BASIC HOME/OFFICE ELECTRICAL/ELECTRONICS EQUIPMENT SERVICING

LEVEL II

Learning Guide-42

Unit of Competence:	Carry-out Preventive Maintenance in Home/Office Electrical/ Electronic Equipment
Module Title:	Carrying-out Preventive Maintenance in Home/Office Electrical/ Electronic Equipment
LG Code:	EELHOS2 M11 LO1-LG-42
TTLM Code:	EELHOS2 M11TTLM 1019v1

Learning Guide #42	**LO 1:** Prepare unit, tools, equipment and workstation for preventive maintenance
Instruction Sheet	

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

- Making Workplace/equipment ready for maintenance
- Verifying Preventive maintenance
- Acquiring Service manuals and service information
- Arranging Workplace
- Preparing tools, test instruments and personal protective equipment

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

- Make Workplace/equipment ready for maintenance
- Verify Preventive maintenance
- Acquire Service manuals and service information
- Arrange Workplace
- Prepare tools, test instruments and personal protective equipment

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 5.
3. Read the information written in the information “Sheet 1, Sheet 2, Sheet 3, Sheet 4 and Sheet 5”.
4. Accomplish the “Self-check 1, Self-check 2, Self-check 3, Self-check 4 and Self-check 5 ” **in page -7, 10, 15,18 and 23** respectively.
5. Do the “LAP test” **in page – 24** (if you are ready).

Information Sheet-1	Making Workplace/equipment ready for maintenance

Introduction

What is maintenance and why is it performed? Past and current maintenance practices in both the private and Government sectors would imply that maintenance is the actions associated with equipment repair after it is broken. Maintenance is the total attention and care given to an equipment or a system in order to continue functioning well, both at its up-time and down time. It is simply the action taken to restore or keep an item in good functional order.

Also the dictionary defines maintenance as follows: "the work of keeping something in proper condition; upkeep." This would imply that maintenance should be actions taken to prevent a device or component from failing or to repair normal equipment degradation experienced with the operation of the device to keep it in proper working order. Unfortunately, data obtained in many studies over the past decade indicates that most private and Government facilities do not expend the necessary resources to maintain equipment in proper working order. Rather, they wait for equipment failure to occur and then take whatever actions are necessary to repair or replace the equipment. Nothing lasts forever and all equipment has associated with it some pre-defined life expectancy or operational life.

The purpose of this competency is to provide the recommended practices and frequencies that would form the core of a regularly scheduled electrical preventive maintenance program. All work associated with electric operated equipment maintenance should be performed in accordance with applicable state, federal and local regulations, OSHA electrical safety regulations, equipment manufacturer's instructions, accepted industry safety standards and work practices.

1.1 Preventive Maintenance

Preventive maintenance can be defined as follows: Actions performed on a time- or machine-run-based schedule that detect, preclude, or mitigate degradation of a component or system with the aim of sustaining or extending its useful life through controlling degradation to an acceptable level.

- Advantages
  - ✓ Cost effective in many capital-intensive processes.
  - ✓ Flexibility allows for the adjustment of maintenance periodicity.
  - ✓ Increased component life cycle.
  - ✓ Energy savings.
  - ✓ Reduced equipment or process failure.
  - ✓ Estimated 12% to 18% cost savings over reactive maintenance program.
- Disadvantages
  - ✓ Catastrophic failures still likely to occur.
  - ✓ Labor intensive.
  - ✓ Includes performance of unneeded maintenance.
  - ✓ Potential for incidental damage to components in conducting unneeded maintenance.

Depending on the facilities current maintenance practices, present equipment reliability, and facility downtime, there is little doubt that many facilities purely reliant on reactive maintenance could save much more than 18% by instituting a proper preventive maintenance program.

While preventive maintenance is not the optimum maintenance program, it does have several advantages over that of a purely reactive program. By performing the preventive maintenance as the equipment designer envisioned, we will extend the life of the equipment closer to design. This translates into cost savings.

Preventive maintenance (cleaning, lubrication, tightening, re-soldering etc.) will generally run the equipment more efficiently resulting in dollar savings. While we will not prevent equipment catastrophic failures, we will decrease the number of failures. Minimizing failures translate into maintenance and capital cost savings.

A quality preventive maintenance program requires a highly motivated preventive maintenance crew. To provide proper motivation, the following activities are suggested:

- Establish inspection and preventive maintenance as a recognized, important part of the overall maintenance program
- Assign competent, responsible people to the preventive maintenance program
- Monitor and follow-up on tasks to ensure quality performance and to show everyone that management does care
- Provide training in precision maintenance on specific equipment
- Set high standards
- Publicize reduced costs with improved up-time and revenues, which are the result of effective preventive maintenance

1.2 OH&S Policies and procedures

Occupational health and safety is an aspect of public health program. Creating a healthy workplace and a healthy work force in any occupational environment is the best way to position that occupation to better delivery of service. Concern for your own safety as well as the safety of others should always be on your mind. Most safety procedures are common sense but, because some hazards are not obvious, there are regulations born out of experience which are designed to make the workplace safer. The need to use safe working practices and safety equipment is to avoid the risk of injury to yourself and to others in the course of your work.

1.2.1 Need of occupational health and safety:

- ✓ We have to ensure in all business about the care of technicians and all the persons involved in business for good health all the time.
- ✓ It provides technicians lives and health.
- ✓ Occupational safety and health rules can decrease technician's injury and illness.

In general, Occupational health and safety (OHS) policies and procedures protect the safety, health and welfare of people at the work place.

1.2.2 Safety requirements of equipment/tools

There may be particular requirements on the equipment you use at work; where this is the case the leaflet will point you towards further information you may need.

1.2.3 What equipment is covered by the Regulations?

Generally, any equipment which is used by an employee at work is covered, for example hammers, knives, drilling machines, power presses, and printers, photocopiers, lifting equipment (including lifts), and motor vehicles. Similarly, if you allow technicians to provide their own equipment and you will need to make sure it complies. Examples of uses of equipment which are covered by the Regulations include starting or stopping the equipment, repairing, modifying, maintaining, servicing, cleaning and transporting.

1.2.4 Codes, Standards, and Regulations

Workers who perform electrical or electronic work, where applicable, shall comply with relevant DOE Orders and should comply with the current revision of the following codes and standards.

- Standards published by the National Fire Protection. Association (NFPA)
  - ✓ National Electrical Code (NEC), NFPA 70
  - ✓ Electrical Safety Requirements for Employee Workplaces, NFPA 70E.
- National Electrical Safety Code, ANSI C2.
- All relevant state and local requirements.

The standards and performance specifications from the following organizations are recommended and should be observed when applicable:

- Institute of Electrical and Electronics Engineers (IEEE)
- National Electrical Manufacturers Association (NEMA)
- American National Standards Institute (ANSI)
- American Society for Testing and Materials (ASTM)

- National Fire Protection Association (NFPA)
- Underwriters Laboratory, Inc. (UL)
- Factory Mutual Engineering Corporation (FMEC)
- Other Nationally Recognized Testing Laboratories recognized by OSHA on a limited basis.

Where no clear applicable code or standard provides adequate guidance or when questions regarding workmanship, judgment, or conflicting criteria arise, personnel safety protection shall be the primary.

1.3 Preparing work station/Equipment

a. Workstation

The first order of activity when working maintenance activity on any type of Electrical/ Electronic equipment is preparing a proper work area.

- ✓ You need a clear, flat workspace on which to rest the device/equipment.
- ✓ Make sure your workspace is large enough to accommodate the work piece.
- ✓ Check to make sure that an adequate number of power receptacles are available to handle all the equipment you may need.
- ✓ Try not to locate your workspace in a high-traffic area.
- ✓ Good lighting is a prerequisite for the work area because the technician must be able to see small details such as part numbers; cracked circuit foils, or solder splashes. An adjustable lamp with a shade is preferable. Fluorescent lighting is particularly desirable.
- ✓ In addition, a magnifying glass can prove to be a helpful item when trying to read small part numbers or when looking for cracks in printed circuit board traces

b. Equipment

- Office Equipment may include but not limited to the following:
  - ✓ Photo copy machine (analogue & Digital
  - ✓ Fax machine
  - ✓ Printer
  - ✓ Scanner
  - ✓ UPS
  - ✓ PC
- Work on energized/de-energized electrical equipment

The first consideration for working on any electrical equipment/system is to have the circuit positively de-energized. All circuits and equipment must be considered energized until opened, tagged and/or locked according to an approved procedure and should be proven de-energized by testing with an approved testing device known to be in proper working order. Review system drawings and/or perform system walk downs. Where the possibility exists that the equipment/circuit can become energized by another source or where capacitive devices (including cables) may retain or build up a charge, the circuit should be

grounded and shorted. The grounding and shorting device should be selected and installed in accordance with appropriate standards. Whenever work is to be performed on a positively de-energized system, the worker must also identify and protect against any accidental contact with any exposed energized parts in the vicinity of the work.

- Working space around electrical equipment

Working space around electrical enclosures or equipment shall be adequate for conducting all anticipated maintenance and operations safely, including sufficient space to ensure safety of personnel working during emergency conditions and workers rescuing injured personnel. Spacing shall provide the dimensional clearance for personnel access to equipment likely to require examination, adjustment, servicing, or maintenance while energized.

Self-Check -1	Written Test

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

1. _____ is the total attention and care given to an equipment or a system in order to continue functioning well, both at its up-time and down time.(2 points)
   A. Repair C. Maintenance
   B. equipment D. Testing
2. Occupational health and safety is an aspect of public health program. (True, False) (1 points)
3. Creating a healthy workplace and a healthy work force in any occupational environment is the best way to position that occupation to better delivery of service. (True, False) (1 points)
4. The need to use safe working practices and safety equipment is to avoid the risk of injury to yourself and to others in the course of your work. (True, False) (1 points)
5. The first order of activity when working maintenance activity on any type of Electrical/ Electronic equipment is preparing a proper work area. (True, False) (1 points)

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

1. C

2. True
3. True
4. True
5. True

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

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

Information Sheet- 2	Verifying Preventive maintenance

2.1 Maintenance Schedules and Documentation

Complete, accurate, and current documentation is essential to an effective maintenance program. Whether performing preventive, predictive, or reliability centered maintenance, keeping track of equipment condition and maintenance—performed and planned—is critical.

The maintenance recordkeeping system must be kept current so that a complete maintenance history of each piece of equipment is available at all times. This is important for planning and conducting an ongoing maintenance program and provides documentation needed for the technician.

Regular maintenance and emergency maintenance must be well documented as should special work done during overhauls and replacement.

The availability of up-to-date drawings to management and maintenance staff is extremely important. Accurate drawings are very important to ongoing maintenance, testing, and new construction; but they are essential during emergencies for troubleshooting. In addition, accurate drawings are important to the continued safety of the staff working on the equipment.

Before performing any maintenance activity in all electrical/electronic equipment prior to watch documents of equipment's preventive maintenance record that is appropriate for electrical preventive maintenance should be inspected, tested, and serviced in accordance with an electrical preventive maintenance program defined by the equipment manufacturer manual.

Inspections, tests, and servicing shall be performed by personnel who are qualified for the work to be performed. These qualifications can be shown by appropriate documentation of work experience, on-the-job, and offsite formal training to verify understanding and retention of minimum knowledge, skills, and abilities.

2.2 Verifying Equipment Preventive maintenance history

Industries that Manufacture electrical/electronic equipment prepares service manual, operating instructions, and user's manual beside to the manufactured equipment which comprises every detail information about the equipment(like how the equipment operates, when did the equipment will be maintained, and how the user must be use the equipment).

Equipment service manual prescribe every detail required information about how, when, the equipment will be service and which type of service employ based on manufacturer and international standard.

Once the defected equipment arrive workshop to be maintain the technician primarily ensure equipment's service profile by verifying equipment preventive maintenance history in line with the company procedures to simplify servicing task.

Ways of verifying equipment's service profile in line with company procedure;

- Does user follow pre-operation procedures of equipment before starting main task properly as company ordered procedure?
- Does user use the equipment properly as company ordered procedure?
- Does user perform preventive maintenance as company ordered?
- Does user perform preventive maintenance following company ordered time schedule?

Self-Check 2	**Written Test**

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

1. Complete, accurate, and current documentation is essential to an effective maintenance program. (True, False) (1 points)
2. The availability of up-to-date drawings to management and maintenance staff is extremely important. (True, False) (1 points)
3. Before performing any maintenance activity in all electrical/electronic equipment prior to watch documents of equipment's preventive maintenance record.(True, False) (1 points)
4. Equipment service manual prescribe every detail required information about how, when, the equipment will be service and which type of service employ based on manufacturer and international standard. (True, False) (1 points)

Answer Sheet

Score = _____
Rating: _____

Name: _____ Date: _____

Part I: True or False Item

1. True
2. True
3. True
4. True

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

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

Information Sheet- 3	Acquiring Service manuals and service information

3.1 Service manuals

Service manuals are available for a great deal of consumer electronics. Once you have exhausted the obvious possibilities or mechanical problems, the cost may be well worth it. Depending on the type of equipment, the price becomes more. Some are more useful than others.

However, not all include the schematics so if you are hoping to repair an electronic problem try to check before buying.

The availability of up-to-date, accurate, and complete diagrams is the foundation of a successful electrical preventive maintenance program. No electrical preventive maintenance program can operate without them, and their importance cannot be overemphasized. The following diagrams are some of those in common use:

3.1.1 Operating instructions/User's/Owner's manual
3.1.2 Component data sheet/handbook

3.1.1 Operating instructions/User's/Owner's manual

Operating Instruction manual prepared by the equipment manufacturer which contains detailed instructions and notes on the operation and use of the machine. Before using the machine/equipment the user must read the manual carefully for his/her safety and benefit, The manual must be kept in a handy place for quick reference.

3.1.2 Component data sheet/handbook

Ultimate success for an electronic or electrical product design can only be achieved through judicious selection of component parts for use in that design. The increasingly competitive economic environment no longer allows designer complacency if corporate survival is to be assured.

Handbook of Components for Electronics prepared thorough and comprehensive sourcebook of practical data, guidelines, and information for all ranges of interests. It contains a next ensive array of property and perform anecdata for all the important component groups; these are presented as a function of the most important design and performance variables. Further, it presents comparison data and guidelines for best trade-off design decisions, extensive test and reliability data, detailed

listings of important specifications and standards, a wealth of data and information on dimensions, configuration, and mechanical and environmental performance.

3.2 Service Information

3.2.1 Job Orders

Definition: Job order is a documented task specifications that an individual is required to complete the task at a given unit of time.

Job orders are very much and highly recommended for each and every skilled worker in his/her work environment particularly in almost all industries. In which, most of these industries required it for the purpose of written report or a documented report of the task being perform.

There are several kinds of job orders as well as formats and required information that may vary depending upon the nature of the industry or a service center.

JOB ORDER CONTENTS

Job Order Control Number	is basically non-identical number usually located at the upper left or right corner of the sheet usually written in different color
Name of Client	This field contains the clients name usually divided in three (3) parts, the family name, first/given name and the middle initial. But some job orders may only have one (1) single field that requires the complete name of the client.
Contact Number	requires the client contact number either a cellular phone number or a landline telephone
Client's Address	requires the current address of the client
Job Description	represents the overall overview of the task to be perform
Date and Time	The date when the job order is requested of delivered
Date Finished	The date when the task is completed.
Signature	Signatures are areas of the job order form that requires the signature of the technician and the client that serves as the specimen of agreement between the two parties.

JOB ORDER

Job Order No:			**Date:**	
Name of Client:	(Family Name):	(Given Name):	MI:	Contact No:
Client's Address:				

Appliance Type:	Brand name:	Model:	Serial:	Color:

Appliance Physical Pre-Conditions:	Symptoms:
1. _____	1. _____
2. _____	2. _____
3. _____	3. _____

Date & Time Received:	Expected Date & Time to be released:	Received by:
Date_____/Time_____	Date_____/Time_____	

Assigned Technician:	Date Received:	Technician's Pre-Condition Findings:
_____		1. _____ 2. _____

Diagnose Results:

1. _____
2. _____
3. _____

Replacements: (If any)

No. of Items	Description	Price/Unit	Total/Unit	Remarks
TOTAL AMOUNT:				

Report:	Signature of Technician:
_____ _____ _____	

Total Billing: (Amount in words)		(w/ Service Charge)
Date & Time Released: Date_____/Time_____	Released by:	Received by: (Owner)

Tabel-1: Sample Job Order

Preparing Job Orders

For most service centers, preparation of job before the start of every task is required. Basically, preparing job orders are just filling out the information required. In addition, a short conversation should take place between the owner and the one who prepares the job order.

Most of the questions that should be ask:

1. When was this equipment started to show irregular operation or malfunctioning.
2. Events took place before the fault happened
3. Repair history of the equipment if any.

These questions are most likely to be ask, since this information could lead some conclusions and future awareness.

Interpreting Job Orders

For most of the industry they provide job orders to their skilled workers to have a concrete formal request of the task to be done. Before each task to be done the worker should be able to secure the job order, "**no job order means NO task to be done**". Upon receiving the job order make sure that all required fields are correctly and clearly written.

First, check date and Job Order control number for its validity. Next, is to check the client's name, address and contact number, this information is highly required, which means that if this required information are missing, the worker should refer to the immediate supervisor.

The most important part of the job order is the task description in which each worker should be able to understand and be able to attain the task requirement within the specific period of time which is also can be seen under the date and time of completion.

As a worker, time consciousness is very important to be able to attain the required span of time.

Once these job plans and work orders are established, implementation of well-executed maintenance is possible.

Self-Check 3	**Written Test**

Directions: Match the terms with the following statements found on the right side. Write the corresponding letter

Column A

_____1. Job Order Control Number
_____2. Name of Client
_____3. Contact Number
_____4. Client's Address
_____5. Job Description
_____6. Date and Time
_____7. Date Finished
_____8. Signature

Column B

a. The date when the task is completed.
b. This field contains the clients name usually divided in three (3) parts, the family name, first/given name and the middle initial. But some job orders may only have one (1) single field that requires the complete name of the client.
c. Is basically non-identical number usually located at the upper left or right corner of the sheet usually written in different color?
d. requires the current address of the client
e. represents the overall overview of the task to be perform
f. requires the client contact number either a cellular phone number or a landline telephone
g. Signatures are areas of the job order form that requires the signature of the technician and the client that serves as the specimen of agreement between the two parties.
h. The date when the job order is requested of delivered

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Part I: Matching Item

1. c 5. e

2. b 6. h

3. f

4. d

7. a

8. g

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

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

Information Sheet- 4	Arranging Workplace

Introduction

Prior to beginning any maintenance work at the workshop, an individual should be designated as the person in charge (PIC) to be responsible for seeing that the safety rules according to company standard procedures are followed and to coordinate all the work activities. All personnel assigned to the job shall comply with the safety rules.

Electrical repair work shall perform only by qualified persons. It is dangerous for an unqualified worker to attempt electrical repair. According to company standard procedures before any electrical maintenance or troubleshooting is performed, sources of electrical energy shall be de-energized, except where it is necessary for troubleshooting, testing, or areas that are infeasible to de-energize.

All energy sources shall be brought to a safe state. For example, capacitors shall be discharged and high capacitance elements shall be short-circuited and grounded

In reference to different company standard procedures a work area should consist of a large workbench, desk, or table (preferably wooden) for performing repair and circuit assembly, with household electrical power (220volts AC) readily accessible to power soldering equipment, power supplies, and any test equipment.

Inexpensive desks intended for computer use function very well for this purpose. Avoid a metal-surface desk, as the electrical conductivity of a metal surface creates both a shock hazard and the very distinct possibility of unintentional "short circuits" developing from circuit components touching the metal table top.

Vinyl and plastic bench surfaces are to be avoided for their ability to generate and store large static-electric charges, which may damage sensitive electronic components. Also, these materials melt easily when exposed to hot soldering irons and molten solder droplets.

The work area should be well-lit and comfortable. The workbench should have a "power strip" to the underside, into which to plug all 220volt devices. It is convenient to have a single switch for shutting off all power in case of an accidental short-circuit!

4.1 Arranging Workplace

After the job order is clearly understood, the worker should immediately perform task planning and preparation based on the job specifications.

The following, where used, will improve the safety of the workplace:

- ✓ Prepare workstation as required based from the job specifications. Make sure that 5's is implemented as well as safety precautions.
- ✓ Make the workplace free of un-necessary objects.
- ✓ Prepare the tools and devices that are only needed.
- ✓ Maintain good housekeeping and cleanliness.
- ✓ Identify and diminish potential hazards.
- ✓ Anticipate problems.
- ✓ Resist pressure to "hurry up."
- ✓ Plan and analyze for safety in each step of a project.
- ✓ Document work.
- ✓ Use properly rated test equipment and verify its condition and operation before and after use.
- ✓ Know and practice applicable emergency procedures.
- ✓ Wear appropriate personal protective equipment (PPE).
- ✓ Refer to system drawings and perform system walk downs.
- ✓ Electrical equipment should be maintained in accordance with the manufactures instructions.

Self-Check 4	**Written Test**

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

1. Electrical repair work shall perform only by qualified persons. (True, False) (1 points)
2. The work area should be well-lit and comfortable. (True, False) (1 points)
3. Prepare workstation as required based from the job specifications. Make sure that 5's is implemented as well as safety precautions. (True, False) (1 points)
4. Make the workplace free of un-necessary objects. (True, False) (1 points)
5. Prepare the tools and devices that are only needed. . (True, False) (1 points)

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Answers:

1. True
2. True
3. True
4. True
5. True

Note: **Satisfactory rating - 3 and above** **Unsatisfactory - below 3**

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

Information Sheet-5	Preparing tools, test instruments and personal protective equipment

5.1 Preparing tools, test instruments and personal protective equipment

Proper tools and instruments are an important part of an electrical preventive maintenance program, and safety protective gear is an essential part of the necessary equipment. Proper tools, instruments, and other equipment will ensure maximum safety and productivity from the maintenance crew. Where specialized instruments and test equipment are needed only occasionally, they can be rented from a variety of sources.

Proper tools and equip are essential for the effective operation of any electrical maintenance works. Equipping the workshop with the correct tools and equipment plays an essential role in achieving timely and good results. For every maintenance activity there is an optimal combination of tools, equipment and technicians. Depending on the nature and content of the works, the technician needs to know which tools to use and how to effectively use it.

Faulty tools, test instruments and equipment is a common reason for poor maintaining work. A major responsibility of the technician is to ensure that selected tools, test instruments and equipment are maintained in a good condition and are readily available when required for the work activities.

Prepare the tools and devices that are only needed. The following tools and devices needed for the following jobs:

- Pre-testing:
  - ✓ Multi-tester
  - ✓ Personal Protective Equipment
  - ✓ Service Manual/Owner’s Operating Manual

- Dis-assembling/Assembling:
  - ✓ Screwdriver
  - ✓ Pliers
  - ✓ Tweezers
  - ✓ Cleaning Brush

- ✓ Wrenches
- ✓ Stripper/Knife
- ✓ Soldering Iron with stand
- ✓ De-soldering pump
- ✓ Allen wrench
- ✓ Service Manual

- Diagnostic/ Test instruments:
  - ✓ Multi-tester
  - ✓ Soldering Iron with stand
  - ✓ De-soldering pump
  - ✓ Soldering lead
  - ✓ Oscilloscope
  - ✓ ESD-free workbench with mirror
  - ✓ Service Manual

Note: It may also require special devices and tools depending on the equipment's need.

- ✓ Soldering paste
- ✓ Thinner
- ✓ Cleaning brush
- ✓ Stripper/Knife
- ✓ Electronic components for replacement

5.1.1 Electrical Personal Protective Equipment (PPE)

Qualified workers are responsible for avoiding and preventing accidents while performing electrical work, repairs, or troubleshooting electrical equipment. Personnel shall wear or use personal protective equipment (PPE), and protective clothing that is appropriate for safe performance of work.

- Electrical Safety Shoes

For safety, one should always wear and take care of electrical safety shoes whenever one works in the vicinity of energized equipment's. Unlike regular safety shoes, electrical safety shoes do not have any exposed metal parts. These are specially designed using non- conducting materials to provide insulation from electric shock.

Figure 1: safety Shoes

- Rubber Gloves

Based on the wall thickness and maximum safe voltage rating, the rubber insulating gloves are classified in various categories. Some of the generally used gloves are shown below inFig.4.

Figure 2: rubber Gloves

- Safety Shorting Probe

Some electronic equipment use large capacitors to filter the electrical power. These capacitors must be discharged before working on the equipment. A safety authority probe will be required for this. The procedures to be minimally followed are:

- ✓ Ensure that input power has been unplugged.
- ✓ Open the equipment to discharge the capacitors. Don't touch any naked terminals without safety gloves on

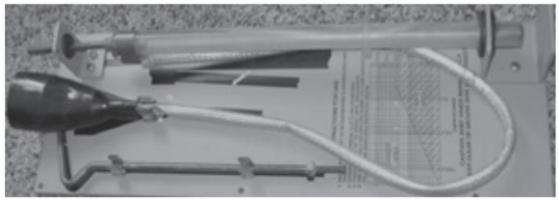


Figure 3: safety Shorting Probe

- Retina Protection

An electronics technician must protect his eyes for this, he needs to know:

- ✓ When to wear eye protection.
- ✓ Which eye protection to wear.
- ✓ Whenever you are doing something that could potentially damage your eyes, you must have eye protection on.

Figure 4**:** google

- Hearing Protection

Working around noisy equipment, may cause damage to eardrums. Generally, this damage manifests itself slowly. Working at places with high vibration field could cause slow and consistent hearing deficit leading to complete or partial deafness. This can be minimized by wearing hearing protection.

The various types of hearing protective aids are shown below.

Figure 5: headphone

- Respiratory Protection

Whenever you work with materials that can possibly lead to respiratory issues, one must take precautions and wearing safety masks is advisable. Some of the masks used in industry are shown in Fig.6.

Figure 6: safety masks

Self-Check 4	**Written Test**

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

1. Selection of proper tools, instruments, and other equipment will ensure maximum safety and productivity. (True, False) (1 points)
2. Equipping the workshop with the correct tools and equipment plays an essential role in achieving timely and good results. (True, False) (1 points)
3. Faulty tools, test instruments and equipment is a common reason for poor maintaining work. (True, False) (1 points)
4. Qualified workers are responsible for avoiding and preventing accidents while performing electrical work, repairs, or troubleshooting electrical equipment. (True, False) (1 points)
5. Some electronic equipment use large capacitors to filter the electrical power. These capacitors must be discharged before working on the equipment. (True, False) (1 points)

Answer Sheet

Score = _____
Rating: _____

Name: _____ Date: _____

Answers:

1. True
2. True
3. True
4. True
5. True

LAP Test	**Practical Demonstration**

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions:

1. You are required to perform the following:

   Task-1 Prepare Job Order
   Task-2 Interpret job order
   Task-3 Plan and Prepare workstation

2. Request your teacher for evaluation and feedback.

List of Reference Materials

1. Troubleshooting and Repair of Consumer Electronics Equipment. Available on: WWW server http://www.repairfaq.org/ [Copyright] [Disclaimer]
2. Printed Circuit Connectors, Electromech. Des., August 1970, pp. 16-23.
3. Forney, E.: Proc. 1969 Ann. Connector Symp., Electronic Connector Study Group, Cherry Hill, N.J.
4. Waters, B.: Proc. 1969 Ann. Connector Symp., Electronic Connector Study Group, Cherry Hill, N.J.
5. Stasch, A.: The Hermetically Sealed Connector and Its Capabilities, Electron Ind., May1964,p. 72.
6. Reliability Statistics for Electromechanical Devices, Amphenol-Borg Electronics Corp.

Learning Guide # 43	**LO 2:** Perform preventive maintenance
Instruction Sheet	

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

- Inspecting external part of equipment
- Opening equipment case according to manual
- Cleaning Internal part of equipment
- Re-soldering Loose connection
- Lubricating Moving parts in accordance manufacturer specification
- Cleaning Mechanical parts

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

- Inspect external part of equipment
- Open equipment case according to manual
- Clean Internal part of equipment
- Re-solder Loose connection
- Lubricate Moving parts in accordance manufacturer specification
- Clean Mechanical parts

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 6.
3. Read the information written in the information “Sheet 1, Sheet 2, Sheet 3, Sheet 4 and Sheet 5”.
4. Accomplish the “Self-check 1, Self-check 3, Self-check 4 and Self-check 5” **in page -28, 35, 39 and 40** respectively.
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1 and Operation Sheet 2” **in page -42, 44, 46, 48, 50, 53, 55, 58**
6. Do the “LAP test” **in page – 42, 45, 47, 48, 52, 54, 56, and 58.** (if you are ready).

Information Sheet-1	Inspecting external part of equipment

Visual Inspection technicians pioneered preventive maintenance as a means to increase the reliability of the equipment. By simply expending the necessary resources to conduct maintenance activities intended by the equipment designer, equipment life is extended and its reliability is increased. In addition to an increase in reliability, costs are saved over that of a program just using reactive maintenance.

Equipment condition will reveal repair work to be done, as well as the nature and frequency of required inspections and tests.
Inspection and testing procedures should be carefully tailored to requirements. The equipment must be visually inspected before disassemble and maintaining activity begins. The aim of the visual inspection is to confirm that all equipment and accessories are undamaged and comply with the relevant Standards.

A checklist for the initial visual inspection of an equipment, including: only;

- correct connection of socket outlets;
- Methods of ‘basic protection’ against electric shock, including the insulation of live parts and placement of live parts out of reach by fitting appropriate barriers and enclosures;
- Methods of ‘fault protection’ against electric shock including the presence of earthing conductors for both protective bonding and supplementary bonding.
- Prevention of detrimental influences (e.g. Corrosion);
- Presence of appropriate devices for isolation and switching;
- Choice and setting of protective devices;
- Presence of danger notices and other warning notices;
- Presence of diagrams, instructions and similar information;

Self-Check 1	**Written Test**

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

1. Visual Inspection technicians pioneered preventive maintenance as a means to increase the reliability of the equipment.. (True, False) (1 points)
2. The equipment must be visually inspected before disassemble and maintaining activity begins. (True, False) (1 points)
3. Checklist for the initial visual inspection of an equipment includes correct connection of socket outlets. (True, False) (1 points)
4. checklist for the initial visual inspection of an equipment includes presence of danger notices and other warning notices (True, False) (1 points)
5. Checklist for the initial visual inspection of an equipment includes presence of appropriate devices for isolation and switching. (True, False) (1 points)

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Answers:

Answers:

1. True
2. True
3. True
4. True
5. True

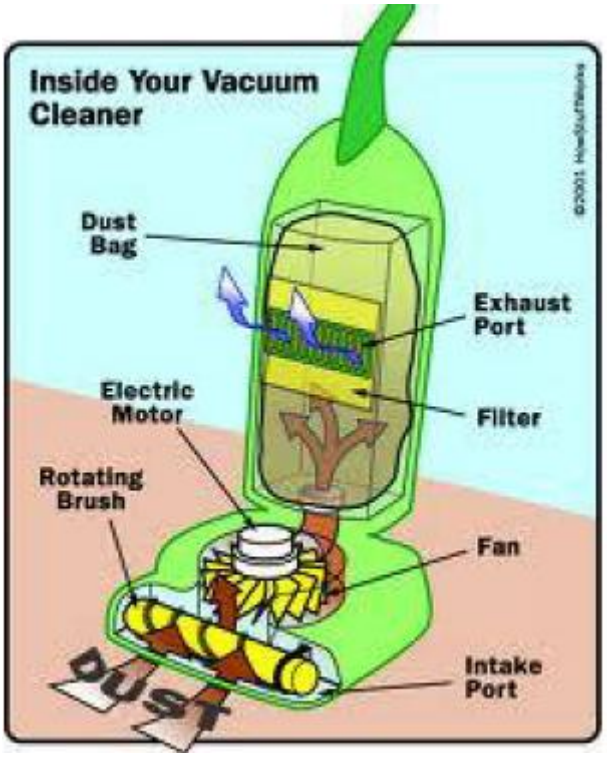
Information Sheet-2	Opening equipment case according to manual

Introduction

Manufacturers seem to take great pride in being very mysterious as to how to open their equipment. Not always, but this is too common to just be a coincidence. Opening the equipment non-destructively may be the most difficult and challenging part of many repairs!

2.1 Vacuum Cleaner

A vacuum cleaner is a device that uses an air pump to create a partial vacuum to suck up dust and dirt, usually from floors, and optionally from other surfaces as well. The dirt is collected by either a dust bag or a cyclone for later disposal. Vacuum cleaners, which are used in homes as well as in industry, exist in a variety of sizes and models— small battery-operated hand-held devices, domestic central vacuum cleaners, huge stationary industrial appliances that can handle several hundred litters of dust before being emptied, and self-propelled vacuum trucks for recovery of large spills or removal of contaminated soil.



Basic Parts of Common Vacuum Cleaner

Dust Bag – serves as the container for the dust and other small materials.

Exhaust Port – serves as an exit of the sucked air from the intake port

Filter – Filter out particles and dust going thru the exhaust port

Electric Motor – drives the suction fan

Fan – provides the pressurized air for suction purposes

Rotating brush – use the prevent large objects from entering the intake port

Intake port – where dust is sucked and stored in the dust bag.

Note:

Please refer to the service manual provided.

2.2 Toasters

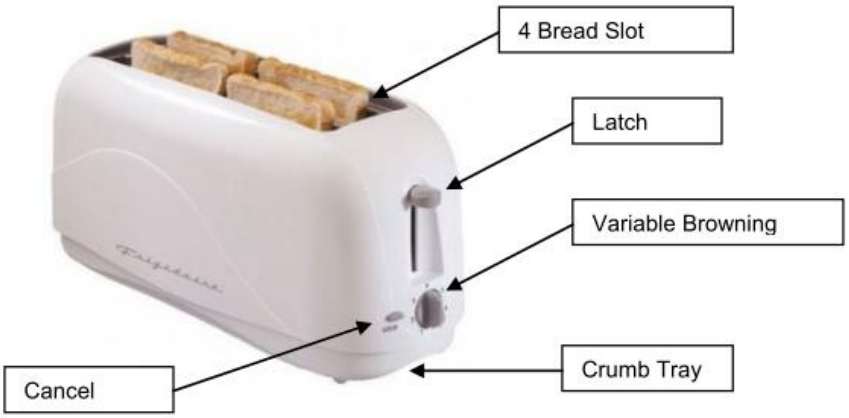
Toasters are categorized as heating appliances. Their function is to develop sufficient heat near a slice of bread to heat and toast it.

Breakfast certainly wouldn't be the same without the pop-uptoaster.

Figure 7. Physical Parts of a Bread Toaster

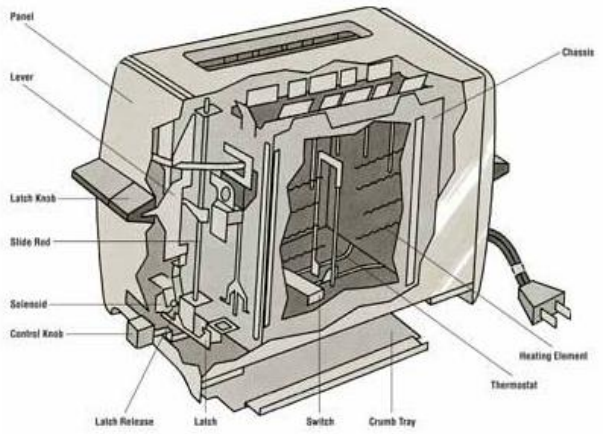
In many homes, toasters malfunction more than any other small appliance. There are two reasons for this. First, toasters are typically built economically to be a throw-away appliance. Replacement models start at.

Second, malfunctions are frequently not the fault of the toaster itself but of food particles that interfere with its operation. Excess pieces of bread broken off by carriage movement fall into the base of the toaster and accumulate, obstructing carriage movement, shorting out heating elements, plugging the latch release, and interfering with solenoid operation.



a.

Figure 2. Internal Parts



b.

Figure 8. Physical Parts of a Bread Toaster

- **Panel –** Serves as external protective cover for the equipment
- **Lever –** Connects the Latch knob with the slide rod
- **Slide Rod –** A metal rod usually functions as the main mechanical part where the levers as well as the bread tray are attached.
- **Solenoid –** An electromagnetic component that enables the latch assembly during toasting
- **Latch –** A mechanical part which is also connected with the switch that provide locking effect.

- **Control knob –** in modern toasters it refers to the variable browning control knob that serves as the timer.
- **Latch Release –** A mechanical switch that releases the Latch
- **Switch –** A mechanical switch that enables the heating element to operate
- **Thermostat –** A device use to control the amount of temperature produce by the heating element
- **Heating Element –** Usually made of Nichrome wire that produces heat.
- **Chassis** – a metallic assembly the holds the heating element, thermostat, etc**.**

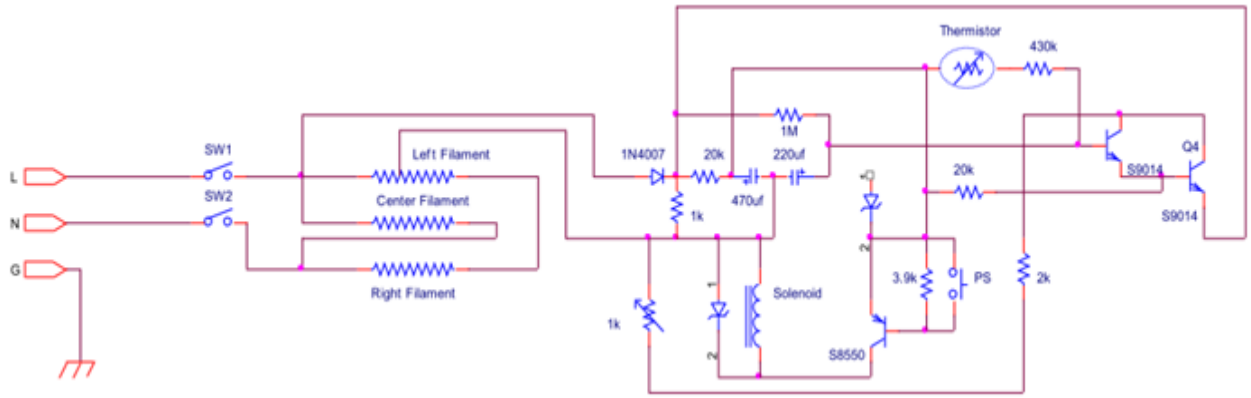


Figure 8. Schematic diagram for Akira: PT-704

Operation Sheet – 1	Bread Toaster Servicing

Purpose: This operation enumerates the proper procedure Bread Toaster Repair and Servicing

Equipment, Tools and Materials:

- Job Order Form
- Pencil/Ball pen
- Faulty equipment
- Appropriate Tools and devices
- Toaster Service Manual

Conditions or Situations for the Operation:

- Consider that the event took place in an appliance service center.
- The Trainee is the service technician

Procedure:

Refer also to the service manual provided for the particular equipment available if any.
Common toaster repairs include servicing the latch assembly, servicing the chassis, recalibrating the thermostat, and servicing the solenoid.
Servicing the Latch Assembly: The carriage and latch are vital components to the operation of pop-up toasters. If they don't work smoothly, bread or other food products cannot be held in position to be heated. To clean and lubricate the latch:

Step 1: To access the latch, remove the end panel by removing levers, knobs, and fasteners. On some models, disassemble the entire case by removing levers, knobs, crumb tray door, and fasteners. Fasteners are usually accessed from the bottom of the toaster, though some models hide them under plates and self-adhesive labels on the side.
Step 2: Once the cover is removed, inspect the latch assembly to determine if there are obvious problems such as a food particle or loose part jamming the assembly. Clean the latch area using a can of compressed air to blow away crumbs.
Step 3: Move the carriage lever up and down to check for smooth operation. If the carriage moves stiffly, carefully lubricate the rod on which the latch lever travels. Use a petroleum lubricant, making sure you don't get any of it on adjacent electrical parts.
Step 4: Check the operation of the latch to ensure that it works smoothly. You may need to carefully bend the latch so it catches properly.
Servicing the Chassis: Most of the mechanism within a toaster is mounted on a frame called the chassis. To repair or replace many internal parts, including the heating elements, you will need to remove the chassis from the toaster shell. Disassemble the toaster by removing levers, knobs, and fasteners, and then carefully lift the shell off the chassis.
Some toasters will require that you disconnect the power cord internally before you can fully remove the chassis. Depending on the problem your toaster is having, you may want to replace the entire chassis or just one or two components.
Recalibrating a Thermostat: The thermostat in a pop-up toaster performs a vital function in telling the solenoid how long you want the heating elements to toast the bread. If your toaster seems to ignore your setting, the thermostat may be out of adjustment.

To recalibrate the toaster:
Step 1: Clean the toaster to ensure that food particles are not jamming the mechanism or shorting out the electronics.
Step 2: To recalibrate the thermostat, make sure the toaster is cool, turn it over on its top, and open the crumb tray cover.
Step 3: On most units, a bracket from the control knob will be visible. On this bracket there will be a calibration knob, screw, or nut that can be turned to recalibrate the thermostat. Moving the bracket toward the solenoid switch typically will shorten the toasting cycle, and moving it away from the solenoid switch will lengthen the cycle. You can shorten the cycle if the toast is too dark or lengthen the cycle if the toast is too light.
Step 4: Close the toaster, plug it in, and toast a piece of bread to determine if the adjustment is correct. If adjusting the thermostat doesn't solve the problem, consider replacing the thermostat or the toaster.
Servicing a Solenoid: The thermostat activates a switch that operates the solenoid. The solenoid releases the latch. So if your toaster burns toast or doesn't want to release the carriage, the solenoid switch or the solenoid itself may be faulty. The solenoid switch is located near the thermostat and can be accessed by opening the crumb tray cover. Test it with a continuity tester. If it is faulty, remove it and replace it with a new switch.
The solenoid is located near the latch at one end of the toaster. To access it, remove the end cover, or the shell. Test the solenoid with a continuity tester and replace if faulty. If either the

solenoid or switch is installed with rivets rather than screws, consider replacing the entire chassis or the toaster itself. Riveted parts are difficult to remove and replace without special tools.

Some Common Problems

Toaster's lever switch won't attract

Electrical Connection

Make sure that the plug is connected to an outlet in your wall. In addition, examine your wiring for any fraying that may be preventing electricity from reaching the main electronic circuit board. Check the rectifier diode, transistors and the solenoid for possible damage.

Toaster won't give heat

Electrical Connection

Check the heating element for possible disconnection or damage

Over toasted

Thermistor problem

Check the condition of the thermistor or the transistor.

Precautions:

- Apply Kaizen/5's
- Safety

Quality Criteria:

- The trainee should be able to perform the following procedures accordingly

Information Sheet-3	Cleaning Internal part of equipment

Electrical equipment working environment and place were installed maters equipment working performance and working life time in relation to company standard. Dust and other chemical compounds found in smoke affects electronic equipment. Therefore by using air blower or other cleaning material we have to clear the equipment parts according to company standard.

Some of effects of dust and other chemical compounds found in smoke on electronic equipment;

- Coats some parts of equipment.
- Coats mechanical parts and promotes the loss of lubrication in all equipment.
- May contribute to deterioration of plastic and rubber parts.

Self-Check 3	Written Test

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

1. Electrical equipment working environment and place were installed maters equipment working performance and working life time in relation to company standard. (True, False) (1 points)
2. Dust and other chemical compounds found in smoke affects electronic equipment. (True, False) (1 points)
3. Some of effects of dust and other chemical compounds found in smoke on electronic equipment is coats some parts of equipment. (True, False) (1 points)
4. Some of effects of dust and other chemical compounds found in smoke on electronic equipment is coats mechanical parts and promotes the loss of lubrication in all equipment (True, False) (1 points)
5. Some of effects of dust and other chemical compounds found in smoke on electronic equipment is may contribute to deterioration of plastic and rubber parts (True, False) (1 points)

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Answers:

1. True
2. True
3. True
4. True
5. True

Information Sheet-4	Re-soldering Loose connection

Introduction

The ease and quality of your work will depend both on proper soldering as well as de-soldering (often called rework) equipment.

However, the purpose of solder is not to physically anchor connections - they must be mechanically secure first to assure reliability. When properly done, solder actually combines with the clean metal surface of the wires, pins, and terminals assuring a low resistance connection.

While there are several conditions must be satisfied to achieve good reliable solder connections, with a little practice, soldering will become essentially automatic and you will know immediately when the results are satisfactory.

4.1 Soldering techniques

Soldering is a skill that is handy to know for many types of construction and repair. For modern small appliances, it is less important than it once was as solderless connectors have virtually replaced solder for internal wiring.

However, there are times where soldering is more convenient. Use of the proper technique is critical to reliability and safety. A good solder connection is not just a bunch of wires and terminals with solder dribbled over them. When done correctly, the solder actually bonds to the surface of the metal (usually copper) parts.

Effective soldering is by no means difficult but some practice may be needed to perfect your technique.

- The following guidelines will assure reliable solder joints:
  - ✓ Use rosin core solder (e.g., 60/40 tin/lead) for electronics work.
  - ✓ Suggested diameter is .030 to .060 inches for appliances. The smaller size is preferred as it will be useful for other types of precision electronics repairs or construction as well.
  - ✓ The rosin is used as a flux to clean the metal surface to assure a secure bond. NEVER use acid core solder or the stuff used to sweat copper pipes! The flux is corrosive and it is not possible to adequately clean up the connections afterward to remove all residue.
  - ✓ Keep the tip of the soldering iron or gun clean and tinned.

- ✓ Buy tips that are permanently tinned - they are coated and will outlast countless normal copper tips.
- ✓ A quick wipe on a wet sponge when hot and a bit of solder and they will be as good as new for a long time. (These should never be filed or sanded).
- ✓ Make sure every part to be soldered - terminal, wire, component leads is free of any surface film, insulation, or oxidation.
- ✓ Fine sandpaper may be used, for example, to clean the surfaces. The secret to a good solder joint is to make sure everything is perfectly clean and shiny and not depend on the flux alone to accomplish this. Just make sure the scrapings are cleared away so they don't cause short circuits.
- ✓ Start with a strong mechanical joint. Don't depend on the solder to hold the connection together. If possible, loop each wire or component lead through the hole in the terminal. If there is no hole, wrap them once around the terminal. Gently anchor them with a pair of needle nose pliers.
- ✓ Use a properly sized soldering iron or gun: 20-25 W iron for fine circuit board work; 25-50 W iron for general soldering of terminals and wires and power circuit boards; 100-200 W soldering gun for chassis and large area circuit planes. With a properly sized iron or gun, the task will be fast - 1 to 2 seconds for a typical connection - and will result in little or no damage to the circuit board, plastic switch housings, insulation, etc.
- ✓ Heat the parts to be soldered, not the solder. Touch the end of the solder to the parts, not the soldering iron or gun. Once the terminal, wires, or component leads are hot, the solder will flow via capillary action, fill all voids, and make a secure mechanical and electrical bond. Sometimes, applying a little from each side will more effectively reach all nooks and crannies.
- ✓ Don't overdo it. Only enough solder is needed to fill all voids. The resulting surface should be concave between the wires and terminal, not bulging with excess solder.
- ✓ Keep everything absolutely still for the few seconds it takes the solder to solidify. Otherwise, you will end up with a bad connection - what is called a 'cold solder joint'.
- ✓ A good solder connection will be quite shiny - not dull gray or granular. If your result is less than perfect reheat it and add a bit of new solder with flux to help it reflow.

4.2 De-soldering techniques

Occasionally, it will be necessary to remove solder - either excess or to replace wires or components. A variety of tools are available for this purpose. The one I recommend is a vacuum solder pump called 'SoldaPullet' .

- The following guidelines will assure reliable De-solder the joints:
  - ✓ Keep the tip of the soldering iron or gun clean and tinned.
  - ✓ Buy tips that are permanently tinned - they are coated and will outlast countless normal copper tips.
  - ✓ A quick wipe on a wet sponge when hot and a bit of solder and they will be as good as new for a long time. (These should never be filed or sanded).

- ✓ Cock the pump, heat the joint to be cleared, and press the trigger.
- ✓ Molten solder is sucked up into the barrel of the device leaving the terminal nearly free of solder.
- ✓ Then use a pair of needle nose pliers and a dental pick to gently free the wires or component. For stubborn joints or those connecting to the power planes (surface or multilayer boards), you may need to add some fresh solder and/or flux and then try again. Generally, if you only get part of the solder off the first time, repeated attempts will fail unless you add some fresh solder.

Self-Check 4	**Written Test**

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

1. The ease and quality of your work will depend both on proper soldering as well as de-soldering (often called rework) equipment. (True, False) (1 points)
2. Soldering is a skill that is handy to know for many types of construction and repair. (True, False) (1 points)
3. In order to get quality soldering keep the tip of the soldering iron or gun clean and tinned. (True, False) (1 points)
4. Buy tips that are permanently tinned - they are coated and will outlast countless normal copper tips. (True, False) (1 points)
5. A quick wipe on a wet sponge when hot and a bit of solder and they will be as good as new for a long time. (These should never be filed or sanded). (True, False) (1 points)

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Answers:

1. True
2. True
3. True
4. True
5. True

Information Sheet-5	Lubricating Moving parts in accordance manufacturer specification

5.1 Lubrication

Lubricants play a key role in machinery element safety. Their main tasks are

- to keep moving parts apart from each other,
- to take heat out of the contact by their through pass,
- to keep surfaces clean,
- to transport functional additives toward the surface and
- to transfer power in the application (hydraulic, automatic transmission, breaks).

What's a Lubricant Expected to Do?

- Reduce Friction
- Minimize Wear
- Cool Parts
- Prevent Corrosion
- Disperse Contaminants

3 Keys to Successful Lubrication

- Viscosity
- Additives
- Lubrication Practices

Five Rights of Lubrication

- Right Type of Lubricant
- Right Quality
- Right Amount
- Right Place
- Right Time

Self-Check 5	Written Test

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

1. Lubricants play a key role in machinery element safety. (True, False) (1 points)
2. Keep moving parts apart from each other is lubricants main task. (True, False) (1 points)
3. Take heat out of the contact by their through pass is lubricants main task(True, False) (1 points)
4. Right Type of Lubricant is rights of Lubrication(True, False) (1 points)

5. Right quality is rights of Lubrication. (True, False) (1 points)

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Answers:

1. True
2. True
3. True
4. True
5. True

Operation Sheet – 1	Equipment Inspection Procedure

Purpose: This operation enumerates the proper procedure of equipment external part Inspection.

Equipment, Tools and Materials:

- Job Order Form
- Pencil/Ball pen
- Equipment
- Appropriate Tools and devices

Conditions or Situations for the Operation:

- Consider that the event took place in an appliance service center/Workshop.
- The Trainee is the service technician

Procedure:

Equipment Inspection Test Procedure

- Upon receiving the equipment from the owner:
  - ✓ Start having an informal conversation and gather information (a sort of investigation) asking some important questions that may lead to some hypothesis of the current fault.
  - ✓ Inspect physical damages such as cracks, missing screws, etc.
  - ✓ At the same time make sure it is documented
  - ✓ After all the checkups are done. Schedule an appointment with the owner and inform the actual condition of the appliance.

Precautions:

- Apply Kaizen/5's
- Safety

Quality Criteria:

- The trainee should be able to perform the following procedures accordingly

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Your will be given a faulty equipment, a workbench with tools and equipment as well as PPEs'.

1. You are required to perform the following:

   Task-1, Inspection procedure

   Task-2, Record your observation

2. Request your teacher for evaluation and feedback

Operation Sheet - 2	Disassembling Procedure

Purpose: This operation enumerates the proper procedure of Home appliance disassembling procedure.

Equipment, Tools and Materials:

- Equipment
- Appropriate Tools and devices
- Home Appliance
  - ✓ Bread Toaster
  - ✓ Vacuum Cleaner
  - ✓ Electric Stove
  - ✓ Blender
  - ✓ Electric Fan
  - ✓ Vacuum Cleaner

Conditions or Situations for the Operation:

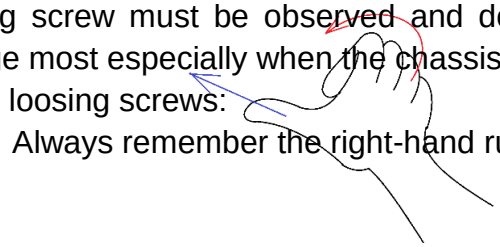
- Consider that the event took place in an appliance service center/workshop.
- The Trainee is the service technician

Procedure:

Disassembling

Disassembling procedure must take place upon confirmation of equipment states through inspection procedure.

- Steps are the following:
  - ✓ Considering that all the materials and tools are already prepared and arrange according to 5S standards and PPE, start with inspecting screw positions.
  - ✓ Make sure that screws must be place in a secure place, a permanent magnet is recommended.
  - ✓ Inspect the size of the screw; remember that screw sizes may vary depending on its location and function. Use appropriate screw driver.
  - ✓ Loosing screw must be observed and done carefully so that threads will not be damage most especially when the chassis is made of plastic.
  - ✓ When loosing screws:
    - Always remember the right-hand rule.



Direction of the rotation

Direction of the screw

- When loosing screw slowly turn screw clockwise (just apply small amount of torque).
- Then turn counter-clock wise to lose the screw, a “tick” sound will be heard after the screw’s thread loses its grip to the chassis.
- Make sure that the thread of the screw follows the thread of the chassis.

✓ Once all the screws are removed from the main chassis make sure to place them in one place.
✓ Remove the unscrewed cover and place it on the safe place.
✓ Make sure that all the body parts that are removed are placed in sequence so as not to miss any parts during the assembling procedure.
✓ Remove connections if necessary.

- **Note:** Make sure that during the disassembling procedure always refer to the service manual. If service manual is un-available make sure that everything should be properly and orderly done.
  For this module, Home/Office electrical/electronic controlled equipment will be the subject of preventive maintenance. The Trainer will provide the equipment for the training. A separate operation manual or supplementary notes will be provided for the particular equipment.

Precautions:

- Apply Kaizen/5’s
- Safety

Quality Criteria:

- The trainee should be able to perform the following procedures accordingly

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Your will be given a faulty equipment, a workbench with tools and equipment as well as PPEs’.

1. You are required to perform the following:
   Task-1, Disassembling Procedure
2. Request your teacher for evaluation and feedback

Operation Sheet - 3	Disassembling Procedure

Purpose: This operation enumerates the proper procedure of office equipment disassembling procedure.

Equipment, Tools and Materials:

- Equipment
- Appropriate Tools and devices
- Office Equipment
  - ✓ Photo copy machine
  - ✓ Printer
  - ✓ UPS
  - ✓ Fax machine
  - ✓ Scanner
  - ✓ PC

Conditions or Situations for the Operation:

- Consider that the event took place in an appliance service center/workshop.
- The Trainee is the service technician

Procedure:

Disassembling

Disassembling procedure must take place upon confirmation of equipment states through inspection procedure.

- Steps are the following:
  - ✓ Considering that all the materials and tools are already prepared and arrange according to 5S standards and PPE, start with inspecting screw positions.
  - ✓ Make sure that screws must be place in a secure place, a permanent magnet is recommended.
  - ✓ Inspect the size of the screw; remember that screw sizes may vary depending on its location and function. Use appropriate screw driver.
  - ✓ Loosing screw must be observed and done carefully so that threads will not be damage most especially when the chassis is made of plastic.
  - ✓ When loosing screws:
    - Always remember the right-hand rule.

- When loosing screw slowly turn screw clockwise (just apply small amount of torque).
- Then turn counter-clock wise to lose the screw, a “tick” sound will be heard after the screw’s thread loses its grip to the chassis.
- Make sure that the thread of the screw follows the thread of the chassis.

✓ Once all the screws are removed from the main chassis make sure to place them in one place.
✓ Remove the unscrewed cover and place it on the safe place.
✓ Make sure that all the body parts that are removed are placed in sequence so as not to miss any parts during the assembling procedure.
✓ Remove connections if necessary.

- **Note:** Make sure that during the disassembling procedure always refer to the service manual. If service manual is un-available make sure that everything should be properly and orderly done.
  For this MODULE, Home/Office electrical/electronic equipment will be the subject of preventive maintenance. The Trainer will provide the equipment for the training. A separate operation manual or supplementary notes will be provided for the particular equipment.

Precautions:

- Apply Kaizen/5’s
- Safety

Quality Criteria:

- The trainee should be able to perform the following procedures accordingly

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Your will be given a faulty equipment, a workbench with tools and equipment as well as PPEs’.

1. You are required to perform the following:
   Task-1, Pre-testing procedure
   Task-2, Disassembling Procedure
   Task-3, Fault Finding
2. Request your teacher for evaluation and feedback

Operation sheet - 4	Cleaning Vacuum Cleaner

Purpose: This operation enumerates the proper procedure for Vacuum Cleaner equipment servicing by cleaning internal part.

Equipment, Tools and Materials:

- ✓ Job Order Form
- ✓ Pencil/Ballpen
- ✓ Equipment
- ✓ Service Manual
- ✓ Appropriate Tools and devices
  - Multi-tester
  - Screw Driver
  - Pliers
  - Electrical Contact cleaner
  - Air-blower

Conditions or Situations for the Operation:

- Consider that the event took place in an appliance service center/workshop.
- The Trainee is the service technician

Procedure:

- ➢ Full information on the servicing is all available on the service manual. For the purpose of this training we utilize LG vacuum cleaners. Please read the service manual provided.

Precautions:

- ✓ Apply Kaizen/5's
- ✓ Safety

Quality Criteria:

- ✓ The trainee should be able to perform the following procedures accordingly

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Your will be given a faulty equipment, a workbench with tools and equipment as well as PPEs'.

1. You are required to perform the following:
   Task-1, inspecting procedure
   Task-2, Disassembling Procedure
   Task-3, Cleaning Vacuum cleaner
   Task-4, Record findings

2. Request your teacher for evaluation and feedback

Operation sheet - 5	Cleaning Photo copier

Purpose: This operation enumerates the proper procedure for Photo copy machine servicing by cleaning external part.

Equipment, Tools and Materials:

- ✓ Job Order Form
- ✓ Pencil/Ballpen
- ✓ Faulty equipment
- ✓ Service Manual
- ✓ Appropriate Tools and devices
  - Multi-tester
  - Screw Driver
  - Pliers
  - Electrical Contact cleaner
  - Air-blower

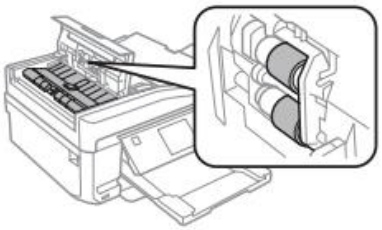
Conditions or Situations for the Operation:

- Consider that the event took place in an appliance service center/workshop.
- The Trainee is the service technician

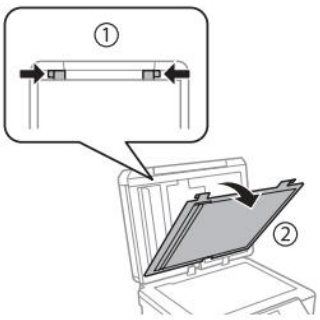
Procedure:

- ☐ Turn off the printer, then disconnect the power cord from the back of the printer.
- ❑ Use a soft, dry, clean cloth to clean the touch panel. Do not use liquid or chemical cleaners.
- ❑ Use a soft, dry, clean cloth to clean the surface of the scanner glass.
  If straight lines appear in the printout or the scanned data, clean the left side of the scanner glass carefully.

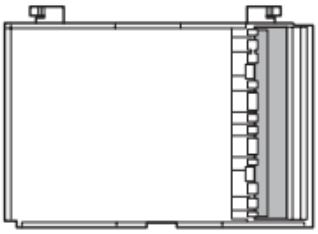
- ❑ If the glass surface is stained with grease or some other hard-to-remove material, use a small amount of glass cleaner and a soft cloth to remove it. Wipe off all remaining liquid.
- ❑ Open the ADF cover and use a soft, dry, clean cloth to clean the roller and the interior of the ADF (only for products with ADF function).



- Do not press the surface of the scanner glass with any force.
- Be careful not to scratch or damage the surface of the scanner glass, and do not use a hard or abrasive brush to clean it. A damaged glass surface can decrease the scan quality.
- Remove the document mat as shown in the illustration (only for products with ADF function).



- Use a soft, dry, clean cloth to clean the inside of the document mat (only for products with ADF function).



Precautions:

- ✓ Apply Kaizen/5's
- ✓ Safety

Quality Criteria:

- ✓ The trainee should be able to perform the following procedures accordingly

Important:
Never use alcohol or thinner to clean the product. These chemicals can damage the product.

Note only for products with fax function:
Close the rear paper feed slot cover and the ADF input tray when you are not using the product to protect the product from dust.

Note only for products without fax function:
Close the rear paper feed slot cover and the output tray when you are not using the product to protect the product from dust.

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Your will be given a faulty equipment, a workbench with tools and equipment as well as PPEs'.

1. You are required to perform the following:
   Task-1, inspecting procedure
   Task-2, Disassembling Procedure
   Task-3, Cleaning Photo copier
   Task-4, Record findings

2. Request your teacher for evaluation and feedback

Operation sheet - 6	Photo copier Servicing

Purpose: This operation enumerates the proper procedure for Photo copy machine servicing by cleaning internal part.

Equipment, Tools and Materials:

- ✓ Job Order Form
- ✓ Pencil/Ballpen
- ✓ Equipment
- ✓ Service Manual
- ✓ Appropriate Tools and devices
  - Multi-tester
  - Screw Driver
  - Pliers
  - Electrical Contact cleaner
  - Air-blower

Conditions or Situations for the Operation:

- Consider that the event took place in an appliance service center/workshop.
- The Trainee is the service technician

Procedure:

To keep your print results at their best, clean the roller inside by using the following procedure.

1. Make sure that no warnings or errors are displayed on the LCD screen, the CD/DVD tray is removed, and the output tray is ejected.
2. Load several sheets of A4-size plain paper in the cassette 2.
3. Enter **Copy** mode from the Home menu.
4. Press ◈ to make a copy without placing a document on the scanner glass.
5. Repeat step 4 until the paper is not smeared with ink.

Precautions:

- ✓ Apply Kaizen/5's
- ✓ Safety

Quality Criteria:

- ✓ The trainee should be able to perform the following procedures accordingly

Caution:
Be careful not to touch the parts inside the product.

Important:

- *Be careful to keep water away from the electronic components.*
- *Do not spray the inside of the product with lubricants.*
- *Unsuitable oils can damage the mechanism. Contact your dealer or a qualified service person if lubrication is needed.*

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Your will be given a faulty equipment, a workbench with tools and equipment as well as PPEs'.

1. You are required to perform the following:
   Task-1, inspecting procedure
   Task-2, Disassembling Procedure
   Task-3, Cleaning Internal Photo copier
   Task-4, Record findings

2. Request your teacher for evaluation and feedback

Operation Sheet - 7	Re-soldering Techniques

Purpose: This operation enumerates the proper procedure of tightening or re-soldering loose connection of defective equipment.

Equipment, Tools and Materials:

- Job Order Form
- Pencil/Ball pen
- Faulty equipment
- Appropriate Tools and devices

Conditions or Situations for the Operation:

- Consider that the event took place in an appliance service center.
- The Trainee is the service technician

Procedure:

Equipment re-soldering Procedure

- Raise the pump, heat the joint to be cleared, and press the trigger.
- Molten solder is sucked up into the barrel of the device leaving the terminal nearly free of solder.
- Then use a pair of needle nose pliers and a dental pick to gently free the wires or component
- For stubborn joints or those connecting to the power planes (surface or multilayer boards), you may need to add some fresh solder and/or flux and then try again

Precautions:

- Apply Kaizen/5's
- Safety

Quality Criteria:

- The trainee should be able to perform the following procedures accordingly

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Your will be given a faulty equipment, a workbench with tools and equipment as well as PPEs'.

1. You are required to perform the following:

   Task-1, Inspecting procedure
   Task-2, Disassembling Procedure
   Task-3, Re-solder loosen part
   Task-4, Record findings

2. Request your teacher for evaluation and feedback

Operation sheet - 8	Lubricating moving parts

Purpose: This operation enumerates the proper procedure for Lubricating moving parts of vacuum cleaner repair and servicing

Equipment, Tools and Materials:

- ✓ Job Order Form
- ✓ Pencil/Ballpen
- ✓ Faulty equipment
- ✓ Service Manual
- ✓ Appropriate Tools and devices
  - Multi-tester
  - Screw Driver
  - Pliers
  - Electrical Contact cleaner

Conditions or Situations for the Operation:

- Consider that the event took place in an appliance service center.
- The Trainee is the service technician

Procedure:

- ➢ Full information on the servicing is all available on the service manual. For the purpose of this training we utilize LG vacuum cleaners. Please read the service manual provided.

Precautions:

- ✓ Apply Kaizen/5's
- ✓ Safety

Quality Criteria:

- ✓ The trainee should be able to perform the following procedures accordingly

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Your will be given a faulty equipment, a workbench with tools and equipment as well as PPEs'.

1. You are required to perform the following:
   - **Task-1,** Pre-testing procedure
   - **Task-2,** Disassembling Procedure
   - **Task-4,** Tighten or re-solder loosen part
   - **Task-3,** Fault Finding

2. Request your teacher for evaluation and feedback

List of Reference Materials

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10. Reliability Statistics for Electromechanical Devices, Amphenol-Borg Electronics Corp.

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