

## TVET CERTIFICATE III in ELECTRONIC SERVICES

**ELSDP301**

### **DVD PLAYER REPAIR**

#### **Repair DVD player**

*Competence*

**Credits: 4**



**Learning hours: 40**

**Sector: Technical Services**

**Sub-sector: Electronic Services**

**Module Note Issue date: November, 2020**

### **Purpose statement**

This core module describes the skills, knowledge and attitude required to DVD player. The learner will be able to select and arrange different materials, equipment and tools used when repairing a DVD player. Moreover, he/she will be able to repair different parts of a DVD player including; DVD player power supply and DVD player control module.

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## Learning Unit 1. Prepare for DVD player repair

### LO 1.1 Prepare the working place

- Types of tools, materials and equipment used for DVD player repair and their use.

**Materials:** A material is a substance or mixture of substances that constitutes an object. Materials can be pure or impure, living or non-living matter. Materials can be classified based on their physical and chemical properties, or on their geological origin or biological function. The matter from which a thing is or can be made.

**Tools:** A tool is an object used to extend the ability of an individual to modify features of the surrounding environment. Although many animals use simple tools, only human beings, whose use of stone tools dates back hundreds of millennia, have been observed using tools to make other tools. A device or implement, especially one held in the hand, used to carry out a particular function.

**Equipment:** Equipment most commonly refers to a set of tools or other objects commonly used to achieve a particular objective. Different jobs require different kinds of equipment.

#### A. Tools and Materials

##### ❖ Universal screwdriver



A **screwdriver** is a tool, manual or powered, for screwing and unscrewing (inserting and removing) screws. A typical simple **screwdriver** has a handle and a shaft, ending in a tip the user puts into the *screw* head before turning the handle.

Something that is universal relates to everyone in the world or everyone in a particular group or society.

##### ❖ Flat screwdriver





### Flat Screws

A **screwdriver** with a **flat** wedge-shaped tip that fits into a slot in the head of a screw, used to tighten or loosen screws that have a straight, linear notch in their heads.

### ❖ Allen keys



### Allen Bolts

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

The tool is usually formed of a single piece of hexagonal rod of hard steel, with blunt ends that are meant to fit snugly into the screw's socket, bent in an "L" shape with unequal arms.

### ❖ Screw driving machine



The purpose is the same with other screwdriver, screw driving machine can open many types of screws by changing bits and it use power.

### ❖ Universal pliers



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❖ **Cutting pliers**



**Diagonal pliers** (or **wire cutters** or **diagonal cutting pliers** or **diagonal cutters** or **side cutting pliers**) are pliers intended for the cutting of wire (they are generally not used to grab or turn anything).

❖ **Stripping pliers**



A wire **stripper** is a portable handheld **tool** used by workers, especially electricians, for removing the protective coating of an electric wire in order to replace or repair the wire. It is also capable of **stripping** the end portions of an electric wire in order to connect them to other wires or to terminals.

❖ **Blower**



An air blower is a machine used for generating flow of air at substantial pressure. The air flow generated is used for different purposes such as small car cleaning blowers, vacuum cleaners,

air conditions, to clean dusty etc. Depending on the application requirement air flow and pressure may vary.

#### ❖ Soldering iron



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#### ❖ Digital multimeters



**Digital multimeter** (DMM, DVOM) is an electronic measuring instrument that combines several measurement functions in one unit. A typical **Digital multimeter** can measure voltage, current, and resistance and it has a numeric display, and may also show a graphical bar representing the measured value.

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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.

## B. PPE





**Personal protective equipment (PPE)** is protective clothing, helmets, goggles, or other garments or equipment designed to protect the wearer's body from injury or infection. The hazards addressed by protective equipment include physical, electrical, heat, chemicals, biohazards, and airborne particulate matter.

- **Working place preparation techniques.**

To prepare the working place to be done there are important steps to follow:

### **Steps 1. Clean the Place**

The first and most important thing to have in your workplace is a big table and cleaned everything. Of course is impossible to repair in hand that is why a table is useful to repair on it without tiredness.

### **Step 2. A Comfy sitting place**



The second to have in your workplace is a comfortable chair, preferably foam covered and with recline and variable height for optimum approach. As electronics work involves hours and hours of sitting and working, it is good idea to have a good chair.

### **Step 3. Enough Lighting**



As mentioned earlier electronics work involves hours of sitting and it also involves focusing on small circuits and connections. Therefore, it is also very important to have a good overhead light source. It keeps the strain on the eyes to a minimum. Observing minute details and small components becomes easy. It is important to have enough lighting in your room so that even the finest details are visible.

#### **Step 4. A Cooling Fan**



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#### **Step 5. Tools, Materials and equipment**



While you are preparing your working place Organize is the name of the game. If your tools, materials and equipment are organized you will work more efficiently and be happy it is

important to have the tools you need very close by, materials and equipment not too close. That is why you have to keep them separately at lower level to your table.

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## LO 1.2 Identify tools, materials and equipment

- Identify of tool, materials and equipment according to their use.

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## Identify PPE

- ❖ **Gloves:** Hands and fingers are often injured, so it is vital to protect them properly. Depending on the sector you work in, you can choose from gloves for **different applications**.
- ❖ **Helmet:** Wearing a **helmet** offers protection and can prevent head injuries. Select a sturdy helmet that is adapted to the working conditions. These days you can find many elegant designs and you can choose extra options such as an adjustable interior harness and comfortable sweatbands.
- ❖ **Safety shoes:** Even your feet need solid protection. **Safety shoes and boots** are the ideal solution to protect the feet against heavy weights.
- ❖ **Overcoat:** Preventing accidents is crucial in a crowded workshop. That is why a good visibility at work is a must a **high-visibility jacket and pants made of a strong fabric** can help prevent accidents. Just like the hand protection, there are versions for different applications.
- ❖ **Glasses:** The eyes are the most complex and fragile parts of our body. Each day, more than 600 people worldwide sustain eye injuries during their work. Thanks to a good pair of **safety glasses**, these injuries could be prevented. Do you come into contact with bright light or infrared radiation? Then **welding goggles or a shield** offer the ideal protection!
- ❖ **Nose mask:** Wearing a **mask** at work is no luxury, definitely not when coming into contact with hazardous materials. **Dust masks** offer protection against fine dust and other dangerous particles. If the materials are truly toxic, use a **full-face mask**. This adheres tightly to the face, to protect the nose and mouth against harmful pollution.
- ❖ **Earmuff:** Do you work in an environment with high sound levels? In that case it is very
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### LO 1.3 Selection of tools, materials and equipment

- Selection of tool, materials and equipment used for DVD Player repair according to their use.
  - A. Tools and Materials
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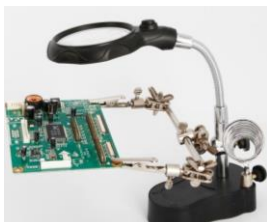
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- **Introduction on DVD player operation (main blocs and their functions).**

- i. **What is a DVD player?**

A **DVD player** is a device that plays DVDs produced under both the DVD-Video and DVD-Audio technical standards, two different and incompatible standards. Some DVD players will also play audio CDs.

DVD players are connected to a television to watch the DVD content, which could be a movie, a recorded TV show, or other content.

The first DVD player was created by Sony Corporation in Japan in collaboration with Pacific Digital Company from the United States in 1997. Some manufacturers originally announced that DVD players would be available as early as the middle of 1996. These predictions were too optimistic. Delivery was initially held up for "political" reasons of copy protection demanded by movie studios, but was later delayed by lack of movie titles. The first players appeared in Japan on November 1, 1996, followed by the United States on March 19, 1997 (a few days earlier than the

DVD-Video launch there) with distribution limited to only seven major cities for the first six months.

ii. **How Does a DVD Player Work (main blocs and their functions)?**

A DVD player is an electronic **D**igital **V**ideo **D**evice. A small motor rotates a flat plastic disc that has been stamped with a digital code representing video and audio data. The data is sent to and translated by a television. A DVD player operates similarly to a CD Player.

DVD's have pits and bumps in their track which holds the information that is required to be played. This information can be a video, audio or a mixture of both. When a DVD player reads this data, the smooth surface is usually taken as a '0' and pits are usually taken as a '1'.

In order to create as well as read these data, a red laser with a wavelength of 600 nanometers. This is about 180 nanometers lesser than the wavelength of CD, which enables it to have a higher density of pits. Thus the size of the DVD increases. Though the first released DVD's were only a single layer, 2 layered discs have been released nowadays. Single layer can hold only up to 4.7 GB of data while double layered DVD can hold up to 17 GB of data. The DVD design is similar to a CD a reflective silver layer in the center and a semi-transparent gold layer on the top of it.

A DVD does not have the capacity to hold hi-def movies. So a MPEG-2 compression system is introduced. As this is used, the data will be encoded onto the DVD as elements of the changing frames. This has to be successfully decoded and decompressed by the DVD player.

iii. **The main blocks diagram of a DVP player**

Take a look at the basic block diagram of how a DVD player works.

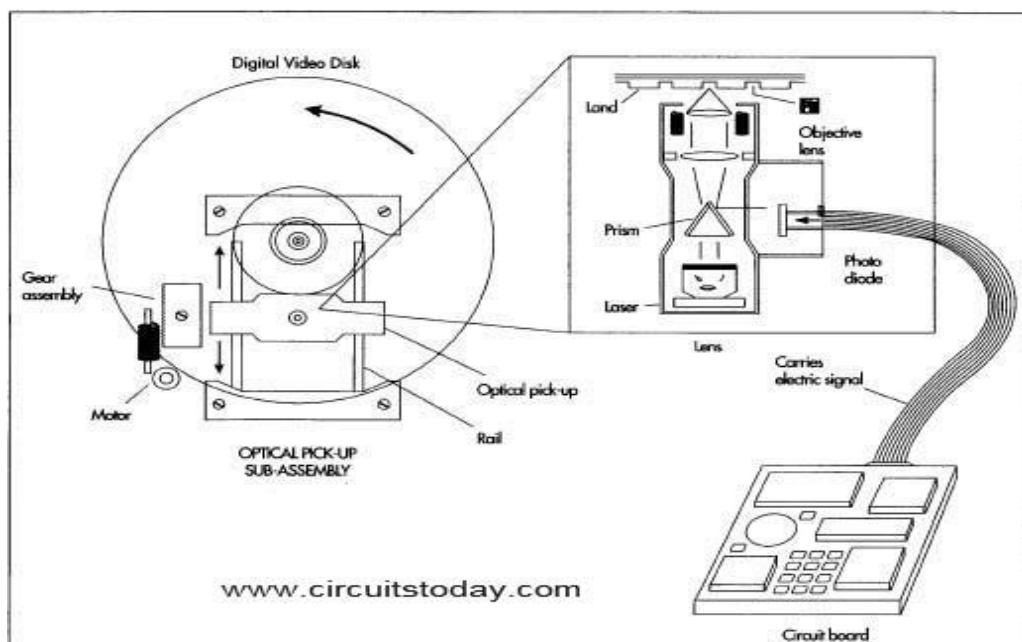




The pits and bumps in the DVD are hit by the laser from the optical mechanism of the DVD player. This laser will be reflected differently according to the change of pits and bumps. Though the laser hits a single spot, the DVD moves in a circular motion so that the entire area is covered. Mirrors are also used to change the spot.

These reflected laser beams are then collected by a light sensor (eg. photo-detector) which converts the different signals into a binary code. In short, the optical system helps in converting the data from the DVD into a digital code.

The binary signal is then sent to a Digital to Analog converter which will be setup in the PCB. Thus the corresponding analog signal of the DVD is obtained. The PCB also has amplifiers which amplify the signal and then sends it to the graphic and audio systems of the computer/TV. Thus, the corresponding audio/video signal is obtained. The basic working of a DVD player is shown below.



- Description of steps on how to disassemble and assemble DVD player

#### **A. Assembling a DVD Player**

As the different parts of the DVD player are all complicated electronic circuits, they are all manufactured by different people. They are later brought together and assembled at one place. During the assembling, the PCB will be connected to the rest of the machine and all the components are placed in the right positions. The whole package is then placed inside an outer plastic housing with a front panel with the buttons for various operations. This DVD player is then sent to a packaging station where they are placed safely inside boxes along with the respective power cords, operating manual, installing disks and so on. They are then taken by the distributors to various shops and then sold to customers.

#### **B. Cautions while assembling a DVD Player**

A DVD player will only be satisfactory to a customer only if it has a high performance. The degree of quality varies according to the flaws in the assembling process. Thorough inspections in both the visual as well as electrical divisions must be done most of the time. Flaws in the positioning of the different components can also cause the player to become faulty. After manufacturing the DVD also, the working performance is tested. To see the adverse effects of these players in different temperatures, the tests will be carried out in excessive heat as well as humidity. Since most of the parts of a DVD player is made by suppliers, they rely on other companies for good quality. The DVD assemblers will set a minimum standard for the supplies that they buy from outside. This specification must be met by them. The lenses and mirrors should be highly polished and cleaned before placing them.

#### **C. Steps of DVD player assembling/disassembling**



**As we mentioned before** they are many DVD Player models manufactured by different people, we are going to take look one example of **YAMAHA DVD-S559 DVD player model** how to disassembling/assembling it step by step. Remove parts in disassembly order as numbered.

**Step 1: Disconnect the power cable from the AC outlet.**

**Step 2: Removal of Top Cabinet (Fig. 2)**

- a. Remove 5 screws (1).
- b. Remove the Top Cabinet in the direction of arrow (A).

**Step 3: Removal of Front Cabinet. (Fig. 2)**

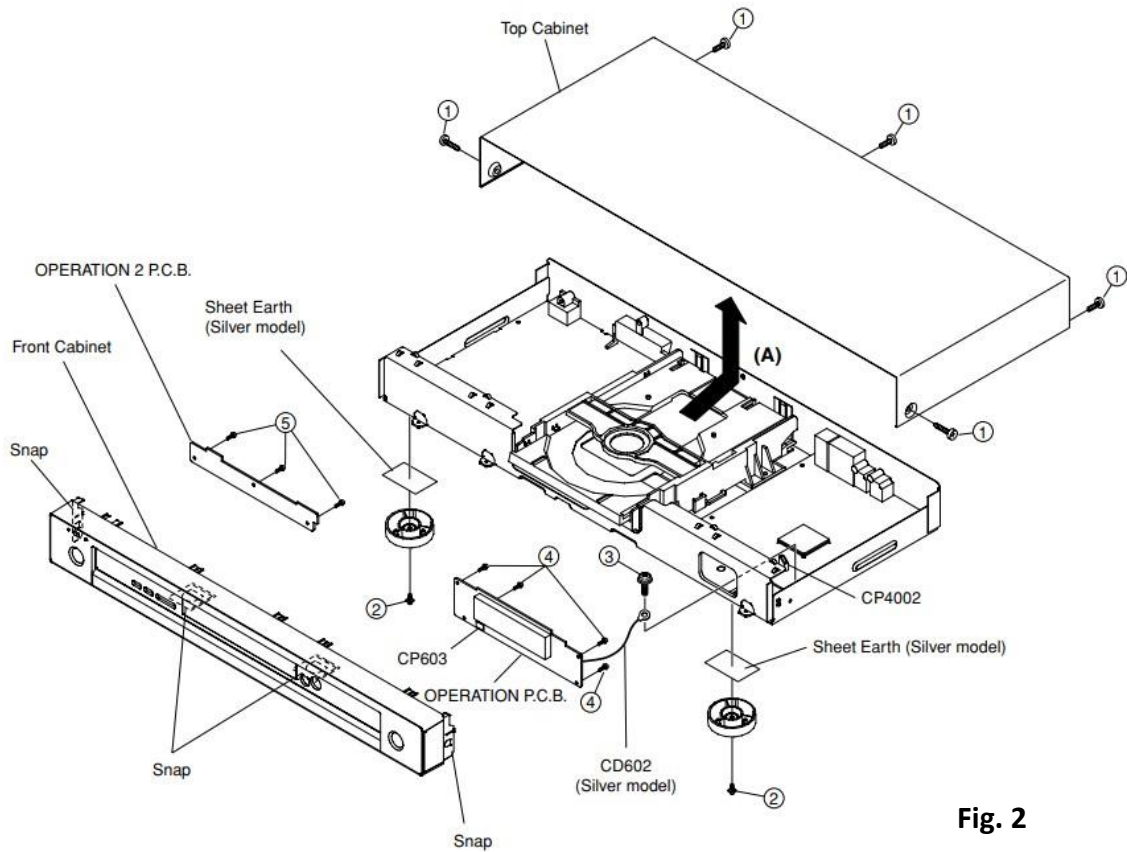
- a. Remove 2 screws (2).
- b. Remove 2 Legs.
- c. Remove 2 Sheet Earth. (Silver model)
- d. Remove 1 cable connection. [CP4002]
- e. Remove 1 screw (3) and the cable. [CD602] (Silver model)
- f. Unlock the Front Cabinet by releasing successively 4 snaps. (2 on the side and 2 on the bottom).
- g. Remove the Front Cabinet.

**Note:** The Sheet Earth once removed cannot be reused. Be sure to use a new Sheet Earth for replacement.

**Step 4: Removal of OPERATION 1 and OPERATION 2 P.C.B.s. (Fig. 2)**

- a. Remove 4 screws (4).
- b. Remove the OPERATION 1 or Button P.C.B.
- c. Remove 1 cable connection. [CP603]
- d. Remove 3 screws (5).
- e. Remove the OPERATION 2 or Display P.C.B.



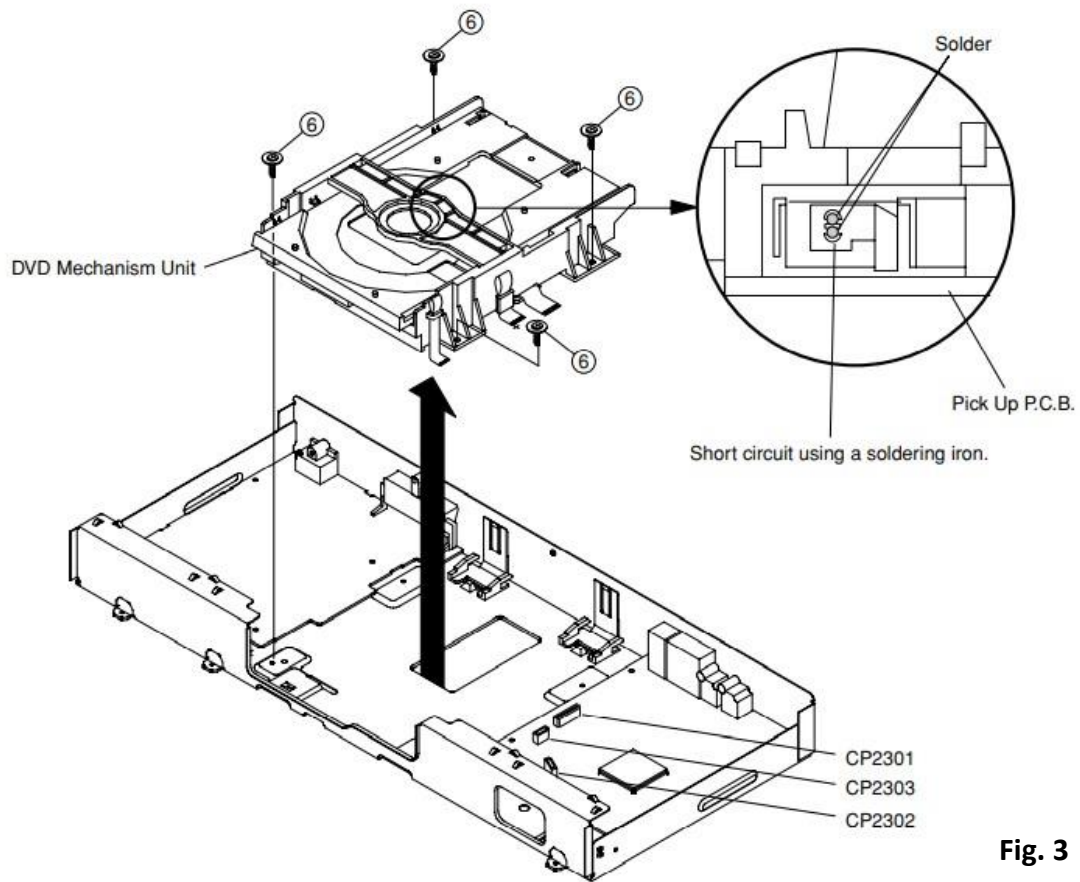


**Fig. 2**

**Step 5: Removal of DVD Mechanism Unit. (Fig. 3)**

- a. Short circuit the position shown in Fig. 3 using a soldering iron. If you remove the DVD Mechanism Unit with no soldering, the Laser may be damaged.
- b. Remove 4 screws (6).
- c. Remove 3 cable connections. [CP2301], [CP2302], [CP2303]
- d. Remove the DVD Mechanism Unit.

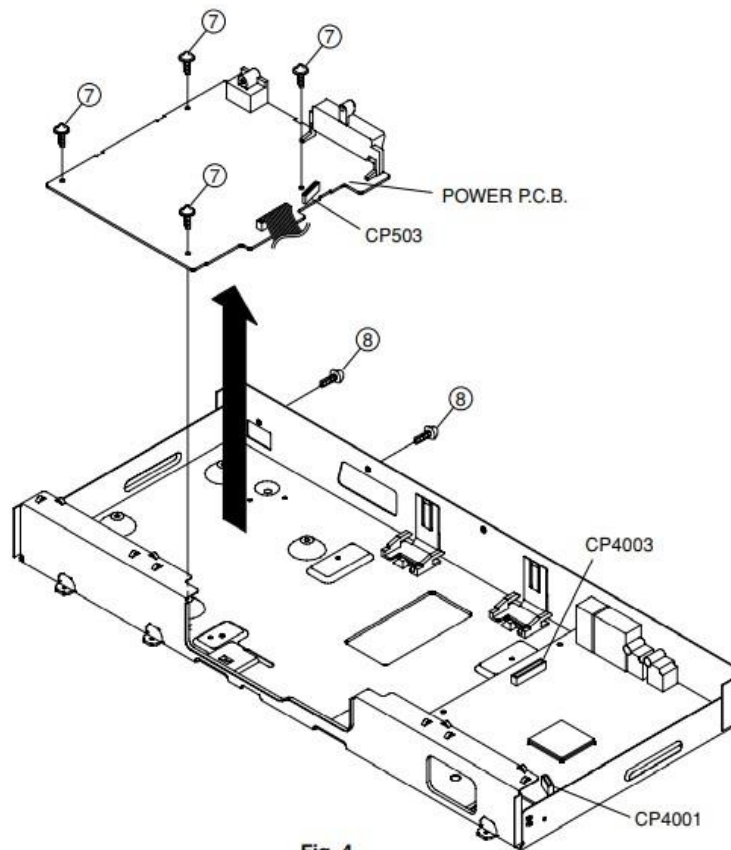




**Fig. 3**

**Step 6: Removal of POWER P.C.B. (Fig. 4)**

- a. Remove 4 screws (7) and 2 screws (8).
- b. Remove 3 cable connections. [CP503], [CP4001], [CP4003]
- c. Remove the POWER P.C.B.



#### Step 7: Removal of DVD P.C.B. (Fig. 5)

- a. Remove 4 screws (9) and 4 screws (0).
- b. Remove the DVD P.C.B. in the direction of arrow (B)

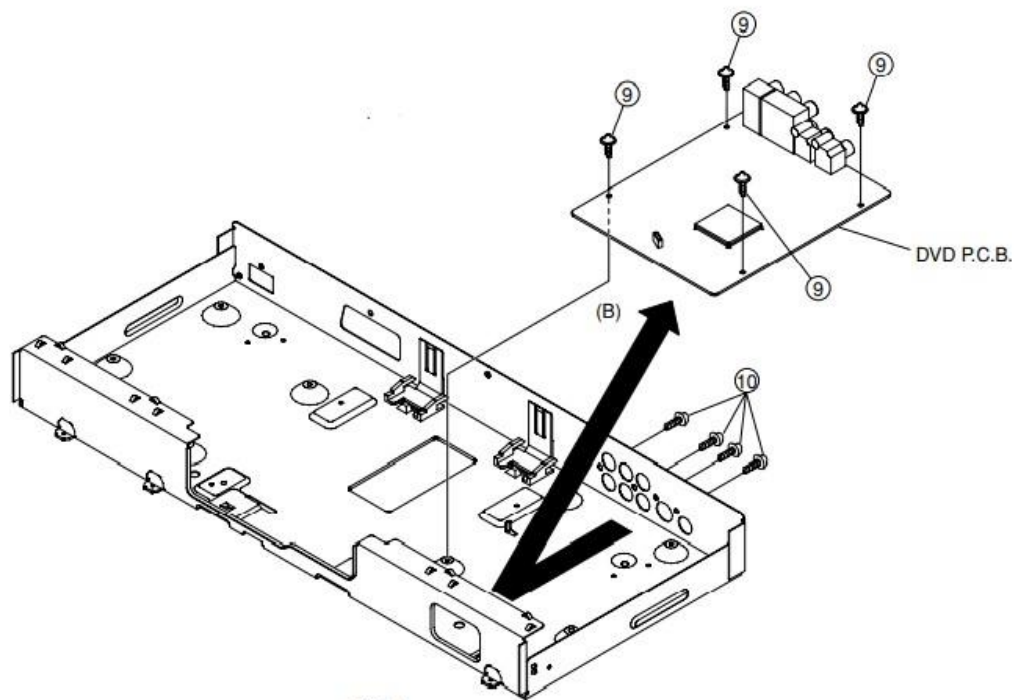


Fig. 5

- **External parts of a DVD player.**

- Cover
- Volume control
- Power inlets
- Audio/video inlet and outlet systems (USB driver, HDMI driver, SD CARD driver)

## LO 1.5 Identify the main parts of DVD player

- **Introduction on DVD player operation (main blocs and their functions).**

### A. Introduction on DVD player operation

#### i. What is a DVD player?

A **DVD player** is a device that plays DVDs produced under both the DVD-Video and DVD-Audio technical standards, two different and incompatible standards. Some DVD players will also play audio CDs.

DVD players are connected to a television to watch the DVD content, which could be a movie, a recorded TV show, or other content.

The first DVD player was created by Sony Corporation in Japan in collaboration with Pacific Digital Company from the United States in 1997. Some manufacturers originally announced that DVD players would be available as early as the middle of 1996. These predictions were too optimistic. Delivery was initially held up for "political" reasons of copy protection demanded by movie studios, but was later delayed by lack of movie titles. The first players appeared in Japan on November 1, 1996, followed by the United States on March 19, 1997 (a few days earlier than the DVD-Video launch there) with distribution limited to only seven major cities for the first six months.

ii. **How Does a DVD Player Work (main blocs and their functions)?**

A DVD player is an electronic **D**igital **V**ideo **D**evice. A small motor rotates a flat plastic disc that has been stamped with a digital code representing video and audio data. The data is sent to and translated by a television. A DVD player operates similarly to a CD Player.

DVD's have pits and bumps in their track which holds the information that is required to be played. This information can be a video, audio or a mixture of both. When a DVD player reads this data, the smooth surface is usually taken as a '0' and pits are usually taken as a '1'.

In order to create as well as read these data, a red laser with a wavelength of 600 nanometers. This is about 180 nanometers lesser than the wavelength of CD, which enables it to have a higher density of pits. Thus the size of the DVD increases. Though the first released DVD's were only a single layer, 2 layered discs have been released nowadays. Single layer can hold only up to 4.7 GB of data while double layered DVD can hold up to 17 GB of data. The DVD design is similar to a CD a reflective silver layer in the center and a semi-transparent gold layer on the top of it.

A DVD does not have the capacity to hold hi-def movies. So a MPEG-2 compression system is introduced. As this is used, the data will be encoded onto the DVD as elements of the changing frames. This has to be successfully decoded and decompressed by the DVD player.

### iii. The main blocks diagram of a DVD player

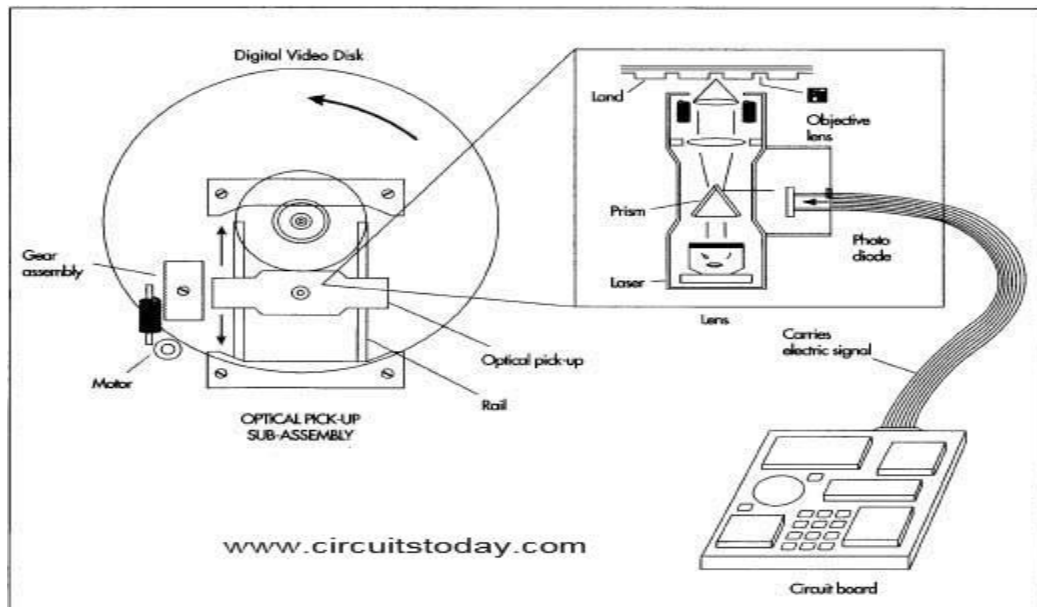
Take a look at the basic block diagram of how a DVD player works.



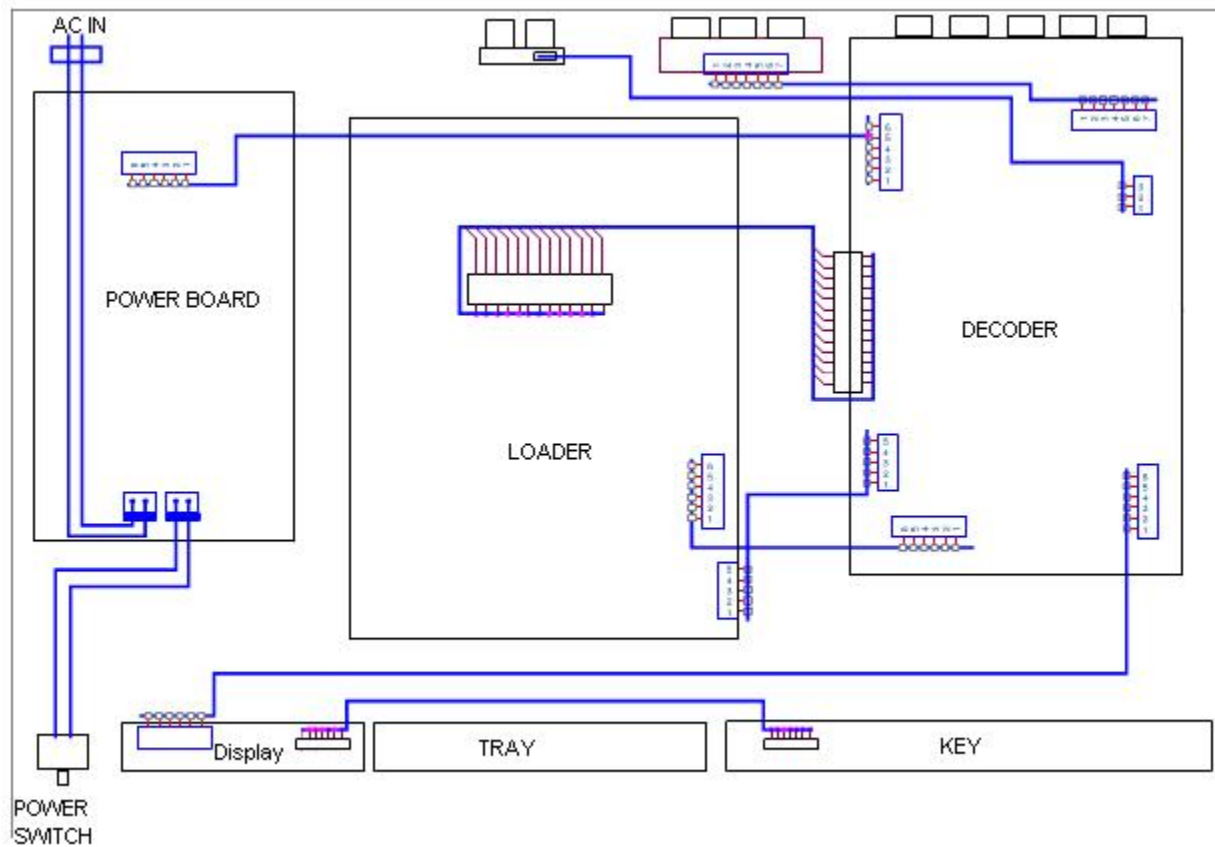
The pits and bumps in the DVD are hit by the laser from the optical mechanism of the DVD player. This laser will be reflected differently according to the change of pits and bumps. Though the laser hits a single spot, the DVD moves in a circular motion so that the entire area is covered. Mirrors are also used to change the spot.

These reflected laser beams are then collected by a light sensor (eg. photo-detector) which converts the different signals into a binary code. In short, the optical system helps in converting the data from the DVD into a digital code.

The binary signal is then sent to a Digital to Analog converter which will be setup in the PCB. Thus the corresponding analog signal of the DVD is obtained. The PCB also has amplifiers which amplify the signal and then sends it to the graphic and audio systems of the computer/TV. Thus, the corresponding audio/video signal is obtained. The basic working of a DVD player is shown below.

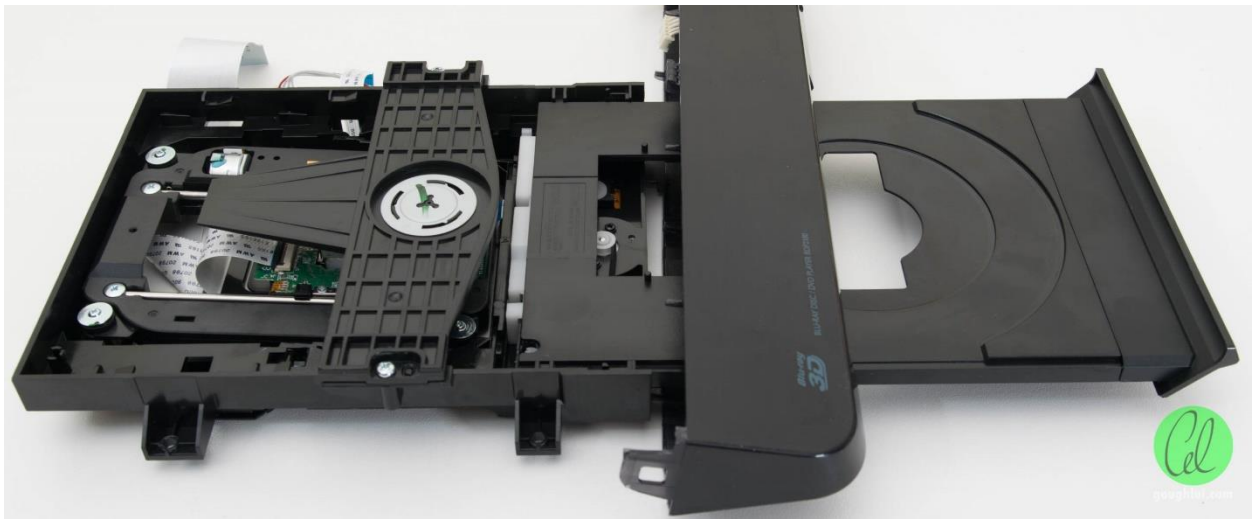


- Internal parts of a DVD player



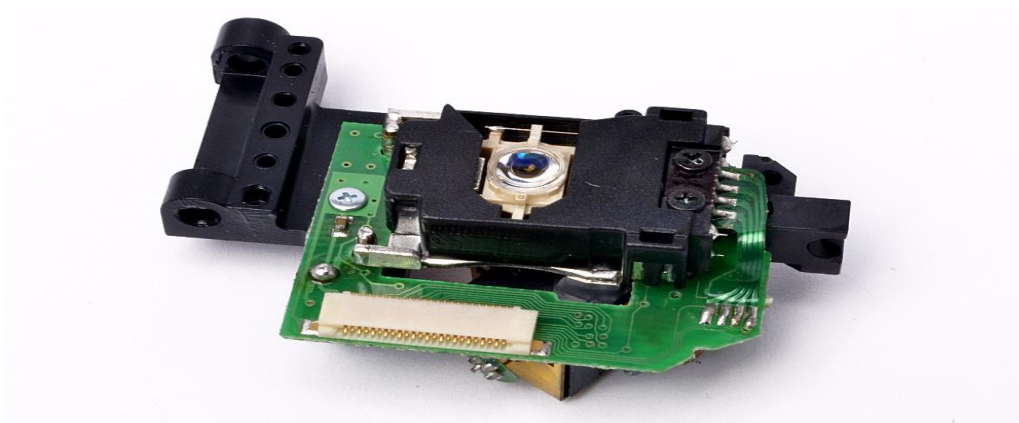
## I. DVD driver

### 1. Disc drive mechanism



The disc drive mechanism consists of a motor that will drive the disc in a circular motion. The mechanism will also have a disc feed – a loading tray that is used to accept the DVD from the user. Thus the entire disc drive is basically a spindle that holds the disc and a motor that is used to circle the disc. The spindle is held in its position with the help of small gears and belts that are attached internally. Some players have an automatic feed system in which, there will be no tray. Instead the disc will be automatically recognized after inserting a part of it.

### 2. Optical system



The optical system mainly consists of the laser beam, lenses, prism, photo-detectors and also mirrors. The output of this mechanism will be the input for the disc-drive. The laser beam will be

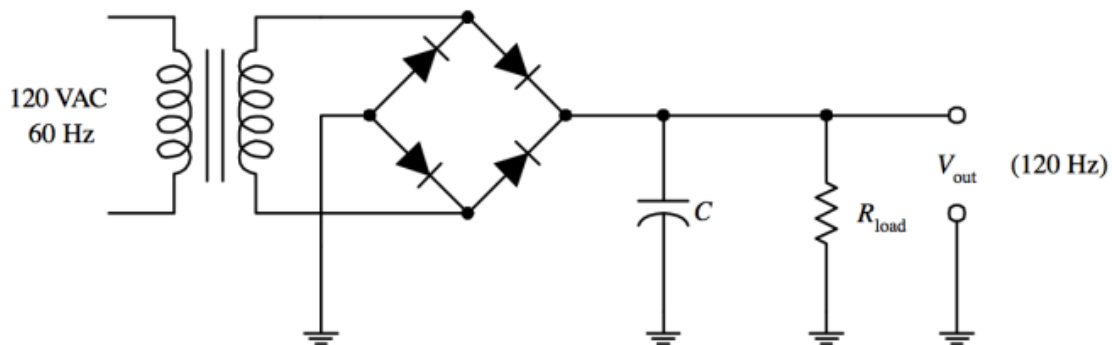


a red laser diode which works at a wavelength of 600 nanometers. The optical system also requires a motor to drive it. The laser system and photo-detector is placed together on a single platform. The laser diode as well as other diodes is made with the help of glass.

## II. DC power supply

A **power supply** is an electrical device that supplies electric power to an electrical load. The primary function of a power supply is to convert electric current from a source to the correct voltage, current, and frequency to power the load. As a result, power supplies are sometimes referred to as electric power converters. Some power supplies are separate standalone pieces of equipment, while others are built into the load appliances that they power.

### Basic power supply circuit



## III. Control module

Control module is used to control all parts of DVD player by receiving power from power supply distribute to other parts and receive data signal from USB, Memory card and CD transmit to output of DVD player.





### Control module components

1. **Central processing chip** controls all the functions of control module.
2. **Quartz crystal** used to generate precise frequencies to help Central processing chip to determine a very precise timing.
3. **Video and Audio processing chip** receive signal from central processing chip convert signal that your TV and stereo will understand
4. **Op Amp chip (Operational amplifier)** will boost the signal from Video/Audio processing chip
5. **Motor controller chip** controls the direction and speed of the motors, so it works with the central processing chip to make sure that motors are moving in the right direction and at the right speed.
6. **EEPROM chip** stores an index of commands of control module even when the power's shut off.

- **External parts of a DVD player.**

- Cover
- Volume control
- Power inlets
- Audio/video inlet and outlet systems (USB driver, HDMI driver, SD CARD driver)

## Learning Unit 2. Repair DVD player power supply

### LO 2.1 Test the power supply according to diagnostic techniques

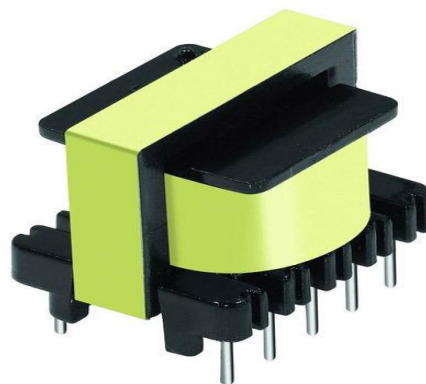
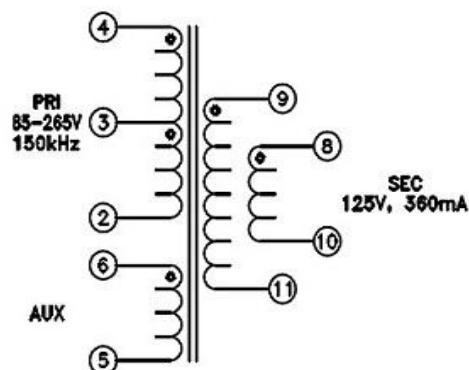
- General faults that occur in DVD player power supply and their diagnostic techniques.

#### 1) Blown up fuse



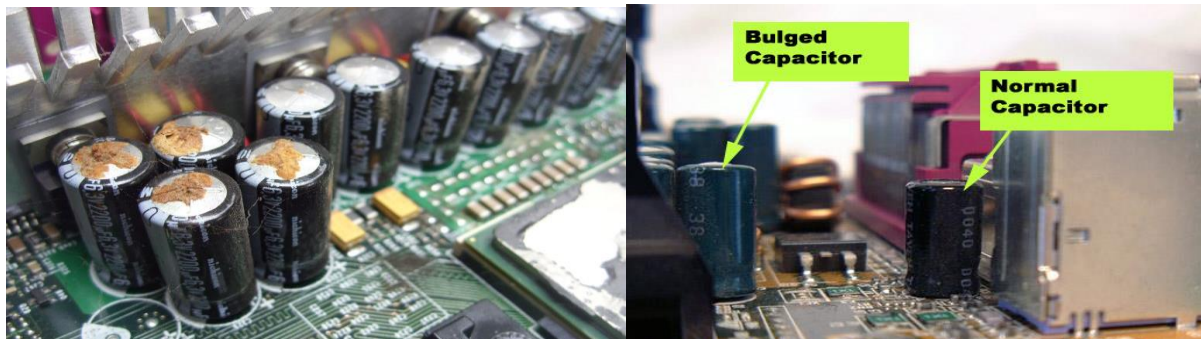
On the other hand, if the fuse is open, than something went really wrong in the circuit. Don't replace the fuse yet, it would just blow again: there is a short circuit somewhere that you have to fix first. Typical problems are blown up power transistors or rectifier diodes, especially on the primary side. Just use the diode function of a multi-meter and check the junctions: shorts are easy to spot. More components can be faulty at the same time and if you don't replace them all, they may blow again, so be careful. Then, I also check for faulty resistors as above and faulty capacitors

#### 2) Blown up chopper transformer



A transformer can fail for a variety of reasons, but the most common causes include lightning strikes, overloading, wear and corrosion, power surges and moisture. Regardless of the cause, the result can be remarkable. Transformers contain mineral oil keeping the transformer cool. When it becomes overcharged, the wiring can create heat and a spark. This massive overpressure may eventually cause the transformer to rupture with a loud boom, flash and possibly a fireball that can create a large plume of smoke that can be seen from a long distance.

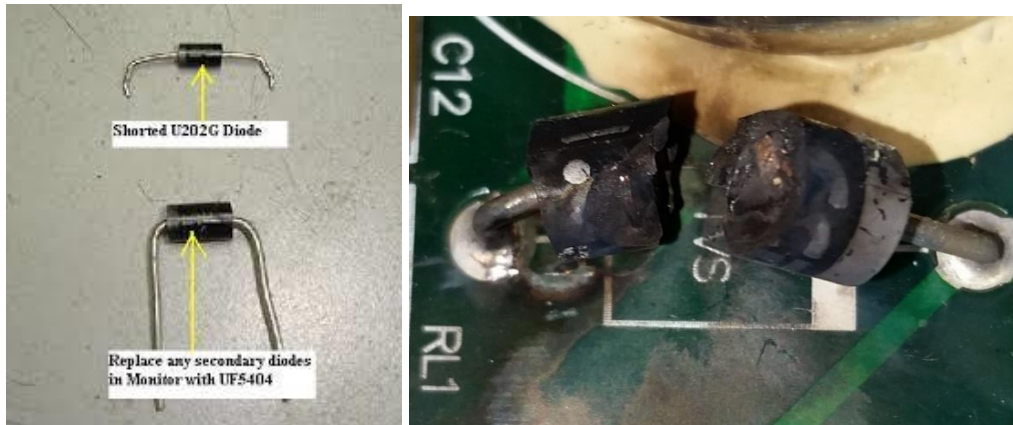
### 3) Blown up main capacitor



**Some problems that can cause your capacitor to blow out include:**

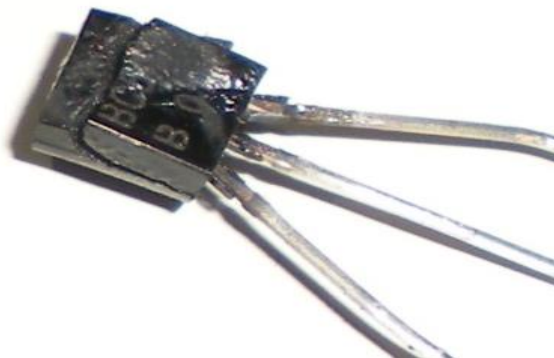
- A power surge due to weather – Like any other electronics in your home, weather can have a destructive effect on your capacitor due to power surges Short-circuiting
- Short-circuiting – Short circuits can be present in your AC electrical components which can directly affect your capacitor. This is why it's key to keep your AC maintained through yearly maintenance.
- Overheating – Especially in San Antonio, the hot weather can be a bit extreme and therefore overheat your AC unit when your capacitor is trying to work overtime.
- Age of the capacitor – like most expensive things in our life, your capacitor may be dead from just being too old.

#### 4) Blown up rectifier



**Diode failure** is another common problem. There are quite a few diodes in a switching supply and failure of any one of them will cause the supply to blow the fuse or shut down. The most common diode failures are shorted +12 volt or -5volt output rectifiers. Failure of these diodes will not blow the fuse. The supply simply detects the short and shuts itself down. Some of these failures may be caused by using the +12 or -5volt outputs to power coin door lamps. The -5volt output is not over-current protected in all power supplies. A shorted lamp socket may blow the diode by drawing too much current from the supply. The +12volt diodes may be blown if 6volt bulbs are inadvertently used instead of 12volt bulbs. The high-voltage input diodes may also short-circuit. This is often accompanied by shorted switching transistors and will blow the fuse.

#### 5) Blown up regulator



The most common failure is the switching regulator power supply or **switching transistors** themselves. The transistors short-circuit, causing massive amounts of current to be drawn across

the transformer and **blowing the fuse**. It is extremely common to find output filter capacitors that are swollen or leaking. Any capacitor that appears to be bad should be replaced. To prevent a recurrence of this all-to-common failure, output filter capacitors should be replaced with special "low ESR" (Equivalent Series Resistance) capacitors. These capacitors are specifically designed to handle the rigors of filtering in a switching supply. Most power supply manufacturers do not install low ESR capacitors as original equipment because they are somewhat more expensive than conventional capacitors. However, it is well worth the money to use them as replacement components as they will greatly extend the life of the power supply in the field. When I work on a power supply, I replace all the output filter capacitors with low ESR caps regardless of whether they appear to be good or bad. Since a service call costs far more than the capacitors, it's a prudent thing to do.

## LO 2.2 Replace defected components according to their types

- Soldering and de-soldering different components of the power supply.

### I. Soldering:



**Soldering** A process in which two or more metal items are joined together by melting and flowing a filler metal (solder) into the joint

### Soldering Tools



- 1) Vise
- 2) Safety glasses
- 3) Solder sucker
- 4) Solder tool
- 5) Diagonal cutters
- 6) Needle nose pliers
- 7) Solder



### a. Soldering Iron Care and Maintenance



- A soldering iron must be coated with a thin coat of solder. This will allow for the transfer of heat to the work piece.
- This procedure is called tinning.
- The tip must be kept coated with a shiny layer of solder by occasional wiping and applying solder directly to the tip.

### b. Tinning Process



Apply Solder to Soldering Iron Tip



Roll Tip on Damp Sponge

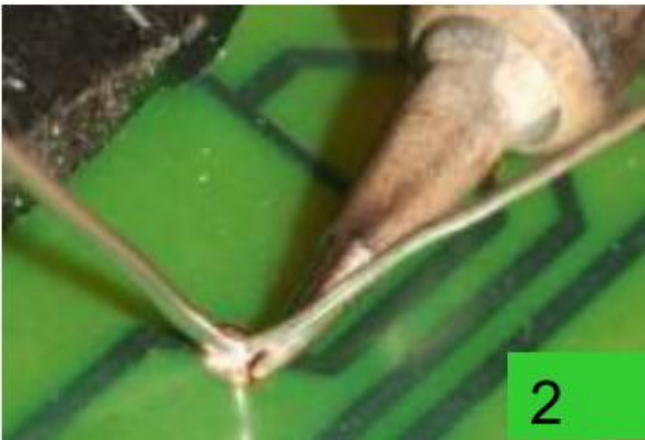


Properly Tinned Soldering Iron Tip

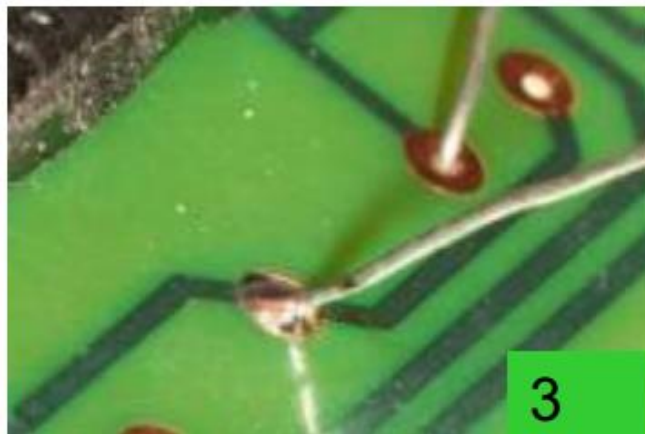
c. Solder Process



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

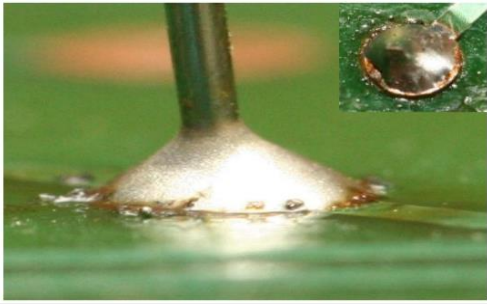


STEP 2: Continue heating and apply a few millimeters of solder. Remove the iron and allow the solder joint to cool naturally.



STEP 3: It only takes a second or two to make the perfect joint, which should appear shiny.

**d. A Good Solder Must Be**



- Smooth
- Bright
- Shiny
- Clean
- Concave fillet

**e. Bad Solder Connections**

Too Much Solder



Too Little Solder



Cold Solder Joint



Not Soldered



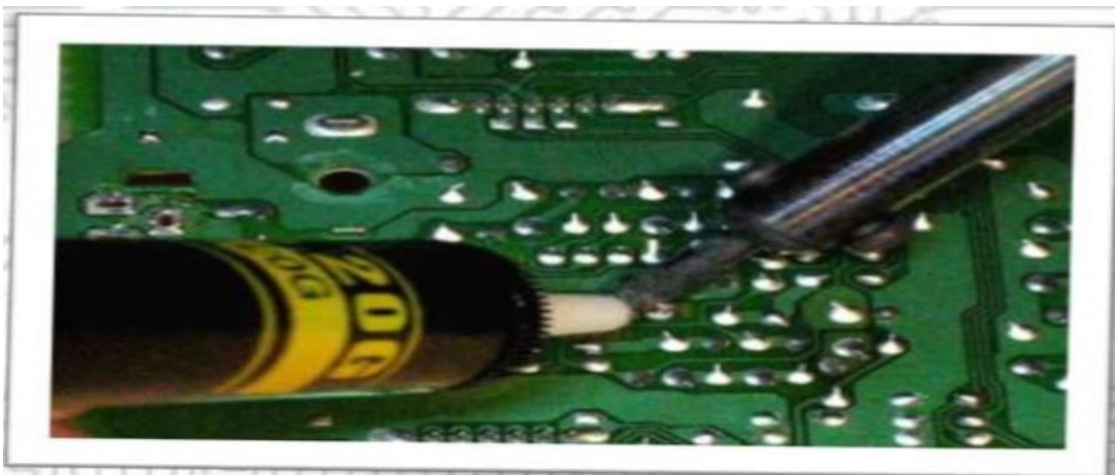
Solder Bridge



Lifted Trace/Pad



**II. Di-soldering:**





Desoldering is the removal of solder and components from a circuit board for troubleshooting, repair, replacement, and salvage.

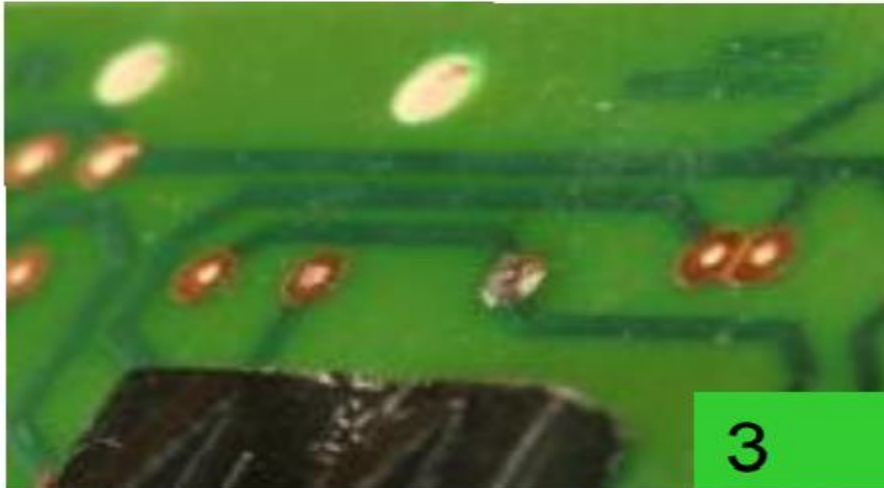
**a. Desolder Process: Solder Sucker**



STEP 1 Apply heat to the connection to be desoldered. When the solder melts, trigger the solder sucker.

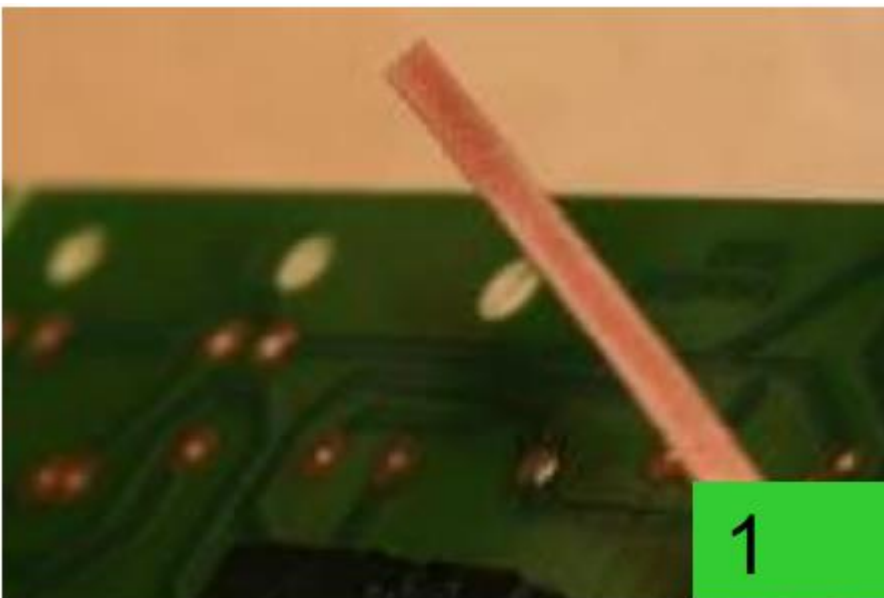


STEP 2: Repeat de-soldering as needed until all solder is removed. Remove soldering iron and solder sucker from area.



STEP 3: Remove component lead.

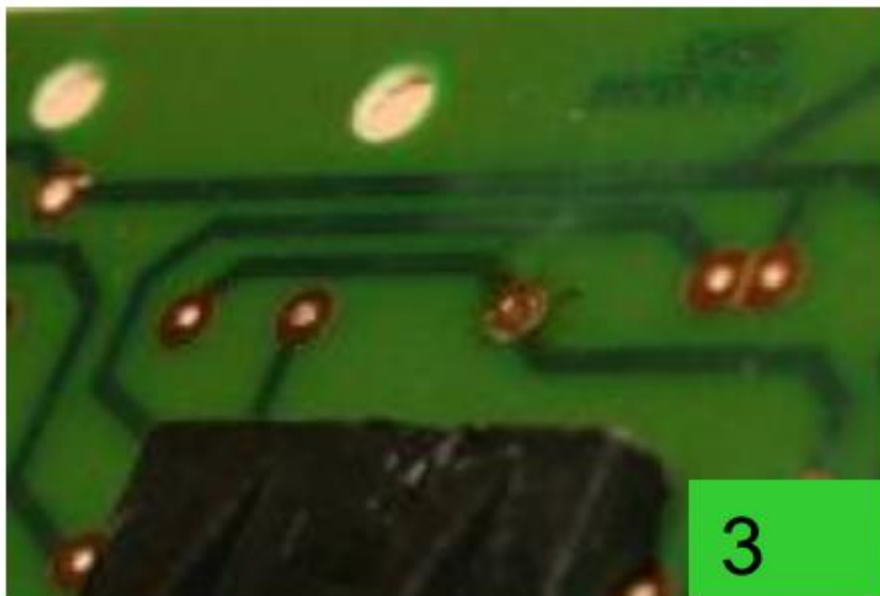
**b. Desolder Process: Solder Wick**



STEP 1 Solder wick is finely braided copper that is used to wick away excess solder from a de-soldered connection.



STEP 2: Apply the solder wick and soldering iron to the de-soldered connection. The solder wick will draw the excess solder off of the PCB pad.



STEP 3: Desoldered PCB pad

### c. Soldering Safety



- Wear safety glasses when soldering. This includes all individuals in the vicinity of someone who is soldering.
- Place soldering iron in an approved holder when not in use. The iron is hot and can cause burns.
- Place the soldering iron so that the cord does not get caught up in your arms or on others.
- Ensure access to proper ventilation.
- Verify that the type of solder is safe to use in your working environment.
- Secure the components to be soldered before beginning the soldering process.
- Provide plenty of space to work.
- Use a properly-sized point for the soldering job to be completed.
- Verify that the tip on the soldering iron has a sharp point and has not been damaged in any way.
- Check the power cord for burned or melted sections that show bare wires. Label those cords DO NOT USE and ask the instructor to repair or replace.
- Do not to touch molten solder - it is hot!
- Make sure that the solder strand is long enough to keep fingers away from the hot iron.

- Tie back long hair and remove or tuck loose clothing.
- Use heat sinks for heat-sensitive parts. Provide sufficient cooling time before removing parts.
- Do not flick solder off of the iron. Flicking can cause solder to spray and hit skin or eyes.
- Hold the scrap end when cutting excess leads so that the scrap lead is not thrown into the air.
- Cut leads evenly with wire cutters.
- Make sure that leads do not short across other traces or leads.
- Thoroughly wash your hands after handling solder.

- **Replacement of the defected components by their corresponding components.**

- **Defected component:** *Electronic components* have a wide range of failure modes. These can be classified in various ways, such as by time or cause. Failures can be caused by excess temperature, excess current or voltage, ionizing radiation, mechanical shock, stress or impact, and many other causes.
- **Components specifications:** A **Component Specification** is a generic description of a **component**. It defines its dependencies to other **components**, what actions that can be performed on it and how those actions affect the dependencies. It also defines what artifacts the **component** can export to other **components**.

## LO 2.3 Conduct after repair test

- **Voltage measurement at different stages of the DVD player power supply.**

### ❖ Chopper transformer

There are two basic reasons for their failure:

- There is excess current in the coil, resulting in the winding heating up and getting damaged.
- The protective insulation between two wires starts breaking down. This leads to the wire getting shorted.

Test	Why?
Winding Resistance	To ensure that correct wire or foil has been used during winding. Checks that transformer has been properly installed in test fixture
Inductance	Ensures that winding has correct primary turns, and the proper air gap or grade of magnetic material. For transformers without air gaps it ensures that core faces have been cleaned and are sufficiently tight.
(Q factor)	Can be used to detect shorted turns in wires or foils that have occurred during assembly.
Turns Ratio and Phasing	Checks that transformer has correct turns on every winding. Verifies that polarity of each winding is correct
Leakage Inductance	Checks that windings have been correctly positioned on bobbin
Interwinding Capacitance	Checks that proper spacing has been achieved between windings
Leakage Current	Required for SMPS transformers used in medical applications

Insulation Resistance	Checks non-safety insulation between windings and screens
Hi-Pot	Checks safety isolation. Primaries to secondaries (and to safety screen and core)

### ❖ Rectifier

There are three pairs of diodes to test. One pair is for the -5volt output. These will be fairly small; approximately the same size as the ubiquitous 1N4004 with which we are all familiar. The +12volt diodes are usually somewhat larger. The two +5volt output diodes are housed together in a "dual-diode" package that looks very much like a transistor. Like the switching transistors, this diode package is mounted on a heatsink. It will generally have the diode schematic symbols printed on it. This diode will usually not test properly in-circuit. Testing can be simplified by unsoldering it with a "solder sucker" instead of removing it completely from the printed circuit board. I have seen very few failures of the +5volt output diodes. All diodes must be replaced with high-speed diodes or the power supply will generate excessive noise.

### ❖ Filter

Follow these tests by replacing all the output capacitors with low ESR (**Equivalent Series Resistance**) caps and fire up the power supply. The supply should be tested under load. Use a 1 ohm, 50watt resistor or equivalent as a "dummy load", connected between the +5volt output and ground (DC COM). This will draw 5 amps from the supply, which is adequate for test purposes. If the supply is still inoperative, the integrated circuit may be bad. Test the IC by removing it from the printed circuit board and installing it in a power supply that you know to be good. I have a spare power supply with a socket in it that I use exclusively to test integrated circuits. Just about all the supplies use the same IC; a type 494. Equivalent integrated circuits are: TL494CN, uA494, uPC494C, IR3MO2, and MB3759. The over-the-counter replacement for these is ECG1729.

### ❖ Regulator

Start by testing the pair of switching transistors. These will be mounted on a heatsink that helps them run cooler. Test them by using an ohmmeter or a digital multimeter set to the diode test range. Check each transistor for a short between emitter and collector. Replace any transistors you find to be bad. By the way, these transistors will always seem to test shorted between base and emitter when tested "in-circuit." I generally don't bother testing the base-emitter junction of the transistors. When the switching transistors fail, they always short between emitter and collector. If you're in doubt, pull the transistors out of circuit to test them. If the transistors are shorted, the fuse will have blown.



## Learning Unit 3. Replace control module and the DVD driver set

### LO 3.1 Replace the control module

- **Testing the control module.**

Control module is used to control all parts of DVD player by receiving power from power supply distribute to other parts and receive data signal from USB, Memory card and CD transmit to output of DVD player. There are six parts that control module use to control a signal from input devices:

1. **Central processing chip** controls all the functions of control module.
2. **Quartz crystal** used to generate precise frequencies to help Central processing chip to determine a very precise timing.
3. **Video and Audio processing chip** receive signal from central processing chip convert signal that your TV and stereo will understand
4. **Op Amp chip (Operational amplifier)** will boost the signal from Video/Audio processing chip
5. **Motor controller chip** controls the direction and speed of the motors, so it works with the central processing chip to make sure that motors are moving in the right direction and at the right speed.
6. **EEPROM chip** stores an index of commands of control module even when the power's shut off.

- **Control module configuration and their faults.**

**A. General faults that occur in DVD player control module and their diagnostic techniques:**

❖ **Loss of image**

1. Disc loaded upside-down.
2. Transportation lock engaged.
3. Dirty, scratched, or defective disc.
4. Dirty or damaged objective lens.
5. Loading (mechanical) not completed reliably.

6. Damaged lens suspension or damaged lens cover preventing free movement.
7. Dirt, gummed up lubrication, or damage in sled drive mechanism.
8. Dirty/defective limit switch or sensor.
9. Defective spindle motor.
10. Spindle table height incorrectly set.
11. Bad component in optical pickup.
12. Cracks in ribbon cable to optical pickup.
13. Need to adjust servo (or less likely, optical) alignment.
14. Faulty power supply, electronics, or control logic.
15. Bad connections including missing/erratic optical deck shield.
16. External interference.

#### ❖ **Loss of audio**

##### **Their diagnostic steps:**

- Microcontroller or control logic problems
  - Bad connections or defective ribbon cable to optical pickup.
  - Missing optical deck shield, ground strap, or other connection
  - Bad connections or dirty contacts affected by temperature.
  - bad ground connection or an electronic fault in the analog circuitry following the D/A stage
  - shield connection to the headphone or line out jack or cable become disconnected.
  - Audio processing chip
  - Op Amp chip (Operational amplifier)
- **Replacement and configuration of control module**
  - ❖ **Control module components**
    1. **Central processing chip** controls all the functions of control module.
    2. **Quartz crystal** used to generate precise frequencies to help Central processing chip to determine a very precise timing.

3. **Video and Audio processing chip** receive signal from central processing chip convert signal that your TV and stereo will understand
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6. **EEPROM chip** stores an index of commands of control module even when the power's shut off.

### LO 3.2 Replace the control module

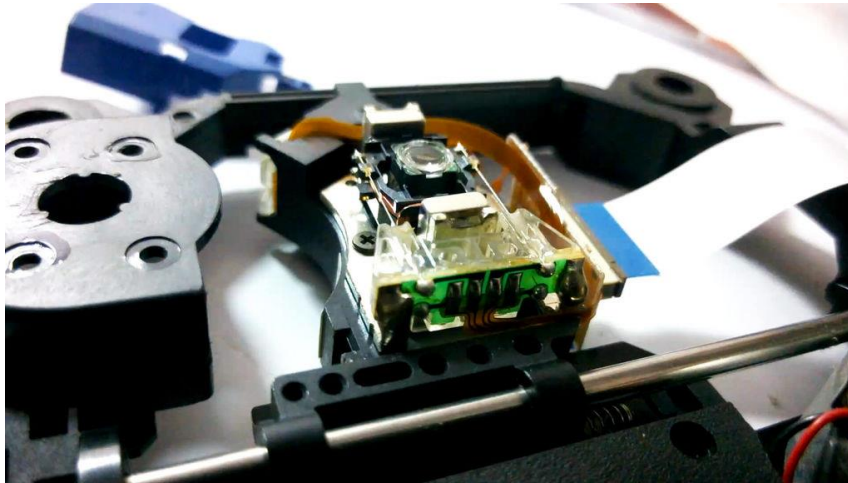
- Testing the control module.

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6. **EEPROM chip** stores an index of commands of control module even when the power's shut off.

- Main components of the DVD driver set

- i. **Lens system**



The optical system mainly consists of the laser beam, lenses, prism, photo-detectors and also mirrors. The output of this mechanism will be the input for the disc-drive. The laser beam will be a red laser diode which works at a wavelength of 600 nanometers. The optical system also requires a motor to drive it. The laser system and photo-detector is placed together on a single platform. The laser diode as well as other diodes is made with the help of glass.

- ii. **DC motor and mechanical driving system**



The disc drive mechanism consists of a motor that will drive the disc in a circular motion. The mechanism will also have a disc feed – a loading tray that is used to accept the DVD from the

user. Thus the entire disc drive is basically a spindle that holds the disc and a motor that is used to circle the disc. The spindle is held in its position with the help of small gears and belts that are attached internally. Some players have an automatic feed system in which, there will be no tray. Instead the disc will be automatically recognized after inserting a part of it.

- **Replacement of the DVD driver set.**

#### **DVD driver components**

1. **Door motor** causes the door to slide out and In
2. **CD motor** cause the spindle to turn around CD
3. **Laser motor** drives gears and causes the laser assembly to move back and forth
4. **Laser read DVD or CD** send digital signal to central processing chip to convert digital to analog signal that TV can read.
5. **Closed loop control switch** is used to rest at 0 then it run sequence again

### **LO 3.3 Conduct of after repair test**

- **Testing the control module**

- ❖ **Video output**

Video output signal is signal from a control module to TV that signal received by Central processing chip from lens system, Central processing chip controls all the functions of control module, Video and Audio processing chip receive signal from central processing chip convert signal that your TV and stereo will understand, so Op Amp chip (Operational amplifier) will boost the signal from Video/Audio processing chip reach to TV.

#### **Process how to connect control module to TV Receive**

- ✓ Using the video signal cable(s), connect the COMPONENT or VIDEO OUT jacks on the rear of the DVD player to the COMPONENT or VIDEO IN jacks of your TV.
- ✓ Turn on your DVD player and TV.
- ✓ Press the AV button of the TV to select the video input if your TV is connected in order to see image.

### ❖ Sound output

Audio output signal is signal from a control module to Amplifier that signal received by Central processing chip from lens system, all the functions of control module controls by Central processing chip, the signal from Central processing chip converted by Video and Audio processing chip that will be a signal amplifier will understand, so Op Amp chip (Operational amplifier) will boost the signal from Video/Audio processing chip reach to Amplifier.

#### **Process how to connect control module to Amplifier**

- ✓ Using the audio cables, connect the AUDIO (red and white) OUT jacks on the rear of the DVD player to the AUDIO (red and white) IN jacks of the Amplifier. If using a Coaxial cable, connect the DIGITAL AUDIO (COAXIAL) jack on the rear of the DVD player to the DIGITAL AUDIO IN (COAXIAL) jack of the Amplifier.
- ✓ Turn on your DVD player, TV, and Amplifier.
- ✓ Press the input select button of the Amplifier to select the audio input your DVD player is connected to in order to hear sound. Refer to your Amplifier's user manual to set the Amplifier's audio input.

### ❖ DVD driver input terminals

By testing DVD driver input terminals make sure all voltage required are reaching in all terminals, Door motor causes the door to slide out and In, CD motor cause the spindle to turn around CD, Laser motor drives gears and causes the laser assembly to move back and forth, all motors are use below 5volt, Laser read DVD or CD send digital signal to central processing chip to convert digital to analog signal that TV can read, Closed loop control switch is used to rest at 0 then it run sequence again, if all parts of DVD driver get voltage well then functions are good.

## Learning Unit 4. Clean the workplace

### LO 4.1 Identify the cleaning tools and materials according to their types

- Identify Tools, materials and equipment used to clean.

#### A. Tools, materials and equipment used to clean the workplace

##### ➤ Vacuum cleaner

Is an electrical machine that cleans floors, rugs, etc., by sucking up dirt, dust, etc.

A **vacuum cleaner**, also known simply as a vacuum or a Hoover, is a device that causes suction in order to remove debris from floors, upholstery, draperies.

##### ➤ Lags or cotton waste

Different types of fabric are obtained with the **cotton** yarn weaving, combined with yarns of other fibres, but this production process creates **waste**: so called **cotton** textile **waste**. This is the term which indicates the textile **waste** of processing that can be of different sizes, such as fibres, threads or fabric pieces.

##### ➤ Cleaning solutions

**Cleaning solution** means a liquid solvent or **solution** used to **clean** the operating surfaces of a printing press and its parts.

##### ➤ Brush

A brush is a common tool with bristles, wire or other filaments. It generally consists of a handle or block to which filaments are affixed in either a parallel or perpendicular orientation, depending on the way the brush is to be gripped during use.

- Collection and arrangement of tools and equipment.

All tools and equipment after complete repairing of fire detector can collect all together and arrange them by types and their use.

- Arrangement of non-used materials (consumables)

After completed repair of fire detector should arrange used materials and non-used materials.

- **Cleaning of working area**

**Cleaning** is the most important and primary aspect of **workshop**. It is a process of removing dirt, dust and grime by using **methods** such as dusting, shaking, sweeping, mopping, **washing** or polishing.

➤ **Cleaning techniques**

The following are the cleaning techniques used while cleaning the working place:

- a) **Blowing**: cleaning using blower/blowing air on surface remove dirty,
- b) **Brushing**: remove (dust or dirt) by sweeping or scrubbing
- c) **Toweling**: wipe or dry with a towel.

Towel an absorbent cloth or paper for wiping and drying something wet, as one for the hands, face, or body after washing or bathing.

➤ **Tools used in cleaning**

Here are the best cleaning tools you need to have in your workplace today:

- 1) Broom, dustpan and mop,
- 2) Scrub brush,
- 3) Spray bottle,
- 4) Microfiber cleaning cloths,
- 5) Vacuum cleaner.

- **Waste materials management**

- i. **Types of waste materials (recyclable, bio-degradable, non- bio-degradable)**

1. **Recyclable Waste**

All discarded items like metals, furniture, organic waste that can be recycled fall under this category. Not all items are recyclable, so you have to be careful when putting things into the recycle bin. If you are not sure whether an item is recyclable or not, then check the item's packaging.



### **1. Organic Waste Or bio-degradable**

Organic waste refers to rotten meat, garden and food waste. This type of rubbish is commonly found in homes. With time, they decompose and turn into manure by the action of microorganisms on them. But be careful; you should not dispose of them anywhere you like.

When decomposing, organic waste produces methane, so, it must not be thrown away with regular waste. Instead, get a green bin and dispose of this type of waste properly.

### **2. Solid Waste or Non-bio-degradable**

Solid waste is any garbage, sludge, and refuse found in industrial and commercial locations.

**The five major types of solid rubbish are;**

- **Glass and Ceramics:** Numerous companies readily recycle ceramics and glass. The catch here is that you have to dispose of them correctly.
- **Plastic waste:** Plastic waste is any container, jar, bottle, and bag that is found in companies and houses. Plastics are non-biodegradable, and most of them cannot be recycled. Do not mix plastic rubbish with regular waste. Instead, sort them out before throwing them away.
- **Paper rubbish:** This refers to all newspapers, packaging materials, cardboards, and other paper products. Paper is recyclable.
- **Metals and Tins:** You can easily find tins and metals in homes because food containers and household materials are made from them. Most metals are recyclable, so take them to a scrap yard or recycling depot after use.

## **LO 4.2 Arrange tools and materials according to their types**

- **Identify Tools, materials and equipment used to clean.**

### **B. Tools, materials and equipment used to clean the workplace**

#### **➤ Vacuum cleaner**

Is an electrical machine that cleans floors, rugs, etc., by sucking up dirt, dust, etc.

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➤ **Lags or cotton waste**

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- 2) Scrub brush,
- 3) Spray bottle,
- 4) Microfiber cleaning cloths,
- 5) Vacuum cleaner.

- **Waste materials management**

- ii. **Types of waste materials (recyclable, bio-degradable, non- bio-degradable)**

- 2. Recyclable Waste**

All discarded items like metals, furniture, organic waste that can be recycled fall under this category. Not all items are recyclable, so you have to be careful when putting things into the recycle bin. If you are not sure whether an item is recyclable or not, then check the item's packaging.

- 3. Organic Waste Or bio-degradable**

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Solid waste is any garbage, sludge, and refuse found in industrial and commercial locations.

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- **Paper rubbish:** This refers to all newspapers, packaging materials, cardboards, and other paper products. Paper is recyclable.
- **Metals and Tins:** You can easily find tins and metals in homes because food containers and household materials are made from them. Most metals are recyclable, so take them to a scrap yard or recycling depot after use.

### **LO 4.3 Manage waste materials according to their types**

- **Identify Tools, materials and equipment used to clean.**

#### **A. Tools, materials and equipment used to clean the workplace**

##### ➤ **Vacuum cleaner**

Is an electrical machine that cleans floors, rugs, etc., by sucking up dirt, dust, etc.

A **vacuum cleaner**, also known simply as a vacuum or a Hoover, is a device that causes suction in order to remove debris from floors, upholstery, draperies.

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Towel an absorbent cloth or paper for wiping and drying something wet, as one for the hands, face, or body after washing or bathing.

### ➤ **Tools used in cleaning**

Here are the best cleaning tools you need to have in your workplace today:

- 1) Broom, dustpan and mop,
- 2) Scrub brush,
- 3) Spray bottle,
- 4) Microfiber cleaning cloths,
- 5) Vacuum cleaner.

- **Waste materials management**

- iii. **Types of waste materials (recyclable, bio-degradable, non- bio-degradable)**

- 1. **Recyclable Waste**

All discarded items like metals, furniture, organic waste that can be recycled fall under this category. Not all items are recyclable, so you have to be careful when putting things into the recycle bin. If you are not sure whether an item is recyclable or not, then check the item's packaging.

- 2. **Organic Waste Or bio-degradable**

Organic waste refers to rotten meat, garden and food waste. This type of rubbish is commonly found in homes. With time, they decompose and turn into manure by the action of microorganisms on them. But be careful; you should not dispose of them anywhere you like.

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- **Metals and Tins:** You can easily find tins and metals in homes because food containers and household materials are made from them. Most metals are recyclable, so take them to a scrap yard or recycling depot after use.

## Learning Unit 5. Elaborate the report and invoice

### LO 5.1 Identify elements of the report

- Introduction on repair report.

**Repair report:** is a document that describes in detail the correct repairing procedures. When you **write** a repair report, it must be kept organized and detailed.

A repair report is written for a clear purpose and to a particular audience. Specific information and evidence are presented, analyzed and applied to a particular problem or issue.

#### 1. Elaboration of the repair report

##### i. Elements of the repair report

- ✓ **Business full address:** is the official location of a company's premises. It could be anything from someone's home **address** right up to a multi-million-pound campus, such as those big tech companies favour and everything in between.
- ✓ **Introduction:** is a beginning section which states the purpose and goals of the following writing. This is generally followed by the body and conclusion. The introduction typically describes the scope of the document and gives the brief explanation or summary of the document.
- ✓ **Body:** is a detailed discussion of your work for those readers who want to know in some depth and completeness what was done. The **body** of the **report** shows what was done, how it was done, what the results were, and what conclusions and recommendations can be drawn.
- ✓ **Conclusion/recommendation:** The conclusion enables you to reinforce the main messages of the document. A conclusion summarizes the report as a whole, drawing inferences from the entire process about what has been found, or decided, and the impact of those findings or decisions.

## ii. Format of the repair report

[Company Name]	<b>Company address</b>	Business Rules Template
[Project Name]		[Version Number]

Verification and Validation (V&V) is the process of ensuring that the software being developed will satisfy functional and other requirements and each step in the process of building the software yields the correct results. The term V&V refers to all of the activities that ensure that the software meets its requirements.

**Introduction**

V&V provides a systematic approach to the development of software and its associated products. Reviews and tests are performed at the end of each phase of the development process to ensure requirements are complete, consistent, and correct. The design, code, documentation, and data satisfy those requirements.

The two major V&V activities are reviews (including inspections and walkthroughs) and testing.

**Body**

Place the V&V plan in context by providing a brief introductory and describing those aspects of the problem and/or solution which influence the V&V needs and approach.

Sample text

This plan is used to assess software products throughout the software development lifecycle, and ensure that the software satisfies functional requirements. The purpose of the plan is to provide a detailed process plan for the Verification and Validation of [system].

**Conclusion**

Describe the major goals of the V&V process to achieve, such as:

- Comply with previous life cycle phase requirements
- Establish the proper basis for initiating the next life cycle phase.
- Satisfy standards, policies, practices, procedures, and conventions.

- Elaboration of the invoice.

**Invoice:** is a sort of bill, displaying the amount due to the buyer. **Invoice** is used for confirmation of sale.

A standard invoice is issued by a business and submitted to a client. This is the most common form of invoice that small businesses create and the format is flexible enough to fit most industries and billing cycles. Standard invoices include the following details about the sale:

- The business's name and contact information
- The client's name and contact information
- An invoice number
- The amount of money the client owes the business for its services

### a) Elements of the invoice

- ✓ Business name
- ✓ Tin number





- **Cost estimation.**

**a) What Is a Cost Estimate?**

A Cost estimate is a quantified expectation of how many resources are required to complete a project or parts of a project.

Such cost estimates are often expressed in currency units. However, other units such as man-days can also be used if the currency amounts are not applicable or irrelevant.

There are different types of cost estimates. The Project Management Body of Knowledge lists the rough order of magnitude (ROM) and the definitive estimate. Both types differ in respect of their accuracy, the project phases in which they are used as well as the available tools and techniques. Some projects use additional, sometimes industry-specific types of estimates.

**b) Project Cost Estimation Techniques**

All of these factors impact project cost estimation, making it difficult to come up with precise estimates. Luckily, there are techniques that can help with developing a more accurate cost estimation.

**Analogous Estimating**

Seek the help of experts who have experience in similar projects, or use your own historical data. If you have access to relevant historical data, try analogous estimating, which can show precedents that help define what your future costs will be in the early stages of the project.

**Statistical Modeling**

There is statistical modeling, or parametric estimating, which also uses historical data of key cost drivers and then calculates what those costs would be if the duration or another aspect of the project is changed.

**Bottom-Up Estimating**

A more granular approach is bottom-up estimating, which uses estimates of individual tasks and then adds those up to determine the overall cost of the project.

### **Three-point Estimate**

Another approach is the three-point estimate, which comes up with three scenarios: most likely, optimistic and pessimistic ranges. These are then put into an equation to develop an estimation.

### **Reserve Analysis**

Reserve analysis determines how much contingency reserve must be allocated. This approach tries to wrangle uncertainty.

### **Cost of Quality**

Cost of quality uses money spent during the project to avoid failures and money applied after the project to address failures. This can help fine-tune your overall project cost estimation. And comparing bids from vendors can also help figure out costs.

### **Dynamic Tools**

Whenever you're estimating costs, it helps to use an online software to collect all of your project information. Project management software that can be used in congress with many of these techniques to help facilitate the process. Use online software to define your project teams, tasks and goals. Even manage your vendors and track costs as the project unfolds.

#### **c) Purpose**

Cost estimating is the predictive process used to quantify, cost, and price the resources required by the scope of the project, to better manage budgets and deliver projects that do not exceed the identified scope, and that are on time throughout the development process.

The need to solidify the estimation process can be seen in four areas:

1. State financial plan
2. Creation of public satisfaction and a positive response
3. Project control
4. Problems currently being encountered

The state financial plan is affected as cost estimates are used to obtain and allocate funding for the overruns of the estimated project costs.

This leads to the second reason for the need for cost estimates: influencing public opinion. Public satisfaction is increased if transportation projects show and prove to the general public that they are timely and within budget. Public declaration of the estimated cost of projects needs to be thoughtfully provided only after care is taken to produce a well-documented, quality estimate. Project control relies on cost estimates to help keep projects within the appropriate fiscal boundaries. Although not necessarily a “check and balance” format, the existence of the original estimate will keep the project from growing and expanding beyond its spending limit. As projects encounter problems, and their estimates come “under fire,” great scrutiny is given to the project and its associated estimates. The ability to confront and solve problems and obstacles relies in large part on the quality of the estimate and the documentation, which, if done properly, will provide critical support to project success.

## LO 5.2 Develop the repair report according to the repaired equipment

- **Introduction on repair report.**

**Repair report:** is a document that describes in detail the correct repairing procedures. When you **write** a repair report, it must be kept organized and detailed.

A repair report is written for a clear purpose and to a particular audience. Specific information and evidence are presented, analyzed and applied to a particular problem or issue.

### 1. Elaboration of the repair report

#### i. Elements of the repair report

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## ii. Format of the repair report

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**Body**

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Sample text

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**Conclusion**

Describe the major goals and the deliverables to achieve, such as:

- Comply with previous life cycle phase requirements
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### LO 5.3 Develop the invoice according to the work done

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## ii. Format of the repair report

**Company address**

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**Body**

Place the V&V plan in context by providing a brief introductory and describing those aspects of the problem and/or solution which influence the V&V needs and approach.

Sample text

This plan is used to assess software products throughout the software development lifecycle, and ensure that the software satisfies functional requirements. The purpose of the plan is to provide a detailed process plan for the Verification and Validation of [system].

**Conclusion**

Describe the main goals of the project, such as:

- Comply with previous life cycle phase requirements
- Establish the proper basis for initiating the next life cycle phase.
- Satisfy standards, policies, practices, procedures, and conventions.

### • Elaboration of the invoice.

**Invoice:** is a sort of bill, displaying the amount due to the buyer. **Invoice** is used for confirmation of sale.

A standard invoice is issued by a business and submitted to a client. This is the most common form of invoice that small businesses create and the format is flexible enough to fit most industries and billing cycles. Standard invoices include the following details about the sale:

- The business's name and contact information
- The client's name and contact information

- An invoice number
- The amount of money the client owes the business for its services

**a) Elements of the invoice**

- ✓ Business name
- ✓ Tin number
- ✓ Company name and address
- ✓ Customer bank account
- ✓ Item number
- ✓ Item name
- ✓ Item specification
- ✓ Item quantity
- ✓ Item unit price and item total price

**b) Format of the invoice**

**[Your Company Name]**  
[Your Company Slogan]

[Street Address]  
[City, ST ZIP Code]  
Phone [(509) 555-0190] Fax [(509) 555-0191]

**TO:**  
[Name]  
[Company Name]  
[Street Address]  
[City, ST ZIP Code]  
[Phone]

**FOR:**  
[Project or service description]  
[P.O. #]

## INVOICE

INVOICE #[100]  
DATE: 27 SEPTEMBER 2016

DESCRIPTION	HOURS	RATE	AMOUNT

Make all checks payable to [Your Company Name]  
Total due in 15 days. Overdue accounts subject to a service charge of 1% per month.

**Thank you for your business!**

- **Cost estimation.**

- a) What Is a Cost Estimate?**

A Cost estimate is a quantified expectation of how many resources are required to complete a project or parts of a project.

Such cost estimates are often expressed in currency units. However, other units such as man-days can also be used if the currency amounts are not applicable or irrelevant.

There are different types of cost estimates. The Project Management Body of Knowledge lists the rough order of magnitude (ROM) and the definitive estimate. Both types differ in respect of their accuracy, the project phases in which they are used as well as the available tools and techniques. Some projects use additional, sometimes industry-specific types of estimates.

- b) Project Cost Estimation Techniques**

All of these factors impact project cost estimation, making it difficult to come up with precise estimates. Luckily, there are techniques that can help with developing a more accurate cost estimation.

### **Analogous Estimating**

Seek the help of experts who have experience in similar projects, or use your own historical data. If you have access to relevant historical data, try analogous estimating, which can show precedents that help define what your future costs will be in the early stages of the project.

### **Statistical Modeling**

There is statistical modeling, or parametric estimating, which also uses historical data of key cost drivers and then calculates what those costs would be if the duration or another aspect of the project is changed.

### **Bottom-Up Estimating**

A more granular approach is bottom-up estimating, which uses estimates of individual tasks and then adds those up to determine the overall cost of the project.

### **Three-point Estimate**

Another approach is the three-point estimate, which comes up with three scenarios: most likely, optimistic and pessimistic ranges. These are then put into an equation to develop an estimation.

### **Reserve Analysis**

Reserve analysis determines how much contingency reserve must be allocated. This approach tries to wrangle uncertainty.

### **Cost of Quality**

Cost of quality uses money spent during the project to avoid failures and money applied after the project to address failures. This can help fine-tune your overall project cost estimation. And comparing bids from vendors can also help figure out costs.

### **Dynamic Tools**

Whenever you're estimating costs, it helps to use an online software to collect all of your project information. Project management software that can be used in congress with many of these techniques to help facilitate the process. Use online software to define your project teams, tasks and goals. Even manage your vendors and track costs as the project unfolds.

### **c) Purpose**

Cost estimating is the predictive process used to quantify, cost, and price the resources required by the scope of the project, to better manage budgets and deliver projects that do not exceed the identified scope, and that are on time throughout the development process.

The need to solidify the estimation process can be seen in four areas:

1. State financial plan
2. Creation of public satisfaction and a positive response
3. Project control
4. Problems currently being encountered

The state financial plan is affected as cost estimates are used to obtain and allocate funding for the overruns of the estimated project costs.

This leads to the second reason for the need for cost estimates: influencing public opinion. Public satisfaction is increased if transportation projects show and prove to the general public that they are timely and within budget. Public declaration of the estimated cost of projects needs to be thoughtfully provided only after care is taken to produce a well-documented, quality estimate. Project control relies on cost estimates to help keep projects within the appropriate fiscal boundaries. Although not necessarily a “check and balance” format, the existence of the original estimate will keep the project from growing and expanding beyond its spending limit. As projects encounter problems, and their estimates come “under fire,” great scrutiny is given to the project and its associated estimates. The ability to confront and solve problems and obstacles relies in large part on the quality of the estimate and the documentation, which, if done properly, will provide critical support to project success.

## LO 5.4 Suitable development of invoice according to the work done

- **Introduction on repair report.**

**Repair report:** is a document that describes in detail the correct repairing procedures. When you **write** a repair report, it must be kept organized and detailed.

A repair report is written for a clear purpose and to a particular audience. Specific information and evidence are presented, analyzed and applied to a particular problem or issue.

### 1. Elaboration of the repair report

#### i. Elements of the repair report

- ✓ **Business full address:** is the official location of a company's premises. It could be anything from someone's home **address** right up to a multi-million-pound campus, such as those big tech companies favour and everything in between.
- ✓ **Introduction:** is a beginning section which states the purpose and goals of the following writing. This is generally followed by the body and conclusion. The introduction typically describes the scope of the document and gives the brief explanation or summary of the document.
- ✓ **Body:** is a detailed discussion of your work for those readers who want to know in some depth and completeness what was done. The **body** of the **report** shows what



was done, how it was done, what the results were, and what conclusions and recommendations can be drawn.

- ✓ **Conclusion/recommendation:** The conclusion enables you to reinforce the main messages of the document. A conclusion summarizes the report as a whole, drawing inferences from the entire process about what has been found, or decided, and the impact of those findings or decisions.

## ii. Format of the repair report

[Company Name] **Company address** Business Rules Template  
[Project Name] [Version Number]

Verification and Validation (V&V) is the process of ensuring that the software being developed will satisfy functional and other requirements and each step in the process of building the software yields the correct results. The term V&V refers to all of the activities that ensure that the software meets its requirements.

**Introduction**

V&V provides a systematic approach to ensuring the quality of software and its associated products. Reviews and tests are performed at the end of each phase of the development process to ensure requirements are complete, correct, and consistent with design, code, documentation, and data satisfy those requirements.

The two major V&V activities are reviews (including inspections and walkthroughs) and testing.

**Body**

Place the V&V plan in context by providing a brief introductory and describing those aspects of the problem and/or solution which influence the V&V needs and approach.

Sample text

This plan is used to assess software products throughout the software development lifecycle, and ensure that the software satisfies functional requirements. The purpose of the plan is to provide a detailed process plan for the Verification and Validation of [system].

**Conclusion**

Describe the major goals and the deliverables to achieve, such as:

- Comply with previous life cycle phase requirements
- Establish the proper basis for initiating the next life cycle phase.
- Satisfy standards, policies, practices, procedures, and conventions.

- **Elaboration of the invoice.**

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**b) Project Cost Estimation Techniques**

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**Reference books:**

1. DVD Player repair guide EBook by Humphrey
2. <http://www.electronicrepairguide.com/how-to-repair-dvd-player.html>
3. [http://www.eserviceinfo.com/equipment\\_type/DVD\\_17.html](http://www.eserviceinfo.com/equipment_type/DVD_17.html)
4. Troubleshooting and repair switch mode power supplies, JESTINE YONG
5. <https://www.repairfaq.org/sam/cdfaq.htm>
6. <https://www.circuitstoday.com/working-of-dvd-player>
7. <https://electronics.howstuffworks.com/dvd-player.htm>
8. <https://www.khanacademy.org/science/electrical-engineering/reverse-engin/dvd-player/v/what-is-inside-a-dvd-player-1-of-5>

**Note:**

*Many contents in this manual are duplicated more than two times due to how the curriculum was developed and arranged.*