Ethiopian TVET-System

# ELECTRONIC COMMUNICATION AND MULTIMEDIA EQUIPMENT SERVICING Level II

Based on May 2011 Occupational Standards

October, 2019

**Module Title: Assembling and Disassembling communication & multimedia Equipment**

**TTLM Code: EEL CMS2 M04 TTLM 1019 v1**

**This module includes the following Learning Guides**

**LG10: Prepare product and work station for assembly**

**LG Code: EEL CMS2 M04 LO10- LG- 10**

**LG11:- Solder/ De-solder components to the board**

**LG Code: EEL CMS2 M04 LO1- LG- 11**

**LG12: Assemble/disassemble boards**

**LG Code: EELCMS2 M04 LO1- LG- 12**

**LG13: Test and inspect assembled products**

**LG Code: EEL CMS2 M04 LO1- LG-13**

| Instruction Sheet | LG10: Prepare product and work station for assembly |
|---|---|

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.

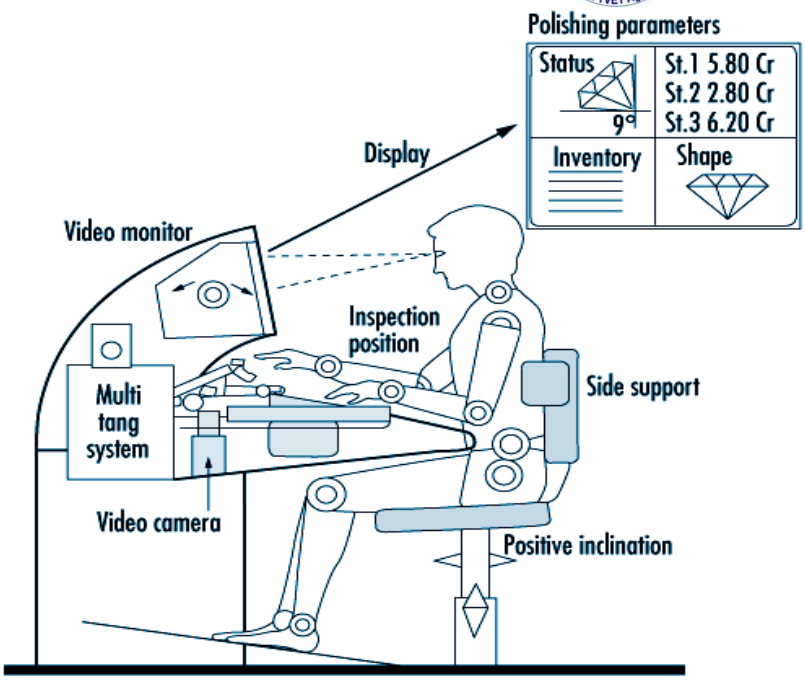



Fig. An Ergonomic workstation design

***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($C_3H_8$), Methane ($CH_4$)
(ii) Non-flammable Gases - Eg., $CO_2$, $SO_2$, $N_2$
(iii) Reactive Gases - Eg., $F_2$ (most reactive), $Cl_2$
(iv) Inert Gases - Eg., Ar, He, $CO_2$, $N_2$
(v) Toxic Gases - Eg., $Cl_2$, $H_2S$, $NH_3$, 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., $O_2$, $N_2$,
(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.*

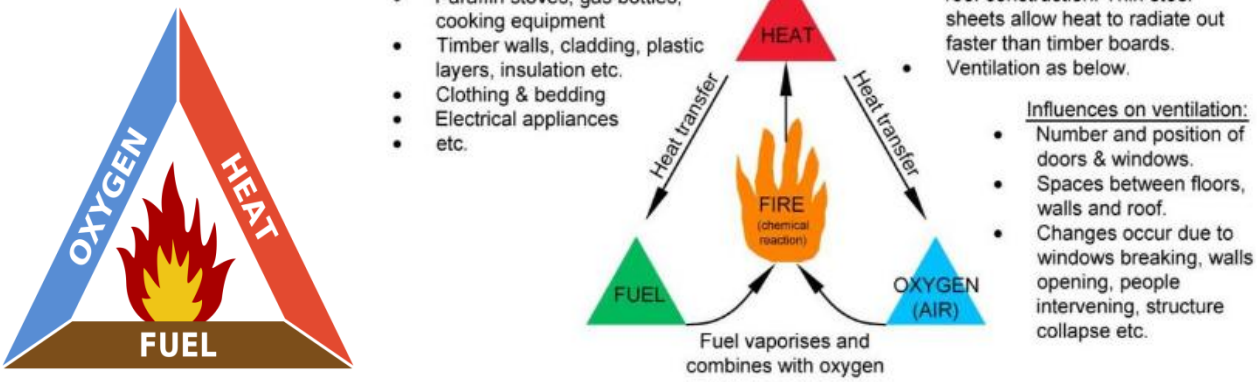



*Fig. Fire triangle*

**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

.

*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 |
|---|---|

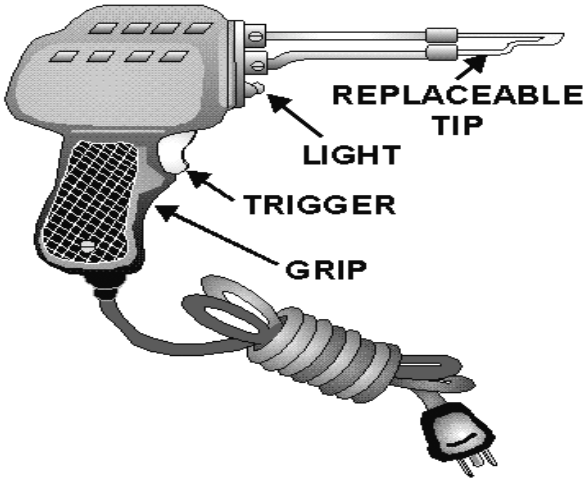
**1.3.** Preparing and checking required **materials, tools and equipment** in accordance with established procedures

### 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.

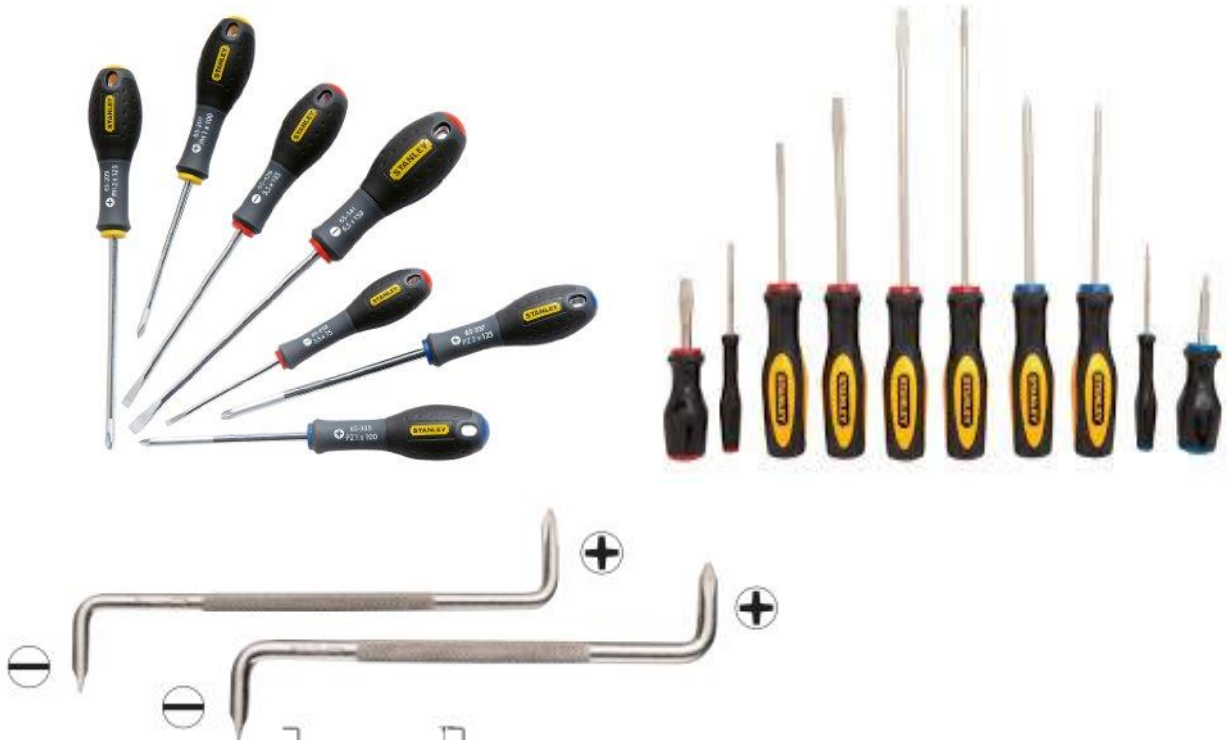


*Fig. different types of screw drivers*

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.

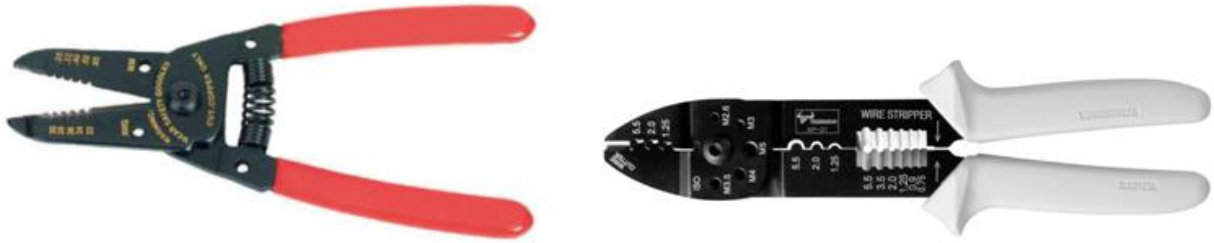



*Figure. Wire stripper*

## 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.

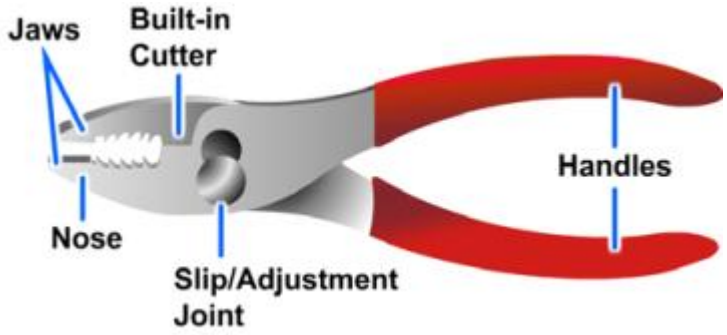



Figure. Round nose pliers.

### 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?

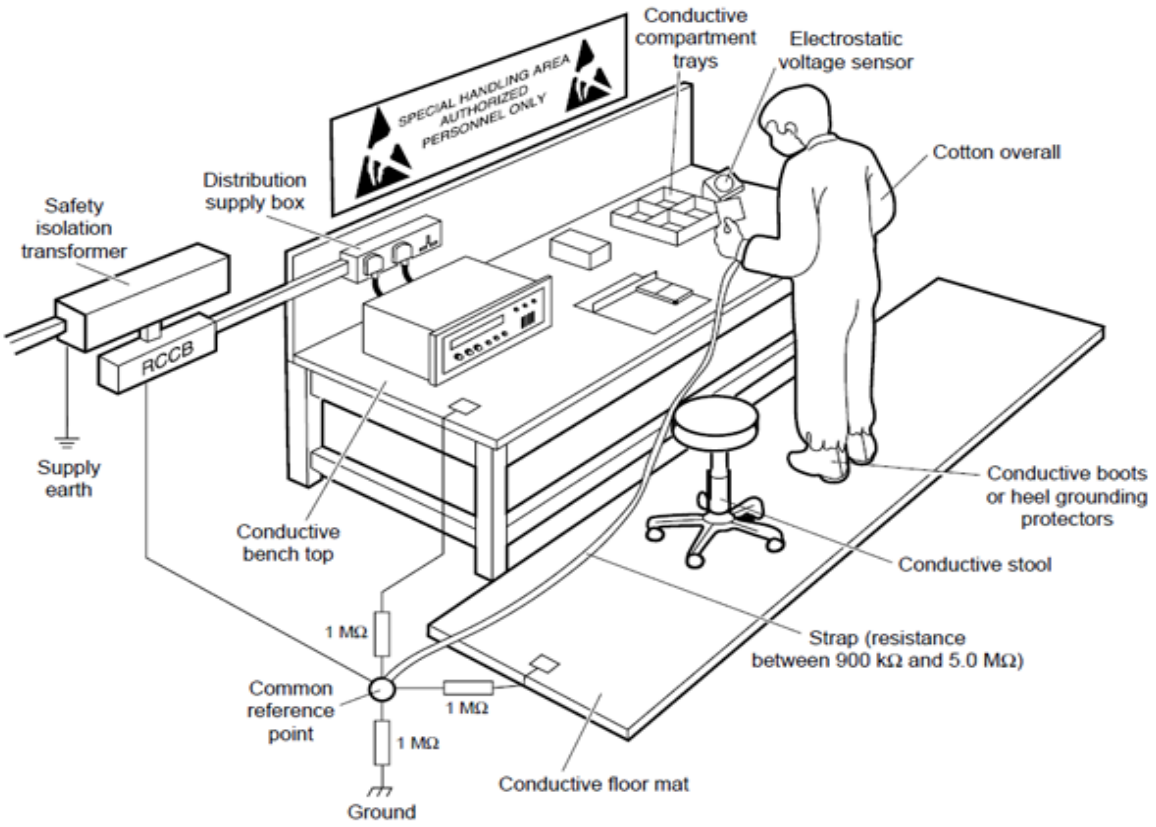
ESD (Electrostatic Discharge) free workbench is especial table used for electronic maintenance technician for safety purpose to conduct accumulated or stored charge from disassembled PBC. ESD bench with mirror is used for the technician for the increment of light when there is no sufficient light in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

   _____

## 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*

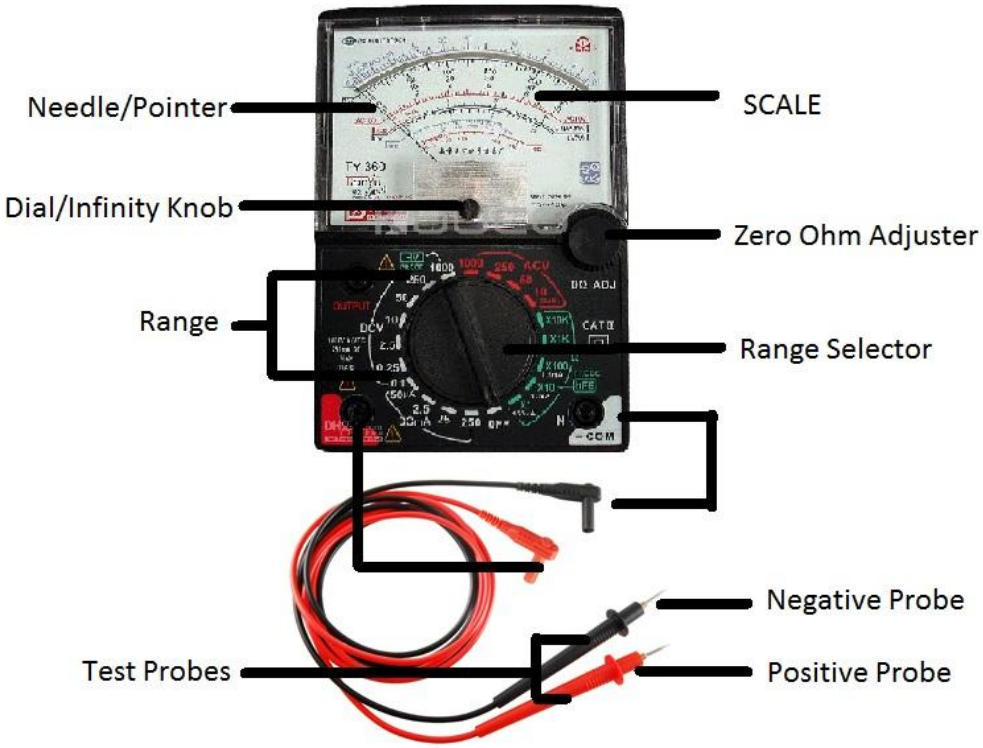



*Figure. Analog multimeter*

## 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.

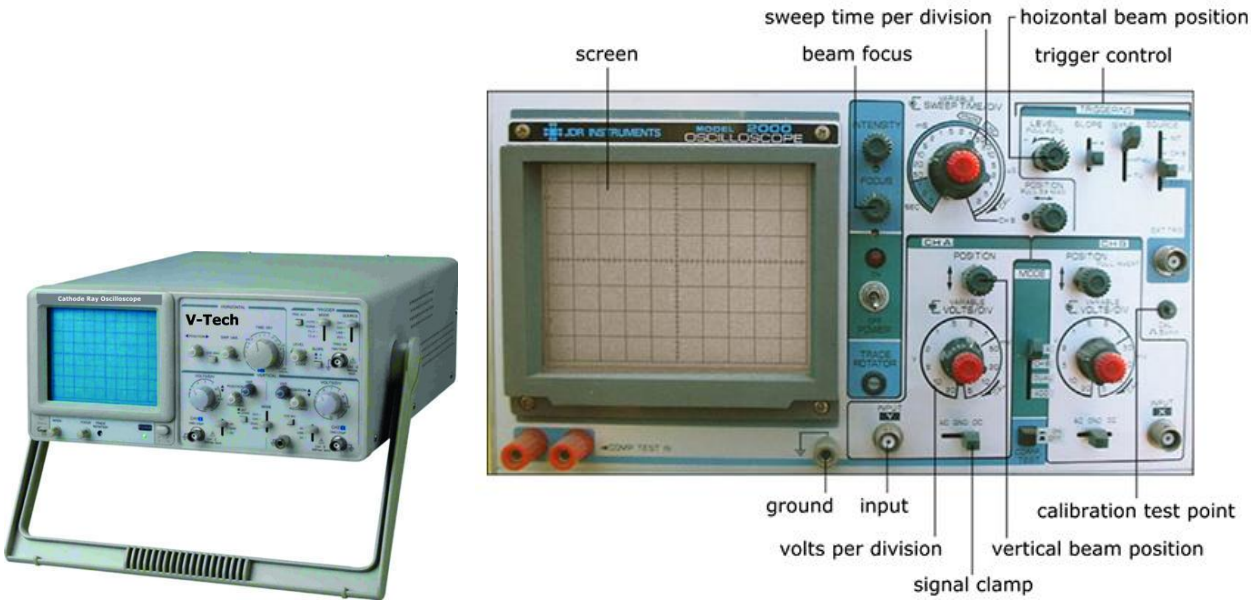



*fig. Analog dual trace oscilloscope*

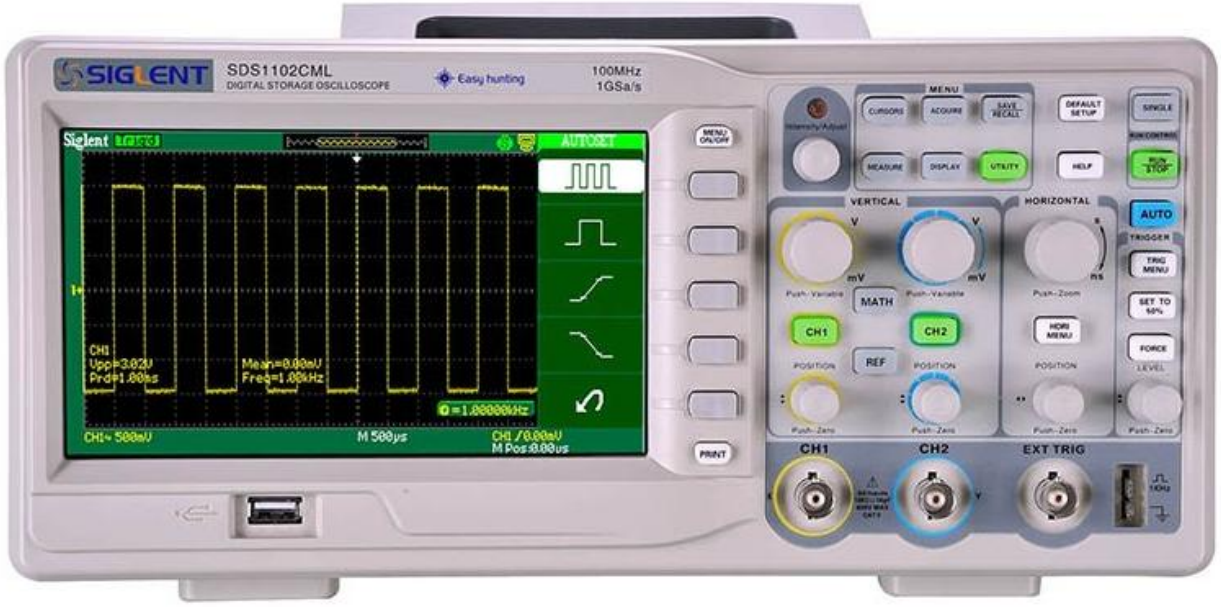



*Figure. Digital oscilloscope*

**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.

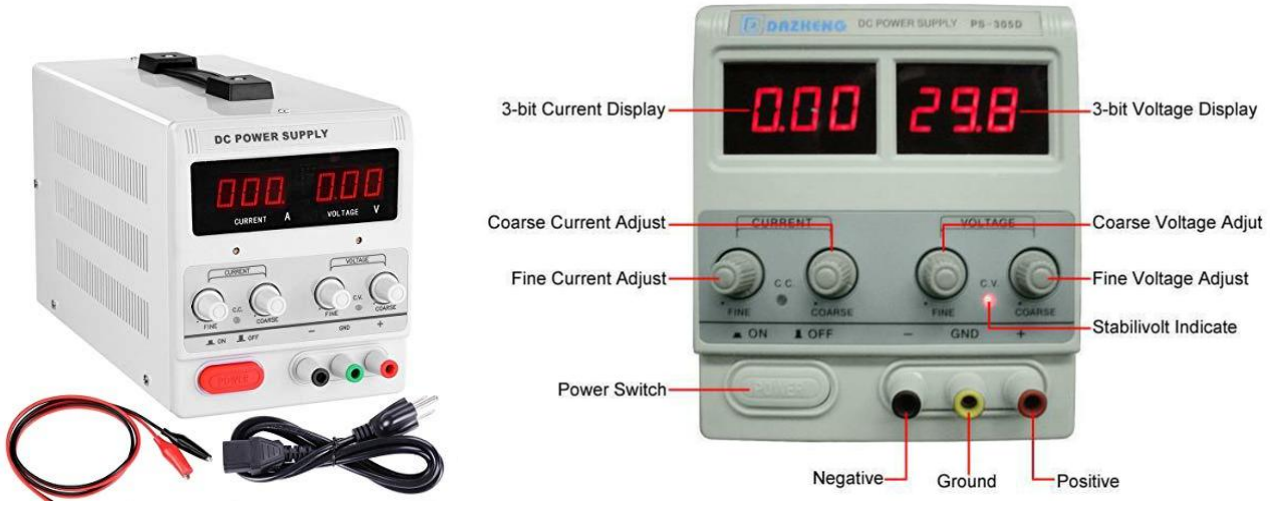



*figure. Digital display DC power supply*


*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

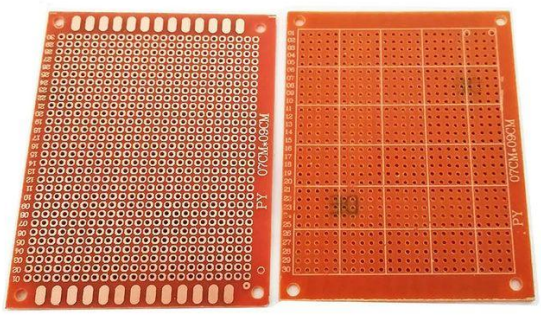
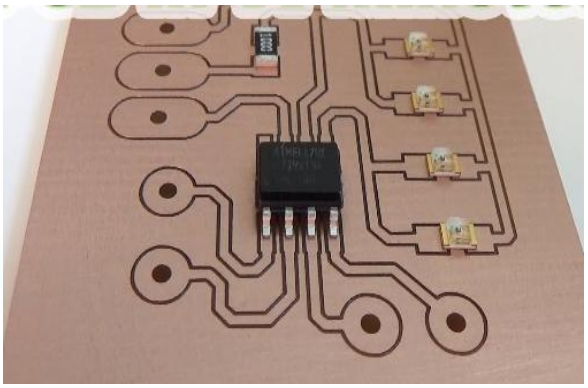
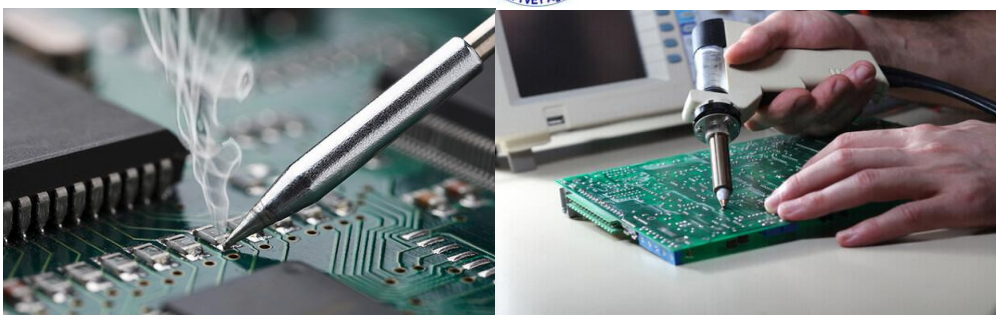


*Fig. Bread Board (PCB)*



*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.

| Instruction Sheet | LG11:- Solder/ De-solder components to the board |
|---|---|

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

- Performing ***Soldering and de-soldering processes***
- Checking process according to established standards and requirements
- checking soldered products in accordance with quality standards

Specifically, **upon completion of this Learning Guide, you will be able to**:

- Perform ***Soldering and de-soldering processes*** in accordance with OH&S policies and procedures
- Check process according to established standards and requirements
- check soldered products in accordance with quality standards

## Learning Instructions:

**Learning Instructions:**

13. Read the specific objectives of this Learning Guide.
14. Follow the instructions described in number 3 to 20.
15. Read the information written in the information “Sheet 1, Sheet 2, Sheet 3 and Sheet 4”.
16. Accomplish the information “Sheet 1, Sheet 2, Sheet 3 and Sheet 4”.in page _____.
17. 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.
18. Submit your accomplished Self-check. This will form part of your training portfolio.
19. 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.
20. 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.
21. 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).

| Information Sheet-1 | Perform Soldering and de-soldering processes |
|---|---|

## 1.1. Perform ***Soldering and de-soldering processes*** in accordance with OH&S policies and procedures

**Introduction**

Soldering is a process used for joining metal parts to form a mechanical or electrical bond. It typically uses a low melting point metal alloy (solder) which is melted and applied to the metal parts to be joined and these bonds to the metal parts and forms a connection when the solder solidifies. It is different to welding in that the parts being joined are not melted and are usually not the same material as the solder. Depending on the part and type of joint it may be possible to simply re-melt the solder and remove the part, or it may be necessary to remove the solder from the joint so the part can be freed. Some methods for removing solder are solder wick, solder sucker or de-soldering tool. Solder wick is a copper braid which is applied to the joint and heated with a soldering iron. De-soldering is the process of removing soldered components by the help of sucker melting the connection using soldering iron, and soldering gun and SMD or hat air gun.

### 1.1.1. Soldering

#### 1.1.1.1. prepare the materials and equipment needed

Before we are just getting start the session it is difficult to know what tools are or aren't very essential, or what must urgently prepared and what are not. So the required materials are dependent on what we are covering in give session. As general we expected


*Fig. Hand tools and power tools*

**Soldering Iron**

The plating on all soldering iron tips will, in due course, fail, even under the most benign conditions. The life of this plating depends upon the application (specially the temperature), the types of solders and fluxes used, and - primarily - the operator's technique. Plating failures can be divided into four main categories:

a) Stress or cracking.
b) Corrosion.
c) 'De-wetting'.
d) Wear or abrasion.

### *1.1.1.2.* wipe the soldering iron tip on a damp sponge and wet it with a small amount of solder

A clean surface is very important if you want a strong, low resistance solder joint. All surfaces to be soldered should be cleaned well.

- **Let the iron cool before cleaning it.** Turn off your solder iron and let it cool down for 15-20 minutes before cleaning the tip. This will allow you to clean the device as thoroughly as possible without risking burns. Clean the tip immediately after the solder iron to limit buildup over time. Place a sticky note near your workspace if you find yourself forgetting often to make cleaning the iron a priority.
    - Used to clean off soldering iron tip
    - Can be made of various materials
    - Should be used every time before soldering a joint


*Fig. soldering flux*

**Wipe the iron off with a damp, cellulose and sulfur-free sponge.** Take a wet sponge and rub it over the top of the solder iron. Doing this first will take care of any mild buildup and help you discern in a safe way whether the tip is still too warm to touch with bare hands. Use sulfur-free sponges made specifically for soldering, as regular sponges will not remove the solder as efficiently.


**Use dampened steel wool to get rid of surface stains or rust.** If you do not regularly clean your solder iron, you may have more stubborn stains or discoloration. Take a steel wool pad and dampen it slightly, then scrub it over the iron's tip to remove rust and any other heavy staining.

Steel wool is the only cleaning item safe to remove rust or stains with. Avoid sandpaper, which is too corrosive for solder iron tips


Fig. cleaning soldering iron

**Wear eye protection while tinning the tip.** After cleaning the tip, it is advised that you coat the tip in a thin, even layer of solder. This is called "tinning," and it helps protect the tip from rust or oxidization. That being said, many chemicals in solder are eye irritants. Solder has a tendency to "spit," or pop if you accidentally hit an air pocket, so keep safety goggles on at all times.

- Tin the solder iron after every use to prevent rusting.
- Make sure to wear eye protection at all times while using a hot solder iron.
- Although gloves are not required for tinning, it is suggested that you wash your hands with soap and water afterward.

- **Apply a small amount of fresh solder to the iron tip.** Melt a small dot of solder over the tip in a thin coat. If applied evenly, this will keep the iron's heat flow in check when it is next used in addition to preventing rust accumulation.


*Fig. adding fresh solder*

- **Keep the solder in place with an alloy cleaner.** After turning the solder iron off and letting it cool, apply a small layer of alloy cleaner over the tip with a microfiber cloth. This will prevent dust buildup over the solder and further diminish the chances of oxidization.


*Fig. using soldering flux*

- **Use high-quality solder.** Although using cheap solder may seem cost-effective in the short term, it can cause damage over time. Impurities in your solder can cause buildup on the tip and inhibit its heat-transferring abilities. 60/40 or 50/50 solder is ideal, with the top number representing what percentage of tin is in the solder.


*Fig. cleaning solder*

- **Remove debris buildup after every use.** After soldering an item, turn the solder iron off and wait for it to cool. Then, remove the tip and tap the barrel to dislodge any

debris. This will prevent buildup from clogging your solder iron over time and diminishing its efficiency.

- **Check the solder iron's cord for burns or cracks.** A solder iron's cord is prone to damage because of the high heat the device is used under. If you notice any cord damage, hire a professional electrician to replace the cord. Solder irons with cord damage are not only inefficient but also dangerous to work with.

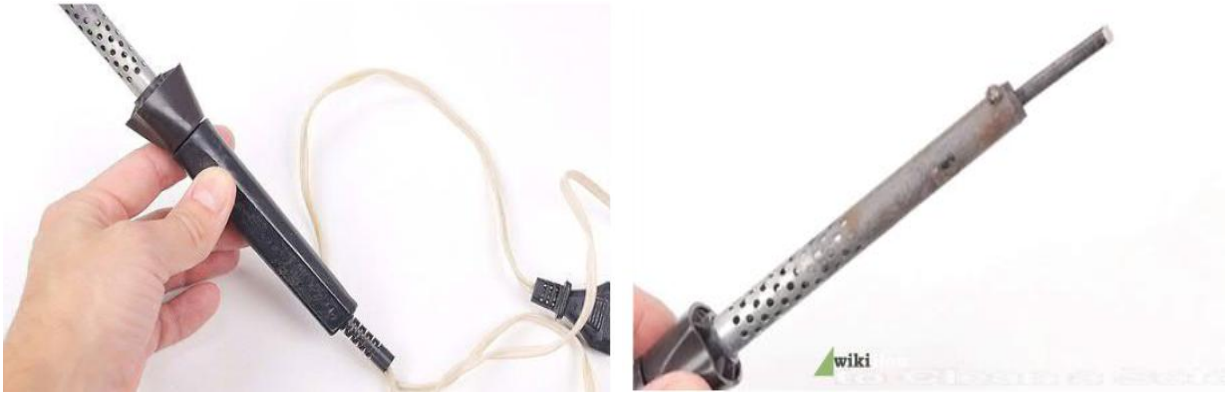



*Fig. checking soldering iron*

- **Wipe off the iron's tip between strokes.** Cleaning the solder iron's tip while it is in use will result in better soldering work. Wipe a wet sponge across the solder iron's tip after each stroke to avoid buildup on the tip. When you're finished with your soldering job, you will have less to clean from the tip if you wipe the iron periodically while using it.


*Fig. soldering gun*

***1.1.1.3.*** apply the hot iron to one side of the joint and then feed in solder from the other

**Heating the joint:** Placing the iron tip on both the component lead and pad--the goal is to get as much surface area contact between the iron tip and joint as possible.

Apply a very small amount of solder to the tip of the iron. This helps conduct the heat to the component and board, but it is not the solder that will make up the joint. To heat the joint you will lay the tip of the iron so that it rests against both the component lead and the board. It is critical that you heat the lead and the board; otherwise the solder will simply pool and refuse to stick to the unheated item. The small amount of solder you applied to the tip before heating the joint will help make contact between the board and the lead. It normally takes a second or two to get the joint hot enough to solder, but larger components and thicker pads/traces will absorb more heat and can increase this time.

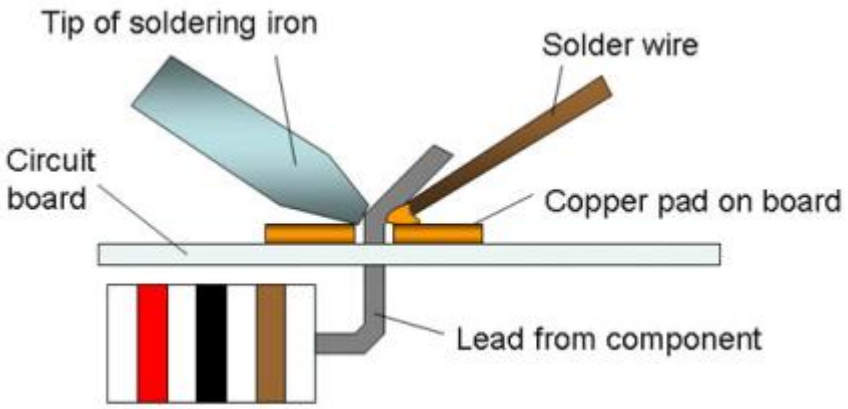
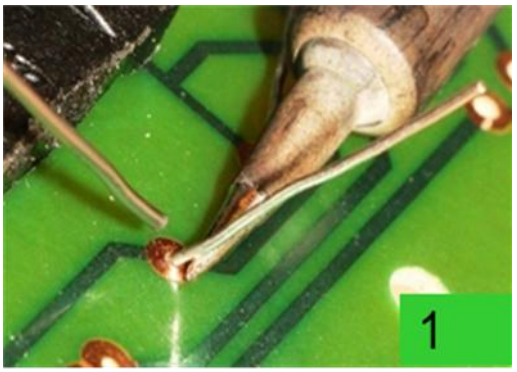
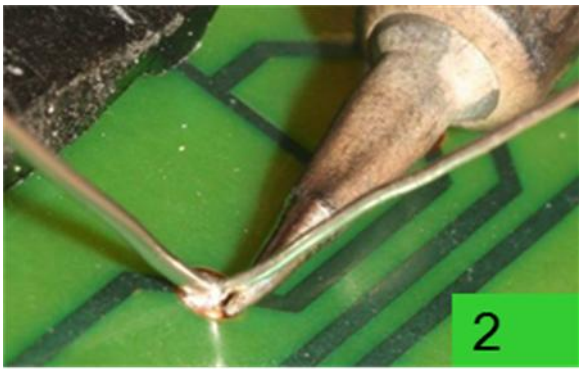



*Fig. heating solders*

Heat both items at the same time by applying the soldering iron to the copper pad and the component lead.

1. Heat both items at the same time by applying the soldering iron to the copper pad and the component lead.



2. Continue heating and apply a few millimeters of solder. Remove the iron and allow the solder joint to cool naturally.

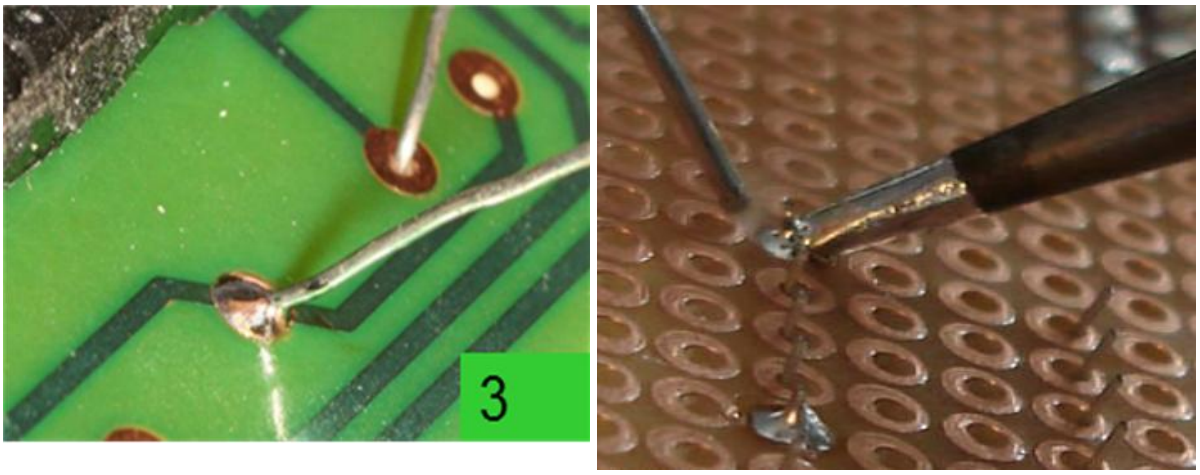



*Fig. removing solders*

**A Good Solder Joint**

- Smooth
- Bright
- Shiny
- Clean
- Concave fillet

## Procedures for Soldering


*Fig. soldering process*

***1.1.1.4.*** allow the flux to work on the surfaces and the solder to flow across the whole joint

Usually touching the tip with rosin-cored solder will supply enough flux so that oxides can be removed with a damp sponge. If this isn't sufficient, you can purchase "tip tinners and cleaners" that are a mixture of solder paste and flux. The flux is oftentimes stronger (more activated) to help remove oxides.

**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 equalize their temperatures.

**The constituents of flux**

A flux may be solid, pasty or liquid, depending on how it is to be used. Its principal constituents are:

- a ‘flux base’, together with widely variable quantities of
- 'activators’ and
- solvents.

When used for wave soldering, fluxes are generally ‘low solids’ with perhaps only a couple of percent of flux, and the balance solvents. The resulting materials are relatively thin and mobile. However, when formulated as part of a paste for reflow soldering, the flux will also contain additives to improve

the paste ‘rheology’ (flow characteristics) and ‘tackiness’, and to help slow the sedimentation of solder particles. In many cases, paste components will have more than one function.

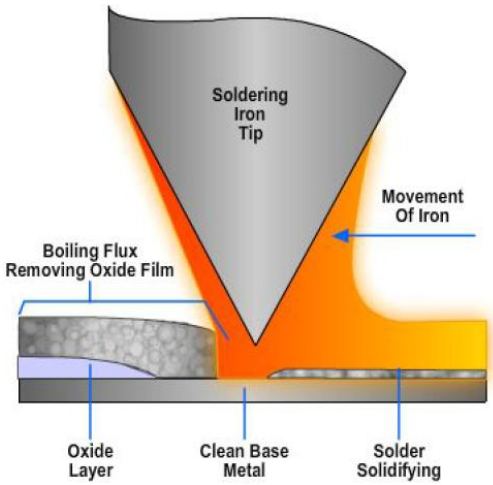




*Fig. using soldering flux*

### *1.1.1.5.* remove the solder, then the iron

Anyone who solders should know the basics of how to use a solder wick, which is braided copper wire. This tool will help to remove solder from any solder joints that you need to change. This is an especially useful tool for those who need to remove solder from circuit boards and other electrical components. Because soldering can be difficult when you first begin, you will want to have solder wick on hand so that you will be able to repair any mistakes that you might make. The use of these wicks is very simple, and they can save you from having to replace parts that you soldered incorrectly

**Step 1 - Prepare Safety Materials**

Set up the exhaust fan so that it will carry the fumes from soldering away from you. If you do not have an exhaust fan, or if the material on which you need to work is not in a location where a fan will work, you can use a safety mask. Do not forget to wear your safety goggles to protect your eyes from solder and other debris.

**Step 2 - Plug in the Soldering Iron**

Plug the soldering iron into the outlet and wait for it to reach a working temperature. Make sure that the iron is safely in its holder so that it does not fall out. It will generally take three to five minutes for most soldering irons to heat to their optimal temperature.

**Step 3 - Use the Solder Wick**

Take a length of the solder wick and hold it on the joint from which you need to remove the solder. Now that the soldering iron is heated up, you can apply the iron to the tip of the wick as well. The heat from the soldering iron will melt the solder. As the solder melts, it will be drawn onto the copper wiring. The process through which this occurs is called capillary action. The solder will fuse to the copper braids on the wick as it cools. This will remove all of the solder from the joint.

**Step 4 - Cut the Wick**

When the wick is coated with the solder that you want to remove, take the wick away from the heat and return the soldering iron to its holder. You can then cut off the tip of the solder wick that is now covered in solder. Check any of the other joints that might need to have solder removed and repeat the process. If you have one joint that has a large amount of solder, you may have to repeat the process.

**Step 5 - Clean Up**

Turn off the soldering iron and wait for it to cool down when you are finished. Dispose of the solder covered wick and clean up your work area so that it will be ready for you the next time that you have to solder.

### *1.1.1.6.* inspect the work

**Methods of inspection**

In order to make sure that PCBs are performing as intended, manufacturers must verify all components are assembled correctly. This is done with a range of techniques including simple manual inspections to automated tests that use advanced PCB inspection equipment.

Manual visual inspections are a great starting point. For simpler units, they may be all that's needed. At Electronic Manufacturing Services Group, we perform a manual visual inspection under magnification of every board we produce to ensure we meet all customer expectations. We also offer other inspection services that involve the use of advanced equipment.

This equipment can speed up the inspection process and may be necessary for more complex board types, such as multi-layer boards and those with high numbers of components.

1. **Visual inspection:-** is non destructive method to the solder joints the accuracy is about 80% effective. However in Visual Inspection method, the ability of technician to find faults in electronic products vary in size, complexity, density and total amount of opportunities

**Instrumental testing method: -** multi-meter is one of the most necessary instruments to test and inspect solder of PCB.

**Structural Process Test System (SPTS)**

Digitalization and analysis system of real-time and automatic video capture is capable of dramatically improving allowance and repeatability of visual inspection. Therefore, structural process test system depends on some form of emitting light like visible light, laser beam and X-ray. All those systems acquire information through processing images to find out and measure defects concerned with solder joint quality. Similar with visual inspection, SPTS is implemented without the need to physically contact circuit board. Different from visual inspection, however, SPTS features such high repeatability and eliminates subjectivity from defect measurement.

**Automatic/Automated Optical Inspection (AOI)**

AOI system relies on multiple light sources, programmable LED library and some cameras to shine solder joints and take shots. Under reflected light, leads and solder joints play a role as mirror

reflecting majority of light while both PCBs and SMDs reflect little light. Light reflected from solder joints fails to provide the practical height data while graphics and intensity of reflected light provides information in terms of solder joint curvature.

Then professional analysis will take place to determine whether solder joints are complete, whether solder is sufficient, whether bad wetting takes place. Apart from that, AOI system also inspects solder bridging and missing components or displacement before or after reflow soldering.

## Automatic Laser Test (ALT) Measurement

ALT is a more direct technology used to test height and shape of solder joints or solder paste deposition. This system runs to measure the height and reflectivity of some surface components when the image of laser beam focuses on one or multiple position sensitive detectors that maintain a certain angle with laser beam.

During ALT measurement, surface height is determined by the light position reflected from position sensitive detectors while surface reflectivity is figured out from the power of reflected light beam. Due to secondary reflection, light beam perhaps shines on position sensitive detectors at multiple positions, which calls for a scheme to distinguish correct measurement. Furthermore, reflected light beam may suffer from shielding or interference of interference material when running along light of position sensitive detectors.

In order to eliminate multiple reflections and prevent shielding, this system should test reflected laser beam along regulated independent optical path. During multiple height measurement for solder joints, ALT system is **OPTIMAL** for solder paste deposition quantity and position alignment prior to component assembly. It provides data for real-time structural process control of solder paste printing including viscosity, alignment, cleanliness, fluidity and squeezing speed and stress.

### X-ray Fluoroscopic System

X-ray fluoroscopic system emits a beam of rays from a single-point light source, which vertically goes through circuit board. With this process carrying on, solder joints weaken the intensity of rays to larger extent than other materials. The intensity changes on ray energy are converted into digital X-ray graphics with a gray scale of 256.

Gray X-ray graphics of some solder joint is actually a density image indicating solder joint thickness, distribution and internal integrity.

On a single-side PCB, X-ray fluoroscopic system is capable of accurately inspecting solder joint defects such as those (including crack, insufficient solder, bridging, misalignment, void etc.) taking place on J-shape wiring devices, gull-wing devices or passive chips. Apart from that, it is able to inspect missing components and reversed tantalum capacitors. When it comes to double-side PCBs, however, X-ray fluoroscopic system fails to accurately inspect those defects due to possible overlapping of X-ray images of solder joints on both sides of a board.

### X-ray Lamination System

Compared with X-ray fluoroscopic system, X-ray lamination system generates focal plane of a horizontal section area through scanning or synchronously spinning with X-ray detector. Off-axis images generated on detectors then lead to the generation of section image with surface thickness of 0.2-0.4mm by single swinging or multiple swinging that causes homogenization. Furthermore, components at front side and back side of focal plane become defocused in laminated images so that solder joints within focal plane are departed from other materials on PCBs.

Depending on laser range finder, X-ray lamination system draws board surface position relative to focal plane and rectifies board warpage. After that, circuit board is moved at a small vertical increment so that it goes across focal plane, after which different sections of the same solder joint can be inspected. It works perfectly for **BGA** and **PTH** solder joint inspection.

Double-sided PCB is vertically moved at large increment to go across focal plane to inspect solder joints at both sides of the board. Through modifying beam's scanning radius and vertically moving focal plane, different amplification factors or visual area sizes can be set. X-ray lamination system can measure parameters of all physical solder joints at different focal planes so that process defect coverage can be provided. Due to the indicated relationship between section image of X rays and given solder paste volume, grey scale readings can be converted into practical sizes by regulated standard units or metric units. After analysis on measurement results, data will be provided to characterization and assembly improvement.

**For example:-** average solder paste thickness or solder paste volume change of solder joints can lead people to be aware of quality levels of solder paste printing and defect sources. X-ray lamination system runs at an inspection speed of 30-40 joints per second. It ensures 100% coverage of key device inspection by running at a flexible sample way, but it fails to cover 100% of devices whose assembly period takes place in fewer than 45 seconds. X-ray lamination system features the highest cost among all inspection methods but greatly shortens time of searching and rework.

### *1.1.2.* De-soldering

**De-soldering** is the process of removal of solder and electronics components from a circuit board by using soldering tools for troubleshooting, repair, replacement, and salvage.

#### *1.1.2.1.* Lay the iron tip to rest against component leads on the board

Laying iron tip against component lead so as to heat the solder for melting and pumping or wicking using sucker as shown in the following picture.

**Steps of de soldering.**

1. Locate the terminals for the component to be removed. ...
2. Clean the terminals. ...
3. Attach a heat sink. ...

4. Clean your soldering iron as it heats. ...
5. Push down on the **desoldering** pump. ...
6. Heat the old solder with your soldering iron. ...
7. Vacuum up the melted solder. ...
8. Empty the **desoldering** pump into the trash.

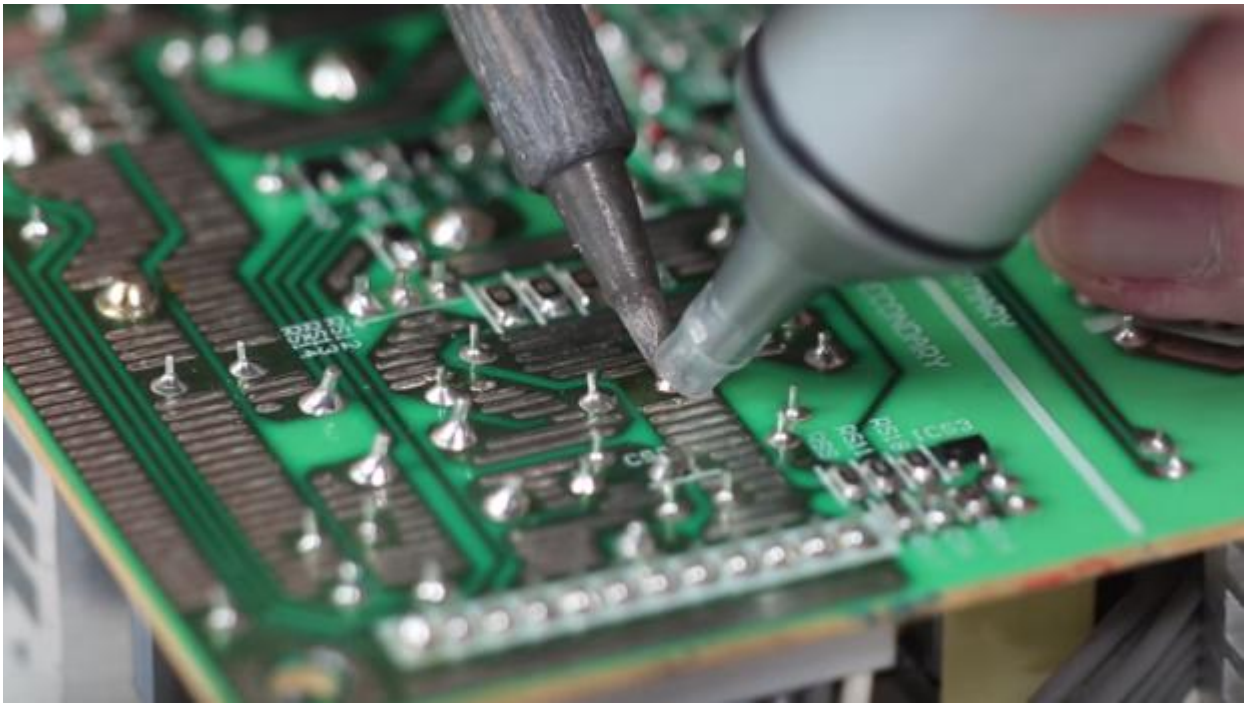


*Fig. de-soldering components*

### *1.1.2.2.* use solder sucker to quickly remove molten solder on the connection

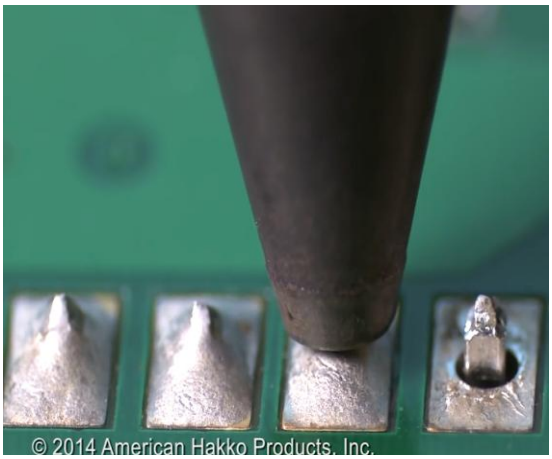
- Solder is a metal alloy and when it cools it creates a strong electrical bond between the parts. Even though soldering can create a permanent connection, it can also be reversed using a desoldering tool as described below
- Desoldering is the elimination of solder from a circuit board. Therefore, the desoldering pump is a device used in achieving the removal of solder from a printed circuit board. Solder sucker it is designed with a spring-loaded plunger.
- The desoldering pump has features which enable it to repel heat and does not get destroyed when the tip is placed on the molten solder. It often requires skill or technical-know-how for efficient use and a better result.

## *Steps required on how to use a desoldering pump*

Fig. A) Soldering sucker

b)

Fig. A) Desoldering gun




B) desolding process

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.

2. The second step is to apply pressure on the plunger by pressing it down. In case of another pump with bulb, you can squash it.

3. In the third step, once the solder is liquefied, position the head of the pump on the solder that needs to be removed

4. The next step involves the release or discharge of the plunger or bulb; some desoldering pumps are designed in such a way that it possesses a release button, so as not to be held the whole process.

5. The next step is to remove the desired free component. You can repeat using this procedure again to eliminate any additional solder. Press down and release the plunger in a continuous pattern to eradicate the solder inside the desoldering pump.

### *1.1.2.3.* **Remove the component on the board**

The best technique I have found to avoid pulling out the plated through holes is to use side cutters to snip through each component leg and then to melt the solder and pull the debris out from the hole with pliers, using a solder sucker later to clean up the hole. This does, of course, destroy the component being removed, but it is defective or suspect anyway surely.

It is possible to use a combined soldering iron/sucker to remove the solder and “wiggle” the leg before removing the heat, so it is not adhered to the side of the hole. This works because once the liquified solder is gone the heat transfer from nozzle to leg is much reduced, and once the leg is wiggled free the solder left down the hole solidifies rapidly having no heat applied.

## *1.1.2.4.* clean the solder pad to remove left-over

### Still not clean?

If after cleaning on the sponge / brass shavings the tip is still not shiny then melt a small amount of solder onto it and clean again. The flux in the solder will help to clean the tip.

### Really oxidized

If the tip is still not clean and shiny then use a tip cleaner. This is a mixture of a more aggressive flux than usually found in solder, and powdered solder. The flux in tip cleaner removes the oxidisation and build up from the soldering iron tip, and then the solder re-tins the tip ready for use.

*Fig. cleaning soldering Iron*

- To use the Tip tinner/cleaner heat the soldering iron.
- Then dip into the tin of tinner/ cleaner with a slight twisting action
- This step will coat the iron in a mixture of flux and solder.

- Wipe the iron on a damp sponge to remove the excess

*Fig. cleaning soldering Iron*

Before we start soldering we want to make sure that the tip is nice and clean and shiny so that it will accept solder. We call this 'tinning'.

We start off by wiping my soldering iron tip through this damp sponge to remove any excess solder and dirt or carbonated material. Then we run some solder onto the tip and wipe away the excess.

Now if we had a tip that was very black and we were finding it hard to get the black material away we can use this which is called tip tinner and cleaner. This helps remove this dark black material.

We run the soldering iron through this and then wipe it through the damp sponge, it helps remove any of this black material.

Again we can run a bit more solder on, wipe away the excess and we have a nice clean, tinned soldering iron ready for our soldering job.

| Information Sheet-2 | Check Process according to established standards and requirements |
|---|---|

## *2.* Check Process according to established standards and requirements

- External visual inspection is a process of verifying the attributes of parts such as Device condition, part markings, and evidence of the device, Ports conditions, dimensions and surface quality. Visual inspection can be used for internal and external surface inspection of a variety of equipment types, including storage tanks, pressure vessels, piping, and other equipment.

- Visual Inspection, used in maintenance of facilities, mean inspection of equipment and structures using either or all of raw human senses such as vision, hearing, touch and smell and/or any non-specialized inspection equipment.

- **Visual Inspection**, or Visual Testing (VT), is the oldest and most basic method of inspection. It is the process of looking over a piece of equipment using the naked eye to look for flaws. It requires no equipment except the naked eye of a trained inspector.

*Fig. Inspection using different methods*

*Checking is the process of proofing the above activity in:*

1. *Visual inspection*
2. *Testing/ automated techniques*
3. *Applying functionality test*

During inspection three elements should be taken into consideration when deciding inspection method:

- Defect type
- Cost and
- Inspection speed

| Information Sheet-3 | Check Soldered products in accordance with quality standards |
|---|---|

## *2.1.* Check Soldered products in accordance with quality standards

**Note**: To check the quality of solder that performed the trainer must choose available option for his activity.

1. **Visual examination:-** is routinely used to study surface features, finishes and the soldering quality and integrity of solder joints. However, only qualified inspectors are able of a proper failure detection and interpretation according to the applicable regulation. Major points of interest during the visual inspection of solder joints are as follows:
   - **a) Degree of wetting** is a measure of solder joint quality. Properly wetted joints show an uninterrupted layer of soldering material that spreads along the whole contact-pad surface. This results from the good wettability of the solder compound on the contact pads and components.
   - **b) Joints Contours** are also inspected as they indicate the volume of solder deposited. The contour should be concave when the amount of solder is enough; but it shall not extend beyond the device contact (see example of excessive solder in the figure).
   - **c) Thermal damage**. Excessive heating, for instance during soldering, may result in different types of failures such as lifted pads, measling and blistering, charred, burned or melted insulation or burns on base materials.
   - **d) Damages on the devices** caused during handling. Comprehensive external visual inspection allows us to detect gross defects in solder joints.

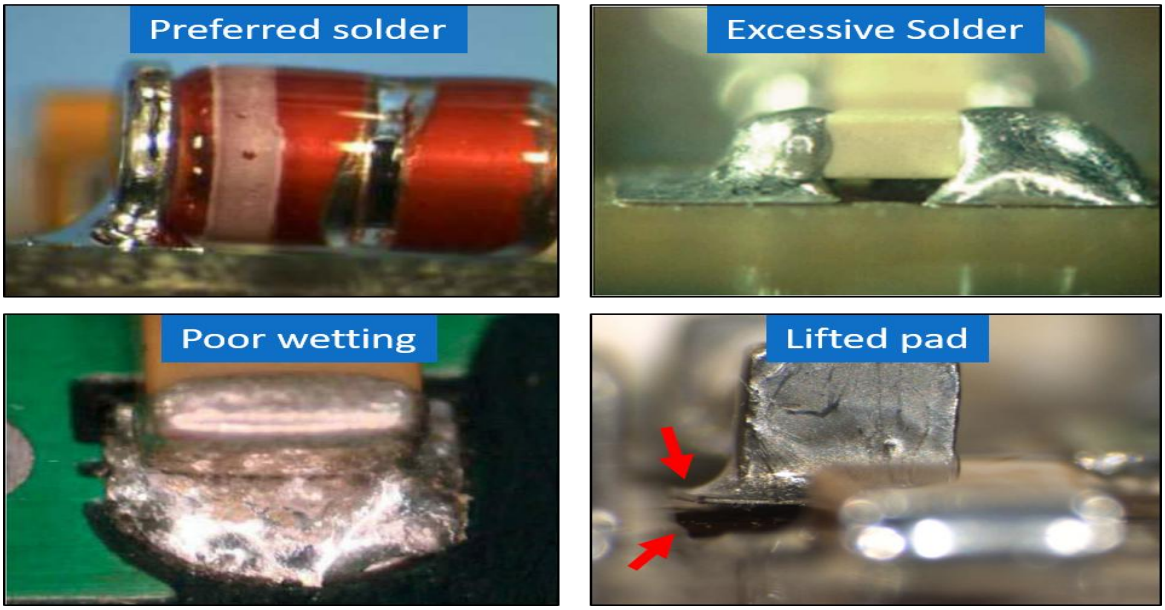
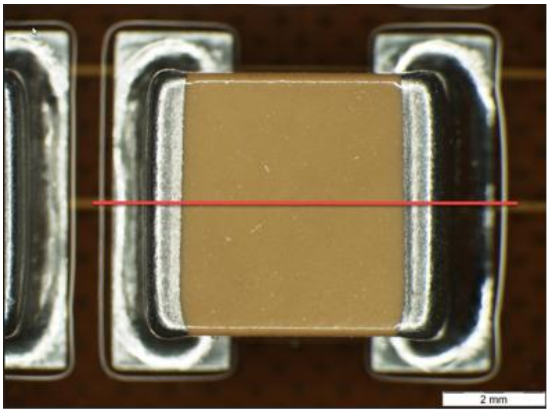
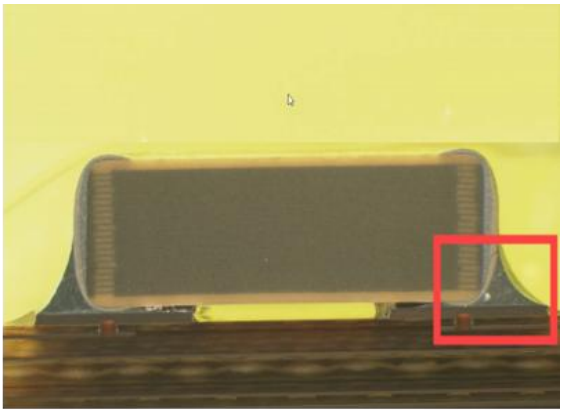
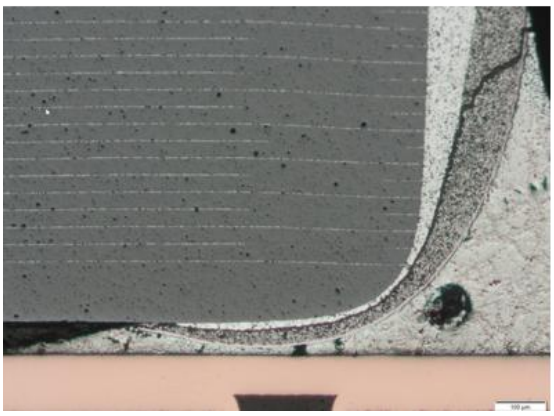
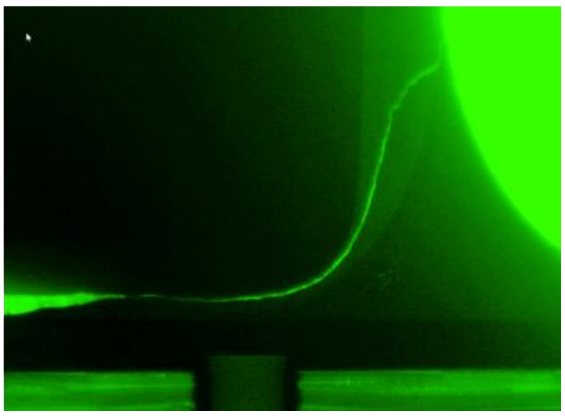
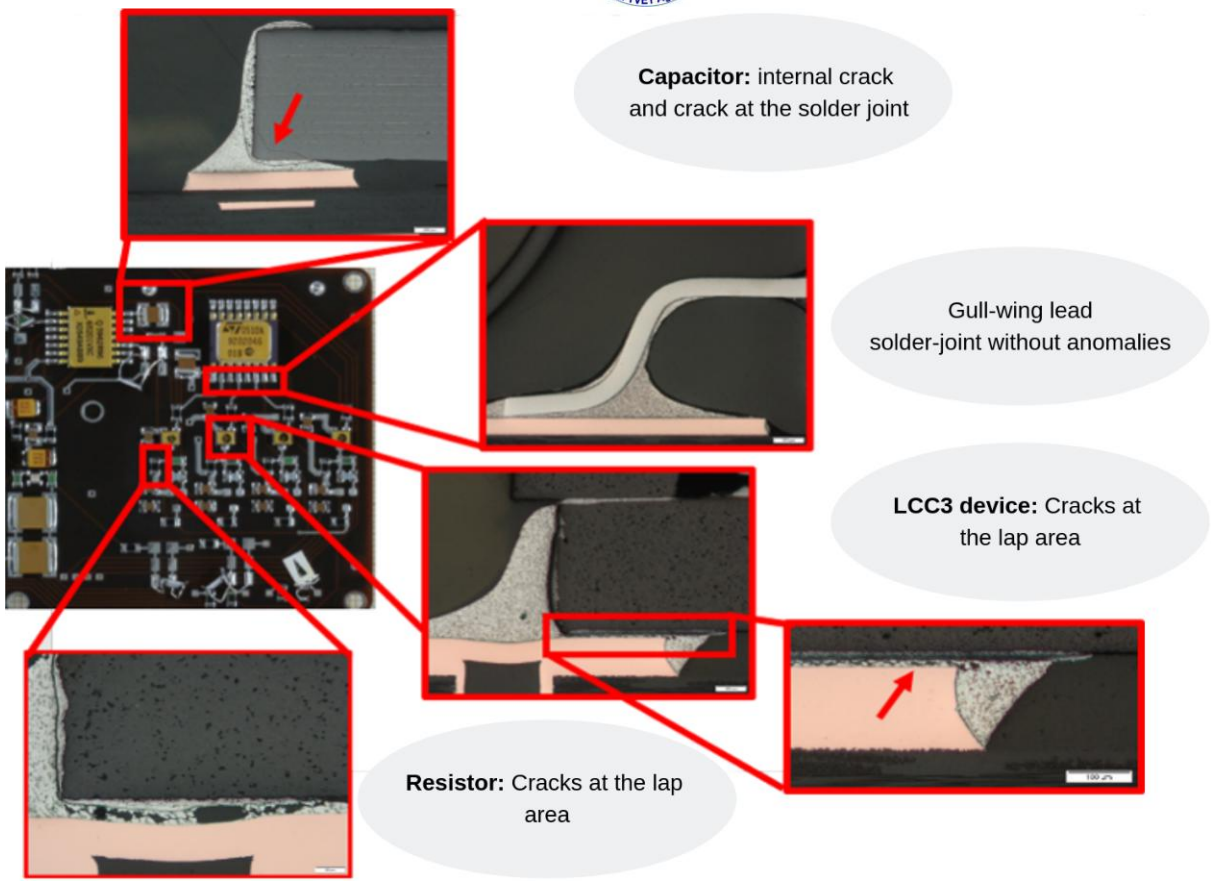



*Fig. Check Soldered products*

2. **Vibration tests: -** are performed to ascertain the ability of package and solder joints to withstand the dynamic loads related to the intended applications and environment. Vibration environment will cause stress on the **PCB substrate, component packages, component leads and solder joints** due to a combination of the bending moments in the PCB and the inertia of the component mass. With these concerns, the standard ECSS-Q-ST-70-08C, clause 13.2, sets out the requirements for PCB and SMD vibration testing.
3. **Temperature cycling**:- is the most commonly used accelerated test. It simulates **temperature-enhanced and thermo-mechanical stress conditions on** SMD solder assemblies. Thus, the conditions of testing vary depending on the environment for which the product is designed to operate.
4. **Micro-sectioning Analysis: -** Once the PCB assembly has been submitted to environmental tests, microsectioning inspection is performed in order to evaluate carefully the PCB raw inner layers, internal solder joint integrity and devices internal structure. Microsection analyses are mandatory for the qualification of soldering procedures in agreement to the ECSS-Q-ST-70-38C soldering verification program. This is so as it is the most reliable tool to reveal the morphology of the solder joints with respect to inter-metallic formation, wetting, cracking and voiding




**Capacitor:** internal crack and crack at the solder joint
Gull-wing lead solder-joint without anomalies
**LCC3 device:** Cracks at the lap area
**Resistor:** Cracks at the lap area

| Instruction sheet | LG12: Assemble/disassemble boards |
|---|---|

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

- Performing **disassembling and** a**ssembling processes**
- Checking process according to established standards
- Checking assembled products in accordance with quality standards

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**:

- Perform a***ssembling and disassembling processes*** in accordance with OH&S policies and procedures
- Check process according to established standards and requirements
- Check assembled products in accordance with quality standards

## Learning Instructions:

### Learning Instructions:

22. Read the specific objectives of this Learning Guide.
23. Follow the instructions described in number 3 to 20.
24. Read the information written in the information "Sheet 1, Sheet 2, and Sheet 3.
25. Accomplish the information "Sheet 1, Sheet 2, and Sheet 3 ".in page _____.
26. 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.
27. If you scored a satisfactory evaluation proceed to "Information Sheet 2". However, if your rating is unsatisfactory, discuss with your trainer for further instructions or go back to learning operation sheet1.
28. Submit your accomplished Self-check. This will form part of your training portfolio.
29. 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.
30. Accomplish the "Self-check 2" in page_____.
    Ask from your teacher for correction (key answers) if any.

31. 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.
32. Accomplish the "Self-check 3" in page _____.
33. 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).
34. If you scored a satisfactory evaluation proceed to "Operation Sheet 1" in page_____, however, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity #1.
35. Read the "Operation Sheet 1" and try to understand the procedures discussed.

| Information sheet -1 | Perform disassembling and assembling processes |
|---|---|

## 3.1 Perform disassembling and assembling processes in accordance with OH&S

To perform assembling and disassembling processes tearing down the device in accordance with the device manual and OH & S policies and procedure by applying the workplace rule. Regarding safety necessary ideas have been already discussed in LO1 please refer to LO1 information sheet about OH&S policies and procedures.

- Use all required PPE and specific safety procedures for your activity.
- Protect your own Health and Safety and that of your co-workers;
- Not initiate or participate in the harassment of another worker; and
- Co-operate with your supervisor and anyone else with duties under the legislation.
- Avoid horseplay during your activity and follow your instruction sheet & instructor recommendation.

### 3.1.1. Supplies, materials and equipment preparation

For required activity necessary materials and equipments must be supplied by the person who provides training. For example we are going to disassemble PC. During your disassembling look your operation sheet and manual of the device.

**SUPPLIES, MATERIALS AND EQUIPMENT HAND TOOLS**

a) Full PPE
b) pair of rubber gloves
c) cutting pliers
d) Phillips screwdriver, and
e) Flathead screwdriver
f) Personal Computer
g) safety goggles
h) Working area/bench


### 3.1.2. Familiarize with the diagram and the product

- A **printed circuit board** (**PCB**) mechanically supports and electrically connects electronic components or electrical components using conductive tracks, pads and other features etched from one or more sheet layers of copper laminated onto and/or between sheet layers of a non-conductive substrate. Components are

generally soldered onto the PCB to both electrically connect and mechanically fasten them to it.

- Printed circuit boards are used in all but the simplest electronic products. They are also used in some electrical products, such as passive switch boxes.

There are different types of PCBs layer

- Single-sided (one copper layer)
- Double-sided (two copper layers on both sides of one substrate layer), or Multi-layer (outer and inner layers of copper, alternating with layers of substrate).

Multi-layer PCBs allow for much higher component density, because circuit traces on the inner layers would otherwise take up surface space between components. The rise in popularity of multilayer PCBs with more than two, and especially with more than four, copper planes was concurrent with the adoption of surface mount technology. However, multilayer PCBs make repair, analysis, and field modification of circuits much more difficult and usually impractical

There are many different thickness PCBs; the most common thickness of PCB products is 1.6mm (0.063"). Some types of PCB are:-

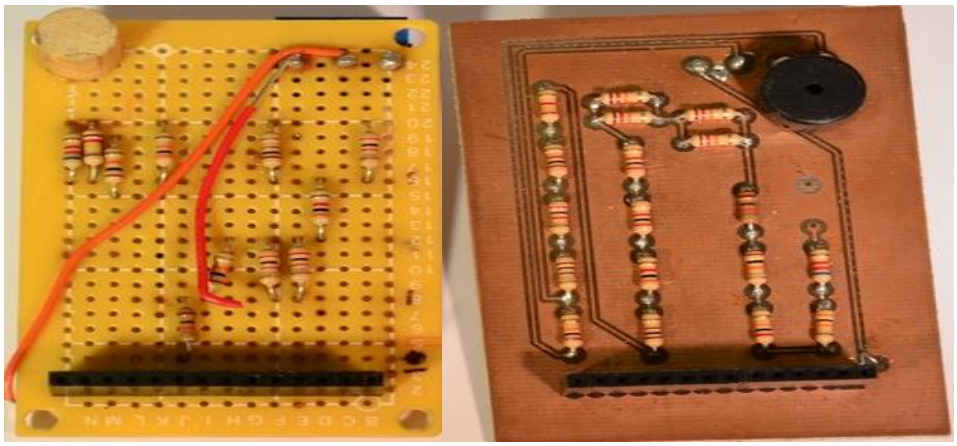
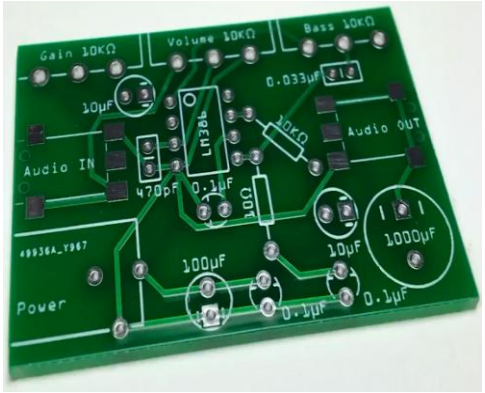


Fig. a) Bread Board b) copper PCB board




C) unsoldered Printed Circuit Board

## COMPUTER CASES

Most computer cases come in four distinct sizes: small form factor (SFF), mini tower, mid tower and full tower. The image below shows the distinct difference between PC case sizes:disassemble and study internal parts of computer



Fig. Disassembled personal computer

## Main components of computer system unit

1. Mother board
2. CPU
3. RAM
4. Power supply
5. Different types of connecting cables
6. Different types of Cards
7. Hard disk

8. CPU Fan…..etc
9. CD/DVD driver


Fig. power supply


Fig. hard disk drive


Fig. RAM(Random Access Memory)


Fig. CPU Fan

CD/DVD driver

## Mother board

Every hardware device installed to the computer connects to the system through the motherboard. Hard drives, power supplies, memory modules and adapter cards all connect to the motherboard via cables, which are inserted into the appropriate slots or connectors on the board. Along the motherboard are circuits that allow these components to transfer data back and forth.

To disassemble the motherboard, you must disconnect all of the components -- both internal and external hardware linked to the circuit board. Disassembling a motherboard requires a fair amount of computer expertise and at least a working knowledge of the different components installed to a computer.

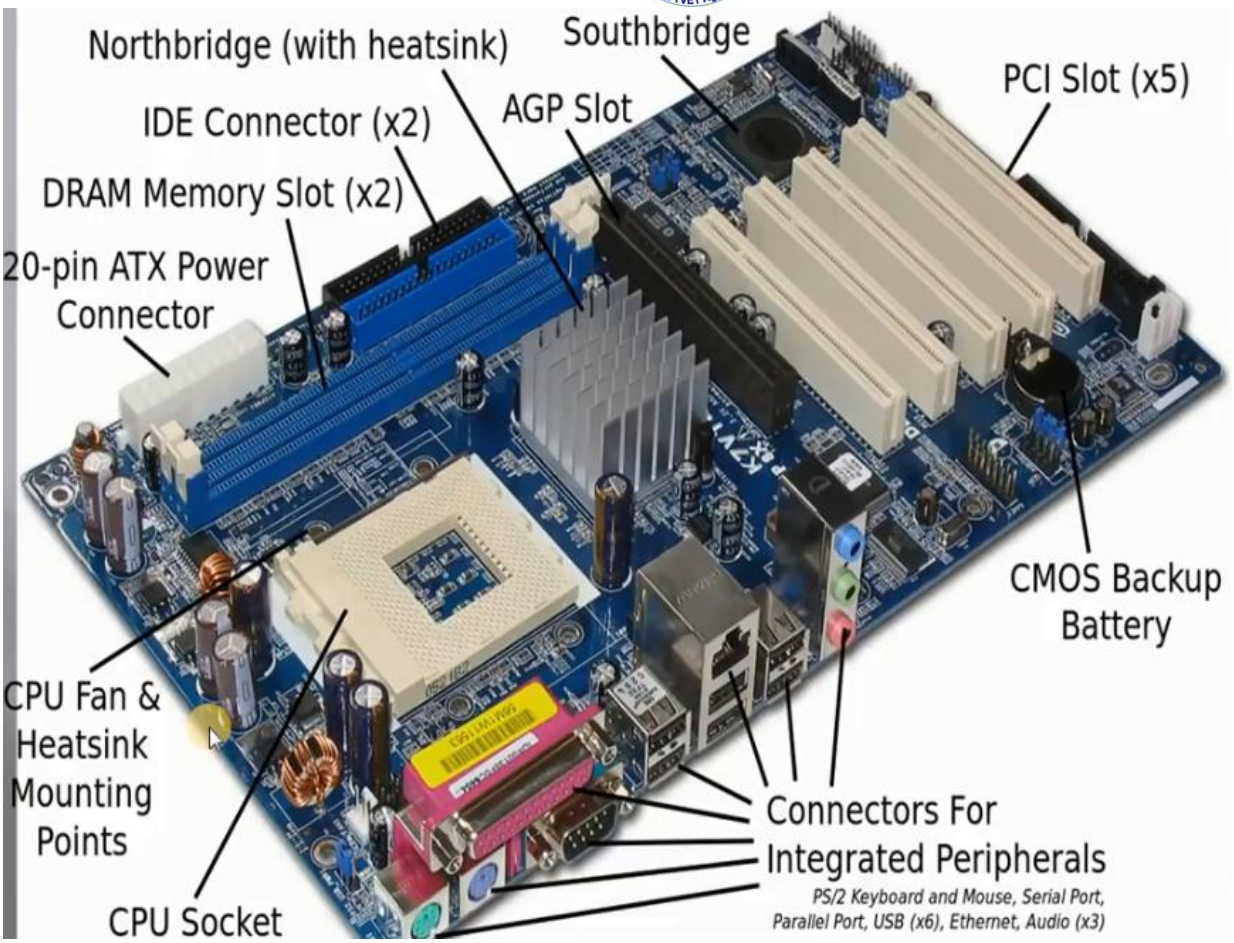



Fig. C) Mother board

| Self-check-2 | Familiarize with the diagram and the product |
|---|---|

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

**Match column "B" to Column "A" and put the answer on the dash space**

| | No | Column "A" | Column "B" |
|---|---|---|---|
| ____ | 1 | Disassembling the unit | A) CD/DVD driver |

| | | | |
|---|---|---|---|
| ____ | **2** | A computer part which hold components | **B) power supply** |
| ____ | **3** |   | **C) hard disk drive** |
| ____ | **4** |   | **D) tearing down** |
| ____ | **5** |   | **E) mother board** |
| ____ | **6** |   | **F) RAM CPU Fan** |
| ____ | **7** |  | **G) RAM** |

| | |
|---|---|
| ***Note:*** **Satisfactory rating - 2 points** | **Unsatisfactory - below 2 points** |
| You can ask you teacher for the copy of the correct answers. | |

| | |
|---|---|
| **Answer sheet** | Score = _____<br>Rating: _____ |

Name: _____ Date: _____

**Short Answer Questions**

1._____

| **Information sheet -2** | **Check process according to established standards** |
|---|---|

## 3.1. Check process according to established standards

Here you will check the process that you have attended in the above disassembling steps and confirm the presence of each part at their correct status and functionality.

To get it open, you will need only some screwdrivers, instruction sheet or service manual and for the most part used only a Philips screwdriver, but the idea is to have a kit with many screwdrivers, because you may need a strange screw or nuts in PC to disassemble.

Every screw is turned by hand and each cable is clipped and tucked away with care to ensure optimal airflow, thermal, and acoustical properties. Once assembled, every finely crafted PC is put through a stringent 200-point checklist to ensure quality control of everything from physical appearance to software, performance, and usability. We're obsessed with perfection. There are no assembly lines in training place (workshop) please follow safe and hazard free procedure for all.

## Case Preparation

- One of our trained and certified technicians gathers the pre-tested components kit required for each system order.
- The case's side panel is removed and stored inside the cardboard container along with the power cord and any other case accessories.
- Any additional case fans are installed in the proper vent areas.
- Motherboard standoffs are installed in the correct configuration to align with the chosen motherboard.

## Motherboard Insertion

- The CPU and RAM are installed on the motherboard prior to insertion into the case to avoid any possible stress or damage.
- Any concealed wiring to be done under the motherboard is taped down to hold the wires while the board is set in place.
- The motherboard is placed inside the case.
- The power cable, case fan cable, CPU fan cable or liquid cooling pump cable, power on button, reset button, internal speaker, and all case LED light cables are connected, tucked, and clipped.

| Information sheet-3 | Check the assembled and disassembled product |
|---|---|

### 3.3. Check the assembled and disassembled product

- After the study is completed, assemble the PC as it is, following service manual or your trainer's instruction. After assembling is completed the functionality of the device is the main criteria of your activity depending on the interests/plan of your work and resource you have provided for this activity.

## Initial Testing

- An assembly technician tests the system with our 200-point checklist.
- The system receives a rigorous battery of diagnostic software testing and benchmarking.
- A separate physical checklist is run to check for things like loose or missing screws, tight cable connections, and audio cable tie downs.
- A separate quality control technician gives the system a final review. If it does not meet this personals seal of approval, it returns to the technician for correction.

## Diagnostic Test

- Every system receives a diagnostic test to ensure all subsystems are properly installed.
- Every screw must be carefully re-tightened and every cable securely strapped before the cover is installed. The case cover is needed for all other tests to make sure it allows proper air flow and minimal vibration during use.

## Performance Test

- After running overnight, the system must properly wake up and restore itself from suspended sleep. This test is run various times on the machine to ensure proper functionality.
- Software is installed to perform a variety of benchmark performance tests. These tests provide information about the overall speed of the system and help diagnose specific problems.
- Benchmark results are compared against systems from other manufacturers as well other in-house PCs.

## Usability Tests

- A variety of basic tests, including CD and DVD functionality, are performed.
- The media reader and optical drives are checked for proper eject operation or any abnormalities.

## Final Testing

- Just prior to shut down and packaging, every system is restarted and tested to see exactly what the customer will experience when they receive the system.

| Instruction Sheet | LG13: Test and inspect assembled products |
|---|---|

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

- Subjecting finished products to final visual inspection and testing
- Documenting & informing work completion to responsible
- Following housekeeping procedures

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**:

- Subject finished products to final visual inspection and testing in accordance with quality standards
- Document & inform work completion to responsible person in accordance with established procedures
- Follow housekeeping procedures in accordance with 5S discipline and established procedures

## Learning Instructions:

**Learning Instructions:**

36. Read the specific objectives of this Learning Guide.
37. Follow the instructions described in number 3 to 20.
38. Read the information written in the information "Sheet 1, Sheet 2, Sheet 3 and Sheet 4".
39. Accomplish the information "Sheet 1, Sheet 2, Sheet 3 and Sheet 4".in page _____.
40. 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.
41. If you scored a satisfactory evaluation proceed to "Information Sheet 2". However, if your rating is unsatisfactory, discuss with your trainer for further instructions or go back to learning operation sheet1.
42. Submit your accomplished Self-check. This will form part of your training portfolio.
43. 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.
44. Accomplish the "Self-check 2" in page _____.
Ask from your teacher for correction (key answers) if any.
45. 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.
46. Accomplish the "Self-check 3" in page _____.

47. 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).
48. If you scored a satisfactory evaluation proceed to “Operation Sheet 1” in page_____, however, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity #1.
49. Read the “Operation Sheet 1” and try to understand the procedures discussed.

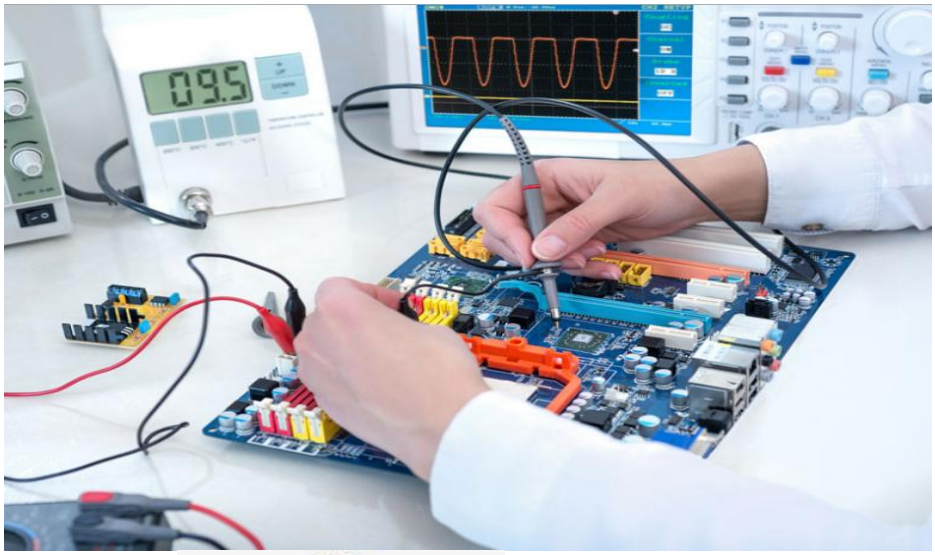
| Information sheet -1 | Subject finished products to final visual in section and testing |
|---|---|

4.1 Subject finished products to final visual in section and testing

- **Inspection** and **testing** are performed before, during, and after manufacturing to ensure that the quality level of the product is within acceptable design standards. Each item in the sample is inspected or **tested** for certain quality characteristics
- An **inspection** is, most generally, an organized examination or formal evaluation exercise. In engineering activities inspection involves the measurements, tests,

and gauges applied to certain characteristics in regard to an object or activity. The results are usually compared to specified requirements and standards for determining whether the item or activity is in line with these targets, often with a Standard Inspection Procedure in place to ensure consistent checking. Inspections are usually non-destructive.

- **Visual inspection** is a common method of quality control, data acquisition, and data analysis. Visual Inspection, used in maintenance of facilities, mean inspection of equipment and structures using either or all of raw human senses such as vision, hearing, touch and smell and/or any non-specialized inspection equipment. Sometimes at higher level visual Inspection requires Ultrasonic, X-Ray equipment, Infra-red…. etc.




*Figture*. A) Inspecting b) recording c) rating or marking

| Self-Check -1 | Written Test |
|---|---|

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

**Choose best answer form give alternatives**

1. why inspection is needed at work completion?
   A) for quality control
   B) for safety purpose
   C) for work completion
   D) All
2. when do we perform inspection ?
   A) during manufacturing
   B) after work completion
   C) during the use of product
   D) all
3._____ is a common method of quality control & data acquisition
   A) Safety
   B) Visual inspection
   C) Cleaning
   D) all

| ***Note:* Satisfactory rating - 2 points** | **Unsatisfactory - below 2 points** |
|---|---|
| You can ask you teacher for the copy of the correct answers. | |
| **Answer sheet** | Score = _____<br>Rating: _____ |

Name: _____ Date: _____

**Short Answer Questions**

1._____

| **Information sheet - 2** | **Document and inform work completion to responsible person** |
|---|---|

4.2 Document and inform work completion to responsible person is in accordance with established procedures

- The Work document, sometimes known as the statement of Work or what document will enumerate. For example:-
  A) The work to be done.
  B) Who is responsible for the work
  C) How the work should be performed (techniques used), and
  D) What materials will be used

- The document will detail how change orders are handled.
- The work requires time limit, schedule and work quality and the completion also must be in time frame and agreement of your instructor/ trainer. Another important component of work is the document of work and record which fully explain the process of work and current status.
- In Special Conditions document will specify or explain certain conditions and clauses that be relevant to specific portions of the job. For example, if there are specific instructions that apply to only one portion of the job, the Special Conditions section is where this will be described.

**908 AW 2014 SAFETY COMPLIANCE CHECKLIST**

Sources for this document include: Air Force Occupational Safety and Health Standards (AFOSH), Air Force Instructions (AFI's), Air Force Technical Orders (TO's), Federal Occupational Safety and Health Act standards (29 CFR), Federal Public Laws (PL), the National Electric Code (NEC), American National Standards Institute, 908 Mishap Prevention Program and the National Fire Protection Agency.

Although the information contained in this publication has been compiled directly from the published sources, it is not intended to be the sole or final source of information pertaining to the subject. It may be necessary to consult the source further for complete information.

Replaces 908 AW 2013 Safety Compliance Checklist — OPR: 908 AW/SE

Current as of 12 Mar 14

INDEX

| PROGRAM INSPECTION | FACILITY MANAGEMENT |
|---|---|
| Sec 1, Supervisor Responsibilities | Sec 24, Abrasive Operations |
| Sec 2, Safety Bulletin Board | Sec 25, Compressed Air/Compressed Gas Cylinders/System |
| Sec 3, Emergency Action Plan | Sec 26, Flammable and Combustibles |
| Sec 4, Respirators | * Inside Storage Rooms |

| | Reference and Title | Publications Date |
|---|---|---|
| 1 | American National Standards | 2012 |
| 2 | 29 Code of Federal Regulations Title 40 (Occupational Safety & Health Agency- (29 CFR)) | N/A |
| 3 | 908 Mishap Prevention Program | 1-Jun-13 |

This is not an all inclusive checklist. Like most checklists, this simply highlights some critical items. Other requirements exist that are not in this checklist. Consult AFI's and AFOSH Standards for a more specific listing.

| Item No. | Compliance Area | Reference | Complies | Complies with Comment | Does Not Comply | N/A |
|---|---|---|---|---|---|---|
| | PROGRAM MANAGEMENT | | | | | |
| | | Reference | C | CWC | DNC | N/A |
| 1 | Supervisor Responsibilities | | | | | |
| 1.1. V | Does the supervisor accomplish Job Safety and Occupational health training for each newly assigned worker and on each worker who has not previously received this training? | AFI 91-202, Para. 2.3.3.1 | | | | |

*Fig. inspection and documentation*

| Self-Check -2 | Written Test |
|---|---|

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

**Part –I: Choose best answer form give alternatives**

**Self check**

1. What is work document?
   A) statement of Work
   B) procedure of work
   C) history of job & standard

D) all

2. What can be listed/written in work document?
   A) The work to be done.
   B) Who is responsible for the work
   C) How the work should be performed
   D) What materials will be used
   E) All
3. Who can be informed about work completion?
   A) Contracting person
   B) Inspector/ quality controller
   C) Trainer/instructor
   D) Coach
   E) All

| ***Note:* Satisfactory rating - 2 points** | **Unsatisfactory - below 2 points** |
|---|---|
| You can ask you teacher for the copy of the correct answers. | |
| **Answer sheet** | Score = _____<br>Rating: _____ |

Name: _____ Date: _____

| Information sheet -3 | Housekeeping procedures and 5s |
|---|---|

4.3 Follow Housekeeping procedures in accordance with 5S discipline and established procedures

- Workshop Housekeeping is operational procedures to ensure
  - ✓ Cleanliness
  - ✓ Safety
  - ✓ sanitation and maintenance for a work area
  - ✓ safety of stored equipment
  - ✓ Safety of store or warehouse.
- Workshop should be kept neat and tidy. Good housekeeping can significantly reduce the risk of an accident and injury, failure to maintain a clean and tidy Workshop can result in accident and injury. Work areas and equipment are to be thoroughly cleaned after use.

- Benches are to be kept clean and free from chemicals and apparatus that are not being used. Aisles and exits are to be kept free from obstructions. All walkways, work stations, access to emergency equipment and exits shall be free from obstruction at all times. Liquid spills shall be cleaned up immediately. Heaps or stacks of equipment shall be stable and shall not obstruct lines of view necessary for supervision of shop users. Wood and metal dusts shall be collected at the end of each operation. Dry sweeping is not recommended and the use of air hoses is not permitted. Flammable and combustible materials shall not be allowed to accumulate in open areas of the workshop. Principle of 5s must be applied to the workplace all time to reduce hazard, to keep work area free and clean, to increase produce quality and to reduce waste.


*Figture. Housekeeping materials*

**THE 5S PRINCIPLES**

| 5S | JAPANESE WORD | ENGLISH TERM | ACTION | EFFECTS |
|---|---|---|---|---|
| 1S | SEIRI | SORT | Identify and eliminate all unnecessary items. | ACTIONS |
| 2S | SEITON | SYSTEMATIZE | Arrange necessary items in good order and easy access. | |
| 3S | SEISO | SWEEP | Clean your workplace thoroughly. | |
| 4S | SEIKETSU | STANDARDIZE | Maintain high standards of housekeeping and workplace organization at all times. | CULTURE |
| 5S | SHITSUKE | SUSTAIN/SELF DISCIPLINE | Create a culture wherein all members practice the above 4S as a way of life. | HABIT |

**Hand Tools**

Ensure electric tools are of the double insulation type and are inspected regularly. Use a soft-face hammer or other safe tool where there is a danger of sparks igniting flammable substances.

Ensure that cutting tools, such as drills and chisels, are kept sharp. Keep tools which are not in use in stores, or stowed so that they cannot be tripped over or be knocked from benches. When working with tools at height makes sures they cannot fall. The use of securing line is highly recommended. Do not leave power tools switched on when disconnected from their power as unexpected starting will occur when power is re-connected.

**Lighting and Air Conditioning**

Position lights so that they cannot light flammable material on. Illuminate gangways and work areas so that possible floor hazards can be seen. Ensure that power cables to lights, air hoses and portable tools do not constitute a hazard. Keep lights and cables away from flammable goods. Illuminate dark corners so that flammable rubbish cannot accumulate without being seen. Make sure that gas cylinder are kept in upright position and are secured from falling at all times.

A housekeeping Standard Operating Procedure (SOP) is a documented, step-by-step process on how to effectively perform housekeeping procedures, such as daily cleaning and maintenance tasks.

**Power Sources**

Ensure that cables, power lines, pipes and hoses are not allowed to trail across gangways or work areas. Check insulation, switches and fuse boxes for possible hazards. Ensure warning signs are clear and easily seen. Ensure that correct type of firefighting equipment, shutdown, and alarm systems are fully operational and accessible in areas containing power supplies not suitable for use in potentially hazardous atmosphere.

*Fig. Cleaning process*

| Self-Check -3 | Written Test |
|---|---|

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

**Part –I: Choose best answer form give alternatives**

**1. Housekeeping is necessary for reducing_____.**

A) Accident and injury
B) failure to maintain a clean and tidy
C) failure of equipment
D) all

**2. Which of the following is not a component of 5s?**

A) Seiri
B) Seiketsu
C) Seiso
D) None

3. Who is the beneficiary from applied 5s at workplace?

A) Trainees
B) Instructor/Trainer
C) Institution/Companies
D) Country
E) All

**PART-II: - write the answer for the following question.**

1. Write types of fire extinguisher and class of fire

   _____

   _____

   _____

| ***Note:*** **Satisfactory rating - 3 points** | **Unsatisfactory - below 3 points** |
|---|---|
| You can ask you teacher for the copy of the correct answers. | |
| **Answer sheet** | Score = _____<br>Rating: _____ |

Name: _____ Date: _____

**Short Answer Questions**

1._____

**Self-check 3 answer**

1. D 2. D 3. E

**Reference**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