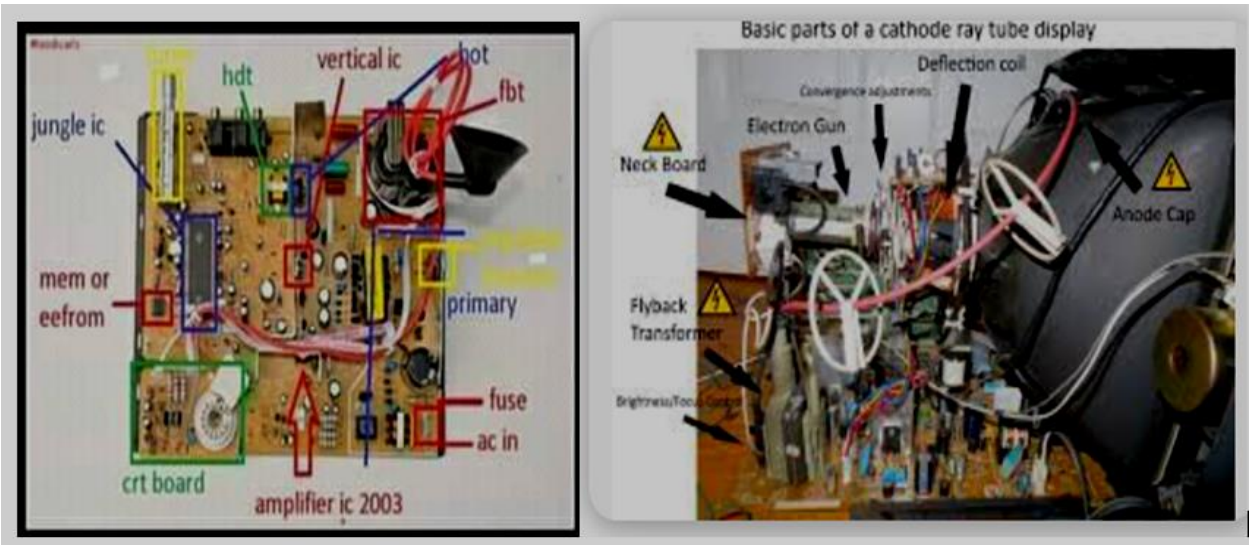
ELECTRICAL/ELECTRONICS EQUIPMENT SERVICING

Level – III

Based on April 2022, Curriculum Version



Module Title: Maintain and repair television receivers

Module Code: EIS EEES2 M03 0322

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Acknowledgement

Ministry of Labor and Skills wish to extend thanks and appreciation to the many representatives of TVET instructors and respective industry experts who donated their time and expertise to the development of this Teaching, Training and Learning Materials (TTLM).

Acronyms

AGC	Automatic Degaussing Circuit
TV	Television
HDTV	High Definition Television
VCR	Video Cassette Recorders
DVD	Digital Versatile Disc
ICs	Integrated Circuits
AC	Alternating current
DC	Direct current
KV	Kilo Volt
PTC	Positive Temperature Coefficient
NTC	Negative Temperature Coefficient
CRT	Cathode Ray Tube
TV Rx	Television Receiver
SMPS	Switch Mode Power Supply
VDR	Voltage Dependent Resistor
AGC	Automatic Gain Control
CCVS	Composite Colour Video Signal
IF	Intermediate Frequency
RF	Radio Frequency
AFT	Automatic Fine Tuning
OHS	Occupational health and safety
LAP	Learning Assistance Program
LED	light emitting diode
PCB	printed circuit boar
ESD	Electro-Static Discharge
DMM	Digital Muli-Meter
VOM	Volt Ohm Meter

Introduction to the Module

In Electrical/electronic equipment servicing filed; the: **Maintain and repair television receivers** project helps to require **Maintain and repair television receivers** includes constructing, diagnosing faults, dismantling, re-assembling, testing and preparing report.

This module is designed to meet the industry requirement under the Electrical/electronic equipment servicing occupational standard, particularly for the unit of competency: **Maintain and repair television receivers**

Module units

- Standard television receivers maintaince tools
- Identify faults
- Maintain/repair Television receivers
- Test functionality of repaired television receivers
- Achieve productivity and quality target

Learning objectives of the Module

At the end of this session, the students will able to:

- Standard television receivers maintaince tools
- Identify faults
- Maintain/repair Television receivers
- Test functionality of repaired television receivers
- Achieve productivity and quality target

Module Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the information Sheets
4. Accomplish the Self-checks
5. Perform Operation Sheets
6. Do the “LAP test”

Unit one: Standard television receivers maintaince tools

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

- Basic concept of television
- Preparing workstation, tools, test instruments and PPE With OHS
- Using service manuals and service information
- Verifying and documenting of defects parts

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

- Basic concept of television
- Prepare workstation, tools, test instruments
- Use service manuals and service information
- Verify and documenting of defects parts

1.1. Prepare standard television receivers maintaince tools

1.1.1. Basic concept of television Receiver

Television is an electronic system for conveying pictures from one place to another. Television, just as any other system dealing with pictures, is dealing with the characteristics of the human eye. This is because it is the eye that determines whether or not the reproducer picture is a faithful rendition of television must begin with a description of the eye and its characteristics.

Television is defined as an audio-visual medium. It blends pictures with sound to produce a communication experience exhibited on the screen. It uses sound to explain the visuals presented on the screen. It addresses the emotion and intellect in a remarkable way (Owauamalam, 2007:238). Television uses the movement of images in a unique way or pattern to express thought and feelings in an exciting and appealing manner. Television is defined by the BBC English Dictionary (1992:1206) as the system of pictures and distance so that people can receive them on a television set.

Television (often abbreviated to TV) is a widely used telecommunication system for broadcasting and receiving moving pictures and sound over a distance. The term may also be used to refer specifically to a television set, programming or television transmission. The word is derived from mixed Latin and Greek roots, meaning **"far sight":** Greek tele (t??e), far, and Latin vision, sight (from video, vis- to see).

Since it first became commercially available from the late 1930s, the television set has become a common household communications device in homes and institutions, particularly in the first world, as a source of entertainment and news.

Since the 1970s, video recordings on VCR tapes and later, digital playback systems such as DVDs have enabled the television to be used to view recorded movies and other programs. A television system may be made up of multiple components, so a screen which lacks an internal tuner to receive the broadcast signals is called a monitor rather than a television. A television may be built to receive different broadcast or video formats, such as high-definition television (HDTV).

1.1.2. The elements of a simple broadcast television system

- An image source. This is an electrical signal representing the visual image, and may be from a camera in the case of live images, a video tape recorder for playback of recorded images, or a film chain-telecine-flying spot scanner for transmission of motion pictures (films).

A. Sound source. This is an electrical signal from a microphone or from the audio output of a video tape recorder or motion picture film scanner.

- A transmitter, which generates radio signals (radio waves) and encodes them with picture and sound information.
- An antenna coupled to the output of the transmitter for broadcasting the encoded signals.
- An antenna to receive the broadcast signals.
- A receiver (also called a tuner), which decodes the picture and sound information from the broadcast signals, and whose input is coupled to the antenna.
- A display device, which turns the electrical signals into visual images.
- An audio amplifier and loudspeaker, which turns electrical signals into sound waves (speech, music, and other sounds) to accompany the images.

Practical television systems include equipment for selecting different image sources, mixing images from several sources at once, insertion of pre-recorded video signals, synchronizing signals from many sources, and direct image generation by computer for such purposes as station identification. The facility for housing such equipment, as well as providing space for stages, sets, offices, etc., is called a television studio, and may be located many miles from the transmitter. Communication from the studio to the transmitter is accomplished via a dedicated cable or radio system.

Television signals were originally transmitted exclusively via land-based transmitters. The quality of reception varied greatly, dependent in large part on the location and type of receiving antenna. This led to the proliferation of large rooftop antennas to improve reception in the 1960s, replacing set-top dipole or "rabbit ears" antennas, which however remained popular. Antenna rotors, set-top controlled servo motors to which the mast of the antenna is mounted, to enable rotating the antenna such that it points to the desired transmitter, would also become popular.

In most cities today, cable television providers deliver signals over coaxial or fiber-optic cables for a fee. Signals can also be delivered by radio from satellites in geosynchronous orbit and received by parabolic dish antennas, which are comparatively large for analog signals, but much smaller for digital. Like cable providers, satellite television providers also require a fee, often less than cable systems. The affordability and convenience of digital satellite reception has led to the proliferation of small dish antennas outside many houses and apartments.

Digital systems may be inserted anywhere in the chain to provide better image transmission quality, reduction in transmission bandwidth, special effects, or security of transmission from reception by non-subscribers. A home today might have the choice of receiving analog or HDTV over the air, analog or digital cable with HDTV from a

cable television company over coaxial cable, or even from the phone company over fiber optic lines. On the road, television can be received by pocket sized televisions, recorded on tape or digital media players, or played back on wireless phones ("mobile" phones) over a high-speed or "broadband" internet connection.

1.1.3. Low voltage power supply

The low voltage power supply is common to almost all stages in both colour and black/white television receivers. The power supply stage is responsible for providing the DC requirements of each circuit and provides the heater needs of the picture tube.

Integrated circuits (ICs) and other solid-state devices used in different selection of the colour TV receivers, required appropriate DC voltages for their operation. The power requirements in a colour TV receiver are:

- A DC voltage of about 110 to 120V for some high-level stage as the horizontal drive output stage, vertical output stage and in few cases, the sound output stage as well.
- A DC voltage of about 200 V for some high-level stage including R, G, and B output stages
- The DC voltages from 12 to 24 V for the ICs and transistors
- A suitable voltage for the filament of the colour picture tube (6.3V ac or 12V ac/dc) and Suitable voltage for the colour picture tube electrodes, these are
  - ✓ About 500 V for the screen
  - ✓ About 500 V for the focusing anode, and
  - ✓ Extra high tension voltage of about 25 KV for precession in line colour picture tubes

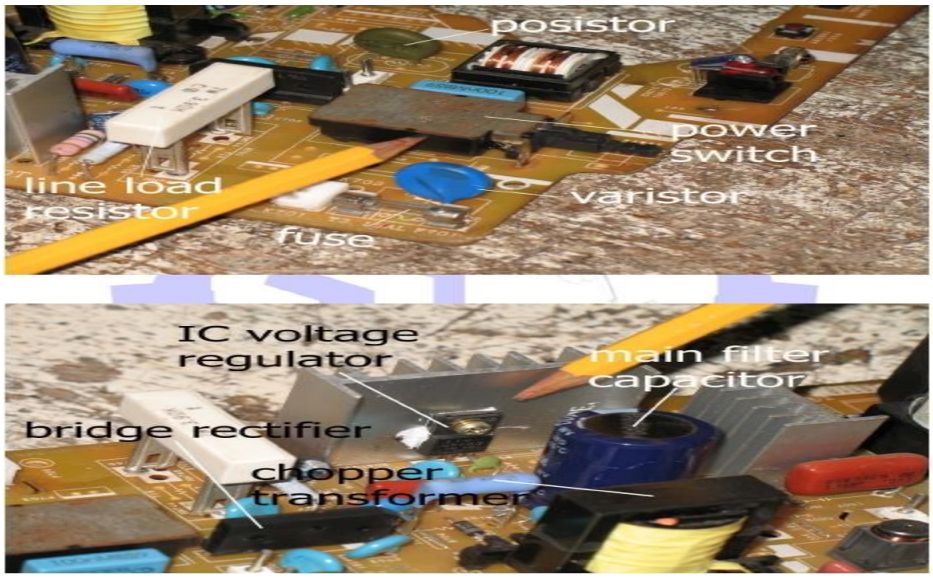


Figure 1.1. :low voltage power supply sections

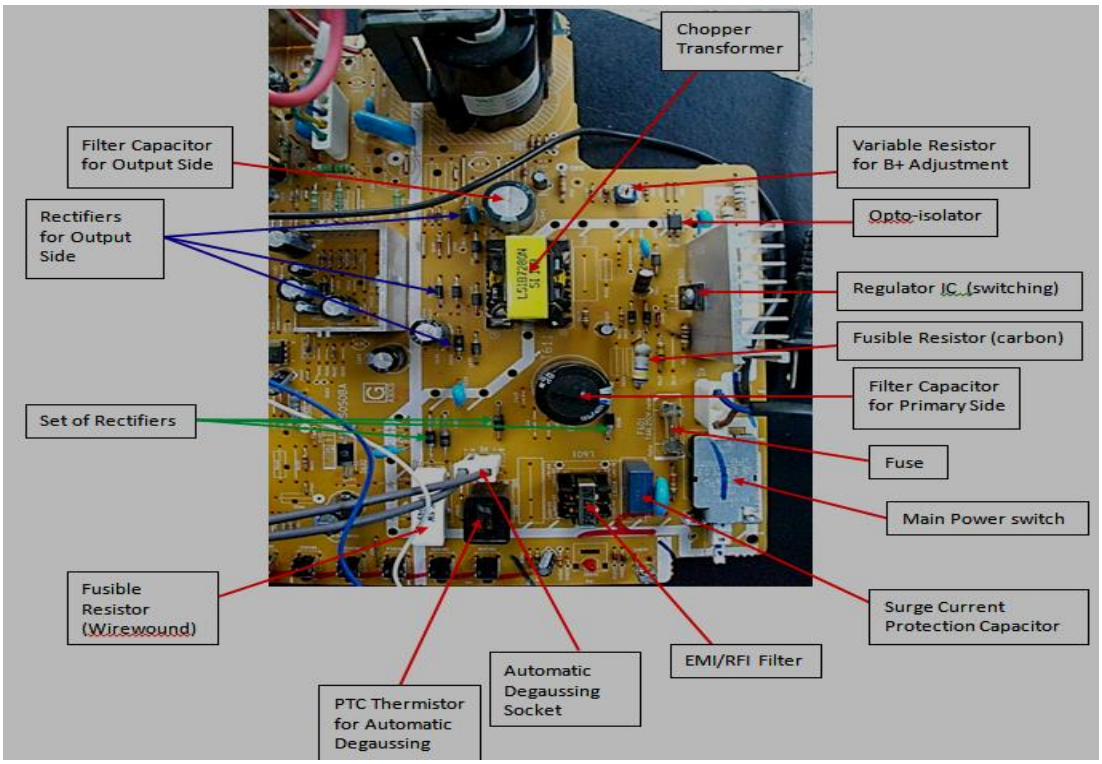


Figure : 1.2. Components of Low Voltage Power Supply

1.1.4. Explanation of all components of low voltage power supply

- **A set of rectifiers -** usually in a bridge configuration - to convert the AC into DC. Small ceramic capacitors are normally placed across the diodes to reduce RF interference.
- **Large filter capacitor is** used to smooth the unregulated DC. This is most often a voltage around 150-300 V DC. In countries with 220 VAC power, it will typically be around 300-320 V DC.
- **A discrete, hybrid, or IC regulator** is used to provide stable DC to the horizontal deflection system. Sometimes feedback from a secondary output of the fly back or even the high voltage is used. This regulator may be either a linear or switching type. In some cases, there is no regulator.
- **Chopper transformer or voltage dividers** and/or regulators to produce additional voltages directly from the line power. This relatively rare except for startup circuits. These voltages will not be isolated from the line.
- **A degauss control circuit** usually including a thermistor or Posistor (a combination of a heater disk and Positive Temperature Coefficient (PTC) thermistor in a single package). When power is turned on, a relatively

high AC current is applied to the degauss coil wrapped around the periphery of the CRT. The PTC thermistor heats up, increases in resistance, and smoothly decreases the current to nearly zero over a couple of seconds.

A startup circuit for booting the horizontal deflection of various voltages to run the TV is derived from the fly back. This may be an IC or discrete multi-vibrator or something else running off a non-isolated voltage or the standby power supply.

A standby power supply for the microcontroller and remote sensor. Usually, this is a separate low voltage power supply using a small power transformer for line isolation. However, some sets use other (probably cheaper) approaches

The two type of power supplies are commonly used in colour TV receivers as

1. The transistor regulated power supplies and
2. The SMPM

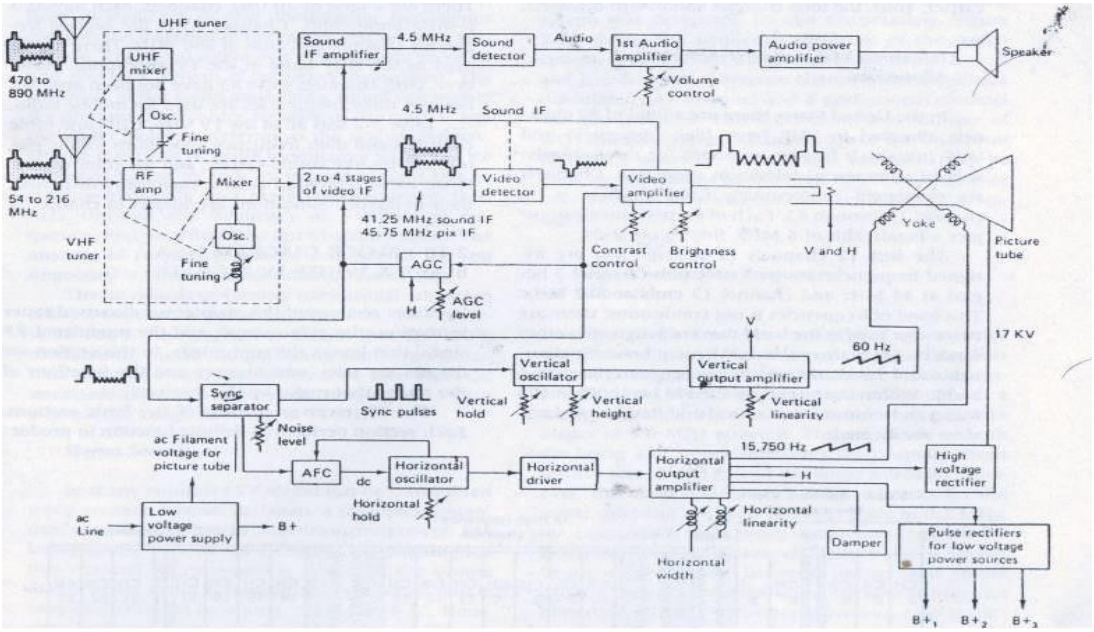


Fig 1.3. Block diagram of black and white TV Rx

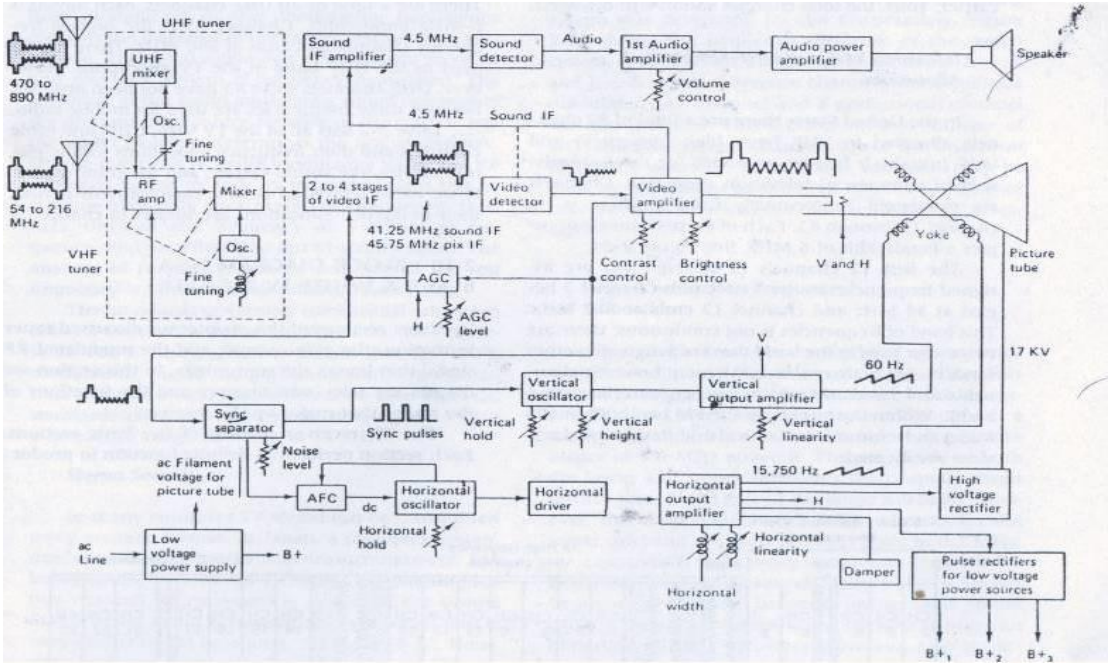


Fig 1.4. Block diagram of black and white TV Rx

1.1.5. Switching mode power supply

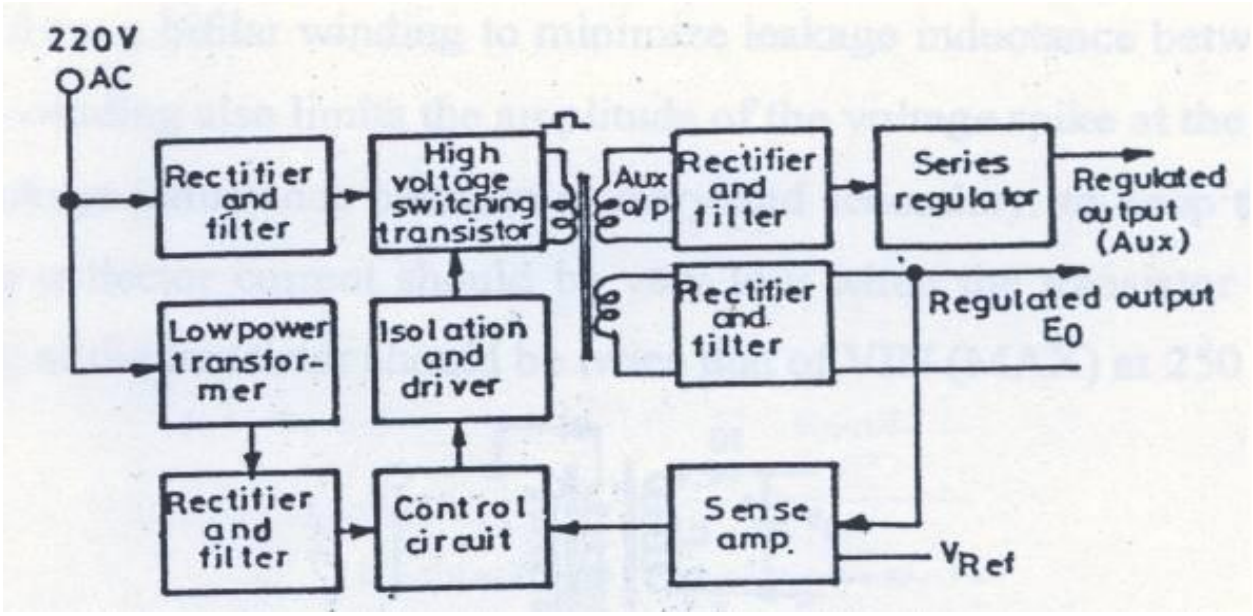


Fig1.5. A: Switch mode power supply block diagram

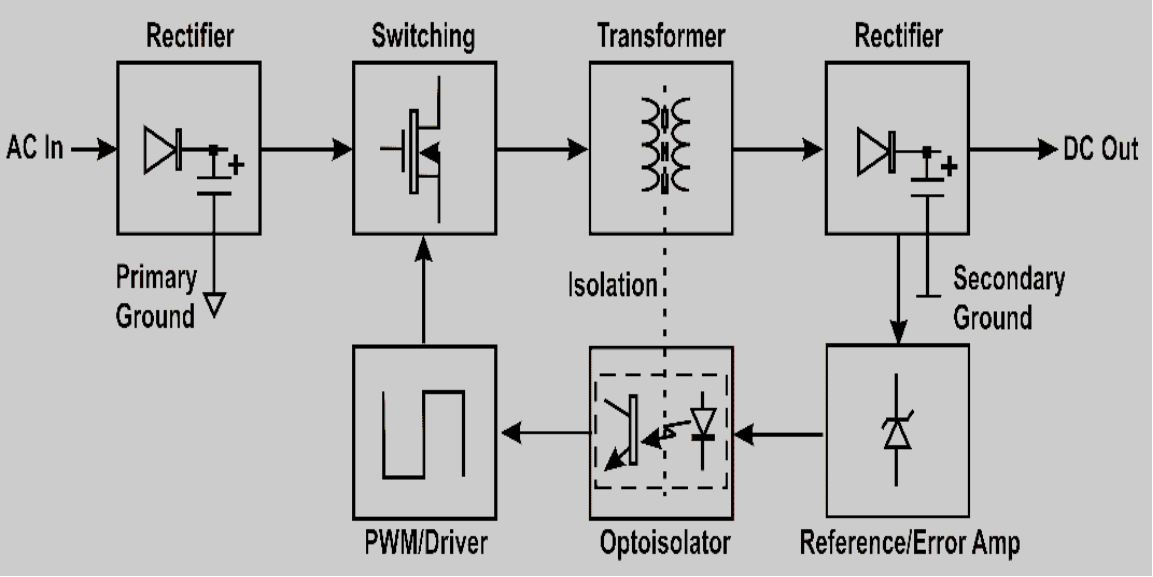


Fig 5.1: Switch mode power supply block diagram

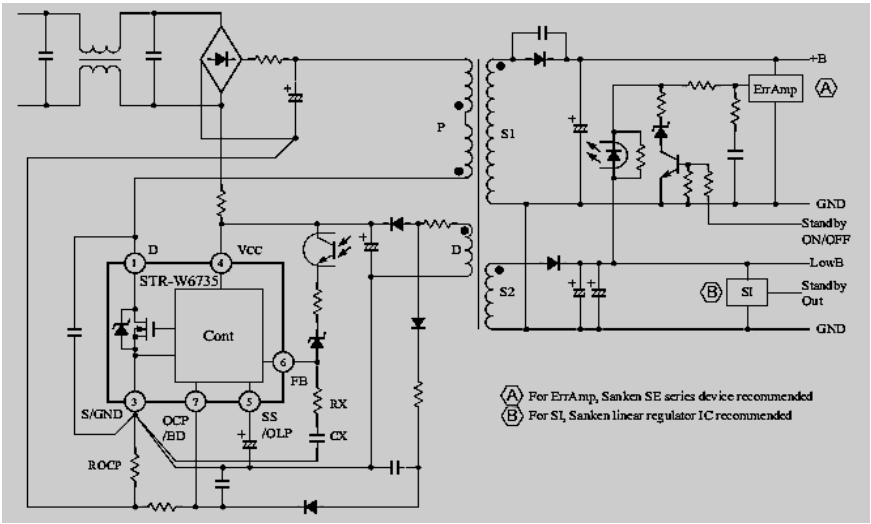


Figure 1.6. : Schematic Diagram of SMPS

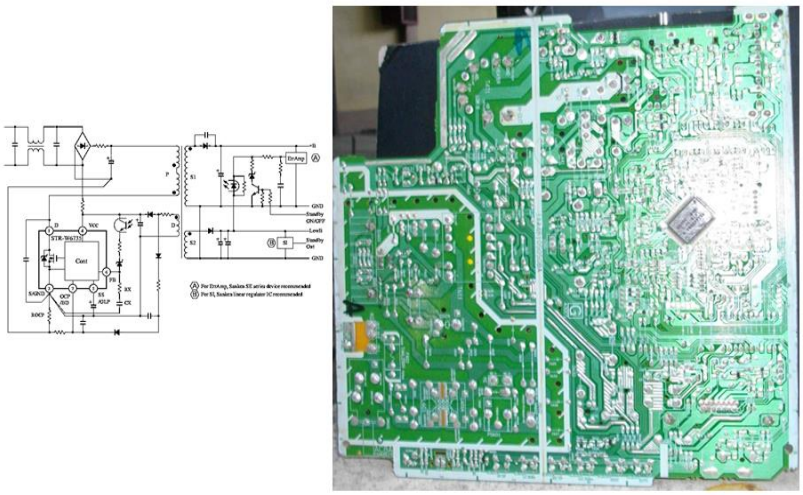


Figure: 1.7. Schematic Diagram of SMPS

The off line power supply uses directly the supply voltage without isolating transformer (step down transformer). This type of power supply is called SMPS. The above block diagram illustrates an off –line SMPS, which works directly from 180V to 250V AC-mains, the main voltage is rectified and filtered by high voltage rectifiers and filter capacitors. The unregulated DC voltage so obtain is chopped at a high frequency (greater than 25 KHz) by the switching transistor and control circuit. The chopped dc is applied to the primary of the transformer and the voltage at its secondary is rectified (using a fast recovery power diode) and smoothed (using IC filter) to give the required output. The transformer is very small in size as it works on a very high frequency. This DC voltage is fed back through a scene amplifier to the control circuit. This control circuit adjusts the duty cycle of the switching transistor via the isolated driver transformer to keep the output voltage constant deposit changes in the voltage or current.

The three main types of SMPS are:

1. Fly back SMPS
2. Forward SMPS
3. Push-pull SMPS

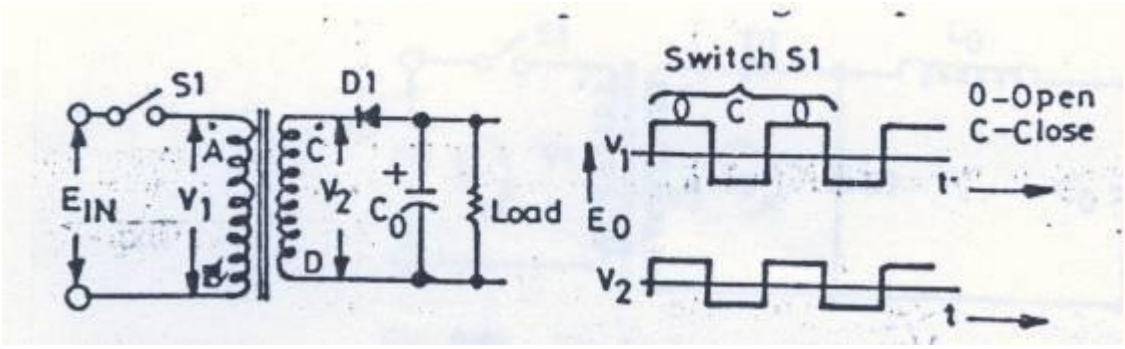


Fig 1.7. Basic fly back switching mode (SM) power supply

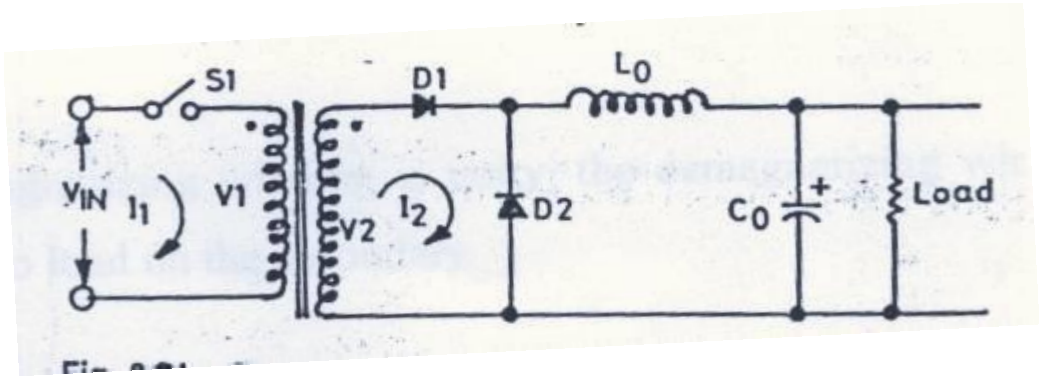


Fig 1.8. The basic forward SMPS

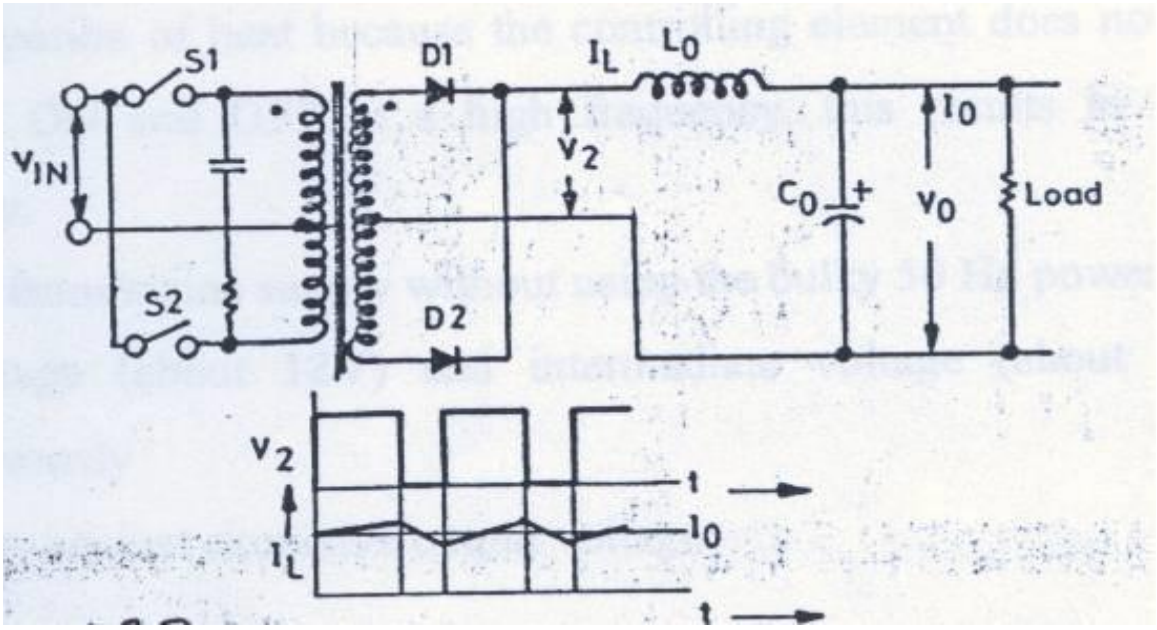


Fig 1.9. Basic circuit of push-pull SMPS

A. The main advantages of SMPS

- Small physical size

- Less dissipation of heat because the controlling element does not conduct continuously, it is switched ON and OFF at a high frequency. This results in low consumption and high efficiency
- Isolation from mains supply without using the bulky 50 Hz power transformer
- Low voltage about (121 voltage) and intermediate voltage (about 130V) can be generated simultaneously.
- Protection against excessive output voltage

B. The power supply section of TV receiver

- Provides the supply voltages 150V, 105V, 18V and 12V to power the different stages of the TV-receiver circuits
- Regulates the different supply voltages against line and load fluctuation and
- Protects itself against accident short and open for loads

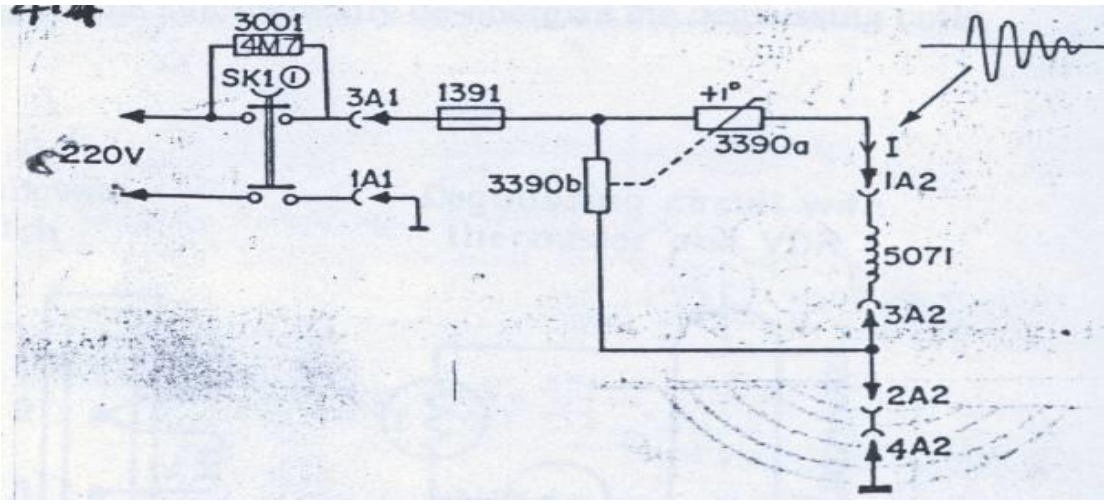
C. Protective devices

The protective devices are used in the power supply unit to protect the system from over voltage and current. For example:

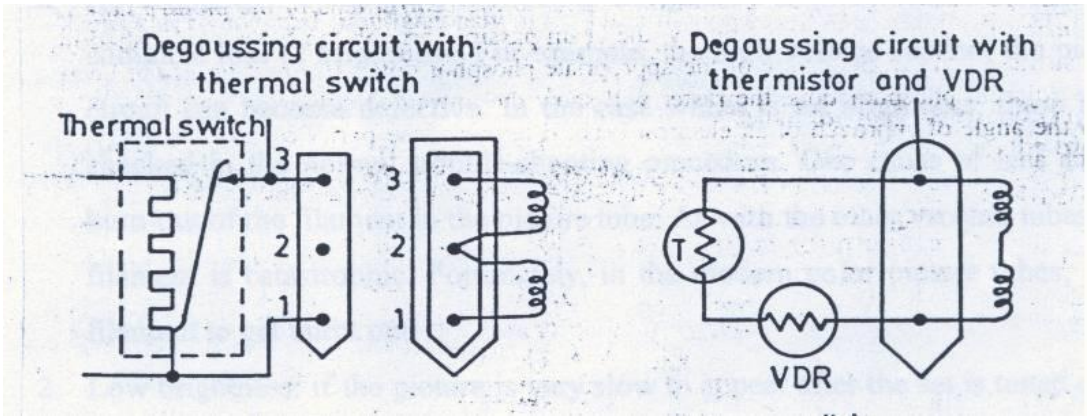
- VDR: - is a semiconductor device it varies its resistance according to the supplied voltage across it, therefore it is said to be voltage dependent resistor. It uses to protect over voltage.
- Fuse:- is most commonly used to protect the system from excess current (over current)

D. ADG circuit

- Before undertaking the purity and convergence adjustments, it is essential to demagnetize the metallic part of the TV set. This process of demagnetization is called degaussing, means, removing residential magnetism which will interfere with the proper scanning of the three beams
- All the modern colour picture tube incorporate automatic degaussing coils on the mild steel shield fitted around the tube. These coils demagnetize the main metal parts of the tube. i.e. the shadow mask, the magnetic shield and the mounting bond.
- A typical automatic degaussing circuit is illustrated in the figure below



Degaussing circuits using the combination of VDR and thermistor operate with the VDR in series and the thermistor in parallel with the coil (fig 4.36). Thus, when power is first turned on, the thermistor provides parallel resistance supplying voltage across the coil. At the same time, the VDR acts as a low resistance path for current. After a short period, the thermistor reduces resistance and essentially short circuits the coils. The VDR on the other hand, increases resistance to reduce current flow to the degaussing coils. Thus, the combination of the thermistor and VDR components automatically de-energise the degaussing coils.



Basically, the degaussing coil (fig 1-6) is simply several hundred turns of about 20 gauge wire which is looped around the picture tube screen. in earlier color receivers, automatic degaussing was not available, thus requiring periodic manual degaussing of the screen. In this, the loop was moved around the screen and the receiver chassis and gradually taken across the room away from the receiver. Occasionally, manual degaussing may still be required during the initial installation of receivers which have been subjected to extensive magnetic fields.

Care should be taken to keep the energized degaussing coil away from the neck of the tube where the purity and deflection components are mounted, otherwise, these may also get demagnetized.

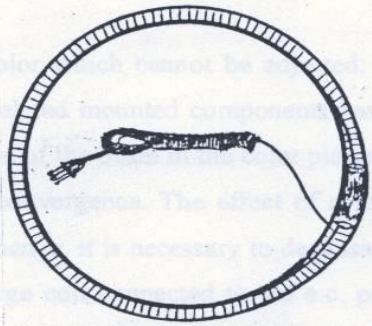


Figure: 1.10. Degaussing coil

E. RF Tuner section

The RF tuner process the incoming signal, the antenna and the RF section is also called the front end of the TV receiver. The function of the RF section is to provide selectivity, there by rejecting interference the TV signal to which the input circuit are tuned to is then heterodyned to a lower frequency (IF). Three subsections are included in RF tuner. Both the RF amplifier and the mixer section provide gain.

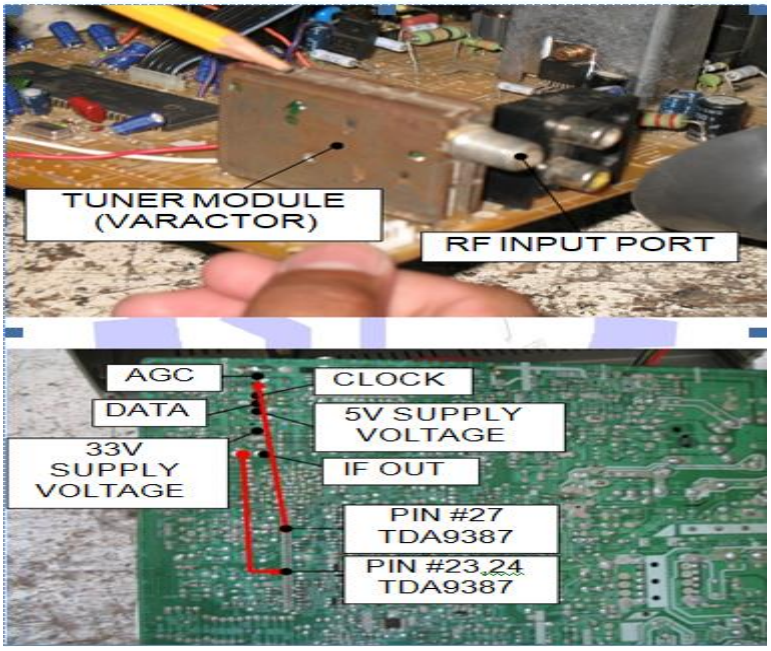


Figure1.11: **Tuner section**

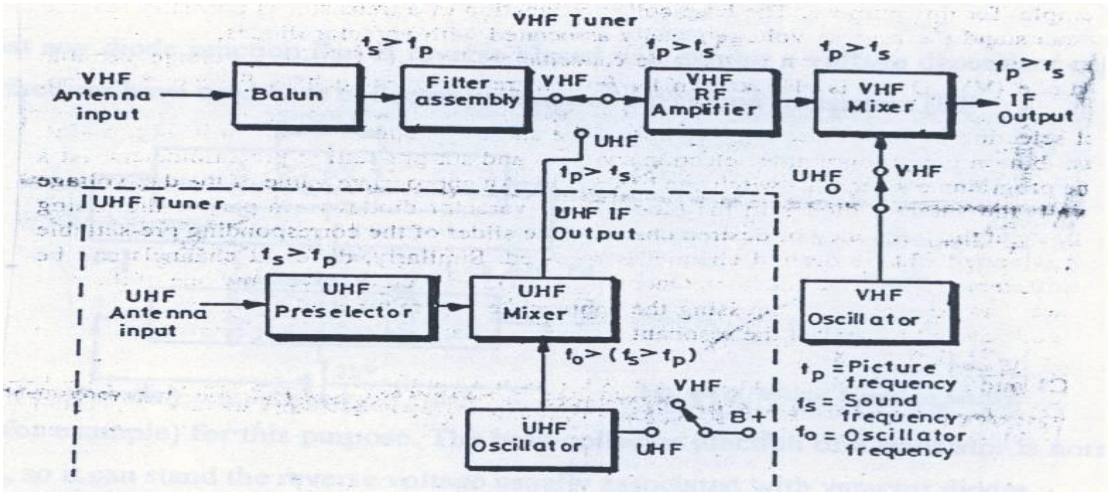


Fig 1.12. RF tuner Block diagram

F. IF section

The function performed by the VIF section in colour TV receiver is almost the same as performed in a black-and-white receiver. These are :-

- Amplification of the video IF (38.9MHz) and sound IF (33.4 MHz) signals, with automatic gain control (AGC)
- Detection of the video IF signal to obtain the composite colour video signal (CCVS)
- Mixing of the two IF signals to obtain the inter carrier sound IF signal (5.5 MHz)

- Pre amplification of video and inter carrier sound IF signal
- Automatic gain control of the video IF amplifier with noise cancellation
- Generating delayed AGC voltage for the RF amplifier in the tuner
- Amplification and limitation of video IF signal for automatic fine tuning (AFT), ,and
- Generating automatic fine tuning voltage for the tuner

The video IF amplifiers are always preceded by the appropriate wave trap for the sound carrier of the adjustment lower channel (31.9MHz), for co-channel sound (33.4 MHz) and for the video carrier of the adjustment higher channel (40.4MHz).

There are two type of filter used in IF section. These are :-

- Stagger tuner filter
- SAW filter
- The output of the video IF amplifier is used to drive the video detector.

G. Video detector

The Y-Signal (luminance) and the colour sidebands along the various synchronizing pulses and the colour burst are recovered from the video detector. The two Ifs, video (38.9MHz) and sound (33.4MHz), beat together to produce the inter-carrier sound IF 95.5MHz). This new sound IF signal is fed to the sound section for further processing.

The video detector of a colour TV Rx is also basically similar to that of a black and white TV Rx. The output of the video detector is a unipolar, negative signal of about 2V amplitude.

H. Audio section

The function of the sound section of colour TV Rx is the same as those of a black and white TV Rx. They are:-

- To amplify the inter-carrier sound IF
- To limit and detect the FM sound IF, and
- To amplify the output of the detector to a level sufficient to drive the loudspeaker

The sound section can utilize an IC in the sound IF subsystem and another in the sound output section or an IC in the sound IF subsystem with a transistorized sound output stage

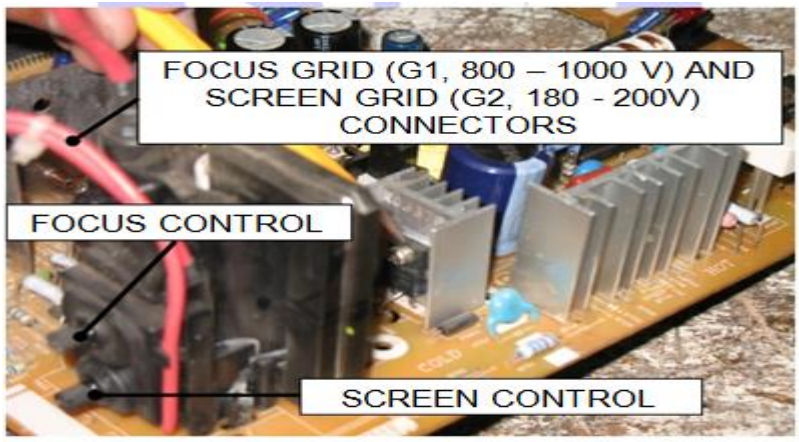


Figure 1.13: audio sections

H. Video section

The nature of the input signal in the video amplifier determines the required characteristics of the video amplifier. The composite signal is obtained at the output of the video detector and consists of the following signals.

- The video (Y) signal (0 to 4.2 MHz)
- The chrominance signal (2.08 to 4.08MHz)
- Horizontal and vertical blanking pulses (15734.26 and 59.94 Hz)
- Horizontal and vertical Sync pulses
- Colour burst
- A DC level that is directly proportional to the signal strength and picture content
- A sound IF of 4.5MHz (Present in inter-carrier receiver)

In short the video amplifier must be able to reproduce without distortion a range of signal frequencies extended from DC to 4.2 MHz and with wave shape that are extremely complex.

In inter-carrier receiver sound IF take off traps tuned to4.5 MHz are provided in the output circuit of the video amplifier.

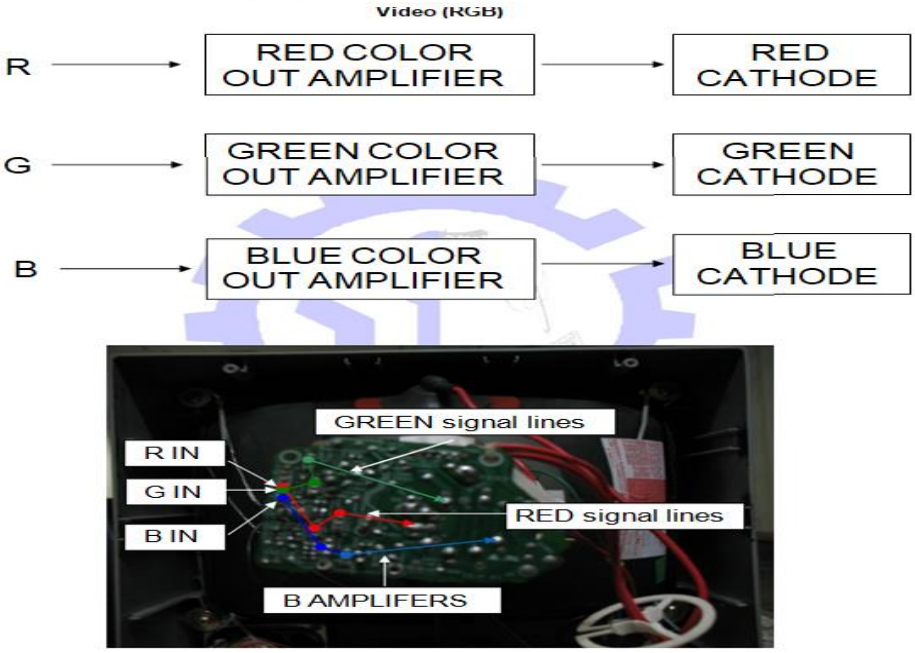


Figure1.14: video section

I. Chroma section

The generation of chrominance signal involves the separation of the luminance signal from natural colour signals while colour television has considerably complicated the variables between different television systems.

Under this topic the trainer should explain

- Primary and secondary colour
- First video amplifier
- Delay lines
- Main y amplifier
- Chroma band pass amplifier
- Chroma delay line
- U and Chroma signals
- U and V signal demodulators
- Colours burst circuits
- Burst pre amplifiers
- Gated burst amplifiers
- Pulse shaper

- Acc amplifier
- Phase discriminator
- Phase identification amplifier and colour killers
- Reference oscillator
- Electronic line by line(PAL) switch
- RGB matrix

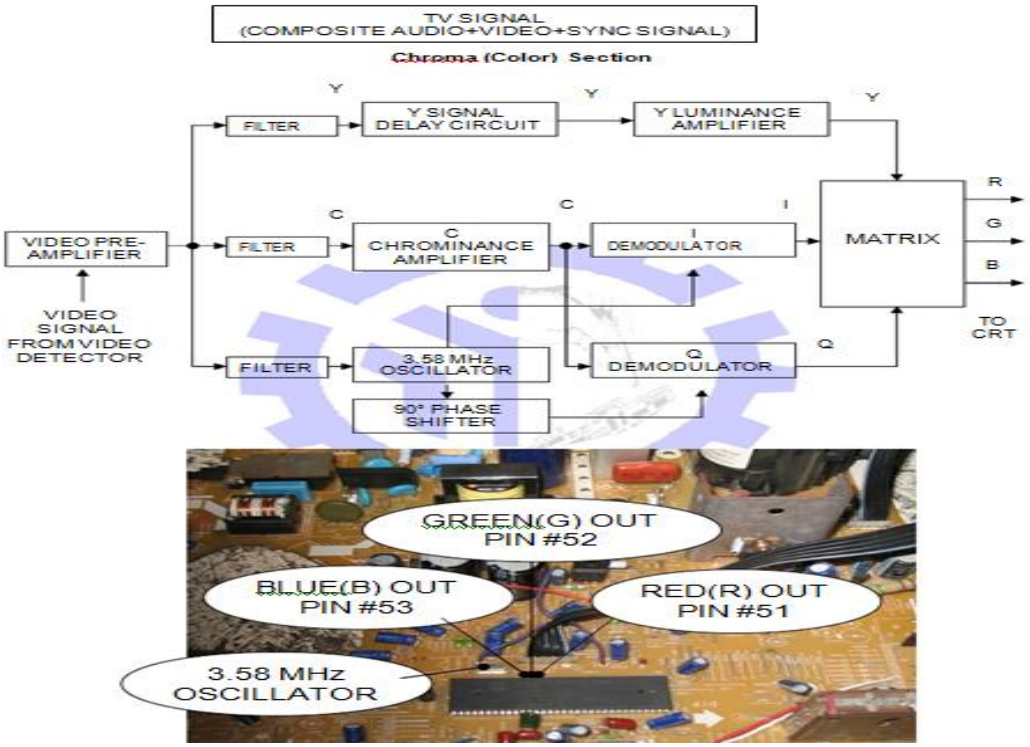


Figure1.15: Chroma section

J. Sync separator

The receiver deflection oscillators are synchronized to the transmitter deflection oscillators by means of the horizontal and vertical sync pulses that are part of the composite video signal. This pulse forces the free running receiver deflection oscillators to assume the frequencies of the pulses. A composite video signal having positive going sync pulses is obtained from the output of the video amplifier and is feed to the input of the sync separator. It is the function of the sync separator stage to remove the blanking pulses and video signal from the composite video signal. Leaving only the vertical and horizontal sync pulses at the output of the stage. This process is called amplitude separation. The output of the sync separator consists of both vertical and horizontal sync pulse of the

same amplitude. These pulses are separated from one another by means of filter circuit called integrators and differentiator. The output of each of these filters is then fed to associated deflection oscillator

K. Horizontal section

It consists of a horizontal oscillator which generates 15.625Hz; the horizontal oscillator is in variably preceded by an AFC circuit. The input to the AFC circuit is the horizontal sync pulses from the differentiating network. The AFC circuit compares the frequency and phase of the sync pulse with that of the horizontal oscillator. Any difference between the two results in a correction voltage which is used to synchronizes horizontal oscillator. The output of the horizontal oscillator is amplified by the horizontal output transformer. The horizontal output transformer feeds in to the deflection coils and to the convergence circuitry. In addition to the horizontal sweep, extremely high voltages are also induced in the horizontal output transformer during fly back



Figure 1.16: Horizontal sections

1.1.6. High voltage power supply

The high voltage power supply gives voltage for those circuits which are low current and high voltage demanding circuits, relative to the circuits which are demanding of high current and low voltage which are supplied from low voltage power supply stage

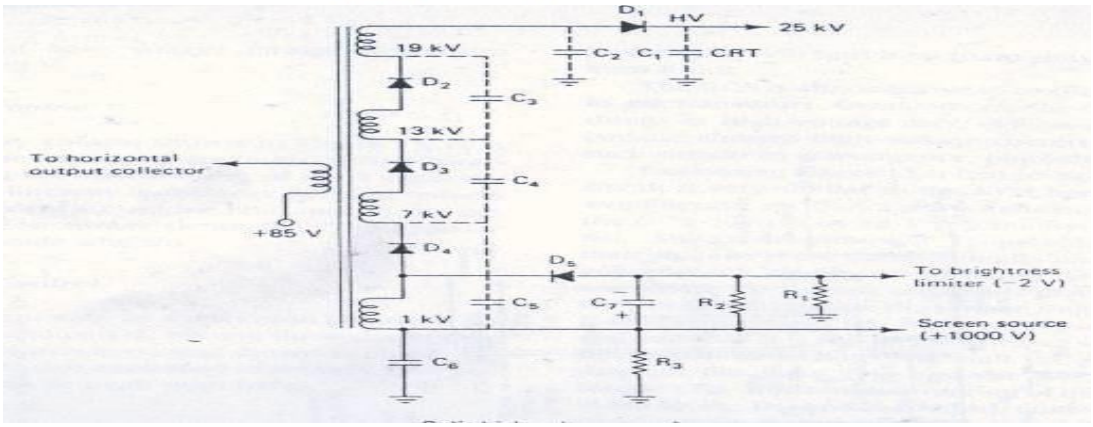


Fig 1.17: Typical diode split high voltage fly back transformer

The primary of the fly back transformer is feed by the collector of the horizontal output transistor. For separate secondary winding each develop voltage pulses. Built in to the transformer and in series with each winding rectifier diode. This voltage forces the diode to conduct and charges the internal capacitors. If any of the diodes in the transformer became defective, the entire transformer must be replaced

A. Vertical section

Vertical deflection circuits are necessary in both colour and black and white television Rx and perform two functions: they generate the vertical deflection saw tooth, and they provide the necessary power amplification to drive the vertical deflection yoke. The vertical deflection amplifiers may also provide important outputs for vertical retrace blanking and in colour receivers they may provide vertical convergency and top and bottom pincushion correction.

The vertical deflection saw tooth current flows through the vertical winding of the yoke and creates a changing magnetic field that forces the electronic beam to deflect from the top to the bottom of the raster.

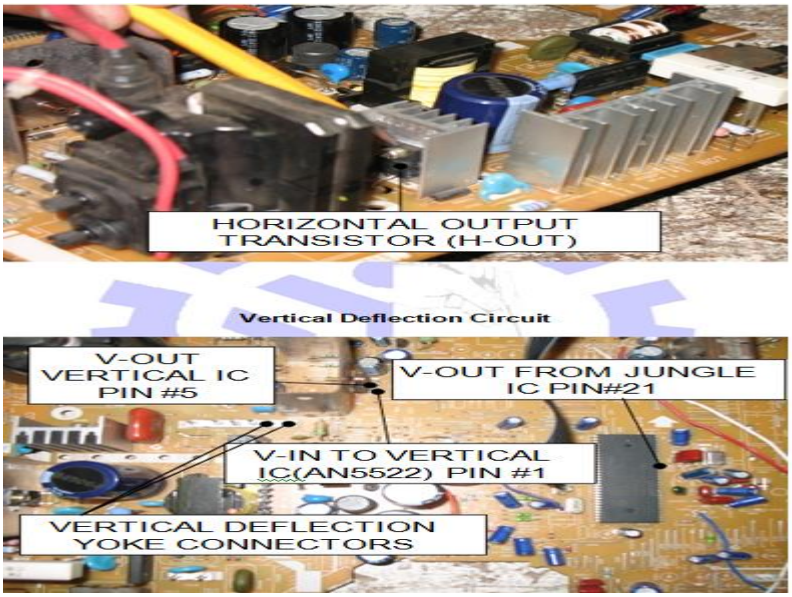


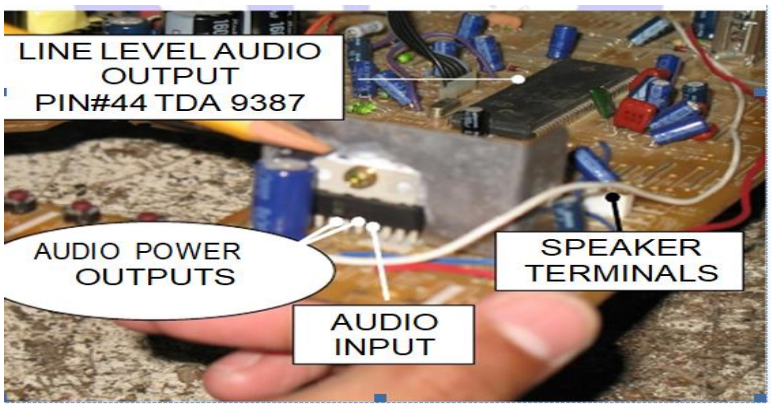
Figure1.18 : Vertical section

B. AGC circuit

The function of the automatic gain control is to keep contrast of the picture relatively constant, despite the variations in the strength of the signal induced by the antenna. The input of the AGC stage is the video signal from the first video amplifier. The AGC stage develops a control voltage proportional to the input video signal. This control voltage is applied to the control stages, i.e. RF amplifier, in the tuner and one or more of the video IF amplifier stage.

C. Control section (microprocessor)

Working from a set of built-in instructions, a microprocessor chip controls and co-ordinates all the TV set's functions in accordance with viewer commands and feed back it receives from inside the set. Use of such a chip in conjunction with a memory store offers a comprehensive and flexible control system tailored to the type, price and features of the set.



System Control

Figure 1.19: system controller

D. Remote commander

The purpose of remote control is to allow essential adjustment of the receiver from a remote position. Colour, tint, on/off, and VHF /UHF channel selection were controlled by remote controls in earlier TV Rxs.

All remote control systems are basically similar. They all have a transmitter that is small enough to be held in the hand operated by the viewer and they all have a remote receiver that is mounted in the receiver cabinet. All remote control functions are controlled by specific signals generated by the transmitter and acted up on by the receiver

E. Color picture tube (CRT)

In all the colour picture tubes, three phosphors and uniformly coated over the inside surface of the screen. These phosphors emit red, green and blue light. The colour picture tubes employ three guns to produce the three beams. Each beam controls the intensity of the color which it produces.

In the RGB drives each colouring video signal is applied to its respective cathode. The three phosphorus are so close to each other, that the three color blend into a resultant mixed color so that the eye sees only one color.]



CRT High Voltage Circuit

Figure1.20 : CRT Section

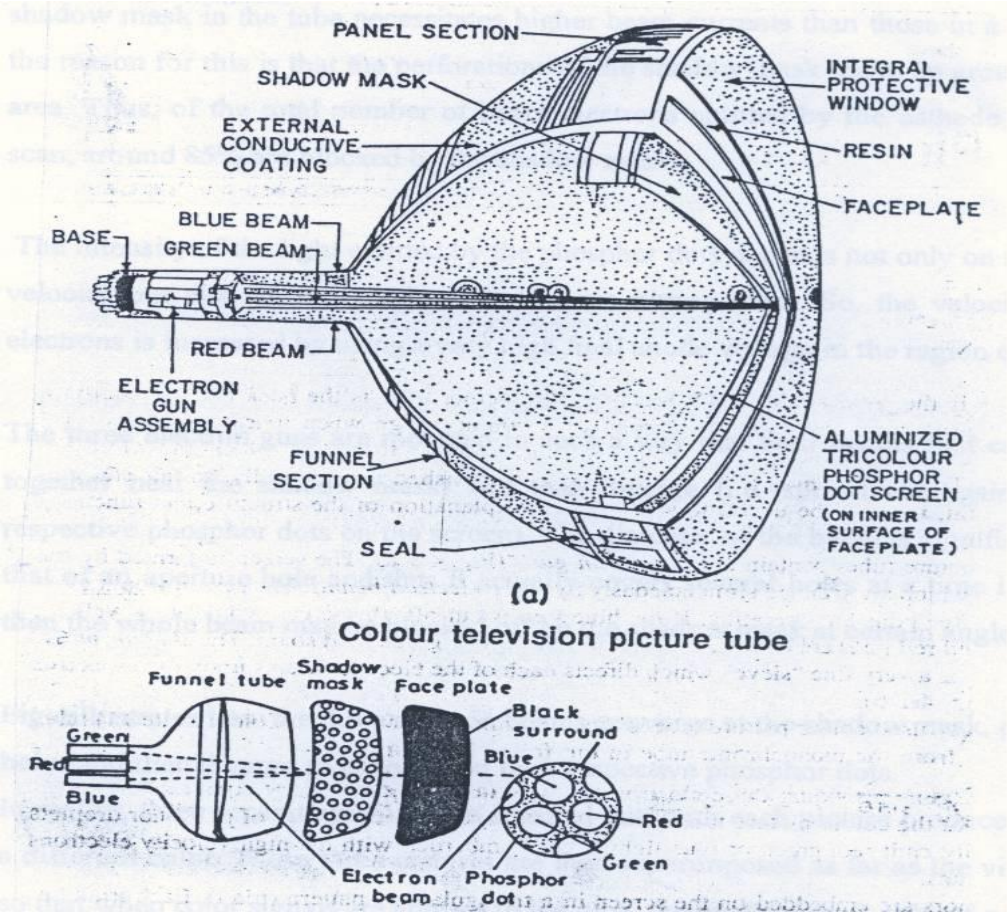


Fig 1.21: Shadow mask type of color CRT

1.2. Tools, test instruments and PPE and With OHS

1.2. 2. Prepare workplace and equipment for maintenance

Understand your responsibilities for keeping work equipment in good working order, how often you need to maintain it and where you can keep a record. You need to carry out maintenance to ensure the workplace structure, equipment, machinery, fixtures and fittings and facilities are in good working order. Inadequate maintenance can lead to dangerous situations, accidents and health problems.

1.2.3. Preparation before maintenance work started.

Safe maintenance work requires proper planning, a safe work area, appropriate equipment, careful work execution and diligent final checks.

- Importance.
- Planning.
- Providing a safe work area.
- Allocating appropriate equipment.
- Work execution.
- Final checks.
- Legislation

A. Important of maintenance at workplace

Regular maintenance is essential to keep equipment, machines and the work environment safe and reliable. Lack of maintenance or inadequate maintenance can lead to dangerous situations, accidents and health problems. Maintenance is a high-risk activity with some of the hazards resulting from the nature of the work.

1.2.4. Personal Protective Equipment or PPE

It is commonly known has been design specifically to protect employees in the work environment. Not only is it important to protect employees but also to protect the employer from unwanted legal claims. Furthermore, PPE is often a legal requirement and it is the responsibility of the employer to ensure employees wear protective clothing and observe safety and health regulations. It is also a responsibility, which employees must take seriously.

1.2.5. Common Personal Protective Equipment (PPE)

During diagnose and troubleshoot Television system, the following Personal Protective Equipment or PPE are most commonly used.

- Safety hat
- Safety shoes
- Ear muffs
- Goggles
- Mask

- Gloves
- Safety belt/Harness



Figure: 1.21. PPE

A. If technicians not use appropriate PPE

The followings are some of the main risks of not using appropriate personal protective equipment:

- The lungs will be affected, example, from breathing in contaminated air
- The head and feet will be affected, example from falling materials
- The eyes, example from flying particles or splashes of corrosive liquids
- The skin will affected, example from contact with corrosive materials
- The body will affected, example from extremes of heat or cold.

1.2.7. Introduction to occupational health and safety

Occupational safety and health (OSH), also commonly referred to as occupational health and safety (OHS), Occupational health, or workplace health and safety (WHS), is a multidisciplinary field concerned with the safety, health, and welfare (wellbeing) of people at work.

OSH may also protect co-workers, family members, employers, customers, and many others who might be affected by the workplace environment. In common-law authorities, employers have a common law responsibility to take reasonable care of the safety of their employees. Ruling law may in addition to force other general duties, introduce specific duties, and create government bodies with powers to regulate workplace safety issues

A. Occupational Health and Safety and You

One of your most important responsibilities is to protect your Health and Safety as well as that of your co-workers. This will discuss some of your duties under the occupational Health and Safety legislation and help you to make your workplace safer and healthier.

I. You have responsibilities to:

- You must also comply with the legislation.
- Protect your own Health and Safety and that of your co-workers;
- Not initiate or participate in the harassment of another worker; and
- Co-operate with your supervisor and anyone else with duties under the legislation.

II. Your Rights

- The right to know the hazards at work and how to control them;
- The right to participate in Occupational Health and Safety; and
- The right to refuse work which you believe to be unusually dangerous. You may not be punished for using these rights. An employer can be required to legally justify any action taken against a worker who is active in Health and Safety.

III. Your Right to Know and Participate

If you are inexperienced, you must receive an orientation which includes;

- What to do in a fire or other emergency;
- First aid facilities;
- Prohibited or restricted areas;
- Workplace hazards; and
- Any other information you should know.
- You must also be supervised closely by a competent supervisor.
- Regularly inspect the workplace;
- Conduct accident investigations;
- Deal with the Health and Safety concerns of employees;
- Investigate refusals to work. and
- Continue refusal measures have been taken to satisfy you that the job is now safe to perform

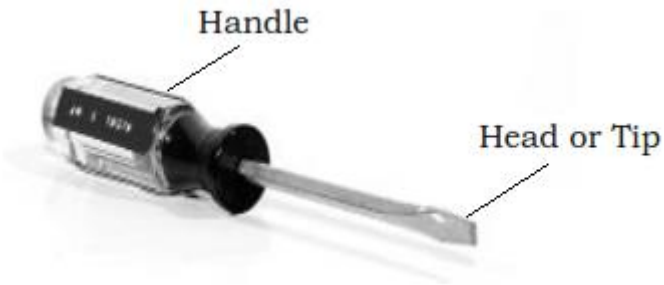
1.2. 8. Electrical tools and Electrical equipment

A. Electrical tools normally refer to electrical hand tools - typically tools used in construction activities such as electrical drills, wire strippers, and can also include electrician tools such as electrical meters (voltmeters, multi-meters, etc.). Electrical tools are plentiful and you can find them for tool shops.

B. Electrical equipment refers to manufactured systems that distribute, transform, protect, or convert electrical energy. Electrical equipment includes motors, generators, transformers, switches and switchgear, and more, and ranges from low voltage (up to 600V), medium voltage (1kV to 38kV) or high voltage.

1.2.6. Driving of Tools

A. Screwdriver. It is a device specifically designed to insert and tighten or to loosen and remove screws. A screwdriver comprises a head or tip which engages with a screw, a mechanism to apply torque by rotating the tip and some way to position and support the screwdriver. A typical hand screwdriver comprises an approximately cylindrical handle of a size and shape to be held by a human hand and an axial shaft fixed to the handle, the tip of which is shaped to fit a particular type of screw. The handle and shaft allow the screwdriver to be positioned and supported when rotated to apply torque.



B. Flat Screwdriver. It is used to drive or fasten negative slotted screws.



C. Phillips Screwdriver. It is used to drive or fasten positive slotted screws. It is a screwdriver that could take greater torque and can provide tighter fastenings.



1.2.9. Soldering Tools

Soldering Iron is a device used for applying heat to melt solder in attaching two metal parts. A soldering iron is composed of a heated metal tip and an insulated handle.

Heating is often achieved electrically, by passing a current, supplied through an electrical cord, through a heating element. For electrical work, wires are usually soldered to printed circuit boards, other wires, or small terminals. A low-power iron (1530 Watts) is suitable for this work.



Fig 1.23. soldering iron

Some soldering irons have interchangeable tips for different types of work. Fine round or chisel tips are typically used for electronics work. A new tip needs to be coated, heated, and then covered with solder before its first use. This procedure is called "tinning". The tinning forms a liquid layer, which facilitates the transfer of heat to the work piece. A dirty tip does not transfer heat well. The tip needs to be kept coated with a shiny layer of solder by occasional wiping and applying solder directly to the tip.

1.3. Use service manuals and service information

1.3.1. General Guidance for services manual for TV

A. Service manual is the full written information provided by the manufacturer regarding the equipment.

This service manual usually accompanies the equipment at time of purchase.

A service manual consists of some or all of the following

- Safety & precautionary measures during dissembling
- Dismantling or blow-up diagram
- Block diagram of the equipment
- Circuit diagram
- PCB lay out
- Parts-list

An **isolation Transformer should always be used** during the servicing of a receiver whose chassis is not isolated from the AC power line. Use a transformer of adequate power rating as this protects the technician from accidents resulting in personal injury from electrical shocks.

It will also protect the receiver and it's components from being damaged by accidental shorts of the circuitry that may be inadvertently introduced during the service operation.

If any fuse (or Fusible Resistor) in this TV receiver is blown, replace it with the specified. When replacing a high wattage resistor (Oxide Metal Film Resistor, over 1 W), keep the resistor 10 mm away from PCB. Proper service and repair is important to the safe, reliable operation of all television Equipment. The service procedures

recommended by television and described in this Service guide are effective methods of performing service operations. Some of these Service operations require the use of tools specially designed for the purpose. The special tools should be used when and as recommended. It is important to note that this manual contains various which should be carefully read in order to minimize the risk of personal injury to service personnel? The possibility exists that improper service methods may damage the equipment and pose risk of personal injury. It is also important to understand that these cautions and notices are not exhaustive. Service should only be performed by an experienced electronics

Technician trained in the proper Television safety and service methods and procedures here after throughout this manual.

1.3.1. Operating instructions/User's/Owner's manual

User documentation, be it called a user manual, user guide, or other, is usually provided to customers once they buy a product or services. The User Manual contains all essential information for the user to make full use of the information system. This manual includes a description of the system functions and capabilities, contingencies and alternate modes of operation, and step-by-step procedures for system access and use. An owner's manual is an instructional book or booklet that is supplied with almost all technologically advanced consumers.

Information contained in the owner's manual typically includes:

Safety instructions; for liability reasons these can be extensive, often including Assembly instructions; for products that arrive in pieces for easier shipping. Installation instructions; for products that need to be installed in a home or workplace Setup instructions; for devices that keep track of time or which maintain user accessible state.

1.3.2. Instructions for normal or intended operations.

A. **Maintenance instructions.**

Troubleshooting instructions; for when the product does not work as expected. Service locations; for when the product requires repair by a factory authorized technician. Regulatory code compliance information; for example with respect to safety or electromagnetic interference.

B. Product technical specifications.

- **Warranty information; sometimes provided as a separate sheet.**

Service Information was a regular program used to give out technical information for the technician. Service information includes the following basic points:

- **Job report sheets:** is blank quantity for the worker to fill up during or after performing the job.

A bill of materials (BOM) provides a list of all the raw materials or components, sub-components, assemblies, and sub-assemblies required to build or repair a product or service. It is a comprehensive list of parts, items, assemblies and other materials required to create a product, as well as instructions required for gathering and using the required materials. The bill of materials explains what, how, and where to buy required materials, and includes instructions for how to assemble the product from the various parts ordered.

- **Customer index** is a measure of how products and services supplied by a company meet or surpass customer expectation. Customer satisfaction is defined as "the number of customers, or percentage of total customers, whose reported experience with a firm, its products, or its services (ratings) exceeds specified satisfaction goals."

Customer Index is an economic indicator that measures the satisfaction of consumers across the country. The four crucial things a customer needs are: Fair price. Good service. Good product. Service Flowchart is a kind of diagram showing how steps in a process fit together, through which you can build a step-by-step picture of the process for analysis, discussion, or communication. A flowchart is a formalized graphic representation of a logic sequence, work or manufacturing process, organization chart, or similar formalized structure.

1.3.3. Safe handling of the LCD panel and during service

The work procedures shown with the Note indication are important for ensuring the safety of the product and the servicing work. Be sure to follow these instructions.

- Before starting the work, secure a sufficient working space.

At all times other than when adjusting and checking the product, be sure to turn OFF the POWER Button and disconnect the power cable from the power source of the TV during servicing.

- To prevent electric shock and breakage of PC board, start the servicing work at least 30

Seconds after the main power has been turned off. Especially when installing and removing the power board, start servicing at least 2 minutes after the main power has been turned off.

- While the main power is on, do not touch any parts or circuits other than the ones specified. If any connection other than the one specified is made between the measuring equipment and the high voltage

power supply block, it can result in electric shock or may trip the main circuit breaker When installing the LCD module in, and removing it from the packing carton, be sure to have at least two persons perform the work.

- When the surface of the panel comes into contact with the cushioning materials, be

Sure to confirm that there is no foreign matter on top of the cushioning materials before

the surface of the panel comes into contact with the cushioning materials. Failure to observe this precaution may result in, the surface of the panel being scratched by foreign matter

- Be sure to handle the circuit board by holding the large parts as the heat sink or ttransformer. Failure to observe this precaution may result in the occurrence of an abnormality in the soldered areas

2.4. Verifying and documenting of defects parts

A. Energy Efficiency (EE) standards and labels- Labels:

- Informative labels affixed to manufactured products (usually in the form of energy use, efficiency, or energy cost)
- Give consumers the data necessary to make informed purchases.

Two types: endorsement labels and comparative labels.

B. **Energy efficiency (EE) standards:**

- Procedures and regulations that prescribe the energy Performance of manufactured products,
- Sometimes prohibit the sale of products that are less efficient than a minimum level.

C. Rational for EE labels & standards:

- They can produce very large energy savings
- Limiting energy demand growth without limiting economic growth
- Require change in the behavior of a manageable number of manufacturers rather than the entire consuming public
- They treat all manufacturers, distributors, and retailers equally
- The resulting energy savings are generally assured

D. Steps in the process of developing energy-efficiency labels and standards

- Decide Whether and How to Implement Energy Efficiency Labels and Standards
- Develop a Testing Capability
- Design and Implement a Labeling Program

- Analyzing and setting standards
- Design and Implement a Communication Campaign
- Ensure Program Integrity
- Evaluating the impact of labeling and standards programs

2.4.1. General information

The first section has to do with general information. This information is used to identify the piece of equipment. It most commonly includes:

- Name of equipment Model or manufacturer
- Serial number
- Location
- Person responsible for equipment

Some equipment maintenance logs also include the Purchase date and Purchase price in this section.

2.4.2. List of maintenance actions

The second section lists all the maintenance actions performed on the equipment. It commonly includes the following fields:

- Date when the action was performed
- Description of the action itself
- Name of the person performing the actions

Lastly, some logs also include a remarks section. This section is useful in case the person performing the maintenance might have any special notes to add for future reference.

Self-Check 1.1

Test I: Say True or False

Instruction: write short answer for the given blank space provided question. You are provided 4 minute for each question and each point has 5 Points.

1. Before starting the work, secure a sufficient working space
2. Television is defined as an audio-visual medium

3. The off line power supply uses directly the supply voltage without isolating transformer (step down transformer
4. All the modern colour picture tube incorporate automatic degaussing coils on the mild steel shield fitted around the tube.

TEST. II : Choose The best answer (each 5 points)

1. Working long hours outside with _____ exposure can affect the fragile tissues in the eye.

   A) UV light B) Hand Gloves

   C) Eye Glass D) All

2. Which one of the following is used to provide stable DC to the horizontal deflection system?

   A. Transformer B. a discrete, hybrid, or IC regulator

   C. Large filter capacitor D. a set of rectifiers

3. Which one of the following is used to produce additional voltages directly from the line power.

   A. Transformer B. Chopper transformer

   C. voltage dividers D. A set of rectifiers E. B & C

4. _____ is used to measure of how products and services supplied by a company meet or surpass customer expectation

   A. Service manual B. Customer index C. Service information D. All

TEST .III: Write Short Answer On the blank space provided below

1. _____ is usually in a bridge configuration - to convert the AC into DC

2. _____is used to smooth the unregulated DC

3._____is a device specifically designed to insert and tighten or to loosen and remove screws

4. _____ is the full written information provided by the manufacturer regarding the equipment

Operation Sheet 1. 1:

Identify Major Section of TV Set

Operation title: Procedures of identify major section Of TV Set

Purpose: To practice and demonstrate the knowledge and skill required to identify major section Of TV Set parts

.

Instruction: Use the given select tools, equipment and to identify major section Of TV Set parts.

So that classification is usually done by preparing your TV set block/circuit diagram using reading drawings. For this operation you have given 5 Hour and you are expected to provide the answer on the given steps.

Step 1 - Prepare Safety Materials

Step 2 - Make your working area free from dust and unwanted objects

Step 3 - Select the appropriate tools and testing instrument

Step 4 - Prepare TV set block/circuit diagram

Step 5 - Open TV set

Step 6 - Identify each stage

Step 7 - Inspect each stage and parts of TV set

Step 8 - Assemble the TV set

Step 9 - Clean Up and Write laboratory report

Tools and requirement:

- TV set
- Service manual
- Set of Philips screw driver
- Set of flat screw driver
- Soldering iron
- Contact cleaner
- Brush
- Blower

LAP Test – 1.1.

Instructions: Given necessary templates, tools, materials and equipment you are required to perform the identify major section Of TV Set parts for the following tasks within 5 hour.

Task -1: Prepare PPE material for starting identification of major section Of TV Set parts.

Task – 2: select appropriate test instrument according to the give designed circuit to be identified.

Task – 3: Open the case according to the service manual

Task – 4: Identify each stage major section Of TV Set according to the circuit diagram

Precautions: select necessary templates, tools, materials and equipment before identify major section Of TV Set parts on the given format

Quality Criteria: the given identification of major section Of TV Set parts is with correct specification.

Unit Two: Identify faults

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

- Observing systematic pre-testing procedure
- Diagnosing the fault in the unit
- Ensuring the unplugging and plug the TV set receiving power supply point
- Carrying out basic earthling test and volt ampere test
- Discharging any large capacitor and cathode ray tube before diagnosis
- **Locating the exact location of the fault**
- Identifying system defects/fault symptoms
- Documenting diagnosis and testing results
- Advising / informing customers

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

- Observe systematic pre-testing procedure
- Diagnose the fault in the unit
- Ensure the unplugging and plug the TV set receiving
- Carry out basic earthling test and volt ampere test
- Discharge any large capacitor and cathode ray tube before diagnosis
- Locate the exact location of the fault
- Identify system defects/fault symptoms
- Document diagnosis and testing results
- Advise / inform the customers

2.1. Observing systematic pre-testing procedure

There are several approaches that troubleshooters use. They may have different steps or processes but they have the following in common: They all approach problems systematically and logically thus minimizing the steps and ruling out trial and error.

- **Visual Inspection**

Observe most faults provide clues as to their cause. There could be visual clues such as signs of damage or improper operation. Don't forget to use your other senses; sounds and smells can also provide valuable clues. Through careful observation and a some reasoning, most faults can be identified to the actual component with very little testing.

Define Problem Area At this stage you apply logic and reasoning to your observations to determine the problem area of the malfunctioning equipment.

Identify Possible Causes Once you have the problem area(s) defined it is necessary to identify all the possible causes of the malfunction.

Determine Most Probable Cause Once the list of possible causes has been made it is necessary to prioritize the items as to the possibility of them being the actual cause of the malfunction.

Test and Repair Once you have determined the most probable cause, you must test it to prove it to be the problem or not. Understand how to use tools such as prints, diagrams and test instruments to identify defective components. Let's first look at prints and diagrams.

Some of the key things you should be able to determine from these are:

- how the circuit should operate
- what kind of features the circuit has
- what voltages you should expect at various points on the circuit
- where components are physically located
- how the components are actually wired together

Practice! Troubleshooting, like any skill, requires practice to become proficient. Practice can be difficult to

get. Depending on your job, you may not have the opportunity for enough troubleshooting practice. And even if you do, your employer may not want you to practice

Troubleshooting on equipment they depend on. Until you become reasonably competent, it is best to practice troubleshooting in a controlled environment.

One option is to build or purchase equipment that can be used for troubleshooting. This equipment is designed with the ability to apply faults to it. Here you can practice your skills in a very realistic environment without affecting equipment in use.

- Interview of customer repair history of unit

Interview of the customer about the component to be repaired is for important as it helps you to identify the defected area of the unit. The customer may give you the clue what was happed during the fault occurred. What he/she see, smell, and heard and so on. Again he/she may tell you the maintenance history of the unit if it has.

- Operate the unit according to manual to confirm defects

System defects/fault symptoms are identified using appropriate tools and equipment and in accordance with safety procedures

- Test instruments required for the job are used in accordance with user manuals
- Circuits are checked and isolated using specified testing procedures
- Identified defects and faults are explained to the **responsible person** in accordance with enterprise or company policy and procedures
- Control settings/adjustments are checked in conformity with service-manual specifications
- Results of diagnosis and testing are documented accurately and completely within the specified time
- Customers are advised/ informed regarding the status and serviceability of the unit according to company procedures

2.2. Diagnosing the fault in the unit

2.2.1. Diagnosing and troubleshooting

Diagnosis is the systematic approach to find where and what type of fault occur in a system and troubleshooting/repair is the activity of correcting the fault and enabling the system to restore to its normal operation condition.

To find fault of a system, systematic and logical approach should be followed. The fault of the system should be observed and tested on each sub-system of input and output by following logical order (flow) of the process in the system.

2.2.2. Troubleshooting Procedures

Trouble shooting procedure is important to reduce the time required for maintenance and troubleshooting is done easily if we have a theoretical knowledge about the equipment.Troubleshooting procedures consists of the following 5 Steps:

Step 1 Preparation

Step 2 Observation

Step 3 Define Problem Area

Step 4 Identify Possible Causes

Step 5 Determine Most Probable Cause

System recognition is the awareness of some undesirable change in the equipment performance. That is,

- The equipment displays some sign of poor performance.
- The performance of the equipment is compared with its normal function.

So here Knowledge of the normal equipment display will enable you to recognize the abnormal display, which provides the trouble symptoms in the first troubleshooting step. Therefore, in order to aware of symptoms, we must have knowledge of the present operating characteristics and the normal design characteristic of the equipment.

Most faults provide obvious clues as to their cause. Through careful observation and a little bit of reasoning, most faults can be identified as to the actual component with very little testing.

When observing malfunctioning equipment, look for visual signs of mechanical damage such as indications of impact, chafed wires, loose components or parts lying in the bottom of the cabinet.

Look for signs of overheating, especially on wiring, relay coils, and printed circuit boards.

- Don't forget to use your other senses when inspecting equipment.
- The smell of burnt insulation is something you won't miss. Listening to the sound of the equipment operating may give you a clue to where the problem is located.
- Checking the temperature of components can also help find problems but careful while doing this, some components may be alive or hot enough to burn you.

- Pay particular attention to areas that were identified either by past history or by the person that reported the problem.

Caution here!

- Do not let these mislead you, past problems are just that past problems, they are not necessarily the problem you are looking for now.
- Also, do not take reported problems as fact; always check for yourself if possible.

The person reporting the problem may not have described it properly or may have made their own incorrect assumptions.

When faced with equipment which is not functioning properly you should:

- Be sure you understand how the equipment is designed to operate. It makes it much easier to analyze faulty operation when you know how it should operate;
- Note the condition of the equipment as found. You should look at the state of the relays (energized or not), which lamps are light, which auxiliary equipment is energized or running etc. This is the best time to give the equipment a thorough inspection (using all your senses). Look for signs of mechanical damage, overheating, unusual sounds, smells etc.
- Test the operation of the equipment including all of its features. Make note of any feature that is not operating properly.
- Make sure you observe these operations very carefully. This can give you a lot of valuable information regarding all parts of the equipment.

2.2.3. General troubleshooting Guide lines

The ultimate goal of troubleshooting is to get the equipment back into operation. This is a very important job because the entire production operation may depend on the troubleshooter's ability to solve the problem quickly and economically, thus returning the equipment to service. Although the actual steps the troubleshooter uses to achieve the ultimate goal may vary, there are a few general guidelines that should be followed.

There are often cases where a familiar piece of equipment or system breaks down. In those cases, an abbreviated five-step troubleshooting process can be used to find the fault, get the system up and running. It is important to note that, although it is a five-step approach, the same basic guidelines of the seven-step troubleshooting method are followed. The steps are simply combined to be specific to the problem at hand.

The general guidelines for a good troubleshooter to follow are:

- Work quickly

- Work efficiently
- Work economically
- Work safely and exercise safety precaution

2.2.4. Troubleshooting techniques or methods

Once the symptom is identified, the reasons that cause it have to be determined. The choice of which method to use depends on the circuit complexity, on symptoms, and on the personal preferences of the technician. The most common troubleshooting techniques are listed below:

A. Power check

It is amazing how many times a simple issue such as a blown fuse or a flat battery is the cause of a circuit malfunction. Initially, therefore, ensure that the power cord is plugged in and that the fuses are not blown

If the circuit is battery powered, make sure that the voltage level is acceptable. If a power supply rectifier is present, check the level of the voltage at the output and make sure that the circuit is powered with the correct polarity.

B. Visual inspection

This inspection is part of the so called sensory checks. Sensory checks rely on the human senses to detect a possible fault.

The visual inspection of the PCB is the simplest troubleshooting technique (which is very effective in many of the cases). The soldered joints have to be inspected thoroughly. If any doubts exist about the quality of a certain joint, it has to be re-soldered.

The PCB has to be inspected visually for any burnt components. Sometimes, components that overheat leave a brownish mark on the board. They can be used as ‘starting points’ in the troubleshooting process and the reasons why they overheat have to be determined.

It is bad practice simply to replace such components, without trying to find out what actually caused the component to overheat. In many cases, the reason is a faulty (or out of range) component near the failed component. It also has to be replaced.

C. Using a sense of touch

This is another sensory check. Overheated components can be detected by simply touching them. However, this check has to be performed with extreme caution. The circuit has to be turned off, and some time allowed for the large capacitors to discharge. Always touch the components with the right hand only.

This is important because in the case of Electric shock it is less likely that the current will pass through the heart. If possible, Wear insulated shoes. In addition, care should be taken not to burn the fingers. Using the sense of touch is a very useful troubleshooting technique in circuits, where everything seems to work properly for A while, and then the circuit fails, due to overheating of a certain component. Identifying such components helps to detect the possible cause of the fault.

Special freezing sprays are available, which allow instant freezing of components. If the circuit begins to operate properly immediately after the heated component is sprayed, this is an indication that this component is causing the circuit failure. Before replacing the component, further investigation is needed to determine what caused the overheating in the first place.

E. Smell check

When certain components fail due to overheating it is possible in most cases to detect a smell of smoke. This is usually the case, if the technician happens to be there at the time the accident occurred. If not, it is usually possible to detect the failed component by visual inspection afterwards.

F. Component replacement

This troubleshooting method relies mostly on the operator's skills and experience. Certain symptoms are an obvious indication of a particular component failure. This statement is especially true for an experienced electronic technician.

For example, some TV service technicians can unmistakably identify the failed component in a TV set (even before opening it), by just briefly examining the symptoms.

Component replacement is a good troubleshooting technique for an experienced electronics technician, as it saves a lot of time and money. Moreover, this technique guarantees the success of the repair, because if enough components are replaced, eventually the faulty one will be replaced too. However, it is recommended that the amateur technician initially applies some logical thinking to the troubleshooting process.

G. Signal Tracing

This troubleshooting technique is not the most common one, but it is the most desirable, as it requires intelligent and logical thinking from the troubleshooter.

This method is based on the measuring of the signal at various test points along the circuit. A test point in the circuit is the point, where the value of the voltage is known to the operator.

This troubleshooting technique relies on finding a point, where the signal becomes incorrect. Thus, the operator knows that the problem exists in that portion of the circuit, between the point where the signal becomes incorrect, and the point where the signal appeared correct for the last time.

In other words, the operator constantly narrows the searched portion of the circuit, until he finds what caused the fault.

There are two basic approaches in conducting the signal tracing. In the first approach, the signal check starts from the input, checking consecutively the test points towards the output. The checks are carried out, until a point when an incorrect signal is found.

The second approach is to start from the output and to work backwards towards the input in the same manner until a correct signal appears.

Troubleshooting any piece of equipment involves a systematic approach of observing the symptom, analyzing the possible causes, and checking these failures by test and measurement. Do not completely unload a switched mode power supply while troubleshooting, for this could cause the supply to self-destruct

2.3. Ensuring the unplugging and plug the TV set

A. Installation

The TV should be installed near an AC power outlet that can be easily plugged and unplugged. Place the TV on a smooth, flat surface to avoid the TV falling and causing injury, or damaging the TV. If you intend to install a TV wall mount, we recommend that you use an authorized TV wall mount. For details, please contact the Xiaomi service hotline. The diameter and length of the screws will vary depending on the wall mount model. Failure to use the correct screws may cause the TV to fall or lead to internal damage.

B. Moving

- Disconnect all cables before moving the TV.
- Large TV needs 2 or more people to move safely. Avoid applying pressure to the LED panel when moving the TV. Avoid shaking the TV or exposing it to excessive vibrations. When moving the TV to a new location or to carry out repairs, package the TV using the original box and packaging materials. Ventilation
- Do not cover the ventilation holes or insert any objects into the case.
- Keep a space for ventilation around the TV. Wall mounting In order to ensure proper ventilation and prevent the buildup of dust or dirt:

- Do not mount the TV flat, upside-down, or backwards or side mount the TV.
- Do not place the TV on a shelf, carpet, bed, or closet.
- Do not cover the TV with fabric (such as curtains) or other materials (such as newspapers). AC power cord Use the AC power cord and socket according to the instructions below to avoid fire, electric shock, damage, or personal injury:
- Insert the plug completely into the AC outlet.
- Use the TV with a 100-240V AC power source.
- When connecting cables, the AC power cord should be unplugged for safety reasons. Be careful not to trip over cables.
- Before carrying out work or moving the TV, disconnect the AC power cord from the AC power outlet.
- Keep the AC power cord away from heat

2.3.1. Unplug the AC power plug and clean it regularly.

If the plug is covered with dust and has water vapor, its insulation quality may deteriorate, producing a fire risk. Avoid excessive pinching, bending, modifying, or twisting of the AC power cord, otherwise the wires may become exposed or broken.

Do not place any heavy objects on the AC power cord.

Do not pull the AC power cord when disconnecting the power.

Do not connect too many devices on the same AC power outlet.

Do not use unsuitable AC power outlets

Wall mounting

In order to ensure proper ventilation and prevent the buildup of dust or dirt:

Do not mount the TV flat, upside-down, or backwards, or side mount the TV.

Do not place the TV on a shelf, carpet, bed, or closet.

Do not cover the TV with fabric (such as curtains) or other materials (such as newspapers)

2.4. Carry out basic earthling test and volt ampere test

2.4.1. Basic Test Methods for Earth Resistance

Broadly speaking, “earth resistance” is the resistance of soil to the passage of electric current. Actually, the earth is a relatively poor conductor of electricity compared to normal conductors like copper wire. But, if the area of a path

for current is large enough, resistance can be quite low and the earth can be a good conductor. It is the earth's abundance and availability that make it an indispensible component of a properly functioning electrical system.

A. **Earth resistance is measured in two ways for two important fields of use**:

A. **Determining effectiveness of "ground" grids and connections** that are used with electrical systems to protect personnel and equipment

B. **Prospecting for good (low resistance) "ground" locations,** or obtaining measured resistance values that can give specific information about what lies some distance below the earth's surface (such as depth to bed rock). It is not the intent of this manual to go too deeply into the theory and mathematics of the subject. As noted in the references at the end, there are many excellent books and papers that cover these. Rather, the information herein is in simple language for easy understanding by the user in industry.

The earth tester generates an AC signal which is fed into the system under test. The instrument then checks the status of the circuits for good connection and noise. If either of these variables is out of specification then the operator is informed. Having checked that the conditions for test are met, the instrument automatically steps through its measurement ranges to find the optimum signal to apply. Measuring the current flowing and the voltage generated the instrument calculates and displays the system resistance in the range of 0.001 to 20,000 ohms, depending on the model chosen.

2.4.3. Testing Challenges in Large Ground Systems

Securing valid measurements when testing large ground systems requires that proper techniques and instrumentation be used. The nature of substation and power station grounding systems and related conditions make testing far more complex than on a simple ground rod. Following are the three key challenges in testing substation ground systems: 1. The physically large area of a substation/power station ground system results in a large "resistance area" and, consequently, long distances to the test probes; ideally, the current test probe should be placed 10 times the maximum distance on the ground system (e.g, 3000 ft for a 300 ft2 ground grid) to find the "flat" portion of the characteristic resistance curve. 2. The large "resistance area" typically gives ground resistance values of less than 0.5 Ω; test instrument resolution is critical if small variances in readings are to be observed; if the test instrument does not have suitable resolution, instrument errors can overwhelm the results.

2.4.4. Hot Ground Problem

Modern equipment consists of two grounds, one of which is a “hot” ground while the other is a “cold” ground. Hot ground is in the primary side of a switch mode power supply while the cold ground is the equipment ground.

Be careful when taking voltage measurements around these grounds. For example, if you want to check the primary circuit of a power supply with power on, always ground your meter or scope to the hot ground, while check the secondary side using the cold ground.

If the “Hot” ground is not used and you use only the cold ground, the voltage measurement might not be correct and it may destroy your meter. One way to prevent this is to use an “isolation transformer

2.5 Discharging any large capacitor and cathode ray tube before diagnosis

2.5 .1. Safe discharging of capacitors in TVs and video monitors

It is essential - for your safety and to prevent damage to the device under test as well as your test equipment - that large or high voltage capacitors be fully discharged before measurements are made, soldering is attempted, or the circuitry is touched in any way. Some of the large filter capacitors commonly found in line operated equipment store a potentially lethal charge.

This doesn't mean that every one of the 250 capacitors in your TV need to be discharged every time you power off and want to make a measurement. However, the large main filter capacitors and other capacitors in the power supplies should be checked and discharged if any significant voltage is found after powering off (or before any testing - the CRT capacitance in a TV or video monitor, for example, can retain a dangerous or at least painful charge for days or longer!)

The technique I recommend is to use a high wattage resistor of about 5 to 50 ohms/V of the working voltage of the capacitor. This isn't critical - a bit more or less will be fine but will affect the time it takes to fully discharge the capacitor. The use of a current limiting resistor will prevent the arc-welding associated with screwdriver discharge but will have a short enough time constant so that the capacitor will drop to a low voltage in at most a few seconds (dependent of course on the RC time constant and its original voltage).

Then check with a voltmeter to be double sure. Better yet, monitor while discharging (not needed for the CRT - discharge is nearly instantaneous even with multi-M ohm resistor).

Obviously, make sure that you are well insulated!

- For the main capacitors in a TV or monitor power supply which might be 400 uF at 200 V, this would mean a 5K, 10W resistor. RC = 2 seconds. 5RC = 10 seconds. A lower wattage resistor can be used since the total energy in not that great. If you want to be more high tech, you can build the capacitor discharge circuit outlined

in the companion document: Capacitor Testing, Safe Discharging, and Other Related Information. This provides a visible indication of remaining charge and polarity.

- For the CRT, use a several M ohm resistor good for 30 kV or more (or a string of lower value resistors to obtain this voltage rating). A 1/4 watt job will just arc over! Discharge to the chassis ground connected to the outside of the CRT - NOT SIGNAL GROUND ON THE MAIN BOARD as you may damage sensitive circuitry. The time constant is very short - a ms or so. However, repeat a few times to be sure, then use a shorting clip as these capacitors have a way of recovering a painful charge if left alone - there have been too many stories of painful experiences from charge developing for whatever reasons ready to bite when the HV lead is reconnected.

Note that if you are touching the little board on the neck of the CRT, you may want to discharge the HV even if you are not disconnecting the fat red wire - the focus and screen (G2) voltages on that board are derived from the CRT HV.

WARNING: Most common resistors - even 5 W jobs - are rated for only a few hundred volts and are not suitable for the 25 kV or more found in modern TVs and monitors. Alternatives to a long string of regular resistors are a high voltage probe or a known good focus/screen divider network. However, note that the discharge time constant with these may be a few seconds.

If you are not going to be removing the CRT anode connection, replacing the fly back, or going near the components on the little board on the neck of the CRT, I would just stay away from the fat red wire and what it is connected to including the focus and screen wires. Repeatedly shoving a screwdriver under the anode cap risks scratching the CRT envelope which is something you really do not want to do.

2.5.2. Discharging Switch Mode Power Supply (SMPS) Capacitors.

Most SMPS have a resistor to drain the charge in the main filter capacitor. But some resistors may fail and the capacitor can hold this charge even after you have turned off the equipment. This capacitor has a range of about 150uf to 330uf at 400 working voltage.

Before you start to work on a power supply, always turn off the power and discharge the capacitor. You can do this by placing a resistor across the two legs of the capacitor. The resistor value can be around 2.2 to 4.7 kilo ohms 10watt. It takes only a few seconds to fully discharge a capacitor. Double-check the capacitor with a voltmeter after every discharge.

Do not discharge capacitor with screwdriver because: -

- It may melt the tip of the screwdriver.

- It will damage the capacitor and its terminal.
- If we are too near to the point of discharge, the heavy spark generated may cause injury to our eyes.

2.6. Locating the exact location of the fault

Fault in electrical equipment or apparatus is defined as an imperfection in the electrical circuit due to which current is deflected from the intended path. In other words, the fault is the abnormal condition of the electrical system which damages the electrical equipment and disturbs the normal flow of the electric current.

A. Safety considerations

Before we outline the basic steps for fault finding on some simple electronic circuits, it is vitally important that you are aware of the potential hazards associated with equipment which uses high voltages or is operated from the AC. mains supply.

Whereas many electronic circuits operate from low voltage supplies and can thus be handled quite safely, the high AC. voltages present in mains operated equipment represent a potentially lethal shock hazard.

The following general rules should always be followed when handling such equipment:

A. Switch off the mains supply and remove the mains power connector whenever any of the following tasks are being performed:

- Dismantling the equipment.
- Inspecting fuses.
- Disconnecting or connecting internal modules.
- De-soldering or soldering components.
- Carrying out continuity tests on switches, transformer windings, bridge rectifiers, etc.

B. When measuring AC and DC voltages present within the power unit take the following precautions:

- Avoid direct contact with incoming mains wiring.
- Check that the equipment is connected to an effective earth.
- Use insulated test prods.
- Select appropriate meter ranges before attempting to take any measurements.
- If in any doubt about what you are doing, switch off at the mains, disconnect the mains connector and think.

2.6.1 Fault Locating Procedures

Fault Locating is a disciplined and logical process in which 'experimental fixing' should never be anticipated. The generalized process of fault finding is illustrated in the flowchart of Figure7.1.

First you need to verify that the equipment really is faulty and that you haven't overlooked something obvious (such as a defective battery or disconnected signal cable). This may sound rather obvious but in some cases a fault may simply be attributable to maladjustment or misconnection. Furthermore, where several items of equipment are connected together, it may not be easy to pinpoint the single item of faulty equipment.

The second stage is that of gathering all relevant information. This process involves asking questions such as:

- In what circumstances did the circuit fail?
- Has the circuit operated correctly before and exactly what has changed?
- Has the deterioration in performance been sudden or progressive?
- What fault symptoms do you notice?

The answers to these questions are crucial and, once the information has been analyzed, the next stage involves separating the 'effects' from the 'causes'. Here you should list each of the possible causes. Once this has been done, you should be able to identify and focus upon the most probable cause. Corrective action (such as component removal and replacement, adjustment or alignment) can then be applied before further functional checks are carried out. It should then be possible to determine whether or not the fault has been correctly identified. Note, however, that the failure of one component can often result in the malfunction or complete failure of another.

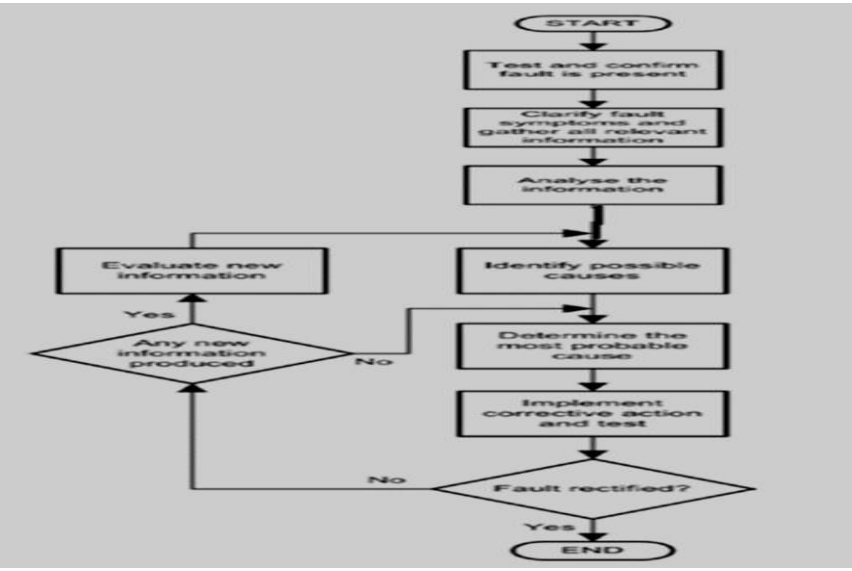


Figure 2.2. The flowchart

As an example, a short-circuit capacitor will often cause a fuse to blow. When the fuse is replaced and the supply is reconnected the fuse will once again blow because the capacitor is still faulty. It is therefore important to consider what other problems may be present when a fault is located.

2.6.3. Common Faults Categories in Power Supplies of Television receiver

No matter what type of power supply you are repairing the faults (problems) fall into the following six categories:

- No Power
- Low Output Voltage
- High Output Voltage
- Power Cycling/Blinking
- Power Shutdown and
- Intermittent Power Problem

Once you have understood the Common Faults or problems, then you can use the necessary step to isolate, troubleshoot and repair any power supplies.

A. No Power

In SMPS this fault has two categories

- Dead and Silent with fuse Blown and
- Dead and Silent with fuse Good

To identify this problem, the followings symptom is existing

- Switch on the equipment (SMPS)
- Make sure that the AC Power cord is properly connected
- Observe the LED light indicator.
- If there is no light you got the symptom then,

B. Test procedures:

- Open the cover observes the fuse.
- Test the fuse with your ohmmeter.
- Test the bridge rectifier and the power FET and
- The secondary diode.



Figure2.3. Basic Way of fault finding for no power

C. Low Output Voltage Chap 11

- **The Symptom:**

✓ Low power output

✓ No LED light

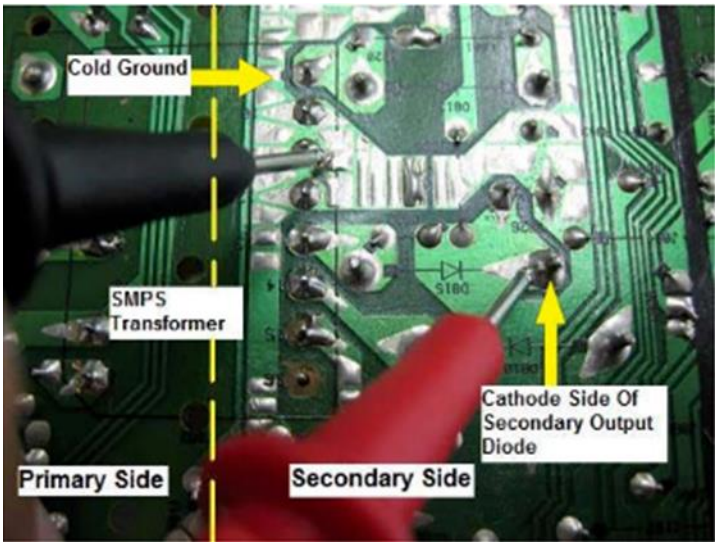


Figure 2.4. Low Output Voltage test

D. High Output Voltage

Symptoms

✓ An increased value of secondary output voltage (Example, from 12V to 15V.)

Test Steps

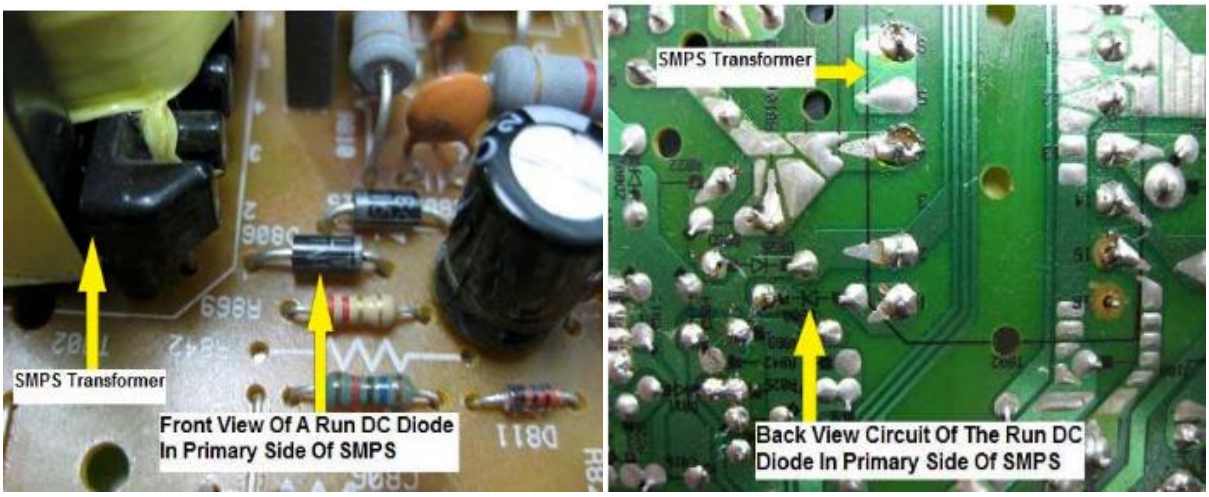


Figure 2.5 : Run DC Circuit Diode and Its location In the primary side of SMPS.

E. Power Cycling/Blinking

Symptoms

- The equipment LED Blinks.

F. Power Shutdown

Symptoms

- ✓ Producing too HIGH output voltage that can burn the equipment and other electronic circuitry.
- ✓ The SMPS shutdown itself whiles you ON.

G. Intermittent Power Problem

Symptoms

- ✓ The SMPS sometimes works and sometimes don't work properly.

2.7. Identify system defects/fault symptoms

2.7.1. Common Television Problems:

TVs require a variety of voltages (at various power levels) to function. The function of the low voltage power supply is to take the AC line input of either 115 VAC 60 Hz (220 VAC 50 Hz or other AC power in Europe and elsewhere) and produce some of these DC voltages. In all cases, the power to the horizontal output transistor of the horizontal deflection system is obtained directly from the low voltage power supply. In some cases, a variety of other DC voltages are derived directly from the AC line by rectification, filtering, and regulation. In other designs, however, most of the low voltages are derived from secondary windings on the fly back (LOPT) transformer of the horizontal deflection system. In still other designs, there is a separate switch mode power supply that provides

some or all of these voltages. There are also various (and sometimes convoluted) combinations of any or all of the above.

There will always be:

2.7.2. A power switch, relay, or triac to enable main power.

A. Set of rectifiers: usually in a bridge configuration - to turn the AC into DC. Small ceramic capacitors are normally placed across the diodes to reduce RF interference. One or more large filter capacitors to smooth the unregulated DC. In the U.S., this is most often a voltage around 150-160 V DC. In countries with 220 VAC power, it will typically be around 300-320 V DC.

A discrete, hybrid, or IC regulator to provide stable DC to the horizontal deflection system. Sometimes feedback from a secondary output of the fly back or even the high voltage is used. This regulator may be either a linear or switching type. In some cases, there is no regulator. Zero or more voltage dividers and/or regulators to produce additional voltages directly from the line power. This relatively rare except for startup circuits. These voltages will not be isolated from the line.

A degauss control circuit usually including a thermostat or Posistor (a combination of a heater disk and Positive Temperature Coefficient (PTC) thermistor in a single package). When power is turned on, a relatively high AC current is applied to the degauss coil wrapped around the periphery of the CRT. The PTC thermistor heats up, increases in resistance, and smoothly decreases the current to nearly zero over a couple of seconds.

A startup circuit for booting the horizontal deflection if various voltages to run the TV are derived from the fly back. This may be an IC or discrete multi-vibrator or something else running off a non-isolated voltage or the standby power supply.

A standby power supply for the microcontroller and remote sensor. Usually, this is a separate low voltage power supply using a small power transformer for line isolation. However, some sets use other (probably cheaper) approaches. See below. Always use an isolation transformer when working on a TV but this is especially important - for your safety - when dealing with the non-isolated line operated power supply. Read and follow the information in the section: Safety guidelines.

B. **Standby power supplies**

Where the TV has a remote control (which most do nowadays), there needs to be some source of voltage(s) for the remote receiver, microcontroller, and other circuitry that watch for the 'power on' commend. These sets are never totally off.

The standby supply may consist of:

- A low voltage power transformer feeding one or more sets of rectifiers, filter capacitors, and possibly regulators.

  A power surge could cause the primary of the transformer to open up. There may also be a thermal fuse under the outer layers of insulation which blew either due to overheating or a power surge. However, if the primary is open, it is best to replace the transformer rather than attempting repairs it.
- One or more voltage dividers connected directly to the AC line feeding rectifiers, filter capacitors, and possibly regulators.

  Open resistors and dried up capacitors are common failures since the resistors are often not rated adequately and run hot, in close proximity to the capacitors.
- A portion of the main (switch mode) power supply that runs all the time.

  Failures could be almost anything that would affect normal operation of the power supply as well as problems with the control circuitry.

C. Totally dead set

This can be as simple as a bad outlet (including blown fuse or tripped circuit breaker due to some other fault), switched outlet and the switch is off, or bad cord set.

- Plug a lamp into the outlet to make sure it is live. If the lamp works, then the problem is the TV. It not, the outlet is defective or the fuse is blown or the circuit breaker is tripped. There is another very simple explanation that is sometimes overlooked: This is a switched outlet. You always wondered what that wall switch was for that didn't seem to do anything and you flipped randomly. :-) Well, now you know!
- Try wiggling the TV's cord both at the outlet (also push the wire toward the plug) and TV (also push the cord toward the TV) with the set on and/or while pressing the power-on button. If you can get a response, even momentarily, the cord likely has broken wires internally.

Beyond these basic causes, troubleshooting will be needed inside the set to determine what is defective.

D. Intermittently dead set - bad cord set

There are two problems which are common with the line cord on appliances. Don't overlook these really simple things when troubleshooting your vacuum cleaner - or fancy electronic equipment! If wiggling the cord has an effect, then the following are likely causes:

- Repeated flexing results in the internal conductors breaking either at the plug or appliance end. If flexing the cord/squeezing/pulling results in the device going on and off, it is bad. If the problem is at the plug end,

cut off the old plug a couple of inches beyond the problem area and replace just the plug. If the problem is at the appliance end, an entire new cord set is best though you can probably cut out the bad section and solder what remains directly to the main board.

In either case, observe the polarity of the cord wires - they will be marked in some way with a ridge or stripe. It is important that the new plug be of the same type (polarized usually) and that the cord is wired the same way.

- The prongs do not fit snugly into older worn outlets. This can usually be remedied by using a pointed tool like an awl or utility knife to spread apart the pair of leaves often used to form each prong of the plug. If the prongs are made of solid metal, it may be possible to spread them apart - widen the space between them. Alternatively, get a 3 to 2 prong adapter just to use as an intermediate connector. Spread the leaves of its prongs. However, a new outlet is best.
- Bad connections on the main board. As you flex the cord, it is also stressing the attachment to the main board and affecting some marginal solder joints.

It is important to deal with these symptoms as soon as possible as erratic power cycling can lead to much more serious and expensive problems down the road.

E. No picture or raster and no sound

The screen is blank with no raster at all. There are indications that the channel numbers are changing in the display. This indicates that some of the low voltages are present but these may be derived from the standby supply. Assuming there is no deflection and no HV, you either have a low voltage power supply problem, bad startup circuit, or bad horizontal output transistor (HOT) or other bad parts in the horizontal deflection.

F. Check for bad fuses.

(If you have HV as indicated by static electricity on the front of the screen and you hear the high pitched whine of the horizontal deflection when it is turned on, then the following does not apply).

- Use an ohmmeter to test the HOT for shorts. If it is bad, look for open fusible resistors or other fuses you did not catch.
- Assuming it is good, measure the voltage on the collector-emitter of the HOT (this is safe if there is no deflection). You should see the B+ - probably between 100 and 150 V.
- If there is no voltage, you have a low voltage power supply problem and/or you have not found all the bad/open parts.

- If there is voltage and no deflection (no high pitched whine and no HV), you probably have a startup problem - all TVs need some kind of circuit to kick start the horizontal deflection until the auxiliary power outputs of the fly back are available. Some Zeniths use a simple multivibrator for this - a couple of transistors. Others power the horizontal oscillator. IC from a special line-derived voltage. The multi-vibrator types are sometimes designed to fail if someone keeps turning the set on and off (like kids playing) since the power rating is inadequate. Test the transistors if it is that type with an ohmmeter. If one is shorted, you have a problem. The usual way a TV service person would test for startup problems is to inject a signal to the base of the HOT of about 15.75 kHz. If the TV then starts and runs once this signal is removed, the diagnosis is confirmed. This is risky - you can blow things up if not careful (including yourself). If you hear the high pitched whine of the deflection and/or feel some static on the screen, confirm that the horizontal deflection and high voltage are working by adjusting the SCREEN control (probably on the fly back). If you can get a raster then your problem is probably in the video or chroma circuits, not the deflection or high voltages.

2.7.3. Faults found on SMPS television receiver using pictures diagram

Cause: l Power Fault.

- **Reason**

✓ Shorted Non-Polar Capacitor

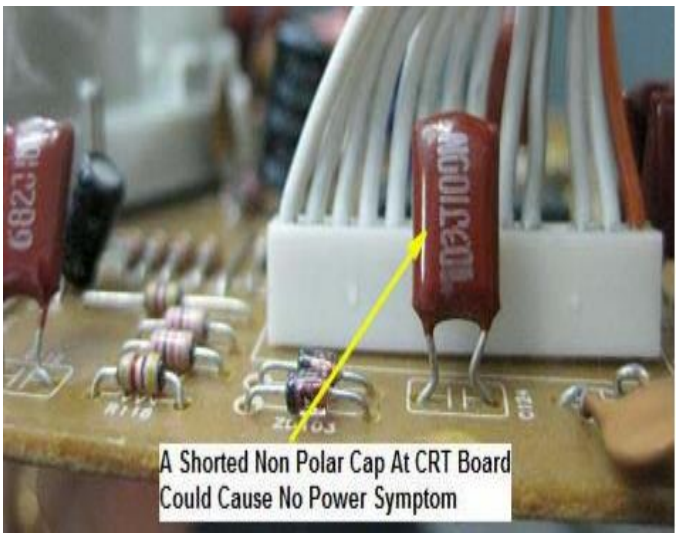


Figure 2.6. Shorted Non Polar Capacitor at CRT Board.

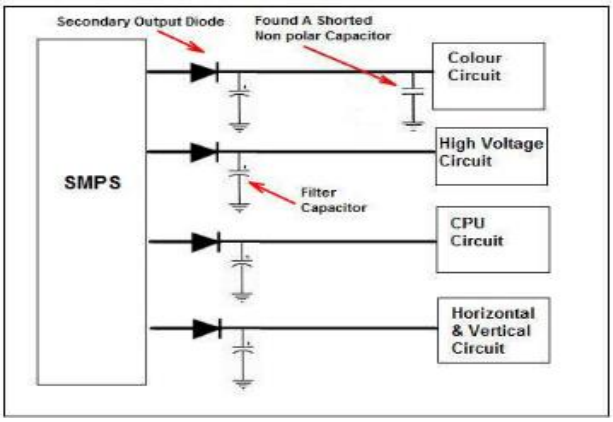


Figure 2.7: The Location of a Shorted Non Polar Capacitor

Case 2: No Power

- **Reason**

✓ Startup resistor is opened.

✓ Shorted Power IC

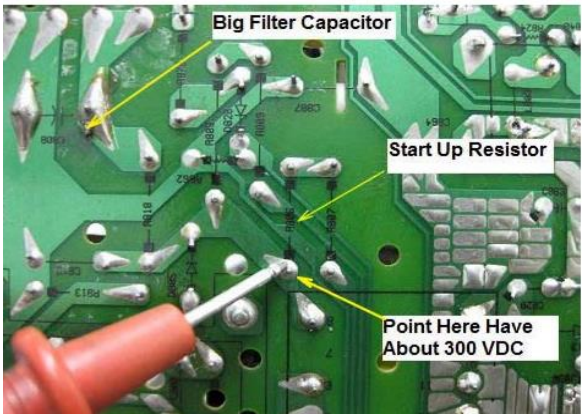


Figure 2.8. Voltage tracing at point of star up resistor

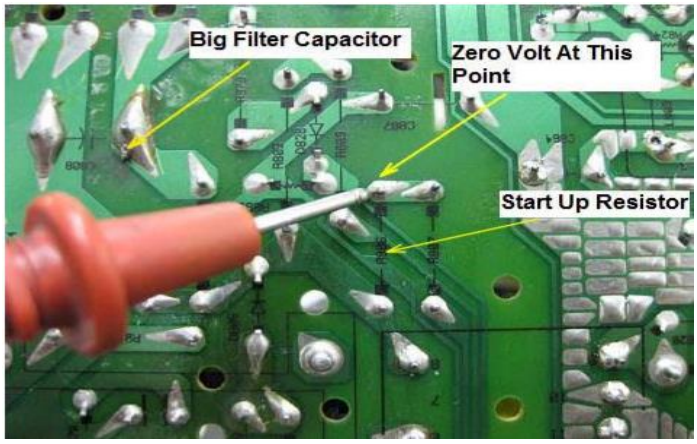


Figure 2.9. Zero Volt after the Star Up Resistor

Case 3: No Power

- **Reason**

✓ Shorted Zener diode

✓ Shorted Power IC

✓ Opt isolator IC Breakdown

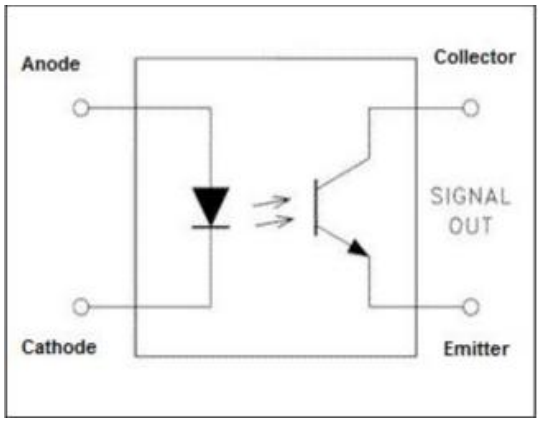


Figure 2.10.Optoisolator IC

Case 4 Low Output Voltage

- **Reason**

✓ Shorted or bad Component in the down stream

✓ Leaky transistor at the secondary side.

✓ Partial shorted primary winding

✓ Bad Electrolytic capacitor

- ✓ Shorted emitter collector pin of Optoisolator IC

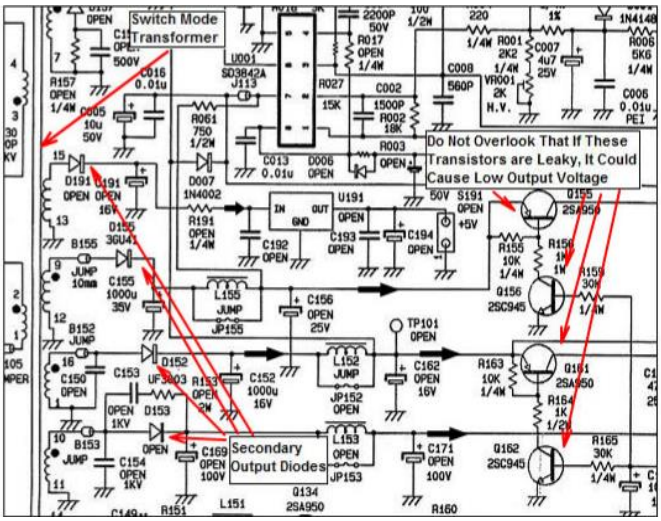


Figure 2.11. Bad Component in the downstream

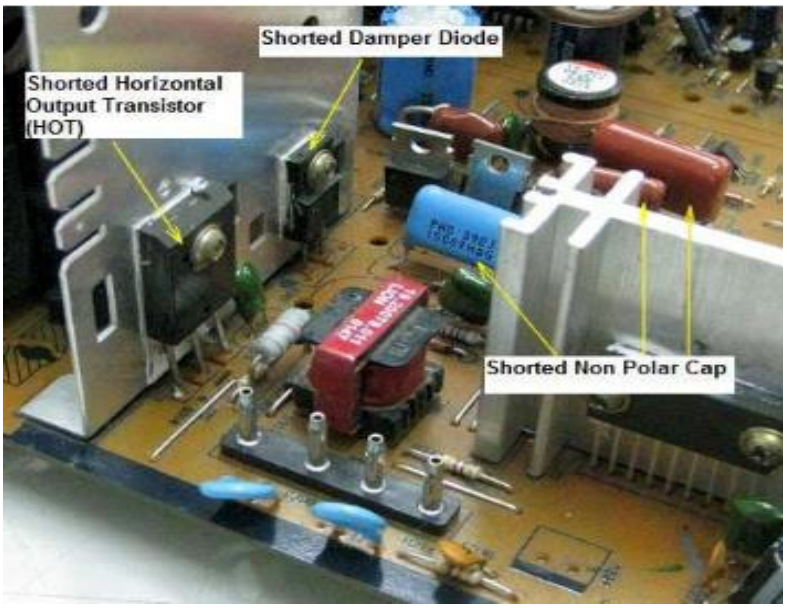


Figure 2.12 :Shorted Component in the downstream

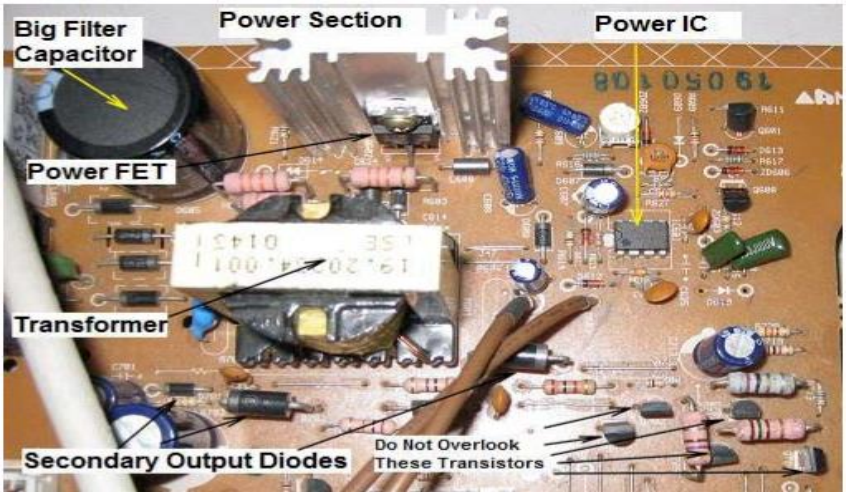


Figure 2.13 Leaky transistor at the secondary side

Case No.5: No Power

- **Reason**

✓ Tiny break in one of the secondary line.

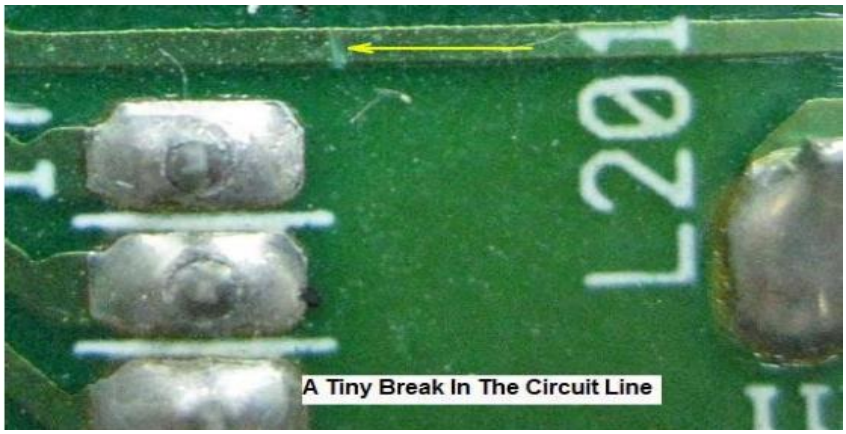


Figure 2.14. 9Tiny breaks in one of the secondary line or Circuit.

Case No.6: No Power

- **Reason**

Here are some other causes that can blow the main fuse:

Shorted bridge rectifier-If one of the diodes in this bridge circuit shorted, the main fuse will surely blow.

Shorted Posistor- If you are repairing a CRT Monitor or Television, you will definitely see a square black box around the main supply section. If this posistor had shorted, it will take a way the fuse too. Posistor can't be test with multimeter, the best is to replace it with a working unit and retest the set.

Big filter capacitor breakdown when under full load- This capacitor can be tested good when check with an ESR or a Digital Capacitance Meter but will fail when under full operating voltage. Sometimes it can go shorted and can be detected by an ohmmeter.

Shorted Power FET- A shorted power Mosfet (FET) will immediately blow the main fuse.

Shorted power IC- A shorted power IC will also blow the main fuse.

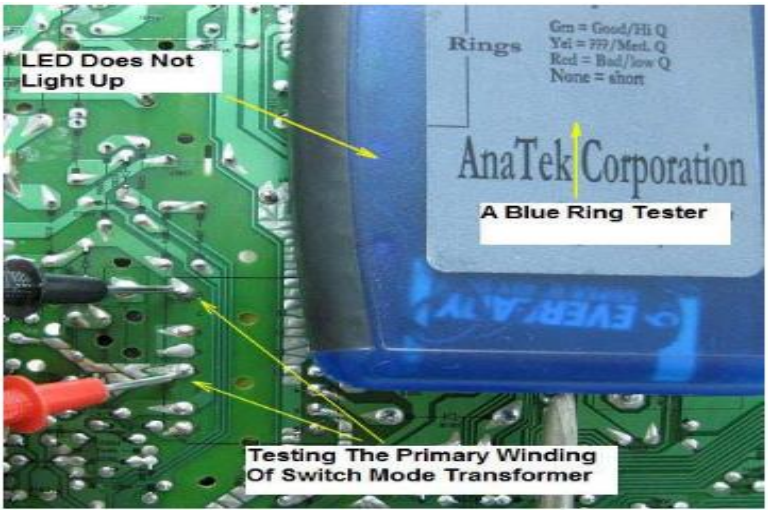


Figure 2.15. Testing primary winding of SMPS

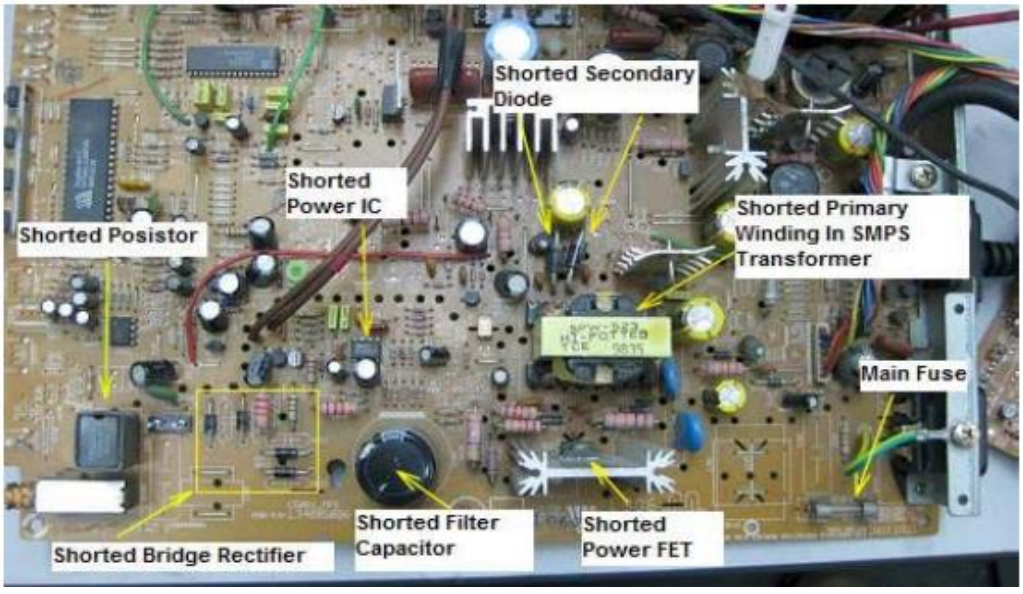


Figure 2.16. Possible shorted components that can blow the main fuse

2.8. Document diagnosis and testing results

Diagnose documentation is a technical communication document intended to give a user or customer information on how to solve and prevent those problems. It's commonly written for computer hardware, electronic goods, and software but they can be written for any product.

Proper documentation would list every stage in the process from start to end. As we discussed troubleshooting is a logical and step by step process that must be followed every time. If problems and customers are not the same, then how can even the best troubleshooting staff survive without proper documentation? It is the life support for troubleshooting.

Troubleshooting documentation is more often than not, lengthy and can be tiring to read. Anyone who is referring to such a document for a particular problem and its resolution should not need to go through the entire documentation to find it. A well-defined and crisply laid out index should be in place to make locating the area of interest easier. The index must also have some help words that describe in layman terms some of the tongue twisting troubleshooting terminology.

Clearly worded documentation is important to improve efficiency. Even if memory fails under pressure, the troubleshooting staff can quickly recover from that by referring to the documentation. The customer will never need to know that the staff 'ran short' to start with. The end perception will be one of knowledge and efficiency. Happy staff and happier customer!

The importance of documentation in troubleshooting and other areas comes from the fact that it is a recording of a crucial and creative process that focuses on problem resolution and problem prevention. It helps members of the same team or different teams work collaboratively on customer issues or internal troubleshooting issues for quicker resolutions.

Documentation can be very inspiring and thought provoking if written well. They provide invaluable and indispensable data that make the entire troubleshooting process and customer service for a company more robust and sustainable.

Although it is often neglected in the troubleshooting process, documentation is as important as any of the other troubleshooting procedures. Documenting a solution involves keeping a record of all the steps taken during the fix-not necessarily just the solution. For the documentation to be of use to other network administrators in the future, it must include several key pieces of information. When documenting a procedure, include the following information. It is a record or the capturing of some event or thing so that the information will not be lost.

2.8.1. Maintenance documentation

Service contract or in-house preventive maintenance is documented. This documentation is required for annual maintenance. Maintenance performed at other times, with the exception of routine cleaning, is documented.

A. The documentation includes:

- Description of the maintenance;
- Date it was done; and
- Name of the service representative and company, or name of
- The analyst if maintenance provided internally.

B. Repair equipment is documented.

The documentation includes:

- Initials of the analyst, and the date the problem was observed,
- Description of the problem;
- Date and initials of the analyst or service represent at performing the repair;
- Synopsis of the repair; and
- Cost of repair, copy of the invoice and any additional information (not required).

C. Reading the service manual

It is difficult to repair any piece of complicated equipment without some service literature. It is possible to repair electronic equipment without the service manual, but it can be very time-consuming. You can lose a lot of valuable servicing time if you are without a good service manual. The service manual is a set of document prepared by the manufacturer to help the service technician to repair or service that set of equipment. A well written manual is the best servicing aid. It contains the following information:

- Describe how a circuit works
- Block diagram of the equipment
- Circuit diagrams
- Signal and voltage test points
- Adjustment procedure
- List of accessories
- List of spare parts with the part numbers, values, tolerances and ratings
- Fault diagnosis steps, generally in the form of flow charts

- Preventive maintenance layout
- Safety precautions to be observed while handling the equipment.

A service manual can be very expensive, but it is worth the investment. With the help of a service manual, a service technician or engineer can:

- Align, calibrate and test the equipment correctly to get the optimum output
- Locate a fault quickly
- Use the correct replacement part Conduct preventive maintenance correctly

By using the right service manual, as well as with the assistance of good tools, testing equipment and your own experience, you are set to multiply your troubleshooting power!!!

2.9. Advising / informing customers

2.9.1. Customer advice

Assuming that your customer has SMPS with kinds of problems, what would you do? What is your decision? What is your next step? And repair or return to the customer? This information sheet helps you to solve such kind of problems or faults in professional way, especially when dealing with the Customer either now or in the future.

First inform them about the problem in the SMPS and tell them that the chance of it being fully repaired is quite slim due to the problems or faults mentioned above. Inform your customer you will impose a price or a fee for the time spent on solving the complicated problems or faults.

From the conversation b/n you and the customer, he/she may say Yes or No answer. Some may say I will think first about it. If the customer says No, then you return the SMPS to the customer and impose a small diagnostic labor charge (it depends on whether you want to charge the customer or not.) That means you can straight away return the SMPS back to the customer. If you have decided not to charge the customer. If the customer says yes or agreed with the repair price, then there are two things that you need to inform the customer:

- **Time:**

✓ Let the customer know in advance that you need a longer time to repair the SMPS otherwise they would be calling you every day (pressuring you).

- **Successful repair rate:**

✓ Inform the customer successful repair rate is not 100% as you are trying your best to make the equipment work again. Otherwise, if you can’t repair the equipment then you will be in the hot soup.

- ✓ You have to inform them that you are trying your best to save the equipment and if it can't be repaired after many attempts then you will return the equipment to them.

Operation Sheet 2. 1:

Diagnosing Faults

Operation title: Procedures of Diagnose faults in the Television Receivers Set

Purpose: To practice and demonstrate the knowledge and skill required Diagnose faults to make functional TV set.

Instruction: Use the given select tools, equipment and testing instrument so that digonose the fault is usually done by preparing your circuit's schematic diagram television receiver set. For this operation you have given 5 Hour and you are expected to provide the answer on the given steps.

Step 1 - Prepare Safety Materials

Step 2 - Make your working area free from dust and unwanted objects

Step 3 - Select the appropriate tools and testing instrument

Step 4 - Diagnose the fault from the system

Step 5 - clean and test the system

Step 6 - complied the completion procedure and documentation

Step 7 - Dispose waste materials

Tools and requirement:

- TV set
- Service manual
- Set of Philips screw driver
- Set of flat screw driver
- Soldering iron
- Contact cleaner
- Brush
- Blower

LAP Test – 2.1.

Instructions: Given necessary templates, tools, materials and equipment you are required to perform the Diagnosing faults in the Television Receivers Set for the following tasks within 5 hour.

Task -1: Prepare PPE material for starting diagnosing faults.

Task – 2: Prepare TV set block/circuit diagram ed.

Task – 3: select appropriate tools and test instrument according to the give designed circuit to be diagnosed

Task – 4: Disassemble the TV set

Task – 5: Trace the voltage input/output

. **Task – 6:** Identify the diagnosed fault of component/part

Task – 7: Repair/replace the faulty part

.

Precautions: select necessary templates, tools, materials and equipment before diagnosing faults in the Television Receivers Set on the given format

Quality Criteria: the given diagnosing faults in the Television Receivers Set is with Correct specification

Unit Three : Maintain and Repair television products

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

- Identifying faults on the PCBs
- Troubleshooting of television
- Maintaining/repairing television receivers
- Observing care and extreme precaution in handling the unit/product

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

- Maintain/repair television receivers
- Troubleshoot of television Unites
- Identify faults on the PCBs of TV
- Observe care and extreme precaution in handling the unit/product

3.1. Identifying faults on the of television PCB

3.1.1. Analysis of all possible faults in this circuit

A. Faulty capacitors

There are three possible problems. The capacitor could be shorted, opened, or leaky. If the capacitor is shorted, it effectively brings both terminals of the load resistor together and therefore the output voltage is zero. This is illustrated in Figure7.4 (a). If the capacitor is open (Figure7.4 (b)), it does not filter the output voltage supplied from the rectifier. The waveform of the voltage, at the output, remains the same as the waveform of the voltage, after the rectifier. Therefore, the waveforms at points C and D are identical. The only difference is that the amplitude of the voltage at the point D is smaller, due to the voltage drop across the resistor R surge. Finally, if the capacitor is leaky the output voltage will appear with increased ripples on the output (Figure7.4 (c)).

A leaky capacitor appears as if there is a leakage resistor, connected to it in parallel. The leakage resistor decreases the time for a discharge, thus the voltage ripples increase at the output.

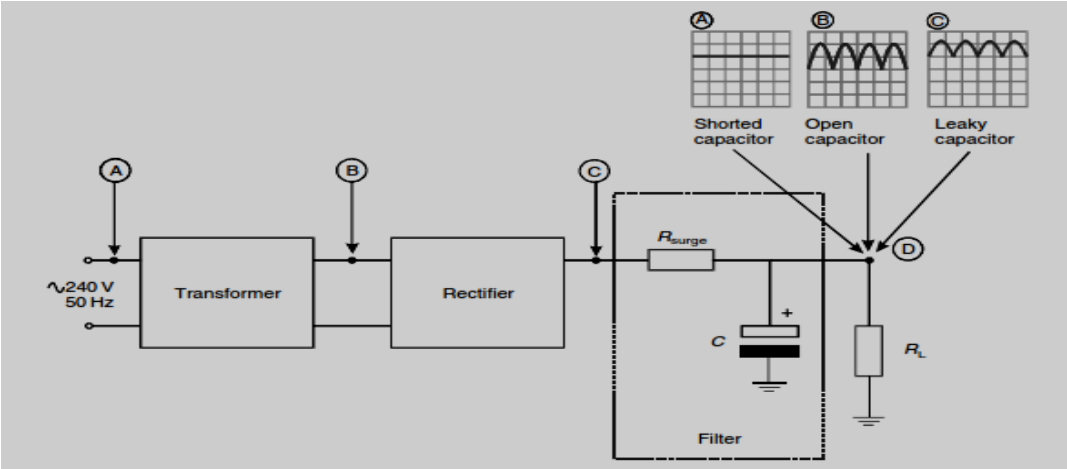


Figure 3.1.Symptoms of a faulty capacitor

B. Faulty Resistor (R_{surge})

There is only one possible faulty condition, namely a blown resistor **R_{surge}** (**R_{surge}** appears as an open circuit). This occurs, when an excessive current flows through it. An excessive current flows through Rsurge if the output terminals are short-circuited or if the capacitor is shorted. In both cases when R surge blows, it brakes the circuit and prevents the diodes (which are more expensive than the resistor) from burning too. The output voltage in this case is zero. Before replacing R surge, ensure that the capacitor, or the output terminals of the circuit, is not shorted and that the conductive paths of the PCB are not shorted out.

C. Shorted diode

Shorted diode appears as a jumper between the points of the connection, as it conducts the current in both directions. Figure 3.8 illustrates the current that flows in the circuit, when the diode D4 is shorted out. During the positive half-period, the current flows through D3 and D4 as normal. The shortened diode exhibits a zero

resistance in both directions and it appears for the circuit, as if it is simply forward-biased. Thus, the positive half-period appears as normal at the point C. However, during the negative half-period the picture changes. The current now flows through D1 and D4 instead of flowing through the rest of the circuit, because these two diodes, connected in series, provide a path of least resistance. Effectively the secondary winding is short-circuited and an excessive current flows through it. Thus, the diode D4 can be damaged quickly, due to overheating. The increase in the current in the secondary winding increases the current in the primary winding. If the circuit is properly fused, the fuse on the primary winding should blow. If this is not the case, the diode D 1 overheats (and even possibly burns) and the voltage at the test point C has the form shown in Figure 7.5. Analytical thinking is required to analyze what happens in the circuit when some other diode shorts out, or when two or more diodes short out simultaneously.

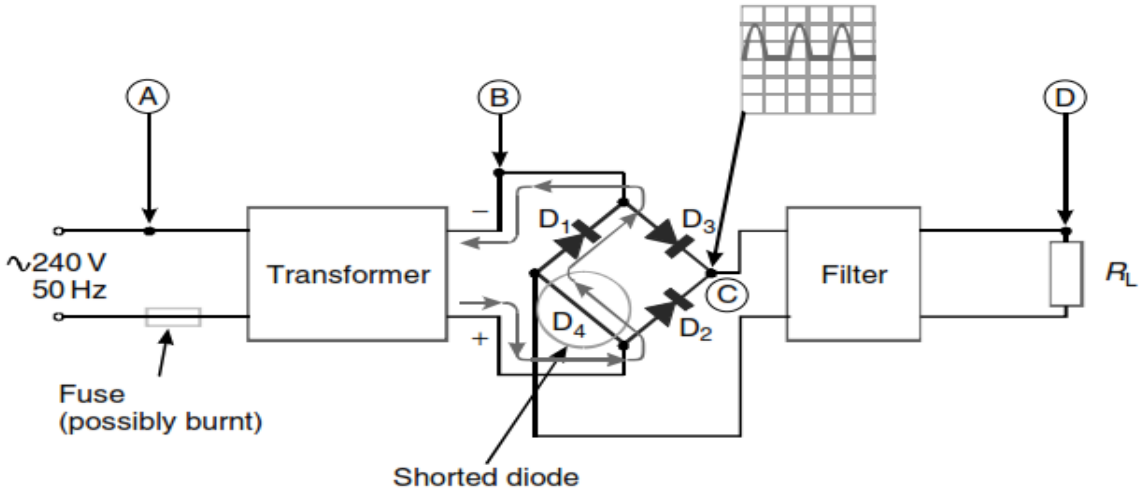


Figure 3.2.Symptoms of a shortened diode

D. Open diode:

Let us assume that the same diode (D4) is open. No current flows through an open diode in both directions. During the negative half period, this diode appears to the circuit to be reverse-biased, and therefore it has no impact on the output voltage. However, during the positive half-period, the path for the current is broken and no voltage appears at the output. In other words, the circuit works as a half-wave rectifier. This can be detected by, the larger ripples in the output voltage. In addition, the frequency of the ripples is 50Hz Instead of 100Hz. This Is illustrated in Figure3.9 Similarly, the circuit can be analysed for other open diodes.

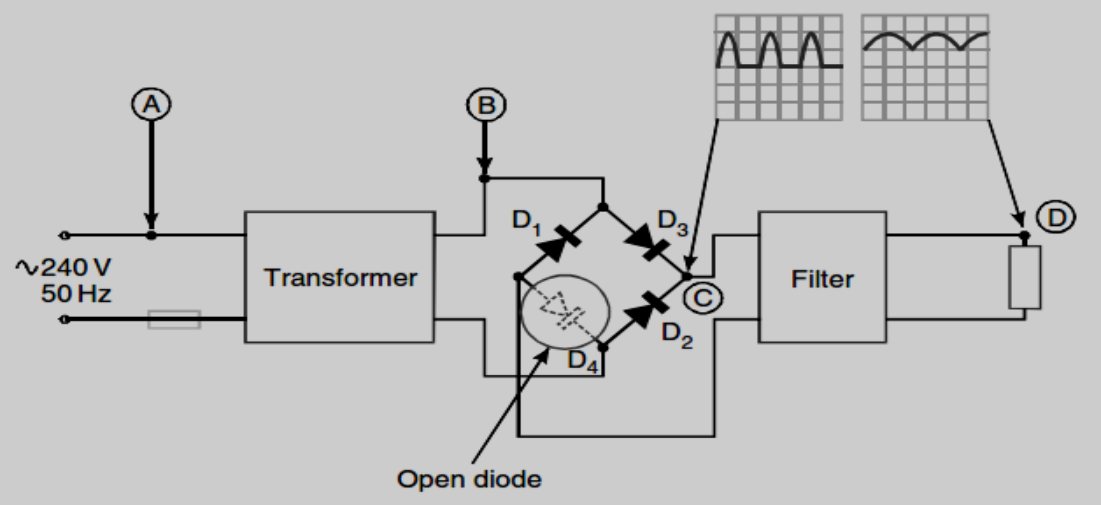


Figure 3.3. Symptoms of an open diode

E. Faulty transformer:

This is not a common fault, though if the rest of the circuit appears in a good working order, the transformer has to be checked. Several faults are possible: the primary or the secondary windings can be open or partially shorted. If one of the windings is open, no voltage is applied to the rest of the circuit. This obviously results in 0 V at the output. If the primary winding is partially shorted, the turns ratio of the transformer is effectively increased. The voltage on the secondary winding is also increased; thus, the level of the voltage at the output of the circuit is higher. A partially shorted secondary winding decreases the turn ratio of the transformer. The voltage supplied to the rectifier is lower; thus, the level of the circuit output voltage is also lower.

F. Blown fuse:

As was mentioned earlier, this occurs when one of the diodes is shorted. Thus, before replacing the fuse, the diodes have to be checked. A partially shorted primary or secondary winding of the transformer can also increase the current to a level, where the fuse blows. Thus, the transformer also has to be tested before replacing the fuse.

G. Testing BJTs

Sometimes the transistor itself may not be faulty, but due to faults in the external circuitry, it may not operate correctly. For example, a cold junction on the transistor base terminal effectively isolates the base from the rest of the circuit. Therefore, the bias voltage on the transistor is 0 V, which will drive it into a cutoff. When checking such a transistor from the component side of the PCB, it will appear to be functioning correctly. Yet, the signal is not present at the output.

3.2. Troubleshooting of television

Troubleshooting is a form of problem solving, often applied to repair failed products or processes. It is a logical, systematic search for the source of a problem so that it can be solved, and so the product or process can be made operational again. Troubleshooting is needed to develop and maintain complex systems where the symptoms of a problem can have many possible causes.

Troubleshooting is used in many fields such as engineering, system administration, electronics, automotive repair, and diagnostic medicine. Troubleshooting requires identification of the malfunction(s) or symptoms within a system. Then, experience is commonly used to generate possible causes of the symptoms. Determining which cause is most likely is often a process of elimination - eliminating potential causes of a problem. Finally, troubleshooting requires confirmation that the solution restores the product or process to its working state.

In general, troubleshooting is the identification of, or diagnosis of "trouble" in the management flow of a corporation or a system caused by a failure of some kind. The problem is initially described as symptoms of malfunction, and troubleshooting is the process of determining and remedying to the causes of these symptoms.

.3.2.1. Subsystems of a television set

A TV set includes the following functional blocks:

1. **Low voltage power supply.** Most of the lower voltages used in the TV may be derived from the horizontal deflection circuits. Sometimes, there is a separate switching power supply but this would be the exception. Rectifier/filter capacitor/regulator from AC line provides the B+ to the switching power supply or horizontal deflection system. Degauss operates off of the line whenever power is turned on (after having been off for a few minutes) to demagnetize the CRT.
2. **Horizontal deflection.** These circuits provide the waveforms needed to sweep the electron beam in the CRT across and back some 15,734 times per second (for NTSC). The horizontal sync pulse from the sync separator locks the horizontal deflection to the video signal.
3. **Vertical deflection.** These circuits provide the waveforms needed to sweep the electron beam in the CRT from top to bottom and back 60 times per second (for NTSC). The vertical sync pulse from the sync separator locks the vertical deflection to the video signal.
4. **CRT high voltage**. A modern color CRT requires up to 30 kV for a crisp bright picture. Rather than having a totally separate power supply, nearly every TV on the planet derives the HV (as well as many

other voltages) from the horizontal deflection using a special transformer called a 'flyback' or 'Line OutPut Transformer (LOPT) for those of you on the other side of the lake.

5. **Tuner, IF, AGC, video and audio demodulators.** Input is the antenna or cable signal and output are baseband video and audio signals. There is usually someplace inside the TV where line level video and audio are present but it may not be accessible from the outside of the cabinet unless you paid for the more expensive model with the A/V option. Very often, the tuner is a shielded metal box positioned on the bottom right (as viewed from the front) separate from the main circuit board. Sometimes it is on the main circuit board. The IF section may be in either place.

   On older or cheap TVs with a knob tuner, this is usually mounted to the front panel by itself. There are usually separate boxes for the VHF and UHF tuners.
6. **Chroma demodulator.** Input is the baseband video signal. Outputs are the individual signals for the red, green, and blue video to the CRT.
7. **Video drivers (RGB).** These are almost always located on a little circuit board plugged directly onto the neck of the CRT. They boost the output of the chroma demodulator to the hundred volts or so needed to drive the cathodes of the CRT.
8. **Sync separator**. Input is baseband video. Output is horizontal and vertical sync pulses to control the deflection circuits.
9. **Audio amplifier/output**. The line level audio is amplified to drive a set of speakers. If this is a stereo TV, then these circuits must also perform the stereo demultiplexing.
10. **System control.** Most modern TVs actually use a microcontroller - a fixed program microcomputer to perform all user interfaces and control functions from the front panel and remote control. These are becoming increasingly sophisticated. However, they do not fail often. Older TVs use a bunch of knobs and switches and these are prone to wear and dirt.

3.3. Maintaining/repairing television receivers

3.3.1. Maintaining Low Voltage Power Supply Problems

A. Totally dead set

This can be as simple as a bad outlet (including blown fuse or tripped circuit breaker due to some other fault), switched outlet and the switch is off, or bad cord set.

- Plug a lamp into the outlet to make sure it is live. If the lamp works, then the problem is the TV. It not, the outlet is defective or the fuse is blown or the circuit breaker is tripped. There is another very Simple explanation that is sometimes overlooked: This is a switched outlet. You always wondered what that wall switch was for that didn't seem to do anything and you flipped randomly. :-) Well, now you know!
- Try twisting the TV's cord both at the outlet (also push the wire toward the plug) and TV (also push the cord toward the TV) with the set on and/or while pressing the power-on button. If you can get a response, even momentarily, the cord likely has broken wires internally. Beyond these basic causes, troubleshooting will be needed inside the set to determine what is defective

B. **Intermittently dead set - bad cord set**

There are two problems which are common with the line cord on appliances. Don't overlook these really simple things when troubleshooting your vacuum cleaner - or fancy electronic equipment! If wiggling the cord has an effect, then the following are likely causes:

- Repeated flexing results in the internal conductors breaking either at the plug or appliance end. If flexing the cord/squeezing/pulling results in the device going on and off, it is bad. If the problem is at the plug end, cut off the old plug a couple of inches beyond the problem area and replace just he plug. If the problem is at the appliance end, an entire new cord set is best though you can probably cut out the bad section and solder what remains directly to the main board.
- In either case, observe the polarity of the cord wires - they will be marked in some way with a ridge or stripe. It is important that the new plug be of the same type (polarized usually) and that the cord is wired the same way.

C. **Power button on set is flakey**

- If the ON/OFF (or other button) on the set itself behaves erratically but the remote control works fine, then it could be a dirty button or cable or other connections to the switch PCB, particularly if the buttons on the set itself are rarely used.
- Why not just continue to use the remote?

- If power is controlled by a hard switch - a pull or click knob, or mechanical push-push switch and this has become erratic due to worn contacts, replacements are available but often only directly from the original manufacturer to physically fit and (where applicable) have the volume or other controls built in. As an alternative, consider mounting a small toggle switch on the side of the cabinet to substitute for the broken switch. This will almost certainly be easier and cheaper - and quite possibly, more reliable.

D. **TV blows fuse**

- A blown fuse is a very common type of fault due to poor design very often triggered by power surges due to outages or lightning storms. However, the most likely parts to short are easily tested, usually in-circuit, with an ohmmeter and then easily removed to confirm.
- Note that it *may be* useful to replace a fuse the *first* time it blows (though it would be better to do some basic checks for shorted components first as there is a small chance that having a fuse blow the second time could result in additional damage which would further complicate the troubleshooting process).
- However, if the new one blows, there is a real problem.
- Sometimes, a fuse will just die of old age or be zapped by a power surge that caused no damage to the rest of the TV. However, it must be an EXACT replacement. Else, there could be safety issues (e.g., fire hazard or equipment damage from too large a current rating) or you could be chasing a non- existent problem (e.g., if the new fuse is not slo-blow and is blown by the degauss circuit inrush current but nothing is actually wrong).If the fuse really blows absolutely instantly with no indication that the circuits are functioning (no high pitched horizontal deflection whine (if your dog hides under the couch whenever the TV is turned on, deflection is probably working).) then this points to a short somewhere quite near the AC power input.

- **The most common places would be:**
  - ✓ Degauss Posistor - very likely.
  - ✓ Horizontal output transistor.
  - ✓ Power supply regulator if there is one.
  - ✓ Power supply chopper (switch mode) transistor if there is one.
  - ✓ Diode(s) in main bridge
  - ✓ Main filter capacitor(s).

- **You should be able to eliminate these one by one.**

  - ✓ Unplug the degauss coil as this will show up as a low resistance.
  - ✓ First, measure across the input to the main power rectifiers - it should not be that low. A reading of only a few ohms may mean a shorted rectifier or two or a shorted Posistor.
  - ✓ Test the rectifiers individually or remove and retest the resistance.
  - ✓ Some sets use a Posistor for degauss control. This is a little cubical (about 1/2" x 3/4" x 1") component with 3 legs. It includes a line operated heater disk (which often shorts out) and a PTC thermistor to control current to the degauss coil. Remove the posistor and try power. If the monitor now works, obtain a replacement but in the meantime you just won't have the automatic degauss.
  - ✓ If these test good, use an ohmmeter with the set unplugged to measure the horizontal output transistor. Even better to remove it and measure it.
  - ✓ If any readings are very low, the transistor is bad.
  - ✓ If the HOT tests bad, try powering the set first with your light bulb and if it just flashes once when the capacitor is charging, then put a fuse in and try it. The fuse should not blow with the transistor removed.
  - ✓ Of course, not much else will work either.
  - ✓ If it tests good, power the set without the transistor and see what happens. If the fuse does not blow, then with the good transistor (assuming it is not failing under load), it would mean that there is some problem with the driving circuits possibly or with the feedback from the voltages derived from the horizontal not regulating properly.

E. **No picture or raster and no sound**

The screen is blank with no raster at all. There are indications that the channel numbers are changing in the display. This indicates that some of the low voltages are present but these may be derived from the standby supply. Assuming there is no deflection and no HV, you either have a low voltage power supply problem, bad start-up circuit, or bad horizontal output transistor (HOT) or other bad parts in the horizontal deflection.

- **Check for bad fuses.**

(If you have HV as indicated by static electricity on the front of the screen and you hear the high pitched

whine of the horizontal deflection when it is turned on, then the following does not apply).

- ✓ Use an ohmmeter to test the HOT for shorts. If it is bad, look for open fusible resistors or other fuses you did not catch.
- ✓ Assuming it is good, measure the voltage on the collector-emitter of the HOT (this is safe if there is no deflection). You should see the B+ - probably between 100 and 150 V.
- ✓ If there is no voltage, you have a low voltage power supply problem and/or you have not found all the bad/open parts.
- ✓ If there is voltage and no deflection (no high pitched whine and no HV), you probably have a start-up problem - all TVs need some kind of circuit to kick start the horizontal deflection until the auxiliary power outputs of the fly back are available.

F. **Reduced width picture and/or hum bars in picture and/or hum in sound**

The most likely cause is a dried up main filter capacitor. Once the effective capacitance drops low enough, 120 Hz (or 100 Hz in countries with 50 Hz power) ripple will make its way into the regulated

G. DC supply (assuming full wave rectification).

Another likely cause of similar symptoms is a defective low voltage regulator allowing excessive ripple. The regulator IC could be bad or filter capacitor following the IC could be dried up.

H. Shorted Components A failure of the horizontal output transistor or power supply switch mode transistor will blow a fuse or fusable resistor. Look for blown fuses and test for open fusable resistors in the power circuits. If you find one, then test the HOT and/or switch mode transistor for shorts.Other possibilities: **rectifier diodes or main filter** capacitor.

H. **TV doesn't power up immediately:** The TV may do nothing, cycle ON and OFF for a while, power up and then shutdown in an endless cycle - or at least for a while. Then it comes on and operates normally until it is turned off.

- **A couple of possibilities**:

- ✓ The main filter capacitor or other filter capacitors in the low voltage power supply is dried up and this can cause all kinds of regulation problems.
- ✓ The power supply regulator is defective (or marginal) allowing excessive voltage on its output and then the X-ray protection circuitry shuts you down.

If there is, then if the picture has serious hum bars in it the main filter cap could be bad. If more or less a decent picture with minor hum bars then it could be the regulator.

I. TV shuts down with bright picture or when brightness is turned up

This is probably a protection circuit kicking in especially if turning power off or pulling the plug is required to restore operation. The detection circuit could be in the power supply or horizontal deflection output circuit. It may be defective or the current may be too high for some other reason. A couple of tests can be performed to

confirm that it is due to beam current:

- Determine if behaviour is similar when adjusting the user brightness control and the screen (G2) pot (on the fly back) or master brightness control.

Disconnect the filaments to the CRT (unsolder a pin on the CRT socket) and see if it still shuts down under the same conditions. If it is over current protection, shut down should now *not* take place since there is no beam current.

J. **Horizontal deflection shutting down**

Confirm that the horizontal deflection is shutting down (along with the high voltage since it is derived from horizontal deflection: listen for the high pitched deflection whine, test for static on the screen, see **if the CRT filaments are lit, turn up the brightness and/or screen control to see if you can get a raster) and then why**:

- Power is failing to the horizontal output transistor - this could be due to a low voltage power supply problem, bad connection, etc.
- Base drive to the horizontal output transistor is failing - could be a fault in the horizontal oscillator or bad connection.
- Problem with the fly back transformer or its secondary loads (fly back may provide other power voltages).

K. **Single Horizontal Line**

CAUTION: To prevent damage to the CRT phosphors, immediately turn down the brightness so the line is just barely visible. If the user controls do not have enough range, you will have to locate and adjust the master brightness or screen/G2 pots. A single horizontal line means that you have lost vertical deflection. High voltage is most likely fine since there is something on the screen.

This could be due to:

Dirty services switch contacts. There is often a small switch located inside on the main board or

perhaps accessible from the back. This is used during setup to set the color background levels. (On some sets, this is located on the CRT neck board and may be a jumper plug or other means of selecting service mode - not an actual switch.) When moved to the 'service' position, it kills vertical deflection and video to the CRT. If the switch somehow changed position or got dirty or corroded contacts, you will have this symptom. Flip the switch back and forth a couple of times. If there is some change, then replace, clean, resolder, or even bypass it as appropriate.

1. Bad connection to deflection yoke or other parts in vertical output circuit. Bad connections are Common in TVs and monitors. check around the pins of large components like transformers, Power transistors and resistors, or connectors for hairline cracks in the solder. Reseat internal Connectors. Check particularly around the connector to the deflection yoke on the CRT.
2. Bad vertical deflection IC or transistor. You will probably need the service manual for this and the following. However, if the vertical deflection is done with an IC, the ECG Semiconductor Master Substitution guide may have its pinout which may be enough to test it with a scope.
3. Other bad parts in vertical deflection circuit though there are not that many parts that would kill the deflection entirely.
4. Loss of power to vertical deflection circuits. Check for blown fusable resistors/fuses and bad Connections.
5. Loss of vertical oscillator or vertical drive signals.

The most likely possibilities are in the deflection output stage or bad connections to the yoke.

3.3.2. Maintaining/Repairing High Voltage Power Supply Problems

A. **Low or no high voltage**

Most of these problems are due to faults in the horizontal deflection system - shorted HOT, shorted Windings or HV rectifiers in the fly back, defective Tripler, or other bad parts on the primary side of the fly back. However, if you discover an inch layer of filth inside the TV, the HV could simply be shorting out - clean it first.

In most cases, these sorts of faults will put an excessive load on the horizontal output circuits so there may be excessive heating of the HOT or other components. You may hear an audible arcing or sizzling sound from internal shorts in the fly back or tripler. Either of these may bet hot, crack, bulge, or exhibit visible damage if left on with the fault present.

B. Snaps, crackles, and other HV breakdown

Various problems can result in occasional or sustained sparking or arcing sounds from inside the monitor. Note that a static electricity build-up is common on the front of the screen. It is harmless and there is nothing you can do about it anyhow. The following may result in occasional or sustained sounds not commonly associated with a properly working TV or monitor. There may or may not be flashes or blanking of the screen at the same time as the audible noise. See the same-named sections that follow for details.

- Arcing, sparking, or corona from CRT HV anode (red wire/suction cup).
- Arcing at CRT spark gaps.
- Arcing from flyback or vicinity.
- Arcing due to bad connections to or disconnected CRT return.

3.3.3. Repairing Raster, Color, and Video Problems

A. No color - black and white picture

This means absolutely no color - equivalent to a black and white picture. Not even a hint of color.

First, confirm that the source is actually in color - try another channel or input device.

Next, check the settings of the color control - it may have accidentally been turned down. If your TV has some kind of automatic picture mode, try turning if off and adjusting the color control. Try adjusting fine tuning if you have such a control and the problem is with a broadcast or cable transmission. At this point with a confirmed color signal source, there is a problem with the chroma circuitry. Note that to the average person, the obvious question becomes: is my color picture tube bad? The answer is a definitive NO. It is virtually impossible for a defective CRT to cause a total loss of color. A defective CRT can cause a lack of a primary color - R, G, or, B or a short between two colors which will mess up the color but is not likely to result in a black and white picture.

Some possibilities in no particular order:

- Weak signal or defect in tuner/IF causing loss of signal strength.
- Defective part around the chroma chip/circuit. Faulty color oscillator.
- Bad connections in area of chroma chip/circuit.
- Defective chroma chip (don't suspect this first just because it is probably very expensive).

B. **Saturated color but almost no brightness**

This means you have lost the luminance input to the chroma decoder or final video chip. A failure of

the brightness limiter may result in similar symptoms.

A few common causes are:

- Check the service switch (if any). Its contacts may be dirty and moving it back and forth a few times or using contact cleaner may be all that is needed.
- Check for open high value resistors around the chroma decoder IC.
- Check for open high value resistors in the brightness limiter circuit.

C. **Brightness control has no effect**

The following assumes that the picture is fine but the brightness is fixed - probably at too high a level. However, there could be several interrelated problems if a common supply voltage were missing, for example. If it is a knob, then it should be varying the control grid (G1) voltages relative to the cathodes (K) of the CRT. This is not likely to be a very complex circuit. If you do not have a schematic, I would start by tracing from the control, check continuity and solder connections. Check the control itself for proper operation with an ohmmeter. A power supply going to one side of the control (negative probably) may be missing. The control grid voltage will end up on the little board on the neck of the CRT - check there as well for bad solder connections or open resistors. If brightness is a digital control, then you will need a schematic unless there is an obvious bad connection.

D. **One color is too weak or too strong**

If the problem is slight and/or has gradually gotten worse, this may just require an adjustment of the color brightness/background/bias and/or color gain/drive controls inside the TV. Even if it appears as though there is an excess, this may actually be a reduction in one of the primary colors. For example, a magenta tinge is represents a reduction in the strength of the green signal.

- Too high an intensity for one of the color channels will result in a tint of one of the primaries: red, green or blue.
- Too low an intensity for one of the color channels will result in a tint of the complement of one of the primaries: yellow, cyan, or magenta.
- Problems mainly in the shadows or dark areas of the picture usually represent a fault with brightness/bias/background.
- Problems mainly in the highlights or bright areas of the picture usually represent a fault with the gain/drive. A color that that is now suddenly brighter or darker than normal resulting in incorrect color

balance or a tint in the background could be due to a number of causes:

• Bad connections or bad component in video amplifier or on CRT neck board for that color.

• Fault in chroma decoder.

• Weak gun in CRT (reduced color).

E. **Retrace lines in picture**

During the time the electron beam is returning from right to left at the end of a line and bottom to top (over the course of multiple lines), it is supposed to be result in no visible light on the screen. However, a number of faults can result in visible retrace lines. The appearance will likely be a general reduction in contrast from the visible horizontal retrace on every scan line and two dozen or so diagonal lines (lower left to upper right) resulting from the vertical retrace. The retrace lines may be either white or gray (possibly with a slight color tint due to unequal settings of the color adjustments) or a primary color - red, green, or blue. Anything in between is also possible but less likely.

F. White/gray retrace lines

Where all colors are involved - the lines are essentially white or gray (or with a slight tint due to slight unequal settings of the color adjustments), look for something common like an incorrectly adjusted screen (G2) or master brightness/background/bias control or a problem in one of these circuits, a defective power supply or a problem in the blanking circuitry: Screen (G2) or master brightness/background/bias control - mark setting and then see if a slight adjustment removes the retrace lines. See the chapter: "TV Adjustments". Of course, if this happened suddenly, the problem is not due to a misadjusted control though a dirty pot is possible - turn it back and forth - this might clean it and restore normal operation.

• **Power supply or connection to CRT neck board** - insufficient voltage will result in the CRT never totally blanking. Check (usually scan derived) power supply components (from flyback).

• **General power supply** - check B+ for correct value and ripple. A main power supply fault might result in these symptoms (and usually many others).

• **Blanking circuit** - this may be a part of the video/chroma chip or separate. Check waveforms to determine if the blanking pulses are making it to the video output.

G. **Red, green, or blue retrace lines**

Where only one color is showing, suspect an incorrectly adjusted individual background/bias control

or bad part on the CRT neck board for that color.

- **Individual brightness/background/bias control(s)** - mark setting of pot for the problem color and then see if a slight adjustment removes the retrace lines. See the chapter: "TV Adjustments". Of course, if this happened suddenly, the problem is not due to a misadjusted control though a dirty pot is possible - turn it back and forth - this might clean it and restore normal operation.
- **Component or connection on CRT neck board** - insufficient voltage to or incorrect biasing of the video driver for this color can result in the CRT never totally blanking. Compare voltages and signals, and swap components between good and bad channels to confirm.
- **Blanking circuit** - this may be a part of the video/chroma chip or separate. Check and compare Waveforms of good and bad colors to determine if the blanking pulses are making it to the video output. There is a slight possibility that a bad CRT may result in visible retrace lines. To eliminate this possibility
- **Disconnect the filament** - all evidence of a picture, raster, and retrace lines should disappear once the filaments/cathodes have cooled (15 seconds or so. If there are still visible retrace lines, the CRT is suffering from cold or field emission from someplace (may not even be the cathode).
- **Turn down the screen (G2) control on the fly back (usually).** If one color remains no matter how you set the control, again there is some kind of weird emission from the CRT. However, if white/gray retrace lines remain, the problem may be in the screen supply.

H. **Bad focus and adjustment changes brightness**

- This is the classic symptom of a short between the focus and screen supplies - probably in focus/screen divider which is part of the flyback or tripler. If you have a high voltage meter, measuring the focus voltage will show that (1) it is low and (2) it is affected by the SCREEN control. Similarly, the SCREEN voltage will be affected by the FOCUS control (which is what is changing the brightness.
- There is a slight possibility that this may be in the CRT as well. Measure the FOCUS and SCREEN Voltage with a high voltage meter. If they are identical pull the plug on the CRT. .

3.3.4. Troubleshooting Audio Problems

A. Picture fine, No audio

- First check that any muting control is not activated. This might be a button on the remote or set

itself. If you have a headphone jack, it may have dirty contacts as plugging in a headphone usually mutes the speaker.

- If the set is mono or only one channel of a stereo set is out, then check for bad connections to the loudspeaker. Test the loudspeaker by disconnecting one of the wires (with the power off!) and Measuring its resistance with an ohmmeter (it should be less than 100 ohms - probably less than 8 ohms). Or momentarily touch a 1.5 volt battery to the speaker terminals - you should get a click or pop from the speaker.
- Next, trace back from the speaker output terminals to the circuit board and look for bad solder Connections or a loose or dirty connector.

If these tests do not reveal anything, you probably need a scope (or audio signal tracer) and Schematic. Or at least the part number off of the chip. Is the final amp a chip also or just a transistor? Have you tested the transistor? If there is little or no buzz from the speaker, that would indicate a problem fairly near the output. If the tuner/if were bad, I would expect some noise/humm pickup from the low level audio stages. Get the part number off of the chip. If it is in a socket, check the contacts for corrosion or looseness.

B. **Weak or distorted audio**

- Assuming you are not attempting to play it at ear shattering levels, this may be due to an alignment problem in the IF/audio demodulator, a bad audio IC or other circuitry, bad connection, or a defective speaker.
- If your TV has an earphone or audio line out jack, try this to see if it is clear. If so, then your problem is in the final audio amp or speaker(s).
- If only one channel of a stereo TV is affected, it is almost certainly the audio amp or speaker for that channel. Interchange connection to the two speakers temporarily and see if the problem moves.
- If the problem is at all intermittent - try gently whacking the TV - then it is likely a bad connection - either a cold solder joint or a dirty or tired IC socket.
- The audio amplifiers in newer TVs are almost always ICs and replacements are usually readily available. If the IC is in a socket, remove the IC, clean the pins and socket contacts and reinstall it. Sometimes, the contacts on old socket lose their springiness and do not provide solid connections. Such a socket will need to be replaced.
- If the set uses discrete transistors, it s also possible for one of these to become noisy.

- If your TV is fairly old - 10 years or so - this may be an alignment problem requiring tweaking of a coil in the sound IF. See your service manual. It may be possible to have similar problems with newer TVs but this is relatively rare.
- There could also be bad electrolytic capacitors, probably in the power supply area. Even though you might think this would result in hum and there is none (even when there is no audio in the program or the sound is turned down) dried up caps can result in distorted sound that may sound like a sort of clipping. An ESR meter is best for testing (with power off!) but carefully jumpering known good caps across suspect ones (again with power off, then turn on the set and check), will eventually find the bad one(s).

3.4. Observing Care and Extreme Precaution

3.4.1. Perform Cleaning of unit

Cleaning a circuit board can seem like a difficult task to tackle, but these boards get dirty all the time. A slew of different materials are hazardous to the performance and safety of these devices. Watching out for such dangers and addressing the damage they cause can keep your work productive and the tools needed for the job functioning properly. Read on to learn how to clean your circuit boards while also maintaining your own safety standards.

How Do Circuit Boards Get Dirty?

Circuit boards are found in nearly all electrical devices, including computers and industrial equipment. Over time, water, dust and grime can find their way into your company's devices and build up to a point where you must take action to prevent permanent damage to the equipment. The fans responsible for keeping equipment's temperature at a cool environment suitable for proper functionality can draw in debris found in the air and any dirt clinging to nearby surfaces. The build-up of unwanted material leads to overheating and component failure.

A liquid such as water is not nearly as detrimental to electronics as the additives it almost always contains. Even plain drinking water contains ions such as sodium chloride and a slew of other minerals that heighten its reaction to electronic devices.

Once a liquid with good conductive qualities contacts an active device, electrical connections travel

through currents to deactivated regions of the circuit board that can lead to short-circuiting. This harms a circuit and damages your device.

3.4.2. Prevention and Safety with Circuit Boards

To avoid dirty circuit boards, you can take preventative steps. Get in the habit of ensuring any electronics not in use are set to the "OFF" position, as the likelihood of adverse repercussions resulting from water damage significantly drop if the affected areas dry before reactivation. Exercise caution when handling circuit boards:

B. Disconnect the device from its power source

- Avoid standing near any water
- Wear dry clothes

Disassembling hardware can be hazardous for the electronics, so make sure you understand how to properly handle the devices you work with and how to reassemble them back to their functioning state.

C. How Do You Clean Circuit Boards?

Cleaning a PCB (Printed Circuit Board) effectively relies on using the right methods and tools.
The easiest ways will use:

- Compressed air
- Baking soda Isopropyl alcohol
- Distilled water
- House ploy a soft brush and lint-free cloth, too, to ensure nothing gets damaged.

C. Using Compressed Air to Clean PCBs

For simple repairs, compressed air provides an unobtrusive way to free up any dust resting on the electronics or inside the machines and blow it out. Use short bursts to spray the air inside the ventilation ports. If you're not satisfied with the dust removed, open the device with a screwdriver and work your way around the components, carefully cleaning the circuitry with the air.

D. Behold cleaners

- **Using Baking Soda to Clean PCBs**

Baking soda, or sodium bicarbonate, is an effective means of removing grime with minimal risk of damaging

the board. It possesses mild abrasive qualities that excel in removing corrosion or residue that will otherwise not come off with simpler means such as a brush and distilled water. Baking soda is most effective when treating corrosion, as it dissolves the troubled area and neutralizes the acidic qualities of the residue.

- **Using Isopropyl Alcohol to Clean PCBs**

Isopropyl alcohol is a great PCB cleaner because it is inexpensive and evaporates quickly. Compared to other cleaners used for similar purposes, alcohol contains fewer chemicals. It is important that isopropyl alcohol used to clean your circuit board is 90% or better. High-percentage isopropyl alcohol can cause adverse effects in contact with the body, so be sure to handle it with care and use latex gloves and goggles.

Self-check 3.1

Instruction: write short answer for the given blank space provided question. You are provided 4 minute for each question and each point has 5 Points.

TEST I. <u>Choose The Best Answer.</u>

1. What will happen the output the of bridge rectifier, if one of the diode in open.
   A. It will give a half wave output.
   B. No/zero output voltage
   C. It will give a half wave output.
   D. High output voltage.
   E. None
2. What will happen the output the of bridge rectifier, if one of the diode in Shorted.
   A. It will give a half wave output.
   B. Zero output voltage
   C. It will give a half wave output.
   D. High output voltage.
   E. None
3. The first step in measuring voltage at the filter capacitor
   A. Identify the positive and negative pins of the Filter Capacitor.
   B. Discharge the big Filter Capacitor.
   C. Set Your Voltmeter in DC range.
   D. Place the BLACK test probe to the negative pin of the Filter Capacitor.
   E. Read the voltage measurement properly.
4. The best point to test the AC input is_____
   A. At the terminals of the power cable
   B. At the two pins of the capacitor
   C. At the two pins of the zener diode
   D. At the two pins of the bridge rectifier
   E. None
5. _____Courses to a Blow fuse in Switch Mode Power Supply.
   A. One of the diodes is shorted.

B. A partially shorted primary of the transformer

C. A partially shorted secondary winding of the transformer

D. High Current flow in the fuse

E. ALL of the above

Operation Sheet 3. 1:

Maintain/Repair defective section of SMPS of the TV set

Operation title: Procedures of Maintain/Repair defective section of SMPS of the TV set

Purpose: To practice and demonstrate the knowledge and skill Maintain/Repair defective section of SMPS of the TV set to make functional SMPS of TV set.

Instruction: Use the given select tools, equipment and testing instrument so that Maintain/Repair the defective is usually done by preparing your circuit's schematic diagram television receiver set. For this operation you have given 5 Hour and you are expected to provide the answer on the given steps.

Step 1 - Prepare Safety Materials

Step 2 - Choose the necessary tools

Step 3 - Prepare your working place

Step 4 - Disassemble the TV set

Step 5 – Identify the SMPS section

Step 6 – Test the power supply section

Step 7 – Trace the voltage input/output

Step 8 – Identify the defective component/part

Step 9 – Repair/replace the defective part

Step 10 - Assemble the TV set

Tools and requirement:

- Defective TV set
- Oscilloscope
- TV set
- Service manual

- Set of Philips screw driver
- Set of flat screw driver
- Soldering iron
- Contact cleaner
- Brush
- Blower

LAP Test – 3.1.

Instructions: Given necessary templates, tools, materials and equipment you are required to perform the Maintain/Repair defective section of SMPS of the TV set for the following tasks within 5 hour.

Task -1: Prepare safety Materials for starting Maintain/Repair faults.

Task – 2: Prepare TV set block/circuit diagram

Task – 3: select appropriate tools and test instrument according to the give designed circuit of SMPS to be Maintained/Repaired

Task – 4: Disassemble the TV set

Task – 5: Trace the voltage input/output

. **Task – 6:** Identify the fault of component/section to be Maintained/Repaired

Task – 7: Repair/replace the faulty part

Precautions: select necessary templates, tools, materials and equipment before Maintaining/Repairing faults in the Television Receivers Set on the given format

Quality Criteria: the given Maintain/Repair defective section of SMPS of the TV set is with correct specification

Unit Four: Test functionality of repaired television receivers

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

- Electronic schematic symbols and diagram interpretation
- Reassembling and repairing TV units
- Supplying and confirming power supply
- Testing functionality of TV unit
- Disposing waste materials

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

- Electronic schematic symbols and diagram interpretation
- Repaire and rreassemble TV units
- Supply and confirm power supply
- Test functionality of TV unit
- Dispose waste materials

4.1. Electronic schematic symbols and diagram interpretation of TV

4.1.1. Block diagram and schematic diagram of TV explanation

A block diagram of a standard home television system is shown on the figure below.

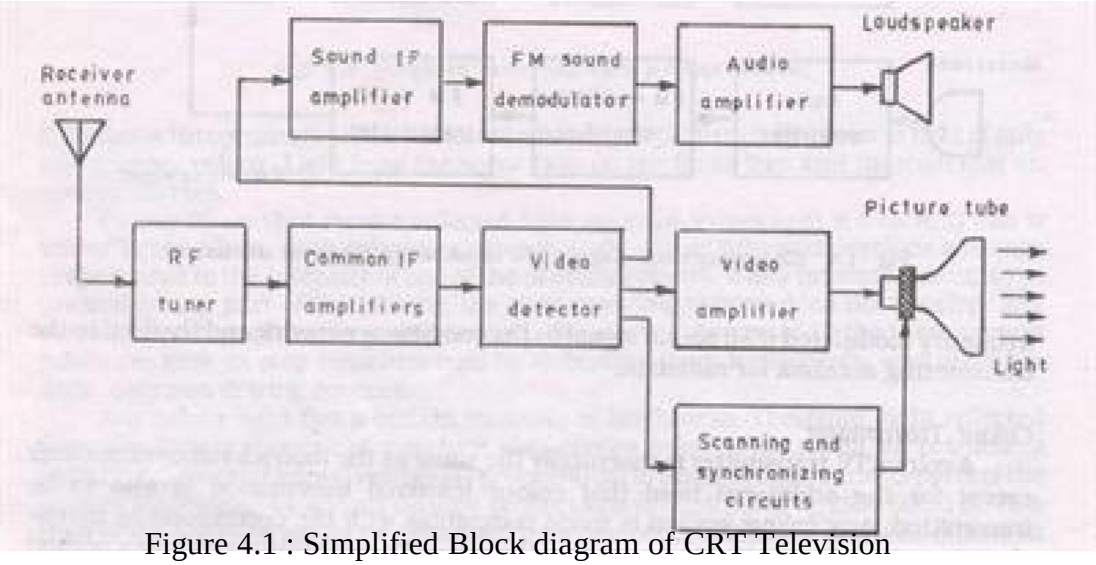


Figure 4.1 : Simplified Block diagram of CRT Television

A. **Receiving antenna**: - picks up signal from the electromagnetic waves travelling through space and, the desired channel is selected by a tuned circuit.

B. Tuner:- it consists of an RF amplifier, local oscillator and mixer.

C. RF Amplifier: with the help of tuned circuits it selects the desired channel and amplifies the RF.

D. Local Oscillator: provides RF of constant amplitude and frequency for the channel selected for reception.

E. Mixer:- receives two signals, one is the channel frequency signal coming from the RF amplifier and the other from the local oscillator frequency signal. The mixer provides the difference of the two frequencies, known as Intermediate frequency (IF). The system makes use of super heterodyne receiving to achieve high selectivity and high gain rejecting interference.

In a TV tuner there are a separate VHF tuner, to select the VHF frequencies, and also a UHF tuner to select the UHF frequencies. The RF Tuner outputs: a constant **Picture IF (PIF) = 38.9MHz**

Sound IF (SIF) = 33.4MHz

- **IF amplifier**: -This amplifies the IF signal.
  The output of the tuner is feed to the first IF amplifier.
- **Video Detector**: - the amplified IF goes to the video detector which removes video signals from the modulated wave and feed it into video amplifier for amplification.
- **Video amplifier**: - there will be a wide band RF coupled amplifiers to amplify the video signal which will further able to drive the picture tube accordingly.
- **Synchronization section:** - This section provides horizontal and vertical synchronize pulses. It also provides color bus which is used as trigger signal to generate CSC (Color Sub carrier) signal. The horizontal and vertical pulses are applied to deflection a coil of PT (Picture tube).The horizontal signal is also used to generate EHT (Extra high tension) supply of about 25 KV.
- **Sound section:** - The output of FM (Frequency Modulator) detector is processed and the audio signal is reproduced by the speaker.

4.1.2. Working principles and Block Diagram of SMPS of TV.

Basically all of the power supply functions are almost the same which is to produce an output voltage for various secondary circuits.

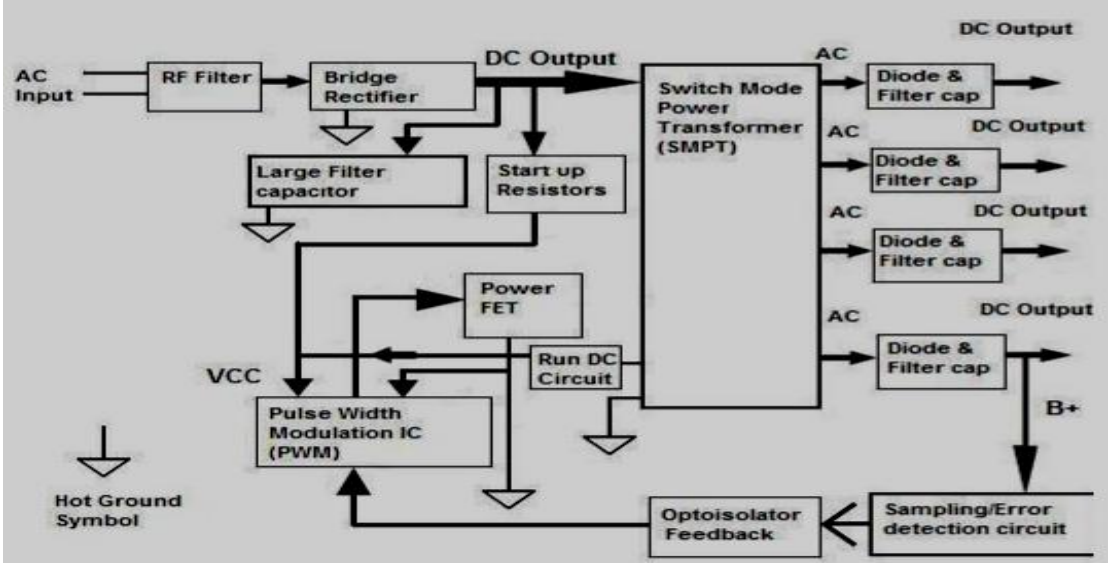


Figure :4.2 : Block Diagram of Typical SMPS Operations

The clean DC voltage will then be given to start up resistors and to the input of switch mode power transformer. Once the voltage passed through the high ohms resistor (start up resistors) the voltage would drop to a value where it then goes to the VCC supply pin of Pulse width modulation (PWM) IC. The **Run DC circuit** that consists of a resistor and a diode will maintain the power IC stable operation.

Once the PWM IC received the voltage, it will produce a signal to drive the transistor (normally FET) and produces a change in the magnetic field in the transformer primary winding. The changing magnetic field induces voltage in the secondary windings.

Each of these AC voltage produced by the secondary windings is then rectified, filtered, and regulated to produce a clean DC voltage. One of the main DC output voltages is the B+ voltage. The output from the B+ voltage supply is then connected, through a sampling error detection circuit and "feedback" loop back to the PWM IC. When the voltage from the B+ supply rises or drop a bit, the PWM IC will act to correct the output.

Note:

Not all SMPS designs are based on the block diagram in Figure4.57. Some older SMPS do not use the PWM IC to drive the FET (some use the bipolar transistor) instead they use an oscillator circuit which consists of some component to drive the FET/ bipolar transistor as seen in the Figure4.58. some do not have sampling error detector/feedback circuit in at the secondary side but instead it was taken from the primary side as seen from Figure4.59. In newer designs, you would not find the power FET because it has been integrated in to the power IC as shown inFigure4.60.

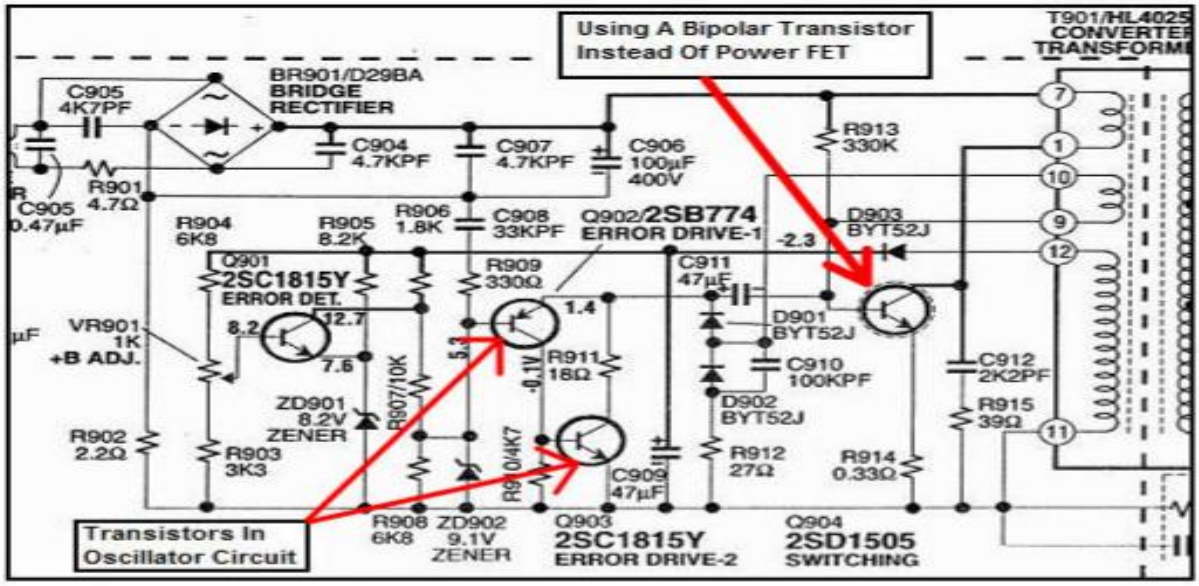


Figure4.58. A Typical Television SMPS without Power IC.

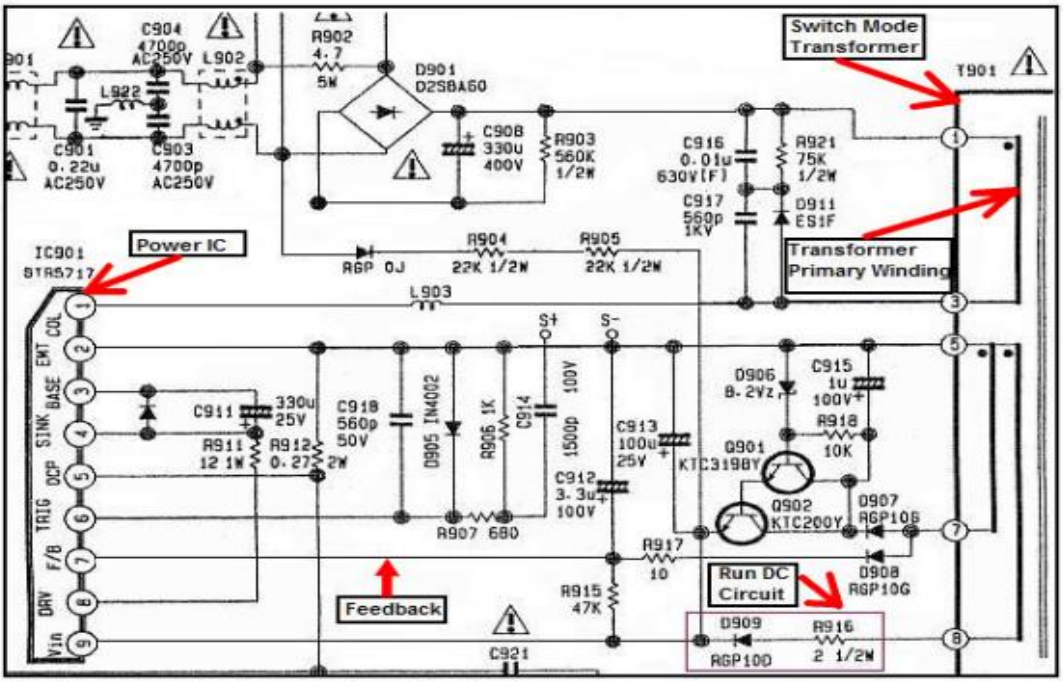


Figure 4.3. A Typical CRT monitorTelevision SMPS without Optoisolator IC

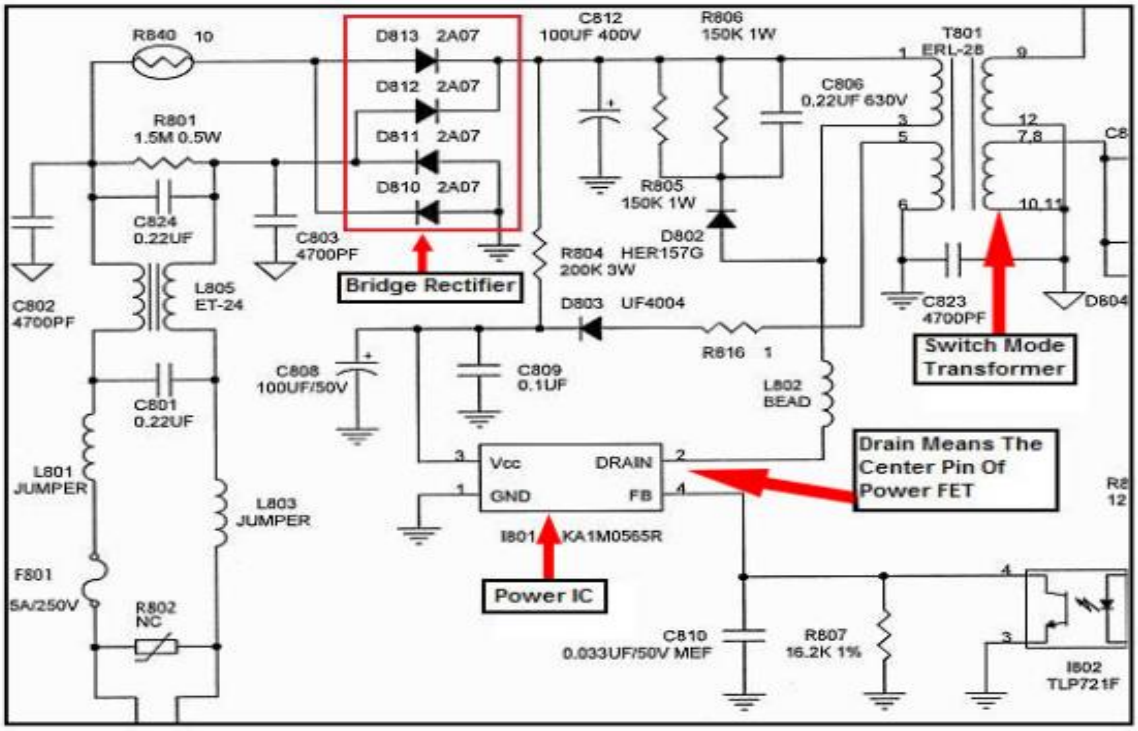


Figure :4.4. A Typical LCD Monitor SMPS withFET Integrated into power IC

Although there are some differences between the designs of SMPS, they basically still operate base on the same principle. Please turn to the next chapter to read the full SMPS circuits operation in details.

4.1.3. Functions and schematic diagrams of SMPS Circuits

There are many types of SMPS in the market and it is impossible to explain all of them in this in topic. However, it will help to guide you with the help of schematic diagram, so that once you have understood how each circuit functions in SMPS then there will be no problem in repairing all types of SMPS because many SMPSin the market are the same, except that some uses more components while others use fewer.

Generally, SMPS consists 11 main circuits in order to form the complete set. Each one of the circuits malfunction could Couse problems in SMPS.

This information sheet uses the LCD Monitor SMPS and some equipment schematic diagrams as a guide to explain how each of these circuit functions and possible causes of faults. The main circuits are:

- Input protection and EMI Filtering Circuit.
- Bridge Circuit
- Start Up and Run DC Circuit.
- Oscillator Circuit.

- Secondary output Voltage Circuit.
- Sampling Circuit.
- Error Detection Circuit.
- Feedback Circuit.
- Protection Circuit.
- Stand-by Circuit.
- Power Factor Correction (PFC)Circuit.

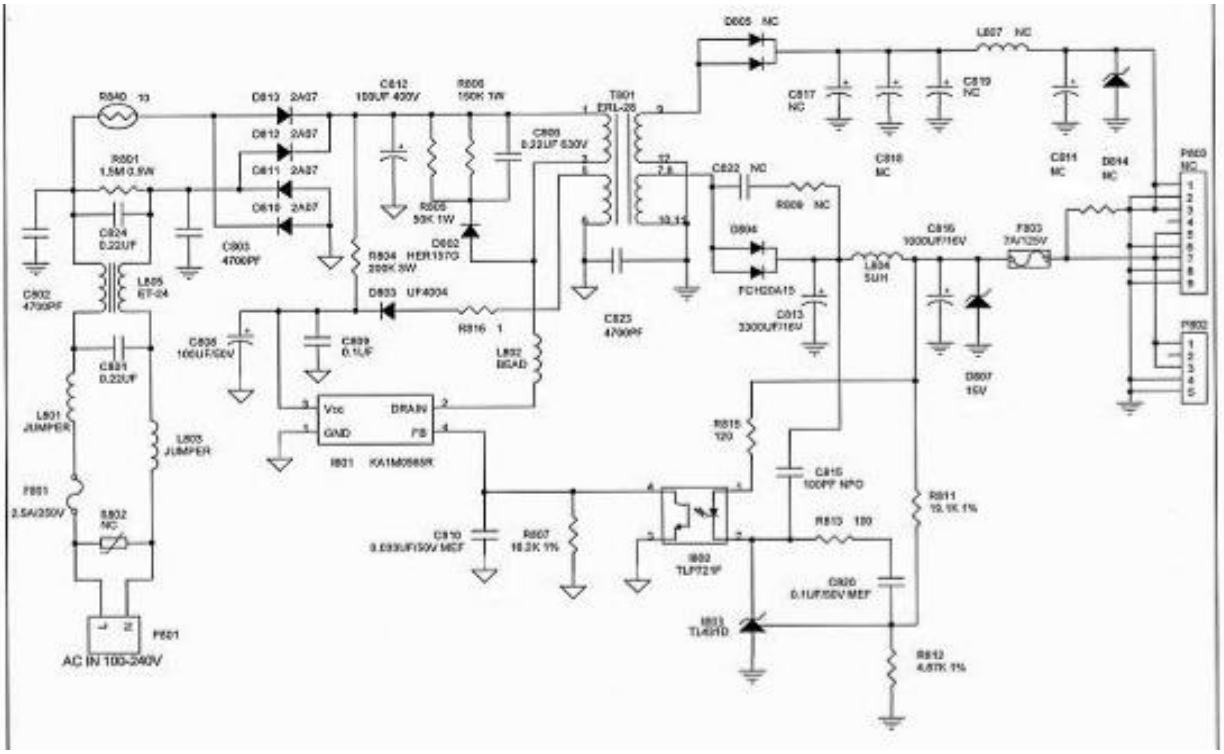


Figure 4.5. Schematic diagram of a Typical LCD Monitor SMPS.

1. Input protection and EMI Filtering Circuit.

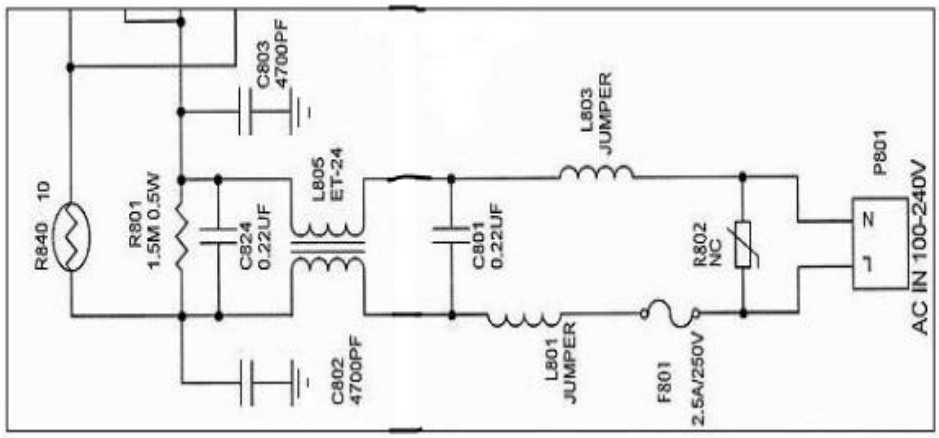


Figure 4.6. Input protection and EMI Filtering Circuit.

- ✓ The first circuit where AC supply enters the SMPS.
- ✓ The Varistor, R802 protects the power supply from transient voltage resulting from lightning strikes of power surge.
- ✓ The fuse F801 protects against faults and effectively isolates from the power supply.
- ✓ Capacitor C801 and C824 are X capacitors used to reduce the differential mode EMI.
- ✓ Resistor R801 discharges C801 and C824 on AC removal, preventing potential user shock.
- ✓ Inductor L805 is used in filtering common mode EMI from coupling back to the AC source.
- ✓ Thermistor R840 limits the initial peak inrush current drawn by the circuit at start up.

2. Bridge Circuit

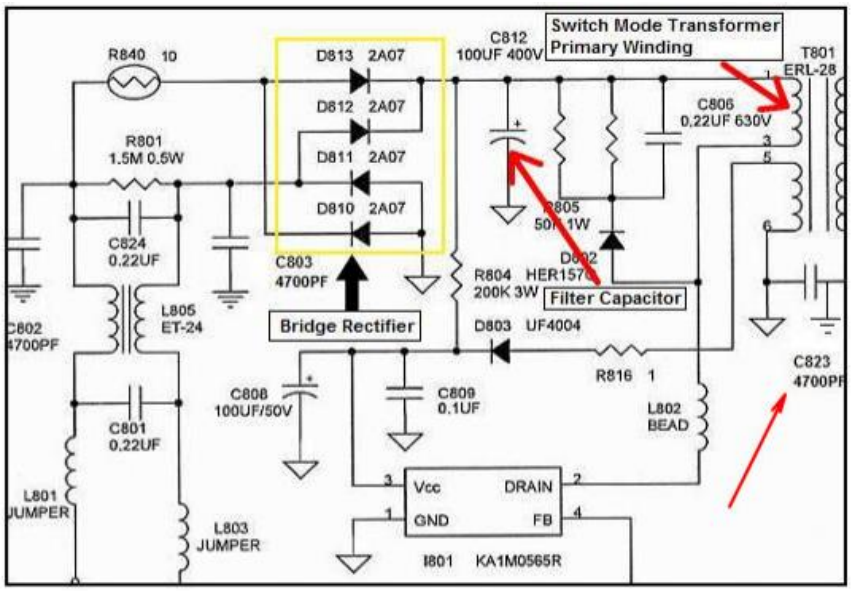


Figure 4.7.Bridge Circuit

It consists either 4 individual diodes or a single package rectifier and a filter capacitor.

It converts the incoming AC to DC voltage and the filter capacitor (usually 220uF,400v) removes the ripples and provides DC to the primary winding of switch mode power transformer.

In some power supply capacitors, you could see they are connected across each diode.

4.2. Reassembling and repairing TV units

.

Reassembling is the process of putting the parts of (something) back together to assemble something again.

A. Steps for disassembling and reassembling Parts

When you perform repairs, you need a procedure that helps you take things apart and get them back together. The procedure here works for repairs that require you to take something apart and put back together again. Allow yourself plenty of time. If things get rough, have some water or a cup of coffee. You may get a whole new perspective when you go back to work. Limit distractions: If the parts fit together before, they'll fit together again.

Follow these instructions, to reassemble the products:

Lay a *clean,* lint-free rag down on a flat surface, near enough to reach without having to get up or walk to it.You'll lay each part on this rag as you remove it. Consequently, the rag shouldn't be in an area where oil or dust or anything else can fall on it and foul up the parts As you remove each part, note (on paper, so you won't forget) where the part came from, how it was attached, and how tightly it was fastened or screwed down. As you remove each part, lay it down on the rag in clockwise order, with each part pointing in the direction it was in before you removed it.

This is the key to the whole system. When you're ready to reassemble things, the placement and

direction of each part tells you when to put it back and how it was oriented. If you're making notes, assign each part a number indicating the order in which you removed it — You can even put numbers on the parts with masking tape if you're afraid that the rag may be moved accidentally. When you're ready to reassemble everything, begin with the last part you removed, and proceed counterclockwise through the parts on the rag.

If you've numbered the parts, they should go on in reverse order



Fig 4.8. Reassembled units are subjected to final testing and Cleaning

Test the equipment thoroughly after repair. After the equipment has been repaired, the equipment must be carefully re-assembled and tested. Run a thorough test to check the equipment and determine if the problem is solved. Thorough checking of the equipment is called 'servicing.'

Do not be discouraged if the equipment still does not work. Simply walk away, clear your mind, and star again by defining your symptoms

4.2.1. Testing and cleaning the final reassembling units

Perform the final test for reassembled units in conformity with manufacturer's specifications

- service manual (information)
- Reassembling and testing repaired
- Reassembling Procedure:

After replacing the defective component of the unit, prepare the parts for re assembling. Make sure that there are no missing parts and as well as the screw/s.

- Fix all the disassembled parts in the housing/compartment, considering the fittings/locks.

- Wires and loose parts should be in proper place to avoid damaged due to misaligned compartment.
- All sides of the housing should fit accordingly.

Moving parts must move as it can be moved by hand and free from obstructions.

- Tighten screw/s accordingly.
- Clean the unit before doing the post-testing procedure.

A. Post-testing Procedure:

- Test the resistance at the AC plug to determine the continuity of the power line to the unit.
- The reason is that there is a low-voltage power supply circuit that controls the functions of the appliance.
- . Energize the unit to check its functionality. Plug the AC cord to the power source. This time, the unit should operate normally. If not, review the documentation and the problem for the second time.

B. Testing Procedure:

- Test the resistance at the AC plugs to determine the continuity of the power line to the AC

the unit. A resistance reading must be observed. Energize the unit to check its functionality.

Press button on at a time observing the behavior. This time, the unit should operate normally. If not, review the documentation and the problem for the second time.

4.3. Supply and confirm power supply

If you're repair LCD/LED TV then you must know how to self test the Power Supply Board (PSU) and IP Board (Inverter Power Supply Board, two in on PCB). This method will help you short cut the fault detection time and

make sure that PSU, INVERTER, IP board and the CCFL lamps are working. So that you can quickly to check the other section or circuits. They are no waiting or wasting time to testing the good section or wrong bought the PSU or IP board. A lot of repairer they don't know how to using this method to testing it or think it is a very tough technical to learn. But after you read this chapter, you will know how to test it and testing it correctly.

Before that, you must know how the LCD TV power supply working first. I will recommend you read this SMPS Power Supply Repair Guide and it will show more details on how SMPS work. When the main AC plug switch on, the LCD TV will automatically lit standby LED light (normally the LED light for standby mode is Red color or Orange color). After TV power on the switch, the LED light will change to Green or Blue color and the power supply will start-up and then the display will appear on the screen.

This is what we saw the LCD TV power on procedure or steps.

Inside the LCD TV, when AC voltage supply to the PSU or IP board, it will input to the Standby Circuit section and auto generate 5V or 3.3V or both. You can measure this standby voltage on the PSU connector without press power on the TV. This standby voltage will direct send to the mainboard and through voltage regulator IC or DC-DC converter circuit and reach the CPU/main chipset (Scaler & MCU inside) or MCU IC (Microcontroller/Micom). So the standby LED light will lit now. When the TV power switch pressed or remote control power on command sent, the main chipset will send out the POWER_ON signal to PSU board to start-up the PFC section and then the PWM section. After that, the 5V, 12V, 18V (audio section use) & 24V will all successful generate. At the same time, CPU will sent out another signals call BL_ON(other signal like DIMMING, P-DIM & etc will sent out at the same time) to Inverter board or section (if it is IP board). When BL_ON signal and 24V are present on inverter board, the backlight system will work. Finally the D TV start-up successfully and video will show on the screen.

4.3.1. Checking standby line or power on signal line

When we checking the PSU board, we could found the marking code wrote on the PCB board near connector. They got many marking code on the PSU board, but their functions are same. Here is a list of these marking codes:

- **Power On Signal** = POWER_ON, PWR_ON, MAIN_ON, SW_POWER, ENABLE & etc
- **Backlight On Signal** = BL_ON, INV_ON, SW-INVERTER, SW_INV, ON/OFF & etc
- **Standby Voltage** = STBY, STB5V, 5VSTB or 33STB, STB3.3V & etc

If the PSU board don't have any marking code on the PCB (normally the OEM PSU board), you can use the volt meter to testing it. When AC voltage was supply to the PSU board, using the volt meter to testing their voltage supply output connector pins. If you found that pin provide 5V or 5.xxV, then this is a standby 5V line. If you found 5V and 3.3V line there, that means the PSU board got both 5V & 3.3V standby voltage line. Or that board have one standby 5V line and one AC_OFF_DET 3.3V line.

Actually this AC_OFF_DET line is a POWER GOOD or PG signal line. Since we want to know how to self test the PSU board without connect to the mainboard, so we must know which one is the standby voltage line. For the POWER_ON signal, starting from the PSU connector pins, and search a pin where it is go to a transformer with secondary side has a big electrolytic capacitor about 400V or 450V. Or that pin is go to a circuit with big electrolytic capacitor about 400V or 450V. So this pin is call a POWER_ON signal line.

4.4. Testing functionality of TV unit

A. Test equipment TV

Don't start with the electronic test equipment, start with some analytical thinking. Your powers of observation (and a little experience) will make a good start. You your ears represents the most important test equipment you have.

Some test equipment will be needed:

- **Multimeter (DMM)** - This is essential for checking of power supply voltages and voltages on the pins of ICs or other components
- **Oscilloscope** - While many problems can be dealt with using just a multimeter, a 'scope will be essential as you get more into advanced troubleshooting. Basic requirements are: dual trace,10-20 MHz minimum vertical bandwidth, delayed sweep desirable but not essential. A good set of proper 10X/1X probes. Higher vertical bandwidth is desirable but most consumer electronics work can be done with a 10 MHz scope. A storage scope or digital scope might be desirable for certain tasks but is by no means essential for basic troubleshooting.
- **A video signal source** - both RF and baseband (RCA jacks). Unless you are troubleshooting tuner or video/audio input problems, either one will suffice. RF sources include a pair of rabbit ears or an outdoor antenna, a cable connection, or a VCR with a working RF modulator. This will be more convenient than an antenna connection and will permit you to control the program material. In fact, making some test tapes

using a camcorder or video camera to record static test patterns will allow you full control of what is being displayed and for how long.

- **Color bar/dot/crosshatch signal generator** - This is a useful piece of equipment if you are doing a lot of TV or monitor repair and need to perform CRT convergence and chroma adjustments.

4.5. Dispose Waste materials

It is inevitable during normal laboratory operations some chemical waste will be generated. This waste may take a number of forms including chemicals, solvents, stock solutions and items contaminated with chemicals such as paper, filters and contaminated laboratory equipment. The improper disposal of chemical waste can pose a number of potential hazards both to the environment and to the safety of staff and students.

• Strong smelling substances such as mercaptans can give off strong-smelling, unpleasant vapors that can linger in drains and pipe work moving throughout the building and escaping in other areas.

• Flammable / reactive substances can give rise to a build-up of flammable vapors in drainage systems which could lead to a risk of fire or explosion in extreme cases.

• Corrosive substances including acids and alkalis can damage pipe work and fittings as well as reacting with other chemicals released into the drainage system potentially leading to the release of harmful vapors.

• Radioactive substances can be released to drains under controlled circumstances but in the event that the licensing of this is very strictly controlled to reduce the risk of radioactive contamination.

• Unexpected reactions may occur when chemicals are released to drain, for example bleach can mix with some common drain cleaning compounds to release the toxic gas chlorine.

• Poisonous substances may enter the environment if released to drain and can either have a toxic affect on watercourses or other discharge sites, they may also introduce toxic residues into drinking water that can persist even after water treatment.

As a result discharging chemicals to foul water drains should be avoided wherever practical and only considered where there is no viable alternative or for relatively innocuous substances.

Self-check 4.1

Instruction: write short answer for the given blank space provided question. You are provided 4 minute for each question and each point has 5 Points.

TEST I. Choose The Best Answer.

6. What will happen the output the of bridge rectifier, if one of the diode in open.
   F. It will give a half wave output.
   G. No/zero output voltage
   H. It will give a half wave output.
   I. High output voltage.
   J. None
7. What will happen the output the of bridge rectifier, if one of the diode in Shorted.
   F. It will give a half wave output.
   G. Zero output voltage
   H. It will give a half wave output.
   I. High output voltage.
   J. None
8. The first step in measuring voltage at the filter capacitor
   F. Identify the positive and negative pins of the Filter Capacitor.
   G. Discharge the big Filter Capacitor.
   H. Set Your Voltmeter in DC range.
   I. Place the BLACK test probe to the negative pin of the Filter Capacitor.
   J. Read the voltage measurement properly.
9. The best point to test the AC input is_____
   F. At the terminals of the power cable
   G. At the two pins of the capacitor
   H. At the two pins of the zener diode
   I. At the two pins of the bridge rectifier
   J. None
10. _____Courses to a Blow fuse in Switch Mode Power Supply.
   F. One of the diodes is shorted.

G. A partially shorted primary of the transformer

H. A partially shorted secondary winding of the transformer

I. High Current flow in the fuse

J. ALL of the above

Operation Sheet 4. 1:

Maintain/Repair defective section of SMPS of the TV set

Operation title: Procedures of Maintain/Repair defective section of SMPS of the TV set

Purpose: To practice and demonstrate the knowledge and skill Maintain/Repair defective section of SMPS of the TV set to make functional SMPS of TV set.

Instruction: Use the given select tools, equipment and testing instrument so that Maintain/Repair the defective is usually done by preparing your circuit's schematic diagram television receiver set. For this operation you have given 5 Hour and you are expected to provide the answer on the given steps.

Step 1 - Prepare Safety Materials

Step 2 - Choose the necessary tools

Step 3 - Prepare your working place

Step 4 - Disassemble the TV set

Step 5 – Identify the SMPS section

Step 6 – Test the power supply section

Step 7 – Trace the voltage input/output

Step 8 – Identify the defective component/part

Step 9 – Repair/replace the defective part

Step 10 - Assemble the TV set

Tools and requirement:

- Defective TV set
- Oscilloscope
- TV set
- Service manual

- Set of Philips screw driver
- Set of flat screw driver
- Soldering iron
- Contact cleaner
- Brush
- Blower

LAP Test – 4.1.

Instructions: Given necessary templates, tools, materials and equipment you are required to perform the Maintain/Repair defective section of SMPS of the TV set for the following tasks within 5 hour.

Task -1: Prepare safety Materials for starting Maintain/Repair faults.

Task – 2: Prepare TV set block/circuit diagram

Task – 3: select appropriate tools and test instrument according to the give designed circuit of SMPS to be Maintained/Repaired

Task – 4: Disassemble the TV set

Task – 5: Trace the voltage input/output

. **Task – 6:** Identify the fault of component/section to be Maintained/Repaired

Task – 7: Repair/replace the faulty part

Precautions: select necessary templates, tools, materials and equipment before Maintaining/Repairing faults in the Television Receivers Set on the given format

Quality Criteria: the given Maintain/Repair defective section of SMPS of the TV set is with correct specification

Unit Five : Achieve productivity and quality target

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

- Correcting routine faults in the TV Set
- Recording customer complaints post service
- Achieving customer satisfaction
- Ensuring free handling of the unit

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

- Correct routine faults in the TV Set
- Record ccustomer complaints post service
- Achieve ccustomer satisfaction
- Ensure free handling of the unit

5.1. Correcting routine faults in the TV Set

A. Preventive maintenance

Preventive maintenance is basically concerned with the correction of a potential trouble and thereby avoids repair costs and time. There is considerable disagreement among electronics equipment manufacturers concerning the need for periodic maintenance or routine checks.

At one extreme, a certain manufacturer recommends preventive maintenance (e.g. replacement of a few parts after a given number of playing hours or times. At the other extreme, another manufacturer recommends no periodic replacement cleaning, lubrication or adjustment of any kind.

5.1.1. Routine/detecting fault finding system in the TV set

The invention discloses a fault detection system and method as well as a television. The fault detection system comprises a fault detection unit, the fault detection unit is connected with a plurality of system chips and/or system power supplies, and the fault condition is determined by acquiring the detection information of the system chips and/or system power supplies. The performance of the fault detection system can be increased, and the working efficiency of working staff to detect faults is improved.

What the present invention adopted is a kind of Embedded detection system, can detect the power issue of system power supply by fault detection unit, and the hardware case such as damage of a plurality of chips in the system, the more deep operating state that can detect each System on Chip/SoC, the operating state that this Embedded monitoring system is primarily aimed at power failure and each chip detects, detection information comprises hardware information and software information, make that the specific aim of detection system is stronger, the staff is easy to determine the fault content, improved the operating efficiency that the staff carries out the detection

system fault, especially for the television set industry, fault detection system provided by the invention can detect the chip and the power failure of dissimilar system for TV set, and the scope of application is bigger.

The function that fault detection unit at first has is exactly that system power supply detects. **General System can include**

- The power supply of several roads,
- The power as 3.3v, 1.8v power supply, the 5v power supply, and
- Every road voltage of supplying with the equal level of same chip substantially all adopts the mode of magnetic bead or inductance parallel connection, as the 3.3v that supplies with integrated chip IC1 may comprise the multichannel connecting line, it is in parallel that but all connecting lines all adopt magnetic bead to isolate, Where in a route road goes wrong like this, another route road then in parallel with it also can go wrong, based on this, when detecting each chip, any one tunnel supply line that only needs to have identical magnitude of voltage on the detection chip gets final product

5.2. Recording customer complaints post service

5.2.1. Customer complaint resolution techniques

Customer complaints are pieces of feedback that point out problems with your company's product or services. These are opportunities for your business to improve its internal processes and create a better customer experience.

- **Below are a few common customer complaints you can expect your service team to encounter.**

A. Long Wait on Hold

If your team works in a call center, Average Time on Hold (ATH) is one of your most important call center metrics. Customers want fast answers and can't afford to spend their afternoon with a phone glued to their ear. In fact, studies show that after about two minutes, customers are likely to hang up the phone and 34% of those customers won't call back. That means you can potentially lose a third of your customer base just because you didn't pick up the phone fast enough.

- **To resolve this customer complaint:**

Long hold times indicate two problems. First, it could mean that your customer demand is too high for your customer service team. In this case, you should consider hiring more reps to meet the needs of your call center. In the meantime, your reps should apologize for the long wait times and work to ensure first call resolution.

The other issue may be that your call center lacks automation. Call center software can provide your service team with features that streamline operations and complete tasks automatically. By adopting this technology, you can

optimize your team's production by removing menial tasks from their day-to-day workflow. This should reduce hold time complaints and create a more satisfying service experience.

B. Unavailable or Out of Stock Product

It's usually a good sign when a product goes out of stock, but if it stays out of stock, customers can become impatient for its return. They may demand a special order or repeatedly call for product updates. This typically indicates a time-sensitive need for your product which should be fulfilled immediately.

C. Making Customers Repeat Their Problem

Customers hate repeating their problems to your reps. This happens when they're either transferred to new reps or dealing with an agent who isn't paying close attention. When customers have to describe their issue multiple times, it's both a frustrating and time-consuming experience.

D. Uninterested Service Rep

Whether it's their tone, personality, or even just the time of day, some customers simply won't get along with your customer service reps. When a rep fails to meet their needs, some customers think it's due to a lack of interest in their case. Sometimes this is true, other times customers have expectations that are higher than what your team can provide. Regardless of where the fault lies, when your reps fail to appear invested, your business's reputation takes the hit.

When dealing with this type of customer complaint, reps should consider what they can do to provide above-and-beyond customer service. Every business has protocol, but it's sometimes worth bending the rules if that means preventing customer churn. At the very least, reps should pay attention to their tone and body language to ensure they're displaying a motivated and attentive demeanor.

If a customer does report an issue with a rep, management should always investigate the issue. Managers should give their reps the benefit of the doubt but try to get every possible detail. Rather than criticizing the rep's approach, look for opportunities to teach the agent about preventing these types of situations. If these issues continue to occur, it may be time to take more severe actions.

E. Poor Product or Service

When your product breaks, you can expect the customer to complain. In some cases, the product isn't broken, rather, the customer doesn't understand how to use it. Other times, customers aren't a good fit for your product or service, but they blame your company for failing to fulfill their needs. No matter how customers arrive at this conclusion, your team needs to know how to prevent them from turning to your competitors



Figure 5.1. Customer resolution Cycle

5.3. Achieving customer satisfaction

Customer Satisfaction encourages Face-to-Face Dealings. This is the most daunting and downright scary part of interacting with a customer. ...

- Be Friendly and Approachable. ...
- Attention to Detail (also known as “The Little Niceties”) ...
- Honor Your Promises.

A. There are 4 great ways to improve your customer satisfaction

- Treat every customer as if they were a VIP. ...
- Keep measuring customer satisfaction. ...
- Find out how to measure customer satisfaction most effectively. ...
- Keep an eye on what customers say about you on social media.

5.3.1. Handle Customer satisfaction

When handling a constant stream of customer needs daily, it can be overwhelming trying to formulate a plan to resolve the complaints coming in. However, it’s not impossible. Empower your service teams to do their best work by following these steps.

A. Collect feedback and look for patterns.

The first step in addressing customer complaints is to dig into the complaints you have received. Using a tracking software will make this process much easier as you'll be able to quickly access feedback and metrics like average call times. Whatever the complaints are, you'll need to examine the feedback you're getting first. You can't fix what you don't know.

B. Talk to your service team.

Next, share this feedback with your service team. Discuss their pain points solving for the customer and gather any additional insights. Are they overwhelmed with the volume of calls and tickets received? Do they have the tools needed to provide the best service possible? Could your current service processes be improved? Your service team is on the frontlines with customers every day so their feedback is invaluable for improving the customer experience.

C. Determine the root causes of the problem.

Now that you have a good grasp of the issues your customers are facing, it's time to address the main causes.

For example, if customers report long call wait times, it could be that they are calling during peak times of the day when your service team is swamped with higher than normal call volumes.

Did you roll out a new product feature that has a few bugs and is causing consistent complaints across the board? Maybe the details of the new feature were not communicated clearly to customers and are causing friction. Getting to the root of the issues will help you formulate a plan which we'll cover next.

D. Create a plan to address customer pain points.

Now that you've found the main cause of your customers' dissatisfaction, it's time to implement a plan to solve the issue. If the root cause is an issue with your current internal service processes, update them to make them more clear to the team and provide more training if necessary.

Maybe your service team noticed an influx of customers calling for information that could be better communicated with a self-serve FAQ page or similar option. Creating a knowledge base customers can use to resolve their issues may be the best solution for light troubleshooting. This way customer doesn't have to wait on hold and it frees up your service rep's time to handle more complicated service requests.

5.4. Ensure free handling of the unit

In field free handling, safety requirements are difficult to satisfy. Take and use a portable isolation transformer and a large rubber mat, and use battery-powered test equipment. The difficulty of maintaining servicing safety in a wide range of unpredictable environments is responsible for the face that equipment must generally be removed to the work shop for all but the simplest cleaning and adjustment work. Other factors are the need for lots of sophisticated test equipments; the fact that many faults are spasmodic or intermittent; and the time wasted by a skilled and well-equipped technician in carrying out a field service itinerary.

For general work shop safety, always keep handy a fire extinguisher suitable for electrical fires, and have electric shock and resuscitation charts clearly displayed near the benches.

Always wear safety goggles when handling or transporting a picture tube, and use a conductive strap to link its rim band, EHT socket and outer conducting coating together before lifting it by its bowl, screen down.

Before investigating the mains-powered switch-mode power supply circuit remember to disconnect the equipment from the mains supply and discharge the main reservoir capacitor with a resistor of say 2K or so, kept in place for several seconds.

Self-check 5.1

Instruction: write the correct answer for the given question provided below. You are provided 4 minute for each question and each point has 5 Points.

TEST I: Say True or False.

1. Customer complaints are pieces of feedback that point out problems with your company's product or services
2. When handling a constant stream of customer needs daily
3. The first step in addressing customer complaints is to dig into the complaints you have received.
4. For general work shop safety, always keep handy a fire extinguisher suitable for electrical fires
5. The difficulty of maintaining servicing safety in a wide range of unpredictable environments

TEST II: Write Short Answer

1. Write the Customer resolution Cycle and explain each steps of cycle.

2. Write the steps to formulate a plan to resolve or handling the complaints satisfaction coming in during Achieve productivity and quality target for television receiver maintaince/Repair.

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