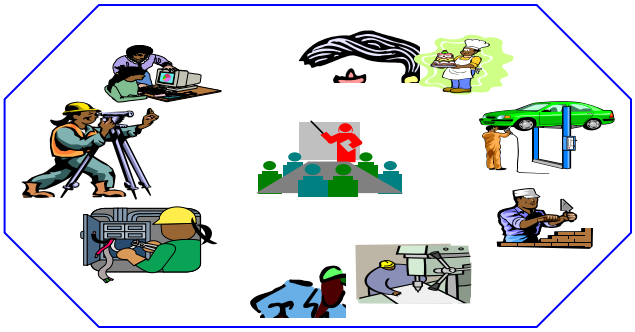

Basic Home/Office Electrical/ Electronic Equipment Servicing Level II

Based on May, 2011E.C, Version 3 Occupational Standard

Module Title: Assembling and Disassembling Home/Office Electrical/Electronic Equipment

LG Code: EEL HOS2 M05 LO (1-4) LG (16-18)

TTLM Code: EEL HOS2 TTLM 1220v1

December 2020

Bishoftu, Ethiopia

Contents

LG #16	LO #1- Prepare product and work station for assemble/ disassemble

Instruction sheet

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

- Preparing workplace in accordance with OH&S policies and procedures
- Consulting with Responsible person
- Preparing materials, tools and equipment

This guide will also assist you to attain the learning outcomes 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 with Responsible person
- Prepare materials, tools and equipment

Learning Instructions:

Read the specific objectives of this Learning Guide.

1. Follow the instructions described below.
2. Read the information written in the "Information Sheets". Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
3. Accomplish the "Self-checks" which are placed following all information sheets.
4. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
5. If you earned a satisfactory evaluation proceed to "Operation sheets
6. Perform "the Learning activity performance test" which is placed following "Operation sheets" ,
7. If your performance is satisfactory proceed to the next learning guide,
8. If your performance is unsatisfactory, see your trainer for further instructions or go back to "Operation sheets".

Information Sheet 1: Preparing workplace in accordance with OH&S policies and procedures

1. Preparing workplace in accordance with OH&S policies and procedure

1.1. Introduction

A health and safety program is a definite plan of action designed to prevent accidents and occupational diseases. Some form of a program is required under occupational health and safety legislation in most Canadian jurisdictions. A health and safety program must include the elements required by the health and safety legislation as a minimum, Because organizations differ, a program developed for one organization cannot necessarily be expected to meet the needs of another. This document summarizes the general elements of a health and safety program. This approach should help smaller organizations to develop programs to deal with their specific needs [1].

Canadian health and safety legislation requires employers to have a health and safety program in their workplace. A written occupational health and safety policy helps promote an effective OHS program. Such a policy should reflect the special needs of your workplace and should be regularly reviewed and updated. This document will assist you in writing and applying a policy for your workplace. This policy communicates a commitment to health and safety. It should be signed by a senior manager or president to further demonstrate the commitment to health and safety.

1.2. Effective policy statement

There are many differences in form and content of corporate policies. Their style, however, is not as important as the clarity with which they identify functional responsibilities over authority.

To be effective, a policy must:

- Involve senior management and representatives in the preparation of the policy,
- Be seen as consistent with the workplace's objectives of operating in an efficient and predictable manner,

- be relevant and appropriate to the nature, scale and OHS hazards and risk associated with that workplaces' needs (not adopted from another workplace), and
- be accepted as equal in importance to the workplace's other policy objectives

1.2.1. Issue should the OHS policy statement cover

The policy statement should provide a clear indication of the company's objectives and plans for occupational health and safety. The following issues should be covered in the statement [2]:

- senior management's commitment to the establishment of a healthy and safe workplace and to the integration of health and safety into all workplace activities,
- the commitment to comply with applicable OHS legal requirements and other requirements – or better, the intention to treat applicable health and safety legislation as a minimum standard rather than maximum,
- responsibility of appropriate personnel in maintaining a healthy and safe workplace and to protect the well-being of all persons in the workplace,
- accountability of all levels of management for carrying out health and safety responsibilities,
- importance of consultation and co-operation between management and employees for effective implementation of policy and any related programs,
- commitment to continual improvement by conducting regular reviews of the policy,
- commitment to monitor the policy's effectiveness by having a method for setting and reviewing OHS objectives and targets,
- that the policy will be documented, posted, and communicated internally as well as externally, as appropriate, and
- commitment to provide adequate funds and details of how money will be available

1.3. Prepare Workplace

A **workplace** is a location where someone works for their employer, a place of employment. Such a place can range from a home office to a large office building or factory. For industrialized societies, the workplace is one of the most important social spaces other than the home, constituting "a central concept for several entities: the worker and his/her

family, the employing organization, the customers of the organization, and the society as a whole". The development of new communication technologies have led to the development of the virtual workplace, a workplace that is not located in any one physical space.

1.3.1. Purpose of the workplace

Workplaces help businesses deliver their products or services to consumers in an efficient way. Corporate team members use their place of work to collaborate and develop new ideas, products and services to offer to their customers. Businesses use factories to create their product and distribution centers to coordinate the shipment of the product to stores or directly to the consumer. Stores exist to sell the product to consumers by giving a space for customers to physically see the product.

1.3.2. safety precautions to take when working with electronic equipment

When working with or testing any electronic equipment, it's always important to be cautious. Whatever type of equipment you're handling, whether simple or complex, it's important to take the right safety precautions.

Working with electricity comes with huge risks that should never be taken lightly. If you're a hobbyist who loves working with electronic components or an electronics professional at your workplace, safety should always come first.

To avoid personal injury, possible damage to equipment or danger of fire, all work on electronic equipment should be conducted following these safety procedures.

General Safety

Before working on any electronics, consider following these basic safety precautions to help reduce any hazards.

- Remove any electronic equipment you're testing or working on from the power source.
- Never assume the power circuit is off. Test and test again with a voltmeter to confirm.
- Remove fuses and replace them only after the power to the circuit is disconnected.
- Don't connect power to a circuit until you're done working on it and rechecked the work.
- Always ensure that all electronics equipment is properly grounded

- If it's damaged, replace it. For instance, replace cables instead of repairing with insulating tape.
- Always use the right electronics repair and maintenance tools.
- Always return covers after removing them to reduce the risk of electric shock.
- Make sure your circuit is not overloaded.
- Always have safety equipment like a fire extinguisher, a basic first aid kit and a mobile phone nearby.

Personal Safety

It's important to ensure that you're safe when working on electronic circuits. Here are some personal safety precautions to keep in mind [3]:

- Always keep your work area dry.
- Always work in a well-ventilated area.
- Don't wear flapping or loose clothing when working.
- Don't work with metallic jewelry on your hands like watches, rings and bracelets.
- Don't use bare hands to remove hot parts.
- Always wear non-conductive shoes.
- Always wear insulator gloves in your hands when carrying out repairs.
- When removing high-voltage charges on capacitors, always use a shorting stick.
- Don't hold the test prods when measuring voltage over 300V.
- Always remove power to a circuit before connecting alligator clips.
- Always wear safety goggles.
- Be careful when handling large capacitors as they can still hold high voltage even after you've disconnected the circuit from power.

High Voltage Safety

One mistake that electronics experts make when doing repairs or maintenance work is assuming routine safety procedures after getting all too familiar with their work. It's important to know that most electronic equipment use high-voltage that is dangerous and can be fatal. Always follow these safety precautions when working on or near high-voltage circuits.

- Don't work on electronic equipment or make repairs with high voltage on.
- Don't take chances doing what you're not sure about.

- Consider using an isolation transformer when working on AC powered electronic circuits or equipment.
- Never tamper with interlocks.
- Don't ground yourself: Make it a practice to use only one hand when connecting equipment to an electronic circuit.

Figure 1.1. High voltage equipments

Fire Safety Precautions

When working with electronic equipment, there is often a risk of fire caused by a short circuit or other reason. Follow these precautionary steps:

- Avoid anything that would cause a fire around your working area like paper, cloth or other combustible materials.
- Look out for damaged wire insulation, overheating of electronic equipment, damaged circuit boards and corrosive components like batteries.
- If there is a burning smell on your electronic equipment, disconnect the power source.
- If there is a fire, use a non-conducting dry powder or CO2 fire extinguisher.
- Always check your circuit to be sure that everything is okay after repairs or maintenance before connecting power.

Electric Shock

One of the major hazards when working with electronic equipment is electric shock. To avoid this, you should take a few safety precautions, including:

- Always read safety procedures that come with every electronic equipment you're about to test or work on.
- Recheck all wires for bad connections
- Always make sure that all parts of electronic equipment are well-mounted to prevent accidents.
- Keep electronic equipment away from water and other liquids
- Always check for signs of wear, defects and fraying on electronic equipment cables, cords and connectors.
- Use special safety rubber gloves and shoes.

Testing Equipment

With the increasing use of electronics in homes and workplaces, safety is becoming more and more important to consumers and service experts. If you're an electronics expert offering repair and maintenance services, it's important to invest in the right new or used testing equipment for your work—that ensures that you're able to carry out your job safely.

Self-Check1	**Written Test**

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

Part I

I. Discuss the following question (each 5 point)

1. Discuss how to prepare workplace in accordance with OHS policy and procedures?
2. Discuss OHS policy and procedures?
3. Explain safety precautions to take when working with electronic equipment?

Part II

II. Choose the correct answer for the following questions (each 5 point)

1. One of the major hazards, when working with electronic equipment is?
   - **a.** Electric Shock
   - c. Precautions
   - **b.** Testing Equipment
   - d. none
2. _____is a location where someone works for their employer, a place of employment
   - a. Personal Safety
   - C. workplace

b. Electric Shock d. all

Note: Satisfactory rating above 25 points Unsatisfactory - below 25

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

Score_____
Rating_____

Information Sheet 2:- Consulting with Responsible person

2.1. Introductions

Consulting is to get information or advice from a person, esp. an expert, or to look at written material in order to get information.

2.2. Consulting with responsible person

Let our electrical consulting experts save you energy. You'd be surprised at the amount of electricity that is wasted by homes, shops and businesses each year, often unwittingly. Our electrical consulting services have been designed to spotlight problem areas and find solutions that cut your energy consumption and save you money.

2.2.1. Electrical consulting: the right solutions for you

Buhler Scherler AG has many years of experience in offering electrical consulting services for national and international clients from a wide range of backgrounds. Expertise include electrical consulting, energy concepts, metrology, process technology and building automation. As an electrical consulting expert we are able to draw on our extensive network to offer customer specific solutions for both large and small projects. Buhler Scherler is committed to finding power management solutions that save you money yet have minimal impact on the environment. Today, ecological issues are more important than ever and business around the globe are adopting greener energy policies. Our electrical consulting team can provide you with the means to save up to 30 percent annually by reducing your overall energy consumption. We'll help you find sustainable energy sources that are economically viable and ecologically sound [4].

2.2.2. Electrical consulting experts: Monitor your energy use with our help

With energy more precious than ever, it's vital that we use our resources in the most responsible manner. Not only does this benefit the environment and create cleaner air through a reduction in Carbon dioxide emissions, you'll enjoy considerable savings from the start. Electrical consulting experts can highlight where you can save energy and help you to monitor your overall usage. The Buhler, Scherler Monitoring Tool is cost-effective and easy to implement. It features a clear

display of energy values with automatic evaluation and is a simple but effective way to monitor and improve your ecological footprint. It's possible to save up to 30 percent compared with prior usage and, of course, less energy wasted means less cash outlay for you. Buhler, Scherler AG has built its reputation as a leader in electrical consulting through energy advice that is truly beneficial to our many satisfied clients. Take a look at www.buhler-scherler.com for more information on our services, including electrical consulting. If less expense and better results are important to you, it makes sense to call on the electrical consulting experts. Buhler, Scherler AG can help you to find the answer that best suits your budget and operation whether you're a large company or a small individual project. We aim to support our clients through every stage of energy optimization via electrical consulting services that are designed with today's ecologically aware world in mind. Don't hesitate to contact us for further advice on any aspect of electrical consulting or take a look at some of the exciting options featured.

Self-Check 2	**Written Test**

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

I. Discuss the following question (each 5 point)

1. Explain Electrical Consulting experts?
2. Discuss Electrical Consulting?
3. Discuss how to consult Office machine Equipments maintenances?

Part II

II. Choose the correct answer for the following questions (each 5 point)

1. _____is to get information or advice from a person, esp. an expert, or to look at written material in order to get information.

   a. Customer c. Consulting

   b. Experts d. none

Note: Satisfactory rating 20 **Unsatisfactory – below 20**

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

Score_____

Rating_____

Information Sheet 3:- Preparing materials, tools and equipment

3.1. Introductions

Working safely with tools and equipment is no simple matter IF one doesn't know how to do it properly.

It turns out that there are various methods and tips that we all need to keep in mind when working with the gear that helps us do our jobs properly. To avoid hazards and work effectively and efficiently using certain items, some safety tips are in order.

3.2. Essential Safety Tips for Working with Tools & Equipment

First of all, we're going to enlighten you on work methods and tools.

- You need to ensure that you are using the correct tools for the job. Using the wrong tools is a safety risk.
- You need to ensure that you protect your eyes when working with a wide range of tools and equipment. Not using safety glasses is a hazard as well.
- You need to use and store sharp objects very carefully. Ensure that you sheath them before you store them away (if you don't or if you aren't very careful with them, you are going to put your safety at risk as well as the safety of others on your team).
- You need to report any injuries or accidents that you or anyone else may have incurred. That way, it will be less likely for accident or injury to happen again.

Following these steps will help reduce risk in your workplace, and help you and your teammates work more safely.

3.2.1. Further Ways to Work Safely

Next up, we'd like to share with you some general safety tips to ensure the safe use of equipment and tools.

- Ensure that your tools are properly maintained and that you use them correctly in order to avoid hazards
- Ensure that you keep your eyes open for any signs of problems with electrical equipment in the work environment (this may include signs such as faulty connections, smoke, sparks, loose wires, etc.)

Figure 2.1. Measure safely

- Ensure that you don't tamper with any electrical equipment that you suspect needs repair (consult with qualified personnel to do the necessary repairs)
- Ensure that you switch off computers, printers and other electrical equipment at the socket
- Ensure that you never overload the socket outlet
- Ensure that you use the right adapters for items of equipment that have two-pin plugs

By keeping these safety tips in mind, you're helping yourself, your coworkers and your organization maintain and enhance a safe and productive workplace.

3.4.1. How to Set Up an Electronics Lab: Tools, Material and Equipment

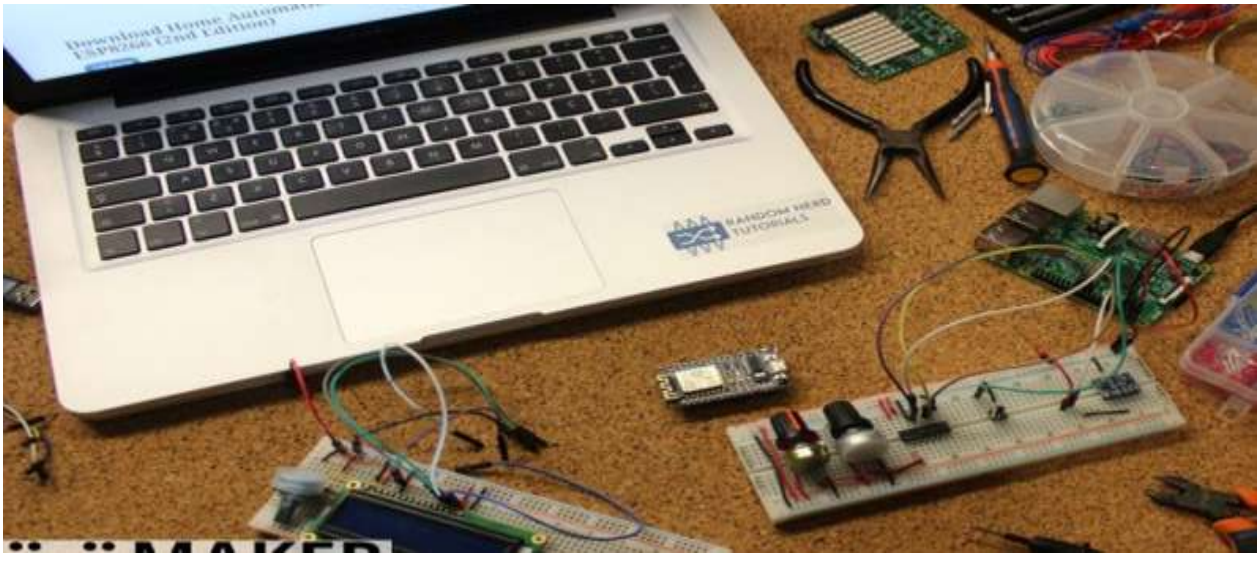

Figure 2.2. Electronics Lab

If you've decided to start learning electronics and you're looking to set up your own hobbyist electronics lab, you're in the right place. This guide will help you learn how to set up an electronics lab and find the right tools and equipment [5].

3.4.1. Setting Up an Electronics Lab

When you're just getting started, it is difficult to know what tools are or aren't essential, or what are the best tools.

This list contains a lot of different tools. You don't need to buy them all at once. Otherwise, you'll end up buying stuff that you don't need or stuff you'll never use! Start by purchasing a few essential tools related to the projects you want to do. Then, as your lab, and your expertise starts growing, upgrade you lab with new tools.

3.4.2. Finding the Right Spot

Making electronics projects is a lot of fun and it is nice to have a specific space to be our lab, a space where we have all we need to make our projects. It doesn't have to be a full room or a big space. But it's important to have "the" space! A space that is ours and where we can have all things we need to get the most of making electronics projects.

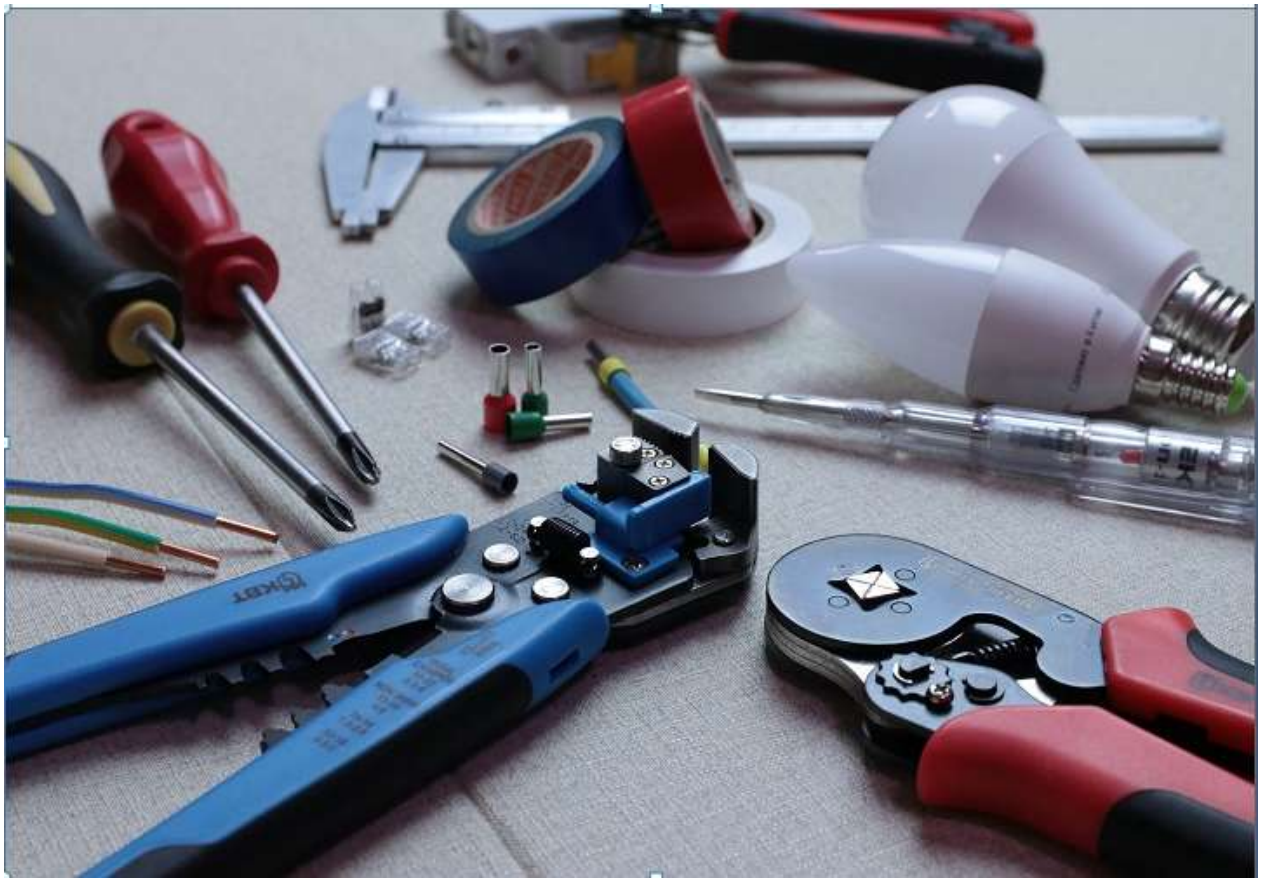

Figure 2.3. Electronics tools

Once you have your spot, you need to set it up! We'll show you some essential tools to set up your own electronics lab.

Multimeter

A multimeter is a measurement tool absolutely necessary. It helps you troubleshooting your circuits. Sometimes your circuits may not work because of faulty wires. Checking the connections with the millimeter can save a lot of time.

If you're looking for one, we truly recommend an auto-range millimeter. The auto-ranging is a great advantage, because it saves you of the hassle of having to guess which range of value the electrical characteristic you're measuring falls under.

Figure 2.4. Millimeter

Soldering Station

Having a soldering station in an electronics lab is absolutely necessary, even if you don't usually build permanent circuits. Many electronics components don't come with header pins or breadboard-friendly pins attached. In these cases, you'll need to do some soldering work. If you don't do a lot of soldering, a simple soldering station will do the job. However, we really recommend getting a good soldering station with enough wattage and adjustable temperature. A good soldering station will last your entire life.

If you're looking for a soldering station, you may be interested in reading our suggestions about the best soldering irons for beginners and electronics hobbyists.

Figure 2.5. Soldering Staions

If you are limited in terms of space, you may want to get a small portable soldering iron. We really recommend the TS80 mini portable soldering iron. It is as good as a regular soldering iron and occupies very little space. Read our review: TS100 Soldering Iron Review – Best Portable Soldering Iron [6].

Soldering Accessories

Besides the soldering station you also need some soldering accessories:

- Solder: the easiest type to work with is 60/40 lead/tin.
- Solder wick: the wick soaks up molten solder, it's useful to clean the excess of solder.
- Cleaning sponge: to clean the tip of your iron while soldering.
- Tip thinner: used to clean the tip of the soldering iron.
- Diagonal cutting pliers: useful to trim the leads after soldering.
- Helping hand: to hold your components together while you solder.
- Flux pen: the flux pen content aids the flowing of a lead-free solder.
- Solder vacuum pump: this tool helps you removing the solder left when desoldering components.

For more soldering accessories, take a look at the Top 10 Soldering Accessories and Tools.

Figure 2.6. Thinner

Bench Power Supply

A voltage supply may not be essential in simple and beginner projects, but it is a really practical tool when it comes to circuits. It allows you to power your circuits before they are finished, to test individual circuits, to experiment, etc. Nowadays, simple bench DC power supplies aren't that expensive anymore. In fact, you can get one for less than $100. Read the best bench power supply for electronics hobbyists buying guide.

Figure 2.7. Electronics Power supply

Oscilloscope

An oscilloscope is a great tool for debugging and better understands what is going on with your circuits. Unlike a millimeter that only shows the voltage at a specific moment, with an oscilloscope you can see what's happening with the voltage over time. We have an Hantek DSO5102P Digital Storage Oscilloscope (DSO) and it is a great entry-level oscilloscope for students, beginners and DIYers (read our review).

Figure 2.8. Hantek DSO5102P Digital Storage Oscilloscope 2Channels 100MHz 1GSa/s

Oscilloscopes are expensive. A cheap regular bench oscilloscope costs at around $300. However, there are very cheap oscilloscope kits that can perform the most basic functions for a very low price. For example, the DSO150 low cost oscilloscope may cost between $25 and $40. This oscilloscope doesn't replace a real oscilloscope, but it is good enough if you're just getting started.

Figure 2.9. Original JYE Tech Assembled DSO-SHELL DSO150 Oscilloscope

Needle-nose Pliers and Wire Cutter

A needle-nose pliers is always handy. You should absolutely get one. Wire cutters are also absolutely essential.

Figure 2.10. Needle-nose Pliers and Wire Cutter

Hot Glue Gun

Hot glue is great. It is very handy for a wide variety of applications if you want to make something stick together. In electronics, hot glue is perfect to fix your circuit into a surface or to attach cables together. As the glue is an insulating material, it can help you protect your circuitry. Check our post about hot glue guns: best hot glue guns – our budget and top picks.

Figure 2.11. Hot Glue Gun

Precision Screwdriver Set

There are components with really small screws and with specific shapes and so, at some point in your projects, you'll need a precision screwdriver. We recommend you getting a set take comes with extension bits because you'll need all of them sooner or later. Take a look at best precision screwdriver sets – our budget and top picks.

Figure 2.12. Precision Screwdriver Set

Tweezers

Tweezers are very useful to manipulate the small electronics components. The tweezers below have an extremely small and pointed tip, which is perfect for electronics.

Figure 2.13 Tweezers

Rotary Tool and Accessories

A rotary tool is great if you like to give your projects a good finished look. This tool is good for working with acrylic, plastic, wood, and more. This tool is not essential for your lab, but it can be very useful.

Figure 2.14: Rotary Tool and Accessories

3D Printer

A 3D printer is not an essential tools in an electronics lab, but it is very useful. With a 3D printer you can take your projects to the next level by building personalized box enclosures, robot parts, and much more [7]. There is a wide variety of 3D printers for all sorts of budgets.

We have a Creality 3D CR-10 3D printer and we're really happy with its performance – you can read our review about the Creality CR-10 3D printer here.

Figure 2.15. 3D printer

Assortment Kits and Electronics Components

Besides the previous tools, you need some electronics components to get started. It is easier and cheaper to get started with assortment kits. Here's some of the assortments kits we recommend:

Figure 2.16. Elegoo EL-CK-003 Upgraded Electronics Fun Kit

Figure 2.17. XL Electronic Component Kit Assortment

Breadboards

Breadboard are a must for prototyping and testing your circuitry. Once you start doing electronics projects, you'll realize that you'll never have enough breadboards for your projects. Check the breadboard options in our Tools page. There are also breadboard kits that come with other useful accessories for the breadboard.

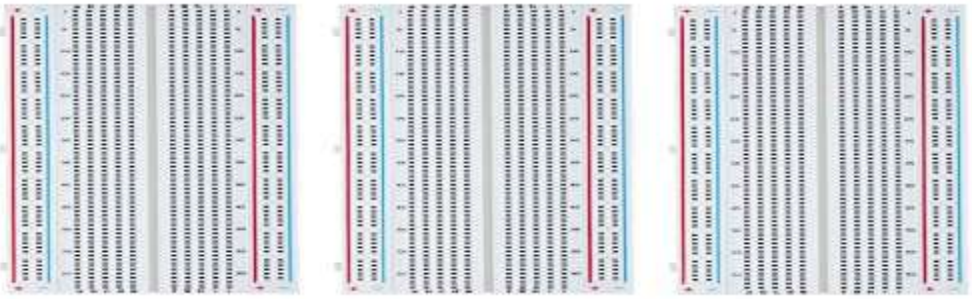

Figure 2.18. Elegoo 3pcs MB-102 Breadboard 830 Point

Figure 2.19. Breadboard Kit

Jumper Wires

Jumper wires are really handy to connect components together. We recommend getting female to female, male to female, and male to male jumper wires.

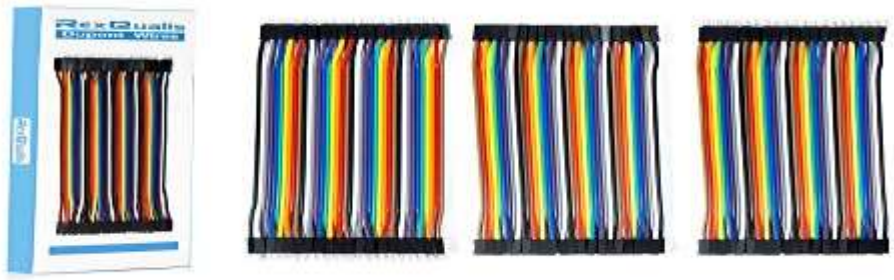

Figure 2.20. 120pcs Multicolored Dupont Wire Kit 40pin Male to Female, 40pin Male to Male, 40pin Female to...

Figure 2.21. Remington Industries Solid Hook-Up Wire Kit, 300V, 0.0253" Diameter, 25' Length

Figure 2.22. WGCD 18 Knurled Shaft Linear Rotary Taper Potentiometer with Cap Kit (18 PCS)

Other Electronics Components

It can also be useful getting kits with transistors, diodes, and capacitors.

Figure 2.23. Electronics-Salon 0.47uF to 1000uF Electrolytic Capacitors Assortment Kit, 13 Values, Total 200...

Figure 2.24. Hilitchi 24-Values 2N2222-S9018 / BC327-BC558 NPN PNP Power General Purpose Transistors...

Figure 2.25. Ltvystore 100PCS 10Value (1N4001~1N5819) Diode Assorted Kit Set with Clear Box

Figure 2.26. 10pF to 100nF 15Values Ceramic Capacitor Set, Hilitchi 525Pcs DIP Monolithic Multilayer Ceramic...

Varied Sensors and Modules

There are a wide variety of sensors and modules compatible with Arduino and other development boards. You can get some of them for a very reasonable price. Check the all the sensors options at our tools page.

Figure 2.27. Elegoo Upgraded 37 in 1 Sensor Modules Kit with Tutorial for Arduino

Arduino Starter Kit

An Arduino Starter Kit is the easiest way to start with digital electronics and programming. We have a full post dedicated to Arduino Starter Kits that you can read here.

Figure 2.28. Elegoo EL-KIT-001 UNO R3 Project Complete Starter Kit with Tutorial for Arduino (63 Items).

Figure 2.29. ARDUINO The Starter Kit

Cabinet organizer

A cabinet organizer is essential so that you have all your components organized. We've put together a list with the Best Storage Organizers For Electronic Components and Parts.

Figure 2.30. Akro-Mils 10164 64 Drawer Plastic Parts Storage Hardware and Craft Cabinet

Maker Advisor Tools Page

You may also find useful taking a look at our Tools page here. We share the components and tools we use more often, and compare the price on different stores, so that you can get the best price.

Self-Check 3	Written Test

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

I. Discuss the following question (each 5 point)

1. Explain How To Set Up an Electronics Lab?
2. Discuss Essential Safety Tips for Working with Tools & Equipment?
3. Discuss at least three ways to work safely with tools, material and equipment?

Part II

II. Choose the correct answer for the following questions (each 5 point)

1. _____ is a measurement tool absolutely necessary. It helps you troubleshooting your circuits and components.

   a. Tachometer c. multimeter
   b. Millimeter all

2. _____is essential so that you have all your components organized. We've put together a list with the Best Storage Organizers for Electronic Components and Parts.

   a. Maker Advisor Tools Page c. a and b
   b. Cabinet organizer d. none

Note: Satisfactory rating 25 points Unsatisfactory - below 25

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

Score = _____
Rating: _____

Operation Sheet #1	Test and Inspect assembled products

Operation Title: - Identify and Prepare materials, tools and equipment for maintainance.

PURPOSE: -

- The trainee's will be able to keep the procedures.
- The trainee's will be able to Identify tools equipment and material for maintenance.
- The trainee's will be able to prepare tools, equipment and material for maintenance.

Conditions or situations for operation: - Have a clean workspace with all necessary tools and equipment.

Equipment, Tools & Materials: - Maintenance room, Millimeter, Screw driver, Test light, Brush, Circuit boards.

Procedure: - 1. Check/Inspect Maintained/ assemble product

- ✓ Step 1: Clean working area.
- ✓ Step 2: Prepare Electronic tools used for maintains.
- ✓ Step 3: Prepare Electronic Equipment for maintenance.

Precautions:-

- ➢ Take ESD precautions.
- ➢ Document everything (backup).
- ➢ Power all devices and disconnect them from the main power supply.

Quality Criteria:-

- ➢ The trainee's use safety for documents &components.
- ➢ The trainee's make Identifications and preparations of tools, equipment and materials.

Lap Test #1	**Practical Demonstration**

Name: _____ Date: _____

Time started: _____Time finished: _____

Instructions: You are required to perform the following individually with the presence of your teacher.

1. How to prepare electronics Tools for maintenance?
2. How to prepare electronic Equipment for maintenance?
3. From General safety precautions show the antistatic:
    - ✓ Electrostatic wrist strip
    - ✓ Antistatic mat
    - ✓ Antistatic box

- Your teacher will evaluate your output either satisfactory or unsatisfactory. If Unsatisfactory, your teacher shall advice you on additional work. But if satisfactory, you can proceed to the next topic

LG #17	LO #2- Solder/ De solder components to the board

Instruction sheet

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 Soldering and de-soldering processes
- Checking solder products

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

- Perform Soldering and de-soldering processes
- Check Soldering and de-soldering processes
- Check solder products

Learning Instructions:

Read the specific objectives of this Learning Guide.

1. Follow the instructions described below.

2. Read the information written in the "Information Sheets". Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.

3. Accomplish the "Self-checks" which are placed following all information sheets.

4. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).

5. If you earned a satisfactory evaluation proceed to "Operation sheets

6. Perform "the Learning activity performance test" which is placed following "Operation sheets" 7. If your performance is satisfactory proceed to the next learning guide,

8. If your performance is unsatisfactory, see your trainer for further instructions or go back to "Operation sheets".

Information Sheet 1: Performing Soldering and de-soldering

1.1. Introduction

The concept of soldering has been know for very many years. Some silver solder joints have been found on items dating back to between 3000 and 2000 BC. More recently soldering developed in the 19th Century for various craft uses and then with the advent of radio and later electronics around the beginning of the 20th Century it came into its own. Initially a tin / lead solder was used, but as the health and general environmental issues of lead became of wider concern, lead-free soldering technology was introduced. In Europe RoHS directives required that electronic circuit boards were lead free by 1 July 2006. However even before this many countries and companies were turning to lead free soldering, often as a result of recycling pressures.

1.2. Solder component to board

Solder is melted by using heat from an iron connected to a temperature controller. It is heated up to temperatures beyond its melting point at around 600 degrees Fahrenheit which then causes it to melt, which then cools creating the soldered joint. As well as creating strong electrical joints solder can also be removed using a disordering tool. Solder is a metal alloy used to create strong permanent bonds; such as copper joining in circuit boards and copper pipe joints. It can also be supplied in two different types and diameters, lead and lead free and also can be between .032" and .062". Inside the solder core is the flux, a material used to strengthen and improve its mechanical properties.

What Metals are Used?

Filler metals used in soldering were once lead based (lead solder), however, owing to regulations, lead-based solders are increasingly replaced with lead free solders, which may consist of antimony, bismuth, brass, copper, indium, tin or silver.

Which Flux Can be Used for Soldering?

Occasionally at the site of the joint, there are impurities such as oil, dirt or oxidation, the flux helps prevent oxidation and can sometimes chemically clean the metal. The flux used is **rosin flux** which helps the mechanical strength and electrical contact of electrical joints. Sometimes it is also possible to apply a 'wetting agent' to reduce the surface tension [8].

Types of Soldering

There are three types of soldering which use increasingly higher temperatures, which in turn produce progressively stronger joints:

- **Soft soldering (90 °C - 450 °C) -** This process has the lowest filler metal melting point of all the soldering types at less than around 400°C these filler metals are usually alloys, often containing lead with liquid us temperatures under 350°C. Because of the low temperatures used in soft soldering it thermally stresses components the least but does not make strong joints and is then therefore unsuitable for mechanical load-bearing applications. It is also not suited for high temperature use as this type of solder loses strength and melts.
- **Hard (silver) soldering (>450 °C)** – Brass or silver is the bonding metal used in this process, and requires a blowtorch to achieve the temperatures at which the solder metals.
- **Brazing (>450 °C)** – This type of soldering uses a metal with a much higher melting point than those used in hard and soft soldering. However, similarly to hard soldering, the metal being bonded is heated as opposed to being melted. Once both the materials are heated sufficiently, you can then place the soldering metal between them which melts and acts as a bonding agent.

Uses of a Soldering Iron

A soldering iron is a **hand tool used to heat solder**, usually from an electrical supply at high temperatures above the melting point of the metal alloy. This allows for the solder to flow between the workpieces needing to be joined.

This soldering tool is made up of an insulated handle and a heated pointed metal iron tip. Good soldering is influenced by how clean the tip of your soldering iron is. To maintain cleanliness, a user will hold the soldering iron and use a wet sponge to clean the soldering iron tip prior to soldering components or making soldered connections.

In addition to the soldering iron, s**older suckers** are an important part of the soldering setup. If excessive solder is applied, these small tools are used to remove the solder, leaving only that desired.

What is a Soldering Gun Used For?

Soldering guns are used for applications where more heat is required as irons use lower power. This tool is used for joining stained glass, light sheet metal and heavy electronic soldering work. When you need to solder intermittently, the soldering gun is much more practical as it cools much quicker.

Figure 1.1. Typical Soldering Iron

1.3. Solder component to boards

- A soldering iron is used to heat the connections to be soldered.
- For electronic circuits, you should use a 25- to 40-watt (W) soldering iron.

- Higher wattage soldering irons are not necessarily hotter; they are just able to heat larger components. A 40-W soldering iron makes joints faster than a 25-W soldering iron does.
- A soldering iron can be purchased at hardware stores and at most large department stores.

Rosin core solder

- Solder has a lower melting point than the metals that are being connected do. The solder melts when it is heated by the soldering iron, but the metals being joined will not melt.
- The rosin core acts as a flux. It prevents oxidation of the metals that are being connected, and enhances the ability of the solder to "wet" the surfaces that are being joined.
- Solder that is used to join copper pipes has an acid core, which is appropriate for pipes, but will corrode electronic connections. Use solder that has a rosin core.
- For most electronics work, a solder with a diameter of 0.75 millimeters (mm) to 1.0 mm is best. Thicker solder might make soldering small joints difficult and also increases the chances of creating solder bridges between copper pads that are not meant to be connected.
- An alloy of 60/40 (60% tin, 40% lead) is used for most electronics work, but lead-free solders are available as well.

Stand on which to hold the hot soldering iron

- There are a variety of stands available. It is important to always keep the hot iron in its stand when not in use.

Sponge

- The damp sponge is used to clean the tip of the iron.

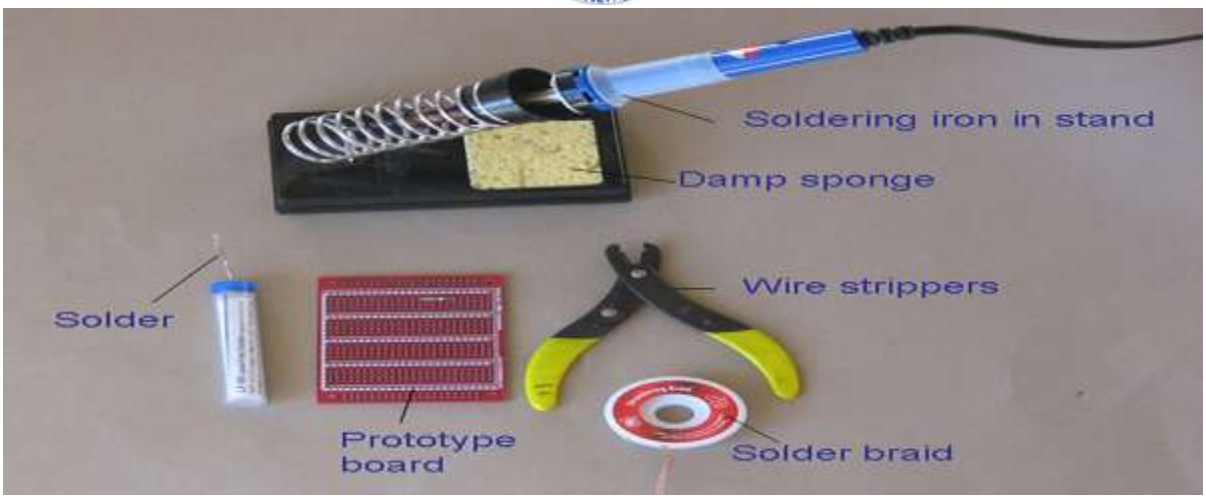

Figure 1.2 Soldering equipment and materials.

The solder in this pure is coiled inside a plastic tube; it is pulled through the top as needed. The spring on the stand holds the hot soldering iron. The damp sponge is used to clean the tip of the iron. Solder braid is used to remove solder; solder is "soaked up" into the braid when it is heated by the soldering iron. The wire strippers can be adjusted to strip the plastic covering off of various thicknesses of wire. The prototype board is used to connect electronic components in a circuit.

- Solder braid
  - This is used to remove solder.
  - To use the braid, place it over the solder to be removed and heat it from above with the iron. The solder will flow into the braid.
  - Solder braid is used to extract an electronic component that is soldered onto a board.
  - It is also used to reduce the amount of solder on a connection.
- Prototype board
  - A prototype board is used to assemble the circuit. The board shown is from but supplies prototype boards.
  - Prototype boards have copper tracks or pads for connecting components.
- Steel wool or fine sandpaper
  - This is used to clean connections prior to soldering.
  - Solder will not flow over a dirty connection.

- Crocodile clips
    - These can be used as heat sinks, if needed

1.4. Disolder Components to boards

Sometimes PC technicians need to replace electronic components, such as electrolytic capacitors and connectors. The most common case is when you have a motherboard were the electrolytic capacitors leaked.

Desoldering and replacing components is not as easy as soldering them. The main problem is that printed circuit boards, especially motherboards, have several layers. You see only two layers (called “solder layer” and “component layer”), but there are other layers inside the printed circuit board, like a sandwich. The holes where the components are soldered to are metalized and serve not only to hold the component, but also to make the electrical connection between the two visible layers and the internal layers, which are not visible. If you make a wrong move while trying to remove a component, you may break the connection between the hole and the internal board layers, destroying your board

How to desolder an electronic component

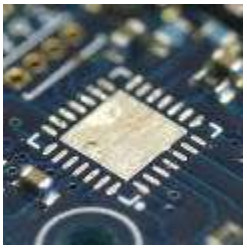

Figure 1.3. Soldered Chips

Quite a while ago, we offered you a a brief soldering tutorial. Given the success of this post, we thought that you'd perhaps like us to explain how to desolder an electronic component without losing your mind...

If you have already tried to desolder a component, you know the issue: a component is generally fixed to the with several contacts and it is difficult to melt the solder on all the contacts at the same time. Solder cools down too fast to try to heat each contact one after the other [9].

Naturally, there are work stations dedicated to component disordering. But if you have one, your line of work is probably about electronic boards rework, and so you won't be much interested by the remainder of this post. Therefore, we are rather going to concentrate on methods available to ordinary people.

In fact, there are many techniques to remove an electronic component from a . Here are the best known:

Brutal: the heat gun

A very simple technique consists in using a heat gun to heat the area where the component is located. After a few seconds, you can easily remove the component. This technique is not very sophisticated as it tends to desolder all the components located in the area. However, it is very efficient to desolder QFN type components that have a central pad soldered on the .

Figure 1.4.Heat gun: very efficient but unselective

Surgical: the desoldering tweezers

Desoldering tweezers are a small pincer of which the ends are in fact two tiny soldering irons. You only have to pinch the component that you want to desolder with the tweezers. This tool is extremely effective for all the two pole SMD components: resistors, capacitors, diodes, and so on...

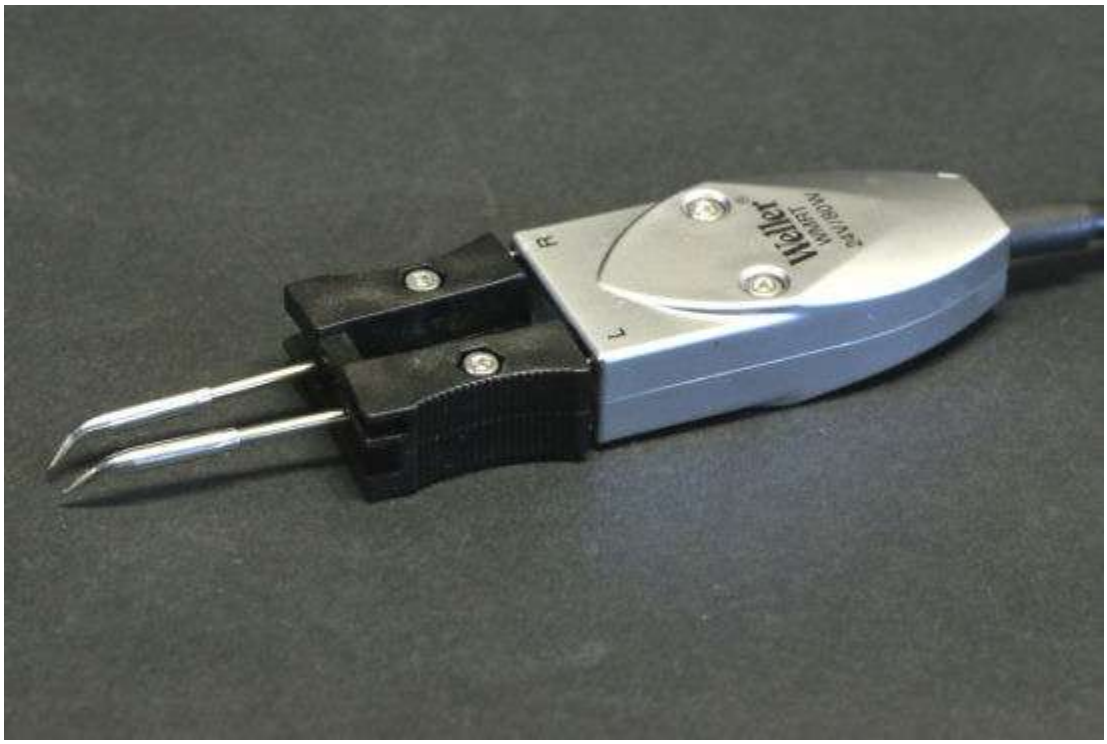

Figure 1.5. Desoldering Tweezers

Cheap: the desoldering braid

A desoldering braid is made of very thin copper wires braided together. Cover your solder with flux, put the end of the braid on it, and delicately press with the tip of a warm soldering iron. Solder melts and is absorbed into the braid by capillarity. It's a useful method for through hole components. However, it doesn't work very well with surface components as there is always some solder which prefers to stay between the component and the .

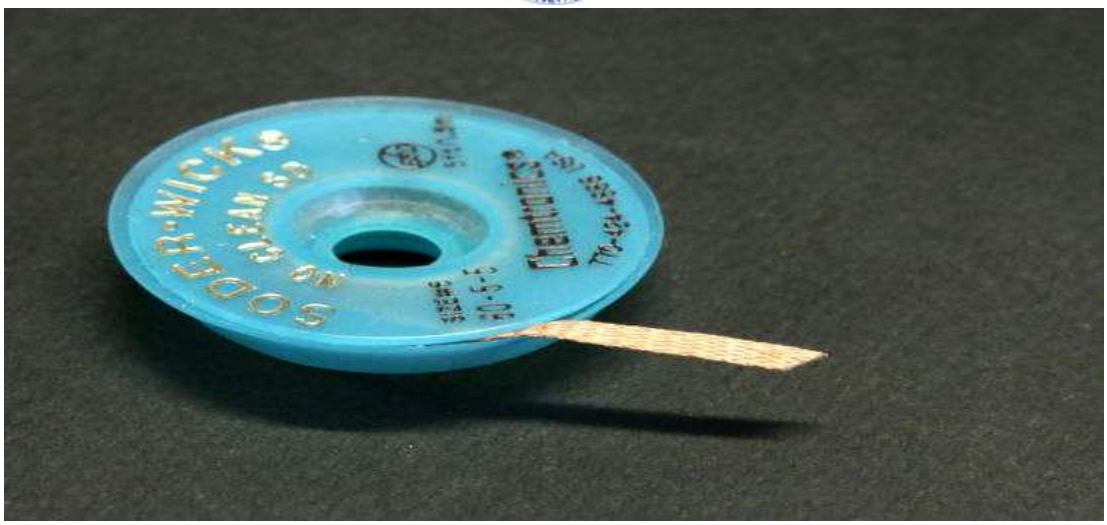

Figure 1.5. Desoldering braid: convenient and cheap

Mechanical: the desoldering pump

A desoldering pump is a kind of spring syringe: you arm it by pushing the piston. By pressing a button, the piston is violently pulled back, creating a suction. The idea is to melt the solder and to aspirate it with the pump. This tool is sometimes efficient for through hole components, sometimes less so. Frankly, it's not the technique we prefer.

Figure 1.6. Desoldering pump

Compressed air

If you don't have a desoldering pump, but have compressed air available, you can use the opposite technique which consists in heating each leg and in expelling the melted solder with a good blast of compressed air. It is very effective and you can reuse the component afterwards. However, you are going to have solder projections everywhere. Take care to protect the remainder of your and the surrounding area before you try it.

Figure 1.7. Compressed air: very efficient but messy

Sharp: cutting pliers

To remove a component from a , the most practical method is to cut each leg with very thin and sharp cutting pliers. You can then remove the component and desolder the legs one after the other. Obviously, it works only if your component has legs. The component is destroyed in the process [10].

Figure 1.8. Cutting pliers, very thin and sharp

For this kind of work, the best cutting pliers that we found so far are sold by a well-known model making brand.

Magical: Chipquik

We saved the best for the end. The ChipQuik company commercializes a product enabling you to desolder most components easily. At first sight, the "SMD removal" kit is nothing more than soldering wire with a flux syringe. But this is not ordinary wire: it's an alloy which is specific in that it melts at a low temperature and remains liquid for a very long time.

Figure 1.9. Chip Quik: a magical product

To desolder a component with this product, put a generous lump of the provided flux on the legs and melt the alloy on each of the legs. The alloy mixes itself with the original solder, and the whole can stay liquid for a good ten seconds. If you work fast enough, you can easily remove the component. You can usually reuse the component afterwards.

Equivalent competing products may exist but, if it is the case, we never heard of them.

Cleaning up

When you have desoldered your component, you find yourself with a not so clean . Pads are covered with solder and flux remains, which makes it harder to place a new component. You must therefore clean the pads. To do so, the simplest way is to use a desoldering braid to remove solder, and then one of these products designed to remove flux remains.

Figure 1.20. Flux cleaner

Conclusion

If you occasionally need to desolder a component, you don't need to invest into expensive equipment. Some basic tools and some dexterity enable you to get out of most situations. This video summarizes the different techniques described in this post.

Self-Check 1	Written Test

Directions: Answer all the questions listed below. .

Part I

I. Choose the best Answer (each 3 point)

1._____ is a kind of spring syringe: you arm it by pushing the piston. By pressing a button, the piston is violently pulled back, creating a suction.

A) Desoldering Pump B) Soldering

C) Multimeter D) All

2. _____is made of very thin copper wires braided together.

A) A desoldering braid B)Desolder Pump

C) Solder D) None

3. _____are used for applications where more heat is required as irons use lower power.

A) Soldering guns B) Screw Driver

C) Pliers D) All

Part II

Explain the following question (each 5 points)

1. List and Explain the steps of desoldering?

2. List and Explain the steps of soldering?

Note: Satisfactory rating 25 points **Unsatisfactory - below 25**

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

Score = _____
Rating: _____

Information sheet #2 & 3	Checking Soldering and de-soldering processes

2.1. Introduction

Solder is a fusible metal alloy used to create a permanent bond between metal work pieces. Solder is melted in order to adhere to and connect the pieces after cooling, which requires that an alloy suitable for use as solder have a lower melting point than the pieces being joined. The solder should also be resistant to oxidative and corrosive effects that would degrade the joint over time. Solder used in making electrical connections also needs to have favorable electrical characteristics.

Soft solder typically has a melting point range of 90 to 450 °C (190 to 840 °F; 360 to 720 K), and is commonly used in electronics, plumbing, and sheet metal work. Alloys that melt between 180 and 190 °C (360 and 370 °F; 450 and 460 K) are the most commonly used. Soldering performed using alloys with a melting point above 450 °C (840 °F; 720 K) is called "hard soldering", "silver soldering", or brazing.

2.2. Checking Soldering Process

Golden rules for soldering

There are a number of hints, tips and golden rules when soldering, we can check soldering process by the following rules.

- **Safety First:** When undertaking any soldering it is necessary to put safety at the top of the list. Soldering irons are very hot and can cause burns. The best course of action is to have a great awareness of safety. However there are a few golden rules as a start. First, always use a soldering iron holder for when the soldering iron is not in use. When in use, be careful where it goes. If someone else is around, they could easily be burned. Also never use one when small children are around [11].
- **Keep the soldering iron bit clean:** As the soldering iron bit remains hot whilst it is in use, it quickly becomes dirty. Frequent cleaning on a wet sponge is needed.

- **Apply solder and soldering iron simultaneously:** One of the keys to good soldering is applying the soldering iron and the solder to the joint at the same time. Don't put solder onto the bit and then carry it to the joint.
- **Don't use too much solder:** It is often tempting to use a bit extra solder, but use just enough to make a good joint. joints should be slightly concave and other joints should have enough to ensure a good joint.
- **Don't keep the iron in place too long:** Once a joint has been made, remove the iron and let the joint and other areas cool.

Additionally with the advent of lead free solder, this should be used if possible. This new solder is now available in the electronics Electronics shops. Although slightly different to the traditional tin lead solder, it reduces the amount of lead being used.

For anyone interested in electronics Electronics, it is essential to ensure that good solder joints are made all the time. Not only will they look better, but they will also result in the circuit working better and more reliably. Dry joints lead to problems, whereas a well constructed and soldered circuit will have a much better chance of working reliably.

Inspect the soldered joints

It is necessary to ensure that once the solder joint has been made that it is satisfactory. This is best done by visually inspecting it.

- **Check for sufficient solder:** Solder joints should have sufficient solder but not too much. For printed circuit board or solder joint, the solder should completely envelope or "wet" the component and the surrounding area of the board and it should have a concave meniscus. It should not be overloaded with solder such that the solder is convex.
- **Check for dry joints:** The joint should look quite shiny. If it has a dry grainy look to it, this is what is termed a dry joint. It results from the soldering iron being applied to the joint for too long, or the joint having been moved while it is cooling. It is not advisable to simply apply more solder. The best course of action is to remove the solder and start again.

1.3. Checking Desoldering process

1.3.1. Easy Tips to Improve Your Desoldering

These tips mainly focus on removing components with the help of desoldering braid (also known as desoldering wire or wick) and its advantages. It's portable, easy to use, one of the most common tools used for repair, and doesn't require constant maintenance like other tools.

1. Keep Your Soldering Iron Tip Clean and Tinned For Effective Heat Conduction

This might seem like a no-brainer, but it's often overlooked and critical for efficient desoldering. Soldering iron tips covered with burnt flux and oxidation will not wet (accept solder) and will conduct heat poorly. A clean and tinned soldering tip conducts heat through the desoldering braid better and starts the wicking action faster [12].

- Before starting, tin the soldering tip by adding fresh wire solder to it.
- If the soldering iron tip isn't responding to the extra solder, revive dirty tips by using a tip cleaner, often referred to as "tip tinner". Plato brand Tip Tinner (part #TT-95) is a halide-free, solid paste which provides quick and safe re-tinning and cleaning of oxidized tips. Roll the hot tip in the compound until the bright tinning surrounds the end of the tip.
- Clean any residual compound from the tip by applying wire solder and then wiping on a damp cellulose sponge or brass wire tip cleaner.
- Finally, apply solder to the tip again to protect it from oxidation.
- Whenever your soldering iron sits for any length of time, or after you are finished soldering, "tin" the soldering tip with fresh solder to prevent oxidation.

2. Minimize the Length of Time That the Board and Components Remain at a High Temperature

Applying high heat levels to the board or its components for an extended period of time can damage your board, components, create brittle solder joints, and lead to service issues down the round.

- Keep your soldering iron set at a reasonable temperature. I know it's tempting to turn your iron all the way up to increase your efficiency, but you could be shocking components. Even with lead-free solders, anything over 700ºF (371ºC) is risking thermal

stressing components. If you find it necessary to keep turning the temperature up throughout the day, refer back to tip #1.

- In a case when there are several components to be replaced on a single assembly or the components are particularly heat sensitive, you can use a preheater. Preheaters allow you to ramp up the board temperature and maintain that temperature while you do your work. Although preheat temperature will be well under the solder melting point, thermal shock to components is minimized because you aren't spiking quickly from ambient temperature.

3. Match Solder Wick Width to Solder Joint or Contact Pad

Desoldering wick generally comes in several different widths so you can match the braid to what you are desoldering. Wick that is too thin won't remove enough solder and requires you to trim and remelt the solder over and over. Wick that is too wide takes longer to heat and may interfere with other components on the circuit board.

Choose a solder wick width that closely matches the size of the contact area. This will ensure that you get proper heat conduction and that you don't desolder unwanted areas. Widths of desoldering wire are designated by the numbers 1 through 6 or color codes, which are the standard in the industry.

- #1/white braid is the smallest (under 1mm wide) and is mainly for SMD's and microcircuits.
- Most will find #2/yellow, #3/green, and #4/blue to be the most common desolder wire.
- #5/brown is ideal for removing large blobs of solder and #6/red is best for desoldering BGA pads or terminals.
- Keep three or four different widths at your work area to cover all cases.
- Wick can be folded or trimmed at an angle to better fit the contact area.

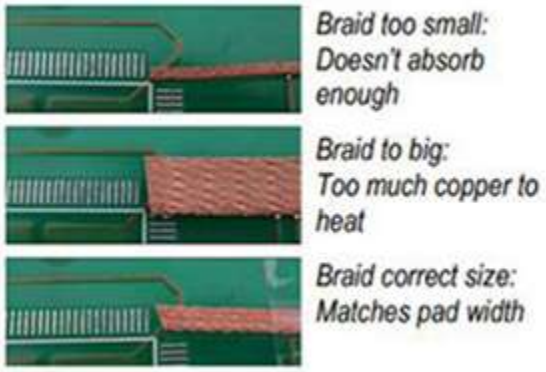

Figure 2.1. Match Solder Wick Width to Solder Joint or Contact Pad

4. Match Soldering Iron Tip to Braid Width for Accuracy

Use a soldering tip that is roughly the width of the braid and contact area. A tip that is too small will require more dwell time. A tip that is too large runs the risk of exposing other components in a dense assembly. Matching the tip allows you to melt the unwanted solder faster and minimizes the time that heat is applied. Use a blade or knife tip when desoldering large areas, like a BGA pad.

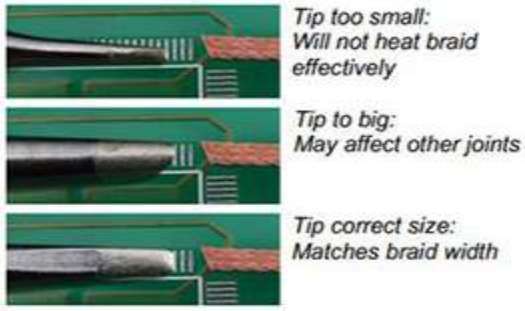

Figure 2.2. Match Soldering Iron Tip to Braid Width for Accuracy

5. Caution: When Drag Desoldering, Move Tip Over Braid, Not the Braid Across the Pads

Dragging the copper braid over pads, for example when Desoldering BGA pads, can scratch OSP coating and even the pads themselves if enough pressure is applied. It's best to apply the braid, and then drag the soldering tip over the braid.

6. **Clip Used Desoldering Wick after Every Use**

The temptation is to desolder an area and keep moving up the spool of braid. However, it's best to work towards the end of the braid to isolate the heat. Once the desoldering wick is brought up to soldering temperature, the flux has been fully activated, so that part will not draw more solder. A long strand of used braid only acts as a heat sink, slowing down your process.

7. Avoid the #1 Rookie Mistake: Lift Up Iron and Braid at The Same Time

This is by far the most common error committed by inexperienced operators. After removing solder, make sure to lift up the iron and braid at the same time. Otherwise, you will solder the braid to the contact and risk lifting the pad.

8. Match Flux Type to Your Cleaning Process

Desoldering braid is available in various flux types depending on your cleaning process and other requirements.

- **Rosin** – Rosin fluxed braid has the fastest wicking action but does leave behind residues that need to be thoroughly cleaned.
- **No-Clean** – No-clean fluxed braid is ideal when cleaning isn't practical or possible. After desoldering, the only thing that remains is a clear, non-ionic residue. For field work, when a thorough cleaning is more challenging, this is the type of braid to use.
- **Unfluxed** – In a production or repair environment where the flux is specified and can't be changed, or when an aqueous flux is needed, you can add your own flux to this type of braid. Unfluxed wick will not remove solder unless flux is added. Different types of fluxes are available in pen packaging, which is ideal for fluxing braid.

9. Choose Static Dissipative Packaging For Static Sensitive Applications

When working around static sensitive assemblies, make sure that the spool of desoldering braid is static dissipative (or ESD-safe). We have seen cases where an operator had a top-dollar ESD-safe workstation, mat, and grounding straps, but was caught with an insulative bobbin. Most dissipative wick packaging can be identified by their blue color. Even if a spool is black, don't assume it is S20.20 compliant.

Figure 2.3. Solder wick

10. Adding Solder to Tight Areas Actually Makes It Easier to Remove

Small amounts of solder in tight crevices can be difficult to remove, but larger uniform solder joints wick right up. As counter-intuitive as it sounds, it helps to add more solder to joints like this before wicking up the unwanted solder.

11. Protect Your Board Against Corrosion By Using a Quality Flux Remover

Flux residues can cause dendritic growth and corrosion on assemblies, so make sure you're using best practices and clean the board. After all, the components have been replaced and excess solder removed, complete the following:

1. Clean the area thoroughly with a quality flux remover
2. Angle the board to allow the cleaner and residues to run off
3. If needed, use a horsehair brush or lint-free wipe to gently scrub the , and then
4. follow with a rinse.
5. If using a wipe, make sure it doesn't leave fibers/lint on your , which may cause issues later.

This is an optional step for no-clean braid, but still a good idea for densely populated or high voltage boards. It is absolutely required, regardless of the flux type, if you plan to follow your repair with conformal coating.

12. Follow Our Recommended Desoldering Process for Best Results

Lastly, we would like to end this post with how to use desoldering wick.

- Place the braid over unwanted solder, preferably on the greatest solder build up so that it maximizes the contact of the braid to the surface area of the solder.
- Next, place your iron tip over the wick at 45 degrees and allow heat to transfer to the pad. Molten solder will absorb into the braid.
- Move the solder tip and braid as needed to remove all of the solder at one time. Careful not to drag the braid over the pads, which can scratch.
- Once the braid is full of solder, you must trim the spent portion and move to fresh braid in order to pull more solder. Remove the iron and braid simultaneously to avoid soldering the wire to the board.

Self Check #2	**Written Test**

Directions: Answer all the questions listed below. .

Part I

Explain the following question (each 5 points)

1. List and Explain how to check soldering process?
2. List and Explain how to check Desoldering process?

Part II

II. Choose the best Answer (each 5 point)

1. _____is a fusible metal alloy used to create a permanent bond between metal work pieces.
   a. Sucker c. Solder
   b. Tweezers d. screw
2. _____ braid has the fastest wicking action but does leave behind residues that need to be thoroughly cleaned.
   a. Rosin fluxed c. a and b
   b. Match Flux d. none

Note: Satisfactory rating 20 points **Unsatisfactory – below20**

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

Score = _____
Rating: _____

Operation Sheet #2	Solder/ De solder components to the board

Operation Title: - Performing Soldering and de-soldering processes

PURPOSE: -

- The trainee's will be able to keep the procedures.
- The trainee's will be able to Perform solder component to boards.
- The trainee's will be able to Perform and checked disolder component to boards

The trainee's will be able to perform Solder/ De solder components to the board properly.

Conditions or situations for operation: - Have a clean workspace with all necessary tools and equipment.

Equipment, Tools & Materials: - Maintenance room, Soldering Iron Maintenance tool kit, table, chair etc.

Procedure: - 1. Soldering component to Boards

Step 1 – Cleaning solder tips

Step 2- Cleaning the Component

Step 3 – Melting the Solder

Step 4 – Placement of soldering Iron to components

Step 5 – Cone shape soldering

Step 6 – Cleaning

Procedure: - 2. Desoldering Components to Boards

Step 1. Keep Your Soldering Iron Tip Clean and Tinned For Effective Heat Conduction

Step 2. Minimize the Length of Time That the Board and Components Remain at a High Temperature

Step 3. Match Solder Wick Width to Solder Joint or Contact Pad

Step 4. Match Soldering Iron Tip to Braid Width for Accuracy

Step 5. When Drag Desoldering, Move Tip Over Braid, Not the Braid Across Pads

Step 6. Clip Used Desoldering Wick after Every Use

Step 7. Avoid the #1 Rookie Mistake: Lift Up Iron and Braid at The Same Time

Step 8. Match Flux Type to Your Cleaning Process

Step 9. Choose Static Dissipative Packaging For Static Sensitive Applications

Step 10. Adding Solder to Tight Areas Actually Makes It Easier to Remove

Step 11. Protect Your Board Against Corrosion By Using a Quality Flux Remover

Step 12. Follow Our Recommended Desoldering Process for Best Results

Precautions:-

- Take ESD precautions.
- Document everything (backup).
- Power all devices and disconnect them from the main power supply.

Quality Criteria:-

- The trainee's use safety for documents &components.
- The trainee's make Solder, Disolder and checked components to boards.

LAP TEST #2	**Practical Demonstration**

Name: _____ Date: _____

Time started: _____Time finished: _____

Instructions: You are required to perform the following individually with the presence of your teacher.

1. How to Solder Electronics component to board?
2. How to DesSolder Electronics component to board?
3. How to checked soldered components?
4. How to check desolder components?

- Your teacher will evaluate your output either satisfactory or unsatisfactory. If Unsatisfactory, your teacher shall advice you on additional work. But if satisfactory, you can proceed to the next topic.

L #18	LO #3- Assemble/ disassemble boards

Instruction sheet

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 establish standards and requirements
- Checking Assembling and Disassembling processes

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

- Perform Soldering and de-soldering processes
- Check establish standards and requirements
- Check Assembling and Disassembling processes

Learning Instructions:

Read the specific objectives of this Learning Guide.

1. Follow the instructions described below.

2. Read the information written in the "Information Sheets". Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.

3. Accomplish the "Self-checks" which are placed following all information sheets.

4. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).

5. If you earned a satisfactory evaluation proceed to "Operation sheets

6. Perform "the Learning activity performance test" which is placed following "Operation sheets"

7. If your performance is satisfactory proceed to the next learning guide,

8. If your performance is unsatisfactory, see your trainer for further instructions or go back to "Operation sheets".

1.1. Assembly process

The various stages in the assembly process including adding solder paste to the board, pick and place of the components, soldering, inspection and test. All these processes are required, and need to be monitored to ensure that product of the highest quality is produced. The assembly process described below assumes that surface mount components are being used as virtually all assembly these days uses surface mount technology.

- **Solder paste:** Prior to the addition of the components to a board, solder paste needs to be added to those areas of the board where solder is required. Typically these areas are the component pads. This is achieved using a solder screen.

  The solder paste is a paste of small grains of solder mixed with flux. This can be deposited into place in a process that is very similar to some printing processes. Using the solder screen, placed directly onto the board and registered in the correct position , a runner is moved across the screen squeezing a small mount of solder paste through the holes in the screen and onto the board. As the solder screen has been generated from the printed circuit board files, it has holes on the positions of the solder pads, and in this way solder is deposited only on the solder pads.

  The amount of solder that is deposited must be controlled to ensure the resulting joints have the right amount of solder.

- **Pick and place:** During this part of the assembly process, the board with the added solder paste is then passed into the pick and place process. Here a machine loaded with reels of components picks the components from the reels or other dispensers and places them onto the correct position on the board.

Figure 1.1. Components Placements

- Typical pick and place machine in use

  The components placed onto the board are held in place by the tension of the solder paste. This is sufficient to keep them in place provided that the board is not jolted.

  In some assembly processes, the pick and place machines add small dots of glue to secure the components to the board. However this is normally done only if the board is to be wave soldered. The disadvantage of the process is that any repair is made far more difficult by the presence of the glue, although some glue is designed to degrade during the soldering process.

  The position and component information required to programmed the pick and place machine is derived from the printed circuit board design information. This enables the pick and place programming to be considerably simplified.

- **Soldering:** Once the components have been added to the board, the next stage of the assembly, production process is to pass it through the soldering machine. Although some boards may be passed through a wave soldering machine, this process is not widely used for surface mount components these days. If wave soldering is used, then solder paste is not added to the board as the solder is provided by the wave soldering machine. Rather than using wave soldering, reflow soldering techniques are used more widely.
- **Inspection:** After the boards have been passed through the soldering process they are often inspected. Manual inspection is not an option for surface mount boards employing a hundred or more components. Instead automatic optical inspection is a far more viable solution.

Machines are available that are able to inspect boards and detect poor joints, misplaced components, and under some instances the wrong component.

- **Test:** It is necessary to test electronic products before they leave the factory. There are several ways in which they may be tested. Further views of test strategies and methods may be found on the "Test and Measurement" section of this website.
- **Feedback:** To ensure that the manufacturing process is running satisfactorily, it is necessary to monitor the outputs. This is achieved by investigating any failures that are detected. The ideal place is at the optical inspection stage as this generally occurs immediately after the soldering stage. This means that process defects can be detected quickly and rectified before too many boards are built with the same problem.

The assembly process for the manufacture of loaded printed circuit boards has been considerably simplified in this overview. The assembly and production processes are generally optimized to ensure very low levels of defects, and in this way produce the highest quality product. In view of the number of components and solder joints in today's products, and the very high demands placed on quality, the operation of this process is critical to the success of the products that are manufactured [14].

1.2. Disassembling process

Although printed circuit boards (s) contain various elements, only the major elements (i.e., those with content levels in wt% or over grade) of and precious metals (e.g., Ag, Au, and platinum groups) contained within s can be recycled. To recover other elements from s, the s should be properly disassembled as the first step of the recycling process. The recovery of these other elements would be beneficial for efforts to conserve scarce resources, reuse electric/electronic components (EECs), and eliminate environmental problems. This paper examines the disassembly of EECs from wasted s (Ws) and the physical separation of these EECs using a self-designed disassembling apparatus and a 3-step separation process of sieving, magnetic separation, and dense medium separation. The disassembling efficiencies were evaluated by using the ratio of grinding area (E(area)) and the weight ratio of the detached EECs (E(weight)). In the disassembly treatment, these efficiencies were improved with an increase of grinder speed and grinder height. 97.7% (E(area)) and 98% (E(weight)) could be accomplished ultimately by 3 repetitive treatments at a grinder speed of 5500 rpm and a grinder height of 1.5mm. Through a series of physical separations, most groups of the EECs (except for the diode, transistor, and IC

chip groups) could be sorted at a relatively high separation efficiency of about 75% or more. To evaluate the separation efficiency with regard to the elemental composition, the distribution ratio (R(dis)) and the concentration ratio (R(conc)) were used. 15 elements could be separated with the highest R(dis) and R(conc) in the same separated division. This result implies that the recyclability of the elements is highly feasible, even though the initial content in EECs is lower than several tens of mg/kg.

Self Check #1	Written Test

Directions: Answer all the questions listed below. .

Part I

Explain the following question (each 5 points)

1. List and Explain How to Assemble?
2. List and Explain how to Disassemble?

Part II

II. Choose the best Answer (each 5 point)

1. _____is necessary to test electronic products before they leave the factory.

a. Test c. desolder

b. Assemble **d.** all

2. _____is not an option for surface mount boards employing a hundred or more components.

a. Manual inspection c. Test

b. Automatic inspection d. none

Note: Satisfactory rating 20 points **Unsatisfactory - below 20**

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

Score = _____
Rating: _____

Information Sheet 2: Checking establish standards and requirements

1.1. Establish Standard

Performance plans are action plans, not static documents. Effective performance plans must detail the specific actions leaders and employees must follow to accomplish the goals and objectives set within it. Leaders understand that without meaningful performance standards, measuring and evaluating individual performance becomes difficult if not impossible. Once the plan is implemented, meaningful performance standards allow leaders to modify and adapt their plans to actual conditions. Leaders must use solid standards to monitor and evaluate all aspects of performance. Any measurement used should determine and create an action both on the part of the employee being evaluated and on the part of the leader performing the evaluation. There is a natural tendency for a leader to focus his or her activities on more prominent areas that will be highlighted and spotlighted, yet every element of the performance plan must be fully addressed.

It should be noted that any standard a leader creates will direct, limit, and change the behavior and performance of their employees. This is important for leaders to understand because what and how they choose to evaluate can have either a positive or negative effect on the performance of their organizational unit.

A common pitfall in establishing performance standards is overdoing them. It burdens all involved with excessive factors and controls. Leaders know that to be effective, they need to set performance standards that are relevant and meaningful. It is far better to have fewer meaningful standards than to establish many useless ones. When applied, these standards will present a true pure of the performance of their organizational unit at any given point in time. Four areas to focus on in creating meaningful performance standards are:

What to Measure

The specific elements that need to be measured will vary by organizational unit. Typically, performance standards are set around productivity and profitability. Most leaders establish performance standards by setting specific performance expectations. Examples include:

- Progress is evaluated by the reaching of specific milestones linked to individual goals and objectives.
- Profitability is evaluated against the budgets established for each activity.
- Efficiency is evaluated by the resource utilization within the organizational unit.

Each organizational unit has key factors that determine their success. Leaders identify these factors as indicators of performance and look for trigger points that are early indicators of the success or failure of these factors.

How to Benchmark

Once leaders know what they want to evaluate, they need to benchmark each critical measurement. This establishes degrees of confidence and reliability in their numbers. They review these statistics over a meaningful period of time to establish a benchmark of past performance in each area. The longer a leader reviews the past performance of a specific area, the higher the degree of confidence and reliability he or she establishes.

Once key performance standards are benchmarked, leaders establish "triggering events" that result in taking immediate action. Since the benchmarked statistic is the standard, a triggering event can be predetermined. This event or "flag" occurs when performance rises above or falls below a specific percentage of the benchmarked standard. This provides leaders an early warning system to proactively deal with performance problems before they get out of hand.

How Frequently to Measure

Leaders are careful not to overburden themselves with needless information. They use performance standards as a means to keep their finger on the pulse of their unit's performance. They can easily determine the frequency for receiving reports of their unit's performance. Some statistics are meaningful on a daily basis, some hourly, and still others only when reported over prolonged periods of time.

What Measurements Indicate

Key performance standards need to inform leaders of the overall performance of their organizational unit. Specific measurements can trigger corrective actions, while others indicate

the progress of the unit against performance plan goals and objectives. Effectively utilized, solid performance standards lead and direct the leader's actions to fine-tune his or her unit's performance. The right balance of key standards points the way to improved overall performance and productivity [15].

1.2. Checking establish standards and requirements

Check Standard and Requirements

A check standard is useful for gathering data on the process

Check standard methodology is a tool for collecting data on the measurement process to expose errors that afflux the process over time. Time-dependent sources of error are evaluated and quantified from the database of check standard measurements. It is a device for controlling the bias and long-term variability of the process once a baseline for these quantities has been established from historical data on the check standard.

Think in terms of data

A check standard can be an artifact or defined quantity

The check standard should be thought of in terms of a database of measurements. It can be defined as an artifact or as a characteristic of the measurement process whose value can be replicated from measurements taken over the life of the process. Examples are:

- measurements on a stable artifact
- differences between values of two reference standards as estimated from a calibration experiment
- values of a process characteristic, such as a bias term, which is estimated from measurements on reference standards and/or test items.
- An artifact check standard must be close in material content and geometry to the test items that are measured in the workload. If possible, it should be one of the test items from the workload. Obviously, it should be a stable artifact and should be available to the measurement process at all times.

Solves the difficulty of sampling the process	Measurement processes are similar to production processes in that they are continual and are expected to produce identical results (within acceptable limits) over time, instruments, operators, and environmental conditions. However, it is difficult to sample the output of the measurement process because, normally, test items change with each measurement sequence.
Surrogate for unseen measurements	Measurements on the check standard, spaced over time at regular intervals, act as surrogates for measurements that could be made on test items if sufficient time and resources were available.

Self Check #1	**Written Test**

Directions: Answer all the questions listed below. .

Part I

Explain the following question (each 5 points)

1. Explain Established Standard?
2. Explain how to check Established standards?

Part II

II. Choose the best Answer (each 5 point)

1. _____is a tool for collecting data on the measurement process to expose errors that afflux the process over time.

a. Check standard methodology
b. Measurement processes
c. a and b
d. none

Note: Satisfactory rating 15 points **Unsatisfactory - below 15**

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

Score = _____
Rating: _____

Information Sheet 2: Checking Assembling and Disassembling processes

1.1. Checking Assembling and disassembling Process

After you've completed a solder joint, you should inspect it to make sure the joint is good. Look at it under a magnifying glass, and gently wiggle the component to see if the joint is stable. A good solder joint should be shiny and fill but not overflow the pad [17].

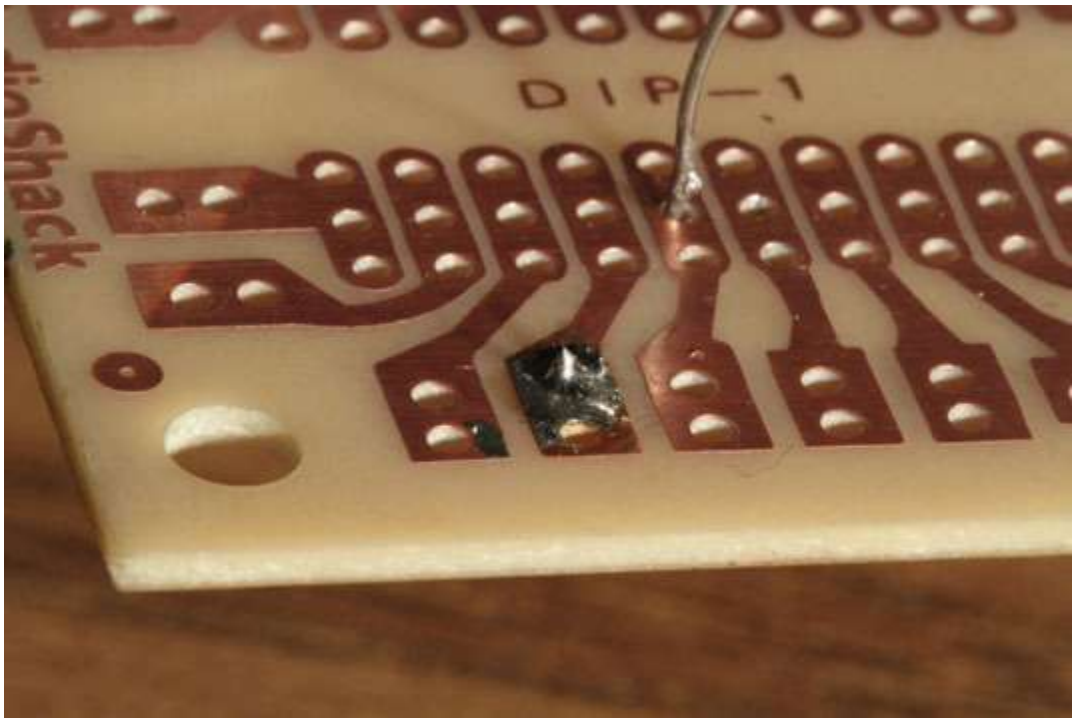

Figure 2.1. Assembled products

Nearly all bad solder joints are caused by one of three things: not allowing the wire and pad to heat sufficiently, applying too much solder, or melting the solder with the soldering iron instead of with the wire lead. Here are some indications of a bad solder joint:

- The pad and lead aren't completely covered with solder, enabling you to see through one side of the hole through which the lead passes**.** Either you didn't apply quite enough solder, or the pad wasn't quite hot enough to accept the solder.

- **The lead is loose in the hole or the solder isn't firmly attached to the pad:** One possible reason for this is that you moved the lead before the solder had completely cooled.
- **The solder isn't shiny:** Shiny solder indicates solder that heated, flowed, and then cooled properly. If the solder gets just barely hot enough to melt, then flows over a wire or pad that isn't heated sufficiently, it will be dull when it cools. (Unfortunately, the new lead-free solder almost always cools dull, so it looks like a bad solder joint even when the joint is good!)
- **Solder overflows the pad and touches an adjacent pad:** This can happen if you apply too much solder. It can also happen if the pad didn't get hot enough to accept the solder, which can cause the solder to flow off the pad and onto an adjacent pad. If solder spills over from one pad to an adjacent pad, your circuit may not work right

Self Check #1	Written Test

Directions: Answer all the questions listed below. .

Part I

Explain the following question(each 15 point)

1. Explain How to check assembled and disassembled process?
2. Define Shiny solder

Part II

II. Choose the best Answer (each 5 point)

1. Solder overflows the pad and touches an adjacent pad can be happen if
   a. The lead is loose in the whole
   b. The solder isn't shiny:
   c. if we apply too much solder.
   d. all

Note: Satisfactory rating 20 points **Unsatisfactory – below 20**

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

Score = _____
Rating: _____

Operation Sheet #3	LO3: Assemble/ disassemble boards

Operation Title: - Assembling & Disassembling of PC

PURPOSE: -

- The trainee's will be able to keep the procedures.
- The trainee's will be able to perform assembling &disassembling a pc properly.

Conditions or situations for operation: - Have a clean workspace with all necessary tools and equipment.

Equipment, Tools & Materials: - Maintenance room, computer, CD, Maintenance tool kit, table, chair etc.

Procedure: - 1. Disassembling the PC

- ✓ Detach keyboard and mouse from the back of the computer
- ✓ Detach monitor
- ✓ Detach serial and parallel devices
- ✓ Detach network cables, speaker cables, Modem phone line
- ✓ Detach power cable.
- ✓ Remove system case
- ✓ Detach internal power cables from storage device
- ✓ Remove hard device and other storage devices.
- ✓ Remove adapter cards
- ✓ Remove power cables from system board
- ✓ Remove CPU
- ✓ Remove RAM & Remove cables from system board
- ✓ Remove screws holding system board in place
- ✓ Remove system board

Procedure: - 2. Reassembly the PC

- ✓ Installing system board(Motherboard)

- ✓ Mounting the motherboard in the case
- ✓ Installing CPU, heat sink & the power lead for the CPU fan.
- ✓ Configure the motherboard jumper. Refer to the Mb manufacturer manual.
- ✓ Installing (Memory) RAM
- ✓ Connecting the power supply
- ✓ Installing the drives (HDD, Floppy & CD-Rom)
- ✓ Connecting I/O &other cables to the motherboard
- ✓ Connect the floppy, HDD & CD-ROM IDE/SATA cable to the motherboard.
- ✓ Installing Additional Expansion Cards.

Precautions:-

- ➢ Take ESD precautions.
- ➢ Document everything (backup).
- ➢ Power all devices and disconnect them from the main power supply.

Quality Criteria:-

- ➢ The trainee's use safety for documents &components.
- ➢ The trainee's make assembling &disassembling the pc with proper procedure.

LAP TEST #3	**Practical Demonstration**

Name: _____ Date: _____

Time started: _____Time finished: _____

Instructions: You are required to perform the following individually with the presence of your teacher.

1. How to Assemble Personal computer?
2. How to Disassemble PC?
5. From General safety precautions show the antistatic:

- ✓ Electrostatic wrist strip
- ✓ Antistatic mat
- ✓ Antistatic box

6. How to operate personal computer?

- Your teacher will evaluate your output either satisfactory or unsatisfactory. If Unsatisfactory, your teacher shall advice you on additional work. But if satisfactory, you can proceed to the next topic

L #19	LO #4- Test and inspect assembled products

Instruction sheet

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

- Inspecting visual and testing finished products
- Documenting work completion
- Observing Housekeeping procedure with 5S discipline.

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

- Inspect visual and testing finished products
- Document work completion
- Observe Housekeeping procedure with 5S discipline.

Learning Instructions:

Read the specific objectives of this Learning Guide.

1. Follow the instructions described below.

2. Read the information written in the "Information Sheets". Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.

3. Accomplish the "Self-checks" which are placed following all information sheets.

4. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).

5. If you earned a satisfactory evaluation proceed to "Operation sheets

6. Perform "the Learning activity performance test" which is placed following "Operation sheets" ,

7. If your performance is satisfactory proceed to the next learning guide,

8. If your performance is unsatisfactory, see your trainer for further instructions or go back to "Operation sheets".

Information Sheet 1: Inspecting visual and testing finished products

1. Inspecting visual and testing finished products

1.1. Types of Testing Methods

- **In-circuit testing**

In-circuit testing (ICT) is the most robust type of testing in existence. the high price reflects that tens of thousands of dollars, though the cost will depend on board and fixture size, among other factors. An , also known as a bed-of-nails test, powers up and actuates the individual circuitry on the board. in most cases, the test is designed for 100% coverage, but you'll get closer to 85-90% coverage. the nice thing about is that the 85-90% you get is totally free of human error.

this test involves using fixed probes laid out in a way that matches the design of the . the probes checks the integrity of the solder connection. the bed of nails tester simply pushes the board down on the bed of probes to start the test. there are access points predesigned in the board that allows the testing probes to make connections with the circuit. they put a certain amount of pressure on the connection to make sure it stays intact is often performed on bigger connections and ball grid arrays (BGAS). this test is for a "mature" product with very few revisions expected. if you don't have design-for-manufacturing as part of your goal, with the proper pads on the board, you may not be able to use an in-circuit test. Unfortunately, you can't change your mind and move to a strategy halfway through production.

- **Flying probe testing**

Flying probe testing is a tried-and-true option that's less expensive than in-circuit testing. it's a non powered type of test that checks for:

- ✓ opens
- ✓ shorts
- ✓ resistance
- ✓ capacitance

- ✓ inductance
- ✓ diode issues

the test works through the use of needles attached to a probe on an x-y grid obtained from basic cad. your ECM programs coordinates to match the circuit board and then runs the program. we touched on flying probe vs. being a common comparison. each has advantages and disadvantages. In some cases, makes it unnecessary to use flying probe testing, but the has to be designed to fit with the test fixture -- which means a higher initial cost. can be faster and less error-prone than flying probe testing, so you might find the extra cost is worth it. while flying probe testing can be cheaper initially, it may actually be less cost-effective for large orders. one final word of caution: flying probe test does not power up the board [19].

- **Automated optical inspection (AOI)**

AOI uses either a single 2d camera or two 3d cameras to take photos of the . the program then compares the photos of your board to a detailed schematic. if there is a board that does not match the schematic to a certain degree, the board is flagged for inspection by a technician. AOI can be useful for detecting issues early to ensure production is shut down. however, it does not power up the board and may not have 100% coverage for all part types.

never rely solely on an automated optical inspection. AOI should be used in conjunction with another test. some of our favorite combos are:

- AOI and flying probe
- AOI and in-circuit test (ICT)
- AOI and functional testing
- **Burn-in testing**

as the name suggestions, burn-in testing is a more intense type of testing for s. it's designed to detect early failures and establish load capacity. because of its intensity, burn-in testing **can be** destructive to the parts being tested.

burn-in testing pushes power through your electronics, usually at its maximum-specified capacity. the power is run through the board continuously for 48 to 168 hours. if a board fails, it is known as an infant mortality. for military or medical applications, boards with high infant mortality are clearly not ideal.

burn-in testing isn't for every project, but there are some where it makes a lot of sense. it can prevent embarrassing or dangerous product launches before they reach customers.

just remember that burn-in testing can shorten the product's lifespan, especially if the test puts your board under more stress than it's rated for. if few or no defects are found, it's possible to reduce the testing limit after a shorter period to avoid over-stressing your .

- **X-ray inspection**

This type of "testing" is really more of an inspection tool, at least for most ECMs. during this test, an x-ray technician is able to locate defects early during the manufacturing process by viewing:

- ✓ solder connections
- ✓ internal traces
- ✓ barrels

there are 2d and 3d axis tests, with 3d offering a faster testing period. X-ray testing can check elements that are usually hidden from view, such as connections and ball grid array packages with solder joints underneath the chip package. while this check can be very useful, it does require trained, experienced operators. Also note that your ECM can't necessarily inspect every layer of a board using an x-ray machine. it's true we can see through the board to detect internal defects, but it's a very time consuming and expensive process (for both ECM and customer).

- **Functional testing**

There are customers who do like a good, old-fashioned functional test. your ECM uses this to verify that the product will power up**.** This test does require a few things:

- ✓ external pieces of equipment
- ✓ fixtures
- ✓ requirements and other standards

this functional test and its parameters are usually provided by the customer. some ECMs can help develop and design such a test.

it does take time. if you want to get your product out the door quickly, this may not be your best choice. but from a quality and longevity standpoint, functional testing can save face and save money.

Figure 4.1. Functional Testing

- **Other functional tests**

There are other types of functional tests that can be used to check your , depending on the circumstances. a functional test verifies a ’s behavior in the product’s end-use environment. the requirements of a functional test, its development, and procedures can vary greatly by and end product

other assembly testing types include:

- ✓ **Solder ability test:** ensures surface sturdiness and increases chances of forming a reliable solder joint
- ✓ **Contamination testing:** detects bulk ionics that can contaminate your board, causing corrosion and other issues
- ✓ **Micro-sectioning analysis:** investigates defects, opens, shorts, and other failures
- ✓ **Time-domain reflector-meter (TDR):** finds failures in high-frequency boards,
- ✓ **Peel test:** finds the measure of strength required to peel the laminate from the board
- ✓ **Solder float test**: determines the level of thermal stress a 's holes can resist

Self Check #1	Written Test

Directions: Answer all the questions listed below.

Part I

Explain the following question (each 15 point)

1. List and explain at least 5 testing method?

Part II

II. Choose the best Answer (each 5 point)

1. _____ is a tried-and-true option that's less expensive than in-circuit testing. it's a non powered type of test that checks for:
   a. Flying probe testing
   b. X-ray inspection
   c. a and b
   d. none
2. Test does require a few things:
   a. External pieces of equipment
   b. fixtures
   c. requirements and other standards
   d. all

Note: Satisfactory rating 25 points **Unsatisfactory – below 25**

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

Score = _____
Rating: _____

Operation Sheet #4	Test and inspect assembled products

Operation Title: - Test and Inspect Assembled Product

PURPOSE: -

- The trainee's will be able to keep the procedures.
- The trainee's will be able to perform testing and Inspect assembled products.

Conditions or situations for operation: - Have a clean workspace with all necessary tools and equipment.

Equipment, Tools & Materials: - Maintenance room, Millimeter, Screw driver, Test light, Brush, Circuit boards.

Procedure: - 1. Check/Inspect Maintained/ assemble product

- ✓ Step 1: Discharge all charged components
- ✓ Step 2: Check the soldered component
- ✓ Step 3: Measure cold test weather component have short or not
- ✓ Step 4: Supply the power to Equipments.
- ✓ Step 5: Check all screws weather properly drive or not.

.

Precautions:-

- ➢ Take ESD precautions.
- ➢ Document everything (backup).
- ➢ Power all devices and disconnect them from the main power supply.

Quality Criteria:-

- ➢ The trainee's use safety for documents &components.
- ➢ The trainee's make test and Inspect assembled product with proper procedure.

LAP TEST #1	**Practical Demonstration**

Name: _____ Date: _____

Time started: _____Time finished: _____

Instructions: You are required to perform the following individually with the presence of your teacher.

1. How to check assembled products?

2. From General safety precautions show the antistatic:

- ✓ Electrostatic wrist strip
- ✓ Antistatic mat
- ✓ Antistatic box

- Your teacher will evaluate your output either satisfactory or unsatisfactory. If Unsatisfactory, your teacher shall advice you on additional work. But if satisfactory, you can proceed to the next topic

Information sheet #2	Documenting Work Completion

2.1. Documenting Work Completion

Document of completion of work sample: For home office electrical electronics equipments

Electronics and other industrial projects (oil and gas, mining etc.) are extremely hard work. Projects can span for many years, and involve thousands of moving pieces and interdependent parts. These projects are already extremely risky for all parties, involving large bets which can be quickly derailed by unexpected delays, quality issues and more.

So when one of these projects come to an end, all parties involved are ready to seal the deal and issue their document of completion for work.

A document of completion of work is issued and signed by project parties when the contractor is deemed to have completed all of the Electronics works contained in the contract.

The main reason we need a document of completion for work in these Electronics and industrial projects is so that the project can be properly handed over, and so that liability and responsibility is handed over too. Documents of completion and these type of documents serve as the mechanism with which parties agree that that phase of the project is closed out - which is critical for disputes, contractor performance assessments and other important outcomes.

One of the difficulties in ending and 'completing' these projects is that there are multiple stages of completion including:

- Practical completion
- Defects liability period
- Completion of works
- Potential latent defects

While we won't get into the mechanics of latent defects here, is it important to know that the document of completion of work isn't necessarily the 'end' of the project.

Even so, signing off on a document of completion of work is an important milestone, and managing the document of completion process smoothly and professionally can have a big impact on stakeholder relations and how well and legally the contract and project is closed out.

Because of this, you'll find a document of completion of work sample below, as well as a more modern approach to documents of completion.

Both methods and frameworks can be used to improve how you manage the completion of work procedures.

Many Electronics and industrial projects still use physical or email documents to manage these type of important communications. And these documents do a great job of establishing the formal communication required to communicate these milestones.

But where these types of documents of completion of work fall short is:

- In providing the level of detail required to properly handover a project (all in one place)
- Providing the right formatting and framework for making the information easy to digest
- In making these documents easier to view, edit and share amongst other parties and collaborators

The document of completion of work example below, which is often called a certificate of completion in Electronics, serves to eliminate these issues by turning your document of completion into a smarter digital document - which more closely resembles your other important project information.

The document of completion of work example below comes pre-built with all of the detail all parties need to effectively certify that the project has been complete.

Every document of completion requires all of the important project details in the first section, the critical financial information in the second section, and then the official certifications and sign offs from the project parties.

You can view this 'better' document of completion of work example by hovering on the document and expanding it, or keep scrolling to find the more traditional document of completion of work sample [20].

Self Check #2	Written Test

Directions: Answer all the questions listed below.

Part I

Choose the best answer (each 5 points)

1. _____is issued and signed by project parties when the contractor is deemed to have completed all of the Electronics works contained in the contract.

A) Document of completion of work B) Document no completed

C) A & B D) None

2. Types of documents of completion of work fall short is:-

A) In providing the level of detail required to properly handover a project (all in one place)

B) Providing the right formatting and framework for making the information easy to digest

C) In making these documents easier to view, edit and share amongst other parties and collaborators.

D) All

3. One of the difficulties in ending and 'completing' these projects is that there are multiple stages of completion including:

A) Practical completion C) Completion of works

C) Defects liability period D) All

4. What are requirements of work completion documents?

A) All of the important project details in the first section,

B) The critical financial information in the second section,

C) Official certifications and sign offs from the project parties.

D) all

Note: Satisfactory rating 20 points **Unsatisfactory - below 20**

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

Score = _____
Rating: _____

Information sheet #3	Observing Housekeeping procedure with 5S discipline.

3.1. Five S Discipline

There are five 5S phases. They can be translated to English as "sort", "set in order", "shine", "standardize", and "sustain". Other translations are possible.

Sort

Figure 3.1. 1S – a red tag area containing items waiting for removal

Seiri is sorting through all items in a location and removing all unnecessary items from the location.

Goals:

- Reduce time loss looking for an item by reducing the number of unnecessary items.
- Reduce the chance of distraction by unnecessary items.
- Simplify inspection.
- Increase the amount of available, useful space.
- Increase safety by eliminating obstacles.

Implementation:

- Check all items in a location and evaluate whether or not their presence at the location is useful or necessary.
- Remove unnecessary items as soon as possible. Place those that cannot be removed immediately in a 'red tag area' so that they are easy to remove later on.

- Keep the working floor clear of materials except for those that are in use for production.

Set in order

Figure 3.2. 2S – simple floor marking

Seiton is putting all necessary items in the optimal place for fulfilling their function in the workplace.

Goal:

- Make the workflow smooth and easy.

Implementation:

- Arrange work stations in such a way that all tooling / equipment is in close proximity, in an easy to reach spot and in a logical order adapted to the work performed. Place components according to their uses, with the frequently used components being nearest to the workplace.
- Arrange all necessary items so that they can be easily selected for use. Make it easy to find and pick up necessary items.
- Assign fixed locations for items. Use clear labels, marks or hints so that items are easy to return to the correct location and so that it is easy to spot missing items.

Figure 3.3. 3S – cleanliness point with cleaning tools and resources

Seiso is sweeping or cleaning and inspecting the workplace, tools and machinery on a regular basis.

Goals:

- Improves the production process efficiency and safety, reduces waste, prevents errors and defects.
- Keep the workplace safe and easy to work in.
- Keep the workplace clean and pleasing to work in.
- When in place, anyone not familiar to the environment must be able to detect any problems within 15m (50 feet) in 5 sec.

Implementation:

- Clean the workplace and equipment on a daily basis, or at another appropriate (high frequency) cleaning interval.
- Inspect the workplace and equipment while cleaning.

Standardize

Seiketsu is to standardize the processes used to sort, order and clean the workplace.

Goal:

- Establish procedures and schedules to ensure the repetition of the first three ‘S’ practices.

Implementation:

- Develop a work structure that will support the new practices and make it part of the daily routine.
- Ensure everyone knows their responsibilities of performing the sorting, organizing and cleaning.
- Use photos and visual controls to help keep everything as it should be.
- Review the status of 5S implementation regularly using audit checklists.

Sustain/self-discipline

Figure 3.4. Shadow Board (with tools' outline) and worker's movement that is being used in Production floor

Shitsuke or sustain is the developed processes by self-discipline of the workers. Also translates as "do without being told".

Goal:

- Ensure that the 5S approach is followed.

Implementation:

- Organize training sessions.
- Perform regular audits to ensure that all defined standards are being implemented and followed.
- Implement improvements whenever possible. Worker inputs can be very valuable for identifying improvements.
- When issues arise, identify their cause and implement the changes necessary to avoid recurrence

3.2. Observe House Keeping Procedures

Effective housekeeping results in:

- reduced handling to ease the flow of materials
- fewer tripping and slipping incidents in clutter-free and spill-free work areas
- decreased fire hazards
- lower worker exposures to hazardous products (e.g. dusts, vapours)
- better control of tools and materials, including inventory and supplies
- more efficient equipment cleanup and maintenance
- better hygienic conditions leading to improved health
- more effective use of space
- reduced property damage by improving preventive maintenance
- less janitorial work
- improved morale
- improved productivity (tools and materials will be easy to find

Poor housekeeping can be a cause of incidents, such as:

- tripping over loose objects on floors, stairs and platforms
- being hit by falling objects
- slipping on greasy, wet or dirty surfaces
- striking against projecting, poorly stacked items or misplaced material
- cutting, puncturing, or tearing the skin of hands or other parts of the body on projecting nails, wire or steel strapping.

Housekeeping procedures

- Provide an orderly and clean work area conducive to the accomplishment of the research program.
- Ensure that work areas are devoid of physical hazards.
- Prevent the accumulation of materials from current and past experiments that constitute a hazard to laboratory personnel.

- Prevent the creation of aerosols of hazardous materials as a result of the physical cleaning procedures employed by custodial staff.

Self Check #2	Written Test

Directions: Answer all the questions listed below.

Part I

Explain the following terms (each 5 points)

1. Explain housekeeping procedures?
2. List and explain effective housekeeping?
3. List and explain poor housekeeping?
4). List and explain 5S discipline?

Part II

II. Choose the best Answer (each 5 point)

1. _____is putting all necessary items in the optimal place for fulfilling their function in the workplace.

a. Seiton c. Set in order

b. Shine d. none

2. Poor housekeeping can be a cause of incidents
    a. tripping over loose objects on floors, stairs and platforms
    b. being hit by falling objects
    c. slipping on greasy, wet or dirty surfaces
    d. striking against projecting, poorly stacked items or misplaced material
    e. all

Note: Satisfactory rating 30 points **Unsatisfactory - below 30**

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

Score = _____
Rating: _____

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The trainers who developed the TTLM

No	Name	Qual.	Educational background	Region	E-mail
1	Gashaw Yifiru	A	Electronics & Communication Technology	Oromia	Gashuyif@gmail.com +251921201589
2	Adinew Babu	A	Electronics & Communication Technology	Oromia	Adinewbabu2015@gmail.com +251917034691