “serious,” and which elements of a safety and health program standard are most commonly cited?
- What are the states’ enforcement policies, and is there any relationship between these and the evidence about the effectiveness of the state programs?
- What type of training do inspectors receive to judge compliance and enforce the standard?

- Are there septic training tools or approaches that have been particularly successful?
- What sorts of communication efforts and other special assistance do states provide to employers prior to and during the early phases of implementation?
- What type of feedback have states received from employers regarding implementation and enforcement, and how have states responded to feedback?

1.1.3. Safety training

Safety training is one of the most important tasks to be carried out by trainer/instructor. Workers need to know not only how to do their jobs, but also how to protect their lives and health and those of their co-workers while working. Within enterprises, managers and supervisors are responsible for ensuring that workers are adequately trained for the work that they are expected to undertake. Such training should include information on the safety and health aspects of the work, and on ways to prevent or minimize exposure to hazards.

On a larger scale, employers' organizations should instigate training and information programs on the prevention and control of hazards, and protection against risks. Where necessary, employers must be in a position to deal with accidents and emergencies, including providing first-aid facilities.

1.1.4. safety systems incorporating,

Safety incorporation is the process of joining different safety system so as to form more comprehensive safety system to attain adaptive occupational health & safety procedure. So under this safety system incorporation topic all the following safety procedure must be integrated.

1. Identify system-level hazards and associated severities
2. Identify mitigation strategies and associated impact
3. Preparing safety or risk administration system to avoid or minimize hazard
4. Periodical training program on OH&S to cop-up with the technology and current occasion

Occupational safety and health (OSH) is generally defined as the science of the anticipation, recognition, evaluation and control of hazards arising in or from the workplace that could impair the health and well-being of workers, taking into account the possible impact on the surrounding communities and the general environment. This domain is necessarily vast, encompassing a large number of disciplines and numerous workplace and environmental hazards. A wide range of structures, skills, knowledge and analytical capacities are needed to coordinate and implement all of the "building blocks" that make up national OSH systems so that protection is extended to both workers and the environment.

1.1.4.1. Work clearance procedures

Work clearance procedures: An official approval, to have permission to perform the task. So clearance procedure is an important prerequisite for any job, especially the usual or correct way.

In this sense work clearances is concerned with the official removal of barriers or putting away responsibility that are carried by someone or an organization to comply with prescribed customs clearance formalities. This includes presentation of details such as description of goods, value, quantity, and exemption notification ….etc.

Work permits serve as a management measure for potential risks related to maintenance work. It is a document that is used to authorize the correct people to carry out particular work at specified

times. A work permit lays down these agreements and conditions, so as to prevent misunderstandings whilst the work is being carried out.

By using work permits, you can make sure that safety measures for carrying out certain work are complied with, and safety barriers are not taken out of service unless compensating measures are put in place.

- The work permit is an operational safety barrier to protect against undesired incidents.
- A work permit is a written document that authorizes specified persons to carry out specified work at a specified time.
- It describes both the work to be carried out and the requirements, which must be fulfilled.
- Work permits are categorized in different levels, depending on risk considerations and the need for coordination.
- A work permit can be created for a WCM-relevant order or for one or more operations.

1.1.4.2. Isolation procedures

Is the act of separating something from the system not being connected to the system. For system isolation control of the workplace or its access must also appoint an ‘authorized person’ who knows and understands the complexities of the plant. The ‘authorized person’ must, as far as practicable, ensure the isolation of all energy sources and potential hazards to those working on the plant. Where required, there may be a need for the ‘authorized person’ to check or verify each isolation point in person

The isolation process is also known in industry as 'lockout /Tagout' and is used to isolate machinery and equipment from its energy source. It is important to ensure the isolation of any unsafe machinery/equipment from potential uncontrolled energy sources during repair, service or maintenance work.

Isolation can be used as a standalone method of ensuring the safety of maintenance staff carrying out maintenance operations at a quarry where permits to work are not necessary or as part of a Work Permits requirements. The basic rules are that there should be isolation from the power source (usually, but not exclusively, electrical energy), the isolator should be locked in position (for example by a padlock), and a sign should be used to indicate that maintenance work is in progress. Any stored energy (hydraulic or pneumatic power, for instance) should also be dissipated before the work starts. Before entering or working on the equipment, it is essential that the effectiveness of the isolation is verified by a suitably competent person

- **E.g.** When the risks are high or when dealing with complex plant.

Shutting off electricity is usually achieved by opening a switch to produce an air gap too wide for electricity to cross. Electrical circuits connecting to equipment typically have a protection device at the source of each phase of the circuit, usually a switchboard. in addition to a single or three phase local isolating switch, which simultaneously opens the supply in each phase at the equipment itself, the protection device can be in the form of:

- Fuses – one per phase, sometimes accompanied by a switch, or combined as a switch fuse unit; or

- Circuit breakers – one per phase, and in the case of circuit breakers protecting a three phase circuit, usually as a three phase combination.

If there is the need to de-energize the circuit to the equipment as well as the equipment itself, then any circuit protection device, such as a switch or circuit breakers, should be opened and fuses removed…etc. Good practice requires that the local isolating switch should also be opened.

All plant of a type that could require an isolation procedure should be designed with appropriate isolation points for its energy sources to enable work on the plant to be carried out safely. It is important to identify all isolation points in a system as it may be necessary to use a local isolator to shut down a specific part of the machine such as a motor while the remainder of the plant remains in operation.

Clear identification markings or labels of the isolation points may be required, where this could assist the isolator select the correct isolation point, particularly where there could be the potential to make an error.

Emergency stop buttons, lanyards and similar quick-stop devices on their own will not necessarily achieve isolation. it is dangerous to rely solely on emergency stopping devices as they are not designed for frequent use and cannot be locked out in all cases.

Emergency stopping devices may allow energy to be inadvertently re-activated and may also allow control circuits to remain live.

Remote control rooms and process computers should be considered when identifying isolation points.

1.1.4.3. Gas and vapor

All matter exists in one of three states or phases - solid, liquid or gas. When a gas co-exists in equilibrium with its corresponding liquid, the gas is termed a vapour. In this situation, molecules are moving from the liquid to the gas phase at the same rate as they are moving from the gas back to the liquid phase.

Classification of Gases

(**a) Classification by chemical properties:**

(i) Flammable Gases - Eg., Propane(C3H8), Methane (CH4)
(ii) Non-flammable Gases - Eg., CO2, SO2, N2
(iii) Reactive Gases - Eg., F2 (most reactive), Cl2
(iv) Inert Gases - Eg., Ar, He, CO2, N2
(v) Toxic Gases - Eg., Cl2, H2S, NH3, CO, SO_2

(b) **Classification by physical properties:**

(i) Compressed Gases (which exist solely in the gaseous state under pressure at normal atmospheric temperature inside the container) Eg., O2, N2,
(ii) Liquefied Gases (which, at normal atmospheric temperatures inside the container, exists partly in the liquid state and partly in the gaseous state, and under pressure, as long as any liquid remains in the container)

Eg., Liquified Petroleum Gases(LPG), Liquified Oxygen(LOX)

(iii) Cryogenic Gases (liquified gases, which exist in the container at temperatures far below normal atmospheric temperature, but usually slightly above their BP at NTP, and at correspondingly low to moderate pressures.

Eg., Air (BP _194.4oC); O2(BP_183oC)

(c) Classification by usage:

(i) Fuel Gases - Eg. Natural Gas(NG), LPG

(ii) Industrial Gases (Comprising entire range of gases utilized for industrial processes, welding and cutting, chemical processing, refrigeration etc.) Eg., H2, O2, N2, C2H2, NH3.

(iii) Medical Gases (Anaesthesia, respiratory therapy etc.)

Use of gas and vapors :- Gas and vapors are used for fire attacking purpose; hence all safety materials must be readily accessed during maintenance and other operation.

Fire- extinguisher gas:- At normal temperatures, carbon-di-oxide is a gas, 1.5 times as dense as air. It is easily liquified and bottled, where it is contained under a pressure of approximately 51 bars (750 1bf/in) at about 15oC. As the fire extinguisher is discharged, the liquid boils off rapidly as a gas, extracting heat from the surrounding atmosphere. The gas, however, extinguishes by smothering, or reducing the oxygen content of the air. The extinguishing concentration of CO2 required for various types of fuels vary from approx. 30% to 62% depending upon the fuel.

There are four classes of fire extinguishers A, B, C and D and each class can put out a different type of fire.

- Class A extinguishers will put out fires in ordinary combustibles such as wood and paper
- Class B extinguishers are for use on flammable liquids like grease, gasoline and oil
- Class C extinguishers are suitable for use only on electrically energized fires
- Class D extinguishers are designed for use on flammable metals

Multipurpose extinguishers can be used on different types of fires and will be labeled with more than one class, like A-B, B-C or A-B-C.
Type of extinguishers and the classes of fire for which they can be used

- Water Class A fire
- Dry chemical powder Class B & C fire
- Foam Class A & B fire
- Carbon dioxide Class B & C fire
- Special dry powder Class D fire

Fig. Fire extinguisher

Fire is a rapid chemical reaction of oxidant with fuel accompanied by the release of energy, indicated by incandescence or flame.

For a fire to happen, the following elements are essential

- *Oxidizer to sustain combustion.*
- *Heat to reach ignition temperature.*
- *Fuel or combustible material.*

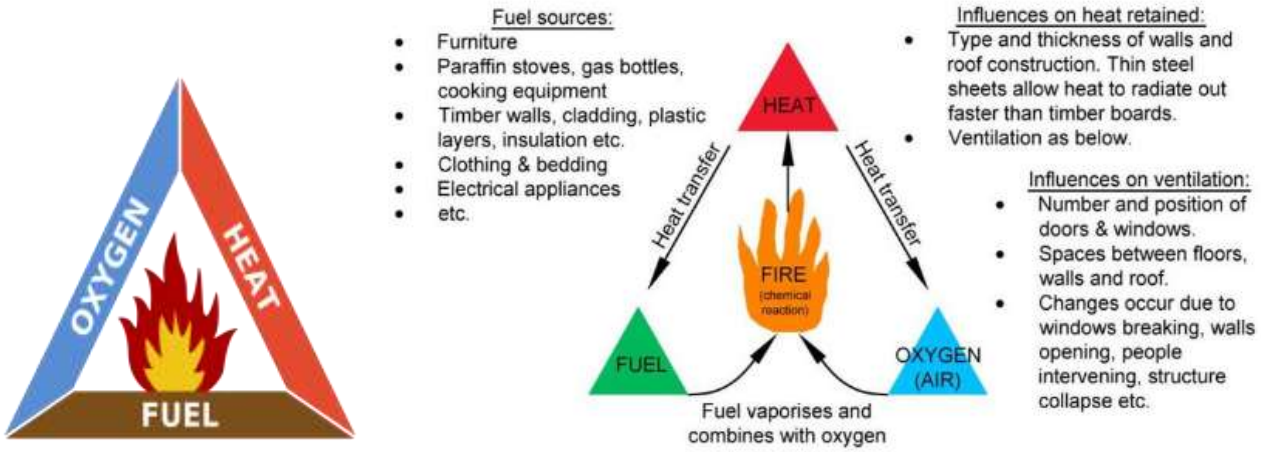

Fig. Fire triangle

Water Mist - (a) This is a comparatively recent development as a Halon Alternative. Fine Water Mist technology relies on relatively small (less than 200 microns) droplet sprays to extinguish fires. The three methods of application of Water Mist are:

(ii) Fixed installation - in a compartment / room for total flooding

(iii) Fixed spray nozzles, for local application, and

(iv) In portable extinguishers.

1.1.4.4. Monitoring/testing procedures

Test & monitoring is a **process** of evaluating and providing feedback of the "currently in progress" **testing** phase and **Test** control is an activity of guiding and taking corrective action based on some metrics or information to improve the efficiency and quality.

The purpose monitoring to ensure that the work environment, plant and equipment, and processes in the workplace conform to, national standards and legislative requirements establish and maintain a procedure for the planning and conduct of occupational safety and health (OSH) inspections, testing and monitoring to meet the OHS needs in implementing its OHS management system and its statutory requirements.

Inspection is taken to mean: "observations of work environment, work practices, equipment used, work posture or reported hazard and may be done with or without an inspection checklist". The inspection may be generic or it may be specific to assess a particular risk, task or part of the Occupational Health and Safety management system (OHSMS).

Examples of independent inspection processes include:

i. inspection of a potentially hazardous process to ensure that controls have been effective
ii. inspection of plant such as pressure vessels to check they conform with specified standards and regulatory requirements
iii. inspection of a work area to ensure that specific site safety rules have been followed or to identify hazards
iv. Inspection of a work site to ensure that controls are effective and to reinforce management commitment to the corporate and local OHSMS.

1.1.4.5. Use of protective equipment and clothing

Personal protective equipment (PPE) is defined as all equipment designed to be worn, or held, to protect against a risk to health and safety. This includes most types of protective clothing, and equipment such as **eye**, **foot** and **head**, ears, lungs, torso, hands and **feet**, protection, safety harnesses, life jackets and high visibility clothing. Additionally, protection from falls may need to be considered. Objects falling from a height present the major hazard against which head protection is provided. Other hazards include striking the head against projections and hair becoming entangled in machinery. Typical methods of protection include helmets, light duty scalp protectors called ‘bump caps’ and hairnets.

All PPE should be subject to regular checks. If replacements are needed then these must be ordered in advance. Where new equipment becomes available or new individuals are employed, it is the responsibility of the employer to ensure they receive the appropriate health and safety training on a continual basis.

The importance of wearing personal protective equipment at the workplace cannot be overstated. It is absolutely vital that both the employer and the employee are responsible in their approaches towards health and safety requirements and that they comply with regulation. When all parties accept responsibility for their roles, workplace risks can be kept to a minimum.

Training is the use of systematic and planned instructions activities to promote safety. Employers are required to train each employee who must use PPE. Employees or workers must be trained to know at least the following:

1.1.4.5.1. Ear muffs/plugs

Noise may be defined as any disagreeable or undesirable sound or sounds, generally of a random nature, which do not have clearly defined frequencies. The usual basis for measuring noise or sound level is the decibel scale. Whether noise of a particular level is harmful or not also depends on the

length of exposure to it. This is the basis of the widely accepted limit of 85 dB of continuous exposure to noise for 8 hours per day.

A peak sound pressure of above 200 pascals or about 120 dB is considered unacceptable and 130 dB is the threshold of pain for humans. If a person has to shout to be understood at 2 m, the background noise is about 85 dB. If the distance is only 1 m, the noise level is about 90 dB. Continuous noise at work causes deafness, makes people irritable, affects concentration, causes fatigue and accident proneness and may mask sounds which need to be heard in order to work efficiently and safely.

Fig.. Ear muffs and its use

Where individuals must be subjected to some noise at work, it may be reduced by ear protectors. These may be disposable ear plugs, reusable ear plugs or ear muffs. The chosen ear protector must be suited to the user and suitable for the type of noise and individual personnel should be trained in its correct use.

1.1.4.5.2. Goggles/glasses/

The eyes are very vulnerable to liquid splashes, flying particles and light emissions such as ultraviolet light, electric arcs and lasers. Types of eye protectors include safety spectacles, safety goggles and face shields.

Fig. safety goggle

1.1.4.5.3. Face shield

Face shields are personal protective equipment devices that are used by many workers (e.g., medical, dental, veterinary) for protection of the facial area and associated mucous membranes (eyes, nose, mouth) from splashes, sprays, and spatter of body fluids. Face shields are generally not used alone, but in conjunction with other protective equipment and are therefore classified as adjunctive personal protective equipment.

Such as ultraviolet light, electric arcs and lasers requires wear of face shield. Screen-based workstations are being used increasingly in industrial and commercial locations by all types of personnel. Working with VDUs (visual display units) can cause eye strain and fatigue.

Fig.. Face shield and its use

1.1.4.5.4.Safety hat

Objects falling from a height present the major hazard against which head protection is provided. Other hazards include striking the head against projections and hair becoming entangled in machinery. Typical methods of protection include helmets, light duty scalp protectors called ‘ bump caps ’ and hairnets.

Types of Hard hats are divided into three industrial classes:

Class A hard hats provide impact and penetration resistance along with limited voltage protection (up to 2,200 volts).

Class B hard hats provide the highest level of protection against electrical hazards, with high-voltage shock and burn protection (up to 20,000 volts). They also provide protection from impact and penetration hazards by flying/falling objects.

Class C hard hats provide lightweight comfort and impact protection but offer no protection from electrical hazards.

Figure. Safety helmet or hard hat

1.1.4.5.5.Safety apparel/suit

A worker’s body may need protection against heat or cold, bad weather, chemical or metal splash, impact or penetration and contaminated dust. Alternatively, there may be a risk of the worker’s own clothes causing contamination of the product, as in the food industry. Appropriate clothing will be recommended in the company’s health and safety policy. Ordinary working clothes and clothing provided for food hygiene purposes are not included in the Personal Protective Equipment at Work Regulations

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Fig. safety cloth

1.1.4.5.6.Safety belt/harness

Safety belt or harness is a body belt or body harness system rigged to allow an employee to be supported on an elevated vertical surface, such as a wall, and work with both hands free while leaning. Is a device consists of straps that are secured about a body in a manner that distributes the arresting forces over at least the thighs, waist, chest, shoulders, and pelvis, with provision for attaching a lanyard, lifeline, or deceleration device.

Fig.. Safety harness and how to use

*1.1.4.5.7.**Safety shoes***

Boots or shoes with in-built toe caps can give protection against impact or falling objects and, when fitted with a mild steel sole plate, can also provide protection from sharp objects penetrating through the sole. Special slip resistant soles can also be provided for employees working in wet areas.

Fig. different types of Safety shoes

*1.1.4.5.8.**Mask***

Breathing reasonably clean air is the right of every individual, particularly at work. Some industrial processes produce dust which may present a potentially serious hazard. The lung disease asbestosis is caused by the inhalation of asbestos dust or particles and the coal dust disease pneumoconiosis, suffered by many coal miners, has made people aware of the dangers of breathing in contaminated air.

Fig. Different types of Respiratory musk

Some people may prove to be allergic to quite innocent products such as fl our dust in the food industry or wood dust in the construction industry. The main effect of inhaling dust is a measurable impairment of lung function. This can be avoided by wearing an appropriate ***mask***, respirator or ***breathingapparatus*** as recommended by the company's health and safety policy and indicated by local safety signs.

*1.1.4.5.9.**Gloves***

Hands and feet may need protection from abrasion, temperature extremes, cuts and punctures, impact or skin infection. ***Gloves*** or ***gauntlets*** provide protection from most industrial processes, but should not be worn when operating machinery because they may become entangled in it. Care in selecting the appropriate protective device is required; for example, barrier creams provide only a limited protection against infection.

Fig. safety glove

1.1.5. Use of codes of practice

A **Code of practice** can be a document that complements occupational health and safety laws and regulations to provide detailed practical guidance on how to comply with legal obligations, and should be followed unless another solution with the same or better health and safety standard is in place or may be a document for the same purpose published by a self-regulating body to be followed by member organizations.

A code of practice may include explanatory information, recommendations for best practice, or references to occupational safety and health laws. While duty holders must comply with the underlying occupational safety and health laws, the preventative strategies outlined do not represent the only acceptable means of achieving a certain standard.

A code of practice does not have the same legal force as a regulation and is not sufficient reason, of itself, for prosecution under the Act.

Codes of practice are developed by the Commission for Occupational Safety and Health (the Commission).

Codes of practice:

- Should be followed, unless there is another solution which achieves the same or better result; and
- Can be used to support prosecution for non-compliance.

A code of practice is a set of written rules which explains how people working in a particular profession should behave. Codes of practice published by governments do not replace the occupational health and safety laws and regulations, and are generally issued in terms of those laws and regulations.

Organizational codes of practice do not have the same authority under law, but serve a similar purpose. Member organizations generally undertake to comply with the codes of practice as a condition of membership and may lose membership if found to be in violation of the code

Codes of practice published by governments do not replace the occupational health and safety laws and regulations, and are generally issued in terms of those laws and regulations. They are intended help understand how to comply with the requirements of regulations. A workplace inspector can refer to a code of practice when issuing an improvement or prohibition notice, and they may be admissible in court proceedings. A court may use a code of practice to establish what reasonably practicable action to manage a specific risk is. Equivalent or better ways of achieving the required work health and safety may be possible, so compliance with codes of practice is not usually mandatory, providing that any alternative systems used provide a standard of health and safety equal to or better than those recommended by the code of practice.

Organizational codes of practice do not have the same authority under law, but serve a similar purpose. Member organizations generally undertake to comply with the codes of practice as a condition of membership and may lose membership if found to be in violation of the code.

1.1.6. Ethiopia electronics code

They are intended help understand how to comply with the requirements of regulations. A workplace inspector can refer to a code of practice when issuing an improvement or prohibition notice, and they may be admissible in court proceedings. A court may use a code of practice to establish what reasonably practicable action to manage a specific risk is. Equivalent or better ways of achieving the required work health and safety may be possible, so compliance with codes of practice is not usually mandatory, providing that any alternative systems used provide a standard of health and safety equal to or better than those recommended by the code of practice.

Self-check 1	Written test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

Part I. Choose the best answer for the following questions? (1 point each)

1. What is work station?
   A) Work space B) Hand tools C) Ergonomics D) any house
2. The goal of production designing and planning is to minimize _____.
   A) Product B) Time C) worker D) waste E) all
3. Which of the following is not correct about modern workstation?
   A) Producing quantity required
   B) Producing customer's needs
   C) zero faults is also the part of principle
   D) Preventing excess inventory
   E) All are correct
   F) None of the above

4. _____is process of identification of all hazards in the workplace
   A) Risk assessment B) OH&S C) safety Training D) PPE
5. _____is situation or thing that has the potential to harm a person.
   A) Safety B) regulation C) Hazard D) Training
6. _____ is the use of systematic and planned instructions activities to promote safety
   A) Occupation B) Training C) PPE D) Faults
7. _____ is a process of evaluating and providing feedback of the "currently in progress
   A) Test & monitoring B) personal testing equipment C) Notifying D) advising
8. Who should you notify for an unsafe condition?
   A. Supervisor B) Safety officer C) Division officer D) Commanding officer
9. Before connecting a power tool to a power source, what position should the tool switch be in?
   A. OFF B) ON C) Locked D) Standby
10. In the protective helmet, what factor minimizes injuries from falling objects?
    A) The fiberglass bill B) The electrical rating C) Shock-absorbing suspension D) The construction shape
11. What safety item is a must when working in high places?
    A) Gloves B) Helmet C) Hearing protection D) Safety belt and safety strap
12. An area or place designed for an activity in accordance with the job requirement is
    A) Practical B) work station C) stationary D) safety first
13. The process by workers notified about safety to protect their life is____
    A) PPE B) Education C) safety training D) managing
14. The **process** of evaluating and providing feedback to current result is known as____
    A) Design B) Communication C) testing & monitoring D) OH & S
15. An equipment that designed to protect head is known as_____
    A) Glove B) musk C) goggle D) safety hat E) all

Note: **Satisfactory rating 3 and 5 points** **Unsatisfactory below 3 and 5 points**

You can ask you teacher for the copy of the correct answers.

Answer sheet

Score _____
Rating _____

Name: _____ Date: _____

Short Answer Questions

Information sheet-2	Consult responsible person for proper work coordination

1.2. Consult **responsible person** for proper work coordination

Consultation happens with workers, industry partners and others whose health and safety is directly affected by our work; and consultation, cooperation and coordination involves duty holders who owe a duty of care for the same work health and safety (WHS) matters is a legal requirement of the Work Health and Safety.

A safe workplace and better WHS outcomes are easier to achieve when workers and other stakeholders participate in activities to identify and improve WHS issues and are involved in decision making about WHS risk management. Consultation issue is concerned with.

- Consult with workers and others to:
  – Encourage the meaningful exchange of information, experience and ideas
  – Ensure their participation and representation in decision making about WHS matters that are likely to affect them.
- Consult with other duty holders who have duty of care for the same WHS matters
- Cooperate with each other
- Coordinate activities so we can all fulfill our individual and concurrent duty of care.

1.2.1. Immediate supervisor

The immediate supervisor performs a pivotal role. He or she connects worker to senior management and vice versa, becoming the primary conduit for the flow of information within an organization. Top down, management imparts its goals and values through the supervisor who can best explain to individuals what these mean and how they may affect worker. The immediate supervisor ensures that worker voices are heard, listens to their concerns and responds to them, and passes that feedback to senior management.

Role of Supervisor

i) **Educator**: Supervisor act as an educator when workers/employees and team members are new. Additionally, supervisor will most likely educate when you hold or attend meetings, write and distribute policies, manuals, or other documents, and provide cross-training opportunities.
ii) **Sponsor**: When acting as a sponsor, supervisor assumes his workers have the skills they need to perform their current jobs and work to provide opportunities for them to showcase their talents and strengths. Additionally, supervisor are expected to support employee career development, even if it means that the employee will move to position outside your team.
iii) **Coach**: supervisor will be coaching an employee when you are explaining, encouraging planning, correcting, or just checking in with his workers.
iv) **Counsel**: Counseling is used when a worker's problems impact performance and is intended to mitigate any further action, including formal disciplinary action. The employee should solve the problem and your role is to be positive, supportive, and encouraging in that process.
v) **Director**: Directing is used when performance problems continue and assumes you have educated, coached, and counseled. During "directing" conversations, you should make recommended alternatives and consequences clear, be calm and serious.

1.2.2. Service supervisor/manager

Customer service managers oversee the performance of their workers to ensure their team is keeping pace with service demands. A customer service manager is in charge of fostering a productive environment on a customer service team. They have a thorough understanding of both customer and business needs and are capable of coming up with solutions that appease both parties.

While this description briefly covers the basic functions that a customer service manager performs, it still doesn't address the business value that this position provides for a company. If you want to separate yourself from other potential candidates applying for this role, then it's important to understand the business advantage that a customer service manager provides.

Role of service manager

- Provide first contact point for all operational aspects of customer service; discussions on productivity, stowage & planning, giving consideration to contractual agreements and commitments.
- Handles customer complaints, workers conflicts and daily operational problems in an even-tempered, fair and consistent manner.
- Demonstrates reliability in all actions with customers and worker.
- Learns and understands the performance business data and applies it fairly to daily operations and decisions in order to increase productivity.
- Effectively manages employee productivity, store expenses and inventory.
- Reaches established monthly goals.
- Communicates questions, problems and results to the Store Leader in a timely manner.
- Learns and utilizes the computer system, software and transfer system.
- Follows daily opening and closing procedures accurately.

Self check -2	Written test

1. The process of asking opinion from formally assigned person/advisor..

A) Consulting B) Interview

C) monitoring D) OH&S

2. The primary conduit for the flow of information within an organization

A) Trainer B) supervisor

C) manager D) worker

3. Who take part by playing role of fostering a productive environment on a customer service team?

A) Work environment B) education C) safety D) service manager

Note: **Satisfactory rating 3 and 5 points** **Unsatisfactory below 3 and 5 points**

You can ask you teacher for the copy of the correct answers.

Answer sheet

Score _____
Rating _____

Name: _____ Date: _____

Short Answer Questions:-

1. _____

_____

Information sheet -3	Preparing and checking required materials, tools and equipment

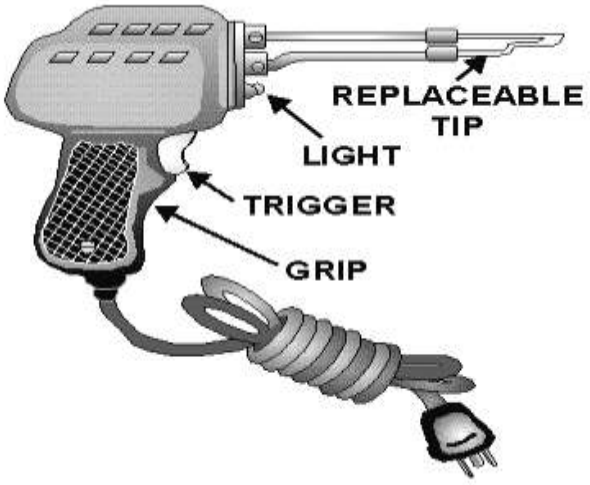
1.3. Preparing and checking required **materials, tools and equipment** in accordance with established procedures

1.3.1. soldering iron and de-soldering tools

Soldering Irons: - soldering irons are device that convert electrical energy to heat energy through systematical designed high resistive wire as heating elements. They are used to solder electronic circuits or connecting wires and other materials using soldering leads as well as using other catalysts that aids either to increase strength of connection or to clean contacts.

Fig. different types of soldering iron

Soldering Gun:- It is especially well adapted to maintenance and troubleshooting work where only a small part of the technician's time is spent actually soldering. A transformer in the soldering gun supplies approximately 1 volt at high current to a loop of copper, which acts as the soldering tip. It heats to soldering temperature in 3 to 5 seconds. However, it may high heat to the point of solder if left on over 30 seconds. This should be avoided; because excess heat will burn the insulation off the wiring of makes to fail electronic components. The gun is operated by a finger switch; it heats up only while the switch is pressed.



1.3.2. screwdriver (assorted)

Sorted screw driver means different size and type in one set. A screwdriver is a device used to insert and tighten screws or to loosen and remove screws. A screwdriver has a head or tip that connects with a screw, a mechanism to apply torque by rotating that tip, and a way to position and support the screwdriver. Screw drivers can be categorized as powered screw driver and manual screw driver. A typical manual screwdriver is made up of a roughly cylindrical handle, with a shaft fixed to the handle, including a tip shaped to fit a particular type of screw. The handle and shaft

support and position the screwdriver, and apply torque when rotated. The blade is made of tempered steel so it will resist wear, bending, and breaking.

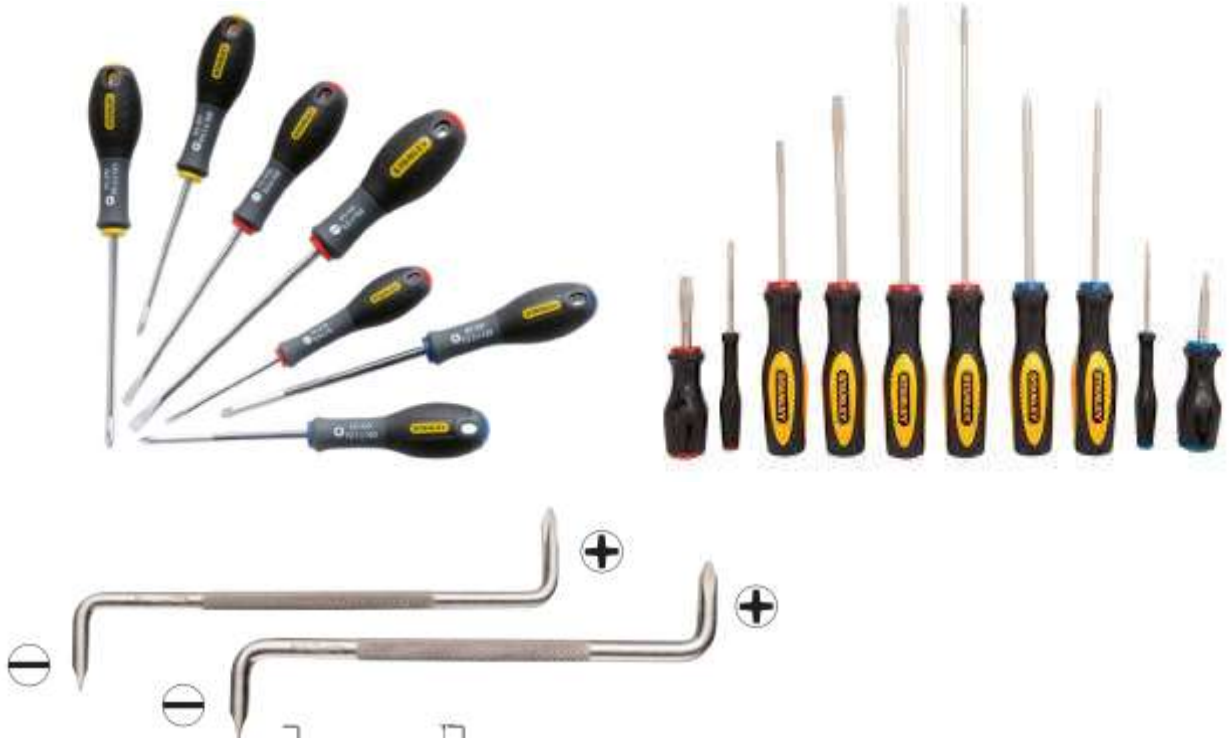


Fig. different types of screw drivers

a) Flat Screwdrivers Usage: Flat head screwdrivers are used with flat head screws only. Don't use screwdrivers as pry bars they will break.
b) Philips Screwdrivers Usage: Philips head screwdrivers are shaped like a" +" on the head, and should only be used with corresponding size screws.
c) Torque screw driver is electrically powered screw driver instead of hand power, but the tip is not different from what we have discussed above, it may be either flat or Philips but it is removable or changeable tip.

1.3.3. wrenches (assorted)

Sorted screw driver means different size and type in one set. A wrench is a tool used to provide a mechanical advantage when torque is applied to hold and turn bolts, nuts, screws, and pipes. Wrenches are forged from steel alloy to prevent breakage. Wrenches are divided into two categories: nonadjustable and adjustable. Nonadjustable wrenches are made to work on a particular size of bolt, nut, screw, or pipe. Adjustable wrenches are made to tighten or loosen a particular size of bolt, nut, screw, or pipe.

a) Open-end wrench, or open-ended spanner: a one-piece wrench with a U-shaped opening that grips two opposite faces of the bolt or nut. This wrench is often double-ended, with a different-sized opening at each end. The engineer’s single open-end wrench has a long, smooth shank providing the user with a better gripping surface. It is used to reach behind or below blind surfaces.

Figure. Open-end wrench

b) A box end wrench surrounds the nut, bolt head, or stud on all sides. Box wrench openings are offset from the shank by 15 degrees to give more room for your knuckles or to give clearance over obstructions. The split-box wrench is used on pipe unions or couplings where you want the protection of a box wrench, but need to slide the wrench around a pipe.

Figure. box end wrench

Figure. split-box wrench

c) **Combination Wrench**: The combination wrench has a box wrench and an open-end wrench on opposite sides of the same tool. The two ends are usually the same size.

Figure. combination wrench

d) **Pipe Wrenches:** - There are four basic types of pipe wrenches: the still son wrench, the spud wrench, the strap wrench, and the chain wrench. They are all used to connect or break pipe joints or to turn cylindrical parts.

Figure.(i) Pipe wrench.

Figure. (ii) Strap pipe wrench.

Figure.(iii) Chain pipe wrench.

Figure.(iv) Adjustable wrench

e) The socket wrench consists of a round metal sleeve with a square opening in one end for insertion of a handle, and a 6- or 12-point wrench opening in the other.

Figure. Different types of socket & box end wrench

1.3.4. Allen wrench/key

A **hex key**, **Allen wrench** or **Allen key**, is a simple tool used to drive bolts and screws with hexagonal sockets in their heads.

The tool is usually formed of a single piece of hexagonal rod of hard steel, with blunt ends that are meant to fit snugly into the screw's socket, bent in an "L" shape with unequal arms. The tool is usually held and twisted by the long arm, creating a large torque at the tip of the short arm. Reversing the tool lets the long arm reach screws in hard-to-reach places.

Each key is meant to be used with screws of a specific socket size, with rather tight tolerances; so the tool is commonly sold in kits that include half a dozen or more keys of different sizes. Usually the size of the key increases with the size of the socket, but not necessarily in direct proportion.

Figure. **Allen wrench** or **Allen key**

1.3.5. utility knife/electrician knife or stripper

A **utility knife** is a knife used for general or utility purposes. There are different types of knife by different parameter. The utility knife was originally a fixed blade knife with a cutting edge suitable for general work such as cutting hides and cordage, scraping hides, butchering animals, cleaning fish, and other tasks. Craft knives are tools mostly used for crafts. Today, the term "utility knife" also includes small folding or retractable-blade knives suited for use in the general workplace or in the construction industry

a) Shop Knife

The shop knife, also called a utility knife, is a general-use tool used to cut material such as drywall, laminates, wallboard, paper, cardboard, linoleum, canvas, upholstery materials, and plastic.

Figure. Utility knife.

b) Pocket Knife

Pocket knives are used for light cutting, sharpening pencils, cutting string, and whittling. They are not suitable for heavy work. There are many styles and shapes. Some are multipurpose and have an assortment of blades, which are used for forcing holes, driving screws, and opening cans, as well as cutting. The blades are hinged and contained within the case when not in use and are spring-loaded to keep them firmly in place when open or closed.

Figure. Pocket Knife

a) Wire Strippers (Multipurpose)

Wire strippers are used to strip insulation from electrical cord. When closed around wire, only the insulation is cut. The wire core remains undamaged. But wire strippers are not knife , they are used only to remove insulation of wire.

Figure. Wire stripper

1.3.6. pliers (assorted)

Pliers are made of hardened steel and come with different head styles that determine their use. Pliers are used to hold, cut, and bend wire and soft metals. Pliers are a special type of adjustable wrench that are scissor-shaped tools with jaws. The jaws usually have teeth to help grip objects and are adjustable because the two handles move on a pivot. **There are different types of pliers.**

a) Lineman's Pliers or combination pliers

The lineman's pliers have serrated jaws, a rod-gripping section, side cutters, a wire cropper, a fixed pivot, and parallel handles. The flat, serrated jaws are used to bend sheet metal and twist electrical wire. The rod-gripping section is used to hold rods and bend small rods. The side cutters are located just above the pivot point, where maximum pressure may be applied.

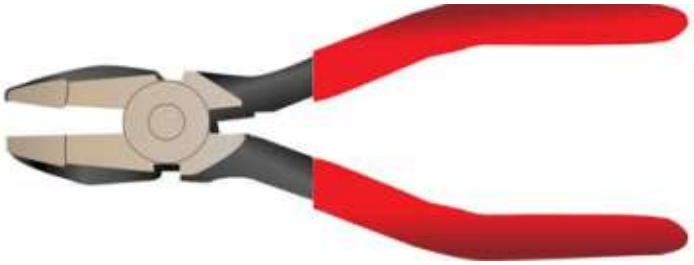


Figure Lineman's pliers

b) **Long Nose Pliers (Needle Nose Pliers**)

Long nose pliers, also known as needle nose pliers. The pointed nose makes them useful for work in tight places where other pliers cannot reach. The jaws and cutting blades meet evenly. The flat nose pliers have flat serrated jaws, a fixed pivot, and curved handles that may have insulated sleeves. These pliers are used to bend light sheet metal and wire.

a) Figure Long nose (needle nose) pliers. *b) Figure. Flat nose pliers.*

c) Round Nose Pliers

The round nose pliers are used to make loops in soft wire. It has jaws that are smooth and round, a fixed pivot, and curved handles, which may have insulated sleeves.

Figure. Round nose pliers.

d) Diagonal Cutting Pliers

The diagonal cutting pliers have a fixed pivot. The jaws are offset by about 15 degrees and are shaped to give enough knuckle clearance while making flush cuts. The diagonal cutting pliers are used for cutting small, light materials, such as wire, cotter pins, and similar materials. These pliers are not to be used to hold or grip objects.

Figure. Diagonal cutting pliers..

e) Slip-Joint Pliers

The slip-joint combination pliers have serrated (grooved) jaws, a rod-gripping section, a cutting edge, and a pivot. The serrated jaws and rod-gripping section are used to hold objects. The cutting edge permits the cutting of soft wire and nails. However, cutting hard materials or large-gauge wire will spring the jaws, making the pliers useless. The pivot is used to adjust the jaw opening to handle large or small objects.

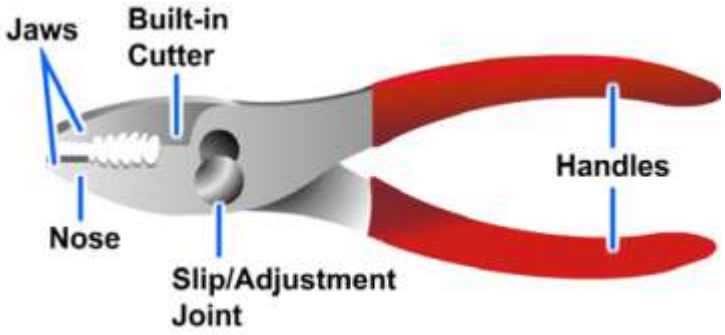


Figure. Round nose pliers.

f) End Cutting Pliers

The end cutting pliers are used to cut wire flush to the working surface. They are designed to keep hands and fingers safely away from the wire ends.

Figure. End cutting pliers.

1.3.7. test jig

PCB test jigs are customized devices used to test a PCB. A test jig facilitates the probe of defined test points to help determine the expected inputs and outputs of the PCB. A test fixture, on the other hand, secures the PCB in farm grip for the execution of the probe. They're customized in accordance with the board's application.

The test jig has two functions:

1. to check that the preamp can hold voltages applied to the power rails, and that the supply currents drawn are within tolerance
2. to provide a fast electronic pulse that is applied to the input of the preamp and compare the output waveform to an expected shape.

Figure. testing jig

During PCB testing there are some well known methods

1. **Bare-Board Tests**

These are tests carried out on boards to determine the board's level of conformity to the appropriate circuit connection. It is usually done when there's no component on it. Bare-board tests primarily comprise capacitance and resistance tests.

Capacitance testing for a bare board revolves around the probe for opens and shorts and this entails charging a net to determine the measure of induced capacity in each net. But due to the variability of the fabrication of circuit boards, this test might have varying degrees of accuracy.

Resistance tests are carried out to determine the level of resistance in each net. The resistance between test points is also tested to determine if it meets the specified limit of resistance or maximum continuity resistance. These tests are carried out in procedures known as continuity tests, short tests, and open tests.

2. **Adjacency Test**

This test determines the degree of isolation between conductors. It is also another aspect of the protocols of short tests. It entails the use of programs created by software for verifying the conformity of nets to the applicable tolerance level. This can be carried out in two methods: Proximity Adjacency and Line of Site Adjacency.

3. Assembly Level Tests

These include tests executed on a PCB with completely assembled components. The tests can be done via manual inspection or with the aid of Automatic Test Equipment (ATE). ATE is a more expensive alternative that facilitates swifter and more accurate execution of PCB tests. However, they must be selected in accordance with the application of the board to be tested in order to achieve optimal results.

4. Impedance Control Test

The alternating current passing through a circuit board is influenced in various ways by the circuit's design as well as the frequency of the current flowing through the circuit. The circuit board's impedance accounts for the unfolding dynamics of these electron interactions. Impedance is also determined by the length, width, height, spacing, and separation of conductors. An impedance control test involves the use of a device known as Time Domain Reflectometer (TDR) to verify the circuit's conformity to the applicable tolerances.

5. Field Effect and Field Measurement Test

This refers to any variation of a test which entails the use of large nets as antennas for sending specific high-frequency alternating current at specific voltages. These tests help in identifying the nets with similar voltage. This allows them to be re-tested for the verification of the shorts.

6. Function Test

This is the final step in the manufacturing processes for PCB. It determines if the finished PCB meets the stipulated quality standards. It is done before the board is shipped out. This test is designed to verify the degree of defect (or lack of it) of the board before it is deployed.

A common functional test, or "hot mock-up" validates the performance of the board's functions in simple ways. But the more complex functional tests involve a series of procedures that authenticate all the board's operations.

The procedures of functional tests are contrived in line with the applicability of the PCB, hence it varies for each board. But generally, functional testers are administered on the PCB through the board's edge connector or test point. The testers replicate the actual electrical environment wherein the PCB will serve its purpose.

1.3.8. ESD-free work bench with mirror

What is ESD and Its Damage for Electronics?

ESD (Electrostatic Discharge) free workbench is especial table used for electronic maintenance technician for safety purpose to conduct accumulated or stored charge from disassembled PBC. ESD bench with mirror is used for the technician for the increment of light when there is no sufficient light in the work area or room.

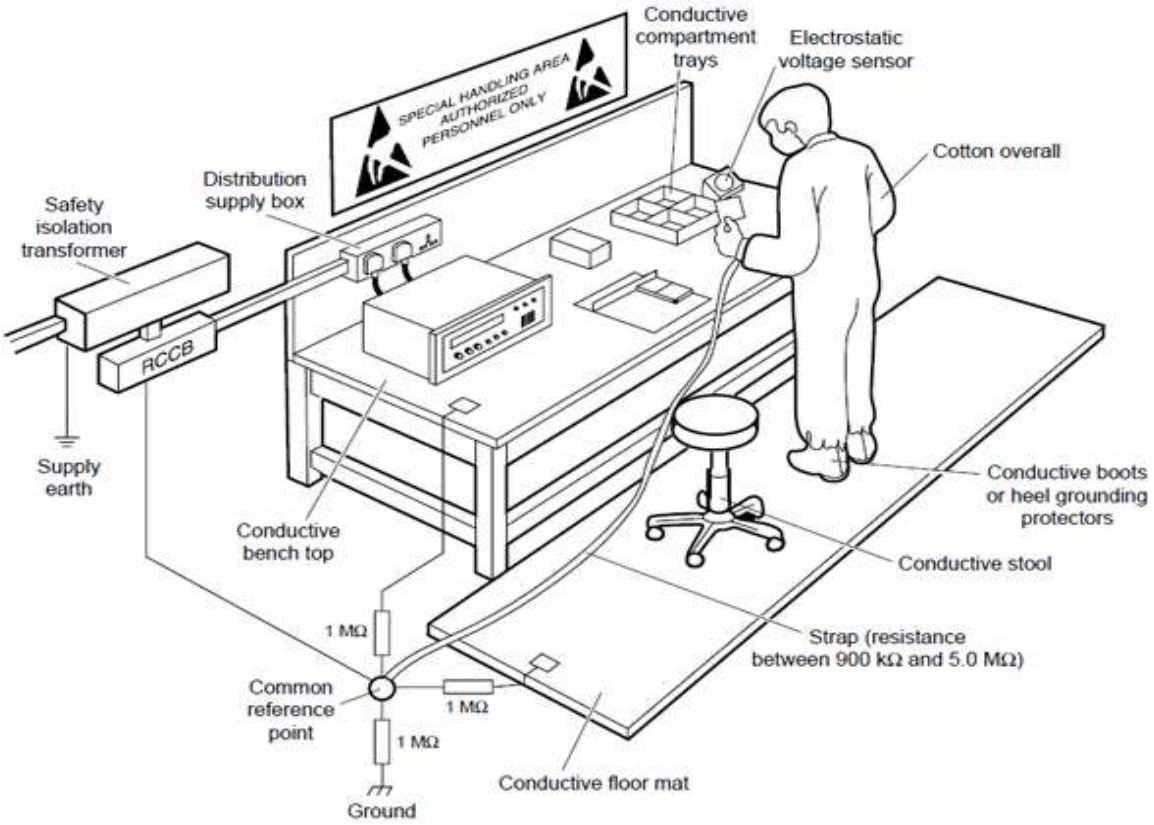
ESD Workbench is widely used in the electronics industry. That's why the static electricity guiding of the workbench is one of the critical elements for any ESD protected area that can be provided by the **ESD Workbench**.

- The conductive surface will short out any connections making operation and testing of the circuit impracticable.

- The conductive surface will provide a low impedance discharge path that will give a very rapid discharge, resulting in high currents flowing and possible damage to the circuitry.
- A further reason for having a high resistance dissipative surface rather than a fully conductive surface is that of safety. If a high voltage is present in a system, then accidentally touching a conductive work surface and a high voltage source can be dangerous. Accordingly, safety precautions necessitate that a high resistance dissipative surface is used.

Static Dissipative Surface

ESD protective work surface should have a resistance value between the 1.0 x 109 and 1.0 x 106 ohms. This is for two reasons, firstly for preventing a rapid discharge of any static that may cause damage, and secondly for safety reasons as mentioned above.



Picture. ESD free Workbench

Other Working Surfaces: The ESD workbench is consists of some different elements shown below:

1. **Shelves**: Shelves are usually used for placing and other electronics spare parts for electronics assembly, repair, and inspection.
2. **Metalwork**: While the metalwork itself is conductive, the paint used is not normally conductive. For an ESD Workbench, it is necessary to utilize static dissipative painting to prevent any sudden discharges.
3. The painting must be strong adhesion and durable because this painting is the core elements for an ESD Workbench, the most valuable things should be used a very long time for high-cost performance.

Why shouldn't an ESD rubber mat on a standard workbench use?

Some user said, "An ESD Workbench can be created by placing an ESD rubber mat on the normal tables and connected with a wire to the ground". Seriously, it is not enough to have an ESD mat on the worktop, why?

1. By placing an ESD mat on the tabletop and a wire connecting, the static discharge will get only one way to the ground that is through the connecting wire, and the static will fail to discharge to the ground if any problem occurs in this wire.
2. The static can be produced anywhere in the environment, on the tools and work bench, In electronics production, repairing and assembly, chips, tools and test equipment may be placed on other parts of the workbench, the static may accumulate here. And when we put the chips on workbench parts, process the electronics with tools, the static damage will happen.

ESD mat usually made by rubber or PVC, poor wear-resistant, accessible to age and short using life. In soldering working, the high-temperature tin slag and welding gun can damage the rubber and PVC material mat.

Characteristics of ESD workbench:

- Durable Material: Strong cold steel with the anti-scratch ESD powder coating. ESD laminating worktop (fireproof)
- Ergonomic design: comfortable and beautiful, can improve the production efficiency
- Modular design: various accessories are changeable for combination
- Standard Model: accessories are exchangeable, higher cost performance for changing damaged parts.
- Permanent ESD property: ESD Laminate top and ESD powder coating are permanently valid.

Self - check -3	Written test

1. A device that convert electric current to heat purposely

   A) PCB B) soldering iron C) gun D) wrench

2. Which of the following is only hand tools loosing and tightening?

   A) Screw driver B) soldering Gun C) Millimeter D) combination player

3. All hand and portable powered tools must be inspected prior to use.

   A) True B) False

4. Power tools must be disconnected from the power source when_____

   A) Not in use. B) Changing accessories C) servicing. D) all of the above.

5. Which of the following tools used to peeling wire for termination

   A) Side cutter D) screw driver C) electrician knife D) long nose pliers

6. Which of the following hand tool used for holding, gripping, and cutting wire

   A) Ed cutter B) side cutting pliers C) Combination Pliers D) Wrench

7. Which of the following is used to make loops in soft wire?

   A) Flat nose pliers

B) Round nose pliers

C) Long nose pliers

D) combination nose pliers

8. A device used to test PCB in advance way

A) Oscilloscope B) Multimeter C) Clamp on ammeter D) test jig

Note: **Satisfactory rating 3 and 5 points** **Unsatisfactory below 3 and 5 points**

You can ask you teacher for the copy of the correct answers.

Answer sheet

Score _____
Rating _____

Name: _____ Date: _____

Short Answer Questions:-

1. _____

_____

Information sheet -4	Preparing parts and materials needed to complete the work

1.4. Preparing parts and materials needed to complete the work according to requirements

In this topic we are going to prepare required components or parts, circuits and units and necessary materials to be disassembled and re-assessable in safety procedure.

The requirements for this LO activity

Tools, Instruments & power supplies	**Materials**	**Facilities**
Digital and Analog Multi-meter	Soldering Lead	Room
Blower	Soldering flux	Sets and table
Digital IC Tester	PCB	Bench work
Oscilloscope	Discharging Materials	
utility knife/stripper	Electronics components	
test jig	Wires	
Soldering iron	Dusting Brush	
Open and closed wrenches	Glue	
AC/DC Power Supply	Cleaning thinner	
Philips and Flat Screw driver		

Sucker		

1. A multi-meter is a device which is used to measure several electrical quantities such as current, voltage, resistance, inductance, capacitance, and electrical frequency.

   The most significant difference between an **analog multi-meter** and the **digital multi-meter** is that the analog multi-meter comprises of a scale and a deflection pointer which actually indicates the value to be measured on the scale, while, in digital multi-meters, a digital display like LCD directly displays the value.

Figure. Digita multimeter

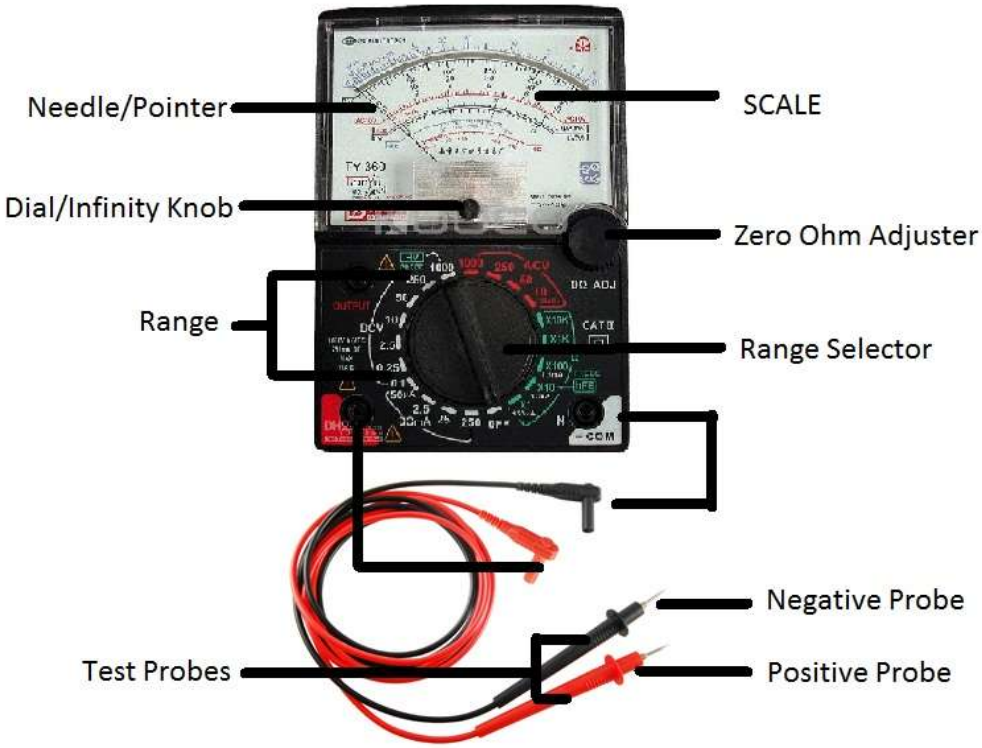


Figure. Analog multimeter

Blower

An air blower is a machine used for generating flow of air at substantial pressure. The air flow generated is used for different purposes such as small car cleaning blowers, vacuum cleaners, air conditions etc. Depending on the application requirement air flow and pressure may vary.

Air Blowers can be categorized in following types on the basis of principle of air flow generation:

2. **Centrifugal Blower -** Air enters axially and leaves the blade radial direction.
3. **Axial Fans**- Air enters axially and also leaves the fan blades in axial direction.

Air blowers have huge requirement in industries and used for applications such as boilers, air ventilation, paint shops, hotel kitchen exhaust etc.

Fig. blowers

Oscilloscopes

Oscilloscopes display the change of an electrical signal over time, with voltage and time as the Y- and X-axes, respectively, on a calibrated scale. The waveform can then be analyzed for properties such as

- Amplitude
- Frequency
- rise time
- time interval
- Distortion and others.

Modern digital instruments may calculate and display these properties directly. Originally, calculation of these values required manually measuring the waveform against the scales built into the screen of the instrument. There are different types of oscilloscope like digital and analog, again further can be categorized as dual channels/trace and single trace. The basic oscilloscope, as shown in the illustration, is typically divided into four sections: the display, vertical controls, horizontal controls and trigger controls.

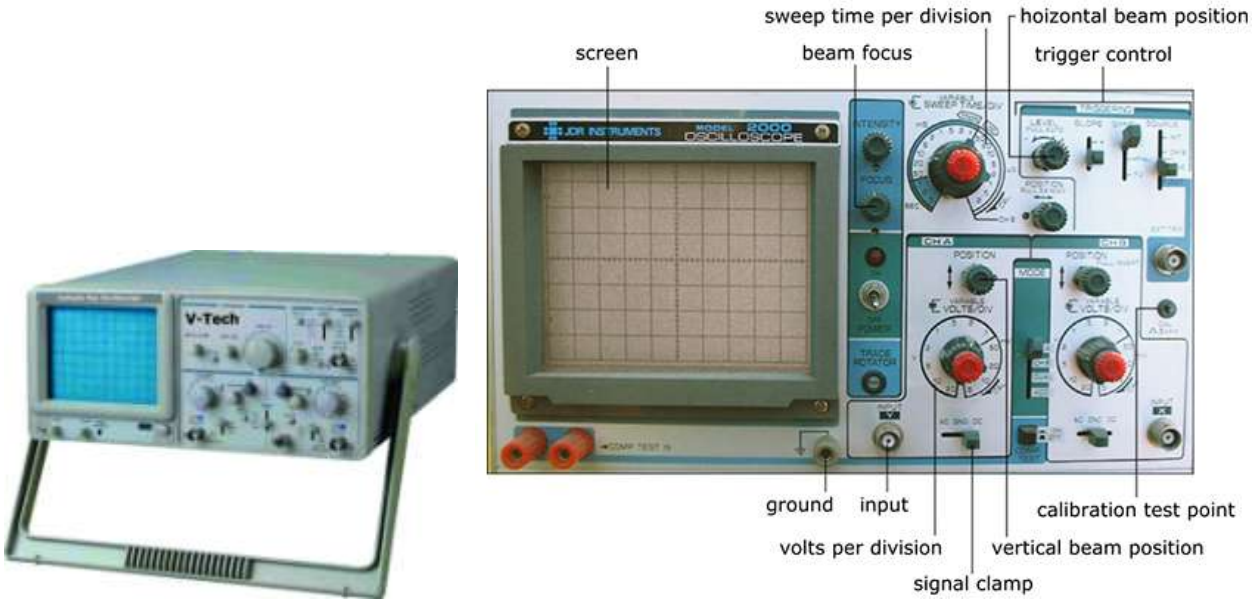


fig. Analog dual trace oscilloscope

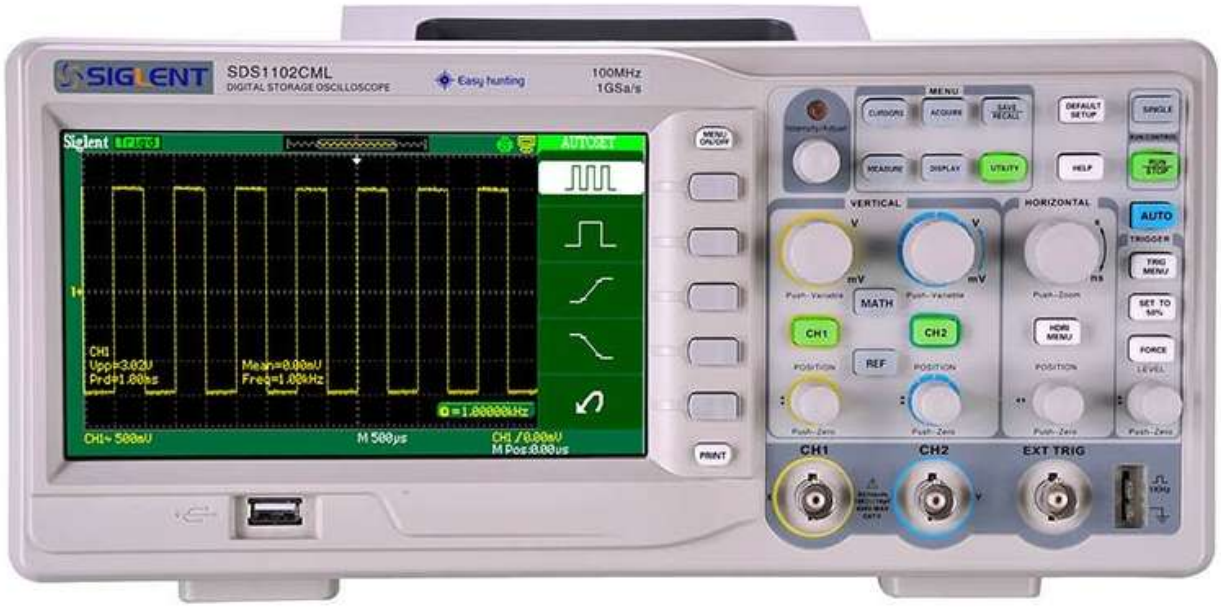


Figure. Digital oscilloscope

DC power supply

The DC power supply series are a bench top single output variable DC power supply. Stable regulated DC power supplies allowing continuous adjustment of both the output voltage and output current levels. They have been designed according to IEC1010–1 concerning safety requirements and comply with.

There are three display types for the power supply series monitoring output voltage and current. They are LCD, LED and two pointer meters. One of them is equipped to the DC power supply. There are different numbers of output voltage and output current ranges for the DC power supply series, too. These difference models of the DC power supply are available for choice of user.

figure. Digital display DC power supply

Picture. A) Analog display DC powe supply 0-30V @ 5Amps *b) multi output dc power supply*

Desoldering Pump/sucker ?

The desoldering pump is otherwise called the "solder sucker," it is designed with a spring-loaded plunger. Therefore, the desoldering pump is a device used in achieving the removal of solder from a printed circuit board. It is a type of device used for this purpose, and it is of two kinds, which are the plunger style and the bulb style. So, if perhaps you are interested in a quick, large job performing device, then it comes to a significant consideration.

Ranging with prices, the desoldering pumps with the top class aluminum build, the tip that can be replaced, quick performance non-manual solder sucker, push buttons, tips that are self-cleaning and can be operated with a hand.

The following are the procedures for using a desoldering pump.

Steps- 1 The first step is to apply heat to the solder with the aid of a soldering iron, but in some cases, some desoldering pump comes along with the irons.

Step-2:- apply pressure on the plunger by pressing it down. In case of another pump with bulb, you can squash it.

Step-3:- once the solder is liquefied, position the head of the pump on the solder that needs to be removed.

Fig. Soldering pump/sucker & wire

What is soldering flux?

Flux is chemically and physically active formula which promotes wetting of a metal surface by molten solder, by removing the oxide or other surface films from the base metals and the solder. The flux also protects the surfaces from re-oxidation during soldering and alters the surface tension of the molten solder and the base metal.

Fluxes are used to:

- assist the wetting process by removing oxidized layers from metallic surfaces, and by modifying the surface tensions
- protect the surfaces of both the solder and the parts to be soldered from oxidation during the soldering process
- assist in the transfer of heat between parts being soldered, and thus help equalise their temperatures.

fig. soldering flux

What is PCB?

PCB is a copper laminated and non-conductive **Printed Circuit Board**, in which all electrical and electronic components are connected together in one common board with physical support for all components with base of board. When PCB is not developed, at that time all components are connected with a wire which increases complexity and decreases reliability of the circuit, by this way we cannot make a very large circuit like motherboard. In PCB, all components are connected without wires, **all components are connected internally**, so it will reduce the complexity of the overall circuit design. PCB is used to provide electricity and connectivity between the components, by which it functions the way it was designed. PCBs can be customised for any specifications to user requirements.

It can be found in many electronics devices like

- TV
- Mobile
- Digital camera

- Computers parts like
- Graphic cards
- Motherboard…..etc.

It also used in many fields like;

- medical devices
- industrial machinery
- automotive industries
- lighting……..etc

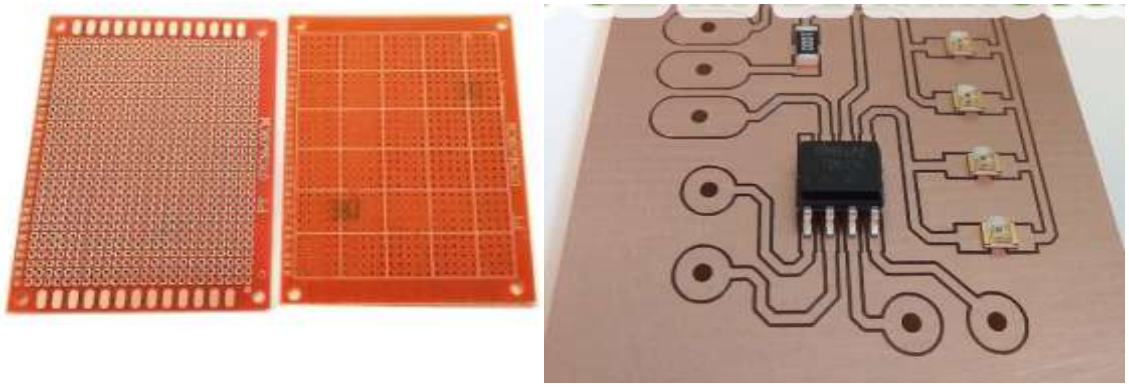
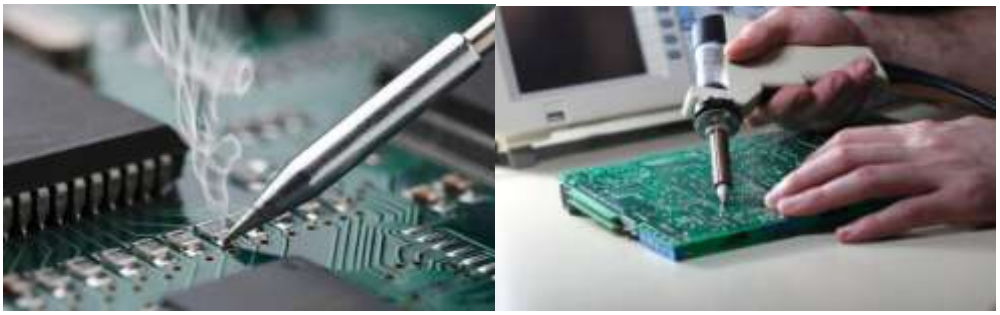


Fig. Bread Board (PCB) *b) Itched PCB*



b) soldered PCB (Printed Circuit Board)

Self-check -4	**Written test**

1. a device used to measure electrical parameter or quantities

   A) tachometer B) Barometer C) multimeter D) Manometer

2. a device used to generate air pressure for cleaning purpose

   A) Conditioner B) hot air gun C) Air conditioner D) bellower

3. Which of the following measuring device used to display electrical signal in plot graphs

A) Digital multimeter B) oscilloscope C) analog Multimeter D) all

4. Advice used to remove solder from PCB after we heat the circuit

A) SMD B) soldering iron C) Brush D) Sucker E) all

5. Wetting material and remove oxidization

A) PCB B) flux C) lead D) Glue E) none

6. A board in which all electronics components installed or connected to

A) PCB B) Lead C) Junction board D) soldering iron

7. The process of removing components from circuit board

A) Soldering B) de-soldering C) terminating D) none

Note: **Satisfactory rating 3 and 5 points** **Unsatisfactory below 3 and 5 points**

You can ask you teacher for the copy of the correct answers.

Answer sheet

Score _____
Rating _____

Name: _____ Date: _____

Short Answer Questions

_____

_____

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 4 hour.

Task 1. Make design of your class and work station

Task 2. Arrange your work station

Task 3. Clean the work station

Task 4. Study your environment which causes hazard

Task 5. Summit report to your findings to your trainer

Task 6. Clean all used hand tools and equipment & restore to their store.

Task 7. Identify and store tools and equipment as per 5s standard.

List of use reference

1. www.macrothink.org/ijhrs
2. https://en.wikipedia.org/wiki/Fire_triangle
3. https://www.hsa.ie/eng/Your_Industry/Quarrying/Maintenance_Operations/Work_Permits_and_Isolation_of_Equipment/

4. https://www.guidesmag.com/personal-protective-equipment-importance/
5. https://en.wikipedia.org/wiki/Code_of_practice
6. Consultation, cooperation and coordination, RMS 17.078 Version 2 1 September 2017
7. https://blog.hubspot.com/service/customer-service-manager
8. https://en.wikipedia.org/wiki/Hex_key
9. NAVEDTRA 14256A, Prepared by LT Ervin Henley, MRC (SW) Karrie Coleman, MRC (SW) Joshua Wieber , Mrs. Delphine Jackson, Mrs. Debra Harrison-Youngs, September 2015 Edition
10. Hazard Identification, Risk Assessment and Control Procedure, western Sydney University, 2017 publication
11. https://www.youtube.com/watch?v=kCB625Ps19E
12. https://en.wikipedia.org/wiki/Oscilloscope
13. https://www.youtube.com/watch?v=6DjsKiR6cT4
14. https://circuitdigest.com/tutorial/basics-of-pcb